Lenovo

ThinkServer®

ThinkServer RS160
User Guide and Hardware Maintenance Manual

Machine Types: 70TD, 70TE, 70TF, and 70TG

Welcome

Before using your server and this document, be sure to read the *Read Me First* that comes with your server.

Lenovo makes constant improvement on the documentation of your server. To get all the latest documents, go to:
http://www.lenovo.com/support

Note: Your server might look slightly different from the illustrations in this document. To show the main parts clearly, some of the illustrations do not show all components.

Contents

Read this first: safety information

Note: Before using the product, be sure to read and understand the multilingual *Safety Information* on the Lenovo Web site at:
https://support.lenovo.com/documents/LNVO-DOCS

قبل استخدام المنتج، تأكد من قراءة *Safety Information* (معلومات السلامة) المتعددة اللغات وفهمها في موقع Lenovo على الويب.

Antes de usar o produto, certifique-se de ler e entender as *Safety Information* (Informações sobre segurança) multilíngues no site da Lenovo.

Преди да използвате продукта, прочетете и разберете многоезичната *Safety Information* (Информация за безопасност) на уебсайта на Lenovo.

Prije korištenja našeg proizvoda svakako s razumijevanjem pročitajte višejezični dokument *Safety Information* (Informacije o sigurnosti) na web-mjestu tvrtke Lenovo.

Před použitím tohoto produktu si nezapomeňte přečíst vícejazyčný dokument *Safety Information* (Bezpečnostní informace) na webu společnosti Lenovo.

Før du bruger produktet, skal du sørge for at læse og forstå *Safety Information* (sikkerhedsforskrifter), der findes på flere sprog, på Lenovos websted.

Lue monikielinen *Safety Information* (Turvaohjeet) -julkaisu Lenovon verkkosivustosta ennen tuotteen käyttöä.

Avant d'utiliser ce produit, prenez connaissance des *Safety Information* (Informations relatives à la sécurité) multilingues sur le site Web Lenovo.

Πριν χρησιμοποιήσετε το προϊόν, φροντίστε να διαβάσετε και να κατανοήσετε τις *Safety Information* (Πληροφορίες ασφαλείας) στο δικτυακό τόπο της Lenovo.

Vor Verwendung des Produkts sollten Sie die mehrsprachigen *Safety Information* (Sicherheitsinformationen) auf der Lenovo Website lesen und verstehen.

לפני השימוש במוצר, הקפידו לקרוא ולהבין את המסמך *Safety Information* (מידע בנושא בטיחות)המופיע בשפות רבות באתר האינטרנט של Lenovo.

A termék használata előtt olvassa át, és ismerje meg a Lenovo webhelyén több nyelven is elérhető *Safety Information*(Biztonsági tájékoztató) című dokumentumot.

Prima di utilizzare il prodotto, accertarsi di leggere e comprendere la documentazione multilingua *Safety Information*(Informazioni sulla sicurezza) sul sito Web Lenovo.

製品をご使用になる前に、Lenovo Web サイトに掲載されているマルチリンガルの *Safety Information* (安全上の注意) を読んで理解してください。

제품을 사용하기 전에 Lenovo 웹 사이트의 다국어 *Safety Information* (안전 정보)를 주의 깊게 읽어보십시오.

Zorg dat u alle *Safety Information* (veiligheidsvoorschriften) op de website van Lenovo hebt gelezen en begrepen voordat u het product gebruikt.

Przed skorzystaniem z produktu należy zapoznać się z wielojęzycznym dokumentem *Safety Information* (Informacje dotyczące bezpieczeństwa), dostępnym w serwisie internetowym Lenovo.

Antes de utilizar o produto, certifique-se de que lê e compreende a documentação multilingue *Safety Information* (Informações sobre Segurança) no sítio da Web da Lenovo.

Înainte de a utiliza produsul, citiţi şi înţelegeţi *Safety Information* (informaţiile de siguranţă) în mai multe limbi de pe site-ul web Lenovo.

