



Hot-adding SAS storage to a bridge-attached MetroCluster FC configuration

ONTAP MetroCluster

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Table of Contents

- Hot-adding SAS storage to a bridge-attached MetroCluster FC configuration 1
 - Hot-adding a stack of SAS disk shelves to an existing pair of FibreBridge 7500N bridges 1
 - Hot-adding a stack of SAS disk shelves and bridges to a MetroCluster system 9
 - Hot-adding a SAS disk shelf to a stack of SAS disk shelves 22
 - Hot-adding an IOM12 disk shelf to a stack of IOM6 disk shelves in a bridge-attached MetroCluster configuration 27

Hot-adding SAS storage to a bridge-attached MetroCluster FC configuration

You can hot-add either an individual SAS disk shelf or a stack and set of bridges to an existing MetroCluster system.

These procedures apply to MetroCluster FC configurations using FC-to-SAS bridges that are either directly attached to the storage controllers or attached to an FC fabric.

These procedures are nondisruptive and take approximately four hours to complete.

You need the admin password and access to an FTP or SCP server.

Hot-adding a stack of SAS disk shelves to an existing pair of FibreBridge 7500N bridges

You can hot-add a stack of SAS disk shelves to an existing pair of FibreBridge 7500N bridges that have available ports.

- You must have downloaded the latest disk and disk shelf firmware.
- All of the disk shelves in the MetroCluster configuration (both the new shelves and existing shelves) must be running the same firmware version.

[NetApp Downloads: Disk Drive Firmware](#)

[NetApp Downloads: Disk Shelf Firmware](#)

- The FibreBridge 7500N bridges must be connected and have available SAS ports.

This procedure is written with the assumption that you are using the recommended bridge management interfaces: the ATTO ExpressNAV GUI and the ATTO QuickNAV utility.

You can use the ATTO ExpressNAV GUI to configure and manage a bridge, and to update the bridge firmware. You can use the ATTO QuickNAV utility to configure the bridge Ethernet management 1 port.

You can use other management interfaces, if required. These options include using a serial port or Telnet to configure and manage a bridge and to configure the Ethernet management 1 port, and using FTP to update the bridge firmware. If you choose any of these management interfaces, you must meet the applicable requirements in [Other bridge management interfaces](#).



If you insert a SAS cable into the wrong port, when you remove the cable from a SAS port, you must wait at least 120 seconds before plugging the cable into a different SAS port. If you fail to do so, the system will not recognize that the cable has been moved to another port.

Steps

1. Properly ground yourself.
2. From the console of either controller, verify that your system has disk autoassignment enabled:

```
storage disk option show
```

The Auto Assign column indicates whether disk autoassignment is enabled.

Node	BKg. FW. Upd.	Auto Copy	Auto Assign	Auto Assign Policy
node_A_1	on	on	on	default
node_A_2	on	on	on	default
2 entries were displayed.				

3. Disable the switch ports for the new stack.
4. Update the FibreBridge firmware on each bridge.

If the new bridge is the same type as the partner bridge upgrade to the same firmware as the partner bridge. If the new bridge is a different type to the partner bridge, upgrade to the latest firmware supported by the bridge and version of ONTAP. See the section "Updating firmware on a FibreBridge bridge" in the *MetroCluster Maintenance Guide*.

5. On each bridge in the pair, enable the SAS port that will connect to the new stack:

SASPortEnable *port-letter*

The same SAS port (B, C, or D) must be used on both bridges.

6. Save the configuration and reboot each bridge:

SaveConfiguration **Restart**

7. Cable the disk shelves to the bridges:
 - a. Daisy-chain the disk shelves in each stack.

The *Installation and Service Guide* for your disk shelf model provides detailed information about daisy-chaining disk shelves.

- b. For each stack of disk shelves, cable IOM A of the first shelf to SAS port A on FibreBridge A, and then cable IOM B of the last shelf to SAS port A on FibreBridge B

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

[Stretch MetroCluster installation and configuration](#)

Each bridge has one path to its stack of disk shelves; bridge A connects to the A-side of the stack through the first shelf, and bridge B connects to the B-side of the stack through the last shelf.



The bridge SAS port B is disabled.

8. Verify that each bridge can detect all of the disk drives and disk shelves to which the bridge is connected.

If you are using the...	Then...
ATTO ExpressNAV GUI	<p>a. In a supported web browser, enter the IP address of a bridge in the browser box.</p> <p>You are brought to the ATTO FibreBridge home page, which has a link.</p> <p>b. Click the link, and then enter your user name and the password that you designated when you configured the bridge.</p> <p>The ATTO FibreBridge status page appears with a menu to the left.</p> <p>c. Click Advanced in the menu.</p> <p>d. View the connected devices:</p> <p>sastargets</p> <p>e. Click Submit.</p>
Serial port connection	<p>View the connected devices:</p> <p>sastargets</p>

The output shows the devices (disks and disk shelves) to which the bridge is connected. The output lines are sequentially numbered so that you can quickly count the devices.



If the text response truncated appears at the beginning of the output, you can use Telnet to connect to the bridge, and then view all of the output by using the `sastargets` command.

