



# ThinkSystem DM3000x and DM5000x Hardware Installation and Maintenance Guide



**Machine Types:** 7Y41, 7Y42, and 7Y57

**Note**

Before using this information and the product it supports, be sure to read and understand the safety information and the safety instructions, which are available at:

[http://thinksystem.lenovofiles.com/help/topic/safety\\_documentation/pdf\\_files.html](http://thinksystem.lenovofiles.com/help/topic/safety_documentation/pdf_files.html)

In addition, be sure that you are familiar with the terms and conditions of the Lenovo warranty for your server, which can be found at:

<http://datacentersupport.lenovo.com/warrantylookup>

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## Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.



Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

ཐོན་རྒྱུ་འདི་བདེ་སྤྱོད་མ་བྱས་གོང་། རྒྱུ་ལྷི་ཡིད་གཟབ་  
བྱ་འདྲ་མིན་ཡོད་པའི་འོད་ཟེར་བལྟ་དགོས།

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

مەزكۇر مەھسۇلاتنى ئورنىتىشتىن بۇرۇن بىخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

Youq mwngz yungh canjbinj neix gaxgonq, itdingh aeu doeg aen  
canjbinj soengq cungj vahgangj ancien siusik.

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## Chapter 1. Introduction

This chapter provides a brief introduction to your system. This chapter contains information about product specifications, management software, tech tips, and security advisories.

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### Specifications

The following information is a summary of the specifications of the system. Depending on the model, some specifications might not apply.

Table 1. Specifications

Specification	Description
Dimension	<ul style="list-style-type: none"><li>• 2U</li><li>• For models with 12 drive bays in the front:<ul style="list-style-type: none"><li>– Height: 86.9 mm (3.42 inches)</li><li>– Width:<ul style="list-style-type: none"><li>– With mounting flanges: 480 mm (18.9 inches)</li><li>– Without mounting flanges: 447 mm (17.6 inches)</li></ul></li><li>– Depth:<ul style="list-style-type: none"><li>– With cable management arm: 638 mm (25.12 inches)</li><li>– Without cable management arm: 508 mm (20 inches)</li></ul></li></ul></li><li>• For models with 24 drive bays in the front:<ul style="list-style-type: none"><li>– Height: 85 mm (3.35 inches)</li><li>– Width:<ul style="list-style-type: none"><li>– With mounting flanges: 480 mm (18.9 inches)</li><li>– Without mounting flanges: 447 mm (17.6 inches)</li></ul></li><li>– Depth:<ul style="list-style-type: none"><li>– With cable management arm: 613 mm (24.13 inches)</li><li>– Without cable management arm: 483 mm (19.02 inches)</li></ul></li></ul></li></ul>
Clearance dimension	<ul style="list-style-type: none"><li>• Front:<ul style="list-style-type: none"><li>– For cooling: 153 mm (6.03 inches)</li><li>– For maintenance: 610 mm (24.03 inches)</li></ul></li><li>• Rear:<ul style="list-style-type: none"><li>– For cooling: 153 mm (6.03 inches)</li><li>– For maintenance: 330 mm (13 inches)</li></ul></li></ul>
Weight (with two controllers)	<ul style="list-style-type: none"><li>• For models with 12 drive bays in the front: 18.7 kg (41.23 lb)</li><li>• For models with 24 drive bays in the front: 19.4 kg (42.77 lb)</li></ul>
Processor	Two 64 bit 12-core 1.5 GHz processors
DIMM	<ul style="list-style-type: none"><li>• Total capacity: 64 GB</li><li>• Four 16 GB DIMMs</li><li>• NVRAM/NVMEM used capacity: 8 GB</li></ul>

Table 1. Specifications (continued)

Specification	Description									
Power supplies	Two hot-swap power supplies for redundancy support									
Storage maximums and limits	<ul style="list-style-type: none"> <li>Max. raw capacity (HA):                             <ul style="list-style-type: none"> <li>For models with 12 drive bays in the front: 2160.8 TB</li> <li>For models with 24 drive bays in the front: 2203.2 TB</li> </ul> </li> </ul> <p><b>Note:</b> Storage disks of the same type and capacity are installed in your system by default. You can change the disks and their combinations based on the system model. For details, refer to the below table.</p> <table border="1"> <thead> <tr> <th>System</th> <th>Same disk type, different disk capacities</th> <th>Different disk types, different disk capacities</th> </tr> </thead> <tbody> <tr> <td>DM3000H and DM5000H</td> <td>Yes</td> <td>Yes</td> </tr> <tr> <td>DM5000F</td> <td>Yes</td> <td>No</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Max. storage devices (HA): 144</li> <li>Max. controllers per cluster (NAS/SAN): 24/12</li> <li>Max. aggregate size 64-bit: 400 TiB</li> <li>Min. root aggregate size: 187 GiB</li> <li>Max. FlexVol size 64-bit: 100 TiB</li> <li>Max. FlexGroup data constituent size: 100 TiB</li> <li>Max. volume count (per controller): 1000</li> <li>Min. root volume size: 150 GiB</li> <li>Volume encryption: supported</li> </ul>	System	Same disk type, different disk capacities	Different disk types, different disk capacities	DM3000H and DM5000H	Yes	Yes	DM5000F	Yes	No
System	Same disk type, different disk capacities	Different disk types, different disk capacities								
DM3000H and DM5000H	Yes	Yes								
DM5000F	Yes	No								
Input/Output (I/O) features	<p>The system (with two controllers) has the following I/O ports:</p> <ul style="list-style-type: none"> <li>Four 12 Gb MiniSAS HD ports</li> <li>Four 10 Gb SFP+ Ethernet ports</li> <li>Eight 10 Gb/16 Gb UTA2 SFP+ ports or eight RJ45 10 GbE host ports</li> <li>Two RJ45 management ports</li> <li>Two host USB Type-A connectors</li> <li>Two RJ45 console ports</li> <li>Two Micro-B USB console ports</li> </ul>									



Table 1. Specifications (continued)

Specification	Description
Power input	<ul style="list-style-type: none"> <li>• Input voltage low range:               <ul style="list-style-type: none"> <li>– Minimum: 100 V ac</li> <li>– Maximum: 120 V ac</li> </ul> </li> <li>• Input voltage high range:               <ul style="list-style-type: none"> <li>– Minimum: 200 V ac</li> <li>– Maximum: 240 V ac</li> </ul> </li> </ul>
Environment	<p>The system is supported in the following environment:</p> <ul style="list-style-type: none"> <li>• Air temperature:               <ul style="list-style-type: none"> <li>– Operating: 5–45°C (41–113°F)</li> <li>– Storage or shipping: -40–70°C (-40–158°F)</li> </ul> </li> <li>• Relative humidity:               <ul style="list-style-type: none"> <li>– Operating: 8%–90%</li> <li>– Storage or shipping: 10%–95%</li> </ul> </li> <li>• Maximum altitude:               <ul style="list-style-type: none"> <li>– Operating: 3048 m (10000 ft)</li> <li>– Storage: 12 192 m (40000 ft)</li> <li>– Shipping: 12 192 m (39 989.8 ft)</li> </ul> </li> </ul>

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## Management software

ONTAP is available for managing your system. For detailed information about how to use ONTAP, go to: [http://thinksystem.lenovofiles.com/help/topic/ontap\\_software/overview.html](http://thinksystem.lenovofiles.com/help/topic/ontap_software/overview.html)

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## Tech Tips

Lenovo continually updates the support website with the latest tips and techniques that you can use to solve issues that you might have with your system. These Tech Tips (also called retain tips or service bulletins) provide procedures to work around issues related to the operation of your system.

To find the Tech Tips available for your system:

1. Go to <http://datacentersupport.lenovo.com> and navigate to the support page for your system.
2. Click **How-tos & Solutions**.

Expand **Symptom** to choose a category for the type of problem that you are having.

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## Security advisories

Lenovo is committed to developing products and services that adhere to the highest security standards in order to protect our customers and their data. When potential vulnerabilities are reported, it is the responsibility of the Lenovo Product Security Incident Response Team (PSIRT) to investigate and provide information to our customers so they may put mitigation plans in place as we work toward providing solutions.

The list of current advisories is available at the following site:

[https://datacentersupport.lenovo.com/product\\_security/home](https://datacentersupport.lenovo.com/product_security/home)

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## Chapter 2. System components

Use the information in this section to learn about each of the components associated with your system.

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### Front view

#### Front view with bezel



Figure 1. Front view with bezel

Table 2. Components on the front bezel

Components	Status	Description
1 Chassis power LED	Solid green	One or two of the power supply is delivering power to the system.
	Off	No power supply is delivering power to the system.
2 Chassis attention LED (front)	Solid amber	The system stops working or there is an error on the system.
	Off	The system is operating normally.
3 Chassis location LED (front)	Solid blue or blinking blue	The chassis location LED is manually activated to help locating the chassis.
	Off	The chassis location LED is not activated.
4 Shelf ID digital display	Number displayed	Display the shelf ID.

## Front view without bezel



Figure 2. Front view of models with 12 drive bays

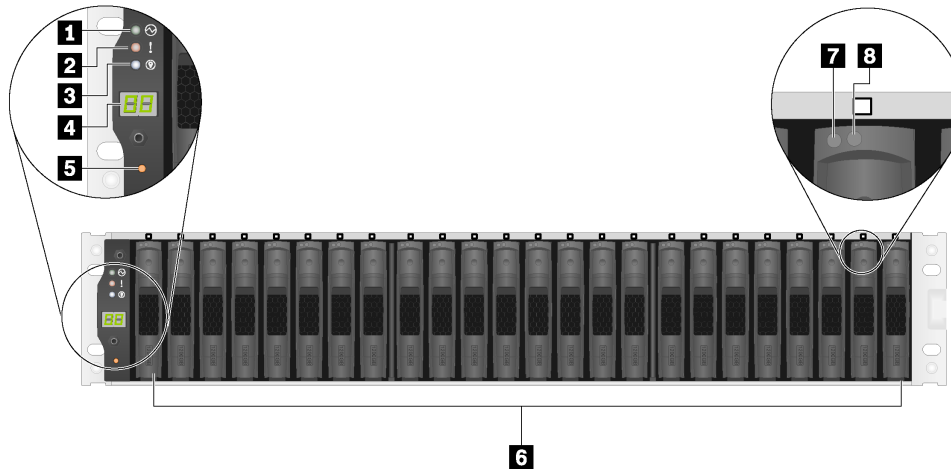


Figure 3. Front view of models with 24 drive bays

Table 3. Components on the front of the system (without bezel)

<b>1</b> Chassis power LED	<b>2</b> Chassis attention LED (front)	<b>3</b> Chassis location LED (front)
<b>4</b> Shelf ID digital display	<b>5</b> Shelf ID change button	<b>6</b> Hot-swap drive bays (12/24)
<b>7</b> Drive activity LED	<b>8</b> Drive status LED	

## Rear view

The rear of the system provides access to several connectors and components, including the power supplies and various connectors.

## Rear view – type 1

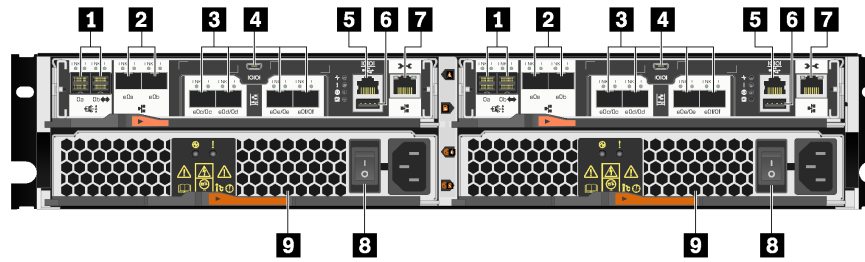


Figure 4. Rear view – type 1

Table 4. Components on the rear of the system

<b>1</b> MiniSAS HD ports (4)	<b>2</b> SFP+ Ethernet ports (4)
<b>3</b> UTA2 SFP+ ports (8)	<b>4</b> Micro-B USB console ports (2)
<b>5</b> RJ45 console ports (2)	<b>6</b> Host USB Type-A connectors (2)
<b>7</b> RJ45 management ports (2)	<b>8</b> Power supply buttons (2)
<b>9</b> Power supplies (2)	

## Rear view – type 2

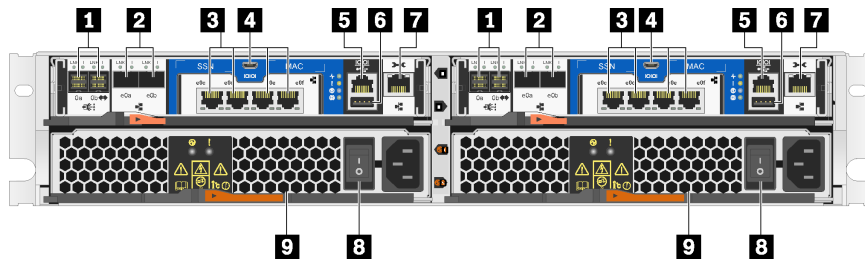


Figure 5. Rear view – type 2

Table 5. Components on the rear of the system

<b>1</b> MiniSAS HD ports (4)	<b>2</b> SFP+ Ethernet ports (4)
<b>3</b> RJ45 10 GbE host ports (8)	<b>4</b> Micro-B USB console ports (2)
<b>5</b> RJ45 console ports (2)	<b>6</b> Host USB Type-A connectors (2)
<b>7</b> RJ45 management ports (2)	<b>8</b> Power supply buttons (2)
<b>9</b> Power supplies (2)	

## Rear view LEDs

The rear of the system provides system LEDs.

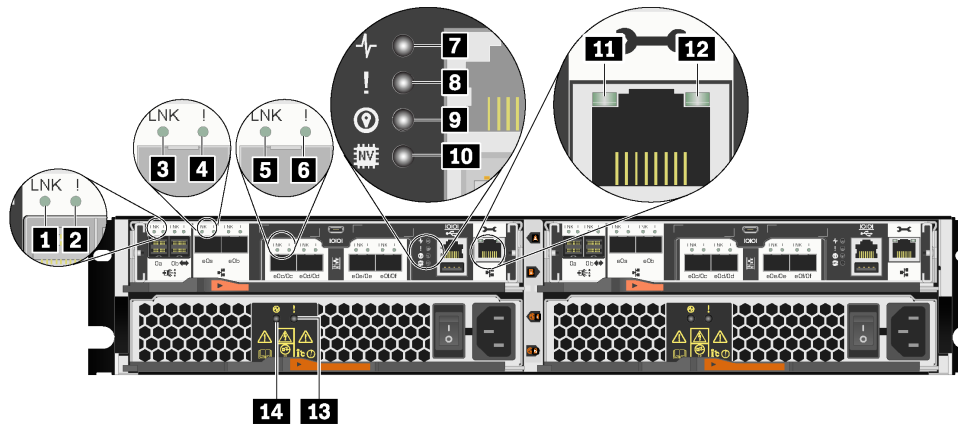


Figure 6. Rear view LEDs – type 1

Table 6. LEDs on the rear of the system

<b>1</b> MiniSAS HD port link LED (4)	<b>2</b> MiniSAS HD port attention LED (4)
<b>3</b> SFP+ Ethernet port link LED (4)	<b>4</b> SFP+ Ethernet port attention LED (4)
<b>5</b> UTA2 SFP+ port link LED (8)	<b>6</b> UTA2 SFP+ port attention LED (8)
<b>7</b> Controller activity LED (2)	<b>8</b> Controller attention LED (2)
<b>9</b> Controller location LED (2)	<b>10</b> NVRAM LED
<b>11</b> RJ45 management port link LED (2)	<b>12</b> RJ45 management port activity LED (2)
<b>13</b> Power supply attention LED (2)	<b>14</b> AC power good LED (2)

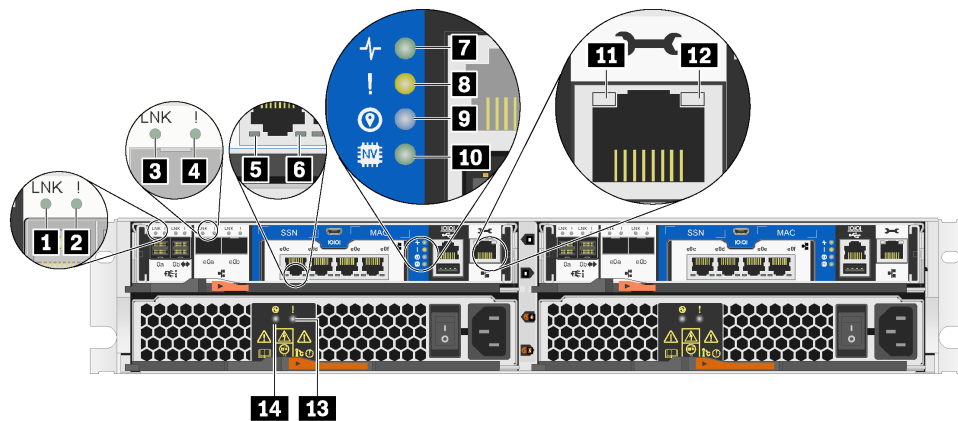


Figure 7. Rear view LEDs – type 2

Table 7. LEDs on the rear of the system

<b>1</b> MiniSAS HD port link LED (4)	<b>2</b> MiniSAS HD port attention LED (4)
<b>3</b> SFP+ Ethernet port link LED (4)	<b>4</b> SFP+ Ethernet port attention LED (4)
<b>5</b> RJ45 10 GbE host port link LED (8)	<b>6</b> RJ45 10 GbE host port activity LED (8)
<b>7</b> Controller activity LED (2)	<b>8</b> Controller attention LED (2)
<b>9</b> Controller location LED (2)	<b>10</b> NVRAM LED

Table 7. LEDs on the rear of the system (continued)

<b>11</b> RJ45 management port link LED (2)	<b>12</b> RJ45 management port activity LED (2)
<b>13</b> Power supply attention LED (2)	<b>14</b> AC power good LED (2)

### 1 2 MiniSAS HD port LEDs

Each MiniSAS HD port has two status LEDs.

Status LED	Color	Status	Description
<b>1</b> MiniSAS HD port link LED	Green	On	Link is established on at least one external SAS lane.
	None	Off	No link is established on any external SAS lane
<b>2</b> MiniSAS HD port attention LED	Yellow	On	SAS link requires attention.
	None	Off	SAS link operates normally.

### 3 4 SFP+ Ethernet port LEDs

Each SFP+ Ethernet port has two status LEDs.

Status LED	Color	Status	Description
<b>3</b> SFP+ Ethernet port link LED	Green	On	A connection is established on the port.
	None	Off	No connection is established on the port.
<b>4</b> SFP+ Ethernet port attention LED	Amber	On	The port requires attention.
	None	Off	The port operates normally.

### 5 6 Type 1 – UTA2 SFP+ port LEDs

Each UTA2 SFP+ port has two status LEDs.

Status LED	Color	Status	Description
<b>5</b> UTA2 SFP+ port link LED	Green	On	A connection is established on the port.
	None	Off	No connection is established on the port.
<b>6</b> UTA2 SFP+ port attention LED	Amber	On	The port requires attention.
	None	Off	The port operates normally.

### 5 6 Type 2 – RJ45 10 GbE host port LEDs

Each RJ45 10 GbE host port has two status LEDs.

Status LED	Color	Status	Description
<b>5</b> RJ45 10 GbE host port link LED	Green	On	A link is established between the port and some upstream device.
	None	Off	No link is established.
<b>6</b> RJ45 10 GbE host port activity LED	Amber	Blinking	Traffic is flowing over the connection.
	None	Off	No traffic is flowing over the connection.

### 7 Controller activity LED

Status	Color	Description
On	Green	The controller is active.
Off	None	The controller is off.

### 8 Controller attention LED

Status	Color	Description
On	Yellow	The controller requires attention.
Off	None	The controller operates normally.

### 9 Controller location LED

Status	Color	Description
On or blinking	Blue	The controller location LED is manually activated to help locating the controller.
Off	None	The controller location LED is not activated.

### 10 NVRAM LED

Status	Color	Description
Blinking	Green	IO is being written to local flash memory.
On	Green	Data is in cache and has not been written to local disks.
Off	None	No data is in cache that needs to be written to local disks.

### 11 12 RJ45 management port LEDs

Each RJ45 management port has two status LEDs.

Status LED	Color	Status	Description
11 RJ45 management port link LED	Green	On	A link is established between the port and some upstream device.
	None	Off	No link is established.
12 RJ45 management port activity LED	Amber	Blinking	Traffic is flowing over the connection.
	None	Off	No traffic is flowing over the connection.

### 13 Power supply attention LED

Status	Color	Description
On	Amber	No AC power is present or power supply is failed.
Off	None	AC power is present.

### 14 AC power good LED

Status	Color	Description
On	Green	AC power is present and good.
Off	None	AC power is not detected.



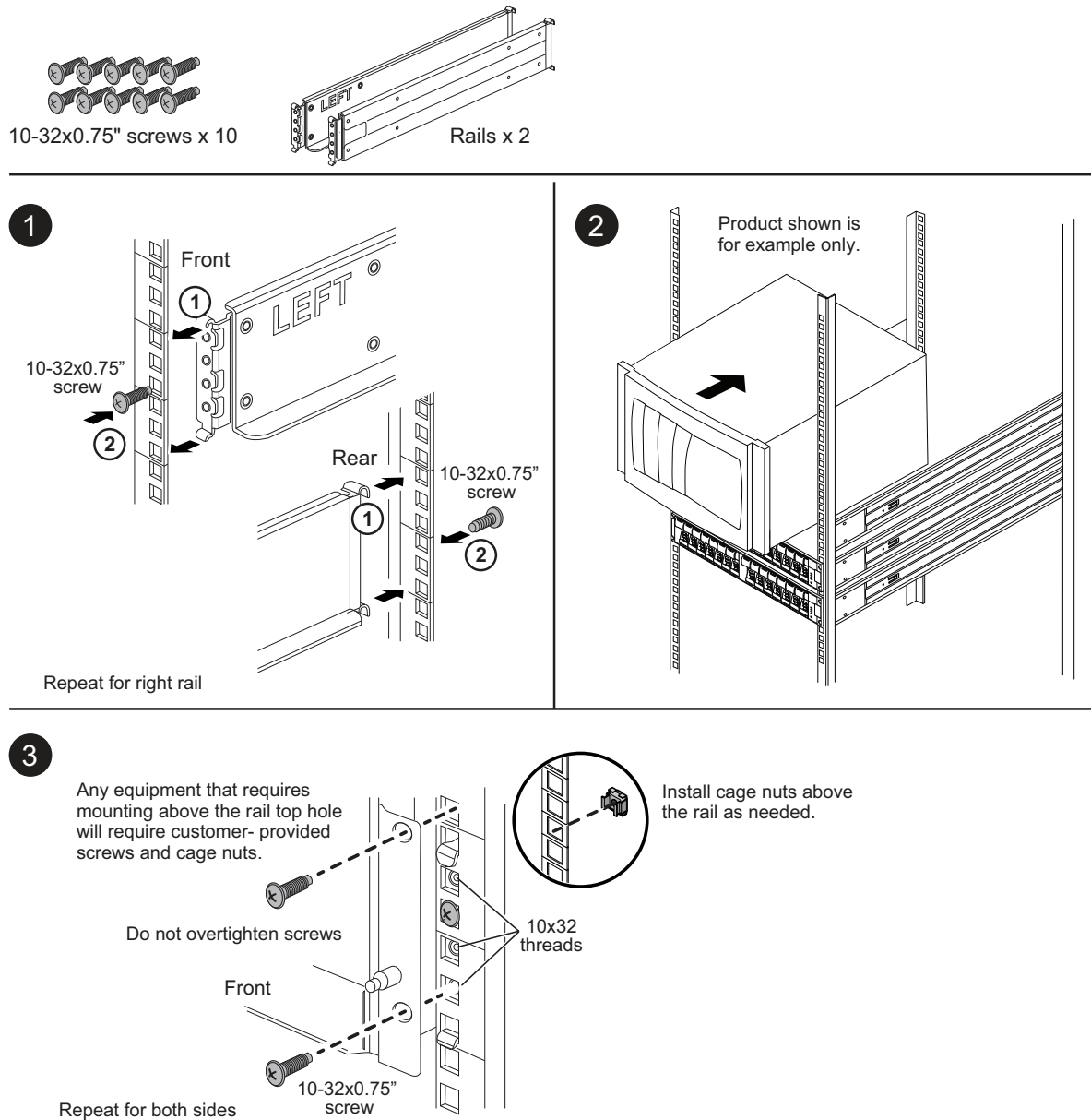
## Chapter 3. Rail kit installation instructions

This chapter includes information about rail kit installation instructions.

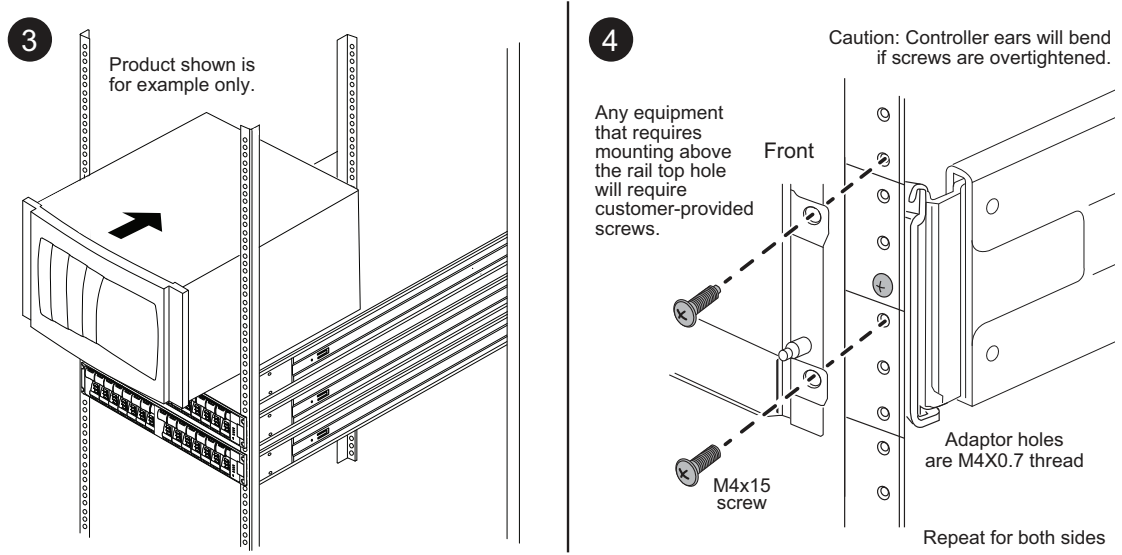
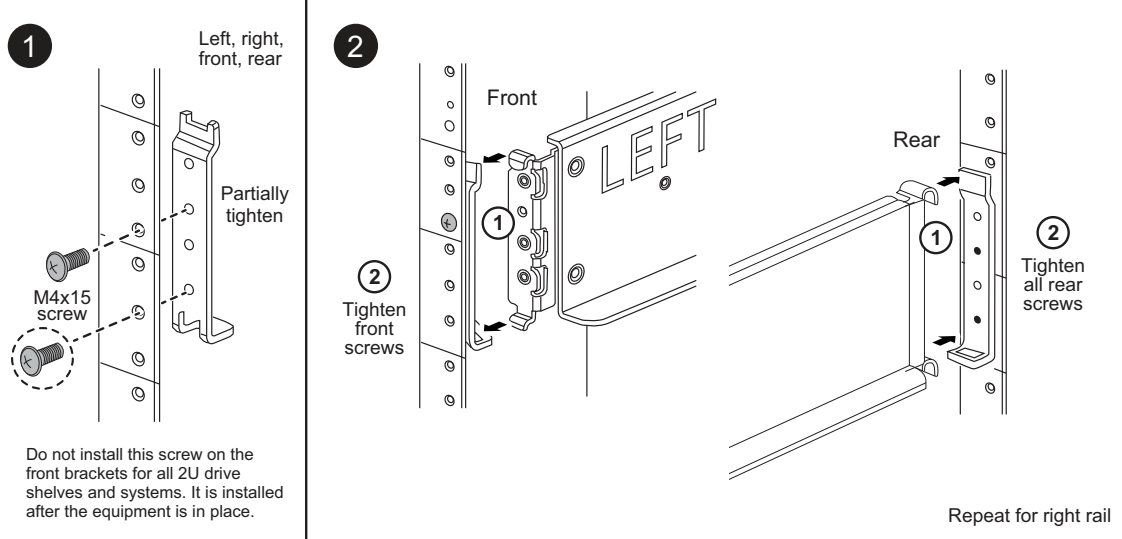
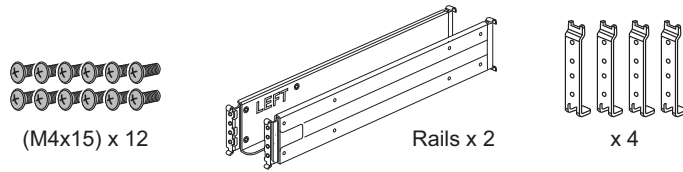
### DM/DE Series 2U24, 3U, 4U rail kit installation instructions

The Rail can be either installed on a standard square-hole four-post rack or a standard round-hole four-post rack by using the round-to-square hole adaptor brackets. Before you begin, verify that you have the correct rail type by examining the PN label located on the rail (PN: SM17A38397).

### Installing Rail to square-hole four-post rack



# Installing Rail to round-hole four-post rack



## DM/DE Series 2U12 rail kit installation instructions

Using this rail kit, a 2U 12-drive enclosure can be installed in a four-post rack.

