NetApp

NS224 shelves

Install and maintain

NetApp
April 19, 2024

Table of Contents

NS224 shelves

Install and cable

Hot-add a shelf - NS224 shelves

You can hot-add an NS224 drive shelf after your HA pair meets certain requirements, and after the preparation tasks applicable to your HA pair are completed.

Requirements for a hot-add

Your HA pair must meet certain requirements before hot-adding an NS224 drive shelf.

- Your platform model and version of ONTAP must support the NS224 shelf and drives you are hot-adding.

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- You must have the correct number and type of cables to connect the shelf.

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- Your HA pair must have enough available RoCE-capable ports to support the number of shelves you are hot-adding.

  For each shelf you are hot-adding, you need a minimum of two RoCE capable ports on each controller. These ports can be on board the controllers, on RoCE-capable PCIe cards, a combination of both, or on RoCE-capable I/O modules, as supported by your platform model.

  If your HA pair does not have enough available RoCE-capable ports, and your platform model supports the use of RoCE-capable PCIe cards or I/O modules, you must have installed the additional cards or I/O modules into the correct controller slots, as supported by your platform model.

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  > ⓘ Non-dedicated RoCE-capable ports must be configured for storage use (not networking use).
  >
  > Prepare non-dedicated RoCE-capable ports for a hot-add

- If you have an AFF A700 HA pair and you are hot-adding the initial NS224 drive shelf (no NS224 drive shelf exists in your HA pair), you must have installed a core dump module (X9170A, NVMe 1TB SSD) in each controller to support core dumps (store core files).

  Replace the caching module or add/replace a core dump module — AFF A700 and FAS9000

- Your HA pair must have less than the maximum number of shelves supported, by at least the number of shelves you plan to hot-add.

  You cannot have exceeded the maximum number of shelves supported by your HA pair after hot-adding shelves.

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- If you are hot-adding a shelf to an HA pair that already has an NS224 shelf, your HA pair cannot have any storage cabling error messages, and it must be cabled as multipath HA.

  You can run Active IQ Config Advisor to view any storage cabling error messages and the corrective actions you should take.

  NetApp Downloads: Config Advisor

- You need a paper clip with one side straightened or a narrow-tipped ballpoint pen.

  To change the shelf ID, you use the paper clip or ballpoint pen to access the shelf ID button behind the Operator Display Panel (ODP).

Considerations for a hot-add

You should familiarize yourself with best practices and aspects about this procedure before hot-adding an NS224 drive shelf.

- If you have an ASA HA pair supporting NS224 shelves, you can use this procedure.
- **Best practice:** The best practice is to have the current version of the Disk Qualification Package (DQP) installed before hot-adding a shelf.

  Having the current version of the DQP installed allows your system to recognize and use newly qualified drives. This avoids system event messages about having noncurrent drive information and prevention of drive partitioning because drives are not recognized. The DQP also notifies you of noncurrent drive firmware.

  NetApp Downloads: Disk Qualification Package

- **Best practice:** The best practice is to run Active IQ Config Advisor before and after hot-adding a shelf.

  Running Active IQ Config Advisor before hot-adding a shelf provides a snap shot of the existing shelf Ethernet (ENET) connectivity, verifies NVMe shelf module (NSM) firmware versions, and allows you to verify a shelf ID already in use in the HA pair. Running Active IQ Config Advisor after hot-adding a shelf allows you to verify shelves are cabled correctly and that shelf IDs are unique within the HA pair.

  NetApp Downloads: Config Advisor

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before adding a new shelf.

  NetApp Downloads: Disk Shelf Firmware

  NetApp Downloads: Disk Drive Firmware

  (i) Do not revert firmware to a version that does not support your shelf and its components.

- After you have cabled a hot-added shelf, ONTAP recognizes the shelf:
  - Drive ownership is assigned if automatic drive assignment is enabled.
  - NSM shelf firmware and drive firmware should be updated automatically, if needed.

    (i) Firmware updates can take up to 30 minutes.

Prepare for a hot-add

You must complete the preparation tasks applicable to your HA pair before hot-adding an NS224 drive shelf.

Prepare non-dedicated RoCE-capable ports for a hot-add

If your HA pair has non-dedicated RoCE-capable ports that you are using to hot-add an NS224 drive shelf, you must make sure the ports are configured for storage use (not networking use). Depending on your platform model, the RoCE-capable ports are on board the controllers, on RoCE-capable PCIe cards, a combination of both, or on RoCE-capable I/O modules.

Before you begin

You must have met the system requirements.

Requirements for a hot-add

About this task

- For some platform models, when a RoCE-capable PCIe card or I/O module is installed in a supported slot on a controller, the ports automatically default to storage use (instead of networking); however, it is recommended that you complete this procedure to verify the RoCE-capable ports are configured for storage use.

- If you determine that the non-dedicated RoCE-capable ports in your HA pair are not configured for storage use, it is a nondisruptive procedure to configure them.

  > (i) If your HA pair is running a version of ONTAP 9.6, you need to reboot the controllers, one at a time.

  > (i) If your HA pair is running ONTAP 9.7 or later, you do not need to reboot the controllers, unless one or both controllers are in maintenance mode. This procedure assumes that neither controller is in maintenance mode.

Steps

1. Verify if the non-dedicated ports in the HA pair are configured for storage use: `storage port show`

   You can enter the command on either controller module.

   If your HA pair is running ONTAP 9.8 or later, the non-dedicated ports display `storage` in the `Mode` column.

   If your HA pair is running ONTAP 9.7 or 9.6, the non-dedicated ports, which display `false` in the `Is Dedicated?` column, also display `enabled` in the `State` column.

2. If the non-dedicated ports are configured for storage use, you are done with this procedure.

   Otherwise, you need to configure the ports by completing steps 3 through 6.

> ⓘ When non-dedicated ports are not configured for storage use, the command output displays the following:
>
> If your HA pair is running ONTAP 9.8 or later, the non-dedicated ports display `network` in the `Mode` column.
>
> If your HA pair is running ONTAP 9.7 or 9.6, the non-dedicated ports, which display `false` in the `Is Dedicated?`` column, also display `disabled` in the `State` column.

3. Configure the non-dedicated ports for storage use, on one of the controller modules:

   You must repeat the applicable command for each port you are configuring.

If your HA pair is running…	Then…
ONTAP 9.8 or later	`storage port modify -node node name -port port name -mode storage`
ONTAP 9.7 or 9.6	`storage port enable -node node name -port port name`

4. If your HA pair is running ONTAP 9.6, reboot the controller module so that the port changes take effect: `system node reboot -node node name -reason reason for the reboot`

   Otherwise, go to the next step.

   > ⓘ The reboot can take up to 15 minutes.

5. Repeat steps for the second controller module:

If your HA pair is running…	Then…
ONTAP 9.7 or later	a. Repeat step 3. b. Go to step 6.
ONTAP 9.6	a. Repeat steps 3 and 4. > ⓘ The first controller must have already completed its reboot. b. Go to step 6.

6. Verify that the non-dedicated ports on both controller modules are configured for storage use: `storage port show`

   You can enter the command on either controller module.

   If your HA pair is running ONTAP 9.8 or later, the non-dedicated ports display `storage` in the `Mode` column.

If your HA pair is running ONTAP 9.7 or 9.6, the non-dedicated ports, which display `false` in the `Is Dedicated?` column, also display `enabled` in the `State` column.

Prepare an AFF A700, AFF A800, AFF C800, AFF A400, or AFF C400 HA pair to hot-add a second shelf

If you have an AFF A700, AFF A800, AFF C800, AFF A400, or AFF C400 HA pair with one NS224 drive shelf that is cabled to one set of RoCE-capable ports on each controller, you must recable the shelf (after you have installed the additional RoCE-capable PCIe cards or I/O modules) across both sets of ports on each controller, before hot-adding the second shelf.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have enabled the ports on the RoCE-capable PCIe cards or I/O modules you installed.

  Prepare non-dedicated RoCE-capable ports for a hot-add

About this task

- Recabling port connections is a nondisruptive procedure when your shelf has multipath-HA connectivity.

  You recable the first shelf across both sets of ports on each controller so that when you hot-add the second shelf, both shelves have more resilient connectivity.

- You move one cable at a time to maintain connectivity to the shelf at all times during this procedure.

Steps

1. Recable the existing shelf's connections across both sets of ports on each controller, as applicable to your platform model.

   (i) Moving a cable does not require any wait time between unplugging the cable from one port and plugging it into another port.

If you have an…	Then…
AFF A700 HA pair	(i) The substeps assume the existing shelf is cabled to RoCE-capable I/O modules in slot 3 on each controller. (i) If needed, you can reference cabling illustrations showing an existing single shelf and the recabled shelf, in a two shelf configuration. Cable a hot-add shelf for an AFF A700 HA pair a. On controller A, move the cable from slot 3 port b (e3b) to slot 7 port b (e7b). b. Repeat the same cable move on controller B.

If you have an…	Then…
AFF A800 or AFF C800 HA pair	ⓘ The substeps assume the existing shelf is cabled to RoCE-capable PCIe cards in slot 5 on each controller.
	ⓘ If needed, you can reference cabling illustrations showing an existing single shelf and the recabled shelf, in a two shelf configuration. Cable a hot-add shelf for an AFF A800 or AFF C800 HA pair a. On controller A, move the cable from slot 5 port b (e5b) to slot 3 port b (e3b). b. Repeat the same cable move on controller B.
AFF A400 HA pair	ⓘ If needed, you can reference cabling illustrations showing an existing single shelf and the recabled shelf, in a two shelf configuration. Cable a hot-add shelf for an AFF A400 HA pair a. On controller A, move the cable from port e0d to slot 5 Port b (e5b). b. Repeat the same cable move on controller B.
AFF C400 HA pair	ⓘ If needed, you can reference cabling illustrations showing an existing single shelf and the recabled shelf, in a two shelf configuration. Cable a hot-add shelf for an AFF C400 HA pair a. On controller A, move the cable from slot 4 port a (e4a) to slot 5 port b (e5b). b. Repeat the same cable move on controller B.

2. Verify that the recabled shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

Prepare to manually assign drive ownership for a hot-add

If you are manually assigning drive ownership for the NS224 drive shelf you are hot-adding, then you need to disable automatic drive assignment if it is enabled.

Before you begin

You must have met the system requirements.

Requirements for a hot-add

About this task

You need to manually assign drive ownership if drives in the shelf will be owned by both controller modules in the HA pair.

Steps

1. Verify whether automatic drive assignment is enabled: `storage disk option show`

   You can enter the command on either controller module.

   If automatic drive assignment is enabled, the output shows `on` in the `Auto Assign` column (for each controller module).

2. If automatic drive assignment is enabled, disable it: `storage disk option modify -node node_name -autoassign off`

   You must disable automatic drive assignment on both controller modules.

Install a drive shelf for a hot-add

Installing a new NS224 drive shelf involves installing the shelf into a rack or cabinet, connecting the power cords (which automatically powers on the shelf), and then setting the shelf ID.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have completed the applicable preparation procedures.

  Prepare for a hot-add

Steps

1. Install the rail-mount kit that came with your shelf by using the installation flyer that came in the kit box.

   > ⓘ   Do not flange-mount the shelf.

2. Install and secure the shelf onto the support brackets and rack or cabinet by using the installation flyer.

   > ⓘ   A fully loaded NS224 shelf can weigh up to 66.78 lbs (30.29 kg) and requires two people to lift or use of a hydraulic lift. Avoid removing shelf components (from the front or rear of the shelf) to reduce the shelf weight, because shelf weight will become unbalanced.

3. Connect the power cords to the shelf, secure them in place with the power cord retainer if they are AC power supplies, or the two thumb screws if they are DC power supplies, and then connect the power cords to different power sources for resiliency.

   A shelf powers up when connected to a power source; it does not have power switches. When functioning correctly, a power supply's bicolored LED illuminates green.

4. Set the shelf ID to a number that is unique within the HA pair:

   More detailed instructions are available:

Change a shelf ID - NS224 shelves

a. Remove the left end cap and locate the small hole to the right of the LEDs.

b. Insert the end of a paper clip or similar tool into the small hole to reach the shelf ID button.

c. Press and hold the button (for up to 15 seconds) until the first number on the digital display blinks, and then release the button.

> (i) If the ID takes longer than 15 seconds to blink, press and hold the button again, making sure to press it in all the way.

d. Press and release the button to advance the number until you reach the desired number from 0 to 9.

e. Repeat substeps 4c and 4d to set the second number of the shelf ID.

It can take up to three seconds (instead of 15 seconds) for the number to blink.

f. Press and hold the button until the second number stops blinking.

After about five seconds, both numbers start blinking and the amber LED on the ODP illuminates.

g. Power-cycle the shelf to make the shelf ID take effect.

You must unplug both power cords from the shelf, wait 10 seconds, and then plug them back in.

When power is restored to the power supplies, their bicolored LEDs illuminate green.

Cable a drive shelf for a hot-add

You cable each NS224 drive shelf you are hot-adding so that each shelf has two connections to each controller module in the HA pair. Depending on the number of shelves you are hot-adding and your platform model, you use RoCE-capable ports on board the controllers, on RoCE-capable PCIe cards, a combination of both, or on RoCE-capable I/O modules.

Considerations when cabling for a hot-add

Familiarizing yourself with proper cable connector orientation, and the location and labeling of ports on the NS224 NSM drive shelf modules can be helpful before cabling your hot-added shelf.

- Cables are inserted with the connector pull-tab facing up.

  When a cable is inserted correctly, it clicks into place.