The following output shows that 10 disks are connected:

```

Tgt VendorID ProductID      Type      SerialNumber
  0 NETAPP    X410_S15K6288A15 DISK      3QP1CLE300009940UHJV
  1 NETAPP    X410_S15K6288A15 DISK      3QP1ELF600009940V1BV
  2 NETAPP    X410_S15K6288A15 DISK      3QP1G3EW00009940U2M0
  3 NETAPP    X410_S15K6288A15 DISK      3QP1EWMP00009940U1X5
  4 NETAPP    X410_S15K6288A15 DISK      3QP1FZLE00009940G8YU
  5 NETAPP    X410_S15K6288A15 DISK      3QP1FZLF00009940TZKZ
  6 NETAPP    X410_S15K6288A15 DISK      3QP1CEB400009939MGXL
  7 NETAPP    X410_S15K6288A15 DISK      3QP1G7A900009939FNNTT
  8 NETAPP    X410_S15K6288A15 DISK      3QP1FY0T00009940G8PA
  9 NETAPP    X410_S15K6288A15 DISK      3QP1FXW600009940VERQ

```

- Verify that the command output shows that the bridge is connected to all of the appropriate disks and disk shelves in the stack.

If the output is...	Then...
Correct	Repeat the previous step for each remaining bridge.
Not correct	a. Check for loose SAS cables or correct the SAS cabling by repeating the step to cable the disk shelves to the bridges. b. Repeat the previous step for each remaining bridge.


10. Cable each bridge to the local FC switches, using the cabling shown in the table for your configuration, switch model, and FC-to-SAS bridge model:



The Brocade and Cisco switches use different port numbering, as shown in the following tables


- On Brocade switches, the first port is numbered “0”.
- On Cisco switches, the first port is numbered “1”.

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)												
DR GROUP 1												
			Brocade 6505		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade G720	
Component	Port		Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2
Stack 1	bridge_x_1a	FC1	8		8		8		8		10	
		FC2	-	8	-	8	-	8	-	8	-	10
	bridge_x_1B	FC1	9	-	9	-	9	-	9	-	11	-
		FC2	-	9	-	9	-	9	-	9	-	11
Stack 2	bridge_x_2a	FC1	10	-	10	-	10	-	10	-	14	-
		FC2	-	10	-	10	-	10	-	10	-	14
	bridge_x_2B	FC1	11	-	11	-	11	-	11	-	17	-
		FC2	-	11	-	11	-	11	-	11	-	17

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)												
Stack 3	bridge_x_3a	FC1	12	-	12	-	12	-	12	-	18	-
		FC2	-	12	-	12	-	12	-	12	-	18
	bridge_x_3B	FC1	13	-	13	-	13	-	13	-	19	-
		FC2	-	13	-	13	-	13	-	13	-	19
Stack y	bridge_x_ya	FC1	14	-	14	-	14	-	14	-	20	-
		FC2	-	14	-	14	-	14	-	14	-	20
	bridge_x_yb	FC1	15	-	15	-	15	-	15	-	21	-
		FC2		15		15		15	-	15	-	21
		Additional bridges can be cabled to ports 16, 17, 20 and 21 in G620, G630, G620-1, and G630-1 switches.										

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)										
DR GROUP 2										
			Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G720	
Component		Port	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	switch 2
Stack 1	bridge_x_51a	FC1	26	-	32	-	56	-	32	-
		FC2	-	26	-	32	-	56	-	32
	bridge_x_51b	FC1	27	-	33	-	57	-	33	-
		FC2	-	27	-	33	-	57	-	33
Stack 2	bridge_x_52a	FC1	30	-	34	-	58	-	34	-
		FC2	-	30	-	34	-	58	-	34
	bridge_x_52b	FC1	31	-	35	-	59	-	35	-
		FC2	-	31	-	35	-	59	-	35

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)

Stack 3	bridge_x_53a	FC1	32	-	36	-	60	-	36	-
		FC2	-	32	-	36	-	60	-	36
	bridge_x_53b	FC1	33	-	37	-	61	-	37	-
		FC2	-	33	-	37	-	61	-	37
Stack y	bridge_x_5ya	FC1	34	-	38	-	62	-	38	-
		FC2	-	34	-	38	-	62	-	38
	bridge_x_5yb	FC1	35	-	39	-	63	-	39	-
		FC2	-	35	-	39	-	63	-	39
		Additional bridges can be cabled to ports 36 - 39 in G620, G630, G620-1, and G-630-1 switches.								

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only

DR GROUP 1											
		Brocade 6505		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G620, brocade G620-1, Brocade G630, Brocade G630-1		Brocade G720	
Component	Port	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2
Stack 1	bridge_x_1a	8		8		8		8		10	
	bridge_x_1b	-	8	-	8	-	8	-	8	-	10
Stack 2	bridge_x_2a	9	-	9	-	9	-	9	-	11	-
	bridge_x_2b	-	9	-	9	-	9	-	9	-	11

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only

Stack 3	bridge_x_3a	10	-	10	-	10	-	10	-	14	-
	bridge_x_4b	-	10	-	10	-	10	-	10	-	14
Stack y	bridge_x_4a	11	-	11	-	11	-	11	-	15	-
	bridge_x_4b	-	11	-	11	-	11	-	11	-	15



Additional bridges can be cabled to ports 12 - 17, 20 and 21 in G620, G630, G620-1, and G630-1 switches. Additional bridges can be cabled to ports 16 - 17, 20 and 21 G720 switches.