### Before you begin

The rail kit includes the following items:

- A pair of slide rails for four-post racks with alignment screws installed for the square-hole rack
- (Optional) rack alignment guide tool
- Flat-head M5 screws pre-installed in rails, qty 8

- Round-head M5 screws pre-installed in rails, qty 2
- Alignment screws

Verify that you have the correct rail type by examining the PN label located on the outer box for the following:

- **Four-Post:** SM17A38396

The kit includes the following types of screws:

Type of hardware	Description	Quantity
Flat-head M5 screw; 14 mm long	You use six M5 screws for attaching the rails to the rack, and two M5 screws for attaching the brackets at the back of the enclosure to the brackets at the back of the rails.	8
Round-head M5 screw; 12 mm long	You use these screws to attach the enclosure to the rails.	2
Alignment screws for racks with square holes 9.4 mm (head) X 7.5 mm (length)	The 9.4mm head screws align the rails in the square-hole rack, 2 in each of 4 corners. <b>Note:</b> Alignment screws for square-hole racks come pre-installed in the rails.	8
Alignment screws for racks with round holes 7 mm (head) X 7.5 mm (length)		8

### About this Procedure

- You can install the enclosure in either a square-hole or round-hole rack.
- You must use only the screws that are provided in the kit.

Step 1. Determine where you want to install the enclosure in the rack. Use the rack alignment guide tool to ensure that you install the enclosure at the same level on either post of the rack.

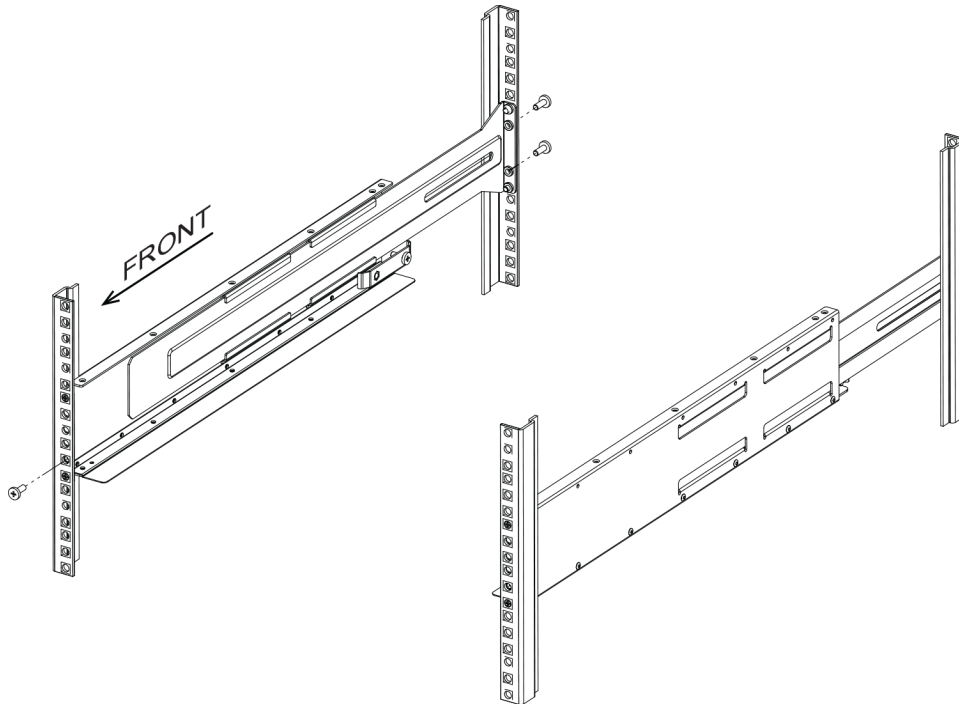
**Note:** When possible, install enclosures starting at the bottom of the rack and working up, so that you can use the enclosures underneath as a guide for installing the next set of rails.

Step 2. Remove the M5 screws from each of the rail ends and the side brackets and saved. Make sure to leave the 8 outer alignment screws (9.4mm head for the square-hole rack) in the rail flanges for proper alignment in the rack.

- If you have a round-hole rack, remove the eight pre-installed square-hole rack alignment screws and install the eight round-hole rack alignment screws.

**Note:** Ensure that you use the screws that are appropriate for your rack.

- Place the rail inside the rack where you want to install the enclosure, and align the alignment screws on the rail with the holes on the front post of the rack.
- Extend the rail to the back post of the rack until the flanges on the rail touch the inside of the rack.
- Insert one flat-head M5 screw through the hole in the front of the rack, and two flat-head M5 screws through the holes at the back of the rack.



e. Repeat these steps for the other rail.

Step 3. Place the back of the enclosure (the end with the connectors) on the rails.

**Attention:** A fully loaded enclosure weighs approximately 65 lb (29 kg). Two persons are required to safely move the enclosure.

Step 4. Carefully slide the enclosure all the way onto the rails.

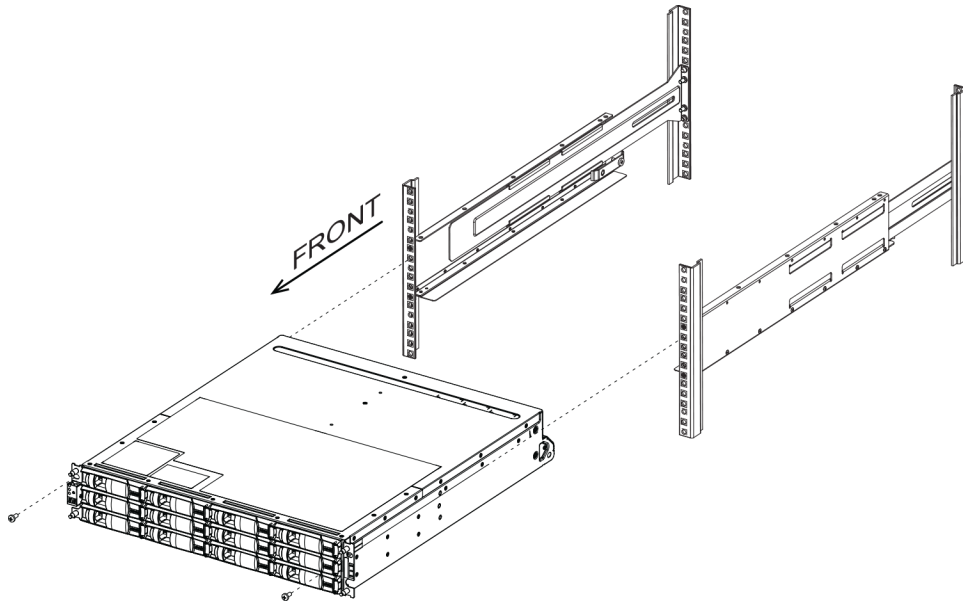
**Note:** If applicable, you might need to remove the shelf end caps or the system bezel to secure the enclosure to the rack post; if so, you need to replace the end caps or bezel when you are done.

**Attention:**

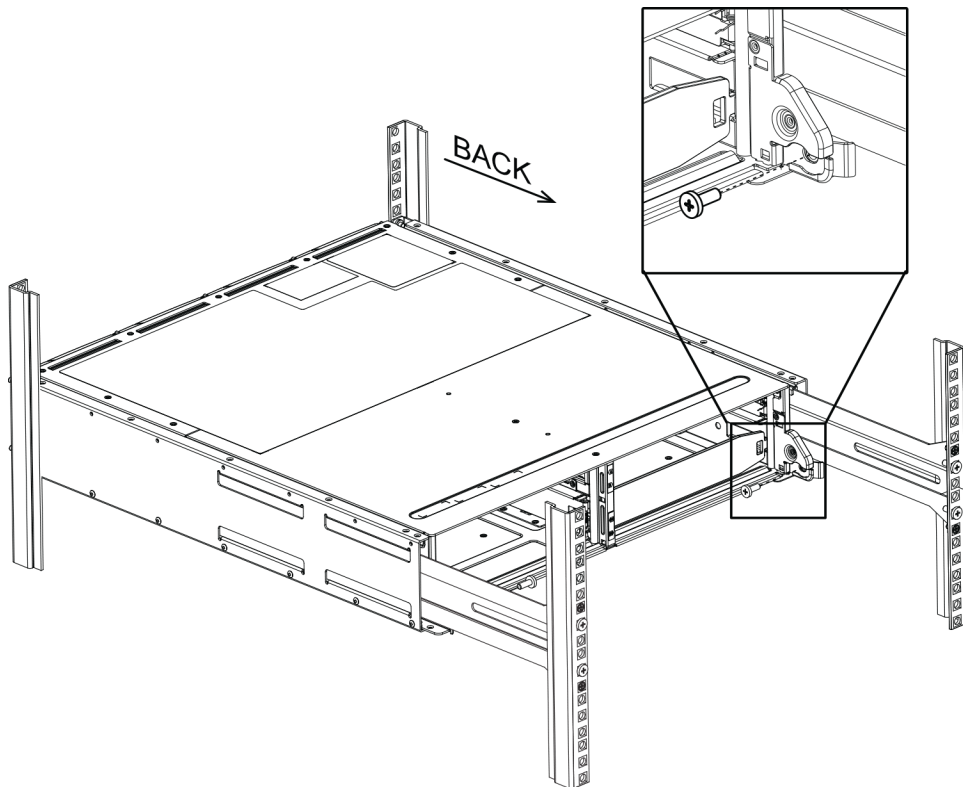
- You might need to adjust the rails to ensure that the enclosure slides all the way onto the rails.
- Two M5 screws are used to secure the enclosure to the back of the rails. You might need to remove the M5 screws on the inner rail to ensure that the enclosure slides all the way back.

**Attention:** Do not place additional equipment on the rails after you finish installing the enclosure. The rails are not designed to bear additional weight.

Step 5. Secure the enclosure to the front of the rack and rails by inserting two round-head M5 screws through the mounting brackets (pre-installed on either side of the front of the enclosure), the holes on the rack, and the holes on the front of rails.



Step 6. Secure the enclosure to the back of the rails by inserting two M5 screws through the brackets at the enclosure and the rail kit bracket.



Step 7. If applicable, replace the shelf end caps or the system bezel.

Step 8. See the appropriate installation instructions or upgrade guide for your shelf or system to complete the installation and setup tasks. Documentation can be found on the ThinkSystem documentation Information Center at:

<http://thinksystem.lenovofiles.com/help/index.jsp>



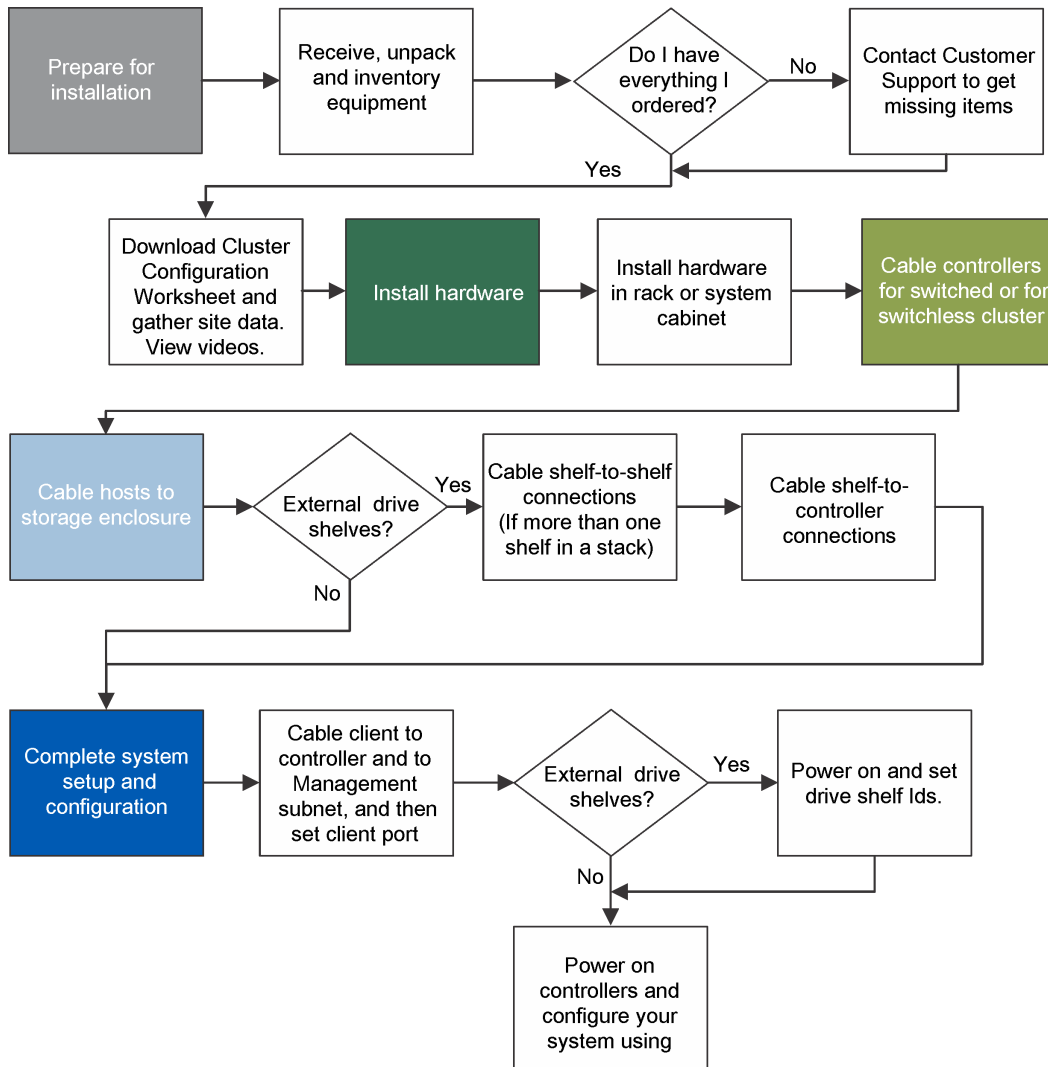
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## Chapter 4. System installation and setup

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### Installation and setup high-level workflow

Before you begin the installation and setup of your new system, you can familiarize yourself with the installation process.



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### Preparing for installation

To install your system, you need to create an account, register the system, and get license keys. You also need to inventory the appropriate number and type of cables for your system and collect specific network information.

#### Before you begin

You need to have access to Lenovo Press for information on your site requirements as well as additional information on your configured system.

## [Lenovo Press](#)

You need to provide the following at your site:

- Rack space for the storage system
- Screwdriver
- Additional networking cables to connect your system to your network switch and Microsoft Windows client
- A client with a USB/serial connection and access to a web browser to configure your system







Step 1. Unpack the contents of all boxes.

Step 2. Record the system serial number from the storage enclosure.



Step 3. Make a note of the number and types of cables you received. The following table identifies the types of cables you might receive. If you receive a cable not listed in the table, refer to the Lenovo Press to locate the cable and identify its use.

## [Lenovo Press](#)

Type of cable...	Connector type	For...
10 GbE cable (order dependent)		Cluster interconnect network
	or 	Data
RJ-45 (order dependant)		Management network and Ethernet data
Storage (order dependent)		Storage
Micro-USB console cable		Console connection during software setup
Power cables		Powering up the system

Step 4. Complete the *Cluster configuration worksheet*.

---

## Installing the hardware

You need to install your system in a 4-post rack or Lenovo system cabinet, as applicable.

Step 1. Install the rail kits, as needed. “DM/DE Series 2U24, 3U, 4U rail kit installation instructions” on page 11

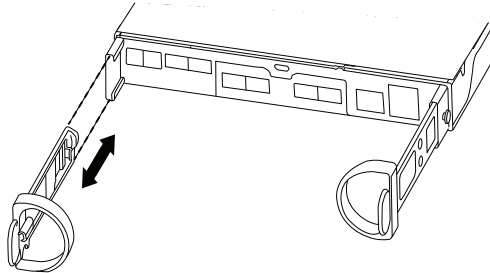
Step 2. Install and secure your system using the instructions included with the rail kit.

**Attention:** You need to be aware of the safety concerns associated with the weight of the system.





Step 3. Attach cable management devices (as shown).



Step 4. Place the bezel on the front of the system.

## Cabling a two-controller switchless cluster, unified network configuration

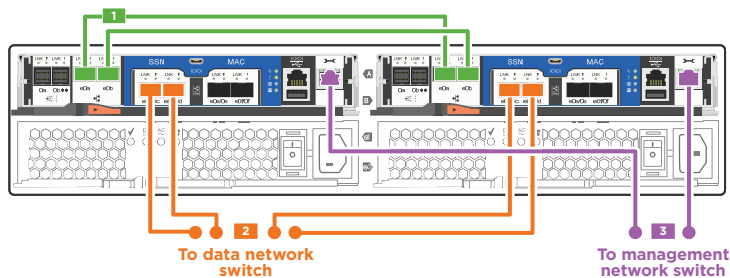
Management network, UTA2 data network, and management ports on the controllers are connected to switches. The cluster interconnect ports are cabled on both controllers.

### Before you begin

See your network administrator for help connecting to the switches.

Step 1. Cable your system using the following steps:

**Note:** As you insert the connector, you should feel it click into place; if you do not feel it click, remove it, turn it around and try again.



Step	Perform on each controller	Ports used
1	Cable the cluster interconnect ports.	<ul style="list-style-type: none"> <li>e0a to e0a</li> <li>e0b to e0b</li> </ul>
2	Cable the UTA2 data ports to the data network switches.	<ul style="list-style-type: none"> <li>e0c and e0d</li> <li>or e0e and e0f</li> </ul>
3	Cable the management ports to the management network switches.	<ul style="list-style-type: none"> <li>e0M</li> </ul>
!	DO NOT the plug power cords in at this point.	Not applicable.

Step 2. To cable your storage, see “Cabling controllers to drive shelves” on page 22.

## Cabling a two-controller switchless cluster, Ethernet network configuration

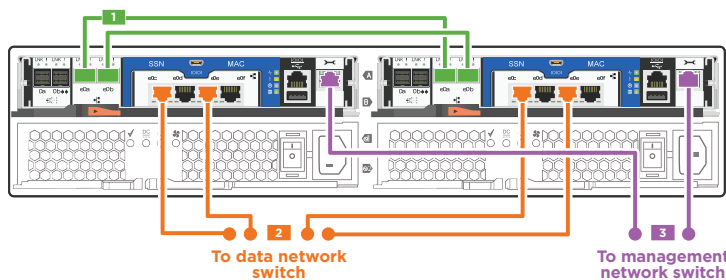
Management network, Ethernet data network, and management ports on the controllers are connected to switches. The cluster interconnect ports are cabled on both controllers.

### Before you begin

See your network administrator for help connecting to the switches.

Step 1. Cable your system using the following steps:

**Note:** As you insert the connector, you should feel it click into place; if you do not feel it click, remove it, turn it around and try again.



Step	Perform on each controller	Ports used
1	Cable the cluster interconnect ports.	<ul style="list-style-type: none"> <li>e0a to e0a</li> <li>e0b to e0b</li> </ul>
2	Cable the Ethernet data ports to the data network switches.	<ul style="list-style-type: none"> <li>e0c and e0d</li> <li>or e0d and e0f</li> </ul>
3	Cable the management ports to the management network switches.	<ul style="list-style-type: none"> <li>e0M</li> </ul>
!	DO NOT the plug power cords in at this point.	Not applicable.

Step 2. To cable your storage, see “Cabling controllers to drive shelves” on page 22.

## Cabling a switched cluster, unified network configuration

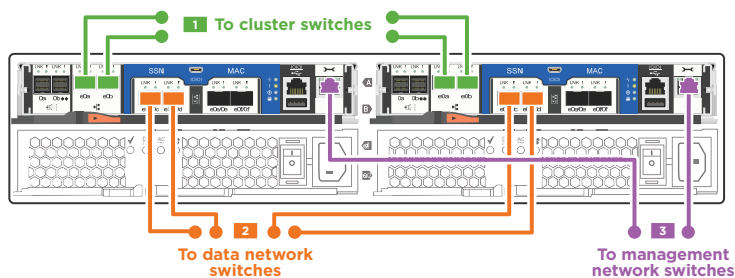
Management network, UTA2 data network, and management ports on the controllers are connected to switches. The cluster interconnect ports are cabled to the cluster interconnect switches.

### Before you begin

See your network administrator for help connecting to the switches.

Step 1. Cable your system using the following steps:

**Note:** As you insert the connector, you should feel it click into place; if you do not feel it click, remove it, turn it around and try again.



Step	Perform on each controller	Ports used
1	Cable the cluster interconnect ports to the cluster interconnect switches.	<ul style="list-style-type: none"> <li>e0a</li> <li>e0b</li> </ul>
2	Cable the UTA2 data ports to the data network switches.	<ul style="list-style-type: none"> <li>e0c and e0d</li> <li>or e0e and e0f</li> </ul>
3	Cable the management ports to the management network switches.	<ul style="list-style-type: none"> <li>e0M</li> </ul>
	DO NOT the plug power cords in at this point.	Not applicable.

Step 2. To cable your storage, see “Cabling controllers to drive shelves” on page 22.

## Cabling a switched cluster, Ethernet network configuration

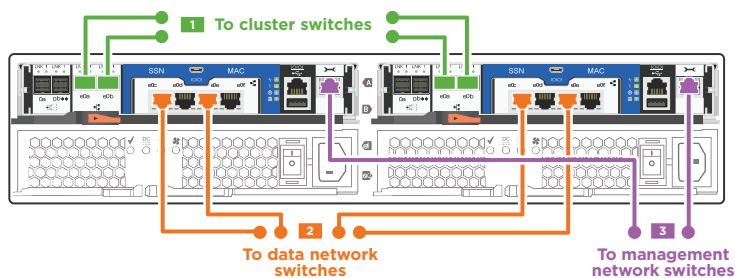
Management network, Ethernet data network, and management ports on the controllers are connected to switches. The cluster interconnect ports are cabled to the cluster interconnect switches.

### Before you begin


See your network administrator for help connecting to the switches.

Step 1. Cable your system using the following steps:

**Note:** As you insert the connector, you should feel it click into place; if you do not feel it click, remove it, turn it around and try again.



Step	Perform on each controller	Ports used
1	Cable the cluster interconnect ports to the cluster interconnect switches.	<ul style="list-style-type: none"> <li>e0a</li> <li>e0b</li> </ul>
2	Cable the UTA2 data ports to the data network switches.	<ul style="list-style-type: none"> <li>e0c and e0e</li> <li>or e0d and e0f</li> </ul>

Step	Perform on each controller	Ports used
3	Cable the management ports to the management network switches.	<ul style="list-style-type: none"> <li>e0M</li> </ul>
	DO NOT the plug power cords in at this point.	Not applicable.

Step 2. To cable your storage, see “Cabling controllers to drive shelves” on page 22.

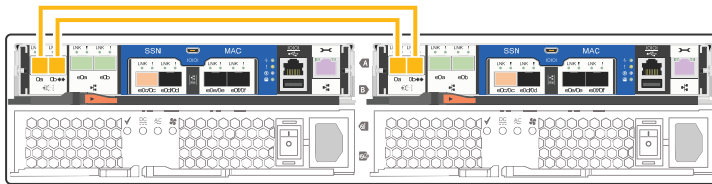
## Cabling controllers to drive shelves

You must cable the controllers to your drive shelves or to the onboard SAS ports if you only have onboard drives and no external drive shelves.

### Cabling storage on a two-controller switchless cluster with no external storage

You must cable the SAS ports together in a two-controller switchless cluster so that both controllers can access the partner's onboard storage.

Step 1. Cable the SAS ports on your two-controller switchless cluster, without external storage, using the following steps:



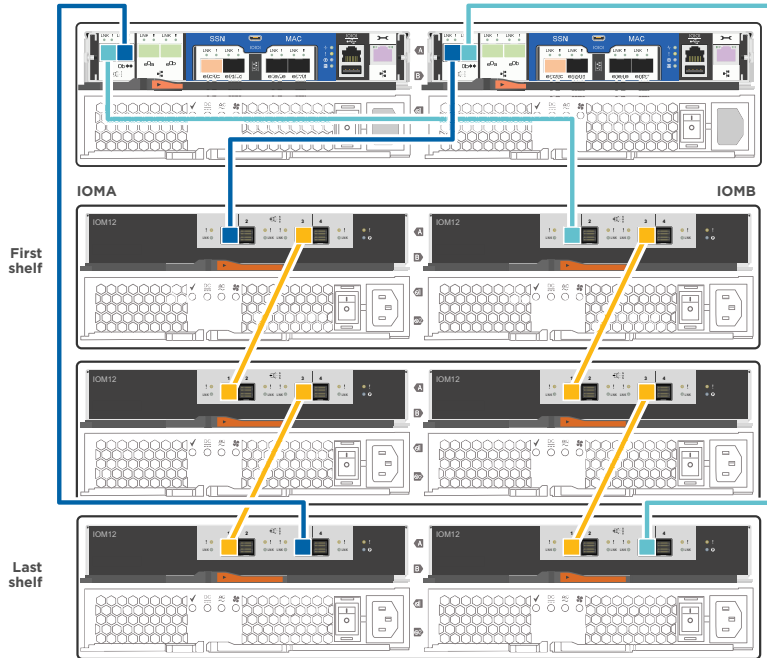
Step	Perform on each controller	Ports used
1	Cable the SAS ports.	<ul style="list-style-type: none"> <li>Controller 1 0a to Controller 2 0b.</li> <li>Controller 1 0b to Controller 2 0a.</li> </ul>

Step 2. To complete setting up your system, see “Completing system setup and configuration” on page 23.

### Cabling storage on an HA pair with external drive shelves

You must cable the shelf-to-shelf connections, and then cable both controllers to the drive shelves.

Step 1. Cable the HA pair with external drive shelves using the following steps:



Step	Perform on each controller	Ports used
1	Cable the shelf-to-shelf ports.	<ul style="list-style-type: none"> <li>Port 3 on IOM A to port 1 on the IOM A on the shelf directly below.</li> <li>Port 3 on IOM B to port 1 on the IOM B on the shelf directly below.</li> </ul>
2	Connect each controller to IOM A in the stack.	<ul style="list-style-type: none"> <li>Controller 1 port 0b to IOM A port 3 on last drive shelf in the stack.</li> <li>Controller 2 port 0a to IOM A port 1 on the first drive shelf in the stack.</li> </ul>
3	Connect each controller to IOM B in the stack	<ul style="list-style-type: none"> <li>Controller 1 port 0a to IOM B port 1 on first drive shelf in the stack.</li> <li>Controller 2 port 0b to IOM B port 3 on the last drive shelf in the stack.</li> </ul>

If you have more than one drive shelf stack, see the *Installation and Cabling Guide* for your drive shelf type.

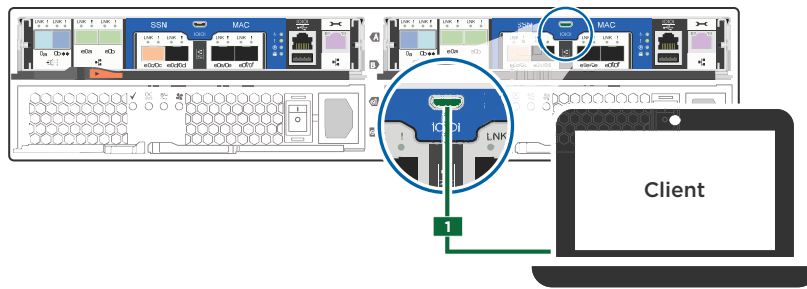
Step 2. To complete setting up your system, see “Completing system setup and configuration” on page 23.

## Completing system setup and configuration

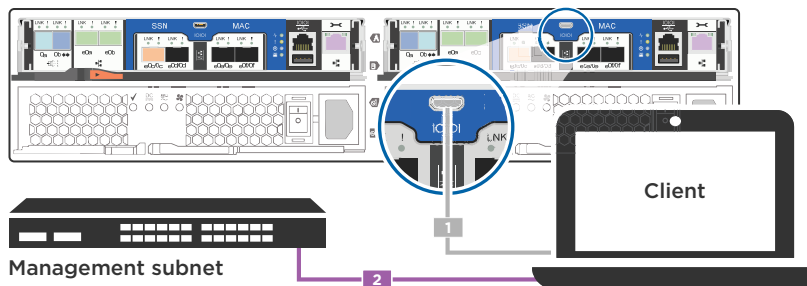
You must cable and configure your Windows client before completing your system setup and configuration.

Step 1. Cable and configure your client:

- a. Connect the console cable to the client and the console port on the controller module using the console cable that came with your system.



- b. Connect the client to the switch on the management subnet.



- c. Assign a TCP/IP address to the client, using one that is on the management subnet.

Step 2. If your system has one or more drive shelves, set the shelf IDs:

- a. Power on the drive shelf, and then remove the end cap on the left of the shelf.
- b. Press and hold the orange button until the first digit blinks, and then press the button to advance the first digit (0-9) to the desired number. The first digit continues to blink.
- c. Press and hold the button until the second digit blinks, and then press the button to advance the second digit (0-9) to the desired number. The first digit stops blinking, and the second digit continues to blink.
- d. Press and hold the button until the second digit stops blinking, and then replace the end cap on the shelf.
- e. Wait about 10 seconds for both digits to start blinking again and for the LED to illuminate, and then power-cycle the drive shelf to make the shelf ID take effect.
- f. Repeat these steps for any remaining drive shelves.

Step 3. Plug the power cords into the power supplies, and then connect them to power sources on different circuits.

Step 4. Turn on the power switches to both controllers.



Step 5. Set the console port on the client to 115,200 baud with N-8-1.

**Note:** See your client's online help for how to configure the console port.

Step 6. Assign an initial controller management IP address to one of the controllers.

If the management network has DHCP...	Then...
Configured	Record the IP address assigned to the new controller modules.
Not configured	<ol style="list-style-type: none"><li>1. Open a console session using PuTTY, a terminal server, or the equivalent for your environment.  <b>Note:</b> Check your client's online help if you do not know how to configure PuTTY.</li><li>2. Enter the management IP address when prompted by the script.</li></ol>

Step 7. Using System Manager from your client, configure your cluster:

a. Point your browser to the controller management IP address (from Step 6).

**Note:** The format for the address is `https://x.x.x.x`.

b. Configure the system using the data you collected in the *Cluster configuration worksheet*.





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## Chapter 5. Hardware replacement procedures

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### Hot-swapping an internal disk drive

When a disk drive fails, the storage system logs a warning message to the system console indicating which disk drive failed, the fault LED on the operator display panel illuminates, and the fault LED on the failed disk drive illuminates. You can hot-swap a disk drive while the system remains powered on.