  After you connect both ends of the cable, the shelf and controller port LNK (green) LEDs illuminate. If a port LNK LED does not illuminate, reseat the cable.
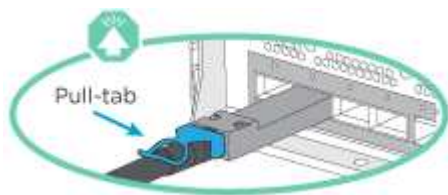
- You can use the following illustration to help you physically identify the shelf NSM ports, e0a and e0b:
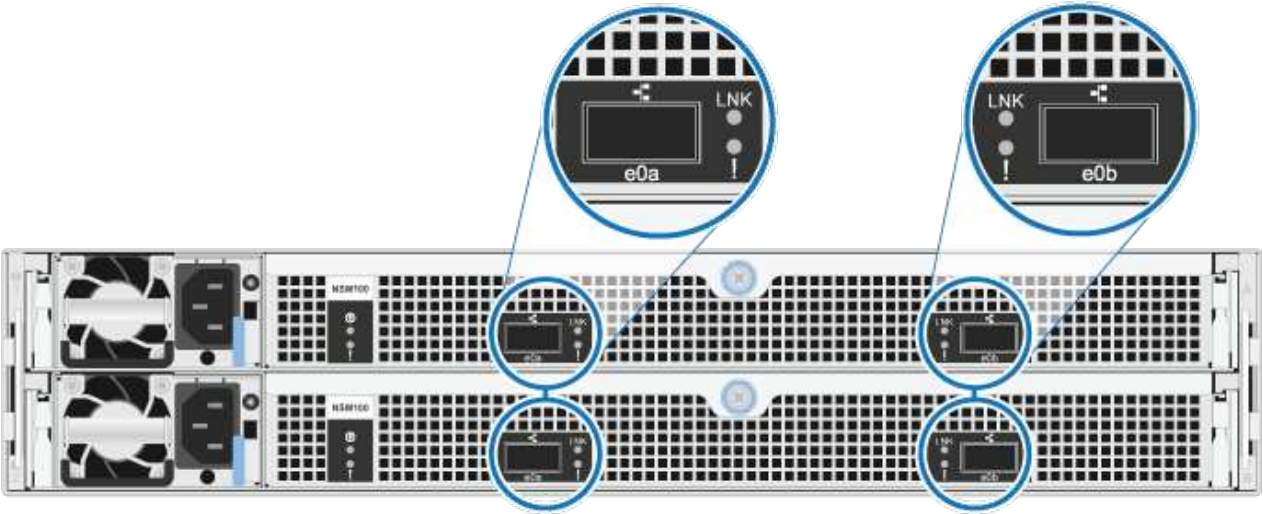
Cable a hot-add shelf for an AFF A900 HA pair

When additional storage is needed, you can hot-add up to three additional NS224 drive shelves (for a total of four shelves) to an AFF A900 HA pair.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have completed the applicable preparation procedures.

  Prepare for a hot-add

- You must have installed the shelves, powered them on, and set the shelf IDs.

  Install a drive shelf for a hot-add

About this task

- This procedure assumes that your HA pair has at least one existing NS224 shelf and that you are hot-adding up to three additional shelves.
- If your HA pair has only one existing NS224 shelf, this procedure assumes that the shelf is cabled across two RoCE-capable 100GbE I/O modules on each controller.
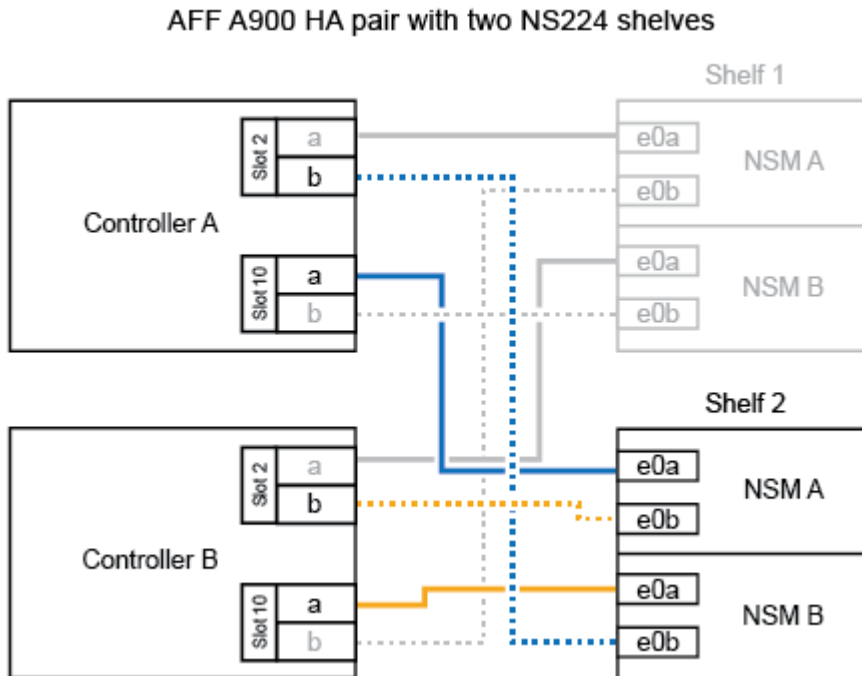
Steps

1. If the NS224 shelf you are hot-adding will be the second NS224 shelf in the HA pair, complete the following substeps.

   Otherwise, go to the next step.

   a. Cable shelf NSM A port e0a to controller A slot 10 port a (e10a).

   b. Cable shelf NSM A port e0b to controller B slot 2 port b (e2b).

   c. Cable shelf NSM B port e0a to controller B slot 10 port a (e10a).

   d. Cable shelf NSM B port e0b to controller A slot 2 port b (e2b).

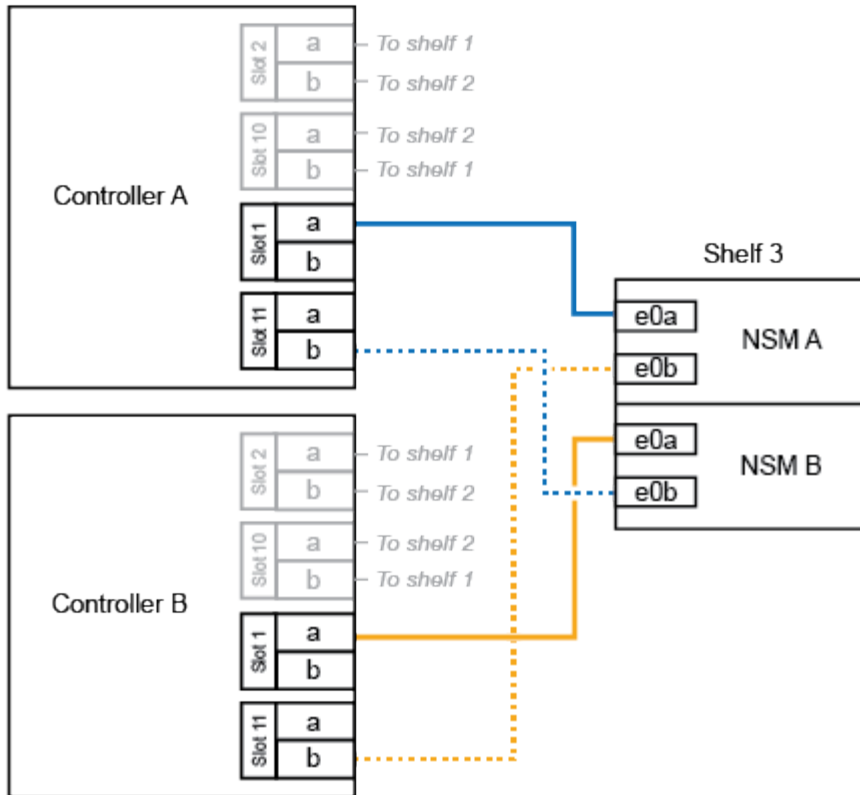The following illustration shows the second shelf cabling (and the first shelf).

AFF A900 HA pair with two NS224 shelves

2. If the NS224 shelf you are hot-adding will be the third NS224 shelf in the HA pair, complete the following substeps.

   Otherwise, go to the next step.

   a. Cable shelf NSM A port e0a to controller A slot 1 port a (e1a).

   b. Cable shelf NSM A port e0b to controller B slot 11 port b (e11b).

   c. Cable shelf NSM B port e0a to controller B slot 1 port a (e1a).

   d. Cable shelf NSM B port e0b to controller A slot 11 port b (e11b).

   The following illustration shows the third shelf cabling.

AFF A900 HA pair with three NS224 shelves

3. If the NS224 shelf you are hot-adding will be the fourth NS224 shelf in the HA pair, complete the following substeps.

   Otherwise, go to the next step.

   a. Cable shelf NSM A port e0a to controller A slot 11 port a (e11a).
   b. Cable shelf NSM A port e0b to controller B slot 1 port b (e1b).
   c. Cable shelf NSM B port e0a to controller B slot 11 port a (e11a).
   d. Cable shelf NSM B port e0b to controller A slot 1 port b (e1b).

   The following illustration shows the fourth shelf cabling.

AFF A900 HA pair with four NS224 shelves
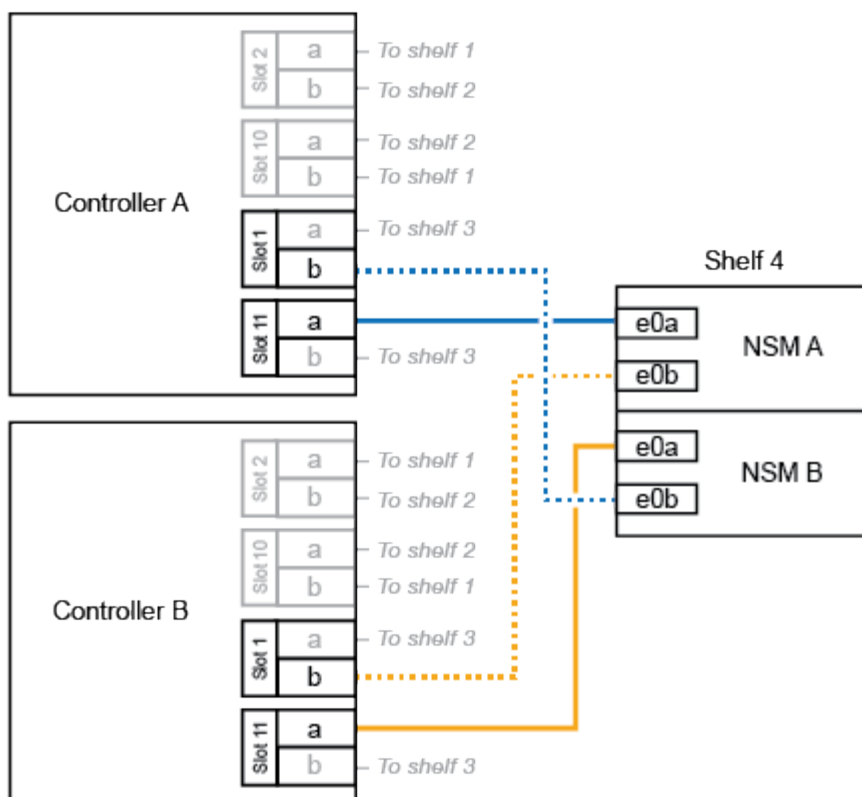
4. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

5. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then reenable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Cable a hot-add shelf for an AFF A250, AFF C250, or FAS500f HA pair

When additional storage is needed, you can hot-add an NS224 drive shelf to a FAS500f or AFF A250 HA pair.

Before you begin

- You must have met the system requirements.

   Requirements for a hot-add

- You must have completed the applicable preparation procedures.

   Prepare for a hot-add

- You must have installed the shelves, powered them on, and set the shelf IDs.

About this task

When viewed from the rear of the platform chassis, the RoCE-capable card port on the left is port "a" (e1a) and the port on the right is port "b" (e1b).

Steps

1. Cable the shelf connections:

   a. Cable shelf NSM A port e0a to controller A slot 1 port a (e1a).

   b. Cable shelf NSM A port e0b to controller B slot 1 port b (e1b).

   c. Cable shelf NSM B port e0a to controller B slot 1 port a (e1a).

   d. Cable shelf NSM B port e0b to controller A slot 1 port b (e1b).
   The following illustration shows the shelf cabling when completed.

AFF A250, AFF C250, or FAS500f HA pair with one NS224 shelf
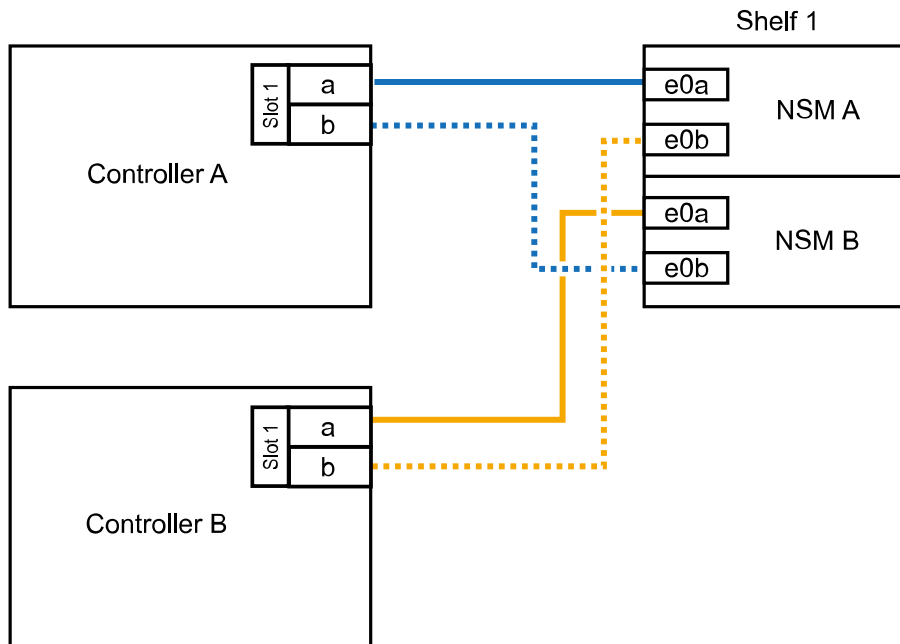
2. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

3. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then reenable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Cable a hot-add shelf for an AFF A700 HA pair

How you cable an NS224 drive shelf in an AFF A700 HA pair depends on the number of shelves you are hot-adding and the number of RoCE-capable port sets (one or two) you are using on the controller modules.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have completed the applicable preparation procedures.