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only

DR GROUP 2											
		Brocade G720		Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade 6510, Brocade DCX 8510-8		Brocade 6520			
Stack 1	bridge_x_51a	32	-	26	-	32	-	56	-		
	bridge_x_51b	-	32	-	26	-	32	-	56		
Stack 2	bridge_x_52a	33	-	27	-	33	-	57	-		
	bridge_x_52b	-	33	-	27	-	33	-	57		
Stack 3	bridge_x_53a	34	-	30	-	34	-	58	-		
	bridge_x_54b	-	34	-	30	-	34	-	58		

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only

Stack y	bridge_x _ya	35	-	31	-	35	-	59	-
	bridge_x _yb	-	35	-	31	-	35	-	59



Additional bridges can be cabled to ports 32 - 39 in G620, G630, G620-1, and G630-1 switches. Additional bridges can be cabled to ports 36 - 39 in G720 switches.

11. Update the disk drive firmware to the most current version from the system console:

disk_fw_update

You must run this command on both controllers.

[NetApp Downloads: Disk Drive Firmware](#)

12. Update the disk shelf firmware to the most current version by using the instructions for the downloaded firmware.

You can run the commands in the procedure from the system console of either controller.

[NetApp Downloads: Disk Shelf Firmware](#)

13. If your system does not have disk autoassignment enabled, assign disk drive ownership.

[Disk and aggregate management](#)



If you are splitting the ownership of a single stack of disk shelves among multiple controllers, you must disable disk autoassignment (`storage disk option modify -autoassign off *` from both nodes in the cluster) before assigning disk ownership; otherwise, when you assign any single disk drive, the remaining disk drives might be automatically assigned to the same controller and pool.



You must not add disk drives to aggregates or volumes until after the disk drive firmware and disk shelf firmware have been updated and the verification steps in this task have been completed.

14. Enable the switch ports for the new stack.
15. 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.

16. If applicable, repeat this procedure for the partner site.

Hot-adding a stack of SAS disk shelves and bridges to a MetroCluster system

You can hot-add (nondisruptively add) an entire stack, including the bridges, to the MetroCluster system. There must be available ports on the FC switches and you must update switch zoning to reflect the changes.

- This procedure can be used to add a stack using either FibreBridge 7500N or 6500N bridges.
- This procedure is written with the assumption that you are using the recommended bridge management interfaces: the ATTO ExpressNAV GUI and the ATTO QuickNAV utility.
 - You use the ATTO ExpressNAV GUI to configure and manage a bridge, and to update the bridge firmware. You use the ATTO QuickNAV utility to configure the bridge Ethernet management 1 port.
 - You can use other management interfaces, if needed. These options include using a serial port or Telnet to configure and manage a bridge, and to configure the Ethernet management 1 port, and using FTP to update the bridge firmware. If you choose any of these management interfaces, your system must meet the applicable requirements in [Other bridge management interfaces](#)

Preparing to hot-add a stack of SAS disk shelves and bridges

Preparing to hot-add a stack of SAS disk shelves and a pair of bridges involves downloading documents as well as the disk drive and disk shelf firmware.

- Your system must be a supported configuration and must be running a supported version of ONTAP.

[NetApp Interoperability Matrix Tool](#)

- All disk drives and disk shelves in the system must be running the latest firmware version.

You might want to update the disk and shelf firmware throughout the MetroCluster configuration prior to adding shelves.

Upgrade, revert, or downgrade

- Each FC switch must have one FC port available for one bridge to connect to it.



You might need to upgrade the FC switch depending on the FC switch compatibility.

- The computer you are using to set up the bridges must be running an ATTO supported web browser to use the ATTO ExpressNAV GUI: Internet Explorer 8 or 9, or Mozilla Firefox 3.

The *ATTO Product Release Notes* have an up-to-date list of supported web browsers. You can access this document using the information in the steps.

Steps

1. Download or view the following documents from the NetApp Support Site:
 - [NetApp Interoperability Matrix Tool](#)
 - The *Installation and Service Guide* for your disk shelf model.
2. Download content from the ATTO website and from the NetApp website:
 - a. Go to the ATTO FibreBridge Description page.
 - b. Using the link on the ATTO FibreBridge Description page, access the ATTO web site and download the following:
 - *ATTO FibreBridge Installation and Operation Manual* for your bridge model.
 - ATTO QuickNAV utility (to the computer you are using for setup).
 - c. Go to the ATTO FibreBridge Firmware Download page by clicking **Continue** at the end of the ATTO FibreBridge Description page, and then do the following:
 - Download the bridge firmware file as directed on the download page.

In this step, you are only completing the download portion of the instructions provided in the links. You update the firmware on each bridge later, when instructed to do so in the [Hot-adding the stack of shelves](#) section.

 - Make a copy of the ATTO FibreBridge Firmware Download page and release notes for reference later.
3. Download the latest disk and disk shelf firmware, and make a copy of the installation portion of the instructions for reference later.

All disk shelves in the MetroCluster configuration (both the new shelves and existing shelves) must be running the same firmware version.