How you hot-swap the disk depends how the disk drive is being used. By using the correct procedure, you can prevent unwanted AutoSupport notifications from being generated. Depending on your context, disk drives with Storage Encryption might require additional steps before and after the hot-swap. See the applicable Data ONTAP storage management guide for information about the commands that apply to your context.

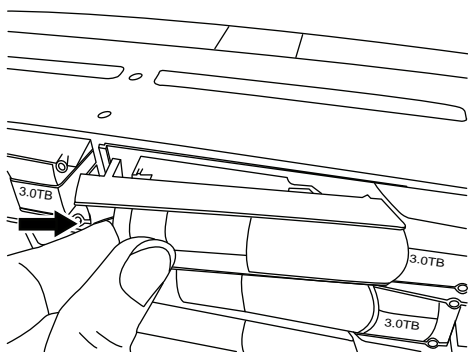
See the [Lenovo Press](#) for information about supported disk drives.

When replacing several disk drives, you must wait one minute between the removal of each failed disk drive and the insertion of the replacement disk drive to allow the storage system to recognize the existence of each new disk.

**Note:** Always use two hands when removing, installing, or carrying a disk drive.

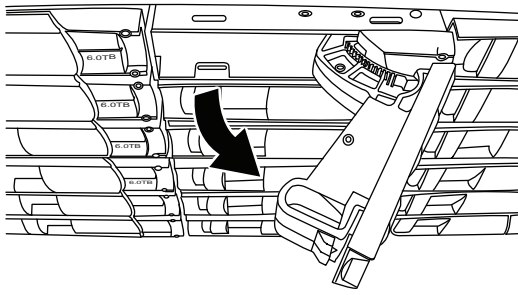
- Step 1. Properly ground yourself.
- Step 2. Gently remove the bezel from the front of the system.
- Step 3. Physically identify the failed disk drive from the system console warning message and the illuminated fault LED on the disk drive.
- Step 4. Press the release button on the disk drive face. Depending on the storage system, the disk drives have the release button located at the top or on the left of the disk drive face.

For example, the following illustration shows a disk drive with the release button located on the left of the disk drive face.



The cam handle on the disk drive springs open partially and the disk drive releases from the midplane.

- Step 5. Pull the cam handle to its fully open position to unseat the disk drive from the midplane and gently slide the disk drive out of the disk shelf. For example, the following illustration shows a disk drive with the cam handle in its fully open position.



**Note:** Use two hands when removing the disk drives but do not place hands on the disk drive boards exposed on the underside of the disk carrier.

- Step 6. With the cam handle in the open position, insert the replacement disk drive into the disk shelf slot, firmly pushing until the disk drive stops.

**Note:** Use two hands when inserting the disk drive.

**Note:** Wait one minute between removal of the failed disk drive and insertion of the replacement disk drive. This allows the system to recognize that a disk drive was removed.

- Step 7. Close the cam handle so that the disk drive is fully seated into the midplane and the handle clicks into place. Be sure to close the cam handle slowly so that it aligns correctly with the face of the disk drive.
- Step 8. If you are replacing another disk drive, repeat Steps 1 through 7.
- Step 9. Reinstall the bezel.
- Step 10. Return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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## Replacing the caching module

You must replace the caching module in the controller module when your system registers a single AutoSupport (ASUP) message that the module has gone offline; failure to do so results in performance degradation.

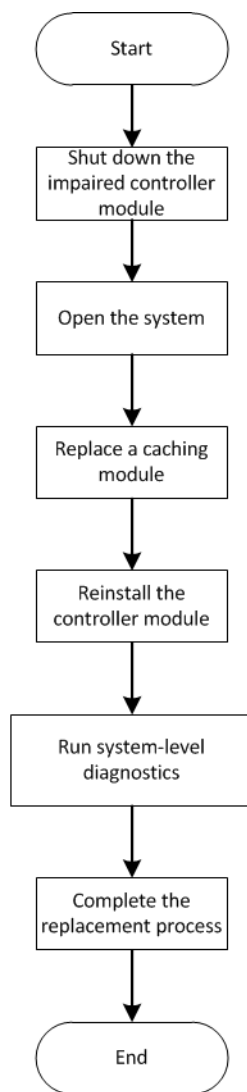
### Before you begin

All other components in the system must be functioning properly; if not, you must contact technical support.

You must replace the failed component with a replacement FRU component you received from your provider.

### Workflow diagram

This diagram shows the workflow of the caching module replacement procedure for a system.



## Shutting down the degraded controller

You can shut down or take over the degraded controller using different procedures, depending on the storage system hardware configuration.

### Shutting down the controller

To shut down the degraded controller, you must determine the status of the node and, if necessary, take over the node so that the healthy node continues to serve data from the degraded controller storage.

#### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode: `cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

You might want to erase the contents of your caching module before replacing it.

- Step 1. Although data on the caching module is encrypted, you might want to erase any data from the impaired caching module and verify that the caching module has no data:
- Erase the data on the module: `system node flash-cache secure-erase run`
  - Verify that the data has been erased from the module: `system node flash-cache secure-erase show -node node_name`

The output should display the caching module status as erased.

- Step 2. If the degraded controller is part of an HA pair, disable automatic giveback from the console of the healthy controller using the following command: `storage failover modify -node local -auto-giveback false`

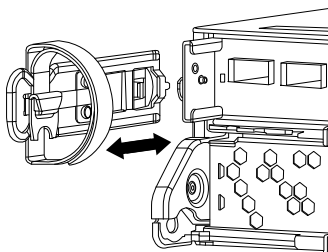
- Step 3. Take the degraded controller to the Autoboot Loader prompt by typing `storage failover takeover <impaired node name>` from the RJ45 management port of the degraded controller.

If the degraded controller is displaying...	Then...
The LOADER prompt	Go to the next step.
Waiting for giveback...	Press Ctrl-C, and then respond <code>y</code> when prompted.
System prompt or password prompt	Take over or halt the degraded controller: <ul style="list-style-type: none"> <li>Take over the degraded controller from the healthy controller: <code>storage failover takeover -ofnode <i>impaired_node_name</i></code> When the degraded controller shows <code>Waiting for giveback...</code>, press Ctrl-C, and then respond <code>y</code>.</li> </ul>

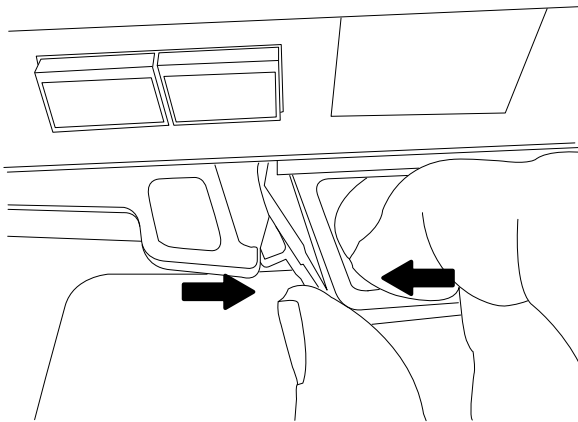
## Opening the system

To access components inside the controller, you must first remove the controller module from the system and then remove the cover on the controller module.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.
- Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.

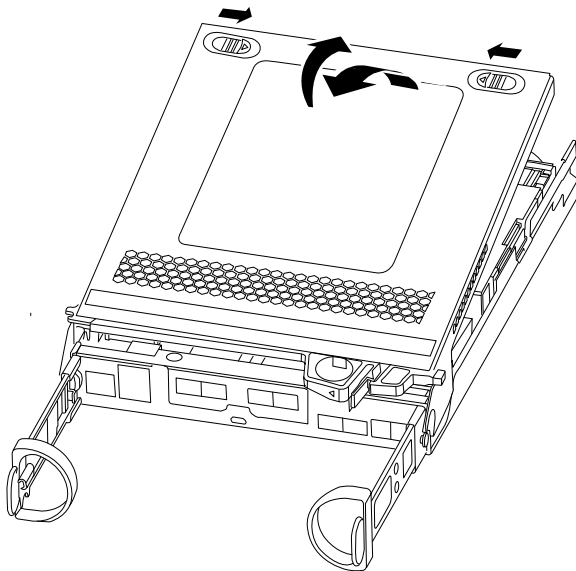


Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



Step 5. Turn the controller module over and place it on a flat, stable surface.

Step 6. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.



## Replacing a caching module

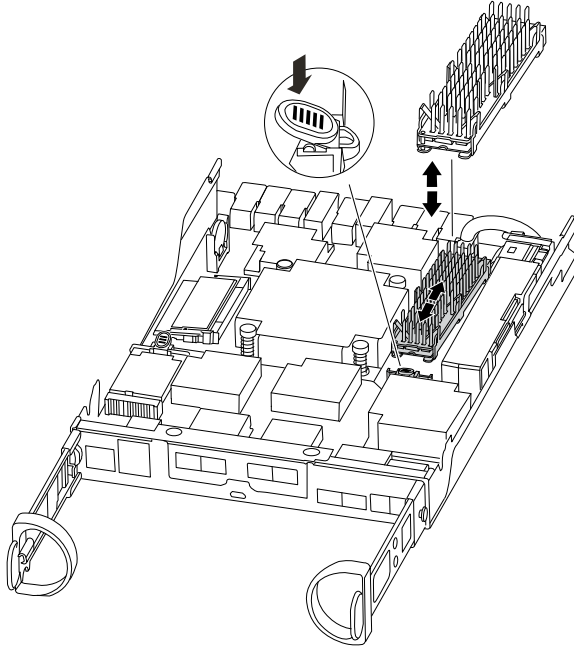
To replace a caching module referred to as the M.2 PCIe card on the label on your controller, locate the slot inside the controller and follow the specific sequence of steps.

### Before you begin

Your storage system must meet certain criteria depending on your situation:

- It must have the appropriate operating system for the caching module you are installing.
- It must support the caching capacity.
- All other components in the storage system must be functioning properly; if not, you must contact technical support.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Locate the caching module at the rear of the controller module and remove it.
  - a. Press the release tab.
  - b. Remove the heatsink.



- Step 3. Gently pull the caching module straight out of the housing.
- Step 4. Insert the new caching module in the controller, and then align the edges of the caching module with the socket housing and gently push it into the socket.
- Step 5. Verify that the caching module is seated squarely and completely in the socket. If necessary, remove the caching module and reseal it into the socket.
- Step 6. Reseat and push the heatsink down to engage the locking button on the caching module housing.
- Step 7. Close the controller module cover, as needed.

## Reinstalling the controller module

After you replace components in the controller module, reinstall it into the chassis.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. If you have not already done so, replace the cover on the controller module.
- Step 3. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

**Note:** Do not completely insert the controller module in the chassis until instructed to do so.

- Step 4. Recable the system, as needed. If you removed the media converters (SFPs), remember to reinstall them if you are using fiber optic cables.
- Step 5. Complete the reinstallation of the controller module by performing these steps:

The controller module begins to boot as soon as it is fully seated in the chassis. Be prepared to interrupt the boot process.

1. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.

**Attention:** Do not use excessive force when sliding the controller module into the chassis; you might damage the connectors.

The controller begins to boot as soon as it is seated in the chassis.

2. If you have not already done so, reinstall the cable management device.
3. Bind the cables to the cable management device with the hook and loop strap.
4. When you see Press Ctrl-C for Boot Menu, press Ctrl-C to interrupt the boot process.
5. Type `boot_ontap menu`.
6. Select option 5 from the menu that appears to boot into maintenance mode.

## Running system-level diagnostics

After installing a new caching module, you should run diagnostics.

### Before you begin

Your system must be at the LOADER prompt to get to the maintenance menu to start System Level Diagnostics.

All commands in the diagnostic procedures are issued from the controller where the component is being replaced.

- Step 1. If the controller to be serviced is not at the LOADER prompt, perform the following steps:
  - a. Select the option to boot to Maintenance mode by typing `halt`
  - b. Once at the LOADER prompt, type `boot_ontap menu`
  - c. When the system appears at the selection menu, choose option 5 to go into Maintenance mode.
- Step 2. Run diagnostics on the caching module: `sldiag device run -dev fcache`
- Step 3. Verify that no hardware problems resulted from the replacement of the caching module: `sldiag device status -dev fcache -long -state failed`  
System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.
- Step 4. Proceed based on the result of the preceding step:

If the system-level diagnostics tests...	Then...
Were completed without any failures	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log was cleared: <code>sldiag device status</code>  The following default response is displayed: SLDIAG: No log messages are present.</li> <li>3. Exit Maintenance mode by typing <code>halt</code>  The controller displays the LOADER prompt.</li> <li>4. If the controller does not automatically start ONTAP, boot the controller from the LOADER prompt: <code>boot_ontap</code></li> <li>5. Return the controller to normal operation by typing: <code>storage failover giveback -ofnode replacement_node_name</code></li> </ol>
Resulted in some test failures	<p>Determine the cause of the problem:</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by typing <code>halt</code></li> <li>2. After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Boot the controller module you are servicing, interrupting the boot by pressing <code>Ctrl-C</code> when prompted to get to the LOADER menu. If you removed the controller in the previous step, fully seat the controller module you are servicing in the chassis. The controller module boots up when fully seated.</li> <li>5. Select Boot to maintenance mode by typing <code>boot_diags</code></li> <li>6. Repeat all the steps necessary to perform the system level diagnostics for the cache module.</li> <li>7. Exit Maintenance mode by entering the following command: <code>halt</code>  After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>8. Rerun the system-level diagnostic test.</li> </ol>



## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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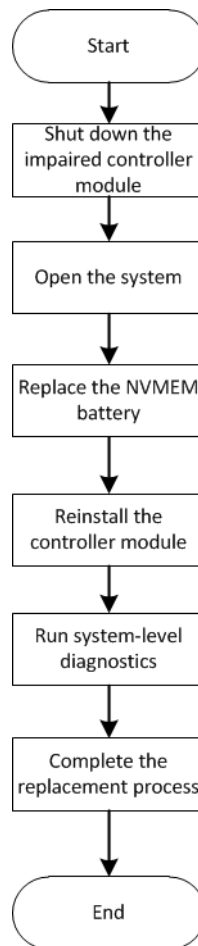
## Replacing the NVMEM battery

To replace an NVMEM battery in the system, you must remove the controller module from the system, open it, replace the battery, and close and reinstall the controller module.

All other components in the system must be functioning properly; if not, you must contact technical support.

## Workflow diagram

This diagram shows the workflow of the NVMEM battery replacement procedure.



## Shutting down the degraded controller

You can shut down or take over the degraded controller using different procedures, depending on the storage system hardware configuration.

## Shutting down the controller

To shut down the degraded controller, you must determine the status of the controller and, if necessary, take over that controller so that the healthy controller continues to serve data for the degraded controller's storage.

### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode:  
`cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

Step 1. If the degraded controller is part of an HA pair, disable automatic giveback from the console of the healthy controller using the following command: `storage failover modify -node local -auto-giveback false`

Step 2. Take the degraded controller to the LOADER prompt by typing `halt`.

If the degraded controller is displaying...	Then...
The LOADER prompt	Go to the next step.
Waiting for giveback...	Press Ctrl-C, and then respond <code>y</code> when prompted.
System prompt or password prompt	Take over or halt the degraded controller: <ul style="list-style-type: none"><li>• For an HA pair, take over the degraded controller from the healthy controller: <code>storage failover takeover -ofnode <i>impaired_node_name</i></code></li></ul> When the degraded controller shows Waiting for giveback..., press Ctrl-C, and then respond <code>y</code> .

Step 3. Turn off the power supplies, and then unplug the degraded controller's power cords from the power source.

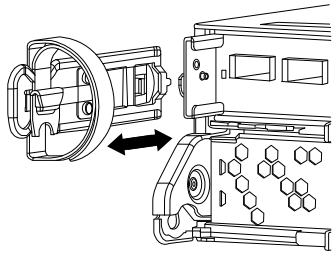
## Opening the system

To access components inside the controller, you must first remove the controller module from the system and then remove the cover on the controller module.

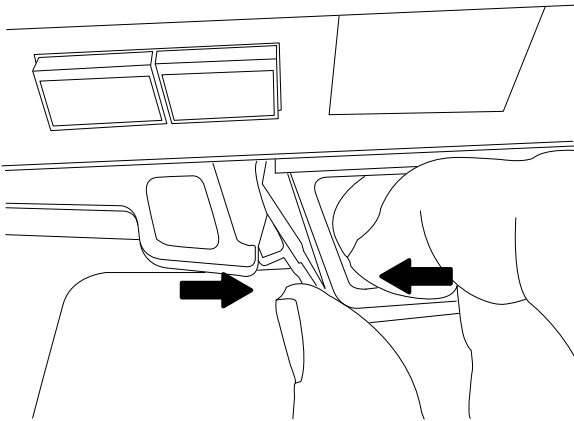
Step 1. If you are not already grounded, properly ground yourself.

Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.

Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.

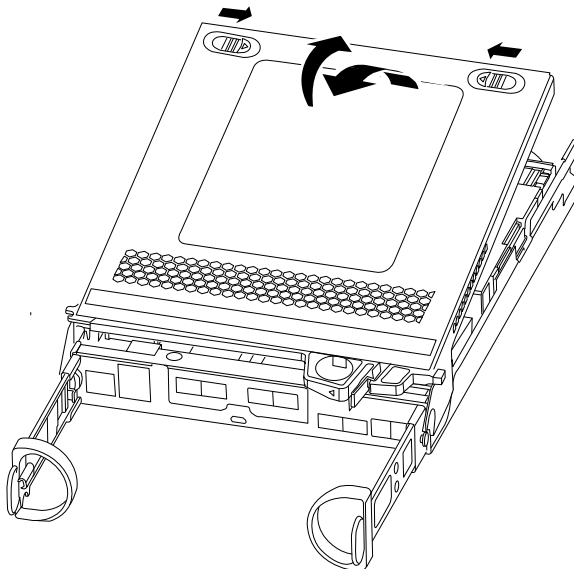


- Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



- Step 5. Turn the controller module over and place it on a flat, stable surface.

- Step 6. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.



## Replacing the NVMEM battery

To replace the NVMEM battery in your system, you must remove the failed NVMEM battery from the system and replace it with a new NVMEM battery.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Check the NVMEM LED:

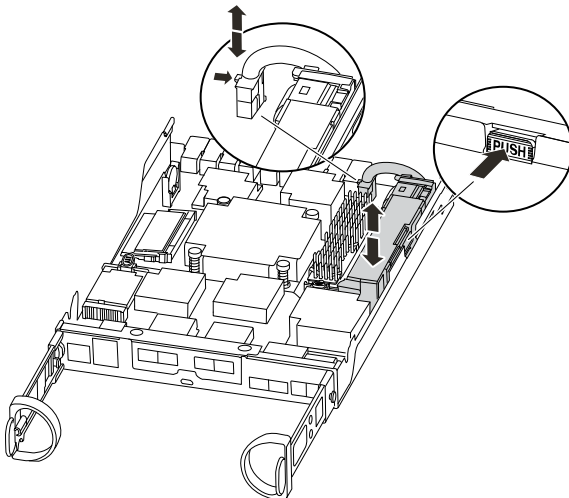
•



**Attention:** The NVRAM LED blinks while destaging contents to the flash memory when you halt the system. After the destage is complete, the LED turns off.

- If power is lost without a clean shutdown, the NVMEM LED flashes until the destage is complete, and then the LED turns off.
- If the LED is on and power is on, unwritten data is stored on NVMEM. This typically occurs during an uncontrolled shutdown after ONTAP has successfully booted.

- Step 3. Locate the NVMEM battery in the controller module.



- Step 4. Locate the battery plug and squeeze the clip on the face of the battery plug to release the plug from the socket, and then unplug the battery cable from the socket.
- Step 5. Remove the battery from the controller module and set it aside.
- Step 6. Remove the replacement battery from its package.
- Step 7. Loop the battery cable around the cable channel on the side of the battery holder.
- Step 8. Position the battery pack by aligning the battery holder key ribs to the “V” notches on the sheet metal side wall.
- Step 9. Slide the battery pack down along the sheet metal side wall until the support tabs on the side wall hook into the slots on the battery pack, and the battery pack latch engages and clicks into the opening on the side wall.
- Step 10. Plug the battery plug back into the controller module.

## Reinstalling the controller module

After you replace components in the controller module, reinstall it into the chassis.

- Step 1. If you are not already grounded, properly ground yourself.

- Step 2. If you have not already done so, replace the cover on the controller module.
- Step 3. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

**Note:** Do not completely insert the controller module in the chassis until instructed to do so.

- Step 4. Recable the system, as needed. If you removed the media converters (SFPs), remember to reinstall them if you are using fiber optic cables.
- Step 5. Complete the reinstallation of the controller module by performing these steps:

The controller module begins to boot as soon as it is fully seated in the chassis. Be prepared to interrupt the boot process.

1. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.

**Attention:** Do not use excessive force when sliding the controller module into the chassis; you might damage the connectors.

The controller begins to boot as soon as it is seated in the chassis.

2. If you have not already done so, reinstall the cable management device.
3. Bind the cables to the cable management device with the hook and loop strap.
4. When you see `Press Ctrl-C for Boot Menu`, press `Ctrl-C` to interrupt the boot process.
5. Type `boot_ontap` menu.
6. Select option 5 from the menu that appears to boot into maintenance mode.

## Running system-level diagnostics

After installing a new NVMEM battery, you should run diagnostics.

### Before you begin

Your system must be at the `LOADER` prompt to get to the maintenance menu to start System Level Diagnostics.

All commands in the diagnostic procedures are issued from the controller where the component is being replaced.

- Step 1. At the `LOADER` prompt, type `boot_ontap` menu.
- Step 2. Select option 5 from the menu that appears to access the special drivers specifically designed for system-level diagnostics to function properly. During the boot process, you can safely respond `y` to the prompts until the Maintenance mode prompt (`*>`) appears.
- Step 3. Run diagnostics on the NVMEM memory: `sldiag device run -dev nvmem`
- Step 4. Verify that no hardware problems resulted from the replacement of the NVMEM battery: `sldiag device status -dev nvmem -long -state failed`  
System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.
- Step 5. Proceed based on the result of the preceding step:

If the system-level diagnostics tests...	Then...
Were completed without any failures	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log was cleared: <code>sldiag device status</code>  The following default response is displayed: SLDIAG: No log messages are present.</li> <li>3. Exit Maintenance mode by typing <code>halt</code>  The controller displays the LOADER prompt.</li> <li>4. Boot the controller from the LOADER prompt: <code>boot_ontap</code></li> <li>5. Return the controller to normal operation by typing: <code>storage failover giveback -ofnode replacement_node_name</code></li> </ol>
Resulted in some test failures	<p>Determine the cause of the problem:</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by typing <code>halt</code></li> <li>2. After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Fully seat the controller module you are servicing in the chassis. The controller module boots up when fully seated.</li> <li>5. Boot the controller module you are servicing, interrupting the boot by pressing <code>Ctrl-C</code> when prompted to get to the LOADER prompt.</li> <li>6. Type <code>boot_ontap</code> menu.</li> <li>7. Select Boot to maintenance mode from the menu.</li> <li>8. Exit Maintenance mode by entering the following command: <code>halt</code>  After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>9. Rerun the system-level diagnostic test.</li> </ol>

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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## Swapping out a power supply

Swapping out a power supply involves turning off, disconnecting, and removing the old power supply and installing, connecting, and turning on the replacement power supply.

### Before you begin

All other components in the system must be functioning properly; if not, you must contact technical support.

### About this task

- The power supplies are redundant and hot-swappable.
- This procedure is written for replacing one power supply at a time.
- Power supplies are auto-ranging.

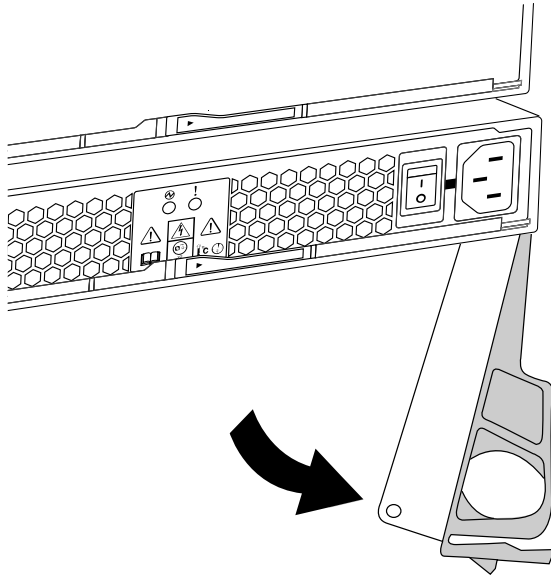
Step 1. Identify the power supply you want to replace, based on console error messages or through the LEDs on the power supplies.

Step 2. If you are not already grounded, properly ground yourself.

Step 3. Turn off the power supply and disconnect the power cables:

- a. Turn off the power switch on the power supply.
- b. Open the power cable retainer, and then unplug the power cable from the power supply.
- c. Unplug the power cable from the power source.

Step 4. Squeeze the latch on the power supply cam handle, and then open the cam handle to fully release the power supply from the mid plane.



Step 5. Use the cam handle to slide the power supply out of the system.

**CAUTION:**

**When removing a power supply, always use two hands to support its weight.**

Step 6. Make sure that the on/off switch of the new power supply is in the Off position.

Step 7. Using both hands, support and align the edges of the power supply with the opening in the system chassis, and then gently push the power supply into the chassis using the cam handle. The power supplies are keyed and can only be installed one way.

**Attention:** Do not use excessive force when sliding the power supply into the system. You can damage the connector.

Step 8. Close the cam handle so that the latch clicks into the locked position and the power supply is fully seated.

Step 9. Reconnect the power supply cabling:

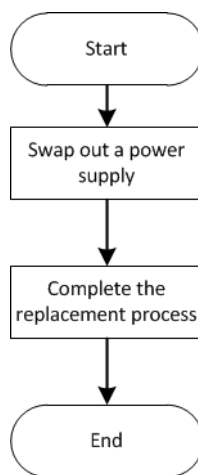
- a. Reconnect the power cable to the power supply and the power source.
- b. Secure the power cable to the power supply using the power cable retainer.

Step 10. Turn on the power to the new power supply, and then verify the operation of the power supply activity LEDs. The power supply LEDs are lit when the power supply comes online. The amber fault LED should be off and the DC good light should be on for each power supply.

## Workflow diagram

This diagram shows the workflow of the power supply replacement procedure for a system.





## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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## Replacing the controller module

You must verify the following prerequisites for the replacement procedure.

### Before you begin

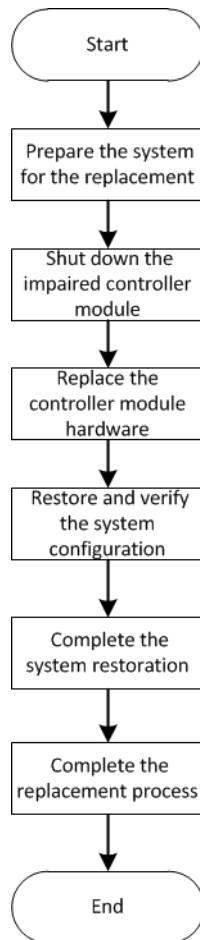
- All disk shelves must be working properly.
- The healthy controller must be able to take over the controller that is being replaced (referred to in this procedure as the degraded controller).

### About this task

- This procedure includes steps for automatically or manually reassigning disks to the *replacement* controller, depending on your system's configuration. You should perform the disk reassignment as directed in the procedure.
- You must replace the failed component with a replacement FRU component you received from your provider.
- You must be replacing a controller module with a controller module of the same model type; you cannot upgrade your system by just replacing the controller module.
- You cannot change any disks or disk shelves as part of this procedure.
- In this procedure, the boot device is moved from the degraded controller to the replacement controller so that the replacement controller will boot up in the same version of ONTAP as the old controller.
- It is important that you apply the commands in these steps on the correct systems:
  - The degraded controller is the controller that is being replaced.
  - The *replacement* controller is the new controller that is replacing the degraded controller.
  - The *healthy* controller is the surviving controller.
- You must always capture the degraded controller's console output to a text file. This provides you a record of the procedure so that you can troubleshoot any issues that you might encounter during the replacement process.

## Workflow diagram

This diagram shows the workflow of the controller module replacement procedure for a system.



## Shutting down the degraded controller

You can shut down or take over the degraded controller using different procedures, depending on the storage system hardware configuration.

### Shutting down the controller

To shut down the degraded controller, you must determine the status of the controller and, if necessary, take over that controller so that the healthy controller continues to serve data for the degraded controller's storage.

#### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode:  
`cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

Step 1. If the degraded controller is part of an HA pair, disable automatic giveback from the console of the healthy controller using the following command: `storage failover modify -node local -auto-giveback false`

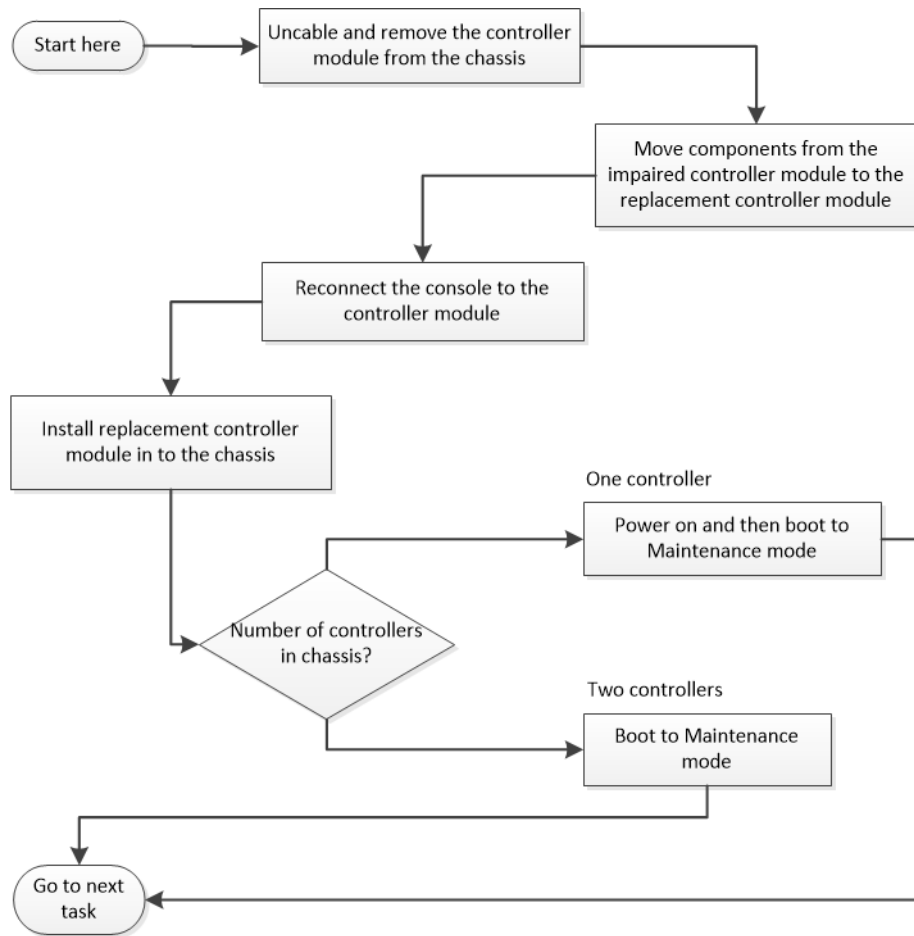
Step 2. Take the degraded controller to the LOADER prompt by typing `halt`.

If the degraded controller is displaying...	Then...
The LOADER prompt	Go to the next step.
Waiting for giveback...	Press Ctrl-C, and then respond <code>y</code> when prompted.
System prompt or password prompt	Take over or halt the degraded controller: <ul style="list-style-type: none"> <li>For an HA pair, take over the degraded controller from the healthy controller:  <code>storage failover takeover -ofnode <i>impaired_node_name</i></code></li> </ul> When the degraded controller shows <code>Waiting for giveback...</code> , press Ctrl-C, and then respond <code>y</code> .

Step 3. Turn off the power supplies, and then unplug the degraded controller's power cords from the power source.

## Replacing the controller module hardware

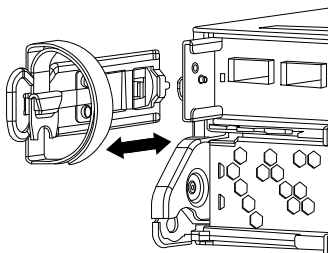
To replace the controller module hardware, you must remove the degraded controller, move FRU components to the replacement controller module, install the replacement controller module in the chassis, and then boot the system to Maintenance mode.



## Opening the system

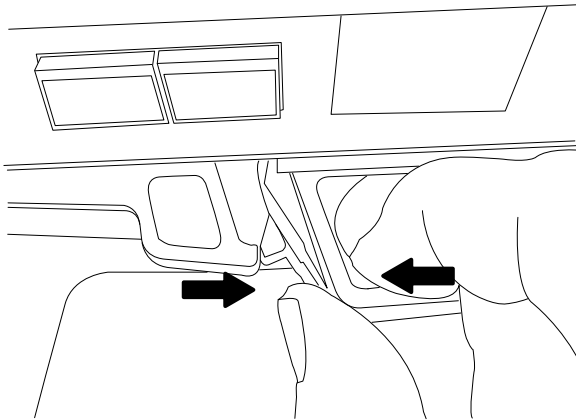
To replace the controller module, you must first remove the old controller module from the chassis.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.
- Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.



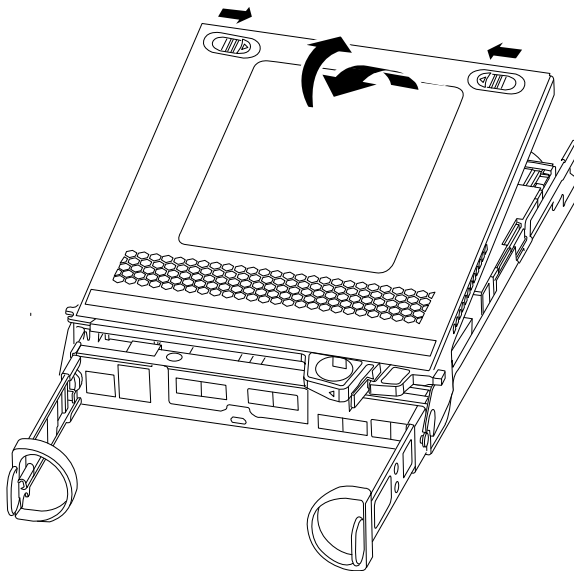
- Step 4. If you left the SFP modules in the system after removing the cables, move them to the new controller module.

Step 5. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



Step 6. Turn the controller module over and place it on a flat, stable surface.

Step 7. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.



### Moving the NVMEM battery

To move the NVMEM battery from the old controller module to the new controller module, you must perform a specific sequence of steps.

Step 1. Check the NVMEM LED:

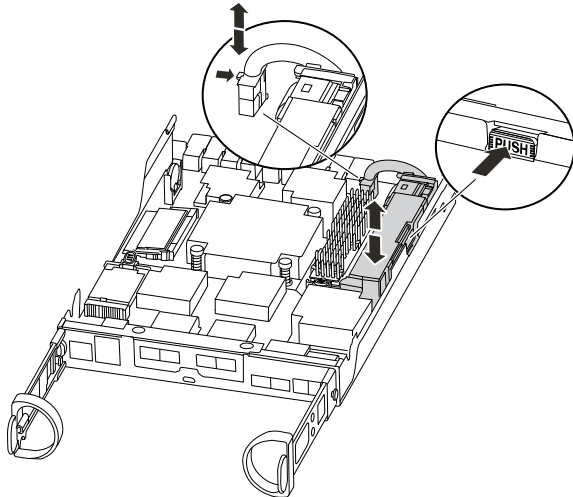
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**Attention:** The NVRAM LED blinks while destaging contents to the flash memory when you halt the system. After the destage is complete, the LED turns off.

- If power is lost without a clean shutdown, the NVMEM LED flashes until the destage is complete, and then the LED turns off.
- If the LED is on and power is on, unwritten data is stored on NVMEM. This typically occurs during an uncontrolled shutdown after ONTAP has successfully booted.

Step 2. Locate the NVMEM battery in the controller module.

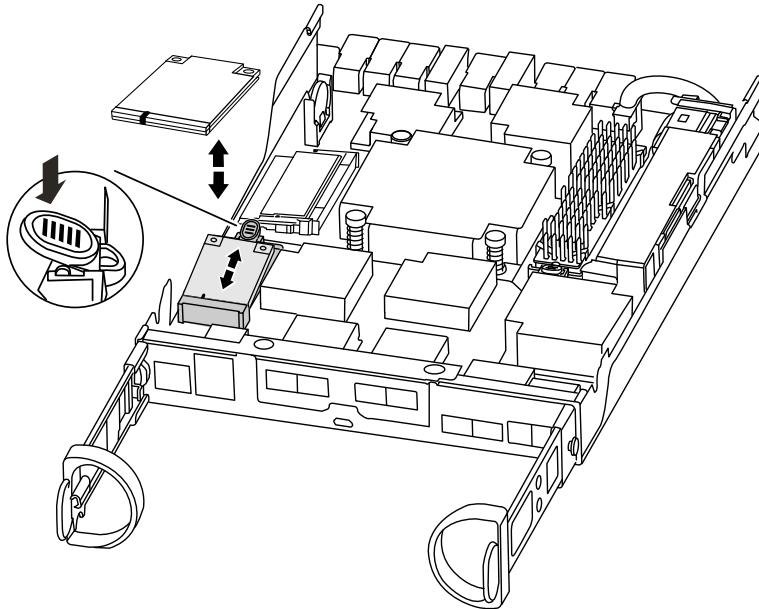


- Step 3. Locate the battery plug and squeeze the clip on the face of the battery plug to release the plug from the socket, and then unplug the battery cable from the socket.
- Step 4. Grasp the battery and press the blue locking tab marked PUSH, and then lift the battery out of the holder and controller module.
- Step 5. Move the NVMEM battery to the replacement controller module.
- Step 6. Loop the battery cable around the cable channel on the side of the battery holder.
- Step 7. Position the battery pack by aligning the battery holder key ribs to the “V” notches on the sheet metal side wall.
- Step 8. Slide the battery pack down along the sheet metal side wall until the support tabs on the side wall hook into the slots on the battery pack, and the battery pack latch engages and clicks into the opening on the side wall.

## Moving the boot media

You must locate the boot media and follow the directions to remove it from the old controller module and insert it in the new controller module.

Step 1. Locate the boot media using the following illustration or the FRU map on the controller module:



Step 2. Press the blue button on the boot media housing to release the boot media from its housing, and then gently pull it straight out of the boot media socket.

**Note:** Do not twist or pull the boot media straight up, because this could damage the socket or the boot media.

Step 3. Move the boot media to the new controller module, align the edges of the boot media with the socket housing, and then gently push it into the socket.

Step 4. Check the boot media to make sure that it is seated squarely and completely in the socket. If necessary, remove the boot media and reseal it into the socket.

Step 5. Push the boot media down to engage the locking button on the boot media housing.

## Moving the DIMMs

To move the DIMMs, you must follow the directions to locate and move them from the old controller module into the replacement controller module.

### Before you begin

You must have the new controller module ready so that you can move the DIMMs directly from the old controller module to the corresponding slots in the new one.

Step 1. Locate the DIMMs on your controller module.

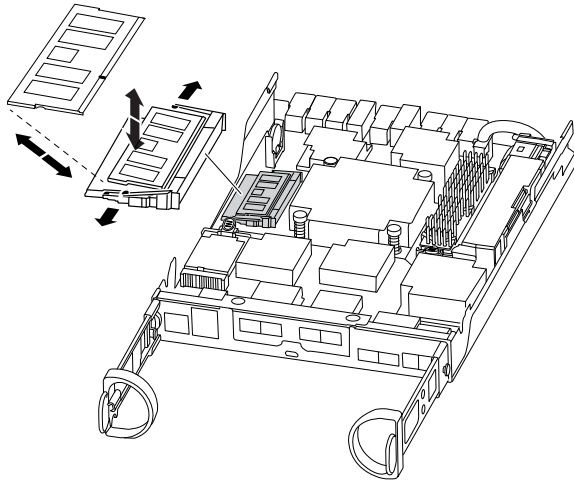
**Note:** Verify that each DIMM is operating properly using the LED states.

Step 2. Note the orientation of the DIMM in the socket so that you can insert the DIMM in the replacement controller module in the proper orientation.

Step 3. Eject the DIMM from its slot by slowly pushing apart the two DIMM ejector tabs on either side of the DIMM, and then slide the DIMM out of the slot.

**Attention:** Carefully hold the DIMM by the edges to avoid pressure on the components on the DIMM circuit board.

The following illustration shows the location of system DIMMs:



- Step 4. Repeat these steps to remove additional DIMMs as needed.
- Step 5. Verify that the NVMEM battery is not plugged into the new controller module.
- Step 6. Locate the slot where you are installing the DIMM.
- Step 7. Make sure that the DIMM ejector tabs on the connector are in the open position, and then insert the DIMM squarely into the slot. The DIMM fits tightly in the slot, but should go in easily. If not, realign the DIMM with the slot and reinsert it.

**Attention:** Visually inspect the DIMM to verify that it is evenly aligned and fully inserted into the slot.

- Step 8. Repeat these steps for the remaining DIMMs.
- Step 9. Locate the NVMEM battery plug socket, and then squeeze the clip on the face of the battery cable plug to insert it into the socket. Make sure that the plug locks down onto the controller module.

### **Moving a caching module, if present**

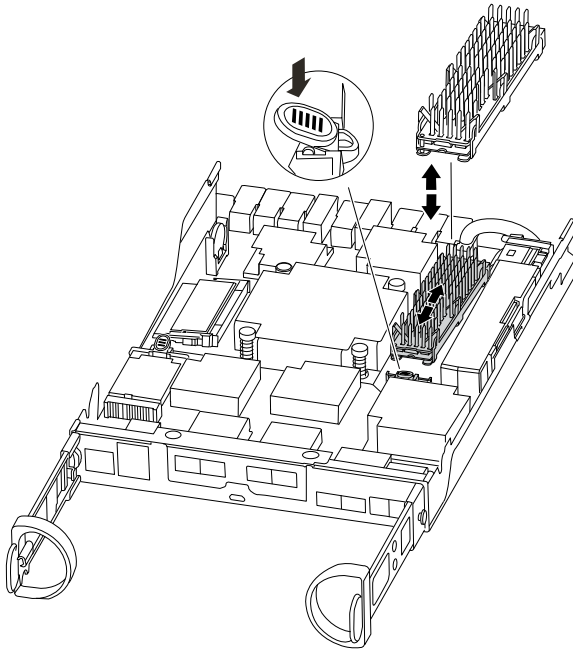
If your system has a caching module, you need to move the caching module from the old controller module to the replacement controller module. The caching module is referred to as the “M.2 PCIe card” on the controller module label.

#### **Before you begin**

You must have the new controller module ready so that you can move the caching module directly from the old controller module to the corresponding slot in the new one. All other components in the storage system must be functioning properly; if not, you must contact technical support.

- Step 1. Locate the caching module at the rear of the controller module and remove it.
  - a. Press the release tab.
  - b. Remove the heatsink.





- Step 2. Gently pull the caching module straight out of the housing.
- Step 3. Insert the new caching module in the controller, and then align the edges of the caching module with the socket housing and gently push it into the socket.
- Step 4. Verify that the caching module is seated squarely and completely in the socket. If necessary, remove the caching module and reseal it into the socket.
- Step 5. Reseat and push the heatsink down to engage the locking button on the caching module housing.
- Step 6. Close the controller module cover, as needed.

### Installing the controller

After you install the components from the old controller module into the new controller module, you must install the new controller module into the system chassis and boot the operating system.

For HA pairs with two controller modules in the same chassis, the sequence in which you install the controller module is especially important because it attempts to reboot as soon as you completely seat it in the chassis.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. If you have not already done so, replace the cover on the controller module.
- Step 3. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

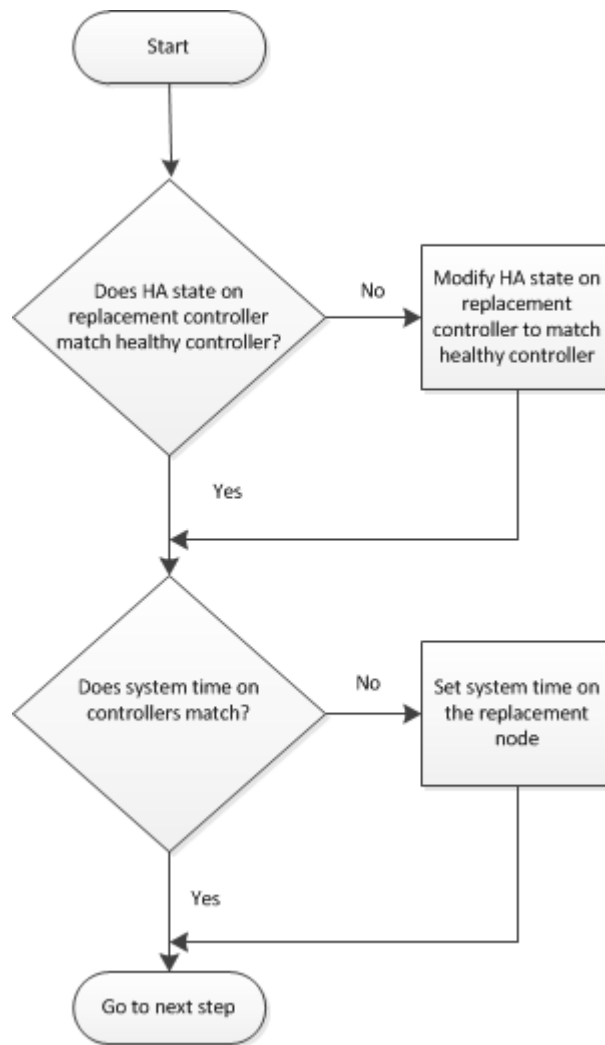
**Note:** Do not completely insert the controller module in the chassis until instructed to do so.

- Step 4. Cable the management and console ports so that you can access the system to perform the tasks in the following sections.
- Step 5. Complete the reinstallation of the controller module:

If your system is in...	Then perform these steps...
An HA pair	<p>The controller module begins to boot as soon as it is fully seated in the chassis. Be prepared to interrupt the boot process.</p> <ol style="list-style-type: none"> <li>1. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.</li> </ol> <p><b>Attention:</b> Do not use excessive force when sliding the controller module into the chassis; you might damage the connectors.</p> <p>The controller begins to boot as soon as it is seated in the chassis.</p> <ol style="list-style-type: none"> <li>2. If you have not already done so, reinstall the cable management device.</li> <li>3. Bind the cables to the cable management device with the hook and loop strap.</li> <li>4. Press Ctrl-C when you see the message Press Ctrl-C for Boot Menu.</li> <li>5. From the Loader prompt type: boot_ontap menu</li> <li>6. Select the option to boot to Maintenance mode from the displayed menu.</li> </ol>

## Restoring and verifying the system configuration

After completing the hardware replacement and booting to Maintenance mode, you verify the low-level system configuration of the replacement controller and reconfigure system settings as necessary.



## Verifying and setting the HA state of the controller module

You must verify the **HA** state of the controller module and, if necessary, update the state to match your system configuration.

- Step 1. In Maintenance mode from the new controller module, verify that all components display the same **HA** state: `ha-config show`

If your system is in...	The HA state for all components should be...
An HA pair	ha

- Step 2. If the displayed system state of the controller module does not match your system configuration, set the **HA** state for the controller module: `ha-config modify node ha-state`
- Step 3. If the displayed system state of the chassis does not match your system configuration, set the **HA** state for the chassis: `ha-config modify chassis ha-state`

## Running system-level diagnostics

You should run comprehensive or focused diagnostic tests for specific components and subsystems whenever you replace the controller.

All commands in the diagnostic procedures are issued from the controller where the component is being replaced.

Step 1. If the controller to be serviced is not at the LOADER prompt, reboot the controller by typing: `halt`

After you issue the command, you should wait until the system stops at the LOADER prompt.

Step 2. At the LOADER prompt, access the special drivers specifically designed for system-level diagnostics to function properly: `boot_diags`  
During the boot process, you can safely respond `y` to the prompts until the Maintenance mode prompt (`*>`) appears.

Step 3. Display and note the available devices on the controller module: `sldiag device show -dev mb`

The controller module devices and ports displayed can be any one or more of the following:

- `bootmedia` is the system booting device.
- `cna` is a Converged Network Adapter or interface not connected to a network or storage device.
- `fcsl` is a Fibre Channel-Arbitrated Loop device not connected to a Fibre Channel network.
- `env` is motherboard environmentals.
- `mem` is system memory.
- `nic` is a network interface card.
- `nvr` is nonvolatile RAM.
- `nvmm` is a hybrid of NVRAM and system memory.
- `sas` is a Serial Attached SCSI device not connected to a disk shelf.

Step 4. Run diagnostics for each component from the maintenance menu. For example: `sldiag device status -dev nvmm -long -state failed`

If you want to run diagnostic tests on...	Then...
Individual components	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Display the available tests for the selected devices: <code>sldiag device show -dev dev_name</code>  <i>dev_name</i> can be any one of the ports and devices identified in the preceding step.</li> <li>3. Examine the output and, if applicable, select only the tests that you want to run: <code>sldiag device modify -dev dev_name -selection only</code>  -selection only disables all other tests that you do not want to run for the device.</li> <li>4. Run the selected tests: <code>sldiag device run -dev dev_name</code>  After the test is complete, the following message is displayed: * &gt; &lt;SLDIAG:_ALL_TESTS_COMPLETED&gt;</li> <li>5. Verify that no tests failed: <code>sldiag device status -dev dev_name -long -state failed</code>  System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.</li> </ol>
Multiple components at the same time	<ol style="list-style-type: none"> <li>1. Review the enabled and disabled devices in the output from the preceding procedure and determine which ones you want to run concurrently.</li> <li>2. List the individual tests for the device: <code>sldiag device show -dev dev_name</code></li> <li>3. Examine the output and, if applicable, select only the tests that you want to run: <code>sldiag device modify -dev dev_name -selection only</code>  -selection only disables all other tests that you do not want to run for the device.</li> <li>4. Verify that the tests were modified: <code>sldiag device show</code></li> <li>5. Repeat these substeps for each device that you want to run concurrently.</li> <li>6. Run diagnostics on all of the devices: <code>sldiag device run</code>  <b>Attention:</b> Do not add to or modify your entries after you start running diagnostics.</li> </ol>

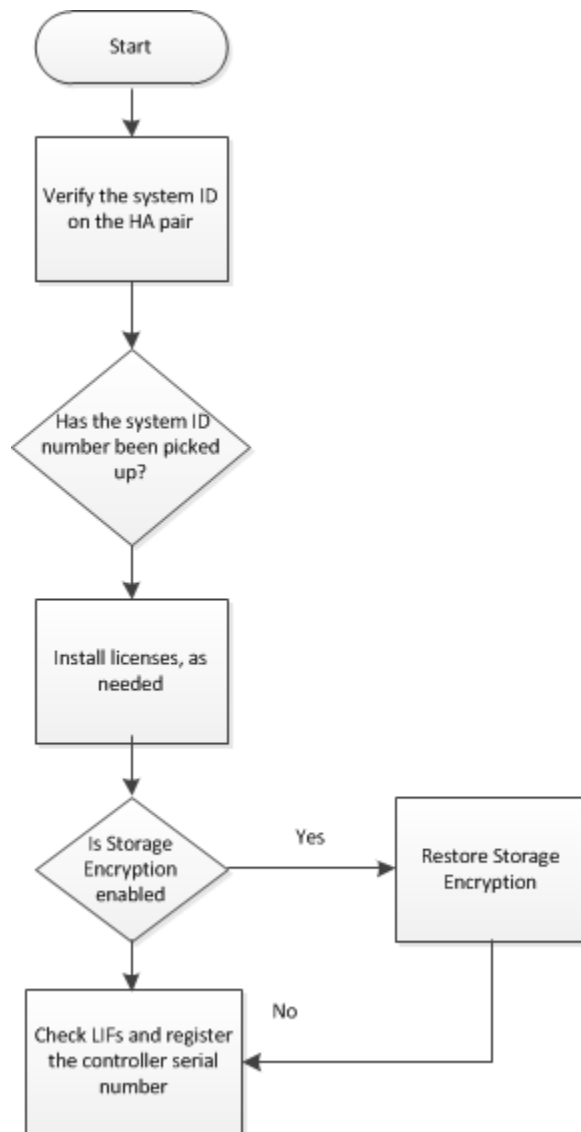
If you want to run diagnostic tests on...	Then...
	<p>After the test is complete, the following message is displayed:            * &gt; &lt;SLDIAG: _ALL_TESTS_COMPLETED&gt;</p> <p>7. Verify that there are no hardware problems on the controller: <code>sldiag device status -long -state failed</code></p> <p>System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.</p>

Step 5. Proceed based on the result of the preceding step.

If the system-level diagnostics tests...	Then...
Were completed without any failures	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log was cleared: <code>sldiag device status</code></li> </ol> <p>The following default response is displayed:            SLDIAG: No log messages are present.</p> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode by typing: <code>halt</code></li> </ol> <p>The system displays the LOADER prompt.</p> <ol style="list-style-type: none"> <li>4. Type <code>boot_ontap</code> to return the controller to normal operation.</li> </ol>
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode: <code>halt</code></li> <li>2. Perform a clean shutdown, and then disconnect the power supplies.</li> <li>3. Verify that you have observed all of the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies, and then power on the storage system.</li> <li>5. Rerun the system-level diagnostics test.</li> </ol>

## Completing system restoration

To complete the replacement procedure and restore your system to full operation, you must recable the storage, confirm disk reassignment, restore the Lenovo Storage Encryption configuration (if necessary), and install licenses for the new controller.



### Recabling the system

After running diagnostics, you must recable the controller module's storage and network connections.

- Step 1. Recable the system.
- Step 2. Verify that the cabling is correct.

### Reassigning disks

If the storage system is in an HA pair, the system ID of the new controller module is automatically assigned to the disks when the giveback occurs at the end of the procedure.

You must use the correct procedure for your configuration:

Controller redundancy	Then use this procedure...
HA pair	"Verifying the system ID change on an HA system" on page 58.

## Verifying the system ID change on an HA system

You must confirm the system ID change when you boot the replacement controller and then verify that the change was implemented.

This procedure applies only to systems running ONTAP in an HA pair.

- Step 1. If the replacement controller is in Maintenance mode (showing the `*>` prompt, exit Maintenance mode and go to the LOADER prompt: `halt`
- Step 2. From the LOADER prompt on the replacement controller, boot the controller, entering `y` if you are prompted to override the system ID due to a system ID mismatch: `boot_ontap`
- Step 3. Wait until the `Waiting for giveback...` message is displayed on the replacement controller console and then, from the healthy controller, verify that the new partner system ID has been automatically assigned.

### Example

```
node1> storage failover show
```

Node	Partner	Takeover Possible	State Description
node1	node2	false	System ID changed on partner (Old: 151759755, New: 151759706), In takeover
node2	node1	-	Waiting for giveback (HA mailboxes)

- Step 4. From the healthy controller, verify that any coredumps are saved:
  - a. Change to the advanced privilege level: `set -privilege advanced`

You can respond `Y` when prompted to continue into advanced mode. The advanced mode prompt appears (`*>`).
  - b. Save any coredumps: `system node run -node local-node-name partner savecore`
  - c. Wait for `savecore` command to complete before issuing the `giveback`. You can enter the following command to monitor the progress of the `savecore` command: `system node run -node local-node-name partner savecore -s`
  - d. Return to the admin privilege level: `set -privilege admin`
- Step 5. Give back the controller:
  - a. From the healthy controller, give back the replaced controller's storage: `storage failover giveback -ofnode replacement_node_name`

The replacement controller takes back its storage and completes booting.

If you are prompted to override the system ID due to a system ID mismatch, you should enter `y`.

**Note:** If the `giveback` is vetoed, you can consider overriding the vetoes. [Find the High-Availability Configuration Guide for your version of ONTAP 9](#)
  - b. After the `giveback` has been completed, confirm that the HA pair is healthy and that takeover is possible: **storage failover show**

The output from the **storage failover show** command should not include the `System ID changed on partner` message.
- Step 6. Verify that the expected volumes are present for each controller: `vol show -node node-name`
- Step 7. If you disabled automatic takeover on reboot, enable it from the healthy controller: `storage failover modify -node replacement-node-name -onreboot true`



## Installing licenses for the replacement controller in ONTAP

You must install new licenses for the replacement controller if the degraded controller was using ONTAP features that require a standard (controller-locked) license. For features with standard licenses, each controller in the cluster should have its own key for the feature.

Until you install license keys, features requiring standard licenses continue to be available to the replacement controller. However, if the degraded controller was the only controller in the cluster with a license for the feature, no configuration changes to the feature are allowed. Also, using unlicensed features on the controller might put you out of compliance with your license agreement, so you should install the replacement license key or keys on the replacement controller as soon as possible.

The licenses keys must be in the 28-character format.

You have a 90-day grace period in which to install the license keys. After the grace period, all old licenses are invalidated. After a valid license key is installed, you have 24 hours to install all of the keys before the grace period ends.

Step 1. Obtain replacement license keys by contacting Lenovo technical support.

**Note:** The new license keys that you require are NOT auto-generated. You should contact Lenovo technical support.

Step 2. Install each license key: `system license add -license -code license-key, license-key...`

Step 3. Remove the old licenses, if desired:

- a. Check for unused licenses: `license clean-up -unused -simulate`
- b. If the list looks correct, remove the unused licenses: `license clean-up -unused`

## Restoring Storage Encryption functionality

After replacing the controller module or NVRAM module for a storage system that you previously configured to use Storage Encryption, you must perform additional steps to ensure uninterrupted Storage Encryption functionality. You can skip this task on storage systems that do not have Storage Encryption enabled.

Step 1. Restore Storage Encryption functionality by running the **key\_manager** setup wizard and to set the FIPS and/or data authentication keys on the disks. [ONTAP 9 Encryption Power Guide](#)

## Verifying LIFs and registering the serial number

Before returning the replacement controller to service, you should verify that the LIFs are on their home ports, and register the serial number of the replacement controller if AutoSupport is enabled, and reset automatic giveback.

Step 1. Verify that the logical interfaces are reporting to their home server and ports: `network interface show -is-home false`

If any LIFs are listed as false , revert them to their home ports: `network interface revert *`

Step 2. Register the system serial number with Lenovo Support.

If...	Then...
AutoSupport is enabled	Send an AutoSupport message to register the serial number.
AutoSupport is not enabled	Call Lenovo Support to register the serial number.

Step 3. If automatic giveback was disabled, reenable it: `storage failover modify -node local -auto-giveback true`

## Setting and verifying system time after replacing the controller

You should check the time and date on the replacement controller module against the healthy controller module in an HA pair. If the time and date do not match, you must reset them on the replacement controller module to prevent possible outages on clients due to time differences.

It is important that you apply the commands in the steps on the correct systems:

- The *replacement controller* is the new controller that replaced the degraded controller as part of this procedure.
- The *healthy controller* is the HA partner of the replacement controller.

Step 1. In *admin* privilege on the replacement controller, check the system time on the controllers: `cluster date show`  
The date and time are displayed for all controllers in the cluster.

Step 2. If necessary, set the time on the replacement controller to match the healthy controller: `cluster date modify -dateandtime "target_date_and_time"`

Step 3. Check the date and time from the replacement controller: `cluster date show`

Step 4. Exit *admin* privilege.

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

## Important information after replacing the controller module

**Important:** Please contact your Lenovo support personnel to obtain replacement licenses for your new controller.

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## Replacing a DIMM

You must replace a DIMM in the controller module when your system registers an increasing number of correctable error correction codes (ECC); failure to do so causes a system panic.