  Prepare for a hot-add

- You must have installed the shelves, powered them on, and set the shelf IDs.

  Install a drive shelf for a hot-add

Steps

1. If you are hot-adding one shelf using one set of RoCE-capable ports (one RoCE capable I/O module) on each controller module, and this is the only NS224 shelf in your HA pair, complete the following substeps.

   Otherwise, go to the next step.

   > (i) This step assumes that you installed the RoCE-capable I/O module in slot 3, instead of slot 7, on each controller module.

   a. Cable shelf NSM A port e0a to controller A slot 3 port a.

   b. Cable shelf NSM A port e0b to controller B slot 3 port b.

   c. Cable shelf NSM B port e0a to controller B slot 3 port a.

   d. Cable shelf NSM B port e0b to controller A slot 3 port b.

   The following illustration shows cabling for one hot-added shelf using one RoCE-capable I/O module in each controller module:

AFF A700 HA pair with one NS224 shelf
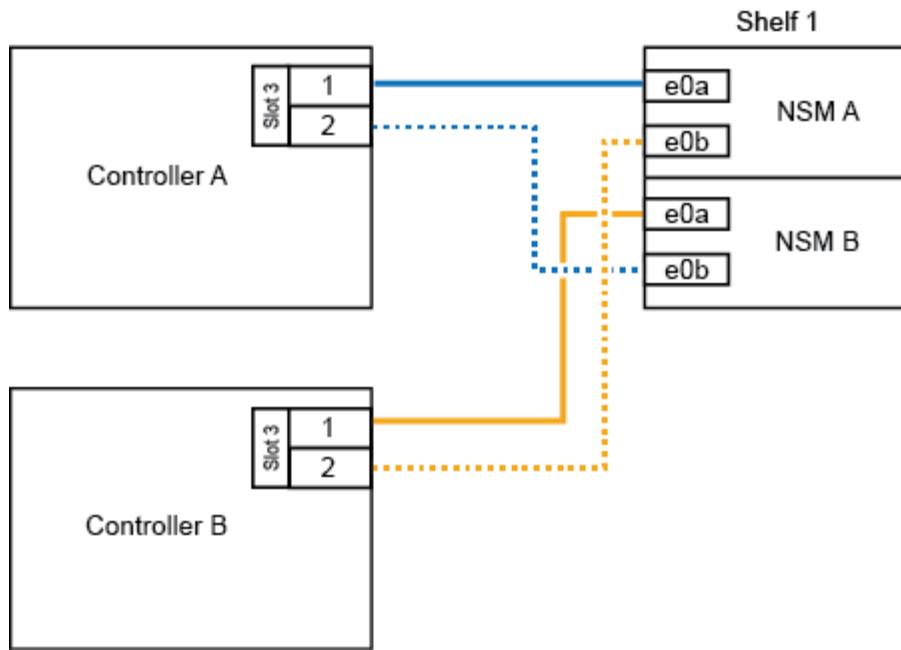
2. If you are hot-adding one or two shelves using two sets of RoCE-capable ports (two RoCE-capable I/O modules) in each controller module, complete the applicable substeps.

Shelves	Cabling
Shelf 1	(i) These substeps assume that you are beginning the cabling by cabling shelf port e0a to the RoCE-capable I/O module in slot 3, instead of slot 7. a. Cable NSM A port e0a to controller A slot 3 port a. b. Cable NSM A port e0b to controller B slot 7 port b. c. Cable NSM B port e0a to controller B slot 3 port a. d. Cable NSM B port e0b to controller A slot 7 port b. e. If you are hot-adding a second shelf, complete the "Shelf 2" substeps; otherwise, go to step 3.
Shelf 2	(i) These substeps assume that you are beginning the cabling by cabling shelf port e0a to the RoCE-capable I/O module in slot 7, instead of slot 3 (which correlates with the cabling substeps for shelf 1). a. Cable NSM A port e0a to controller A slot 7 port a. b. Cable NSM A port e0b to controller B slot 3 port b. c. Cable NSM B port e0a to controller B slot 7 port a. d. Cable NSM B port e0b to controller A slot 3 port b. e. Go to step 3.

The following illustration shows cabling for the first and second hot-added shelves:
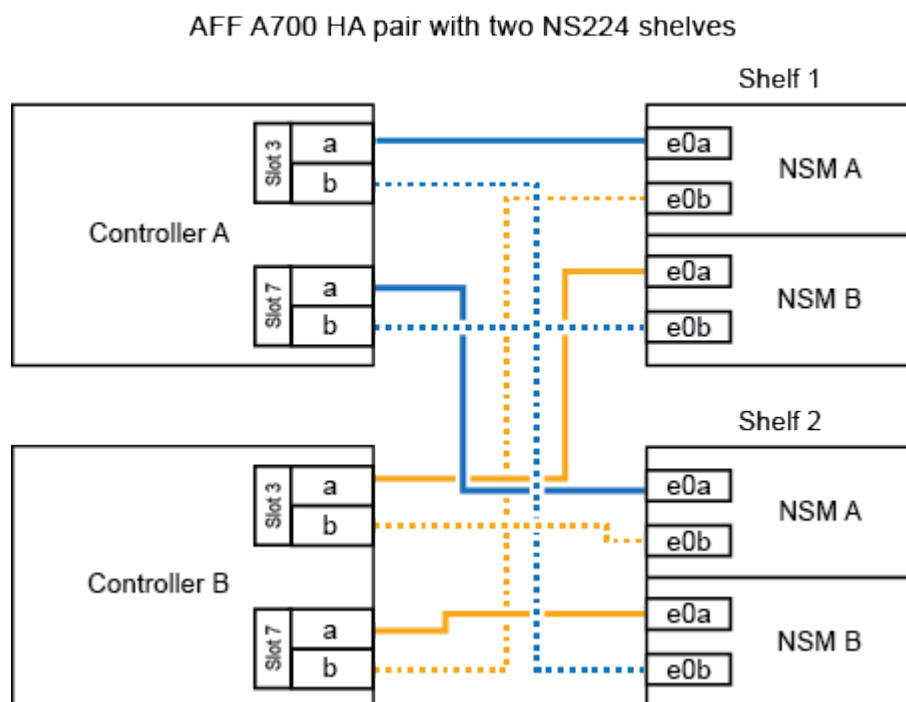
AFF A700 HA pair with two NS224 shelves

3. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

4. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then reenable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Cable a hot-add shelf for an AFF A800 or AFF C800 HA pair

How you cable an NS224 drive shelf in an AFF A800 or AFF C800 HA pair depends on the number of shelves you are hot-adding and the number of RoCE-capable port sets (one or two) you are using on the controller modules.

Before you begin

• You must have met the system requirements.

   Requirements for a hot-add

• You must have completed the applicable preparation procedures.

   Prepare for a hot-add

• You must have installed the shelves, powered them on, and set the shelf IDs.

Steps

1. If you are hot-adding one shelf using one set of RoCE-capable ports (one RoCE-capable PCIe card) on each controller module, and this is the only NS224 shelf in your HA pair, complete the following substeps.

   Otherwise, go to the next step.

   > ⓘ   This step assumes you installed the RoCE-capable PCIe card in slot 5.

   a. Cable shelf NSM A port e0a to controller A slot 5 port a (e5a).

   b. Cable shelf NSM A port e0b to controller B slot 5 port b (e5b).

   c. Cable shelf NSM B port e0a to controller B slot 5 port a (e5a).

   d. Cable shelf NSM B port e0b to controller A slot 5 port b (e5b).

   The following illustration shows cabling for one hot-added shelf using one RoCE-capable PCIe card on each controller module:
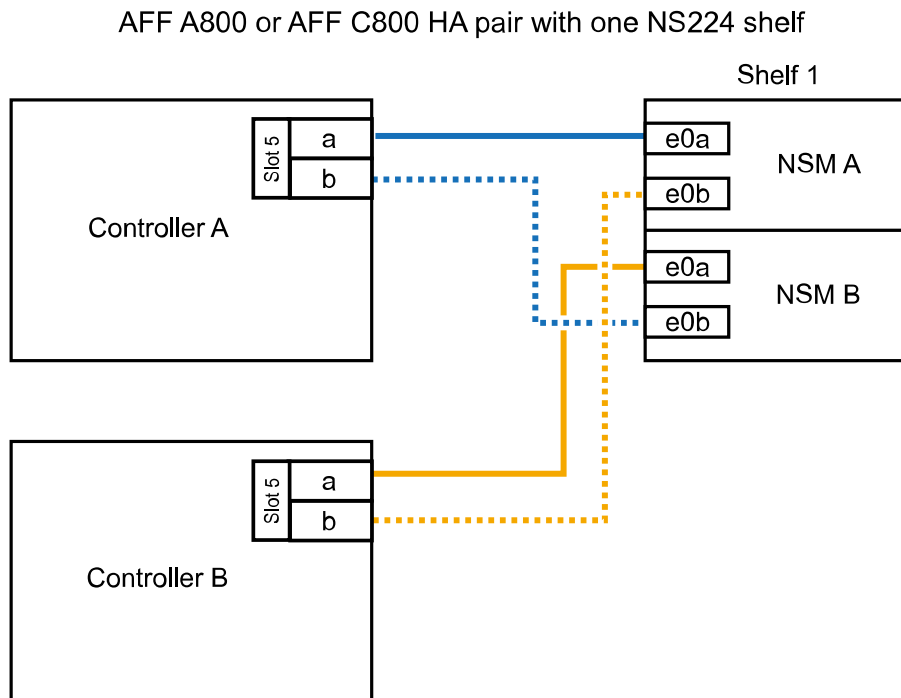
   AFF A800 or AFF C800 HA pair with one NS224 shelf

2. If you are hot-adding one or two shelves using two sets of RoCE-capable ports (two RoCE-capable PCIe cards) on each controller module, complete the applicable substeps.

   > ⓘ   This step assumes you installed the RoCE-capable PCIe cards in slot 5 and slot 3.

Shelves	Cabling
Shelf 1	(i) These substeps assume you are beginning the cabling by cabling shelf port e0a to the RoCE-capable PCIe card in slot 5, instead of slot 3. a. Cable NSM A port e0a to controller A slot 5 port a (e5a). b. Cable NSM A port e0b to controller B slot 3 port b (e3b). c. Cable NSM B port e0a to controller B slot 5 port a (e5a). d. Cable NSM B port e0b to controller A slot 3 port b (e3b). e. If you are hot-adding a second shelf, complete the "Shelf 2" substeps; otherwise, go to step 3.
Shelf 2	(i) These substeps assume you are beginning the cabling by cabling shelf port e0a to the RoCE-capable PCIe card in slot 3, instead of slot 5 (which correlates with the cabling substeps for shelf 1). a. Cable NSM A port e0a to controller A slot 3 port a (e3a). b. Cable NSM A port e0b to controller B slot 5 port b (e5b). c. Cable NSM B port e0a to controller B slot 3 port a (e3a). d. Cable NSM B port e0b to controller A slot 5 port b (e5b). e. Go to step 3.

The following illustration shows cabling for two hot-added shelves:

AFF A800 or AFF C800 HA pair with two NS224 shelves
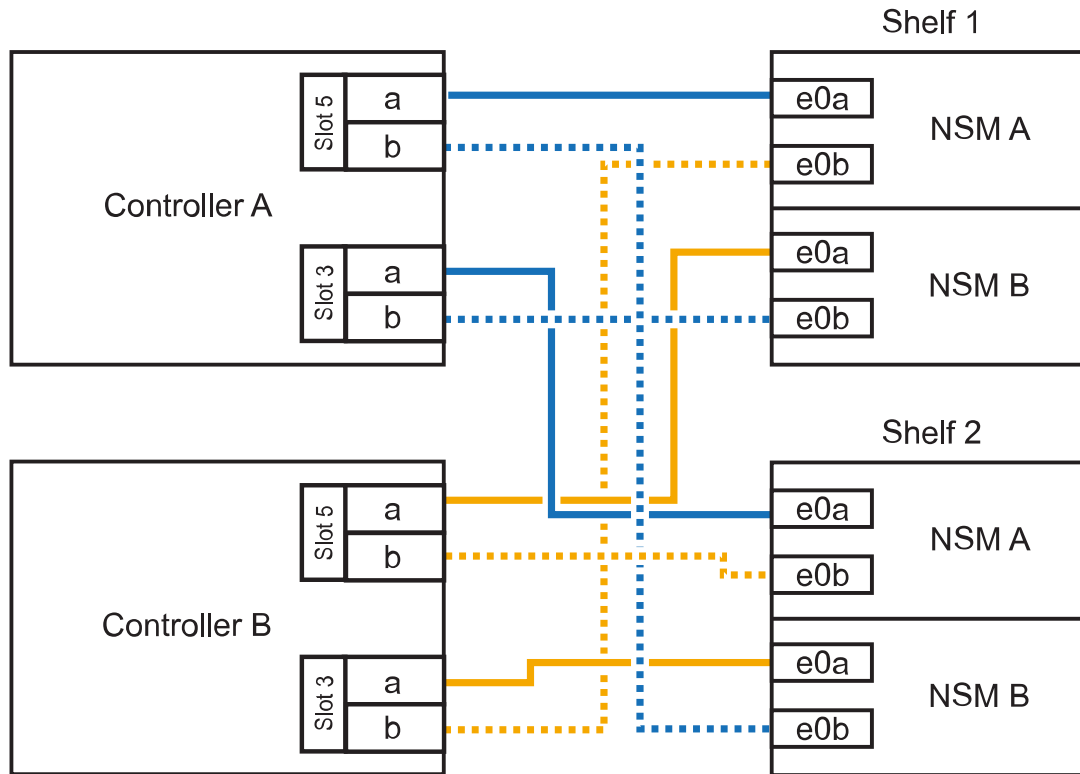
3. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

4. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then reenable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Cable a hot-add shelf for an AFF A400 HA pair

How you cable an NS224 drive shelf in an AFF A400 HA pair depends on the number of shelves you are hot-adding and the number of RoCE-capable port sets (one or two) you are using on the controller modules.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have completed the applicable preparation procedures.

  Prepare for a hot-add

- You must have installed the shelves, powered them on, and set the shelf IDs.

