ThinkSystem SR650 V2 Maintenance Manual

Machine Types: 7Z72 and 7Z73

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:
https://pubs.lenovo.com/safety_documentation/

In addition, ensure 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

Twentieth Edition (May 2025)

Contents

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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.

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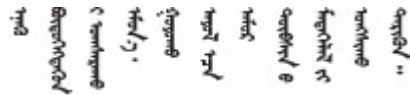
Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

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 pečítaje 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་རྫས་འདི་བདེ་སྐྱོད་མ་བྱས་གོང་། སྐོར་གྱི་ཡིད་གཟབ་
བྱ་འདུ་མིན་ཡོད་པའི་འོད་སྲེར་བསྟུ་དགོས།

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

مەزكۇر مەھسۇلاتنى ئورنتشتىن بۇرۇن بىخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

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

Safety inspection checklist

Use the information in this section to identify potentially unsafe conditions with your server. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury.

Notes:
- The product is not suitable for use at visual display workplaces according to §2 of the Workplace Regulations.
- The set-up of the server is made in the server room only.

CAUTION:
This equipment must be installed or serviced by trained personnel, as defined by the NEC, IEC 62368-1 & IEC 60950-1, the standard for Safety of Electronic Equipment within the Field of Audio/Video, Information Technology and Communication Technology. Lenovo assumes you are qualified in the servicing of equipment and trained in recognizing hazards energy levels in products. Access to the equipment is by the use of a tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

Important: Electrical grounding of the server is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Use the following checklist to verify that there are no potentially unsafe conditions:
1. Make sure that the power is off and the power cord is disconnected.
2. Check the power cord.
   - Make sure that the third-wire ground connector is in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
   - Make sure that the power cord is the correct type.

     To view the power cords that are available for the server:
     a. Go to: http://dcsc.lenovo.com/#/
     b. Click **Preconfigured Model** or **Configure to order**.
     c. Enter the machine type and model for your server to display the configurator page.
     d. Click **Power ➙ Power Cables** to see all line cords.

- Make sure that the insulation is not frayed or worn.
3. Check for any obvious non-Lenovo alterations. Use good judgment as to the safety of any non-Lenovo alterations.
4. Check inside the server for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.
5. Check for worn, frayed, or pinched cables.
6. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Chapter 1. ThinkSystem SR650 V2 (7Z72 and 7Z73)

The ThinkSystem™ SR650 V2 server (7Z72 and 7Z73) is a 2-socket 2U server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The SR650 V2 server supports the third-generation Intel® Xeon® Scalable Processors and offers high scalability with up to 32 memory modules, up to 8 x PCIe slots, and up to 20 x 3.5-inch/40 x 2.5-inch drive bays.

Performance, ease of use, reliability, and expansion capabilities were key considerations in the design of the server. These design features make it possible for you to customize the system hardware to meet your needs today and provide flexible expansion capabilities for the future.

The server comes with a limited warranty. For details about the warranty, see:
https://support.lenovo.com/us/en/solutions/ht503310

For details about your specific warranty, see:
http://datacentersupport.lenovo.com/warrantylookup

Identifying your server

When you contact Lenovo for help, the machine type and serial number information helps support technicians to identify your server and provide faster service.

The machine type and serial number are on the ID label on the right rack latch in the front of the server.
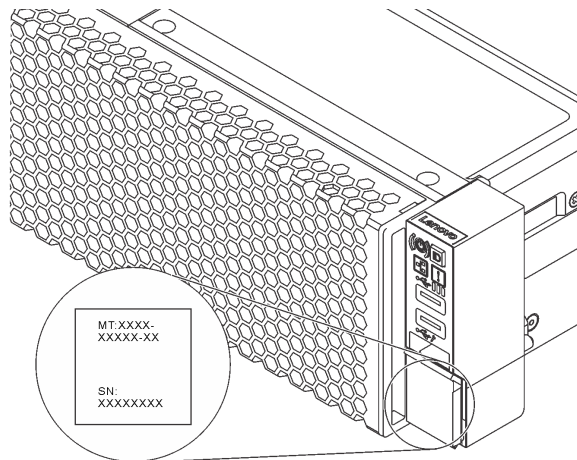
Figure 1. Location of the ID label

XCC network access label

The Lenovo XClarity Controller (XCC) network access label is attached to the pull-out information tab on the front of the server. The label provides the default host name and default IPv6 link local address of the XCC. After you get the server, peel the network access label away and store it in a safe place.
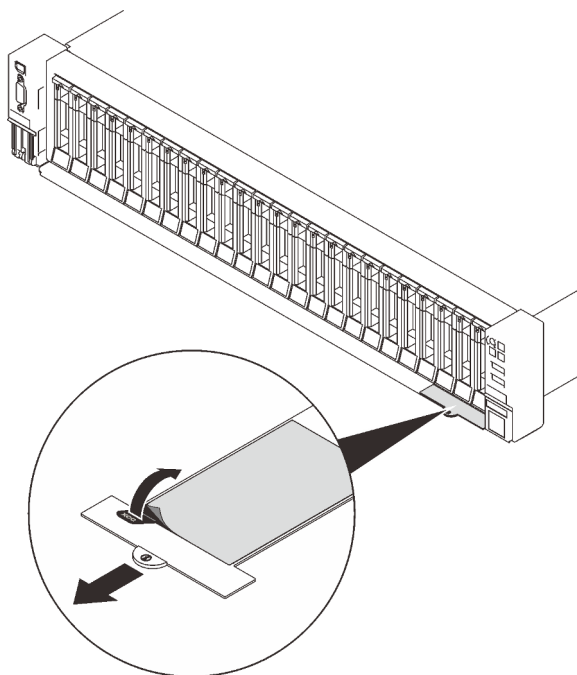
Figure 2. Location of the XCC network access label

Quick response code

The system service label, which is on the top cover, provides a quick response (QR) code for mobile access to service information. Scan the QR code with a mobile device and a QR code reader application to get quick access to the Lenovo Service Web site for this server. The Lenovo Service Information Web site provides additional information for parts installation and replacement videos, and error codes for server support.

The following illustration shows the QR code:
https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v2

Figure 3. QR code

Specifications

The following sections contain information about the technical specifications and environmental specifications of the system.

-
-

Technical specifications

Table 1. Technical specifications

Specification	Description
Dimension	2U - Height: 86.5 mm (3.4 inches) - Width: - With rack latches: 482.1 mm (19.0 inches) - Without rack latches: 445.0 mm (17.5 inches) - Depth: 763.7 mm (30.1 inches) **Note:** The depth is measured with rack latches installed, but without the security bezel installed.
Weight	Up to 38.8 kg (85.5 lb), depending on the server configuration
Processor (depending on the model)	- Up to two 3rd Gen Intel Xeon scalable processors - Designed for Land Grid Array (LGA) 4189 socket - Up to 40 cores per socket - Supports 3 Intel Ultra Path Interconnect (UPI) links at 11.2 GT/s - Thermal Design Power (TDP): up to 270 watts For a list of supported processors, see https://serverproven.lenovo.com/.
Memory	- Memory slots: 32 DIMM slots that support up to: 32 DRAM DIMMs 16 DRAM DIMMs and 16 Intel Optane Persistent Memory (PMEMs) - Memory module types: - TruDDR4 3200, dual-rank, 16 GB/32 GB/64 GB RDIMM - TruDDR4 3200, quad-rank, 128 GB 3DS RDIMM - TruDDR4 2933, octal-rank, 256 GB 3DS RDIMM - TruDDR4 3200, 128 GB/256 GB/512 GB PMEM - Minimum memory: 16 GB - Maximum memory: - Without PMEMs: 2 TB using 32 x 64 GB RDIMMs 8 TB using 32 x 256 GB 3DS RDIMMs - With PMEMs: 10 TB: 16 x 128 GB 3DS RDIMMs + 16 x 512 GB PMEMs (Memory Mode) Total 10 TB installed memory capacity, of which 8 TB (PMEMs) is used as system memory and 2 TB (3DS RDIMMs) is used as cache. 12 TB: 16 x 256 GB 3DS RDIMMs + 16 x 512 GB PMEMs (App Direct Mode) Total 12 TB installed memory capacity, of which 4 TB (3DS RDIMMs) is used as system memory and 8 TB (PMEMs) is used as persistent memory for storage. **Note:** The operating speed and total memory capacity depend on the processor model and UEFI settings. See "Memory module installation rules and order" on page 242 for detailed information about memory configuration and setup. For a list of supported memory options, see https://serverproven.lenovo.com/.

Table 1. Technical specifications (continued)

Specification	Description
Operating systems	Supported and certified operating systems: • Microsoft Windows Server • Red Hat Enterprise Linux • SUSE Linux Enterprise Server • VMware ESXi • Canonical Ubuntu Complete list of operating systems: https://lenovopress.lenovo.com/osig OS deployment instructions: See "Deploy the operating system" in *Setup Guide* **Note:** VMware ESXi does not support ThinkSystem 2.5 U.3 6500 ION 30.72TB Read Intensive NVMe PCIe 4.0 x4 HS SSD.

Internal drives	• Front drive bays:
	  – Up to 24 x 2.5-inch hot-swap SAS/SATA/NVMe drives
	  – Up to 12 x 3.5-inch hot-swap SAS/SATA/NVMe drives
	• Middle drive bays:
	  – Up to 8 x 2.5-inch hot-swap SAS/SATA/NVMe drives
	  – Up to 4 x 3.5-inch hot-swap SAS/SATA drives
	• Rear drive bays:
	  – Up to 8 x 2.5-inch hot-swap SAS/SATA drives
	  – Up to 4 x 3.5-inch hot-swap SAS/SATA drives
	  – Up to two 7mm drives
	• Up to two internal M.2 drives
	Note:
	Oversubscription occurs when the system supports 32 NVMe drives using NVMe switch adapters. For details, see https://lenovopress.lenovo.com/lp1392-thinksystem-sr650-v2-server#nvme-drive-support.
	For details about supported internal storage, see https://lenovopress.com/lp1392-thinksystem-sr650-v2-server#internal-storage.
	
	For thermal information about server models with middle or rear drive bays, see "Server models with middle/rear drive bays" on page 262.

Expansion slots	• Up to eight PCIe slots • One OCP adapter slot PCIe slot availability is based on riser selection and rear drive bay selection. See "Rear view" on page 42 and "PCIe slots and PCIe adapters" on page 256.

Input/Output (I/O) features	• Front:
	  – One VGA connector (optional)
	  – One USB 3.2 Gen 1 (5 Gbps) connector
	  – One USB 2.0 connector with XClarity Controller management
	  – One external diagnostics connector
	  – One LCD diagnostics panel (optional)
	• Rear:
	  – One VGA connector
	  – Three USB 3.2 Gen 1 (5 Gbps) connectors
	  – One XClarity Controller network connector
	  – Two or four Ethernet connectors on the OCP 3.0 Ethernet adapter (optional)
	  – One serial port (optional)

Table 1. Technical specifications (continued)

Specification	Description
Storage controller	- Onboard SATA ports with software RAID support (Intel VROC SATA RAID, formerly known as Intel RSTe) - Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID) - VROC Intel-SSD-Only (also known as Intel VROC standard): supports RAID levels 0, 1, 5, and 10 with Intel NVMe drives only - VROC Premium: requires a Feature on Demand (FoD) license and supports RAID levels 0, 1, 5, and 10 with Intel and non-Intel NVMe drives - SAS/SATA HBA adapters - ThinkSystem 430-8i SAS/SATA 12Gb HBA - ThinkSystem 430-16i SAS/SATA 12Gb HBA - ThinkSystem 430-8e SAS/SATA 12Gb HBA - ThinkSystem 430-16e SAS/SATA 12Gb HBA - ThinkSystem 4350-8i SAS/SATA 12Gb HBA - ThinkSystem 4350-16i SAS/SATA 12Gb HBA - ThinkSystem 440-8i SAS/SATA PCIe Gen4 12Gb HBA - ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb HBA - ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA - ThinkSystem 440-8e SAS/SATA 12Gb HBA - ThinkSystem 440-16e SAS/SATA PCIe Gen4 12Gb HBA - SAS/SATA RAID adapters - ThinkSystem RAID 530-8i PCIe 12Gb Adapter - ThinkSystem RAID 530-16i PCIe 12Gb Adapter - ThinkSystem RAID 930-8i 2GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 930-8e 4GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 930-16i 4GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 930-16i 8GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 930-24i 4GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 5350-8i PCIe 12Gb Adapter - ThinkSystem RAID 5350-8i PCIe 12Gb Internal Adapter - ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Internal Adapter - ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Internal Adapter - ThinkSystem RAID 540-8i PCIe Gen4 12Gb Adapter - ThinkSystem RAID 540-16i PCIe Gen4 12Gb Adapter - ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter - ThinkSystem RAID 940-8i 8GB Flash PCIe Gen4 12Gb Adapter - ThinkSystem RAID 940-8e 4GB Flash PCIe 12Gb Adapter - ThinkSystem RAID 940-16i 4GB Flash PCIe Gen4 12Gb Adapter - ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Adapter - ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Internal Adapter - ThinkSystem RAID 940-32i 8GB Flash PCIe Gen4 12Gb Adapter - NVMe adapters - ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter for U.3 (Tri-mode) - ThinkSystem RAID 940-8i 8GB Flash PCIe Gen4 12Gb Adapter for U.3 (Tri-mode) - ThinkSystem RAID 940-16i 4GB Flash PCIe Gen4 12Gb Adapter for U.3 (Tri-mode) - ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Adapter for U.3 (Tri-mode) - ThinkSystem 4-Port PCIe Gen4 NVMe Retimer Adapter - ThinkSystem 1611-8P PCIe Gen4 Switch Adapter - Expander: ThinkSystem 48 port 12Gb Internal Expander **Notes:** - For technical rules for RAID controllers, see "PCIe slots and PCIe adapters" on page 256. - For more information about the RAID/HBA adapters, see https://lenovopress.lenovo.com/lp1288-thinksystem-raid-adapter-and-hba-reference.
Graphics processing unit (GPU)	Your server supports the following GPUs: Full length, full height, double-wide: NVIDIA® V100S, A100, A40, A30, A16, A800, RTX 6000, A6000, H100, L40, AMD® Instinct MI210

Table 1. Technical specifications (continued)

Specification	Description

	• Full length, full height, single-wide: NVIDIA A10
	• Half length, low profile, single-wide: NVIDIA T4, P620, A2, L4
	Notes:
	• For GPU supporting matrix, see "Server models with GPUs" on page 264.
	• To prevent potential thermal issues, change the **Misc** setting in the BIOS from **Option3** (default value) to **Option1** if the following two conditions are met:
	  – The server is equipped with a GPU adapter.
	  – The UEFI firmware version is AFE128B or later.
	  For the method of changing the **Misc** setting, see https://support.lenovo.com/us/en/solutions/TT1832.

System fans	• Supported fan types:
	  – Standard fan (60 x 60 x 36 mm, single-rotor, 17000 RPM)
	  – Performance fan (60 x 60 x 56 mm, dual-rotor, 19000 RPM)
	• Fan redundancy: N+1 redundancy, one redundant fan rotor
	  – One CPU: five hot-swap system fans (4+1 redundancy, one redundant fan rotor)
	  – Two CPUs: six hot-swap system fans (5+1 redundancy, one redundant fan rotor)
	Notes:
	• Single-rotor hot-swap fans cannot be mixed with dual-rotor hot-swap fans.
	• When the system is powered off but still plugged in to AC power, fans 1 and 2 may continue to spin at a much lower speed. This is the system design to provide proper cooling.

Table 1. Technical specifications (continued)

Specification	Description
Electrical input	The server supports up to two power supplies for redundancy. *Table 2. Electrical input for power supplies* {{TABLE2}} **CAUTION:** • **240 V dc input (input range: 180-300 V dc) is supported in Chinese Mainland ONLY.** • **Power supply with 240 V dc input cannot support hot plugging power cord function. Before removing the power supply with dc input, please turn off server or disconnect dc power sources at the breaker panel or by turning off the power source. Then, remove the power cord.**
Minimal configuration for debugging	• One processor in socket 1 • One DIMM in slot 3 • One power supply • One HDD/SSD drive, one M.2 drive, or one 7mm drive (if OS is needed for debugging) • Five system fans

Table 2:

Power supply	100–127 V ac	200–240 V ac	240 V dc	-48 V dc
500-watt 80 PLUS Platinum	√	√	√	
750-watt 80 PLUS Platinum	√	√	√	
750-watt 80 PLUS Titanium		√	√	
1100-watt 80 PLUS Platinum	√	√	√	
1100-watt 80 PLUS Titanium		√	√	
1800-watt 80 PLUS Platinum		√	√	
2600-watt 80 PLUS Titanium		√	√	
1100-watt				√

Environmental specifications

Ambient temperature/altitude/humidity

The server is designed for standard data center environment and is recommended to be placed in industrial data center. Depending on hardware configurations, the server complies with ASHRAE Class A2, ASHRAE Class A3, or Class A4 specifications with certain thermal restrictions. For detailed thermal information, see "Thermal rules" on page 262. System performance may be impacted when operating temperature is outside permitted conditions.

Ambient temperature	- Operating - ASHRAE class A2: 10°C to 35°C (50°F to 95°F) The maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft) - ASHRAE class A3: 5°C to 40°C (41°F to 104°F) The maximum ambient temperature decreases by 1°C for every 175 m (574 ft) increase in altitude above 900 m (2,953 ft) - ASHRAE class A4: 5°C to 45°C (41°F to 113°F) The maximum ambient temperature decreases by 1°C for every 125 m (410 ft) increase in altitude above 900 m (2,953 ft) - Server off: -10°C to 60°C (14°F to 140°F) - Shipment/storage: -40°C to 70°C (-40°F to 158°F)
Maximum altitude	3050 m (10 000 ft)
Relative humidity (non-condensing)	- Operating: - ASHRAE class A2: 20%–80%; maximum dew point: 21°C (70°F) - ASHRAE class A3: 8%–85%; maximum dew point: 24°C (75°F) - ASHRAE class A4: 8%–90%; maximum dew point: 24°C (75°F) - Shipment/storage: 8%–90%

Vibration and shock

The server has the following vibration and shock limits:
- Vibration
  - Operating: 0.21 G rms at 5 Hz to 500 Hz for 15 minutes across 3 axes
  - Non-operating: 1.04 G rms at 2 Hz to 200 Hz for 15 minutes across 6 surfaces
- Shock
  - Operating: 15 G for 3 milliseconds in each direction (positive and negative X, Y, and Z axes)
  - Non-operating:
    - 23-31 kg: 35 G for 152 in./sec velocity change across 6 surfaces
    - 32 kg - 68 kg: 35 G for 136 in./sec velocity change across 6 surfaces

Acoustic noise emissions

The server has the following acoustic noise emissions declaration.

Configuration	Sound power levels (L_{WAd})	Sound pressure level (L_{pAm})
Typical	- Idling: 5.9 Bel - Operating: 6.2 Bel	- Idling: 42.6 dBA - Operating: 45.8dBA
Storage	- Idling: 7.6 Bel - Operating: 7.6 Bel	- Idling: 60 dBA - Operating: 60.3 dBA
GPU	- Idling: 7.2 Bel - Operating: 8.5 Bel	- Idling: 56.3 dBA - Operating: 68.5 dBA

The declared sound levels are based on the following configurations, which may change depending on configurations/conditions, for example high-power processors and GPUs, and high-power network adapters such as the Mellanox ConnectX-6 HDR/200GbE QSFP56 PCIe Adapters or the Broadcom 57454 10GBASE-T 4-port OCP Ethernet Adapter.

Configura-tion	Processor	Memory	Drive	RAID adapter	OCP card	Power supply	GPU adapter
Typical	2 x 165W CPUs	8 x 64G DIMMs	8 x 2.4 TB SAS HDDs	RAID 940-8i	Intel X710-T2L 10GBASE-T 2-port OCP	2 x 750W PSUs	No
Storage	2 x 165W CPUs	16 x 64G DIMMs	20 x 14 TB SAS HDDs	RAID 940-8i		2 x 1100W PSUs	No
GPU	2 x 205W CPUs	32 x 64G DIMMs	16 x 2.4 TB SAS HDDs	RAID 940-8i		2 x 1800W PSUs	3 x V100S GPUs

Notes:
- These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.
- Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room; the noise levels from other equipment; the room ambient temperature, and employee's location in relation to the equipment. Further, compliance with such government regulations depends on a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. Lenovo recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

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 3. Limits for particulates and gases

Contaminant	Limits
Reactive gases	Severity level G1 as per ANSI/ISA 71.04-1985[1]: • The copper reactivity level shall be less than 200 Angstroms per month (Å/month ≈ 0.0035 µg/cm^2-hour weight gain).[2] • The silver reactivity level shall be less than 200 Angstroms per month (Å/month ≈ 0.0035 µg/cm^2-hour weight gain).[3] • The reactive monitoring of gaseous corrosivity must be conducted approximately 5 cm (2 in.) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Airborne particulates	Data centers must meet the cleanliness level of ISO 14644-1 class 8. For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness might be met by choosing one of the following filtration methods: • The room air might be continuously filtered with MERV 8 filters. • Air entering a data center might be filtered with MERV 11 or preferably MERV 13 filters. For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center. • The deliquescent relative humidity of the particulate contamination should be more than 60% RH.[4] • Data centers must be free of zinc whiskers.[5]

[1] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

[2] The derivation of the equivalence between the rate of copper corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.

[3] The derivation of the equivalence between the rate of silver corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Ag_2S is the only corrosion product.

[4] 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.

[5] Surface debris is randomly collected from 10 areas of the data center on a 1.5 cm diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.

Firmware updates

Several options are available to update the firmware for the server.

Update method terminology

- **In-band update**. The installation or update is performed using a tool or application within an operating system that is executing on the server's core CPU.

- **Out-of-band update**. The installation or update is performed by the Lenovo XClarity Controller collecting the update and then directing the update to the target subsystem or device. Out-of-band updates have no dependency on an operating system executing on the core CPU. However, most out-of-band operations do require the server to be in the S0 (Working) power state.

- **On-Target update.** The installation or update is initiated from an installed operating system executing on the target server itself.

- **Off-Target update.** The installation or update is initiated from a computing device interacting directly with the server's Lenovo XClarity Controller.

- **UpdateXpress System Packs (UXSPs)**. UXSPs are bundled updates designed and tested to provide the interdependent level of functionality, performance, and compatibility. UXSPs are server machine-type specific and are built (with firmware and device driver updates) to support specific Windows Server, Red

Hat Enterprise Linux (RHEL) and SUSE Linux Enterprise Server (SLES) operating system distributions. Machine-type-specific firmware-only UXSPs are also available.

You can use the tools listed here to update the most current firmware for your server and the devices that are installed in the server.

- Best practices related to updating firmware is available at the following site:
  - http://lenovopress.com/LP0656
- The latest firmware can be found at the following site:
  - https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v2/downloads/driver-list
- You can subscribe to product notification to stay up to date on firmware updates:
  - https://datacentersupport.lenovo.com/tw/en/solutions/ht509500

Firmware updating tools

See the following table to determine the best Lenovo tool to use for installing and setting up the firmware:

Tool	Update Methods Supported	Core System Firmware Updates	I/O Devices Firmware Updates	Graphical user interface	Command line interface	Supports UXSPs
Lenovo XClarity Provisioning Manager (LXPM)	In-band[2] On-Target	√		√		
Lenovo XClarity Controller (XCC)	Out-of-band Off-Target	√	Selected I/O devices	√		
Lenovo XClarity Essentials OneCLI (OneCLI)	In-band Out-of-band On-Target Off-Target	√	All I/O devices		√	√
Lenovo XClarity Essentials UpdateXpress (LXCE)	In-band Out-of-band On-Target Off-Target	√	All I/O devices	√		√

Tool	Update Methods Supported	Core System Firmware Updates	I/O Devices Firmware Updates	Graphical user interface	Command line interface	Supports UXSPs
Lenovo XClarity Essentials Bootable Media Creator (BoMC)	In-band Out-of-band Off-Target	√	All I/O devices	√ (BoMC application)	√ (BoMC application)	√
Lenovo XClarity Administrator (LXCA)	In-band[1] Out-of-band[2] Off-Target	√	All I/O devices	√		√
Lenovo XClarity Integrator (LXCI) for VMware vCenter	Out-of-band Off-Target	√	Selected I/O devices	√		
Lenovo XClarity Integrator (LXCI) for Microsoft Windows Admin Center	In-band Out-of-band On-Target Off-Target	√	All I/O devices	√		√
Lenovo XClarity Integrator (LXCI) for Microsoft System Center Configuration Manager	In-band On-Target	√	All I/O devices	√		√
Notes: 1. For I/O firmware updates. 2. For BMC and UEFI firmware updates.						

- **Lenovo XClarity Provisioning Manager**

  From Lenovo XClarity Provisioning Manager, you can update the Lenovo XClarity Controller firmware, the UEFI firmware, and the Lenovo XClarity Provisioning Manager software.

  Note: By default, the Lenovo XClarity Provisioning Manager Graphical User Interface is displayed when you start the server and press the key specified in the on-screen instructions. If you have changed that default to be the text-based system setup, you can bring up the Graphical User Interface from the text-based system setup interface.

  For additional information about using Lenovo XClarity Provisioning Manager to update firmware, see:

"Firmware Update" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/

Important: Lenovo XClarity Provisioning Manager (LXPM) supported version varies by product. All versions of Lenovo XClarity Provisioning Manager are referred to as Lenovo XClarity Provisioning Manager and LXPM in this document, unless specified otherwise. To see the LXPM version supported by your server, go to https://pubs.lenovo.com/lxpm-overview/.

• **Lenovo XClarity Controller**

If you need to install a specific update, you can use the Lenovo XClarity Controller interface for a specific server.

Notes:

– To perform an in-band update through Windows or Linux, the operating system driver must be installed and the Ethernet-over-USB (sometimes called LAN over USB) interface must be enabled.

For additional information about configuring Ethernet over USB, see:

"Configuring Ethernet over USB" section in the XCC documentation version compatible with your server at https://pubs.lenovo.com/lxcc-overview/

Important: Lenovo XClarity Controller (XCC) supported version varies by product. All versions of Lenovo XClarity Controller are referred to as Lenovo XClarity Controller and XCC in this document, unless specified otherwise. To see the XCC version supported by your server, go to https://pubs.lenovo.com/lxcc-overview/.

– If you update firmware through the Lenovo XClarity Controller, make sure that you have downloaded and installed the latest device drivers for the operating system that is running on the server.

For additional information about using Lenovo XClarity Controller, see:

"Updating Server Firmware" section in the XCC documentation compatible with your server at https://pubs.lenovo.com/lxcc-overview/

• **Lenovo XClarity Essentials OneCLI**

Lenovo XClarity Essentials OneCLI is a collection of command line applications that can be used to manage Lenovo servers. Its update application can be used to update firmware and device drivers for your servers. The update can be performed within the host operating system of the server (in-band) or remotely through the BMC of the server (out-of-band).

For additional information about using Lenovo XClarity Essentials OneCLI, see:

https://pubs.lenovo.com/lxce-onecli/onecli_c_update

• **Lenovo XClarity Essentials UpdateXpress**

Lenovo XClarity Essentials UpdateXpress provides most of OneCLI update functions through a graphical user interface (GUI). It can be used to acquire and deploy UpdateXpress System Pack (UXSP) update packages and individual updates. UpdateXpress System Packs contain firmware and device driver updates for Microsoft Windows and for Linux.

You can obtain Lenovo XClarity Essentials UpdateXpress from the following location:

https://datacentersupport.lenovo.com/solutions/lnvo-xpress

• **Lenovo XClarity Essentials Bootable Media Creator**

You can use Lenovo XClarity Essentials Bootable Media Creator to create bootable media that is suitable for firmware updates, VPD updates, inventory and FFDC collection, advanced system configuration, FoD Keys management, secure erase, RAID configuration, and diagnostics on supported servers.

You can obtain Lenovo XClarity Essentials BoMC from the following location:

- **Lenovo XClarity Administrator**

  If you are managing multiple servers using the Lenovo XClarity Administrator, you can update firmware for all managed servers through that interface. Firmware management is simplified by assigning firmware-compliance policies to managed endpoints. When you create and assign a compliance policy to managed endpoints, Lenovo XClarity Administrator monitors changes to the inventory for those endpoints and flags any endpoints that are out of compliance.

  For additional information about using Lenovo XClarity Administrator, see:

  http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/update_fw.html

- **Lenovo XClarity Integrator offerings**

  Lenovo XClarity Integrator offerings can integrate management features of Lenovo XClarity Administrator and your server with software used in a certain deployment infrastructure, such as VMware vCenter, Microsoft Admin Center, or Microsoft System Center.

  For additional information about using Lenovo XClarity Integrator offerings, see:

  https://pubs.lenovo.com/lxci-overview/

Turn on the server

After the server performs a short self-test (power status LED flashes quickly) when connected to input power, it enters a standby state (power status LED flashes once per second).

The server can be turned on (power status LED on) in any of the following ways:
- You can press the power button.
- The server can respond to remote power-on requests sent to Lenovo XClarity Controller via Lenovo XClarity Essentials OneCLI, IPMItool, or SSH CLI.

  For example, run the following command on Lenovo XClarity Essentials OneCLI to power on your server:
  `OneCli.exe ospower turnon` **--bmc** *USERID:PASSW0RD@host*

  For more information about running the `ospower` command, see OneCLI ospower command.

If the system UEFI power policy is set to "always on", the system will be powered on automatically when an AC source is plugged in.

For information about powering off the server, see "Turn off the server" on page 15.

System boot/startup time

The system boot/startup time varies by hardware configurations and may change depending on your server configuration and conditions.
- For typical configurations without PMEM memory modules, it takes about 3 minutes for the system to start up.

  Configuration example: 2 x processors, 16 x RDIMMs, 1 x RAID adapter, 1 x NIC adapter
- For configurations with PMEM memory modules installed, it may take up to 15 minutes for the system to start up.

  Configuration example: 2 x processors, 16 x RDIMMs, 16 x PMEMs, 1 x RAID adapter, 1 x NIC adapter
- For configurations with PMEM memory modules installed and Intel Volume Management Device (VMD) enabled, it may take about 20 minutes or longer for the system to start up.

  Configuration example: 2 x processors, 16 x RDIMMs, 16 x PMEMs, 1 x RAID adapter, 1 x NIC adapter

Turn off the server

The server remains in a standby state when it is connected to a power source, allowing the Lenovo XClarity Controller to respond to remote power-on requests. To remove all power from the server (power status LED off), you must disconnect all power cables.

Note: If there is an OCP 3.0 Ethernet adapter installed, when the system is powered off but still plugged in to AC power, system fans will continue to spin at a much lower speed. This is the system design to provide proper cooling for the OCP 3.0 Ethernet adapter.

To place the server in a standby state (power status LED flashes once per second):

Note: The Lenovo XClarity Controller can place the server in a standby state as an automatic response to a critical system failure.
- Start an orderly shutdown using the operating system (if supported by your operating system).
- Press the power button to start an orderly shutdown (if supported by your operating system).
- Press and hold the power button for more than 4 seconds to force a shutdown.
- Send remote power-off commands to Lenovo XClarity Controller via Lenovo XClarity Essentials OneCLI, IPMItool, or SSH CLI.

When in a standby state, the server can respond to remote power-on requests sent to the Lenovo XClarity Controller. For information about powering on the server, see .

Chapter 2. Server components

This section provides information to help you locate your server components.

Front view

The front view of the server varies by model. Depending on the model, your server might look slightly different from the illustrations in this topic.

Refer to the following front view for different server models:

Front view with eight 2.5-inch front drive bays (model 1)

Figure 4. Front view with eight 2.5-inch front drive bays (model 1)

Table 4. Components on the front of the server

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 Drive bay fillers (2)	**6** "Front I/O module (on rack latch)" on page 27
7 Rack latch (right)	**8** "Pull-out information tab" on page 1
9 Drive bays (8)	**10** Rack latch (left)

Front view with eight 2.5-inch front drive bays (model 2)
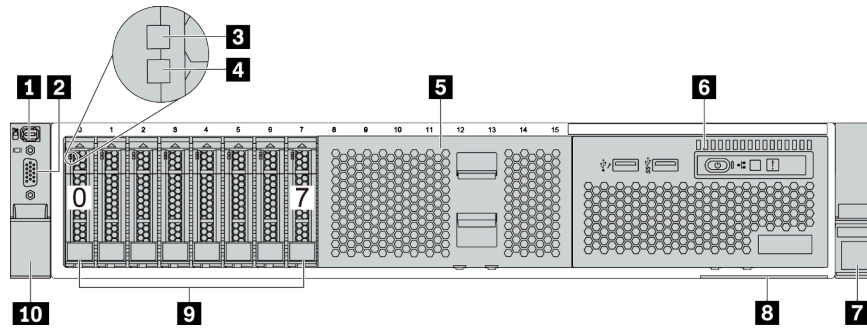
Table 5. Components on the front of the server

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 Drive bay filler	**6** "Front I/O module (on media bay)" on page 27
7 Rack latch (right)	**8** "Pull-out information tab" on page 1
9 Drive bays (8)	**10** Rack latch (left)

Front view with sixteen 2.5-inch front drive bays (model 1)

Table 6. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 Drive bay filler	**6** "Front I/O module (on rack latch)" on page 27
7 Rack latch (right)	**8** "Pull-out information tab" on page 1
9 Drive bays (16)	**10** Rack latch (left)

Front view with sixteen 2.5-inch front drive bays (model 2)
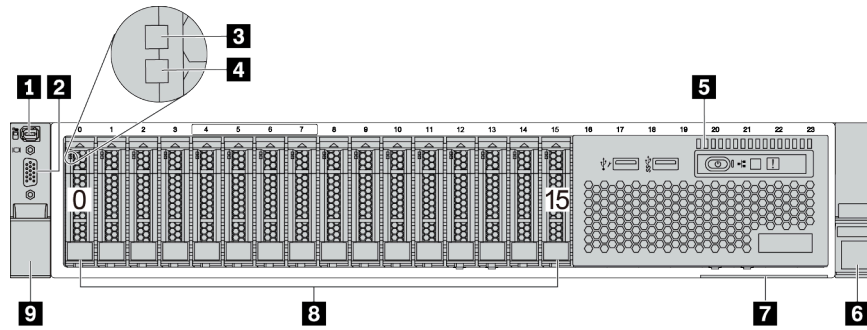
Table 7. Components on the front of the server

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 "Front I/O module (on media bay)" on page 27	**6** Rack latch (right)
7 "Pull-out information tab" on page 1	**8** Drive bays (16)
9 Rack latch (left)	

Front view with twenty-four 2.5-inch front drive bays
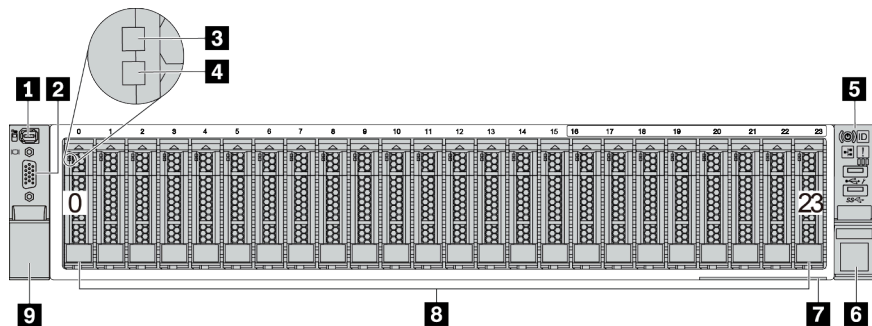
Table 8. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 "Front I/O module (on rack latch)" on page 27	**6** Rack latch (right)
7 "Pull-out information tab" on page 1	**8** Drive bays (24)
9 Rack latch (left)	

Front view with 2.5-inch front drive bays (backplane-less)

The following illustration shows the front view of server models with 2.5-inch front drive bays (backplane-less).
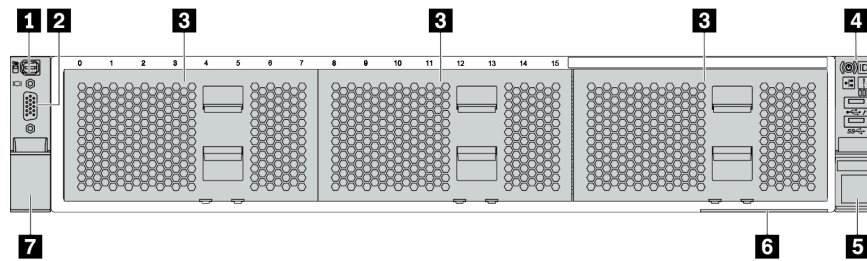
Table 9. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 Drive bay fillers(3)	**4** "Front I/O module (on rack latch)" on page 27
5 Rack latch (right)	**6** "Pull-out information tab" on page 1
7 Rack latch (left)	

Front view with eight 3.5-inch front drive bays
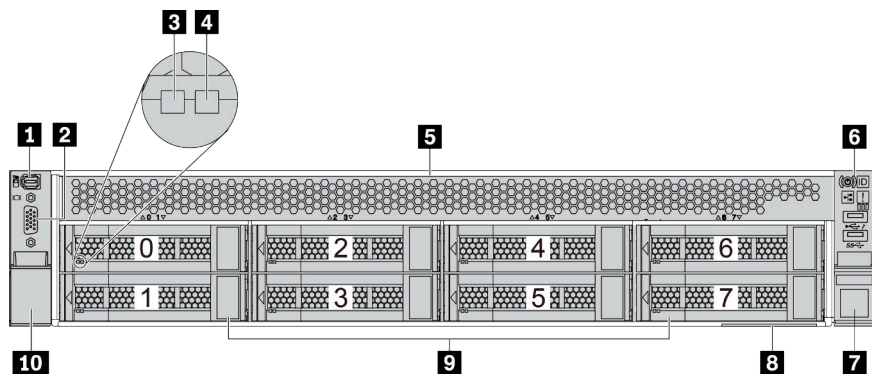
Table 10. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 Drive bay filler	**6** "Front I/O module (on rack latch)" on page 27
7 Rack latch (right)	**8** "Pull-out information tab" on page 1
9 Drive bays (8)	**10** Rack latch (left)

Front view with twelve 3.5-inch front drive bays
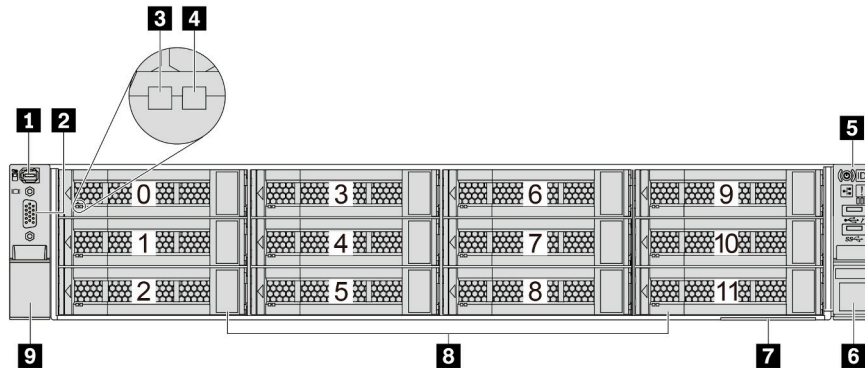
Table 11. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Drive activity LED" on page 48	**4** "Drive status LED" on page 48
5 "Front I/O module (on rack latch)" on page 27	**6** Rack latch (right)
7 "Pull-out information tab" on page 1	**8** Drive bays (12)
9 Rack latch (left)	

Front view with 3.5-inch front drive bays (backplane-less)
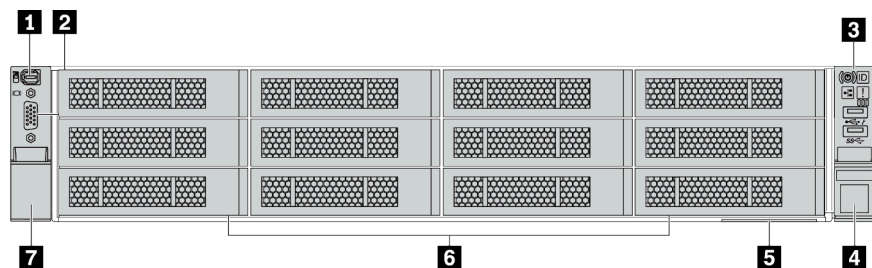
Table 12. Components on the front of server models

Callout	Callout
1 "External diagnostics connector" on page 36	**2** "VGA connector (optional)" on page 49
3 "Front I/O module (on rack latch)" on page 27	**4** Rack latch (right)
5 "Pull-out information tab" on page 1	**6** Drive bay fillers (12)
7 Rack latch (left)	

Front I/O module

The front I/O module provides controls, connectors, and LEDs. The front I/O module varies by model.
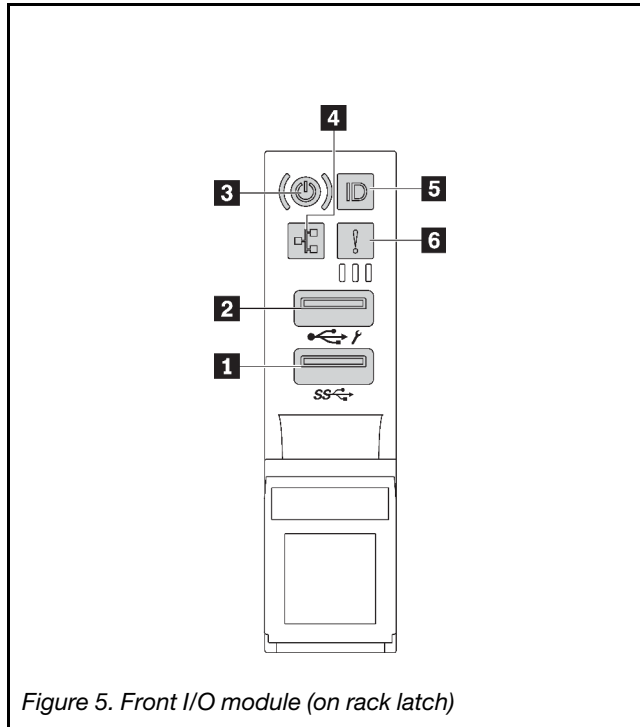
Figure 5. Front I/O module (on rack latch)
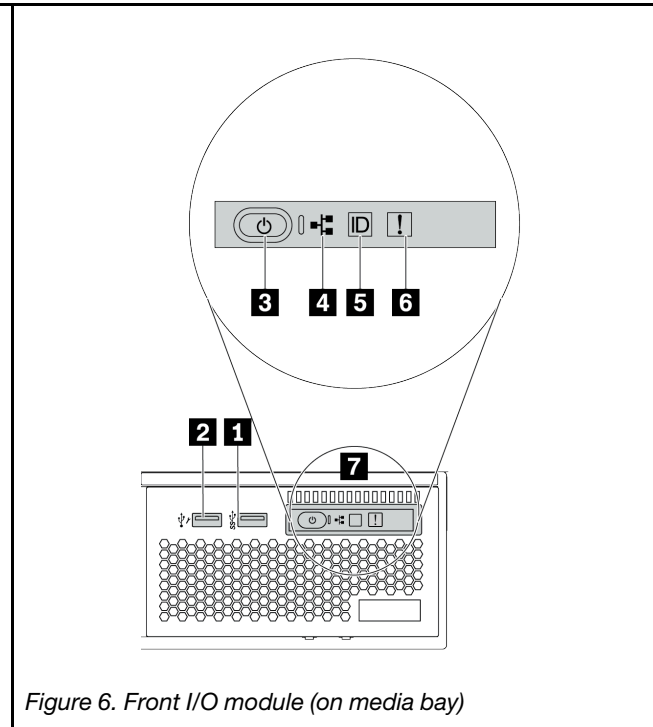
Figure 6. Front I/O module (on media bay)

Table 13. Components on the front I/O module

Callout	Callout
1 USB 3 (5 Gbps) connector	**2** USB 2.0 connector with XClarity Controller management
3 Power button with power status LED	**4** Network activity LED (for OCP 3.0 Ethernet adapter)
5 System ID button with system ID LED	**6** System error LED
7 Integrated diagnostic panel	

1 USB 3 (5 Gbps) connector

The USB 3.2 Gen 1 (5 Gbps) connector can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.

2 USB 2.0 connector with XClarity Controller management

Depending on the setting, this connector supports USB 2.0 function, XClarity Controller management function, or both.
- If the connector is set for USB 2.0 function, it can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.
- If the connector is set for XClarity Controller management function, it can be used to connect the server to an android or iOS device, where you can then install and launch the Lenovo XClarity Mobile app to manage the system using XClarity Controller.

For details about using the Lenovo XClarity Mobile app, refer to http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/lxca_usemobileapp.html

- If the connector is set to have both functions, you can press the system ID button for three seconds to switch between the two functions.

3 Power button with power status LED

You can press this button to turn the server on and off manually. The power status LED helps you determine the current power status.

Status	Color	Description
Off	None	Power is not present, or the power supply has failed.
Fast blinking (about four flashes per second)	Green	The server is off, but the XClarity Controller is initializing, and the server is not ready to be powered on.
Slow blinking (about one flash per second)	Green	The server is off and is ready to be powered on (standby state).
Solid on	Green	The server is on and running.

4 Network activity LED

Compatibility of the NIC adapter and the network activity LED

NIC adapter	Network activity LED
OCP 3.0 Ethernet adapter	Support
PCIe NIC adapter	Not support

When an OCP 3.0 Ethernet adapter is installed, the network activity LED on the front I/O module helps you identify the network connectivity and activity. If no OCP 3.0 Ethernet adapter is installed, this LED is off.

Status	Color	Description
On	Green	The server is connected to a network.
Blinking	Green	The network is connected and active.
Off	None	The server is disconnected from the network. **Note:** If the network activity LED is off when an OCP 3.0 Ethernet adapter is installed, check the network ports in the rear of your server to determine which port is disconnected.

5 System ID button with system ID LED

Use this system ID button and the blue system ID LED to visually locate the server. A system ID LED is also located on the rear of the server. Each time you press the system ID button, the state of both the system ID LEDs changes. The LEDs can be changed to on, blinking, or off.

If the XClarity Controller USB connector is set to have both the USB 2.0 function and XClarity Controller management function, you can press the system ID button for three seconds to switch between the two functions.

6 System error LED

The system error LED provides basic diagnostic functions for your server. If the system error LED is lit, one or more LEDs elsewhere in the server might also be lit to direct you to the source of the error.

Status	Color	Description	Action
On	Yellow	An error has been detected on the server. Causes might include but are not limited to the following errors: • A fan failure • A memory error • A storage failure • A PCIe device failure • A power supply failure • A CPU error • A system board error	Check the event log to determine the exact cause of the error. Alternatively, follow the light path diagnostics to determine if additional LEDs are lit that will direct you to identify the cause of the error. For information about light path diagnostics, see "Light path diagnostics" on page 443.
Off	None	The server is off, or the server is on and is working correctly.	None.

7 Integrated diagnostic panel
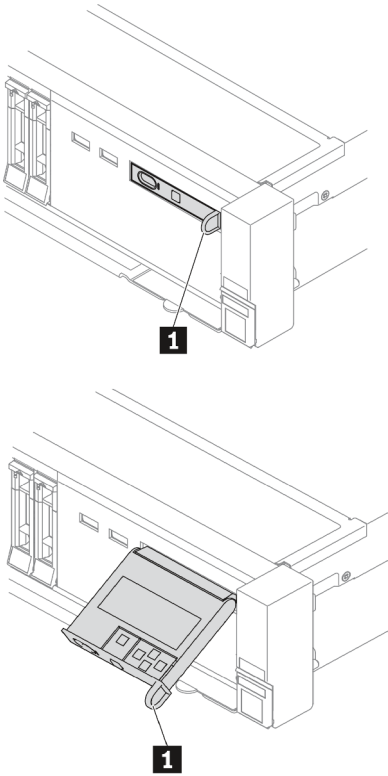
The integrated diagnostic panel provides an LCD diagnostic display to quickly access system information such as active errors, system status, firmware information, network information, and health information. For details, see "Integrated diagnostics panel" on page 29.

Integrated diagnostics panel

The integrated diagnostics panel is attached to the front of the server, while it allows quick access to system information such as errors, system status, firmware, network, and health information.

- "Diagnostics panel location" on page 30
- "Diagnostics panel overview" on page 31
- "Options flow diagram" on page 31
- "Full menu list" on page 32

Diagnostics panel location

Location	The LCD diagnostics panel is attached to the front of the server.
Callout	▮ The handle with which the panel can be pulled out and inserted into the server. **Notes:** • The panel can be inserted or pulled out regardless of the system status. • When pulling out the panel, carefully hold it by the handle and avoid any hard pulling.

Diagnostics panel overview

The diagnostics device consists of an LCD display and 5 navigation buttons.

Status Dashboard
System Name   Ambient Temp
System Status   Power
Active Alerts   Checkpoint Code | Active Session
 	
Menu: • Active Alerts
       • Status Dashboard
       • VPD
       • System Firmware
       • XCC Network
       • Environmental
       • Active Sessions
       • Actions
	1 LCD display

	2 Scroll buttons (up/down/left/right) Press the scroll buttons to locate and select system information.
	3 Select button Press the select button to select from the options in the menu.

Options flow diagram

The LCD diagnostics panel/handset shows various system information. Navigate through the options with the scroll keys.

Depending on the model, the options and entries on the LCD display might be different.

Power consumption/
Temparature

Select

Scroll up/down/left/right

```
◄   Status Dashboard   ►
XXXXX                25 C
System Init.         11 W
1 Active Alerts      0x09
```

Checkpoint Code

◄

| System Status Dashboard | ↔ | Active Alerts | ↔ | System VPD | ↔ | System Firmware |

►
▲
▼

Active Alerts
- Alerts 1
- ...
- Alerts 31

System VPD
- Machine Type Model Serial Number
- Universal Unique ID

System Firmware
- uEFI
- XCC Primary
- XCC Backup

◄

| XCC Network Information | ↔ | System Environment | ↔ | Active Sessions | ↔ | Actions |

►
▲

XCC Network Information
- XCC Hostname
- MAC Address
- IPv4 Network Mask
- IPv4 DNS
- IPv6 Link Local IP
- Stateless IPv6 IP
- Static IPv6 IP
- Current IPv6 Gateway
- IPv6 DNS

System Environment
- Ambient Temp
- Exhaust Temp
- PSU 1
- FAN 1 - FAN 4
- FAN 5 - FAN 8

Active Sessions
- User Session 1
- ...
- User Session 31

Actions
- Restore XCC to Defaults
- Force XCC Reset
- Request XCC Reset
- Set UEFI MEM test
- Clear CMOS
- Request Virtual Reset
- Modify XCC IPv4 Address
- Modify System Name
- Generate / Download FFDC Service Data

▼

Full menu list

Following is the list of options. Switch between an option and the subordinate information entries with the select button, and switch among options or information entries with the scroll buttons.

Depending on the model, the options and entries on the LCD display might be different.

Home Menu (System Status Dashboard)

Home Menu	Example
▉1 System name ▉2 System status ▉3 Active alert quantity ▉4 Temperature ▉5 Power consumption ▉6 Checkpoint code	◄ Status Dashboard ► ▉1 XXXXX 25 C ▉4 ▉2 System Init. 11 W ▉5 ▉3 1 Active Alerts 0x09 ▉6

Active Alerts

Sub Menu	Example
Home screen: Active error quantity **Note:** The "Active Alerts" menu displays only the quantity of active errors. If no errors occur, the "Active Alerts" menu will not be available during navigation.	1 Active Alerts
Details screen: • Error message ID (Type: Error/Warning/Information) • Occurrence time • Possible sources of the error	Active Alerts: 1 Press ▼ to view alert details FQXSPPU009N(Error) 04/07/2020 02:37:39 PM CPU 1 Status: Configuration Error

System VPD Information

Sub Menu	Example
• Machine type and serial number • Universal Unique ID (UUID)	Machine Type: xxxx Serial Num: xxxxxx Universal Unique ID: xxxxxxxxxxxxxxxxxxxxxxxxxxxx

System Firmware

Sub Menu	Example
UEFI • Firmware level (status) • Build ID • Version number • Release date	```UEFI (Inactive) Build: D0E101P Version: 1.00 Date: 2019-12-26```
XCC Primary • Firmware level (status) • Build ID • Version number • Release date	```XCC Primary (Active) Build: DVI399T Version: 4.07 Date: 2020-04-07```
XCC Backup • Firmware level (status) • Build ID • Version number • Release date	```XCC Backup (Active) Build: D8BT05I Version: 1.00 Date: 2019-12-30```

XCC Network Information

Sub Menu	Example
• XCC hostname • MAC address • IPv4 Network Mask • IPv4 DNS • IPv6 Link Local IP • Stateless IPv6 IP • Static IPv6 IP • Current IPv6 Gateway • IPv6 DNS **Note:** Only the MAC address that is currently in use is displayed (extension or shared).	```XCC Network Information XCC Hostname: XCC-xxxx-SN MAC Address: xx:xx:xx:xx:xx:xx IPv4 IP: xx.xx.xx.xx IPv4 Network Mask :x.x.x.x IPv4 Default Gateway : x.x.x.x```

System Environmental Information

Sub Menu	Example

• Ambient temperature
• Exhaust temperature
• PSU status
• Spinning speed of fans by RPM
	```Ambient Temp: 24 C```
	```Exhaust Temp: 30 C```
	
	```PSU1: Vin= 213 w```
	```Inlet= 26 C```
	
	```FAN1 Front: 21000 RPM```
	```FAN2 Front: 21000 RPM```
	```FAN3 Front: 21000 RPM```
	```FAN4 Front: 21000 RPM```