In this step, you are only completing the download portion of the instructions provided in the links and making a copy of the installation instructions. You update the firmware on each disk and disk shelf later, when instructed to do so in the [Hot-adding the stack of shelves](#) section.

- a. Download the disk firmware and make a copy of the disk firmware instructions for reference later.

[NetApp Downloads: Disk Drive Firmware](#)

- b. Download the disk shelf firmware and make a copy of the disk shelf firmware instructions for reference later.

[NetApp Downloads: Disk Shelf Firmware](#)

4. Gather the hardware and information needed to use the recommended bridge management interfaces—the ATTO ExpressNAV GUI and ATTO QuickNAV utility:
 - a. Acquire a standard Ethernet cable to connect from the bridge Ethernet management 1 port to your network.
 - b. Determine a non-default user name and password for accessing the bridges.

It is recommended that you change the default user name and password.

- c. Obtain an IP address, subnet mask, and gateway information for the Ethernet management 1 port on each bridge.
- d. Disable VPN clients on the computer you are using for setup.

Active VPN clients cause the QuickNAV scan for bridges to fail.

5. Acquire four screws for each bridge to flush-mount the bridge “L” brackets securely to the front of the rack.

The openings in the bridge “L” brackets are compliant with rack standard ETA-310-X for 19-inch (482.6 mm) racks.

6. If necessary, update the FC switch zoning to accommodate the new bridges that are being added to the configuration.

If you are using the Reference Configuration Files provided by NetApp, the zones have been created for all ports, so you do not need to make any zoning updates. There must be a storage zone for each switch port that connects to the FC ports of the bridge.

Hot-adding a stack of SAS disk shelves and bridges

You can hot-add a stack of SAS disk shelves and bridges to increase the capacity of the bridges.

The system must meet all of the requirements to hot-add a stack of SAS disk shelves and bridges.

[Preparing to hot-add a stack of SAS disk shelves and bridges](#)

- Hot-adding a stack of SAS disk shelves and bridges is a nondisruptive procedure if all of the interoperability requirements are met.

[NetApp Interoperability Matrix Tool](#)

[Using the Interoperability Matrix Tool to find MetroCluster information](#)

- Multipath HA is the only supported configuration for MetroCluster systems that are using bridges.

Both controller modules must have access through the bridges to the disk shelves in each stack.

- You should hot-add an equal number of disk shelves at each site.
- If you will be using in-band management of the bridge rather than IP management, the steps for configuring the Ethernet port and IP settings can be skipped, as noted in the relevant steps.



Starting with ONTAP 9.8, the **storage bridge** command is replaced with **system bridge**. The following steps show the **storage bridge** command, but if you are running ONTAP 9.8 or later, the **system bridge** command is preferred.



If you insert a SAS cable into the wrong port, when you remove the cable from a SAS port, you must wait at least 120 seconds before plugging the cable into a different SAS port. If you fail to do so, the system will not recognize that the cable has been moved to another port.

Steps

1. Properly ground yourself.
2. From the console of either controller module, check whether your system has disk autoassignment enabled:

storage disk option show

The Auto Assign column indicates whether disk autoassignment is enabled.

Node	BKg. FW. Upd.	Auto Copy	Auto Assign	Auto Assign Policy
node_A_1	on	on	on	default
node_A_2	on	on	on	default
2 entries were displayed.				

3. Disable the switch ports for the new stack.
4. If configuring for in-band management, connect a cable from FibreBridge RS-232 serial port to the serial (COM) port on a personal computer.

The serial connection will be used for initial configuration, and then in-band management via ONTAP and the FC ports can be used to monitor and manage the bridge.

5. If configuring for IP management, configure the Ethernet management 1 port for each bridge by following the procedure in section 2.0 of the *ATTO FibreBridge Installation and Operation Manual* for your bridge model.

In systems running ONTAP 9.5 or later, in-band management can be used to access the bridge via the FC ports rather than the Ethernet port. Starting with ONTAP 9.8, only in-band management is supported and SNMP management is deprecated.

When running QuickNAV to configure an Ethernet management port, only the Ethernet management port that is connected by the Ethernet cable is configured. For example, if you also wanted to configure the Ethernet management 2 port, you would need to connect the Ethernet cable to port 2 and run QuickNAV.

6. Configure the bridge.

If you retrieved the configuration information from the old bridge, use the information to configure the new bridge.

Be sure to make note of the user name and password that you designate.

The *ATTO FibreBridge Installation and Operation Manual* for your bridge model has the most current information on available commands and how to use them.



Do not configure time synchronization on ATTO FibreBridge 7600N or 7500N. The time synchronization for ATTO FibreBridge 7600N or 7500N is set to the cluster time after the bridge is discovered by ONTAP. It is also synchronized periodically once a day. The time zone used is GMT and is not changeable.

- a. If configuring for IP management, configure the IP settings of the bridge.

To set the IP address without the QuickNAV utility, you need to have a serial connection to the FibreBridge.

If using the CLI, you must run the following commands:

```
set ipaddress mp1 ip-address
```

```
set ipsubnetmask mp1 subnet-mask
```

```
set ipgateway mp1 x.x.x.x
```

```
set ipdhcp mp1 disabled
```

```
set ethernetspeed mp1 1000
```

- b. Configure the bridge name.