Steps

1. If you are hot-adding one shelf using one set of RoCE-capable ports (onboard RoCE-capable ports) on each controller module, and this is the only NS224 shelf in your HA pair, complete the following substeps.

   Otherwise, go to the next step.

   a. Cable shelf NSM A port e0a to controller A port e0c.

   b. Cable shelf NSM A port e0b to controller B port e0d.

   c. Cable shelf NSM B port e0a to controller B port e0c.

   d. Cable shelf NSM B port e0b to controller A port e0d.

   The following illustration shows cabling for one hot-added shelf using one set of RoCE-capable ports on each controller module:

   AFF A400 HA pair with one NS224 shelf
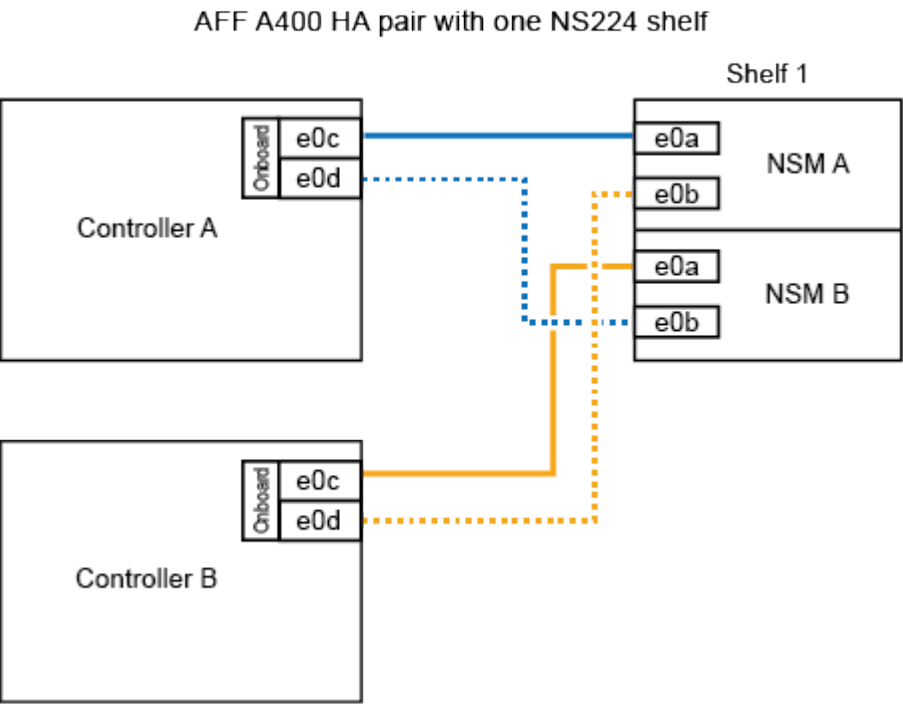
2. If you are hot-adding one or two shelves using two sets of RoCE-capable ports (on board and PCIe card RoCE-capable ports) on each controller module, complete the following substeps.

Shelves	Cabling
Shelf 1	a. Cable NSM A port e0a to controller A port e0c. b. Cable NSM A port e0b to controller B slot 5 port 2 (e5b). c. Cable NSM B port e0a to controller B port e0c. d. Cable NSM B port e0b to controller A slot 5 port 2 (e5b). e. If you are hot-adding a second shelf, complete the "Shelf 2" substeps; otherwise, go to step 3.

Shelves	Cabling
Shelf 2	a. Cable NSM A port e0a to controller A slot 5 port 1 (e5a).
	b. Cable NSM A port e0b to controller B port e0d.
	c. Cable NSM B port e0a to controller B slot 5 port 1 (e5a).
	d. Cable NSM B port e0b to controller A port e0d.
	e. Go to step 3.

The following illustration shows cabling for two hot-added shelves:

AFF A400 HA pair with two NS224 shelves
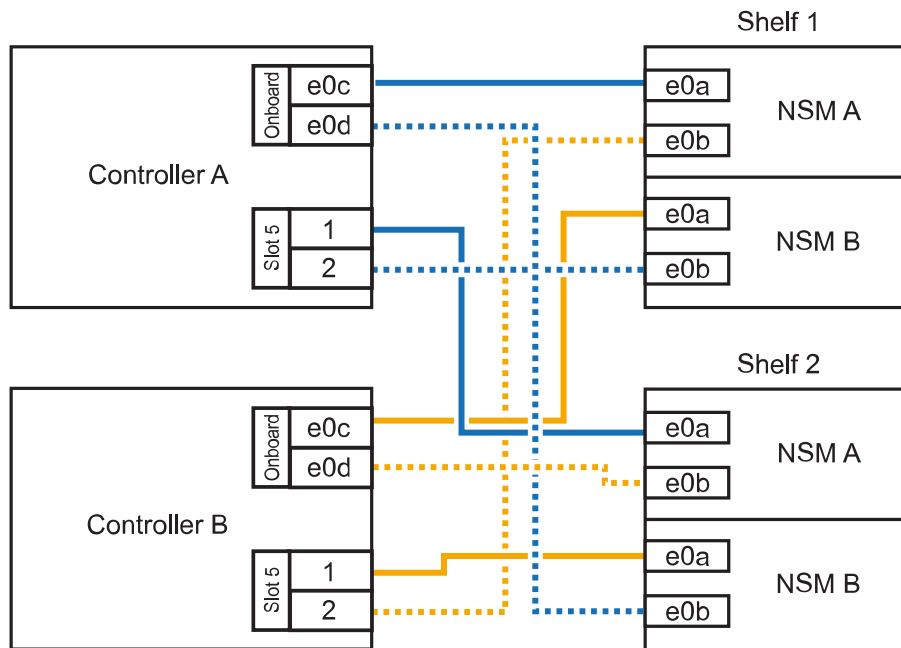
3. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

4. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then re enable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Cable a hot-add shelf for an AFF C400 HA pair

How you cable an NS224 drive shelf in an AFF C400 HA pair depends on the number of shelves you are hot-adding and the number of RoCE-capable port sets (one or two) you are using on the controller modules.

Before you begin

- You must have met the system requirements.

  Requirements for a hot-add

- You must have completed the applicable preparation procedures.

  Prepare for a hot-add

- You must have installed the shelves, powered them on, and set the shelf IDs.
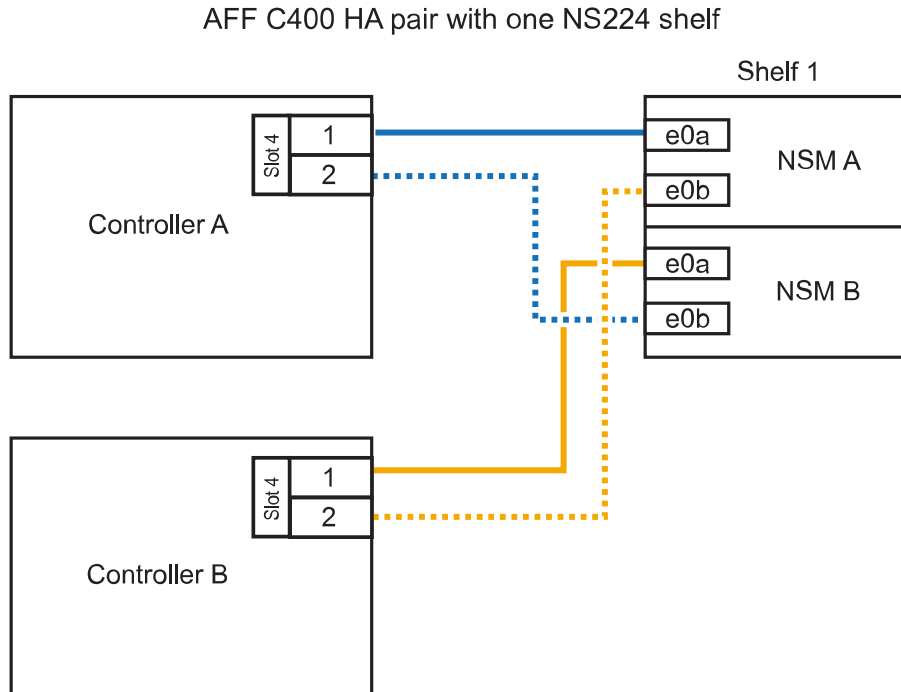
  Install a drive shelf for a hot-add

Steps

1. If you are hot-adding one shelf using one set of RoCE-capable ports on each controller module, and this is the only NS224 shelf in your HA pair, complete the following substeps.

   Otherwise, go to the next step.

   a. Cable shelf NSM A port e0a to controller A slot 4 port 1 (e4a).

   b. Cable shelf NSM A port e0b to controller B slot 4 port 2 (e4b).

   c. Cable shelf NSM B port e0a to controller B slot 4 port 1 (e4a).

   d. Cable shelf NSM B port e0b to controller A slot 4 port 2 (e4b).

   The following illustration shows cabling for one hot-added shelf using one set of RoCE-capable ports on each controller module:


   AFF C400 HA pair with one NS224 shelf

2. If you are hot-adding one or two shelves using two sets of RoCE-capable ports on each controller module, complete the following substeps.

Shelves	Cabling
Shelf 1	a. Cable NSM A port e0a to controller A slot 4 port 1 (e4a). b. Cable NSM A port e0b to controller B slot 5 port 2 (e5b). c. Cable NSM B port e0a to controller B port slot 4 port 1 (e4a). d. Cable NSM B port e0b to controller A slot 5 port 2 (e5b). e. If you are hot-adding a second shelf, complete the "Shelf 2" substeps; otherwise, go to step 3.
Shelf 2	a. Cable NSM A port e0a to controller A slot 5 port 1 (e5a). b. Cable NSM A port e0b to controller B slot 4 port 2 (e4b). c. Cable NSM B port e0a to controller B slot 5 port 1 (e5a). d. Cable NSM B port e0b to controller A slot 4 port 2 (e4b). e. Go to step 3.

The following illustration shows cabling for two hot-added shelves:

AFF C400 HA pair with two NS224 shelves
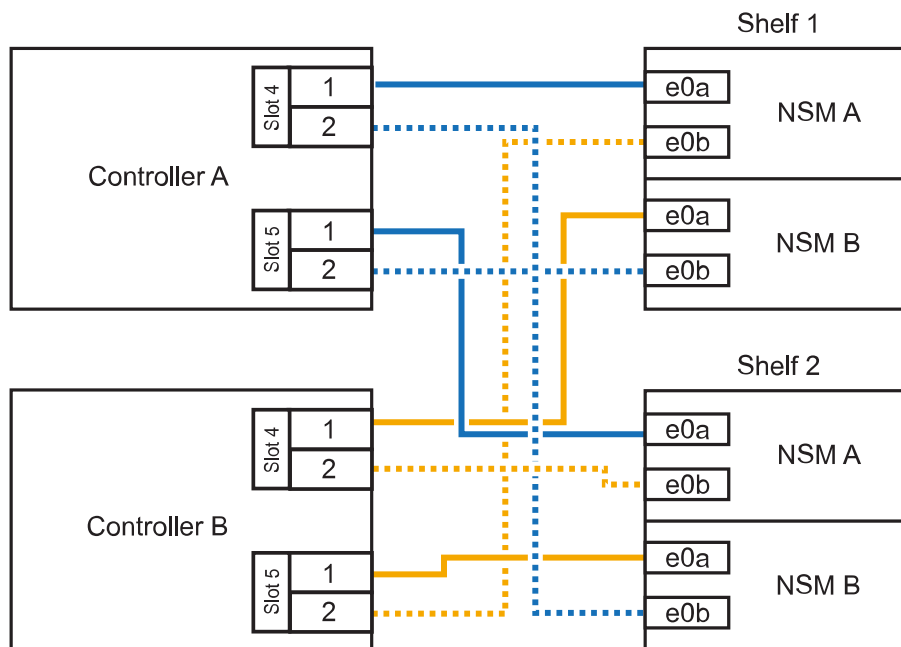
3. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

4. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then re enable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

Cable a hot-add shelf for an AFF A320 HA pair

You cable a second NS224 drive shelf to an existing HA pair when additional storage is needed.

Before you begin

- You must have met the system requirements.

- You must have completed the applicable preparation procedures.

- You must have installed the shelves, powered them on, and set the shelf IDs.

About this task

This procedure assumes that your AFF A320 HA pair has an existing NS224 shelf and that you are hot-adding a second shelf.

Steps

1. Cable the shelf to the controller modules.

   a. Cable NSM A port e0a to controller A port e0e.

   b. Cable NSM A port e0b to controller B port e0b.

   c. Cable NSM B port e0a to controller B port e0e.

   d. Cable NSM B port e0b to controller A port e0b.
      The following illustration shows cabling for the hot-added shelf (shelf 2):

AFF A320 HA pair with two NS224 shelves
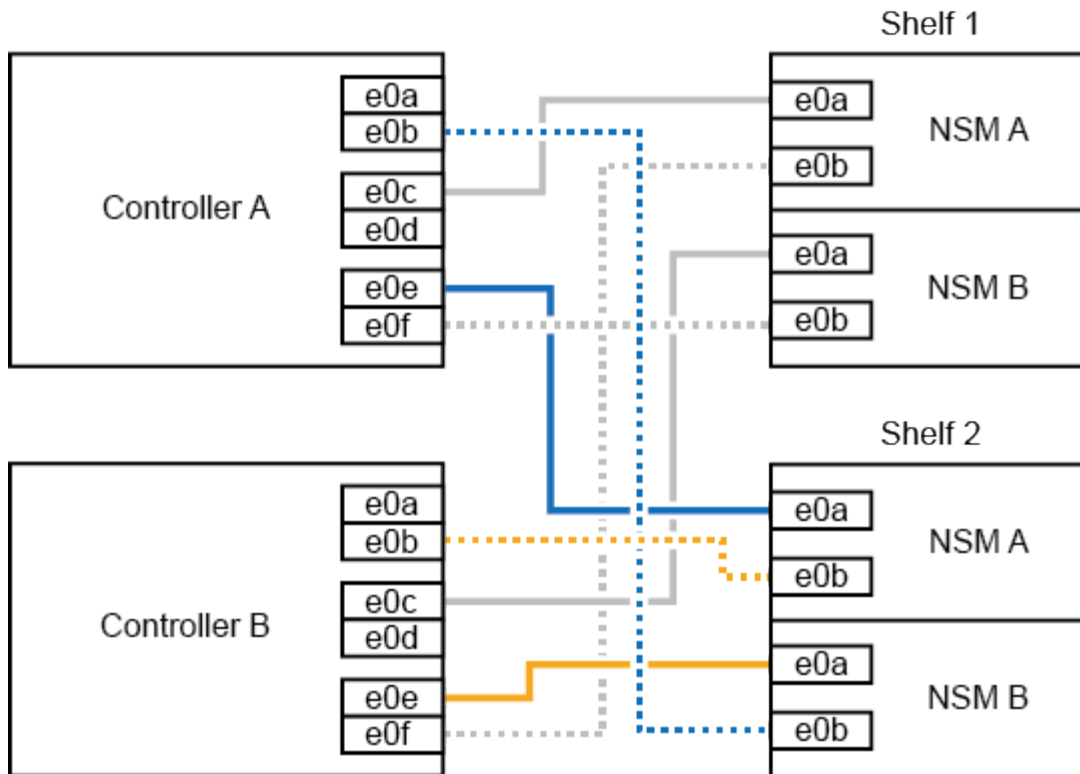
2. Verify that the hot-added shelf is cabled correctly.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

3. If you disabled automatic drive assignment as part of the preparation for this procedure, you need to manually assign drive ownership and then re enable automatic drive assignment, if needed.