Active Sessions

Sub Menu	Example
Quantity of active sessions	```Active User Sessions: 1```

Actions

Sub Menu	Example

Several quick actions supported for users
• Restore XCC to Defaults
• Force XCC Reset
• Request XCC Reset
• Set UEFI Memory Test
• Clear CMOS
• Request Virtual Reseat
• Modify XCC Static IPv4 Address/Net mask/ Gateway
• Modify System Name
• Generate/Download FFDC Service Data
	```Request XCC Reset?```
	``` This will request the BMC to reboot itself.```
	```Hold √ for 3 seconds```

External diagnostics handset

The external diagnostics handset is an external device that can be connected to the server with a cable, and it allows quick access to system information such as errors, system status, firmware, network, and health information.

Note: The external diagnostics handset is an optional part that needs to be purchased separately.

Location of the external diagnostics handset

Location	Description
The external LCD diagnostics handset is connected to the server with an external cable. 	**1** External LCD diagnostics handset
	2 Magnetic bottom With this component, the diagnostic handset can be attached to the top or side of the rack with hands spared for service tasks.
	3 External diagnostics connector This connector is located on the front of the server and is used to connect an external LCD diagnostics handset.

Note: Pay attention to the following steps when unplugging the external handset:
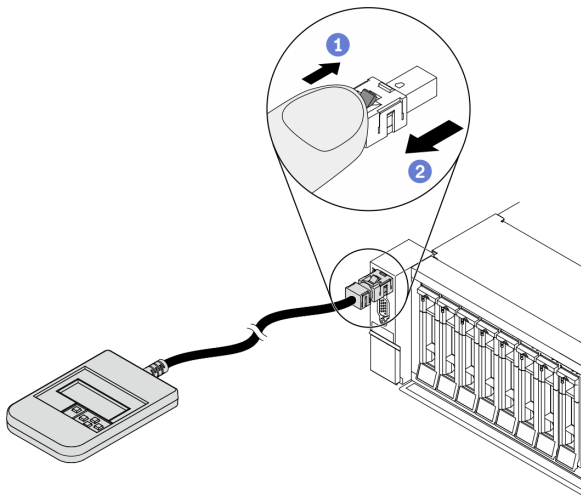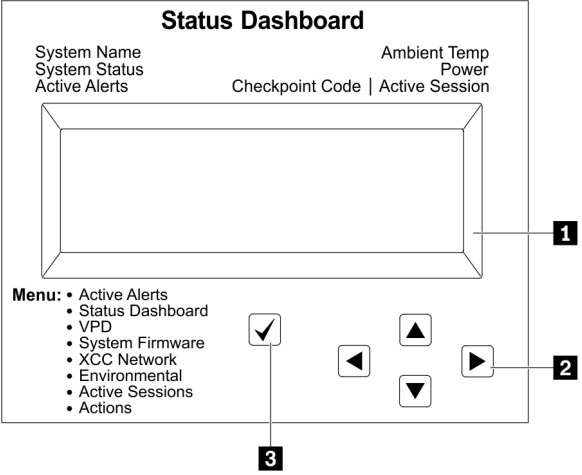
Step 1. Press the plastic clip on the plug in the shown direction.

Step 2. Gently pull out the cable from the connector while keeping the clip pressed down.

Diagnostics panel overview

The diagnostics device consists of an LCD display and 5 navigation buttons.

	1 LCD display
	2 Scroll buttons (up/down/left/right) Press the scroll buttons to locate and select system information.
	3 Select button Press the select button to select from the options in the menu.

Options flow diagram

The LCD diagnostics panel/handset shows various system information. Navigate through the options with the scroll keys.

Depending on the model, the options and entries on the LCD display might be different.
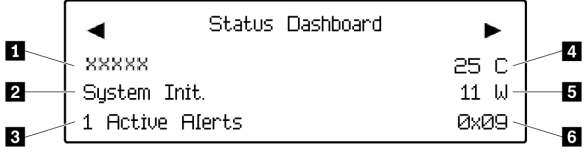
Full menu list

Following is the list of options. Switch between an option and the subordinate information entries with the select button, and switch among options or information entries with the scroll buttons.

Depending on the model, the options and entries on the LCD display might be different.

Home Menu (System Status Dashboard)

Home Menu	Example
1 System name **2** System status **3** Active alert quantity **4** Temperature **5** Power consumption **6** Checkpoint code	

Active Alerts

Sub Menu	Example
Home screen: Active error quantity **Note:** The "Active Alerts" menu displays only the quantity of active errors. If no errors occur, the "Active Alerts" menu will not be available during navigation.	`1 Active Alerts`

Details screen:
• Error message ID (Type: Error/Warning/Information)
• Occurrence time
• Possible sources of the error
	`Active Alerts: 1`
	`Press ▼ to view alert details`
	`FQXSPPU009N(Error)`
	`04/07/2020 02:37:39 PM`
	`CPU 1 Status:`
	`Configuration Error`

System VPD Information

Sub Menu	Example

• Machine type and serial number
• Universal Unique ID (UUID)
	`Machine Type: xxxx`
	`Serial Num: xxxxxx`
	`Universal Unique ID:`
	`xxxxxxxxxxxxxxxxxxxxxxxxxxxxx`

System Firmware

Sub Menu	Example

UEFI
• Firmware level (status)
• Build ID
• Version number
• Release date
	`UEFI (Inactive)`
	`Build: D0E101P`
	`Version: 1.00`
	`Date: 2019-12-26`

XCC Primary
• Firmware level (status)
• Build ID
• Version number
• Release date
	`XCC Primary (Active)`
	`Build: DVI399T`
	`Version: 4.07`
	`Date: 2020-04-07`

XCC Backup
• Firmware level (status)
• Build ID
• Version number
• Release date
	`XCC Backup (Active)`
	`Build: D8BT05I`
	`Version: 1.00`
	`Date: 2019-12-30`

XCC Network Information

Sub Menu	Example

• XCC hostname
• MAC address
• IPv4 Network Mask
• IPv4 DNS
• IPv6 Link Local IP
• Stateless IPv6 IP
• Static IPv6 IP
• Current IPv6 Gateway
• IPv6 DNS
Note: Only the MAC address that is currently in use is displayed (extension or shared).
	`XCC Network Information`
	`XCC Hostname: XCC-xxxx-SN`
	
	`MAC Address:`
	`xx:xx:xx:xx:xx:xx`
	`IPv4 IP:`
	`xx.xx.xx.xx`
	
	`IPv4 Network Mask`
	`:x.x.x.x`
	`IPv4 Default Gateway`
	`: x.x.x.x`

System Environmental Information

Sub Menu	Example
- Ambient temperature - Exhaust temperature - PSU status - Spinning speed of fans by RPM	```Ambient Temp: 24 C Exhaust Temp: 30 C PSU1: Vin= 213 w Inlet= 26 C FAN1 Front: 21000 RPM FAN2 Front: 21000 RPM FAN3 Front: 21000 RPM FAN4 Front: 21000 RPM```

Active Sessions

Sub Menu	Example
Quantity of active sessions	`Active User Sessions: 1`

Actions

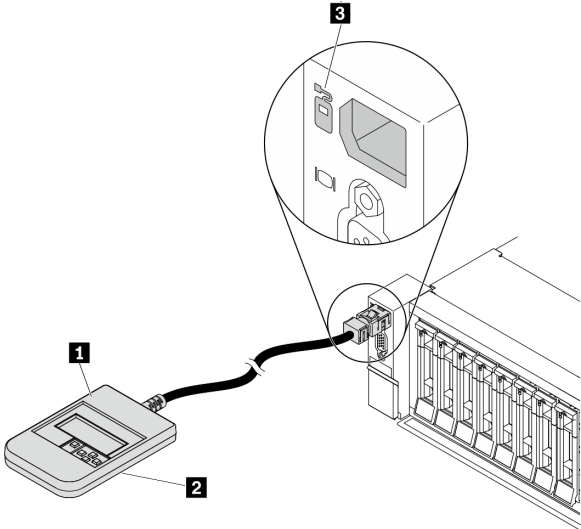| Sub Menu	Example
Several quick actions supported for users - Restore XCC to Defaults - Force XCC Reset - Request XCC Reset - Set UEFI Memory Test - Clear CMOS - Request Virtual Reseat - Modify XCC Static IPv4 Address/Net mask/ Gateway - Modify System Name - Generate/Download FFDC Service Data	```Request XCC Reset? This will request the BMC to reboot itself. Hold √ for 3 seconds```

Rear view

The rear of the server provides access to several connectors and components.

Refer to the following rear view for different server models:

Rear view with eight PCIe slots
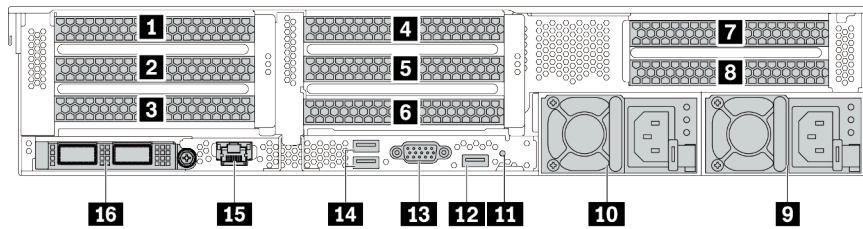
Table 14. Components on the rear of the server

Callout	Callout
1 PCIe slot 1 (on riser 1 assembly)	**2** PCIe slot 2 (on riser 1 assembly)
3 PCIe slot 3 (on riser 1 assembly)	**4** PCIe slot 4 (on riser 2 assembly)
5 PCIe slot 5 (on riser 2 assembly)	**6** PCIe slot 6 (on riser 2 assembly)
7 PCIe slot 7 (on riser 3 assembly)	**8** PCIe slot 8 (on riser 3 assembly)
9 Power supply 1	**10** Power supply 2 (optional)
11 NMI button	**12** USB 3 (5 Gbps) connector (DCI)
13 VGA connector	**14** USB 3 (5 Gbps) connectors (DCIs)
15 XClarity Controller network connector	**16** Ethernet connectors on OCP 3.0 Ethernet adapter (optional)

Note: For more information about each component, see "Rear components overview" on page 48.

Rear view with four 2.5-inch rear drive bays and six PCIe slots
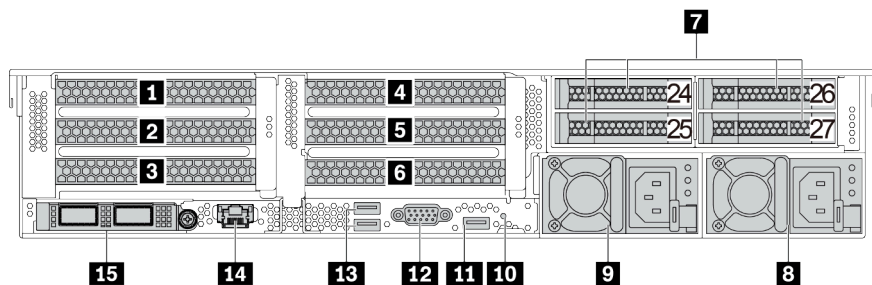
Table 15. Components on the rear of the server

Callout	Callout
1 PCIe slot 1 (on riser 1 assembly)	**2** PCIe slot 2 (on riser 1 assembly)
3 PCIe slot 3 (on riser 1 assembly)	**4** PCIe slot 4 (on riser 2 assembly)
5 PCIe slot 5 (on riser 2 assembly)	**6** PCIe slot 6 (on riser 2 assembly)
7 2.5-inch rear drive bays (4)	**8** Power supply 1
9 Power supply 2 (optional)	**10** NMI button
11 USB 3 (5 Gbps) connector (DCI)	**12** VGA connector
13 USB 3 (5 Gbps) connectors (DCIs)	**14** XClarity Controller network connector
15 Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

Note: For more information about each component, see "Rear components overview" on page 48.

Rear view with eight 2.5-inch rear drive bays and four PCIe slots
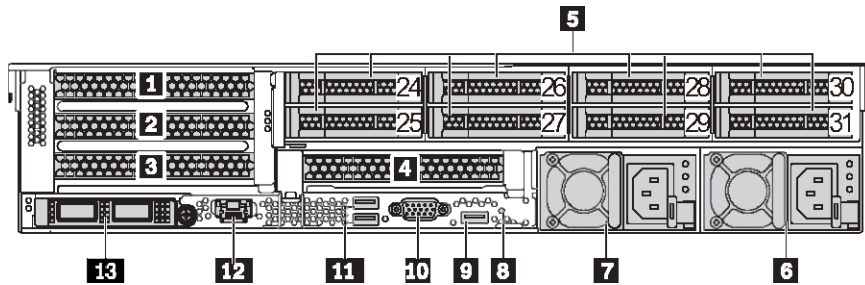
Table 16. Components on the rear of the server

Callout	Callout
1 PCIe slot 1 (on riser 1 assembly)	**2** PCIe slot 2 (on riser 1 assembly)
3 PCIe slot 3 (on riser 1 assembly)	**4** PCIe slot 6 (on riser 2 assembly)
5 2.5-inch rear drive bays (8)	**6** Power supply 1
7 Power supply 2 (optional)	**8** NMI button
9 USB 3 (5 Gbps) connector (DCI)	**10** VGA connector
11 USB 3 (5 Gbps) connectors (DCIs)	**12** XClarity Controller Network connector
13 Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

Note: For more information about each component, see "Rear components overview" on page 48.

Rear view with two 3.5-inch rear drive bays and four PCIe slots
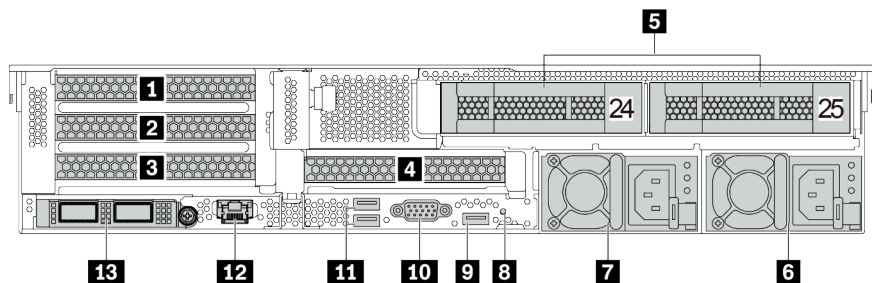
Table 17. Components on the rear of the server

Callout	Callout
1 PCIe slot 1 (on riser 1 assembly)	**2** PCIe slot 2 (on riser 1 assembly)
3 PCIe slot 3 (on riser 1 assembly)	**4** PCIe slot 6 (on riser 2 assembly)
5 3.5-inch rear drive bays (2)	**6** Power supply 1
7 Power supply 2 (optional)	**8** NMI button
9 USB 3 (5 Gbps) connector (DCI)	**10** VGA connector
11 USB 3 (5 Gbps) connectors (DCIs)	**12** XClarity Controller Network connector
13 Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

Note: For more information about each component, see "Rear components overview" on page 48.

Rear view with four 3.5-inch rear drive bays and two PCIe slots
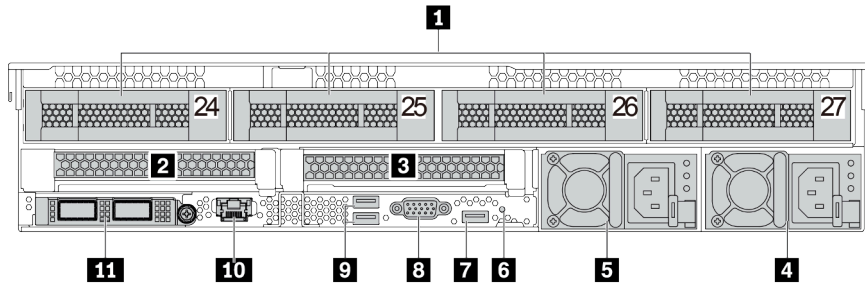
Table 18. Components on the rear of the server

Callout	Callout
1 3.5-inch rear drive bays (4)	**2** PCIe slot 3 (on riser 1 assembly)
3 PCIe slot 6 (on riser 2 assembly)	**4** Power supply 1
5 Power supply 2 (optional)	**6** NMI button
7 USB 3 (5 Gbps) connector (DCI)	**8** VGA connector
9 USB 3 (5 Gbps) connectors (DCIs)	**10** XClarity Controller Network connector
11 Ethernet connectors on OCP 3.0 Ethernet adapter (optional)	

Note: For more information about each component, see "Rear components overview" on page 48.

Rear components overview

Drive LEDs

Each hot-swap drive comes with an activity LED and status LED and the signals are controlled by the backplanes. Different colors and speeds indicate different activities or status of the drive. The following illustration shows the LEDs on a Hard disk drive or solid–state drive.
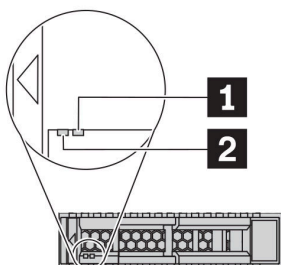
Figure 7. Drive LEDs

Drive LED	Status	Description
1 Drive status LED (right)	Solid yellow	The drive has an error.
	Blinking yellow (blinking slowly, about one flash per second)	The drive is being rebuilt.
	Blinking yellow (blinking rapidly, about four flashes per second)	The RAID adapter is locating the drive.
2 Drive activity LED (left)	Solid green	The drive is powered but not active.
	Blinking green	The drive is active.

Ethernet connectors

Figure 8. OCP 3.0 Ethernet adapter (two connectors, seen from the rear)

Figure 9. OCP 3.0 Ethernet adapter (four connectors, seen from the rear)

The OCP 3.0 Ethernet adapter provides two or four extra Ethernet connectors for network connections.

By default, Ethernet connector 1 (the first port starting from the left in the rear server view) on the OCP 3.0 Ethernet adapter can also function as a management connector using the shared management capacity. If the shared management connector fails, traffic can automatically switch over to another connector on the adapter.

Hot-swap drives and drive bays

The drive bays on the front and rear of your server are designed for hot-swap drives. The number of the installed drives in your server varies by model. When you install drives, follow the order of the drive bay numbers.

The EMI integrity and cooling of the server are protected by having all drive bays occupied. Vacant drive bays must be occupied by drive fillers.

NMI button

Use this button only when you are directed to do so by Lenovo Support. Press this button to force a nonmaskable interrupt (NMI) to the processor. By this way, you can make the operating system halt (such as Windows Blue Screen of Death) and take a memory dump. You might have to use a pen or the end of a straightened paper clip to press the button.

PCIe slots

The PCIe slots are on the rear of the server and your server supports up to eight PCIe slots on riser 1, 2, and 3 assemblies. For more information, see "PCIe slots and PCIe adapters" on page 256.

Power supplies

The hot-swap redundant power supply helps you avoid significant interruption to the operation of the system when a power supply fails. You can purchase a power supply option from Lenovo and install the power supply to provide power redundancy without turning off the server.

On each power supply, there are three status LEDs near the power cord connector. For information about the LEDs, see "Rear view LEDs" on page 50.

USB 3 (5 Gbps) connectors

The USB 3.2 Gen 1 (5 Gbps) connectors are direct connect interfaces (DCIs) for debugging, which can be used to attach a USB-compatible device, such as a USB keyboard, USB mouse, or USB storage device.

VGA connector

The VGA connectors on the front and rear of the server can be used to attach a high-performance monitor, a direct-drive monitor, or other devices that use a VGA connector.

XClarity Controller network connector

The XClarity Controller network connector can be used to attach an Ethernet cable to manage the baseboard management controller (BMC).

Rear view LEDs

The illustration in this section shows the LEDs on the rear of the server.
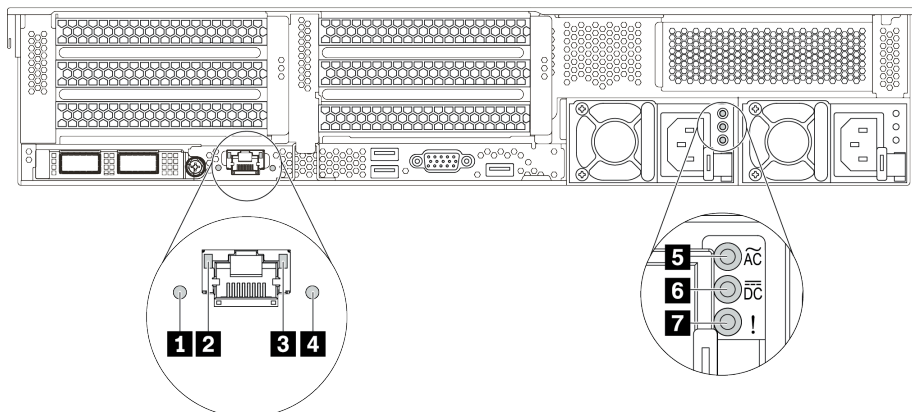
Figure 10. Rear view LEDs of the server

Table 19. LEDs on the rear of the server

Callout	Callout
1 System ID LED	**2** Ethernet link LED
3 Ethernet activity LED	**4** System error LED
5 Power input LED	**6** Power output LED
7 Power supply error LED	

1 System ID LED

The blue system ID LED helps you to visually locate the server. A system ID LED is also located on the front of the server. Each time you press the system ID button, the state of both the system ID LEDs changes. The LEDs can be changed to on, blinking, or off.

2 **3** Ethernet status LEDs

The BMC management connector has two status LEDs.

Ethernet status LED	Color	Status	Description
2 Ethernet link LED	Green	On	Network link is established.
	None	Off	Network link is disconnected.
3 Ethernet activity LED	Green	Blinking	Network link is connected and active.
	None	Off	The server is disconnected from a LAN.

4 System error LED

The system error LED provides basic diagnostic functions for your server. If the system error LED is lit, one or more LEDs elsewhere in the server might also be lit to direct you to the source of the error. For more information, see "Front I/O module" on page 27.

5 **6** **7** Power supply LEDs

Each hot-swap power supply has three status LEDs.

LED	Description
5 Power input LED	• Green: The power supply is connected to the ac power source. • Off: The power supply is disconnected from the ac power source or a power problem occurs.
6 Power output LED	• Green: The server is on and the power supply is working normally. • Blinking green: The power supply is in zero-output mode (standby). When the server power load is low, one of the installed power supplies enters into the standby state while the other one delivers entire load. When the power load increases, the standby power supply will switch to active state to provide sufficient power to the server. To disable zero-output mode, log in to the Lenovo XClarity Controller web interface, choose **Server Configuration ➙ Power Policy**, disable **Zero Output Mode**, and then click **Apply**. If you disable zero-output mode, both power supplies will be in the active state. • Off: The server is powered off, or the power supply is not working properly. If the server is powered on but the power output LED is off, replace the power supply.
7 Power supply error LED	• Yellow: The power supply has failed. To resolve the issue, replace the power supply. • Off: The power supply is working normally.

System board components

The illustration in this section shows the component locations on the system board.
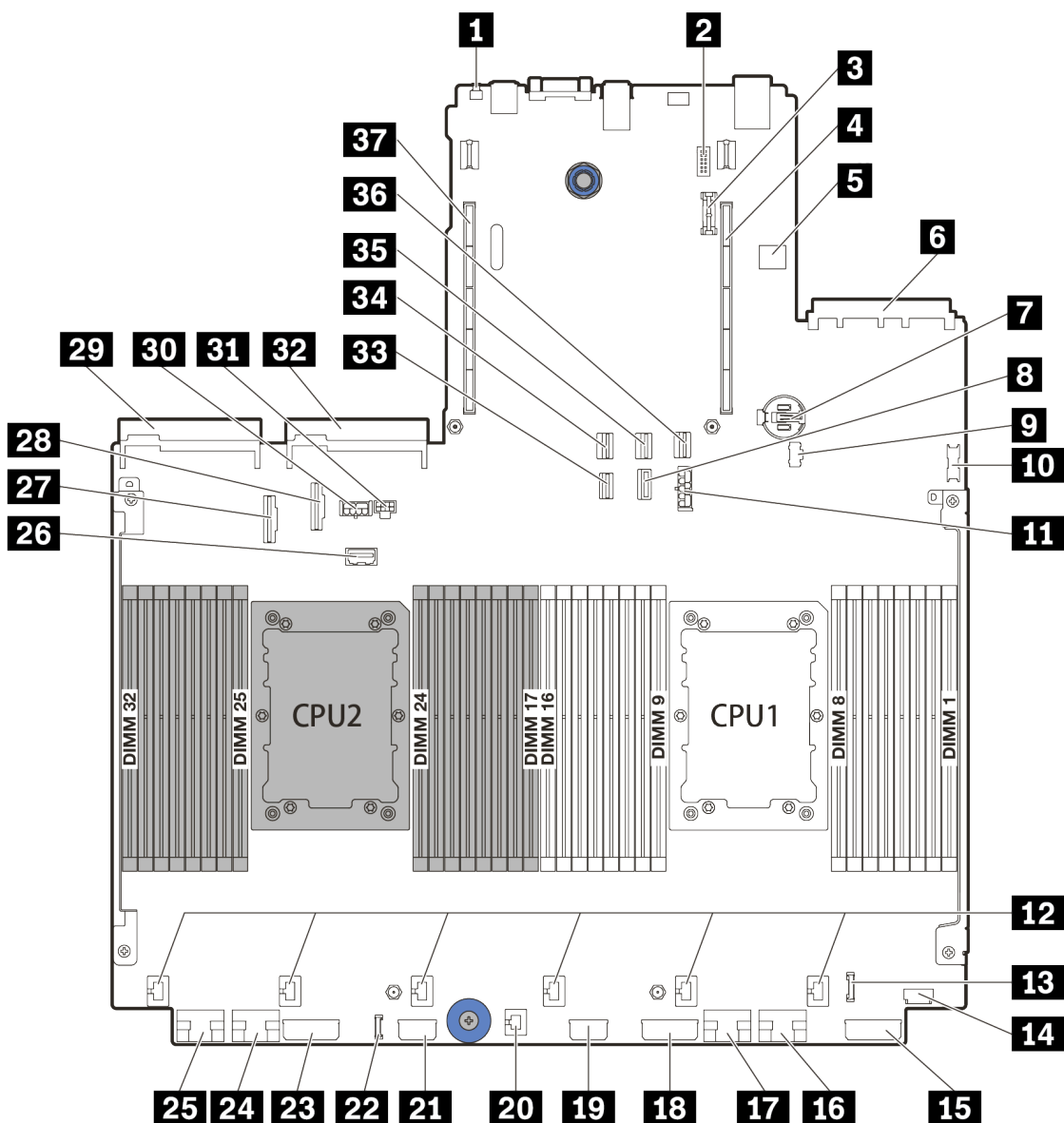
Figure 11. System board components

1 NMI button	**2** Serial port module connector
3 TPM module connector	**4** Riser 1 slot
5 Internal USB connector	**6** OCP 3.0 Ethernet adapter connector
7 CMOS battery (CR2032)	**8** 7mm backplane signal connector
9 M.2 power connector	**10** Front USB connector
11 7mm backplane power connector	**12** Fan connectors
13 Front I/O connector	**14** Front VGA connector
15 Backplane 3 power connector	**16** PCIe connector 1
17 PCIe connector 2	**18** Backplane 2 power connector

19	CFF expander power connector	**20**	Intrusion switch connector
21	CFF RAID/HBA power connector	**22**	External diagnostics connector
23	Backplane 1 power connector	**24**	PCIe connector 3
25	PCIe connector 4	**26**	Riser 3 Sideband Connector
27	PCIe connector 5	**28**	PCIe connector 6
29	Power supply 1 connector	**30**	GPU power connector
31	Riser 3 power connector	**32**	Power supply 2 connector
33	M.2/Rear backplane signal connector	**34**	SATA connector 2
35	SATA connector 0	**36**	SATA connector 1
37	Riser 2 slot		

System board LEDs

The illustration in this section shows the LEDs on the system board.
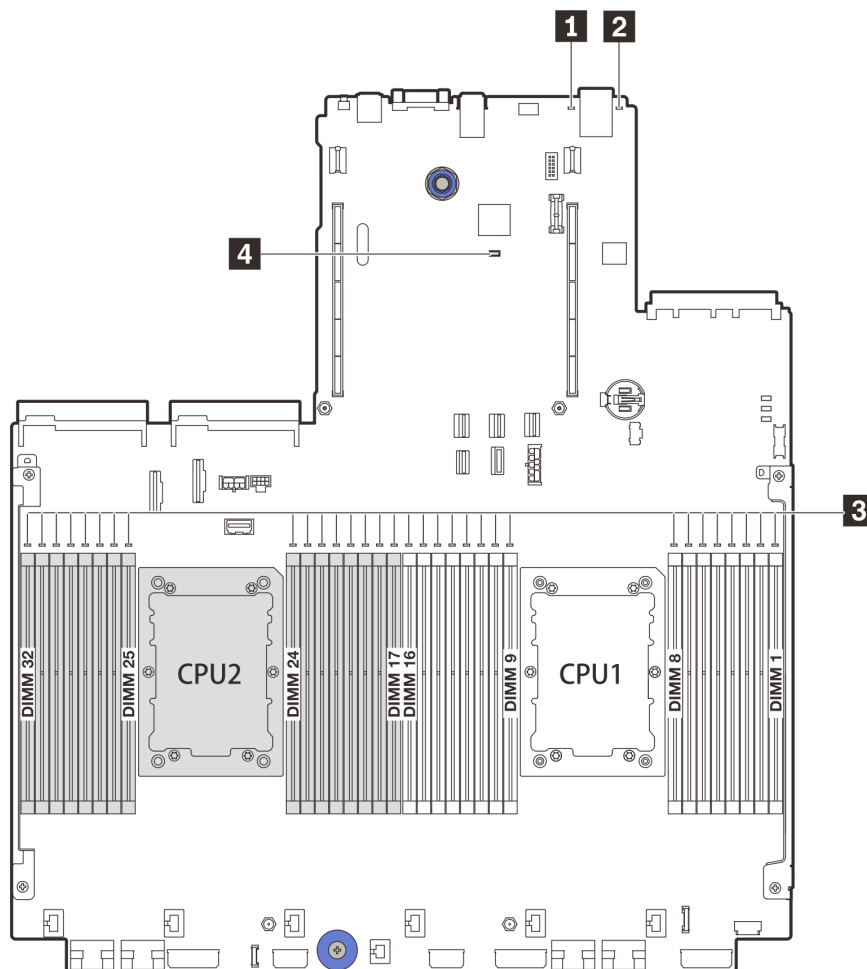
Figure 12. System board LEDs

Table 20. LEDs on the system board

Callout	Callout
1 System error LED	**2** System ID LED
3 DIMM error LEDs	**4** BMC heartbeat LED

1 System error LED

When this yellow LED is lit, one or more LEDs elsewhere in the server might also be lit to direct you to the source of the error. For more information, see "Front I/O module" on page 27.

2 System ID LED

The blue system ID LED helps you to visually locate the server. A system ID LED is also located on the front of the server. Each time you press the system ID button, the state of both the system ID LEDs changes. The LEDs can be changed to on, blinking, or off.

3 DIMM error LEDs

When a DIMM error LED is lit, it indicates that the corresponding memory module has failed.

4 BMC heartbeat LED

The BMC heartbeat LED helps you identify the BMC status.

Status	Color	Description
On	Green	The BMC is not alive.
Blinking	Green	The BMC is alive.
Off	None	The BMC is not alive.

Switch block

The following illustrates locations and functions of the switch block on the system board.

Important:
- Before you move any jumpers, turn off the server; then, disconnect all power cords and external cables. Do not open your server or attempt any repair before reading and understanding the following information:
    - https://pubs.lenovo.com/safety_documentation/
    - "Handling static-sensitive devices" on page 239
- If there is a clear protective sticker on the top of the switch blocks, you must remove and discard it to access the switches.
- Any system-board switch or jumper block that is not shown in the illustrations in this document is reserved.
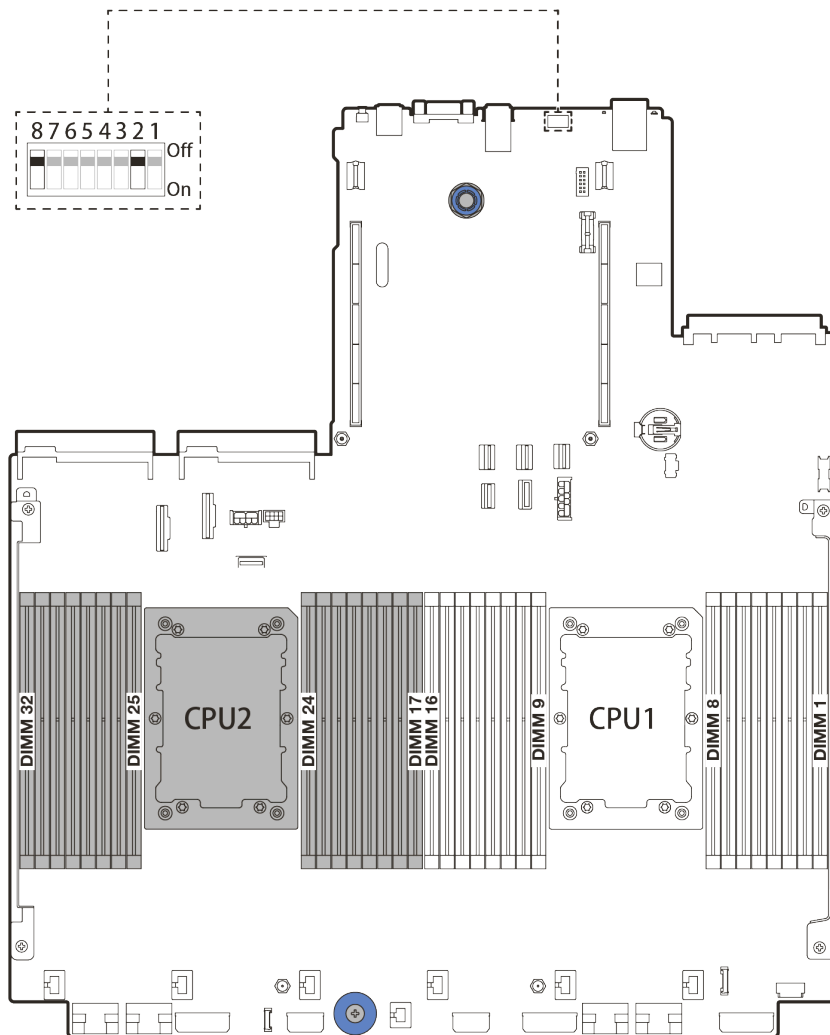
Figure 13. SW8 switch block on system board

Table 21. SW8 switch block

Switch number	Switch name	Description
SW8-1	ME firmware security override switch	• OFF: The switch is in default setting. • ON: Enable Flash security override.
SW8-2	Clear CMOS switch	• OFF: The switch is in default setting. • ON: Clear the real-time clock (RTC) registry.
SW8-3	Force XCC reset switch	• OFF: The switch is in default setting. • ON: Force the Lenovo XClarity Controller to update to the latest version.
SW8-4	Force XCC update switch	• OFF: The switch is in default setting. • ON: Force XClarity Controller to boot from a backup image.
SW8-5	XCC SPI0 half ROM switch	• OFF: The switch is in default setting. • ON: Enable low security mode for XClarity Controller firmware (For development purpose only)

Table 21. SW8 switch block (continued)

Switch number	Switch name	Description
SW8-6	Low security switch	• OFF: The switch is in default setting. • ON: Enable low security mode for XClarity Controller firmware (For development purpose only).
SW8-7	Reserved	This switch is reserved for development purpose only.
SW8-8	Override power-on password switch	• OFF: The switch is in default setting. • ON: Override the power-on password.

Parts list

Use the parts list section to identify each of the components that are available for your server.

2.5-inch drive bay chassis

Use the parts list in this section to identify each of the components that are available for server models with 2.5-inch front drive bays.

For more information about ordering the parts shown in Figure 14 "Server components (2.5-inch drive bay chassis)" on page 59:

https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v2/parts

It is highly recommended that you check the power summary data for your server using Lenovo Capacity Planner before purchasing any new parts.

Note: Depending on the model, your server might look slightly different from the illustration. Some parts are available only on some models.

Figure 14. Server components (2.5-inch drive bay chassis)

The parts listed in the following table are identified as one of the following:

- **T1:** Tier 1 customer replaceable unit (CRU). Replacement of Tier 1 CRUs is your responsibility. If Lenovo installs a Tier 1 CRU at your request with no service agreement, you will be charged for the installation.
- **T2:** Tier 2 customer replaceable unit (CRU). You may install a Tier 2 CRU yourself or request Lenovo to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **F:** Field replaceable unit (FRU). FRUs must be installed only by trained service technicians.
- **C:** Consumable and Structural parts. Purchase and replacement of consumable and structural parts (components, such as a filler or bezel) is your responsibility. If Lenovo acquires or installs a structural component at your request, you will be charged for the service.

Description	Type	Description	Type
1 Top cover	T1	**2** Rear 4 x 2.5-inch drive cage	T1
3 Rear 8 x 2.5-inch drive cage	T1	**4** Riser cages: • Riser 1 or riser 2 cage (3FH) • Riser 3 cage (2FH) • 1U riser cage (LP)	T1
5 Riser cards: • Riser 1 • Riser 2 • Riser 3	• T1 • T1 • T2	**6** PCIe adapter	T1
7 Power supply	T1	**8** Serial port module	T1
9 Processor	F	**10** Memory module	T1
11 Heat sinks • 2U entry heat sink • 2U standard heat sink • High performance T-shape heat sink • 1U heat sink	F	**12** Heat sink PEEK nut	T2
13 Rear wall brackets	C	**14** 7mm drive	T1
15 7mm drive bay filler	C	**16** 7mm drive cage (2FH + 7mm)	T1
17 7mm drive cage (1U)	T1	**18** 7mm drive backplanes	T2
19 OCP 3.0 Ethernet adapter	T1	**20** OCP Enablement Kit for vSphere DSE	T1
21 CFF RAID adapter/expander	T2	**22** M.2 drive backplane	T1
23 M.2 drive	T1	**24** M.2 retainer clip	T1
25 CMOS battery (CR2032)	C	**26** RAID flash power module holder	C
27 RAID flash power module	T1	**28** TPM adapter (for Chinese Mainland only)	F
29 Left rack latch with VGA and external diagnostic connector	T1	**30** Right rack latch with front I/O assembly	T1
31 Standard right rack latch	C	**32** Standard left rack latch with external diagnostic connector	T1
33 External diagnostic handset	T1	**34** Intrusion switch	T1
35 Security bezel	T1	**36** Integrated diagnostics panel	T1
37 Front I/O assembly with integrated diagnostics panel	T1	**38** 4 x 2.5-inch drive filler	C
39 8 x 2.5-inch drive filler	C	**40** 2.5-inch drive	T1
41 2.5-inch drive filler	C	**42** Chassis	F
43 Rear 8 x 2.5-inch drive backplane	T1	**44** Middle/Rear 4 x 2.5-inch drive backplane	T1
45 Front 8 x 2.5-inch drive backplane	T1	**46** Fan cage	T1
47 Fan module • Standard fan • Performance fan	T1	**48** System board	F
49 Middle 8 x 2.5-inch drive cage	T1	**50** Air baffle filler (for standard air baffle)	C

Description	Type	Description	Type
51 Add-on air baffle (for GPU air baffle)	T1	**52** Air baffle filler (for GPU air baffle)	C
53 Standard air baffle	T1	**54** GPU air baffle	T1

3.5-inch drive bay chassis

Use the parts list in this section to identify each of the components that are available for server models with 3.5-inch front drive bays.

For more information about ordering the parts shown in Figure 15 "Server components (3.5-inch drive bay chassis)" on page 63:

https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v2/parts

It is highly recommended that you check the power summary data for your server using Lenovo Capacity Planner before purchasing any new parts.

Note: Depending on the model, your server might look slightly different from the illustration. Some parts are available only on some models.

Figure 15. Server components (3.5-inch drive bay chassis)

The parts listed in the following table are identified as one of the following:
- **T1:** Tier 1 customer replaceable unit (CRU). Replacement of Tier 1 CRUs is your responsibility. If Lenovo installs a Tier 1 CRU at your request with no service agreement, you will be charged for the installation.
- **T2:** Tier 2 customer replaceable unit (CRU). You may install a Tier 2 CRU yourself or request Lenovo to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **F:** Field replaceable unit (FRU). FRUs must be installed only by trained service technicians.
- **C:** Consumable and Structural parts. Purchase and replacement of consumable and structural parts (components, such as a filler or bezel) is your responsibility. If Lenovo acquires or installs a structural component at your request, you will be charged for the service.

Description	Type	Description	Type
1 Top cover	T1	**2** Rear 4 x 2.5-inch drive cage	T1
3 Rear 4 x 3.5-inch drive cage	T1	**4** Rear 2 x 3.5-inch drive cage	T1
5 Riser cages: • Riser 1 or riser 2 cage (3FH) • Riser 3 cage (2FH) • 1U riser cage (LP)	T1	**6** Riser cards: • Riser 1 • Riser 2 • Riser 3	• T1 • T1 • T2
7 PCIe adapter	T1	**8** Power supply	T1
9 Serial port module	T1	**10** Processor	F
11 Memory module	T1	**12** Heat sinks • 2U entry heat sink • 2U standard heat sink • High performance T-shape heat sink • 1U heat sink	F
13 Heat sink PEEK nut	T2	**14** Rear wall brackets	C
15 7mm drive	T1	**16** 7mm drive bay filler	C
17 7mm drive cage (2FH + 7mm)	T1	**18** 7mm drive cage (1U)	T1
19 7mm drive backplanes	T2	**20** OCP 3.0 Ethernet adapter	T1
21 OCP Enablement Kit for vSphere DSE	T1	**22** M.2 drive backplane	T1
23 M.2 drive	T1	**24** M.2 retainer clip	T1
25 CMOS battery (CR2032)	C	**26** RAID flash power module holder	C
27 RAID flash power module	T1	**28** TPM adapter (for Chinese Mainland only)	F
29 Left rack latch with VGA and external diagnostic connector	T1	**30** Right rack latch with front I/O module	T1
31 Standard right rack latch	T1	**32** Standard left rack latch with external diagnostic connector	T1
33 External diagnostic handset	T1	**34** Intrusion switch	T1
35 Security bezel	T1	**36** 4 x 3.5-inch drive filler	C
37 3.5-inch drive filler	C	**38** 3.5-inch drive	T1
39 Chassis	F	**40** Front 8 x 3.5-inch drive backplane	T1
41 Front 12 x 3.5-inch drive backplane	T1	**42** Middle/Rear 4 x 3.5-inch drive backplane	T1
43 Middle/Rear 4 x 2.5-inch drive backplane	T1	**44** Rear 2 x 3.5-inch drive backplane	T1
45 Fan cage	T1	**46** Fan module • Standard fan • Performance fan	T1
47 System board	F	**48** Middle 4 x 3.5-inch drive cage	T1
49 Middle 8 x 2.5-inch drive cage	T1	**50** Air baffle filler (for standard air baffle)	C
51 Add-on air baffle (for GPU air baffle)	T1	**52** Air baffle filler (for GPU air baffle)	C
53 Standard air baffle	T1	**54** GPU air baffle	T1

Power cords

Several power cords are available, depending on the country and region where the server is installed.

To view the power cords that are available for the server:
1. Go to: http://dcsc.lenovo.com/#/
2. Click **Preconfigured Model** or **Configure to order**.
3. Enter the machine type and model for your server to display the configurator page.
4. Click **Power** ➙ **Power Cables** to see all line cords.

Notes:
- For your safety, a power cord with a grounded attachment plug is provided to use with this product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.
- Power cords for this product that are used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).
- For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum of 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.
- For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum of 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.
- For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.
- Power cords for a specific country or region are usually available only in that country or region.

Chapter 3. Internal cable routing

Some of the components in the server have internal cables and cable connectors.

To connect cables, observe the following guidelines:
- Turn off the server before you connect or disconnect any internal cables.
- See the documentation that comes with any external devices for additional cabling instructions. It might be easier for you to route cables before you connect the devices to the server.
- Cable identifiers of some cables are printed on the cables that come with the server and optional devices. Use these identifiers to connect the cables to the correct connectors.
- Ensure that the cable is not pinched and does not cover any connectors or obstruct any components on the system board.
- Ensure that the relevant cables pass through the cable clips.

Attention: Strictly observe the following instructions to avoid damaging cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
- Connect cable connectors vertically or horizontally in alignment with the orientations of the corresponding cable sockets, avoiding any tilt.
- To disconnect cables from the system board, do as follows:
    1. Press and hold all latches, release tabs, or locks on cable connectors to release the cable connectors.
    2. Remove the cable connectors vertically or horizontally in alignment with the orientations of the corresponding cable sockets, avoiding any tilt.

    Note: The cable connectors might look different from those in the illustration, but the removal procedure is the same.
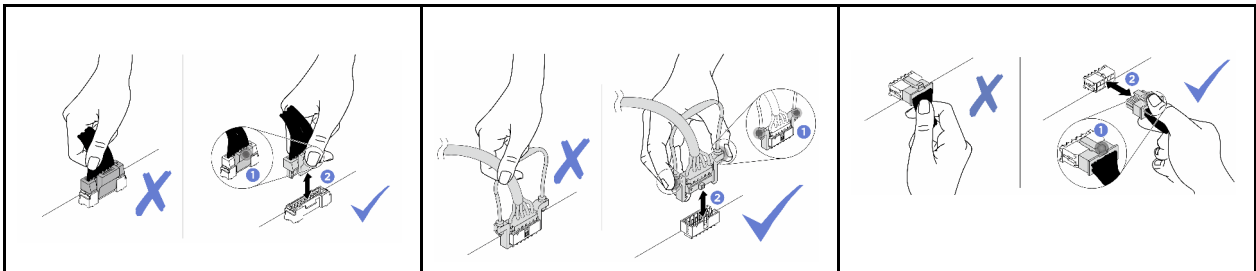
Front I/O connectors

Use the section to understand the cable routing for the front I/O connectors, including VGA connector, external diagnostics connector, front operator panel connector, and front USB connectors.

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-

Front I/O connectors on rack latches

Note: When routing cables from rack latches, ensure that it is fixed on the upper frame of the cable retainer. For details, refer to .
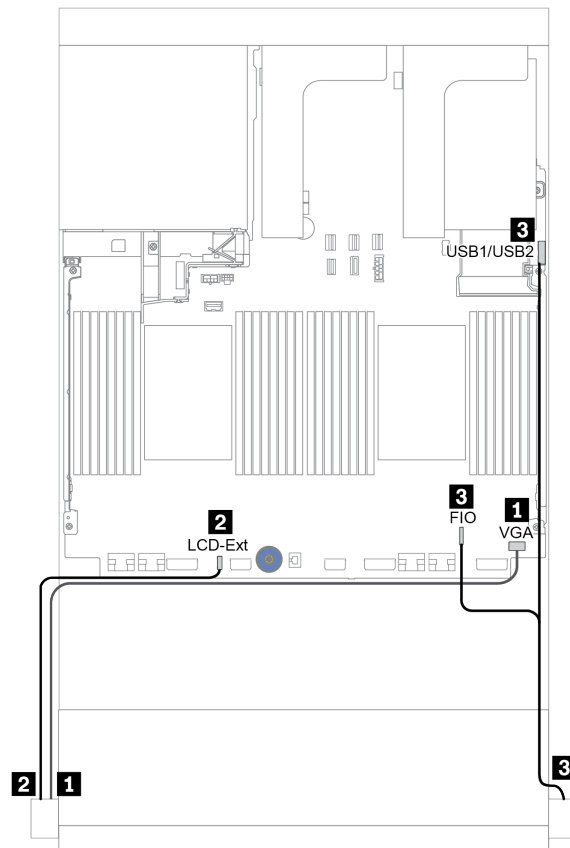
Figure 16. Front I/O connector cable routing (rack latches)

From	To
1 VGA cable on the left rack latch	VGA connector on the system board
2 External diagnostics cable on the left rack latch	External LCD connector on the system board
3 Front panel and front USB cable on the right rack latch	Front I/O and front USB connectors on the system board

Front I/O connectors on the front media bay

The illustration shows the cable routing for the front operator panel and front USB connectors on the media bay.
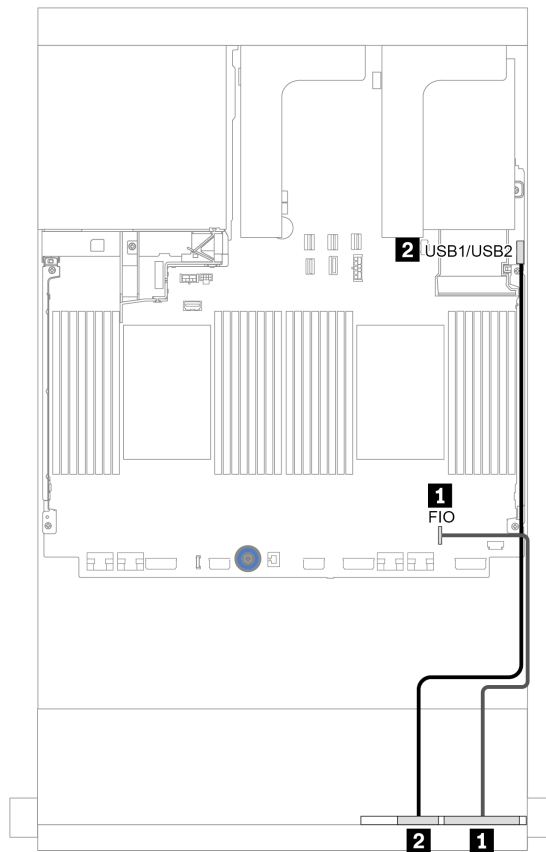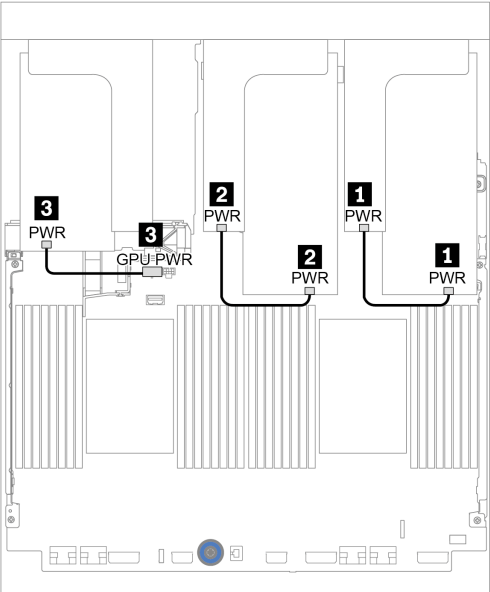
Figure 17. Front I/O connector cable routing (media bay)

From	To
1 Front operator panel cable	Front I/O connector on the system board
2 Front USB cable	Front USB connector on the system board

GPUs

Use this section to understand the routing for GPUs.

Cable routing	From	To
	1 GPU power cable	Power connector on the riser 1
	2 GPU power cable	Power connector on the riser 2
	3 GPU power cable	GPU power connector on the system board
	Notes: • The illustration shows one GPU adapter installed on each riser card. If there are two GPU adapters installed, the GPU power cable is a Y cable. • If your GPU adapter TDP is equal to or lower than 75 watts, the adapter can be powered directly by the riser slot. Power cable connection is no needed.	

If you need to install an M.2 backplane on the GPU air baffle, refer to below illustration for cable routing on the air baffle. Route the GPU power cable from riser 2 beneath the M.2 backplane holder to the GPU power connector on the GPU adapter.
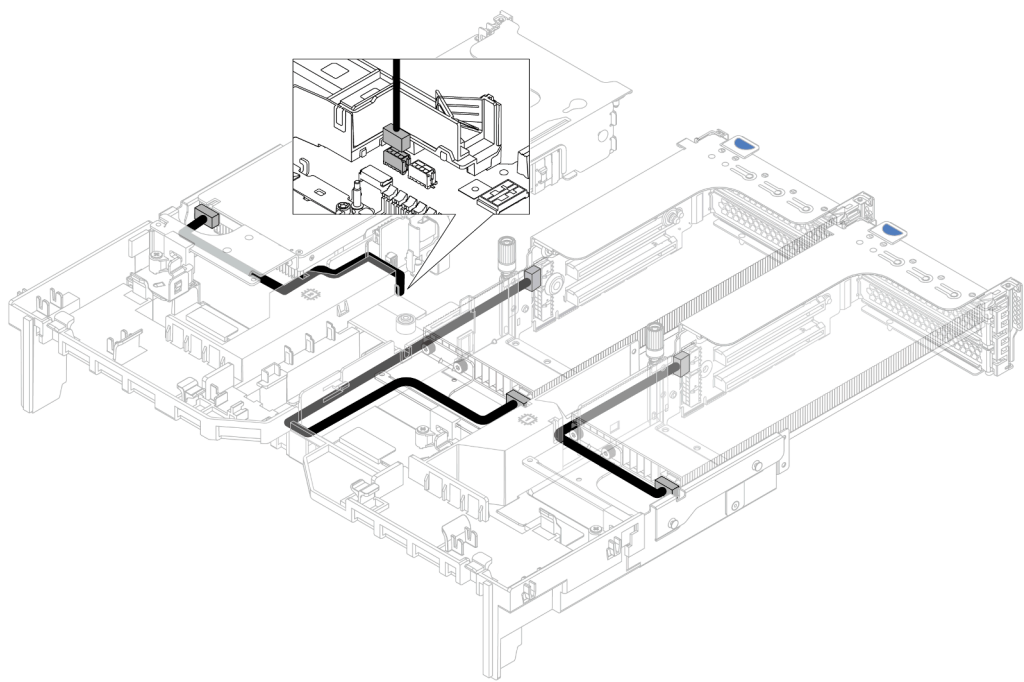
Riser cards

Use this section to understand the cable routing for riser cards.

The server supports up to three riser cards: riser card 1, riser card 2, and riser card 3. Riser card 1 or 2 is installed directly on the system board, while riser card 3 needs to be connected to system board.

Note: When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.

- "Riser card 3 power and sideband connection" on page 72
- "Riser card 3 (x8/x8 PCIe) signal cable connection for one processor" on page 73
- "Riser card 3 (x8/x8 PCIe) signal cable connection for two processors" on page 74
- "Riser card 3 (x16/x16 PCIe) signal cable connection for one processor" on page 75
- "Riser card 3 (x16/x16 PCIe) signal cable connection for two processors" on page 76

The riser card types vary by server model. For detailed information, see "PCIe slots and PCIe adapters" on page 256.

Riser card 3 power and sideband connection

The power and sideband connections for x8/x8 PCIe riser card 3 and x16/x16 PCIe riser card 3 are the same.
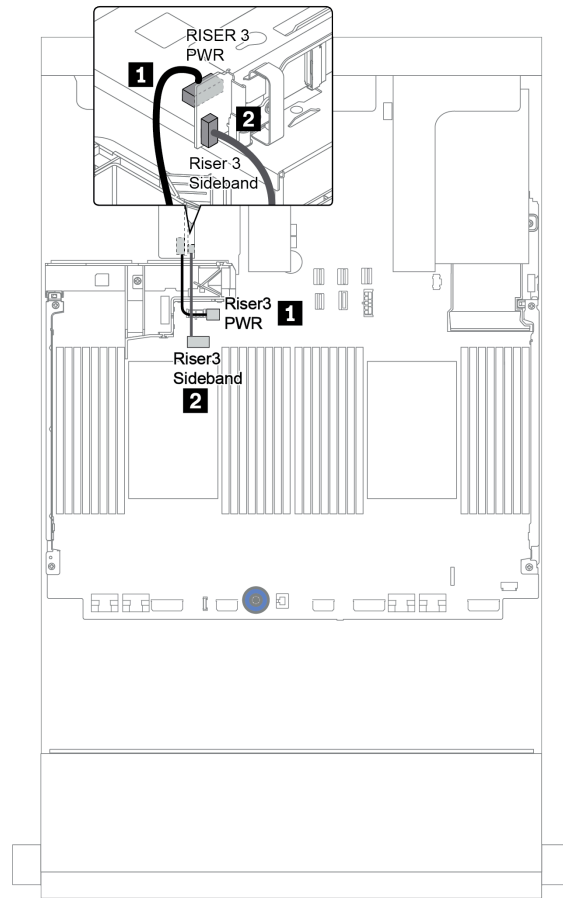
Figure 18. Riser card 3 power and sideband connection

From	To
1 Power connector on the riser card	Riser 3 power connector on the system board
2 Sideband connector on the riser card	Riser 3 sideband on the system board

Riser card 3 (x8/x8 PCIe) signal cable connection for one processor

The following illustration shows the signal cable connections for the x8/x8 PCIe riser card 3 when only one processor is installed.

Notes: The below option kits are needed when you want to add the x8/x8 PCIe riser card 3 if your server comes with only one processor and no riser 3:
- ThinkSystem SR650 V2 PCIe G4 x8/x8 Riser 3 Option Kit
- ThinkSystem SR650 V2 x8/x8 PCIe G4 Riser3 Cable Kit for CPU1
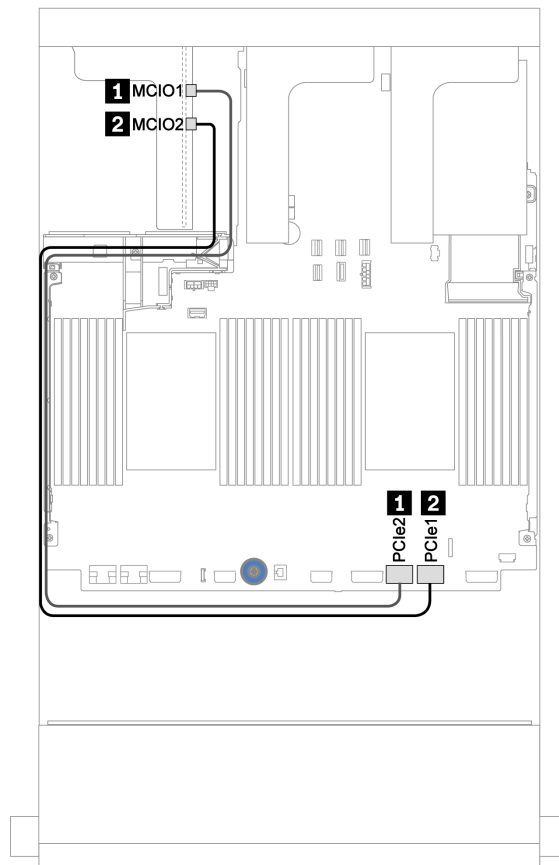
Figure 19. Cable routing for the x8/x8 PCIe riser card 3 (one processor)
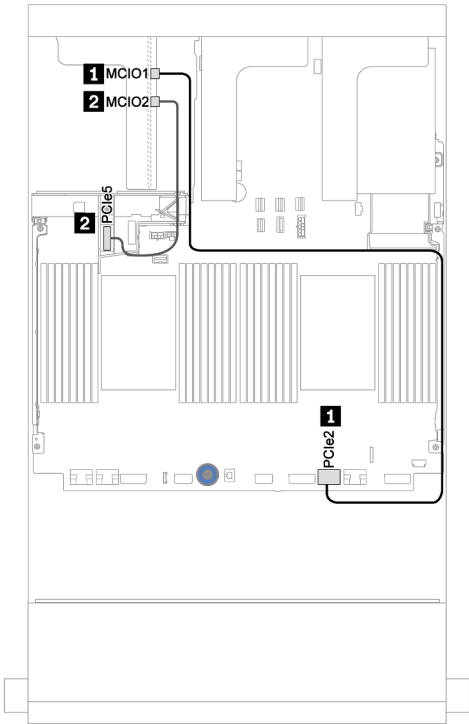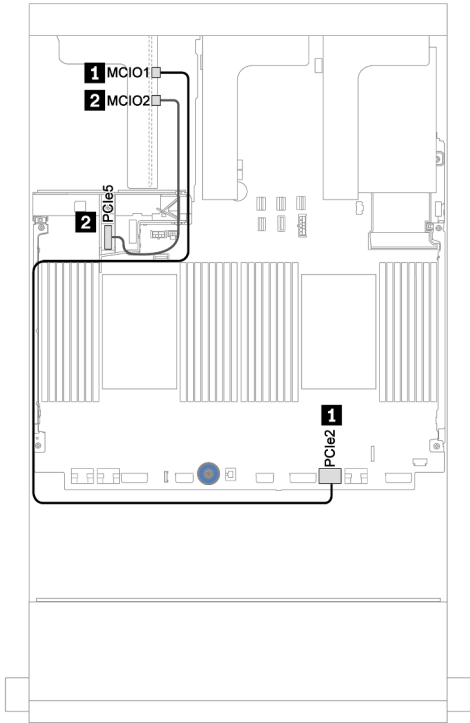
From	To
1 MCIO 1 on the riser card	PCIe connector 2 on the system board
2 MCIO 2 on the riser card	PCIe connector 1 on the system board

Riser card 3 (x8/x8 PCIe) signal cable connection for two processors

The following illustration shows the signal cable connections for the x8/x8 PCIe riser card 3 when two processors are installed.

Notes:
- The below option kit is needed when you want to add the x8/x8 PCIe riser card 3 if your server comes with two processors and no riser 3:
  - ThinkSystem SR650 V2 PCIe G4 x8/x8 Riser 3 Option Kit
- The below option kit is needed when you want to add a second processor if your server comes with one processor and the x8/x8 PCIe riser card 3:
  - ThinkSystem SR650 V2 x8/x8 PCIe G4 Riser3 Cable Kit for CPU1

	For configuration with 32 NVMe drives

From	To	From	To
1 MCIO 1 on the riser card	PCIe connector 2 on the system board	**1** MCIO 1 on the riser card	PCIe connector 2 on the system board
2 MCIO 2 on the riser card	PCIe connector 5 on the system board	**2** MCIO 2 on the riser card	PCIe connector 5 on the system board

Riser card 3 (x16/x16 PCIe) signal cable connection for one processor

The following illustration shows the signal cable connections for the x16/x16 PCIe riser card 3 when only one processor is installed.

Notes: The below option kit is needed when you want to add the x16/x16 PCIe riser card 3 if your server comes with only one processor and no riser 3. In this scenario, only PCIe slot 7 is available.
- ThinkSystem SR650 V2 PCIe G4 x16/x16 Riser3 Option Kit
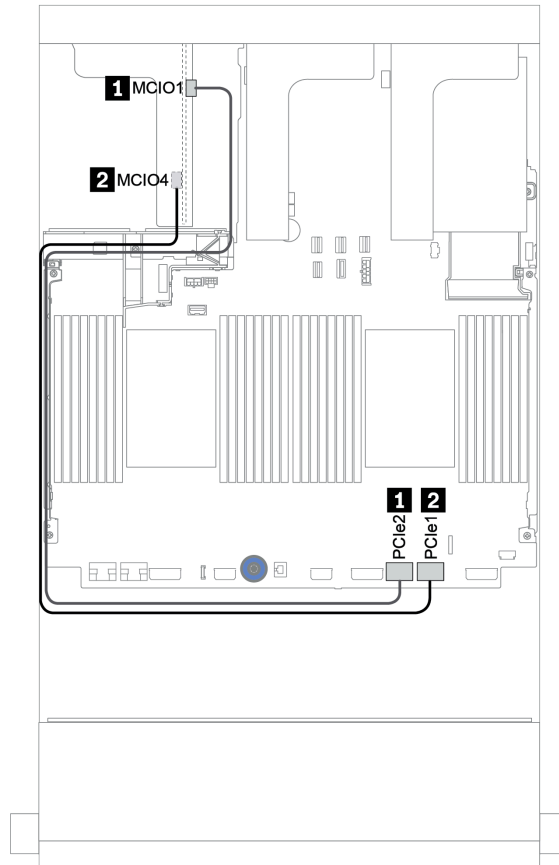
Figure 20. Cable routing for the x16/x16 PCIe riser card 3 (one processor)

From	To
1 MCIO 1 on the riser card	PCIe connector 2 on the system board
2 MCIO 4 on the riser card	PCIe connector 1 on the system board

Riser card 3 (x16/x16 PCIe) signal cable connection for two processors

The following illustration shows the signal cable connections for the x16/x16 PCIe riser card 3 when two processors are installed.

Notes:
- The below option kit is needed when you want to add the x16/x16 PCIe riser card 3 if your server comes with two processors and no riser 3:
  - ThinkSystem SR650 V2 PCIe G4 x16/x16 Riser3 Option Kit
- The below option kit is needed when you want to add a second processor if your server comes with one processor and the x16/x16 PCIe riser card 3:
  - ThinkSystem SR650 V2 x16/x16 PCIe G4 Riser3 Cable Kit for CPU1

	For configuration with 32 NVMe drives

From	To	From	To
1 MCIO 1 and MCIO 4 on the riser card	PCIe connectors 1 and 2 respectively on the system board	**1** MCIO 1 on the riser card	PCIe connector 2 on the system board
2 MCIO 2 and MCIO 3 on the riser card	PCIe connectors 5 and 6 respectively on the system board	**2** MCIO 2 and MCIO 3 on the riser card	PCIe connectors 5 and 6 respectively on the system board
		3 MCIO 4 on the riser card	PCIe connectors 1 on the system board

RAID flash power module

Use this section to understand the cable routing for RAID flash power modules (also called supercap).

The location of RAID flash power modules varies by the server hardware configurations.

Figure 21. On the chassis
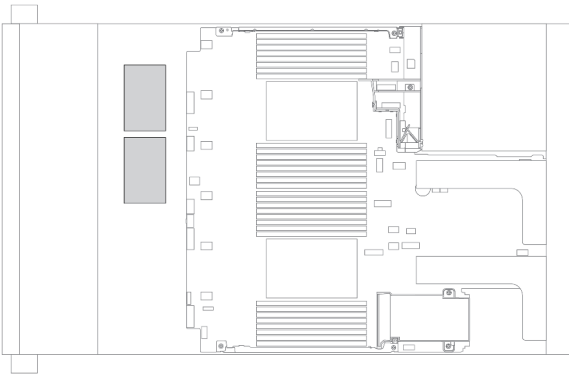
Figure 22. On standard air baffle

Figure 23. On GPU air baffle
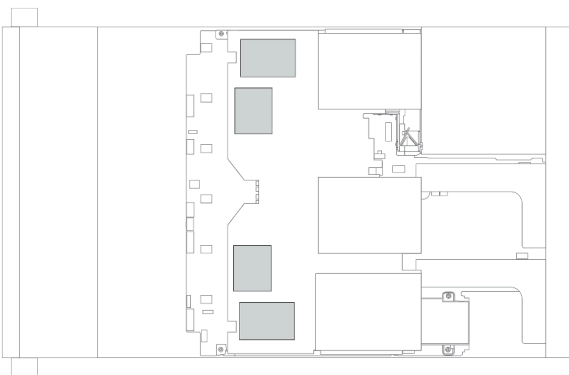
Figure 24. On the 2.5-inch middle drive cage
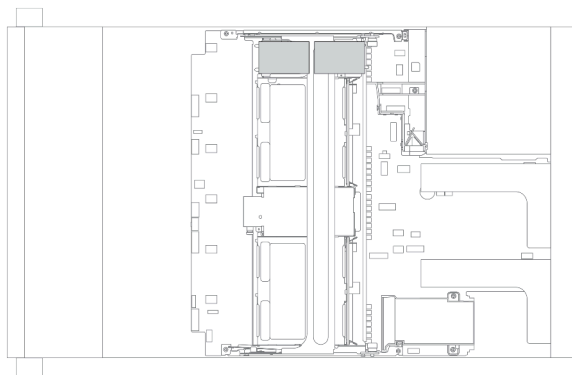
Note: The supercap holder on the chassis is not supported if the 12 x 3.5-inch drive backplane with expander is installed.

An extension cable is provided for each RAID flash power module for cable connection. Connect the cable from the RAID flash power module to the corresponding RAID adapter as shown.
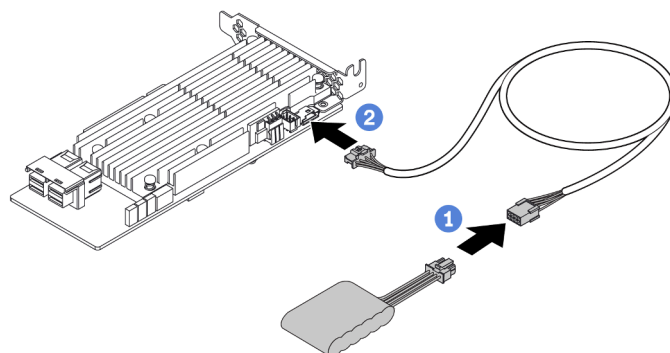
From	To
RAID flash power module	Supercap connector on the RAID adapter

7mm drives

This section provides cable routing information for the 7mm drives.
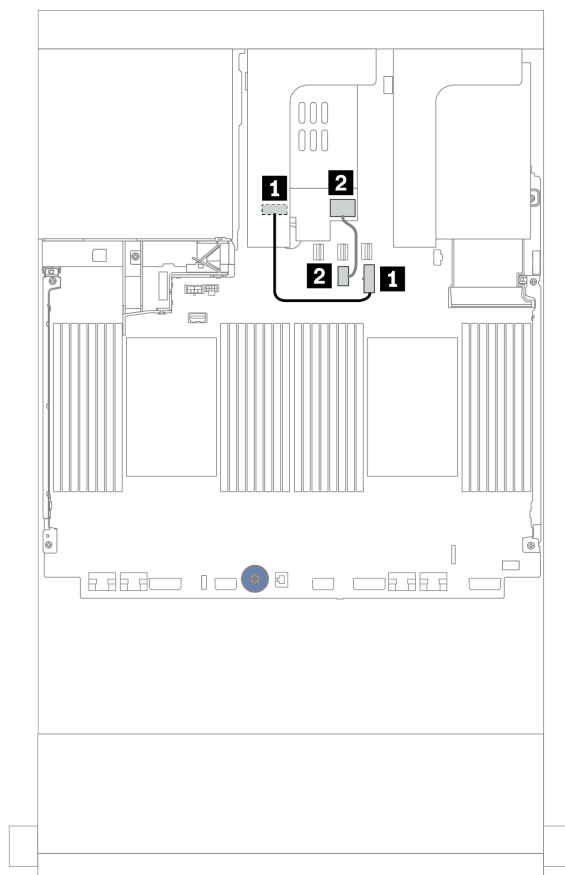
Figure 25. Cable routing for 7mm drives

From	To
1 Power connector on the 7mm backplane	7mm power connector on the system board
2 Signal connector on the 7mm backplane	7mm signal connector on the system board

M.2 drives

This section provides cable routing information for the M.2 drives.

The location of the M.2 module **1** varies by the server hardware configurations.

Table 22. M.2 module location

Figure 26. On standard air baffle	*Figure 27. On GPU air baffle*
Figure 28. On 8 x 2.5 middle drive cage	*Figure 29. On 4 x 3.5 middle drive cage*
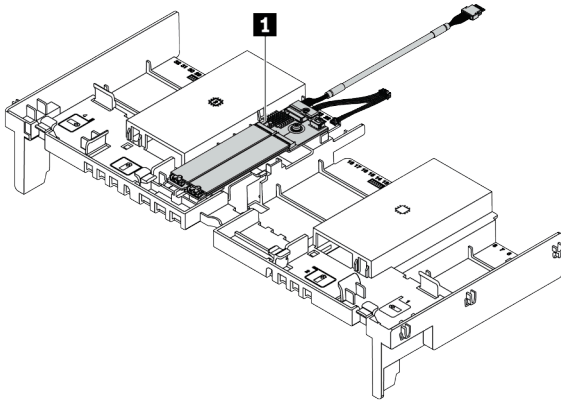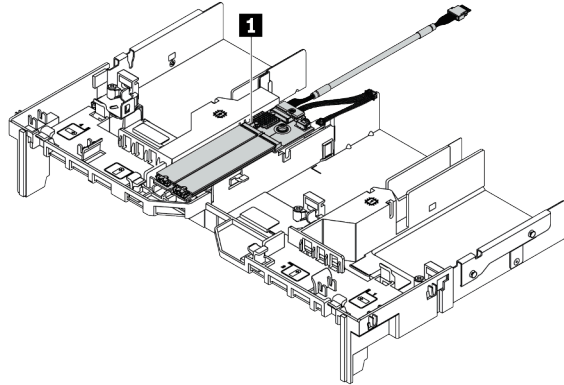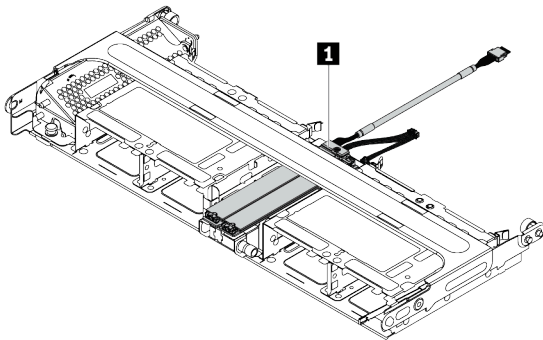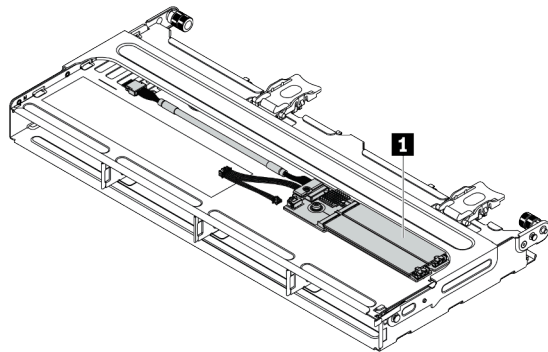
The following illustration shows the cable connection for M.2 module on the air baffle. It is the same for the M.2 module on other locations.
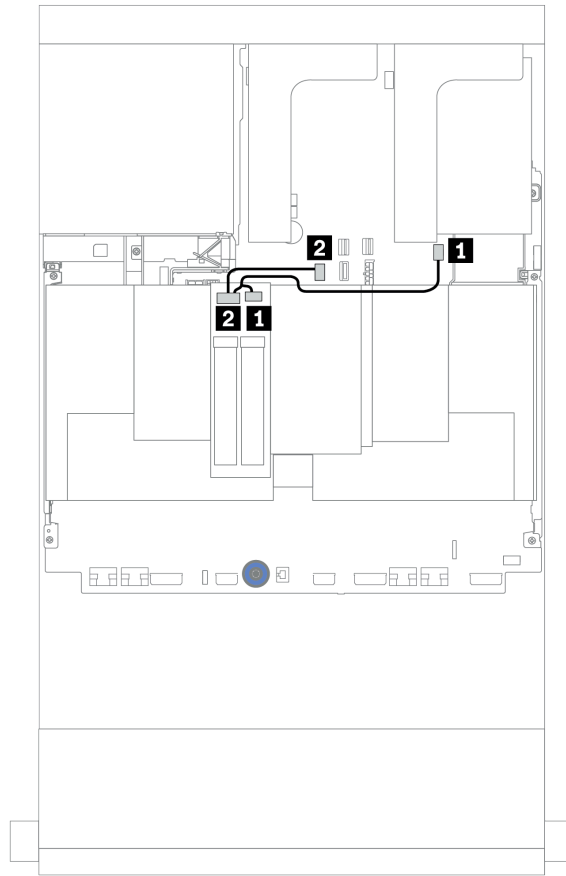
Figure 30. Cable routing for M.2 drives

From	To
1 M.2 power cable	M.2 power connector on the system board
2 M.2 signal cable	M.2 signal connector on the system board

DPU adapter

This section provides cable routing information for the ThinkSystem NVIDIA BlueField-2 25GbE SFP56 2-Port PCIe Ethernet DPU w/BMC & Crypto (DPU adapter).
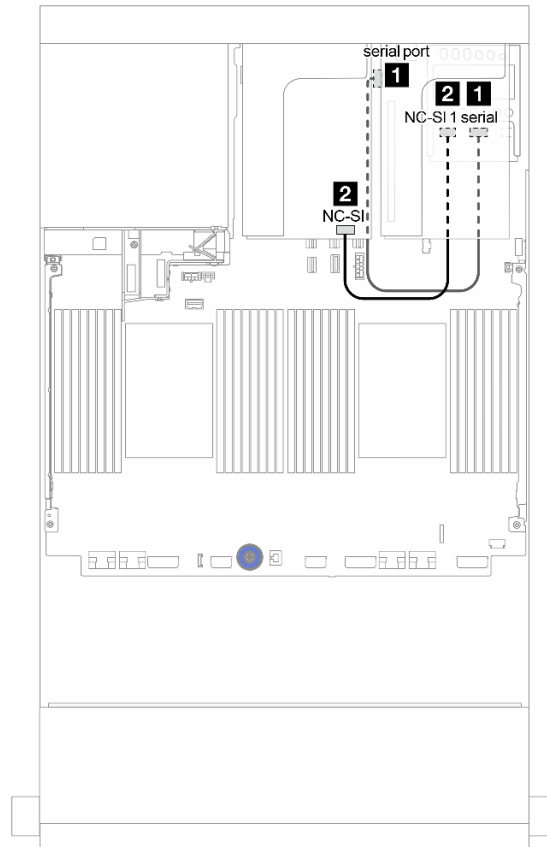
Figure 31. Cable routing for the DPU adapter

From	To
1 OCP enablement kit for vSphere DSE: serial connector	System board: serial port connector
2 OCP enablement kit for vSphere DSE: NC-SI 1 connector	DPU adapter: NC-SI connector

Backplanes: server models with 2.5-inch drive backplanes

This section provides backplane cable connection information for server models with 2.5-inch drive backplanes.

Before you start

Ensure below parts are removed before starting cable routing for front backplanes.
- Top cover (see "Remove the top cover" on page 435)
- Air baffle (see "Remove the air baffle" on page 265)
- Fan cage (see "Remove the system fan cage" on page 426)

Power cable connections

Connect the power cables for the front 2.5-inch drive backplanes as illustrated. Power cable connections are the same for the following 8 x 2.5-inch front drive backplanes.
- 8 x 2.5-inch SAS/SATA backplane
- 8 x 2.5-inch NVMe backplane
- 8 x 2.5-inch AnyBay backplane
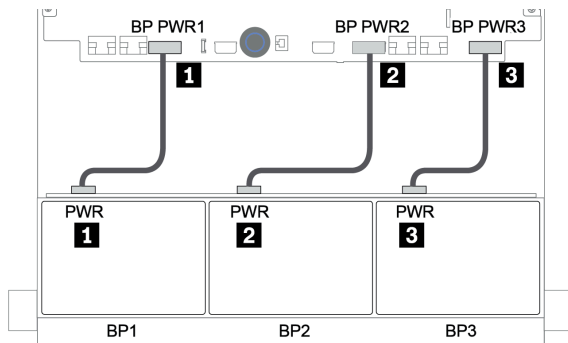
Figure 32. Power cable connections for 8 x 2.5-inch drive backplanes

Signal cable connections

Refer to the specific topic for signal cable connections depending on the backplanes you have installed.
- SAS/SATA:
  - "One 8 x SAS/SATA backplane" on page 88
  - "Two 8 x SAS/SATA backplanes" on page 93
  - "Three 8 x SAS/SATA backplanes" on page 97
- NVMe:
  - "One 8 x NVMe backplane" on page 125
  - "Two 8 x NVMe backplanes" on page 128
  - "Three 8 x NVMe backplanes" on page 129
- AnyBay:
  - "One 8 x AnyBay backplane" on page 132
  - "8i RAID adapters (Tri-mode)" on page 140
  - "Three 8 x AnyBay backplanes" on page 142
- SAS/SATA, NVMe, and AnyBay combinations:
  - "One 8 x SAS/SATA and one 8 x NVMe backplanes" on page 143
  - "One 8 x SAS/SATA and one 8 x AnyBay backplanes" on page 150
  - "One 8 x AnyBay and one 8 x NVMe backplanes" on page 157
  - "One 8 x SAS/SATA and two 8 x NVMe backplanes" on page 158
  - "One 8 x SAS/SATA and two 8 x AnyBay backplanes" on page 160
  - "Two 8 x SAS/SATA and one 8 x NVMe backplanes" on page 163

Controller selections

This section provides controller selection information for configurations with 2.5-inch front drive bays.

The server supports both Gen 3 and Gen 4 RAID/HBA adapters:
- **Gen 3 RAID/HBA adapters**: 430-8i, 4350-8i, 430-16i, 4350-16i, 530-8i, 5350-8i, 530-16i, 930-8i, 9350-8i, 930-16i, 9350-16i
- **Gen 4 RAID/HBA adapters**: 440-8i, 440-16i, 540-8i, 540-16i, 940-8i, 940-16i, 940-32i

For more information about the controllers, see "Technical specifications" on page 3.

The following table lists the supported controller combinations for configurations with 2.5-inch front drive bays.

S/S: SATA/SAS, Any: AnyBay, OB: onboard, EXP: expander

Front bays			Mid bays		Rear bays		CPUs	Controllers
S/S 2.5"	NVM-e 2.5"	Any 2.5"	S/S 2.5"	NVM-e 2.5"	S/S 2.5"	S/S 3.5"		
8	0	0	0	0	0	0	1 or 2	"OB SATA" on page 89
							1 or 2	"1 x RAID/HBA 8i" on page 90
							1 or 2	"1 x RAID/HBA 16i" on page 90
							1 or 2	"CFF RAID 8i" on page 91
							1 or 2	"CFF RAID/HBA 16i" on page 92
16	0	0	0	0	0	0	1 or 2	"OB SATA + 1 x RAID 8i" on page 94
							1 or 2	"2 x RAID/HBA 8i" on page 95
							1 or 2	"1 x RAID/HBA 16i" on page 95
							1 or 2	"1 x RAID 32i" on page 95
							1 or 2	"CFF RAID/HBA 16i" on page 96
24	0	0	0	0	0	0	1 or 2	"3 x RAID 8i" on page 98
							1 or 2	"1 x RAID/HBA 32i" on page 99
							1 or 2	"1 x HBA 16i + 1 x RAID 530-8i" on page 100
							1 or 2	"2 x HBA 8i + 1 x RAID 530-8i" on page 98
							1 or 2	"1 x RAID/HBA 8i + CFF EXP" on page 101
							1 or 2	"CFF RAID/HBA 16i + CFF EXP" on page 102
24	0	0	0	0	4	0	2	"4 x RAID 8i" on page 105
							1 or 2	"1 x RAID 32i" on page 107
							1 or 2	"CFF EXP + 1 x RAID/HBA 8i" on page 109
							2	"CFF EXP + CFF RAID/HBA 16i" on page 111
24	0	0	8	0	0	0	2	"CFF EXP + CFF RAID/HBA 16i" on page 113

Front bays			Mid bays		Rear bays		CPUs	Controllers
S/S 2.5"	NVMe 2.5"	Any 2.5"	S/S 2.5"	NVMe 2.5"	S/S 2.5"	S/S 3.5"		
24	0	0	8	0	4	0	2	"CFF EXP + 1 x RAID/HBA 8i" on page 116
							2	"CFF EXP + CFF RAID/HBA 16i" on page 118
24	0	0	8	0	8	0	2	"CFF EXP + CFF RAID/HBA 16i" on page 121
							2	"CFF EXP + 1 x RAID/HBA 16i" on page 123
0	8	0	0	0	0	0	2	"OB NVMe" on page 126
							1 or 2	"OB NVMe + 1 x Retimer" on page 127
0	16	0	0	0	0	0	2	"OB NVMe + 1 x Retimer" on page 128
	24	0	0	0	0	0	2	"OB NVMe + 3 x Retimer" on page 130
0	24	0	0	8	0	0	2	"4 x 1611-8P" on page 131
8	8	0	0	0	0	0	2	"OB SATA + OB NVMe" on page 144
							2	"1 x RAID/HBA 8i + OB NVMe" on page 145
							2	"1 x RAID/HBA 16i + OB NVMe" on page 145
							2	"1 x CFF RAID 8i + OB NVMe" on page 146
							2	"CFF RAID/HBA 16i + OB NVMe" on page 147
							1 or 2	"OB SATA + OB NVMe + Retimer" on page 148
							1 or 2	"1 x RAID/HBA 8i + OB NVMe + Retimer" on page 149
							1 or 2	"1 x RAID/HBA 16i + OB NVMe + Retimer" on page 149
16	8	0	0	0	0	0	2	"CFF RAID/HBA 16i + OB NVMe" on page 164
							2	"1 x RAID/HBA 8i + CFF EXP + OB NVMe" on page 165
							1 or 2	"1 x RAID/HBA 8i + CFF EXP + Retimer" on page 166
8	16	0	0	0	0	0	2	"1 x RAID/HBA 8i + OB NVMe + Retimer" on page 158
							2	"1 x RAID/HBA 16i + OB NVMe + Retimer" on page 158
0	0	8	0	0	0	0	2	"OB SATA + OB NVMe" on page 133
							2	"1 x RAID/HBA 8i + OB NVMe" on page 134
							2	"1 x RAID/HBA 16i + OB NVMe" on page 134
							2	"CFF RAID 8i + OB NVMe" on page 135
							2	"CFF RAID/HBA 16i + OB NVMe" on page 136
							1 or 2	"1 x RAID/HBA 8i + OB NVMe + Retimer" on page 137

Front bays			Mid bays		Rear bays		CPUs	Controllers
S/S 2.5"	NVMe 2.5"	Any 2.5"	S/S 2.5"	NVMe 2.5"	S/S 2.5"	S/S 3.5"		
							1 or 2	"1 x RAID/HBA 16i + OB NVMe + Retimer" on page 137
							1 or 2	"1 x RAID 940-8i Tri-mode" on page 138
0	0	16	0	0	0	0	1 or 2	"2 x RAID 940-8i Tri-mode" on page 140
							1 or 2	"1 x CFF RAID 940-16i Tri-mode" on page 141
0	0	24	0	0	0	0	1 or 2	"3 x RAID 940-8i Tri-mode" on page 142
0	8	8	0	0	0	0	2	"1 x RAID/HBA 8i + OB NVMe + Retimer" on page 157
							2	"1 x RAID/HBA 16i + OB NVMe + Retimer" on page 157
8	0	8	0	0	0	0	2	"2 x RAID/HBA 8i + OB NVMe" on page 151
							2	"1 x RAID/HBA 16i + OB NVMe" on page 151
							2	"1 x RAID/HBA 32i + OB NVMe" on page 151
							2	"CFF RAID/HBA 16i + OB NVMe" on page 152
							1 or 2	"2 x RAID/HBA 8i + OB NVMe + Retimer" on page 153
							1 or 2	"1 x RAID/HBA 16i + OB NVMe + Retimer" on page 153
							1 or 2	"OB SATA + 1 x RAID 940-8i Tri-mode" on page 154
							1 or 2	"1 x RAID/HBA 8i + 1 x RAID 940-8i Tri-mode" on page 155
							1 or 2	"1 x RAID/HBA 16i + 1 x RAID 940-8i Tri-mode" on page 155
							1 or 2	"CFF RAID/HBA 16i + 1 x RAID 940-8i Tri-mode" on page 156
8	0	16	0	0	0	0	1 or 2	"1x RAID/HBA 8i + 2 x RAID 940-8i Tri-mode" on page 161
							1 or 2	"1 x RAID/HBA 16i + 2 x RAID 940-8i Tri-mode" on page 161
							1 or 2	"1 x RAID/HBA 8i + 1 x RAID 940-16i Tri-mode" on page 162
							1 or 2	"1 x RAID/HBA 16i + 1 x RAID 940-16i Tri-mode" on page 162
16	0	8	0	0	0	0	2	"3 x RAID/HBA 8i + OB NVMe" on page 169
							2	"1 x RAID 32i + OB NVMe" on page 171
							2	"CFF EXP + 1 x RAID/HBA 8i + OB NVMe" on page 172

Front bays			Mid bays		Rear bays		CPUs	Controllers
S/S 2.5"	NVM-e 2.5"	Any 2.5"	S/S 2.5"	NVM-e 2.5"	S/S 2.5"	S/S 3.5"		
							2	"CFF RAID/HBA 16i + CFF EXP + OB NVMe" on page 174
							1 or 2	"1 x RAID 32i + OB NVMe + Retimer" on page 176
							1 or 2	"CFF EXP + 1 x RAID/HBA 8i + OB NVMe + Retimer" on page 177
16	0	8	0	0	4	0	2	"4 x RAID/HBA 8i + OB NVMe" on page 180
							2	"1 x RAID 32i + OB NVMe" on page 183
							2	"CFF EXP + 1 x RAID/HBA 8i + OB NVMe" on page 185
							2	"CFF RAID/HBA 16i + CFF EXP + OB NVMe" on page 188
							1 or 2	"1 x RAID 32i + OB NVMe + Retimer" on page 191
							1 or 2	"CFF EXP + 1 x RAID/HBA 8i + OB NVMe + Retimer" on page 193

One 8 x SAS/SATA backplane

This section provides cable routing information for the server model with one 8 x 2.5-inch SAS/SATA front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Onboard connectors" on page 89
- "8i/16i RAID/HBA adapter" on page 90
- "CFF 16i RAID/HBA adapter" on page 92

Onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA configuration with onboard connectors.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
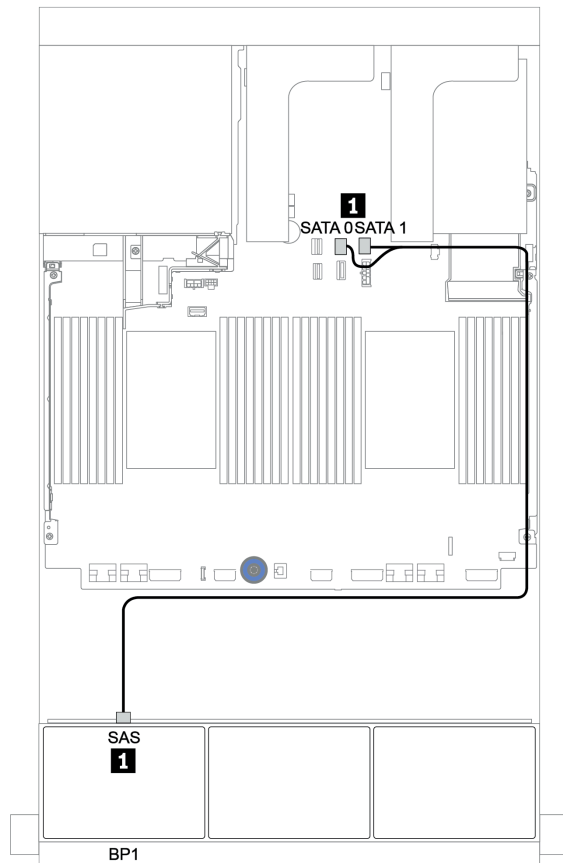
Figure 33. Cable routing for the 8 x 2.5-inch SAS/SATA configuration with onboard connectors

8i/16i RAID/HBA adapter

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA configuration with one 8i/16i RAID/HBA adapter.

From	To
Backplane 1: SAS	8i/16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
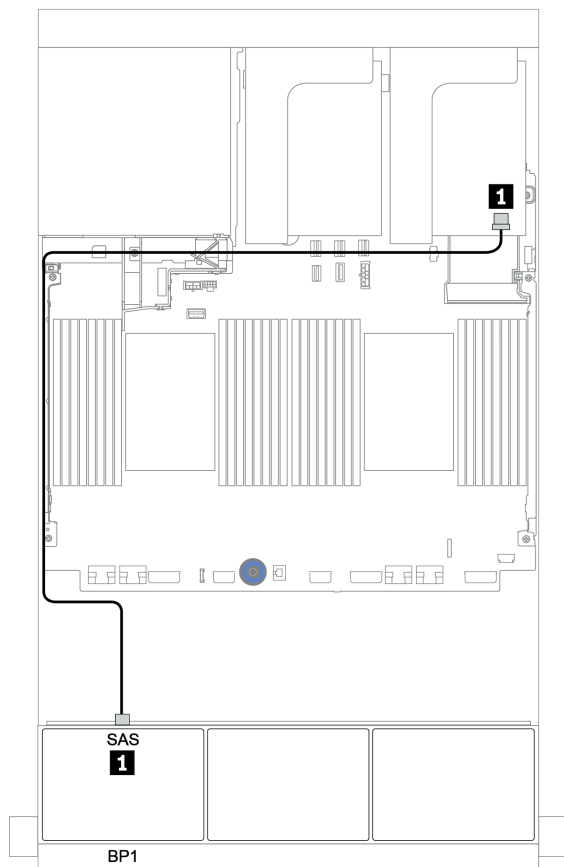
Figure 34. Cable routing for the 8 x 2.5-inch SAS/SATA configuration with one 8i/16i RAID/HBA adapter

CFF 8i RAID adapter

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA configuration with one CFF 8i RAID adapter.

From	To
Backplane 1: SAS	CFF 8i RAID adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 3
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 35. Cable routing for the 8 x 2.5-inch SAS/SATA configuration with one CFF 8i RAID adapter

CFF 16i RAID/HBA adapter

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	• When 2 CPUs installed: PCIe 3 or 5 • When 1 CPU installed: PCIe 1 or 2
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Notes:
- The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
- The following illustration shows the cable routing when two processors are installed. When only one processor is installed, the only different is cable **2** which should be connected to PCIe 1 or PCIe 2 on the system board.
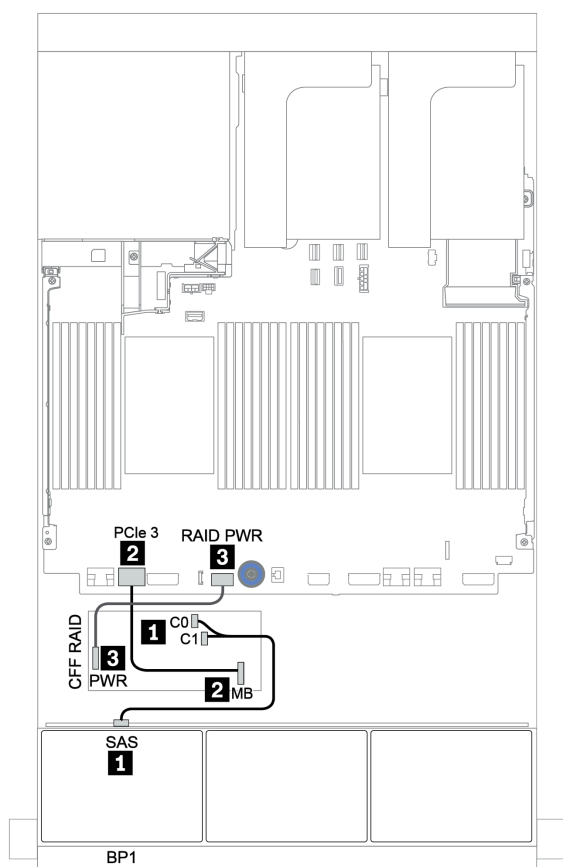
Figure 36. Cable routing for the 8 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter

Two 8 x SAS/SATA backplanes

This section provides cable routing information for the server model with two 8 x 2.5-inch SAS/SATA front drive backplanes.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "8i/16i/24i/32i RAID/HBA adapter" on page 95
- "CFF 16i RAID/HBA adapter" on page 96

Onboard connectors + 8i RAID adapter

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA configuration with one 8i RAID adapter.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 37. Cable routing for the 16 x 2.5-inch SAS/SATA configuration with one 8i RAID adapter

8i/16i/24i/32i RAID/HBA adapter

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA configuration with two 8i RAID/HBA adapters or one 16i/24i/32i RAID/HBA adapter.

From	To			
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0	24i RAID/HBA adapter on PCIe slot 2: C0C1	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C2C3 • Gen 4: C1	24i RAID/HBA adapter on PCIe slot 2: C2C3	32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	/	/	24i RAID/HBA adapter on PCIe slot 2: C4C5	/

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
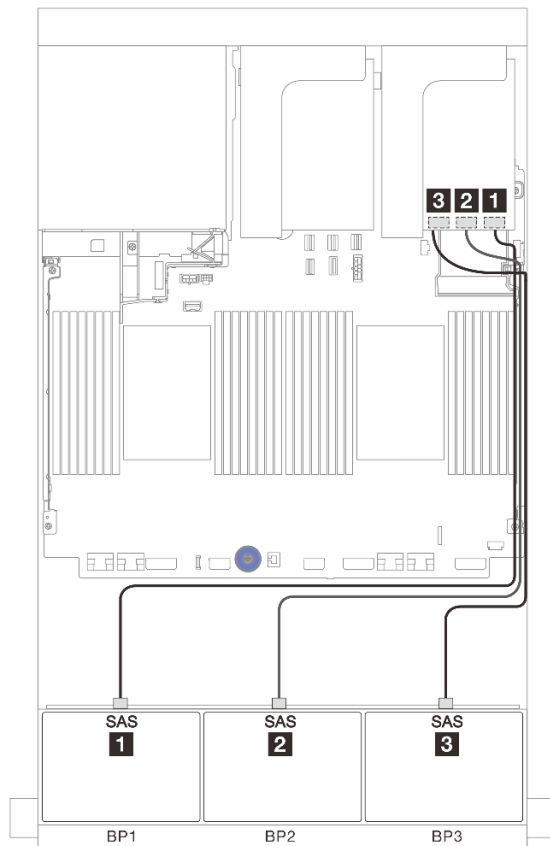
Figure 38. Cable routing for the 16 x 2.5-inch SAS/SATA configuration with two 8i RAID/HBA adapters or one 16i/24i/32i RAID/HBA adapter

CFF 16i RAID/HBA adapter

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
Backplane 2: SAS	CFF 16i RAID/HBA adapter: C2, C3
CFF 16i RAID/HBA adapter: MB (CFF input)	• When 2 CPUs installed: PCIe 3 or 5 • When 1 CPU installed: PCIe 1 or 2
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Notes:
- The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
- The following illustration shows the cable routing when two processors are installed. When only one processor is installed, the only different is cable **3** which should be connected to PCIe 1 or PCIe 2 on the system board.

Figure 39. Cable routing for 16 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter

Three 8 x SAS/SATA backplanes

This section provides cable routing information for the server model with three 8 x 2.5-inch SAS/SATA front drive backplanes.

To connect power cables for the front backplane(s), refer to .

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:

Front backplanes: 24 x SAS/SATA

3 x 8i RAID/HBA adapters

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0
Backplane 3: SAS	8i RAID/HBA adapter on PCIe slot 5: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 40. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with three 8i RAID/HBA adapters

24i/32i RAID adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	• 24i RAID adapter on PCIe slot 2: C0C1 • 32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	• 24i RAID adapter on PCIe slot 2: C2C3 • 32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	• 24i RAID adapter on PCIe slot 2: C4C5 • 32i RAID adapter on PCIe slot 2: C2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
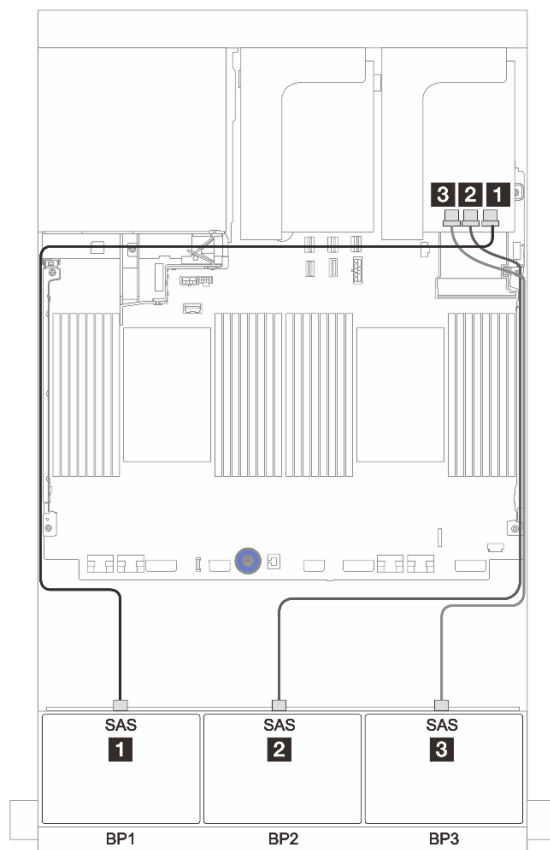
Figure 41. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one 24i/32i RAID adapter

16i HBA adapter + 8i RAID adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	16i RAID/HBA adapter on PCIe slot 2: C0C1
Backplane 2: SAS	16i RAID/HBA adapter on PCIe slot 2: C2C3
Backplane 3: SAS	8i RAID adapter on PCIe slot 3: C0C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
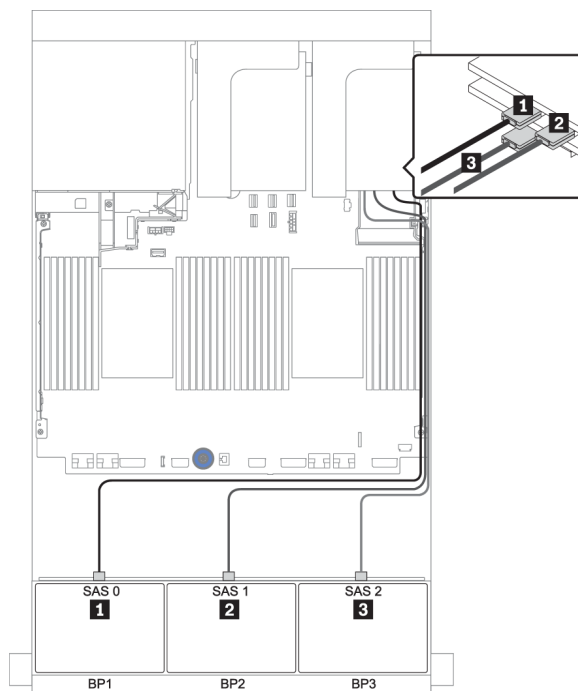
Figure 42. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one 16i HBA adapter and one 8i RAID adapter

CFF expander + 8i RAID/HBA adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 43. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF expander and one 8i RAID/HBA adapter

CFF 16i RAID/HBA adapter + CFF expander

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	• When 2 CPUs installed: PCIe 3 or 5 • When 1 CPU installed: PCIe 1 or 2
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Notes:
- The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
- The following illustration shows the cable routing when two processors are installed. When only one processor is installed, the only different is cable **5** which should be connected to PCIe 1 or PCIe 2 on the system board.

Figure 44. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter and one CFF expander

Front + rear backplanes: 24 x SAS/SATA + 4 x SAS/SATA

4 x 8i RAID/HBA adapters

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0
Backplane 3: SAS	8i RAID/HBA adapter on PCIe slot 5: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 45. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with three 8i RAID/HBA adapters

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for the rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	8i RAID/HBA adapter on PCIe slot 6: • Gen 3: C0C1 • Gen 4: C0
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 46. Cable routing for the rear 4 x 2.5-inch SAS/SATA backplane

32i RAID adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	• 24i RAID adapter on PCIe slot 2: C0C1 • 32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	• 24i RAID adapter on PCIe slot 2: C2C3 • 32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	• 24i RAID adapter on PCIe slot 2: C4C5 • 32i RAID adapter on PCIe slot 2: C2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 47. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one 24i/32i RAID adapter

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for the rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	32i RAID adapter on PCIe slot 2: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
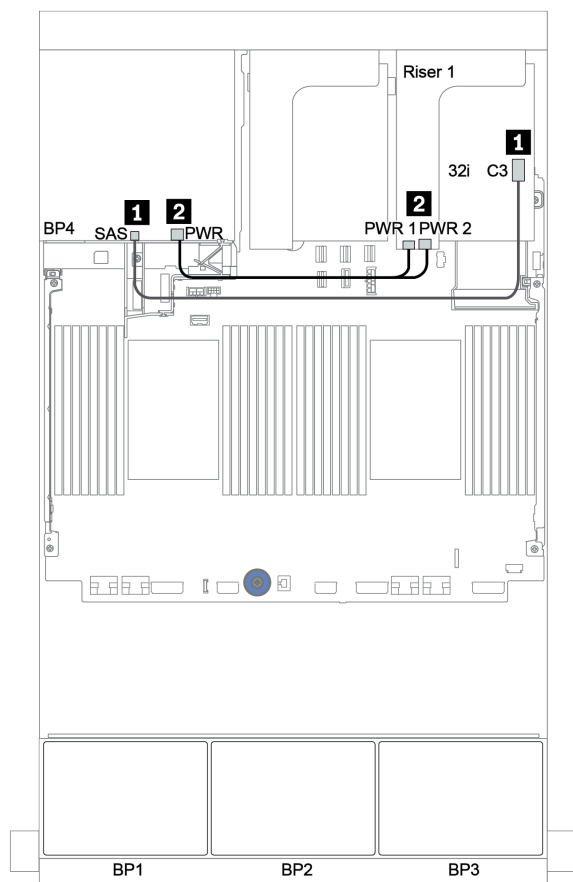
Figure 48. Cable routing for the rear 4 x 2.5 SAS/SATA backplane

CFF expander + 8i RAID/HBA adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 49. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF expander and one 8i RAID/HBA adapter

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for the 4 x 2.5-inch SAS/SATA rear backplane.

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
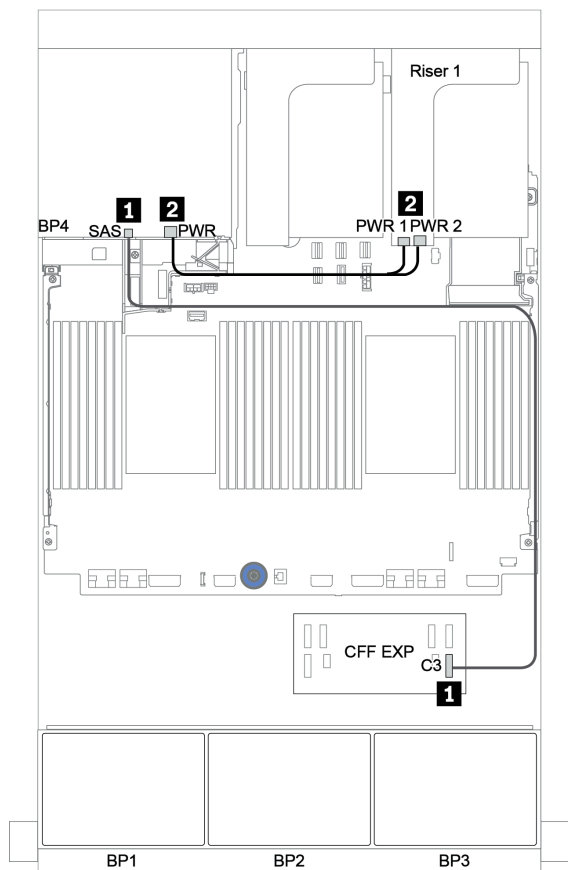
Figure 50. Cable routing for the 4 x 2.5-inch SAS/SATA rear backplane

CFF 16i RAID/HBA adapter + CFF expander

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 3
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 51. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter and one CFF expander

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for the 4 x 2.5-inch SAS/SATA rear backplane if installed.

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
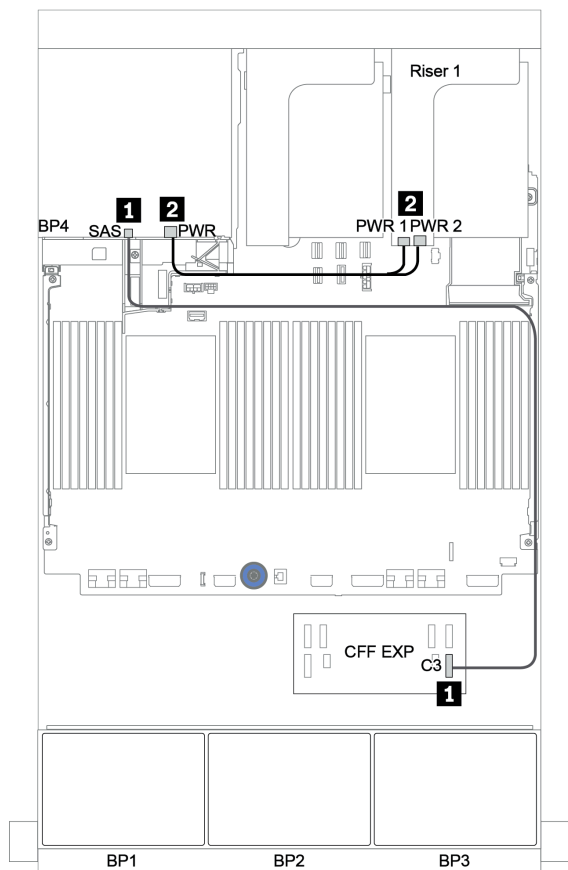
Figure 52. Cable routing for the 4 x 2.5-inch SAS/SATA rear backplane

Front + middle backplanes: 24 x SAS/SATA + 8 x SAS/SATA

- "Front backplanes: 24 x 2.5-inch SAS/SATA" on page 113
- "Middle backplanes: 8 x 2.5-inch SAS/SATA" on page 114

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 3
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

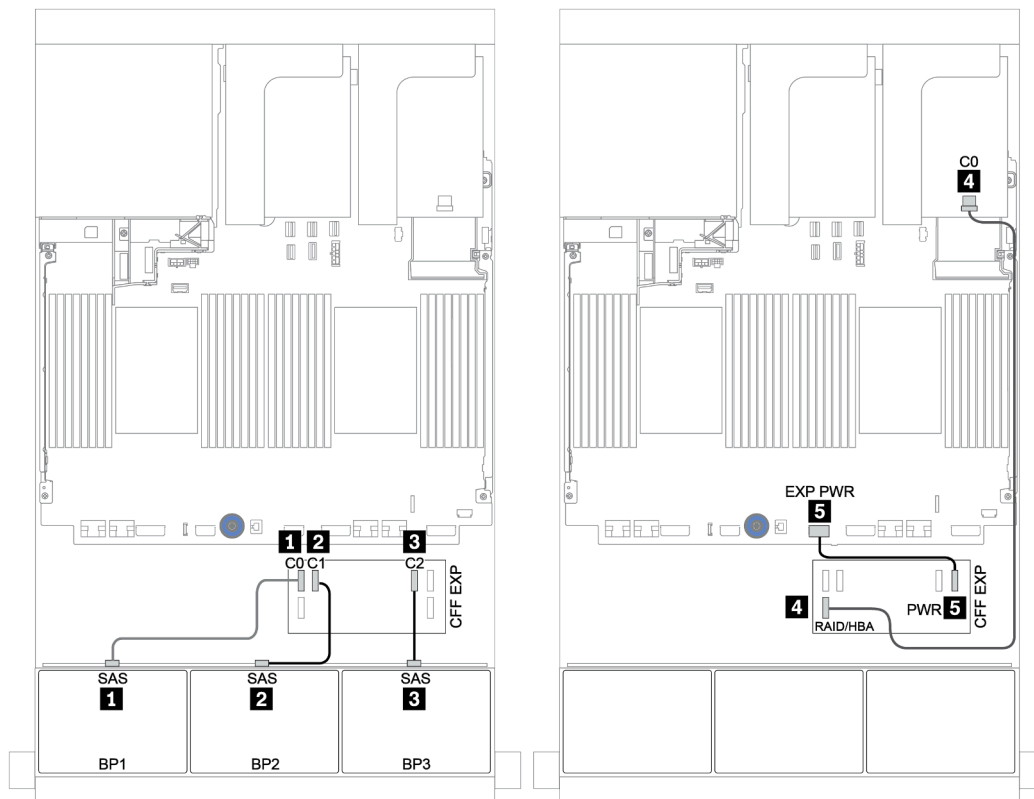Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
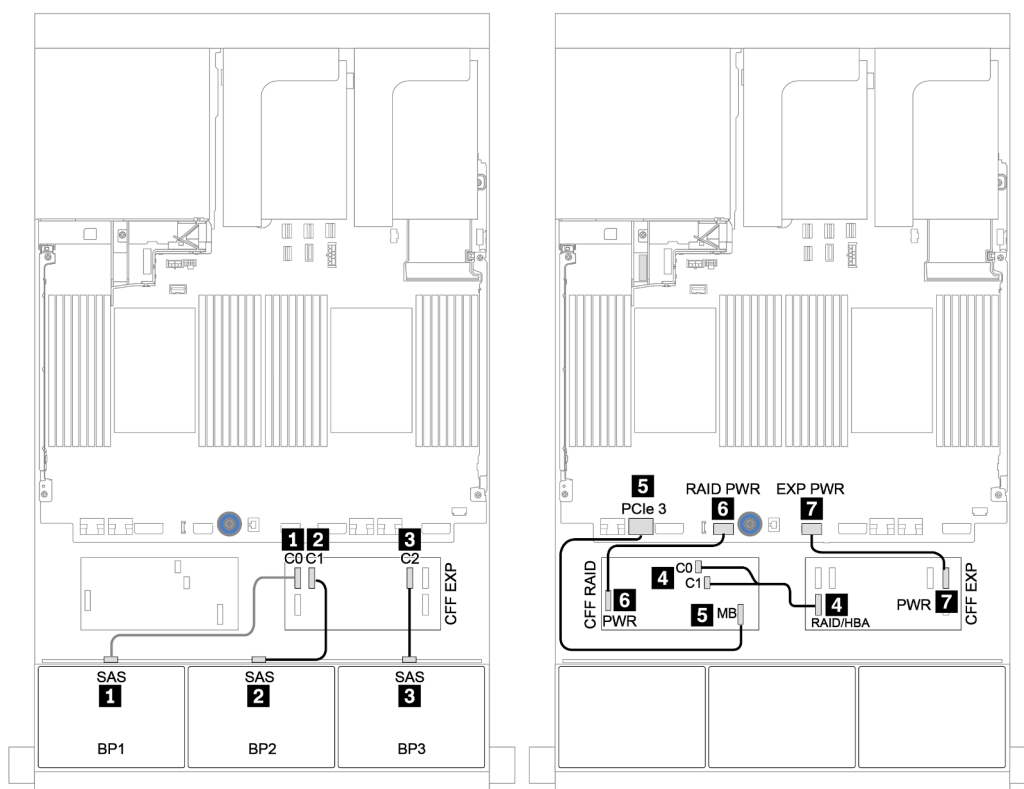

Figure 53. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one 8i adapter and one CFF expander

Middle backplanes: 8 x 2.5-inch SAS/SATA

From	To
Backplane 5: SAS	CFF expander: C3
Backplane 6: SAS	
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
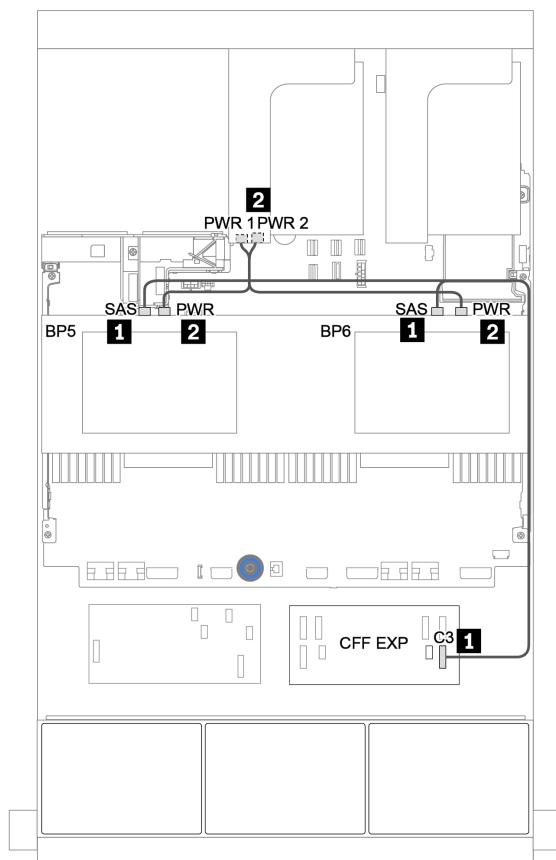
Figure 54. Cable routing for two middle 4 x 2.5 SAS/SATA backplanes

Front + middle + rear backplanes: 24 x SAS/SATA + 8 x SAS/SATA + 4 x SAS/SATA

- "CFF expander + 8i RAID/HBA adapter" on page 116
- "CFF 16i RAID/HBA adapter + CFF expander" on page 118

CFF expander + 8i RAID/HBA adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 55. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF expander and one 8i RAID/HBA adapter

Middle and rear backplanes: 8 x 2.5-inch SAS/SATA + 4 x 2.5-inch SAS/SATA

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 5: SAS	
Backplane 6: SAS	CFF expander: C4
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
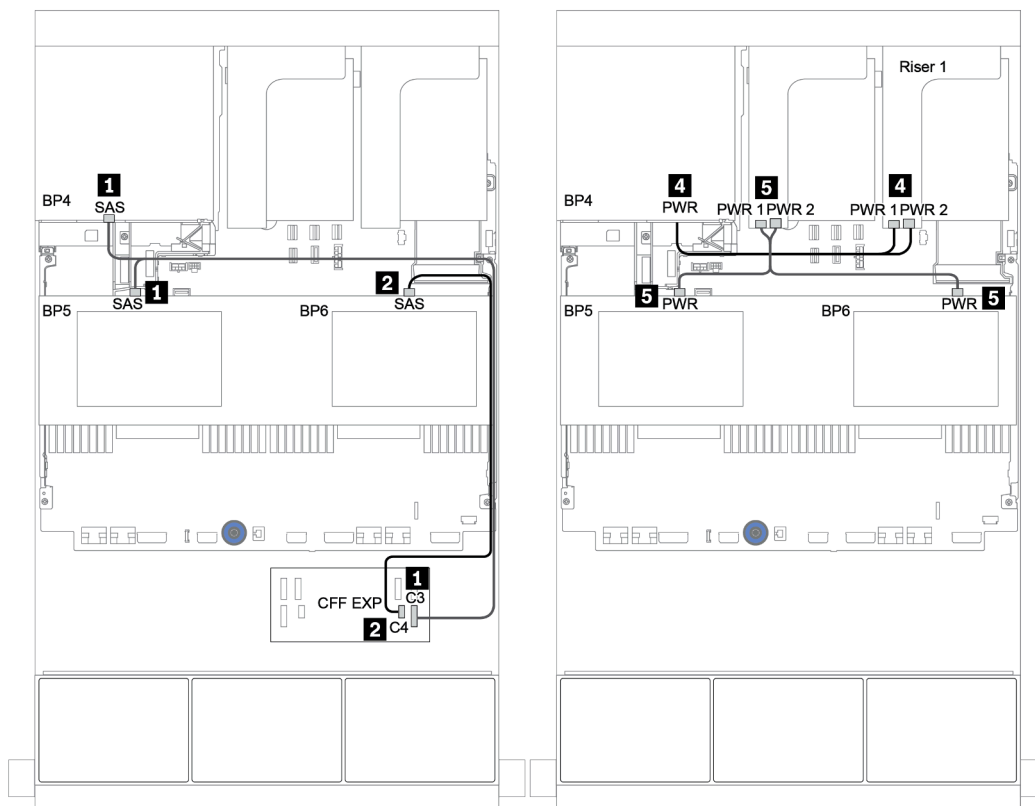
Figure 56. Cable routing for the two 4 x 2.5-inch SAS/SATA middle backplanes and one 4 x 2.5-inch SAS/SATA rear backplane

CFF 16i RAID/HBA adapter + CFF expander

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 3
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 57. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter and one CFF expander

Middle and rear backplanes: 8 x 2.5-inch SAS/SATA + 4 x 2.5-inch SAS/SATA

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 5: SAS	
Backplane 6: SAS	CFF expander: C4
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
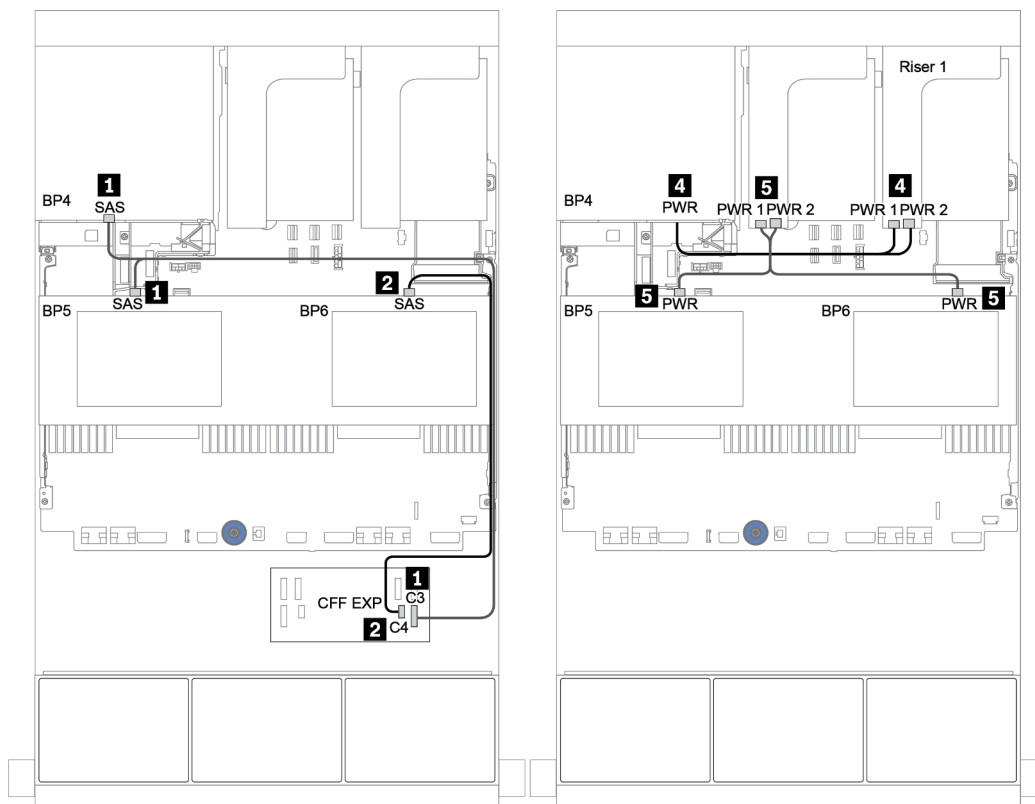
Figure 58. Cable routing for the 4 x 2.5-inch SAS/SATA middle backplanes and 4 x 2.5 SAS/SATA rear backplane

Front + middle + rear backplanes: 24 x SAS/SATA + 8 x SAS/SATA + 8 x SAS/SATA

CFF expander + CFF 16i RAID/HBA adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 3
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

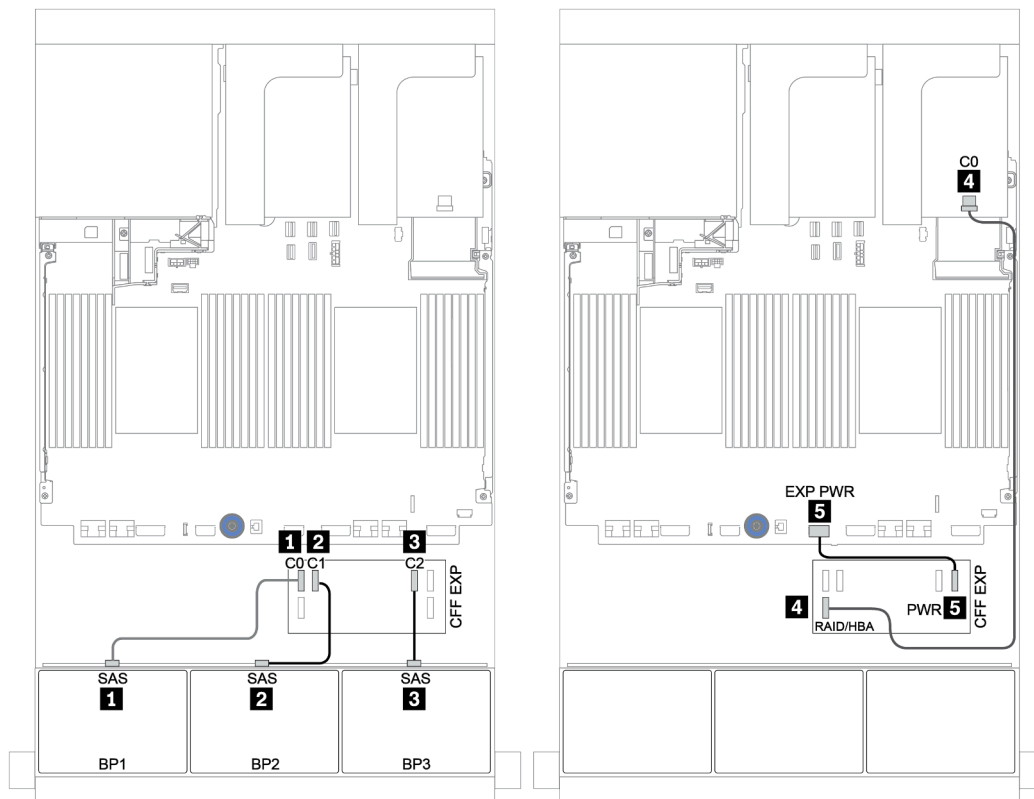**Note:** The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 59. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF 16i RAID/HBA adapter and one CFF expander

Middle and rear backplanes: 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch SAS/SATA

From	To
Backplane 4: SAS 0	CFF 16i RAID/HBA adapter: C2
Backplane 4: SAS 1	CFF 16i RAID/HBA adapter: C3
Backplane 5: SAS	CFF expander: C3
Backplane 6: SAS	
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
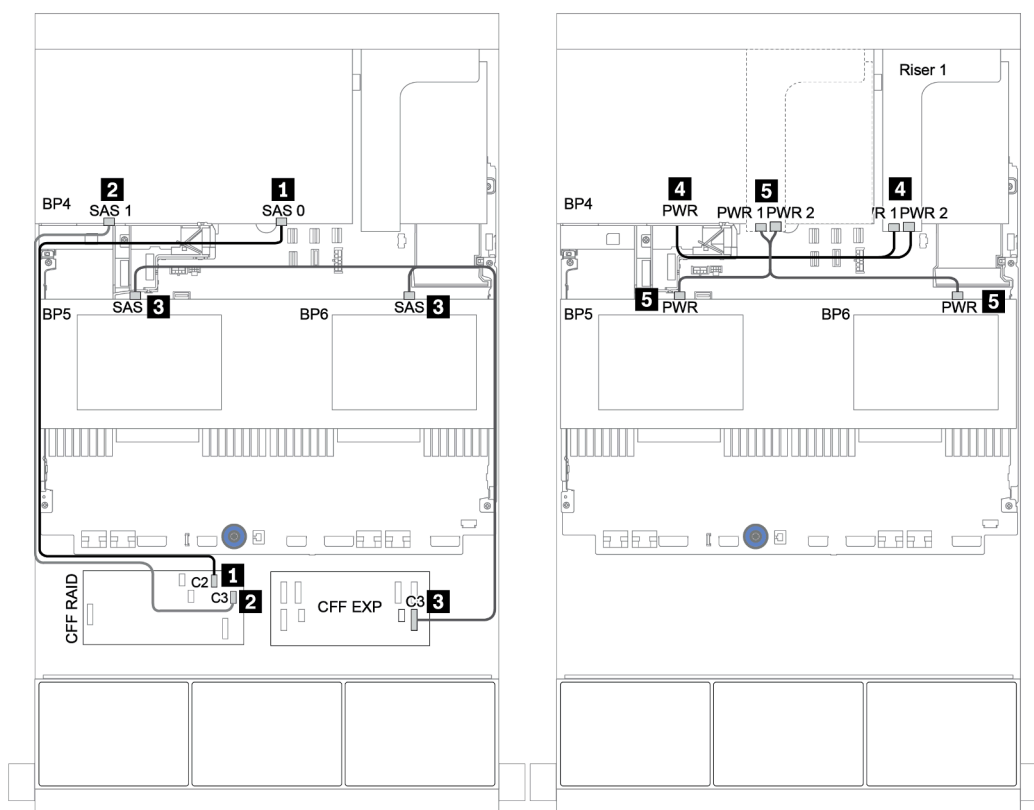
Figure 60. Cable routing for middle 4 x 2.5 SAS/SATA backplanes and rear 8 x 2.5 SAS/SATA backplane

CFF expander + 430/4350-16i adapter

Front backplanes: 24 x 2.5-inch SAS/SATA

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	16i RAID/HBA adapter on PCIe slot 2: C0C1
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
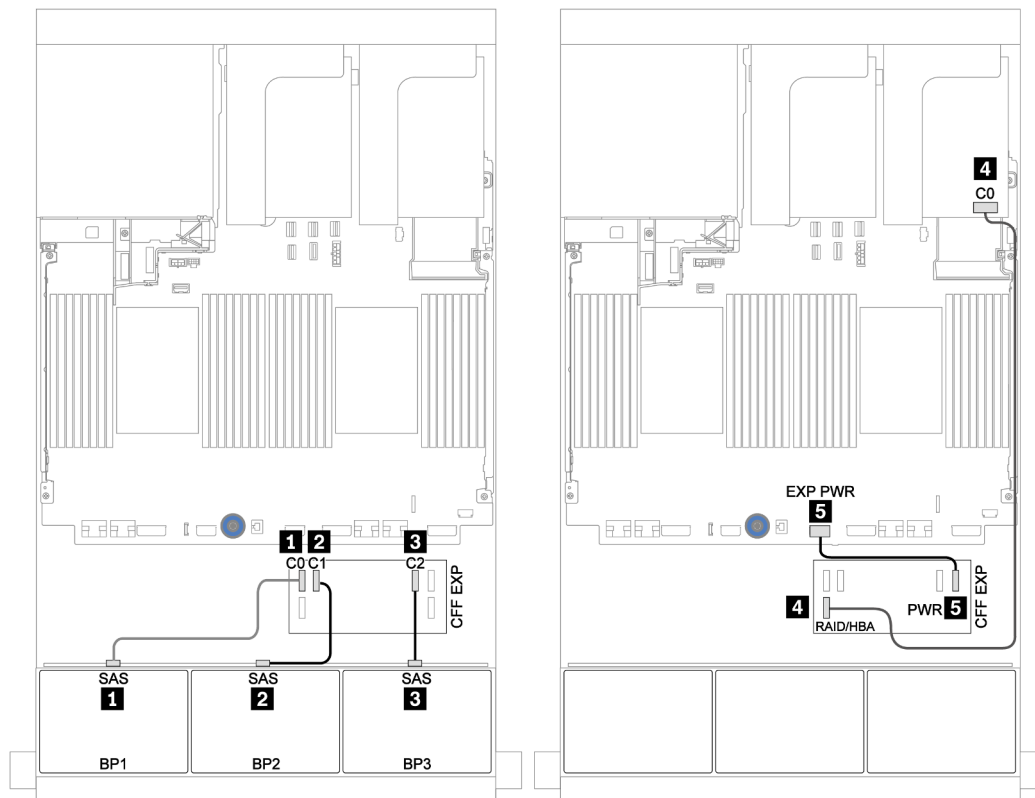
Figure 61. Cable routing for the 24 x 2.5-inch SAS/SATA configuration with one CFF expander and one 430/4350-16i adapter

Middle and rear backplanes: 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch SAS/SATA

From	To
Backplane 4: SAS 0	CFF expander: C4
Backplane 4: SAS 1	CFF expander: C5
Backplane 5: SAS	CFF expander: C3
Backplane 6: SAS	
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
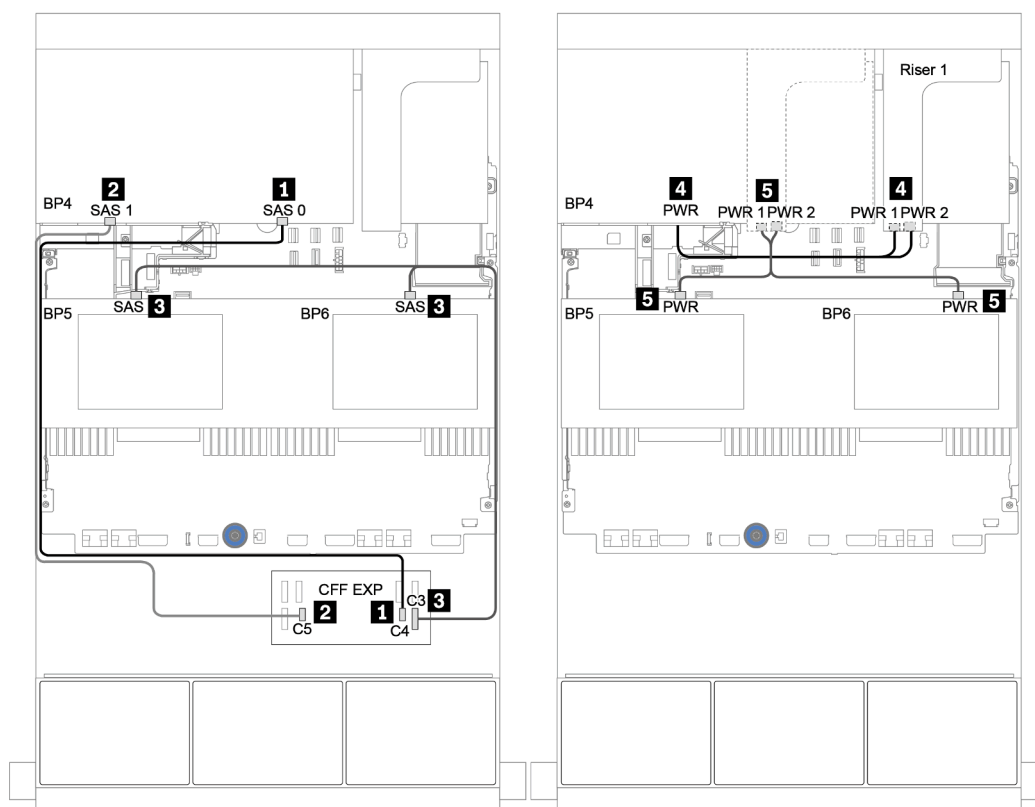
Figure 62. Cable routing for middle 4 x 2.5 SAS/SATA backplanes and rear 8 x 2.5 SAS/SATA backplane

One 8 x NVMe backplane

This section provides cable routing information for the server model with 8 x 2.5-inch NVMe front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Retimer card" on page 127
- "Onboard connectors" on page 126

Onboard connectors

The following shows the cable connections for the 8 x 2.5-inch NVMe configuration with onboard connectors.

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
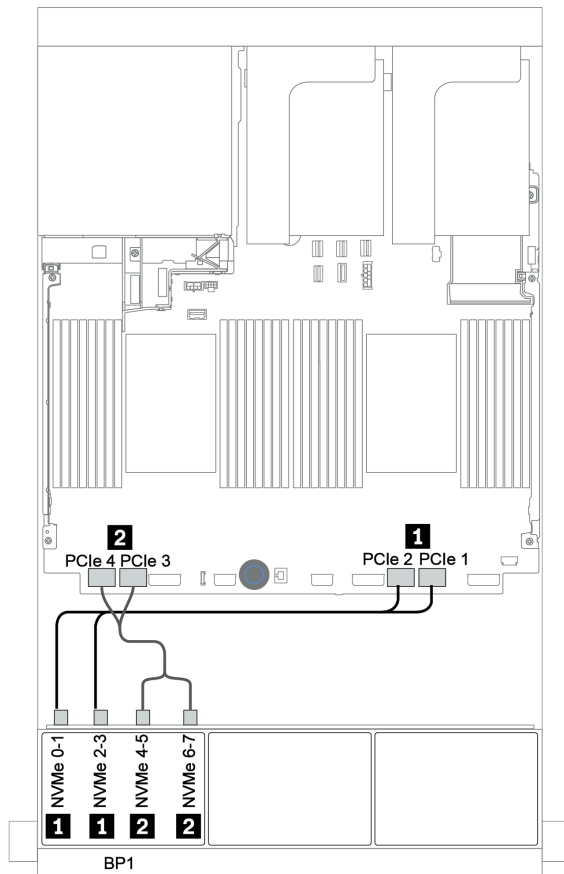
Figure 63. Cable routing for the 8 x 2.5-inch NVMe configuration with onboard connectors

Retimer card

The following shows the cable connections for the 8 x 2.5-inch NVMe configuration with one retimer card.

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
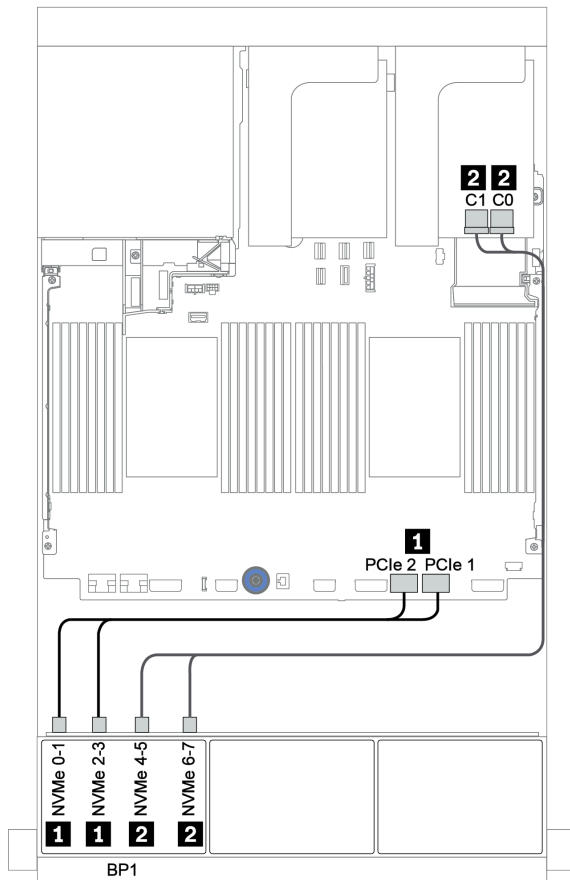
Figure 64. Cable routing for the 8 x 2.5-inch NVMe configuration with one retimer card

Two 8 x NVMe backplanes

This section provides cable routing information for the server model with two 8 x 2.5-inch NVMe front drive backplanes.

Onboard connectors + retimer card

The following shows the signal cable connections for the 16 x 2.5-inch NVMe configuration with onboard connectors and one retimer card.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 3, PCIe 4
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
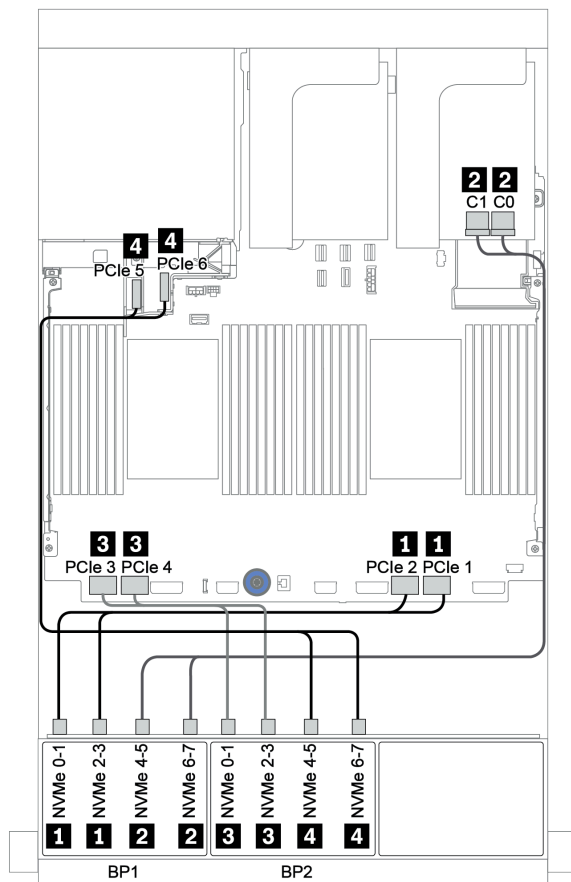
Figure 65. Cable routing for 16 x 2.5-inch NVMe configuration with one retimer card

Three 8 x NVMe backplanes

This section provides cable routing information for the server model with three 8 x 2.5-inch NVMe front drive backplanes.

To connect power cables for the 8 x 2.5-inch NVMe backplanes, refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the 8 x 2.5-inch NVMe backplanes, refer to the following cable routing scenarios depending on your server configuration:
- "Retimer cards (24 x NVMe)" on page 130
- "Switch cards (32 x NVMe)" on page 131

Retimer cards (24 x NVMe)

The following shows the cable connections for the 24 x 2.5-inch NVMe configuration with three retimer cards.

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1
Backplane 2: NVMe 0-1, 2-3	Retimer card on PCIe slot 2: C0, C1
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 5, PCIe 6
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 4: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
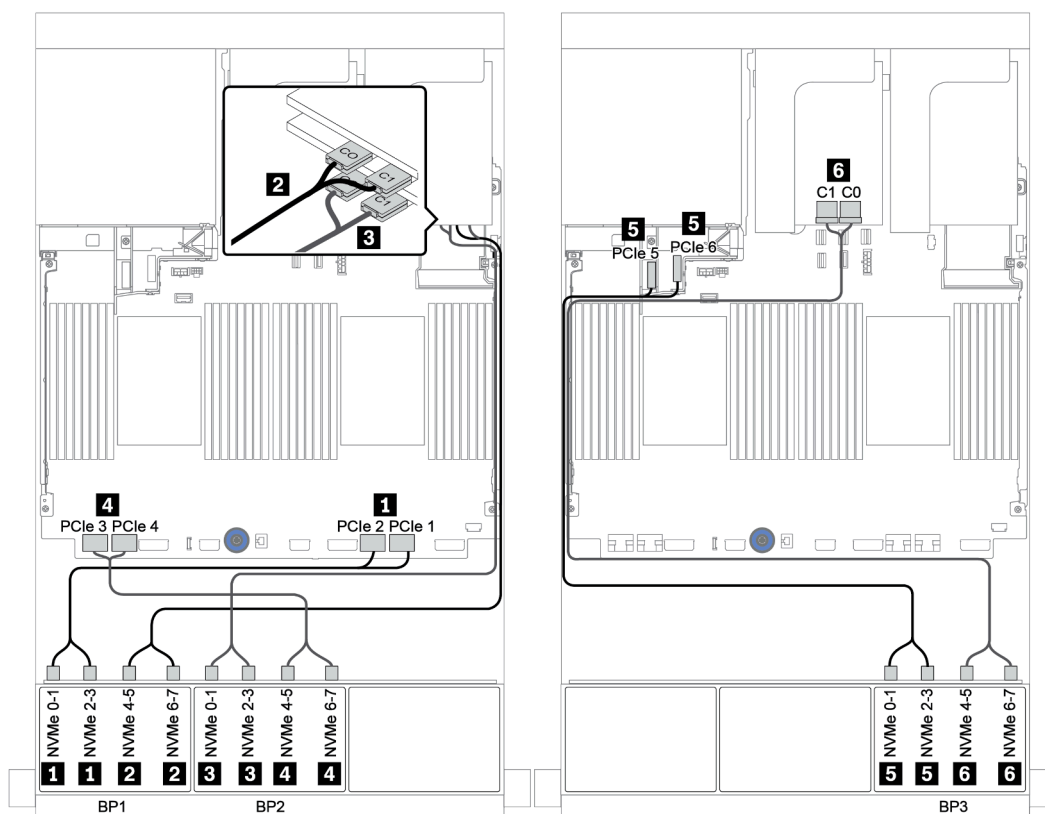
Figure 66. Cable routing for the 24 x 2.5-inch NVMe configuration with three retimer cards

Switch cards (32 x NVMe)

The following shows the cable connections for the 32 x 2.5-inch NVMe configuration with four switch cards.

Note: Oversubscription occurs when the system supports 32 NVMe drives using NVMe switch adapters. For details, see https://lenovopress.lenovo.com/lp1392-thinksystem-sr650-v2-server#nvme-drive-support.

From	To
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Switch card on PCIe slot 1: C0, C1, C2, C3
Backplane 2: NVMe 0-1, 2-3, 4-5, 6-7	Switch card on PCIe slot 2: C0, C1, C2, C3
Backplane 3: NVMe 0-1, 2-3, 4-5, 6-7	Switch card on PCIe slot 4: C0, C1, C2, C3
Backplane 5: NVMe 0-1, 2-3	Switch card on PCIe slot 5: C0, C1
Backplane 6: NVMe 0-1, 2-3	Switch card on PCIe slot 5: C2, C3

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 67. Cable routing for the 32 x 2.5-inch NVMe configuration with four switch cards

One 8 x AnyBay backplane

This section provides cable routing information for the server model with one 8 x 2.5-inch AnyBay front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Onboard connectors" on page 133
- "8i/16i RAID/HBA adapter + onboard connectors" on page 134
- "CFF 8i RAID adapter + onboard connectors" on page 135
- "CFF 16i RAID/HBA adapter + onboard connectors" on page 136
- "8i/16i RAID/HBA adapter + retimer card" on page 137
- "8i RAID adapter (Tri-mode)" on page 138

Onboard connectors

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with onboard connectors.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Onboard SATA cable routing	Onboard NVMe cable routing
 Figure 68. Onboard SATA cable routing	 *Figure 69. Onboard NVMe cable routing*

8i/16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and onboard connectors.

From	To
Backplane 1: SAS	8i/16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 70. SAS/SATA cable routing

Figure 71. NVMe cable routing

CFF 8i RAID adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with one CFF 8i RAID adapter and onboard connectors.

From	To
Backplane 1: SAS	CFF 8i RAID adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 72. SAS/SATA cable routing

Figure 73. NVMe cable routing

CFF 16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with one CFF 16i RAID/HBA adapter and onboard connectors.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

**Note:** The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 74. SAS/SATA cable routing
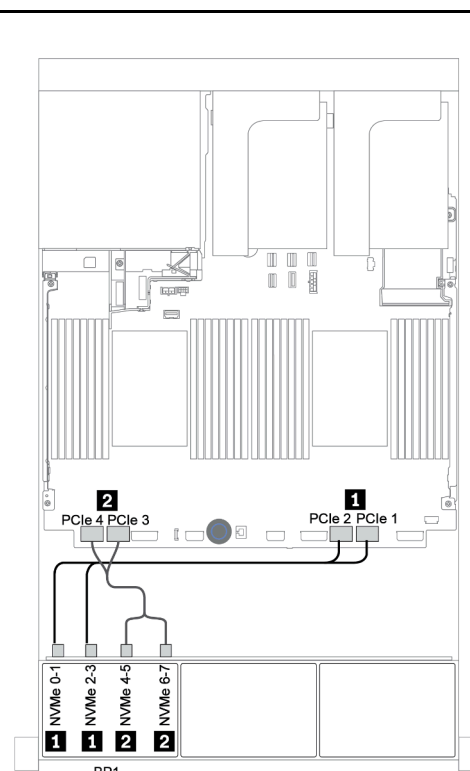
Figure 75. NVMe cable routing

8i/16i RAID/HBA adapter + retimer card

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA and one retimer card.

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 76. SAS/SATA cable routing

Figure 77. NVMe cable routing

8i RAID adapter (Tri-mode)

The following shows the cable connections for the 8 x 2.5-inch AnyBay configuration with one Tri-mode 8i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	Tri-mode 8i RAID adapter on PCIe slot 2: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 78. Cable routing for the 8 x 2.5-inch AnyBay configuration with one Tri-mode 8i RAID adapter

Two 8 x AnyBay backplanes

This section provides cable routing information for the server model with two 8 x 2.5-inch AnyBay front drive backplanes.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "8i RAID adapters (Tri-mode)" on page 140
- "CFF 16i RAID adapter (Tri-mode)" on page 141

8i RAID adapters (Tri-mode)

The following shows the signal cable connections for the 16 x 2.5-inch AnyBay configuration with two Tri-mode 8i RAID adapters for U.3 drives.

From	To
Backplane 1: SAS	Tri-mode 8i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 3: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
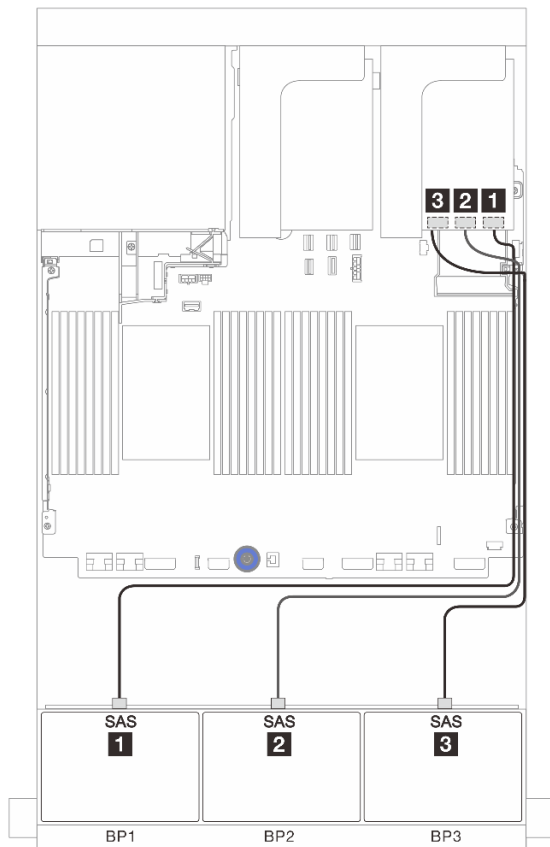
Figure 79. Cable routing for the 16 x 2.5-inch AnyBay configuration with two Tri-mode 8i RAID adapters

CFF 16i RAID adapter (Tri-mode)

The following shows the cable connections for the 16 x 2.5-inch AnyBay configuration with one Tri-mode CFF 16i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	Tri-mode CFF 16i RAID adapter: C0, C1
Backplane 2: SAS	Tri-mode CFF 16i RAID adapter: C2, C3
Tri-mode CFF 16i RAID adapter: MB (CFF input)	Onboard: PCIe 1, or PCIe 2
Tri-mode CFF 16i RAID adapter: PWR	Onboard: RAID PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
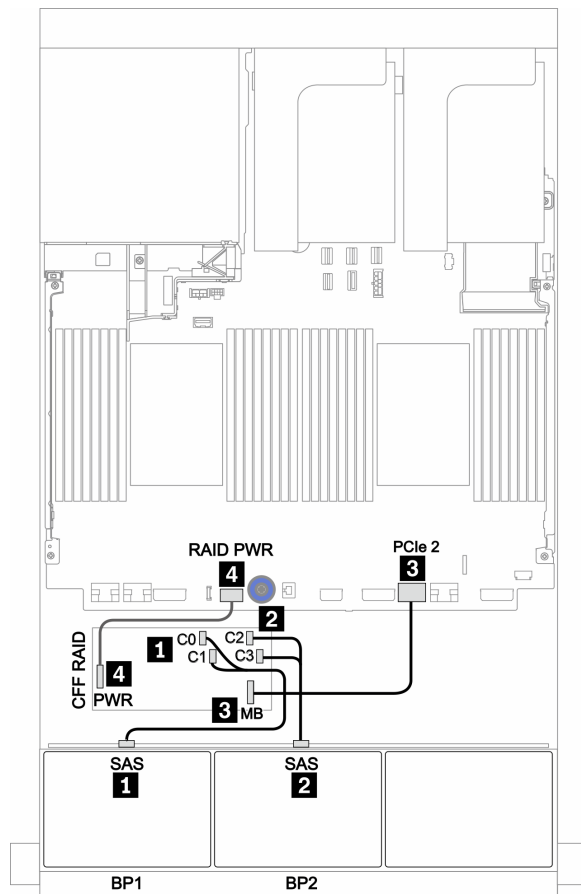
Figure 80. Cable routing for the 16 x 2.5-inch AnyBay configuration with one Tri-mode CFF 16i RAID adapter

Three 8 x AnyBay backplanes

This section provides cable routing information for the server model with three 8 x 2.5-inch AnyBay front drive backplanes.

8i RAID adapters (Tri-mode)

The following shows the signal cable connections for the 24 x 2.5-inch AnyBay configuration with three Tri-mode 8i RAID adapters for U.3 drives.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

From	To
Backplane 1: SAS	Tri-mode 8i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 3: C0
Backplane 3: SAS	Tri-mode 8i RAID adapter on PCIe slot 5: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
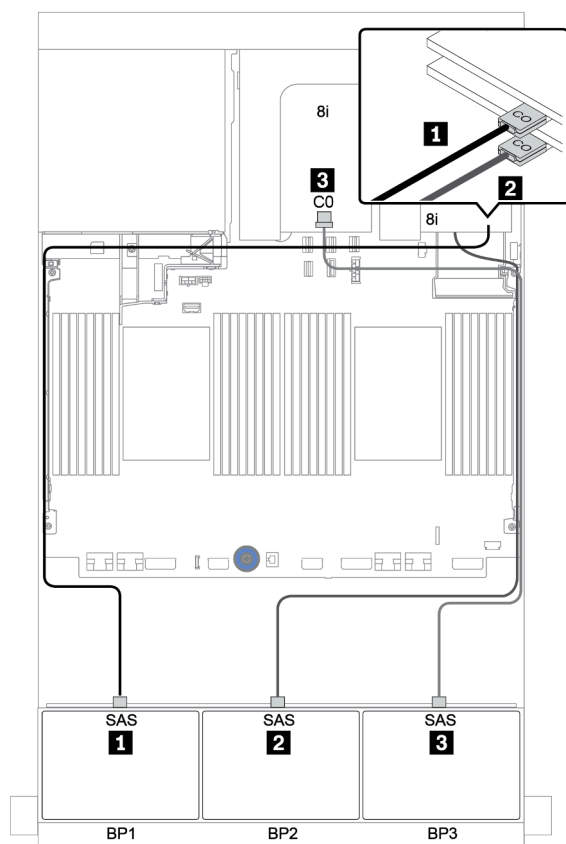
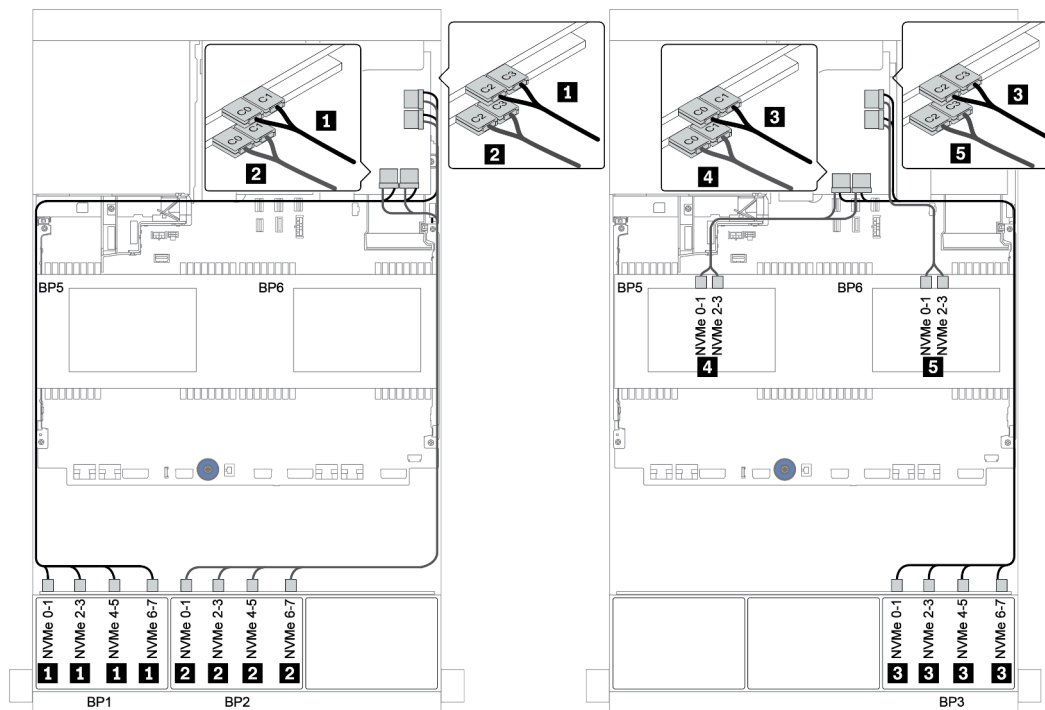Figure 81. Cable routing for the 24 x 2.5-inch AnyBay configuration with three Tri-mode 8i RAID adapters

One 8 x SAS/SATA and one 8 x NVMe backplanes

This section provides cable routing information for the server model with one 8 x SAS/SATA front drive backplane and one 8 x NVMe front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
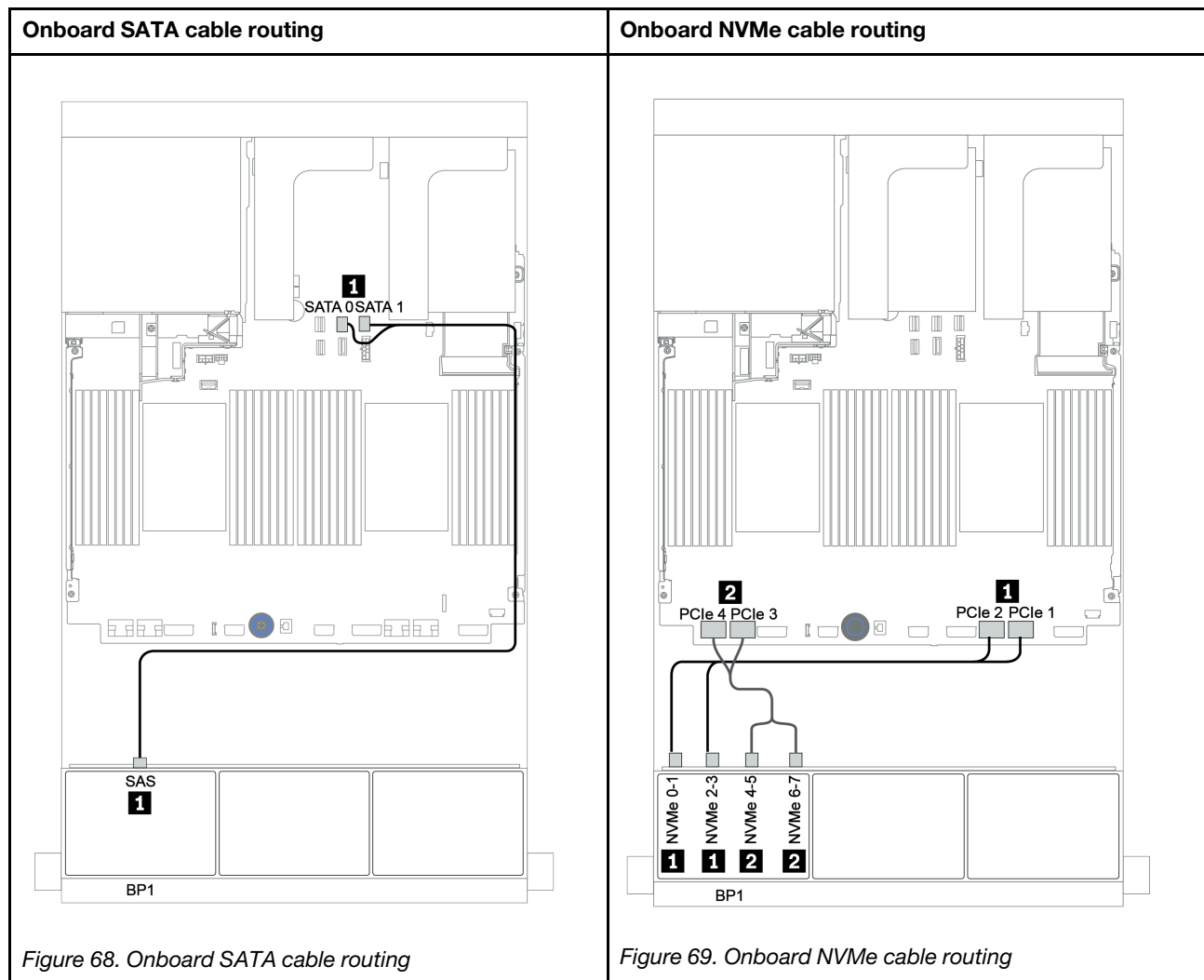- "Onboard connectors + retimer card" on page 148
- "8i/16i RAID/HBA adapter + retimer card" on page 149
- "Onboard connectors" on page 144
- "8i/16i RAID/HBA adapter + onboard connectors" on page 145
- "CFF 16i RAID/HBA adapter + onboard connectors" on page 147

Onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with onboard connectors.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

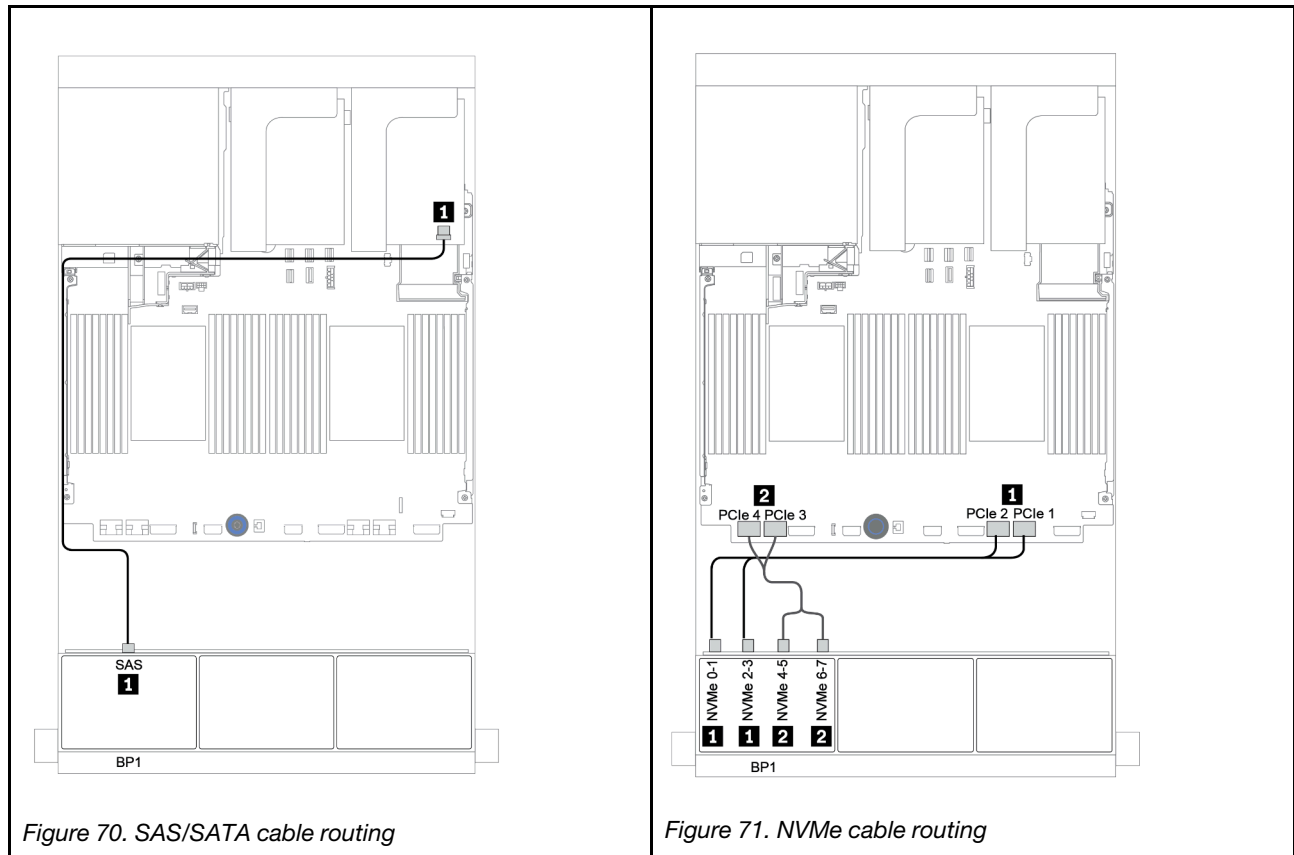Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
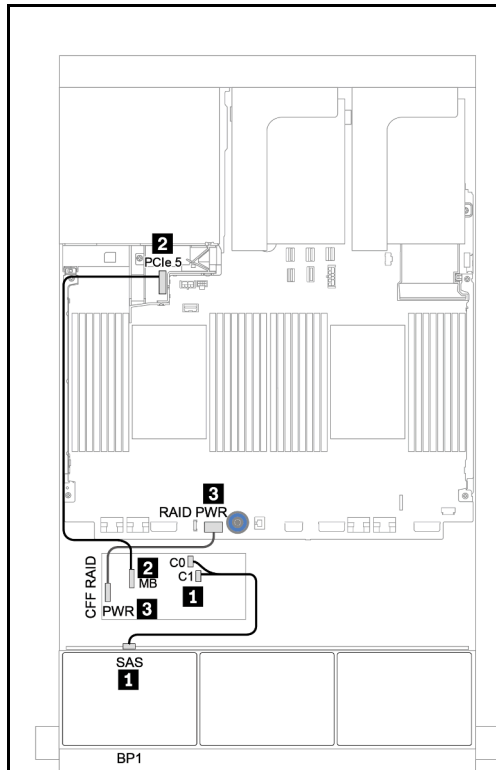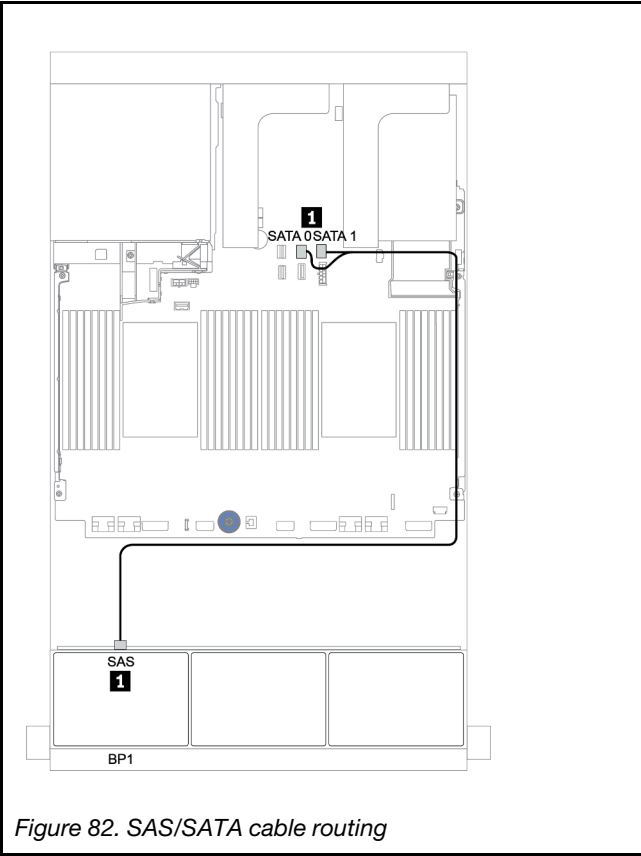

Figure 82. SAS/SATA cable routing
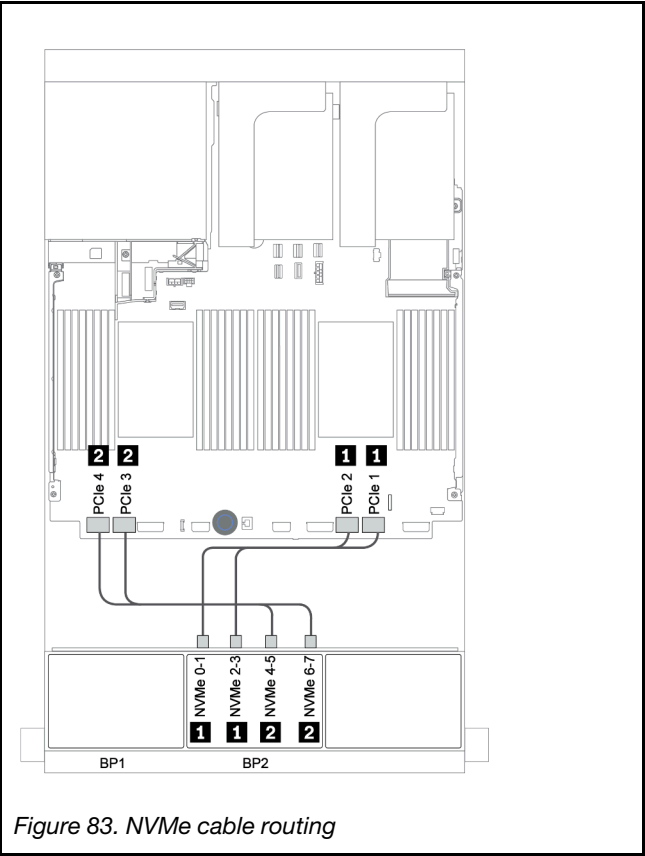
Figure 83. NVMe cable routing

8i/16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one 8i/16i RAID/HBA adapter.

From	To
Backplane 1: SAS	8i/16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 84. SAS/SATA cable routing

Figure 85. NVMe cable routing

CFF 8i RAID + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one CFF 8i RAID adapter.

From	To