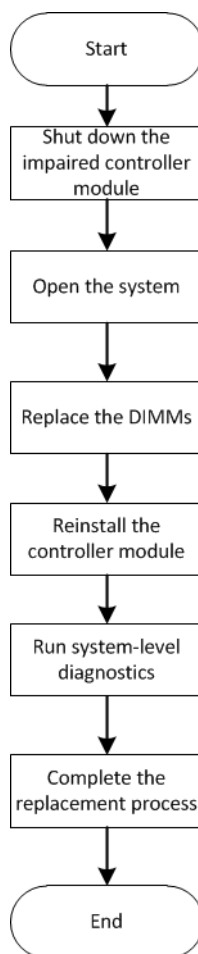
### Before you begin

All other components in the system must be functioning properly; if not, you must contact technical support.

You must replace the failed component with a replacement FRU component you received from your provider.

## Workflow diagram

This diagram shows the workflow of the DIMM replacement procedure for a system.



## Shutting down the degraded controller

You can shut down or take over the degraded controller using different procedures, depending on the storage system hardware configuration.

### Shutting down the controller

To shut down the degraded controller, you must determine the status of the controller and, if necessary, take over that controller so that the healthy controller continues to serve data for the degraded controller's storage.

#### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode: `cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

Step 1. If the degraded controller is part of an HA pair, disable automatic giveback from the console of the healthy controller using the following command: `storage failover modify -node local -auto-giveback false`

Step 2. Take the degraded controller to the LOADER prompt by typing halt.

If the degraded controller is displaying...	Then...
The LOADER prompt	Go to the next step.
Waiting for giveback...	Press Ctrl-C, and then respond <code>y</code> when prompted.
System prompt or password prompt	Take over or halt the degraded controller: <ul style="list-style-type: none"> <li>For an HA pair, take over the degraded controller from the healthy controller:  <code>storage failover takeover -ofnode <i>impaired_node_name</i></code></li> </ul> When the degraded controller shows <code>Waiting for giveback...</code> , press Ctrl-C, and then respond <code>y</code> .

Step 3. Turn off the power supplies, and then unplug the degraded controller's power cords from the power source.

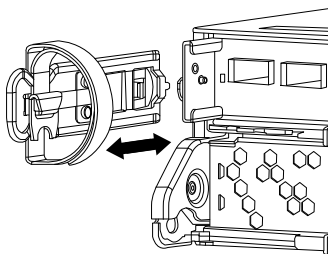
## Opening the system

To access components inside the controller, you must first remove the controller module from the system and then remove the cover on the controller module.

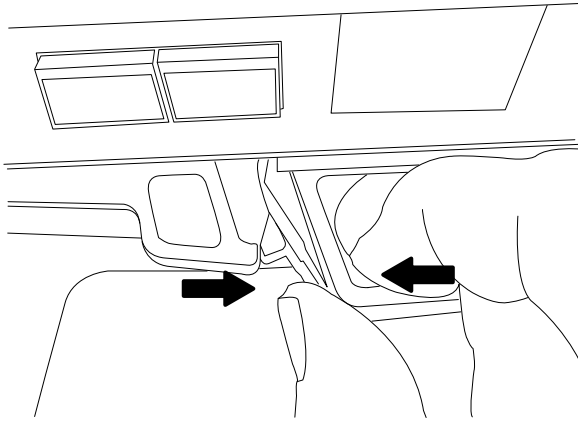
Step 1. If you are not already grounded, properly ground yourself.

Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.

Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.

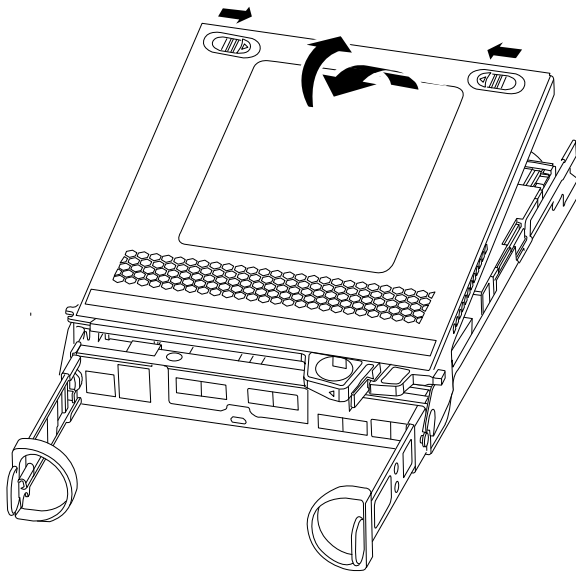


Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



Step 5. Turn the controller module over and place it on a flat, stable surface.

Step 6. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.



## Replacing the DIMMs

To replace the DIMMs, locate them inside the controller and follow the specific sequence of steps.

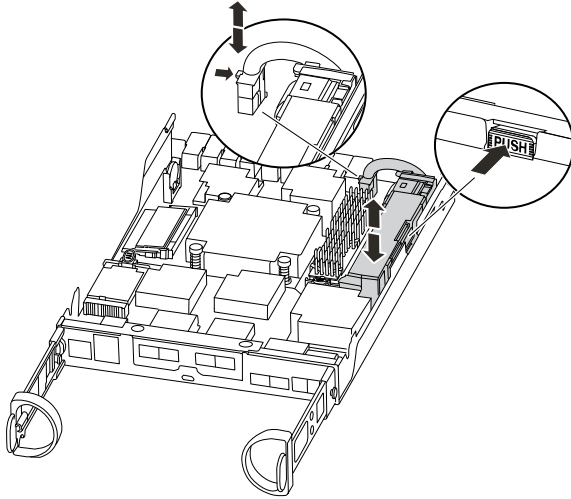
If you are replacing a DIMM, you need to remove it after you have unplugged the NVMEM battery from the controller module.

Step 1. If you are not already grounded, properly ground yourself.

Step 2. Check the NVMEM LED on the controller module. You must perform a clean system shutdown before replacing system components to avoid losing unwritten data in the nonvolatile memory (NVMEM). The LED is located on the back of the controller module. Look for the following icon:



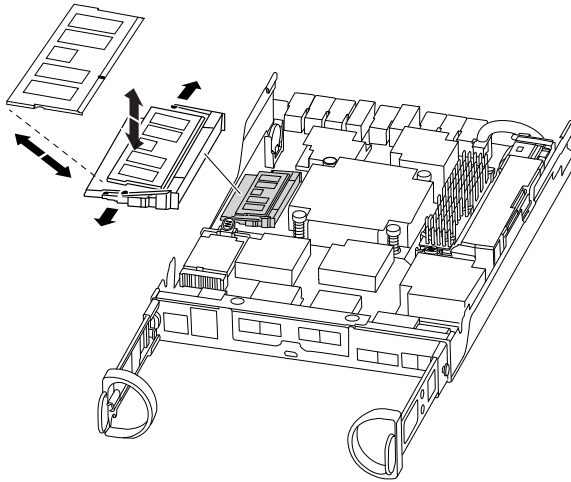
- Step 3. If the NVMEM LED is not flashing, there is no content in the NVMEM; you can skip the following steps and proceed to the next task in this procedure.
- Step 4. If the NVMEM LED is flashing, there is data in the NVMEM and you must disconnect the battery to clear the memory:
- Locate the battery, press the clip on the face of the battery plug to release the lock clip from the plug socket, and then unplug the battery cable from the socket.



- Confirm that the NVMEM LED is no longer lit.
  - Reconnect the battery connector.
- Step 5. Return to step 2 of this procedure to recheck the NVMEM LED.
- Step 6. Locate the DIMMs on your controller module.
- Note:** Verify that each DIMM is operating properly using the LED states.
- Step 7. Note the orientation of the DIMM in the socket so that you can insert the replacement DIMM in the proper orientation.
- Step 8. Eject the DIMM from its slot by slowly pushing apart the two DIMM ejector tabs on either side of the DIMM, and then slide the DIMM out of the slot.

**Attention:** Carefully hold the DIMM by the edges to avoid pressure on the components on the DIMM circuit board.

The following illustration shows the location of system DIMMs:



- Step 9. Remove the replacement DIMM from the antistatic shipping bag, hold the DIMM by the corners, and align it to the slot. The notch among the pins on the DIMM should line up with the tab in the socket.
- Step 10. Make sure that the DIMM ejector tabs on the connector are in the open position, and then insert the DIMM squarely into the slot. The DIMM fits tightly in the slot, but should go in easily. If not, realign the DIMM with the slot and reinsert it.
- Attention:** Visually inspect the DIMM to verify that it is evenly aligned and fully inserted into the slot.
- Step 11. Push carefully, but firmly, on the top edge of the DIMM until the ejector tabs snap into place over the notches at the ends of the DIMM.
- Step 12. Locate the NVMEM battery plug socket, and then squeeze the clip on the face of the battery cable plug to insert it into the socket. Make sure that the plug locks down onto the controller module.
- Step 13. Close the controller module cover.

## Reinstalling the controller module

After you replace components in the controller module, reinstall it into the chassis.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. If you have not already done so, replace the cover on the controller module.
- Step 3. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.
- Note:** Do not completely insert the controller module in the chassis until instructed to do so.
- Step 4. Recable the system, as needed. If you removed the media converters (SFPs), remember to reinstall them if you are using fiber optic cables.
- Step 5. Complete the reinstallation of the controller module by performing these steps:

The controller module begins to boot as soon as it is fully seated in the chassis. Be prepared to interrupt the boot process.

1. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.

**Attention:** Do not use excessive force when sliding the controller module into the chassis; you might damage the connectors.

The controller begins to boot as soon as it is seated in the chassis.

2. If you have not already done so, reinstall the cable management device.
3. Bind the cables to the cable management device with the hook and loop strap.
4. When you see Press Ctrl-C for Boot Menu, press Ctrl-C to interrupt the boot process.
5. Type `boot_ontap` menu.
6. Select option 5 from the menu that appears to boot into maintenance mode.

## Running system-level diagnostics

After installing a new DIMM, you should run diagnostics.

### Before you begin

Your system must be at the LOADER prompt to get to the maintenance menu to start System Level Diagnostics.

### About this task

All commands in the diagnostic procedures are issued from the controller where the component is being replaced.

- Step 1. If the controller to be serviced is not at the LOADER prompt, perform the following steps:
- a. Select the Maintenance mode option from the displayed menu.
  - b. After the controller boots to Maintenance mode, halt the controller: `halt` After you issue the command, you should wait until the system stops at the LOADER prompt.

**Important:** During the boot process, you can safely respond y to prompts.

- Step 2. At the LOADER prompt, access the special drivers specifically designed for system-level diagnostics to function properly: `boot_diags`  
During the boot process, you can safely respond y to the prompts until the Maintenance mode prompt (\*>) appears.

- Step 3. Run diagnostics on the system memory: `sldiag device run -dev mem`

- Step 4. Verify that no hardware problems resulted from the replacement of the DIMMs: `sldiag device status -dev mem -long -state failed`  
System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.

- Step 5. Proceed based on the result of the preceding step:



If the system-level diagnostics tests...	Then...
Were completed without any failures	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log was cleared: <code>sldiag device status</code>  The following default response is displayed: SLDIAG: No log messages are present.</li> <li>3. Exit Maintenance mode by typing <code>halt</code>  The controller displays the LOADER prompt.</li> <li>4. If the controller does not automatically start ONTAP, boot the controller from the LOADER prompt: <code>boot_ontap</code></li> <li>5. Return the controller to normal operation by typing: <code>storage failover giveback -ofnode replacement_node_name</code></li> </ol>
Resulted in some test failures	<p>Determine the cause of the problem:</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by typing <code>halt</code></li> <li>2. After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Boot the controller module you are servicing, interrupting the boot by pressing <code>Ctrl-C</code> when prompted to get to the LOADER menu. If you removed the controller in the previous step, fully seat the controller module you are servicing in the chassis. The controller module boots up when fully seated.</li> <li>5. Select Boot to maintenance mode by typing <code>boot_diags</code></li> <li>6. Repeat all the steps necessary to perform the system level diagnostics for the cache module.</li> <li>7. Exit Maintenance mode by entering the following command: <code>halt</code>  After you issue the command, wait until the system stops at the LOADER prompt.</li> <li>8. Rerun the system-level diagnostic test.</li> </ol>

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

---

## Replacing the boot media

The boot media stores a primary and secondary set of system (*boot image*) files that the system uses when it boots. Depending on your network configuration, you can perform either a nondisruptive or disruptive replacement.

### Before you begin

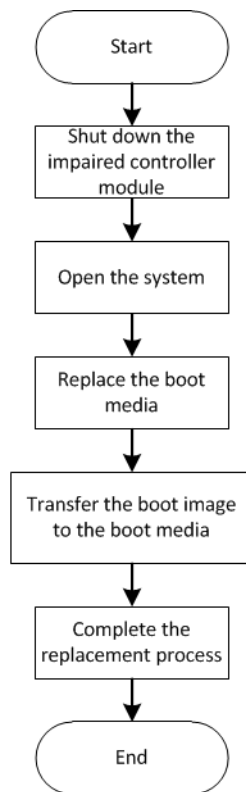
You must have a USB flash drive, formatted to FAT32, with the appropriate amount of storage to hold the `image_XXX.tgz`.

### About this task

- The nondisruptive and disruptive methods for replacing a boot media both require you to restore the `var` file system:
  - For nondisruptive replacement, the HA pair must be connected to a network to restore the `var` file system.
  - For disruptive replacement, you do not need a network connection to restore the `var` file system, but the process requires two reboots.
- You must replace the failed component with a replacement FRU component you received from your provider.
- It is important that you apply the commands in these steps on the correct controller:
  - The *degraded controller* is the controller on which you are performing maintenance.
  - The *healthy controller* is the HA partner of the degraded controller.

## Workflow diagram

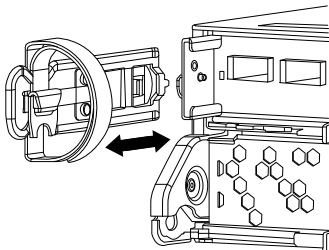
This diagram shows the workflow of the boot media replacement procedure for a system.



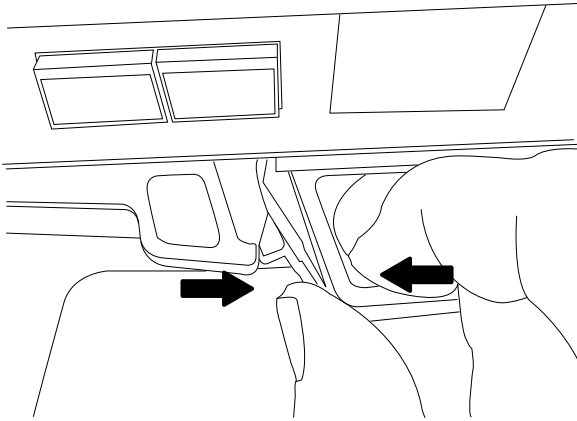
## Opening the system

To access components inside the controller, you must first remove the controller module from the system and then remove the cover on the controller module.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.
- Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.

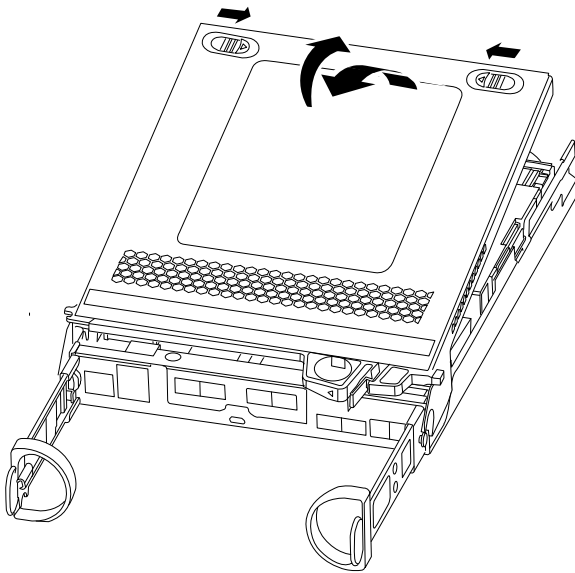


- Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



Step 5. Turn the controller module over and place it on a flat, stable surface.

Step 6. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.

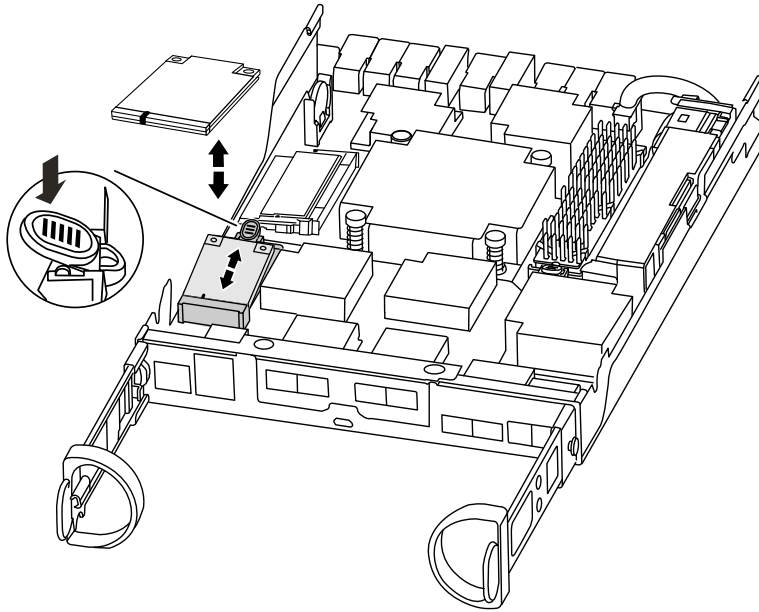


## Replacing the boot media

You must locate the boot media in the controller and follow the directions to replace it.

Step 1. If you are not already grounded, properly ground yourself.

Step 2. Locate the boot media using the following illustration or the FRU map on the controller module:



Step 3. Press the blue button on the boot media housing to release the boot media from its housing, and then gently pull it straight out of the boot media socket.

**Note:** Do not twist or pull the boot media straight up, because this could damage the socket or the boot media.

Step 4. Align the edges of the replacement boot media with the boot media socket, and then gently push it into the socket.

Step 5. Check the boot media to make sure that it is seated squarely and completely in the socket. If necessary, remove the boot media and reseat it into the socket.

Step 6. Push the boot media down to engage the locking button on the boot media housing.

Step 7. Close the controller module cover.

## Transferring the boot image to the boot media

You can install the system image to the replacement boot media using a USB flash drive with the image installed on it. However, you must restore the var file system during this procedure.

### Before you begin

You must have a USB flash drive, formatted to FAT32, with the following items:

- A copy of the same image version of ONTAP as what the degraded controller was running. You can download the appropriate image from the Lenovo Support Site.
- If your system is an HA pair, you must have a network connection.

Step 1. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

Step 2. Reinstall the cable management device and recable the system, as needed. When recabling, remember to reinstall the media converters (SFPs) if they were removed.

Step 3. Insert the USB flash drive into the USB slot on the controller module. Make sure that you install the USB flash drive in the slot labeled for USB devices, and not in the USB console port.

Step 4. Push the controller module all the way into the system, making sure that the cam handle clears the USB flash drive, firmly push the cam handle to finish seating the controller module, push the cam handle to the closed position, and then tighten the thumbscrew.  
The controller begins to boot as soon as it is completely installed into the chassis.

Step 5. Interrupt the boot process to stop at the LOADER prompt by pressing Ctrl-C when you see Starting AUTOBOOT press Ctrl-C to abort....

If you miss this message, press Ctrl-C to boot to Maintenance mode, and then select the option to boot to LOADER.

Step 6. For systems with one controller in the chassis, reconnect the power and turn on the power supplies.  
The system begins to boot and stops at the LOADER prompt.

Step 7. Boot the recovery image: `boot_recovery ontap_image_name.tgz`

**Note:** If the image.tgz file is named something other than image.tgz, such as boot\_recovery 9\_4.tgz, you need to include the different file name in the **boot\_recovery** command.

The system boots to the boot menu and prompts you for the boot image name.

Step 8. Enter the boot image name that is on the USB flash drive: `image_name.tgz`

After image\_name.tgz is installed, the system prompts you to restore the backup configuration (the var file system) from the healthy controller.

Step 9. Restore the var file system:

If your system has...	Then...
A network connection	<ol style="list-style-type: none"> <li>1. Press <code>y</code> when prompted to restore the backup configuration.</li> <li>2. Set the healthy controller to advanced privilege level: <code>set -privilege advanced</code></li> <li>3. Run the restore backup command: <code>system node restore-backup -node local -target-address <i>impaired_node_IP_address</i></code></li> <li>4. Return the controller to admin level: <code>set -privilege admin</code></li> <li>5. Press <code>y</code> when prompted to use the restored configuration.</li> <li>6. Press <code>y</code> when prompted to reboot the controller.</li> </ol>
No network connection	<ol style="list-style-type: none"> <li>1. Press <code>n</code> when prompted to restore the backup configuration.</li> <li>2. Reboot the system when prompted by the system.</li> <li>3. Select the <b>Update flash from backup config</b> (sync flash) option from the displayed menu.If you are prompted to continue with the update, press <code>y</code>.</li> </ol>

Step 10. Although ONTAP 9 retains the environment variable settings, it is a best practice to verify that they are set as expected.

- a. Take the controller to the LOADER prompt.
- b. Check the environment variable settings with the **printenv** command.
- c. If an environment variable is not set as expected, modify it with the **setenv environment\_variable\_name changed\_value** command.
- d. Save your changes using the **saveenv** command.
- e. Reboot the controller.

Step 11. The next step depends on your system configuration:

If your system is in...	Then...
An HA pair	<p>After the degraded controller is displaying the Waiting for Giveback... message, perform a giveback from the healthy controller:</p> <ol style="list-style-type: none"> <li>1. Perform a giveback from the healthy controller: <b>storage failover giveback -ofnode partner_node_name</b></li> </ol> <p>This initiates the process of returning ownership of the degraded controller's aggregates and volumes from the healthy controller back to the degraded controller.</p> <p><b>Note:</b> If the giveback is vetoed, you can consider overriding the vetoes. <a href="#">ONTAP 9 High-Availability Configuration Guide</a></p> <ol style="list-style-type: none"> <li>2. Monitor the progress of the giveback operation by using the <b>storage failover show-giveback</b> command.</li> <li>3. After the giveback operation is complete, confirm that the HA pair is healthy and that takeover is possible by using the <b>storage failover show</b> command.</li> <li>4. Restore automatic giveback if you disabled it by using the <b>storage failover modify</b> command.</li> </ol>

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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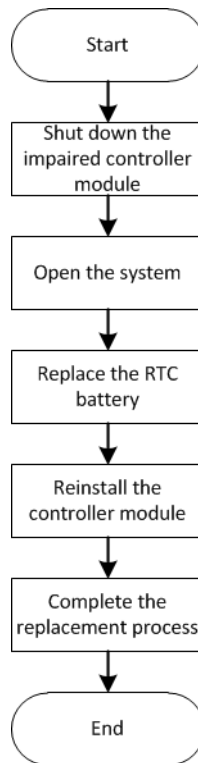
## Replacing the real-time clock battery

You replace the real-time clock (RTC) battery in the controller module so that your system's services and applications that depend on accurate time synchronization continue to function.

- You can use this procedure with all versions of ONTAP supported by your system
- All other components in the system must be functioning properly; if not, you must contact technical support.

## Workflow diagram

This diagram shows the workflow of the RTC battery replacement procedure for a system.



## Shutting down the degraded controller

You can shut down or take over the degraded controller using different procedures, depending on the storage system hardware configuration.

### Shutting down the controller

To shut down the degraded controller, you must determine the status of the controller and, if necessary, take over that controller so that the healthy controller continues to serve data for the degraded controller's storage.

#### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode: `cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

Step 1. If the degraded controller is part of an HA pair, disable automatic giveback from the console of the healthy controller using the following command: `storage failover modify -node local -auto-giveback false`

Step 2. Take the degraded controller to the LOADER prompt by typing `halt`.



If the degraded controller is displaying...	Then...
The LOADER prompt	Go to the next step.
Waiting for giveback...	Press Ctrl-C, and then respond <i>y</i> when prompted.
System prompt or password prompt	Take over or halt the degraded controller: <ul style="list-style-type: none"> <li>For an HA pair, take over the degraded controller from the healthy controller:  <pre>storage failover takeover -ofnode <i>impaired_node_name</i></pre> </li> </ul> <p>When the degraded controller shows <i>Waiting for giveback...</i>, press Ctrl-C, and then respond <i>y</i>.</p>

Step 3. Turn off the power supplies, and then unplug the degraded controller's power cords from the power source.

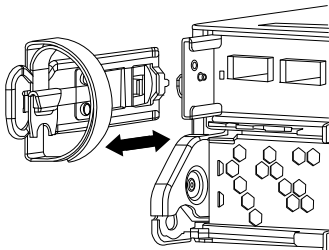
## Opening the system

To access components inside the controller, you must first remove the controller module from the system and then remove the cover on the controller module.

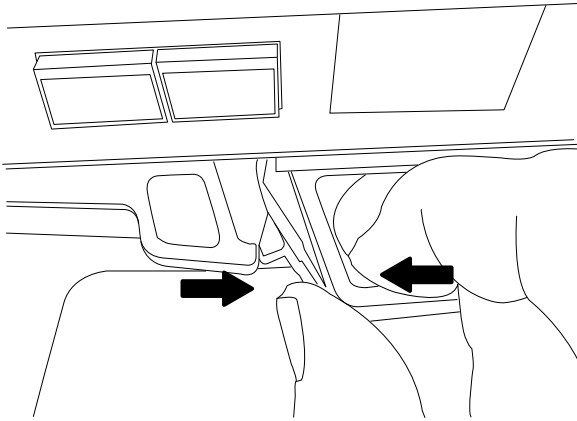
Step 1. If you are not already grounded, properly ground yourself.

Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.

Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.

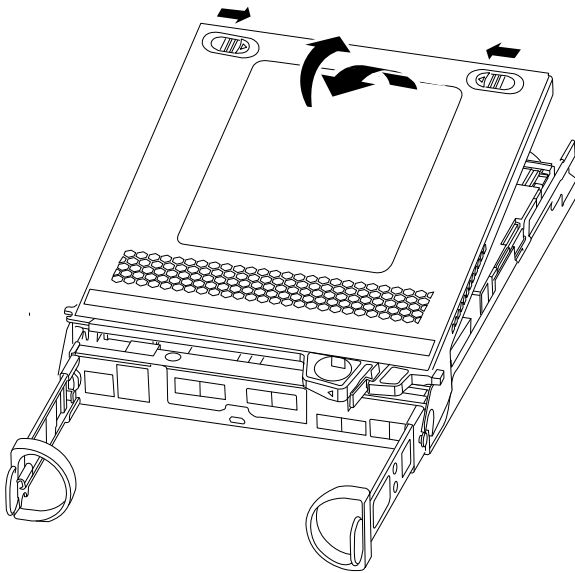


Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



Step 5. Turn the controller module over and place it on a flat, stable surface.

Step 6. Open the cover by sliding in the blue tabs to release the cover, and then swing the cover up and open.

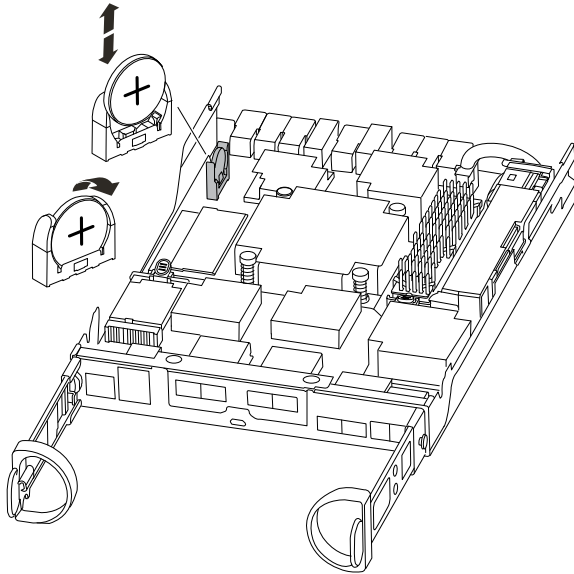


## Replacing the RTC battery

To replace the RTC battery, locate it inside the controller and follow the specific sequence of steps.

Step 1. If you are not already grounded, properly ground yourself.

Step 2. Locate the RTC battery.



Step 3. Gently push the battery away from the holder, rotate it away from the holder, and then lift it out of the holder.

**Note:** Note the polarity of the battery as you remove it from the holder. The battery is marked with a plus sign and must be positioned in the holder correctly. A plus sign near the holder tells you how the battery should be positioned.

Step 4. Remove the replacement battery from the antistatic shipping bag.

Step 5. Locate the empty battery holder in the controller module.

Step 6. Note the polarity of the RTC battery, and then insert it into the holder by tilting the battery at an angle and pushing down.

Step 7. Visually inspect the battery to make sure that it is completely installed into the holder and that the polarity is correct.

## Reinstalling the controller

After you replace a component within the controller module, you must reinstall the controller module in the system chassis and boot it.

Step 1. If you are not already grounded, properly ground yourself.

Step 2. If you have not already done so, replace the cover on the controller module.

Step 3. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

**Note:** Do not completely insert the controller module in the chassis until instructed to do so.

Step 4. Recable the system, as needed. If you removed the media converters (SFPs), remember to reinstall them if you are using fiber optic cables.

Step 5. Complete the reinstallation of the controller module: The controller module begins to boot as soon as it is fully seated in the chassis. Be prepared to interrupt the boot process.

a. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.

**Attention:** Do not use excessive force when sliding the controller module into the chassis to avoid damaging the connectors.

- b. If you have not already done so, reinstall the cable management device.
- c. Bind the cables to the cable management device with the hook and loop strap.
- d. Reconnect the power cables to the power supplies and to the power sources, and then turn on the power to start the boot process.