   Otherwise, you are done with this procedure.

   Complete the hot-add

Complete the hot-add

If you disabled automatic drive assignment as part of the preparation for the NS224 drive shelf hot-add, you need to manually assign drive ownership and then reenable automatic drive assignment if needed.

Before you begin

You must have already cabled your shelf as instructed for your HA pair.

Cable a drive shelf for a hot-add

Steps

1. Display all unowned drives: `storage disk show -container-type unassigned`

   You can enter the command on either controller module.

2. Assign each drive: `storage disk assign -disk disk_name -owner owner_name`

   You can enter the command on either controller module.

   You can use the wild card character to assign more than one drive at once.

3. Reenable automatic drive assignment if needed: `storage disk option modify -node node_name -autoassign on`

   You must reenable automatic drive assignment on both controller modules.

Change a shelf ID - NS224 shelves

You can change a shelf ID in a system when ONTAP is not yet running or when hot-adding a shelf prior to it being cabled to the system. You can also change a shelf ID when ONTAP is up and running (controller modules are available to serve data) and all drives in the shelf are unowned, spares, or part of offlined aggregate(s).

Before you begin

- If ONTAP is up and running (controller modules are available to serve data), you must have verified that all drives in the shelf are unowned, spares, or part of offlined aggregate(s).

  You can verify the state of the drives by using the `storage disk show -shelf shelf_number` command. Output in the `Container Type` column should display `spare` or `broken` if it is a failed drive. Additionally, the `Container Name` and `Owner` columns should have a dash.

- You need a paper clip with one side straightened or a narrow-tipped ballpoint pen.

  You use the paper clip or ballpoint pen to access the shelf ID button through the small hole, to the right of the LEDs, in the Operator Display Panel (ODP).

About this task

- A valid shelf ID is 00 through 99.
- Shelf IDs must be unique within an HA pair.
- You must power cycle a shelf (unplug both power cords, wait the appropriate amount of time, and then plug them back in) in order for the shelf ID to take effect.

  The amount of time you wait before plugging the power cords back in depends on the state of ONTAP, as described later in this procedure.

  (i) | NS224 shelves do not have power switches on the power supplies.

Steps

1. Power on the shelf, if it's not already on.

   You connect the power cords first to the shelf, securing them in place with the power cord retainer, and then connect the power cords to different power sources for resiliency.

2. Remove the left end cap to locate the small hole to the right of the LEDs.

3. Change the first number of the shelf ID:

   a. Insert the paper clip or ballpoint pen into the small hole.

   b. Press and hold the button until the first number on the digital display blinks, and then release the button.

      It can take up to 15 seconds for the number to blink. This activates the shelf ID programming mode.

      > (i) If the ID takes longer than 15 seconds to blink, press and hold the button again, making sure to press it in all the way.

   c. Press and release the button to advance the number until you reach the desired number from 0 to 9.

      Each press and release duration can be as short as one second.

      The first number continues to blink.

4. Change the second number of the shelf ID:

   a. Press and hold the button until the second number on the digital display blinks.

      It can take up to three seconds for the number to blink.

      The first number on the digital display stops blinking.

   b. Press and release the button to advance the number until you reach the desired number from 0 to 9.

      The second number continues to blink.

5. Lock in the desired number and exit the programming mode by pressing and holding the button until the second number stops blinking.

   It can take up to three seconds for the number to stop blinking.

   Both numbers on the digital display start blinking and the amber LED on the ODP illuminates after about five seconds, alerting you that the pending shelf ID has not yet taken effect.

6. Power-cycle the shelf to make the shelf ID take effect.

   You must unplug the power cord from both power supplies on the shelf, wait the appropriate amount of time, and then plug them back into the shelf power supplies to complete the power cycle.

   A power supply is powered on as soon as the power cord is plugged in. Its bicolored LED should illuminate green.

   - If ONTAP is not yet running or you are hot-adding a shelf (that has not yet been cabled to the system), wait at least 10 seconds.

   - If ONTAP is running (controllers are available to serve data), and all drives in the shelf are unowned, spares, or part of offlined aggregate(s), wait at least 70 seconds.

     This time allows ONTAP to properly delete the old shelf address and update the copy of the new shelf address.

7. Replace the left end cap.

Cable shelves as switch-attached storage - NS224 shelves

If you have a system in which the NS224 drive shelves need to be cabled as switch-attached storage (not direct-attached storage), use the information provided.

- Cable NS224 drive shelves through storage switches:

  NS224 NVMe Drive Shelf Cabling Guide

- Install your storage switches:

  AFF and FAS Switch Documentation

- Confirm supported hardware, such as storage switches and cables, for your platform model:

  NetApp Hardware Universe

Maintain

Replace the boot media - NS224 shelves

When the boot media fails on an NS224 drive shelf in an HA pair that is running ONTAP 9.7 or later, or the shelf is running NVMe shelf module (NSM) firmware version 0111 or later, you can replace the boot media. Replacing the boot media can be done nondisruptively, while the drive shelf is powered on, and I/O is in progress.

Before you begin

- Your HA pair must already be running ONTAP 9.7 or later, which has the minimum supported version of NSM firmware, or your HA pair must already be running a version of ONTAP 9.6 with NSM firmware version 0111 or later.

  You can enter the `storage shelf show -module` command at the console of either controller to verify the version of NSM firmware on your shelf.

  > ⓘ If your shelf is not running NSM firmware version 0111 or later, you cannot replace the boot media, you must replace the NSM module.
  >
  > Replace an NSM module - NS224 shelves

- You need a Phillips #1 screwdriver.

  The screw used to secure the boot media to the board requires a Phillips #1 screwdriver; using a different type of screwdriver could strip the screw.

- The shelf's partner NSM module must be up and running, and be cabled correctly so that your shelf maintains connectivity when you remove the NSM module with the failed FRU (target NSM module).

  NetApp Downloads: Config Advisor

- All other components in the system must be functioning properly.

About this task

- After the boot media is replaced, the boot image from the shelf's partner NSM module is automatically copied to the replacement boot media.

  This can take up to five minutes.

- Allow at least 70 seconds between removal and installation of the NVMe shelf module (NSM).

  This allows enough time for ONTAP to process the NSM removal event.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf:
  `storage shelf location-led modify -shelf-name` *shelf_name* `-led-status on`

  If you do not know the *shelf_name* of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- After replacing the boot media, you can return the failed part to NetApp as described in the RMA instructions shipped with the kit.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- You can use the following animation or the written steps to replace the boot media.

  Animation - Replace the boot media in an NS224 drive shelf

Steps

1. Make sure that both NSM modules in the shelf are running the same version of firmware: version 0200 or later.

2. Properly ground yourself.

3. Disconnect the cabling from the NSM module that contains the FRU that you are replacing:

   a. Disconnect the power cord from the power supply by opening the power cord retainer if it is an AC power supply, or unscrewing the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

      Power supplies do not have a power switch.

   b. Disconnect the storage cabling from the NSM module ports.

      Make a note of the NSM module ports that each cable is connected to. You reconnect the cables to the same ports when you reinsert the NSM module, later in this procedure.

4. Remove the NSM module from the shelf:

   a. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

      > ⓘ If you are removing the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

b. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

The latching mechanisms raise, clearing the latching pins on the shelf.

c. Gently pull until the NSM module is about one third of the way out of the shelf, grasp the NSM module sides with both hands to support its weight, and then place it on a flat stable surface.

When you begin pulling, the latching mechanism arms extend from the NSM module and lock in their fully extended position.

5. Loosen the NSM module cover thumb screw and open the cover.

6. Physically locate the failed boot media.

The boot media is located along the shelf chassis wall opposite from the power supply.

7. Replace the boot media:

a. Using the Phillips #1 screwdriver, carefully remove the screw securing the bottom (notched) end of the boot media to the board.

b. Remove the boot media by rotating the notched end up slightly and then gently pulling it towards you until it releases from the socket.

You can hold the boot media by placing your thumb and forefinger on the side edges, at the notched end.

c. Unpack the boot media from the antistatic bag.

d. Insert the replacement boot media by pushing it gently into the socket until it is seated squarely and completely in the socket.

You can hold the boot media by placing your thumb and forefinger on the side edges, at the notched end. Make sure that the side with the heat sink is facing up.

When correctly seated, and when you let go of the boot media, the notched end of the boot media is angled up, away from the board, because it is not yet secured with the screw.

e. Gently hold down the notched end of the boot media as you insert and tighten the screw with the screwdriver to secure the boot media in place.

> (i) Tighten the screw just enough to hold the boot media securely in place, but do not overtighten.

8. Close the NSM module cover, and then tighten the thumb screw.

9. Reinsert the NSM module into the shelf:

a. Make sure that the latching mechanism arms are locked in the fully extended position.

b. Using both hands, gently slide the NSM module into the shelf until the weight of the NSM module is fully supported by the shelf.

c. Push the NSM module into the shelf until it stops (about half an inch from the back of the shelf).

You can place your thumbs on the orange tabs on the front of each finger loop (of the latching mechanism arms) to push in the NSM module.

d. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM

module.

> ⓘ If you are inserting the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

   e. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

   f. Gently push forward to get the latches over the stop.

   g. Release your thumbs from the tops of the latching mechanisms, and then continue pushing until the latching mechanisms snap into place.

     The NSM module should be fully inserted into the shelf and flush with the edges of the shelf.

10. Reconnect the cabling to the NSM module:

   a. Reconnect the storage cabling to the same two NSM module ports.

     Cables are inserted with the connector pull-tab facing up. When a cable is inserted correctly, it clicks into place.

   b. Reconnect the power cord to the power supply, and then secure the power cord with the power cord retainer if it is an AC power supply, or tighten the two thumb screws if it is a DC power supply.

     When functioning correctly, a power supply's bicolored LED illuminates green.

     Additionally, both NSM module port LNK (green) LEDs illuminate. If a LNK LED does not illuminate, reseat the cable.

11. Verify that the attention (amber) LEDs on the NSM module containing the failed boot media and the shelf operator display panel are no longer illuminated.

   It can take between 5 to 10 minutes for the attention LEDs to turn off. This is the amount of time it takes the NSM module to reboot and the boot media image copy to complete.

   If the fault LEDs remain on, the boot media might not be seated correctly or there might be another issue and you should contact technical support for assistance.

12. Verify that the NSM module is cabled correctly, by running Active IQ Config Advisor.

   If any cabling errors are generated, follow the corrective actions provided.

   NetApp Downloads: Config Advisor

Replace a DIMM - NS224 shelves

You can replace a faulty DIMM nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

Before you begin
- The shelf's partner NSM module must be up and running, and be cabled correctly so that your shelf maintains connectivity when you remove the NSM module with the failed FRU (target NSM module).

   NetApp Downloads: Config Advisor

- All other components in the system, including the other three DIMMs, must be functioning properly.

About this task

- Allow at least 70 seconds between removal and installation of the NVMe shelf module (NSM).

  This allows enough time for ONTAP to process the NSM removal event.

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before replacing FRU components.

  NetApp Downloads: Disk Shelf Firmware

  NetApp Downloads: Disk Drive Firmware

  > ℹ️ Do not revert firmware to a version that does not support your shelf and its components.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf:
  `storage shelf location-led modify -shelf-name `*`shelf_name`*` -led-status on`

  If you do not know the *`shelf_name`* of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- When you unpack the replacement DIMM, save all packing materials for use when you return the failed DIMM.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- You can use the following animation or the written steps to replace a DIMM.

  Animation - Replace a DIMM in an NS224 drive shelf

Steps

1. Properly ground yourself.

2. Disconnect the cabling from the NSM module that contains the FRU that you are replacing:

   a. Disconnect the power cord from the power supply by opening the power cord retainer if it is an AC power supply, or unscrewing the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

   Power supplies do not have a power switch.

   b. Disconnect the storage cabling from the NSM module ports.

   Make a note of the NSM module ports that each cable is connected to. You reconnect the cables to the same ports when you reinsert the NSM module, later in this procedure.

3. Remove the NSM module from the shelf:

   a. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM

module.

> ℹ️ If you are removing the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

b. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

The latching mechanisms raise, clearing the latching pins on the shelf.

c. Gently pull until the NSM module is about one third of the way out of the shelf, grasp the NSM module sides with both hands to support its weight, and then place it on a flat stable surface.

When you begin pulling, the latching mechanism arms extend from the NSM module and lock in their fully extended position.

4. Loosen the NSM module cover thumb screw and open the cover.

The FRU label on the NSM module cover shows the location of the four DIMMs, two on either side of the heat sink, in the center of the NSM module.