Backplane 1: SAS	CFF 8i RAID adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
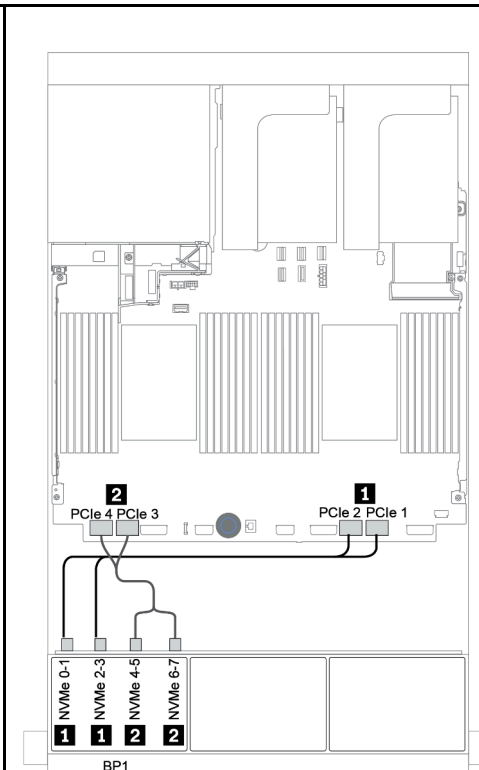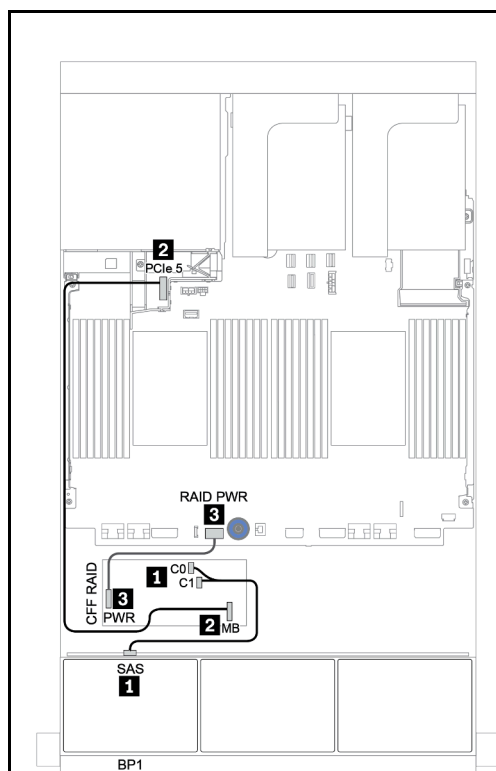

*Figure 86. SAS/SATA cable routing*
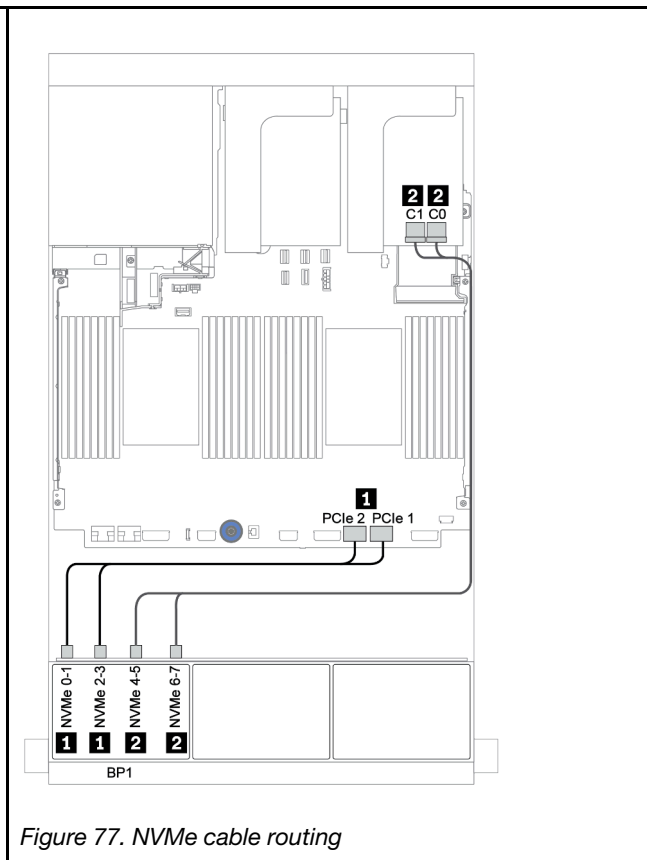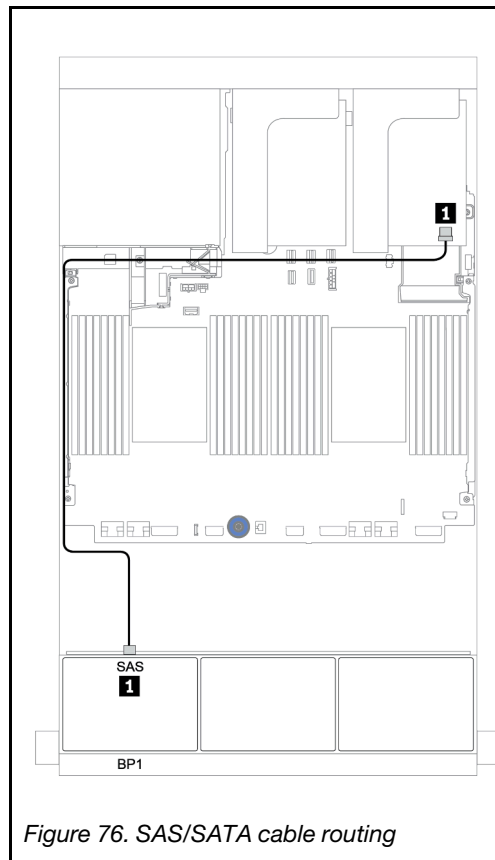

Figure 87. NVMe cable routing

CFF 16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one CFF 16i RAID/HBA adapter.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 88. SAS/SATA cable routing

Figure 89. NVMe cable routing

Onboard connectors + retimer card

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one retimer card.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

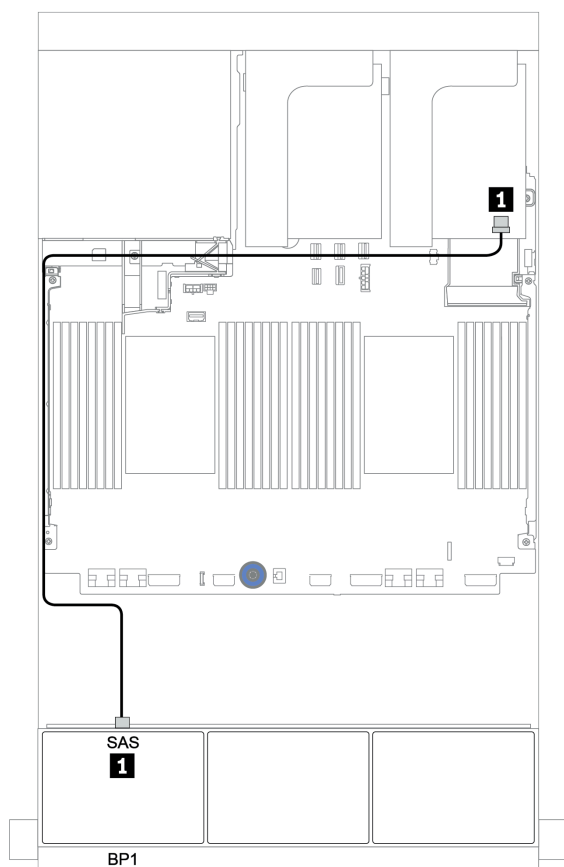Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 90. SAS/SATA cable routing

Figure 91. NVMe cable routing

8i/16i RAID/HBA adapter + retimer card

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one 8i/16i RAID/HBA adapter and one retimer card.

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 92. SAS/SATA cable routing

Figure 93. NVMe cable routing

One 8 x SAS/SATA and one 8 x AnyBay backplanes

This section provides cable routing information for the server model with one 8 x SAS/SATA and one 8 x AnyBay front drive backplanes.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "8i/16i RAID/HBA adapter + retimer card" on page 153
- "8i/16i/32i RAID/HBA adapter + onboard connectors" on page 151
- "CFF 16i RAID/HBA adapter" on page 152
- "Onboard connectors + 8i RAID adapter (Tri-mode)" on page 154
- "8i/16i RAID/HBA adapter + 8i RAID adapter (Tri-mode)" on page 155
- "CFF 16i RAID/HBA adapter + 8i RAID adapter (Tri-mode)" on page 156

8i/16i/32i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with two 8i RAID/HBA adapters or one 16i/32i RAID/HBA adapter.

From	To		
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0	• Gen 3: C2C3 • Gen 4: C1	32i RAID adapter on PCIe slot 2: C1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2		
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4		

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
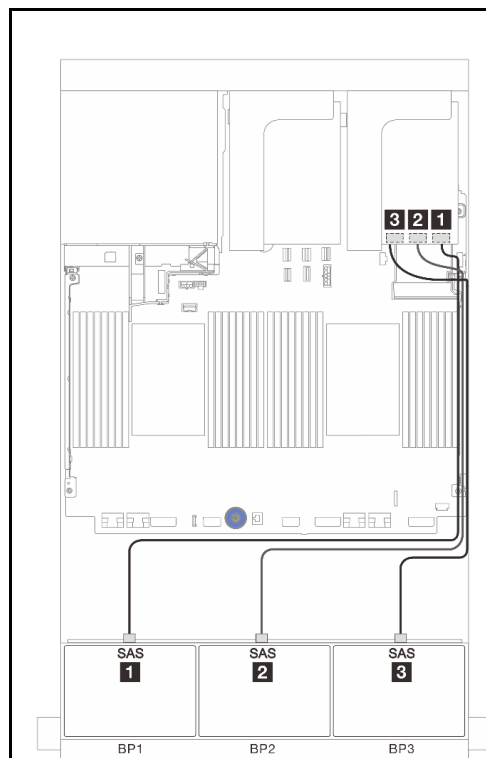
Figure 94. SAS/SATA cable routing
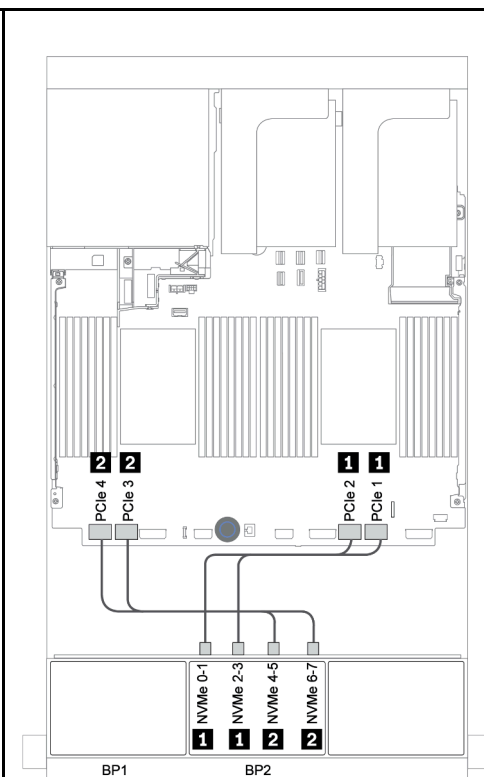
Figure 95. NVMe cable routing

CFF 16i RAID/HBA adapter

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one CFF 16i RAID/HBA adapter.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
Backplane 2: SAS	CFF 16i RAID/HBA adapter: C2, C3
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 96. SAS/SATA cable routing

Figure 97. NVMe cable routing

8i/16i RAID/HBA adapter + retimer card

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one retimer card and two 8i RAID/HBA adapters or one 16i RAID/HBA adapter

From	To	
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0	• Gen 3: C2C3 • Gen 4: C1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2	
Backplane 2: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 98. SAS/SATA cable routing

Figure 99. NVMe cable routing

Onboard connectors + 8i RAID adapter (Tri-mode)

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one Tri-mode 8i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	Onboard: SATA 0, SATA 1
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 2: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 100. Cable routing for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one Tri-mode 8i RAID adapter

8i/16i RAID/HBA adapter + 8i RAID adapter (Tri-mode)

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and one Tri-mode 8i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 3: C0

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
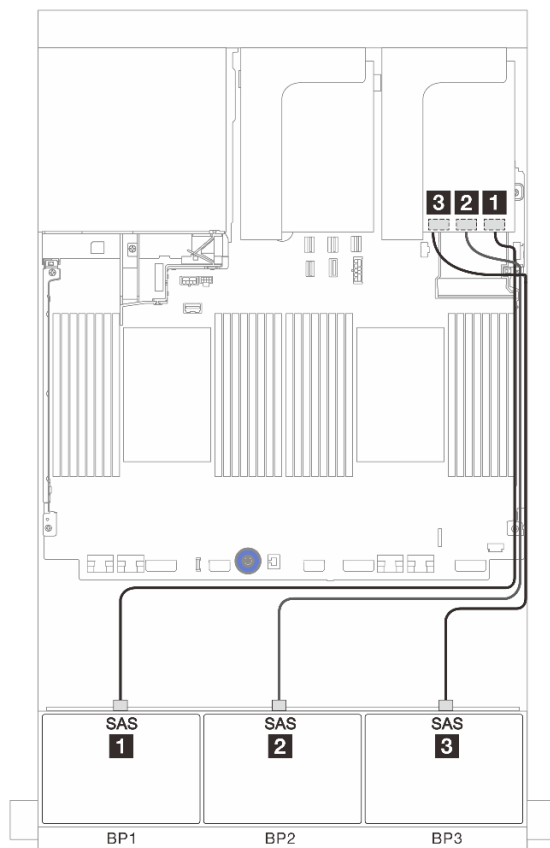
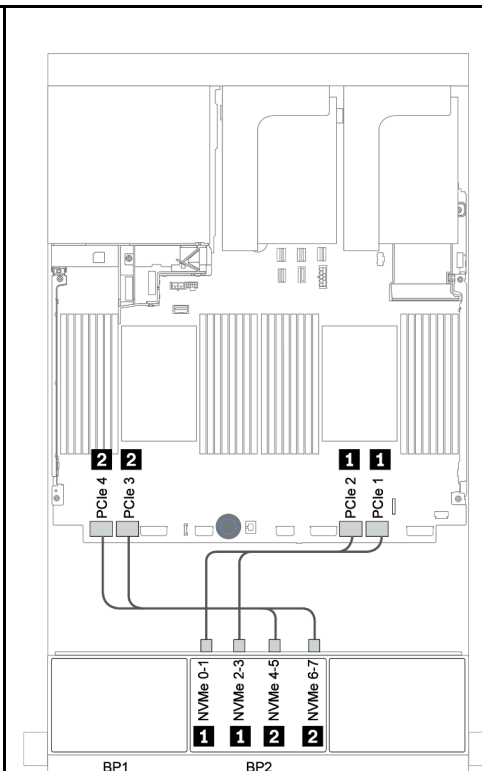*Figure 101. Cable routing for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and one Tri-mode 8i RAID adapter*
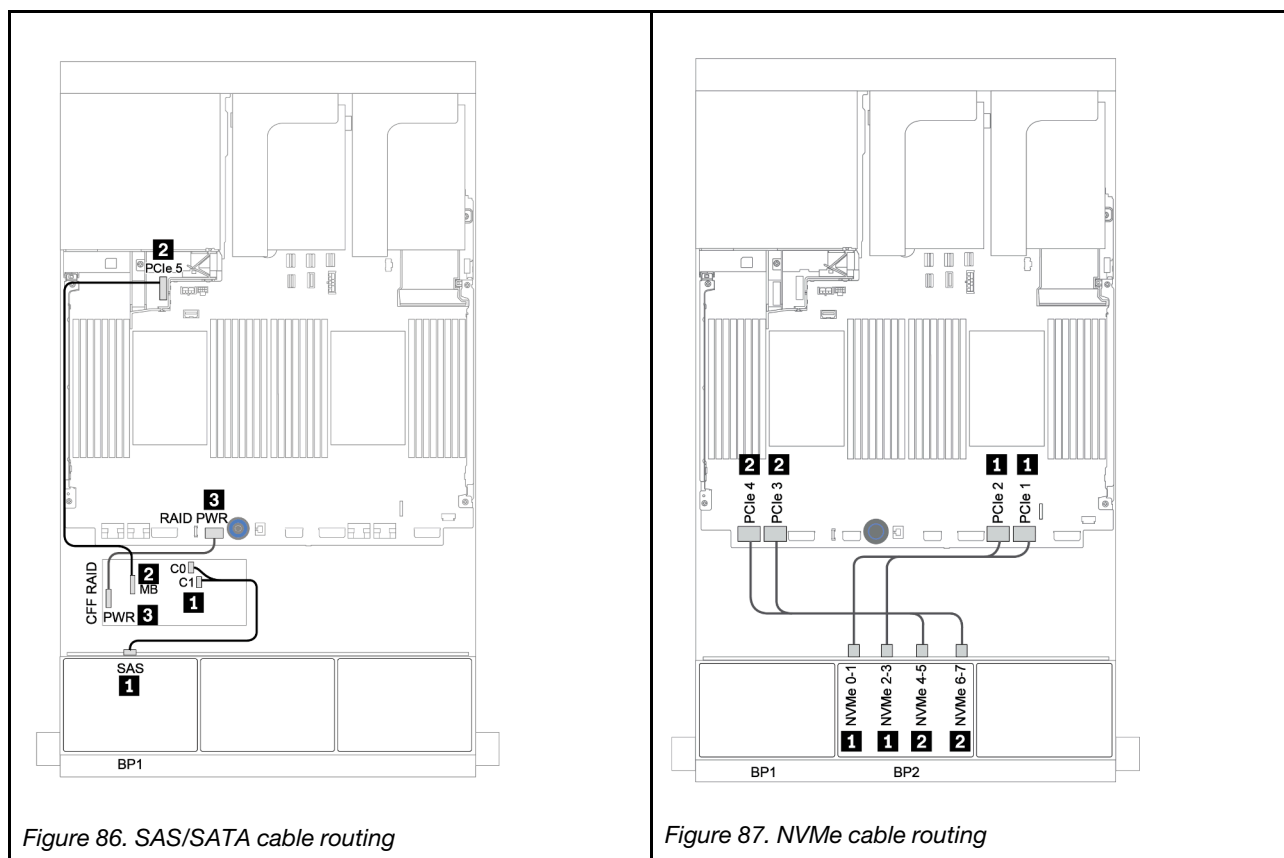
CFF 16i RAID/HBA adapter + 8i RAID adapter (Tri-mode)

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one CFF 16i RAID/HBA adapter and one Tri-mode 8i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	• When 2 CPUs installed: PCIe 3 or 5 • When 1 CPU installed: PCIe 1 or 2
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 2: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Notes:
- The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.
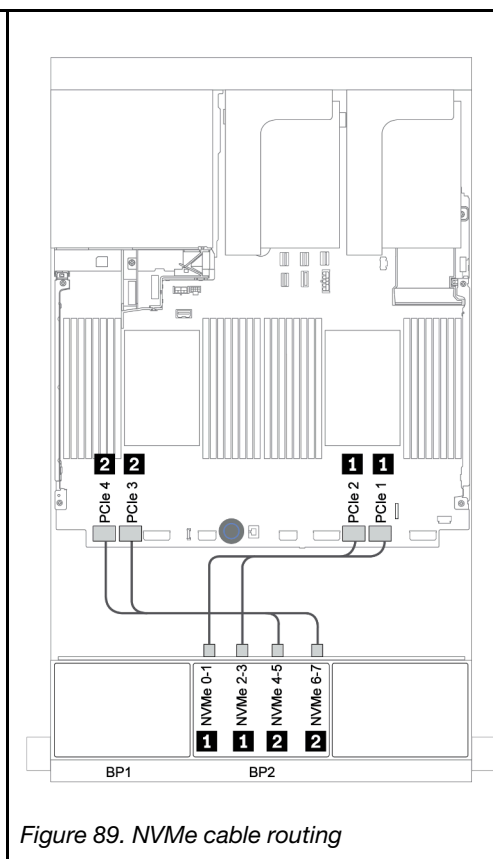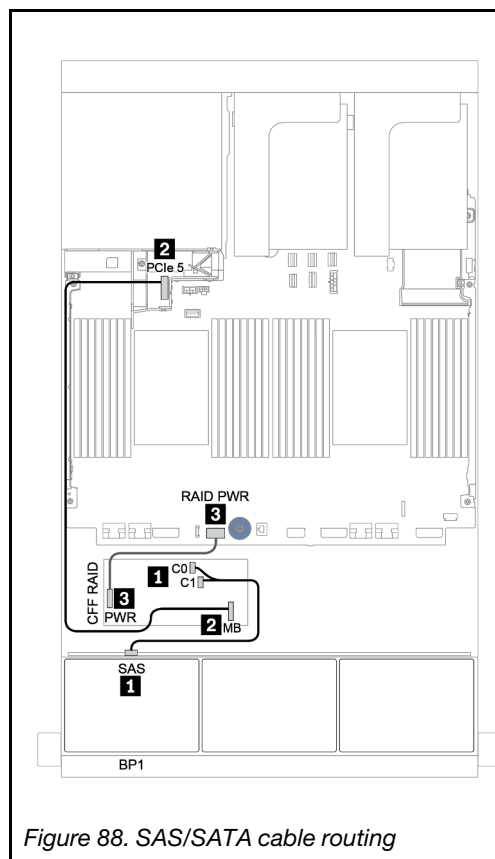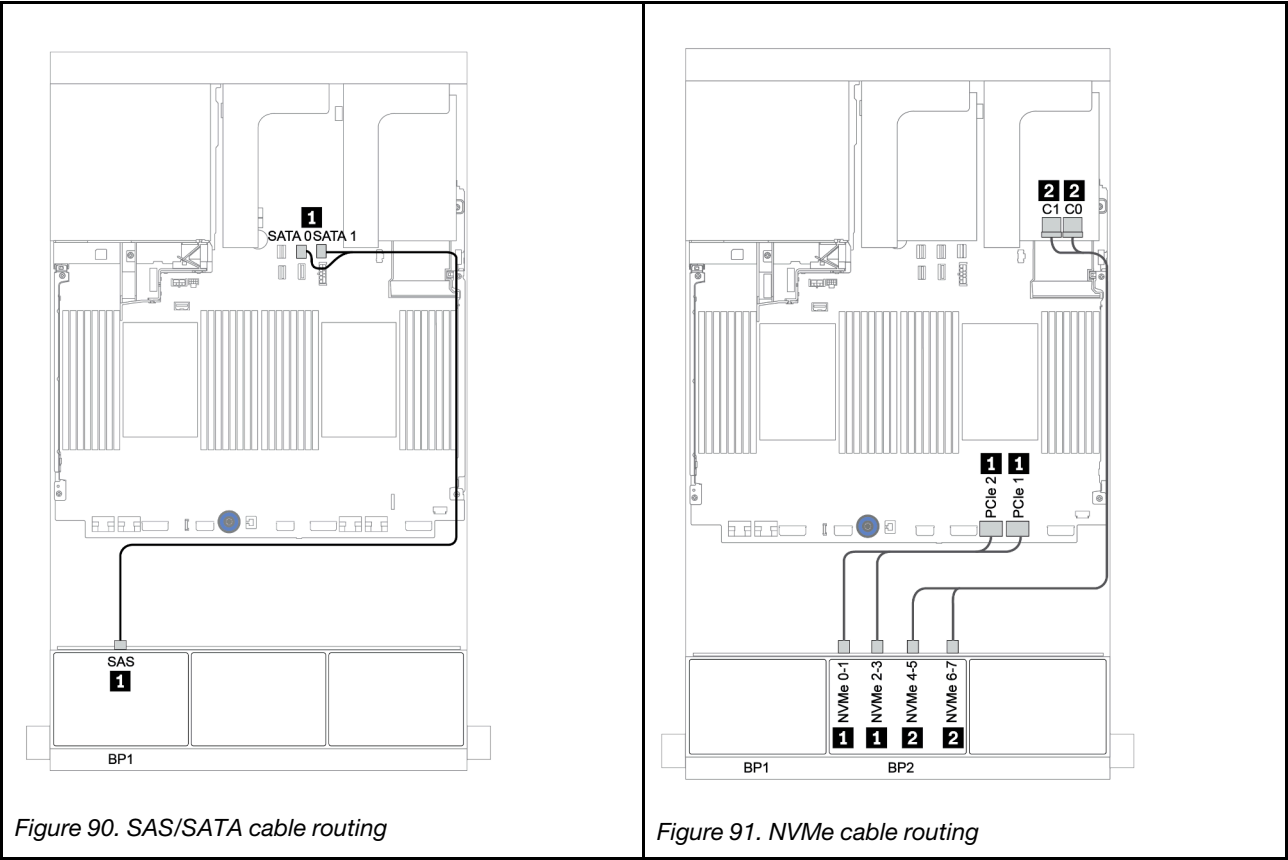- The following illustration shows the cable routing when two processors are installed. When only one processor is installed, the only different is cable **3** which should be connected to PCIe 1 or PCIe 2 on the system board.

Figure 102. Cable routing for the 8 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one CFF 16i RAID/HBA adapter and one Tri-mode 8i RAID adapter

One 8 x AnyBay and one 8 x NVMe backplanes

This section provides cable routing information for the server model with one 8 x AnyBay front drive backplane and one 8 x NVMe front drive backplane.

One 8i/16i RAID/HBA adapter + onboard connectors + one retimer card

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 3, PCIe 4
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 5, PCIe 6

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

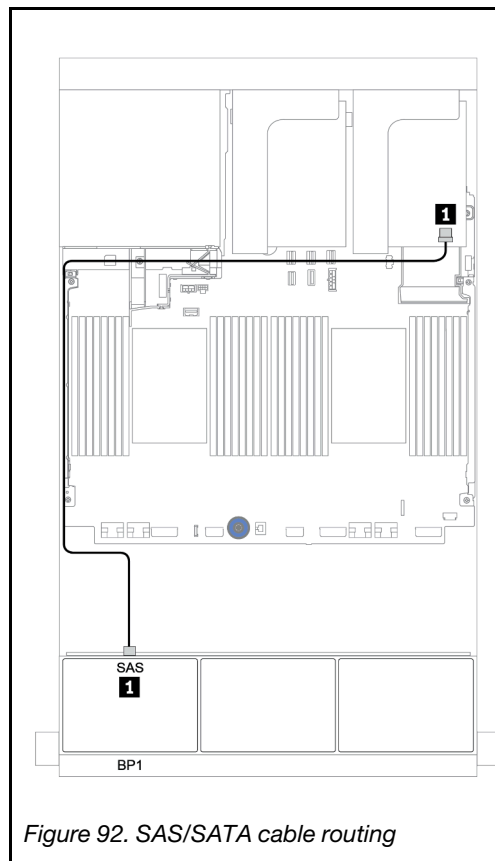Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

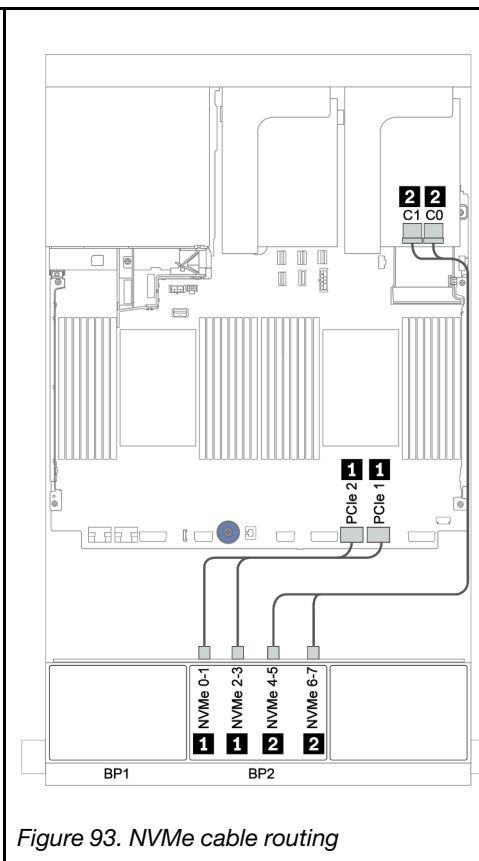Figure 103. SAS/SATA cable routing
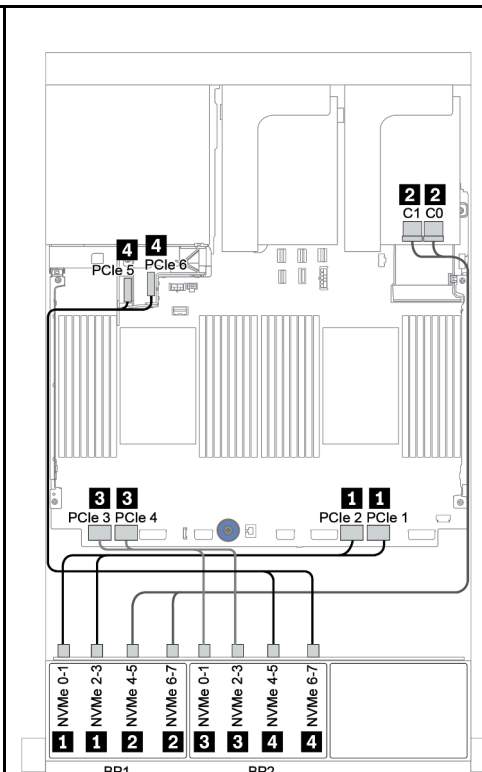
Figure 104. NVMe cable routing

One 8 x SAS/SATA and two 8 x NVMe backplanes

This section provides cable routing information for the server model with one 8 x SAS/SATA front drive backplane and two 8 x NVMe front drive backplanes.

8i/16i RAID/HBA adapter + retimer card

The following shows the signal cable connections for the 8 x 2.5-inch SAS/SATA + 16 x 2.5-inch NVMe configuration with one 8i/16i RAID/HBA adapter and one retimer card.

To connect power cables for the front backplane(s), refer to .

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 5: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 3, PCIe 4
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 5, PCIe 6

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
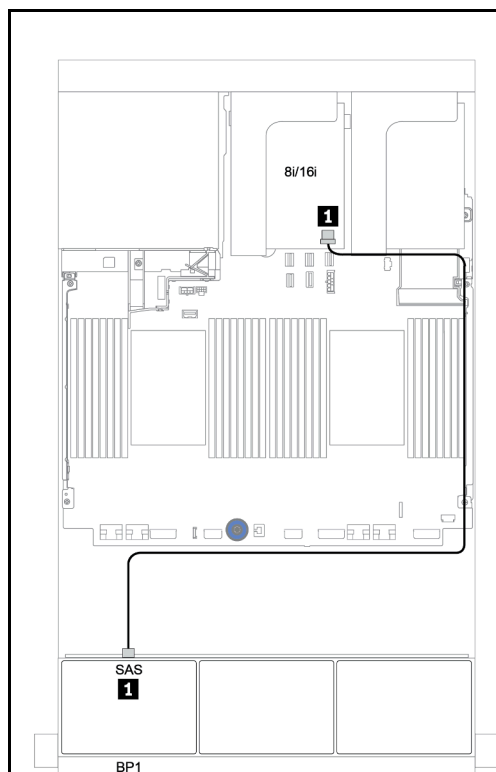
Figure 105. SAS/SATA cable routing

Figure 106. NVMe cable routing

One 8 x SAS/SATA and two 8 x AnyBay backplanes

This section provides cable routing information for the server model with one 8 x SAS/SATA and two 8 x AnyBay front drive backplanes.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "8i/16i RAID/HBA adapter + 8i RAID adapters (Tri-mode)" on page 161
- "8i/16i RAID/HBA adapter + 16i RAID adapter (Tri-mode)" on page 162

8i/16i RAID/HBA adapter + 8i RAID adapters (Tri-mode)

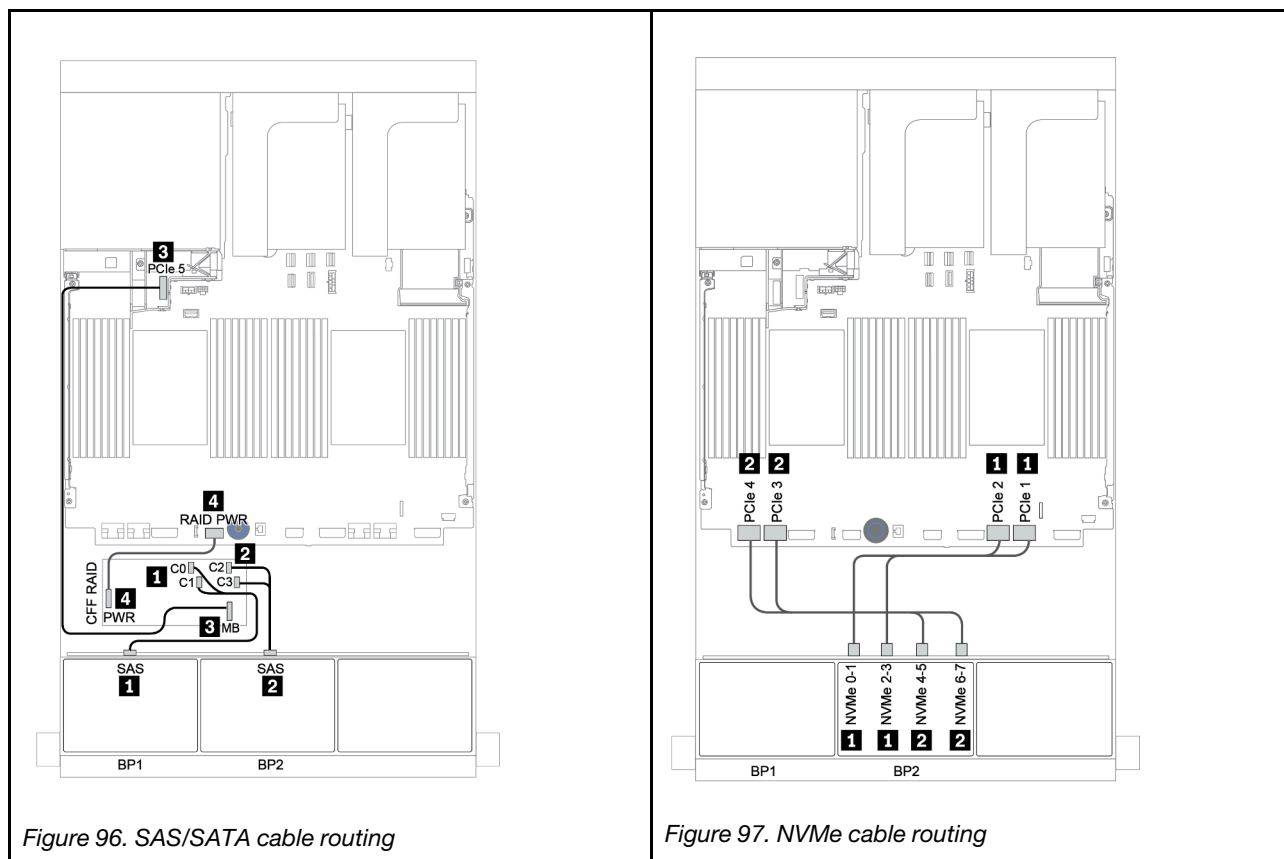The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 16 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and two Tri-mode 8i RAID adapters for U.3 drives.

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 3: C0
Backplane 2: SAS	Tri-mode 8i RAID adapter on PCIe slot 5: C0

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
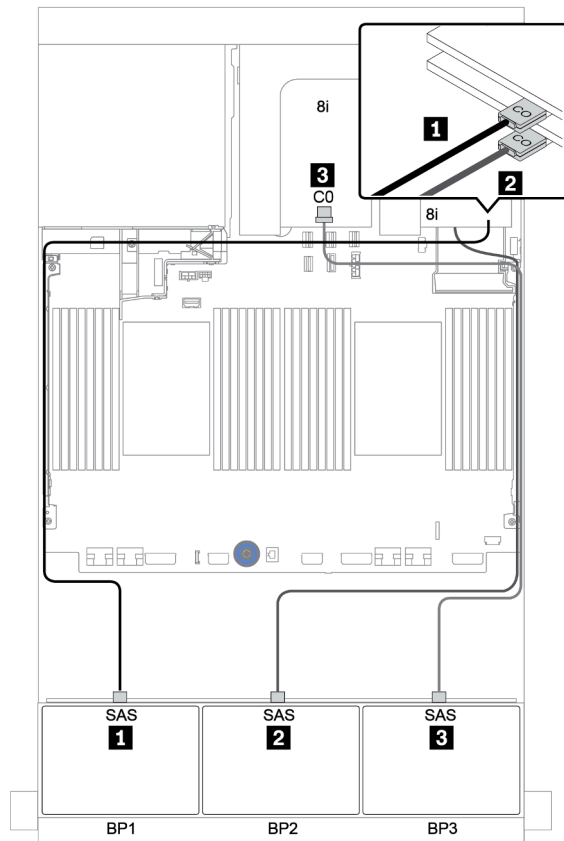
Figure 107. Cable routing for the 8 x 2.5-inch SAS/SATA + 16 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and two Tri-mode 8i RAID adapters

8i/16i RAID/HBA adapter + 16i RAID adapter (Tri-mode)

The following shows the cable connections for the 8 x 2.5-inch SAS/SATA + 16 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and one Tri-mode 16i RAID adapter for U.3 drives.

From	To
Backplane 1: SAS	8i/16i* RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	Tri-mode 16i RAID adapter on PCIe slot 3: C0
Backplane 2: SAS	Tri-mode 16i RAID adapter on PCIe slot 3: C1

Note: *If a 16i RAID adapter is used, SAS cable **1** has an extra dummy connector (not shown in below illustration) to connect to the other connector of the 16i RAID adapter.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
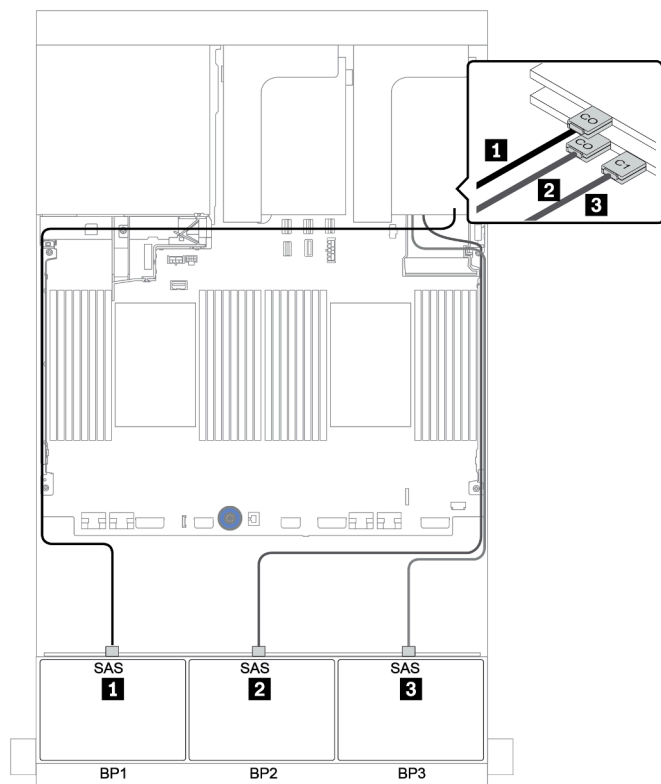
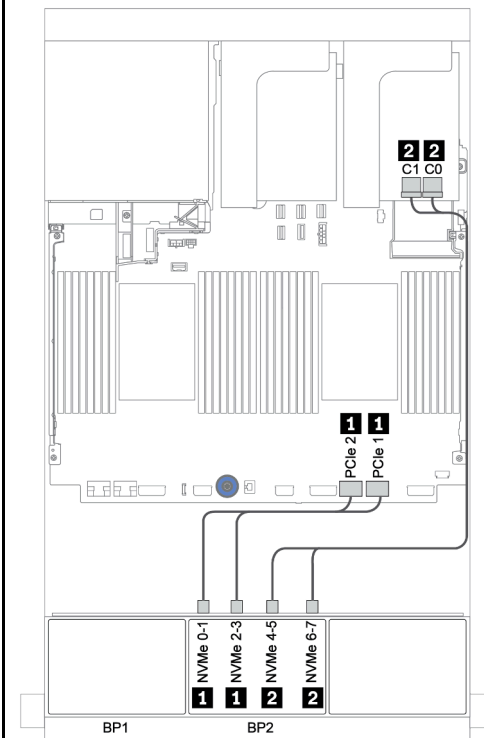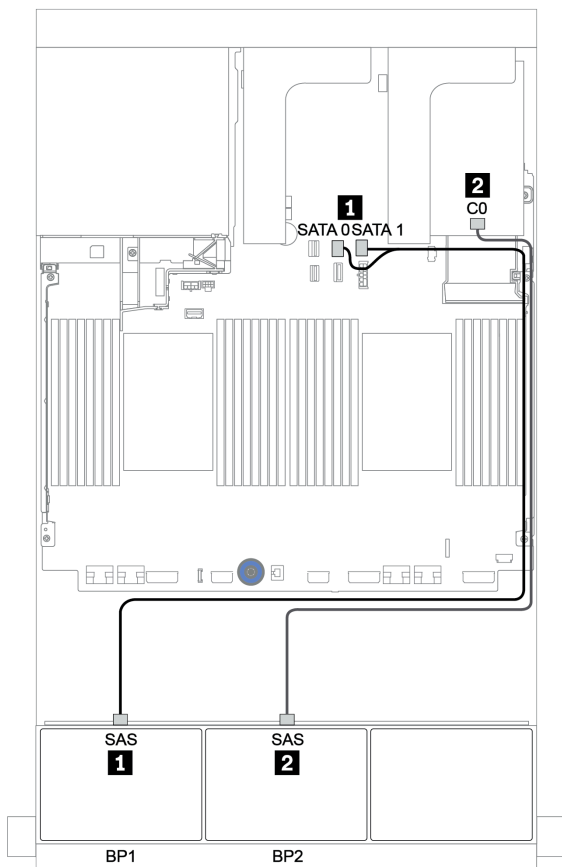Figure 108. Cable routing for the 8 x 2.5-inch SAS/SATA + 16 x 2.5-inch AnyBay configuration with one 8i/16i RAID/HBA adapter and one Tri-mode 16i RAID adapter

Two 8 x SAS/SATA and one 8 x NVMe backplanes

This section provides cable routing information for the server model with two 8 x SAS/SATA front drive backplanes and one 8 x NVMe front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "CFF expander + 8i RAID/HBA adapter + retimer card" on page 166
- "CFF expander + 8i RAID/HBA adapter + onboard connectors" on page 165
- "CFF 16i RAID/HBA adapter + onboard connectors" on page 164

CFF 16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one CFF 16i RAID/HBA adapter and onboard connectors.

From	To
Backplane 1: SAS	CFF 16i RAID/HBA adapter: C0, C1
Backplane 2: SAS	CFF 16i RAID/HBA adapter: C2, C3
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
Backplane 2: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 2: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 109. SAS/SATA cable routing

Figure 110. NVMe cable routing

CFF expander + 8i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one CFF expander, one 8i RAID/HBA adapter, and onboard connectors.

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 111. SAS/SATA cable routing

Figure 112. NVMe cable routing

CFF expander + 8i RAID/HBA adapter + retimer card

The following shows the cable connections for the 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch NVMe configuration with one CFF expander, one 8i RAID/HBA adapter, and one retimer card.

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
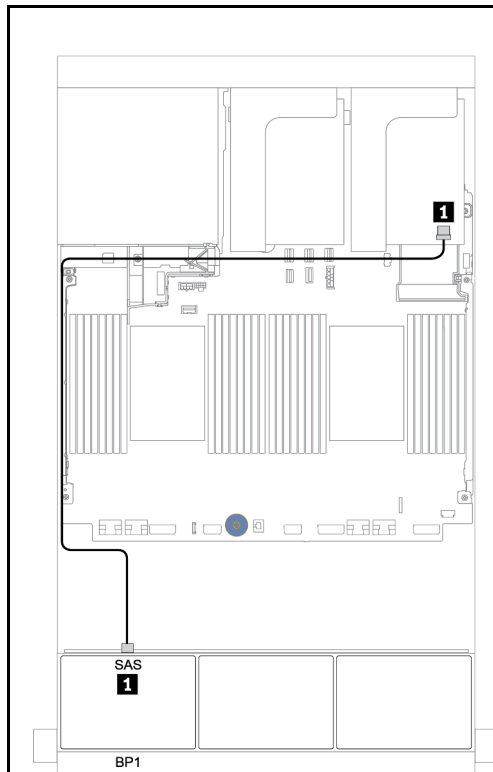

Figure 113. SAS/SATA cable routing

Figure 114. NVMe cable routing

Two 8 x SAS/SATA and one 8 x AnyBay backplanes

This section provides cable routing information for the server model with two 8 x SAS/SATA and one 8 x AnyBay front drive backplanes.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 2.5-inch drive backplanes" on page 83.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Front backplanes: 16 x SAS/SATA + 8 x AnyBay" on page 168
- "Front + rear backplane: 16 x SAS/SATA + 8 x AnyBay + 4 x SAS/SATA" on page 179

Front backplanes: 16 x SAS/SATA + 8 x AnyBay

8i RAID/HBA adapters + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0
Backplane 3: SAS	8i RAID/HBA adapter on PCIe slot 5: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 115. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 116. NVMe cable routing (two processors)

32i RAID adapter + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

From	To
Backplane 1: SAS	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	32i RAID adapter on PCIe slot 2: C2
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
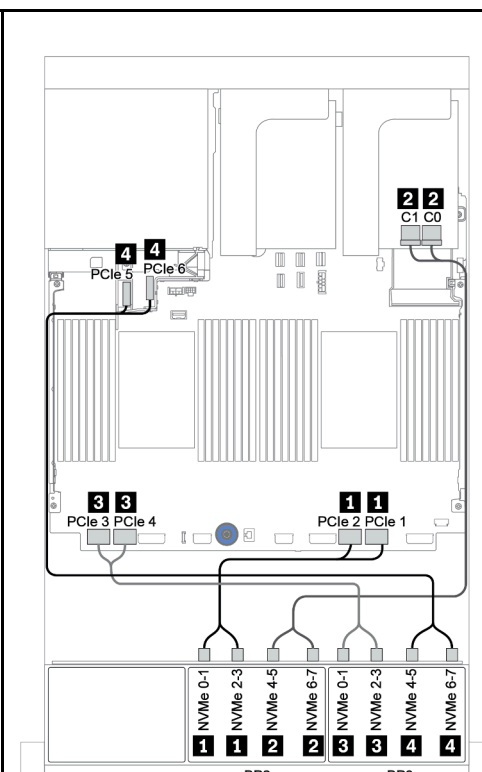

Figure 117. SAS/SATA cable routing
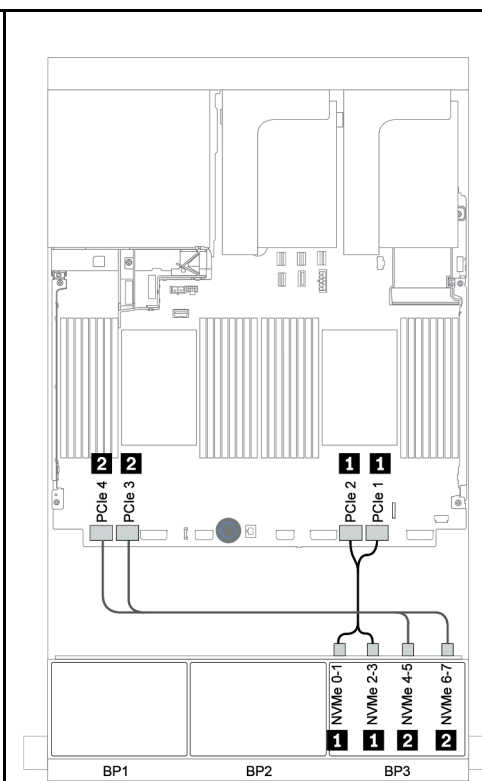
Figure 118. NVMe cable routing

CFF expander + 8i RAID/HBA adapter + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 119. SAS/SATA cable routing

NVMe cable routing

From	To
BP3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
BP3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 120. NVMe cable routing (two processors)

CFF 16i RAID/HBA adapter + CFF expander + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 121. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
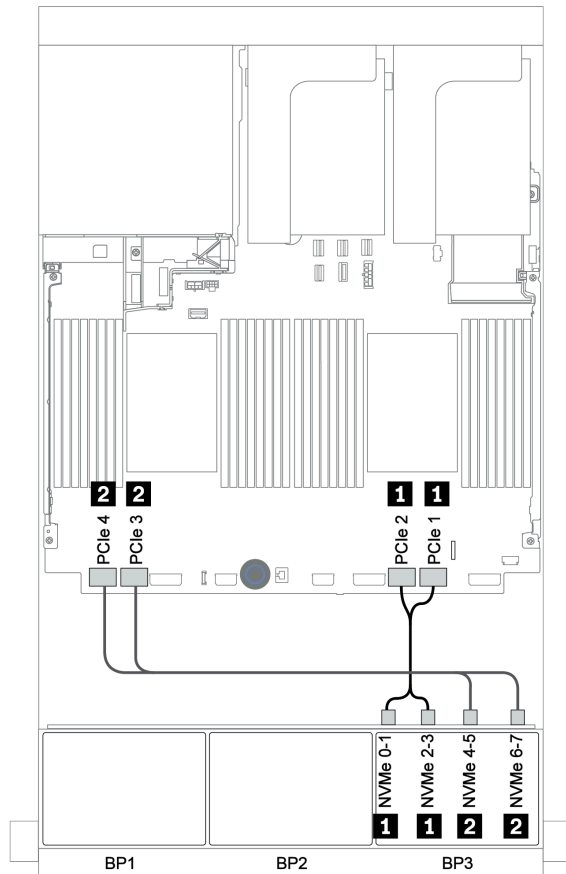
Figure 122. NVMe cable routing

32i RAID adapter + retimer card

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

The following shows the cable connections for 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one 32i RAID adapter and one retimer card.

From	To
Backplane 1: SAS	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	32i RAID adapter on PCIe slot 2: C2
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 123. SAS/SATA cable routing

Figure 124. NVMe cable routing

CFF expander + 8i RAID/HBA adapter + retimer card

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 125. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
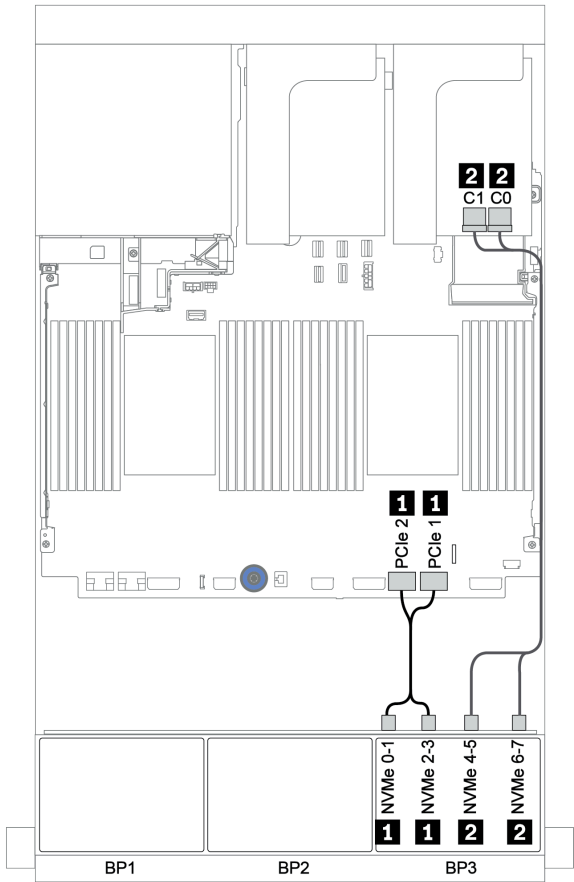
Figure 126. NVMe cable routing (one processor)

Front + rear backplane: 16 x SAS/SATA + 8 x AnyBay + 4 x SAS/SATA

8i RAID/HBA adapters + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 2: SAS	8i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0
Backplane 3: SAS	8i RAID/HBA adapter on PCIe slot 5: • Gen 3: C0C1 • Gen 4: C0

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 127. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
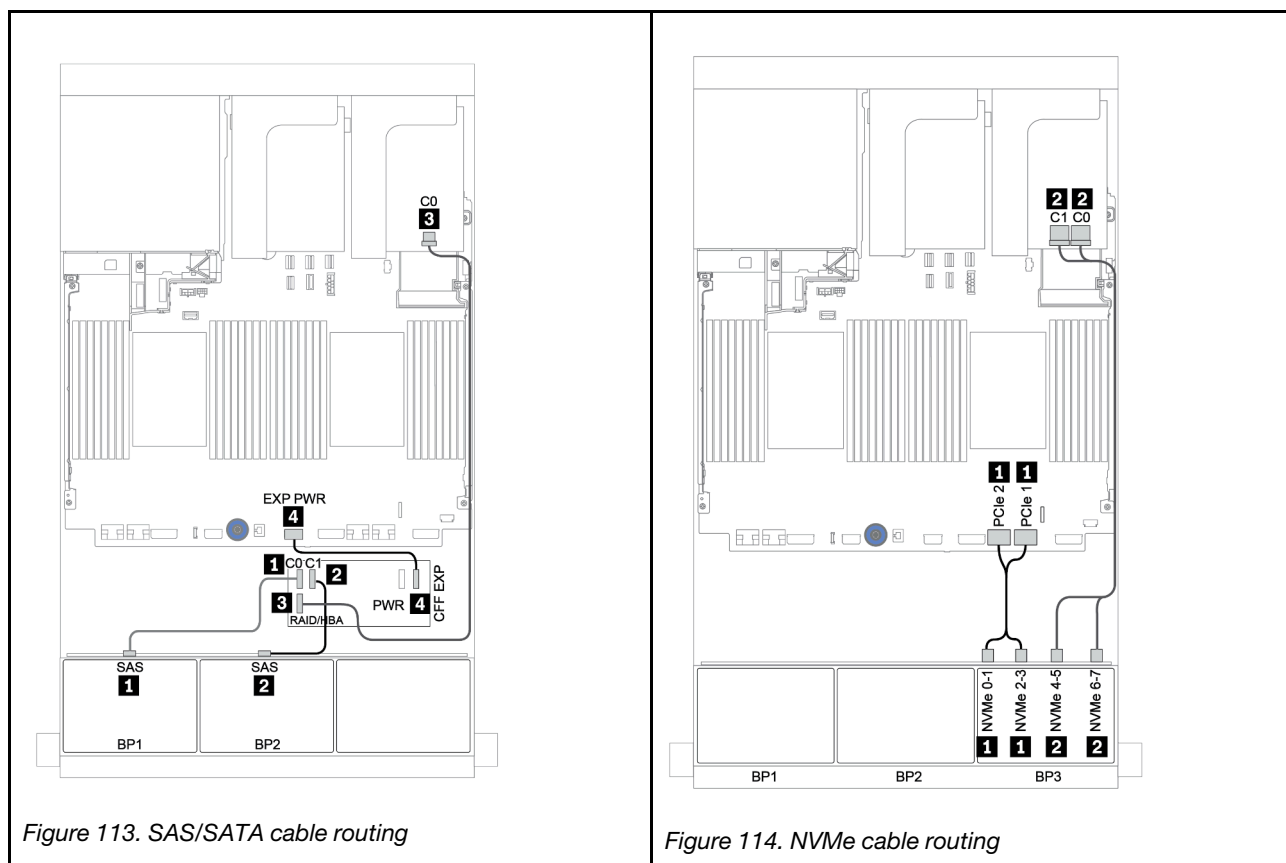

Figure 128. NVMe cable routing (two processors)

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	8i RAID/HBA adapter on PCIe slot 6: • Gen 3: C0C1 • Gen 4: C0
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 129. Cable routing for the rear 2.5-inch SAS/SATA backplane

32i RAID adapter + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

From	To
Backplane 1: SAS	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	32i RAID adapter on PCIe slot 2: C2
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
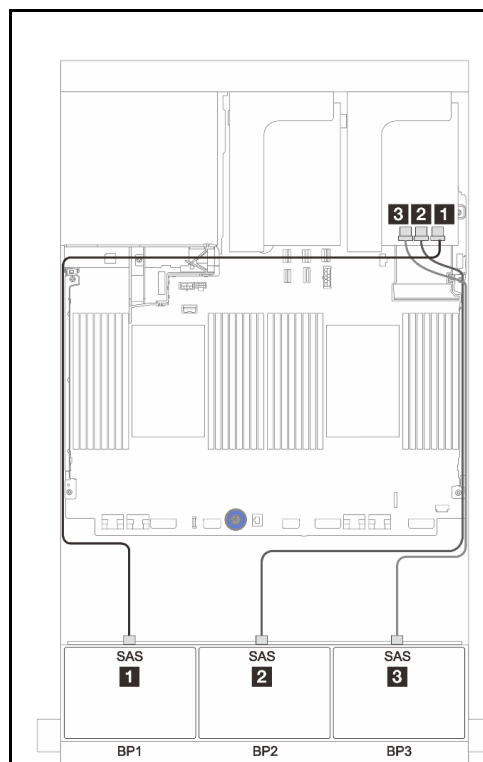
Figure 130. SAS/SATA cable routing
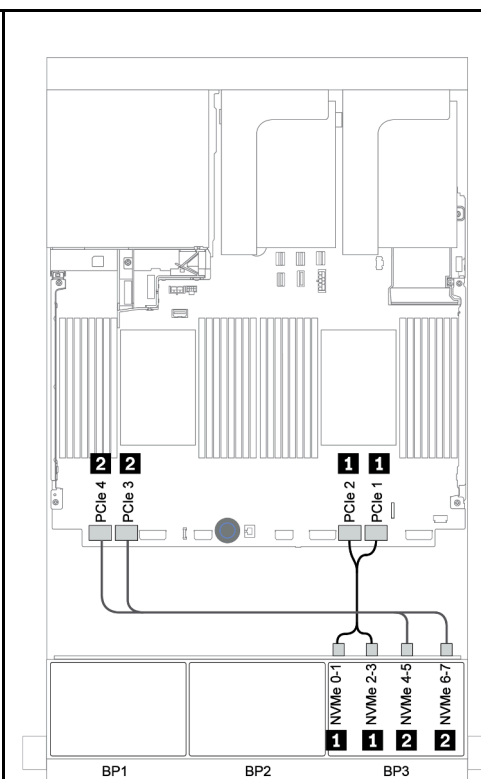
Figure 131. NVMe cable routing

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	32i RAID adapter on PCIe slot 2: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
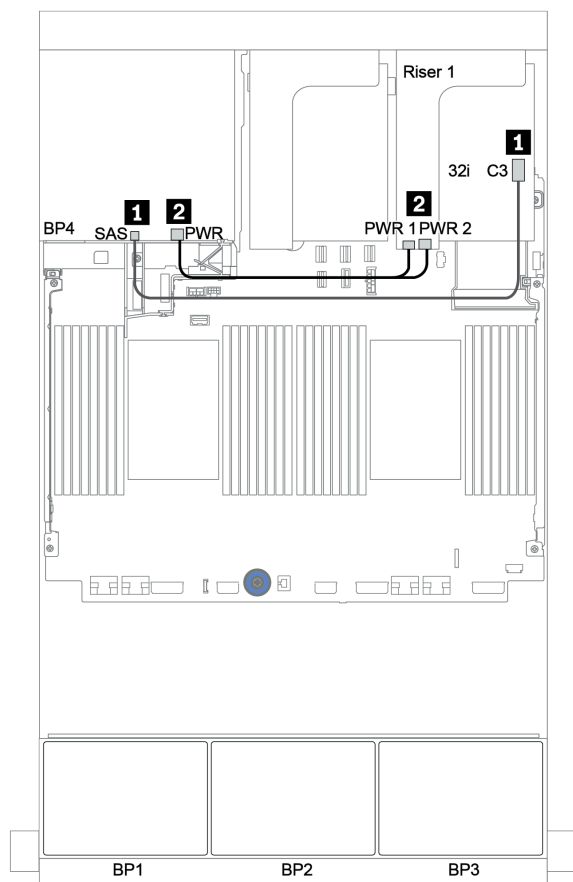
Figure 132. Cable routing for the rear 4 x 2.5-inch SAS/SATA backplane

CFF expander + 8i RAID/HBA adapter + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 133. SAS/SATA cable routing

NVMe cable routing

From	To
BP3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
BP3: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
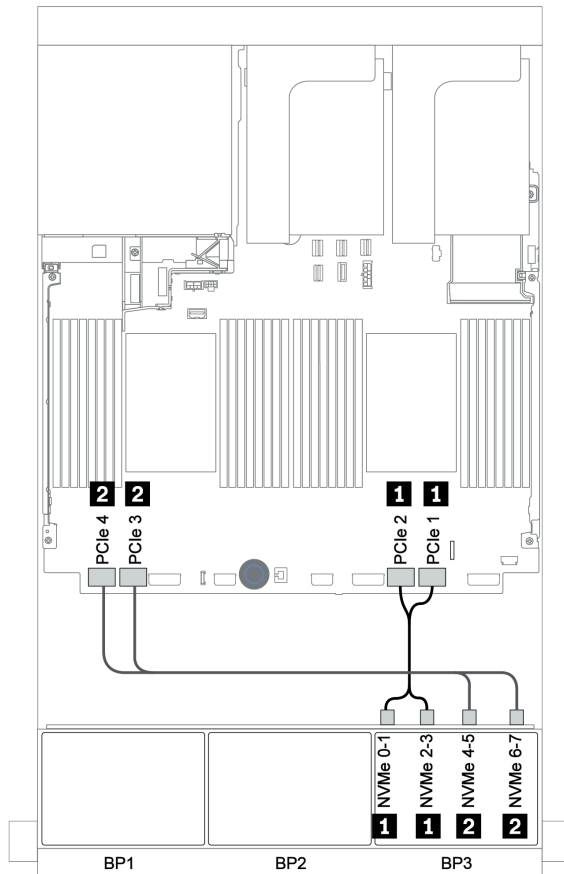
Figure 134. NVMe cable routing (two processors)

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2
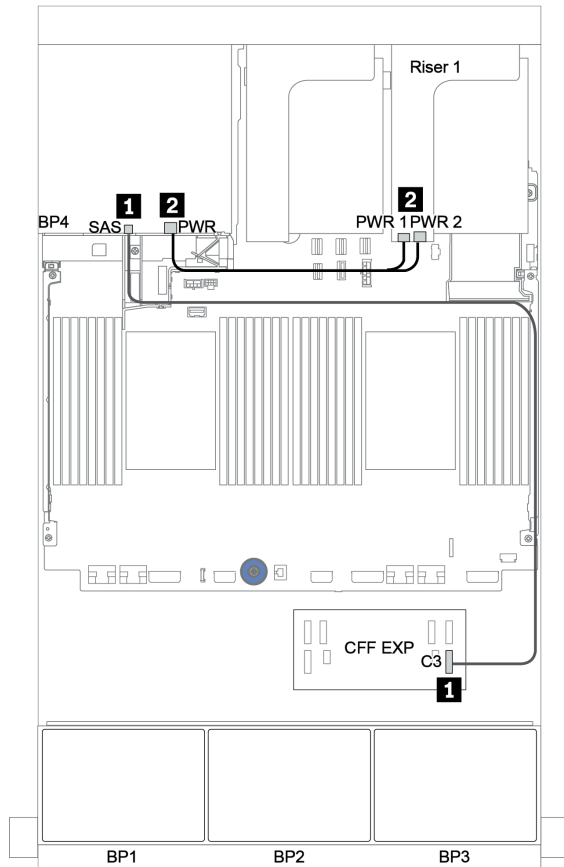
Figure 135. Cable routing for rear 4 x 2.5-inch SAS/SATA backplane

CFF 16i RAID/HBA adapter + CFF expander + onboard connectors

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	CFF 16i RAID/HBA adapter: C0, C1
CFF 16i RAID/HBA adapter: MB (CFF input)	Onboard: PCIe 5
CFF 16i RAID/HBA adapter: PWR	Onboard: RAID PWR
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Note: The CFF adapter in the following illustration might look slightly different from your CFF adapter, but the cable connections are the same.

Figure 136. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 1: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 1: NVMe 4-5, 6-7	Onboard: PCIe 3, PCIe 4

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
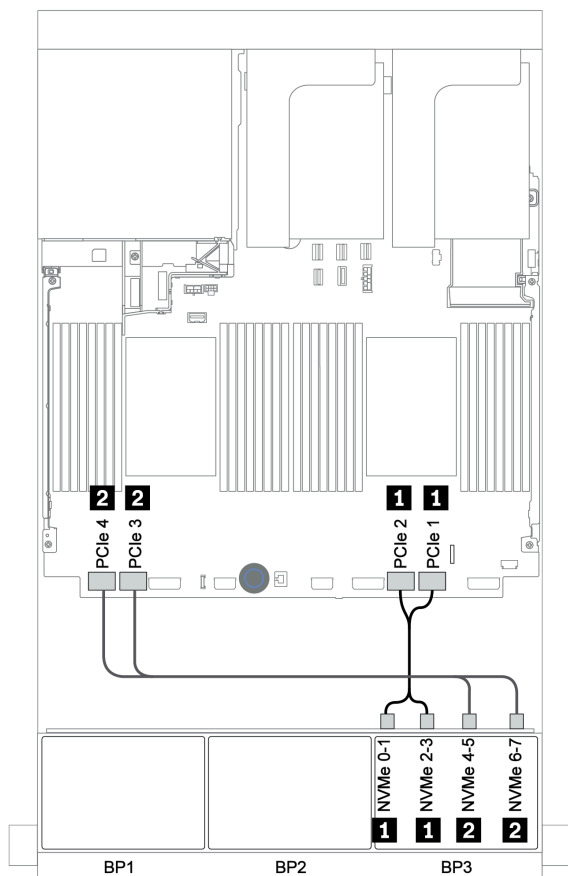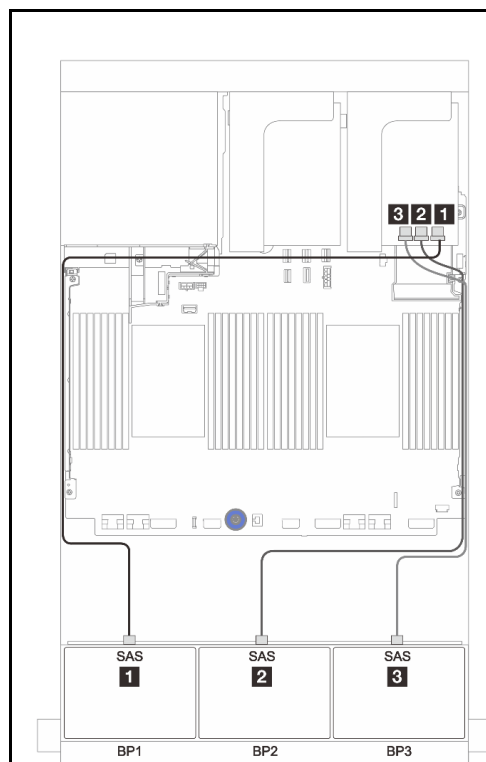

Figure 137. NVMe cable routing

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2
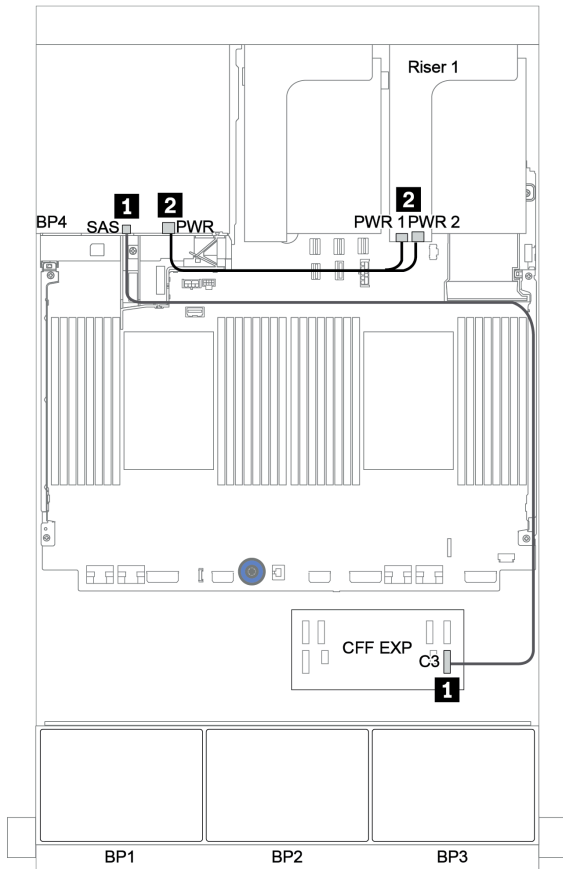
Figure 138. Cable routing for rear 4 x 2.5-inch SAS/SATA backplane

32i RAID adapter + retimer card

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

The following shows the cable connections for 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay configuration with one 32i RAID adapter and one retimer card.

From	To
Backplane 1: SAS	32i RAID adapter on PCIe slot 2: C0
Backplane 2: SAS	32i RAID adapter on PCIe slot 2: C1
Backplane 3: SAS	32i RAID adapter on PCIe slot 2: C2
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 139. SAS/SATA cable routing
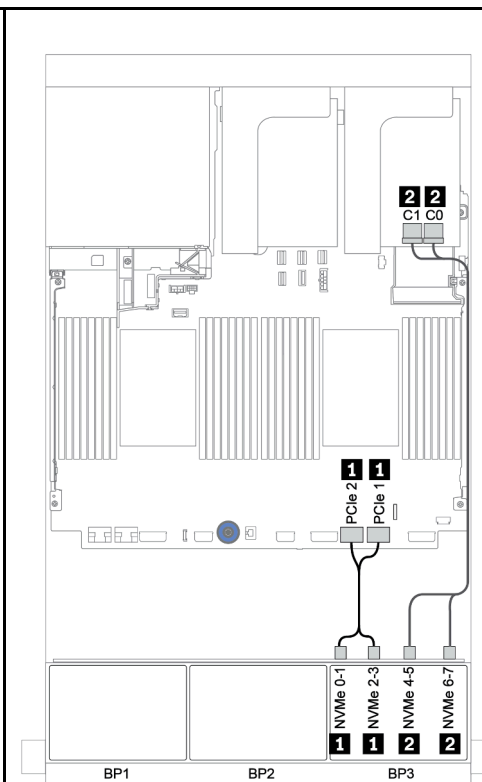
Figure 140. NVMe cable routing

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	32i RAID adapter on PCIe slot 2: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2
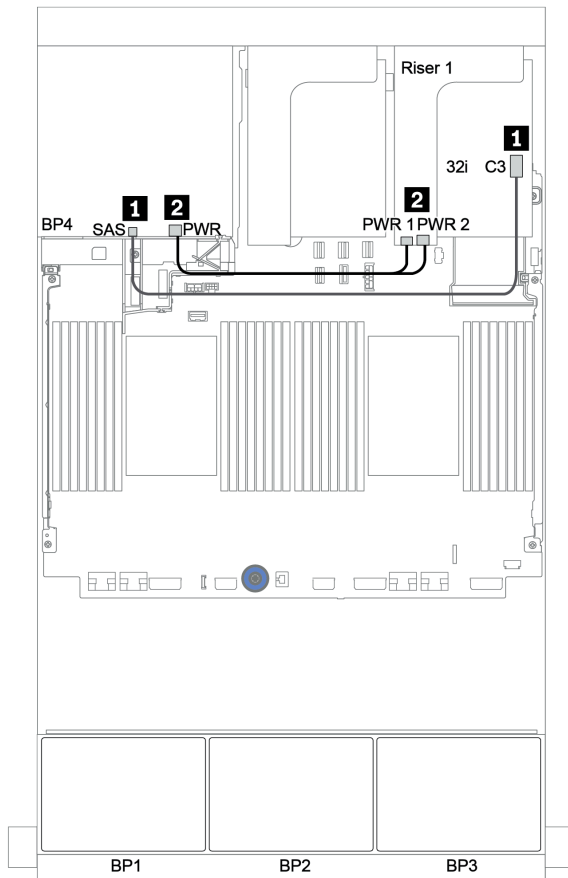
Figure 141. Cable routing for the rear 4 x 2.5-inch SAS/SATA backplane

CFF expander + 8i RAID/HBA adapter + retimer card

Front backplanes: 16 x 2.5-inch SAS/SATA + 8 x 2.5-inch AnyBay

SAS/SATA cable routing

From	To
Backplane 1: SAS	CFF expander: C0
Backplane 2: SAS	CFF expander: C1
Backplane 3: SAS	CFF expander: C2
CFF expander: RAID/HBA	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
CFF expander: PWR	Onboard: EXP PWR

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 142. SAS/SATA cable routing

NVMe cable routing

From	To
Backplane 3: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 3: NVMe 4-5, 6-7	Retimer card on PCIe slot 1: C0, C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
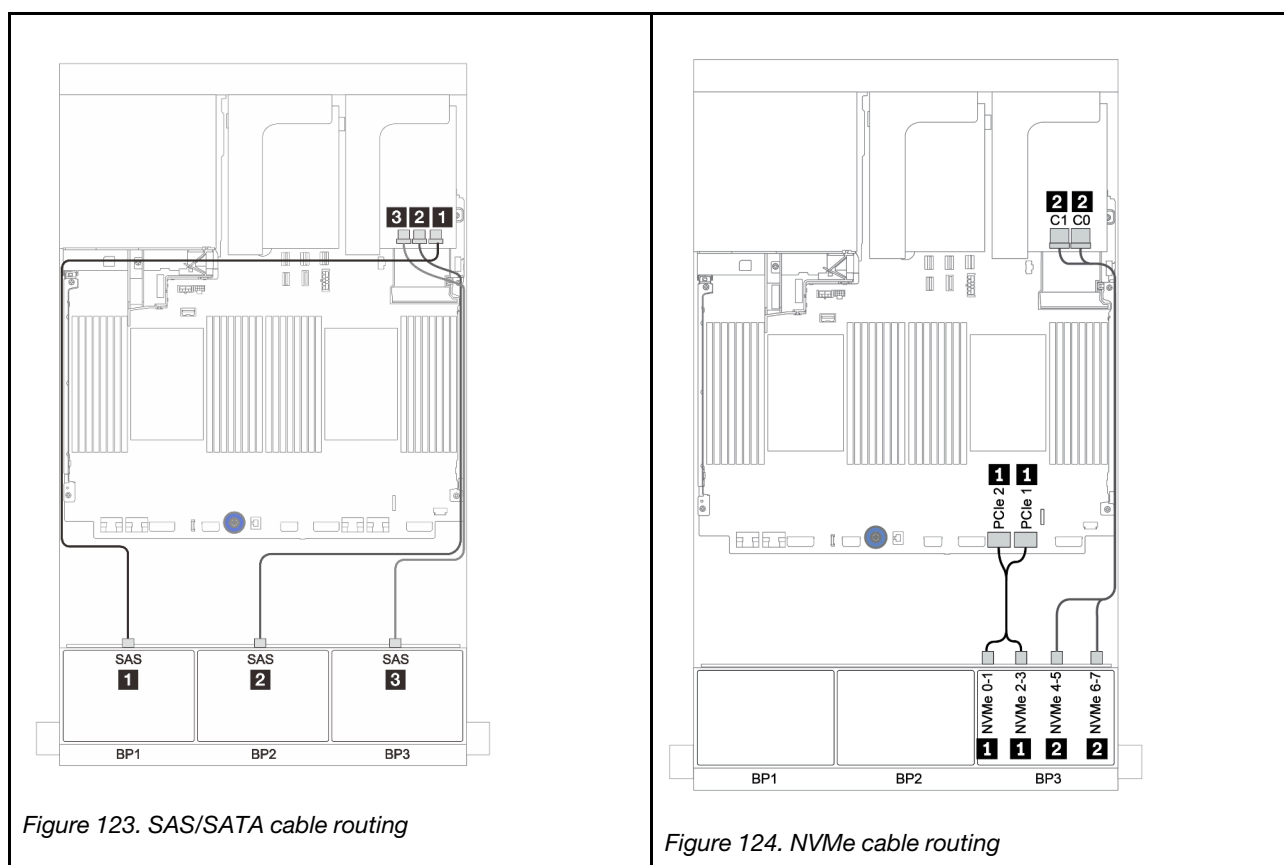

Figure 143. NVMe cable routing (one processor)

Rear backplane: 4 x 2.5-inch SAS/SATA

The following shows the cable connections for a rear 4 x 2.5-inch SAS/SATA backplane if installed.

From	To
Backplane 4: SAS	CFF expander: C3
Backplane 4: PWR	Riser 1: PWR1, PWR2
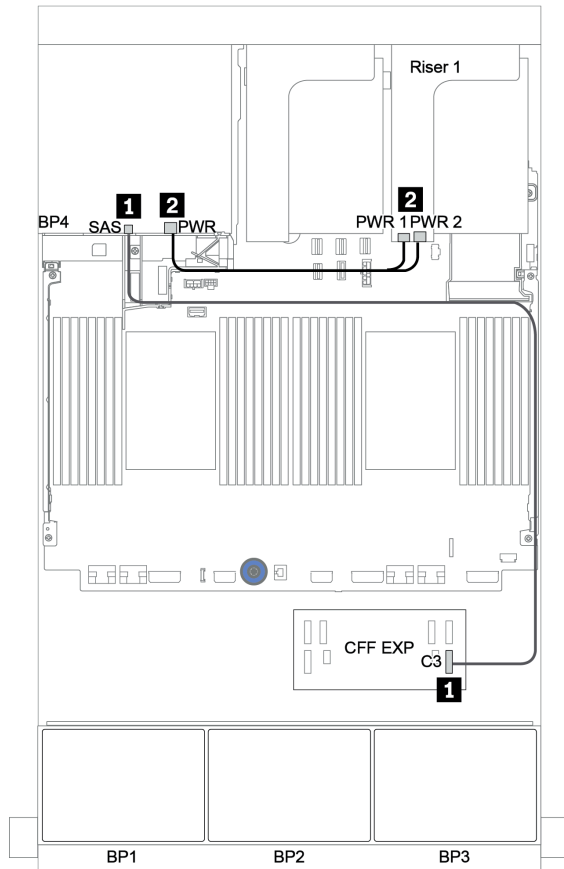
Figure 144. Cable routing for the rear 4 x 2.5-inch SAS/SATA backplane

Backplanes: server models with 3.5-inch drive backplanes

This section provides backplane cable connection information for server models with 3.5-inch drive backplanes.

Before you start

Ensure below parts are removed before starting cable routing for front backplanes.
- Top cover (see "Remove the top cover" on page 435)
- Air baffle (see "Remove the air baffle" on page 265)
- Fan cage (see "Remove the system fan cage" on page 426)

Power cable connections

Connect the power cables for the front 3.5-inch drive backplanes as illustrated.
- **8 x 3.5-inch SAS/SATA front drive backplane**
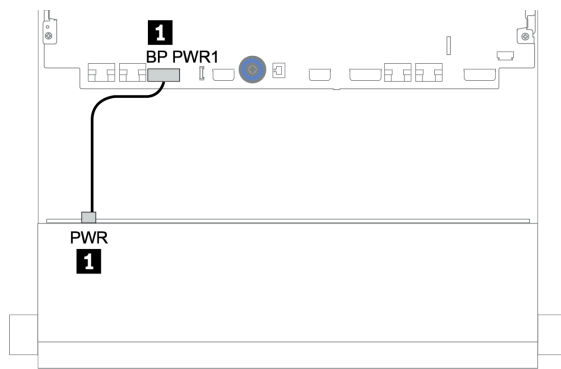
Figure 145. Power cable routing for the 8 x 3.5-inch SAS/SATA drive backplane

- **12 x 3.5-inch front drive backplanes**

  Power cable connections for the below front drive backplanes are the same.
  – 12 x 3.5-inch SAS/SATA drive backplane
  – 12 x 3.5-inch AnyBay drive backplane
  – 12 x 3.5-inch SAS/SATA Expander drive backplane
  – 12 x 3.5-inch AnyBay Expander drive backplane
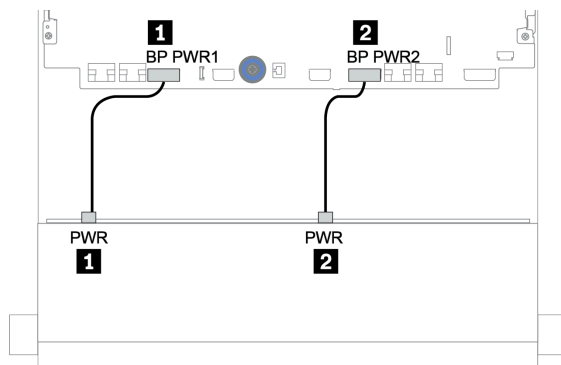
Figure 146. Power cable routing for the 12 x 3.5-inch drive backplane

Signal cable connections

Refer to the specific topic for signal cable connections depending on the backplanes you have installed.
- "8 x 3.5-inch SAS/SATA backplane" on page 199
- "12 x 3.5-inch SAS/SATA backplane" on page 201
- "12 x 3.5-inch AnyBay backplane" on page 220
- "12 x 3.5-inch SAS/SATA Expander backplane" on page 233
- "12 x 3.5-inch AnyBay Expander backplane" on page 235

Controller selections

This section provides controller selection information for configurations with 3.5-inch front drive bays.

The server supports both Gen 3 and Gen 4 RAID/HBA adapters:
- **Gen 3 RAID/HBA adapters**: 430-8i, 4350-8i, 430-16i, 4350-16i, 530-8i, 5350-8i, 530-16i, 930-8i, 9350-8i, 930-16i, 9350-16i
- **Gen 4 RAID/HBA adapters**: 440-8i, 440-16i, 540-8i, 540-16i, 940-8i, 940-16i, 940-32i

For more information about the controllers, see "Technical specifications" on page 3.

The following table lists the supported controller combinations for configurations with 3.5-inch front drive bays.

S/S: SATA/SAS, Any: AnyBay, OB: onboard, EXP: expander

Front bays		Mid bays		Rear bays		CPUs	Controllers
S/S 3.5"	Any 3.5"	S/S 3.5"	NVMe 2.5"	S/S 2.5"	S/S 3.5"		
8	0	0	0	0	0	1 or 2	"OB SATA" on page 199
						1 or 2	"1 x RAID/HBA 8i" on page 200
12	0	0	0	0	0	1 or 2	"OB SATA" on page 202
						1 or 2	"1 x RAID/HBA 16i" on page 203
12	0	0	0	0	2	1 or 2	"OB SATA + OB SATA" on page 205
						1 or 2	"1 x RAID/HBA 16i" on page 207
						1 or 2	"1 x RAID/HBA 16i + OB SATA" on page 208
						1 or 2	"1 x RAID/HBA 16i + 1 x RAID/HBA 8i" on page 209
12	0	0	0	0	4	1 or 2	"OB SATA + 1 x RAID/HBA 8i" on page 206
						1 or 2	"1 x RAID/HBA 16i" on page 207
						1 or 2	"1 x RAID/HBA 16i + OB SATA" on page 208
						1 or 2	"1 x RAID/HBA 16i + 1 x RAID/HBA 8i" on page 209
12	0	0	0	4	0	1 or 2	"OB SATA + 1 x RAID/HBA 8i" on page 206
						1 or 2	"1 x RAID/HBA 16i" on page 207
						1 or 2	"1 x RAID/HBA 16i + OB SATA" on page 208
						1 or 2	"1 x RAID/HBA 16i + 1 x RAID/HBA 8i" on page 209

Front bays		Mid bays		Rear bays		CPUs	Controllers
S/S 3.5"	Any 3.5"	S/S 3.5"	NVMe 2.5"	S/S 2.5"	S/S 3.5"		
12	0	4	0	0	0	2	"OB SATA + 8i RAID adapter" on page 211
12	0	0	8	0	0	2	"1 x RAID/HBA 16i + OB NVMe" on page 212
12	0	4	0	0	4	2	"OB SATA + 1 x 430/4350-8i HBA adapter" on page 216
						2	"1 x RAID 32i" on page 218
12	0	4	0	4	0	2	"OB SATA + 1 x RAID/HBA 8i" on page 216
						2	"1 x RAID 32i" on page 218
						1	"OB SATA + 1 x RAID 940-16i" on page 219
0	12	0	0	0	0	2	"OB SATA + OB NVMe" on page 221
						2	"1 x RAID/HBA 16i + OB NVMe" on page 222
0	12	0	0	0	4	2	"1 x RAID/HBA 16i + OB NVMe" on page 224
						2	"1 x RAID/HBA 16i + 1 x RAID 8i + OB NVMe" on page 226
0	12	4	0	0	4	2	"1 x RAID 32i + OB NVMe" on page 229
8	4	4	0		4	1	"1 x RAID 940-16i + OB NVMe" on page 231
12	0	0	0	0	0	1 or 2	"1 x RAID 8i " on page 233
	0	0	0	0	2	1 or 2	"1 x RAID 8i + OB NVMe" on page 234
	0	0	0	0	4	1 or 2	"1 x RAID 8i + OB NVMe" on page 234
	0	0	0	4		1 or 2	"1 x RAID 8i + OB NVMe" on page 234
8	4	0	0	0	0	1 or 2	"1 x RAID 8i + OB NVMe" on page 235
8	4	0	0	4	0	1 or 2	"1 x RAID 8i + OB NVMe" on page 236

8 x 3.5-inch SAS/SATA backplane

This section provides cable routing information for the server model with the 8 x 3.5-inch SAS/SATA front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 3.5-inch drive backplanes" on page 196.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Onboard connectors" on page 199
- "8i RAID/HBA adapter" on page 200

Onboard connectors

The following shows the cable connections for the 8 x 3.5-inch SAS/SATA configuration with onboard connectors.

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
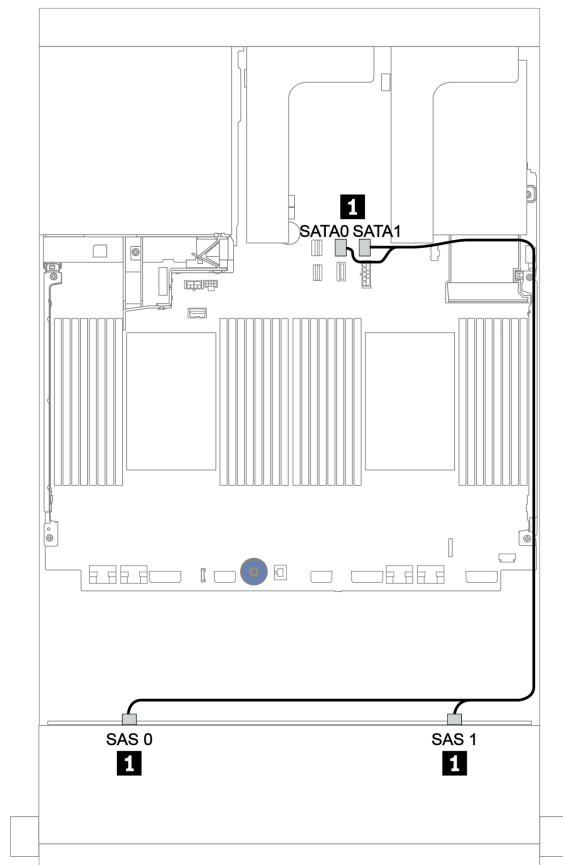
Figure 147. Cable routing for the 8 x 3.5-inch SAS/SATA configuration with onboard connectors

8i RAID/HBA adapter

The following shows the cable connections for the 8 x 3.5-inch SAS/SATA configuration with one 8i RAID/HBA adapter.

From	To
Backplane 1: SAS 0, SAS 1	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0

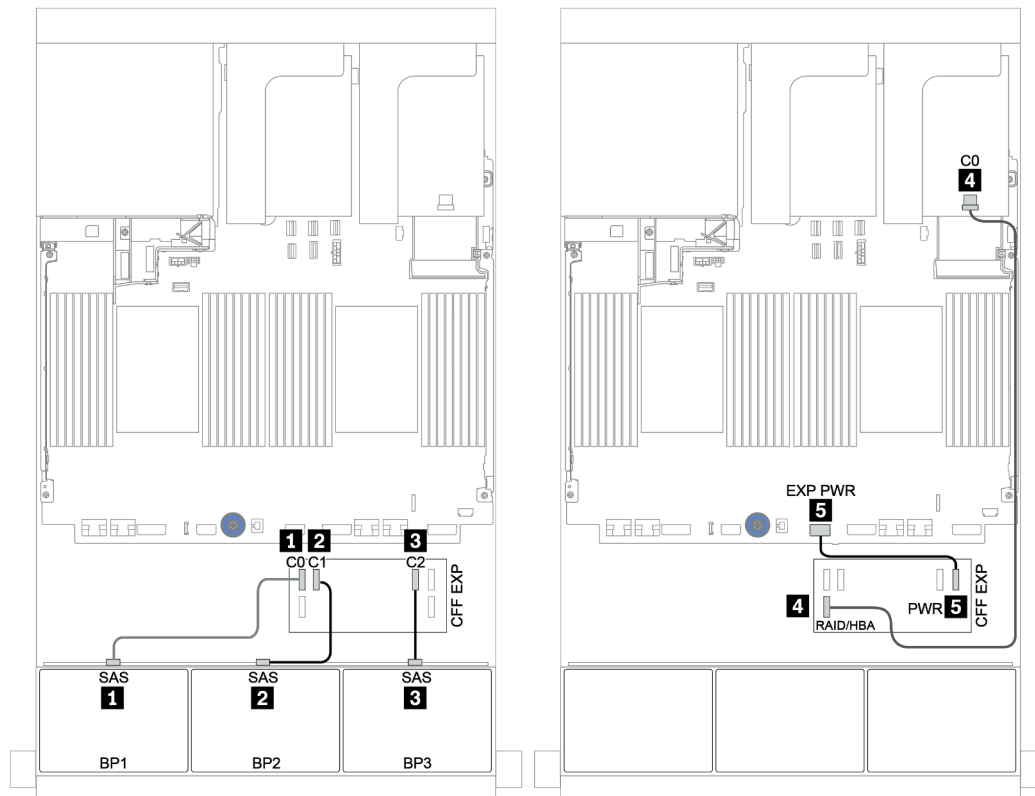Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 148. Cable routing for the 8 x 3.5-inch SAS/SATA configuration with one 8i RAID/HBA adapter

12 x 3.5-inch SAS/SATA backplane

This section provides cable routing information for the server model with the 12 x 3.5-inch SAS/SATA front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 3.5-inch drive backplanes" on page 196.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:

Front backplane: 12 x 3.5" SAS/SATA

This topic provides cable routing information for the server model with 12 x 3.5-inch SAS/SATA front drive backplane.

- "Onboard connectors" on page 202
- "16i RAID/HBA adapter" on page 203

Onboard connectors

The following shows the cable connections for the 12 x 3.5-inch SAS/SATA configuration with onboard connectors.

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2

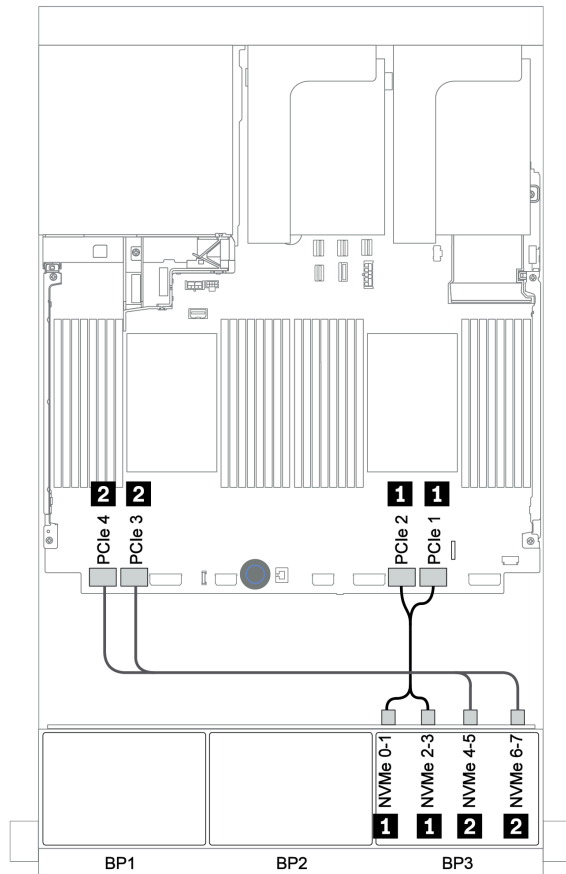Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
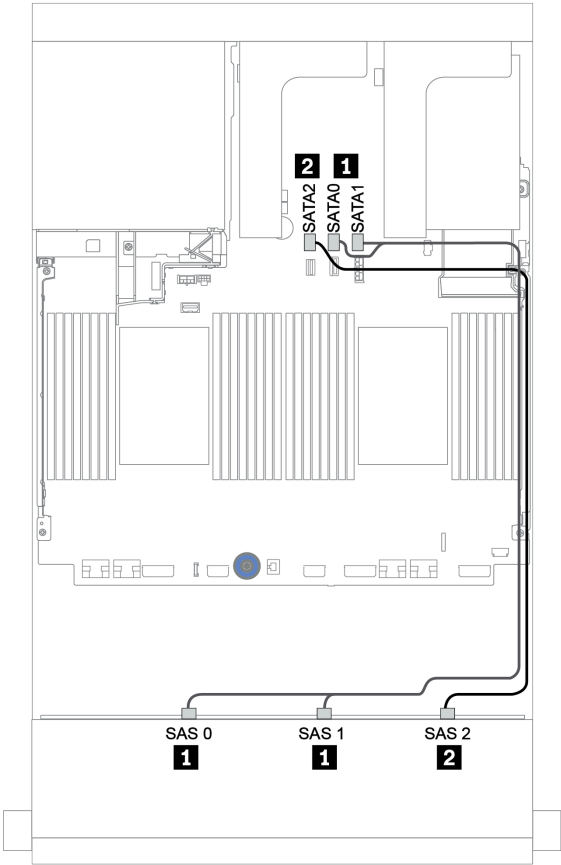
Figure 149. Cable routing for the 12 x 3.5-inch SAS/SATA configuration with onboard connectors

16i RAID/HBA adapter

The following shows the cable connections for the 12 x 3.5-inch SAS/SATA configuration with one 16i RAID/HBA adapter.

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	• Gen 3: C2C3 • Gen 4: C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

*Figure 150. Cable routing for the 12 x 3.5-inch SAS/SATA configuration with one 16i RAID/HBA adapter*

Front + rear backplanes: 12 x 3.5" SAS/SATA + 4 x 2.5"/2 x 3.5"/4 x 3.5" SAS/SATA

This topic provides cable routing information for the 12 x 3.5-inch SAS/SATA front backplane and a 4 x 2.5-inch/2 x 3.5-inch/4 x 3.5-inch SAS/SATA rear backplane.

Depending on the rear backplane and controller you use, refer to the specific configuration for cable routing information.

Config.	Front backplane	Rear backplane	Front backplane controller	Rear backplane controller
"1" on page 205	12 x 3.5-inch SAS/SATA	2 x 3.5-inch SAS/SATA	Onboard connectors	Onboard connectors
"2" on page 206		4 x 3.5-inch/4 x 2.5-inch SAS/SATA	Onboard connectors	8i RAID/HBA adapter
"3" on page 207		2 x 3.5-inch/4 x 3.5-inch/4 x 2.5-inch SAS/SATA	One shared 16i RAID/HBA adapter	
"4" on page 208		2 x 3.5-inch/4 x 3.5-inch/4 x 2.5-inch SAS/SATA	16i RAID/HBA adapter	Onboard connectors
"5" on page 209		2 x 3.5-inch/4 x 3.5-inch/4 x 2.5-inch SAS/SATA	16i RAID/HBA adapter	8i RAID/HBA adapter

Onboard connectors + onboard connectors

Front + rear backplanes: 12 x 3.5" SAS/SATA + 2 x 3.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2
Backplane 4: SAS	Onboard: Rear BP
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 151. Front backplane cable routing

Figure 152. Rear backplane cable routing
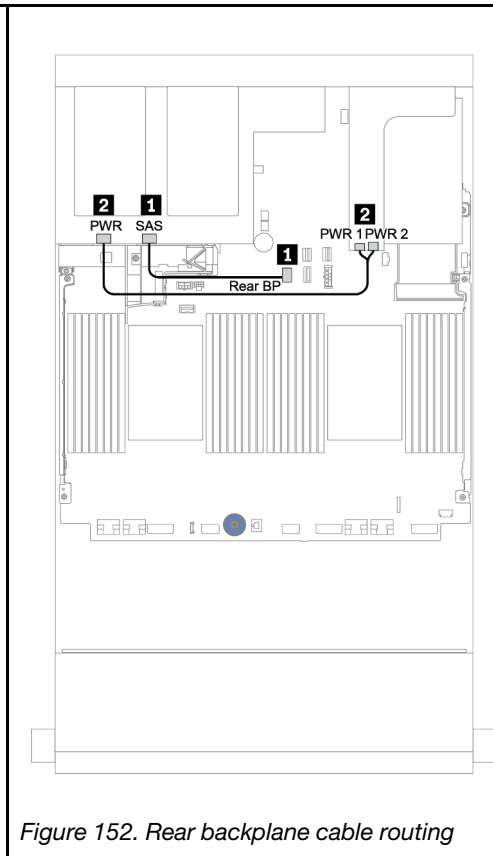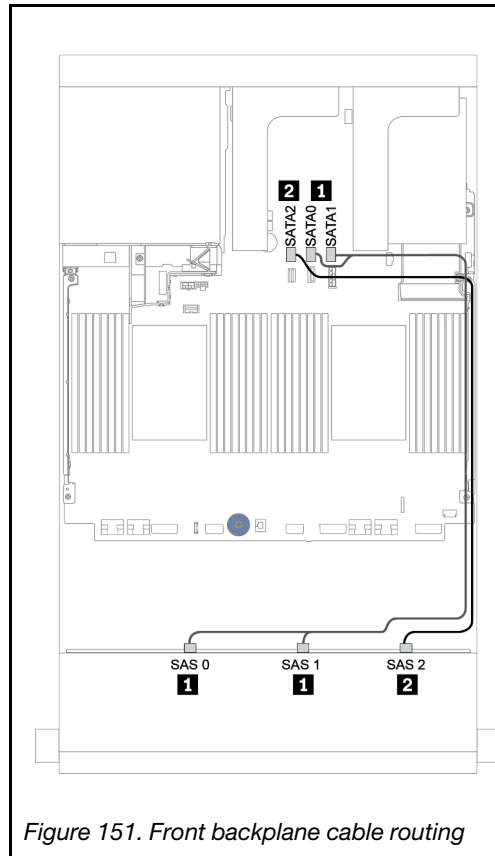
Onboard connectors + 8i RAID/HBA adapter

Front + rear backplanes: 12 x 3.5" SAS/SATA + 4 x 3.5"/4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2
Backplane 4: SAS	8i RAID/HBA[1]: C0C1 (Gen 3) or C0 (Gen 4)
Backplane 4: PWR	Riser 1: PWR1, PWR2

Notes:

- For a 4 x 3.5-inch SAS/SATA rear backplane, the 8i adapter[1] is installed on PCIe slot 3.
- For a 4 x 2.5-inch SAS/SATA rear backplane, the 8i adapter[1] is installed on PCIe slot 2.

Below illustration uses the 4 x 3.5-inch SAS/SATA rear backplane as an example for cable routing. Cable routing for the 4 x 2.5-inch SAS/SATA rear backplane is similar.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
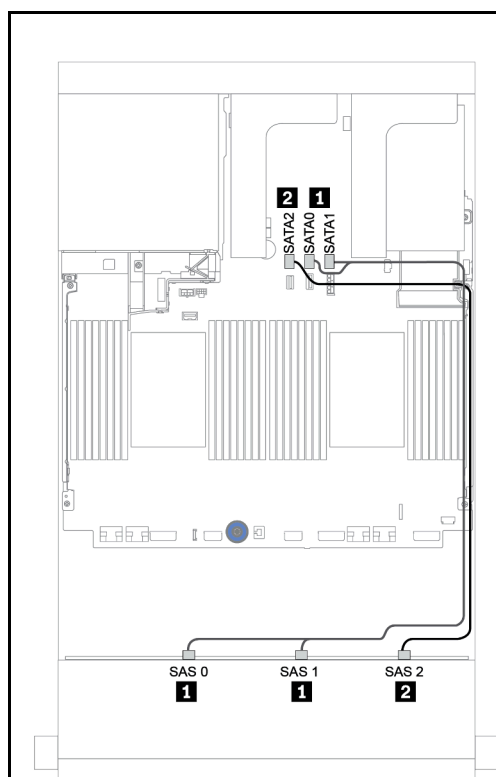
Figure 153. Front backplane cable routing

Figure 154. Rear backplane cable routing

16i/24i RAID/HBA adapter

Front + rear backplanes: 12 x 3.5" SAS/SATA + 2 x 3.5"/4 x 3.5"/4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	• 16i RAID/HBA [1]: C0C1 (Gen 3) or C0 (Gen 4) • 24i RAID/HBA: C0C1
Backplane 1: SAS 2	• 16i RAID/HBA [1]: C2C3 (Gen 3) or C1 (Gen 4) • 24i RAID/HBA: C2C3
Backplane 4: SAS	
Backplane 4: PWR	Riser 1: PWR1, PWR2

Notes:

- For a 2 x 3.5/4 x 2.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 2.
- For a 4 x 3.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 3.

Below illustration uses the 4 x 3.5-inch SAS/SATA backplane as an example for cable routing. Cable routing for the other backplanes is similar.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 155. Cable routing for the 12 x 3.5-inch SAS/SATA configuration with a 4 x 3.5-inch SAS/SATA rear backplane

16i RAID/HBA adapter + Onboard connectors

Front + rear backplanes: 12 x 3.5" SAS/SATA + 2 x 3.5"/4 x 3.5"/4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA [1]: C0C1 (Gen 3) or C0 (Gen 4)
Backplane 1: SAS 2	16i RAID/HBA [1]: C2C3 (Gen 3) or C1 (Gen 4)
Backplane 4: SAS	Onboard: SATA 0
Backplane 4: PWR	Riser 1: PWR1, PWR2

Notes:

- For a 2 x 3.5/4 x 2.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 2.
- For a 4 x 3.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 3.

Below illustration uses the 4 x 3.5-inch SAS/SATA backplane as an example for cable routing. Cable routing for the other backplanes is similar.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 156. Front backplane cable routing

Figure 157. Rear backplane cable routing

16i RAID/HBA adapter + 8i RAID/HBA adapter

Front + rear backplanes: 12 x 3.5" SAS/SATA + 2 x 3.5"/4 x 3.5"/4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA [1]: C0C1 (Gen 3) or C0 (Gen 4)
Backplane 1: SAS 2	16i RAID/HBA [1]: C2C3 (Gen 3) or C1 (Gen 4)
Backplane 4: SAS	8i RAID/HBA [2]: C0C1 (Gen 3) or C0 (Gen 4)
Backplane 4: PWR	Riser 1: PWR1, PWR2

Notes:
- For a 2 x 3.5-inch/4 x 2.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 2 and the 8i adapter[2] is installed on and PCIe slot 3.
- For a 4 x 3.5-inch SAS/SATA rear backplane, the 16i adapter[1] is installed on PCIe slot 3 and the 8i adapter[2] is installed on and PCIe slot 6.

Below illustration uses the 4 x 3.5-inch SAS/SATA backplane as an example for cable routing. Cable routing for the other backplanes is similar. Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
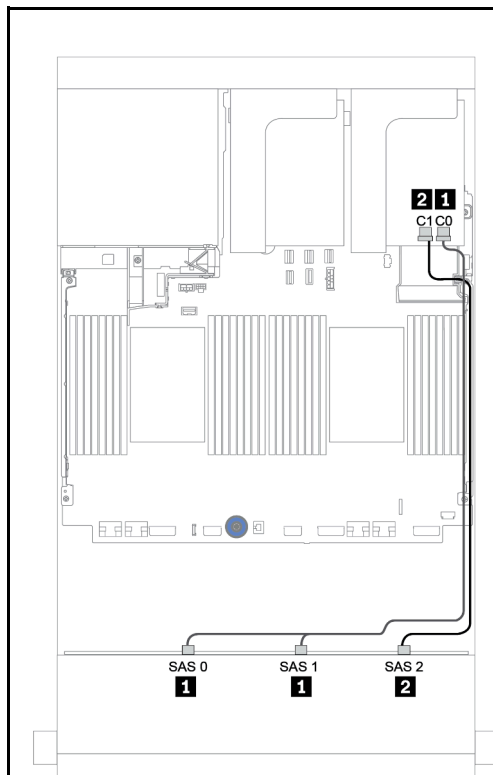
Figure 158. Front backplane cable routing

Figure 159. Rear backplane cable routing

Front + middle backplanes: 12 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA/8 x 2.5" NVMe

This topic provides cable routing information for the 12 x 3.5-inch SAS/SATA front backplane with a 4 x 3.5-inch SAS/SATA middle backplane or two a 4 x 2.5-inch NVMe middle backplane.

- "Onboard connectors + 430/4350-8i HBA adapter" on page 216
- "32i RAID adapter" on page 218

12 x 3.5 SAS/SATA + 4 x 3.5 SAS/SATA

- "Front backplane: 12 x 3.5" SAS/SATA" on page 211
- "Middle backplane: 4 x 3.5" SAS/SATA" on page 212

Front backplane: 12 x 3.5" SAS/SATA

The following shows the cable connections with onboard connectors.

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
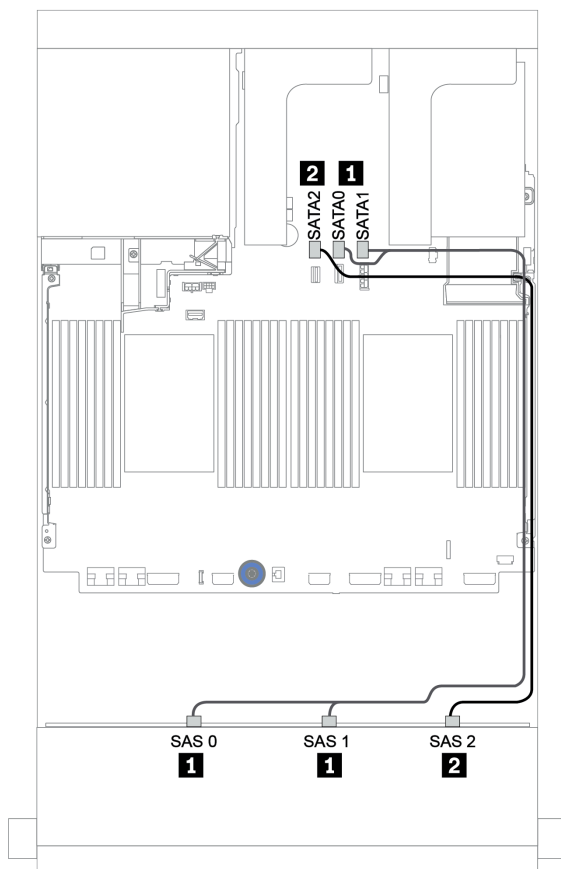
Figure 160. Cable routing for the 12 x 3.5-inch SAS/SATA front backplane with onboard connectors

Middle backplane: 4 x 3.5" SAS/SATA

The following shows the cable connections for the middle backplane with one Gen 4 8i adapter.

From	To
Backplane 5: SAS	8i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 5: PWR	Riser 2: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
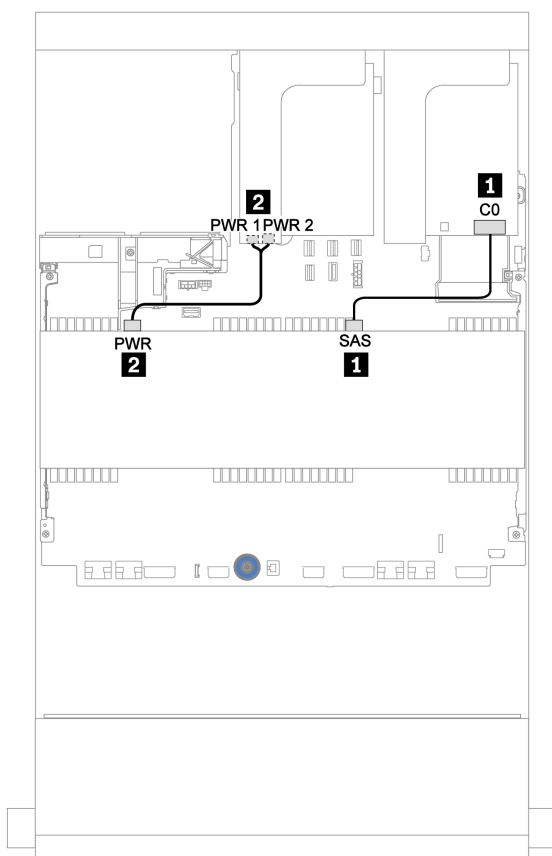
Figure 161. Cable routing for the 4 x 3.5-inch SAS/SATA middle backplane

12 x 3.5" SAS/SATA + 8 x 2.5" NVMe

This topic provides cable routing information for the 12 x 3.5-inch SAS/SATA front backplane with two 4 x 2.5-inch NVMe middle backplanes.

- "Front backplane: 12 x 3.5" SAS/SATA" on page 212
- "Middle backplanes: 8 x 2.5" NVMe" on page 213

Front backplane: 12 x 3.5" SAS/SATA

The following shows the cable connections for the 12 x 3.5-inch SAS/SATA front backplane with one 16i RAID/HBA adapter.

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	• Gen 3: C2C3 • Gen 4: C1

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
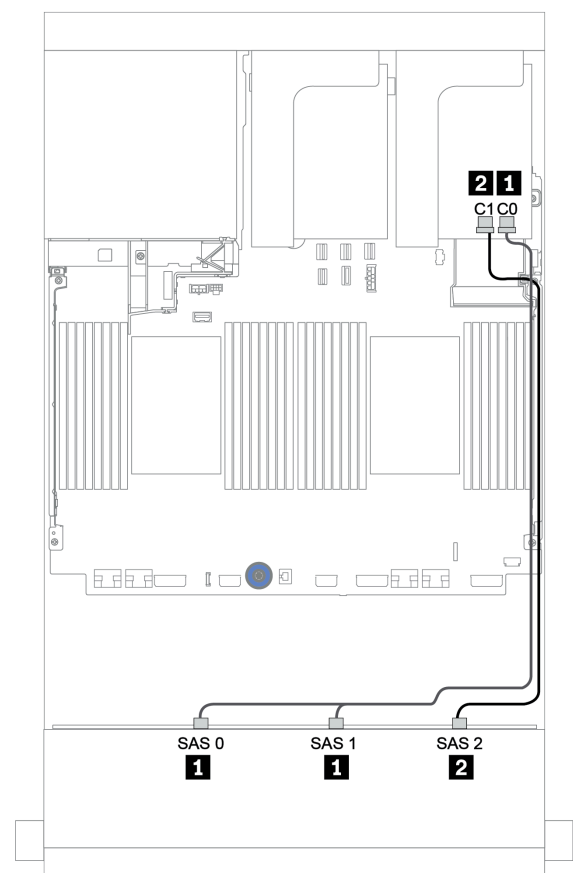
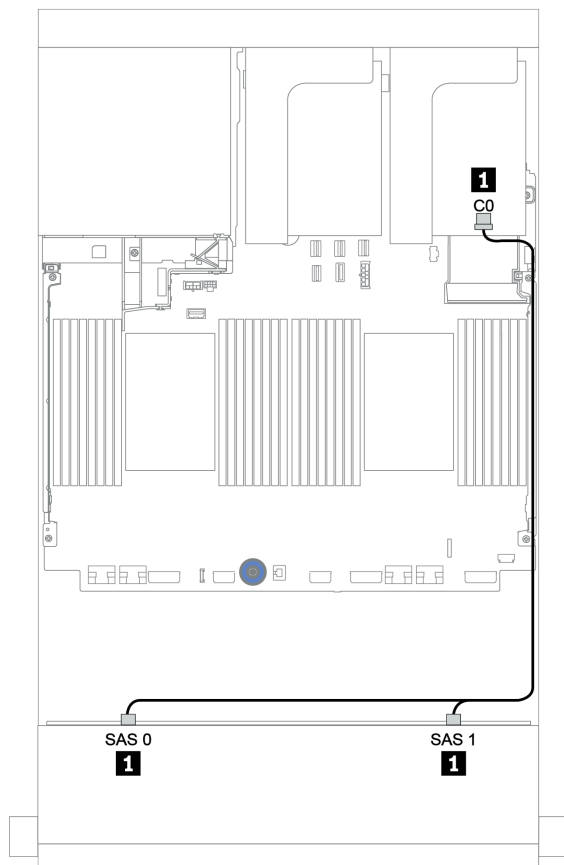Figure 162. Cable routing for the 12 x 3.5-inch SAS/SATA front backplane with one 16i RAID/HBA adapter

Middle backplanes: 8 x 2.5" NVMe

The following shows the cable connections for the two 4 x 2.5-inch NVMe drive backplanes with onboard connectors.

From	To
Backplane 5: NVMe 0-1, 2-3	Onboard: PCIe 1, PCIe 2
Backplane 6: NVMe 0-1, 2-3	Onboard: PCIe 3, PCIe 4
Backplane 5: PWR	Riser 2: PWR1, PWR2
Backplane 6: PWR	

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
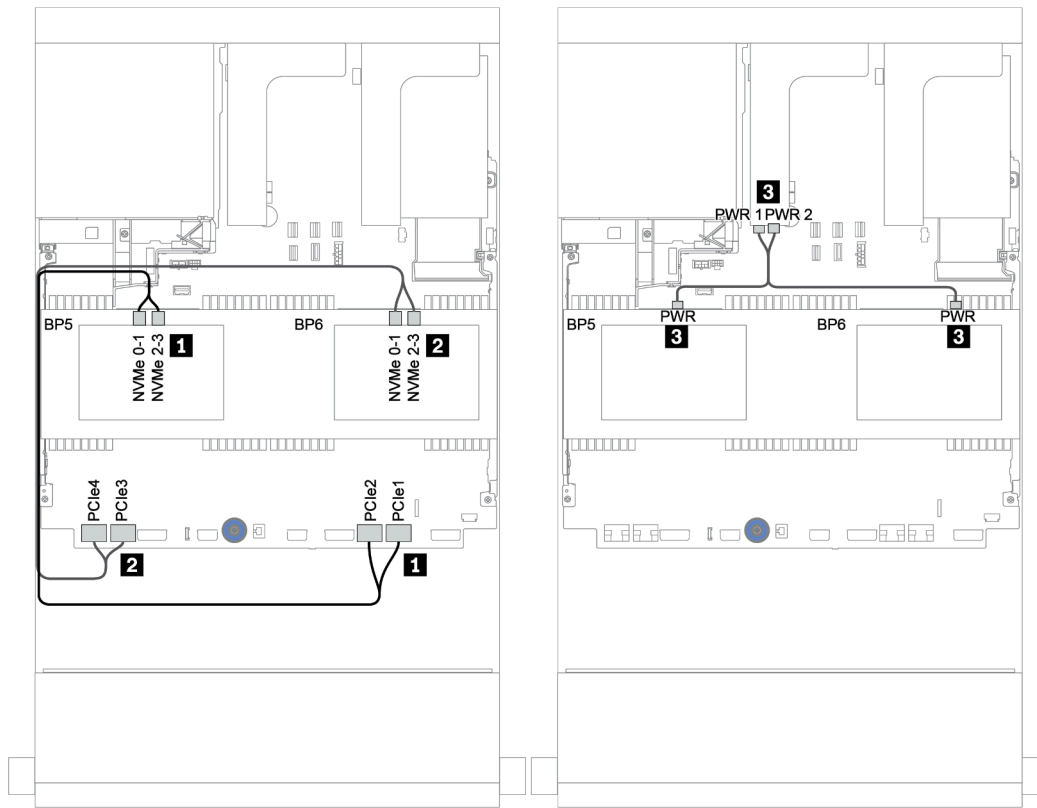
Figure 163. Cable routing for the two 4 x 2.5-inch NVMe middle drive backplanes

Front + middle + rear backplanes: 12 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA + 4 x 3.5"/ 4 x 2.5" SAS/SATA

This topic provides cable routing information for the 12 x 3.5-inch SAS/SATA front backplane with a 4 x 3.5-inch SAS/SATA middle backplane and a 4 x 3.5-inch/4 x 2.5-inch SAS/SATA rear backplane.

Onboard connectors + 430/4350-8i HBA adapter

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Front backplane: 12 x 3.5" SAS/SATA

The following shows the cable connections with onboard connectors.

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 164. Cable routing for the 12 x 3.5-inch SAS/SATA front backplane with onboard connectors

Middle + rear backplanes: 4 x 3.5" SAS/SATA + 4 x 3.5"/4 x 2.5" SAS/SATA

The following shows the cable connections with one 430/4350-8i HBA adapter.

From	To
Backplane 4: SAS	8i adapter [1]: C0C1
Backplane 5: SAS	
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2

Notes:

- For a 4 x 3.5-inch SAS/SATA rear backplane, the 8i adapter[1] is installed on PCIe slot 3.
- For a 4 x 2.5-inch SAS/SATA rear backplane, the 8i adapter[1] is installed on PCIe slot 2.

Below illustration uses the 4 x 3.5-inch SAS/SATA rear backplane as an example for cable routing. Cable routing for the 4 x 2.5-inch SAS/SATA rear backplane is similar.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
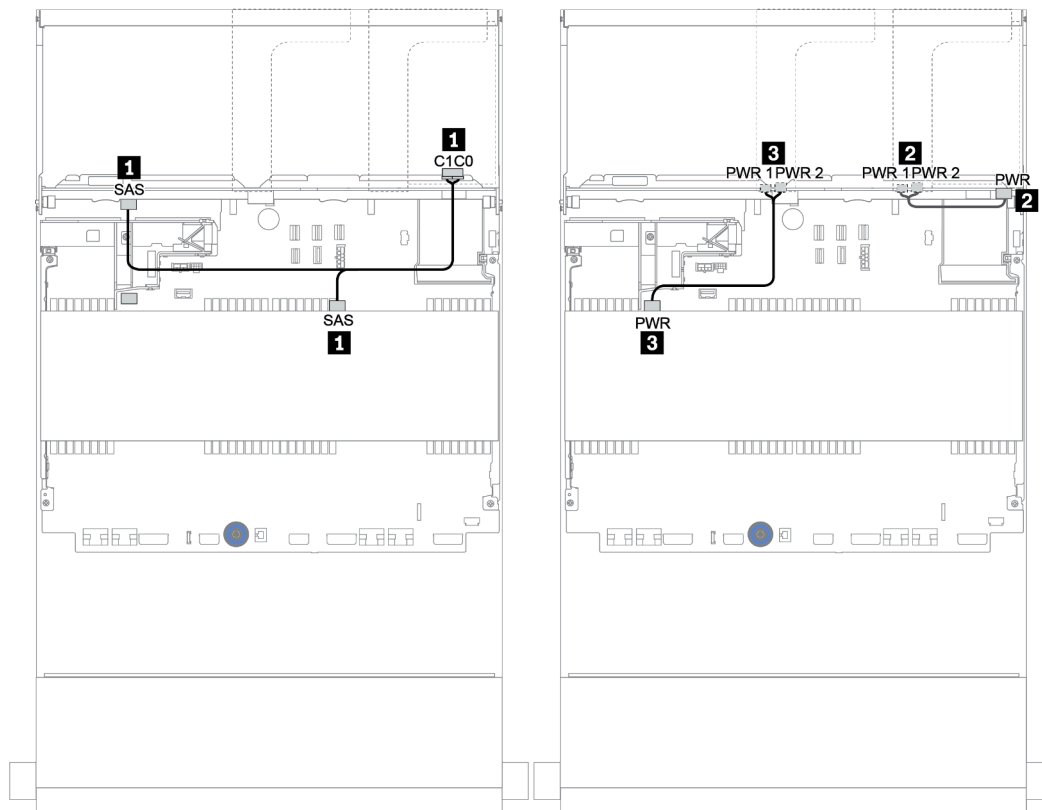
Figure 165. Cable routing for the 4 x 3.5-inch SAS/SATA middle backplane and 4 x 3.5-inch SAS/SATA rear backplane

32i RAID adapter

Front + middle + rear backplanes: 12 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA + 4 x 3.5"/4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	32i RAID [1]: C0
Backplane 1: SAS 2	32i RAID [1]: C1
Backplane 4: SAS	
Backplane 5: SAS	32i RAID [1]: C2
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2

Notes:
- For a 4 x 3.5-inch SAS/SATA rear backplane, the 32i adapter[1] is installed on PCIe slot 3.
- For a 4 x 2.5-inch SAS/SATA rear backplane, the 32i adapter[1] is installed on PCIe slot 2.

Below illustration uses the 4 x 3.5-inch SAS/SATA rear backplane as an example for cable routing. Cable routing for the 4 x 2.5-inch SAS/SATA rear backplane is similar.

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
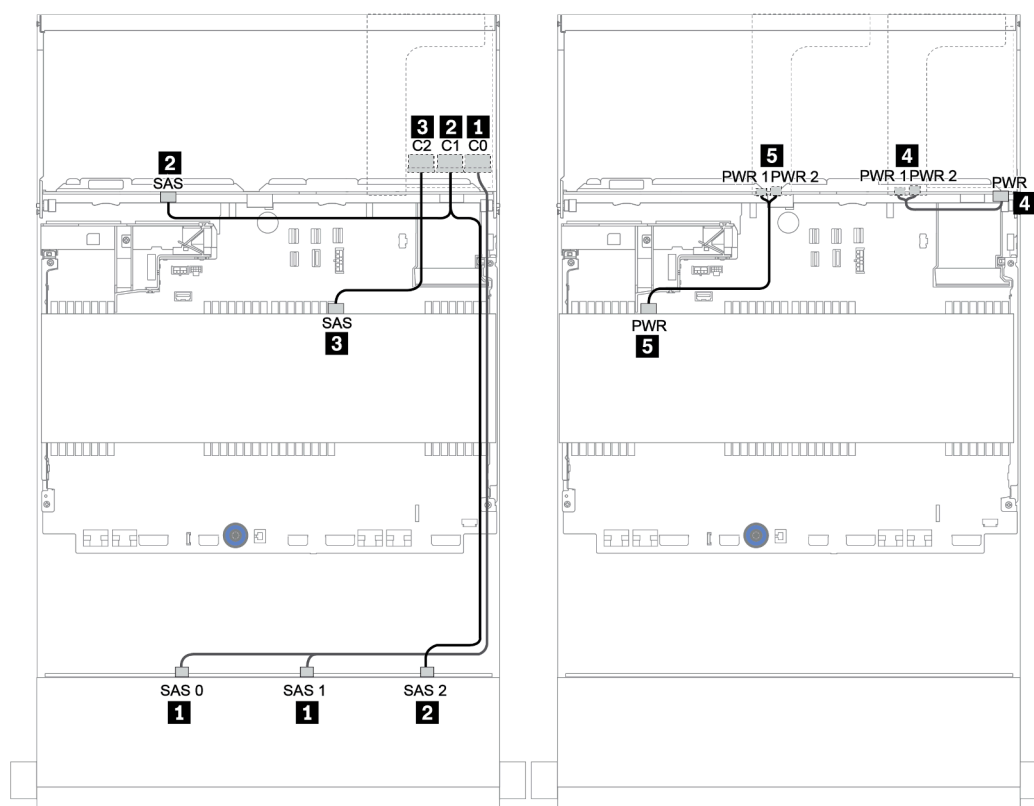
Figure 166. Cable routing for the 12 x 3.5-inch SAS/SATA + 4 x 3.5-inch SAS/SATA + 4 x 3.5-inch SAS/SATA configuration with one 32i RAID adapter

16i RAID adapter + onboard connectors

Front + middle + rear backplanes: 12 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA + 4 x 2.5" SAS/SATA

From	To
Backplane 1: SAS 0, SAS 1	16i RAID: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	16i RAID: • Gen 3: C2C3 • Gen 4: C1
Backplane 5: SAS	
Backplane 4: SAS	Onboard: SATA 0
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 167. SAS/SATA cable routing
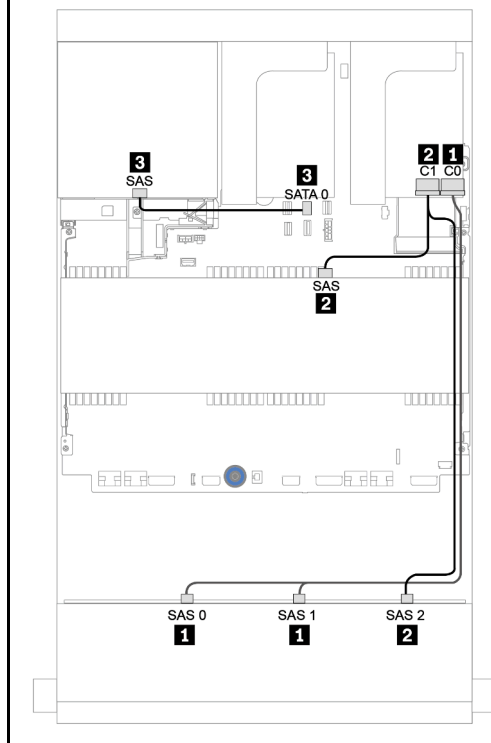
Figure 168. Power cable routing
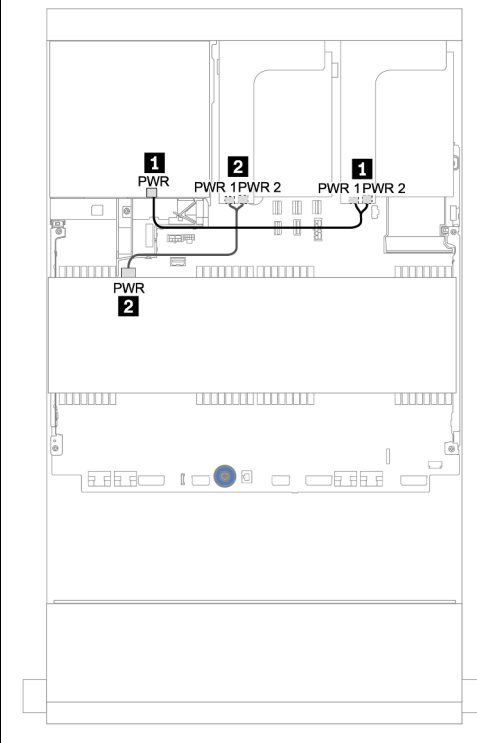
12 x 3.5-inch AnyBay backplane

This section provides cable routing information for the server model with 12 x 3.5-inch AnyBay front drive backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 3.5-inch drive backplanes" on page 196.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:
- "Front backplane: 12 x 3.5" AnyBay" on page 221
- "Front + rear backplanes: 12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA" on page 223
- "12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA" on page 229

Front backplane: 12 x 3.5" AnyBay

This topic provides cable routing information for the server model with 12 x 3.5-inch AnyBay front drive backplane.

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Onboard connectors

The following shows the cable connections for the 12 x 3.5-inch AnyBay front backplane with onboard connectors.

From	To
Backplane 1: SAS 0, SAS 1	Onboard: SATA 0, SATA 1
Backplane 1: SAS 2	Onboard: SATA 2
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Onboard: PCIe 1, 2, 3, 4
Backplane 1: NVMe 8-9, 10-11	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
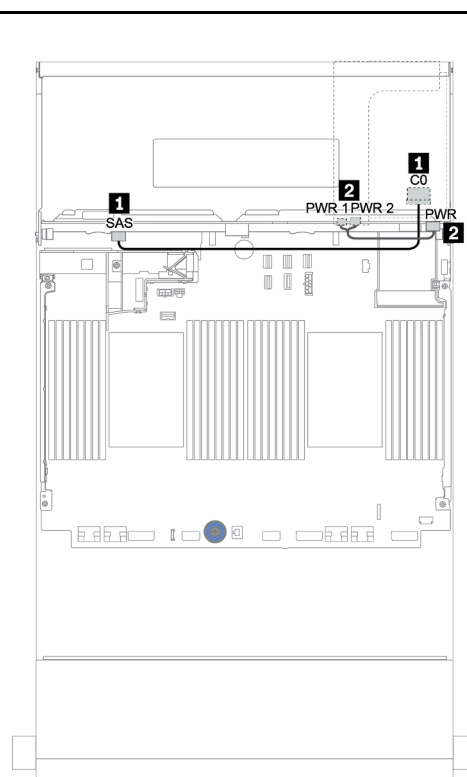

Figure 169. SAS/SATA cable routing

Figure 170. NVMe cable routing

16i RAID/HBA adapter + onboard connectors

The following shows the cable connections for the 12 x 3.5-inch AnyBay front backplane with one 16i RAID/HBA adapter.

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA adapter on PCIe slot 2: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	• Gen 3: C2C3 • Gen 4: C1
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Onboard: PCIe 1, 2, 3, 4
Backplane 1: NVMe 8-9, 10-11	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 171. SAS/SATA cable routing

Figure 172. NVMe cable routing

Front + rear backplanes: 12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA

This topic provides cable routing information for the 12 x 3.5-inch AnyBay front backplane with a 4 x 3.5-inch SAS/SATA rear backplane.

- "16i/24i RAID/HBA adapter + onboard connectors" on page 224
- "16i RAID/HBA adapter + 8i RAID/HBA adapter + onboard connectors" on page 226

16i/24i RAID/HBA adapter + onboard connectors

This topic provides cable routing information for the 12 x 3.5-inch AnyBay front backplane with a 4 x 3.5-inch SAS/SATA rear backplane.

Signal cable routing

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA adapter on PCIe slot 3: - Gen 3: C0C1 - Gen 4: C0 24i RAID/HBA adapter on PCIe slot 3: C0C1
Backplane 1: SAS 2 Backplane 4: SAS	16i RAID/HBA adapter on PCIe slot 3: - Gen 3: C2C3 - Gen 4: C1 24i RAID/HBA adapter on PCIe slot 3: C2C3
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Onboard: PCIe 1, 2, 3, 4
Backplane 1: NVMe 8-9, 10-11	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 173. SAS/SATA cable routing

Figure 174. NVMe cable routing

Power cable routing

From	To
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 175. Power cable routing for the rear backplane

16i RAID/HBA adapter + 8i RAID/HBA adapter + onboard connectors

This topic provides cable routing information for the 12 x 3.5-inch AnyBay front backplane with a 4 x 3.5-inch SAS/SATA rear backplane.

Signal cable routing

From	To
Backplane 1: SAS 0, SAS 1	16i RAID/HBA adapter on PCIe slot 3: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	• Gen 3: C2C3 • Gen 4: C1
Backplane 4: SAS	8i RAID/HBA adapter on PCIe slot 6: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Onboard: PCIe 1, 2, 3, 4
Backplane 1: NVMe 8-9, 10-11	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
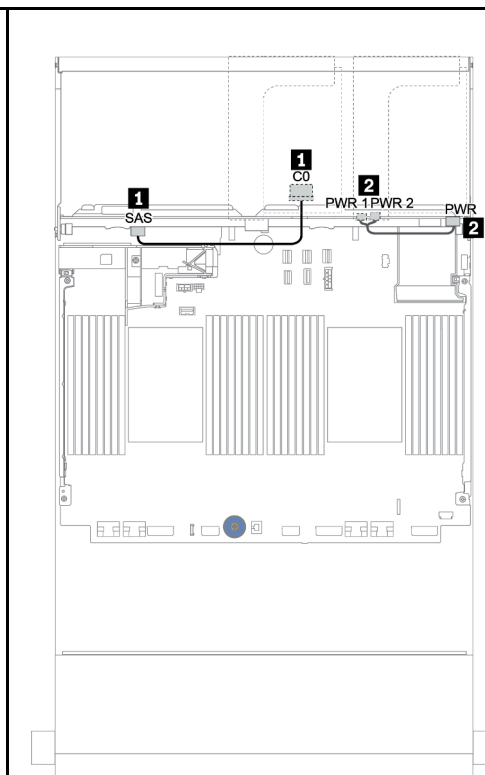

Figure 176. SAS/SATA cable routing

Figure 177. NVMe cable routing

Power cable routing

From	To
Backplane 4: PWR	Riser 1: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**

Figure 178. Power cable routing for the rear backplane

Front + middle + rear backplanes: 12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA + 4 x 3.5"/4 x 2.5" SAS/SATA

This topic provides cable routing information for the 12 x 3.5-inch AnyBay front backplane with a 4 x 3.5-inch SAS/SATA middle backplane and a 4 x 3.5-inch/4 x 2.5-inch SAS/SATA rear backplane.

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12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA

This topic provides cable routing information for the 12 x 3.5" AnyBay + 4 x 3.5" SAS/SATA + 4 x 3.5" SAS/SATA configuration with one 32i RAID adapter.

Signal cable routing

From	To
Backplane 1: SAS 0, SAS 1	32i RAID adapter on PCIe slot 3: • C0
Backplane 1: SAS 2	• C1
Backplane 4: SAS	
Backplane 5: SAS	• C2
Backplane 1: NVMe 0-1, 2-3, 4-5, 6-7	Onboard: PCIe 1, 2, 3, 4
Backplane 1: NVMe 8-9, 10-11	Onboard: PCIe 5, PCIe 6

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
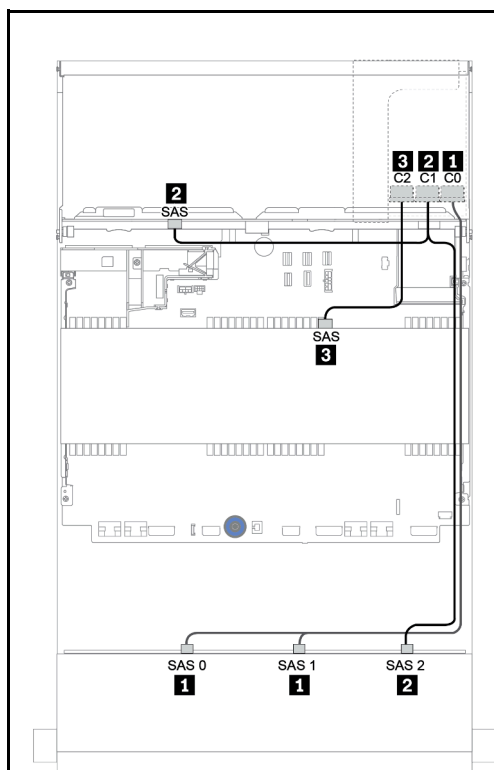
Figure 179. SAS/SATA cable routing
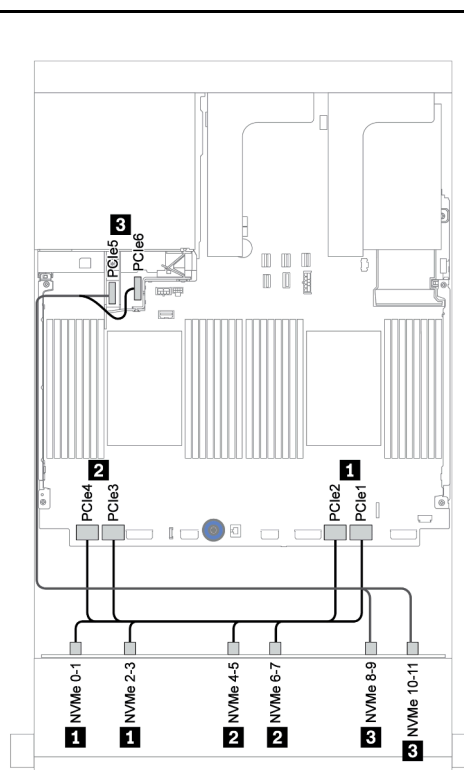
Figure 180. NVMe cable routing

Power cable routing

From	To
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
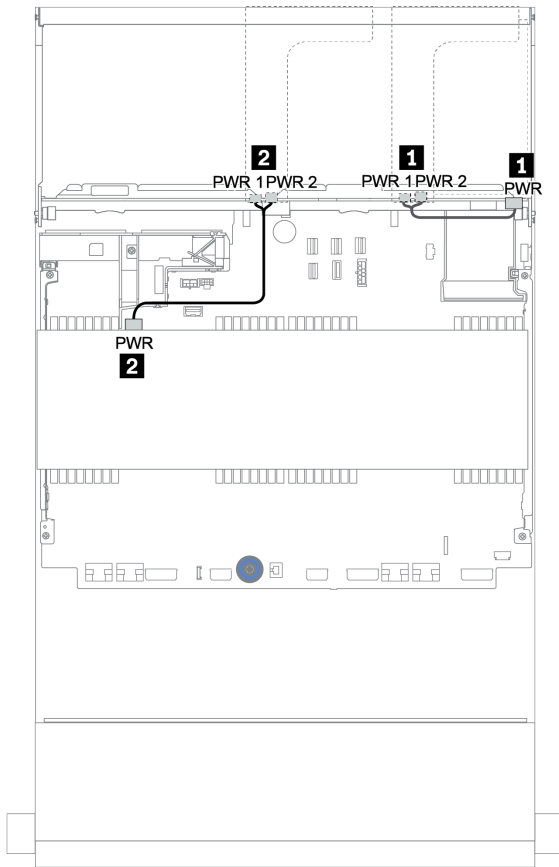
Figure 181. Power cable routing for middle and rear backplanes

12 x 3.5" (8 x SAS/SATA + 4 x AnyBay) + 4 x 3.5" SAS/SATA + 4 x 2.5" SAS/SATA

This topic provides cable routing information for the (8 x 3.5" SAS/SATA + 4 x 3.5" AnyBay) + 4 x 3.5" SAS/SATA + 4 x 2.5" SAS/SATA configuration with one 16i RAID adapter.

Signal cable routing

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

From	To
Backplane 1: SAS 0, SAS 1	16i RAID: • Gen 3: C0C1 • Gen 4: C0
Backplane 1: SAS 2	16i RAID: • Gen 3: C2C3 • Gen 4: C1
Backplane 5: SAS	
Backplane 4: SAS	Onboard: SATA 0
Backplane 1: NVMe 8-9	Onboard: PCIe 1
Backplane 1: NVMe 10-11	Onboard: PCIe 2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 182. SAS/SATA cable routing
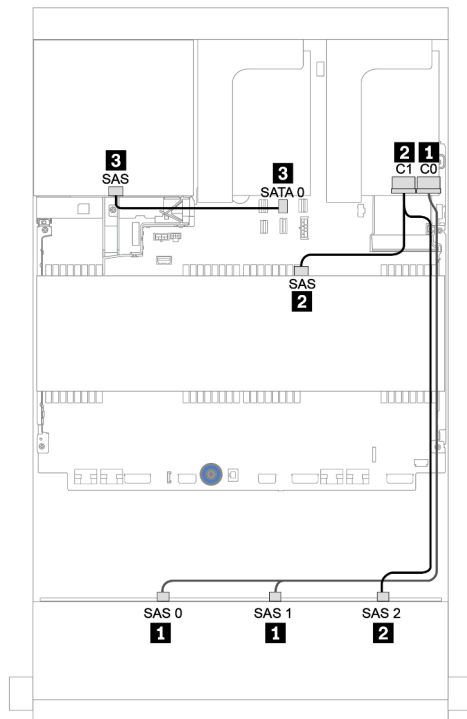
Figure 183. NVMe cable routing
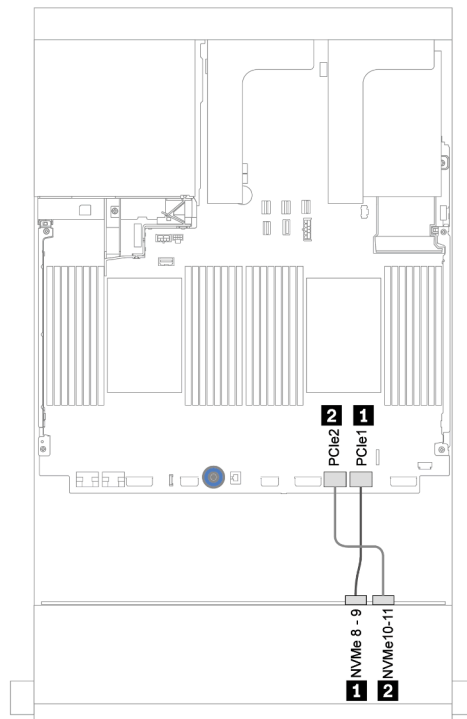
Power cable routing

From	To
Backplane 4: PWR	Riser 1: PWR1, PWR2
Backplane 5: PWR	Riser 2: PWR1, PWR2

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
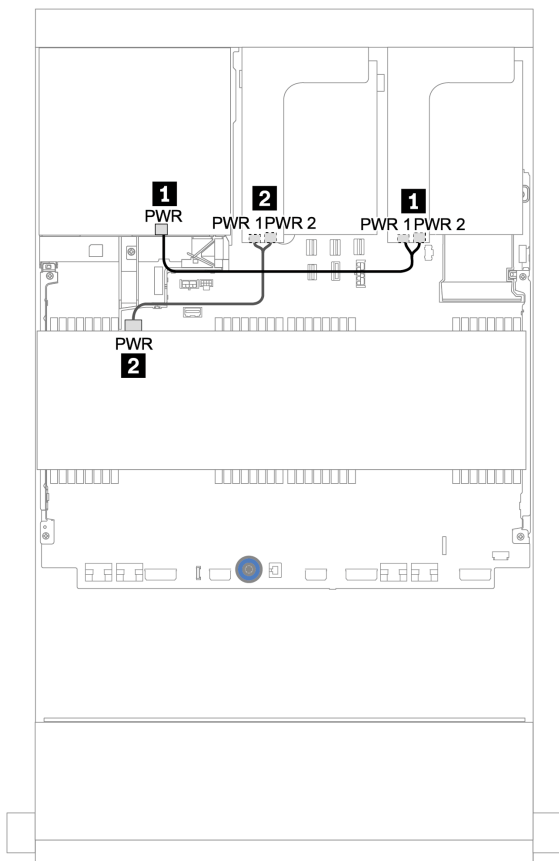
Figure 184. Power cable routing for middle and rear backplanes

12 x 3.5-inch SAS/SATA Expander backplane

This section provides cable routing information for the configurations with the front 12 x 3.5-inch SAS/SATA Expander backplane.

To connect power cables for the front backplane(s), refer to "Backplanes: server models with 3.5-inch drive backplanes" on page 196.

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:

Front backplane: 12 x 3.5" SAS/SATA

This topic provides cable routing information for the front 12 x 3.5-inch SAS/SATA Expander backplane.

8i adapter

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**
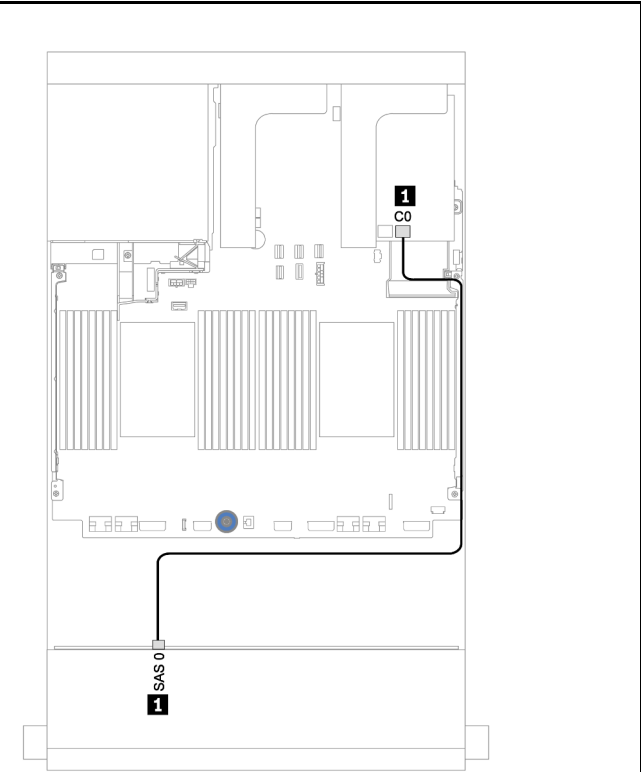
Figure 185. Cable routing with a RAID 930/9350-8i adapter
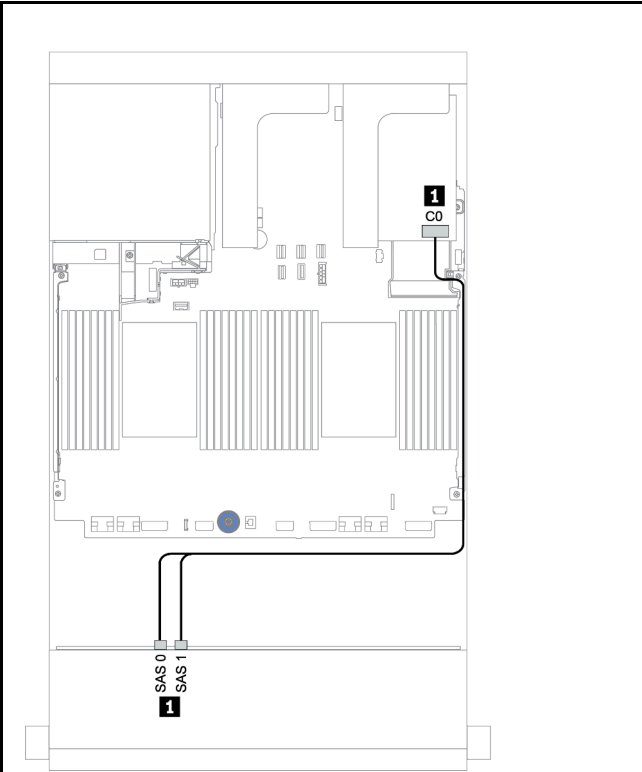
Figure 186. Cable routing with a RAID 940-8i adapter

From	To	From	To
Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0	Backplane 1: SAS 0, SAS 1	RAID 8i adapter on riser 1: C0

Front + rear backplanes: 12 x 3.5" SAS/SATA + 2 x 3.5"/4 x 3.5"/4 x 2.5" SAS/SATA

This topic provides cable routing information for the front 12 x 3.5-inch SAS/SATA Expander backplane and a 2 x 3.5-inch/4 x 3.5-inch/4 x 2.5-inch SAS/SATA rear drive backplane.

8i adapter

Below illustration uses the 4 x 2.5-inch SAS/SATA rear backplane as an example for cable routing. Cable routing for the other rear backplanes is similar.
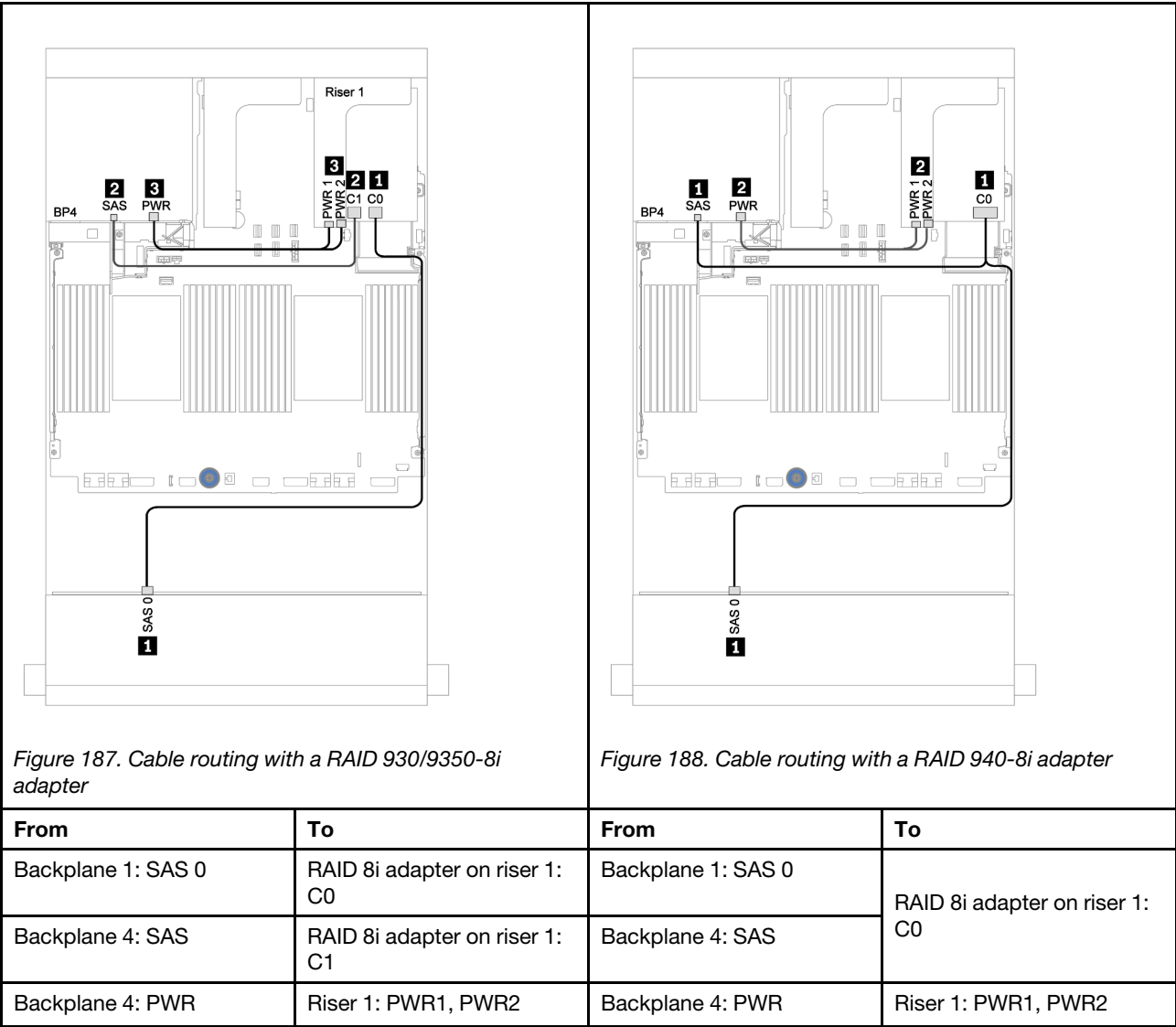
Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**

Figure 187. Cable routing with a RAID 930/9350-8i adapter

Figure 188. Cable routing with a RAID 940-8i adapter

From	To	From	To
Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0	Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0
Backplane 4: SAS	RAID 8i adapter on riser 1: C1	Backplane 4: SAS	
Backplane 4: PWR	Riser 1: PWR1, PWR2	Backplane 4: PWR	Riser 1: PWR1, PWR2

12 x 3.5-inch AnyBay Expander backplane

This section provides cable routing information for the configurations with the front 12 x 3.5-inch AnyBay Expander backplane.

To connect power cables for the front backplane(s), refer to .

To connect signal cables for the front backplane(s), refer to the following cable routing scenarios depending on your server configuration:

Front backplane: 8 x 3.5" SAS/SATA+ 4 x 3.5" AnyBay

This topic provides cable routing information for the front 12 x 3.5-inch AnyBay Expander backplane.

8i adapter

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, … **n** ↔ **n**
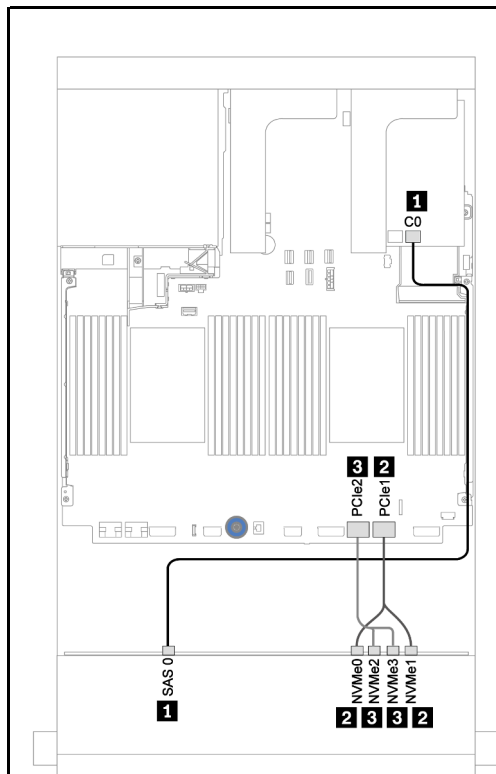
Figure 189. Cable routing with a RAID 930/9350-8i adapter
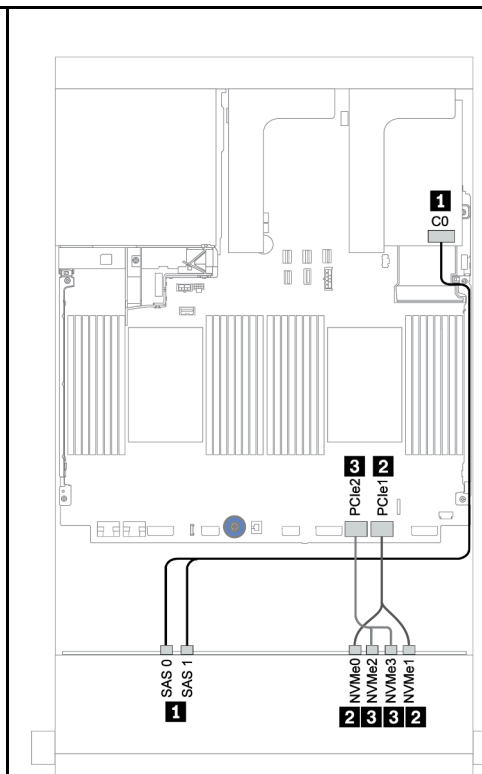
Figure 190. Cable routing with a RAID 940-8i adapter

From	To	From	To
Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0	Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0
Backplane 1: NVMe 0-1	Onboard: PCIe 1	Backplane 1: SAS 1	
Backplane 1: NVMe 2-3	Onboard: PCIe 2	Backplane 1: NVMe 0-1	Onboard: PCIe 1
		Backplane 1: NVMe 2-3	Onboard: PCIe 2

Front + rear backplanes: 12 x 3.5" (8 x SAS/SATA + 4 x AnyBay) + 4 x 2.5" SAS/SATA

This topic provides cable routing information for the front 12 x 3.5-inch AnyBay Expander backplane and a 4 x 2.5-inch SAS/SATA rear drive backplane.

8i adapter

Connections between connectors: **1** ↔ **1**, **2** ↔ **2**, **3** ↔ **3**, ... **n** ↔ **n**


Figure 191. Cable routing with a RAID 930/9350-8i adapter

Figure 192. Cable routing with a RAID 940-8i adapter

From	To	From	To
Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0	Backplane 1: SAS 0	RAID 8i adapter on riser 1: C0
Backplane 4: SAS	RAID 8i adapter on riser 1: C1	Backplane 4: SAS	
Backplane 1: NVMe 0-1	Onboard: PCIe 1	Backplane 1: NVMe 0-1	Onboard: PCIe 1
Backplane 1: NVMe 2-3	Onboard: PCIe 2	Backplane 1: NVMe 2-3	Onboard: PCIe 2
Backplane 4: PWR	Riser 1: PWR1, PWR2	Backplane 4: PWR	Riser 1: PWR1, PWR2

Chapter 4. Hardware replacement procedures

This section provides installation and removal procedures for all serviceable system components. Each component replacement procedure references any tasks that need to be performed to gain access to the component being replaced.

For more information about ordering parts:

https://datacentersupport.lenovo.com/products/servers/thinksystem/sr650v2/parts

Note: If you replace a part, such as an adapter, that contains firmware, you might also need to update the firmware for that part. For more information about updating firmware, see "Firmware updates" on page 10.

Installation Guidelines

Before installing components in your server, read the installation guidelines.

Before installing optional devices, read the following notices carefully:

Attention: Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Read the safety information and guidelines to ensure your safety at work:
  https://pubs.lenovo.com/safety_documentation/
- Make sure the components you are installing are supported by your server. For a list of supported optional components for the server, see https://serverproven.lenovo.com/.
- When you install a new server, download and apply the latest firmware. This will help ensure that any known issues are addressed, and that your server is ready to work with optimal performance. Go to ThinkSystem SR650 V2 Drivers and Software to download firmware updates for your server.

  Important: Some cluster solutions require specific code levels or coordinated code updates. If the component is part of a cluster solution, verify the latest Best Recipe code level menu for cluster supported firmware and driver before you update the code.
- It is good practice to make sure that the server is working correctly before you install an optional component.
- Keep the working area clean, and place removed components on a flat and smooth surface that does not shake or tilt.
- Do not attempt to lift an object that might be too heavy for you. If you have to lift a heavy object, read the following precautions carefully:
  – Make sure that you can stand steadily without slipping.
  – Distribute the weight of the object equally between your feet.
  – Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  – To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Make sure that you have an adequate number of properly grounded electrical outlets for the server, monitor, and other devices.
- Back up all important data before you make changes related to the disk drives.
- Have a small flat-blade screwdriver, a small Phillips screwdriver, a Torx T8 screwdriver, and a Torx T30 screwdriver available.
- To view the error LEDs on the system board and internal components, leave the power on.
- You do not have to turn off the server to remove or install hot-swap power supplies, hot-swap fans, or hot-plug USB devices. However, you must turn off the server before you perform any steps that involve removing or installing adapter cables, and you must disconnect the power source from the server before you perform any steps that involve removing or installing a riser card.

- Blue on a component indicates touch points, where you can grip to remove a component from or install it in the server, open or close a latch, and so on.
- Terra-cotta on a component or an orange label on or near a component indicates that the component can be hot-swapped if the server and operating system support hot-swap capability, which means that you can remove or install the component while the server is still running. (Terra-cotta can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.
- The Red strip on the drives, adjacent to the release latch, indicates that the drive can be hot-swapped if the server and operating system support hot-swap capability. This means that you can remove or install the drive while the server is still running.

  Note: See the system specific instructions for removing or installing a hot-swap drive for any additional procedures that you might need to perform before you remove or install the drive.
- After finishing working on the server, make sure you reinstall all safety shields, guards, labels, and ground wires.

Safety inspection checklist

Use the information in this section to identify potentially unsafe conditions with your server. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury.

Notes:
- The product is not suitable for use at visual display workplaces according to §2 of the Workplace Regulations.
- The set-up of the server is made in the server room only.

CAUTION:
This equipment must be installed or serviced by trained personnel, as defined by the NEC, IEC 62368-1 & IEC 60950-1, the standard for Safety of Electronic Equipment within the Field of Audio/Video, Information Technology and Communication Technology. Lenovo assumes you are qualified in the servicing of equipment and trained in recognizing hazards energy levels in products. Access to the equipment is by the use of a tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

Important: Electrical grounding of the server is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Use the following checklist to verify that there are no potentially unsafe conditions:
1. Make sure that the power is off and the power cord is disconnected.
2. Check the power cord.
   - Make sure that the third-wire ground connector is in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
   - Make sure that the power cord is the correct type.

     To view the power cords that are available for the server:
     a. Go to: http://dcsc.lenovo.com/#/
     b. Click **Preconfigured Model** or **Configure to order**.
     c. Enter the machine type and model for your server to display the configurator page.
     d. Click **Power ➙ Power Cables** to see all line cords.
   - Make sure that the insulation is not frayed or worn.
3. Check for any obvious non-Lenovo alterations. Use good judgment as to the safety of any non-Lenovo alterations.
4. Check inside the server for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.

5. Check for worn, frayed, or pinched cables.
6. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

System reliability guidelines

Review the system reliability guidelines to ensure proper system cooling and reliability.

Make sure the following requirements are met:
- When the server comes with redundant power, a power supply must be installed in each power-supply bay.
- Adequate space around the server must be spared to allow server cooling system to work properly. Leave approximately 50 mm (2.0 in.) of open space around the front and rear of the server. Do not place any object in front of the fans.
- For proper cooling and airflow, refit the server cover before you turn the power on. Do not operate the server for more than 30 minutes with the server cover removed, for it might damage server components.
- Cabling instructions that come with optional components must be followed.
- A failed fan must be replaced within 48 hours after malfunction.
- A removed hot-swap fan must be replaced within 30 seconds after removal.
- A removed hot-swap drive must be replaced within two minutes after removal.
- A removed hot-swap power supply must be replaced within two minutes after removal.
- Every air baffle that comes with the server must be installed when the server starts (some servers might come with more than one air baffle). Operating the server with a missing air baffle might damage the processor.
- All processor sockets must contain either a socket cover or a processor with heat sink.
- When more than one processor is installed, fan population rules for each server must be strictly followed.

Working inside the server with the power on

You might need to keep the power on with the server cover removed to look at system information on the display panel or to replace hot-swap components. Review these guidelines before doing so.

Attention: The server might stop and data loss might occur when internal server components are exposed to static electricity. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding systems when working inside the server with the power on.
- Avoid loose-fitting clothing, particularly around your forearms. Button or roll up long sleeves before working inside the server.
- Prevent your necktie, scarf, badge rope, or hair from dangling into the server.
- Remove jewelry, such as bracelets, necklaces, rings, cuff links, and wrist watches.
- Remove items from your shirt pocket, such as pens and pencils, in case they fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hairpins, and screws, into the server.

Handling static-sensitive devices

Review these guidelines before you handle static-sensitive devices to reduce the possibility of damage from electrostatic discharge.

Attention: Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

- Limit your movement to prevent building up static electricity around you.
- Take additional care when handling devices during cold weather, for heating would reduce indoor humidity and increase static electricity.

- Always use an electrostatic-discharge wrist strap or other grounding system, particularly when working inside the server with the power on.
- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from the package and install it directly into the server without putting it down. If it is necessary to put the device down, put it back into the static-protective package. Never place the device on the server or on any metal surface.
- When handling a device, carefully hold it by the edges or the frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Keep the device from others' reach to prevent possible damages.

Memory module installation rules and order

Memory modules must be installed in a specific order based on the memory configuration that you implement on your server.

Your server has 32 memory slots with 16 channels. For a list of supported memory options, see:

https://serverproven.lenovo.com/

More information about optimizing memory performance and configuring memory is available at the Lenovo Press Web site:

https://lenovopress.com/servers/options/memory

In addition, you can take advantage of a memory configurator, which is available at the following site:

http://1config.lenovo.com/#/memory_configuration

The following illustration helps you to locate the memory module slots on the system board.

Note: It is recommended to install memory modules with the same rank in each channel.
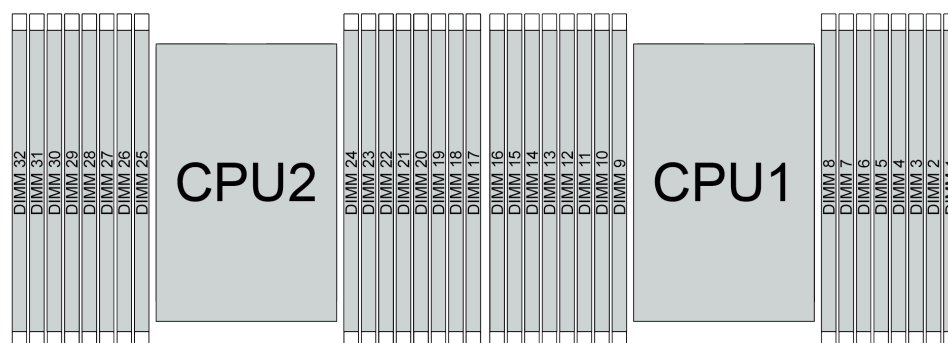
Figure 193. Memory module slots on the system board

Table 23. Memory slot and channel identification

Channel	F0	F1	E0	E1	H0	H1	G0	G1	C1	C0	D1	D0	A1	A0	B1	B0
Slot number	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Memory module installation guideline

- Two types of configurations are supported. Consider corresponding rules and population sequence accordingly:
  - "DRAM DIMM installation order" on page 243 (RDIMMs or 3DS RDIMMs)
  - "PMEM and DRAM DIMM installation order" on page 248
- A label on each DIMM identifies the DIMM type. This information is in the format **xxxxx _n_Rxxx PC4-xxxxx-xx-xx-xxx**. Where **_n_** indicates if the DIMM is single-rank (n=1) or dual-rank (n=2).
- At least one DIMM is required for each processor. Install at least eight DIMMs per processor for good performance.
- When you replace a DIMM, the server provides automatic DIMM enablement capability without requiring you to use the Setup utility to enable the new DIMM manually.

Attention:
- Always populate DIMMs with the maximum number of ranks in the farthest DIMM slot, followed by the nearest DIMM slot.
- Do not mix RDIMMs and 3DS RDIMMs in the same server.
- Mixing 128 GB and 256 GB 3DS RDIMMs is not supported.

DRAM DIMM installation order

For RDIMMs or 3DS RDIMMs, the following memory modes are available:
-
-

Independent mode

In independent memory mode, memory channels can be populated with DIMMs in any order and you can populate all channels for each processor in any order with no matching requirements. Independent memory mode provides the highest level of memory performance, but lacks failover protection. The DIMM installation order for independent memory mode varies based on the number of processors and memory modules installed in the server.

Follow the rules below when installing memory modules in independent mode:
- All memory modules to be installed must be of the same type. x4 and x8 DIMMs can be mixed in the same channel.
- Memory modules from different vendors are supported.
- There must be at least one DDR4 DIMM per socket.
- In each memory channel, populate slot 0 first.
- If a memory channel has two DIMMs, populate the DIMM with a higher number of ranks in slot 0; if the two DIMMs have the same number of ranks, populate the DIMM with a higher capacity in slot 0.
- A maximum of 8 logical ranks (ranks seen by the host) per channel is allowed.
- A maximum of two different DIMM capacities are supported per system.
  - For channels A, C, E, and G, populated DIMMs must have the same total capacity for each channel.
  - For channels B, D, F, and H, populated DIMMs must have the same total capacity for each channel, which can be different from that of the other set (channels A, C, E, and G).
- If there are more than two DIMMs, populate them in a right-and-left symmetrical manner across a CPU socket.

With one processor

The following table shows the sequence of populating memory modules (with the **same capacity**) for independent mode when only one processor is installed.

Table 24. Independent mode with one processor (DIMMs with same capacity)

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 DIMM			3													
2 DIMMs			3				7									
4 DIMMs[1]			3				7			10				14		
6 DIMMs	1		3				7			10				14		16
8 DIMMs[1, 2]	1		3		5		7			10		12		14		16
12 DIMMs	1	2	3	4			7	8	9	10			13	14	15	16
16 DIMMs[1, 2]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Notes:
1. DIMM configurations that support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.
2. DIMM configurations that support Software Guard Extensions (SGX). See "Enable Software Guard Extensions (SGX)" in *Setup Guide* to enable this feature.

The following table shows the sequence of populating memory modules (with **different capacities**) for independent mode when only one processor is installed.

Table 25. Independent mode with one processor (DIMMs with different capacities)

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2 DIMM			3		5											
4 DIMMs			3		5							12		14		
8 DIMMs[1, 2]	1		3		5		7			10		12		14		16
12 DIMMs[1, 2]	1		3	4	5		7	8	9	10		12	13	14		16
16 DIMMs[1, 2]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Notes:
1. DIMM configurations that support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.
2. DIMM configurations that support Software Guard Extensions (SGX). See "Enable Software Guard Extensions (SGX)" in *Setup Guide* to enable this feature.

With two processors

The following table shows the sequence of populating memory modules (with the **same capacity**) for independent mode when two processors are installed.

Table 26. Independent mode with two processors (DIMMs with same capacity)

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2 DIMMs			3													
4 DIMMs			3				7									
8 DIMMs[1]			3				7			10				14		
12 DIMMs	1		3				7			10				14		16
16 DIMMs[1,2]	1		3		5		7			10		12		14		16
24 DIMMs	1	2	3	4			7	8	9	10			13	14	15	16
32 DIMMs[1,2]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Total DIMMs	CPU 2															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
2 DIMMs			19													
4 DIMMs			19				23									
8 DIMMs[1]			19				23			26				30		
12 DIMMs	17		19				23			26				30		32
16 DIMMs[1,2]	17		19		21		23			26		28		30		32
24 DIMMs	17	18	19	20			23	24	25	26			29	30	31	32
32 DIMMs[1,2]	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Notes:
1. DIMM configurations that support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.
2. DIMM configurations that support Software Guard Extensions (SGX). See "Enable Software Guard Extensions (SGX)" in *Setup Guide* to enable this feature.

The following table shows the sequence of populating memory modules (with the **different capacities**) for independent mode when two processors are installed.

Table 27. Independent mode with two processors (DIMMs with different capacities)

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
4 DIMMs			3		5											
8 DIMMs			3		5							12		14		
16 DIMMs[1,2]	1		3		5		7			10		12		14		16
24 DIMMs[1,2]	1		3	4	5		7	8	9	10		12	13	14		16
32 DIMMs[1,2]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total DIMMs	CPU 2															

Table 27. Independent mode with two processors (DIMMs with different capacities) (continued)

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
4 DIMMs			19		21											
8 DIMMs			19		21							28		30		
16 DIMMs[1, 2]	17		19		21		23			26		28		30		32
24 DIMMs[1, 2]	17		19	20	21		23	24	25	26		28	29	30		32
32 DIMMs[1, 2]	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Notes:
1. DIMM configurations that support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.
2. DIMM configurations that support Software Guard Extensions (SGX). See "Enable Software Guard Extensions (SGX)" in *Setup Guide* to enable this feature.

Mirroring mode

Memory-mirroring mode provides full memory redundancy while reducing the total system memory capacity in half. Memory channels are grouped in pairs with each channel receiving the same data. If a failure occurs, the memory controller switches from the DIMMs on the primary channel to the DIMMs on the backup channel. The DIMM installation order for memory mirroring varies based on the number of processors and DIMMs installed in the server.

In mirroring mode, each memory module in a pair must be identical in size and architecture. The channels are grouped in pairs with each channel receiving the same data. One channel is used as a backup of the other, which provides redundancy.

Follow the rules below when installing memory modules in mirroring mode:
- All memory modules to be installed must be of the same type with the same capacity, frequency, voltage, and ranks.
- Mirroring can be configured across channels in the same iMC, and the total DDR4 memory size of the primary and secondary channels must be the same.
- Partial Memory Mirroring is a sub-function of memory mirroring. It requires to follow the memory population for memory mirroring.

With one processor

The following table shows the memory module population sequence for mirroring mode when only one processor is installed.

Table 28. Mirroring mode with one processor

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8 DIMMs	1		3		5		7			10		12		14		16
16 DIMMs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Note: DIMM configurations listed in the table support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.

With two processors

The following table shows the memory module population sequence for mirroring mode when two processors are installed.

Table 29. Mirroring mode with two processors

Total DIMMs	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
16 DIMMs	1		3		5		7			10		12		14		16
32 DIMMs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total DIMMs	**CPU 2**															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
16 DIMMs	17		19		21		23			26		28		30		32
32 DIMMs	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Note: DIMM configurations listed in the table support the Sub NUMA Clustering (SNC) feature, which can be enabled via UEFI. SNC is not supported if DIMM population does not follow the sequence indicated by the table above.

PMEM and DRAM DIMM installation order

This section contains information of how to install PMEMs and DRAM DIMMs properly.

When PMEMs and DRAM DIMMs are mixed in the system, the following modes are supported:
- "App Direct Mode" on page 254
- "Memory Mode" on page 255

See the following topics to learn how to set up and configure PMEMs.
- "PMEM rules" on page 248
- "Setting up the system for PMEM for the first time" on page 248
- "PMEM Management options" on page 248
- "Adding or replacing PMEMs in App Direct Mode" on page 252

PMEM rules

Make sure to meet the following requirements when applying PMEMs in the system.
- All the PMEMs that are installed must be of the same part number.
- All the DRAM DIMMs that are installed must be of the same type, rank, and capacity with minimum capacity of 16 GB. It is recommended to use Lenovo DRAM DIMMs with the same part number.

Setting up the system for PMEM for the first time

Complete the following steps when installing PMEMs to the system for the first time.
1. Determine the mode and combination (see "App Direct Mode" on page 254 or "Memory Mode" on page 255).
2. Consider "PMEM rules" on page 248 and acquire the PMEMs and DRAM DIMMs that meet the requirements.
3. Remove all the memory modules that are presently installed (see "Remove a memory module" on page 320).
4. Follow the adopted combination to install all the PMEMs and DRAM DIMMs (see "Install a memory module" on page 322).
5. Disable security on all the installed PMEMs (see "PMEM Management options" on page 248).
6. Make sure the PMEM firmware is the latest version. If not, update it to the latest version (see https://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/update_fw.html).
7. Configure the PMEMs so that the capacity is available for use (see "PMEM Management options" on page 248).

PMEM Management options

PMEMs can be managed with the following tools:
- Lenovo XClarity Provisioning Manager

  To open LXPM, power on the system and press **F1** as soon as the logo screen appears. If a password has been set, enter the password to unlock LXPM.

  Go to **UEFI Setup ➙ System Settings ➙ Intel Optane PMEMs** to configure and manage PMEMs.

  For more details, see the "Using Lenovo XClarity Provisioning Manager" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.

  Note: If the text-based interface of Setup Utility opens instead of LXPM, go to **System Settings ➙ <F1> Start Control** and select **Tool Suite**. Then, reboot the system, and as soon as the logo screen appears, press the key specified in the on-screen instructions to open LXPM. (For more information, see the

"Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.)

- **Setup Utility**

  To enter Setup Utility:

  1. Power on the system and press the key specified in the on-screen instructions to open LXPM.

     (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.)
  2. Go to **UEFI Settings ➙ System Settings**, click on the pull-down menu on the upper right corner of the screen, and select **Text Setup**.
  3. Reboot the system, and as soon as the logo screen appears, press the key specified in the on-screen instructions.

  Go to **System Configuration and Boot Management ➙ System Settings ➙ Intel Optane PMEMs** to configure and manage PMEMs.

- **Lenovo XClarity Essentials OneCLI**

  Some management options are available in commands that are executed in the path of Lenovo XClarity Essentials OneCLI in the operating system. See https://pubs.lenovo.com/lxce-onecli/download_use_onecli to learn how to download and use Lenovo XClarity Essentials OneCLI.

Following are the available management options:

- **Intel Optane PMEMs details**

  Select this option to view the following details concerning each of the installed PMEMs:

  - Number of Intel Optane PMEMs detected
  - Total raw capacity
  - Total memory capacity
  - Total App Direct capacity
  - Total unconfigured capacity
  - Total inaccessible capacity
  - Total reserved capacity

  Alternatively, view PMEM details with the following command in OneCLI:

  ```
  OneCli.exe config show IntelOptanePMEM --bmc XCC_Account:XCC_Password@XCC_IP
  ```

  Notes:
  - *XCC_Account* stands for XCC user ID.
  - *XCC_Password* stands for XCC user password.
  - *XCC_IP* stands for XCC IP address.

- **Goals**
  - **Memory Mode [%]**

    Select this option to define the percentage of PMEM capacity that is invested in system memory, and hence decide the PMEM mode:
    - **0%:** App Direct Mode
    - **100%:** Memory Mode
    Go to **Goals ➙ Memory Mode [%]**, input the memory percentage, and reboot the system.

    Notes:
    - Before changing from one mode to another:

      1. Back up all the data and delete all the created namespaces. Go to **Namespaces ➙ View/Modify/Delete Namespaces** to delete the created namespaces.

2. Perform secure erase on all the installed PMEMs. Go to **Security** ➔ **Press to Secure Erase** to perform secure erase.
– Make sure the capacity of installed PMEM and DRAM DIMMs meets system requirements for the new mode (see "App Direct Mode" on page 254 or "Memory Mode" on page 255).
– After the system is rebooted and the input goal value is applied, the displayed value in **System Configuration and Boot Management** ➔ **Intel Optane PMEMs** ➔ **Goals** will go back to the following default selectable options:

- **Scope:** [Platform]
- **Memory Mode [%]:** 0
- **Persistent Memory Type:** [App Direct]

These values are selectable options for PMEM settings, and do not represent the current PMEM status.

In addition, you can take advantage of a memory configurator, which is available at the following site: http://1config.lenovo.com/#/memory_configuration

Alternatively, set PMEM Goals with the following commands in OneCLI:
– For Memory Mode:
1. Set create goal status.