Step 6. Return the controller to normal operation:

If your system is in...	Issue this command from the partner's console...
An HA pair	<code>storage failover giveback -ofnode <i>impaired_node_name</i></code>

Step 7. If automatic giveback was disabled, reenable it: `storage failover modify -node local -auto-giveback true`

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

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## Replacing the chassis

To replace the chassis, you must move the power supplies, hard drives, and controller module or modules from the impaired chassis to the new chassis, and swap out the impaired chassis from the equipment rack or system cabinet with the new chassis of the same model as the impaired chassis.

### Before you begin

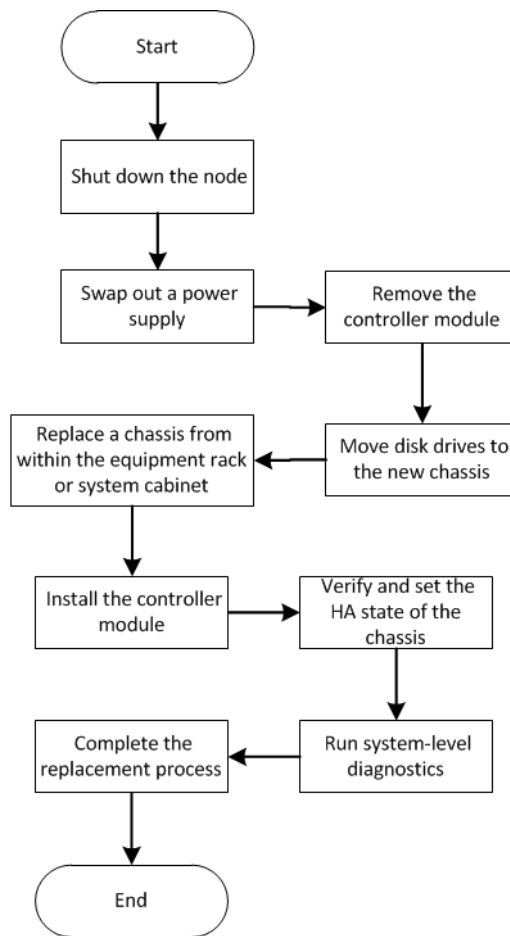
All other components in the system must be functioning properly; if not, you must contact technical support.

### About this task

- You can use this procedure with all versions of ONTAP supported by your system.
- This procedure is written with the assumption that you are moving all disk drives and controller module or modules to the new chassis, and that the chassis is a new component from Lenovo.

## Workflow diagram

This diagram shows the workflow of the chassis replacement procedure for a system.



## Shutting down the controller

You must shut down the controller or controllers in the chassis prior to moving them to the new chassis.

### Before you begin

- If you have a cluster with more than two controllers, check the health and Epsilon from advanced mode: `cluster show -epsilon*`
- If the cluster is not in quorum or a controller that is not the degraded controller shows false for eligibility and health, correct the issue before proceeding to the subsequent operation.
- If Epsilon resides in the degraded controller:
  1. Remove Epsilon from the degraded controller: `cluster modify -node degraded_node -epsilon false`
  2. Assign Epsilon to a healthy controller in the cluster: `cluster modify -node healthy_node -epsilon true`

Step 1. If your system has two controller modules, disable the HA pair.

If your system is running clustered ONTAP with...	Then...
Two controllers in the cluster	<pre>cluster ha modify -configured false storage failover modify -node node0 -enabled false</pre>
More than two controllers in the cluster	<pre>storage failover modify -node node0 -enabled false</pre>

Step 2. Halt the controller, pressing `y` when you are prompted to confirm the halt: `system node halt -node node_name`

The confirmation message looks like the following:

```
Warning: Rebooting or halting node
"node_name" in an HA-enabled cluster may result in client disruption or data access
failure. To ensure continuity of service, use the "storage
failover takeover" command. Are you sure you want to halt node
"node_name"? {y|n}:
```

**Attention:** You must perform a clean system shutdown before replacing the chassis to avoid losing unwritten data in the nonvolatile memory (NVMEM). If the NVMEM LED is flashing, there is content in the NVMEM that has not been saved to disk. You need to reboot the controller and start from the beginning of this procedure. If repeated attempts to cleanly shut down the controller fail, be aware that you might lose any data that was not saved to disk.

Step 3. Where applicable, halt the second controller to avoid a possible quorum error message in an HA pair configuration:: `system node halt -node second_node_name -ignore-quorum-warnings true`

## Swapping out a power supply

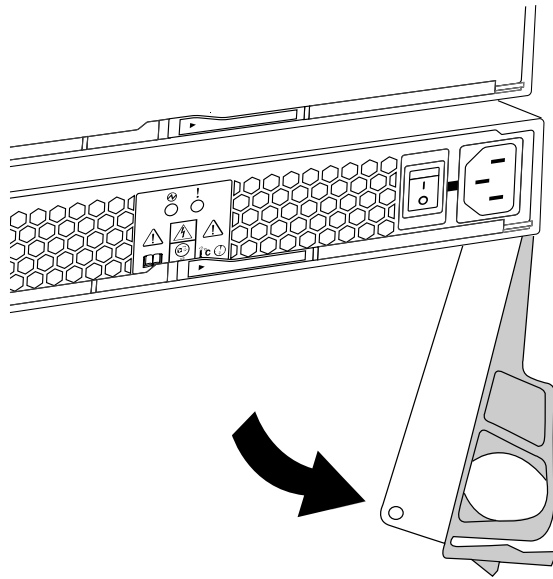
Swapping out a power supply when replacing a chassis involves turning off, disconnecting, and removing the power supply from the old chassis and installing and connecting it on the replacement chassis.

Step 1. If you are not already grounded, properly ground yourself.

Step 2. Turn off the power supply and disconnect the power cables:

- a. Turn off the power switch on the power supply.
- b. Open the power cable retainer, and then unplug the power cable from the power supply.
- c. Unplug the power cable from the power source.

Step 3. Squeeze the latch on the power supply cam handle, and then open the cam handle to fully release the power supply from the mid plane.



Step 4. Use the cam handle to slide the power supply out of the system.

**CAUTION:**

**When removing a power supply, always use two hands to support its weight.**

Step 5. Repeat the preceding steps for any remaining power supplies.

Step 6. Using both hands, support and align the edges of the power supply with the opening in the system chassis, and then gently push the power supply into the chassis using the cam handle. The power supplies are keyed and can only be installed one way.

**Attention:** Do not use excessive force when sliding the power supply into the system. You can damage the connector.

Step 7. Close the cam handle so that the latch clicks into the locked position and the power supply is fully seated.

Step 8. Reconnect the power cable and secure it to the power supply using the power cable locking mechanism.

**Attention:** Only connect the power cable to the power supply. Do not connect the power cable to a power source at this time.

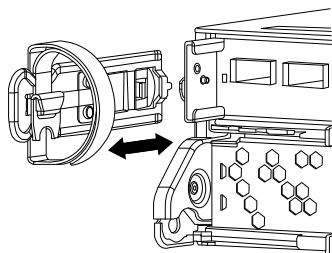
## Removing the controller module

To replace the chassis, you must remove the controller module or modules from the old chassis.

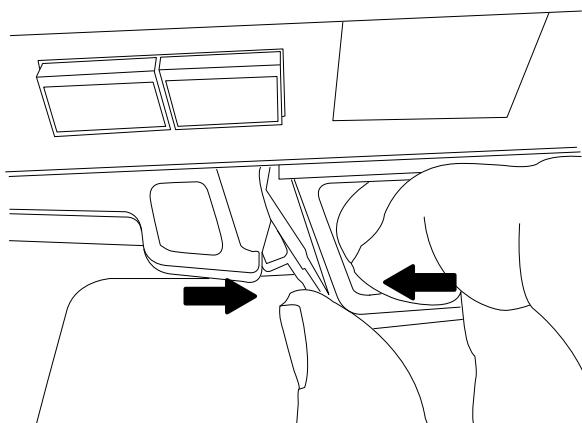
Step 1. If you are not already grounded, properly ground yourself.

Step 2. Loosen the hook and loop strap binding the cables to the cable management device, and then unplug the system cables and SFPs (if needed) from the controller module, keeping track of where the cables were connected. Leave the cables in the cable management device so that when you reinstall the cable management device, the cables are organized.

Step 3. Remove and set aside the cable management devices from the left and right sides of the controller module.



- Step 4. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the controller module from the midplane, and then, using two hands, pull the controller module out of the chassis.



- Step 5. Set the controller module aside in a safe place, and repeat these steps if you have another controller module in the chassis.

## Moving drives to the new chassis

You need to move the drives from each bay opening in the old chassis to the same bay opening in the new chassis.

- Step 1. Gently remove the bezel from the front of the system.

- Step 2. Remove the drives:

- a. Press the release button at the top of the carrier face below the LEDs.
- b. Pull the cam handle to its fully open position to unseat the drive from the midplane, and then gently slide the drive out of the chassis.  
The drive should disengage from the chassis, allowing it to slide free of the chassis.

**Attention:** When removing a drive, always use two hands to support its weight.

**Attention:** Drives are fragile. Handle them as little as possible to prevent damage to them.

- Step 3. Align the drive from the old chassis with the same bay opening in the new chassis.

- Step 4. Gently push the drive into the chassis as far as it will go. The cam handle engages and begins to rotate upward.

- Step 5. Firmly push the drive the rest of the way into the chassis, and then lock the cam handle by pushing it up and against the drive holder. Be sure to close the cam handle slowly so that it aligns correctly with the front of the drive carrier. It click when it is secure.

- Step 6. Repeat the process for the remaining drives in the system.



## Replacing a chassis from within the equipment rack or system cabinet

You must remove the existing chassis from the equipment rack or system cabinet before you can install the replacement chassis.

- Step 1. Remove the screws from the chassis mount points.
- Step 2. With the help of two or three people, slide the old chassis off the rack rails in a system cabinet or L brackets in an equipment rack and set it aside.
- Step 3. If you are not already grounded, properly ground yourself.
- Step 4. Using two or three people, install the replacement chassis into the equipment rack or system cabinet by guiding the chassis onto the rack rails in a system cabinet or L brackets in an equipment rack.
- Step 5. Slide the chassis all the way into the equipment rack or system cabinet.
- Step 6. Secure the front of the chassis to the equipment rack or system cabinet, using the screws you removed from the old chassis.

## Installing the controller

After you install the controller module and any other components into the new chassis, boot it to a state where you can run the interconnect diagnostic test.

For HA pairs with two controller modules in the same chassis, the sequence in which you install the controller module is especially important because it attempts to reboot as soon as you completely seat it in the chassis.

- Step 1. If you are not already grounded, properly ground yourself.
- Step 2. Align the end of the controller module with the opening in the chassis, and then gently push the controller module halfway into the system.

**Note:** Do not completely insert the controller module in the chassis until instructed to do so.

- Step 3. Recable the console to the controller module, and then reconnect the management port.
- Step 4. Repeat the preceding steps if there is a second controller to install in the new chassis.
- Step 5. Complete the installation of the controller module:

If your system is in...	Then perform these steps...
An HA pair	<ol style="list-style-type: none"><li>1. With the cam handle in the open position, firmly push the controller module in until it meets the midplane and is fully seated, and then close the cam handle to the locked position.  <b>Attention:</b> Do not use excessive force when sliding the controller module into the chassis to avoid damaging the connectors.</li><li>2. If you have not already done so, reinstall the cable management device.</li><li>3. Bind the cables to the cable management device with the hook and loop strap.</li><li>4. Repeat the preceding steps for the second controller module in the new chassis.</li></ol>

Step 6. Connect the power supplies to different power sources, and then turn them on.

Step 7. Boot each controller to Maintenance mode:

- a. As each controller starts the booting, press `Ctrl-C` to interrupt the boot process when you see the message `Press Ctrl-C for Boot Menu`.

**Note:** If you miss the prompt and the controller modules boot to ONTAP, enter `halt`, and then at the LOADER prompt enter `boot_ontap`, press `Ctrl-C` when prompted, and then repeat this step.

- b. From the boot menu, select the option for Maintenance mode.

## Verifying and setting the HA state of the chassis

You must verify the HA state of the chassis, and, if necessary, update the state to match your system configuration.

Step 1. In Maintenance mode, from either controller module, display the HA state of the local controller module and chassis: `ha-config show`

The HA state should be the same for all components.

Step 2. Proceed based on the results of Step 1.

If the displayed system state for the chassis...	Then...
Matches your system configuration	Go to the next step.
Does not match your system configuration	<ol style="list-style-type: none"><li>1. Set the HA state for the chassis: <code>ha-config modify chassis HA-state</code>  The value for <i>HA-state</i> can be one of the following:<ul style="list-style-type: none"><li>• ha</li><li>• non-ha</li></ul></li><li>2. Confirm that the setting has changed: <code>ha-config show</code></li></ol>

Step 3. If you have not already done so, recable the rest of your system.

Step 4. The next step depends on your system configuration.

If your system is in...	Then...
An HA pair with a second controller module	Exit Maintenance mode: <code>halt</code>  The LOADER prompt appears.

## Running system-level diagnostics

After installing a new chassis, you should run interconnect diagnostics.

### Before you begin

Your system must be at the LOADER prompt to get to the maintenance menu to start System Level Diagnostics.

## About this task

All commands in the diagnostic procedures are issued from the controller where the component is being replaced.

- Step 1. If the controller to be serviced is not at the LOADER prompt, perform the following steps:
- Select the Maintenance mode option from the displayed menu.
  - After the controller boots to Maintenance mode, halt the controller: `halt` After you issue the command, you should wait until the system stops at the LOADER prompt.

**Important:** During the boot process, you can safely respond `y` to prompts.

- Step 2. Repeat the previous step on the second controller if you are in an HA configuration.

**Note:** Both controllers must be in Maintenance mode to run the interconnect test.

- Step 3. At the LOADER prompt, access the special drivers specifically designed for system-level diagnostics to function properly: `boot_diags`  
During the boot process, you can safely respond `y` to the prompts until the Maintenance mode prompt (`*>`) appears.

- Step 4. Enable the interconnect diagnostics tests from the Maintenance mode prompt: `sldiag device modify -dev interconnect -sel enable`

The interconnect tests are disabled by default and must be enabled to run separately.

- Step 5. Run the interconnect diagnostics test from the Maintenance mode prompt: `sldiag device run -dev interconnect`

You only need to run the interconnect test from one controller.

- Step 6. Verify that no hardware problems resulted from the replacement of the chassis: `sldiag device status -dev interconnect -long -state failed`  
System-level diagnostics returns you to the prompt if there are no test failures, or lists the full status of failures resulting from testing the component.

- Step 7. Proceed based on the result of the preceding step.

If the system-level diagnostics tests...	Then...						
Were completed without any failures	<ol style="list-style-type: none"> <li>1. Clear the status logs: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log was cleared: <code>sldiag device status</code></li> </ol> <p>The following default response is displayed: SLDIAG: No log messages are present.</p> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode on both controllers: <code>halt</code></li> </ol> <p>The system displays the LOADER prompt.</p> <p><b>Attention:</b> You must exit Maintenance mode on both controllers before proceeding any further.</p> <ol style="list-style-type: none"> <li>4. Enter the following command on both controllers at the LOADER prompt: <code>boot_ontap</code></li> <li>5. Return the controller to normal operation:</li> </ol> <table border="1" data-bbox="919 926 1422 1461"> <thead> <tr> <th data-bbox="919 926 1170 1003">If your system is running ONTAP...</th> <th data-bbox="1170 926 1422 1003">Then...</th> </tr> </thead> <tbody> <tr> <td data-bbox="919 1003 1170 1304">With two controllers in the cluster</td> <td data-bbox="1170 1003 1422 1304">           Issue these commands:  <code>node::&gt; cluster ha modify -configured true</code>   <code>node::&gt; storage failover modify -node node0 -enabled true</code> </td> </tr> <tr> <td data-bbox="919 1304 1170 1461">With more than two controllers in the cluster</td> <td data-bbox="1170 1304 1422 1461">           Issue this command:  <code>node::&gt; storage failover modify -node node0 -enabled true</code> </td> </tr> </tbody> </table> <p>You have completed system-level diagnostics.</p>	If your system is running ONTAP...	Then...	With two controllers in the cluster	Issue these commands: <code>node::&gt; cluster ha modify -configured true</code>  <code>node::&gt; storage failover modify -node node0 -enabled true</code>	With more than two controllers in the cluster	Issue this command: <code>node::&gt; storage failover modify -node node0 -enabled true</code>
If your system is running ONTAP...	Then...						
With two controllers in the cluster	Issue these commands: <code>node::&gt; cluster ha modify -configured true</code>  <code>node::&gt; storage failover modify -node node0 -enabled true</code>						
With more than two controllers in the cluster	Issue this command: <code>node::&gt; storage failover modify -node node0 -enabled true</code>						
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode: <code>halt</code></li> <li>2. Perform a clean shutdown, and then disconnect the power supplies.</li> <li>3. Verify that you have observed all of the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> </ol>						

If the system-level diagnostics tests...	Then...
	<ol style="list-style-type: none"><li data-bbox="911 233 1425 296">4. Reconnect the power supplies, and then power on the storage system.</li><li data-bbox="911 306 1425 338">5. Rerun the system-level diagnostics test.</li></ol>

## Completing the replacement process

After you replace the part, you can return the failed part to Lenovo, as described in the RMA instructions shipped with the kit. Contact technical support at [Lenovo Support](#) if you need the RMA number or additional help with the replacement procedure.

## Important information after replacing the chassis

**Note:** After replacing the chassis, move the system tag from the old chassis to the new chassis.



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## Chapter 6. Upgrading controller hardware

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### Considerations for upgrading controller hardware

To plan for the upgrade, you should familiarize yourself with the general upgrade considerations. If necessary, you should contact technical support for recommendations and guidance specific to the configuration of your cluster.

- Both the original controllers and the new controllers must be running the same and supported software version before the upgrade. [ONTAP 9 Upgrade and Revert/Downgrade Guide](#)
- You must observe the maximum cluster size. When you upgrade by moving volumes, new controllers are joined to the cluster before the original controllers are removed from the cluster. You must be sure that the number of controllers in the cluster does not exceed the supported maximum cluster size during the procedure.

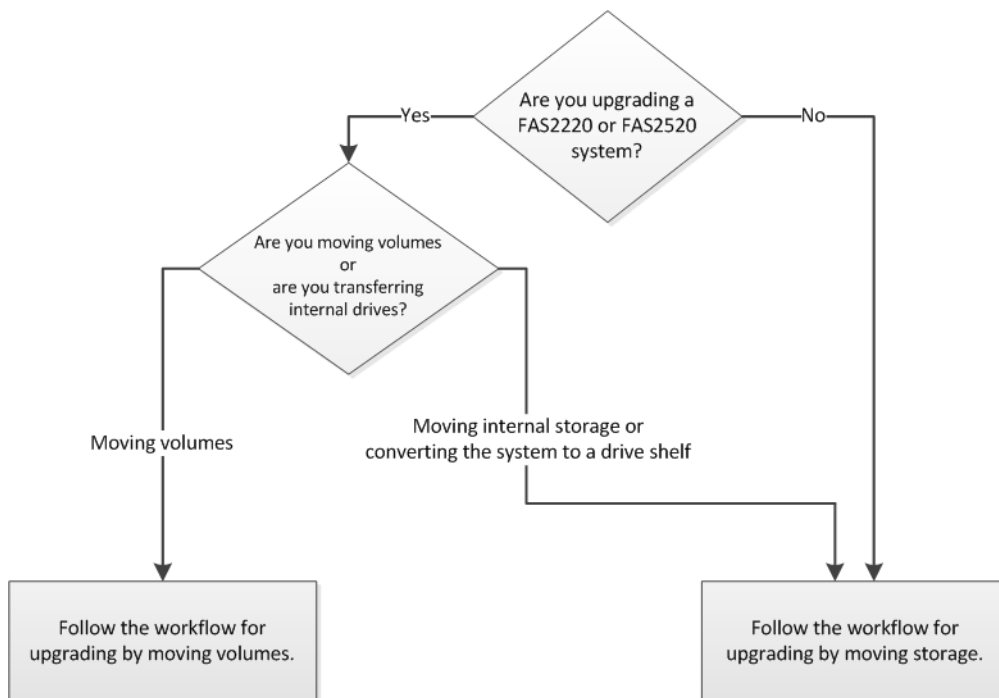
#### [Lenovo Press](#)

- When combining different platform models of controllers in a cluster, you must be aware of the storage platform mixing rules. [Lenovo Press](#)
- The new controllers must have enough storage to accommodate storage associated with the original controllers. [ONTAP 9 Disks and Aggregates Power Guide](#)
- The procedure for upgrading by moving storage is disruptive; the procedure for upgrading by moving volumes is nondisruptive.
- If the new system has fewer slots than the original system, or if it has fewer or different types of ports, you might need to add an adapter to the new system. [Lenovo Press](#)
- For controllers that are in a MetroCluster configuration, the controllers must not be in a switchover state when you perform the upgrade.
- If the original controllers or new controllers use FlexArray Virtualization software, you might need to perform additional steps.
- If your cluster has SAN hosts, you should familiarize yourself with potential issues about LUN serial number changes and the steps in resolving the issues.
- If your system uses out-of-band ACP, you might need to migrate from out-of-band ACP to in-band ACP.

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### Methods for upgrading controller hardware

In general, how you upgrade the controller hardware depends on the platform models of the original controllers. You upgrade either by moving the storage (a disruptive procedure) or by moving the volumes (a nondisruptive procedure).

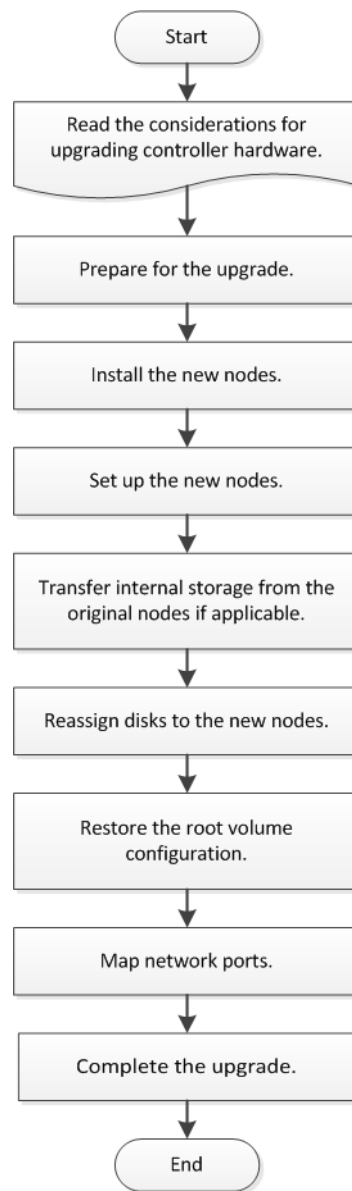



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## Workflow for upgrading by moving storage

Upgrading by moving storage is a disruptive procedure. Before you start, you should read the considerations. After installing and setting up the new controllers, you can transfer storage and reassign disks to the new controllers. You then perform additional configurations and complete the upgrade.

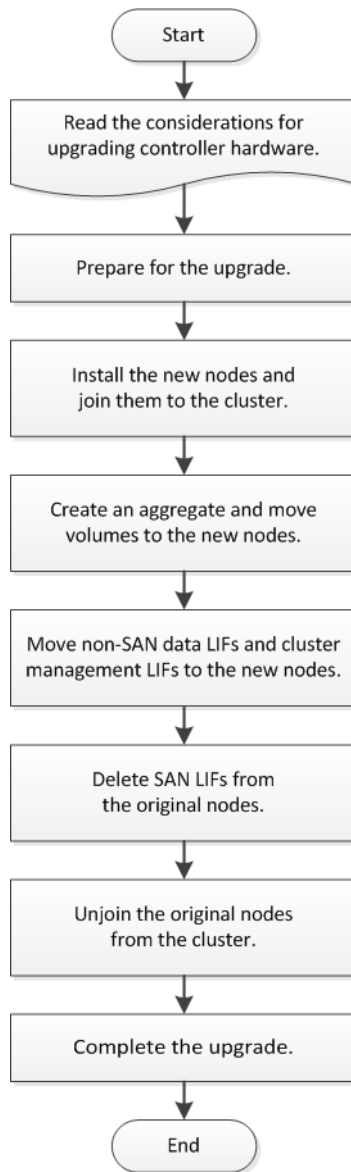




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## Workflow for upgrading by moving volumes

Upgrading by moving volumes is a nondisruptive procedure. Before you start, you should read the considerations and prepare the original controllers. You join the new controllers to the cluster and move volumes to the new controllers. You then perform additional configurations, unjoin original controllers, reassign disks, and complete the upgrade.




---

## Upgrading controller hardware

You upgrade the controller hardware either by moving the storage (a disruptive procedure) or by moving the volumes (a nondisruptive procedure).

### Upgrading controller hardware by moving storage

If you are upgrading by moving storage, you prepare the original controllers and set up the new controllers. Some platform models support transferring internal storage to the new controllers. You reassign disks and restore root volume configuration to the new controllers and configure network ports. Upgrading by moving storage is a disruptive procedure.

#### Preparing for the upgrade when moving storage

Before upgrading by moving storage, you must gather license information from the original controllers, plan network configuration, send an AutoSupport message about the upgrade, record the system IDs, destroy the mailboxes, power down the controllers, and remove the chassis.

- Step 1. Display and record license information from the original controllers by using the **system license show** command.
- Step 2. If you use Storage Encryption on the original controllers and the new controllers have encryption-enabled disks, make sure that the original controllers' disks are correctly keyed:
- Display information about self-encrypting disks (SEDs) by using the **storage encryption disk show** command.
  - If any disks are associated with a non-manufacture secure ID (non-MSID) key, rekey them to an MSID key by using the **storage encryption disk modify** command.
- Step 3. Record port and LIF configuration information on the original controllers:

To display information about...	Enter...
Shelves, numbers of disks in each shelf, flash storage details, memory, NVRAM, and network cards	<code>system node run -node <i>node_name</i> sysconfig</code>
Cluster network and controller management LIFs	<code>network interface show -role cluster,node-mgmt</code>
Physical ports	<code>network port show -node <i>node_name</i> -type physical</code>
Failover groups	<code>network interface failover-groups show -vserver <i>vserver_name</i></code>  <b>Note:</b> Record the names and ports of failover groups that are not clusterwide.
VLAN configuration	<code>network port vlan show -node <i>node_name</i></code>  <b>Note:</b> Record each network port and VLAN ID pairing.
Interface group configuration	<code>network port ifgrp show -node <i>node_name</i> -instance</code>  <b>Note:</b> Record the names of the interface groups and the ports assigned to them.
Broadcast domains	<code>network port broadcast-domain show</code>
IPspace information	<code>network ipspace show</code>

- Step 4. Obtain information about the default cluster ports, data ports, and controller management ports for each new controller that you are upgrading to. [Lenovo Press](#)
- Step 5. As needed, adjust the configuration of the network broadcast domains on the original controllers for compatibility with that of the new controllers: `network port broadcast-domain modify`
- Step 6. If VLANs are configured on interface groups, remove the VLANs: `network port vlan delete -node node_name -port ifgrp -vlan-id VLAN_ID`
- Step 7. If any interface groups are configured on the original controllers, delete the ports that are assigned to the interface groups: `network port ifgrp remove-port -node node_name -ifgrp ifgrp_name -port port_name`
- Step 8. Send an AutoSupport message from each original controller to inform technical support of the upgrade: `system node autosupport invoke -node node_name -type all -message "Upgrading node_name from platform_original to platform_new"`

Step 9. Disable high availability or storage failover on each original controller:

If you have a...	Enter...
Two-controller cluster	1. cluster ha modify -configured false 2. storage failover modify -node <i>node_name</i> -enabled false
Cluster with more than two controllers	storage failover modify -node <i>node_name</i> -enabled false

Step 10. If the original controllers are in a two-controller MetroCluster configuration, switch over storage and client access and heal the root aggregates:

- a. Check the MetroCluster status by using the **metrocluster show** command to determine whether automatic switchover has occurred.
- b. If automatic switchover has not occurred, perform a planned switchover operation from the healthy controller by using the **metrocluster switchover** command.
- c. Resynchronize the data aggregates by using the **metrocluster heal -phase aggregates** command from the surviving cluster.
- d. Heal the root aggregates by using the **metrocluster heal -phase root-aggregates** command.
- e. Verify that the heal operation is complete by using the **metrocluster operation show** command on the destination cluster.

Step 11. Reboot the controller: `system node reboot -node node_name`

You can suppress the quorum check during the reboot process by using the `-ignore-quorum-warnings` option.

Step 12. Interrupt the reboot process by pressing Ctrl-C to display the boot menu when the system prompts you to do so.

Step 13. From the boot menu, select **(5) Maintenance mode boot** to access Maintenance mode. A message might appear asking you to ensure that the partner controller is down or takeover is manually disabled on the partner controller. You can enter `yes` to continue.

Step 14. Record each original controller's system ID, which is obtained through disk ownership information in Maintenance mode: `disk show -v`

You need the system IDs when you assign disks from the original controllers to the new controllers.

### Example

```
*> disk show -v
Local System ID: 118049495
DISK  OWNER                POOL  SERIAL NUMBER          HOME
-----
0a.33  node1 (118049495)  Pool0  3KS6BN970000973655KL  node1 (118049495)
0a.32  node1 (118049495)  Pool0  3KS6BCKD000097363ZHK  node1 (118049495)
0a.36  node1 (118049495)  Pool0  3KS6BL9H000097364W74  node1 (118049495)
...
```

Step 15. If you have FC or CNA port configuration, display the configuration in Maintenance mode: `ucadmin show`

You should record the command output for later reference.

### Example

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

Step 16. In Maintenance mode, destroy each original controller's mailboxes: `mailbox destroy local`

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

Step 17. Confirm that you want to destroy the mailboxes: `y`

The system displays a message similar to the following:  
 .....Mailboxes destroyed  
 Takeover On Reboot option will be set to ON after the node boots.  
 This option is ON by default except on setups that have iSCSI or FCP license.  
 Use "storage failover modify -node <nodename> -onreboot false" to turn it OFF.

```
*>
```

Step 18. Exit Maintenance mode: `halt`

Step 19. Turn off the power to the original controllers, and then unplug them from the power source.