5. Physically identify the faulty DIMM.

When a DIMM is faulty, the system logs a warning message to the system console indicating which DIMM is faulty.

6. Replace the faulty DIMM:

a. Note the orientation of the DIMM in the slot so that you can insert the replacement DIMM using the same orientation.

b. Eject the DIMM from its slot by slowly pushing apart the ejector tabs at both ends of the DIMM slot, and then lift the DIMM out of the slot.

> ℹ️ Carefully hold the DIMM by the corners or edges to avoid pressure on the DIMM circuit board components.

The ejector tabs remain in the open position.

c. Remove the replacement DIMM from its antistatic shipping bag.

d. Hold the DIMM by the corners, and then insert the DIMM squarely into a slot.

The notch on the bottom of the DIMM, among the pins, should line up with the tab in the slot.

When inserted correctly, the DIMM should go in easily but fit tightly in the slot. If not, reinsert the DIMM.

e. Push down carefully, but firmly, on the top edge of the DIMM until the ejector tabs snap into place over the notches at both ends of the DIMM.

7. Close the NSM module cover, and then tighten the thumb screw.

8. Reinsert the NSM module into the shelf:

a. Make sure that the latching mechanism arms are locked in the fully extended position.

b. Using both hands, gently slide the NSM module into the shelf until the weight of the NSM module is fully supported by the shelf.

c. Push the NSM module into the shelf until it stops (about half an inch from the back of the shelf).

You can place your thumbs on the orange tabs on the front of each finger loop (of the latching mechanism arms) to push in the NSM module.

d. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

> ℹ️ If you are inserting the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

e. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

f. Gently push forward to get the latches over the stop.

g. Release your thumbs from the tops of the latching mechanisms, and then continue pushing until the latching mechanisms snap into place.

The NSM module should be fully inserted into the shelf and flush with the edges of the shelf.

9. Reconnect the cabling to the NSM module:

a. Reconnect the storage cabling to the same two NSM module ports.

Cables are inserted with the connector pull-tab facing up. When a cable is inserted correctly, it clicks into place.

b. Reconnect the power cord to the power supply, and then secure the power cord with the power cord retainer if it is an AC power supply, or tighten the two thumb screws if it is a DC power supply.

When functioning correctly, a power supply's bicolored LED illuminates green.

Additionally, both NSM module port LNK (green) LEDs illuminate. If a LNK LED does not illuminate, reseat the cable.

10. Verify that the attention (amber) LEDs on the NSM module containing the failed DIMM and the shelf operator display panel are no longer illuminated.

The NSM module attention LEDs turn off after the NSM module reboots and no longer detects a DIMM issue. This can take three to five minutes.

11. Verify that the NSM module is cabled correctly, by running Active IQ Config Advisor.

If any cabling errors are generated, follow the corrective actions provided.

NetApp Downloads: Config Advisor

Hot-swap a drive - NS224 shelves

You can replace a failed drive nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

Before you begin

- The drive that you are installing must be supported by the NS224 shelf.

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- If SED authentication is enabled, you must use the SED replacement instructions in the ONTAP documentation.

  Instructions in the ONTAP documentation describe additional steps you must perform before and after replacing an SED.

NetApp encryption overview with the CLI

- All other components in the system must be functioning properly; if not, contact technical support.
- Verify that the drive you are removing is failed.

  You can verify that the drive is failed by running the `storage disk show -broken` command. The failed drive appears in the list of failed drives. If it does not, you should wait, and then run the command again.

  > (i) Depending on the drive type and capacity, it can take up to several hours for the drive to appear in the list of failed drives.

About this task

- **Best practice:** The best practice is to have the current version of the Disk Qualification Package (DQP) installed before hot-swapping a drive.

  Having the current version of the DQP installed allows your system to recognize and use newly qualified drives. This avoids system event messages about having noncurrent drive information and prevention of drive partitioning because drives are not recognized. The DQP also notifies you of noncurrent drive firmware.

NetApp Downloads: Disk Qualification Package

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before replacing FRU components.

NetApp Downloads: Disk Shelf Firmware

NetApp Downloads: Disk Drive Firmware

  > (i) Do not revert firmware to a version that does not support your shelf and its components.

- Drive firmware is automatically updated (nondisruptively) on new drives that have non-current firmware versions.

  > (i) Drive firmware checks occur every two minutes.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf: `storage shelf location-led modify -shelf-name shelf_name -led-status on`

  If you do not know the `shelf_name` of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command,

but using the `off` option.

- When you unpack the replacement drive, save all packing materials for use when you return the failed drive.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- The following animation provides an overview of the physical removal and insertion portions of the drive hot-swap procedure.

  Animation - Hot-swapping a drive in an NS224 drive shelf

Steps

1. If you want to manually assign drive ownership for the replacement drive, you need to disable automatic drive assignment if it is enabled.

   > (i) You need to manually assign drive ownership if drives in the shelf are owned by both controller modules in the HA pair.

   > (i) You manually assign drive ownership and then reenable automatic drive assignment later in this procedure.

   a. Verify whether automatic drive assignment is enabled: `storage disk option show`

      You can enter the command on either controller module.

      If automatic drive assignment is enabled, the output shows `on` in the `Auto Assign` column (for each controller module).

   b. If automatic drive assignment is enabled, disable it: `storage disk option modify -node node_name -autoassign off`

      You must disable automatic drive assignment on both controller modules.

2. Properly ground yourself.

3. Physically identify the failed drive.

   When a drive fails, the system logs a warning message to the system console indicating which drive failed. Additionally, the attention (amber) LED on the drive shelf operator display panel and the failed drive illuminate.

   > (i) The activity (green) LED on a failed drive can be illuminated (solid), which indicates that the drive has power, but should not be blinking, which indicates I/O activity. A failed drive has no I/O activity.

4. Remove the failed drive:

   a. Press the release button on the drive face to open the cam handle.

   b. Slide the drive out of the shelf using the cam handle and supporting the drive with your other hand.

5. Wait a minimum of 70 seconds before inserting the replacement drive.

This allows the system to recognize that a drive was removed.

6. Insert the replacement drive:

   a. With the cam handle in the open position, use both hands to insert the replacement drive.

   b. Push until the drive stops.

   c. Close the cam handle so that the drive is fully seated into the mid plane and the handle clicks into place.

   Be sure to close the cam handle slowly so that it aligns correctly with the face of the drive.

7. Verify that the drive's activity (green) LED is illuminated.

   When the drive's activity LED is solid, it means that the drive has power. When the drive's activity LED is blinking, it means that the drive has power and I/O is in progress. If the drive firmware is automatically updating, the LED blinks.

8. If you are replacing another drive, repeat steps 3 through step 7.

9. If you disabled automatic drive assignment in step 1, manually assign drive ownership, and then reenable automatic drive assignment if needed:

   a. Display all unowned drives: `storage disk show -container-type unassigned`

   You can enter the command on either controller module.

   b. Assign each drive: `storage disk assign -disk disk_name -owner owner_name`

   You can enter the command on either controller module.

   You can use the wildcard character to assign more than one drive at once.

   c. Reenable automatic drive assignment if needed: `storage disk option modify -node node_name -autoassign on`

   You must reenable automatic drive assignment on both controller modules.

Drive shelf

Overview - NS224 shelves

The NetApp NS224 drive shelf is a 2U rack unit that can hold up to 24 drives. The NS224 drive shelf is compatible with 2.5" small form factor drives and supports both SAS and SATA interfaces.

Take the following actions to maintain your NS224 drive shelf.

- Cold-replace a shelf
- Hot-remove a shelf
- Monitor shelf LEDs

Cold-replace a shelf - NS224 shelves

When replacing a drive shelf in a production system that has disks in use, you need to perform a cold shelf replacement. This is a disruptive procedure. It requires you to halt the controllers in your HA pair.

Use the KB article How to replace a shelf chassis using a cold shelf removal procedure.

Hot-remove a shelf - NS224 shelves

You can hot-remove an NS224 drive shelf that has had the aggregates removed from the drives, in an HA pair that is up and serving data (I/O is in progress).

Before you begin

- Your HA pair cannot be in a takeover state.

- You must have removed all aggregates from the drives (the drives must be spares) in the shelf you are removing.

  > (i) If you attempt this procedure with aggregates on the shelf you are removing, you could fail the system with a multidisk panic.

  You can use the `storage aggregate offline -aggregate` *aggregate_name* command and then the `storage aggregate delete -aggregate` *aggregate_name* command.

- If your system shipped in a system cabinet, you need a Phillips screwdriver to remove the screws securing the shelf to the cabinet rear uprights.

About this task

- If you are hot-removing more than one shelf, you remove one shelf at a time.

- **Best practice:** The best practice is to remove drive ownership after you remove the aggregates from the drives in the shelf you are removing.

  Removing ownership information from a spare drive allows the drive to be properly integrated into another node (as needed).

  The procedure for removing ownership from drives can be found in the disks and aggregates content:

  Disks and aggregates overview

  > (i) The procedure requires you to disable automatic drive assignment. You reenable automatic drive assignment at the end of this procedure (after you have hot-removed the shelf).

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf:
  `storage shelf location-led modify -shelf-name` *shelf_name* `-led-status on`

  If you do not know the *shelf_name* of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the off option.

- After disconnecting a shelf from non-dedicated RoCE capable ports (on board the controllers, on RoCE capable PCIe cards, a combination of both, or on I/O modules), you have the option of reconfiguring these ports for networking use.

  (i) If your HA pair is running a version of ONTAP 9.6, you need to reboot the controllers one at a time. If your HA pair is running ONTAP 9.7 or later, you do not need to reboot the controllers, unless one or both controllers are in maintenance mode. This procedure assumes that neither controller is in maintenance mode.

Steps

1. Properly ground yourself.

2. Verify that the drives in the shelf you are removing have no aggregates (are spares) and that ownership is removed:

   a. Enter the following command to list all of the drives in the shelf that you are removing: `storage disk show -shelf` *shelf_number*

      You can enter the command on either controller module.

   b. Check the output to verify that there are no aggregates on the drives.

      Drives with no aggregates have a dash in the `Container Name` column.

   c. Check the output to verify that ownership is removed from the drives.

      Drives with no ownership have a dash in the `Owner` column.

      (i) If you have failed drives, they display broken in the `Container Type` column. (Failed drives do not have ownership.)

      The following output shows drives on the shelf being removed (shelf 2) are in a correct state for removing the shelf. The aggregates are removed on all of the drives; therefore, a dash appears in the `Container Name` column for each drive. Ownership is also removed on all of the drives; therefore, a dash appears in the `Owner` column for each drive.

```
cluster1::> storage disk show -shelf 2

           Usable              Disk    Container   Container
Disk         Size Shelf Bay Type    Type        Name        Owner
-------- -------- ----- --- ------  ----------- ----------- ---------
...
2.2.4           -     2   4 SSD-NVM spare                -           -
2.2.5           -     2   5 SSD-NVM spare                -           -
2.2.6           -     2   6 SSD-NVM broken               -           -
2.2.7           -     2   7 SSD-NVM spare                -           -
...
```

3. Physically locate the shelf you are removing.

4. Disconnect the cabling from the shelf you are removing:

    a. Disconnect the power cords from the power supplies by opening the power cord retainer if they are AC power supplies, or unscrewing the two thumb screws if they are DC power supplies, and then unplug the power cords from the power supplies.

        Power supplies do not have a power switch.

    b. Disconnect the storage cabling (from the shelf to the controllers).

5. Physically remove the shelf from the rack or cabinet.

    > (i) A fully loaded NS224 shelf can weigh up to 66.78 lbs (30.29 kg) and requires two people to lift or use of a hydraulic lift. Avoid removing shelf components (from the front or rear of the shelf) to reduce the shelf weight, because shelf weight will become unbalanced.

    > (i) If your system was shipped in a cabinet, you must first unscrew the two Phillips screws securing the shelf to the rear uprights. The screws are located on the inside shelf walls of the bottom NSM module. You should remove both NSM modules to access the screws.

6. If you are removing more than one shelf, repeat steps 2 through 5.

    Otherwise, go to the next step.

7. If you disabled automatic drive assignment when you removed ownership from the drives, reenable it:
    `storage disk option modify -autoassign on`

    You run the command on both controller modules.

8. You have the option of reconfiguring the non-dedicated RoCE capable ports for networking use, by completing the following substeps.

    Otherwise, you are done with this procedure.

    a. Verify the names of the non-dedicated ports, currently configured for storage use: `storage port show`

        You can enter the command on either controller module.

        > (i) The non-dedicated ports configured for storage use are displayed in the output as follows: If your HA pair is running ONTAP 9.8 or later, the non-dedicated ports display `storage` in the `Mode` column. If your HA pair is running ONTAP 9.7 or 9.6, the non-dedicated ports, which display `false` in the `Is Dedicated?` column, also display `enabled` in the `State` column.

    b. Complete the set of steps applicable to the version of ONTAP your HA pair is running:

If your HA pair is running…	Then…
ONTAP 9.8 or later	a. Reconfigure the non-dedicated ports for networking use, on the first controller module: `storage port modify -node` *node name* `-port` *port name* `-mode network` You must run this command for each port you are reconfiguring. b. Repeat the above step to reconfigure the ports on the second controller module. c. Go to substep 8c to verify all port changes.
ONTAP 9.7	a. Reconfigure the non-dedicated ports for networking use, on the first controller module: `storage port disable -node` *node name* `-port` *port name* You must run this command for each port you are reconfiguring. b. Repeat the above step to reconfigure the ports on the second controller module. c. Go to substep 8c to verify all port changes.
A version of ONTAP 9.6	a. Reconfigure the RoCE capable ports for networking use, on the first controller module: `storage port disable -node` *node name* `-port` *port name* You must run this command for each port you are reconfiguring. b. Reboot the controller module to make the port changes take effect: `system node reboot -node` *node name* `-reason` *reason* `for the reboot` (i) The reboot must complete before you proceed to the next step. The reboot can take up to 15 minutes. c. Reconfigure the ports on the second controller module, by repeating the first step (a). d. Reboot the second controller to make the port changes take effect, by repeating the second step (b). e. Go to substep 8c to verify all port changes.

c. Verify that the non-dedicated ports of both controller modules are reconfigured for networking use:
`storage port show`

You can enter the command on either controller module.