The bridges should each have a unique name within the MetroCluster configuration.

Example bridge names for one stack group on each site:

- bridge_A_1a
 - bridge_A_1b
 - bridge_B_1a
 - bridge_B_1b
- If using the CLI, you must run the following command:

```
set bridgename bridgename
```

- c. If running ONTAP 9.4 or earlier, enable SNMP on the bridge:

```
set SNMP enabled
```

In systems running ONTAP 9.5 or later, in-band management can be used to access the bridge via the FC ports rather than the Ethernet port. Starting with ONTAP 9.8, only in-band management is supported and SNMP management is deprecated.

7. Configure the bridge FC ports.

- a. Configure the data rate/speed of the bridge FC ports.

The supported FC data rate depends on your model bridge.

- The FibreBridge 7600 bridge supports up to 32, 16, or 8 Gbps.
- The FibreBridge 7500 bridge supports up to 16, 8, or 4 Gbps.
- The FibreBridge 6500 bridge supports up to 8, 4, or 2 Gbps.



The FCDataRate speed you select is limited to the maximum speed supported by both the bridge and the switch to which the bridge port connects. Cabling distances must not exceed the limitations of the SFPs and other hardware.

If using the CLI, you must run the following command:

```
set FCDataRate port-number port-speed
```

- b. If you are configuring a FibreBridge 7500N or 6500N bridge, configure the connection mode that the port uses to ptp.



The FCConnMode setting is not required when configuring a FibreBridge 7600N bridge.

If using the CLI, you must run the following command:

```
set FCConnMode port-number ptp
```

- c. If you are configuring a FibreBridge 7600N or 7500N bridge, you must configure or disable the FC2 port.

- If you are using the second port, you must repeat the previous substeps for the FC2 port.
- If you are not using the second port, then you must disable the port:

```
FCPortDisable port-number
```

- d. If you are configuring a FibreBridge 7600N or 7500N bridge, disable the unused SAS ports:

```
SASPortDisable sas-port
```



SAS ports A through D are enabled by default. You must disable the SAS ports that are not being used. If only SAS port A is used, then SAS ports B, C, and D must be disabled.

8. Secure access to the bridge and save the bridge's configuration.

- a. From the controller prompt check the status of the bridges:

```
storage bridge show
```

The output shows which bridge is not secured.

- b. Check the status of the unsecured bridge's ports:

```
info
```

The output shows the status of Ethernet ports MP1 and MP2.

- c. If Ethernet port MP1 is enabled, run the following command:

```
set EthernetPort mp1 disabled
```




If Ethernet port MP2 is also enabled, repeat the previous substep for port MP2.

- d. Save the bridge's configuration.

You must run the following commands:

SaveConfiguration

FirmwareRestart

You are prompted to restart the bridge.

9. Update the FibreBridge firmware on each bridge.

If the new bridge is the same type as the partner bridge upgrade to the same firmware as the partner bridge. If the new bridge is a different type to the partner bridge, upgrade to the latest firmware supported by the bridge and version of ONTAP. See the section "Updating firmware on a FibreBridge bridge" in the *MetroCluster Maintenance Guide*.

10. Cable the disk shelves to the bridges:

- a. Daisy-chain the disk shelves in each stack.

The *Installation Guide* for your disk shelf model provides detailed information about daisy-chaining disk shelves.

- b. For each stack of disk shelves, cable IOM A of the first shelf to SAS port A on FibreBridge A, and then cable IOM B of the last shelf to SAS port A on FibreBridge B.

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

[Stretch MetroCluster installation and configuration](#)

Each bridge has one path to its stack of disk shelves; bridge A connects to the A-side of the stack through the first shelf, and bridge B connects to the B-side of the stack through the last shelf.



The bridge SAS port B is disabled.

11. Verify that each bridge can detect all of the disk drives and disk shelves to which the bridge is connected.

If you are using the...	Then...
ATTO ExpressNAV GUI	<p>a. In a supported web browser, enter the IP address of a bridge in the browser box.</p> <p>You are brought to the ATTO FibreBridge home page, which has a link.</p> <p>b. Click the link, and then enter your user name and the password that you designated when you configured the bridge.</p> <p>The ATTO FibreBridge status page appears with a menu to the left.</p> <p>c. Click Advanced in the menu.</p> <p>d. View the connected devices: sastargets</p> <p>e. Click Submit.</p>
Serial port connection	<p>View the connected devices:</p> <p>sastargets</p>

The output shows the devices (disks and disk shelves) to which the bridge is connected. The output lines are sequentially numbered so that you can quickly count the devices.



If the text response truncated appears at the beginning of the output, you can use Telnet to connect to the bridge, and then view all of the output by using the **sastargets** command.