Step 20. Label and remove all cables from the original controllers.

Step 21. Remove the chassis containing the original controllers.

## Installing the new controllers

When you upgrade by moving storage, you begin by installing the new controllers and attaching power, console, and network connections to the new controllers.

Step 1. If needed, install any adapters in the new controllers, following the instructions in the appropriate adapter installation guide.

Step 2. Install the new controllers, following the *Installation and Setup Instructions* for the platform. Do not attach disk selves from the original controllers to the new controllers at this point.

Step 3. Attach power and console connections to the new controllers, following the *Installation and Setup Instructions* for the platform.

Step 4. Attach the network cables.

Step 5. Transfer all remaining cables from the original controller to the corresponding ports on the new controller. This includes Fibre Channel or other external disk shelf cables, and Ethernet cables.

## Setting up the new controllers

During the process of upgrading by moving storage, you power on the new controllers, boot the software image, and configure the new controllers.

Step 1. Turn on the power to the first new controller, and then immediately press Ctrl-C at the console terminal to access the boot environment prompt (also called the LOADER prompt). If you are upgrading to a system with both controllers in the same chassis, the other controller also reboots. You can disregard booting the other controller for now.

Step 2. If the new controller has a single-chassis configuration (with controllers in the same chassis):  
 a. Switch the console cable from the current new controller to the other new controller.

- b. Turn on the power to the second new controller, and then interrupt the boot process by pressing Ctrl-C at the console terminal to access the boot environment prompt. The power should already be on if both controllers are in the same chassis. Leave the second new controller at the boot environment prompt; you return to this procedure and repeat these steps after the first new controller is installed.
- c. Switch the console cable back to the first new controller.

Step 3. At the boot environment prompt, enter the following command: `set - defaults`

Step 4. At the boot environment prompt, configure the netboot connection for a management LIF:

If DHCP is...	Then...
Currently running	Configure the automatic connection: <code>ifconfig e0M - auto</code>
In a single-chassis configuration (with controllers in the same chassis)	Configure the manual connection: <code>ifconfig e0M - addr=<i>ip_addr</i> mask=<i>netmask</i> - gw=<i>gateway</i> - dns=<i>dns_addr</i> - domain=<i>dns_domain</i></code>

Step 5. At the boot environment prompt, perform netboot on the new controller: `netboot http://path_to_the_web-accessible_directory/netboot/kernel`

The *path\_to\_the\_web-accessible\_directory* is the location of the downloaded `netboot.tgz` file.

Step 6. From the boot menu, select option **(7) Install new software first** to download and install the new software image to the boot device. Disregard the following message: "This procedure is not supported for Non-Disruptive Upgrade on an HA pair". It applies to nondisruptive upgrades of software, not to upgrades of controllers.

Step 7. If you are prompted to continue the procedure, enter `y`, and when prompted for the package, enter the URL of the image file: `http://path_to_the_web-accessible_directory/image.tgz`. If the system prompts you for the user name, you can press Enter to continue.

Step 8. Enter `n` to skip the backup recovery when you see a prompt similar to the following:  
Do you want to restore the backup configuration now? {y|n}

Step 9. Reboot by entering `y` when you see a prompt similar to the following:  
The node must be rebooted to start using the newly installed software. Do you want to reboot now? {y|n}

Step 10. Interrupt the reboot process by pressing Ctrl-C to display the boot menu when the system prompts you to do so.

Step 11. From the boot menu, select **(5) Maintenance mode boot** to access Maintenance mode.

Step 12. If necessary, make changes to the FC or CNA ports on the controller, and then reboot the controller to Maintenance mode. [ONTAP 9 SAN Administration Guide](#)

Step 13. From Maintenance mode, verify that the controller and chassis settings have the correct HA state:  
`ha-config show`

If you have...	Then...
An HA configuration	<p>You should verify that the command output shows ha:</p> <pre>*&gt; ha-config show   Chassis HA configuration: ha   Controller HA configuration: ha</pre> <p>Systems record in a PROM. The state must be the same on all components within the HA pair</p> <p>The <b>ha-config modify controller ha</b> command configures ha for the controller setting. The <b>ha-config modify chassis ha</b> command configures ha for the chassis setting.</p> <p><a href="#">ONTAP 9 High-Availability Configuration Guide</a></p>
A MetroCluster configuration	<p>You should verify that the command output shows the correct MetroCluster setting:</p> <ul style="list-style-type: none"> <li>• mcc-2n for two-controller MetroCluster configurations</li> <li>• mcc for other MetroCluster configurations</li> </ul> <p>For example:</p> <pre>*&gt; ha-config show   Chassis HA configuration: mcc-2n   Controller HA configuration: mcc-2n</pre> <p>The <b>ha-config modify controller {mcc-2n  mcc}</b> command modifies the controller setting and the <b>ha-config modify chassis {mcc-2n  mcc}</b> command modifies the chassis setting for MetroCluster configurations.</p> <p><a href="#">ONTAP 9 Fabric-attached MetroCluster Installation and Configuration Guide</a></p> <p><a href="#">ONTAP 9 Stretch MetroCluster Installation and Configuration Guide</a></p>

Step 14. Enter y to confirm that you want to destroy the local mailboxes.

Step 15. Exit Maintenance mode: halt  
The system stops at the boot environment prompt.

### Optional: Moving internal storage or converting the system to a drive shelf

If your original controller is one of the supported models, you can move its internal SATA drives or SSDs to a drive shelf that is attached to the new controllers during the process of upgrading by moving storage. You can also convert the system to a drive shelf and attach it to the new controllers.

You can move drives or drive shelves only within the same cluster.

## Moving internal drives from an original controller

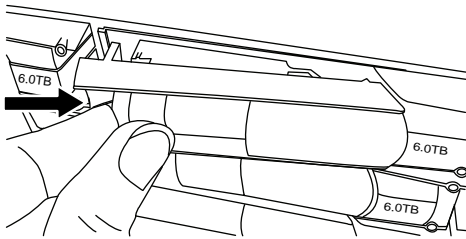
If your original controller is one of the supported models, during the process of upgrading by moving storage you can move the controller's internal SATA drives or SSDs to a drive shelf that is attached to the new controller in the same cluster. You cannot transfer SAS drives to a drive shelf attached to the new controllers.

### Before you begin

- You must have reviewed “Considerations for upgrading controller hardware” on page 89 about moving internal drives. You should contact technical support if you need guidance specific to your configuration.
- The SATA or SSD drive carriers from the original controller must be compatible with the new drive shelf.
- A compatible drive shelf must already be attached to the new controller.
- The drive shelf must have enough free bays to accommodate the SATA or SSD drive carriers from the original controller.

Step 1. Gently remove the bezel from the front of the system.

Step 2. Press the release button on the left side of the drive carrier. The following illustration shows a drive with the release button located on the left of the carrier face:

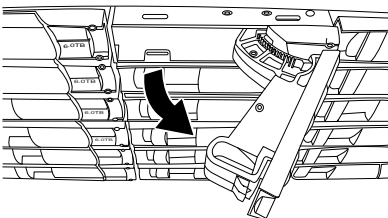


The cam handle on the carrier partially springs open, and the carrier releases from the midplane.

Step 3. Pull the cam handle to its fully open position to unseat the carrier from the midplane, and then gently slide the carrier out of the drive shelf.

**Attention:** Always use two hands when removing, installing, or carrying a drive. However, do not place your hands on the drive boards exposed on the underside of the carrier.

The following illustration shows a carrier with the cam handle in its fully open position:



Step 4. With the cam handle in the open position, insert the carrier into a slot in the new drive shelf, firmly pushing until the carrier stops.

**Attention:** Use two hands when inserting the carrier.

Step 5. Close the cam handle so that the carrier is fully seated in the midplane and the handle clicks into place. You should close the handle slowly so that it aligns correctly with the face of the carrier.

Step 6. Repeat Step 2 through Step 5 for all of the drives that you are moving to the new system.



## Converting an original controller to a drive shelf

If your original controller is one of the supported models, during the process of upgrading by moving storage you can convert the controller to a drive shelf and then attach it to the new controllers in the same cluster.

### Before you begin

You must have reviewed “Considerations for upgrading controller hardware” on page 89 about converting a controller to a drive shelf. You should contact technical support if you need guidance specific to your configuration.

- Step 1. Replace the controller modules in the controller you are converting with appropriate IOM modules. [Lenovo Press](#)
- Step 2. Set the drive shelf ID.  
Each drive shelf, including the chassis, requires a unique ID.
- Step 3. Reset other drive shelf IDs as needed.
- Step 4. Turn off power to any drive shelves connected to the new controllers, and then turn off power to the new controllers.
- Step 5. Cable the converted drive shelf to a SAS port on the new system, and, if you are using out-of-band ACP cabling, to the ACP port on the new controller.
- Step 6. Turn on the power to the converted drive shelf and any other drive shelves attached to the new controllers.
- Step 7. Turn on the power to the new controllers, and then interrupt the boot process on each controller by pressing Ctrl-C to access the boot environment prompt.

## Reassigning disks to the new controllers

You must reassign the disks that belonged to the original controllers to the new controllers.

You perform the steps in this section on both new controllers, completing each step on one controller and then the other controller before going on to the next step.

- Step 1. From the new controller's boot environment prompt (LOADER prompt), switch to Maintenance mode: `boot_primary maint`
- Step 2. If the new controller has a root aggregate:
  - a. Take the root aggregate of the new controller offline: `aggr offline aggr0`
  - b. Destroy the root aggregate: `aggr destroy aggr0`
- Step 3. Display the new controller's system ID: `disk show -v`

### Example

```
*> disk show -v
Local System ID: 101268854
...
```

You should record the new controller's system ID for later reference.

- Step 4. Reassign the controller's spare disks, disks belonging to the root aggregate, and any SFO aggregates: `disk reassign -s original_sysid -d new_sysid -p partner_sysid`

The *original\_sysid* value is what you recorded in Step 14 on page 94.

You specify `-p partner_sysid` when shared disks are present.

The system displays a message similar to the following:

```
Partner node must not be in Takeover mode during disk reassignment from maintenance mode.
Serious problems could result!!
```

Do not proceed with reassignment if the partner is in takeover mode. Abort reassignment (y/n)?n

After the node becomes operational, you must perform a takeover and giveback of the HA partner node to ensure disk reassignment is successful.

Do you want to continue (y/n)?y

Step 5. Enter y to continue.

The system displays a message similar to the following:

The system displays the following message:

Disk ownership will be updated on all disks previously belonging to Filer with sysid <sysid>.

Do you want to continue (y/n)? y

Step 6. Enter y to continue.

Step 7. Make sure that the original system's root aggregate is set to the root option and that other aggregates are online: `aggr status`

You should see output similar to the following:

```
*> aggr status
      Aggr State      Status      Options
aggr0 online      raid_dp, aggr      root
                   64-bit
```

Step 8. Exit Maintenance mode: `halt`

## Restoring the root volume configuration

After you install and boot the new controllers and reassign disks, you must restore configuration information from the root volume to the boot devices.

You need to perform the steps in this section on both new controllers, completing each step on one controller and then the other before going on to the next step.

Step 1. Access the boot menu from the boot environment prompt (LOADER prompt): `boot_ontap`

Step 2. Press Ctrl-C to display the boot menu when the system prompts you to do so.

Step 3. From the boot menu, select **(6) Update flash from backup config**.

The system displays the following message:

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

Step 4. Enter y to continue.

The update flash process runs for several minutes, and then the system reboots. The startup process then asks you to confirm the system ID mismatch.

Step 5. Confirm the mismatch by entering y.

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

The startup sequence proceeds normally.

## Mapping network ports

To enable the new controller to communicate with other controllers in the cluster and with the network after the upgrade, you need to make sure that the physical ports on the new controller map correctly to the physical ports on the original controller.

Step 1. Locate the original controllers' port and LIF configuration information that you recorded previously. "Preparing for the upgrade when moving storage" on page 92.

Step 2. Record information for each new controller's ports, broadcast domains, and IPspaces. [Lenovo Press](#)

Step 3. Make the following changes:

- a. Boot the new controller to the storage system prompt if you have not already done so.

- b. Add the correct ports to the Cluster broadcast domain: `network port modify -ip-space Cluster -mtu 9000`

### Example

This example adds Cluster port e1b on “node-new”: `network port modify -node node-new -port e1b -ip-space Cluster -mtu 9000`

- c. Migrate the LIFs to the new ports, once for each LIF: `network interface migrate -vserver vservers_name -lif lif_name -source-node node-new -destination-node node-new -destination-port port_name`

SAN data LIFs can be migrated only when they are offline.

- d. Modify the home port of the Cluster LIFs: `network interface modify -vserver Cluster -lif lif_name -home-port port_name`
- e. Remove the old ports from the Cluster broadcast domain: `network port broadcast-domain remove-ports -ip-space Cluster -broadcast-domain Cluster -ports node-new:port`
- f. Display the health state of the new controller: `cluster show -node node-new -fields health`

Step 4. Delete any ports of the original controller that no longer exist on the new controller (advanced privilege level): `network port delete -node node_name -port port_name`

Step 5. Adjust the controller-management broadcast domain and migrate the controller-management and cluster-management LIFs if necessary:

- a. Display the home port of a LIF: `network interface show -fields home-node,home-port`
- b. Display the broadcast domain containing the port: `network port broadcast-domain show -ports node_name:port_name`
- c. Add or remove ports from broadcast domains as necessary: `network port broadcast-domain add-ports / network port broadcast-domain remove-ports`
- d. Modify a LIF’s home port if necessary: `network interface modify -vserver vservers_name -lif lif_name -home-port port_name`

Step 6. Adjust the intercluster broadcast domains and migrate the intercluster LIFs, if necessary, using the same commands in Step 5.

Step 7. Adjust any other broadcast domains and migrate the data LIFs, if necessary, using the same commands in Step 5.

Step 8. Adjust all the LIF failover groups: `network interface modify -failover-group failover_group -failover-policy failover_policy`

### Example

The following command sets the failover policy to broadcast-domain-wide and uses the ports in failover group “fg1” as failover targets for LIF “data1” on “node3”: `network interface modify -vserver node3 -lif data1 -failover-policy broadcast-domain-wide -failover-group fg1`

Step 9. Display the new controller's network port attributes: `network port show -node node-new`

## Completing the upgrade

To complete the procedure of upgrading by moving storage, you need to delete any unused ports and LIFs from the new controllers, re-enable storage failover or high availability, configure the Service Processor (SP), install new licenses, and set up AutoSupport. You might also need to set up Storage Encryption and configure the FC or CNA ports.

Step 1. From the storage system prompt, display information about logical interfaces by using the **network interface show** command.

- Step 2. Delete any unused ports from the new controllers by using the **network port delete** command (advanced privilege level).
- Step 3. If you are in a SAN environment, delete unused LIFs from the port set so that you can remove them:
  - a. Display the port set list by using the **lun portset show** command.
  - b. Remove any unused LIFs from the port set by using the **lun portset remove** command.
- Step 4. Remove each unused LIF from the new controllers by using the **network interface delete** command.
- Step 5. Re-enable storage failover or high availability on the new controller pair as needed:

If you have a...	Then...
Two-controller cluster	Re-enable high availability: <code>cluster ha modify -configured true</code>
A cluster with more than two controllers	Re-enable storage failover: <code>storage failover modify -node <i>node_name</i> -enabled true</code>

- Step 6. If the original controllers were in a MetroCluster configuration and you performed a switchover operation during the preparation for the upgrade, perform a switchback by using the **metrocluster switchback** command.
- Step 7. Configure the SP on the new controllers as needed by using the **system service-processor network modify** command.
- Step 8. Install new licenses on the new controllers as needed by using the **system license add** command.
- Step 9. Set up AutoSupport on the new controllers by using the **system node autosupport modify** command.
- Step 10. From each new controller, send a post-upgrade AutoSupport message to technical support: `system node autosupport invoke -node node_name -type all -message "node_name successfully upgraded from platform_old to platform_new"`
- Step 11. If the new controllers have Storage Encryption enabled, launch the key management setup wizard to configure Storage Encryption by using the **security key-manager setup** command. [ONTAP 9 Disks and Aggregates Power Guide](#)
- Step 12. If the new controllers have FC ports (onboard or on FC adapters), onboard CNA ports, or a CNA card, configure the FC or CNA ports, enter the following command from the storage system prompt: `system node hardware unified-connect modify -node node-name -adapter adapter-name -mode {fc|cna} -type {target|initiator}`

[ONTAP 9 SAN Administration Guide](#)

You can modify the CNA configuration only when the CNA adapters are offline.

- Step 13. Set up a switchless cluster on the new controllers if necessary.

## Upgrading controller hardware by moving volumes

If you are upgrading by moving volumes, you prepare the original controllers and join the new controllers to the cluster. You move volumes to the new controllers, configure LIFs, and unjoin the original controllers from the cluster. Upgrading by moving volumes is a nondisruptive procedure.

### Preparing for the upgrade when moving volumes

You need to perform a few preparation steps before upgrading controller hardware by moving volumes.

- Step 1. Display the volumes on the original controllers by using the **volume show** command. You use the command output to prepare the list of volumes to move to the new controllers.
- Step 2. Display and record license information from the original controllers by using the **system license show** command.
- Step 3. If you use Storage Encryption on the original controllers and the new controllers have encryption-enabled disks, make sure that the original controllers' disks are correctly keyed:
  - a. Display information about self-encrypting disks (SEDs) by using the **storage encryption disk show** command.
  - b. If any disks are associated with a non-manufacture secure ID (non-MSID) key, rekey them to an MSID key by using the **storage encryption disk modify** command.
- Step 4. Send an AutoSupport message from each original controller to inform technical support of the upgrade: `system node autosupport invoke -node node_name -type all -message "Upgrading node_name from platform_original to platform_new"`

## Installing the new controllers and joining them to the cluster

You must install the new controllers and join them to the cluster so that you can move volumes from the original controllers.

When you upgrade controller hardware by moving volumes, both the original controllers and the new controllers must be in the same cluster.

- Step 1. Install the new controllers and join them to the cluster:

If the cluster is running...	Follow instructions in...
ONTAP 9.0 or later	<a href="#">ONTAP 9 Cluster Expansion Express Guide</a>

## Creating an aggregate and moving volumes to the new controllers

You create at least an aggregate on each of the new controllers to store the volumes you want to move from the original controllers. You must identify an aggregate for each volume and move each volume individually.

### Before you begin

Data protection mirror relationships must have been initialized before you can move a volume.

- Step 1. Create at least one aggregate on each new controller: `storage aggregate create -aggregate aggr_name -node new_node_name -diskcount integer`
- Step 2. Add the new aggregate to the same SVM as the aggregate on the original controller from which you want to move the volumes by using the **vserver add-aggregates** command.

Both the new aggregate and the old aggregate from which the volume will be moved must be in the same SVM.

- Step 3. Verify that the new aggregate is now assigned to the same SVM as the aggregate on the original controller by using the **vserver show -vserver svm\_name** command.
- Step 4. Display information for the volumes that you want to move from the original controllers to the new controllers: `volume show -vserver svm_name -node original_node_name`

You should retain the command output for later reference.

### Example

The following example displays volumes on the “vs1” SVM and the “node0” controller:

```
cluster::> volume show -vserver vs1 -node node0
Vserver  Volume      Aggregate  State  Type    Size  Available  Used%
-----
vs1      clone       aggr1      online RW      40MB   37.87MB   5%
vs1      vol1        aggr1      online RW      40MB   37.87MB   5%
vs1      vs1root     aggr1      online RW      20MB   18.88MB   5%
3 entries were displayed.
```

- Step 5. Determine an aggregate to which you can move a given volume: `volume move target-aggr show -vserver svm_name -volume vol_name`

### Example

The following example shows that the “user\_max” volume on the “vs2” SVM can be moved to any of the listed aggregates:

```
cluster::> volume move target-aggr show -vserver vs2 -volume user_max
Aggregate Name  Available Size  Storage Type
-----
aggr2           467.9GB      FCAL
node12a_aggr3  10.34GB      FCAL
node12a_aggr2  10.36GB      FCAL
node12a_aggr1  10.36GB      FCAL
node12a_aggr4  10.36GB      FCAL
5 entries were displayed
```

- Step 6. Run a validation check on each volume that you want to move to verify that it can be moved to the specified aggregate: `volume move start -vserver svm_name -volume volume_name -destination-aggregate destination_aggregate_name -perform-validation-only true`

- Step 7. Move the volumes one at a time (advanced privilege level): `volume move start -vserver svm_name -volume vol_name -destination-aggregate destination_aggr_name -cutover-window integer`

You cannot move the controller root volume (vol0). Other volumes, including SVM root volumes, can be moved.

- Step 8. Display the outcome of the **volume move** operation to verify that the volumes were moved successfully: `volume move show -vserver svm_name -volume vol_name`

- Step 9. If the **volume move** operation does not complete the final phase after multiple attempts, force the move to finish: `volume move trigger-cutover -vserver svm_name -volume vol_name -force true`

Forcing the **volume move** operation to finish can disrupt client access to the volume that you are moving.

- Step 10. Verify that the volumes were moved successfully to the specified SVM and are in the correct aggregate: `volume show -vserver svm_name`

## Moving non-SAN data LIFs and cluster management LIFs to the new controllers

After you have moved the volumes from the original controllers, you need to migrate the non-SAN data LIFs and cluster-management LIFs from the original controllers to the new controllers.

You cannot migrate a LIF that is used for copy-offload operations with VMware vStorage APIs for Array Integration (VAAI).

- Step 1. From the controller where the cluster LIF is hosted, change the home ports for the non-SAN data LIFs from the original controllers to the new controllers: `network interface modify -vserver vserver_name -lif lif_name -home-node new_node_name -home-port {netport|lifgrp}`

- Step 2. Take one of the following actions:

If you want to migrate...	Then enter...
A specific LIF	<code>network interface migrate -vserver <i>vserver_name</i> -lif <i>lif_name</i> -source-node <i>source_node_name</i> -destination-node <i>dest_node_name</i> -destination-port <i>dest_port_name</i></code>
All the non-SAN data LIFs and cluster-management LIFs	<code>network interface migrate-all -node <i>node_name</i></code>

### Example

The following command migrates a LIF named `datalif1` on the SVM `vs0` to the port `e0d` on `node0b`:  
`cluster::> network interface migrate -vserver vs0 -lif datalif1 -destination-node node0b -destination-port e0d`

The following command migrates all the data and cluster-management LIFs from the current (local) controller:

```
cluster::> network interface migrate-all -node local
```

- Step 3. Check whether the home controller of the cluster-management LIF is on one of the original controllers: `network interface show -lif cluster_mgmt -fields home-node`
- Step 4. If the home controller of the cluster management LIF is on one of the original controllers, complete the following steps:
- Switch the home controller of the cluster-management LIF to one of the new controllers:  
`network interface modify -vserver cluster_name -lif cluster_mgmt -home-node new_node_name -home-port {netport|lifgrp}`
  - Migrate the cluster-management LIF to one of the new controllers: `network interface migrate -vserver vserver_name -lif cluster_mgmt -destination-node new_node_name -destination-port {netport|lifgrp}`

### Deleting SAN LIFs from the original controllers

If the cluster is in a SAN environment, you must delete any SAN LIFs from the original controllers before you can unjoin the original controllers from the cluster.

- Step 1. If you have iSCSI initiators, complete the following steps:
- Display a list of active initiators currently connected to an SVM on the original controllers, once for each of the old LIFs: `iscsi connection show -vserver Vserver_name -lif old_lif`

### Example

The following example shows the output of the command with an active initiator connected to SVM `vs1`:

```
cluster::> iscsi connection show -vserver vs1 -lif data2
-----
Vserver  Tpgroup  Conn  Local      Remote      TCP Recv
Name     Name     TSIH  ID         Address     Address     Size
-----
vs1      data     9     1 10.229.226.166  10.229.136.188  131400
```

- If any initiators are still logged in to an original controller, log out of the sessions from your host computer.
- Step 2. Display the port set list to determine if any iSCSI or FC LIFs on the original controllers belong to a port set: `lun portset show`

### Example

The following example shows output of the **lun portset show** command:

```
cluster:> lun portset show
Virtual
Server   Portset      Protocol Port Names          Igroups
-----
js11     ps0          mixed   LIF1,                 igroup1
         ps1          iscsi   LIF2,                 igroup2
         ps2          fcp     LIF3,                 -
         LIF4
```

3 entries were displayed.

- Step 3. If any iSCSIs or FC LIFs on an original controller are members of a port set, remove them from the port set: `lun portset remove -vserver vserver_name -portset portset_name -port-name lif_name`
- Step 4. Delete the LIFs on the original controllers: `network interface delete -vserver vserver_name -lif lif_name`

## Unjoining the original controllers from the cluster

After the volumes have been moved to the new controllers, you unjoin the original controllers from the cluster. When you unjoin a controller, the controller's configuration is erased and all disks are initialized.

- Step 1. Disable high-availability configuration on the original controllers: `storage failover modify -node original_node_name -enabled false`
- Step 2. Access the advanced privilege level: `set -privilege advanced`
- Step 3. Identify the controller that has epsilon: `cluster show`

In the following example, "node0" currently holds epsilon:

```
cluster::*>
node           Health Eligibility Epsilon
-----
node0          true   true       true
node1          true   true       false
node2          true   true       false
node3          true   true       false
```

- Step 4. If one of the original controllers holds epsilon, move epsilon to a different controller:
- Remove epsilon from the original controller: `cluster modify -node original_node_name -epsilon false`
  - Assign epsilon to a different controller: `cluster modify -node new_node_name -epsilon true`

- Step 5. From a controller that will remain in the cluster, unjoin each original controller from the cluster (advanced privilege level): `cluster unjoin -node original_node_name`
- The system displays a message similar to the following:

```
Warning: This command will unjoin node node_name from the cluster. You
must unjoin the failover partner as well. After the node is
successfully unjoined, erase its configuration and initialize all
disks by using the "Clean configuration and initialize all disks (4)"
option from the boot menu.
Do you want to continue? {y|n}: y
```

- Step 6. Enter `y` to continue.  
The unjoined controller is automatically rebooted and stops at the boot menu.
- Step 7. From the unjoined controller's boot menu, select option **(4) Clean configuration and initialize all disks** to erase the controller's configuration and initialize all disks.  
The system displays a message similar to the following:  
Zero disks, reset config and install a new file system?:  
This will erase all the data on the disks, are you sure?:
- Step 8. Enter `y` at both prompts.
- Step 9. If the cluster has only two controllers remaining, configure high availability for the two-controller cluster: `cluster ha modify -configured true`



## Completing the upgrade

To complete the procedure of upgrading by moving volumes, you need to configure the Service Processor (SP), install new licenses, and set up AutoSupport. You might also need to set up Storage Encryption and configure the FC or NCA ports.

- Step 1. Configure the SP on the new controllers as needed by using the **system service-processor network modify** command.
- Step 2. Install new licenses on the new controllers as needed by using the **system license add** command.
- Step 3. Set up AutoSupport on the new controllers by using the **system node autosupport modify** command.
- Step 4. From each new controller, send a post-upgrade AutoSupport message to technical support:  
`system node autosupport invoke -node node_name -type all -message "node_name successfully upgraded from platform_old to platform_new"`
- Step 5. If the new controllers have Storage Encryption enabled, launch the key management setup wizard to configure Storage Encryption by using the **security key-manager setup** command. [ONTAP 9 Disks and Aggregates Power Guide](#)
- Step 6. If the new controllers have FC ports (onboard or on FC adapters), onboard CNA ports, or a CNA card, configure the FC or CNA ports, enter the following command from the storage system prompt: `system node hardware unified-connect modify -node node-name -adapter adapter-name -mode {fc|cna} -type {target|initiator}` [ONTAP 9 SAN Administration Guide](#) You can modify the CNA configuration only when the CNA adapters are offline.
- Step 7. Set up a switchless cluster on the new controllers if necessary.



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## Chapter 7. System level diagnostics

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### Introduction to system-level diagnostics

System-level diagnostics provides a command-line interface for tests that search for and determine hardware problems on supported storage systems. You use system-level diagnostics to confirm that a specific component is operating properly or to help identify faulty components.

System-level diagnostics is available for supported storage systems only. Entering system-level diagnostics at the command-line interface of unsupported storage systems generates an error message.

You run system-level diagnostics after one of the following common troubleshooting situations:

- Initial system installation
- Addition or replacement of hardware components
- System panic caused by an unidentified hardware failure
- Access to a specific device becomes intermittent or the device becomes unavailable
- System response time becomes sluggish

To run system-level diagnostics, you must already be running Data ONTAP because you need to reach the **Maintenance mode boot** option in Data ONTAP. There are several approaches to get to this option, but this is the recommended approach taken in the procedures documented in this guide. Some hardware components in your system may require a specific approach, and this would be documented in the applicable field replaceable unit (FRU) flyer. This guide does not provide detailed definitions of specific commands, subcommands, tests, or conditions.

Once the command is entered, the tests run in the background and the passed or failed outcome of the tests is logged in the internal memory-based log, which has a fixed size. Some tests are utilities and will simply state completed rather than passed or failed. After you run the appropriate tests, the procedures documented in this guide help you generate status report. Once the test results show a successful completion of system-level diagnostics, it is a recommended best practice to clear the log.

In the event of test failures, the status reports will help technical support make appropriate recommendations. The failure could be resolved by reinstalling the FRU, by ensuring cables are connected, or by enabling specific tests recommended by technical support and then re-running those tests. If the failure cannot be resolved, then there is a hardware failure and the affected hardware must be replaced.

There are no error messages that require further definitions or explanations.

### Requirements for running system-level diagnostics

Depending on the system-level diagnostic tests you are running, you need to be aware of time and system hardware requirements.

Each documented task has slight differences; use the recommended procedure for the task.