If your HA pair is running ONTAP 9.8 or later, the non-dedicated ports display `network` in the `Mode` column.

If your HA pair is running ONTAP 9.7 or 9.6, the non-dedicated ports, which display `false` in the `Is Dedicated?` column, also display `disabled` in the `State` column.

Monitor drive shelf LEDs - NS224 shelves

both:imagesdir: ../media/

You can monitor the health of your drive shelf by understanding the location and status conditions of the LEDs on your drive shelf components.

- The location (blue) LEDs, on a shelf's operator display panel (ODP) and both NSM modules, can be activated to aid in physically locating the shelf that needs servicing: `storage shelf location-led modify -shelf-name` *shelf_name* `-led-status on`

  If you do not know the *shelf_name* of the affected shelf, run the `storage shelf show` command.

  Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- An LED state can be:
  - "On": The LED illumination is solid/steady
  - "Off": The LED is not illuminated
  - "Blink": The LED turns on and off at varying intervals depending on the FRU status
  - "Any state": The LED can be "On", "Off", or "Blink"

Operator display panel LEDs

The LEDs on the drive shelf front operator display panel (ODP) indicate whether your drive shelf is functioning normally or there are problems with the hardware.

The following illustration and table describes the three LEDs on the ODP:

LED icon	LED name & color	State	Description
⊘	Power (Green)	On	One or more power supplies are supplying power to the drive shelf.
!	Attention (Amber)	On	• An error occurred with the function of one of more shelf FRUs. Check event messages to determine corrective action to take. • If the two-digit shelf ID is also blinking, the shelf ID is in a pending state. Power cycle the drive shelf for the shelf ID to take affect.
⊙	Location (Blue)	On	The system administrator activated this LED function.

NSM module LEDs

The LEDs on an NSM module indicate whether the module is functioning normally, whether it is ready for I/O traffic, and whether there are any problems with the hardware.

The following illustration and tables describe NSM module LEDs associated with the function of a module and the function of each NVMe port on a module.
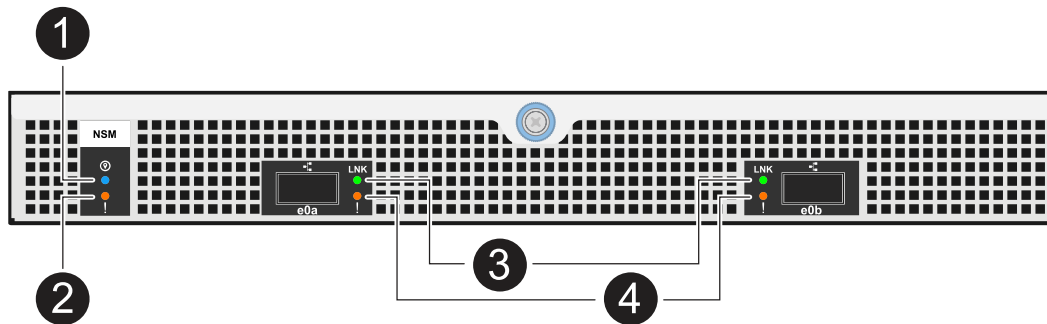
Call out	LED icon	Color	Description
1	⊙	Blue	NSM module: Location
2	!	Amber	NSM module: Attention
3	LNK	Green	NVMe port/link: status
4	!	Amber	NVMe port/link: attention

Status	NSM Attention (Amber)	Port LNK (Green)	Port Attention (Amber)
NSM normal	Off	Any state	Off
NSM fault	On	Any state	Any state
NSM VPD Error	On	Any state	Any state
No host port connection	Any state	Off	Off
Host port connection link active	Any state	On/Blinks with activity	Any state
Host port connection w/ fault	On	On/Off if all lanes are faulted	On
BIOS boot from BIOS image after power up	Blink	Any state	Any state

Power supply LEDs

The LEDs on an AC or DC power supply (PSU) indicate whether the PSU is functioning normally or there are hardware problems.

The following illustration and tables describe the LED on a PSU. (The illustration is an AC PSU; however, the

LED location is the same on the DC PSU):
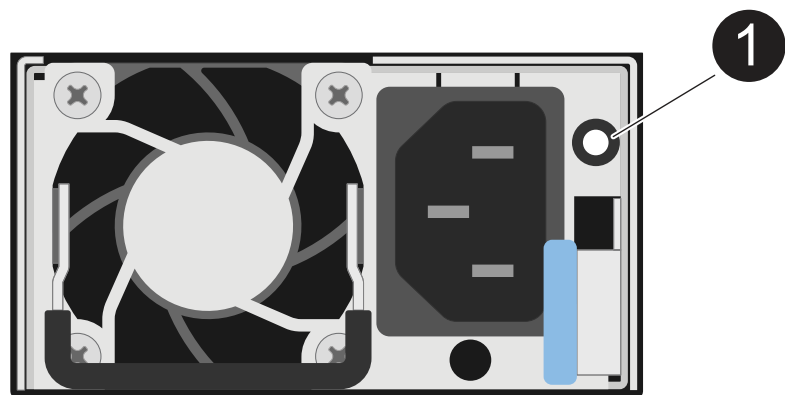
Call out	Description
1	The bi-color LED indicates power/activity when green and a fault when amber.

Status	Power/activity (Green)	Attention (Amber)
No AC/DC power to the enclosure	Off	Off
No AC/DC power to the PSU	Off	On
AC/DC power on, but PSU not in enclosure	Blink	Off
PSU operating correctly	On	Off
PSU failure	Off	On
Fan failure	Off	On
Firmware update mode	Blink	Off

Drive LEDs

The LEDs on an NVMe drive indicates whether it is functioning normally or there are problems with the hardware.

The following illustration and tables describe the two LEDs on an NVMe drive:
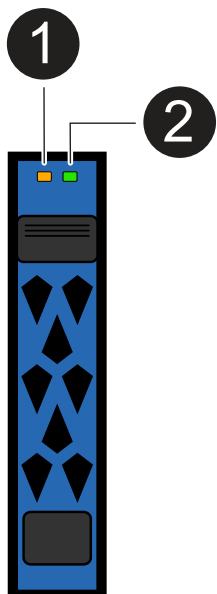
Call out	LED name	Color
❶	Attention	Amber
❷	Power/activity	Green

Status	Power/Activity (Green)	Attention (Amber)	Associated ODP LED
Drive installed and operational	On/Blinks with activity	Any state	N/A
Drive failure	On/Blinks with activity	On	Attention (Amber)
SES device identify set	On/Blinks with activity	Blinks	Attention (Amber) is off
SES device fault bit set	On/Blinks with activity	On	Attention (Amber)
Power control circuit failure	Off	Any state	Attention (Amber)

Replace a fan - NS224 shelves

You can replace a failed fan nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

Before you begin

- The shelf's partner NSM module must be up and running, and be cabled correctly so that your shelf maintains connectivity when you remove the NSM module with the failed FRU (target NSM module).

  [NetApp Downloads: Config Advisor](#)

- All other components in the system, including the other four fans, must be functioning properly.

About this task

- Allow at least 70 seconds between removal and installation of the NVMe shelf module (NSM).

  This allows enough time for ONTAP to process the NSM removal event.

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before replacing FRU components.

  [NetApp Downloads: Disk Shelf Firmware](#)

  [NetApp Downloads: Disk Drive Firmware](#)

  > ℹ️   Do not revert firmware to a version that does not support your shelf and its components.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf:
  ```
  storage shelf location-led modify -shelf-name shelf_name -led-status on
  ```

  If you do not know the `shelf_name` of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- When you unpack the replacement fan, save all packing materials for use when you return the failed fan.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- You can use the following animation or the written steps to replace a fan.

  [Animation - Replace a fan in an NS224 drive shelf](#)

Steps

1. Properly ground yourself.
2. Disconnect the cabling from the NSM module that contains the FRU that you are replacing:

   a. Disconnect the power cord from the power supply by opening the power cord retainer if it is an AC power supply, or unscrewing the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

   Power supplies do not have a power switch.

   b. Disconnect the storage cabling from the NSM module ports.

   Make a note of the NSM module ports that each cable is connected to. You reconnect the cables to the same ports when you reinsert the NSM module, later in this procedure.

3. Remove the NSM module from the shelf:

   a. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

   > ⓘ   If you are removing the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

   b. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

   The latching mechanisms raise, clearing the latching pins on the shelf.

   c. Gently pull until the NSM module is about one third of the way out of the shelf, grasp the NSM module sides with both hands to support its weight, and then place it on a flat stable surface.

   When you begin pulling, the latching mechanism arms extend from the NSM module and lock in their fully extended position.

4. Loosen the NSM module cover thumb screw and open the cover.

   > ⓘ   The FRU label on the NSM module cover shows the location of the five fans, along the rear wall of the NSM module.

5. Physically identify the failed fan.

   When a fan fails, the system logs a warning message to the system console indicating which fan failed.

6. Replace the failed fan:

   a. Remove the failed fan by firmly grasping the sides, where the blue touch points are located, and then lift it vertically to disconnect it from the socket.

   b. Insert the replacement fan by aligning it within the guides, and then push down until the fan module connector is fully seated in the socket.

7. Close the NSM module cover, and then tighten the thumb screw.

8. Reinsert the NSM module into the shelf:

   a. Make sure that the latching mechanism arms are locked in the fully extended position.

   b. Using both hands, gently slide the NSM module into the shelf until the weight of the NSM module is fully supported by the shelf.

   c. Push the NSM module into the shelf until it stops (about half an inch from the back of the shelf).

   You can place your thumbs on the orange tabs on the front of each finger loop (of the latching mechanism arms) to push in the NSM module.

   d. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

   > ⓘ   If you are inserting the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

e. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

f. Gently push forward to get the latches over the stop.

g. Release your thumbs from the tops of the latching mechanisms, and then continue pushing until the latching mechanisms snap into place.

   The NSM module should be fully inserted into the shelf and flush with the edges of the shelf.

9. Reconnect the cabling to the NSM module:

   a. Reconnect the storage cabling to the same two NSM module ports.

      Cables are inserted with the connector pull-tab facing up. When a cable is inserted correctly, it clicks into place.

   b. Reconnect the power cord to the power supply, and then secure the power cord with the power cord retainer if it is an AC power supply, or tighten the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

      When functioning correctly, a power supply's bicolored LED illuminates green.

      Additionally, both NSM module port LNK (green) LEDs illuminate. If a LNK LED does not illuminate, reseat the cable.

10. Verify that the attention (amber) LEDs on the NSM module containing the failed fan and the shelf operator display panel are no longer illuminated.

    The NSM module attention LEDs turn off after the NSM module reboots and no longer detects a fan issue. This can take three to five minutes.

11. Verify that the NSM module is cabled correctly, by running Active IQ Config Advisor.

    If any cabling errors are generated, follow the corrective actions provided.

    NetApp Downloads: Config Advisor

Replace an NSM module - NS224 shelves

You can replace an impaired NVMe shelf module (NSM) nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

Before you begin
- The shelf's partner NSM module must be up and running, and be cabled correctly so that your shelf maintains connectivity when you remove the failed NSM module.

  NetApp Downloads: Config Advisor

- All other components in the system must be functioning properly.

About this task
- Replacing the NSM module involves moving the DIMMs, fans and power supply from the impaired NSM module to the replacement NSM module.

  You do not move the real-time clock (RTC) battery or boot media. They come preinstalled in the

replacement NSM module.

- Allow at least 70 seconds between removal and installation of the NVMe shelf module (NSM).

  This allows enough time for ONTAP to process the NSM removal event.

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before replacing FRU components.

  NetApp Downloads: Disk Shelf Firmware

  NetApp Downloads: Disk Drive Firmware

  > ⓘ   Do not revert firmware to a version that does not support your shelf and its components.

- Shelf (NSM) firmware is automatically updated (nondisruptively) on a new NSM module that has a non-current firmware version.

  NSM module firmware checks occur every 10 minutes. An NSM module firmware update can take up to 30 minutes.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf:
  `storage shelf location-led modify -shelf-name` *shelf_name* `-led-status on`

  If you do not know the `shelf_name` of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- When you unpack the replacement NSM module, save all packing materials for use when you return the failed NSM module.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- You can use the following animation or the written steps to replace an NSM module.

  Animation - Replace an NSM module in an NS224 drive shelf

Steps

1. Properly ground yourself.
2. Physically identify the impaired NSM module.

   The system logs a warning message to the system console indicating which module is impaired. Additionally, the attention (amber) LED on the drive shelf operator display panel and the impaired module illuminate.

3. Disconnect the cabling from the impaired NSM module:
   a. Disconnect the power cord from the power supply by opening the power cord retainer if it is an AC power supply, or unscrewing the two thumbs screws if it is a DC power supply, and then unplug the power cord from the power supply.

Power supplies do not have a power switch.

b. Disconnect the storage cabling from the NSM module ports.

Make a note of the NSM module ports that each cable is connected to. You reconnect the cables to the same ports on the replacement NSM module, later in this procedure.

4. Remove the NSM module from the shelf:

a. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

> ⓘ If you are removing the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

b. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

The latching mechanisms raise, clearing the latching pins on the shelf.

c. Gently pull until the NSM module is about one third of the way out of the shelf, grasp the NSM module sides with both hands to support its weight, and then place it on a flat stable surface.

When you begin pulling, the latching mechanism arms extend from the NSM module and lock in their fully extended position.

5. Unpack the replacement NSM module, and set it on a level surface near the impaired NSM module.

6. Open the cover of the impaired NSM module and the replacement NSM module by loosening the thumbscrew on each cover.

> ⓘ The FRU label on the NSM module cover shows the location of the DIMMs and fans.

7. Move the DIMMs from the impaired NSM module to the replacement NSM module:

a. Note the orientation of the DIMMs in the slots so that you can insert the DIMMs into the replacement NSM module using the same orientation.

b. Eject a DIMM from its slot by slowly pushing apart the ejector tabs at both ends of the DIMM slot, and then lift the DIMM out of the slot.