The following output shows that 10 disks are connected:

```

Tgt  VendorID  ProductID      Type          SerialNumber
 0  NETAPP    X410_S15K6288A15  DISK          3QP1CLE300009940UHJV
 1  NETAPP    X410_S15K6288A15  DISK          3QP1ELF600009940V1BV
 2  NETAPP    X410_S15K6288A15  DISK          3QP1G3EW00009940U2M0
 3  NETAPP    X410_S15K6288A15  DISK          3QP1EWMP00009940U1X5
 4  NETAPP    X410_S15K6288A15  DISK          3QP1FZLE00009940G8YU
 5  NETAPP    X410_S15K6288A15  DISK          3QP1FZLF00009940TZKZ
 6  NETAPP    X410_S15K6288A15  DISK          3QP1CEB400009939MGXL
 7  NETAPP    X410_S15K6288A15  DISK          3QP1G7A900009939FNNT
 8  NETAPP    X410_S15K6288A15  DISK          3QP1FY0T00009940G8PA
 9  NETAPP    X410_S15K6288A15  DISK          3QP1FXW600009940VERQ

```

- Verify that the command output shows that the bridge is connected to all of the appropriate disks and disk shelves in the stack.

If the output is...	Then...
Correct	Repeat Step 11 for each remaining bridge.
Not correct	a. Check for loose SAS cables or correct the SAS cabling by repeating Step 10. b. Repeat Step 11.


13. If you are configuring a fabric-attached MetroCluster configuration, cable each bridge to the local FC switches, using the cabling shown in the table for your configuration, switch model, and FC-to-SAS bridge model:




Brocade and Cisco switches use different port numbering, as shown in the following tables.

- On Brocade switches, the first port is numbered “0”.
- On Cisco switches, the first port is numbered “1”.

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)												
DR GROUP 1												
			Brocade 6505		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade G720	
Component	Port		Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2
Stack 1	bridge _x_1a	FC1	8		8		8		8		10	
		FC2	-	8	-	8	-	8	-	8	-	10
	bridge _x_1B	FC1	9	-	9	-	9	-	9	-	11	-
		FC2	-	9	-	9	-	9	-	9	-	11
Stack 2	bridge _x_2a	FC1	10	-	10	-	10	-	10	-	14	-
		FC2	-	10	-	10	-	10	-	10	-	14
	bridge _x_2B	FC1	11	-	11	-	11	-	11	-	17	-
		FC2	-	11	-	11	-	11	-	11	-	17

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)												
Stack 3	bridge_x_3a	FC1	12	-	12	-	12	-	12	-	18	-
		FC2	-	12	-	12	-	12	-	12	-	18
	bridge_x_3B	FC1	13	-	13	-	13	-	13	-	19	-
		FC2	-	13	-	13	-	13	-	13	-	19
Stack y	bridge_x_3a	FC1	14	-	14	-	14	-	14	-	20	-
		FC2	-	14	-	14	-	14	-	14	-	20
	bridge_x_3b	FC1	15	-	15	-	15	-	15	-	21	-
		FC2		15		15		15	-	15	-	21
		Additional bridges can be cabled to ports 16, 17, 20 and 21 in G620, G630, G620-1, and G630-1 switches.										

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)										
DR GROUP 2										
			Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G720	
Component	Port		Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	switch 2
Stack 1	bridge_x_51a	FC1	26	-	32	-	56	-	32	-
		FC2	-	26	-	32	-	56	-	32
	bridge_x_51b	FC1	27	-	33	-	57	-	33	-
		FC2	-	27	-	33	-	57	-	33

Configurations using FibreBridge 7500N or 7600N using both FC ports (FC1 and FC2)										
Stack 2	bridge_x_52a	FC1	30	-	34	-	58	-	34	-
		FC2	-	30	-	34	-	58	-	34
	bridge_x_52b	FC1	31	-	35	-	59	-	35	-
		FC2	-	31	-	35	-	59	-	35
Stack 3	bridge_x_53a	FC1	32	-	36	-	60	-	36	-
		FC2	-	32	-	36	-	60	-	36
	bridge_x_53b	FC1	33	-	37	-	61	-	37	-
		FC2	-	33	-	37	-	61	-	37
Stack y	bridge_x_5ya	FC1	34	-	38	-	62	-	38	-
		FC2	-	34	-	38	-	62	-	38
	bridge_x_5yb	FC1	35	-	39	-	63	-	39	-
		FC2	-	35	-	39	-	63	-	39
<div><div></div><div>Additional bridges can be cabled to ports 36 - 39 in G620, G630, G620-1, and G-630-1 switches.</div></div>										

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only											
DR GROUP 1											
		Brocade 6505		Brocade 6510, Brocade DCX 8510-8		Brocade 6520		Brocade G620, brocade G620-1, Brocade G630, Brocade G630-1		Brocade G720	
Component	Port	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2	Switch 1	Switch 2
Stack 1	bridge_x_1a	8		8		8		8		10	
	bridge_x_1b	-	8	-	8	-	8	-	8	-	10

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only


Stack 2	bridge_x_2a	9	-	9	-	9	-	9	-	11	-
	bridge_x_2b	-	9	-	9	-	9	-	9	-	11
Stack 3	bridge_x_3a	10	-	10	-	10	-	10	-	14	-
	bridge_x_4b	-	10	-	10	-	10	-	10	-	14
Stack y	bridge_x_ya	11	-	11	-	11	-	11	-	15	-
	bridge_x_yb	-	11	-	11	-	11	-	11	-	15



Additional bridges can be cabled to ports 12 - 17, 20 and 21 in G620, G630, G620-1, and G630-1 switches. Additional bridges can be cabled to ports 16 - 17, 20 and 21 G720 switches.