```
OneCli.exe config set IntelOptanePMEM.CreateGoal Yes
--bmc USERID:PASSWORD@10.104.195.86
```
2. Define the PMEM capacity that is invested in system volatile memory.

```
OneCli.exe config set IntelOptanePMEM.MemoryModePercentage 100
--bmc USERID:PASSWORD@10.104.195.86
```

Where *100* stands for the percentage of capacity that is invested in system volatile memory.
– For App Direct Mode:
1. Set create goal status.

```
OneCli.exe config set IntelOptanePMEM.CreateGoal Yes
--bmc USERID:PASSWORD@10.104.195.86
```
2. Define the PMEM capacity that is invested in system volatile memory.

```
OneCli.exe config set IntelOptanePMEM.MemoryModePercentage 0
--bmc USERID:PASSWORD@10.104.195.86
```

Where *0* stands for the percentage of capacity that is invested in system volatile memory.
3. Set the PMEM mode.

```
OneCli.exe config set IntelOptanePMEM.PersistentMemoryType "App Direct"
--bmc USERID:PASSWORD@10.104.195.86
```

Where *App Direct* stands for the PMEM mode. You can input *App Direct* for App Direct interleaved or *App Direct Not Interleaved* for App Direct not interleaved.
– **Persistent Memory Type**

In App Direct Mode, the PMEMs that are connected to the same processor are by default interleaved (displayed as **App Direct**), while memory banks are used in turns. To set them as not interleaved in the Setup Utility, go to **Intel Optane PMEMs** ➔ **Goals** ➔ **Persistent Memory Type [(PMEM mode)]**, select **App Direct Not Interleaved** and reboot the system.

Note: Setting PMEM App Direct capacity to not interleaved will turn the displayed App Direct regions from one region per processor to one region per PMEM.
- **Regions**

After the memory percentage is set and the system is rebooted, regions for the App Direct capacity will be generated automatically. Select this option to view the App Direct regions per processor.
- **Namespaces**

App Direct capacity of PMEMs requires the following steps before it is truly available for applications.

1. Namespaces must be created for region capacity allocation.
2. Filesystem must be created and formatted for the namespaces in the operating system.

Each App Direct region can be allocated into one namespace. Create namespaces in the following operating systems:

– Windows: Use *powershell* command. To create a namespace, use Windows Server 2019 or later versions.
– Linux: Use *ndctl* command.
– VMware: Reboot the system, and VMware will create namespaces automatically.

After creating namespaces for App Direct capacity allocation, make sure to create and format filesystem in the operating system so that the App Direct capacity is accessible for applications.

- **Security**

  – Enable Security

    Attention: By default, PMEM security is disabled. Before enabling security, make sure all the country or local legal requirements regarding data encryption and trade compliance are met. Violation could cause legal issues.

    PMEMs can be secured with passphrases. Two types of passphrase protection scope are available for PMEM:

    – **Platform:** Choose this option to run security operation on all the installed PMEM units at once. A platform passphrase is stored and automatically applied to unlock PMEMs before operating system starts running, but the passphrase still has to be disabled manually for secure erase.

    Alternatively, enable/disable platform level security with the following commands in OneCLI:
    - Enable security:
      1. Enable security.

         ```
         OneCli.exe config set IntelOptanePMEM.SecurityOperation "Enable Security"
         --bmc USERID:PASSWORD@10.104.195.86
         ```
      2. Set the security passphrase.

         ```
         OneCli.exe config set IntelOptanePMEM.SecurityPassphrase "123456"
         --bmc USERID:PASSWORD@10.104.195.86
         ```

         Where *123456* stands for the passphrase.
      3. Reboot the system.
    - Disable security:
      1. Disable security.

         ```
         OneCli.exe config set IntelOptanePMEM.SecurityOperation "Disable Security"
         --bmc USERID:PASSWORD@10.104.195.86
         ```
      2. Enter passphrase.

         ```
         OneCli.exe config set IntelOptanePMEM.SecurityPassphrase "123456"
         --bmc USERID:PASSWORD@10.104.195.86
         ```
      3. Reboot the system.

    – **Single PMEM:** Choose this option to run security operation on one or more selected PMEM units.

      Notes:
      - Single PMEM passphrases are not stored in the system, and security of the locked units needs to be disabled before the units are available for access or secure erase.
      - Always make sure to keep records of the slot number of locked PMEMs and corresponding passphrases. In the case the passphrases are lost or forgotten, the stored data cannot be backed up or restored, but you can contact Lenovo service for administrative secure erase.

- After three failed unlocking attempts, the corresponding PMEMs enter "exceeded" state with a system warning message, and the PMEM unit can only be unlocked after the system is rebooted.

  To enable passphrase, go to **Security ➙ Press to Enable Security**.
- Secure Erase

  Notes:
  - Password is required to perform Secure Erase when security enabled.
  - Before executing secure erase, make sure ARS (Address Range Scrub) is done on all PMEMs or on the specific PMEMs selected. Otherwise, secure erase cannot be started on all PMEMs or the specific PMEM selected, and the following text message will pop out:
    ```
    The passphrase is incorrect for single or multiple or all
    Intel Optane PMEMs selected, or maybe there is namespace
    on the selected PMEMs. Secure erase operation is not done
    on all Intel Optane PMEMs selected.
    ```

  Secure erase cleanses all the data that is stored in the PMEM unit, including encrypted data. This data deletion method is recommended before returning or disposing a malfunctioning unit, or changing PMEM mode. To perform secure erase, go to **Security ➙ Press to Secure Erase**.

  Alternatively, perform platform level secure erase with the following command in OneCLI:
  ```
  OneCli.exe config set IntelOptanePMEM.SecurityOperation "Secure Erase Without Passphrase"
  --bmc USERID:PASSWORD@10.104.195.86
  ```
- **PMEM Configuration**

  PMEM contains spared internal cells to stand in for the failed ones. When the spared cells are exhausted to 0%, there will be an error message, and it is advised to back up data, collect service log, and contact Lenovo support.

  There will also be a warning message when the percentage reaches 1% and a selectable percentage (10% by default). When this message appears, it is advised to back up data and run PMEM diagnostics (see the "Diagnostics" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/). To adjust the selectable percentage that the warning message requires, go to **Intel Optane PMEMs ➙ PMEM Configuration**, and input the percentage.

  Alternatively, change the selectable percentage with the following command in OneCLI:
  ```
  OneCli.exe config set IntelOptanePMEM.PercentageRemainingThresholds 20
  --bmc USERID:PASSWORD@10.104.195.86
  ```

  Where *20* is the selectable percentage.

Adding or replacing PMEMs in App Direct Mode

Complete the following steps before adding or replacing PMEMs in App Direct Mode.

1. Back up stored data in PMEM namespaces.
2. Disable PMEM security with one of the following options:
   - **Lenovo XClarity Provisioning Manager**

     Go to **UEFI Setup ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.
   - **Setup Utility**

     Go to **System Configuration and Boot Management ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.
3. Delete namespaces with command corresponding to the operating system that is installed:
   - **Linux** command:
     ```
     ndctl destroy-namespace all -f
     ```
   - **Windows** Powershell command

```
Get-PmemDisk | Remove-PmemDisk
```

4. Clear Platform Configuration Data (PCD) and Namespace Label Storage Area (LSA) with the following ipmctl command (for both Linux and Windows).