> ⓘ Carefully hold the DIMM by the corners or edges to avoid pressure on the DIMM circuit board components. The ejector tabs remain in the open position.

c. Hold the DIMM by the corners, and then insert the DIMM squarely into a slot on the replacement NSM module.

The notch on the bottom of the DIMM, among the pins, should line up with the tab in the slot.

When inserted correctly, the DIMM should go in easily but fit tightly in the slot. If not, reinsert the DIMM.

d. Push down carefully, but firmly, on the top edge of the DIMM until the ejector tabs snap into place over the notches at both ends of the DIMM.

e. Repeat substeps 7a through 7d for the remaining DIMMs.

8. Move the fans from the impaired NSM module to the replacement NSM module:

a. Firmly grasp a fan from the sides, where the blue touch points are located, and then lift it vertically to disconnect it from the socket.

You might need to gently rock the fan back and forth to disconnect it before lifting it out.

b. Align the fan with the guides in the replacement NSM module, and then push down until the fan module connector is fully seated in the socket.

c. Repeat substeps 8a and 8b for the remaining fans.

9. Close the cover of each NSM module, and then tighten each thumbscrew.

10. Move the power supply from the impaired NSM module to the replacement NSM module:

a. Rotate the handle up, to its horizontal position, and then grasp it.

b. With your thumb, press the blue tab to release the locking mechanism.

c. Pull the power supply out of the NSM module while using your other hand to support its weight.

d. Using both hands, support and align the edges of the power supply with the opening in the replacement NSM module.

e. Gently push the power supply into the NSM module until the locking mechanism clicks into place.

(i) Do not use excessive force or you might damage the internal connector.

f. Rotate the handle down, so it is out of the way of normal operations.

11. Insert the replacement NSM module into the shelf:

a. Make sure that the latching mechanism arms are locked in the fully extended position.

b. Using both hands, gently slide the NSM module into the shelf until the weight of the NSM module is fully supported by the shelf.

c. Push the NSM module into the shelf until it stops (about half an inch from the back of the shelf).

You can place your thumbs on the orange tabs on the front of each finger loop (of the latching mechanism arms) to push in the NSM module.

d. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

(i) If you are inserting the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

e. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

f. Gently push forward to get the latches over the stop.

g. Release your thumbs from the tops of the latching mechanisms, and then continue pushing until the latching mechanisms snap into place.

The NSM module should be fully inserted into the shelf and flush with the edges of the shelf.

12. Reconnect the cabling to the NSM module:

a. Reconnect the storage cabling to the same two NSM module ports.

Cables are inserted with the connector pull-tab facing up. When a cable is inserted correctly, it clicks

into place.

b. Reconnect the power cord to the power supply, and then secure the power cord with the power cord retainer if it is an AC power supply, or tighten the two thumb screws if it is a DC power supply.

When functioning correctly, a power supply's bicolored LED illuminates green.

Additionally, both NSM module port LNK (green) LEDs illuminate. If a LNK LED does not illuminate, reseat the cable.

13. Verify that the attention (amber) LED on the shelf operator display panel is no longer illuminated.

The operator display panel attention LED turns off after the NSM module reboots. This can take three to five minutes.

14. Verify that the NSM module is cabled correctly, by running Active IQ Config Advisor.

If any cabling errors are generated, follow the corrective actions provided.

NetApp Downloads: Config Advisor

15. Make sure that both NSM modules in the shelf are running the same version of firmware: version 0200 or later.

Hot-swap a power supply - NS224 shelves

You can replace a failed power supply nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

About this task

- Do not mix power supplies with different efficiency ratings or with different input types.

  Always replace like for like.

- If you are replacing more than one power supply, you must do so one at a time so that the shelf maintains power.
- **Best practice:** The best practice is to replace the power supply within two minutes of removal from the NSM module.

  If you exceed the two minutes, the shelf continues to function, but ONTAP sends messages to the console about the degraded power supply until the power supply is replaced.

- Do not revert firmware to a version that does not support your shelf and its components.
- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf: `storage shelf location-led modify -shelf-name` *shelf_name* `-led-status on`

  If you do not know the `shelf_name` of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the off option.

- When you unpack the replacement power supply, save all packing materials for use when you return the failed power supply.

If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

Use the appropriate procedure for your type of PSU: AC or DC.

Option 1: Replace an AC power supply

To replace an AC power supply, you can watch the animation or complete the following steps.

Animation - Hot-swap a power supply in an NS224 drive shelf

Steps

1. Properly ground yourself.

2. Physically identify the failed power supply.

    The system logs a warning message to the system console indicating which power supply failed. Additionally, the attention (amber) LED on the shelf operator display panel illuminates and the bicolored LED on the failed power supply illuminates red.

3. Disconnect the power cord from the power supply by opening the power cord retainer, and then unplug the power cord from the power supply.

    Power supplies do not have a power switch.

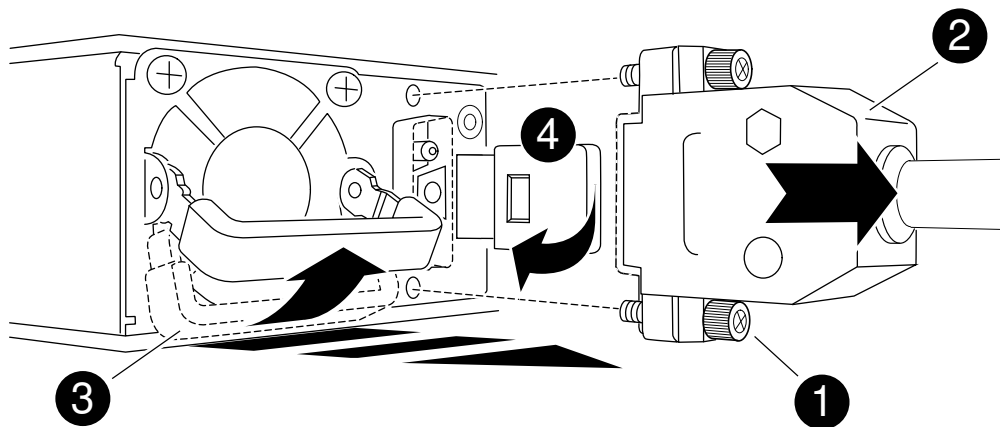4. Remove the power supply:

    a. Rotate the handle up, to its horizontal position, and then grasp it.

    b. With your thumb, press the blue tab to release the locking mechanism.

    c. Pull the power supply out of the NSM module while using your other hand to support its weight.

5. Insert the replacement power supply:

    a. Using both hands, support and align the edges of the power supply with the opening in the NSM module.

    b. Gently push the power supply into the NSM module until the locking mechanism clicks into place.

    > ⓘ Do not use excessive force or you might damage the internal connector.

    c. Rotate the handle down, so it is out of the way of normal operations.

6. Connect the power cord to the power supply and secure the power cord with the power cord retainer.

    When functioning correctly, a power supply's bicolored LED illuminates green.

Option 2: Replace a DC power supply

To replace a DC power supply, complete the following steps.

1. Properly ground yourself.

2. Physically identify the failed power supply.

    The system logs a warning message to the system console indicating which power supply failed. Additionally, the attention (amber) LED on the shelf operator display panel illuminates and the bicolored LED on the failed power supply illuminates red.

3. Disconnect the power supply:

    a. Unscrew the two thumb screws on the D-SUB DC power cable connector.

        The illustration and table in step 4 shows the two thumb screws (item #1) and the D-SUB DC

power cable connector (item #2).

    b. Unplug the D-SUB DC power cable connector from the power supply and set it aside.

4. Remove the power supply:

    a. Rotate the handle up, to its horizontal position, and then grasp it.

    b. With your thumb, press the blue tab to release the locking mechanism.

    c. Pull the power supply out of the NSM module while using your other hand to support its weight.

> (i) The power supply is short. Always use two hands to support it when removing it from the NSM module so that it does not swing free from the NSM module and injure you.

❶		Thumb screws
❷		D-SUB DC power cable connector
❸		Power supply handle
❹		Blue power supply locking tab

5. Insert the replacement power supply:

    a. Using both hands, support and align the edges of the power supply with the opening in the NSM module.

    b. Gently push the power supply into the NSM module until the locking mechanism clicks into place.

A power supply must properly engage with the internal connector and locking mechanism. Repeat this step if you feel the power supply is not properly seated.

> (i) Do not use excessive force or you might damage the internal connector.

    c. Rotate the handle down, so it is out of the way of normal operations.

6. Reconnect the D-SUB DC power cable:

> Once power is restored to the power supply, the status LED should be green.
>
> a. Plug the D-SUB DC power cable connector into the power supply.
>
> b. Tighten the two thumb screws to secure the D-SUB DC power cable connector to the power supply.

Replace the real-time clock battery - NS224 shelves

You can replace a failed real-time clock (RTC) battery nondisruptively in an NS224 drive shelf that is powered on, and while I/O is in progress.

Before you begin

- The shelf's partner NSM module must be up and running, and be cabled correctly so that your shelf maintains connectivity when you remove the NSM module with the failed FRU (target NSM module).

  NetApp Downloads: Config Advisor

- All other components in the system must be functioning properly.

About this task

- Allow at least 70 seconds between removal and installation of the NVMe shelf module (NSM).

  This allows enough time for ONTAP to process the NSM removal event.

- After you replace the RTC battery, reinstall the NSM module, and the module boots, the real-time clock time is updated by ONTAP.

- **Best practice:** The best practice is to have current versions of NVMe shelf module (NSM) firmware and drive firmware on your system before replacing FRU components.

  NetApp Downloads: Disk Shelf Firmware

  NetApp Downloads: Disk Drive Firmware

  ⓘ Do not revert firmware to a version that does not support your shelf and its components.

- If needed, you can turn on the shelf's location (blue) LEDs to aid in physically locating the affected shelf: `storage shelf location-led modify -shelf-name shelf_name -led-status on`

  If you do not know the `shelf_name` of the affected shelf, run the `storage shelf show` command.

  A shelf has three location LEDs: one on the operator display panel and one on each NSM module. Location LEDs remain illuminated for 30 minutes. You can turn them off by entering the same command, but using the `off` option.

- When you unpack the replacement RTC battery, save all packing materials for use when you return the failed RTC battery.

  If you need the RMA number or additional help with the replacement procedure, contact technical support at NetApp Support, 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific).

- You can use the following animation or the written steps to replace an RTC battery.

Animation - Replace an RTC battery in an NS224 drive shelf

Steps

1. Properly ground yourself.

2. Disconnect the cabling from the NSM module that contains the FRU that you are replacing:

   a. Disconnect the power cord from the power supply by opening the power cord retainer if it is an AC power supply, or unscrewing the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

      Power supplies do not have a power switch.

   b. Disconnect the storage cabling from the NSM module ports.

      Make a note of the NSM module ports that each cable is connected to. You reconnect the cables to the same ports when you reinsert the NSM module, later in this procedure.

3. Remove the NSM module from the shelf:

   a. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

      > (i) If you are removing the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

   b. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

      The latching mechanisms raise, clearing the latching pins on the shelf.

   c. Gently pull until the NSM module is about one third of the way out of the shelf, grasp the NSM module sides with both hands to support its weight, and then place it on a flat stable surface.

      When you begin pulling, the latching mechanism arms extend from the NSM module and lock in their fully extended position.

4. Loosen the NSM module cover thumb screw and open the cover.

   The FRU label on the NSM module cover shows the location of the RTC battery, near the front of the NSM module and to the right of the power supply.

5. Physically identify the failed RTC battery.

6. Replace the RTC battery:

   a. Remove the battery by gently pushing it away from the holder until it is at an inclined angle (tilted away from the holder), and then lift it out of the holder.

   b. Insert the replacement battery into the holder at an inclined angle (tilted away from the holder), push it into an upright position, and then press it firmly into the connector until it is fully seated.

      > (i) The positive side of the battery, marked with a plus sign, is oriented outward (away from the holder), corresponding to the plus sign marked on the NSM module board.

7. Close the NSM module cover, and then tighten the thumb screw.

8. Reinsert the NSM module into the shelf:

   a. Make sure that the latching mechanism arms are locked in the fully extended position.

   b. Using both hands, gently slide the NSM module into the shelf until the weight of the NSM module is fully supported by the shelf.

   c. Push the NSM module into the shelf until it stops (about half an inch from the back of the shelf).

   You can place your thumbs on the orange tabs on the front of each finger loop (of the latching mechanism arms) to push in the NSM module.

   d. Loop your index fingers through the finger holes of the latching mechanisms on either side of the NSM module.

   > (i) If you are inserting the bottom NSM module, and if the bottom rail is obstructing access to the latching mechanisms, place your index fingers through the finger holes from the inside (by crossing your arms).

   e. With your thumbs, press down and hold the orange tabs on top of the latching mechanisms.

   f. Gently push forward to get the latches over the stop.

   g. Release your thumbs from the tops of the latching mechanisms, and then continue pushing until the latching mechanisms snap into place.

   The NSM module should be fully inserted into the shelf and flush with the edges of the shelf.

9. Reconnect the cabling to the NSM module:

   a. Reconnect the storage cabling to the same two NSM module ports.

   Cables are inserted with the connector pull-tab facing up. When a cable is inserted correctly, it clicks into place.

   b. Reconnect the power cord to the power supply, and then secure the power cord with the power cord retainer if it is an AC power supply, or tighten the two thumb screws if it is a DC power supply, and then unplug the power cord from the power supply.

   When functioning correctly, a power supply's bicolored LED illuminates green.

   Additionally, both NSM module port LNK (green) LEDs illuminate. If a LNK LED does not illuminate, reseat the cable.

10. Verify that the attention (amber) LEDs on the NSM module containing the failed RTC battery and the shelf operator display panel are no longer illuminated

    The NSM module attention LEDs turn off after the NSM module reboots and no longer detects an RTC battery issue. This can take three to five minutes.

11. Verify that the NSM module is cabled correctly, by running Active IQ Config Advisor.

    If any cabling errors are generated, follow the corrective actions provided.

    NetApp Downloads: Config Advisor