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only

DR GROUP 2											
		Brocade G720		Brocade G620, Brocade G620-1, Brocade G630, Brocade G630-1		Brocade 6510, Brocade DCX 8510-8		Brocade 6520			
Stack 1	bridge_x_51a	32	-	26	-	32	-	56	-		
	bridge_x_51b	-	32	-	26	-	32	-	56		
Stack 2	bridge_x_52a	33	-	27	-	33	-	57	-		
	bridge_x_52b	-	33	-	27	-	33	-	57		

Configurations using FibreBridge 6500N bridges or FibreBridge 7500N or 7600N using one FC port (FC1 or FC2) only									
Stack 3	bridge_x_53a	34	-	30	-	34	-	58	-
	bridge_x_54b	-	34	-	30	-	34	-	58
Stack y	bridge_x_ya	35	-	31	-	35	-	59	-
	bridge_x_yb	-	35	-	31	-	35	-	59
 Additional bridges can be cabled to ports 32 - 39 in G620, G630, G620-1, and G630-1 switches. Additional bridges can be cabled to ports 36 - 39 in G720 switches.									

14. If you are configuring a bridge-attached MetroCluster system, cable each bridge to the controller modules:
 - a. Cable FC port 1 of the bridge to a 16 Gb or 8 Gb FC port on the controller module in cluster_A.
 - b. Cable FC port 2 of the bridge to the same speed FC port of the controller module in cluster_A.
 - c. Repeat these substeps on other subsequent bridges until all of the bridges have been cabled.
15. Update the disk drive firmware to the most current version from the system console:

disk_fw_update

You must run this command on both controller modules.

[NetApp Downloads: Disk Drive Firmware](#)

16. Update the disk shelf firmware to the most current version by using the instructions for the downloaded firmware.

You can run the commands in the procedure from the system console of either controller module.

[NetApp Downloads: Disk Shelf Firmware](#)

17. If your system does not have disk autoassignment enabled, assign disk drive ownership.

[Disk and aggregate management](#)



If you are splitting the ownership of a single stack of disk shelves among multiple controller modules, you must disable disk autoassignment on both nodes in the cluster (`storage disk option modify -autoassign off *`) before assigning disk ownership; otherwise, when you assign any single disk drive, the remaining disk drives might be automatically assigned to the same controller module and pool.



You must not add disk drives to aggregates or volumes until after the disk drive firmware and disk shelf firmware have been updated and the verification steps in this task have been completed.

18. Enable the switch ports for the new stack.

19. 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.

20. If applicable, repeat this procedure for the partner site.

Related information

[In-band management of the FC-to-SAS bridges](#)

Hot-adding a SAS disk shelf to a stack of SAS disk shelves

You can hot-add one or more SAS disk shelves to a stack of SAS disk shelves.

Preparing to hot-add SAS disk shelves

Preparing to hot-add a SAS disk shelf involves downloading documents as well as the disk drive and disk shelf firmware.

- Your system must be a supported configuration and must be running a supported version of ONTAP.
- All disk drives and disk shelves in the system must be running the latest firmware version.

You might want to update the disk and shelf firmware throughout the MetroCluster configuration prior to adding shelves.

[Upgrade, revert, or downgrade](#)



A mix of IOM12 modules and IOM6 modules is supported within the same stack if your system is running a supported version of ONTAP. To establish whether your version of ONTAP supports shelf mixing, refer to the Interoperability Matrix Tool (IMT). <https://mysupport.netapp.com/NOW/products/interoperability>[NetApp Interoperability] If your version of ONTAP is not supported and you cannot upgrade or downgrade the IOM modules on the existing stack or the new shelf that is to be added to a supported combination of IOM modules, you need to do one of the following:

- Start a new stack on a new SAS port (if supported by the bridge-pair).
- Start a new stack on an additional bridge-pair.

Steps

1. Download or view the following documents from the NetApp Support Site:
 - [NetApp Interoperability Matrix Tool](#)
 - The *Installation Guide* for your disk shelf model.
2. Verify that the disk shelf you are hot-adding is supported.

[NetApp Interoperability Matrix Tool](#)

3. Download the latest disk and disk shelf firmware:



In this step, you are only completing the download portion of the instructions provided in the links. You need to follow the steps found in the [Hot-adding a disk shelf](#) section for installing the disk shelf.

- a. Download the disk firmware and make a copy of the disk firmware instructions for reference later.

[NetApp Downloads: Disk Drive Firmware](#)

- b. Download the disk shelf firmware and make a copy of the disk shelf firmware instructions for reference later.

[NetApp Downloads: Disk Shelf Firmware](#)

Hot-adding a disk shelf

You can hot-add a disk shelf when you want to increase storage without any reduction in performance.

- The system must meet all of the requirements in [Preparing to hot-add SAS disk shelves](#).
- Your environment must meet one of the following scenarios to hot-add a shelf:
 - You have two FibreBridge 7500N bridges connected to a stack of SAS disk shelves.
 - You have one FibreBridge 7500N bridge and one FibreBridge 6500N bridge connected to a stack of SAS disk shelves.
 - You have two FibreBridge 6500N bridges connected to a stack of SAS disk shelves.
- This procedure is for hot-adding a disk shelf to the last disk shelf in a stack.