```
ipmctl delete -pcd
```

Notes: See the following links to learn how to download and use impctl in different operating systems:
- Windows: https://datacentersupport.lenovo.com/us/en/videos/YTV101407
- Linux: https://datacentersupport.lenovo.com/us/en/solutions/HT508642

5. Reboot the system.

App Direct Mode

In this mode, PMEMs act as independent and persistent memory resources directly accessible by specific applications, and DRAM DIMMs act as system memory. Ensure that the ratio of total DRAM DIMM capacity to total PMEM capacity within a processor is between 1:1 and 1:8.

With one processor

Table 30. Memory population in App Direct Mode with one processor

Configuration	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 PMEM and 6 DIMMs*	D		D		P		D			D				D		D
1 PMEM and 8 DIMMs*	D		D	P	D		D			D		D		D		D
2 PMEMs and 12 DIMMs	D	D	D	D	P		D	D	D	D		P	D	D	D	D
4 PMEMs and 4 DIMMs	P		D		P		D			D		P		D		P
4 PMEMs and 8 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
8 PMEMs and 8 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D

- **D**: DRAM DIMMs
- **P**: Persistent Memory Module (PMEM)

Note: * Not-interleaved mode only. Does not support 100% interleaved mode.

With two processors

Table 31. Memory population in App Direct Mode with two processors

• **D**: DRAM DIMMs
• **P**: Persistent Memory Module (PMEM)

Configuration	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2 PMEM and 12 DIMMs*	D		D		P		D			D				D		D
2 PMEM and 16 DIMMs*	D		D	P	D		D			D		D		D		D
4 PMEMs and 24 DIMMs	D	D	D	D	P		D	D	D	D		P	D	D	D	D
8 PMEMs and 8 DIMMs	P		D		P		D			D		P		D		P
8 PMEMs and 16 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
16 PMEMs and 16 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D

Configuration	CPU 2															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
2 PMEM and 12 DIMMs*	D		D		P		D			D				D		D
2 PMEM and 16 DIMMs*	D		D	P	D		D			D		D		D		D
4 PMEMs and 24 DIMMs	D	D	D	D	P		D	D	D	D		P	D	D	D	D
8 PMEMs and 8 DIMMs	P		D		P		D			D		P		D		P
8 PMEMs and 16 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
16 PMEMs and 16 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D

Note: * Not-interleaved mode only. Does not support 100% interleaved mode.

Memory Mode

In this mode, PMEMs act as volatile system memory, while DRAM DIMMs act as cache. Ensure that the ratio of DRAM DIMM capacity to PMEM capacity is between 1:4 and 1:16.

With one processor

Table 32. Memory Mode with one processor

• **D**: DRAM DIMMs
• **P**: Persistent Memory Module (PMEM)

Configuration	CPU 1															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
4 PMEMs and 4 DIMMs	P		D		P		D			D		P		D		P
4 PMEMs and 8 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
8 PMEMs and 8 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D

With two processors

Table 33. Memory Mode with two processors

• **D**: DRAM DIMMs
• **P**: Persistent Memory Module (PMEM)

Configuration	CPU 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8 PMEMs and 8 DIMMs	P		D		P		D			D		P		D		P
8 PMEMs and 16 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
16 PMEMs and 16 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D
Configuration	**CPU 2**															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
8 PMEMs and 8 DIMMs	P		D		P		D			D		P		D		P
8 PMEMs and 16 DIMMs	D		D	P	D		D	P	P	D		D	P	D		D
16 PMEMs and 16 DIMMs	D	P	D	P	D	P	D	P	P	D	P	D	P	D	P	D

Technical rules

This topic provides technical rules for the server.

PCIe slots and PCIe adapters

This topic provides installation rules for PCIe adapters.
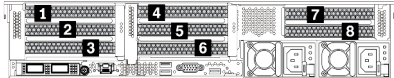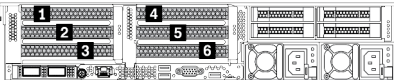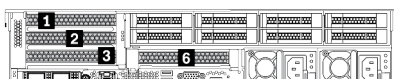
Slot configurations

Your server supports the following rear configurations with different types of riser cards.
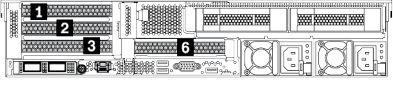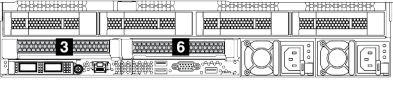
Notes:
- When only one processor is installed, the server supports riser 1 and riser 3. If the 12 x 3.5-inch AnyBay Expander backplane is installed, then riser 3 is not supported.
- When two processors are installed, the server supports riser 1, riser 2, and riser 3. Riser 1 must be selected, then you can select riser 2 or riser 3.

*E: empty

Server rear view	PCIe slots		
	Slots 1–3 on riser 1: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	Slots 4–6 on riser 2: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	Slots 7–8 on riser 3: • Type 1: x16/x16 • Type 2: x8/x8
	Slots 1–3 on riser 1: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	Slots 4–6 on riser 2: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	NA
	Slots 1–3 on riser 1: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	Slot 6 on riser 2: x16	NA

Server rear view	PCIe slots		
	Slots 1–3 on riser 1: • Type 1: x16/x8/x8 • Type 2: x16/x16/E • Type 3: E/x16/x16	Slot 6 on riser 2: x16	NA
	Slot 3 on riser 1: x16	Slot 6 on riser 2: x16	NA

Notes:

- **7mm drive cage installation rules**:
  - For server models with 8 PCIe slots or a 4 x 2.5-inch rear drive cage, a 2FH+7mm SSD drive cage can be installed on slot 3 or slot 6, but not both at the same time.
  - For server models with an 8 x 2.5-inch/2 x 3.5-inch rear drive cage, one of the 7mm drive cages can be installed:
    - 2FH+7mm SSD drive cage: slot 3
    - 7mm SSD drive cage: slot 6
  - For server models with a 4 x 3.5-inch rear drive cage or a GPU installed, a low-profile 7mm drive cage can be installed only on slot 6.
- **Serial port module installation rules:**
  - For server models with 8 PCIe slots or a 4 x 2.5-inch rear drive cage:
    - If both riser 1 and riser 2 use the x16/x16/E riser card and a 7mm drive cage is installed on slot 6, then a serial port module can be installed on slot 3.
    - If only one of riser 1 and riser 2 (not both) uses the x16/x16/E riser card, a 7mm drive cage and a serial port module cannot be installed at the same time. If no 7mm drive cage is installed, then a serial port module can be installed on slot 6.
    - If both riser 1 and riser 2 do not use the x16/x16/E riser card, no serial port module is supported.
  - For server models with an 8 x 2.5-inch/2 x 3.5-inch rear drive cage:
    - If riser 1 uses the x16/x16/E riser card, a serial port module can be installed on slot 3 and a 7mm SSD cage can be installed on slot 6.
    - If riser 1 does not use the x16/x16/E riser card, a 7mm drive cage and a serial port module cannot be installed at the same time. If no 7mm drive cage is installed, then a serial port module can be installed on slot 6.
  - For server models with a 4 x 3.5-inch rear drive cage, a 7mm drive cage and a serial port module cannot be installed at the same time. If no 7mm drive cage is installed, then a serial port module can be installed on slot 3 or slot 6.
  - For server models with a double-wide GPU, the serial port module can be installed only on slot 6.

Supported PCIe adapters and slot priorities

The following table lists the recommended slot installation priority for common PCIe adapters.

PCIe adapter	Maximum supported	Suggested slot priority
GPU adapternote1 on page 260		
Double-wide GPU (V100S, A100, A40, A30, A6000, A16, A800, H100, L40)	3	• 1 CPU: 2, 7 • 2 CPUs: 2, 5, 7
Double-wide GPU (AMD MI210)	2	• 1 CPU: 2, 7 • 2 CPUs: 2, 5, 7
Single-wide GPU (P620, T4, A4, A2, L4)	8	• 1 CPU: 1, 2, 3, 7, 8 • 2 CPUs: 1, 4, 7, 8, 2, 5, 3, 6

PCIe adapter	Maximum supported	Suggested slot priority
Single-wide GPU (A10)	4	• 1 CPU: 1, 2, 7 • 2 CPUs: 1, 4, 5, 7, 8
NVMe switch cardnote		
ThinkSystem 1611-8P PCIe Gen4 Switch Adapter	4	2 CPUs: 1, 2, 4, 5
PCIe retimer card		
ThinkSystem x16 Gen 4.0 Re-timer adapter	3	• 1 CPU: 1, 2, 3 • 2 CPUs: 1, 3, 2, 4
Internal CFF RAID/HBA/Expander		
5350-8i, 9350-8i, 9350-16i	1	Not installed in PCIe slots. CFF RAID/HBA adapters are supported only in the 2.5-inch drive bay chassis.
440-16i, 940-16i		
ThinkSystem 48 port 12Gb Internal Expander		
Internal SFF RAID/HBA adapter note3 on page 260		

9350-8i	4	• 1 CPU:
		  – With other SFF RAID adapters: 2, 3, 1
		  – Without other SFF RAID adapters: 3, 2, 1
		• 2 CPUs:
		  – With other SFF RAID adapters:
		    – Configurations with 2.5-inch front drive bays: 2, 3, 5, 6, 1, 4
		    – Configurations with 3.5-inch front drive bays:
		      • With rear drive bays: 2, 3, 5, 6, 1, 4
		      • Without rear drive bays: 2, 3, 1
		  – Without other SFF RAID adapters:
		    – Configurations with 2.5-inch front drive bays: 3, 2, 5, 6, 1, 4
		    – Configurations with 3.5-inch front drive bays:
		      • With rear drive bays: 3, 2, 5, 6, 1, 4
		      • Without rear drive bays: 3, 2, 1

9350-16i	2	

430-8i, 4350-8i, 530-8i, 5350-8i, 930-8i	4	• 1 CPU: 2, 3, 1
		• 2 CPUs:
		  – Configurations with 2.5-inch front drive bays: 2, 3, 5, 6, 1, 4
		  – Configurations with 3.5-inch front drive bays: 2, 3, 1

430-16i, 4350-16i, 530-16i, 930-16i	2	
440-8i, 540-8i, 540-16i, 940-8i, 940-16i (8GB)	4	
440-16i, 940-16i (4GB)	2	
930-24i, 940-32i	1	
940-8i (Tri-mode)	3	
940-16i 4GB (Tri-mode)	2	
940-16i 8GB (Tri-mode)	4	
External RAID/HBA adapter		
430-8e, 430-16e, 440-16e	8	• 1 CPU: 2, 3, 1, 7, 8 • 2 CPUs: 2, 5, 3, 6, 7, 8, 1, 4
930-8e, 940-8e	4	
PCIe SSD adapter		

PCIe adapter	Maximum supported	Suggested slot priority
All supported PCIe SSD adapters	8	• 1 CPU: 2, 3, 1, 7, 8 • 2 CPUs: 2, 5, 3, 6, 7, 8, 1, 4
FC HBA adapter		
All supported FC HBA adapters	8	• 1 CPU: 2, 3, 1, 7, 8 • 2 CPUs: 2, 5, 3, 6, 7, 8, 1, 4
NIC adapter		
ThinkSystem NVIDIA BlueField-2 25GbE SFP56 2-Port PCIe Ethernet DPU w/BMC & Crypto	1	• 1 CPU: 1, 2, 3 • 2 CPUs: 1, 4, 2, 5, 3
Mellanox ConnectX-6 Lx 100GbE QSFP28 2-port PCIe Ethernet Adapter Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter v2	6	• 1 CPU: 1, 2, 7 • 2 CPUs: 1, 4, 2, 5, 7, 8
Broadcom 57454 10/25GbE SFP28 4-port PCIe Ethernet Adapter_Refresh ThinkSystem Intel E810-DA4 10/25GbE SFP28 4-port PCIe Ethernet Adapter ThinkSystem Broadcom 57504 10/25GbE SFP28 4-port PCIe Ethernet Adapter	6	• 1 CPU: 2, 3, 1, 7 • 2 CPUs: 2, 5, 3, 6, 7, 8, 1, 4
Xilinx Alveo U50[note4 on page 260]	6	• 1 CPU: 2, 1, 7 • 2 CPUs: 2, 5, 1, 4, 7, 8
ThinkSystem Intel X710-T2L 10GBASE-T 2-port PCIe Ethernet Adapter		• 1 CPU: 2, 3, 1, 8 • 2 CPUs: 2, 5, 3, 6, 8, 1, 4
All other supported NIC adapters	8	• 1 CPU: 2, 3, 1, 7, 8 • 2 CPUs: 2, 5, 3, 6, 7, 8, 1, 4
InfiniBand adapter		
Mellanox ConnectX-6 HDR100 IB/100GbE VPI 1-port x16 PCIe 3.0 HCA w/ Tall Bracket	6	• 1 CPU: 1, 2, 7 • 2 CPUs: 1, 4, 2, 5, 7, 8
Mellanox ConnectX-6 HDR100 IB/100GbE VPI 2-port x16 PCIe 3.0 HCA w/ Tall Bracket		
ThinkSystem NVIDIA ConnectX-7 NDR400 OSFP 1-Port PCIe Gen5 Adapter		
ThinkSystem NVIDIA ConnectX-7 NDR200/ HDR QSFP112 2-Port PCIe Gen5 x16 InfiniBand Adapter [note]		
Mellanox ConnectX-6 HDR IB/200GbE Single Port x16 PCIe Adapter w/ Tall Bracket	6	Refer to below [note5 on page 260] for detailed installation rules.
Mellanox HDR Auxiliary x16 PCIe 3.0 Connection Card Kit	3	

Notes:

1. Rules for GPU adapters:
   - All installed GPU adapters must be identical.
   - If a double-wide GPU adapter is installed in slot 5, 7 or 2, the adjacent slot 4, 8, or 1 respectively is not available.
   - If a single-wide 150W GPU adapter is installed on PCIe slot 1, 4, or 7, the adjacent slot 2, 5, or 8 respectively cannot be installed with an Ethernet adapter of 100GbE or higher.
   - For thermal rules for supported GPUs, see "Thermal rules" on page 262.
2. Oversubscription occurs when the system supports 32 NVMe drives using NVMe switch adapters. For details, see https://lenovopress.lenovo.com/lp1392-thinksystem-sr650-v2-server#nvme-drive-support.
3. Rules for the internal standard form factor (SFF) RAID/HBA adapters:
   - RAID 930/940 series or 9350 series adapters require a RAID flash power module.
   - Mixing of RAID/HBA 430/530/930 adapters (Gen 3) and RAID/HBA 440/940 adapters (Gen 4) in the same system is not allowed.
   - RAID/HBA adapters belonged to the same generation (Gen 3 or Gen 4) are allowed to be mixed in the same system.
   - The RAID/HBA 4350/5350/9350 adapters cannot be mixed with the following adapters in the same system:
     – RAID/HBA 430/530/930 adapters
     – RAID/HBA 440/540/940 adapters, except for external RAID/HBA 440-8e/440-16e/940-8e adapters
   - The RAID 940-8i or RAID 940-16i adapter supports Tri-mode. When Tri-mode is enabled, the server supports SAS, SATA and U.3 NVMe drives at the same time. NVMe drives are connected via a PCIe x1 link to the controller.

     Note: To support Tri-mode with U.3 NVMe drives, **U.3 x1 mode** must be enabled for the selected drive slots on the backplane through the XCC Web GUI. Otherwise, the U.3 NVMe drives cannot be detected. For more information, see "U.3 NVMe drive can be detected in NVMe connection, but cannot be detected in Tri-mode" on page 455.
   - The virtual RAID on CPU (VROC) key and Tri-mode are not supported at the same time.
   - For more information about controller selection for different server configurations, see "Controller selections (2.5-inch chassis)" on page 84 and "Controller selections (3.5-inch chassis)" on page 197.
4. To install the Xilinx Alveo U50 adapter, follow the following rules:
   - The ambient temperature must be limited to 30°C or lower.
   - No fan fails.
   - No VMware operating system is installed.
   - The Xilinx Alveo U50 adapter is not supported in server models with 24 x 2.5-inch drives or 12 x 3.5-inch drives.
   - The Xilinx Alveo U50 adapter must be installed with the performance fan.
5. If one of the below InfiniBand adapters are installed:
   - Primary adapter: Mellanox ConnectX-6 HDR IB/200GbE Single Port x16 PCIe Adapter, up to 6 adapters, can be installed independently.
   - Secondary adapter: Mellanox HDR Auxiliary x16 PCIe 3.0 Connection Card Kit, up to 3 adapters, must be installed with the primary adapter.

Adapter selection	Adapter	Quantity	PCIe slot
Option 1	Primary adapter	1	1 or 2
	Secondary adapter	1	4 or 5
Option 2	Primary adapter	2	1 and 2
	Secondary adapter	2	4 and 5
Option 3	Primary adapter	3	1, 2, and 7

Adapter selection	Adapter	Quantity	PCIe slot
	Secondary adapter	3	4, 5, and 8
Option 4	Primary adapter only	Up to 6	1, 4, 7, 2, 5, 8

Attention:
– When the primary adapter is used with active optical cables (AOC) in the 12 x 3.5-inch or 24 x 2.5-inch configuration, follow "Thermal rules" on page 262 and ensure that the ambient temperature must be limited to 30°C or lower. This configuration might lead to high acoustic noise and is recommended to be placed in industrial data center, not office environment.
– When both the primary adapter and GPU adapters are used at the same time, follow the thermal rules for GPU adapters. For detailed information, see "Server models with GPUs" on page 264.

6. Rules for ThinkSystem NVIDIA ConnectX-7 NDR200/200GbE QSFP112 2-port PCIe Gen5 x16 InfiniBand Adapter:
   - VMware 7.0 U3 does not support the adapter.
   - VMware 8.0 U2 in-box supports the adapter.
   - Windows 2019 & 2022 can support the adapter.
   - The adapter with active optical cables (AOC) is not supported in the 12 x 3.5-inch or 24 x 2.5-inch configuration with middle drive bays.
   - When the adapter installed, AOC is not supported in PCIe slot 3 and slot 6 by the following configuration.
     – 12 x 3.5-inch configuration
     – 24 x 2.5-inch configuration
     – 12 x 3.5-inch configuration with rear drive bays
     – 24 x 2.5-inch configuration with rear drive bays

Thermal rules

This topic provides thermal rules for the server.

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Server models with front drive bays only

This section provides thermal information for server models with front drive bays only.

Max.Temp.: Maximum ambient temperature at sea level; E: entry; S: standard; P: performance

Front drive bays	Max. Temp.	CPU TDP[1] (watts)	Heat sink	Air baffle	Fan type	Max. DIMM Qty.	
						DRAM[2]	PMEM[3]
• 8 x 2.5" • 16 x 2.5" • 8 x 3.5"	45°C	105–165	2U (E)	S	S	32	16
	45°C	185–205	2U (S)	S	S	32	16
	35°C	220–240	2U (S)	S	S	32	16
	30°C	250–270	T-shape (P)	S	P	32	16
24 x 2.5"	30°C	105–165	2U (Entry)	S	S	32	16
	30°C	185–240	2U (S)	S	S	32	16
	30°C	250–270	T-shape (P)	S	P	32	16
12 x 3.5"	30°C	105–165	2U (E)	S	S	32	4
	30°C	185–240	2U (S)	S	S	32	4

Notes:
1. The following processors have below exceptions:
    - The Intel Xeon 6334 HCC 165W processor should use the 2U standard heat sink instead of the 2U entry heat sink.
    - The Intel Xeon 8351N XCC 225W processor should follow rules for processors with TDP ranging from 250 watts to 270 watts.
2. The 256 GB 3DS RDIMMs are supported only in below server models:
    - 8 x 2.5"
    - 16 x 2.5"
    - 8 x 3.5"
3. When a 256 GB 3DS RDIMM or 512 GB PMEM is installed, the ambient temperature must be limited to 30°C or lower.

Server models with middle/rear drive bays

This section provides thermal information for server models with middle or rear drive bays.

Max.Temp.: Maximum ambient temperature at sea level; S/S: SAS/SATA; Any: AnyBay; E: entry; S: standard; P: performance; NA: none

Front drive bays	Middle drive bays	Rear drive bays	Max. Temp.	CPU TDP[1] (watts)	Heat sink	Air baffle	Fan type[2]	Max. DIMM Qty.	
								DRAM[3]	PMEM
24 x 2.5" S/S 16 x 2.5" S/S + 8 x Any	NA	4 x 2.5" S/S	30°C	105–165	2U (E)	S	P	32	16
			30°C	185–205	2U (S)	S	P	32	16
24 x 2.5" Any	8 x 2.5" Any	NA	30°C	105–165	1U (S)	NA	P	32	16
			30°C	185–205	T-shape (P)	NA	P	32	16
24 x 2.5" S/S	8 x 2.5" S/S	4 x 2.5" S/S	30°C	105–165	1U (S)	NA	P	32	16
		8 x 2.5" S/S	30°C	185–205	T-shape (P)	NA	P	32	16
12 x 3.5" S/S	NA	2 x 3.5" S/S	30°C	105–165	2U (E)	NA	P	32	4
		4 x 2.5" S/S 4 x 3.5" S/S	30°C	185–205	2U (S)	S	P	32	4
	8 x 2.5" Any	NA	30°C	105–165	1U (S)	NA	P	32	4
			30°C	185–205	T-shape (P)	NA	P	32	4
	4 x 3.5" S/S	4 x 2.5" S/S	30°C	105–165	1U (S)	NA	P	32	4
		4 x 3.5" S/S	30°C	185–205	T-shape (P)	NA	P	32	4
12 x 3.5" Any	NA	4 x 3.5" S/S	30°C	105–165	2U (E)	S	P	32	
			30°C	185–205	2U (S)	S	P	32	4
	4 x 3.5" S/S	4 x 3.5" S/S	30°C	105–165	1U (S)	NA	P	32	4
			30°C	185–205	T-shape (P)	NA	P	32	4

Notes:

1. The Intel Xeon 6334 HCC 165W processor is not included. When this processor is used, middle drive bays or rear drive bays are not supported.
2. When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.
3. The 256 GB 3DS RDIMMs are not supported.
4. For the 12 x 3.5" SAS/SATA (front) + 8 x 2.5" NVMe (middle) configuration, the ambient temperature must be limited to 25°C or lower when the following NVMe SSDs are installed:
   - 2.5" U.3 PM1733a 30.72TB RI NVMe SSD
   - 2.5" U.3 PM1733a 15.36T RI NVMe SSD
   - 2.5" U.2 P5520 7.68TB NVMe SSD
   - 2.5" U.2 P5520 15.36TB NVMe SSD
   - 2.5" U.2 P5620 6.4 TB NVMe SSD
   - 2.5" U.2 P5620 12.8TB NVMe SSD

Server models with GPUs

This section provides thermal information for server models with GPUs.

- Category 1: single-wide GPU (<= 75 W): P620, T4, A4, A2, L4
- Category 2: single-wide GPU (150 W): A10
- Category 3: double-wide GPU (165 W, 250 W, 300 W, 350 W): V100S, A100, A40, A30, A6000, A16, AMD MI210, A800, L40, H100

Max.Temp.: Maximum ambient temperature at sea level; E: entry; S: standard; P: performance; C1/C2/C3: Category 1/2/3

Front drive bays	Max. Temp.	CPU TDP[1] (watts)	Heat sink	Air baffle	Fan type	Max. GPU Qty.			Max. DIMM Qty.	
						C1	C2	C3	DRAM[2]	PME-M
8 x 2.5" 16 x 2.5"[3] 8 x 3.5"	30°C	105–165	2U (E)	S	P	8			32	16
			1U (S)	GPU	P		4		32	16
			1U (S)	GPU	P			3	32	16
	30°C	185–205	2U (S)	S	P	8			32	16
			1U (S)	GPU	P		4		32	16
			1U (S)	GPU	P			3[5]	32	16
	30°C	220–270	T-shape (P)	S	P	8			32	16
				GPU	P		4		32	16
				GPU	P			3[5]	32	16
24 x 2.5"[4]	30°C	105–165	2U (E)	S	P	6			32	4
			1U (S)	GPU	P		4		32	4
			1U (S)	GPU	P			2	32	4
	30°C	185–240	T-shape (P)	S	P	6			32	4
				GPU	P		4		32	4
				GPU	P			2	32	4

Notes:
1. The following processors have below exceptions:
   - The Intel Xeon 6334 HCC 165W processor should use the 2U standard heat sink instead of the 2U entry heat sink.
   - The Intel Xeon 8351N XCC 225W processor should follow rules for processors with TDP ranging from 250 watts to 270 watts.
2. The 256 GB 3DS RDIMMs are supported only in below server configurations:
   - 8 x 2.5"
   - 16 x 2.5"
   - 8 x 3.5"
3. For the 16 x 2.5-inch AnyBay configuration, a maximum of two NVIDIA A40 or L40 GPU adapters are supported in PCIe slot 2 and slot 5 when the ambient temperature is 30°C and a maximum of three NVIDIA A40 or L40 GPU adapters are supported in PCIe slot 2, slot 5 and slot 7 when the ambient temperature is 25°C.
4. The NVIDIA V100S, A40, A100 80G, A800, L40, and H100 adapters are not supported by the 24 x 2.5-inch configuration.

5. For the AMD MI210 adapter, a maximum of two adapters are supported.

Air baffle replacement

Use this information to remove and install the air baffle.

The air baffle varies by the server hardware configuration. Refer to "Technical rules" on page 256 to select the appropriate air baffle for your server. The replacement procedures for the air baffles are the same.
- "Remove the air baffle" on page 265
- "Install the air baffle" on page 267

Figure 194. Standard air baffle

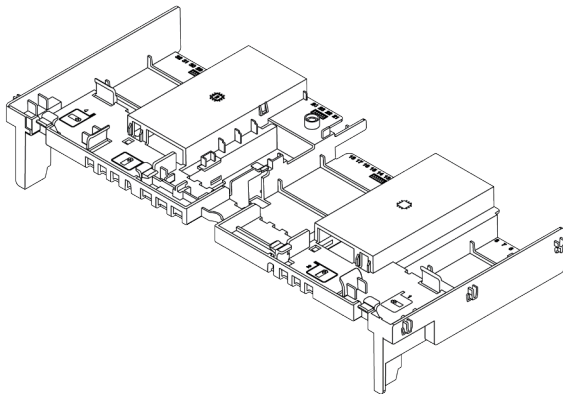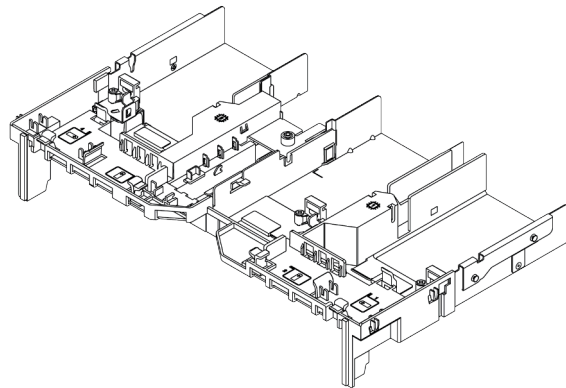*Figure 195. Air baffle for GPU*

Remove the air baffle

Use this information to remove the air baffle.

About this task

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

Attention:

- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

## Procedure

Step 1. Prepare your server.

    a.   Remove the top cover. See "Remove the top cover" on page 435.

    b.   If there is a RAID flash power module installed on the air baffle, disconnect the cable of the RAID flash power module first.

    c.   If there is an M.2 drive installed on the air baffler, disconnect M.2 backplane cables from the system board.

    d.   If there is a GPU installed on the air baffle, remove the GPU first. See "Remove a GPU adapter" on page 291.

Step 2. Grasp the air baffle and carefully lift it out of the server.

    Note: The illustrated air baffle is the standard air baffle. The removal procedure is the same for the GPU air baffle. For more information, see "Remove a GPU adapter" on page 291.
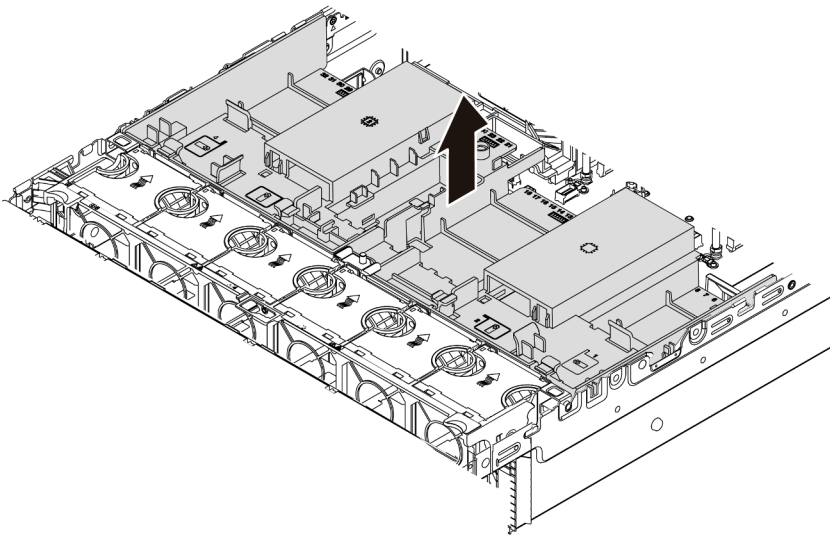
Figure 196. Air baffle removal

Step 3. (Optional) Remove the standard air baffler filler from the standard air baffle.
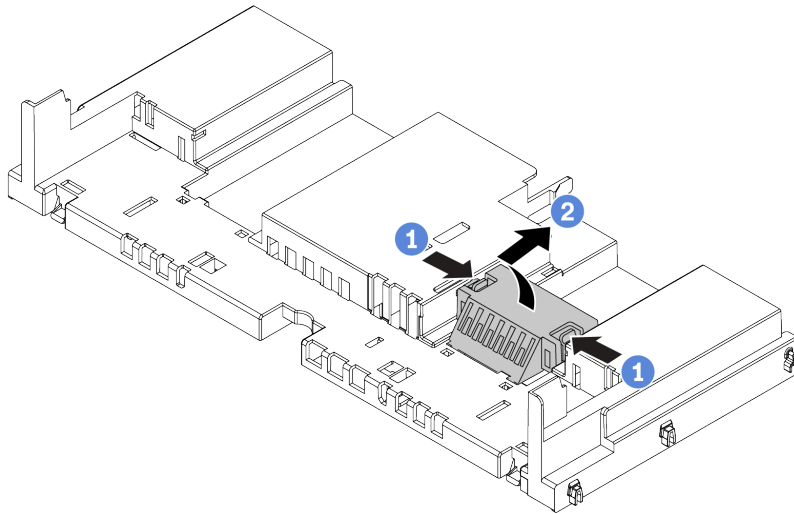
Figure 197. Air baffle filler removal

After you finish

Attention: For proper cooling and airflow, install the air baffle before you turn on the server. Operating the server without the air baffle might damage server components.

Demo video

[Watch the procedure on YouTube](#)

Install the air baffle

Use this information to install the air baffle.

About this task

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

Attention:

- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

Procedure

Note: The illustrated air baffle is a standard air baffle. The installation method is the same for the GPU air baffle. For more information, see "Install a GPU adapter" on page 295.

Step 1. Refer to "Technical rules" on page 256 to select the appropriate air baffle for your server.

Step 2. (Optional) If the 1U standard heat sink or T-shape performance heat sink is installed, install the air baffle filler to fill the gap between the heat sink and the air baffle.

       Note: The following illustration shows the air baffle upside down.
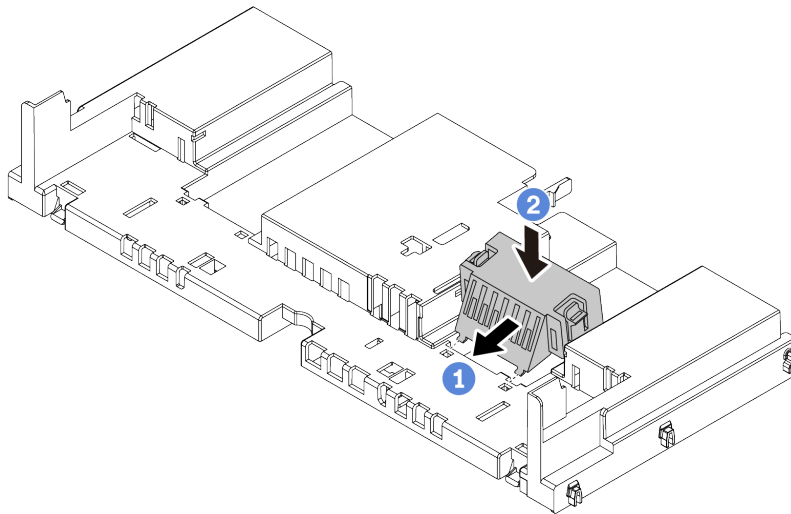
Figure 198. Air baffle filler installation

Step 3. Align the tabs on both sides of the air baffle with the corresponding slots on both sides of the chassis. Then, lower the air baffle into the chassis and press the air baffle down until it is securely seated.
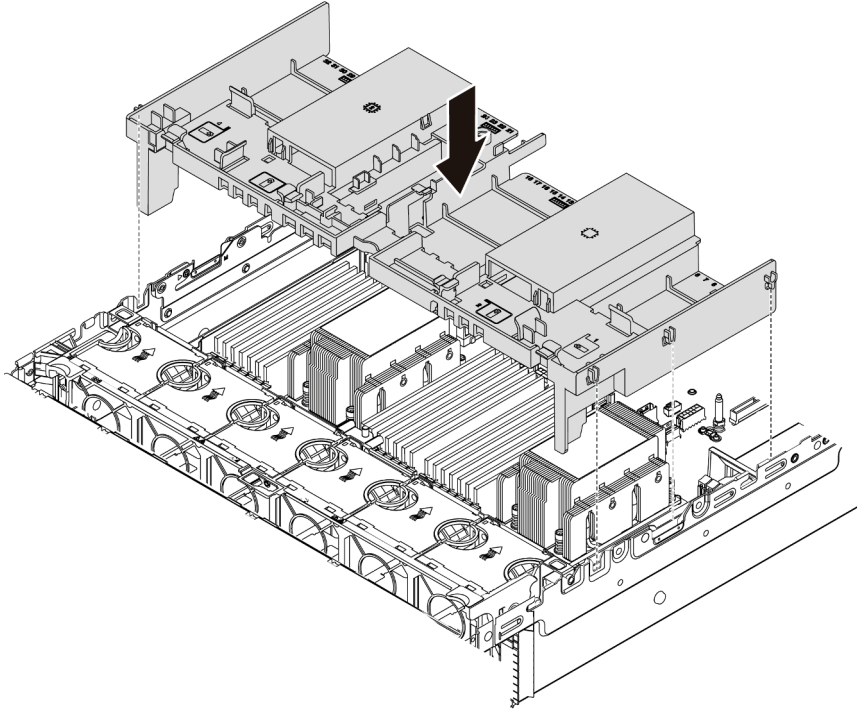
Figure 199. Installation of the standard air baffle

After you finish

1. Reconnect cables of RAID flash power modules if you have disconnected them. See "RAID flash power module" on page 77.
2. Reconnect cables of the M.2 backplane if you have disconnected them. See "M.2 drives" on page 80.
3. If you have removed a GPU adapter, reinstall it. See "Install a GPU adapter" on page 295.
4. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Cable wall brackets replacement

Use this information to remove and install the full-height or half-height cable wall brackets.

For most server models, your server comes with half-height cable wall brackets at both side of the system board. If you need to upgrade your server to 32 NVMe drives, you need to replace the half-height cable wall brackets with full-height cable wall brackets for cable routing. The full-height cable wall brackets come with the 32 NVMe cable kit.

- "Remove the half-height cable wall brackets" on page 270
- "Install the full-height cable wall brackets" on page 272

Remove the half-height cable wall brackets

Use this information to remove the half-height cable wall brackets.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   Prepare your server.

    a.   Remove the top cover. See "Remove the top cover" on page 435.

    b.   If your server comes with an air baffle or middle cage, remove it first.
- "Remove the air baffle" on page 265
- "Remove the middle drive cage" on page 325

    c.   Remove the fan cage. See "Remove the system fan cage" on page 426.

    d.   Record all the cables that are passing through the cable wall brackets and disconnect them.

Step 2.   Remove the half-height cable wall brackets.

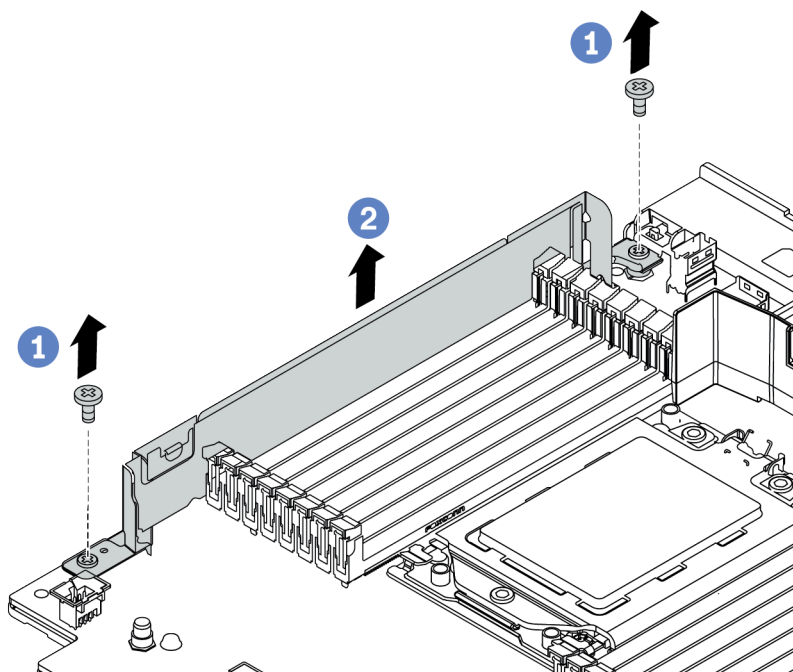*Figure 200. Cable wall brackets removal*

   a.   Remove the two screws.

   b.   Lift the brackets up from the system board.

After you finish
1. Install the full-height cable wall brackets. See "Install the full-height cable wall brackets" on page 272.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install the full-height cable wall brackets

Use this information to install the full-height cable wall brackets.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
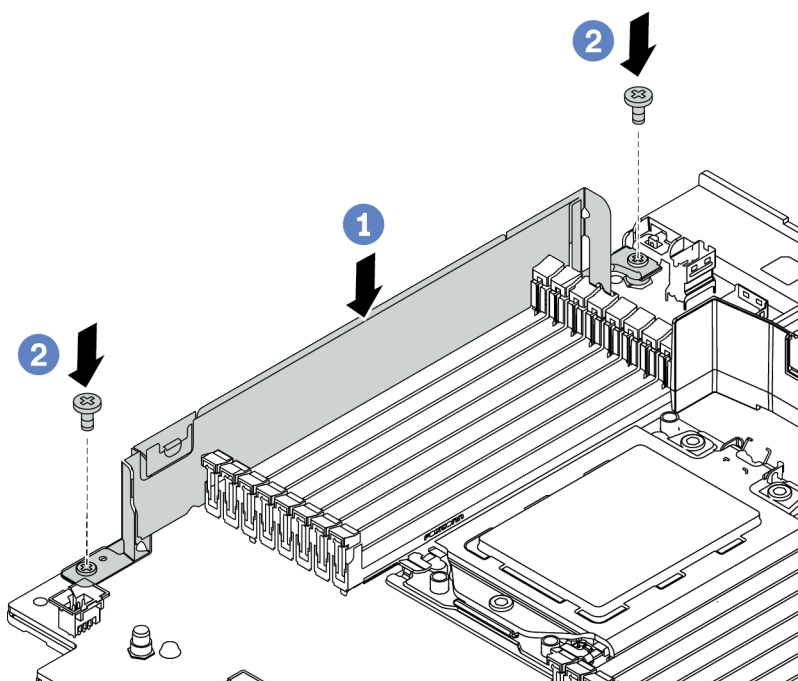
Procedure

Figure 201. Cable wall brackets installation

Step 1. Align the cable wall brackets with the two holes on the system board. Install the brackets onto the system board.

Step 2. Install the two screws to secure the brackets.

After you finish

1. Install any parts you have removed. See Chapter 4 "Hardware replacement procedures" on page 237.
2. Connect any cables. See Chapter 3 "Internal cable routing" on page 67.
3. Complete the parts replacement. See "Complete the parts replacement" on page 440.

CMOS battery (CR2032) replacement

Use this information to remove and install the CMOS battery.

- "Remove the CMOS battery" on page 273
- "Install the CMOS battery" on page 275

Remove the CMOS battery

Use this information to remove the CMOS battery.

About this task

The following tips describe information that you must consider when removing the CMOS battery.
- Lenovo has designed this product with your safety in mind. The lithium CMOS battery must be handled correctly to avoid possible danger. If you replace the CMOS battery, you must adhere to local ordinances or regulations for battery disposal.
- If you replace the original lithium battery with a heavy-metal battery or a battery with heavy-metal components, be aware of the following environmental consideration. Batteries and accumulators that contain heavy metals must not be disposed of with normal domestic waste. They will be taken back free of charge by the manufacturer, distributor, or representative, to be recycled or disposed of in a proper manner.
- To order replacement batteries, call your support center or business partner. For Lenovo support telephone numbers, see https://datacentersupport.lenovo.com/supportphonelist for your region support details.

Note: After you replace the CMOS battery, you must reconfigure the server and reset the system date and time.

S004

CAUTION:
When replacing the lithium battery, use only Lenovo specified part number or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**

- **Heat to more than 100°C (212°F)**

- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

S002

CAUTION:
The power-control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Remove any parts and disconnect any cables that might impede your access to the CMOS battery.

Step 3. Locate the CMOS battery. See "System board components" on page 51.

Step 4. Open the battery clip as shown and carefully take the CMOS battery out of the socket.

> **Attention:**
> - Failing to remove the CMOS battery properly might damage the socket on the system board. Any damage to the socket might require replacing the system board.
> - Do not tilt or push the CMOS battery by using excessive force.
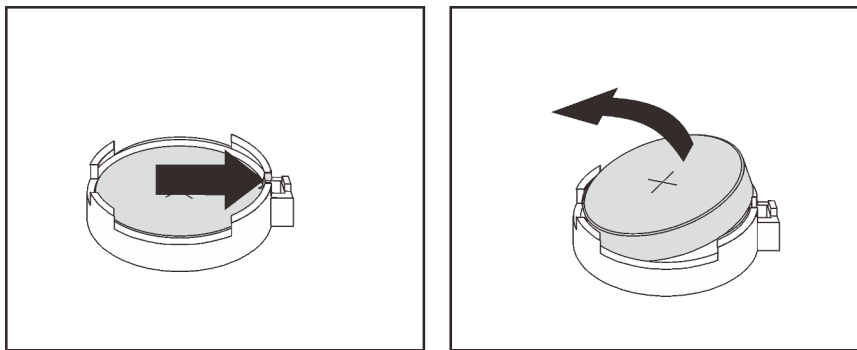
Figure 202. CMOS battery removal

After you finish

1. Install a new one. See "Install the CMOS battery" on page 275.
2. Dispose of the CMOS battery as required by local ordinances or regulations.

Demo video

Watch the procedure on YouTube

Install the CMOS battery

Use this information to install the CMOS battery.

About this task

The following tips describe information that you must consider when installing the CMOS battery.
- Lenovo has designed this product with your safety in mind. The lithium CMOS battery must be handled correctly to avoid possible danger. If you replace the CMOS battery, you must adhere to local ordinances or regulations for battery disposal.
- If you replace the original lithium battery with a heavy-metal battery or a battery with heavy-metal components, be aware of the following environmental consideration. Batteries and accumulators that contain heavy metals must not be disposed of with normal domestic waste. They will be taken back free of charge by the manufacturer, distributor, or representative, to be recycled or disposed of in a proper manner.
- To order replacement batteries, call your support center or business partner. For Lenovo support telephone numbers, see https://datacentersupport.lenovo.com/supportphonelist for your region support details.

Note: After you install the CMOS battery, you must reconfigure the server and reset the system date and time.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

  S002

  CAUTION:
  The power-control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   Touch the static-protective package that contains the CMOS battery to any unpainted surface on the outside of the server. Then, take the CMOS battery out of the package.

Step 2.   Install the CMOS battery. Ensure that the CMOS battery is seated in place.
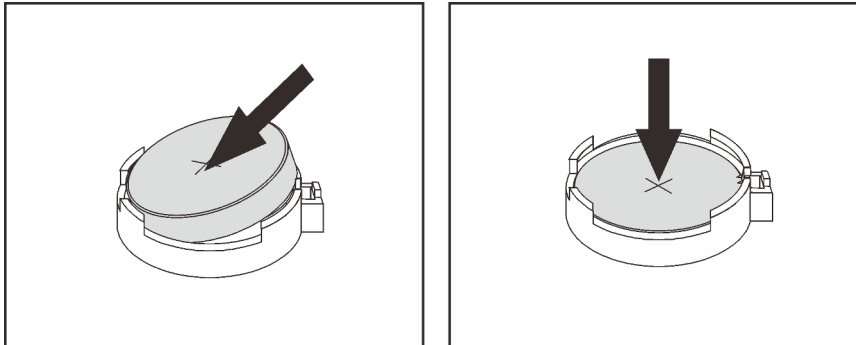
Figure 203. CMOS battery installation

After you finish
1. Complete the parts replacement. See "Complete the parts replacement" on page 440.
2. Use the Setup utility to set the date, time, and any passwords.

   Note: After you install the CMOS battery, you must reconfigure the server and reset the system date and time.

Demo video

Watch the procedure on YouTube

Front drive backplane replacement

Use this information to remove and install a front drive backplane.

Remove the 2.5-inch front drive backplane

Use this information to remove the 2.5-inch front drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Prepare your server.

    a. Remove all the installed drives and fillers (if any) from the drive bays. See "Remove a hot-swap drive" on page 303.

    b. Remove the top cover. See "Remove the top cover" on page 435.

    c. Remove the system fan cage for easier operation. See "Remove the system fan cage" on page 426.

    d. Remove the air baffle if needed. See "Remove the air baffle" on page 265.

Step 2. Remove the 2.5-inch drive backplane.

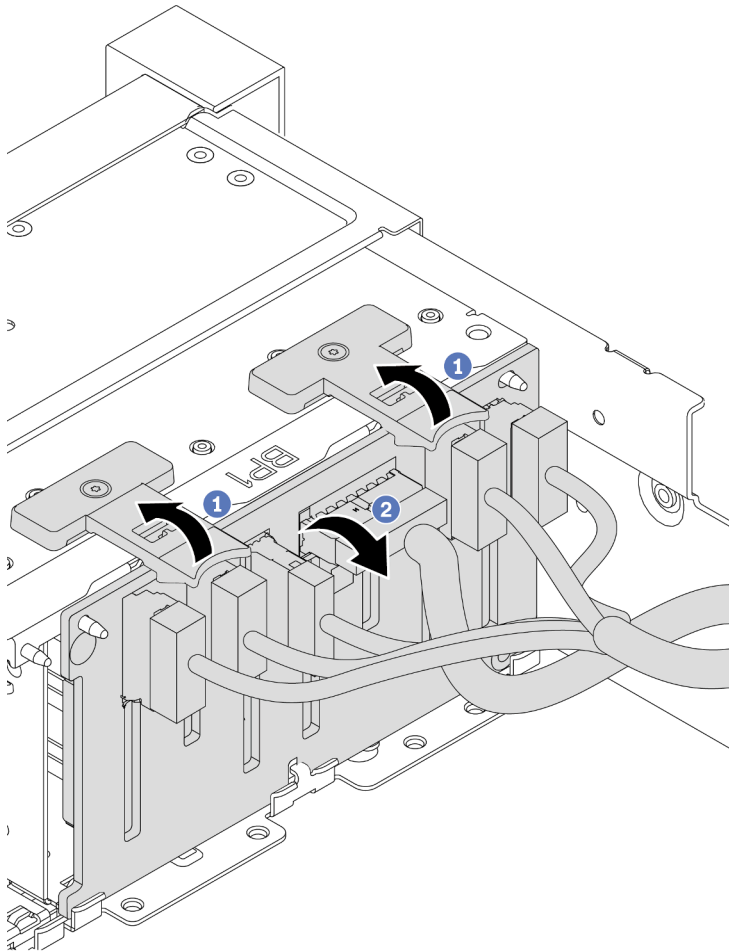> **Note:** Depending on the specific type, your backplane might look different from the illustration.

Figure 204. 2.5-inch drive backplane removal

a. Lift the release tabs.

b. Rotate the backplane from the top to disengage it from the two pins on the chassis.

Step 3. Record the cable connections on the backplane and then disconnect all cables from the backplane.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install the 2.5-inch front drive backplane

Use this information to install the 2.5-inch front drive backplane.

About this task

The server supports up to three 2.5-inch drive backplanes of below types. Depending on the backplane type and quantity, the installation location of the backplanes varies.
- 2.5-inch SAS/SATA 8-bay backplane
- 2.5-inch AnyBay 8-bay backplane
- 2.5-inch NVMe 8-bay backplane

Note: The AnyBay backplane and NVMe backplane listed above use the same physical circuit board. The difference is which connectors on the backplane are cabled: NVMe and SAS/SATA, or just NVMe.

The following table lists the supported backplane combinations. Install the backplane according to your server configuration.
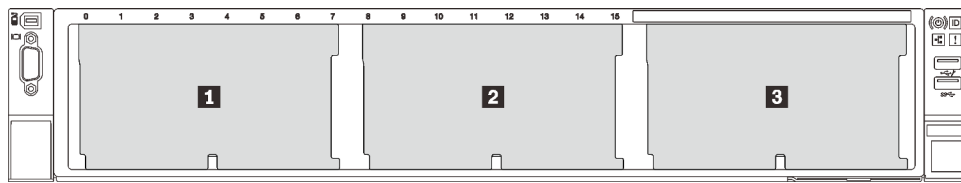

Figure 205. Drive backplane numbering

Back-plane quantity	Backplane **1**	Backplane **2**	Backplane **3**
1	• SAS/SATA 8-bay • NVMe 8-bay • AnyBay 8-bay		
2	SAS/SATA 8-bay	SAS/SATA 8-bay	
	SAS/SATA 8-bay	• NVMe 8-bay • AnyBay 8-bay	
	AnyBay 8-bay	NVMe 8-bay	
	NVMe 8-bay	NVMe 8-bay	
3	SAS/SATA 8-bay	SAS/SATA 8-bay	SAS/SATA 8-bay
	SAS/SATA 8-bay	SAS/SATA 8-bay	• AnyBay 8-bay • NVMe 8-bay
	SAS/SATA 8-bay	NVMe 8-bay	NVMe 8-bay
	NVMe 8-bay	NVMe 8-bay	NVMe 8-bay

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new backplane to any unpainted surface on the outside of the server. Then, take the new backplane out of the package and place it on a static-protective surface.

Step 2. Connect the cables to the backplane. See Chapter 3 "Internal cable routing" on page 67.

Step 3. Install the 2.5-inch drive front backplane.

> **Note:** Depending on the specific type, your backplane might look different from the illustration.
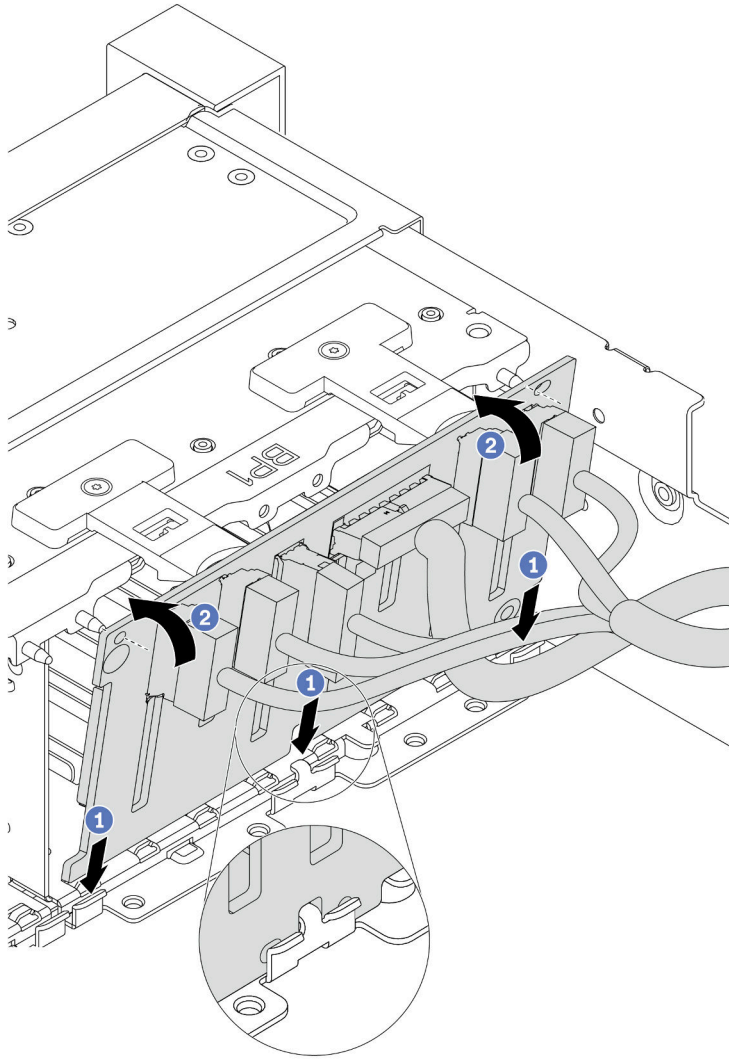

Figure 206. 2.5-inch drive backplane installation

a. Align the bottom of the backplane with the slots on of the chassis.

b. Rotate the backplane to the vertical position and align the holes in the backplane with the pins on the chassis and press the backplane into position. The release tabs will secure the backplane in place.

After you finish

1. Reinstall all the drives and fillers (if any) into the drive bays. See "Install a hot-swap drive" on page 304.
2. Reinstall the fan cage. See "Install the system fan cage" on page 428.

3. Reinstall the air baffle if you have removed it. See "Install the air baffle" on page 267.
4. Complete the parts replacement. See "Complete the parts replacement" on page 440.
5. If you have installed an Anybay backplane with U.3 NVMe drives for Trimode, enable **U.3 x1 mode** for the selected drive slots on the backplane through the XCC Web GUI. See "U.3 NVMe drive can be detected in NVMe connection, but cannot be detected in Tri-mode" on page 455.

Demo video

Watch the procedure on YouTube

Remove the 3.5-inch front drive backplane

Use this information to remove the 3.5-inch front drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Prepare your server.

    a. Remove all the installed drives and fillers (if any) from the drive bays. See "Remove a hot-swap drive" on page 303.

    b. Remove the top cover. See "Remove the top cover" on page 435.

    c. Remove the system fan cage for easier operation. See "Remove the system fan cage" on page 426.

    d. Remove the air baffle if needed. See "Remove the air baffle" on page 265.

Step 2. Lift the release tabs and rotate the backplane backward slightly to release it from the two pins on the chassis.

Note: Depending on the specific type, your backplane might look different from the illustration. For the 3.5-inch 12-bay backplane or the 3.5-inch 12-bay backplane with expender, some cables might need to be removed from their retaining clips or moved to the side to remove the backplane.
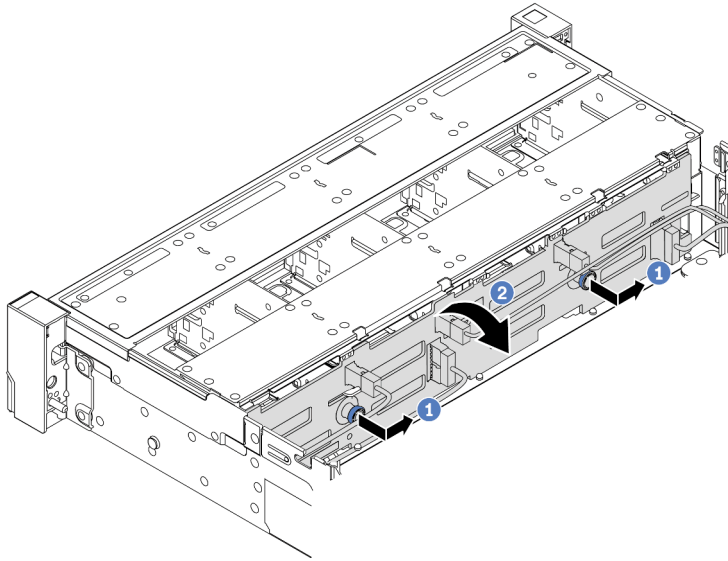
Figure 207. 3.5-inch drive backplane removal

    a.   Pull out the plungers and slightly slide the backplane to the side as shown.

    b.   Rotate the backplane down to release it from the four hooks on the chassis. Then, carefully lift the backplane out of the chassis.

Step 3.   Record the cable connections on the backplane and then disconnect cables from the backplane.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install the 3.5-inch front drive backplane

Use this information to install the 3.5-inch front drive backplane.

About this task

The server supports one of the following backplanes. The installation procedure for the backplanes is the same.
- 3.5-inch 8-bay SAS/SATA backplane
- 3.5-inch 12-bay SAS/SATA backplane
- 3.5-inch 12-bay AnyBay backplane
- 3.5-inch 12-bay SAS/SATA backplane with Expander
- 3.5-inch 8-bay SAS/SATA + 4-bay AnyBay backplane with Expander

Note: The backplanes with Expander and the 4 x 3.5-inch middle drive cage are not supported at the same time.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new backplane to any unpainted surface on the outside of the server. Then, take the new backplane out of the package and place it on a static-protective surface.

Step 2. Connect the cables to the backplane. See Chapter 3 "Internal cable routing" on page 67.

Note: If you find it easier to reconnect cables to the backplane after the backplane is installed. You can install the backplane first, and then reconnect the cables.

Step 3. Install the 3.5-inch drive backplane.

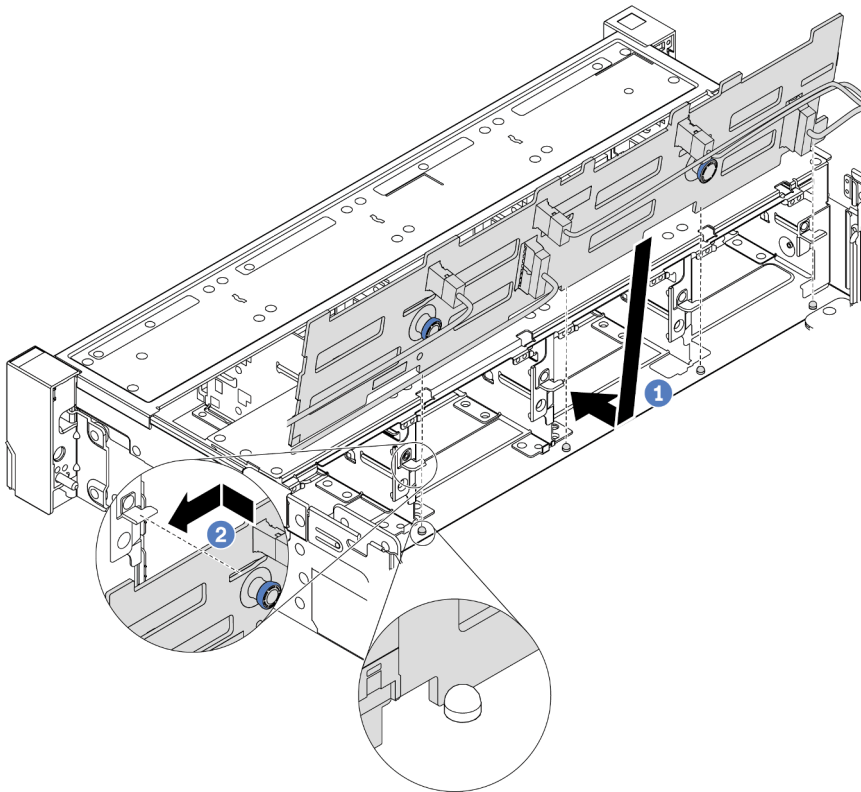**Note:** Depending on the specific type, your backplane might look different from the illustration.

Figure 208. 3.5-inch drive backplane installation

a. Align the backplane with the chassis and lower it into the chassis. Then, put the backplane into place with it leaning backward slightly.

b. Rotate the backplane to vertical position to ensure that the four hooks on the chassis pass through the corresponding holes in the backplane. Then, slide the new backplane as shown until it is secured into place.

After you finish

1. Reinstall all the drives and fillers (if any) into the drive bays. See "Install a hot-swap drive" on page 304.
2. Reinstall the fan cage. See "Install the system fan cage" on page 428.
3. Reinstall the air baffle if you have removed it. See "Install the air baffle" on page 267.
4. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Front I/O module replacement

Use this information to remove and install the front I/O module.

The front I/O module varies by model. The front I/O module for most models is on the right rack latch. The front I/O module on the front media bay is supported only in the following server models:
- Server models with eight 2.5-inch front drive bays
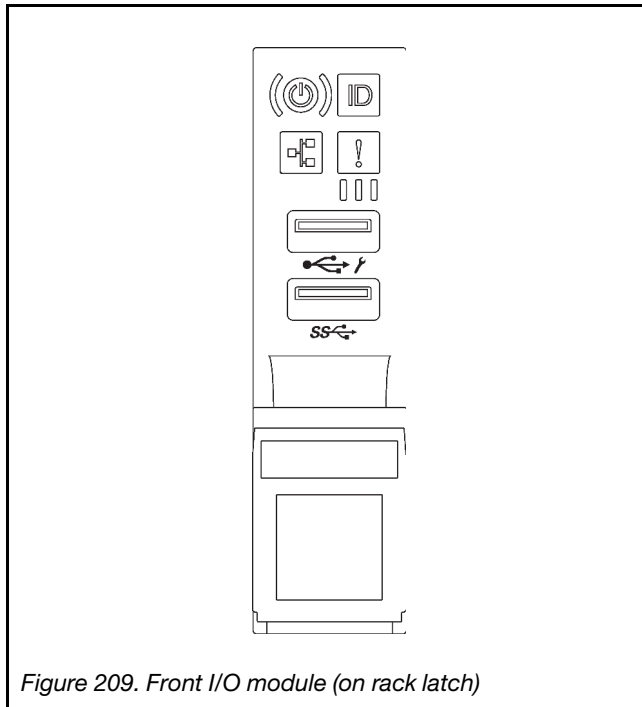- Server models with sixteen 2.5-inch front drive bays

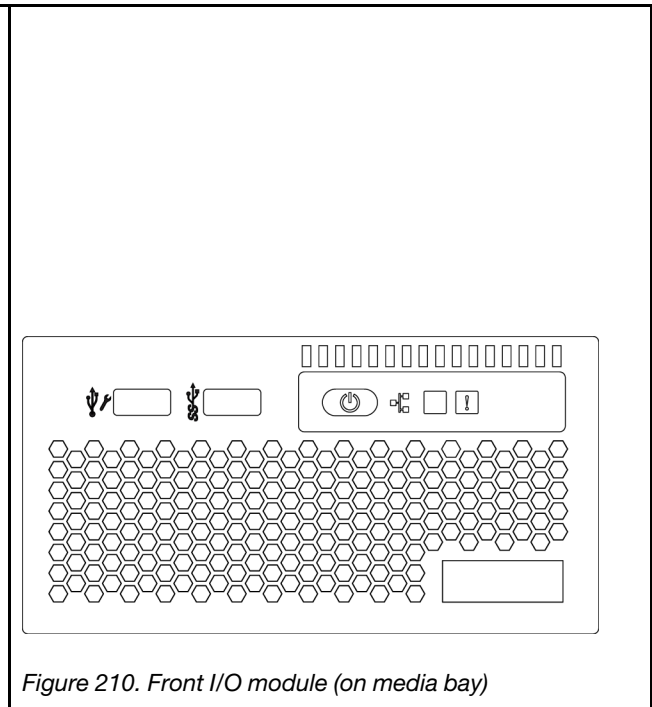Figure 209. Front I/O module (on rack latch)

Figure 210. Front I/O module (on media bay)

To replace the front I/O module on the rack latch, see "Rack latches replacement" on page 364.

To replace the front I/O assembly on the media bay:
- "Remove the front I/O module" on page 286
- "Install the front I/O module" on page 288

Remove the front I/O module

Use this information to remove the front I/O module.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. If the security bezel is installed, remove it. See "Remove the security bezel" on page 408.

Step 2. Remove the top cover. See "Remove the top cover" on page 435.

Step 3. Remove the air baffle. See "Remove the air baffle" on page 265.

Step 4. Disconnect the cables of the front I/O module from the system board. See "Front I/O connectors" on page 67.

> **Attention:** To avoid damaging the system board, make sure to follow the instructions in Chapter 3 "Internal cable routing" on page 67 when disconnecting cables from the system board.

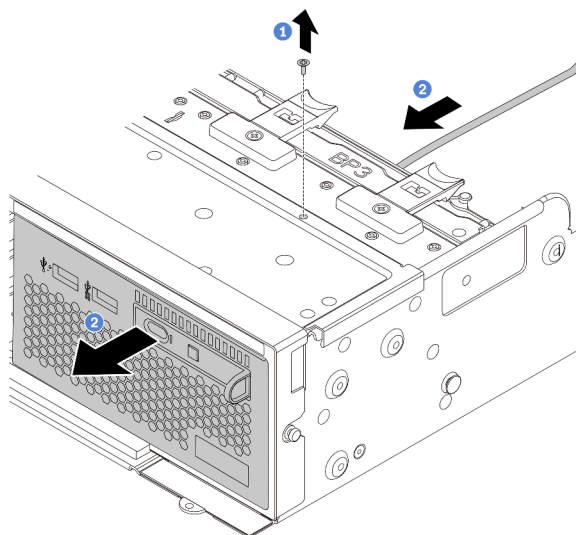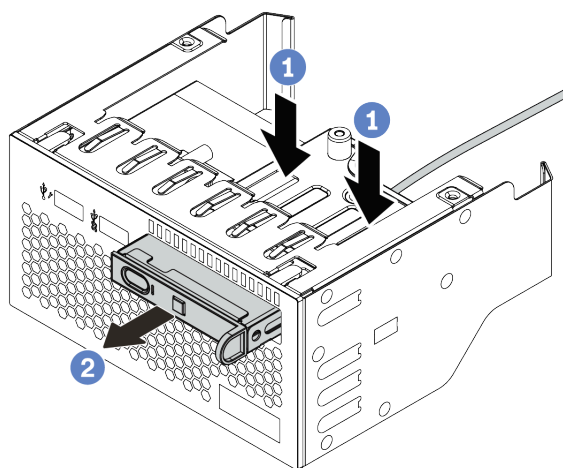Step 5. Remove the front I/O module from the front chassis.

Figure 211. Front I/O module removal

a. Remove the screws that secure the front I/O module.

b. Slide the media bay out of the front chassis.

Step 6. Remove the integrated diagnostics panel from its assembly.

Figure 212. Integrated diagnostic panel removal

a. Press down the clips as shown.

b. Pull the diagnostics panel by its handle to get it out of its assembly.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install the front I/O module

Use this information to install the front I/O module.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the front I/O module to any unpainted surface on the outside of the server. Then, take the front I/O module out of the package and place it on a static-protective surface.
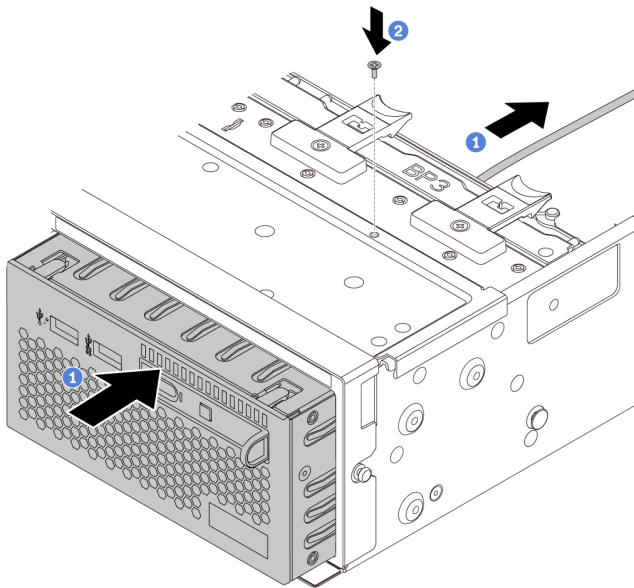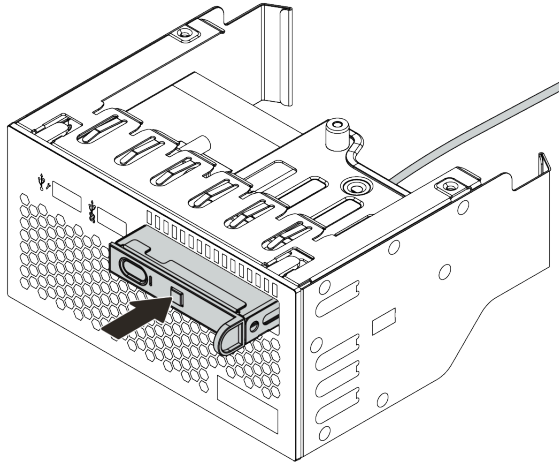
Step 2. Install the front I/O module.

Figure 213. Front I/O module installation

    a.   Insert the front I/O module into the front chassis.

    b.   Install the screws to secure the front I/O module in place.

Step 3. Insert the integrated diagnostics panel into the assembly. Ensure that the panel is fully seated into the assembly.

Figure 214. Integrated diagnostics panel installation

After you finish

1. Connect the cables of the front I/O module to the system board. See "Front I/O connectors" on page 67.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.
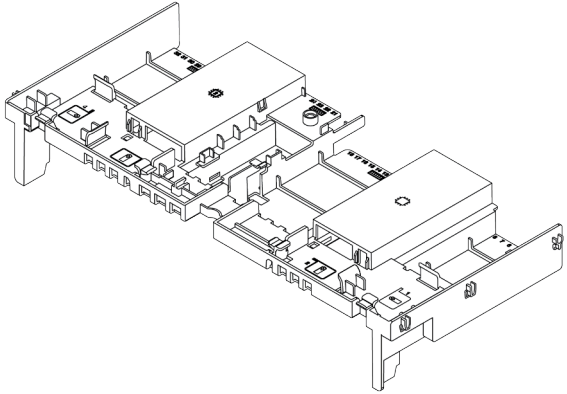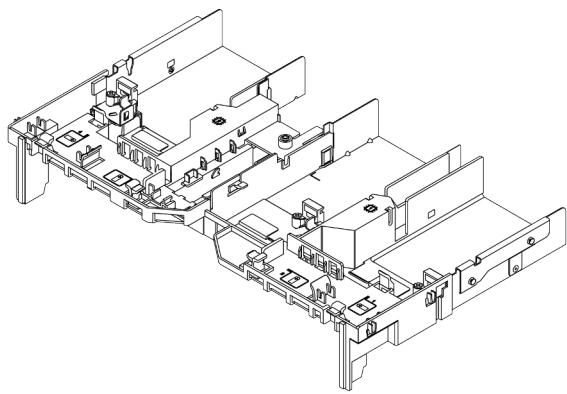
GPU replacement

Use this information to remove and install a GPU adapter.

Notes: To prevent potential thermal issues, change the **Misc** setting in the BIOS from **Option3** (default value) to **Option1** if the following two conditions are met:
- The server is equipped with a GPU adapter.
- The UEFI firmware version is AFE128B or later.

For the method of changing the **Misc** setting, see https://support.lenovo.com/us/en/solutions/TT1832.
-
-

Air baffle	Supported GPU adapter
 Figure 215. Standard air baffle	Half length, low profile, single-wide: • NVIDIA Tesla T4 • NVIDIA Quadro P620 • NVIDIA A2
 Figure 216. GPU Air baffle	Full length, full height, double-wide: • NVIDIA Tesla V100S • NVIDIA A100 • NVIDIA A30 • NVIDIA A40 • NVIDIA A16 • NVIDIA Quadro RTX 6000 • NVIDIA Quadro RTX A6000 • AMD Instinct MI210 • NVIDIA A800 Full length, full height, single-wide: NVIDIA A10

Notes:
- All installed GPU adapters must be identical.
- If a double-wide GPU adapter is installed in slot 5, 7 or 2, the adjacent slot 4, 8, or 1 respectively is not available.

- If a single-wide 150W GPU adapter is installed on PCIe slot 1, 4, or 7, the adjacent slot 2, 5, or 8 respectively cannot be installed with an Ethernet adapter of 100GbE or higher.
- For thermal rules for supported GPUs, see "Thermal rules" on page 262.

Remove a GPU adapter

Use this information to remove a GPU adapter.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Depending on the specific type, your GPU adapter might look different from the illustration in this topic.

Procedure

Step 1.   Remove the top cover. See "Remove the top cover" on page 435.

Step 2.   (Optional) If you are removing a GPU adapter on riser 3 assembly, you might need to disconnect cables from the system board first.

Notes:
- If you need to disconnect cables from the system board, disengage all latches or release tabs on cable connectors first. Failing to release the tab before removing the cables will damage the cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
- The connectors on your system board might look different from those in the illustration, but the removal procedure is the same.

    1. Press the release tab to release the connector.

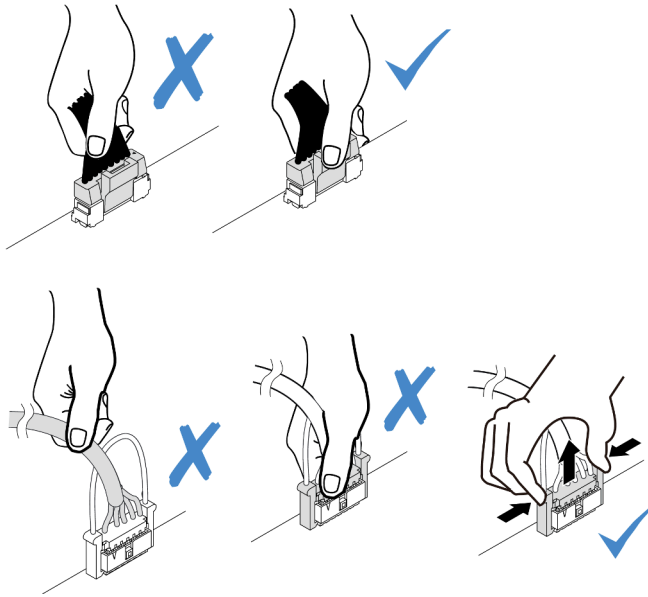   2. Disengage the connector from the cable socket.

Figure 217. Disconnecting cables from the system board

Step 3. Remove the riser assembly that has the GPU adapter installed from the system board.

Note: The following uses riser 1 assembly as an example for illustration. The procedure is similar for the other riser assemblies.
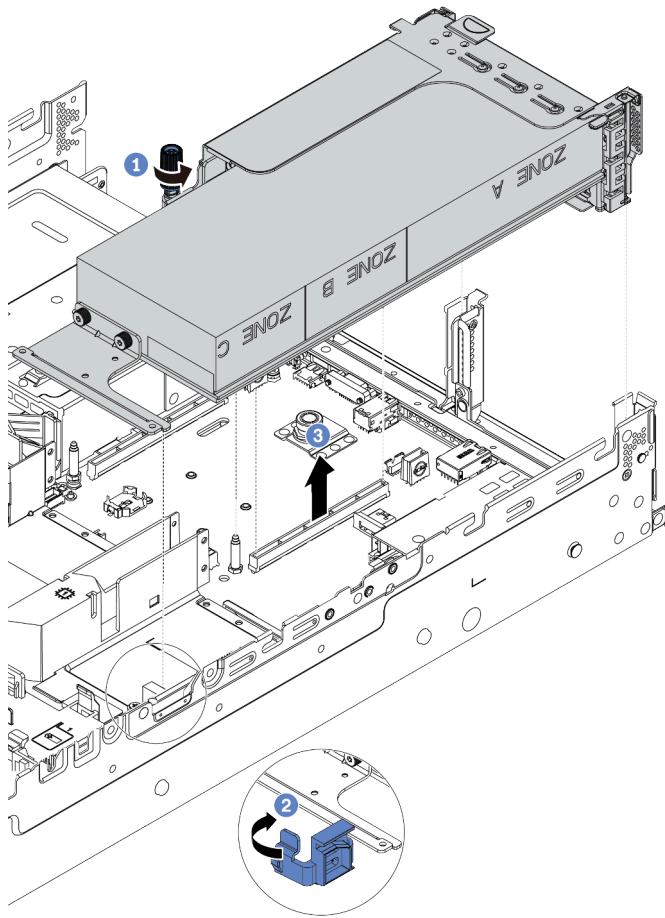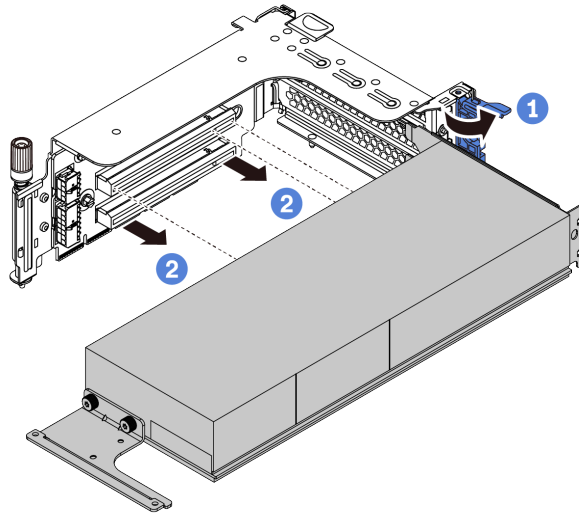
Figure 218. Removing the riser assembly

a. Loosen the screw that secures the riser assembly.

b. Open the blue latch on the GPU air baffle.

c. Grasp the riser assembly by its edges and carefully lift it straight up and off the chassis.

Step 4. Disconnect the power cable from the GPU adapter.

Step 5. Remove the GPU adapter from the riser bracket.

Figure 219. Removing the GPU adapter

a. Rotate the GPU adapter retention latch to the open position.

b. Grasp the GPU adapter by its edges and carefully pull it out of the PCIe slot.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a GPU adapter

Use this information to install a GPU adapter.

About this task

Higher GPU power requires higher PSU power. Use Lenovo Capacity Planner to calculate the required power capacity for what is configured for the server. More information about Lenovo Capacity Planner is available at:

https://datacentersupport.lenovo.com/solutions/lnvo-lcp

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- GPU adapters are supported on some server models with requirements. See "Thermal rules" on page 262.
- All installed GPU adapters must be identical.

Procedure

Step 1. Locate the appropriate PCIe slot for the GPU adapter. See "PCIe slots and PCIe adapters" on page 256

Step 2. Install the GPU adapter into the PCIe slot on the riser card.
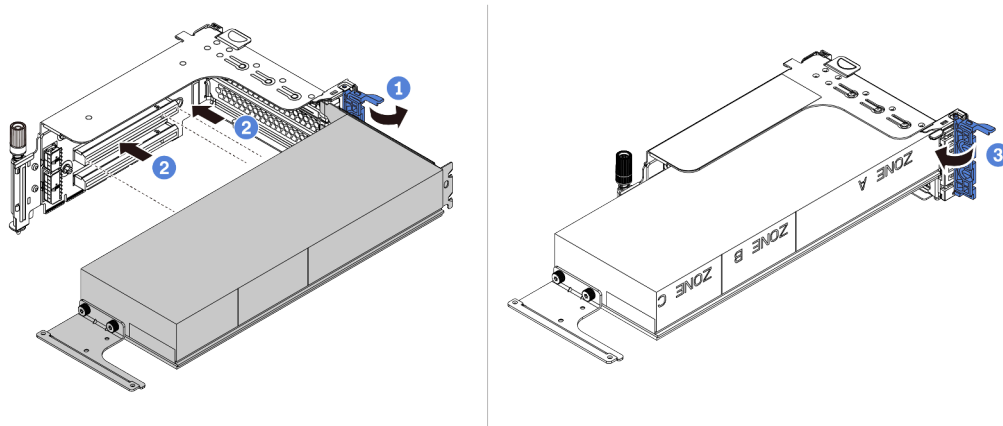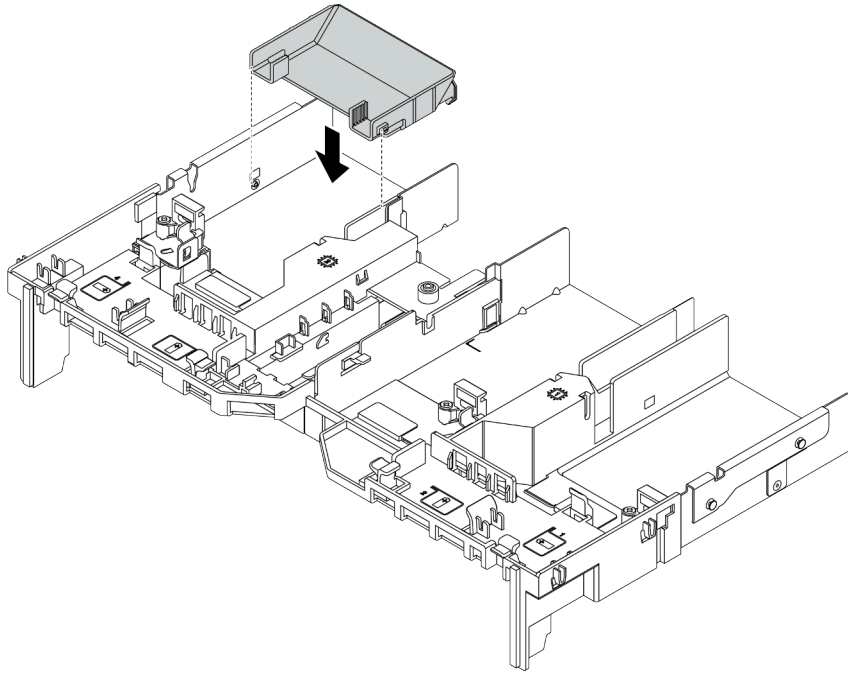

Figure 220. Installing the GPU adapter

    a. Open the blue latch on the riser cage.

    b. Align the GPU adapter with the PCIe slot on the riser card. Then, carefully press the GPU adapter straight into the slot until it is securely seated.

    c. Close the blue latch.

Step 3. Connect the GPU power cable to the GPU power connector on the riser card or system board. See "GPUs" on page 70.

Step 4. Install the GPU air baffle.

    Note: If a single-wide 150W GPU adapter (FHFL) is to be installed but the adjacent slot will be left empty or installed with a half-length adapter, install an add-on air baffle on the GPU air baffle first.

Figure 221. Installing an add-on air baffle

Step 5.   Install the riser assembly.
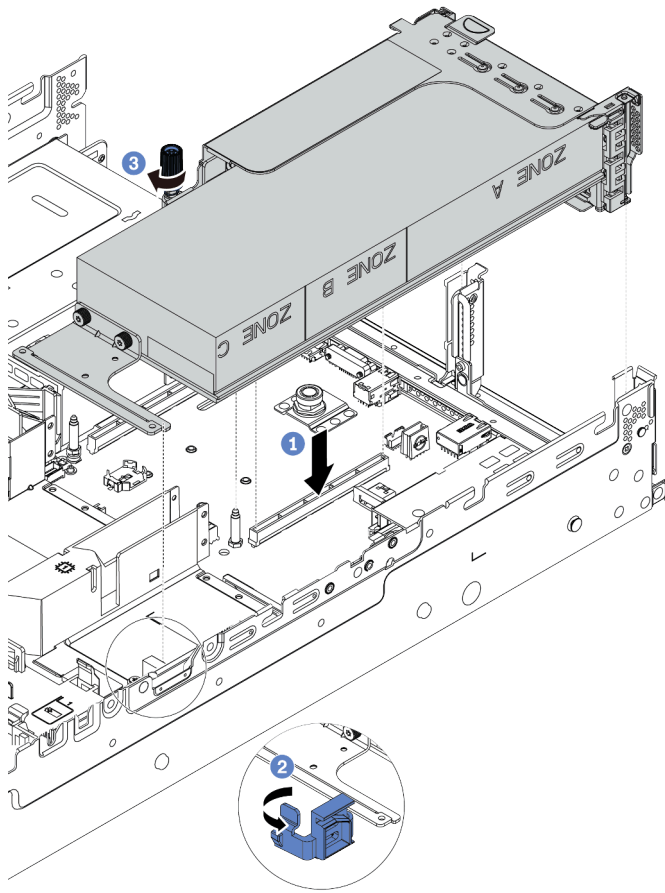
Figure 222. Installing the riser assembly

a. Align the riser card with the PCIe slot on the system board. Carefully press the riser card straight into the slot until it is securely seated.

b. If you are installing a full-length GPU adapter, open the blue latch on the GPU air baffle and fix the end of the GPU adapter. Then, close the blue latch.

c. Tighten the screw to fix the riser cage.

Step 6. Connect the GPU power cable to the power connector on the GPU adapter, and route the power cable properly. See "GPUs" on page 70.

Step 7. (Optional) If a certain slot is not installed with a GPU adapter, install a filler on the GPU air baffle.
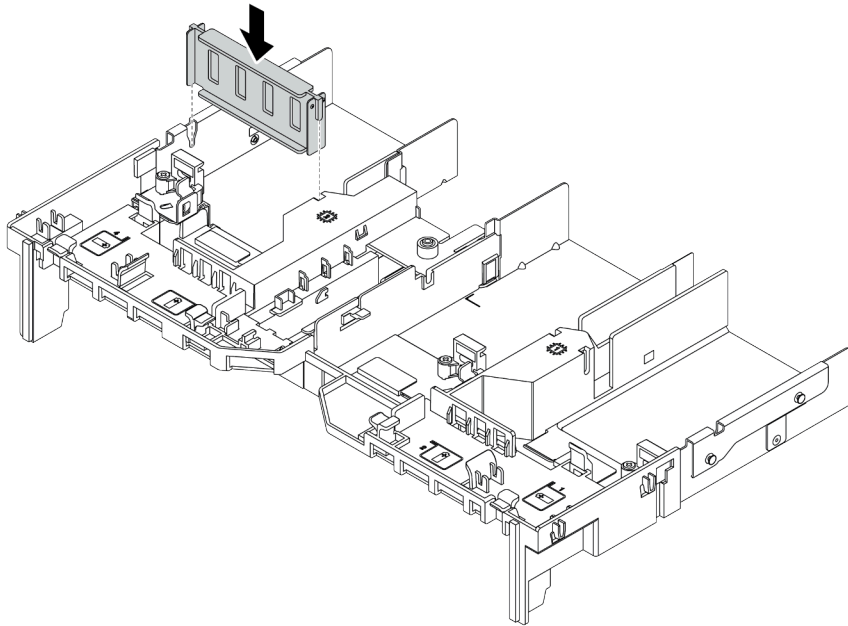
Figure 223. Installing the GPU air baffle filler

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Heat sink Torx T30 nut replacement

Use this information to remove and install a heat sink Torx T30 nut.

- "Remove a heat sink Torx T30 nut" on page 299
- "Install a heat sink Torx T30 nut" on page 300

Remove a heat sink Torx T30 nut

This task has instructions for removing a PEEK (Polyether ether ketone) Torx T30 nut on the heat sink.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- If the server is in a rack, remove it from the rack.
- Do not touch the processor contacts. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.

Note: The heat sink, processor, and processor carrier for your system might be different from those shown in the illustrations.

Procedure

Step 1.   Make preparations for this task.

    a.   Remove the top cover. See "Remove the top cover" on page 435.

    b.   If your server comes with an air baffle or a middle cage, remove it first.
- "Remove the air baffle" on page 265
- "Remove the middle drive cage" on page 325

    c.   Remove the system fan cage. "Remove the system fan cage" on page 426.

    d.   Remove the PHM. See "Remove a processor and heat sink" on page 353.

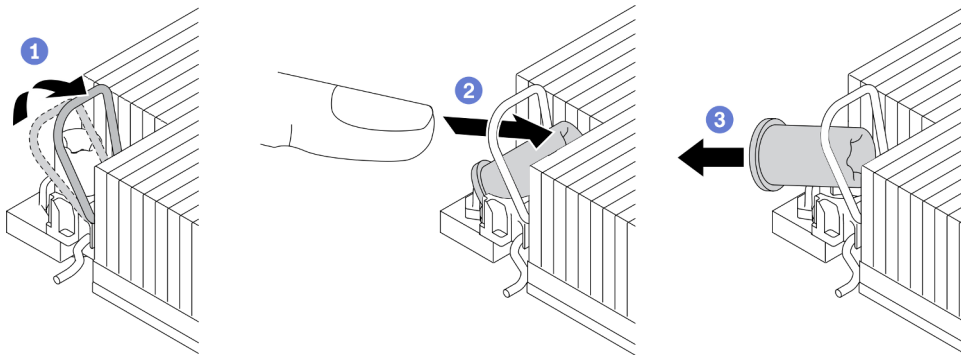Step 2.   Remove the Torx T30 nut.

Figure 224. Removing a Torx T30 nut from the heat sink

Note: Do not touch the gold contacts on the bottom of the processor.

    a.   Rotate the anti-tilt wire bail inwards.

b. Push the upper edge of the Torx T30 nut towards the center of the heat sink until it disengages.

c. Remove the Torx T30 nut.

   Attention: Visually inspect the removed Torx T30 nut, if the nut is cracked or damaged, make sure no debris or broken pieces are left inside your server.

After you finish

1. Install a new Torx T30 nut. See .
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a heat sink Torx T30 nut

This task has instructions for installing a PEEK (Polyether ether ketone) Torx T30 nut on the heat sink.

About this task

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Do not touch the processor contacts. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.

Note: The heat sink, processor, and processor carrier for your system might be different from those shown in the illustrations.

Procedure
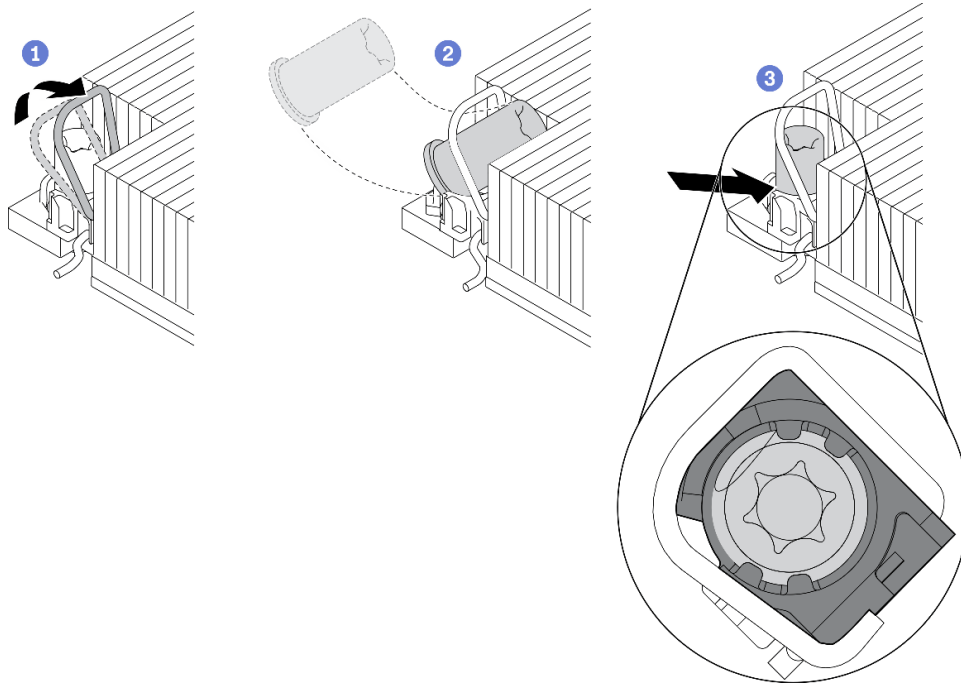
Step 1. Install the Torx T30 nut.

Figure 225. Installing a Torx T30 nut into the heat sink

Note: Do not touch the gold contacts on the bottom of the processor.

a. Rotate the anti-tilt wire bail inwards.

b. Orient the Torx T30 nut under the anti-tilt wire bail; then, align the Torx T30 nut with the socket at an angle as shown.

c. Push the lower edge of the Torx T30 nut into the socket until it clicks into place. Make sure the Torx T30 nut is secured under the four clips in the socket.

After you finish

1. Reinstall the PHM. See "Install a processor and heat sink" on page 358.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Hot-swap drive replacement

Use this information to remove and install a hot-swap drive. You can remove or install a hot-swap drive without turning off the server, which helps you avoid significant interruption to the operation of the system.

Notes:
- The term "hot-swap drive" refers to all the supported types of hot-swap hard disk drives, hot-swap solid-state drives, and hot-swap NVMe drives.
- Use any documentation that comes with the drive and follow those instructions in addition to the instructions in this topic. Ensure that you have all the cables and other equipment that are specified in the documentation that comes with the drive.
- The electromagnetic interference (EMI) integrity and cooling of the server are protected by having all drive bays covered or occupied. The vacant bays are either covered by an EMI-protective panel or occupied by drive fillers. When installing a drive, save the removed drive filler in case that you later remove the drive and need the drive filler to cover the place.
- To avoid damage to the drive connectors, ensure that the top cover is in place and fully closed whenever you install or remove a drive.

Remove a hot-swap drive

Use this information to remove a hot-swap drive.

About this task

The following describes the information that you must consider for this task:
- Ensure that you have backed up data on your drive, especially if it is part of a RAID array.
    - Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
    - Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- To ensure that there is adequate system cooling, do not operate the server for more than two minutes without either a drive or a drive filler installed in each bay.

Procedure

Step 1. If the security bezel is installed, remove it first. See "Remove the security bezel" on page 408.

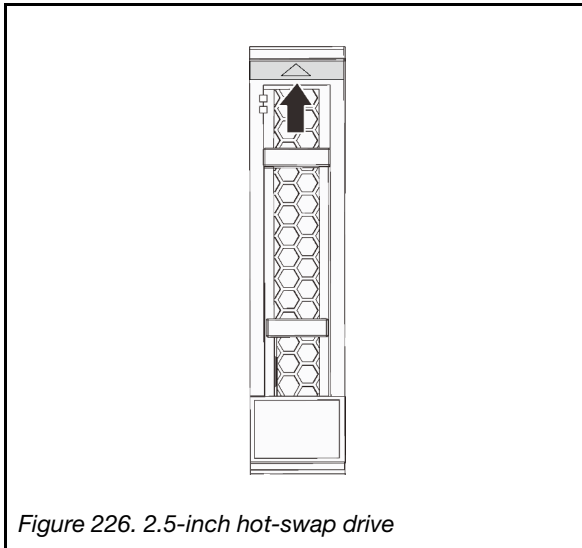Step 2. Slide the release latch to the left to open the drive tray handle.
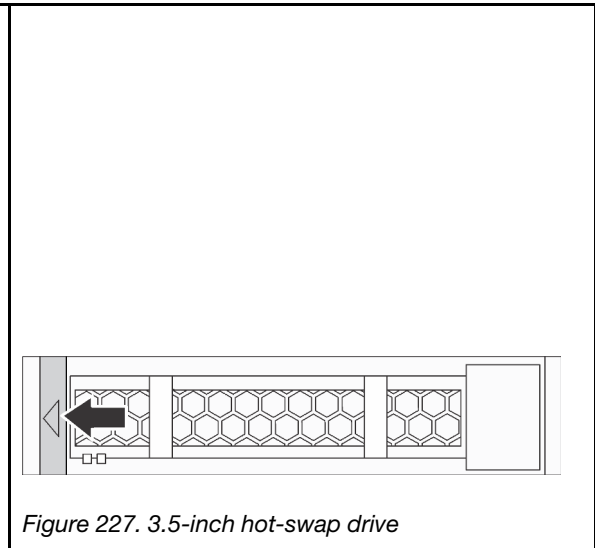

| Figure 226. 2.5-inch hot-swap drive | Figure 227. 3.5-inch hot-swap drive |

Step 3. Grasp the handle and slide the drive out of the drive bay.
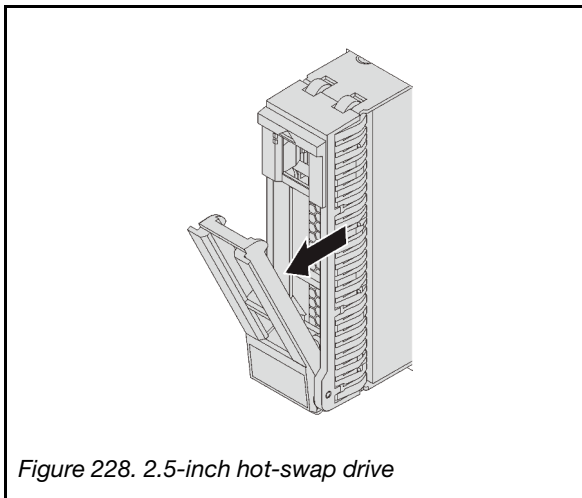
| Figure 228. 2.5-inch hot-swap drive | Figure 229. 3.5-inch hot-swap drive |
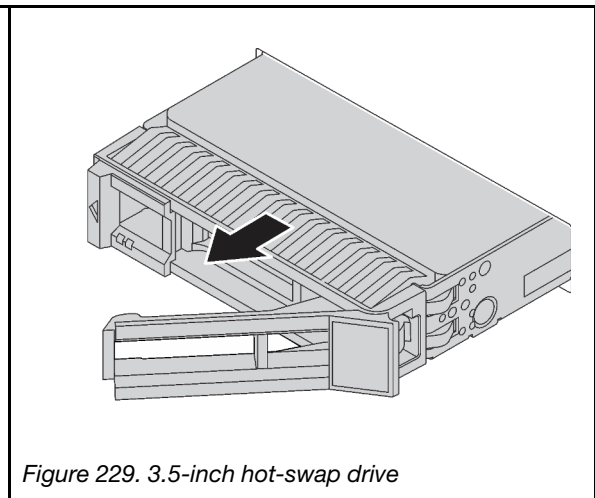
After you finish

1. Install a new drive or drive filler to cover the drive bay. See "Install a hot-swap drive" on page 304.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a hot-swap drive

Use this information to install a hot-swap drive.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the drive to any unpainted surface on the outside of the server. Then, take the drive out of the package and place it on a static-protective surface.

Step 2. Install the drive in the drive bay.

    a. Ensure that the drive tray handle is in the open position. Slide the drive into the drive bay until it snaps into position.

    b. Close the drive tray handle to lock the drive in place.

Figure 230. 2.5-inch hot-swap drive

Figure 231. 3.5-inch hot-swap drive

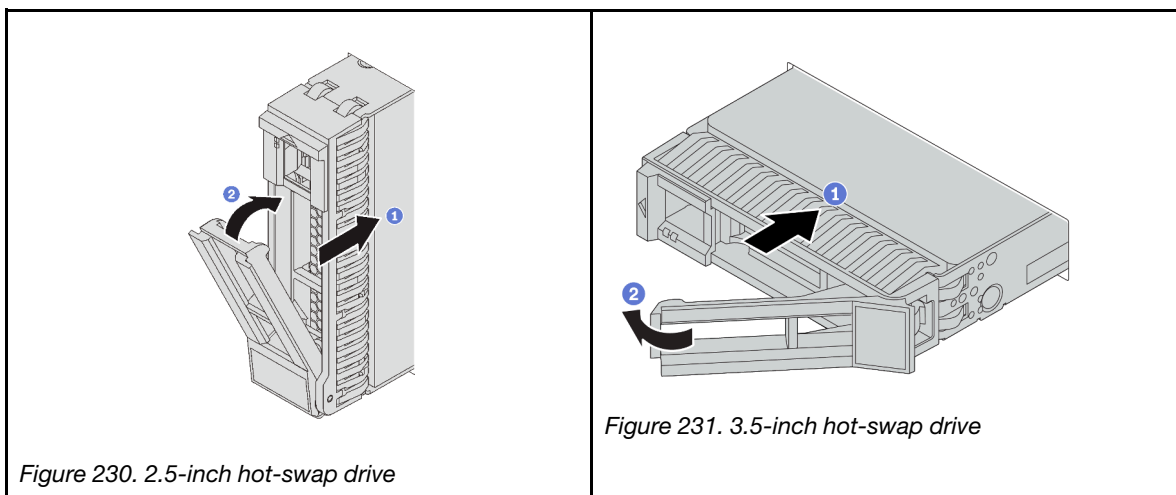Step 3. Check the drive status LED to verify that the drive is operating correctly.

    a. If the yellow drive status LED is lit continuously, that drive is faulty and must be replaced.

    b. If the green drive activity LED is flashing, the drive is being accessed.

Step 4. Continue to install additional hot-swap drives if necessary.

After you finish

1. Reinstall the security bezel if you have removed it. See "Install the security bezel" on page 410.
2. Use the Lenovo XClarity Provisioning Manager to configure the RAID if necessary. See https://pubs.lenovo.com/lxpm-overview/.
3. If you have installed U.3 NVMe drives on a 2.5-inch AnyBay 8-bay backplane for Tri-mode, enable **U.3 x1 mode** for the selected drive slots on the backplane through the XCC Web GUI. See "U.3 NVMe drive can be detected in NVMe connection, but cannot be detected in Tri-mode" on page 455.

Demo video

Watch the procedure on YouTube

Internal RAID/HBA/expander adapter replacement

Use this information to remove and install an internal customer form factor (CFF) RAID adapter, internal CFF HBA adapter, or internal CFF RAID expander adapter.

The server supports RAID/HBA adapters in two form factors:
- Customer form factor (CFF): RAID/HBA adapters in this form factor are supported only when two processors are installed. CFF RAID/HBA adapters are installed between the front backplane and fan cage.
- Standard form factor (SFF): RAID/HBA adapters in this form factor are installed in the PCIe expansion slots, see "PCIe adapter and riser assembly replacement" on page 336.

Remove an internal RAID/HBA/expander adapter

Use this information to remove an internal CFF RAID adapter, internal CFF HBA adapter, or internal CFF RAID expander adapter.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Record the cabling for cables that are crossing over the adapter; then, disconnect all the cables.

   Notes:
   - If you need to disconnect cables from the system board, disengage all latches or release tabs on cable connectors first. Failing to release the tab before removing the cables will damage the cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
   - The connectors on your system board might look different from those in the illustration, but the removal procedure is the same.

      1. Press the release tab to release the connector.

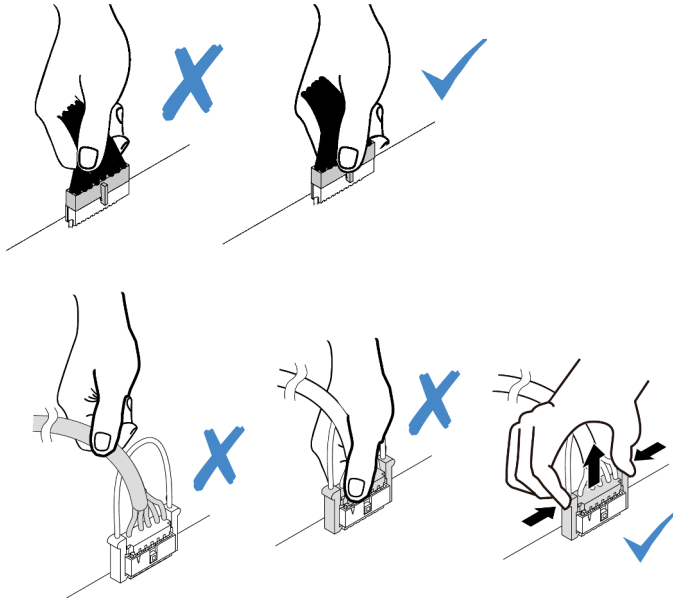   2. Disengage the connector from the cable socket.

Figure 232. Disconnecting cables from the system board

Step 3. Disconnect all cables from the adapter.

Step 4. Lift the blue touch point, slightly slide the adapter as shown, and carefully lift it out of the chassis.
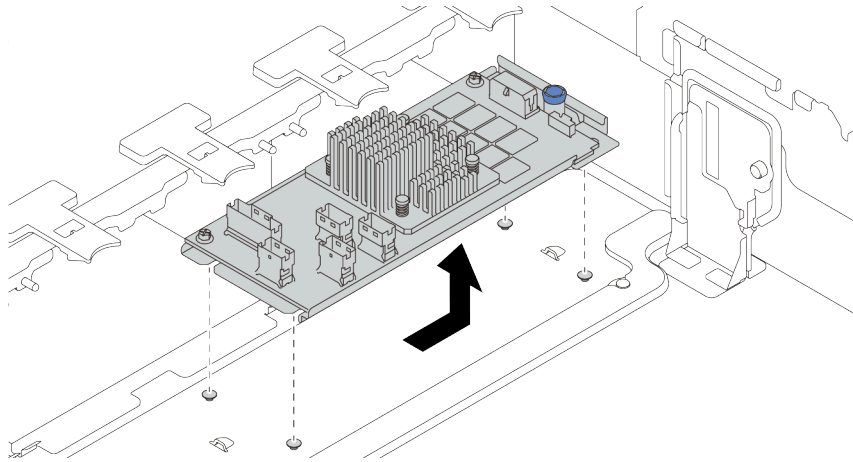

Figure 233. Internal CFF adapter removal

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

[Watch the procedure on YouTube](#)

Install an internal RAID/HBA/expander adapter

Use this information to install an internal CFF RAID adapter, internal CFF HBA adapter, or internal CFF RAID expander adapter.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- The CFF RAID/HBA adapter is supported only when two processors are installed.

Procedure

Step 1. Touch the static-protective package that contains the adapter to any unpainted surface on the outside of the server. Then, take the adapter out of the package and place it on a static-protective surface.

Note: The adapter is shipped with and preinstalled on a mounting bracket, check and ensure that the adapter is fixed in place. If there are any loosen screws, tighten the screws using a No.1 Phillips torque screwdriver. The maximum torque value is 4.8 ± 0.5 inch-pounds.

Step 2. Align the notches on the mounting bracket with the pins on the chassis, place down the adapter, and slightly slide it as shown to secure it on the chassis.
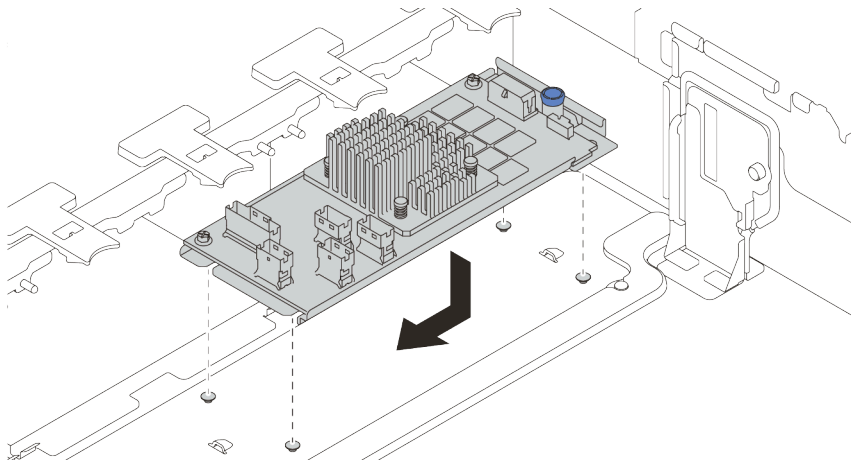

Figure 234. Internal CFF adapter installation

Step 3. Connect cables to the adapter. See Chapter 3 "Internal cable routing" on page 67.

After you finish

1. You might need to update the firmware or driver after replacing the adapter.
   - Go to http://datacentersupport.lenovo.com see the latest firmware and driver updates for your server.
   - Go to "Firmware updates" on page 10 for more information on firmware updating tools
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Intrusion switch replacement

Use this information to remove and install the intrusion switch. The intrusion switch informs you that the server cover is not properly installed or closed by creating an event in the system event log (SEL).

-
-

Remove the intrusion switch

Use this information to remove the intrusion switch.

About this task
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   If the server is installed in a rack, extend the server from the rack.

Step 2.   Remove the top cover. See .

Step 3.   Remove the fan cage from the system board. See .

Step 4.   Remove the system fans from the fan cage. See .

Step 5. Remove the intrusion switch assembly from the fan cage.

> **Note:** The blowup in the illustration shows the fan cage upside down.

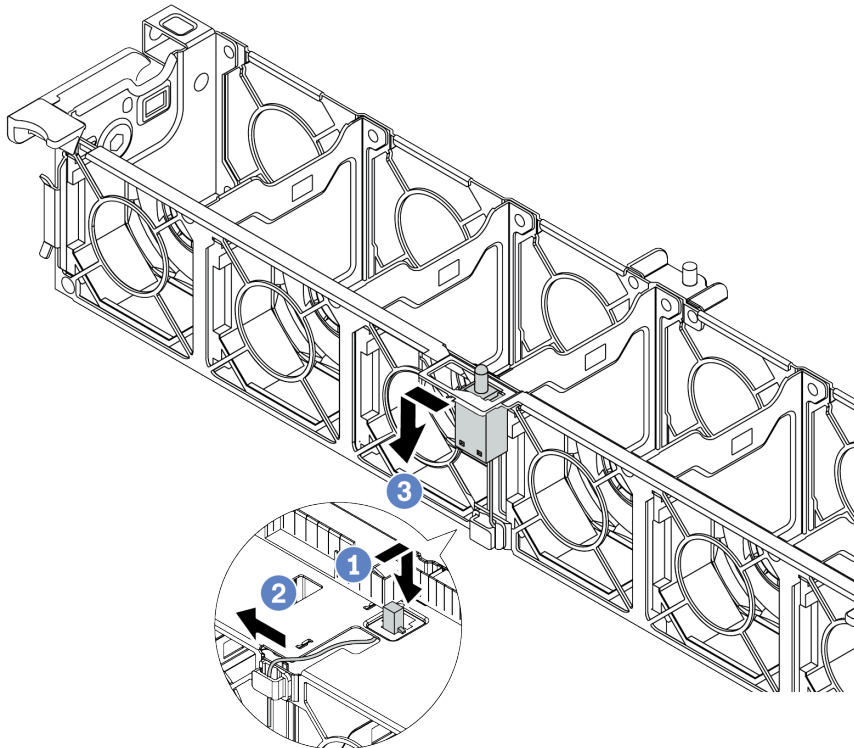*Figure 235. Intrusion switch removal*

    a.   Move the intrusion switch connector forward to disengage it from the keyhole.

    b.   Release the intrusion switch cable from the cable clip.

    c.   Slide and pull the intrusion switch to remove it from the holder.

After you finish

1. Install a new intrusion switch. See "Install the intrusion switch" on page 310.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install the intrusion switch

Use this information to install the intrusion switch.

About this task
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new intrusion switch to any unpainted surface on the outside of the server. Then, take the new intrusion switch out of the package and place them on a static-protective surface.
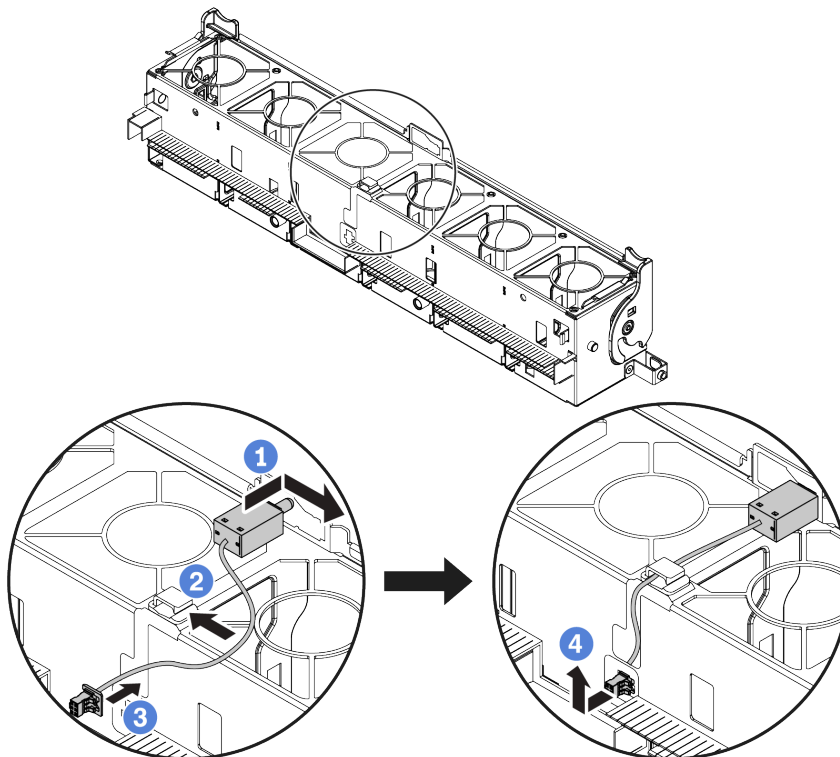
Step 2. Rotate the fan cage by 90 degrees in the direction shown in the picture.
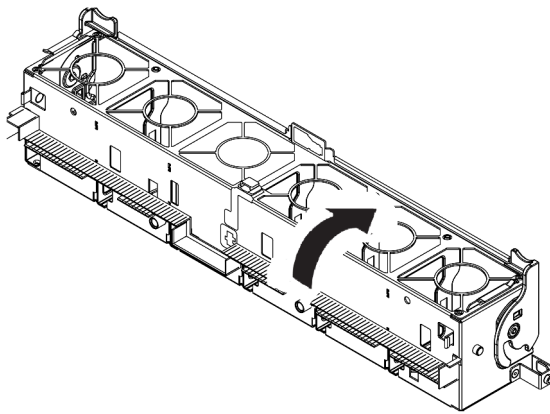
Step 3. Install the intrusion switch onto the fan cage.

Note: Ensure that the intrusion switch cable is routed through the cable clip and the pre-cut slot. Otherwise, the cable may slide under the fan cage, the contact surface between the fan cage and the system board may get uneven, and the fan connection may get loose.
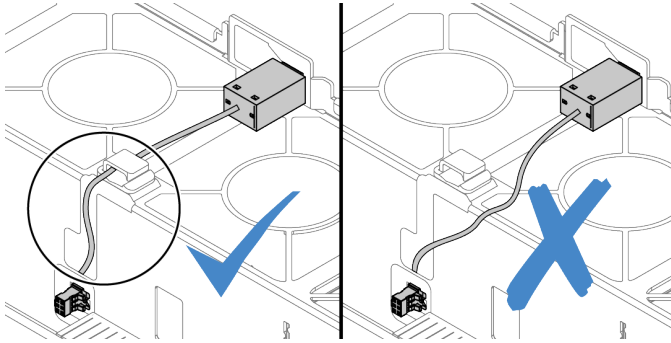
a. Insert the intrusion switch onto the holder on the fan cage and push it in the direction as shown until it is fully seated.

b. Fix the intrusion switch cable into the cable clip.

c. Route the cable into the fan cage through the pre-cut slot on the fan cage bottom.

d. Insert the intrusion switch connector into the connector keyhole, and move it in the shown direction until it is fully seated.

Step 4. Install the fan cage back into the chassis. See "Install the system fan cage" on page 428.

Step 5. Install system fans into the fan cage. "Install a system fan" on page 424.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

M.2 backplane and M.2 drive replacement

Use this information to remove and install the M.2 backplane and M.2 drive.

The position of the M.2 module **1** vary by server hardware configuration. This topic uses the M.2 module on the standard air baffle as an example for replacement illustration. The replacement procedure is the same for the others.

Table 34. M.2 module position

Figure 236. On standard air baffle

Figure 237. On GPU air baffle

Figure 238. On 8 x 2.5 middle drive cage

Figure 239. On 4 x 3.5 middle drive cage

-
-
-
-
-

Remove the M.2 backplane

Use this information to remove the M.2 backplane.

About this task

Attention:

- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Disconnect the M.2 cables from the M.2 backplane.
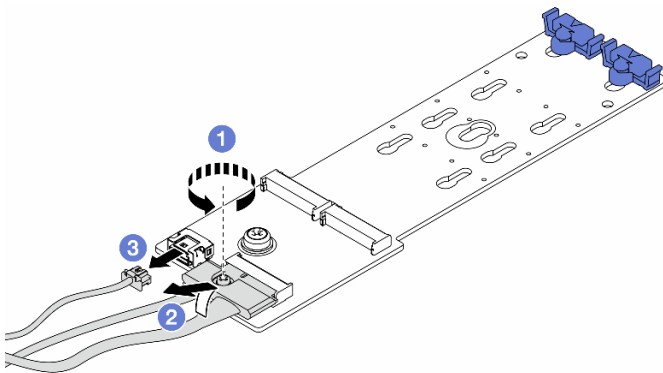
Figure 240. Disconnecting M.2 cables

1. Loosen the screw on the signal cable.
2. Tilt the connector and remove it.
3. Remove the power cable.

Step 3.   Remove the M.2 backplane.
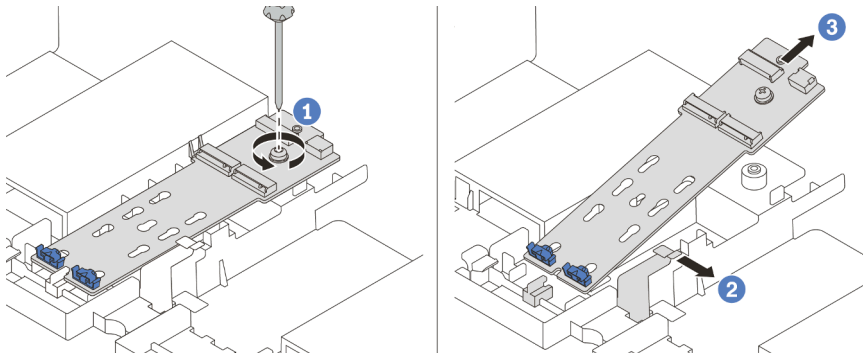
Figure 241. M.2 backplane removal

1. Unfasten the screw that secures the M.2 backplane to the air baffle.
2. Slide and release the M.2 backplane retention clip on the air baffle.
3. Remove the M.2 backplane from the air baffle.

After you finish

1. Remove the M.2 drives from the M.2 backplane. See "Remove an M.2 drive" on page 316.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Remove an M.2 drive

Use this information to remove an M.2 drive.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Figure 242. M.2 drive removal

Step 1. Press both sides of the retainer **2**.

Step 2. Slide the retainer away from the M.2 drive.

Step 3. Rotate the rear end of M.2 drive to an angle of approximately 30 degrees.

Step 4. Pull the M.2 drive away from the connector **1**.

After you finish
1. Install a new M.2 drive. See "Install an M.2 drive" on page 317.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install an M.2 drive

Use this information to install an M.2 drive.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new part to any unpainted surface on the outside of the server. Then, take the new part out of the package and place them on a static-protective surface.

Step 2. (Optional) Adjust the retainer on the M.2 backplane to accommodate the particular size of the M.2 drive you wish to install. See "Adjust the retainer on the M.2 backplane" on page 318.

Step 3. Locate the connector on the M.2 backplane.

> **Notes:**
> - Your M.2 backplane might look different from the following illustrations, but the installation method is the same.
> - Some M.2 backplanes support two identical M.2 drives. Install the M.2 drive in slot 0 first.
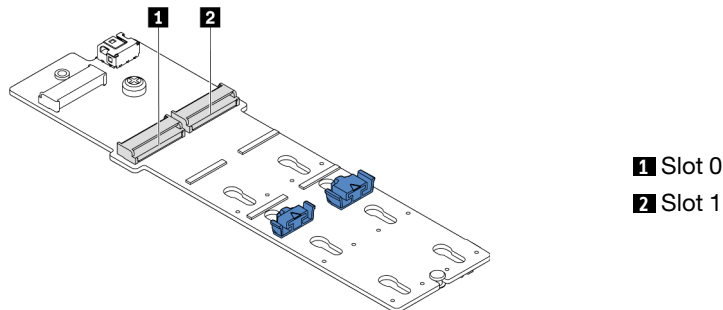
1 Slot 0
2 Slot 1

Figure 243. M.2 drive slot

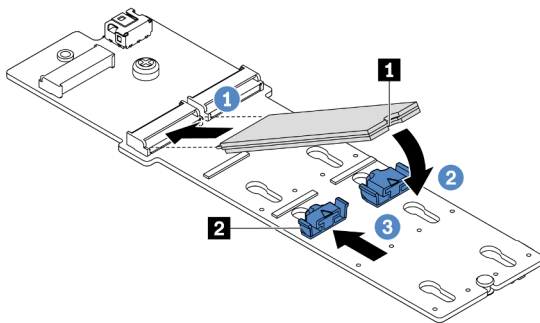Step 4. Install the M.2 drive on the M.2 backplane.

Figure 244. M.2 drive installation

1. Hold the M.2 drive at an angle, and insert it into the M.2 slot.

2. Rotate the M.2 drive down until the notch **1** catches on the lip of the retainer **2**.
3. Slide the retainer toward the M.2 drive to secure it in place.

After you finish
1. Reinstall the M.2 backplane. See "Install the M.2 backplane" on page 318.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Adjust the retainer on the M.2 backplane
Use this information to adjust the retainer on the M.2 backplane.

About this task

Sometimes you need to adjust the M.2 drive retainer to a correct keyhole that can accommodate the particular size of the M.2 drive you wish to install.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure
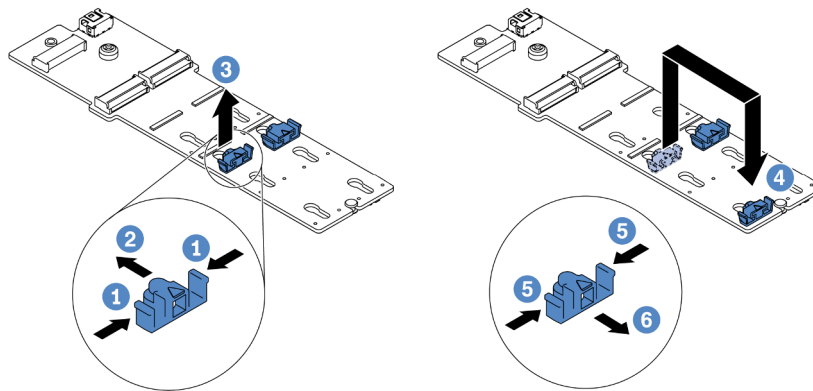
Figure 245. M.2 retainer adjustment

Step 1.   Press both sides of the retainer.

Step 2.   Move the retainer forward until it is in the large opening of the keyhole.

Step 3.   Take the retainer out of the keyhole.

Step 4.   Insert the retainer into the correct keyhole.

Step 5.   Press both sides of the retainer.

Step 6.   Slide the retainer backwards (toward the small opening of the keyhole) until it is seated in place.

Install the M.2 backplane

Use this information to install the M.2 backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Install the M.2 backplane.

Note: Your M.2 backplane might look different from the following illustrations, but the installation method is the same.
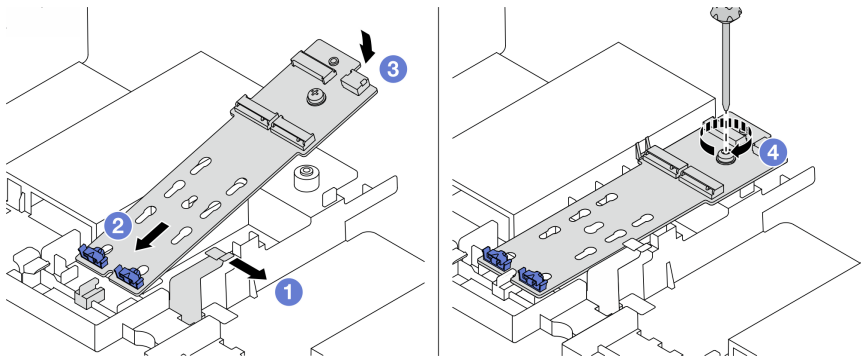
Figure 246. M.2 backplane installation

1. Open the retention clip on the air baffle.
2. Insert the M.2 backplane at an angle of approximately 30 degrees into the tray.
3. Rotate the M.2 backplane downward into place.
4. Tighten the screw to secure the M.2 backplane.

Step 2. Connect the cables to the M.2 backplane and system board. See "M.2 drives" on page 80.
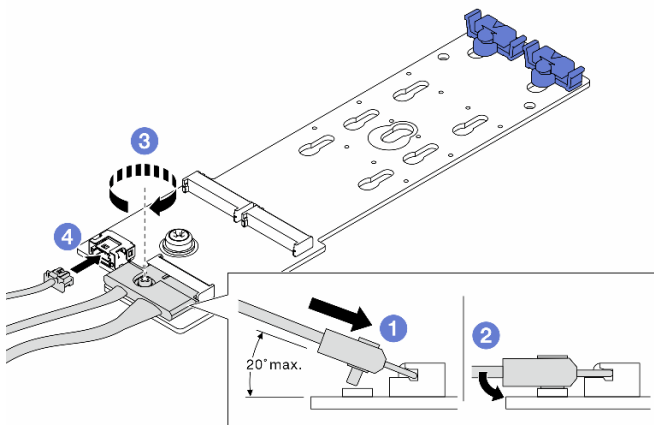
Figure 247. Connecting M.2 cables

1. Tilt the connector at an angle of 20 degrees or lower, and insert it until its bottom surface reaches the ramp.

2. Press the connector down flat.
3. Tighten the screw on the signal cable.
4. Connect the power cable.

After you finish

Complete the parts replacement. See .

Demo video

Watch the procedure on YouTube

Memory module replacement

Use this information to remove and install a memory module.

Remove a memory module

Use this information to remove a memory module.

About this task

Attention:
- Read to ensure that you work safely.
- Memory modules are sensitive to static discharge and require special handling. Refer to the standard guidelines for .
  – Always wear an electrostatic-discharge strap when removing or installing memory modules. Electrostatic-discharge gloves can also be used.
  – Never hold two or more memory modules together so that they touch. Do not stack memory modules directly on top of each other during storage.
  – Never touch the gold memory module connector contacts or allow these contacts to touch the outside of the memory module connector housing.
  – Handle memory modules with care: never bend, twist, or drop a memory module.
  – Do not use any metal tools (such as jigs or clamps) to handle the memory modules, because the rigid metals may damage the memory modules.
  – Do not insert memory modules while holding packages or passive components, which can cause package cracks or detachment of passive components by the high insertion force.

Procedure

Step 1. If any of the modules to be removed is PMEM:
- In the case of system board replacement, keep records of the slots in which the modules are installed, and make sure to install them back to the exact same slots after system board replacement.
- If the removed PMEM is to be replaced or reused in a different configuration, make sure to complete the following procedure before physically removing the module.

  Attention: Without the following steps being completed, the removed PMEM will not be usable in another system or configuration.
  1. Back up stored data in PMEM namespaces.
  2. Disable PMEM security with one of the following options:

- **Lenovo XClarity Provisioning Manager**

  Go to **UEFI Setup ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.
- **Setup Utility**

  Go to **System Configuration and Boot Management ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.

3. Delete namespaces with command corresponding to the operating system that is installed:
   - **Linux** command:

     `ndctl destroy-namespace all -f`
   - **Windows** Powershell command

     `Get-PmemDisk | Remove-PmemDisk`
4. Clear Platform Configuration Data (PCD) and Namespace Label Storage Area (LSA) with the following ipmctl command (for both Linux and Windows).

   `ipmctl delete -pcd`

   Notes: See the following links to learn how to download and use impctl in different operating systems:
   - Windows: https://datacentersupport.lenovo.com/us/en/videos/YTV101407
   - Linux: https://datacentersupport.lenovo.com/us/en/solutions/HT508642
5. Reboot the system.

Step 2. Power off the server and disconnect all power cords.

Step 3. Remove the top cover. See "Remove the top cover" on page 435.

Step 4. If your server comes with an air baffle or a middle cage, remove it. See "Remove the air baffle" on page 265 or "Remove the middle drive cage" on page 325.

Step 5.   Remove the memory module from the slot.

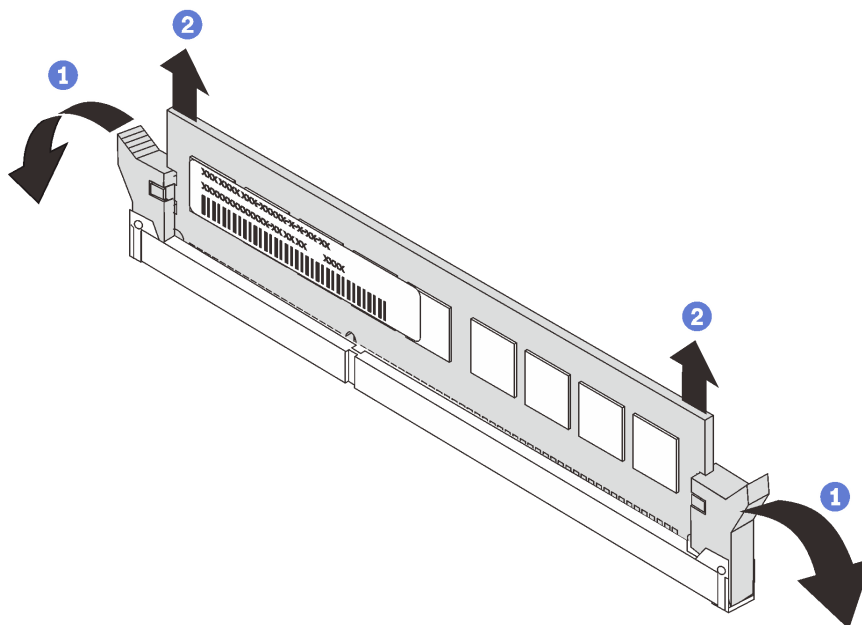*Figure 248. Memory module removal*

    a.   Gently open the retaining clip on each end of the memory module slot.

    b.   Grasp the memory module at both ends and carefully lift it out of the slot.

After you finish

1. Install a memory module filler or a new memory module to cover the slot. See "Install a memory module" on page 322.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a memory module

Use this information to install a memory module.

About this task

See "Memory module installation rules and order" on page 242 for detailed information about memory configuration and setup, and make sure to adopt a supported configuration.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Memory modules are sensitive to static discharge and require special handling. Refer to the standard guidelines for "Handling static-sensitive devices" on page 239:
  - Always wear an electrostatic-discharge strap when removing or installing memory modules. Electrostatic-discharge gloves can also be used.

- Never hold two or more memory modules together so that they do not touch each other. Do not stack memory modules directly on top of each other during storage.
- Never touch the gold memory module connector contacts or allow these contacts to touch the outside of the memory module connector housing.
- Handle memory modules with care: never bend, twist, or drop a memory module.
- Do not use any metal tools (such as jigs or clamps) to handle the memory modules, because the rigid metals may damage the memory modules.
- Do not insert memory modules while holding packages or passive components, which can cause package cracks or detachment of passive components by the high insertion force.

Procedure

Step 1. Locate the required memory module slot on the system board. Ensure that you observe the installation rules and sequence in "Memory module installation rules and order" on page 242.

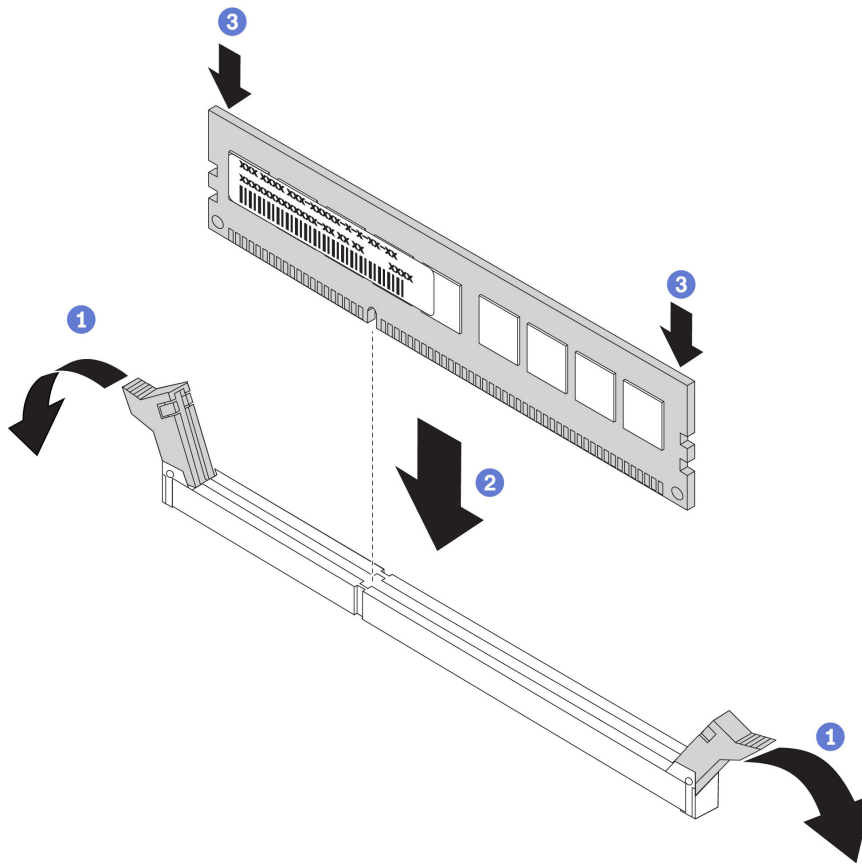Step 2.   Install the memory module into the slot.

Figure 249. Memory module installation

a.   Gently open the retaining clip on each end of the memory module slot.

b.   Align the memory module with the slot, and gently place the memory module on the slot with both hands.

c.   Firmly press both ends of the memory module straight down into the slot until the retaining clips snap into the locked position.

Note: If there is a gap between the memory module and the retaining clips, the memory module has not been correctly inserted. In this case, open the retaining clips, remove the memory module, and then reinsert it.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video
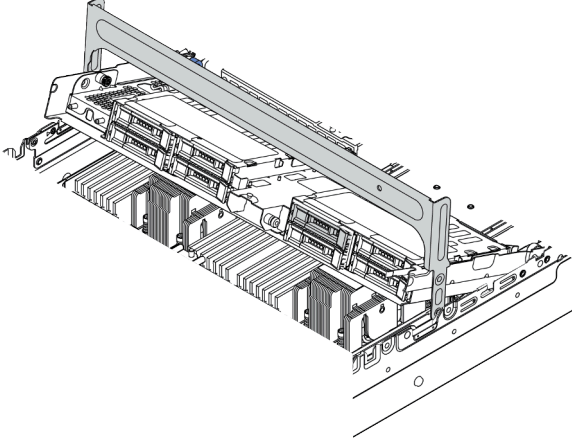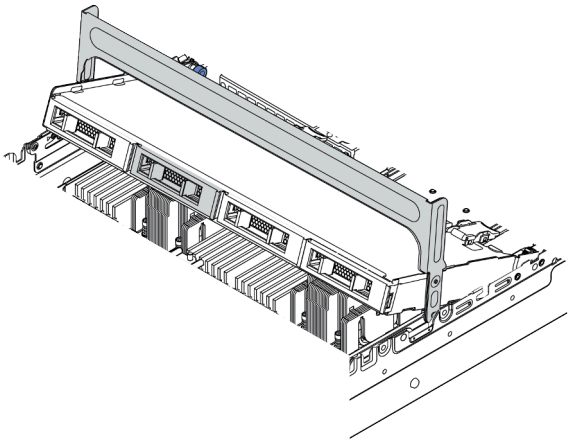
Watch the procedure on YouTube

Middle drive backplane and drive cage replacement

Use this information to remove and install the 2.5-inch or 3.5-inch middle drive backplane and drive cage.

Depending on the server configurations, some server models support one of the following middle drive cages. For detailed information, see .

Drive cage type	Backplane type
2.5-inch 8-bay middle drive cage 	• Two 2.5-inch SAS/SATA 4-bay backplanes • Two 2.5-inch NVMe 4-bay backplanes
3.5-inch 4-bay middle drive cage 	One 3.5-inch SAS/SATA 4-bay backplane

Remove the middle drive cage

Use this information to remove the middle drive cage.

About this task

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Prepare your server.

    a. Remove the top cover. See "Remove the top cover" on page 435.

    b. Remove the system fan cage for easier operation. See "Remove the system fan cage" on page 426.

    c. Disconnect cables from the middle drive cage.

    d. Remove all the installed drives and fillers (if any) from the drive bays. See "Remove a hot-swap drive" on page 303.

Step 2. Remove the middle drive cage and drives.

    Note: The illustration shows removing the 2.5-inch middle drive cage. The procedure is the same for removing the 3.5-inch middle drive cage.
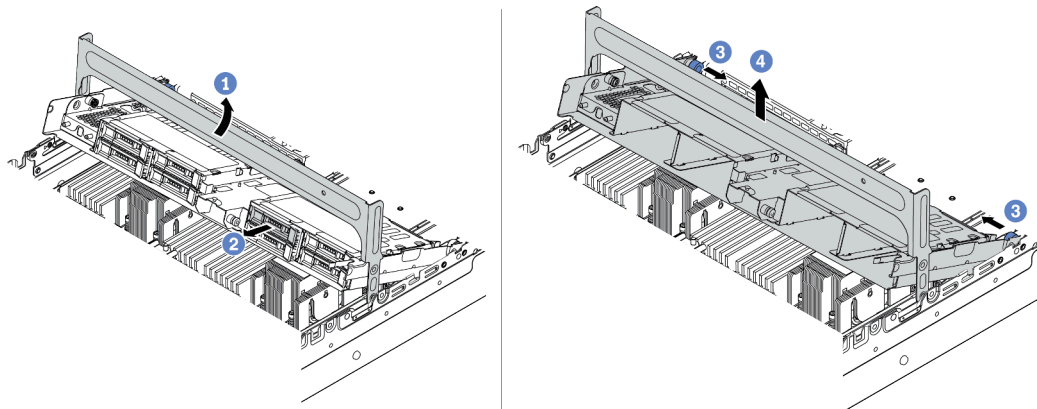
Figure 250. Removing the middle drive cage and drives

    a. Rotate the drive cage handle to open it.

    b. Remove the drives from the drive cage.

    c. Pull and twist plunger pins to release the drive cage.

    d. Carefully lift the drive cage up from the chassis.

Step 3.   Press the latch as shown and close the handle.
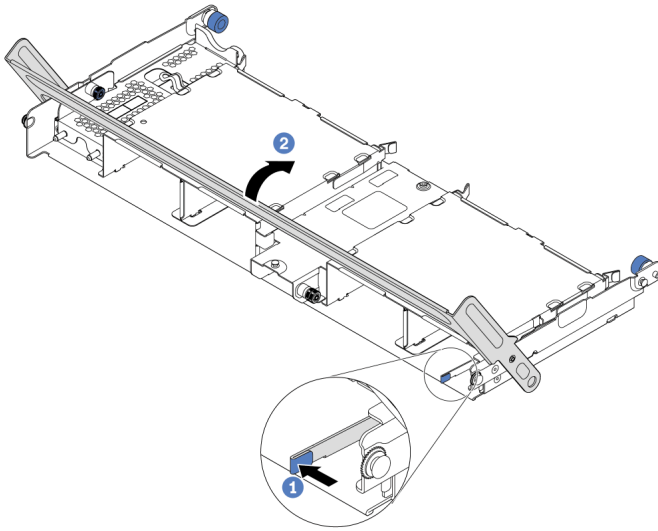
Figure 251. Closing the drive cage handle

After you finish

Remove the backplanes from the middle drive cage. See "Remove the middle drive backplane" on page 328.

Demo video

Watch the procedure on YouTube

Remove the middle drive backplane

Use this information to remove the 2.5-inch or 3.5-inch middle drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Remove the middle drive backplane.

>   **Note:** Depending on the specific type, your backplane might look different from the illustration.

Figure 252. Removing the 2.5-inch middle drive backplane

>   a. Slightly pivot the release latches outwards in the direction as shown.
>
>   b. Rotate the backplane from the top to disengage it from the pins on the drive cage.
>
>   c. Carefully lift the backplane out of the drive cage.
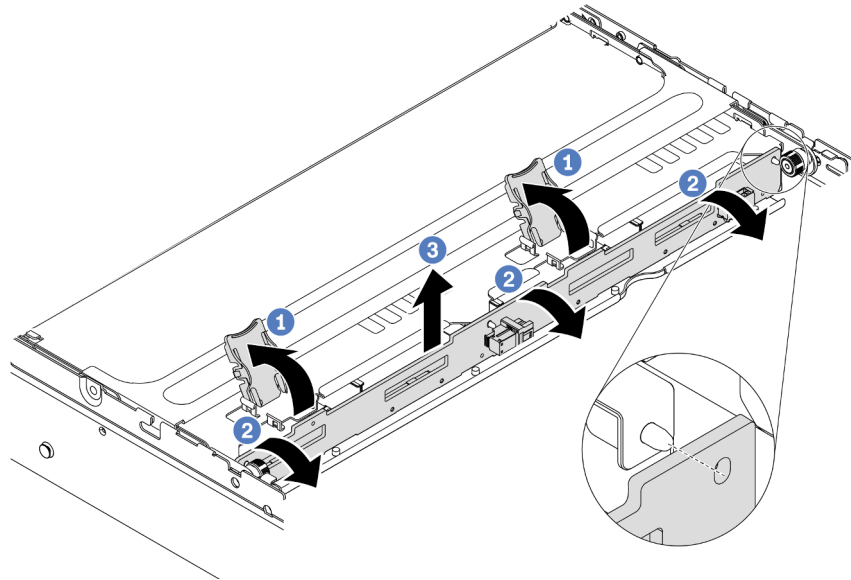
Figure 253. Removing the 3.5-inch middle drive backplane

    a.   Open the release latches.

    b.   Rotate the backplane from the top to disengage it from the pins on the drive cage.

    c.   Carefully lift the backplane out of the drive cage.

After you finish

1. Do one of the following:
   - If you are replacing the backplane, install a new backplane to the drive cage.
   - If you are replacing the drive cage, install the backplane to a new drive cage.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

[Watch the procedure on YouTube](https://www.youtube.com)

Install the middle drive backplane

Use this information to install the 2.5-inch or 3.5-inch middle drive backplane.

About this task

Your server supports the following middle drive backplanes:
- Two 2.5-inch SAS/SATA 4-bay backplanes
- Two 2.5-inch NVMe 4-bay backplanes
- One 3.5-inch SAS/SATA 4-bay backplane

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new component to any unpainted surface on the outside of the server. Then, take the new component out of the package and place it on a static-protective surface.

Step 2. Connect the cables to the backplane. See Chapter 3 "Internal cable routing" on page 67.

Step 3. Install the backplane onto the middle drive cage.

Figure 254. Installing the 2.5-inch middle drive backplane

a. Align the bottom of the backplane with the studs at the bottom of the drive cage, and lower the backplane into the drive cage.

b. Push the top of the backplane forward until it clicks in place. Ensure that the holes in the backplane pass through the pins on the drive cage, and the release latches secure the backplane in position.
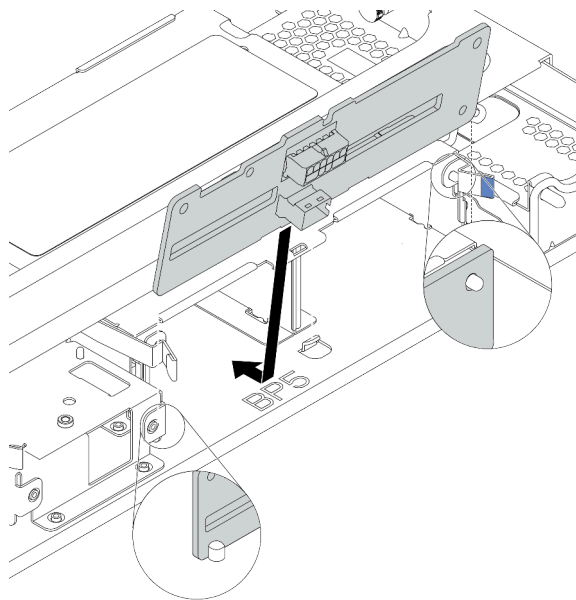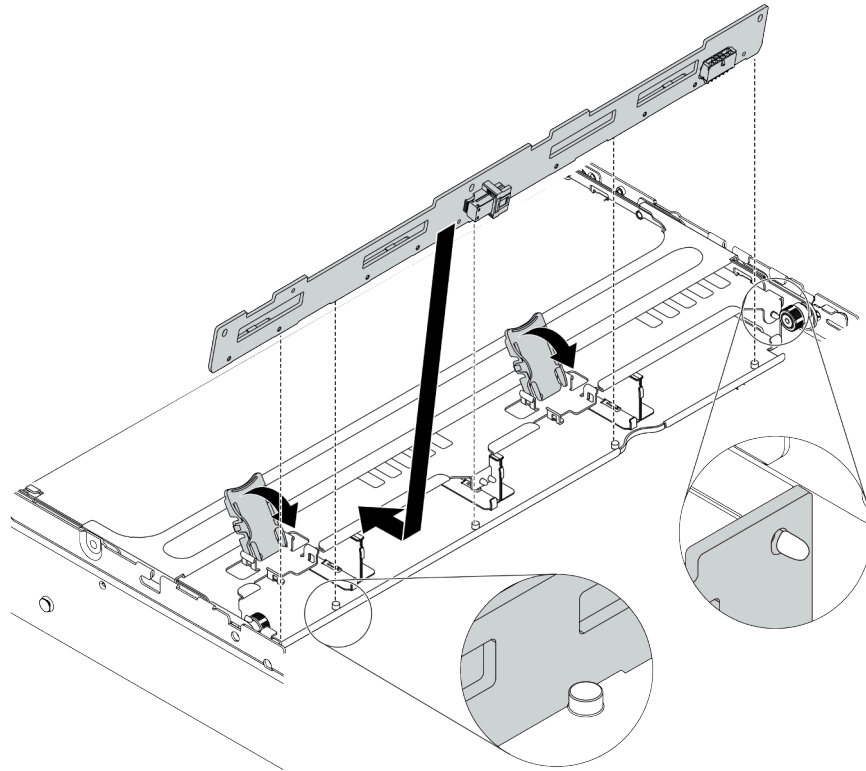
Figure 255. Installing the 3.5-inch middle drive backplane

    a.   Align the bottom of the backplane with the studs at the bottom of the drive cage, and lower the backplane into the drive cage.

    b.   Push the top of the backplane forward so that the holes in the backplane pass through the pins on the drive cage, and close the release latches to secure the backplane in position.

After you finish

Install the drive cage onto the chassis. See "Install the middle drive cage" on page 331.

Demo video

Watch the procedure on YouTube

Install the middle drive cage

Use this information to install the middle drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

- The middle drive cage is supported on some server models with thermal requirements. See "Thermal rules" on page 262 to ensure that the server is under permitted ambient temperature and the correct heat sink and system fans are used. If needed, replace your heat sink or system fan first.
  - "Processor and heat sink replacement (trained technician only)" on page 353
  - "System fan replacement" on page 422
- When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.
- If you are upgrading the server to the 32 x 2.5-inch NVMe configuration, replace your cable wall bracket first. See "Cable wall brackets replacement" on page 270.

Procedure

Step 1.   Install the middle drive cage and drives.

Notes:
- The illustration shows installing the 2.5-inch middle drive cage. The procedure is the same for installing the 3.5-inch middle drive cage.
- If any cables need to go through beneath the middle cage, route the cables before installing the middle cage.
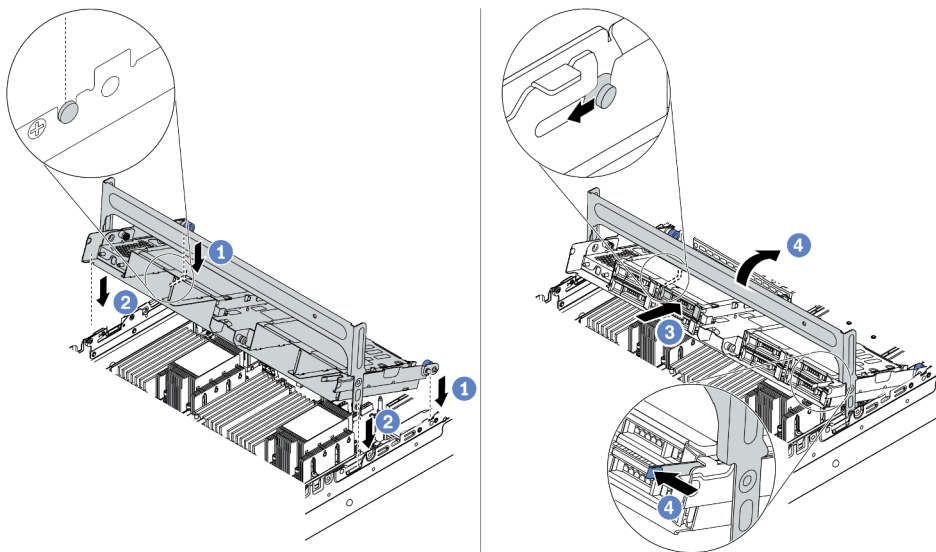
Figure 256. Installing the middle drive cage and drives

a.   Align the pins on the middle cage with the corresponding slots on the chassis.

b.   Lower the drive cage down into place.

c.   Install drives into the middle drive cage. See "Install a hot-swap drive" on page 304.

d.   Rotate the handle to close it.

Step 2.   Connect cables from the drive backplanes to the system board or RAID/HBA adapters. See Chapter 3 "Internal cable routing" on page 67.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

OCP 3.0 Ethernet adapter replacement

Use this information to remove and install the OCP 3.0 Ethernet adapter.

- "Remove the OCP 3.0 Ethernet adapter" on page 333
- "Install the OCP 3.0 Ethernet adapter" on page 334

Remove the OCP 3.0 Ethernet adapter

Use this information to remove the OCP 3.0 Ethernet adapter.

About this task

CAUTION:
Power off the server and disconnect all power cords from their power sources before performing this procedure.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the OCP 3.0 Ethernet adapter.

Figure 257. OCP 3.0 Ethernet adapter removal

　　　a. Loosen the thumbscrew that secures the card.

　　　b. Pull out the OCP 3.0 Ethernet adapter.

After you finish
1. Install a new OCP 3.0 Ethernet adapter or a card filler.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Install the OCP 3.0 Ethernet adapter

Use this information to install the OCP 3.0 Ethernet adapter.
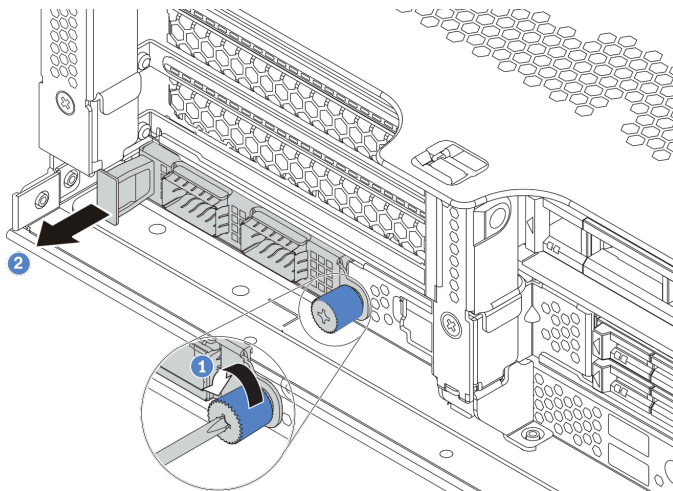
About this task

CAUTION:
Power off the server and disconnect all power cords from their power sources before performing this procedure.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new adapter to any unpainted surface on the outside of the server. Then, take the adapter out of the package and place it on a static-protective surface.

Step 2. Remove the OCP 3.0 Ethernet adapter filler if there is.

Step 3.   Install the OCP 3.0 Ethernet adapter.

> **Note:** Ensure that the Ethernet adapter is fully seated and the thumbscrew is securely tightened. Otherwise, the OCP 3.0 Ethernet adapter will not get full connection and may not function.
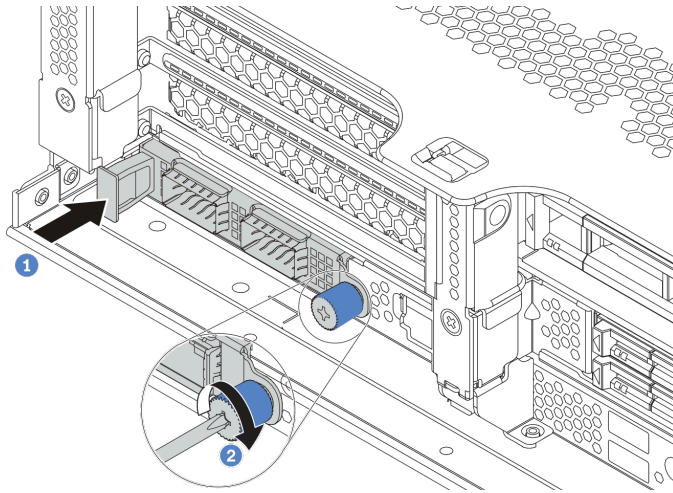
Figure 258. OCP 3.0 Ethernet adapter installation

a.   Push the OCP 3.0 Ethernet adapter into the slot until it is fully seated.

b.   Tighten the thumbscrew to secure the card.

Notes:

Figure 259. OCP 3.0 Ethernet adapter (two connectors, seen from the rear)
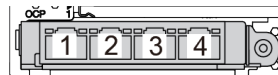
Figure 260. OCP 3.0 Ethernet adapter (four connectors, seen from the rear)

- The OCP 3.0 Ethernet adapter provides two or four extra Ethernet connectors for network connections.
- By default, Ethernet connector 1 (the first port starting from the left in the rear server view) on the OCP 3.0 Ethernet adapter can also function as a management connector using the shared management capacity. If the shared management connector fails, traffic can automatically switch over to another connector on the adapter.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube
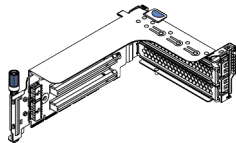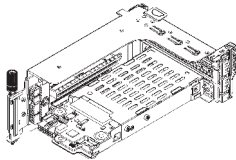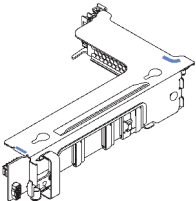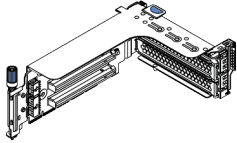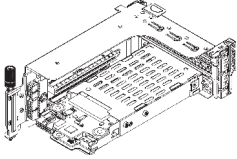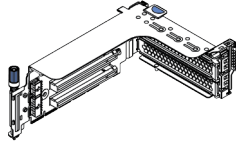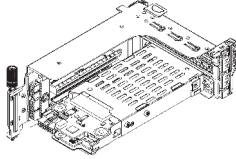
PCIe adapter and riser assembly replacement

Use this information to remove and install a riser assembly and PCIe adapter. The PCIe adapter can be an Ethernet card, a host bus adapter, a RAID adapter, an add-in PCIe SSD adapter, or any other supported PCIe adapters. PCIe adapters vary by type, but the installation and removal procedures are the same.

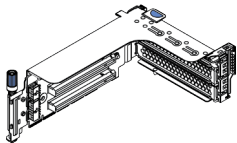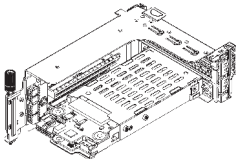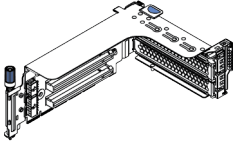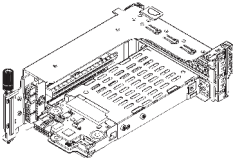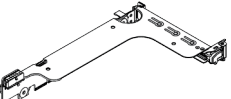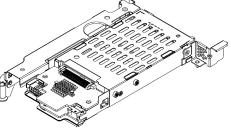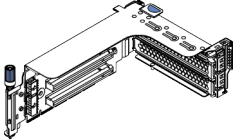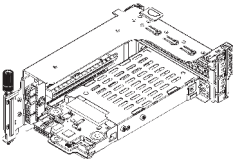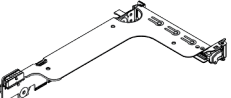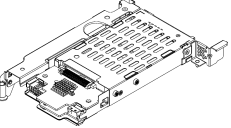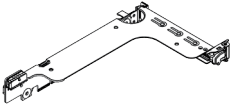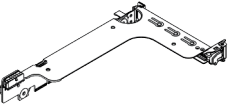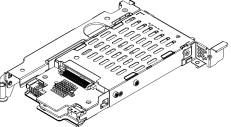Riser cages vary by server rear configurations. This topic uses the riser 1 cage with three full-height (FH) slots as an example for illustration. The replacement procedure is the same for other riser cages.

- "Remove a PCIe adapter and riser assembly" on page 338
- "Install a PCIe adapter and riser assembly" on page 342

Note: The server supports only one riser assembly with 7mm drive cage. To replace a 7mm drive cage, see "Rear 7mm drive backplane and drive cage replacement" on page 398.

Server rear configuration	Riser 1 cage	Riser 2 cage	Riser 3 cage
Configuration with 8 PCIe slots	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	Type 3: 2FH riser cage
Configuration with a 4 x 2.5-inch rear drive cage	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	

Server rear configuration	Riser 1 cage	Riser 2 cage	Riser 3 cage
Configuration with an 8 x 2.5-inch rear drive cage	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	• Type 3: 1FH riser cage • Type 4: 7mm riser cage	
Configuration with a 2 x 3.5-inch rear drive cage	• Type 1: 3FH riser cage • Type 2: 2FH + 7mm riser cage	• Type 3: 1FH riser cage • Type 4: 7mm riser cage	
Configuration with a 4 x 3.5-inch rear drive cage	Type 3: 1FH riser cage	• Type 3: 1FH riser cage • Type 4: 7mm riser cage	

Remove a PCIe adapter and riser assembly

Use this information to remove a PCIe adapter and riser assembly. The PCIe adapter can be an Ethernet card, a host bus adapter, a RAID adapter, an add-in PCIe SSD adapter, or any other supported PCIe adapters.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.

Procedure

Note: The illustration shows removing the riser 1 assembly. The procedure is the same for removing other riser assemblies.

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Remove the air baffle if needed. See "Remove the air baffle" on page 265.

Step 3. If there is any PCIe adapter installed on the riser card, record the cable connections first. Then, disconnect all cables from the PCIe adapter.

> **Notes:**
> - If you need to disconnect cables from the system board, disengage all latches or release tabs on cable connectors first. Failing to release the tab before removing the cables will damage the cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
> - The connectors on your system board might look different from those in the illustration, but the removal procedure is the same.
>
>   1. Press the release tab to release the connector.
>   2. Disengage the connector from the cable socket.

Figure 261. Disconnecting cables from the system board

Step 4. Remove the riser assembly.
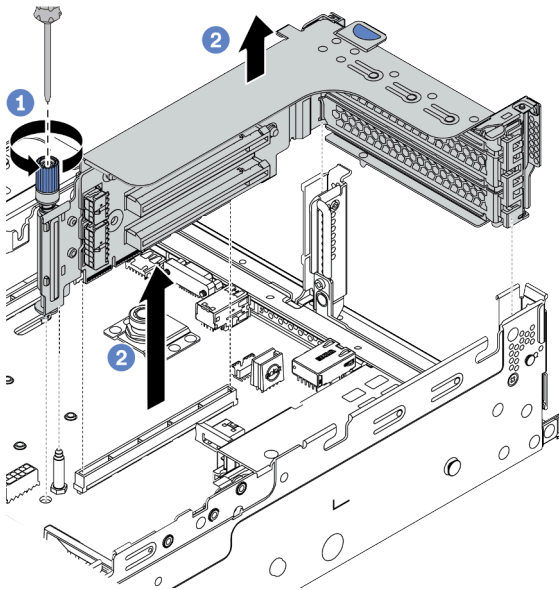
Figure 262. Riser assembly removal

a. Loosen the screw that secures the riser assembly.

b. Grasp the riser assembly by its edges and carefully lift it straight up and off the chassis.

Step 5. Remove a PCIe adapter from the riser assembly.

Note: For PCIe adapters in riser 1 and riser 2 and ThinkSystem AMD X3522 10/25GbE DSFP28 2-port PCIe Ethernet Adapter, remove the screw that secures the adapter first.
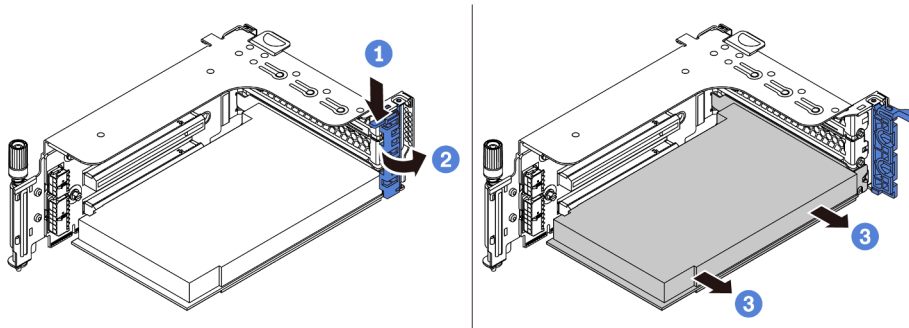
Figure 263. PCIe adapter removal

a.   Press the retainer clip downward.

b.   Rotate the PCIe adapter retention latch to the open position.

c.   Grasp the PCIe adapter by its edges and carefully pull it out of the PCIe slot.

After you finish

1. Do one of the following:
   - If you are replacing the riser assembly, install the removed PCIe adapter to a new riser assembly.
   - If you are replacing a PCIe adapter, install a new PCIe adapter to the riser assembly.
   - If you are replacing a riser card, remove the riser card from the riser cage, and install a new riser card to the riser cage.
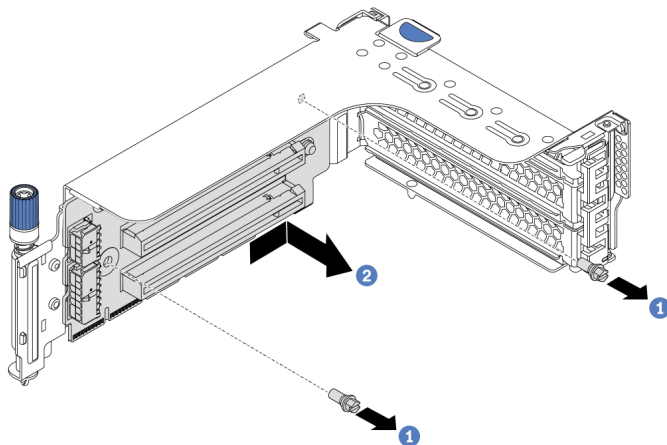
Figure 264. Riser card removal

2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

[Watch the procedure on YouTube](#)

Install a PCIe adapter and riser assembly

Use this information to install a PCIe adapter and riser assembly. The PCIe adapter can be an Ethernet card, a host bus adapter, a RAID adapter, an add-in PCIe SSD adapter, or any other supported PCIe adapters.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Read "Technical rules" on page 256 for PCIe slots to select an appropriate PCIe slot for the PCIe adapter.
- When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.

Procedure

Note: The illustration shows installing the riser 1 assembly. The procedure is the same for installing other riser assemblies.

Step 1. Touch the static-protective package that contains the new component to any unpainted surface on the outside of the server. Then, take the new component out of the package and place it on a static-protective surface.

Step 2. (Optional) Install a riser card in the riser cage.
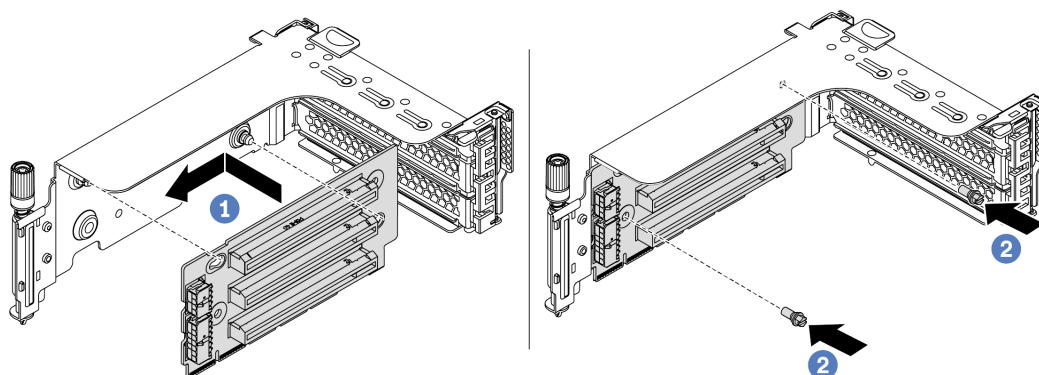
Figure 265. Riser card installation

a. Align the holes in the riser card with the mounting studs on the bracket. Install the riser card to the bracket in the direction as shown.

b. Install the two screws to secure the riser card to the bracket.

Step 3.   Install a PCIe adapter.

Notes:

- Carefully handle the PCIe adapter by its edges.
- For PCIe adapters in riser 1 and riser 2 and ThinkSystem AMD X3522 10/25GbE DSFP28 2-port PCIe Ethernet Adapter, install the screw to secure the adapter before closing the retention latch if the server needs to be shipped.
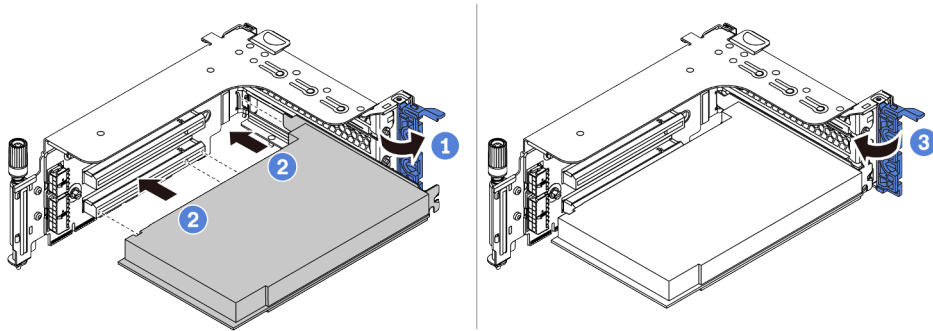
Figure 266. PCIe adapter installation

a.   Align the PCIe adapter with the PCIe slot on the riser card. Carefully press the PCIe adapter straight into the slot until it is securely seated and its bracket also is secured.

b.   Rotate the PCIe adapter retention latch to the closed position.

Step 4.   Install the riser assembly into chassis.
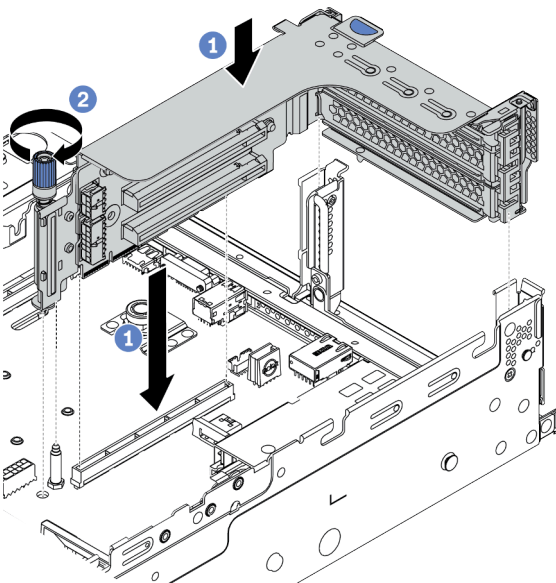
Figure 267. Riser assembly installation

a.   Align the riser card with the riser slot on the system board. Carefully press the riser card straight into the slot until it is securely seated.

b.   Tighten the screw to secure the riser cage.

Step 5.   Connect cables to the riser card and PCIe adapter. See Chapter 3 "Internal cable routing" on page 67.

After you finish

1. If you have installed a RAID 930 or 940 adapter, install a RAID flash power module. See "RAID flash power module replacement" on page 370.
2. You might need to update the firmware or driver after replacing the adapter.
    - Go to http://datacentersupport.lenovo.com see the latest firmware and driver updates for your server.
    - Go to "Firmware updates" on page 10 for more information on firmware updating tools
3. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Power supply unit replacement

Use this information to remove and install a power supply unit.

-
-

Safety precautions

The section lists safety precautions that apply to AC and DC power supply units respectively. Understand and apply the safety precautions before removing or installing a power supply unit.

Safety precautions for AC power supplies

The following tips describe the information that you must consider when you replace an AC power supply.

S035

CAUTION:
Never remove the cover on a power supply or any part that has this label attached. Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

S002

CAUTION:
The power-control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

⚠️**DANGER**

Electrical current from power, telephone, and communication cables is hazardous.
To avoid a shock hazard:

- **Connect all power cords to a properly wired and grounded electrical outlet/source.**

- **Connect any equipment that will be attached to this product to properly wired outlets/sources.**

- **When possible, use one hand only to connect or disconnect signal cables.**

- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**

- **The device might have more than one power cord, to remove all electrical current from the device, ensure that all power cords are disconnected from the power source.**

Safety precautions for DC power supplies

The following tips describe the information that you must consider when you replace a DC power supply.

CAUTION:

240 V DC input (input range: 180-300 V) is supported in Chinese Mainland ONLY.

Perform the following steps to safely remove the power cord of one 240 V DC power supply unit. Otherwise, there can be data loss and other damages to the equipment. Damages and losses resulting from inappropriate operations will not be covered by the manufacturer's warranty.
 1. **Turn off the server.**
 2. **Disconnect the power cord from the power source.**
 3. **Disconnect the power cord from the power supply unit.**

S035

CAUTION:
Never remove the cover on a power supply or any part that has this label attached. Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

CAUTION:
The power-control button on the device does not turn off the electrical current supplied to the device. The device also might have more than one connection to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals.

S029

DANGER

For -48V dc power supply, electrical current from power cables is hazardous.
To avoid a shock hazard:

• **To connect or disconnect -48V dc power cables when you need to remove/install redundancy power supply unit(s).**

To Connect:	To Disconnect:
1. Turn OFF subject dc power source(s) and equipment(s) that are attached to this product.	1. Disconnect or turn off the subject dc power source(s) (at the breaker panel) before removing the power supply unit(s).
2. Install the power supply unit(s) into the system housing.	2. Remove the subject dc cord(s) and make sure the wire terminal of power cord(s) is insulated.
3. Attach dc power cord(s) to the product.	3. Unplug the subject power supply unit(s) from the system housing.
• Ensure correct polarity of -48 V dc connections: RTN is + and -Vin (typical 48 V dc) is -. Earth ground should be connected very well.	
4. Connect dc power cord(s) to subject power source(s).	
5. Turn ON all the power source(s).	

Remove a power supply unit

Use this information to remove a power supply unit.

About this task

The following describes the information that you must consider when removing a power supply:

Note: If the power supply unit to be removed is the only one installed, the power supply is non-hot-swap and before removing it, you must turn off the server first. To support redundancy mode or hot-swap, install an additional hot-swap power supply.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   If a cable management arm (CMA) is installed, adjust the CMA to gain access to the power supply bay.

   a.   Press down the stop bracket **1** and rotate it to the open position.

   b.   Rotate the CMA out of the way to gain access to the power supply.

   Note: Your CMA kit might look different from the illustration.
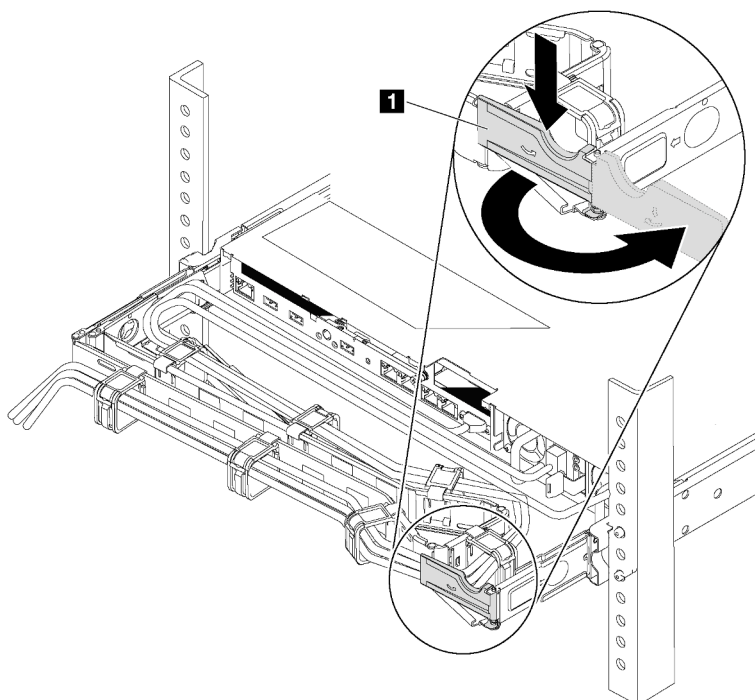
Figure 268. CMA adjustment

Step 2. Disconnect the power cord from the hot-swap power supply and the electrical outlet.
- For AC power input, disconnect both ends of the power cord and keep it in an ESD-safe place.
- For –48V DC power input:
  1. Disconnect the power cords from the electrical outlet.
  2. Use a slotted screwdriver to loosen the captive screws on the power supply terminal block.
  3. Disconnect the power cords from the power supply unit, make the wire terminal insulated, and keep them in an ESD-safe place.

Note: If you are replacing two power supplies, replace them one by one to ensure that the power supply to the server is not interrupted. Do not disconnect the power cord from the secondly replaced power supply until the power output LED for the firstly replaced power supply is lit. For the location of the power output LED, refer to "Rear view LEDs" on page 50.

Step 3. Press the release tab toward the handle and carefully pull the handle at the same time to slide the hot-swap power supply out of the chassis.

Note: If your CMA kit obstructs in the way, slightly pull the power supply upwards when sliding the power supply out of the chassis.
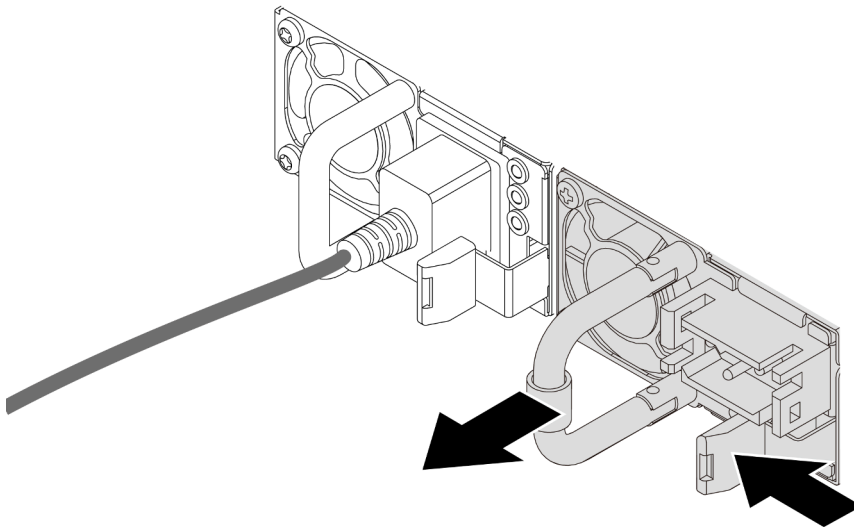
Figure 269. Hot-swap power supply removal

After you finish

1. Install a new power supply or install the power-supply filler to cover the power supply bay. See "Install a power supply unit" on page 350.

   Important: To ensure proper cooling during normal server operation, both of the power supply bays must be occupied. This means that each bay must have a power supply installed; or one has a power supply installed and the other has a power supply filler installed.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a power supply unit

Use this information to install a power supply.

About this task

The following describes the information that you must consider when installing a power supply:
- The server is shipped with only one power supply by default. In this case, the power supply is non-hot-swap and before removing it, you must turn off the server first. To support redundancy mode or hot-swap, install an additional hot-swap power supply.
- If you are replacing the existing power supply with a new power supply:
  - Use Lenovo Capacity Planner to calculate the required power capacity for what is configured for your server. More information about Lenovo Capacity Planner is available at:

    https://datacentersupport.lenovo.com/solutions/lnvo-lcp
  - Ensure that the devices that you are installing are supported. For a list of supported optional devices for the server, go to:
    https://serverproven.lenovo.com/
  - Attach the power information label that comes with this option onto the existing label near the power supply.

Figure 270. Example power supply unit label on the top cover

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the hot-swap power supply to any unpainted surface on the outside of the server. Then, take the hot-swap power supply out of the package and place it on a static-protective surface.

Step 2. If there is a power-supply filler installed, remove it.
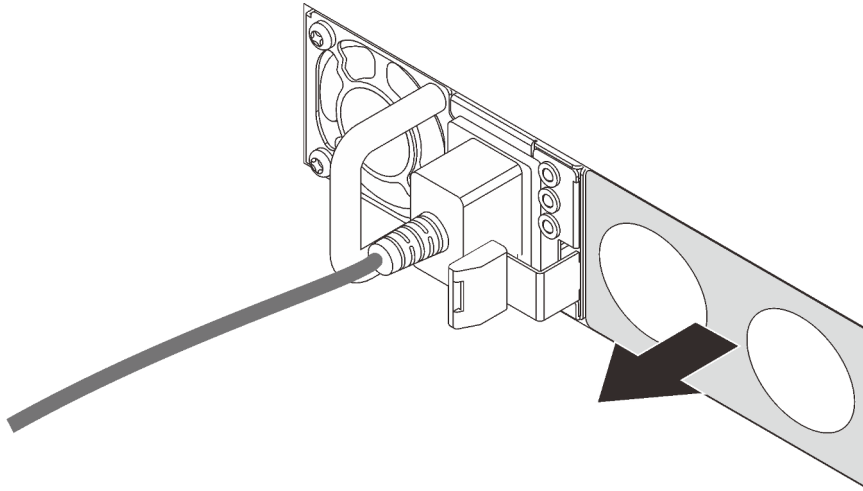
Figure 271. Hot-swap power supply filler removal

Step 3. Slide the new hot-swap power supply into the bay until it snaps into position.
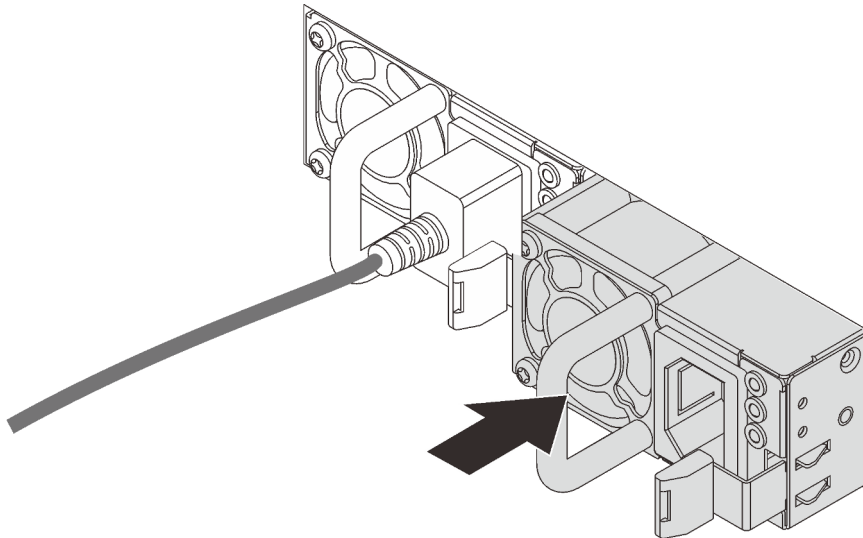
Figure 272. Hot-swap power supply installation

Step 4. Connect the power supply unit to a properly grounded electrical outlet.
- For AC power supply units:
    1. Connect one end of the power cord to the power connector on the power supply unit.
    2. Connect the other end of the power cord to a properly grounded electrical outlet.
- For –48V DC power supply units:
    1. Use a slotted screwdriver to loosen the 3 captive screws on the power supply terminal block.
    2. Check the type label on the power supply block and each power cord.

Type	PSU terminal block	Power cord
Input	-Vin	-Vin

Ground	$\underset{\underline{\underline{\underline{\underline{\underline{}}}}}{\bigoplus}$	GND
Input	RTN	RTN

3. Face the groove side of each power cord pin upwards, plug the pins into corresponding holes on the power block, use the table above for guidance, and ensure that the pins find correct slots.
4. Tighten the captive screws on the power block, and ensure that the screws and cord pins are secured in place and no bare metal parts show.
5. Connect the other end of the cables to a properly grounded electrical outlet, and ensure that the cable ends find correct outlets.

Step 5.   Route the cables and ensure that they are not blocking access to other chassis components.

After you finish

1. If you have adjusted the CMA to gain access to the power supply bay, properly readjust the CMA back in place.
2. If the server is turned off, turn on the server. Ensure that both the power input LED and the power output LED on the power supply are lit, indicating that the power supply is operating properly.

Demo video

Watch the procedure on YouTube

Processor and heat sink replacement (trained technician only)

Use this information to remove and install a processor and heat sink (PHM).

Attention: Before you reuse a processor or heat sink, make sure that you use Lenovo proven alcohol cleaning pad and thermal grease.

Remove a processor and heat sink

This task has instructions for removing an assembled processor and heat sink, known as a processor-heat-sink module (PHM). This task requires a Torx T30 screwdriver. This procedure must be executed by a trained technician.

About this task

S002

CAUTION:
The power-control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- If the server is in a rack, remove it from the rack.
- Each processor socket must always contain a cover or a PHM. When removing or installing a PHM, protect empty processor sockets with a cover.
- Do not touch the processor socket or processor contacts. Processor-socket contacts are very fragile and easily damaged. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.
- Do not allow the thermal grease on the processor or heat sink to come in contact with anything. Contact with any surface can compromise the thermal grease, rendering it ineffective. Thermal grease can damage components, such as the electrical connectors in the processor socket.
- Remove and install only one PHM at a time. If the system board supports multiple processors, install the PHMs starting with the first processor socket.

Note: The heat sink, processor, and processor carrier for your system might be different from those shown in the illustrations.

The following illustration shows the components of the PHM.
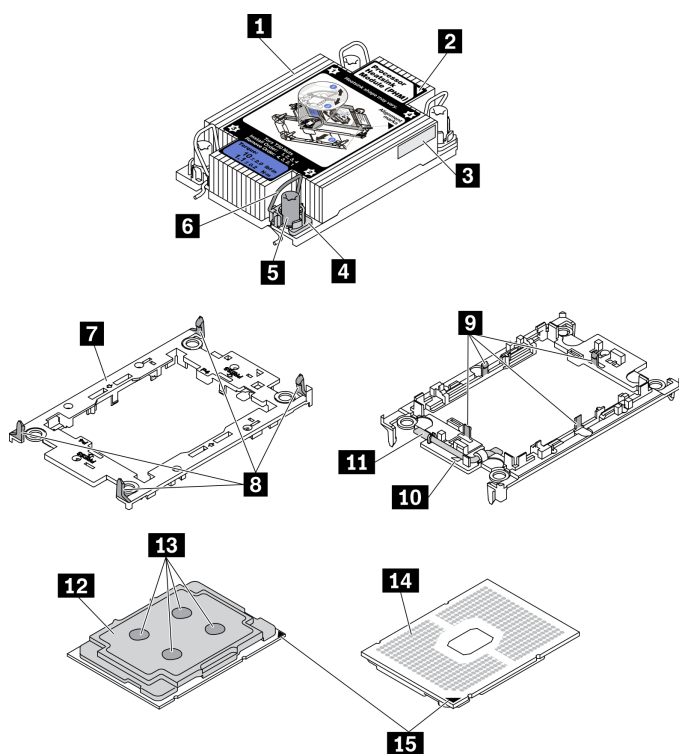
Figure 273. PHM components

1 Heat sink	**9** Clips to secure processor in carrier
2 Heat sink triangular mark	**10** Carrier triangular mark
3 Processor identification label	**11** Processor ejector handle
4 Nut and wire bail retainer	**12** Processor heat spreader
5 Torx T30 nut	**13** Thermal grease
6 Anti-tilt wire bail	**14** Processor contacts
7 Processor carrier	**15** Processor triangular mark
8 Clips to secure carrier to heat sink	

Procedure

Step 1. Make preparations for this task.

    a. Remove the top cover. See "Remove the top cover" on page 435.

    b. If your server comes with an air baffle or a middle cage, remove it first.
- "Remove the air baffle" on page 265
- "Remove the middle drive cage" on page 325

    c. Remove the system fan cage. "Remove the system fan cage" on page 426.

Step 2. If the processor comes with a T-shaped heat sink, fully loosen the two heat sink screws as shown.
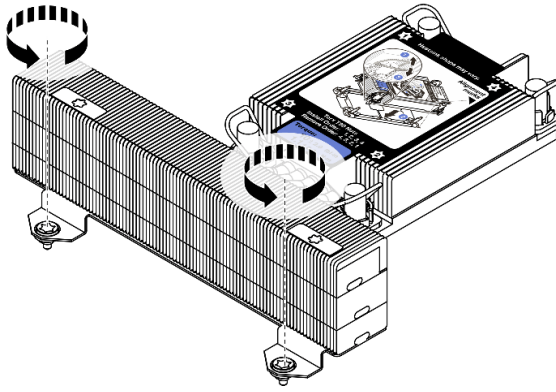
Figure 274. Loosening T-shaped heat sink screws

Step 3.   Remove the PHM from the system board.
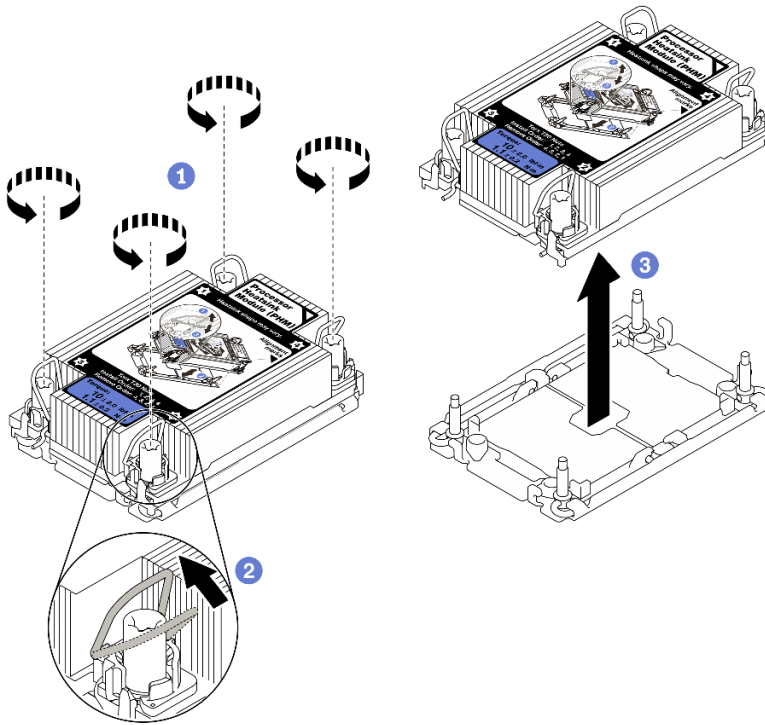
Figure 275. Removing a PHM

a.   Fully loosen the Torx T30 nuts on the PHM *in the removal sequence shown* on the heat-sink label.

b.   Rotate the anti-tilt wire bails inward.

c.   Carefully lift the PHM from the processor socket. If the PHM cannot be fully lifted out of the socket, further loosen the Torx T30 nuts and try lifting the PHM again.

Notes:
- Do not touch the contacts on the bottom of the processor.
- Keep the processor socket clean from any object to prevent possible damages.

After you finish

- Each processor socket must always contain a cover or a PHM. Protect empty processor sockets with a cover or install a new PHM.
- If you are not going to install a PHM back, cover the processor socket with the socket cover and install a PHM filler.
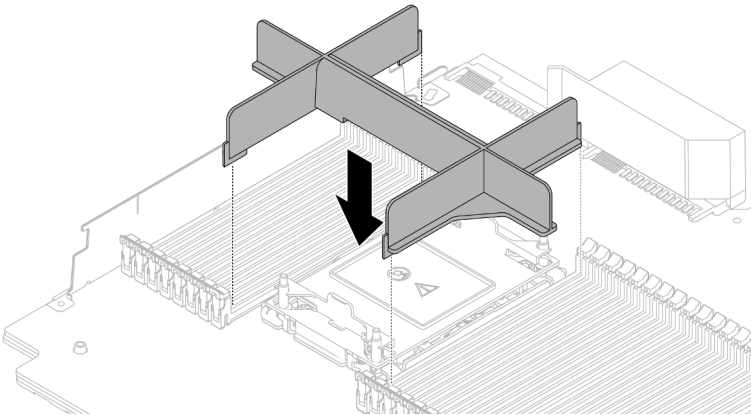
Figure 276. Installing a PHM filler

- If you are removing the PHM as part of a system board replacement, set the PHM aside.
- If you are reusing the processor or heat sink, separate the processor from its retainer. See "Separate the processor from carrier and heat sink" on page 356
- If you are instructed to return the defective component, please package the part to prevent any shipping damage. Reuse the packaging the new part arrived in and follow all packaging instructions.

Demo video

Watch the procedure on YouTube

Separate the processor from carrier and heat sink

This task has instructions for separating a processor and its carrier from an assembled processor and heat sink, known as a processor-heat-sink module (PHM). This procedure must be executed by a trained technician.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Do not touch the processor contacts. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.
- Do not allow the thermal grease on the processor or heat sink to come in contact with anything. Contact with any surface can compromise the thermal grease, rendering it ineffective. Thermal grease can damage components, such as the electrical connectors in the processor socket.

Note: The heat sink, processor, and processor carrier for your system might be different than those shown in the illustrations.

Procedure

Step 1. Separate the processor from the heat sink and carrier.
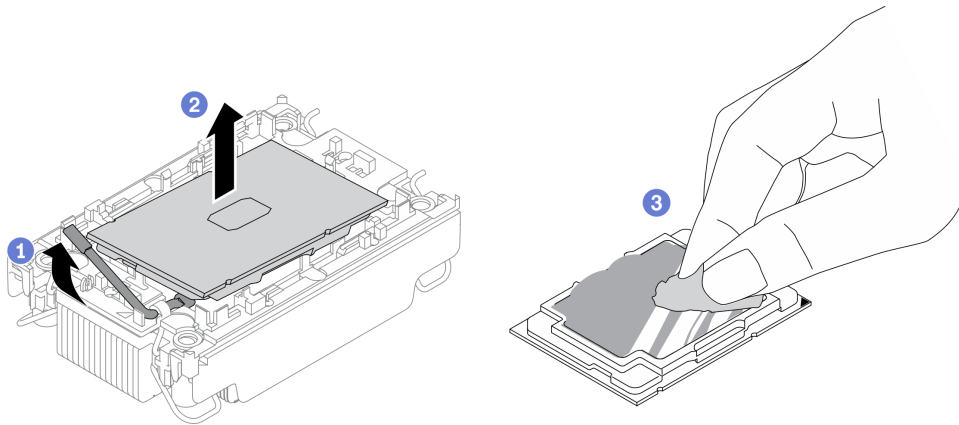
Figure 277. Separating a processor from the heat sink and carrier

Note: Do not touch the contacts on the processor.

a. Lift the handle to release the processor from the carrier.

b. Hold the processor by its edges; then, lift the processor from the heat sink and carrier.

c. Without putting the processor down, wipe the thermal grease from the top of the processor with an alcohol cleaning pad; then, place the processor on a static protective surface with the processor-contact side up.

Step 2. Separate the processor carrier from the heat sink.
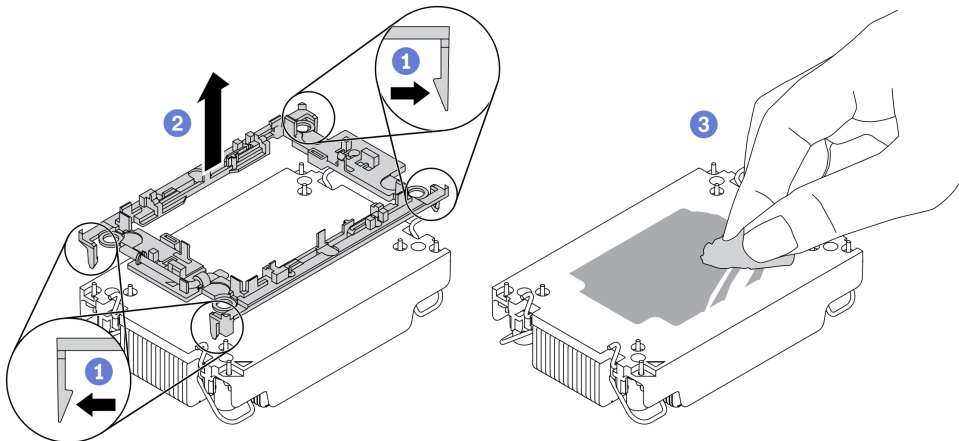
Figure 278. Separating a processor carrier from the heat sink

Note: The processor carrier will be discarded and replaced with a new one.

a. Release the retaining clips from the heat sink.

b. Lift the carrier from the heat sink.

c. Wipe the thermal grease from the bottom of the heat sink with an alcohol cleaning pad.

After you finish

If you are instructed to return the defective component, please package the part to prevent any shipping damage. Reuse the packaging the new part arrived in and follow all packaging instructions.

Install a processor and heat sink

This task has instructions for installing an assembled processor and heat sink, known as a processor-heat-sink module (PHM). This task requires a Torx T30 screwdriver. This procedure must be executed by a trained technician.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Each processor socket must always contain a cover or a PHM. When removing or installing a PHM, protect empty processor sockets with a cover.
- Do not touch the processor socket or processor contacts. Processor-socket contacts are very fragile and easily damaged. Contaminants on the processor contacts, such as oil from your skin, can cause connection failures.
- Do not allow the thermal grease on the processor or heat sink to come in contact with anything. Contact with any surface can compromise the thermal grease, rendering it ineffective. Thermal grease can damage components, such as the electrical connectors in the processor socket.
- Remove and install only one PHM at a time. If the system board supports multiple processors, install the PHMs starting with the first processor socket.
- To ensure the best performance, check the manufacturing date on the new heat sink and make sure it does not exceed 2 years. Otherwise, wipe off the existing thermal grease and apply the new grease onto it for optimal thermal performance.

Notes:
- The heat sink, processor, and processor carrier for the system might be different from those shown in the illustrations.
- PHMs are keyed for the socket where they can be installed and for their orientation in the socket.
- See https://serverproven.lenovo.com/ for a list of processors supported for your server. All processors on the system board must have the same speed, number of cores, and frequency.
- Before you install a new PHM or replacement processor, update your system firmware to the latest level. See "Update the firmware" in the *ThinkSystem SR650 V2 Setup Guide*.

The following illustration shows the components of the PHM.
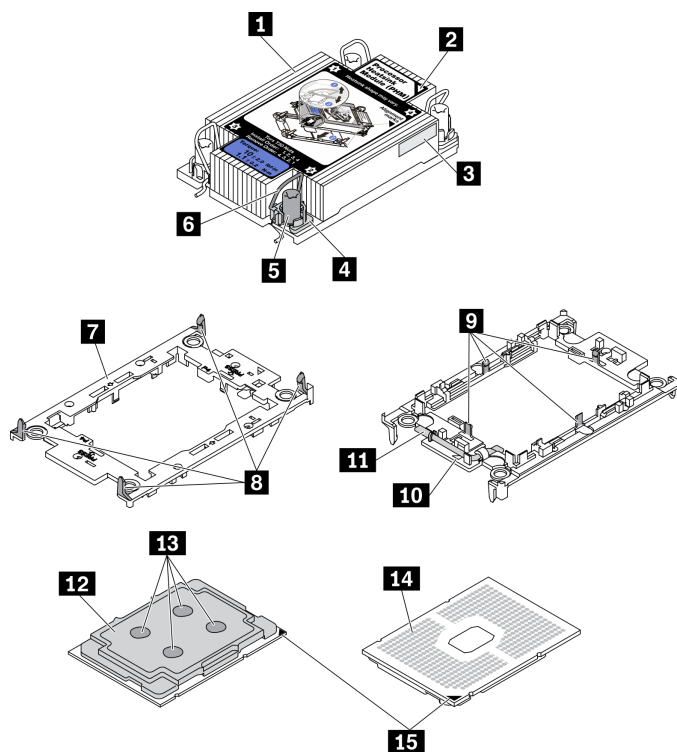
Figure 279. PHM components

1 Heat sink	**9** Clips to secure processor in carrier
2 Heat sink triangular mark	**10** Carrier triangular mark
3 Processor identification label	**11** Processor ejector handle
4 Nut and wire bail retainer	**12** Processor heat spreader
5 Torx T30 nut	**13** Thermal grease
6 Anti-tilt wire bail	**14** Processor contacts
7 Processor carrier	**15** Processor triangular mark
8 Clips to secure carrier to heat sink	

Procedure

Step 1. If you are replacing a processor and reusing the heat sink.

   a. Remove the processor identification label from the heat sink and replace it with the new label that comes with the replacement processor.

   b. If there is any old thermal grease on the heat sink, wipe the thermal grease from the bottom of the heat sink with an alcohol cleaning pad.

Step 2. If you are replacing a heat sink and reusing the processor.

   a. Remove the processor identification label from the old heat sink and place it on the new heat sink in the same location. The label is on the side of the heat sink closest to the triangular alignment mark.

   Note: If you are unable to remove the label and place it on the new heat sink, or if the label is damaged during transfer, write the processor serial number from the processor identification

label on the new heat sink in the same location as the label would be placed using a permanent marker.

b. Install processor in the new carrier.

   Note: Replacement heat sinks come with both gray and black processor carriers. Make sure to use the carrier with the same color as the one you discarded earlier.
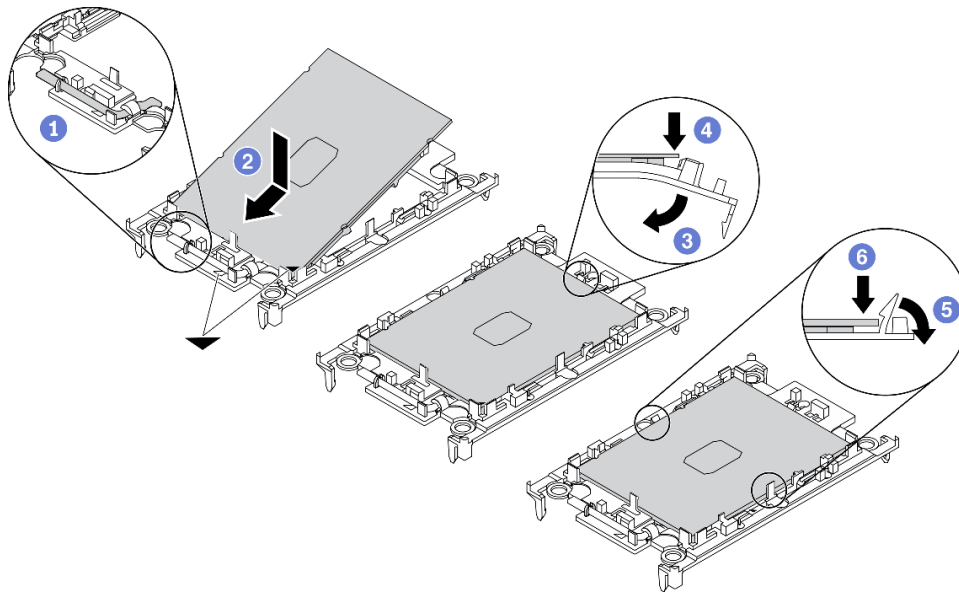
Figure 280. Installing a processor carrier

1. Make sure the handle on the carrier is in the closed position.
2. Align the processor on the new carrier so that the triangular marks align; then, insert the marked end of the processor into the carrier.
3. Hold the inserted end of the processor in place; then, pivot the unmarked end of the carrier down and away from the processor.
4. Press the processor and secure the unmarked end under the clip on the carrier.
5. Carefully pivot the sides of the carrier down and away from the processor.
6. Press the processor and secure the sides under the clips on the carrier.

   Note: To prevent the processor from falling out of the carrier, keep the processor-contact side up and hold the processor-carrier assembly by the sides of the carrier.

Step 3. Apply thermal grease.

   a. Carefully place the processor and carrier in the shipping tray with the processor-contact side down. Make sure the triangular mark on the carrier is aligned with the triangular mark in the shipping tray.

   b. If there is any old thermal grease on the processor, gently wipe the top of the processor with an alcohol cleaning pad.

   Note: Make sure the alcohol has fully evaporated before applying new thermal grease.

   c. Apply the thermal grease on the top of the processor with syringe by forming four uniformly spaced dots, while each dot consists of about 0.1 ml of thermal grease.
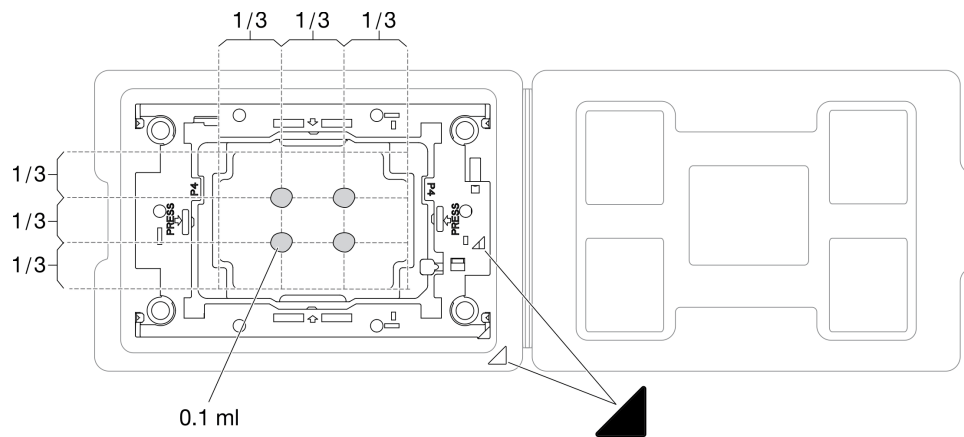
Figure 281. Thermal grease application with processor in shipping tray

Step 4.   Assemble the processor and heat sink.
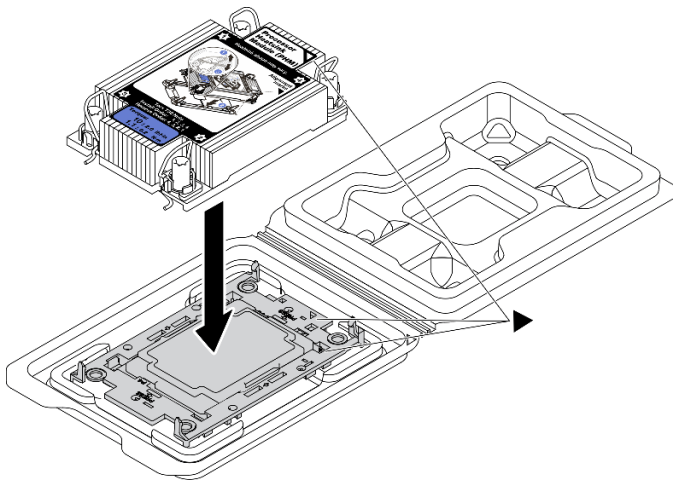
Figure 282. Assembling the PHM with processor in shipping tray

a.   Align the triangular mark on the heat sink label with the triangular mark on the processor carrier and processor.

b.   Install the heat sink onto the processor-carrier.

c.   Press the carrier into place until the clips at all four corners engage.

Step 5.   Install the processor-heat-sink module into the system board socket.
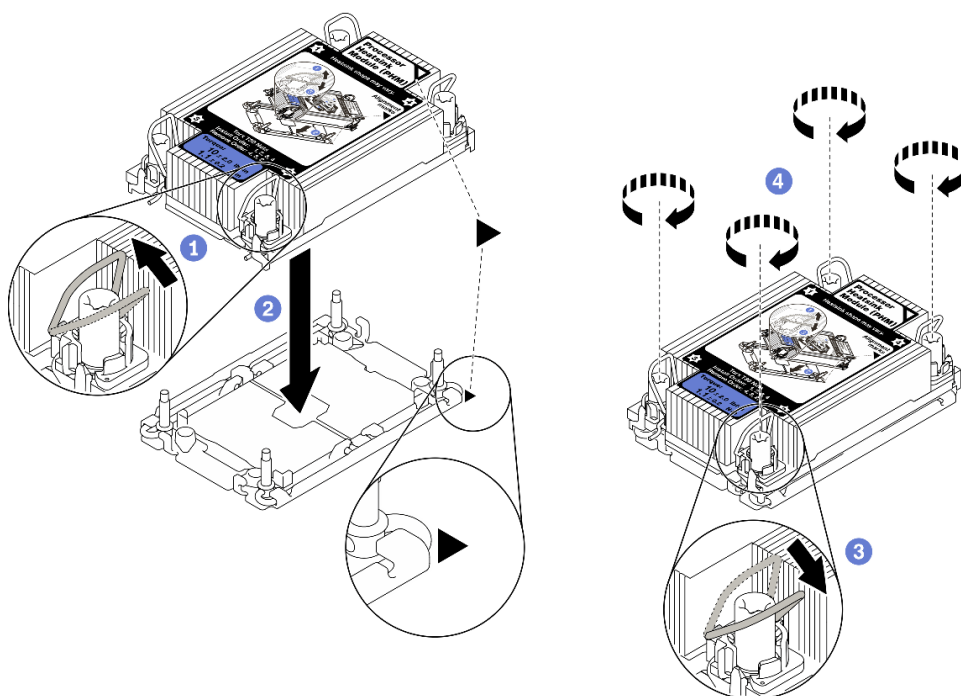
Figure 283. Installing a PHM

1. Rotate the anti-tilt wire bails inward.
2. Align the triangular mark and four Torx T30 nuts on the PHM with the triangular mark and threaded posts of the processor socket; then, insert the PHM into the processor socket.
3. Rotate the anti-tilt wire bails outward until they engage with the hooks in the socket.
4. Fully tighten the Torx T30 nuts *in the installation sequence shown* on the heat-sink label. Tighten the screws until they stop; then, visually inspect to make sure that there is no gap between the screw shoulder beneath the heat sink and the processor socket. (For reference, the torque required for the fasteners to fully tighten is 1.1 newton-meters, 10 inch-pounds).

Step 6.   If the processor comes with a T-shaped heat sink, fully tighten the two heat sink screws as shown. (For reference, the torque required for the fasteners to fully tighten is 1.1 newton-meters, 10 inch-pounds).
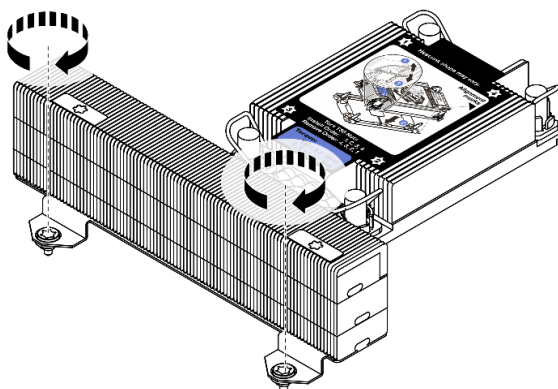
Figure 284. Tightening T-shaped heat sink screws

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Rack latches replacement

Use this information to remove and install the rack latches.

Note: Depending on the model, the left rack latch might be assembled with a VGA connector and the right rack latch might be assembled with the front I/O module.

- "Remove the rack latches" on page 364
- "Install the rack latches" on page 367

Remove the rack latches

Use this information to remove the rack latches.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

  Note: If the rack latches are not assembled with a VGA connector or the front I/O module, you can remove the rack latches without powering off the server.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. If the server is installed with the security bezel, remove it first. See "Remove the security bezel" on page 408.

Step 2. Disconnect the VGA cable, the front-I/O-assembly cable, or both cables from the system board.

   Notes:
   - If you need to disconnect cables from the system board, disengage all latches or release tabs on cable connectors first. Failing to release the tab before removing the cables will damage the cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
   - The connectors on your system board might look different from those in the illustration, but the removal procedure is the same.

        1. Press the release tab to release the connector.

        2. Disengage the connector from the cable socket.
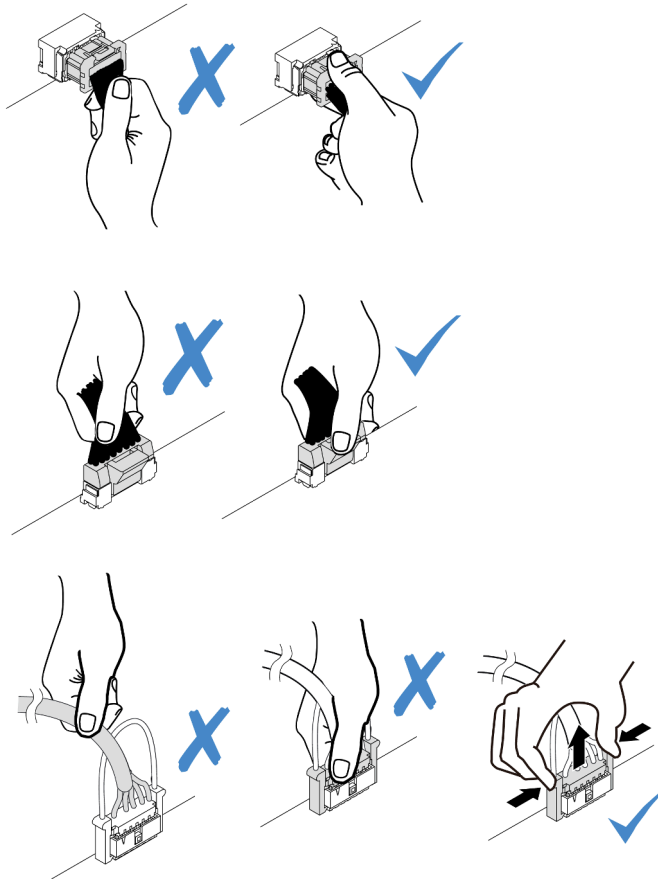
Figure 285. Disconnecting cables from the system board

Step 3. Remove the screws that secure the cable retainer on the side of the server. Then, remove the cable retainer from the chassis.
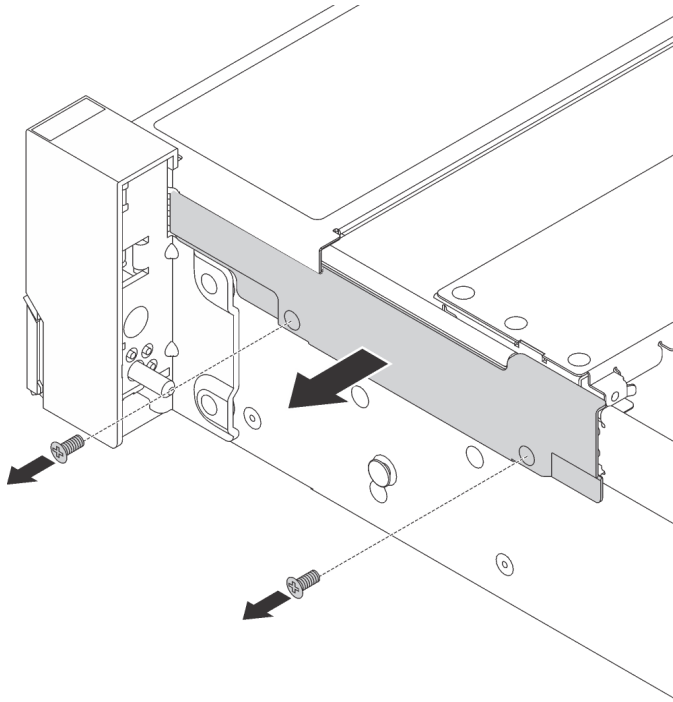
Figure 286. Cable retainer removal

Step 4.   On each side of the server, remove the screws that secure the rack latch.
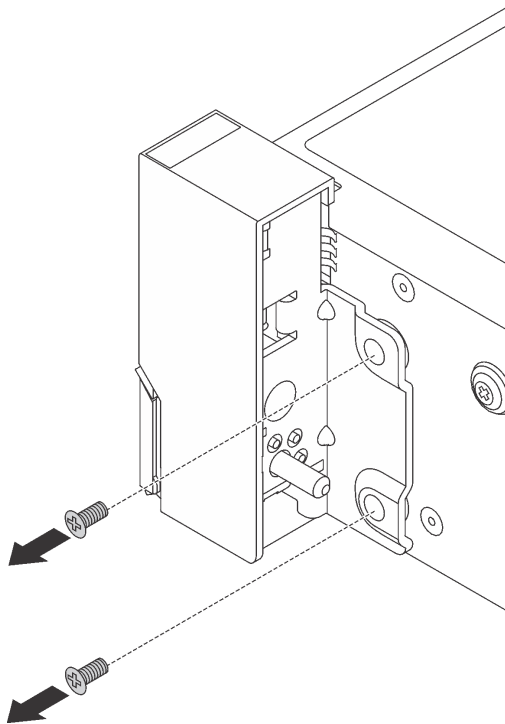
Figure 287. Screws removal

Step 5.   On each side of the server, slide the rack latch forward slightly and then remove the rack latch from the chassis.

Figure 288. Rack latch removal

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

[Watch the procedure on YouTube](#)

Install the rack latches

Use this information to install the rack latches.

About this task

Attention:
- Read ["Installation Guidelines" on page 237](#) to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

    Note: If the rack latches are not assembled with a VGA connector or the front I/O module, you can install the rack latches without powering off the server.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new rack latches to any unpainted surface on the outside of the server. Then, take the new rack latches out of the package and place them on a static-protective surface.

Step 2. On each side of the server, align the rack latch with the pin on the chassis. Then, press the rack latch onto the chassis and slightly slide it backward.
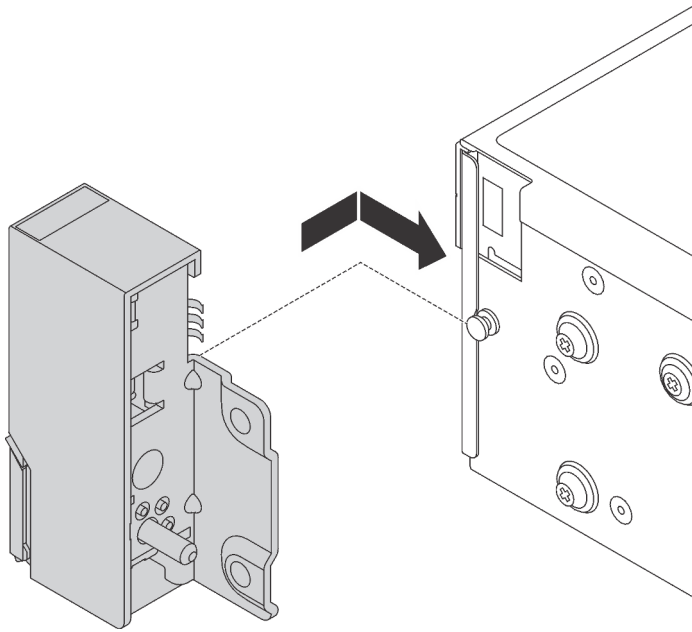
Figure 289. Rack latch installation

Step 3. Install the screws to secure the rack latch on each side of the server.
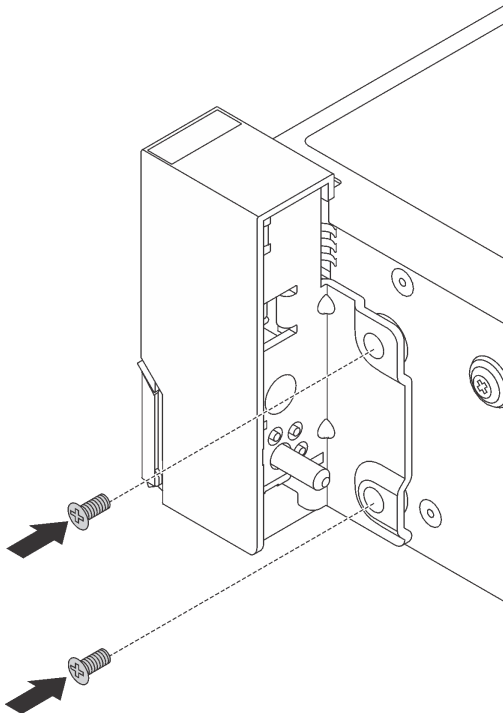
Figure 290. Screws installation

Step 4. Route the bundle cable for I/O connectors on the right or left latches as shown. Then, install the screws to secure the cable retainer.

Note: To avoid unnecessary damage to the bundle cable, ensure that it is routed and fixed on the upper frame of the cable retainer.
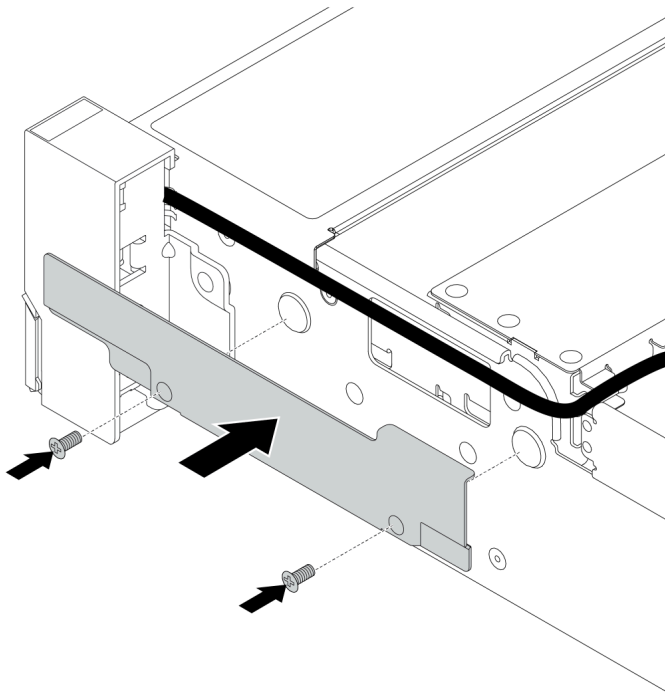
Figure 291. Cable retainer installation

Step 5. Connect the cables to the system board. See "Front I/O connectors" on page 67.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

RAID flash power module replacement

The RAID flash power module protects the cache memory on the installed RAID adapter. Use this information to remove and install a RAID flash power module (also called supercap).

The location of RAID flash power modules varies by the server hardware configurations.

Figure 292. On the chassis

Figure 293. On standard air baffle

Figure 294. On GPU air baffle

Figure 295. On the 2.5-inch middle drive cage

Note: The supercap holder on the chassis is not supported if the 12 x 3.5-inch drive backplane with expander is installed.

Remove a RAID flash power module from the chassis

Use this information to remove a RAID flash power module from the chassis.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Disconnect the cable of the RAID flash power module.

Step 3. Remove the RAID flash power module.

Figure 296. RAID flash power module removal

    a.   Open the retention clip on the supercap holder.

    b.   Take the RAID flash power module out of the holder.

Step 4.   Remove the supercap holder as shown if necessary.
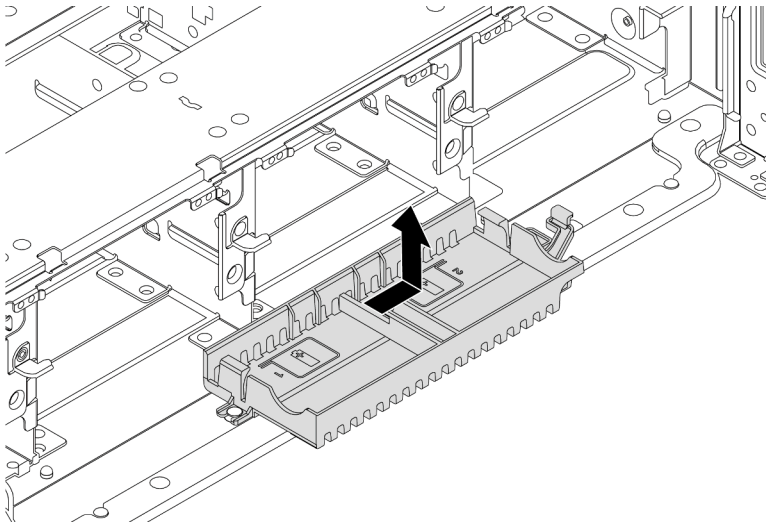
Figure 297. Supercap holder removal
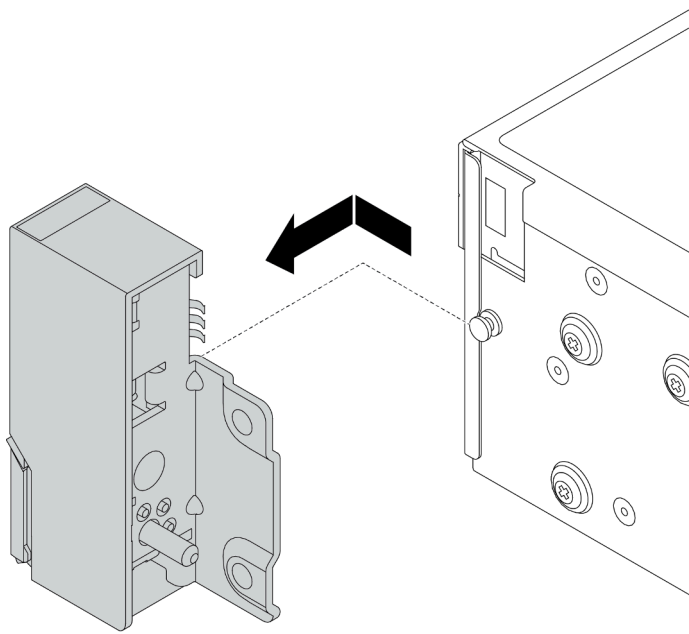
After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install a RAID flash power module on the chassis

Use this information to install a RAID flash power module (also called supercap) on the chassis.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new RAID flash power module to any unpainted surface on the outside of the server. Then, take the new RAID flash power module out of the package and place it on a static-protective surface.

Step 2. Install the supercap holder.
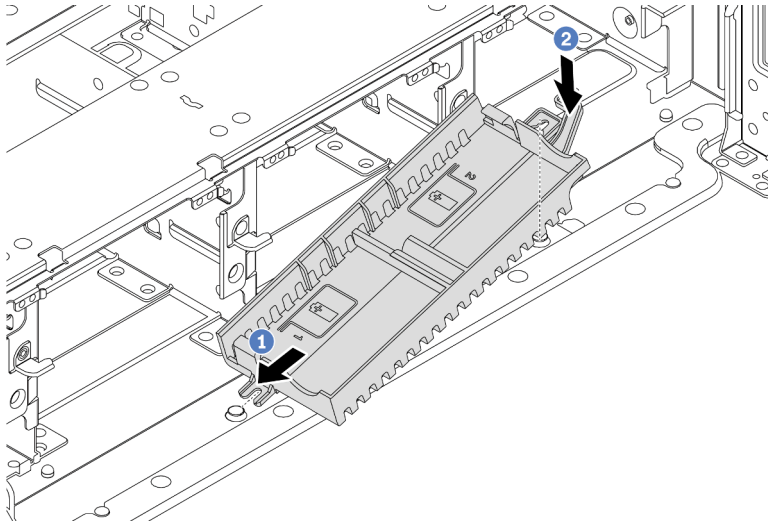
Figure 298. Supercap holder installation

a.   Align the notch on the supercap holder with the pin on the chassis.

b.   Pivot the supercap holder inward until the other side clicks into place.

Step 3.   Install the RAID flash power module.
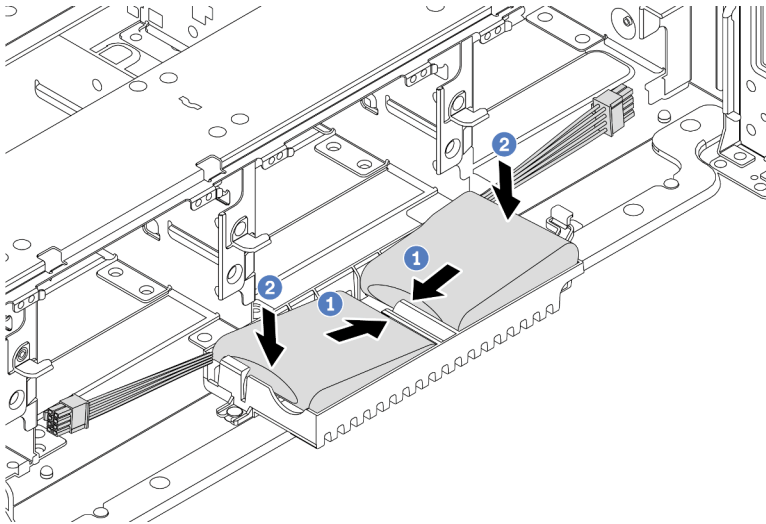
Figure 299. RAID flash power module installation

a.   Insert the RAID flash power module into the retaining clip at one side as shown.

b.   Press the RAID flash power module down on the other side until it snaps into place.

Step 4.   Connect the RAID flash power module to an adapter with the extension cable that comes with the RAID flash power module. See "RAID flash power module" on page 77.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440

Remove a RAID flash power module from the air baffle

Use this information to remove a RAID flash power module (also called supercap) from the air baffle.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Disconnect the cable of the RAID flash power module.

Step 3. Remove the RAID flash power module from the air baffle.

Figure 300. RAID flash power module removal

    a. Open the retention clip on the holder of the RAID flash power module.

    b. Take the RAID flash power module out of the holder.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Install a RAID flash power module on the air baffle

Use this information to install a RAID flash power module (also called supercap) on the air baffle.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new RAID flash power module to any unpainted surface on the outside of the server. Then, take the new RAID flash power module out of the package and place it on a static-protective surface.

Step 2. Install the RAID flash power module.

Figure 301. RAID flash power module installation (on the air baffle)

    a. Open the retention clip on the holder.

    b. Put a RAID flash power module into the holder.

    c. Press it down to secure it into the holder.

Step 3. Connect the RAID flash power module to an adapter with the extension cable that comes with the RAID flash power module. See "RAID flash power module" on page 77.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440

Demo video

Remove a RAID flash power module from the middle 2.5-inch drive cage

Use this information to remove a RAID flash power module (also called supercap) from the middle 2.5-inch drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Disconnect the cable of the RAID flash power module.

Step 3. Open the drive cage handle.
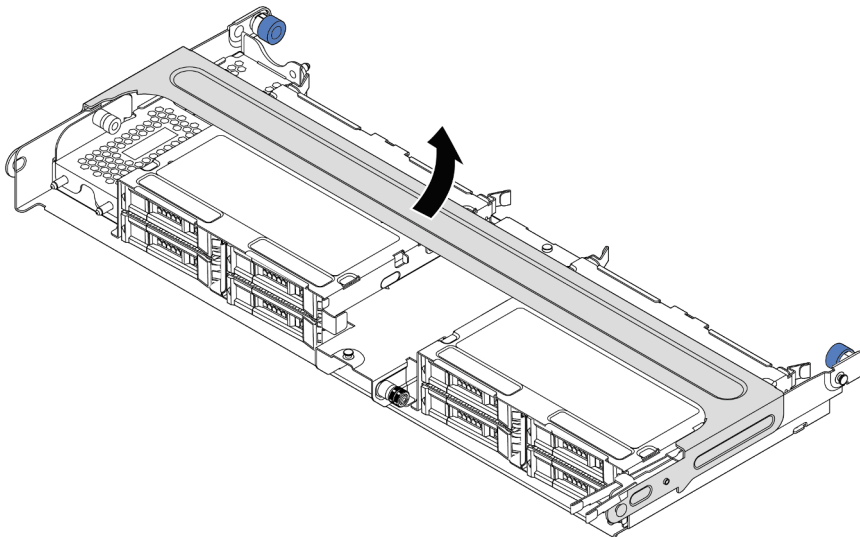
Figure 302. Opening the handle of the middle drive cage

Step 4. Remove the RAID flash power module.
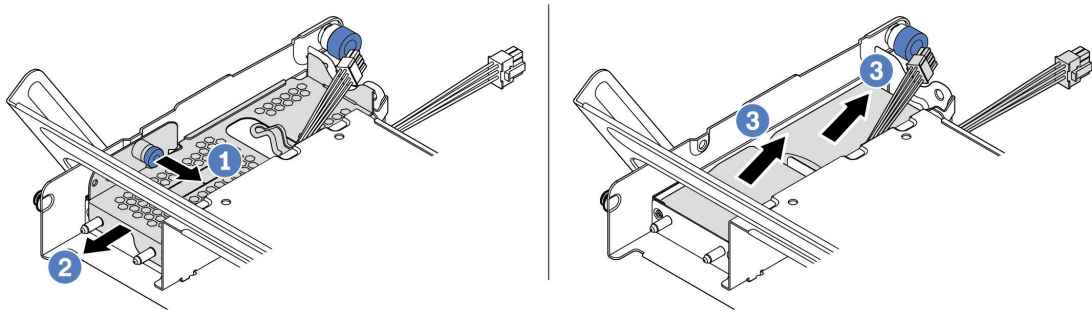
Figure 303. Removing the RAID flash power module

a. Pull out the blue latch on the supercap cover.

b. Slide the cover out of the holder.

c. Take the RAID flash power module out of the holder.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install a RAID flash power module on the middle drive cage

Use this information to install a RAID flash power module (also called supercap) on the middle 2.5-inch drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new RAID flash power module to any unpainted surface on the outside of the server. Then, take the new RAID flash power module out of the package and place it on a static-protective surface.

Step 2. Install the RAID flash power module.

Figure 304. Installing the RAID flash power module

a. Put a RAID flash power module into the holder, and press it down to secure it into the holder.

b. Align the pins on the metal cover with the holes in the supercap holder, pull out the blue latch on the cover, and slide the cover into the holder until the pins pass through the holes. Then, release the blue latch to lock the cover into place.
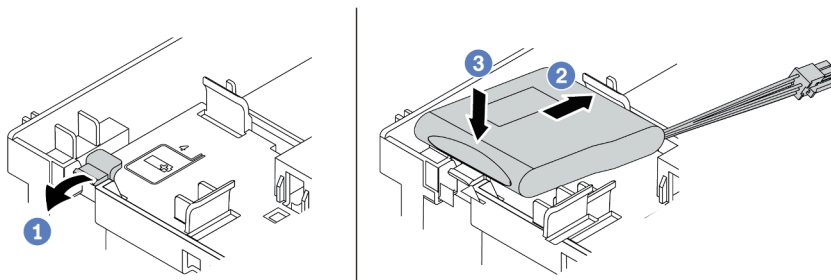
Step 3. Connect the RAID flash power module to an adapter with the extension cable that comes with the RAID flash power module. See "RAID flash power module" on page 77.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440
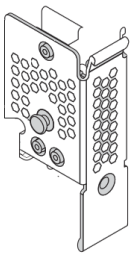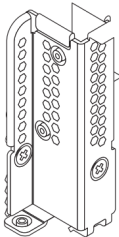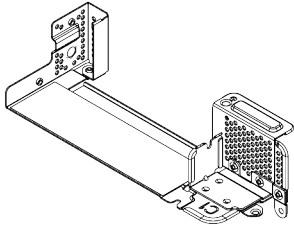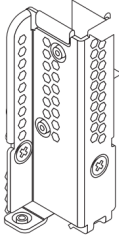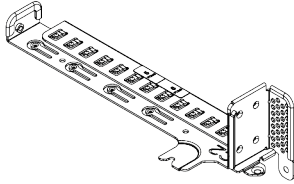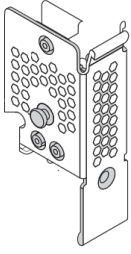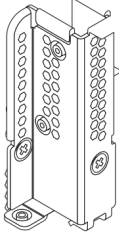
Rearwall bracket replacement

Use this information to remove and install a rearwall bracket.

The rearwall brackets vary by server rear configurations. This topic uses the A1, B1, and C1 brackets as an example for replacement illustration. The replacement procedure is the same for B2 and C2 brackets.
- "Remove a rearwall bracket" on page 382
- "Install a rearwall bracket" on page 384

Rearwall bracket matrix

Server rear config.	Required rearwall brackets		
Configuration with 8 PCIe slots	The server requires 3 rearwall brackets:		
	A1 rearwall bracket on the left	B1 rearwall bracket on the middle	C1 rearwall bracket on the right
Configuration with 4 x 2.5-inch rear drives	The server requires 3 rearwall brackets:		
	A1 rearwall bracket on the left	B1 rearwall bracket on the middle	C2 rearwall bracket on the right
Configuration with 2 x 3.5-inch rear drives	The server requires 2 rearwall brackets:		
	A1 rearwall bracket on the left	B1 rearwall bracket on the middle	
Configuration with 8 x 2.5-inch rear drives	The server requires 2 rearwall brackets:		

Server rear config.	Required rearwall brackets		
	A1 rearwall bracket on the left	B2 rearwall bracket on the middle	
Configuration with 4 x 3.5-inch rear drives	The server requires no rearwall brackets		

Remove a rearwall bracket

Use this information to remove a rearwall bracket.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Remove the riser assembly or rear drive cage.
- "PCIe adapter and riser assembly replacement" on page 336
- "Rear 2.5-inch drive backplane and drive cage replacement" on page 386
- "Rear 3.5-inch drive backplane and drive cage replacement" on page 392

Step 3. Remove the rearwall bracket.

   a. Remove the screws.

   b. Remove the bracket from the chassis as shown.

   Note: The illustrations show removing the A1, B1, and C1 rearwall brackets. The procedure is the same for removing other rearwall brackets.
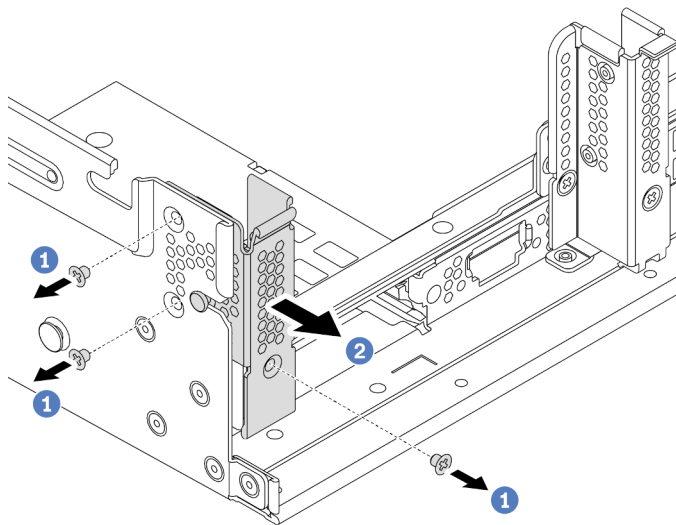
Figure 305. A1 rearwall bracket removal (left)
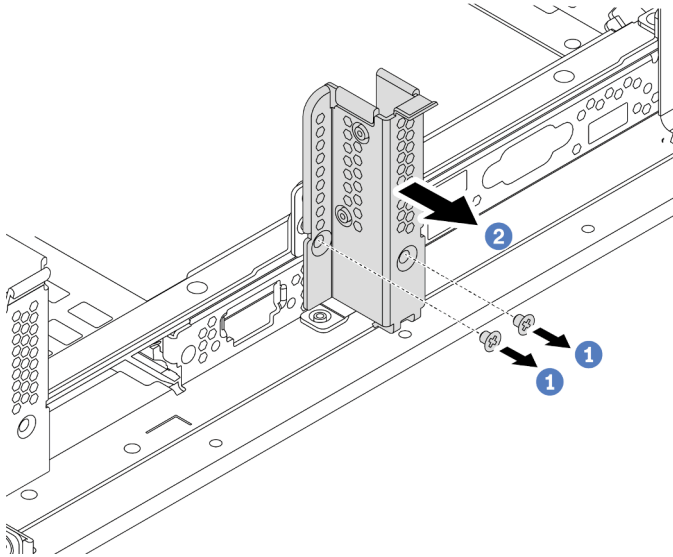
Figure 306. B1 rearwall bracket removal (middle)
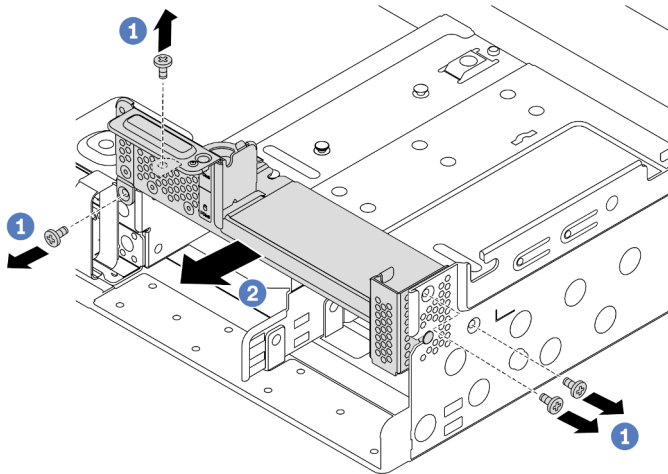
Figure 307. C1 rearwall bracket removal (right)

After you finish

1. Install required rearwall brackets back to the rear chassis.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a rearwall bracket

Use this information to install a rearwall bracket.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new component to any unpainted surface on the outside of the server. Then, take the new component of the package and place it on a static-protective surface.

Step 2. Install the rearwall brackets.

   a. Align the rearwall bracket with the chassis rearwall, and insert the bracket into place.

   b. Install the screws to secure the rearwall bracket.

   Note: The illustrations show installing the A1, B1, and C1 rearwall brackets. The procedure is the same for installing other rearwall brackets.
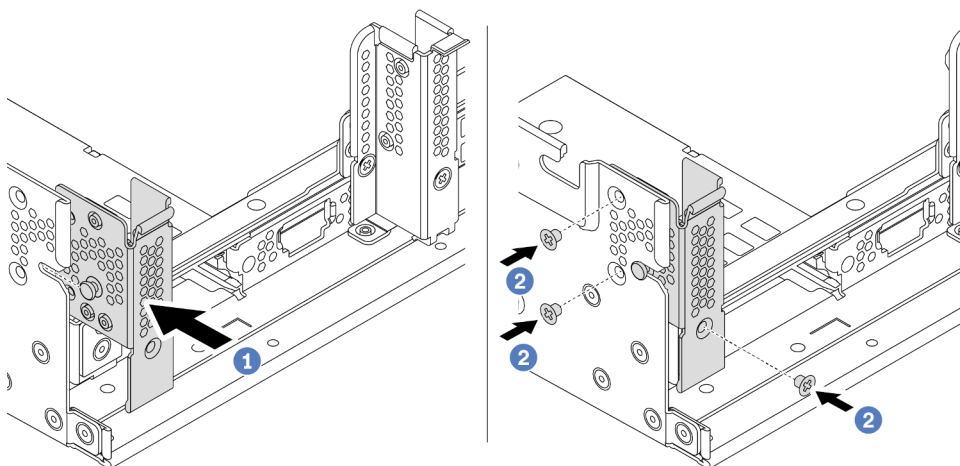
Figure 308. A1 rearwall bracket installation (left)
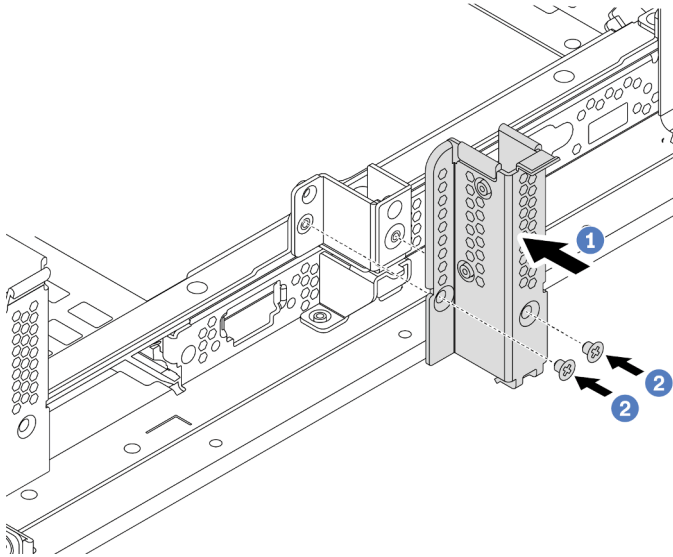
Figure 309. B1 rearwall bracket installation (middle)
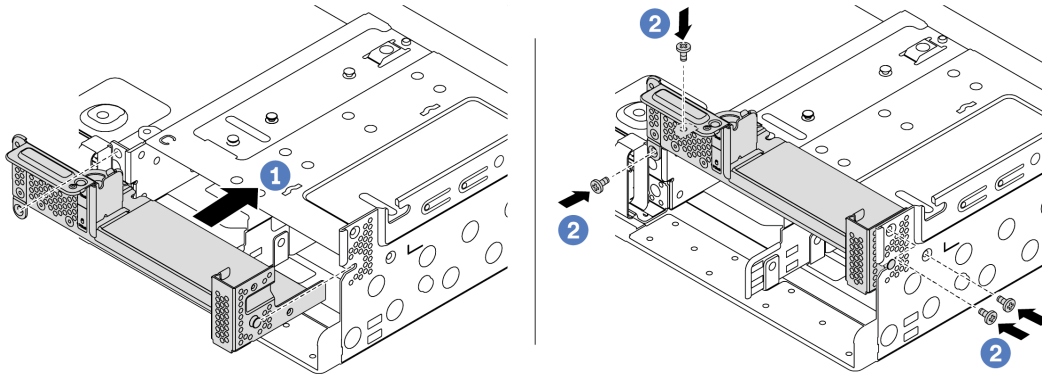
Figure 310. C1 rearwall bracket installation (right)

After you finish

1. Install a rear drive cage or riser assemblies.
   - "PCIe adapter and riser assembly replacement" on page 336
   - "Rear 2.5-inch drive backplane and drive cage replacement" on page 386
   - "Rear 3.5-inch drive backplane and drive cage replacement" on page 392
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube
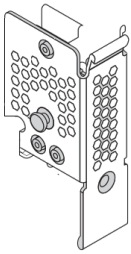
Rear 2.5-inch drive backplane and drive cage replacement

Use this information to remove and install 2.5-inch rear drive backplane and drive cage.

Remove the 2.5-inch rear drive cage

Use this information to remove the 2.5-inch 4-bay or 8-bay rear drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Prepare your server.

    a. Remove the top cover. See "Remove the top cover" on page 435.

    b. Disconnect the cables from the rear drive backplane.

    c. Remove all the installed drives and fillers (if any) from the drive bays. See "Remove a hot-swap drive" on page 303.

Step 2. Remove the rear drive cage.

    a. Twist and pull out the blue plungers.

    b. Slide the drive cage towards the rear of the chassis to release it.

Figure 311. Removing the 4 x 2.5-inch rear drive cage
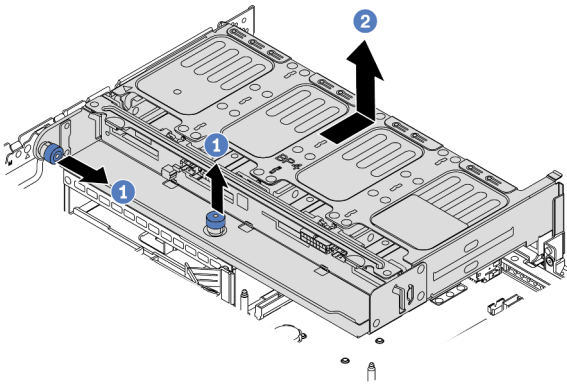
Figure 312. Removing the 8 x 2.5-inch rear drive cage

After you finish

Remove the backplane from the drive cage. See "Remove the 2.5-inch rear drive backplane" on page 387.

Remove the 2.5-inch rear drive backplane

Use this information to remove the 2.5-inch 4-bay or 8-bay rear drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Remove the middle drive backplane.

Figure 313. Removing the rear 4 x 2.5-inch drive backplane

a. Open the release latches in the direction as shown.

b. Rotate the backplane from the top to disengage it from the pins on the drive cage.

c. Carefully lift the backplane out of the drive cage.
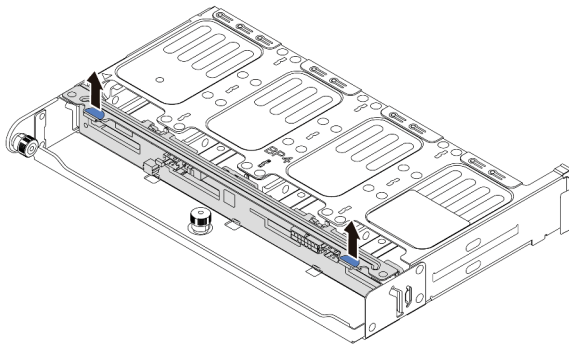
Figure 314. Removing the rear 8 x 2.5-inch drive backplane

a. Hold the backplane and carefully lift the backplane out of the drive cage.

After you finish

1. Do one of the following:
    - If you are replacing the backplane, install a new backplane to the drive cage.
    - If you are replacing the drive cage, install the backplane to a new drive cage.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install the 2.5-inch rear drive backplane

Use this information to install the 2.5-inch 4-bay or 8-bay rear drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.

- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new backplane to any unpainted surface on the outside of the server. Then, take the new backplane out of the package and place it on a static-protective surface.

Step 2. Connect cables to the backplane. See Chapter 3 "Internal cable routing" on page 67.

Step 3. Install the rear drive backplane.

Figure 315. Installing the 4 x 2.5-inch rear drive backplane

a. Align the bottom of the backplane with the studs at the bottom of the drive cage.

b. Lower the backplane into the drive cage so that the holes in the backplane pass through the pins on the drive cage, and press the backplane into position. The release latches will secure the backplane in place.
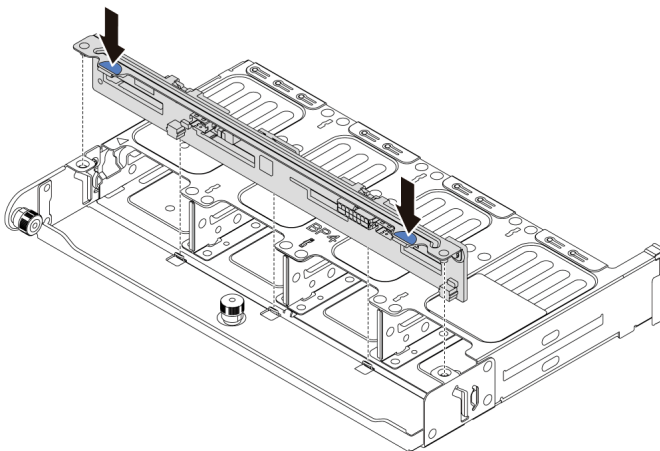
Figure 316. Installing the 8 x 2.5-inch rear drive backplane

a. Align the pins of the backplane with the holes at both sides of the drive cage.

b. Lower the backplane into the drive cage so that the pins of the backplane pass through the holes on the drive cage, and press the backplane into position.

After you finish

Install the drive cage onto the chassis. See "Install the 2.5-inch rear drive cage" on page 390.

Install the 2.5-inch rear drive cage

Use this information to install the 2.5-inch 4-bay or 8-bay rear drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- The rear drive cage is supported on some server models with thermal requirements. See "Thermal rules" on page 262 to ensure that the server is under permitted ambient temperature and the correct heat sink and system fans are used. If needed, replace your heat sink or system fan first.
  - "Processor and heat sink replacement (trained technician only)" on page 353
  - "System fan cage replacement" on page 426
- When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.

Procedure

Step 1. (Optional) If existing rearwall brackets are not for the rear drive cage, install the rearwall brackets that come with the rear drive cage. See "Rearwall bracket replacement" on page 379

Step 2. Install the required riser brackets. See "PCIe adapter and riser assembly replacement" on page 336.

Step 3. Install the rear drive cage.

Figure 317. Installing the 4 x 2.5-inch rear drive cage

a. Align the rear drive cage with the chassis, and lower the drive cage into the chassis.

b. Move the rear drive cage forward until it clicks into position.

Figure 318. Installing the 8 x 2.5-inch rear drive cage

a. Align the rear drive cage with the chassis, and lower the drive cage into the chassis. Move the rear drive cage forward until it clicks into position.

b. Twist and release the blue plunger to secure the drive cage in place.

Step 4. Connect cables from the rear backplane to the system board or RAID/HBA adapters. See Chapter 3 "Internal cable routing" on page 67.

After you finish

1. Reinstall the drives or drive fillers into the rear drive cage. See "Install a hot-swap drive" on page 304.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Rear 3.5-inch drive backplane and drive cage replacement

Use this information to remove and install the 3.5-inch rear drive backplane and drive cage.

Remove the 3.5-inch rear drive cage

Use this information to remove the 3.5-inch 2-bay or 4-bay rear drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.
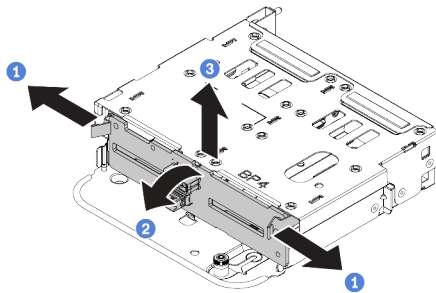
Procedure

Step 1. Prepare your server.

    a. Remove the top cover. See "Remove the top cover" on page 435.

    b. Disconnect the cables from the rear drive backplane.

    c. Remove all the installed drives and fillers (if any) from the drive bays. See "Remove a hot-swap drive" on page 303.

Step 2.   Remove the rear drive cage.

Figure 319. Removing the 2 x 3.5-inch rear drive cage

Figure 320. Removing the 4 x 3.5-inch rear drive cage

a.   Twist and pull out the blue plungers.

b.   Slide the drive cage towards the rear of the chassis to release it.

After you finish

Remove the backplane from the drive cage. See "Remove the 3.5-inch drive rear backplane" on page 394.

Demo video

Watch the procedure on YouTube

Remove the 3.5-inch drive rear backplane

Use this information to remove the 3.5-inch 2-bay or 4-bay rear drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Figure 321. Removing the 2 x 3.5-inch rear drive backplane
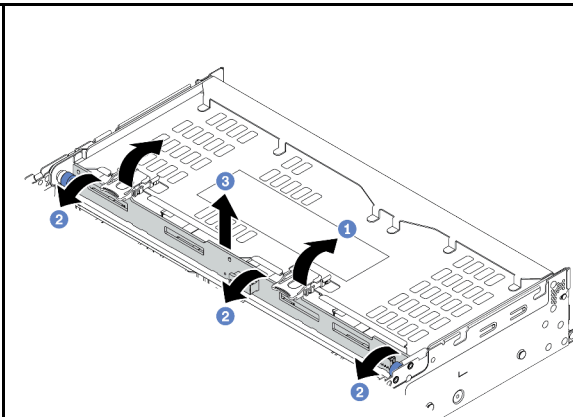
Figure 322. Removing the 4 x 3.5-inch rear drive backplane

Step 1. Open the release latches in the direction as shown.

Step 2. Rotate the backplane from the top to disengage it from the pins on the drive cage.

Step 3. Carefully lift the backplane out of the drive cage.

After you finish
1. Do one of the following:
   - If you are replacing the backplane, install a new backplane to the drive cage.
   - If you are replacing the drive cage, install the backplane to a new drive cage.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install the 3.5-inch rear drive backplane

Use this information to install the 3.5-inch 2-bay or 4-bay rear drive backplane.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new backplane to any unpainted surface on the outside of the server. Then, take the new backplane out of the package and place it on a static-protective surface.

Step 2. Connect cables to the backplane. See Chapter 3 "Internal cable routing" on page 67.

Step 3. Install the drive backplane.

Figure 323. Installing the 2 x 3.5-inch rear drive backplane

Figure 324. Installing the 4 x 3.5-inch rear drive backplane

a. Align the bottom of the backplane with the studs at the bottom of the drive cage.

b. Lower the backplane into the drive cage so that the holes in the backplane pass through the pins on the drive cage, and press the backplane into position.

After you finish

Install the drive cage onto the chassis. See "Install the 3.5-inch rear drive cage" on page 396.

Demo video

Watch the procedure on YouTube

Install the 3.5-inch rear drive cage

Use this information to install the 3.5-inch 2-bay or 4-bay rear drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- The rear drive cage is supported on some server models with thermal requirements. See "Thermal rules" on page 262 to ensure that the server is under permitted ambient temperature and the correct heat sink and system fans are used. If needed, replace your heat sink or system fan first.
  - "Processor and heat sink replacement (trained technician only)" on page 353
  - "System fan cage replacement" on page 426
- When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.

Procedure

Step 1.   (Optional) If existing rearwall brackets are not for the rear drive cage, install the rearwall brackets that come with the rear drive cage. See "Rearwall bracket replacement" on page 379

Step 2.   Install the required riser brackets. See "PCIe adapter and riser assembly replacement" on page 336.

Step 3.   Install the rear drive cage.

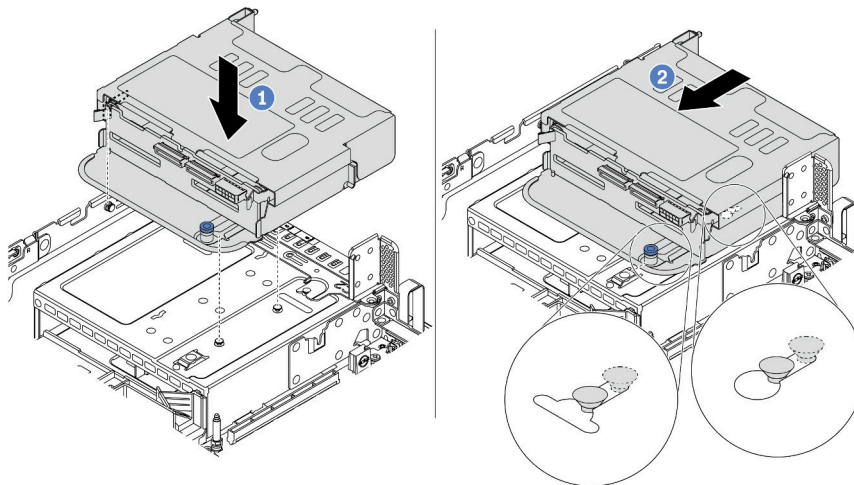

Figure 325. Installing the 2 x 3.5-inch rear drive cage

Figure 326. Installing the 4 x 3.5-inch rear drive cage

a.   Align the rear drive cage with the chassis, and lower the drive cage into the chassis. Move the rear drive cage forward until it clicks into position.
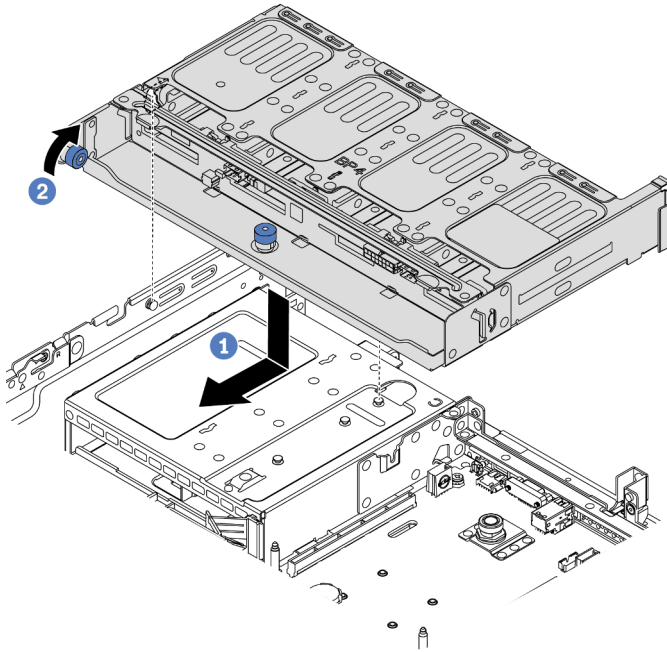
b.   Twist and release the blue plunger to secure the drive cage in place.

Step 4.   (Optional) If you are installing the 4 x 3.5-inch drive cage, install the top cover support bracket.
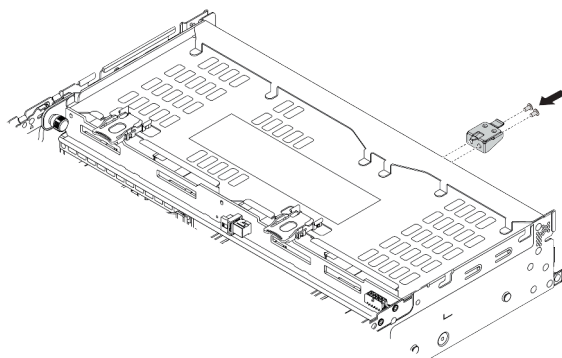
Figure 327. Installing the top cover support bracket

Step 5.   Connect cables from the rear backplane to the system board or RAID/HBA adapters. See Chapter 3 "Internal cable routing" on page 67.

After you finish

1. Reinstall the drives or drive fillers into the rear drive cage. See "Install a hot-swap drive" on page 304.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Rear 7mm drive backplane and drive cage replacement

Use this information to remove and install the rear 7mm drive backplanes and drive cage.

Depending on server configuration, the server supports one of the below rear 7mm drive cages. The replacement procedures for both drive cages and drive backplanes are similar. This topic uses the 7mm drive cage **1** as an example for illustration.

1 2FH+7mm SSD riser cage	**2** 7mm SSD riser cage

-
-
-
-

Remove the 7mm drive cage

Use this information to remove the 7mm drive cage.

About this task

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.
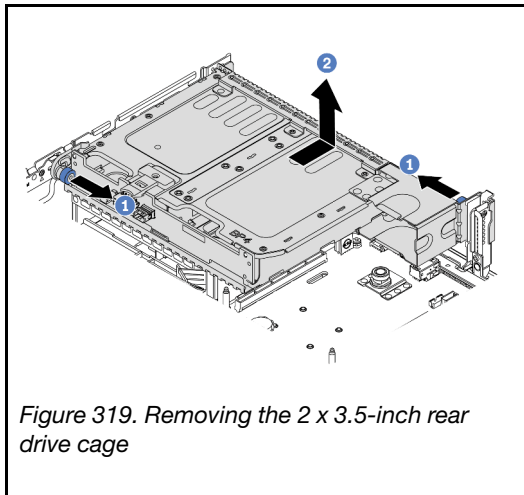
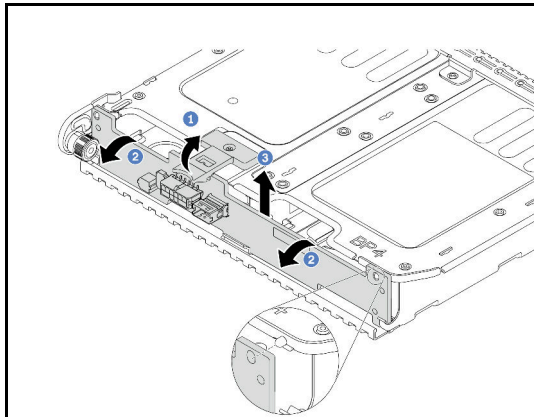### Procedure

Step 1.   Remove the top cover. See .

Step 2.   Remove all the installed drives and fillers (if any) from the drive bays. See .

Step 3.   Record the cable connections for 7mm drives and then disconnect all cables from the backplanes.

Step 4. Remove the riser assembly with 7mm drive cage from the rear chassis.
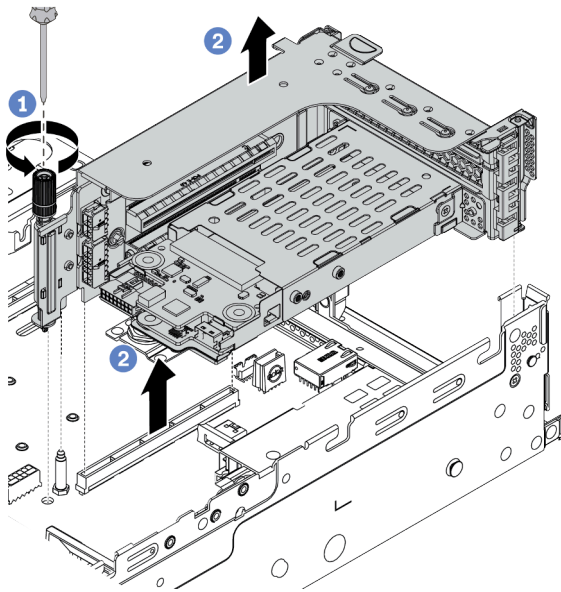
Figure 328. Riser assembly removal

a. Loosen the screw of the riser cage.

b. Carefully lift the riser assembly up from the chassis.

Step 5. Remove the 7mm drive cage from the riser assembly.
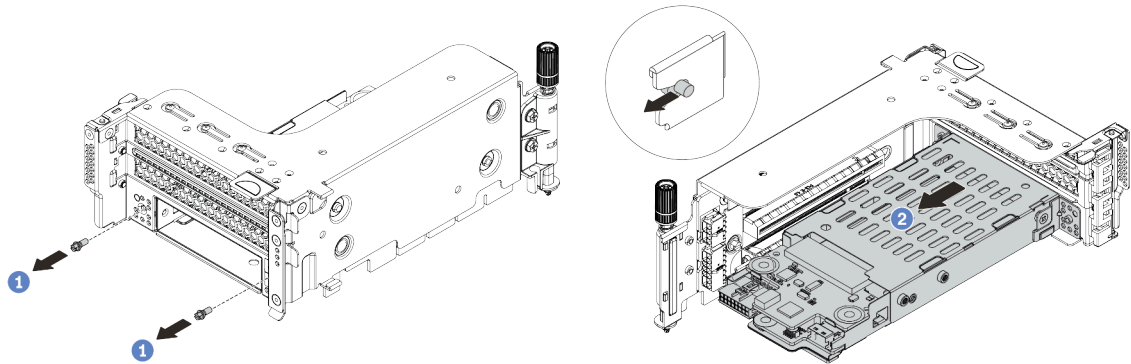
Figure 329. 7mm drive cage removal

a. Remove the two screws.

b. Slightly and horizontally slide the cage out of the riser cage.

Step 6. (Optional) Remove the 7mm drive cage securing clip from the riser cage.
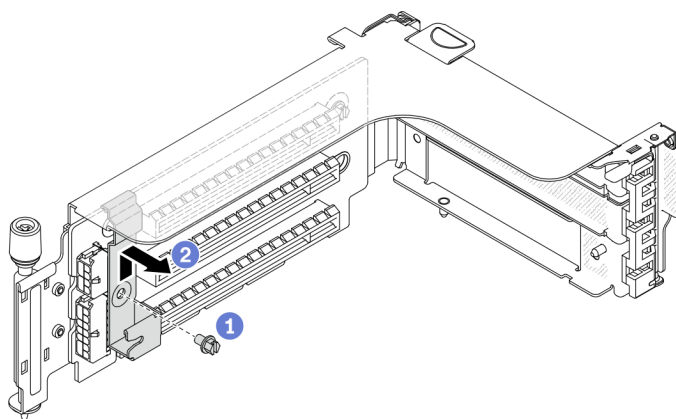
Figure 330. 7mm drive cage securing clip removal

After you finish

Remove the two 7mm backplanes from the 7mm drive cage. See "Remove the 7mm drive backplanes" on page 400.

Demo video

Watch the procedure on YouTube

Remove the 7mm drive backplanes

Use this information to remove the 7mm drive backplanes.
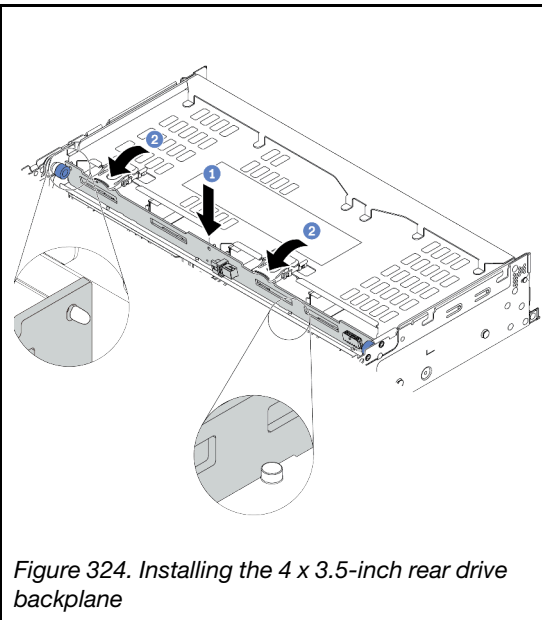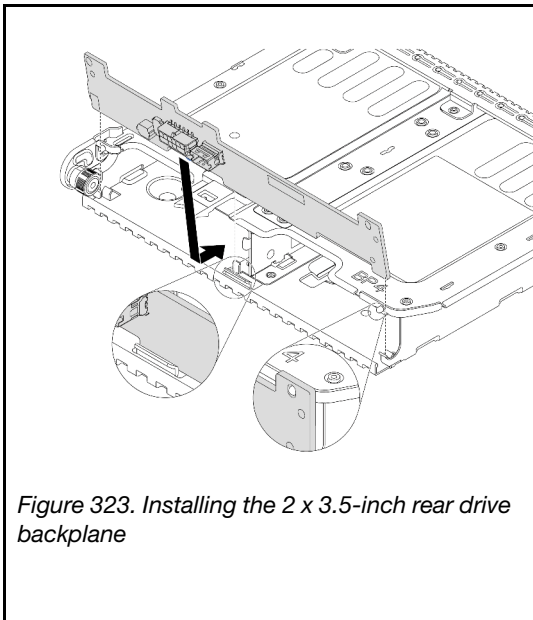
About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Before you remove or make changes to drives, drive controllers (including controllers that are integrated on the system board), drive backplanes or drive cables, back up all important data that is stored on drives.
- Before you remove any component of a RAID array (drive, RAID card, etc.), back up all RAID configuration information.
- If one or more NVMe solid-state drives are to be removed, it is recommended to disable them beforehand via the operating system.

Procedure

Step 1. Remove the 7mm drive backplane on the top.
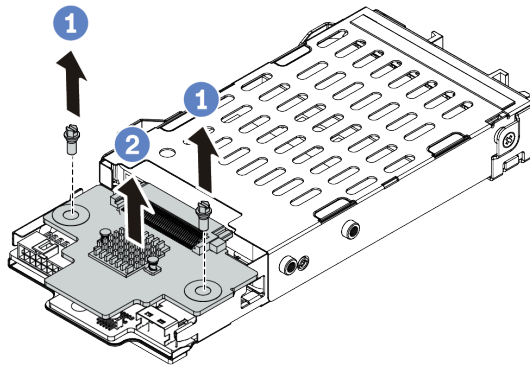
Figure 331. 7mm drive backplane removal (top)

    a.   Remove the two screws.

    b.   Vertically lift the backplane up and put it aside.

Step 2. Remove the 7mm drive backplane at the bottom.
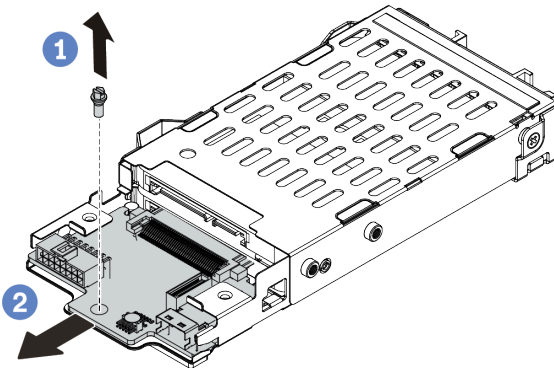
Figure 332. 7mm drive backplane removal (bottom)

    a.   Remove the screw.

    b.   Remove the backplane horizontally from the cage as shown.

After you finish

1. Do one of the following:
   - If you are replacing the backplanes, install new backplanes to the drive cage.
   - If you are replacing the drive cage, install the backplanes to a new drive cage.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

[Watch the procedure on YouTube](#)

Install the 7mm drive backplanes

Use this information to install the 7mm drive backplanes.
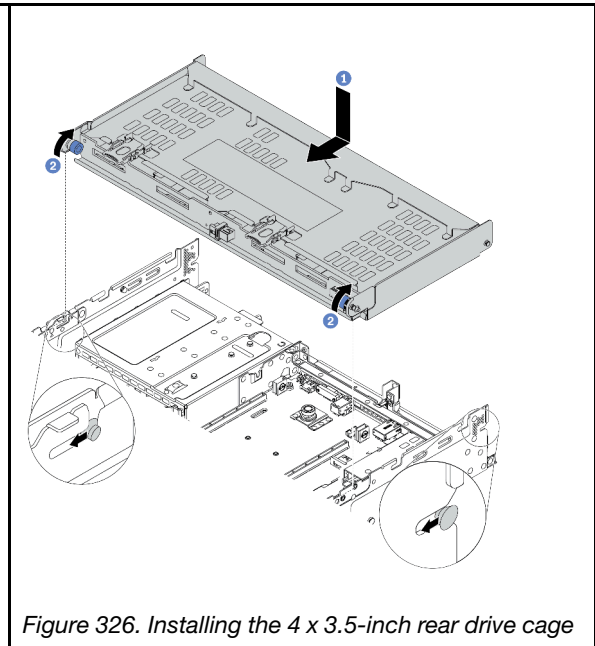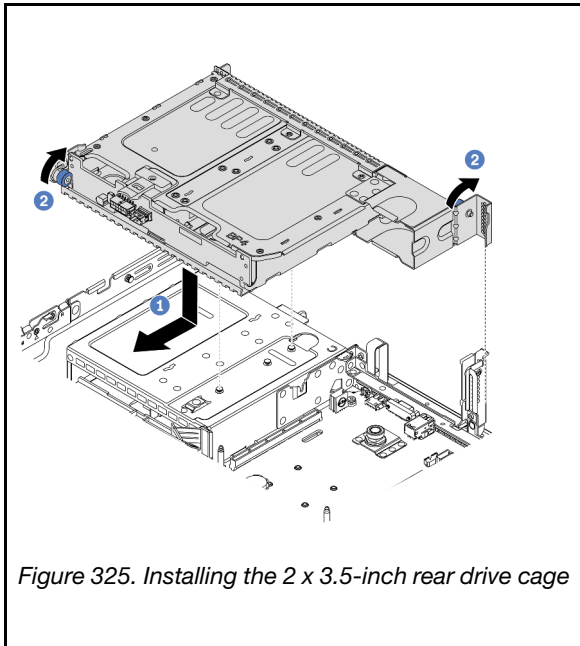
About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Read "PCIe slots and PCIe adapters" on page 256 to ensure that you follow the installation rules for 7mm drive cages.

Procedure

Step 1. Touch the static-protective package that contains the new component to any unpainted surface on the outside of the server. Then, take the new component out of the package and place it on a static-protective surface.

Step 2. Connect the cables to the backplanes. See "7mm drives " on page 78.

Step 3. Install the 7mm drive backplane at the bottom.
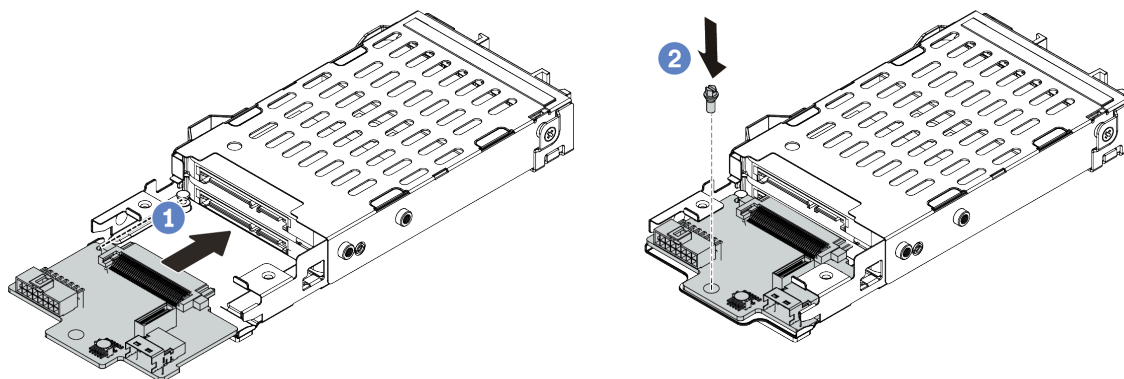
Figure 333. 7mm drive backplane installation (bottom)

a. Align the notch at edge of the backplane with the pin on the cage, and slightly slide the backplane into the cage until it is fully seated.

b. Install the screw to secure it.

Step 4. Install the 7mm drive backplane on the top.
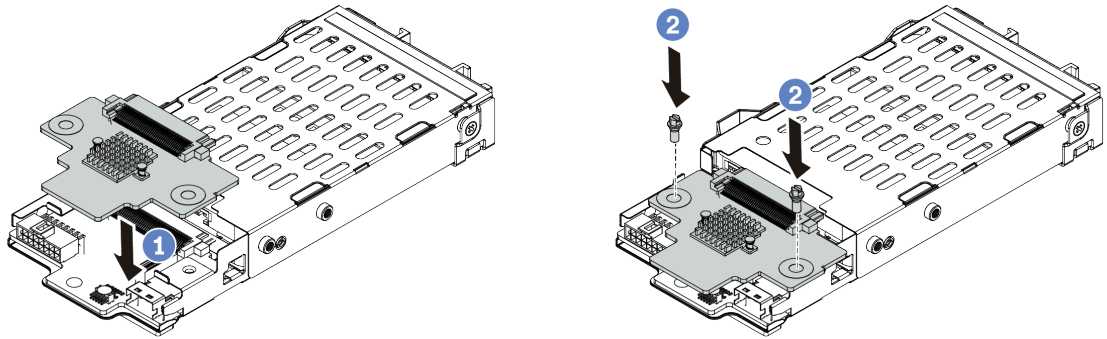
Figure 334. 7mm drive backplane installation (top)

a. Align the holes in the backplane with the holes on the cage, and put the backplane down onto the cage.

b. Install the two screws to secure the backplane in place.

After you finish

Install the 7mm drive cage onto the riser cage. See "Install the 7mm drive cage" on page 403.

Demo video

Watch the procedure on YouTube

Install the 7mm drive cage

Use this information to install the 7mm drive cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. (Optional) Hook the securing clip over the riser adapter on the riser cage.
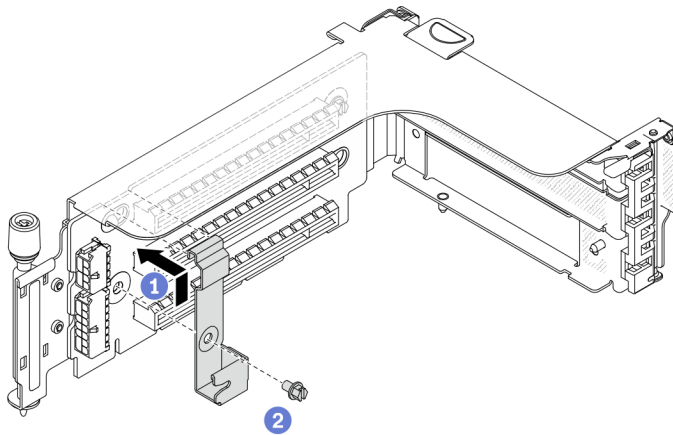
Figure 335. 7mm drive cage securing clip installation

Step 2. Install the 7mm drive cage to the riser cage.
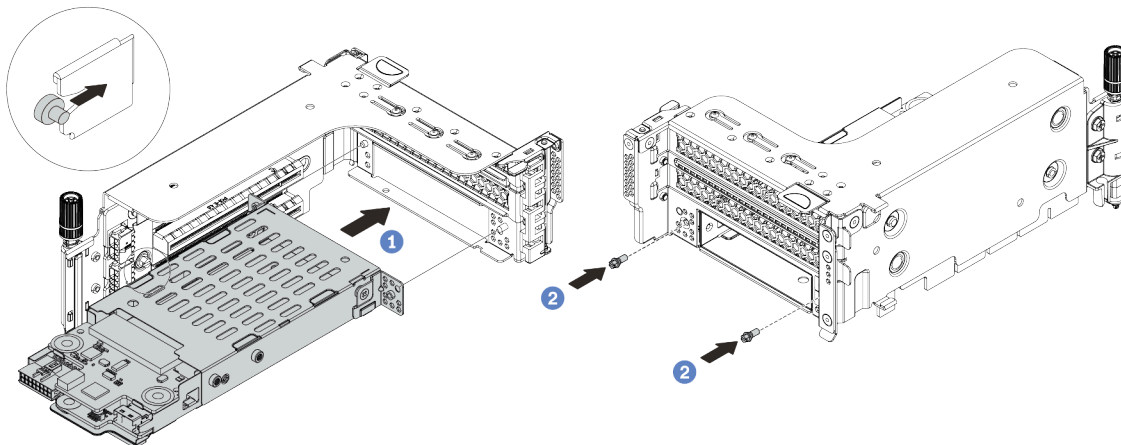
Figure 336. 7mm drive cage installation

a. Align the left-side pin on the 7mm drive cage with the positioning slot on the securing clip, the two holes on the side brackets of the 7mm drive cage with the two holes on the front of the riser cage.

b. Install the two screws to secure the 7mm drive cage in place.

Step 3.   Install the 7mm riser assembly to the riser slot on the system board.
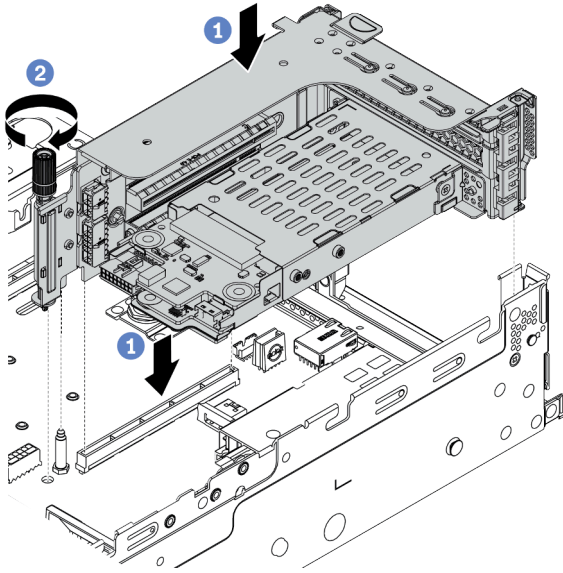
Figure 337. Riser assembly installation

a.   Align the riser assembly with the slot on the system board, lower and insert the riser into the riser slot.

b.   Tighten the screw to secure the riser assembly in place.

Step 4.   Connect the cables from the backplanes to the system board. See "7mm drives " on page 78.

After you finish

1. Reinstall all the drives and fillers (if any) into the drive bays. See "Install a hot-swap drive" on page 304.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Replacement of OCP enablement kit for vSphere DSE

Use this information to remove and install the ThinkSystem OCP Enablement Kit for Distributed Services Engine (OCP enablement kit for vSphere DSE).

Note: The OCP enablement kit for vSphere DSE is used in combination with ThinkSystem NVIDIA BlueField-2 25GbE SFP56 2-Port PCIe Ethernet DPU w/BMC & Crypto (DPU adapter). For replacement of DPU adapter, see "PCIe adapter and riser assembly replacement" on page 336.
- "Remove the OCP enablement kit for vSphere DSE" on page 405
- "Install the OCP enablement kit for vSphere DSE" on page 406

Remove the OCP enablement kit for vSphere DSE

Use this information to remove the OCP enablement kit for vSphere DSE.

About this task

CAUTION:
Power off the server and disconnect all power cords from their power sources before performing this procedure.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   Remove the OCP enablement kit for vSphere DSE.
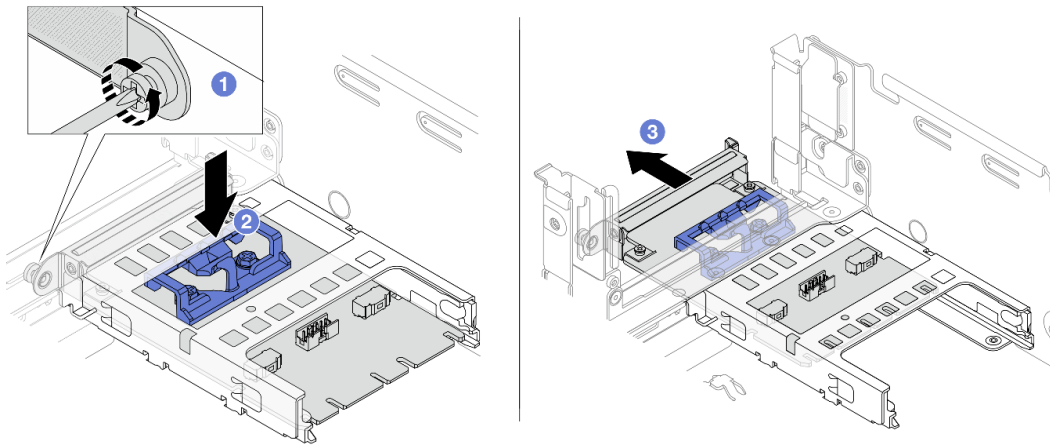
Figure 338. OCP enablement kit for vSphere DSE removal

    a.   Loosen the screw that secures the OCP enablement kit for vSphere DSE.

    b.   Press and hold the blue latch.

    c.   Push the OCP enablement kit for vSphere DSE by the latch out from the chassis.

After you finish
1. Install a replacement unit or a filler.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install the OCP enablement kit for vSphere DSE

Use this information to install the OCP enablement kit for vSphere DSE.

About this task

CAUTION:
Power off the server and disconnect all power cords from their power sources before performing this procedure.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.

- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1.   Touch the static-protective package that contains the new adapter to any unpainted surface on the outside of the server. Then, take the adapter out of the package and place it on a static-protective surface.

Step 2.   If a filler is installed, remove it.

Step 3.   Install the OCP enablement kit for vSphere DSE.

Note: Ensure that the OCP enablement kit for vSphere DSE is fully seated and the screw is securely tightened. Otherwise, the OCP enablement kit for vSphere DSE will not get full connection and may not function.
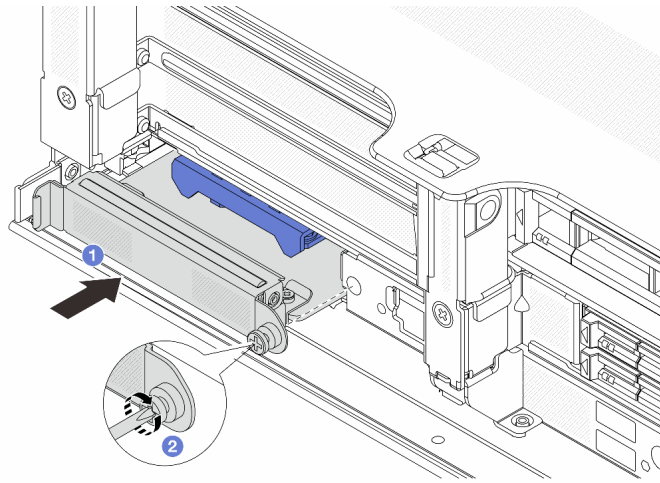
Figure 339. OCP enablement kit for vSphere DSE installation

a.   Slide the OCP enablement kit for vSphere DSE into the slot until it is fully seated.

b.   Tighten the screw to secure the OCP enablement kit for vSphere DSE.

Step 4.   Connect the cable to the OCP enablement kit for vSphere DSE. See "DPU adapter" on page 81.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Security bezel replacement

Use this information to remove and install the security bezel.

Remove the security bezel

Use this information to remove the security bezel.

About this task

Attention: Read "Installation Guidelines" on page 237 to ensure that you work safely.

Procedure

Step 1. Use the key to unlock the security bezel.
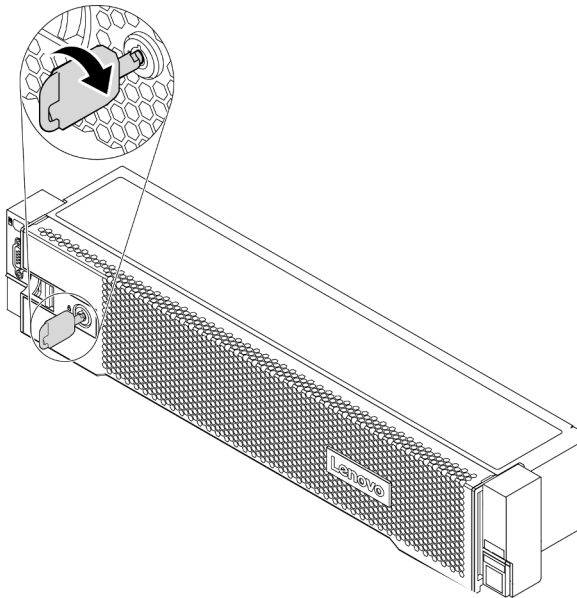
Figure 340. Unlocking the security bezel

Step 2. Press the release latch **1** and rotate the security bezel outward to remove it from the chassis.
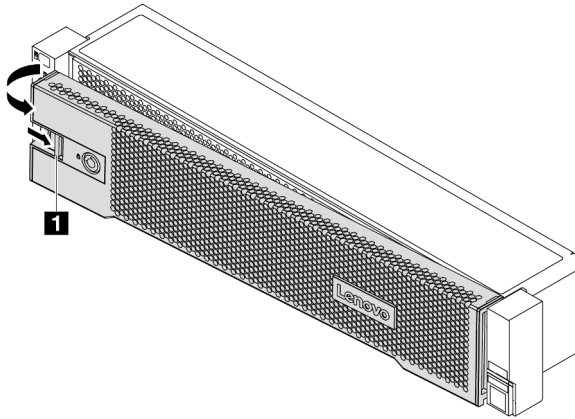
Figure 341. Security bezel removal

After you finish

Note: Before you ship the rack with the server installed, reinstall and lock the security bezel into place.

Demo video

[Watch the procedure on YouTube](#)

Install the security bezel

Use this information to install the security bezel.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Before you ship the rack with the server installed, reinstall and lock the security bezel into place.

Procedure

Step 1. If you have removed the rack latches, reinstall them. See "Install the rack latches" on page 367.

Step 2. If the key is held inside the security bezel, remove it out of the security bezel.

    a. ❶ Press the latch to release the key.

    b. ❷ Remove the key from the retaining clip in the shown direction.
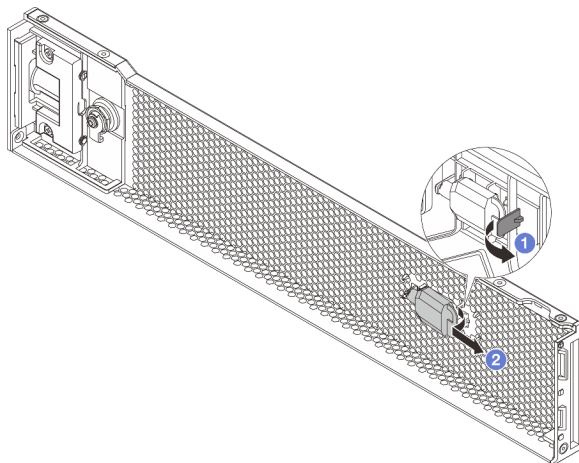
Figure 342. Key removal

Step 3. Carefully insert the tabs on the security bezel into the slots on the right rack latch. Then, press and hold the release latch **1** and rotate the security bezel inward until the other side clicks into place.
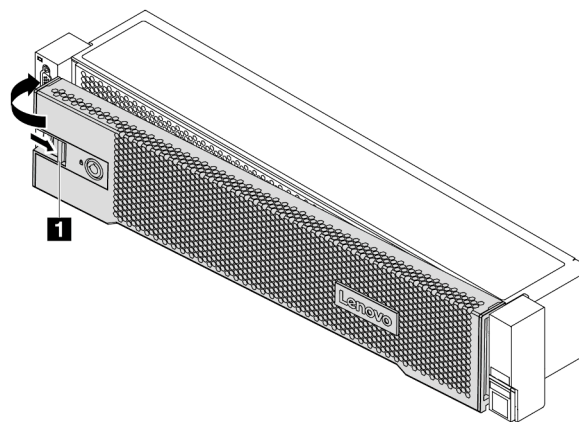
Figure 343. Security bezel installation

Step 4. Use the key to lock the security bezel to the closed position.
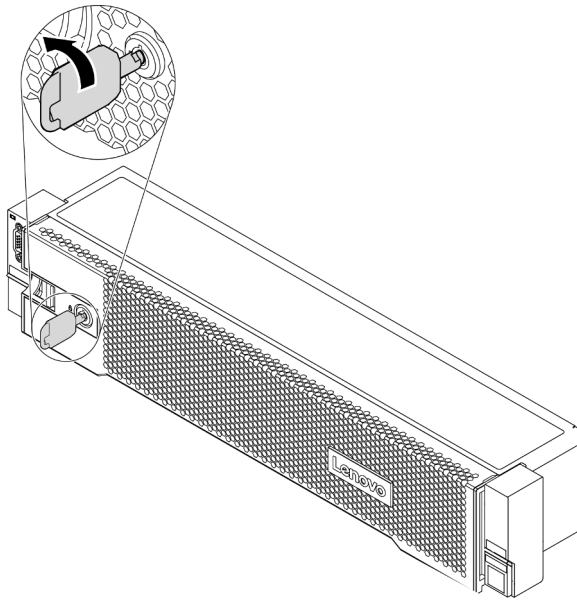
Figure 344. Locking the security bezel

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

System board replacement (trained technician only)

Use this information to remove and install the system board.

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Remove the system board

Use this information to remove the system board.

About this task

A system board provides different connectors or slots to connect different components or peripherals of the system for communication. If the system board fails, it must be replaced. Before removing the system board, record all system configuration information, such as Lenovo XClarity Controller (XCC) IP addresses, vital product data, and the machine type, model number, serial number, Universally Unique Identifier, and asset tag of the server.

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

S012

CAUTION:
Hot surface nearby.

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Prepare your server.

    a. Remove the top cover. See .

    b. If your server comes with an air baffle, a middle cage, or a rear cage, remove it first.
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c. If your server has an CFF adapter or a RAID flash power module installed on the front of the chassis, remove it first.
   - "Remove an internal RAID/HBA/expander adapter" on page 306
   - "Remove a RAID flash power module from the chassis" on page 370

d. Record where the cables are connected to the system board; then, disconnect all the cables.

e. Remove any of the following components that are installed on the system board and put them in a safe, static-protective place.
   - "Remove a system fan" on page 422
   - "Remove the system fan cage" on page 426
   - "Remove a memory module" on page 320
   - "Processor and heat sink replacement (trained technician only)" on page 353
   - "Remove the CMOS battery" on page 273
   - "Remove a PCIe adapter and riser assembly" on page 338
   - "Remove the OCP 3.0 Ethernet adapter" on page 333

f. Pull out the power supplies slightly. Ensure that they are disconnected from the system board.

Step 2. Remove the system board.

Note: The system board might look slightly different from your system board, but the removal procedure is the same.
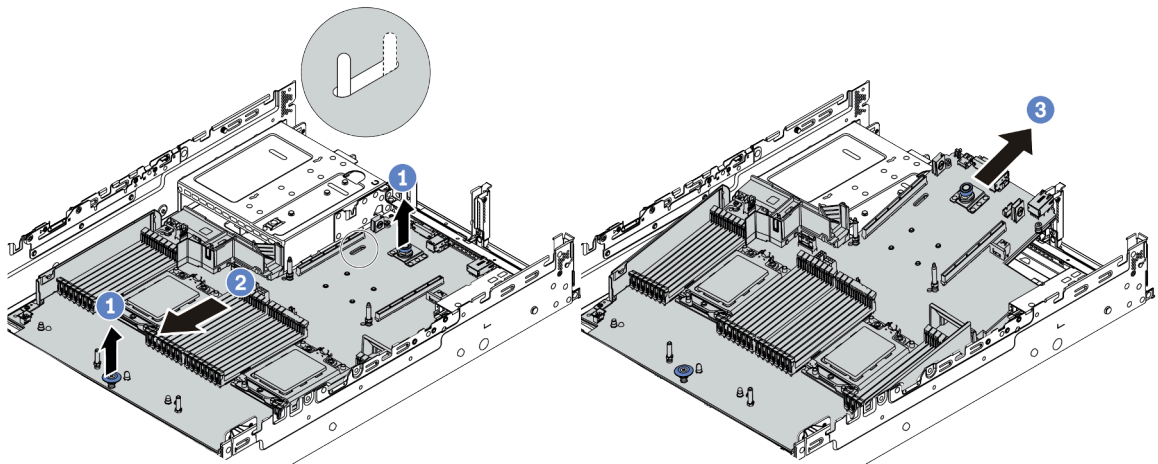
Figure 345. System board removal

a. Lift the two release pins at the same time.

b. Slide the system board towards the front of the chassis until it stops.

c. Tilt and lift the system board out of the chassis.

After you finish
- If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

  Important: Before you return the system board, make sure that the CPU socket is covered. Install the processor socket dust covers from the new system board on the removed system board.
- If you are planning to recycle the system board, follow the instructions in "Disassembling the system board for recycle" on page 473 for compliance with local regulations.

Demo video

Install the system board

Use this information to install the system board.

About this task

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

S012

CAUTION:
Hot surface nearby.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Touch the static-protective package that contains the new system board to any unpainted surface on the outside of the server. Then, take the new system board out of the package and place it on a static-protective surface.

Step 2. Install the new system board to the server.

> **Note:** The system board might look slightly different from your system board, but the installation procedure is the same.
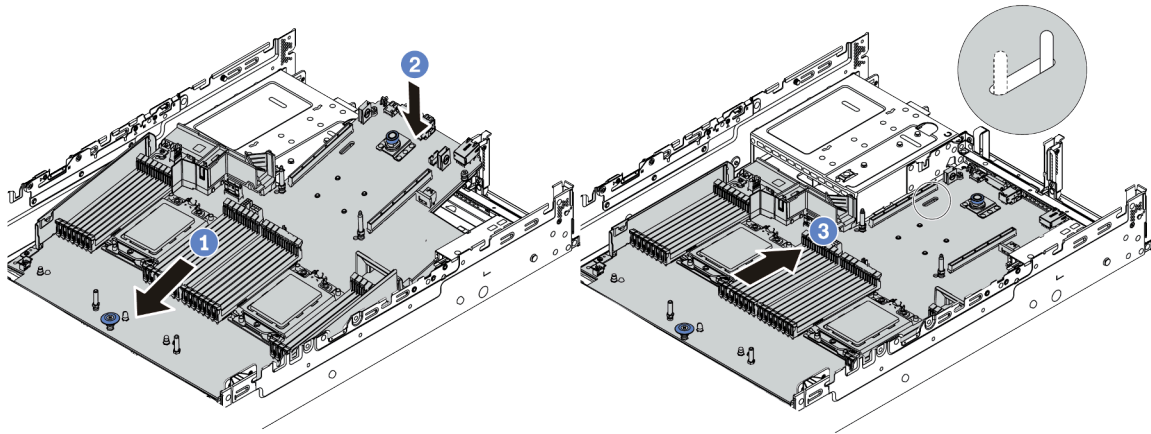
Figure 346. System board installation

    a.   Insert the front end of the system board towards the front of the chassis until it stops.

    b.   Lower the other end down into the chassis.

    c.   Slide the system board towards the rear of the chassis until it clicks into place. Ensure that rear connectors on the new system board are inserted into the corresponding holes in the rear panel.

Step 3.   A new system board comes with half-height cable holders by default. If the old system board is installed with full-height cable holders, remove them from the old system board and install them to the new system board. See "Cable wall brackets replacement" on page 270.

After you finish

1. Install any components that you have removed:
   - "Install a processor and heat sink" on page 358
   - "Install a memory module" on page 322
   - "Install the CMOS battery" on page 275
   - "Install an internal RAID/HBA/expander adapter" on page 308
   - "Install a RAID flash power module on the chassis" on page 373
   - "Install a system fan" on page 424
   - "Install the system fan cage" on page 428
   - "Install a PCIe adapter and riser assembly" on page 342
   - "Install the 2.5-inch rear drive cage" on page 390
   - "Install the 3.5-inch rear drive cage" on page 396
   - "Install the OCP 3.0 Ethernet adapter" on page 334
2. Properly route and secure the cables in the server. See Chapter 3 "Internal cable routing" on page 67.
3. Install the air baffle or a middle drive cage if you have removed it. See "Install the air baffle" on page 267 or "Install the middle drive cage" on page 331.
4. Install the top cover. See "Install the top cover" on page 437.
5. Push the power supplies into the bays until they click into place.
6. Connect power cords to the server and turn on the server.
7. Update the server with the latest RAID firmware. See "Firmware updates" on page 10.
8. Update the machine type and serial number of the system board. See "Update the machine type and serial number" on page 417.
9. Enable TPM. See "Enable TPM" on page 418.
10. Optionally, enable Secure Boot. See "Enable UEFI Secure Boot" on page 420.

Demo video

Update the machine type and serial number

After the system board is replaced by trained service technicians, the machine type and serial number must be updated.

There are two methods available to update the machine type and serial number:
- From Lenovo XClarity Provisioning Manager

  To update the machine type and serial number from Lenovo XClarity Provisioning Manager:
  1. Start the server and press the key according to the on-screen instructions to display the Lenovo XClarity Provisioning Manager interface.
  2. If the power-on Administrator password is required, enter the password.
  3. From the System Summary page, click **Update VPD**.
  4. Update the machine type and serial number.
- From Lenovo XClarity Essentials OneCLI

  Lenovo XClarity Essentials OneCLI sets the machine type and serial number in the Lenovo XClarity Controller. Select one of the following methods to access the Lenovo XClarity Controller and set the machine type and serial number:
  - Operate from the target system, such as LAN or keyboard console style (KCS) access
  - Remote access to the target system (TCP/IP based)

  To update the machine type and serial number from Lenovo XClarity Essentials OneCLI:
  1. Download and install Lenovo XClarity Essentials OneCLI.

     To download Lenovo XClarity Essentials OneCLI, go to the following site:

     https://datacentersupport.lenovo.com/solutions/HT116433
  2. Copy and unpack the OneCLI package, which also includes other required files, to the server. Make sure that you unpack the OneCLI and the required files to the same directory.
  3. After you have Lenovo XClarity Essentials OneCLI in place, type the following commands to set the machine type and serial number:
     ```
     onecli config set SYSTEM_PROD_DATA.SysInfoProdName <m/t_model> [access_method]
     onecli config set SYSTEM_PROD_DATA.SysInfoSerialNum <s/n> [access_method]
     onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifier <system model> [access_method]
     onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifierEx <system model> --override [access_method]
     ```

     Where:

     <m/t_model>
     > The server machine type and model number. Type `xxxxyyyyyy`, where *xxxx* is the machine type and *yyyyyy* is the server model number.

     <s/n>
     > The serial number on the server. Type `zzzzzzzz` (length 8-10 characters), where *zzzzzzzz* is the serial number.

     <system model>
     > The system model. Type `system yyyyyyyy`, where *yyyyyyyy* is the product identifier.

     [access_method]
     > The access method that you select to use from the following methods:

     > - Online authenticated LAN access, type the command:
     >   ```
     >   [--bmc-username <xcc_user_id> --bmc-password <xcc_password>]
     >   ```
     >   Where:

xcc_user_id
>   The BMC/IMM/XCC account name (1 of 12 accounts). The default value is USERID.

xcc_password
>   The BMC/IMM/XCC account password (1 of 12 accounts).

Example commands are as follows:
```
onecli config set SYSTEM_PROD_DATA.SysInfoProdName <m/t_model> --bmc-username <xcc_user_id>
--bmc-password <xcc_password>
onecli config set SYSTEM_PROD_DATA.SysInfoSerialNum <s/n> --bmc-username <xcc_user_id> --bmc-
password <xcc_password>
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifier <system model> --bmc-username xcc_user_
id --bmc-password xcc_password
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifierEx <system model> --override --bmc-
username xcc_user_id --bmc-password xcc_password
```
–   Online KCS access (unauthenticated and user restricted):

You do not need to specify a value for *access_method* when you use this access method.

Example commands are as follows:
```
onecli config set SYSTEM_PROD_DATA.SysInfoProdName <m/t_model>
onecli config set SYSTEM_PROD_DATA.SysInfoSerialNum <s/n>
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifier <system model>
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifierEx <system model> --override
```

Note: The KCS access method uses the IPMI/KCS interface, which requires that the IPMI driver be installed.
–   Remote LAN access, type the command:
```
[--bmc <xcc_user_id>:<xcc_password>@<xcc_external_ip>]
```

Where:

xcc_external_ip
>   The BMC/IMM/XCC IP address. There is no default value. This parameter is required.

xcc_user_id
>   The BMC/IMM/XCC account (1 of 12 accounts). The default value is USERID.

xcc_password
>   The BMC/IMM/XCC account password (1 of 12 accounts).

Note: BMC, IMM, or XCC internal LAN/USB IP address, account name, and password are all valid for this command.

Example commands are as follows:
```
onecli config set SYSTEM_PROD_DATA.SysInfoProdName <m/t_model> --bmc <xcc_user_id>:<xcc_
password>@<xcc_external_ip>
onecli config set SYSTEM_PROD_DATA.SysInfoSerialNum <s/n> --bmc <xcc_user_id>:<xcc_
password>@<xcc_external_ip>
```