The following requirements must be met when running system-level diagnostics; otherwise, parts of the tests fail and error messages appear in the status report:

#### General requirements

- Each system being tested must be on a separate network. The network interface test assigns unique static IP addresses, beginning with 172.25.150.23, to all available network interfaces on a storage system. This

results in network interface ports on different storage controllers being assigned the same IP address. If all the systems being tested are on the same network, then duplicate ip address warning messages appear on the connected consoles. These warning messages do not affect the test results.

### System memory requirements

- You need to set aside time when running memory tests; the larger the memory capacity of your storage system, the longer it takes.

### NIC requirements

- All adjacent network interface ports on the system must be connected for best performance using a standard Ethernet cable. Examples of adjacent ports are e0a and e0b or e2c and e2d.

**Attention:** e0M and e0P ports cannot be connected together due to an internal switch connection. In systems with e0M and e0P ports, the most efficient pairings are e0M with e0a and e0P with e0b.

- If there are a number of network interface ports on the system, you may need to run the NIC system-level diagnostic test several times, limiting each run to no more than two pairs each time.

### SAS requirements

- When running the SAS system-level diagnostic tests, adjacent SAS ports must be connected for best performance; storage shelves must be disconnected from the ports.

### FC-AL requirements

- When running the FC-AL system-level diagnostic tests, you must have loopback hoods on FC-AL interfaces on the motherboard or expansion adapters for best performance; all other cables for storage or Fibre Channel networks must be disconnected from the ports.

### CNA requirements

- The use of loopback hoods is not a requirement for running CNA system-level diagnostics tests.

### Interconnect requirements

- Both platform controller modules in a dual controller system must be in Maintenance mode for the interconnect system-level diagnostic test to run.

**Attention:** You will receive a warning message if you attempt to run the interconnect system-level diagnostic test with other system-level diagnostic tests.

## How to use online command-line help

You can get command-line syntax help from the command line by entering the name of the command followed by **help** or the question mark (?).

The fonts or symbols used in syntax help are as follows:

<b>keyword</b>	Specifies the name of a command or an option that must be entered as shown.
< > (less than, greater than symbols)	Specify that you must replace the variable identified inside the symbols with a value.
(pipe)	Indicates that you must choose one of the elements on either side of the pipe.

[ ] (brackets)	Indicate that the element inside the brackets is optional.
{ } (braces)	Indicate that the element inside the braces is required.

You can also type the question mark at the command line for a list of all the commands that are available at the current level of administration (administrative or advanced).

The following example shows the result of entering the **environment help** command at the storage system command line. The command output displays the syntax help for the **environment** commands.

```
toaster> environment help
Usage: environment status |
[status] [shelf [<adapter>]] |
[status] [shelf_log] |
[status] [shelf_stats] |
[status] [shelf_power_status] |
[status] [chassis [all | list-sensors | Fan | Power | Temp | Power Supply | RTC Battery | NVRAM4-temperature-7 | NVRAM4-battery-7]]
```

---

## Running system installation diagnostics

You run diagnostics after an initial system installation to identify the version of system-level diagnostics and the supported devices on your storage system, and to verify that the installation is successful and that all hardware is functioning properly.

### Before you begin

Your storage system must already be running Data ONTAP.

- Step 1. At the storage system prompt, switch to the LOADER prompt: `halt`
- Step 2. Enter the following command at the LOADER prompt: `boot_diags`

**Note:** You must run this command from the LOADER prompt for system-level diagnostics to function properly. The **boot\_diags** command starts special drivers designed specifically for system-level diagnostics.

- Step 3. View the version of system-level diagnostics present on your storage system by entering the following command: `sldiag version show`  
The version is displayed in the format System Level Diagnostics *X.nn.nn*. The *X* is an alpha reference and *nn.nn* are major and minor numeric references, respectively.
- Step 4. Identify the device types in your new system installation so that you know which components to verify by entering the following command: `sldiag device types`  
Your storage system displays some or all of the following devices:
  - `ata` is an Advanced Technology Attachment device.
  - `bootmedia` is the system booting device.
  - `cna` is a Converged Network Adapter not connected to a network or storage device.
  - `env` is motherboard environmentals.
  - `fcache` is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
  - `fcsl` is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.
  - `fcvi` is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
  - `interconnect` or `nvr4m-ib` is the high-availability interface.

- mem is system memory.
- nic is a Network Interface Card not connected to a network.
- nvram is nonvolatile RAM.
- nvmem is a hybrid of NVRAM and system memory.
- sas is a Serial Attached SCSI device not connected to a disk shelf.
- serviceproc is the Service Processor.
- storage is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
- toe is a TCP Offload Engine, a type of NIC.

Step 5. Run all the default selected diagnostic tests on your storage system by entering the following command: `sldiag device run`

Step 6. View the status of the test by entering the following command: `sldiag device status`  
 Your storage system provides the following output while the tests are still running:  
 There are still test(s) being processed.  
 After all the tests are complete, the following response appears by default:  
 \*> <SLDIAG:\_ALL\_TESTS\_COMPLETED>

Step 7. Verify that there are no hardware problems on your new storage system by entering the following command: `sldiag device status -long -state failed`

### Example

The following example shows how the full status of the failures is displayed in a test run without the appropriate hardware:

```
*> sldiag device status -long -state failed

TEST START -----
DEVTYPE: nvram_ib
NAME: external loopback test
START DATE: Sat Jan 3 23:10:55 GMT 2009

STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan 3 23:11:04 GMT 2009

LOOP: 1/1
TEST END -----

TEST START -----
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan 3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
```

```
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
  Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK  OK
Error Count: 2  Run Time: 70 secs
>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END -----
```

If the system-level diagnostics tests...	Then...
Were completed without any failures	<p>There are no hardware problems and your storage system returns to the prompt.</p> <ol style="list-style-type: none"> <li>1. Clear the status logs by entering the following command: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log is cleared by entering the following command: <code>sldiag device status</code></li> </ol> <p>The following default response is displayed:  SLDIAG: No log messages are present.</p> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>4. Enter the following command at the Loader prompt to boot the storage system: <code>boot_ontap</code></li> </ol> <p>You have completed system-level diagnostics.</p>
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>2. Perform a clean shutdown and disconnect the power supplies.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies and power on the storage system.</li> <li>5. Repeat Steps 1 through 7 of <i>Running system installation diagnostics</i>.</li> </ol>

## Running system panic diagnostics

Running diagnostics after your storage system suffers a system panic can help you to identify the possible cause of the panic.

Step 1. At the storage system prompt, switch to the LOADER prompt: `halt`

Step 2. Enter the following command at the LOADER prompt: `boot_diags`

**Note:** You must run this command from the LOADER prompt for system-level diagnostics to function properly. The `boot_diags` command starts special drivers designed specifically for system-level diagnostics.

Step 3. Run diagnostics on all the devices by entering the following command: `sldiag device run`

Step 4. View the status of the test by entering the following command: `sldiag device status`



Your storage system provides the following output while the tests are still running:

There are still test(s) being processed.

After all the tests are complete, you receive the following default response:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

- Step 5. Identify the cause of the system panic by entering the following command: `sldiag device status -long -state failed`

### Example

The following example shows how the full status of the failures is displayed in a test run without the appropriate hardware:

```
*> sldiag device status -long -state failed
```

```
TEST START -----
DEVTYPE: nvram_ib
NAME: external loopback test
START DATE: Sat Jan  3 23:10:55 GMT 2009
```

```
STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan  3 23:11:04 GMT 2009
```

```
LOOP: 1/1
```

```
TEST END -----
```

```
TEST START -----
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009
```

```
STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 16ib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2
```

```
Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309
```

```
Started adapter interrupt test
Adapter interrupt test OK
```

```
Started adapter reset test.
Adapter reset OK
```

```
Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN
```

```
Started adapter Retry LIP test
Adapter Retry LIP OK
```

```
ERROR: failed to init adaptor port for IOCTL call
```

```
ioctl_status.class_type = 0x1
```

```
ioctl_status.subclass = 0x3
```

```
ioctl_status.info = 0x0
Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK OK
```

Error Count: 2 Run Time: 70 secs  
 >>>> ERROR, please ensure the port has a shelf or plug.  
 END DATE: Sat Jan 3 23:12:07 GMT 2009

LOOP: 1/1  
 TEST END -----

If the system-level diagnostics tests...	Then...
Were completed without any failures	<p>There are no hardware problems and your storage system returns to the prompt.</p> <ol style="list-style-type: none"> <li>1. Clear the status logs by entering the following command: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log is cleared by entering the following command: <code>sldiag device status</code></li> </ol> <p>The following default response is displayed:  <small>SLDIAG: No log messages are present.</small></p> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>4. Enter the following command at the Loader prompt to boot the storage system: <code>boot_ontap</code></li> </ol> <p>You have completed system-level diagnostics.</p>
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>2. Perform a clean shutdown and disconnect the power supplies.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies and power on the storage system.</li> <li>5. Repeat Steps 1 through 5 of <i>Running system panic diagnostics</i>.</li> </ol>

**After you finish**

If the failures persist after repeating the steps, you need to replace the hardware.

---

**Running slow system response diagnostics**

Running diagnostics can help you identify the causes of slow system response times.

- Step 1. At the storage system prompt, switch to the LOADER prompt: halt
- Step 2. Enter the following command at the LOADER prompt: boot\_diags

**Note:** You must run this command from the LOADER prompt for system-level diagnostics to function properly. The **boot\_diags** command starts special drivers designed specifically for system-level diagnostics.

- Step 3. Run diagnostics on all the devices by entering the following command: sldiag device run
- Step 4. View the status of the test by entering the following command: sldiag device status

Your storage system provides the following output while the tests are still running:

There are still test(s) being processed.

After all the tests are complete, the following response appears by default:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

- Step 5. Identify the cause of the system sluggishness by entering the following command: sldiag device status -long -state failed

### Example

The following example shows how the full status of the failures is displayed in a test run without the appropriate hardware:

```
*> sldiag device status -long -state failed
```

```
TEST START -----
DEVTYPE: nvrAm_ib
NAME: external loopback test
START DATE: Sat Jan 3 23:10:55 GMT 2009
```

```
STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan 3 23:11:04 GMT 2009
```

```
LOOP: 1/1
TEST END -----
```

```
TEST START -----
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan 3 23:10:56 GMT 2009
```

```
STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2
```

```
Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309
```

```
Started adapter interrupt test
Adapter interrupt test OK
```

```
Started adapter reset test.
Adapter reset OK
```

```
Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN
```

```
Started adapter Retry LIP test
```

```
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
  Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK OK
Error Count: 2 Run Time: 70 secs
>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan 3 23:12:07 GMT 2009

LOOP: 1/1
TEST END -----
```

If the system-level diagnostics tests...	Then...
Were completed without any failures	<p>There are no hardware problems and your storage system returns to the prompt.</p> <ol style="list-style-type: none"> <li>1. Clear the status logs by entering the following command: <code>sldiag device clearstatus</code></li> <li>2. Verify that the log is cleared by entering the following command: <code>sldiag device status</code></li> </ol> <p>The following default response is displayed:</p> <pre>SLDIAG: No log messages are present.</pre> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>4. Enter the following command at the Loader prompt to boot the storage system: <code>boot_ontap</code></li> </ol> <p>You have completed system-level diagnostics.</p>
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>2. Perform a clean shutdown and disconnect the power supplies.</li> <li>3. Verify that you observed all the requirements for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies and power on the storage system.</li> <li>5. Repeat Steps 1 through 5 of <i>Running slow system response diagnostics</i>.</li> </ol>
Resulted in the same test failures	<p>Technical support might recommend modifying the default settings on some of the tests to help identify the problem.</p> <ol style="list-style-type: none"> <li>1. Modify the selection state of a specific device or type of device on your storage system by entering the following command: <code>sldiag device modify [-dev devtype mb slots slotnum] [-name device] [-selection enable disable default only]</code></li> </ol> <p><code>-selection enable disable default only</code> allows you to enable, disable, accept the default selection of a specified device type or named device, or only enable the</p>

If the system-level diagnostics tests...	Then...
	<p>specified device or named device by disabling all others first.</p> <ol style="list-style-type: none"> <li>2. Verify that the tests were modified by entering the following command: <code>sldiag option show</code></li> <li>3. Repeat Steps 3 through 5 of <i>Running slow system response diagnostics</i>.</li> <li>4. After you identify and resolve the problem, reset the tests to their default states by repeating substeps 1 and 2.</li> <li>5. Repeat Steps 1 through 5 of <i>Running slow system response diagnostics</i>.</li> </ol>

### After you finish

If the failures persist after repeating the steps, you need to replace the hardware.

---

## Running hardware installation diagnostics

You run diagnostics after adding or replacing hardware components in your storage system to verify that the component has no problems and that the installation is successful.

Step 1. At the storage system prompt, switch to the LOADER prompt: `halt`

Step 2. Enter the following command at the LOADER prompt: `boot_diags`

**Note:** You must run this command from the LOADER prompt for system-level diagnostics to function properly. The `boot_diags` command starts special drivers designed specifically for system-level diagnostics.

Step 3. Run the default tests on the particular device you added or replaced by entering the following command: `sldiag device run [-dev devtype|mb|slots|slotnum] [-name device]`

- `-dev devtype` specifies the type of device to be tested.
  - `ata` is an Advanced Technology Attachment device.
  - `bootmedia` is the system booting device.
  - `cna` is a Converged Network Adapter not connected to a network or storage device.
  - `env` is motherboard environmentals.
  - `fcache` is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
  - `fcsl` is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.
  - `fcvi` is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
  - `interconnect` or `nvr-am-ib` is the high-availability interface.
  - `mem` is system memory.
  - `nic` is a Network Interface Card not connected to a network.
  - `nvr-am` is nonvolatile RAM.
  - `nvmem` is a hybrid of NVRAM and system memory.
  - `sas` is a Serial Attached SCSI device not connected to a disk shelf.

- serviceproc is the Service Processor.
- storage is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
- toe is a TCP Offload Engine, a type of NIC.
- mb specifies that all the motherboard devices are to be tested.
- slot *slotnum* specifies that a device in a specific slot number is to be tested.
- -name *device* specifies a given device class and type.

Step 4. View the status of the test by entering the following command: `sldiag device status`  
 Your storage system provides the following output while the tests are still running:  
 There are still test(s) being processed.  
 After all the tests are complete, the following response appears by default:  
 \*> <SLDIAG:\_ALL\_TESTS\_COMPLETED>

Step 5. Verify that no hardware problems resulted from the addition or replacement of hardware components on your storage system by entering the following command: `sldiag device status [-dev devtype|mb|slotslotnum] [-name device] -long -state failed`

### Example

The following example pulls up the full status of failures resulting from testing a newly installed FC-AL adapter:

```
*> sldiag device status -dev fcal -long -state failed

TEST START -----
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 16ib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
Started INTERNAL LOOPBACK:
```

```
INTERNAL LOOPBACK OK
Error Count: 2 Run Time: 70 secs
>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan 3 23:12:07 GMT 2009
```

```
LOOP: 1/1
TEST END -----
```

If the system-level diagnostics tests...	Then...
Were completed without any failures	<p>There are no hardware problems and your storage system returns to the prompt.</p> <ol style="list-style-type: none"> <li>1. Clear the status logs by entering the following command: <code>sldiag device clearstatus [-dev devtype mb  slotslotnum]</code></li> <li>2. Verify that the log is cleared by entering the following command: <code>sldiag device status [-dev devtype mb slotslotnum]</code></li> </ol> <p>The following default response is displayed:</p> <pre>SLDIAG: No log messages are present.</pre> <ol style="list-style-type: none"> <li>3. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>4. Enter the following command at the Loader prompt to boot the storage system: <code>boot_ontap</code></li> </ol> <p>You have completed system-level diagnostics.</p>
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>2. Perform a clean shutdown and disconnect the power supplies.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies and power on the storage system.</li> <li>5. Repeat Steps 1 through 6 of <i>Running hardware installation diagnostics</i>.</li> </ol>

### After you finish

If the failures persist after repeating the steps, you need to replace the hardware.



---

## Running device failure diagnostics

Running diagnostics can help you determine why access to a specific device becomes intermittent or why the device becomes unavailable in your storage system.

Step 1. At the storage system prompt, switch to the LOADER prompt: `halt`

Step 2. Enter the following command at the LOADER prompt: `boot_diags`

**Note:** You must run this command from the LOADER prompt for system-level diagnostics to function properly. The `boot_diags` command starts special drivers designed specifically for system-level diagnostics.

Step 3. Run diagnostics on the device causing problems by entering the following command: `sldiag device run [-dev devtype|mb|slotslotnum] [-name device]`

- `-dev devtype` specifies the type of device to be tested.
  - `ata` is an Advanced Technology Attachment device.
  - `bootmedia` is the system booting device.
  - `cna` is a Converged Network Adapter not connected to a network or storage device.
  - `env` is motherboard environmentals.
  - `fcache` is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
  - `fcsl` is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.
  - `fcvi` is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
  - `interconnect` or `nvr-am-ib` is the high-availability interface.
  - `mem` is system memory.
  - `nic` is a Network Interface Card not connected to a network.
  - `nvr-am` is nonvolatile RAM.
  - `nvmem` is a hybrid of NVRAM and system memory.
  - `sas` is a Serial Attached SCSI device not connected to a disk shelf.
  - `serviceproc` is the Service Processor.
  - `storage` is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
  - `toe` is a TCP Offload Engine, a type of NIC.
- `mb` specifies that all the motherboard devices are to be tested.
- `slot slotnum` specifies that a device in a specific slot number is to be tested.
- `-name device` specifies a given device class and type.

Step 4. View the status of the test by entering the following command: `sldiag device status`

Your storage system provides the following output while the tests are still running:

There are still test(s) being processed.

After all the tests are complete, the following response appears by default:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

Step 5. Identify any hardware problems by entering the following command: `sldiag device status [-dev devtype|mb|slotslotnum] [-name device] -long -state failed`

### Example

The following example shows how the full status of failures resulting from testing the FC-AL adapter are displayed:

```

*> sdiag device status fcal -long -state failed

TEST START -----
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK OK
Error Count: 2 Run Time: 70 secs
>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END -----

```

If the system-level diagnostics tests...	Then...
Resulted in some test failures	<p>Determine the cause of the problem.</p> <ol style="list-style-type: none"> <li>1. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>2. Perform a clean shutdown and disconnect the power supplies.</li> <li>3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.</li> <li>4. Reconnect the power supplies and power on the storage system.</li> <li>5. Repeat Steps 1 through 5 of <i>Running device failure diagnostics</i>.</li> </ol>
Resulted in the same test failures	<p>Technical support might recommend modifying the default settings on some of the tests to help identify the problem.</p> <ol style="list-style-type: none"> <li>1. Modify the selection state of a specific device or type of device on your storage system by entering the following command: <code>sldiag device modify [-dev devtype mb slots slotnum] [-name device] [-selection enable disable default only]</code>   -<code>selection enable disable default only</code> allows you to enable, disable, accept the default selection of a specified device type or named device, or only enable the specified device or named device by disabling all others first.</li> <li>2. Verify that the tests were modified by entering the following command: <code>sldiag option show</code></li> <li>3. Repeat Steps 3 through 5 of <i>Running device failure diagnostics</i>.</li> <li>4. After you identify and resolve the problem, reset the tests to their default states by repeating substeps 1 and 2.</li> <li>5. Repeat Steps 1 through 5 of <i>Running device failure diagnostics</i>.</li> </ol>
Were completed without any failures	<p>There are no hardware problems and your storage system returns to the prompt.</p> <ol style="list-style-type: none"> <li>1. Clear the status logs by entering the following command: <code>sldiag device clearstatus [-dev devtype mb slots slotnum]</code></li> </ol>

If the system-level diagnostics tests...	Then...
	<ol style="list-style-type: none"> <li>2. Verify that the log is cleared by entering the following command: <code>sldiag device status [-dev devtype mb slots/slotnum]</code> The following default response is displayed: SLDIAG: No log messages are present.</li> <li>3. Exit Maintenance mode by entering the following command: <code>halt</code></li> <li>4. Enter the following command at the Loader prompt to boot the storage system: <code>boot_ontap</code></li> </ol> <p>You have completed system-level diagnostics.</p>

### After you finish

If the failures persist after repeating the steps, you need to replace the hardware.

---

## Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about Lenovo products, you will find a wide variety of sources available from Lenovo to assist you.

On the World Wide Web, up-to-date information about Lenovo systems, optional devices, services, and support are available at:

<http://datacentersupport.lenovo.com>

**Note:** This section includes references to IBM web sites and information about obtaining service. IBM is Lenovo's preferred service provider for ThinkSystem.

---

### Before you call

Before you call, there are several steps that you can take to try and solve the problem yourself. If you decide that you do need to call for assistance, gather the information that will be needed by the service technician to more quickly resolve your problem.

#### Attempt to resolve the problem yourself

You can solve many problems without outside assistance by following the troubleshooting procedures that Lenovo provides in the online help or in the Lenovo product documentation. The Lenovo product documentation also describes the diagnostic tests that you can perform. The documentation for most systems, operating systems, and programs contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

You can find the product documentation for your ThinkSystem products at the following location:

<http://thinksystem.lenovofiles.com/help/index.jsp>

You can take these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Check for updated software, firmware, and operating-system device drivers for your Lenovo product. The Lenovo Warranty terms and conditions state that you, the owner of the Lenovo product, are responsible for maintaining and updating all software and firmware for the product (unless it is covered by an additional maintenance contract). Your service technician will request that you upgrade your software and firmware if the problem has a documented solution within a software upgrade.
- If you have installed new hardware or software in your environment, check <http://www.lenovo.com/us/en/serverproven/> to make sure that the hardware and software is supported by your product.
- Go to <http://datacentersupport.lenovo.com> and check for information to help you solve the problem.
  - Check the Lenovo forums at [https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv\\_eg](https://forums.lenovo.com/t5/Datacenter-Systems/ct-p/sv_eg) to see if someone else has encountered a similar problem.

You can solve many problems without outside assistance by following the troubleshooting procedures that Lenovo provides in the online help or in the Lenovo product documentation. The Lenovo product documentation also describes the diagnostic tests that you can perform. The documentation for most systems, operating systems, and programs contains troubleshooting procedures and explanations of error

messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

### Gathering information needed to call Support

If you believe that you require warranty service for your Lenovo product, the service technicians will be able to assist you more efficiently if you prepare before you call. You can also see <http://datacentersupport.lenovo.com/warrantylookup> for more information about your product warranty.

Gather the following information to provide to the service technician. This data will help the service technician quickly provide a solution to your problem and ensure that you receive the level of service for which you might have contracted.

- Hardware and Software Maintenance agreement contract numbers, if applicable
- Machine type number (Lenovo 4-digit machine identifier)
- Model number
- Serial number
- Current system UEFI and firmware levels
- Other pertinent information such as error messages and logs

As an alternative to calling Lenovo Support, you can go to <https://www-947.ibm.com/support/servicerequest/Home.action> to submit an Electronic Service Request. Submitting an Electronic Service Request will start the process of determining a solution to your problem by making the pertinent information available to the service technicians. The Lenovo service technicians can start working on your solution as soon as you have completed and submitted an Electronic Service Request.

---

## Collecting service data

Service data is collected automatically in the background for the controllers by enabling the AutoSupport function on ONTAP. To collect service data, do the following:

1. Input the user name and password to enter the ONTAP main interface.
2. Click the Settings button on the top right corner of the interface. Then, click **Autosupport**.
3. Select each of the controllers and verify that the AutoSupport configuration is enabled for each of the controllers.
4. Then, select how the AutoSupport data is sent.

**Note:** The available transport protocols are http, https, and smtp.

5. If necessary, configure the proxy.
6. Configure the mail-host and e-mail recipient that will receive the data.

---

## Contacting Support

You can contact Support to obtain help for your issue.

You can receive hardware service through a Lenovo Authorized Service Provider. To locate a service provider authorized by Lenovo to provide warranty service, go to <https://datacentersupport.lenovo.com/serviceprovider> and use filter searching for different countries. For Lenovo support telephone numbers, see <https://datacentersupport.lenovo.com/supportphonenumber>. In the U.S. and Canada, call 1-800-426-7378.

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

**China product support**

To contact product support in China, go to:

<http://support.lenovo.com.cn/lenovo/wsi/es/ThinkSystem.html>

You can also call 400-106-8888 for product support. The call support is available Monday through Friday, from 9 a.m. to 6 p.m.

**Taiwan product support**

To contact product support for Taiwan, call 0800-016-888. The call support is available 24 hours a day, 7 days a week.





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## Appendix B. Notice of Privacy Practices

Lenovo recognizes that privacy is of great importance to individuals everywhere – our customers, website visitors, product users...everyone. This is why the responsible use and protection of personal and other information under our care is a core Lenovo value.

Our full privacy statement is available at the link below. If you have any further questions or concerns, please feel free to reach us at [privacy@lenovo.com](mailto:privacy@lenovo.com).

<https://www.lenovo.com/us/en/privacy/>

To view this privacy statement in other languages, visit the sites below:

- Chinese: <https://www.lenovo.com.cn/public/privacy.html>
- English (UK): <https://www3.lenovo.com/gb/en/privacy/>
- English (Canada): <https://www3.lenovo.com/ca/en/privacy/>
- French (Canada): <https://canada.lenovo.com/fr/sdwww3/ca/en/privacy/>
- German: <https://www.lenovo.com/de/de/privacy/>
- French: <https://www.lenovo.com/fr/fr/privacy/>
- Swedish: <https://www.lenovo.com/se/sv/privacy/>
- Danish: <https://www.lenovo.com/dk/da/privacy/>
- Spanish: <https://www.lenovo.com/es/es/privacy/>
- Japanese: <http://www.lenovo.com/privacy/jp/ja/>
- Brazilian Portuguese: <https://www.lenovo.com/br/pt/privacy/>
- Italian: <https://www.lenovo.com/it/it/privacy/>
- Hungarian: <https://www.lenovo.com/hu/hu/privacy/>
- Russian: <https://www.lenovo.com/ru/ru/privacy/>
- Korean: <https://www.lenovo.com/kr/ko/privacy/>
- Polish: <https://www.lenovo.com/pl/pl/privacy/>

Our service provider NetApp will also collect certain information when you use this device. More information about NetApp's privacy practices is available at the link below:

<https://www.netapp.com/us/legal/privacypolicy/index.aspx>.

To view NetApp's privacy policy in other languages, visit the sites below:

- German: <https://www.netapp.com/de/legal/privacypolicy/index.aspx>
- Japanese: <https://www.netapp.com/jp/legal/privacypolicy/index.aspx>
- French: <https://www.netapp.com/fr/legal/privacypolicy/index.aspx>
- Spanish: <https://www.netapp.com/es/legal/privacypolicy/index.aspx>



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## Appendix C. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area.

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*Lenovo (United States), Inc.  
1009 Think Place  
Morrisville, NC 27560  
U.S.A.  
Attention: Lenovo VP of Intellectual Property*

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Any references in this publication to non-Lenovo Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this Lenovo product, and use of those Web sites is at your own risk.

Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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## Trademarks

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## Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1 024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard-disk-drive bays with the largest currently supported drives that are available from Lenovo.

Maximum memory might require replacement of the standard memory with an optional DIMM.

Each solid-state memory cell has an intrinsic, finite number of write cycles that the cell can incur. Therefore, a solid-state device has a maximum number of write cycles that it can be subjected to, expressed as total bytes written (TBW). A device that has exceeded this limit might fail to respond to system-generated commands or might be incapable of being written to. Lenovo is not responsible for replacement of a device that has exceeded its maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the device.

Lenovo makes no representations or warranties with respect to non-Lenovo products. Support (if any) for the non-Lenovo products is provided by the third party, not Lenovo.

Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

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## Particulate contamination

**Attention:** Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the device that is described in this document.

Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the device to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If Lenovo determines that the levels of particulates or gases in your environment have caused damage to the device, Lenovo may condition provision of repair or replacement of devices or parts

on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 8. Limits for particulates and gases

Limits for particulates and gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> <li>The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2<sup>1</sup>.</li> <li>Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282.</li> <li>The deliquescent relative humidity of the particulate contamination must be more than 60%<sup>2</sup>.</li> <li>The room must be free of conductive contamination such as zinc whiskers.</li> </ul>
Gaseous	<ul style="list-style-type: none"> <li>Copper: Class G1 as per ANSI/ISA 71.04-1985<sup>3</sup></li> <li>Silver: Corrosion rate of less than 300 Å in 30 days</li> </ul>
<p><sup>1</sup> ASHRAE 52.2-2008 - <i>Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size</i>. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.</p> <p><sup>2</sup> The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p><sup>3</sup> ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p>	

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## Telecommunication regulatory statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact a Lenovo representative or reseller for any questions.

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## Electronic emission notices

When you attach a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Additional electronic emissions notices are available at:

<http://thinksystem.lenovofiles.com/help/index.jsp>

## Taiwan BSMI RoHS declaration

單元 Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (PB)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr <sup>+6</sup> )	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組套件	-	○	○	○	○	○
空氣傳動設備	-	○	○	○	○	○
冷卻組套件	-	○	○	○	○	○
內存模組	-	○	○	○	○	○
處理器模組	-	○	○	○	○	○
電纜組套件	-	○	○	○	○	○
電源供應器	-	○	○	○	○	○
儲備設備	-	○	○	○	○	○
電路卡	-	○	○	○	○	○
光碟機	-	○	○	○	○	○
<p>備考1. “超出0.1 wt %”及“超出0.01 wt %”係指限用物質之百分比含量超出百分比含量基準值。            Note1: “exceeding 0.1 wt%” and “exceeding 0.01 wt%” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.</p> <p>備考2. “○”係指該項限用物質之百分比含量未超出百分比含量基準值。            Note2: “○”indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.</p> <p>備考3. “-”係指該項限用物質為排除項目。            Note3: The “-” indicates that the restricted substance corresponds to the exemption.</p>						

## Taiwan import and export contact information

Contacts are available for Taiwan import and export information.

委製商/進口商名稱: 台灣聯想環球科技股份有限公司  
 進口商地址: 台北市南港區三重路 66 號 8 樓  
 進口商電話: 0800-000-702

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**Lenovo**