This procedure is written with the assumption that the last disk shelf in a stack is connected from IOM A to

bridge A and from IOM B to bridge B.

- This is a nondisruptive procedure.
- You should hot-add an equal number of disk shelves at each site.
- If you are hot-adding more than one disk shelf, you must hot-add one disk shelf at a time.



Each pair of FibreBridge 7500N or 7600N bridges can support up to four stacks.



Hot-adding a disk shelf requires you to update the disk drive firmware on the hot-added disk shelf by running the `storage disk firmware update` command in advanced mode. Running this command can be disruptive if the firmware on existing disk drives in your system is an older version.



If you insert a SAS cable into the wrong port, when you remove the cable from a SAS port, you must wait at least 120 seconds before plugging the cable into a different SAS port. If you fail to do so, the system will not recognize that the cable has been moved to another port.

Steps

1. Properly ground yourself.
2. Verify disk shelf connectivity from the system console of either controller:

sysconfig -v

The output is similar to the following:

- Each bridge on a separate line and under each FC port to which it is visible; for example, hot-adding a disk shelf to a set of FibreBridge 7500N bridges results in the following output:

```
FC-to-SAS Bridge:
cisco_A_1-1:9.126L0: ATTO  FibreBridge7500N 2.10  FB7500N100189
cisco_A_1-2:1.126L0: ATTO  FibreBridge7500N 2.10  FB7500N100162
```

- Each disk shelf on a separate line under each FC port to which it is visible:

```
Shelf    0: IOM6  Firmware rev. IOM6 A: 0173 IOM6 B: 0173
Shelf    1: IOM6  Firmware rev. IOM6 A: 0173 IOM6 B: 0173
```

- Each disk drive on a separate line under each FC port to which it is visible:

```
cisco_A_1-1:9.126L1    : NETAPP    X421_HCOBD450A10 NA01 418.0GB
(879097968 520B/sect)
cisco_A_1-1:9.126L2    : NETAPP    X421_HCOBD450A10 NA01 418.0GB
(879097968 520B/sect)
```

3. Check whether your system has disk autoassignment enabled from the console of either controller:

storage disk option show

The autoassignment policy is shown in the Auto Assign column.

Node	BKg. FW. Upd.	Auto Copy	Auto Assign	Auto Assign Policy
node_A_1	on	on	on	default
node_A_2	on	on	on	default
2 entries were displayed.				

4. If your system does not have disk autoassignment enabled, or if disk drives in the same stack are owned by both controllers, assign disk drives to the appropriate pools.

Disk and aggregate management



If you are splitting a single stack of disk shelves between two controllers, disk autoassignment must be disabled before you assign disk ownership; otherwise, when you assign any single disk drive, the remaining disk drives might be automatically assigned to the same controller and pool.

The `storage disk option modify -node node-name -autoassign off` command disables disk autoassignment.



Disk drives must not be added to aggregates or volumes until the disk drive and disk shelf firmware have been updated.

5. Update the disk shelf firmware to the most current version by using the instructions for the downloaded firmware.

You can run the commands in the procedure from the system console of either controller.

NetApp Downloads: Disk Shelf Firmware

6. Install and cable the disk shelf:

Note the following considerations:

- For FibreBridge 6500N bridges:

Wait at least 10 seconds before connecting the port. The SAS cable connectors are keyed; when oriented correctly into a SAS port, the connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector).

- For FibreBridge 7500N bridges:

Do not force a connector into a port. The mini-SAS cables are keyed; when oriented correctly into a SAS port, the SAS cable clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented up (on the topside of the

connector).

- a. Install the disk shelf, power it on, and set the shelf ID.

The *Installation Guide* for your disk shelf model provides detailed information about installing disk shelves.



You must power-cycle the disk shelf and keep the shelf IDs unique for each SAS disk shelf within the entire storage system.

- b. Disconnect the SAS cable from the IOM B port of the last shelf in the stack, and then reconnect it to the same port in the new shelf.

The other end of this cable remains connected to bridge B.

- c. Daisy-chain the new disk shelf by cabling the new shelf IOM ports (of IOM A and IOM B) to the last shelf IOM ports (of IOM A and IOM B).

The *Installation Guide* for your disk shelf model provides detailed information about daisy-chaining disk shelves.

7. Update the disk drive firmware to the most current version from the system console.

NetApp Downloads: Disk Drive Firmware

- a. Change to the advanced privilege level:

```
set -privilege advanced
```

You need to respond with **y** when prompted to continue into advanced mode and see the advanced mode prompt (*>).

- b. Update the disk drive firmware to the most current version from the system console:

```
storage disk firmware update
```

- c. Return to the admin privilege level:

```
set -privilege admin
```

- d. Repeat the previous substeps on the other controller.

8. 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.
9. If you are hot-adding more than one disk shelf, repeat the previous steps for each disk shelf that you are hot-adding..

Hot-adding an IOM12 disk shelf to a stack of IOM6 disk shelves in a bridge-attached MetroCluster configuration

Depending on your version of ONTAP, you can hot-add an IOM12 disk shelf to a stack of IOM6 disk shelves in a bridge-attached MetroCluster configuration.

To perform this procedure, see [Hot-adding shelves with IOM12 modules to a stack of shelves with IOM6 modules](#).

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