```
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifier <system model> --bmc xcc_user_id:xcc_
password@xcc_external_ip
onecli config set SYSTEM_PROD_DATA.SysInfoProdIdentifierEx <system model> --override --bmc xcc_
user_id:xcc_password@xcc_external_ip
```
4.   Reset the Lenovo XClarity Controller to the factory defaults. See "Resetting the BMC to Factory Default" section in the XCC documentation compatible with your server at https://pubs.lenovo.com/lxcc-overview/.

Enable TPM

The server supports Trusted Platform Module (TPM) of version 2.0.

Note: For customers in the Chinese Mainland, integrated TPM is not supported. However, customers in the Chinese Mainland can install a TPM adapter (sometimes called a daughter card), only version 2.0 is available.

When a system board is replaced, you must make sure that the TPM policy is set correctly.

CAUTION:
Take special care when setting the TPM policy. If it is not set correctly, the system board can become unusable.

Set the TPM policy

By default, a replacement system board is shipped with the TPM policy set to **undefined**. You must modify this setting to match the setting that was in place for the system board that is being replaced.

There are two methods available to set the TPM policy:
- From Lenovo XClarity Provisioning Manager

  To set the TPM policy from Lenovo XClarity Provisioning Manager:
  1. Start the server and press the key according to the on-screen instructions to display the Lenovo XClarity Provisioning Manager interface.
  2. If the power-on Administrator password is required, enter the password.
  3. From the System Summary page, click **Update VPD**.
  4. Set the policy to one of the following settings.
     - **NationZ TPM 2.0 enabled - China only**. Customers in the Chinese Mainland should choose this setting if a NationZ TPM 2.0 adapter is installed.
     - **TPM enabled - ROW**. Customers outside of the Chinese Mainland should choose this setting.
     - **Permanently disabled**. Customers in the Chinese Mainland should use this setting if no TPM adapter is installed.

     Note: Although the setting **undefined** is available as a policy setting, it should not be used.
- From Lenovo XClarity Essentials OneCLI

  Note: Please note that a Local IPMI user and password must be setup in Lenovo XClarity Controller for remote accessing to the target system.

  To set the TPM policy from Lenovo XClarity Essentials OneCLI:
  1. Read TpmTcmPolicyLock to check whether the TPM_TCM_POLICY has been locked:
     ```
     OneCli.exe config show imm.TpmTcmPolicyLock --override --imm <userid>:<password>@<ip_address>
     ```

     Note: The imm.TpmTcmPolicyLock value must be 'Disabled', which means TPM_TCM_POLICY is NOT locked and changes to the TPM_TCM_POLICY are permitted. If the return code is 'Enabled' then no changes to the policy are permitted. The planar may still be used if the desired setting is correct for the system being replaced.
  2. Configure the TPM_TCM_POLICY into XCC:
     - For customers in Chinese Mainland with no TPM, or customers that require to disable TPM:
       ```
       OneCli.exe config set imm.TpmTcmPolicy "NeitherTpmNorTcm" --override --imm <userid>:<password>@<ip_address>
       ```
     - For customers in Chinese Mainland that require to enable TPM:
       ```
       OneCli.exe config set imm.TpmTcmPolicy "NationZTPM20Only" --override --imm <userid>:<password>@<ip_address>
       ```
     - For customers outside Chinese Mainland that require to enable TPM:
       ```
       OneCli.exe config set imm.TpmTcmPolicy "TpmOnly" --override --imm <userid>:<password>@<ip_address>
       ```
  3. Issue reset command to reset system:
     ```
     OneCli.exe misc ospower reboot --imm <userid>:<password>@<ip_address>
     ```
  4. Read back the value to check whether the change has been accepted:
     ```
     OneCli.exe config show imm.TpmTcmPolicy --override --imm <userid>:<password>@<ip_address>
     ```

     Notes:

- If the read back value is matched it means the TPM_TCM_POLICY has been set correctly.

imm.TpmTcmPolicy is defined as below:
- Value 0 use string "Undefined", which means UNDEFINED policy.
- Value 1 use string "NeitherTpmNorTcm", which means TPM_PERM_DISABLED.
- Value 2 use string "TpmOnly", which means TPM_ALLOWED.
- Value 4 use string "NationZTPM20Only", which means NationZ_TPM20_ALLOWED.
- Below 4 steps must also be used to 'lock' the TPM_TCM_POLICY when using OneCli/ASU commands:

5. Read TpmTcmPolicyLock to check whether the TPM_TCM_POLICY has been locked , command as below:

```
OneCli.exe config show imm.TpmTcmPolicyLock --override --imm <userid>:<password>@<ip_address>
```

The value must be 'Disabled', it means TPM_TCM_POLICY is NOT locked and must be set.

6. Lock the TPM_TCM_POLICY:

```
OneCli.exe config set imm.TpmTcmPolicyLock "Enabled" --override --imm <userid>:<password>@<ip_address>
```

7. Issue reset command to reset system, command as below:

```
OneCli.exe misc ospower reboot --imm <userid>:<password>@<ip_address>
```

During the reset, UEFI will read the value from imm.TpmTcmPolicyLock, if the value is 'Enabled' and the imm.TpmTcmPolicy value is valid, UEFI will lock the TPM_TCM_POLICY setting.

Note: The valid values for imm.TpmTcmPolicy include 'NeitherTpmNorTcm', 'TpmOnly', and 'NationZTPM20Only'.

If the imm.TpmTcmPolicyLock is set as 'Enabled' but imm.TpmTcmPolicy value is invalid, UEFI will reject the 'lock' request and change imm.TpmTcmPolicyLock back to 'Disabled'.

8. Read back the value to check whether the 'Lock' is accepted or rejected. Command as below:

```
OneCli.exe config show imm.TpmTcmPolicy --override --imm <userid>:<password>@<ip_address>
```

Note: If the read back value is changed from 'Disabled' to 'Enabled' that means the TPM_TCM_POLICY has been locked successfully. There is no method to unlock a policy once it has been set other than replacing system board.

imm.TpmTcmPolicyLock is defined as below:

Value 1 uses string "Enabled" , which means lock the policy. Other values are not accepted.

Enable UEFI Secure Boot

Optionally, you can enable UEFI Secure Boot.

There are two methods available to enable UEFI Secure Boot:
• From Lenovo XClarity Provisioning Manager

To enable UEFI Secure Boot from Lenovo XClarity Provisioning Manager:
1. Start the server and press the key specified in the on-screen instructions to display the Lenovo XClarity Provisioning Manager interface. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.)
2. If the power-on Administrator password is required, enter the password.
3. From the UEFI Setup page, click **System Settings ➙ Security ➙ Secure Boot**.
4. Enable Secure Boot and save the settings.
• From Lenovo XClarity Essentials OneCLI

To enable UEFI Secure Boot from Lenovo XClarity Essentials OneCLI:
1. Download and install Lenovo XClarity Essentials OneCLI.

To download Lenovo XClarity Essentials OneCLI, go to the following site:

https://datacentersupport.lenovo.com/solutions/HT116433

2. Run the following command to enable Secure Boot:
   `OneCli.exe config set SecureBootConfiguration.SecureBootSetting Enabled --bmc` *<userid>:<password>*@*<ip_ address>*

   where:
   – *<userid>:<password>* are the credentials used to access the BMC (Lenovo XClarity Controller interface) of your server. The default user ID is USERID, and the default password is PASSW0RD (zero, not an uppercase o)
   – *<ip_address>* is the IP address of the BMC.

   For more information about the Lenovo XClarity Essentials OneCLI `set` command, see:

   https://pubs.lenovo.com/lxce-onecli/onecli_r_set_command

Note: If disabling UEFI secure boot is needed, run the following command:
`OneCli.exe config set SecureBootConfiguration.SecureBootSetting Disabled --bmc` *<userid>:<password>*@*<ip_ address>*

System fan replacement

Use this information to remove and install a system fan.

-
-

Remove a system fan

Use this information to remove a system fan.

About this task

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

Attention:
- Read to ensure that you work safely.
- When removing a hot-swap fan without powering off the server, do not touch the system fan cage. With power on, complete the replacement within 30 seconds to ensure proper operation.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See .

Step 2. Remove the system fan.
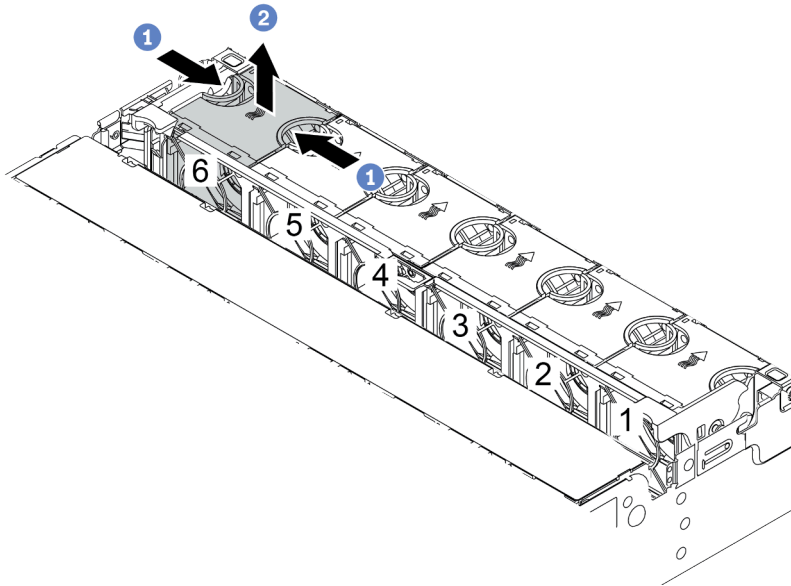
Figure 347. System fan removal

   a. Grasp the top of the system fan with your fingers.

   b. Lift the system fan out of the server.

After you finish
1. Install a new system fan or install a fan filler to cover the place. See "Install a system fan" on page 424.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install a system fan

Use this information to install a system fan.

About this task

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S017

CAUTION:
Hazardous moving fan blades nearby. Keep fingers and other body parts away.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- When installing a hot-swap fan without powering off the server, do not touch the system fan cage. With power on, complete the replacement within 30 seconds to ensure proper operation.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- When there is only one processor installed, six system fans are needed if a middle drive cage, rear drive cage, or riser 3 is installed.

Procedure

Step 1. Touch the static-protective package that contains the new system fan to any unpainted surface on the outside of the server. Then, take the new system fan out of the package and place it on a static-protective surface.

Step 2. Position the system fan above the system fan cage. The system fan connector on the bottom of the system fan should face the rear of the chassis. Press the system fan straight down until it is seated into place.
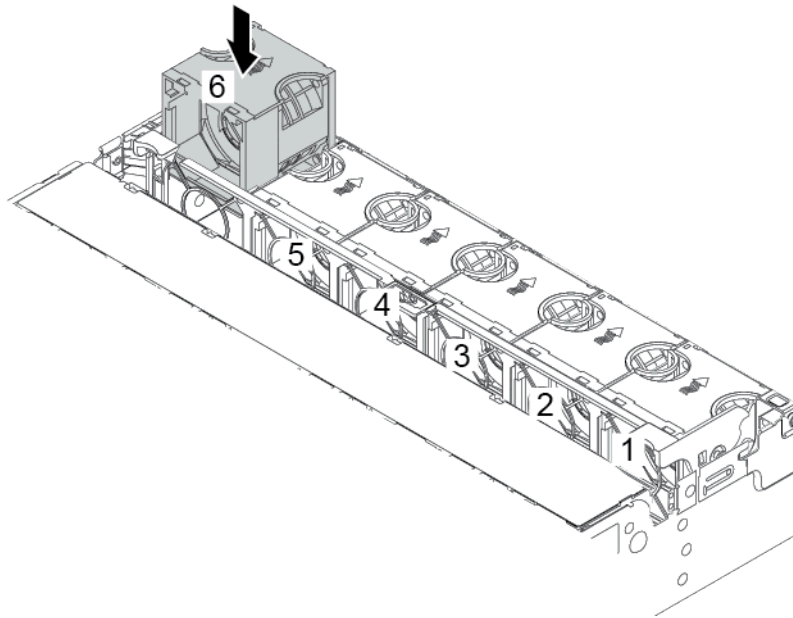
Figure 348. System fan installation

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

System fan cage replacement

Use this information to remove and install the system fan cage.

-
-

Remove the system fan cage

Use this information to remove the system fan cage.

About this task

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. (Optional) If you are replacing the system fan cage, remove all system fans first. See "Remove a system fan" on page 422.If you are removing the system fan cage to access other components, you can remove it with the system fans installed.

Step 3. Remove the system fan cage.
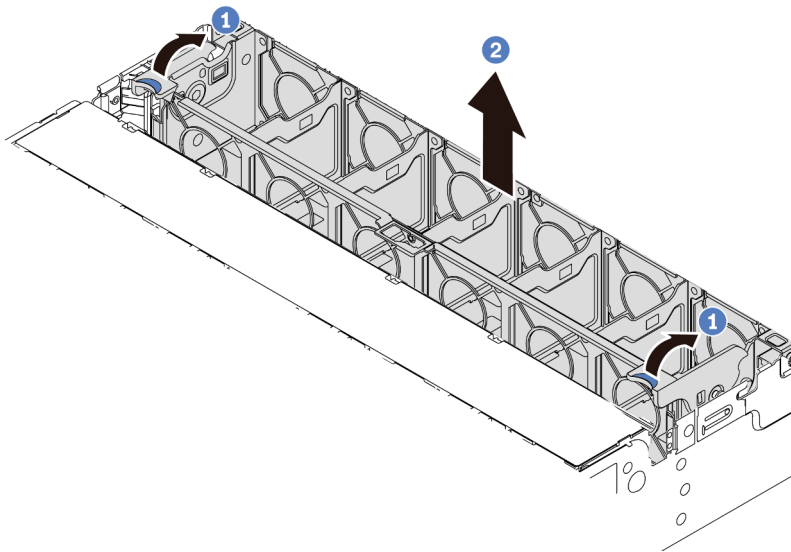
Figure 349. System fan cage removal

a. Rotate the levers of the system fan cage to the rear of the server.

b. Lift the system fan cage straight up and out of the chassis.

After you finish

If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Demo video

Watch the procedure on YouTube

Install the system fan cage

Use this information to install the system fan cage.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Figure 350. System fan cage installation

Step 1. Align the system fan cage with the mounting guides on both sides of chassis, and lower it into the chassis.

Step 2. Rotate the fan cage levers down until the fan cage clicks into place.

> **Note:** If there are system fans installed in the system fan cage, ensure that the system fans are correctly connected to the system fan connectors on the system board.

After you finish

1. If you have removed the system fans, reinstall them. See "Install a system fan" on page 424.
2. Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Serial port module replacement

Use this information to remove and install a serial port module.

Remove a serial port module

Use this information to remove a serial port module.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Note: The riser bracket in below illustrations might look different from your riser bracket.

Step 1. Remove the top cover. See "Remove the top cover" on page 435.

Step 2. Disconnect the cable of the serial port module from the system board.

> **Notes:**
> - If you need to disconnect cables from the system board, disengage all latches or release tabs on cable connectors first. Failing to release the tab before removing the cables will damage the cable sockets on the system board. Any damage to the cable sockets might require replacing the system board.
> - The connectors on your system board might look different from those in the illustration, but the removal procedure is the same.
>   1. Press the release tab to release the connector.
>   2. Disengage the connector from the cable socket.

Figure 351. Disconnecting the serial port cable

Step 3. Remove the riser bracket from the server.
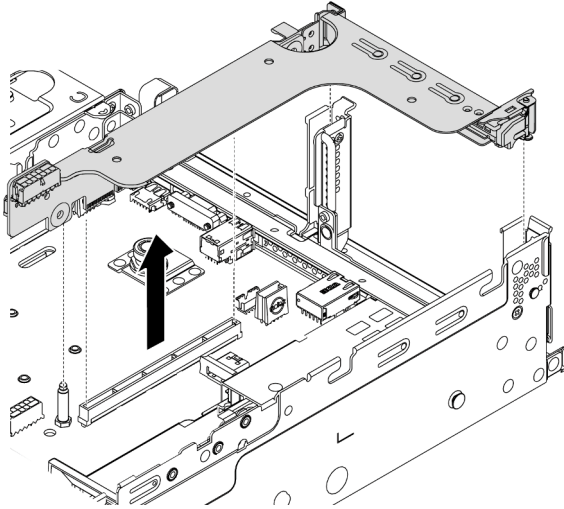
Figure 352. Removing the riser bracket

Step 4. Open the retention latch and remove the serial port module from the riser bracket.
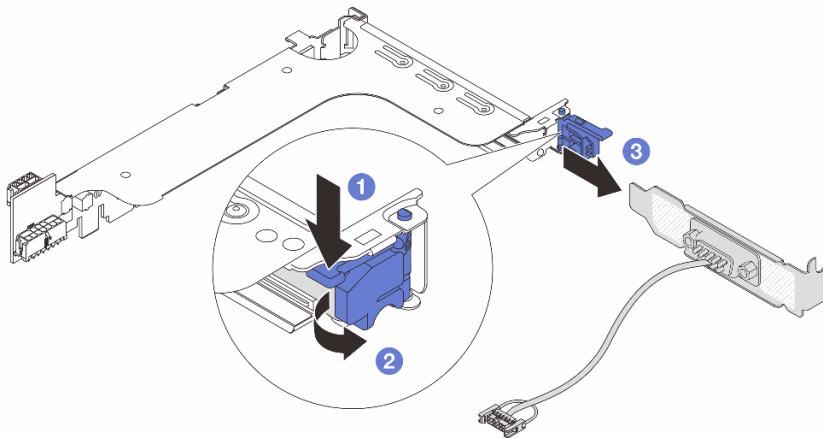
Figure 353. Removing the serial port module

Step 5. (Optional) If you need to replace the serial port bracket, use a 5 mm wrench to disassemble the serial port cable from the bracket.
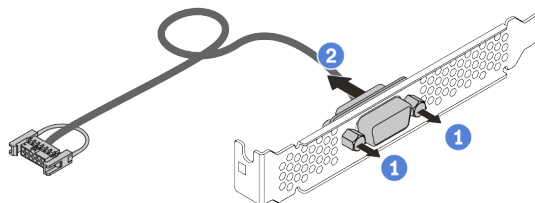
Figure 354. Disassembling the serial port module

After you finish

1. Install a new serial port module, a PCIe adapter, or a PCIe slot bracket to cover the place. See "Install a serial port module" on page 432 and "Install a PCIe adapter and riser assembly" on page 342.
2. If you are instructed to return the defective component, follow all packaging instructions and use any packaging materials that are provided.

Install a serial port module

Use this information to install a serial port module.

About this task

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
- Read the "PCIe slots and PCIe adapters" on page 256 to ensure that you install the serial port module to a correct PCIe slot.

Procedure

Note: The riser bracket in below illustrations might look different from your riser bracket.

Step 1.   Touch the static-protective package that contains the new component to any unpainted surface on the outside of the server. Then, take the component out of the package and place it on a static-protective surface.

Step 2.   Use a 5 mm wrench to install the serial port cable into the bracket.
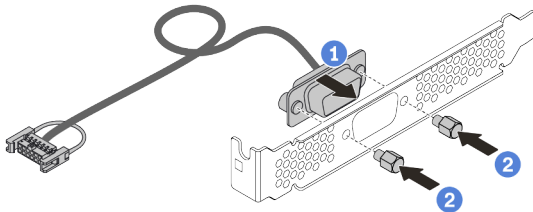
Figure 355. Assembling the serial port module

Step 3.   Install the serial port module to the riser bracket.
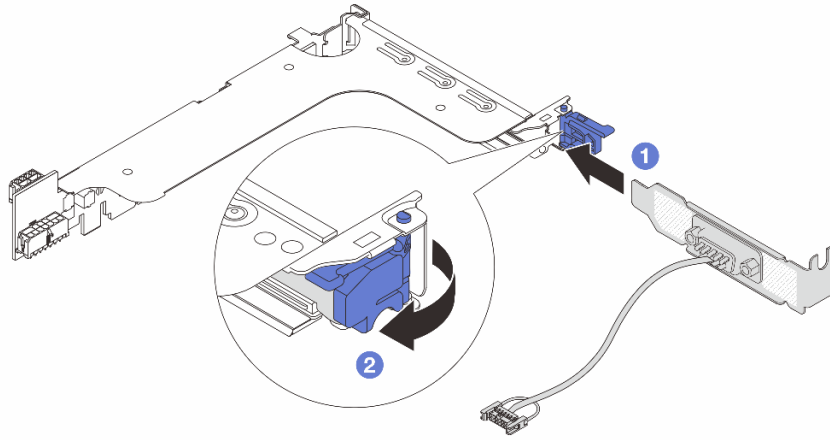
Figure 356. Installing the serial port module

Step 4. Install the riser assembly back to the server.
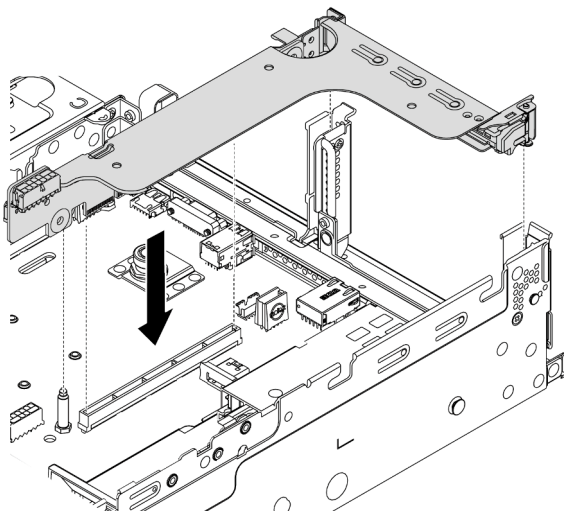
Figure 357. Installing the riser assembly

Step 5. Connect the cable of the serial port module to the serial-port-module connector on the system board. For the location of the serial-port-module connector, refer to "System board components" on page 51.

After you finish

1. Complete the parts replacement. See "Complete the parts replacement" on page 440.
2. To enable the serial port module, do one of the following according to the installed operating system:
   - For Linux operating system:

     Open the ipmitool and enter the following command to disable the Serial over LAN (SOL) feature:

     `-I lanplus -H IP -U USERID -P PASSWORD sol deactivate`
   - For Microsoft Windows operating system:
     a. Open the ipmitool and enter the following command to disable the SOL feature:

```
-I lanplus -H IP -U USERID -P PASSWORD sol deactivate
```
b. Open Windows PowerShell and enter the following command to disable the Emergency Management Services (EMS) feature:

```
Bcdedit /ems no
```
c. Restart the server to ensure that the EMS setting takes effect.

Top cover replacement

Use this information to remove and install the top cover.

-
-

Remove the top cover

Use this information to remove the top cover.

About this task

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S014

CAUTION:
Hazardous voltage, current, and energy levels might be present. Only a qualified service technician is authorized to remove the covers where the label is attached.

Attention:
- Read to ensure that you work safely.
- Power off the server and disconnect all power cords for this task.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.
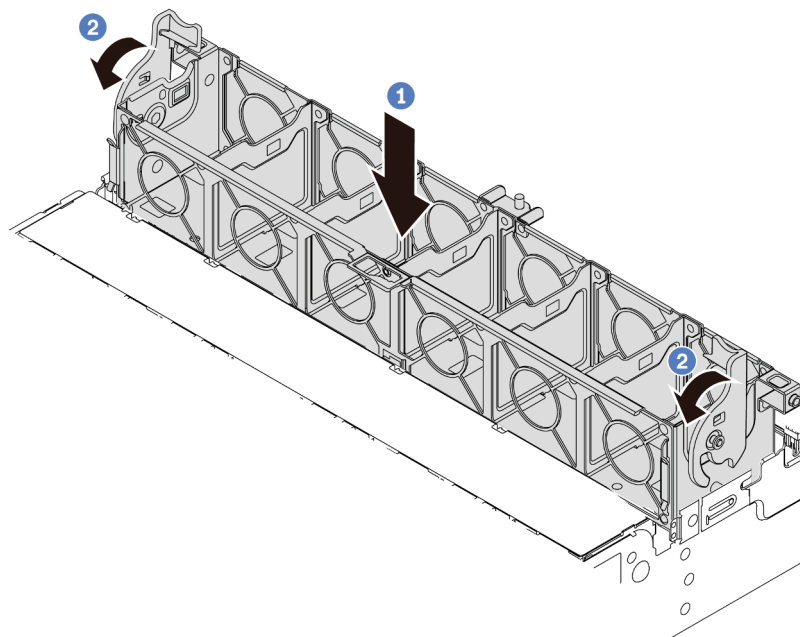
Procedure

Step 1. If the server is installed in a rack, remove the server from the rack. See the Rack Installation Guide that comes with the rail kit for your server.

Step 2. Remove the top cover.

> **Attention:** Handle the top cover carefully. Dropping the top cover with the cover latch open might damage the cover latch.
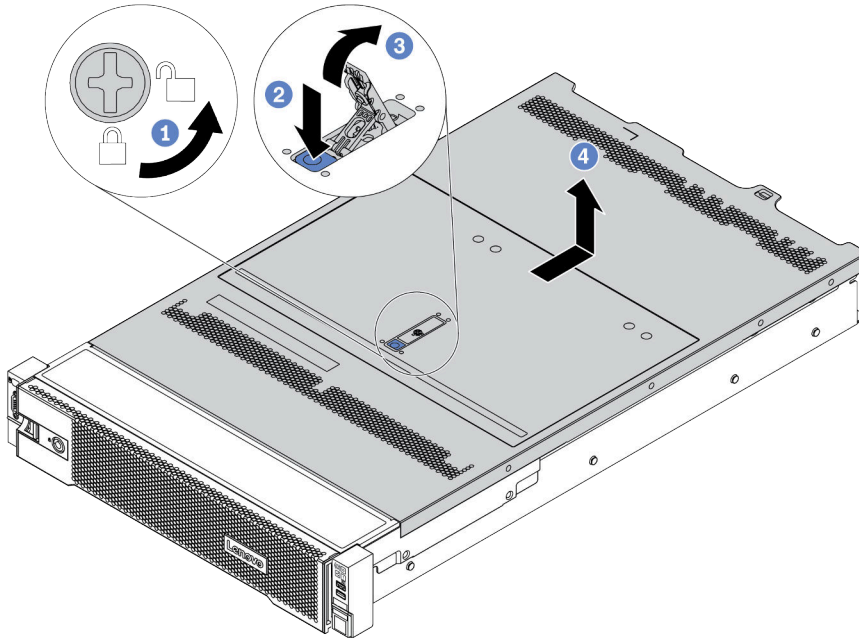
Figure 358. Top cover removal

a. Use a screwdriver to turn the cover lock to the unlocked position as shown.

b. Press the release button on the cover latch. The cover latch then gets released to some extent.

c. Fully open the cover latch as shown.

d. Slide the top cover to the rear until it is disengaged from the chassis. Then, lift the top cover off the chassis and place the top cover on a flat clean surface.

Demo video

[Watch the procedure on YouTube](#)

Install the top cover

Use this information to install the top cover.

About this task

Operating the server with the top cover removed might damage server components. For proper cooling and airflow, install the top cover before you turn on the server.

S033

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in spattered metal, burns, or both.

S014

CAUTION:
Hazardous voltage, current, and energy levels might be present. Only a qualified service technician is authorized to remove the covers where the label is attached.

Attention:
- Read "Installation Guidelines" on page 237 to ensure that you work safely.
- Prevent exposure to static electricity, which might lead to system halt and loss of data, by keeping static-sensitive components in their static-protective packages until installation, and handling these devices with an electrostatic-discharge wrist strap or other grounding system.

Procedure

Step 1. Check your server and ensure that:
- All components are installed and seated correctly.
- All internal cables are connected and routed correctly. See Chapter 3 "Internal cable routing" on page 67.
- No tools or loose screws are left inside your server.

Step 2. A new top cover comes without sponges by default. If the old top cover is installed with sponges, remove the sponges from the old top cover and attach them to the new top cover.

Figure 359. Remove the sponges from the old top cover

Figure 360. Attach the sponges to the new top cover
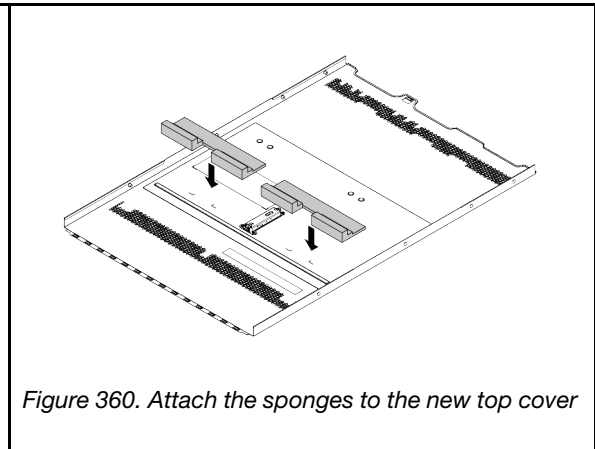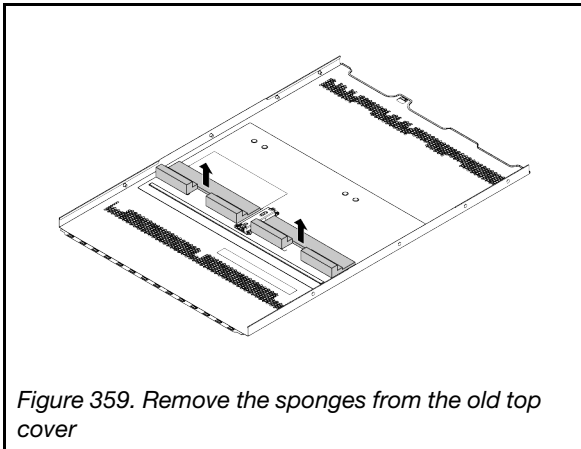
Step 3. Install the top cover to your server.

Attention: Handle the top cover carefully. Dropping the top cover with the cover latch open might damage the cover latch.
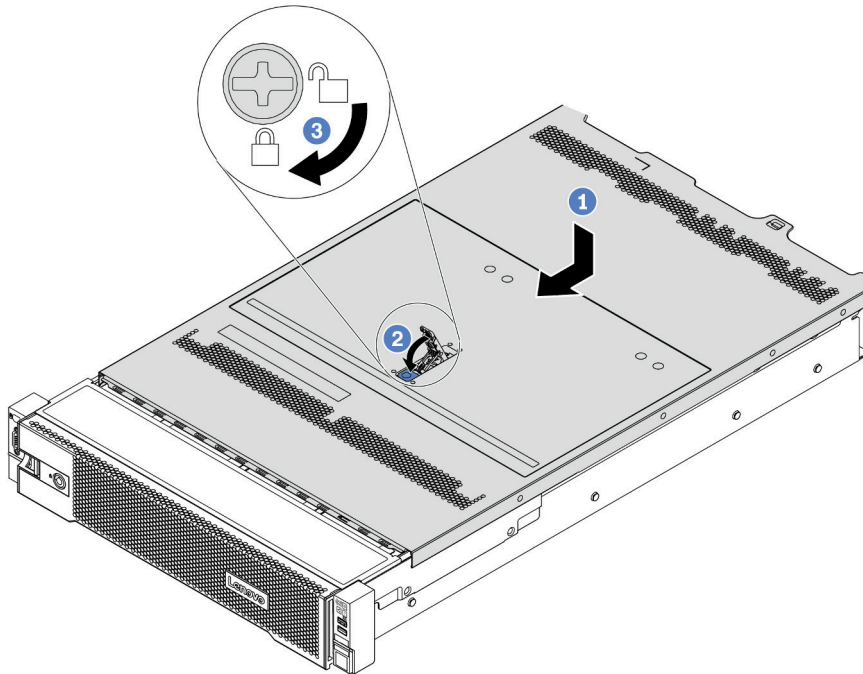
Figure 361. Top cover installation

a. Ensure that the cover latch is in the open position. Lower the top cover onto the chassis until both sides of the top cover engage the guides on both sides of the chassis. Then, slide the top cover to the front of the chassis.

   Note: Before you slide the top cover forward, ensure that all the tabs on the top cover engage the chassis correctly.

b. Rotate the cover latch until the top cover snaps into position. Ensure that the cover latch is completely closed.

c. Use a screwdriver to turn the cover lock to the locked position.

After you finish

Complete the parts replacement. See "Complete the parts replacement" on page 440.

Demo video

Watch the procedure on YouTube

Complete the parts replacement

Use this information to complete the parts replacement.

To complete the parts replacement, do the following:
1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your server.
2. Properly route and secure the cables in the server. See Chapter 3 "Internal cable routing" on page 67.
3. If you have removed the top cover, reinstall it. See "Install the top cover" on page 437.
4. Reconnect external cables and power cords to the server.

   Attention: To avoid component damage, connect the power cords last.
5. Update the server configuration if necessary.
   - Download and install the latest device drivers: http://datacentersupport.lenovo.com
   - Update the system firmware. See "Firmware updates" on page 10.
   - Configure RAID if you have installed or removed a hot-swap drive, a RAID adapter, or the M.2 backplane and M.2 drive. See Lenovo XClarity Provisioning Manager User Guide, which is available for download at:
     https://pubs.lenovo.com/lxpm-overview/

Chapter 5. Problem determination

Use the information in this section to isolate and resolve issues that you might encounter while using your server.

Lenovo servers can be configured to automatically notify Lenovo Support if certain events are generated. You can configure automatic notification, also known as Call Home, from management applications, such as the Lenovo XClarity Administrator. If you configure automatic problem notification, Lenovo Support is automatically alerted whenever a server encounters a potentially significant event.

To isolate a problem, you should typically begin with the event log of the application that is managing the server:
- If you are managing the server from the Lenovo XClarity Administrator, begin with the Lenovo XClarity Administrator event log.
- If you are using some other management application, begin with the Lenovo XClarity Controller event log.

Event logs

An *alert* is a message or other indication that signals an event or an impending event. Alerts are generated by the Lenovo XClarity Controller or by UEFI in the servers. These alerts are stored in the Lenovo XClarity Controller Event Log. If the server is managed by the Lenovo XClarity Administrator, alerts are automatically forwarded to the management application.

Note: For a listing of events, including user actions that might need to be performed to recover from an event, see the *Messages and Codes Reference*, which is available at:
https://pubs.lenovo.com/sr650-v2/pdf_files.html

Lenovo XClarity Controller event log

The Lenovo XClarity Controller monitors the physical state of the server and its components using sensors that measure internal physical variables such as temperature, power-supply voltages, fan speeds, and component status. The Lenovo XClarity Controller provides various interfaces to systems management software and to system administrators and users to enable remote management and control of a server.

The Lenovo XClarity Controller monitors all components of the server and posts events in the Lenovo XClarity Controller event log.
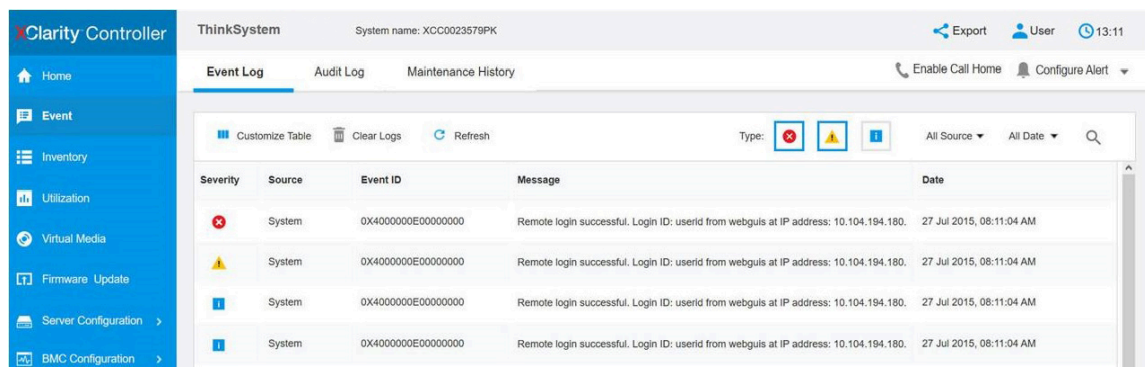
Figure 362. Lenovo XClarity Controller event log

For more information about accessing the Lenovo XClarity Controller event log, see:

"Viewing Event Logs" section in the XCC documentation compatible with your server at https://pubs.lenovo.com/lxcc-overview/.

Lenovo XClarity Administrator event log

If you are using Lenovo XClarity Administrator to manage server, network, and storage hardware, you can view the events from all managed devices through the XClarity Administrator.

Figure 363. Lenovo XClarity Administrator event log

For more information about working with events from XClarity Administrator, see:

http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/events_vieweventlog.html

Light path diagnostics

Light path diagnostics is a system of LEDs on various external and internal components of the server that leads you to the failed component. When an error occurs, LEDs are lit on the front I/O module, the rear panel, the system board, and the failed component. By viewing the following LEDs, you can often identify the system and device status and diagnose problems.

- "Front I/O module" on page 27
- "Integrated diagnostics panel" on page 29
- "Rear view LEDs" on page 50
- "System board LEDs" on page 54

General problem determination procedures

Use the information in this section to resolve problems if the event log does not contain specific errors or the server is inoperative.

If you are not sure about the cause of a problem and the power supplies are working correctly, complete the following steps to attempt to resolve the problem:

1. Power off the server.
2. Make sure that the server is cabled correctly.
3. Remove or disconnect the following devices if applicable, one at a time, until you find the failure. Power on and configure the server each time you remove or disconnect a device.
   - Any external devices.
   - Surge-suppressor device (on the server).
   - Printer, mouse, and non-Lenovo devices.
   - Each adapter.
   - Hard disk drives.
   - Memory modules until you reach the minimum configuration that is supported for the server.

     See "Technical specifications" on page 3 to determine the minimum configuration for your server.
4. Power on the server.

If the problem is solved when you remove an adapter from the server, but the problem recurs when you install the same adapter again, suspect the adapter. If the problem recurs when you replace the adapter with a different one, try a different PCIe slot.

If the problem appears to be a networking problem and the server passes all system tests, suspect a network cabling problem that is external to the server.

Resolving suspected power problems

Power problems can be difficult to solve. For example, a short circuit can exist anywhere on any of the power distribution buses. Usually, a short circuit will cause the power subsystem to shut down because of an overcurrent condition.

Complete the following steps to diagnose and resolve a suspected power problem.

Step 1.   Check the event log and resolve any errors related to the power.

       Note: Start with the event log of the application that is managing the server.

Step 2.   Check for short circuits, for example, if a loose screw is causing a short circuit on a circuit board.

Step 3.   Remove the adapters and disconnect the cables and power cords to all internal and external devices until the server is at the minimum configuration that is required for the server to start. See "Specifications" on page 2 to determine the minimum configuration for your server.

Step 4.   Reconnect all ac power cords and turn on the server. If the server starts successfully, reseat the adapters and devices one at a time until the problem is isolated.

If the server does not start from the minimum configuration, replace the components in the minimum configuration one at a time until the problem is isolated.

Resolving suspected Ethernet controller problems

The method that you use to test the Ethernet controller depends on which operating system you are using. See the operating-system documentation for information about Ethernet controllers, and see the Ethernet controller device-driver readme file.

Complete the following steps to attempt to resolve suspected problems with the Ethernet controller.

Step 1. Make sure that the correct device drivers, which come with the server are installed and that they are at the latest level.

Step 2. Make sure that the Ethernet cable is installed correctly.
- The cable must be securely attached at all connections. If the cable is attached but the problem remains, try a different cable.
- Make sure that the cable rating is applicable for the network speed selected. For example, an SFP+ cable is only suitable for 10G operation. An SFP25 cable is needed for 25G operation. Likewise for Base-T operation, a CAT5 cable is required for 1G Base-T operation while a CAT6 cable is required for 10G Base-T operation.

Step 3. Set both the adapter port and the switch port to auto-negotiation. If auto-negotiation is not supported on one of the ports, try configuring both ports manually to match each other.

Step 4. Check the Ethernet controller LEDs on the server. These LEDs indicate whether there is a problem with the connector, cable, or hub.

Although some adapters may vary, when installed vertically the adapter link LED is typically on the left of the port and the activity LED is typically on the right.

- The Ethernet link status LED is lit when the Ethernet controller receives a link indication from the switch. If the LED is off, there might be a defective connector or cable or a problem with the switch.

- The Ethernet transmit/receive activity LED is lit when the Ethernet controller sends or receives data over the Ethernet network. If the Ethernet transmit/receive activity is off, make sure that the hub and network are operating and that the correct device drivers are installed.

Step 5. Check the network activity LED on the rear of the server. The network activity LED is lit when data is active on the Ethernet network. If the network activity LED is off, make sure that the hub and network are operating and that the correct device drivers are installed.

Step 6. Check for operating-system-specific causes of the problem, and also make sure that the operating system drivers are installed correctly.

Step 7. Make sure that the device drivers on the client and server are using the same protocol.

If the Ethernet controller still cannot connect to the network but the hardware appears to be working, the network administrator must investigate other possible causes of the error.

Troubleshooting by symptom

Use this information to find solutions to problems that have identifiable symptoms.

To use the symptom-based troubleshooting information in this section, complete the following steps:
1. Check the event log of Lenovo XClarity Controller and follow the suggested actions to resolve any event codes.

   For more information about event logs, see "Event logs" on page 441)
2. Review this section to find the symptoms that you are experiencing and follow the suggested actions to resolve the issue.
3. If the problem persists, contact support (see "Contacting Support" on page 477).

Power on and power off problems

Use this information to resolve issues when powering on or powering off the server.

- "Embedded hypervisor is not in the boot list" on page 448
- "Server does not power on (no indication that input power is connected to the server)" on page 448
- "The power button does not work (server does not start)" on page 448
- "Server does not power off" on page 449

Embedded hypervisor is not in the boot list

Complete the following steps until the problem is solved.
1. Check https://serverproven.lenovo.com/ to validate that the embedded hypervisor device is supported for the server.
2. If the server has been installed, moved, or serviced recently, or if this is the first time the embedded hypervisor is being used, make sure that the device is connected properly and that there is no physical damage to the connectors.
3. Make sure that the embedded hypervisor device is listed in the list of available boot options. From the management controller user interface, click **Server Configuration ➙ Boot Options**.

   For information about accessing the management controller user interface, see:

   "Accessing the XClarity Controller web interface" section in the XCC documentation compatible with your server at https://pubs.lenovo.com/lxcc-overview/.
4. See the documentation that comes with the optional embedded hypervisor flash device to validate that the device is configured correctly.
5. Check http://datacentersupport.lenovo.com for any tech tips (service bulletins) related to the embedded hypervisor and the server.
6. Make sure that other software works on the server to ensure that it is working properly.

Server does not power on (no indication that input power is connected to the server)

Complete the following steps until the problem is resolved:
1. Check the event log for any events related to the server not powering on.
2. Check for any LEDs that are flashing amber.
3. Check the power LED on the front operator panel.
4. Check the front operator panel LCD display for error indications.
5. Check the power supply LEDs and ensure that the power supplies are functioning:
   a. Make sure that both power supplies installed in the server are of the same type. Mixing different power supplies in the server will cause a system error.
   b. Make sure that the power cords are correctly connected to a working electrical outlet. The power source meets the input power requirements for the installed power supplies (see the power supply labels).
   c. Disconnect and reconnect the input power cords.
   d. Reseat the power supplies.
   e. Replace the power supplies one by one, and check the power button function after installing each one.
6. If the problem still cannot be resolved, please collect the failure information with system logs captured to Lenovo support.

The power button does not work (server does not start)

Note: The power button will not function until approximately 1 to 3 minutes after the server has been connected to ac power to allow time for BMC to initialize.

Complete the following steps until the problem is resolved:
1. Verify that input power is applied to the server and that the power supplies are functioning. See "Server does not power on (no indication that input power is connected to the server)" on page 448.

2. If you just installed an optional device, remove it, and restart the server. If the server starts, you might have installed more devices than the power supply supports.
3. Make sure that:
   - The type of memory that is installed is correct.
   - The processors are installed in the correct sequence.
   - The minimum number of DIMMs are installed and functional for your processor configuration.
4. Make sure that the power button on the server is working correctly:

   Reseat the operator information panel cable. If the problem remains, replace the operator information panel.
5. If the problem still cannot be resolved, please collect the failure information with system logs captured to Lenovo support.

Server does not power off

Complete the following steps until the problem is resolved:
1. Determine whether you are using an Advanced Configuration and Power Interface (ACPI) or a non-ACPI operating system. If you are using a non-ACPI operating system, complete the following steps:
   a. Press `Ctrl+Alt+Delete`.
   b. Turn off the server by pressing the power button and holding it down for 5 seconds.
   c. Restart the server.
   d. If the server fails POST and the power button does not work, disconnect the power cord for 20 seconds; then, reconnect the power cord and restart the server.
2. If the problem remains or if you are using an ACPI-aware operating system, suspect the system board.

Memory problems

See this section to resolve issues related to memory.

-
-
-
-
-
-
-
-
-

Displayed system memory is less than installed physical memory

Complete the following procedure to solve the problem:

Note: Each time you install or remove a memory module, you must disconnect the server from the power source; then, wait 10 seconds before restarting the server.

1. Make sure that:
   - No error LEDs are lit on the operator information panel.
   - No memory module error LEDs are lit on the system board.
   - Memory mirrored channel does not account for the discrepancy.
   - The memory modules are seated correctly.
   - You have installed the correct type of memory module (see "PMEM rules" in *Setup Guide* for requirements).
   - After changing or replacing a memory module, memory configuration is updated accordingly in the Setup Utility.

- All banks of memory are enabled. The server might have automatically disabled a memory bank when it detected a problem, or a memory bank might have been manually disabled.
- There is no memory mismatch when the server is at the minimum memory configuration.
- When PMEMs are installed:
  a. Refer to "PMEM rules" in *Setup Guide* and see if the displayed memory fits the mode description.
  b. If the memory is set in App Direct Mode, ensure that all the saved data have been backed up, and created namespaces are deleted before any PMEM is replaced or added.
  c. If PMEMs are recently set in Memory Mode, turn it back to App Direct Mode and examine if there is namespace that has not been deleted.
  d. Go to the Setup Utility, select **System Configuration and Boot Management → Intel Optane PMEMs → Security**, and make sure security of all the PMEM units is disabled.
2. Reseat the memory modules, and then restart the server.
3. Check the POST error log:
   - If a memory module was disabled by a systems-management interrupt (SMI), replace the memory module.
   - If a memory module was disabled by the user or by POST, reseat the memory module; then, run the Setup utility and enable the memory module.
4. Run memory diagnostics. When you start a solution and press the key according to the on-screen instructions, the LXPM interface is displayed by default. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) You can perform memory diagnostics with this interface. From the Diagnostic page, go to **Run Diagnostic → Memory test** or **PMEM test**.

   Notes: When PMEMs are installed, run diagnostics based on the mode that is set presently:
   - App Direct Mode:

     – Run Memory Test for DRAM memory modules.
     – Run PMEM Test for PMEMs.
   - Memory Mode:

     Run both Memory Test and PMEM Test for PMEMs.
5. Reverse the modules between the channels (of the same processor), and then restart the server. If the problem is related to a memory module, replace the failing memory module.

   Note: When PMEMs are installed, only adopt this method in Memory Mode.
6. Re-enable all memory modules using the Setup utility, and then restart the server.
7. (Trained technician only) Install the failing memory module into a memory module connector for processor 2 (if installed) to verify that the problem is not the processor or the memory module connector.
8. (Trained technician only) Replace the system board.

Multiple memory modules in a channel identified as failing

Note: Each time you install or remove a memory module, you must disconnect the server from the power source; then, wait 10 seconds before restarting the server.

Complete the following procedure to solve the problem:
1. Reseat the memory modules; then, restart the server.
2. Remove the highest-numbered memory module of those that are identified and replace it with an identical known good memory module; then, restart the server. Repeat as necessary. If the failures continue after all identified memory modules are replaced, go to step 4.
3. Return the removed memory modules, one at a time, to their original connectors, restarting the server after each memory module, until a memory module fails. Replace each failing memory module with an identical known good memory module, restarting the server after each memory module replacement. Repeat step 3 until you have tested all removed memory modules.
4. Replace the highest-numbered memory module of those identified; then, restart the server. Repeat as necessary.

5. Reverse the memory modules between the channels (of the same processor), and then restart the server. If the problem is related to a memory module, replace the failing memory module.
6. (Trained technician only) Install the failing memory module into a memory module connector for processor 2 (if installed) to verify that the problem is not the processor or the memory module connector.
7. (Trained technician only) Replace the system board.

Attempt to change to another PMEM mode fails

After the PMEM mode is changed and the system is successfully restarted, if the PMEM mode stays the same instead of being changed, check the DRAM DIMMs and PMEM capacity to see if it meets the requirement of the new mode (see "PMEM rules" in *Setup Guide*).

Extra namespace appears in an interleaved region

If there are two created namespaces in one interleaved region, VMware ESXi ignores the created namespaces and creates an extra new namespace during system booting. Delete the created namespaces in either the Setup Utility or the operating system before the first booting with ESXi.

Migrated PMEMs are not supported

If this warning message appears, complete the following steps:

```
Intel Optane PMEM interleave set (DIMM X) is migrated from another system (Platform ID: 0x00). These migrated PMEMs are not supported nor warranted in this system.
```

1. Move the modules back to the original system with the exact same configuration as the previous one.
2. Back up stored data in PMEM namespaces.
3. Disable PMEM security with one of the following options:
   - **Lenovo XClarity Provisioning Manager**

     Go to **UEFI Setup ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.
   - **Setup Utility**

     Go to **System Configuration and Boot Management ➙ System Settings ➙ Intel Optane PMEMs ➙ Security ➙ Press to Disable Security**, and input passphrase to disable security.
4. Delete namespaces with command corresponding to the operating system that is installed:
   - **Linux** command:

     ```
     ndctl destroy-namespace all -f
     ```
   - **Windows** Powershell command

     ```
     Get-PmemDisk | Remove-PmemDisk
     ```
5. Clear Platform Configuration Data (PCD) and Namespace Label Storage Area (LSA) with the following ipmctl command (for both Linux and Windows).

   ```
   ipmctl delete -pcd
   ```

   Notes: See the following links to learn how to download and use impctl in different operating systems:
   - Windows: https://datacentersupport.lenovo.com/us/en/videos/YTV101407
   - Linux: https://datacentersupport.lenovo.com/us/en/solutions/HT508642
6. Reboot the system, and press the key according to the on-screen instructions to enter Setup Utility. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.)
7. Power off the system.
8. Remove the modules to be reused for a new system or configuration.

Invalid memory population detected

```
Invalid memory population (unsupported DIMM population) detected. Please verify memory configuration is valid.
```

If this warning message appears, complete the following steps:

1. See "Memory module installation rules and order" in *Setup Guide* to make sure the present memory module population sequence is supported.
2. If the present sequence is indeed supported, see if any of the modules is displayed as "disabled" in Setup Utility.
3. Reseat the module that is displayed as "disabled," and reboot the system.
4. If the problem persists, replace the memory module that is displayed as "disabled."

PMEMs installed in wrong slots after system board replacement

```
DIMM X of Intel Optane PMEM persistent interleave set should be moved to DIMM Y.
```

If this warning message appears, complete the following steps:
1. Record each of the instructions of changing PMEM slot from XCC events.
2. Power off the system, and remove the PMEMs that are mentioned in the warning messages. It is suggested to label these PMEMs to avoid confusion.
3. Install the PMEMs in the correct slot number indicated in the warning messages. Remove the labels to avoid blocking airflow and cooling.
4. Complete replacement and power on the system. Make sure there is no similar warning messages in XCC.

Note: Do not perform any provisioning on PMEM to avoid data lost when the messages are still present in XCC events.

After PMEMs are reconfigured, error messages and LEDs persist to indicate PMEMs are installed in wrong slots

AC the system or restart XCC to solve this problem.

Cannot create goal successfully when installing PMEMs to the system for the first time

When seeing ones of the following messages:
• ERROR: Cannot retrieve memory resources info
• ERROR: One or more PMEM modules do not have PCD data. A platform reboot is recommended to restore valid PCD data.
Complete the following steps to solve the problem.

1. If the PMEMs have been installed in another system with stored data, perform the following steps to erase the data.
   a. Based on the original population order, install the PMEMs to the original system where they were installed previously, and back up the data from the PMEMs to other storage devices.
   b. Disable PMEM security with one of the following options:
      • **Lenovo XClarity Provisioning Manager**

        Go to **UEFI Setup → System Settings → Intel Optane PMEMs → Security → Press to Disable Security**, and input passphrase to disable security.
      • **Setup Utility**

        Go to **System Configuration and Boot Management → System Settings → Intel Optane PMEMs → Security → Press to Disable Security**, and input passphrase to disable security.
   c. Delete namespaces with command corresponding to the operating system that is installed:
      • **Linux** command:

        ```
        ndctl destroy-namespace all -f
        ```
      • **Windows** Powershell command

        ```
        Get-PmemDisk | Remove-PmemDisk
        ```
   d. Clear Platform Configuration Data (PCD) and Namespace Label Storage Area (LSA) with the following ipmctl command (for both Linux and Windows).

        ```
        ipmctl delete -pcd
        ```

Notes: See the following links to learn how to download and use impctl in different operating systems:

- Windows: https://datacentersupport.lenovo.com/us/en/videos/YTV101407
- Linux: https://datacentersupport.lenovo.com/us/en/solutions/HT508642

2. Install the PMEMs back to the target system., and upgrade system firmware to the latest version without entering Setup Utility.
3. If the problem persists, overwrite PMEMs with the following ndctl command.

   `ndctl sanitize-dimm --overwrite all`
4. Monitor the overwrite status with the following command.

   `watch -n 1 "ipmctl show -d OverwriteStatus -dimm"`
5. When seeing all PMEM `OverwriteStatus=Completed`, reboot the system and see if the problem persists.

Hard disk drive problems

Use this information to resolve issues related to the hard disk drives.

Server cannot recognize a hard drive

Complete the following steps until the problem is solved.
1. Observe the associated yellow hard disk drive status LED. If the LED is lit, it indicates a drive fault.
2. If the status LED is lit, remove the drive from the bay, wait 45 seconds, and reinsert the drive, making sure that the drive assembly connects to the hard disk drive backplane.
3. Observe the associated green hard disk drive activity LED and the yellow status LED and perform corresponding operations in different situations:

   - If the green activity LED is flashing and the yellow status LED is not lit, the drive is recognized by the controller and is working correctly. Run the diagnostics tests for the hard disk drives. When you start a server and press the key according to the on-screen instructions, the LXPM is displayed by default. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic** ➔ **HDD test**.
   - If the green activity LED is flashing and the yellow status LED is flashing slowly, the drive is recognized by the controller and is rebuilding.
   - If neither LED is lit or flashing, check whether the hard disk drive backplane is correctly seated. For details, go to step 4.
   - If the green activity LED is flashing and the yellow status LED is lit, replace the drive. If the activity of the LEDs remains the same, go to step Hard disk drive problems. If the activity of the LEDs changes, return to step 1.
4. Make sure that the hard disk drive backplane is correctly seated. When it is correctly seated, the drive assemblies correctly connect to the backplane without bowing or causing movement of the backplane.
5. Reseat the backplane power cable and repeat steps 1 through 3.
6. Reseat the backplane signal cable and repeat steps 1 through 3.
7. Suspect the backplane signal cable or the backplane:
   - Replace the affected backplane signal cable.
   - Replace the affected backplane.

8. Run the diagnostics tests for the hard disk drives. When you start a server and press the key according to the on-screen instructions, the LXPM is displayed by default. You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → Disk Drive Test**.

Based on those tests:
- If the backplane passes the test but the drives are not recognized, replace the backplane signal cable and run the tests again.
- Replace the backplane.
- If the adapter fails the test, disconnect the backplane signal cable from the adapter and run the tests again.
- If the adapter fails the test, replace the adapter.

Multiple hard drives fail

Complete the following steps until the problem is solved:
- View the Lenovo XClarity Controller event log for events related to power supplies or vibration issues and resolve those events.
- Make sure that the device drivers and firmware for the hard disk drive and server are at the latest level

Important: Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.

Multiple hard drives are offline

Complete the following steps until the problem is solved:
- View the Lenovo XClarity Controller event log for events related to power supplies or vibration issues and resolve those events.
- View the storage subsystem log for events related to the storage subsystem and resolve those events.

One or two 7mm drives identified as failing

Complete the following steps until the problem is solved:
1. Remove and reinstall the reported drive(s) in the same drive bay or another drive bay.
2. If the problem persists, consider replacing the current drives with new ones.
3. If the problem still persists, consider replacing the bottom backplane.
4. If the problem still persists, consider replacing the top backplane.

A replacement hard disk drive does not rebuild

Complete the following steps until the problem is solved:
1. Make sure that the hard disk drive is recognized by the adapter (the green hard disk drive activity LED is flashing).
2. Review the SAS/SATA RAID adapter documentation to determine the correct configuration parameters and settings.

Green drive activity LED does not represent actual state of associated drive

Complete the following steps until the problem is solved:
1. If the green drive activity LED does not flash when the drive is in use, run the diagnostics tests for the hard disk drives. When you start a server and press F1, the Lenovo XClarity Provisioning Manager interface is displayed by default. You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → HDD test**
2. If the green hard disk drive activity LED does not flash when the drive is in use, run the diagnostics tests for the hard disk drives. When you start a server and press the key according to the on-screen instructions, the LXPM is displayed by default. You can perform hard drive diagnostics from this interface. From the Diagnostic page, click **Run Diagnostic → HDD test**
3. If the drive passes the test, replace the backplane.
4. If the drive fails the test, replace the drive.

Yellow drive activity LED does not represent actual state of associated drive

Complete the following steps until the problem is solved:
1. Turn off the server.
2. Reseat the SATA/SAS adapter.
3. Reseat the backplane signal cable and backplane power cable.
4. Reseat the drive.
5. Power on the server and observe the activity of the drive LEDs.

U.3 NVMe drive can be detected in NVMe connection, but cannot be detected in Tri-mode

In Tri-mode, NVMe drives are connected via a PCIe x1 link to the controller. To support Tri-mode with U.3 NVMe drives, **U.3 x1 mode** must be enabled for the selected drive slots on the backplane through the XCC Web GUI. By default, the backplane setting is **U.2 x4 mode**.

Complete the following steps to enable **U.3 x1 mode**:
1. Log into the XCC Web GUI, and choose **Storage ➙ Detail** from the navigation tree on the left.
2. In the window that is displayed, click the icon next to **Backplane**.
3. In the dialog box that is displayed, select the target drive slots and click **Apply**.
4. Do a DC power cycle to make the setting take effect.

Monitor and video problems

Use this information to solve problems related to a monitor or video.

- "Incorrect characters are displayed" on page 456
- "Screen is blank" on page 456
- "Management controller remote presence cannot work" on page 456
- "Screen goes blank when you start some application programs" on page 456
- "The monitor has screen jitter, or the screen image is wavy, unreadable, rolling, or distorted" on page 456
- "The wrong characters appear on the screen" on page 457

Incorrect characters are displayed

Complete the following steps:
1. Verify that the language and locality settings are correct for the keyboard and operating system.
2. If the wrong language is displayed, update the server firmware to the latest level. See "Firmware updates" on page 10.

Screen is blank

Note: Make sure that the expected boot mode has not been changed from the UEFI to Legacy or vice versa.
1. If the server is attached to a KVM switch, bypass the KVM switch to eliminate it as a possible cause of the problem: connect the monitor cable directly to the correct connector on the rear of the server.
2. If the server is installed with the graphical adapters while turning on the server, the Lenovo logo is displayed on the screen after approximately 3 minutes. This is normal operation while the system loads.
3. Make sure that:
   - The server is turned on and there is power supplied to the server.
   - The monitor cables are connected correctly.
   - The monitor is turned on and the brightness and contrast controls are adjusted correctly.
4. Make sure that the correct server is controlling the monitor, if applicable.
5. Make sure that the video output is not affected by corrupted server firmware; see "Firmware updates" on page 10.
6. If the problem remains, contact Lenovo Support.

Management controller remote presence cannot work

The management controller remote presence function is unable to display the system screen when an optional video adapter is present. To use the management controller remote presence function, remove the optional video adapter or use the onboard VGA as the display device. The management controller remote presence function is disabled if you install an optional video adapter.

Screen goes blank when you start some application programs

1. Make sure that:
   - The application program is not setting a display mode that is higher than the capability of the monitor.
   - You installed the necessary device drivers for the application.

The monitor has screen jitter, or the screen image is wavy, unreadable, rolling, or distorted

1. If the monitor self-tests show that the monitor is working correctly, consider the location of the monitor. Magnetic fields around other devices (such as transformers, appliances, fluorescents, and other monitors) can cause screen jitter or wavy, unreadable, rolling, or distorted screen images. If this happens, turn off the monitor.

   Attention: Moving a color monitor while it is turned on might cause screen discoloration.

   Move the device and the monitor at least 305 mm (12 in.) apart, and turn on the monitor.

   Notes:

a. To prevent diskette drive read/write errors, make sure that the distance between the monitor and any external diskette drive is at least 76 mm (3 in.).

b. Non-Lenovo monitor cables might cause unpredictable problems.

2. Reseat the monitor cable.

3. Replace the components listed in step 2 one at a time, in the order shown, restarting the server each time:

a. Monitor cable

b. Video adapter (if one is installed)

c. Monitor

d. (Trained technician only) System board.

The wrong characters appear on the screen

Complete the following steps until the problem is solved:

1. Verify that the language and locality settings are correct for the keyboard and operating system.

2. If the wrong language is displayed, update the server firmware to the latest level. See "Firmware updates" on page 10.

Keyboard, mouse, KVM switch or USB-device problems

Use this information to solve problems related to a keyboard, mouse, KVM switch or USB-device problems.

- "All or some keys on the keyboard do not work" on page 458
- "Mouse does not work" on page 458
- "KVM switch problems" on page 458
- "USB-device does not work" on page 458

All or some keys on the keyboard do not work

1. Make sure that:
   - The keyboard cable is securely connected.
   - The server and the monitor are turned on.
2. If you are using a USB keyboard, run the Setup utility and enable keyboardless operation.
3. If you are using a USB keyboard and it is connected to a USB hub, disconnect the keyboard from the hub and connect it directly to the server.
4. Replace the keyboard.

Mouse does not work

1. Make sure that:
   - The mouse cable is securely connected to the server.
   - The mouse device drivers are installed correctly.
   - The server and the monitor are turned on.
   - The mouse option is enabled in the Setup utility.
2. If you are using a USB mouse and it is connected to a USB hub, disconnect the mouse from the hub and connect it directly to the server.
3. Replace the mouse.

KVM switch problems

1. Make sure that the KVM switch is supported by your server.
2. Make sure that the KVM switch is powered on correctly.
3. If the keyboard, mouse or monitor can be operated normally with direct connection to the server, then replace the KVM switch.

USB-device does not work

1. Make sure that:
   - The correct USB device driver is installed.
   - The operating system supports USB devices.
2. Make sure that the USB configuration options are set correctly in system setup.

   Restart the server and press key according to the on-screen instructions to display the LXPM system setup interface. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) Then, click **System Settings ➙ Devices and I/O Ports ➙ USB Configuration**.
3. If you are using a USB hub, disconnect the USB device from the hub and connect it directly to the server.

Optional-device problems

Use this information to solve problems related to optional devices.

- "External USB device is not recognized" on page 459
- "PCIe adapter is not recognized or is not functioning" on page 459
- "Insufficient PCIe resources are detected." on page 459
- "A Lenovo optional device that was just installed does not work." on page 459

- "A Lenovo optional device that worked previously does not work now" on page 460

External USB device is not recognized

Complete the following steps until the problem is resolved:
1. Update the UEFI firmware to the latest version.
2. Make sure that the proper drivers are installed on the compute node. See the product documentation for the USB device for information about device drivers.
3. Use the Setup utility to make sure that the device is configured correctly.
4. If the USB device is plugged into a hub or the console breakout cable, unplug the device and plug it directly into the USB port on the front of the compute node.

PCIe adapter is not recognized or is not functioning

Complete the following steps until the problem is resolved:
1. Update the UEFI firmware to the latest version.
2. Check the event log and resolve any issues related to the device.
3. Validate that the device is supported for the server (see https://serverproven.lenovo.com/). Make sure that the firmware level on the device is at the latest supported level and update the firmware if applicable.
4. Make sure that the adapter is installed in a correct slot.
5. Make sure that the proper device drivers are installed for the device.
6. Resolve any resource conflicts if running legacy mode (UEFI). Check legacy ROM boot orders and modify the UEFI setting for MM config base.

   Note: Ensure that you modify the ROM boot order associated with the PCIe adapter to the first execution order.
7. Check http://datacentersupport.lenovo.com for any tech tips (also known as retain tips or service bulletins) that might be related to the adapter.
8. Ensure any adapter external connections are correct and that the connectors are not physically damaged.
9. Make sure that the PCIe adapter is installed with the supported operating system.

Insufficient PCIe resources are detected.

If you see an error message stating "Insufficient PCI Resources Detected," complete the following steps until the problem is resolved:
1. Press Enter to access System Setup Utility.
2. Select **System Settings ➙ Devices and I/O Ports ➙ MM Config Base**; then, modify the setting to increase the device resources. For example, modify 3 GB to 2 GB or modify 2 GB to 1 GB.
3. Save the settings and restart the system.
4. If the error recurs with the highest device resource setting (1GB), shutdown the system and remove some PCIe devices; then, power on the system.
5. If the reboot failed, repeat step 1 to step 4.
6. If the error recurs, press Enter to access System Setup Utility.
7. Select **System Settings ➙ Devices and I/O Ports ➙ PCI 64–Bit Resource Allocation**, then; modify the setting from **Auto** to **Enable**.
8. If the Boot Device does not support MMIO above 4GB for Legacy Boot, use UEFI Boot Mode or remove/ disable some PCIe devices.
9. DC cycle the system and ensure the system is enter UEFI boot menu or the operating system; then, capture the FFDC log.
10. Contact Lenovo technical support.

A Lenovo optional device that was just installed does not work.

1. Check the XCC event log for any events associated with the device.
2. Make sure that:
   - The device is supported for the server (see https://serverproven.lenovo.com/).

- You followed the installation instructions that came with the device and the device is installed correctly.
- You have not loosened any other installed devices or cables.
- You updated the configuration information in system setup. When you start a server and press the key according to the on-screen instructions to display the Setup Utility. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) Whenever memory or any other device is changed, you must update the configuration.

3. Reseat the cable connection and ensure that there is no physical damage to the cable.
4. Reseat the device that you have just installed.
5. Replace the device that you have just installed.

A Lenovo optional device that worked previously does not work now

1. Check the XCC event log for any events associated with the device.
2. Make sure that all of the cable connections for the device are secure.
3. If the device comes with test instructions, use those instructions to test the device.
4. Reseat the cable connection and check if any physical parts have been damaged, .
5. Replace the cable.
6. Reseat the failing device.
7. Replace the failing device.

Serial-device problems

Use this information to solve problems with serial ports or devices.

Number of displayed serial ports is less than the number of installed serial ports

Complete the following steps until the problem is solved.
1. Make sure that:
   - Each port is assigned a unique address in the Setup utility and none of the serial ports is disabled.
   - The serial-port adapter (if one is present) is seated correctly.
2. Reseat the serial port adapter.
3. Replace the serial port adapter.

Serial device does not work

1. Make sure that:
   - The device is compatible with the server.
   - The serial port is enabled and is assigned a unique address.
   - The device is connected to the correct connector.
2. Reseat the following components:
   a. Failing serial device.
   b. Serial cable.
3. Replace the following components:
   a. Failing serial device.
   b. Serial cable.
4. (Trained technician only) Replace the system board.

Intermittent problems

Use this information to solve intermittent problems.

- "Intermittent external device problems" on page 463
- "Intermittent KVM problems" on page 463
- "Intermittent unexpected reboots" on page 463

Intermittent external device problems

Complete the following steps until the problem is solved.
1. Update the UEFI and XCC firmware to the latest versions.
2. Make sure that the correct device drivers are installed. See the manufacturer's website for documentation.
3. For a USB device:
   a. Make sure that the device is configured correctly.

      Restart the server and press the key according to the on-screen instructions to display the LXPM system setup interface. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) Then, click **System Settings ➙ Devices and I/O Ports ➙ USB Configuration**.
   b. Connect the device to another port. If using a USB hub, remove the hub and connect the device directly to the compute node. Make sure that the device is configured correctly for the port.

Intermittent KVM problems

Complete the following steps until the problem is solved.

Video problems:
1. Make sure that all cables and the console breakout cable are properly connected and secure.
2. Make sure that the monitor is working properly by testing it on another compute node.
3. Test the console breakout cable on a working compute node to ensure that it is operating properly. Replace the console breakout cable if it is defective.

Keyboard problems:

Make sure that all cables and the console breakout cable are properly connected and secure.

Mouse problems:

Make sure that all cables and the console breakout cable are properly connected and secure.

Intermittent unexpected reboots

Note: Some uncorrectable errors require that the server reboot so that it can disable a device, such as a memory DIMM or a processor to allow the machine to boot up properly.
1. If the reset occurs during POST and the POST watchdog timer is enabled, make sure that sufficient time is allowed in the watchdog timeout value (POST Watchdog Timer).

   To check the POST watchdog time, restart the server and press the key according to the on-screen instructions to display the LXPM system setup interface. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https://pubs.lenovo.com/lxpm-overview/.) Then, click **BMC Settings ➙ POST Watchdog Timer**.
2. If the reset occurs after the operating system starts, enter the operating system when the system operates normally and set up operating system kernel dump process (Windows and Linux base operating systems will be using different method). Enter the UEFI setup menus and disable the feature, or disable it with the following OneCli command.

```
OneCli.exe config set SystemRecovery.RebootSystemOnNMI Disable --bmcxcc_userid PASSWORD@xcc_ipaddress
```

3. See the management controller event log to check for an event code that indicates a reboot. See "Event logs" on page 441 for information about viewing the event log. If you are using Linux base operating system, then capture all logs back to Lenovo support for further investigation.

Power problems

Use this information to resolve issues related to power.

System error LED is on and event log "Power supply has lost input" is displayed

To resolve the problem, ensure that:
1. The power supply is properly connected to a power cord.
2. The power cord is connected to a properly grounded electrical outlet for the server.
3. Make sure that the power supply AC source is stable within the supported range.
4. Swap the power supply to see if the issue follows the power supply, if it follows the power supply, then replace the failing one.
5. Review the event log and see how the problem it is to follow the event log actions to resolve the problems.

Network problems

Use this information to resolve issues related to networking.

- "Cannot wake server using Wake on LAN" on page 466
- "Could not log in using LDAP account with SSL enabled" on page 466

Cannot wake server using Wake on LAN

Complete the following steps until the problem is resolved:
1. If you are using the dual-port network adapter and the server is connected to the network using Ethernet 5 connector, check the system-error log or XCC system event log, make sure:
    a. Fan 3 is running in standby mode, if Emulex dual port 10GBase-T embedded adapter is installed.
    b. The room temperature is not too high (see "Specifications" on page 2).
    c. The air vents are not blocked.
    d. The air baffle is installed securely.
2. Reseat the dual-port network adapter.
3. Turn off the server and disconnect it from the power source; then, wait 10 seconds before restarting the server.
4. If the problem still remains, replace the dual-port network adapter.

Could not log in using LDAP account with SSL enabled

Complete the following steps until the problem is resolved:
1. Make sure that the license key is valid.
2. Generate a new license key and log in again.

Observable problems

Use this information to solve observable problems.

Server hangs during the UEFI boot process

If the system hangs during the UEFI boot process with the message `UEFI: DXE INIT` on the display, make sure that Option ROMs were not configured with a setting of **Legacy**. You can remotely view the current settings for Option ROMs by running the following command using the Lenovo XClarity Essentials OneCLI:

`onecli config show EnableDisableAdapterOptionROMSupport --bmc` *xcc_userid*`:`*xcc_password*`@`*xcc_ipaddress*

To recover a system that hangs during the boot process with Legacy Option ROM settings, see the following Tech Tip:

https://datacentersupport.lenovo.com/us/en/solutions/ht506118

If legacy Option ROMs must be used, do not set slot Option ROMs to **Legacy** on the Devices and I/O Ports menu. Instead, set slot Option ROMs to **Auto** (the default setting), and set the System Boot Mode to **Legacy Mode**. Legacy option ROMs will be invoked shortly before the system boots.

The server immediately displays the POST Event Viewer when it is turned on

Complete the following steps until the problem is solved.
1. Correct any errors that are indicated by the light path diagnostics LEDs.
2. Make sure that the server supports all the processors and that the processors match in speed and cache size.

   You can view processor details from system setup.

   To determine if the processor is supported for the server, see https://serverproven.lenovo.com/.
3. (Trained technician only) Make sure that processor 1 is seated correctly
4. (Trained technician only) Remove processor 2 and restart the server.
5. Replace the following components one at a time, in the order shown, restarting the server each time:
   a. (Trained technician only) Processor
   b. (Trained technician only) System board

Server is unresponsive (POST is complete and operating system is running)

Complete the following steps until the problem is solved.
- If you are in the same location as the compute node, complete the following steps:
    1. If you are using a KVM connection, make sure that the connection is operating correctly. Otherwise, make sure that the keyboard and mouse are operating correctly.
    2. If possible, log in to the compute node and verify that all applications are running (no applications are hung).
    3. Restart the compute node.
    4. If the problem remains, make sure that any new software has been installed and configured correctly.
    5. Contact your place of purchase of the software or your software provider.
- If you are accessing the compute node from a remote location, complete the following steps:
    1. Make sure that all applications are running (no applications are hung).
    2. Attempt to log out of the system and log back in.
    3. Validate the network access by pinging or running a trace route to the compute node from a command line.
        a. If you are unable to get a response during a ping test, attempt to ping another compute node in the enclosure to determine whether it is a connection problem or compute node problem.
        b. Run a trace route to determine where the connection breaks down. Attempt to resolve a connection issue with either the VPN or the point at which the connection breaks down.
    4. Restart the compute node remotely through the management interface.
    5. If the problem remains, verify that any new software has been installed and configured correctly.
    6. Contact your place of purchase of the software or your software provider.

Server is unresponsive (POST failed and cannot start System Setup)

Configuration changes, such as added devices or adapter firmware updates, and firmware or application code problems can cause the server to fail POST (the power-on self-test).

If this occurs, the server responds in either of the following ways:
- The server restarts automatically and attempts POST again.
- The server hangs, and you must manually restart the server for the server to attempt POST again.

After a specified number of consecutive attempts (automatic or manual), the server reverts to the default UEFI configuration and starts System Setup so that you can make the necessary corrections to the configuration and restart the server. If the server is unable to successfully complete POST with the default configuration, there might be a problem with the system board.

You can specify the number of consecutive restart attempts in System Setup. Restart the server and press the key according to the on-screen instructions to display the LXPM system setup interface. (For more information, see the "Startup" section in the LXPM documentation compatible with your server at https:// pubs.lenovo.com/lxpm-overview/.) Then, click **System Settings ➔ Recovery and RAS ➔ POST Attempts ➔ POST Attempts Limit**. Available options are 3, 6, 9, and disable.

If the issue cannot be resolved by the actions mentioned above, call the service team to review the issue symptom and confirm whether the system board replacement is necessary.

Voltage planar fault is displayed in the event log

Complete the following steps until the problem is solved.
1. Revert the system to the minimum configuration. See "Specifications" on page 2 for the minimally required number of processors and DIMMs.
2. Restart the system.
    - If the system restarts, add each of the removed items one at a time and restart the system each time until the error occurs. Replace the item for which the error occurs.
    - If the system does not restart, suspect the system board.

Unusual smell

Complete the following steps until the problem is solved.
1. An unusual smell might be coming from newly installed equipment.
2. If the problem remains, contact Lenovo Support.

Server seems to be running hot

Complete the following steps until the problem is solved.

Multiple compute nodes or chassis:
1. Make sure that the room temperature is within the specified range (see "Environmental specifications" on page 7).
2. Make sure that the fans are installed correctly.
3. Update the UEFI and XCC to the latest versions.
4. Make sure that the fillers in the server are installed correctly (see *Maintenance Manual* for detailed installation procedures).
5. Use the IPMI command to ramp up the fan speed to the full fan speed to see whether the issue can be resolved.

   Note: The IPMI raw command should only be used by trained technician and each system has its own specific PMI raw command.
6. Check the management processor event log for rising temperature events. If there are no events, the compute node is running within normal operating temperatures. Note that you can expect some variation in temperature.

Cracked parts or cracked chassis

Contact Lenovo Support.

Software problems

Use this information to solve software problems.

1. To determine whether the problem is caused by the software, make sure that:
   - The server has the minimum memory that is needed to use the software. For memory requirements, see the information that comes with the software.

     Note: If you have just installed an adapter or memory, the server might have a memory-address conflict.
   - The software is designed to operate on the server.
   - Other software works on the server.
   - The software works on another server.
2. If you receive any error messages while you use the software, see the information that comes with the software for a description of the messages and suggested solutions to the problem.
3. Check the operating system logs for any events related to your software and attempt to resolve them.
4. Contact your place of purchase of the software.

Appendix A. Hardware disassembling for recycle

Follow the instructions in this section to recycle components with compliance with local laws or regulations.
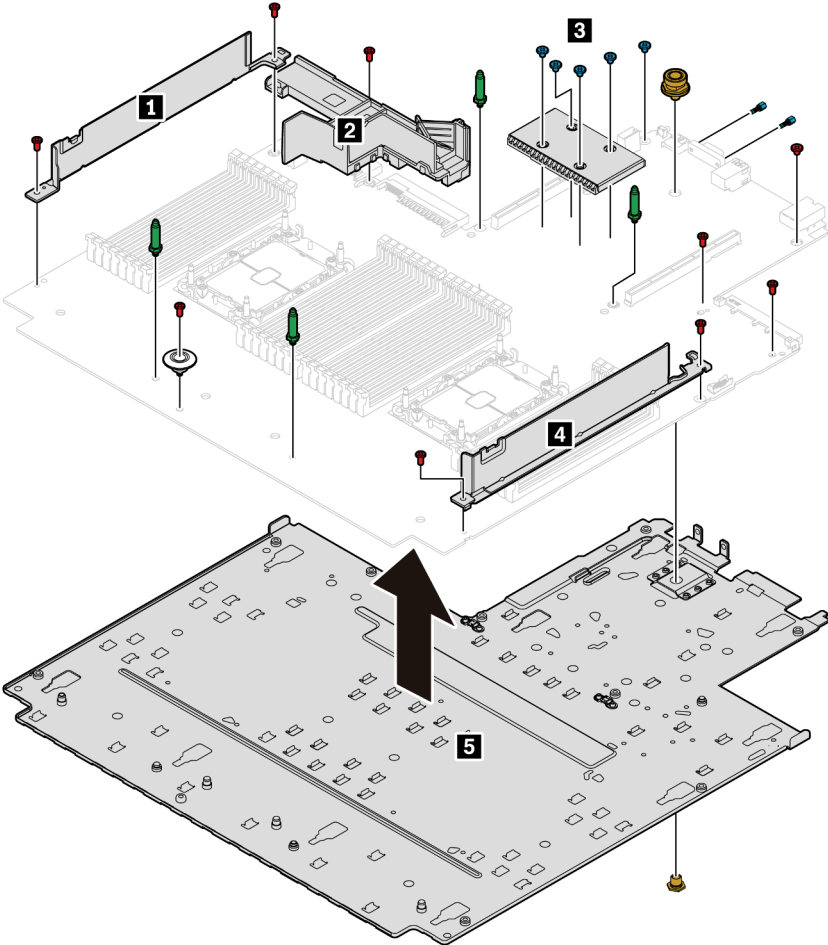
Disassembling the system board for recycle

Follow the instructions in this section to disassemble the system board before recycling.

About this task

Recycle the system board in compliance with local environmental, waste or disposal regulations.

Procedure

Screws	Qty.	Tools
	9	PH2 screwdriver
	5	PH1 screwdriver
	4	7 mm wrench
	2	5 mm wrench
	1	11 mm and 16 mm wrench

Note: The screws showed in the illustration are marked in colors for better to distinguish.

Figure 364. Disassembling the system board

Step 1. Remove the system board from the server (see).

Step 2. Remove the screws as illustrated and separate the components ◤1◢ ◤2◢* ◤3◢ ◤4◢ ◤5◢ from the system board.

Note: The PSU air baffle **2** is available on some models.

After you finish

After disassembling the system board, comply with local regulations when recycling.

Appendix B. 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.

Tech Tips

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

To find the Tech Tips available for your server:
1. Go to http://datacentersupport.lenovo.com and navigate to the support page for your server.
2. Click on **How To's** from the navigation pane.
3. Click **Article Type ➙ Solution** from the drop-down menu.

   Follow the on-screen instructions to choose the category for the problem that you are having.

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 location:
https://datacentersupport.lenovo.com/product_security/home

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 https://pubs.lenovo.com/

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 https://serverproven.lenovo.com/ to make sure that the hardware and software are 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 to see if someone else has encountered a similar problem.

Gathering information needed to call Support

If you require warranty service for your Lenovo product, the service technicians will be able to assist you more efficiently if you prepare the appropriate information before you call. You can also go to 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://support.lenovo.com/servicerequest 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

To clearly identify the root cause of a server issue or at the request of Lenovo Support, you might need collect service data that can be used for further analysis. Service data includes information such as event logs and hardware inventory.

Service data can be collected through the following tools:
- **Lenovo XClarity Provisioning Manager**

  Use the Collect Service Data function of Lenovo XClarity Provisioning Manager to collect system service data. You can collect existing system log data or run a new diagnostic to collect new data.
- **Lenovo XClarity Controller**

  You can use the Lenovo XClarity Controller web interface or the CLI to collect service data for the server. The file can be saved and sent to Lenovo Support.
  - For more information about using the web interface to collect service data, see the "Downloading service data" section in the XCC documentation version compatible with your server at https://pubs.lenovo.com/lxcc-overview/.
  - For more information about using the CLI to collect service data, see the "ffdc command" section in the XCC documentation version compatible with your server at https://pubs.lenovo.com/lxcc-overview/.

- **Lenovo XClarity Administrator**

  Lenovo XClarity Administrator can be set up to collect and send diagnostic files automatically to Lenovo Support when certain serviceable events occur in Lenovo XClarity Administrator and the managed endpoints. You can choose to send diagnostic files to Lenovo Support using Call Home or to another service provider using SFTP. You can also manually collect diagnostic files, open a problem record, and send diagnostic files to the Lenovo Support Center.

  You can find more information about setting up automatic problem notification within the Lenovo XClarity Administrator at http://sysmgt.lenovofiles.com/help/topic/com.lenovo.lxca.doc/admin_setupcallhome.html.

- **Lenovo XClarity Essentials OneCLI**

  Lenovo XClarity Essentials OneCLI has inventory application to collect service data. It can run both in-band and out-of-band. When running in-band within the host operating system on the server, OneCLI can collect information about the operating system, such as the operating system event log, in addition to the hardware service data.

  To obtain service data, you can run the `getinfor` command. For more information about running the `getinfor`, see https://pubs.lenovo.com/lxce-onecli/onecli_r_getinfor_command.

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/supportphonelist for your region support details.

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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 memory module.

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.

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Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

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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.

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:

https://pubs.lenovo.com/important_notices/

Taiwan Region 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^{+6})	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機架	○	○	○	○	○	○
外部蓋板	○	○	○	○	○	○
機械組合件	−	○	○	○	○	○
空氣傳動設備	−	○	○	○	○	○
冷卻組合件	−	○	○	○	○	○
內存模組	−	○	○	○	○	○
處理器模組	−	○	○	○	○	○
電纜組合件	−	○	○	○	○	○
電源供應器	−	○	○	○	○	○
儲備設備	−	○	○	○	○	○
印刷電路板	−	○	○	○	○	○

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 0.1wt%" and "exceeding 0.01 wt%" indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.

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.

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.

Taiwan Region import and export contact information

Contacts are available for Taiwan Region import and export information.

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進口商地址: 台北市南港區三重路 66 號 8 樓
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