Før du bruker produktet, må du lese og forstå den flerspråklige *Safety Information* (sikkerhetsinformasjonen) på nettstedet til Lenovo.

Перед использованием продукта обязательно ознакомьтесь с разделом *Safety Information* (Информация по технике безопасности), представленным на нескольких языках на веб-сайте Lenovo.

在使用产品之前，请务必先阅读和了解 Lenovo Web 站点上的多语言 *Safety Information*《安全信息》。

Pre korišćenja proizvoda, obavezno pažljivo i sa razumevanjem pročitajte višejezične *Safety Information* (Bezbednosne informacije) na veb lokaciji kompanije Lenovo.

Skôr než produkt začnete používať, prečítajte si viacjazyčné *Safety Information* (Bezpečnostné informácie) na webovej lokalite spoločnosti Lenovo.

Pred uporabo izdelka poskrbite, da boste prebrali in razumeli razdelek *Safety Information* (Varnostne informacije), ki je na spletnem mestu Lenovo na voljo v več jezikih.

Antes de usar el producto, asegúrese de leer y entender la sección *Safety Information* (Información de seguridad) multilingüe del sitio web de Lenovo.

Innan du använder den här produkten är det viktigt att du har läst och förstått den flerspråkiga *Safety Information* (säkerhetsinformationen) på Lenovos webbplats.

使用本產品之前，請務必先閱讀及瞭解 Lenovo 網站上多國語言版本的*Safety Information*（安全資訊）。

Ürünü kullanmadan önce, Lenovo web sitesindeki *Safety Information* (Güvenlik Bilgileri) belgesini (birden çok dilde yayınlanmaktadır) mutlaka okuyun.

Перш ніж використовувати продукт, обов'язково прочитайте *Safety Information* (інструкції з техніки безпеки), доступні різними мовами на веб-сайті Lenovo.

ก่อนใช้ผลิตภัณฑ์นี้ โปรดอ่านและทำความเข้าใจกับ *Safety Information (ข้อมูลความปลอดภัย)* หลายภาษา

บนเว็บไซต์ *Lenovo*

Important: Ensure that you read and understand all caution and danger statements in this document before you perform the procedures. Read and understand any additional safety information that is included with the server or optional device before you install, remove, or replace the device.

Statement 1

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- Connect all power cords to a properly wired and grounded electrical outlet.
- Ensure that all power cord connectors are securely and completely plugged into receptacles.
- Connect to properly wired outlets any equipment that will be attached to this product.
- 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.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.

To connect:	To disconnect:
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlets.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlets.	4. Remove all cables from devices.
5. Turn devices ON.	

Statement 2

⚠ **DANGER**

Danger of explosion if battery is incorrectly replaced.

When replacing the lithium coin cell battery, use only the same or an equivalent type that is recommended by the 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.

Statement 3

⚠

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.

- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Statement 4
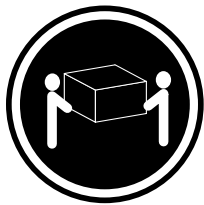
≥ 18 kg (39.7 lb)

< 32 kg (70.5 lb)
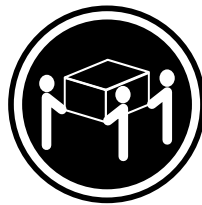
≥ 32 kg (70.5 lb)

< 55 kg (121.2 lb)
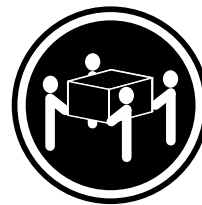
≥ 55 kg (121.2 lb)

< 100 kg (220.5 lb)

CAUTION:
Use safe practices when lifting.

Statement 5

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.
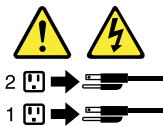
Statement 6

CAUTION:
If you install a strain-relief bracket option over the end of the power cord that is connected to the device, you must connect the other end of the power cord to a power source that is easily accessible in case it needs to be disconnected.

Statement 7

![warning triangle symbol]

CAUTION:
If the device has doors, ensure that you remove or secure the doors before moving or lifting the device to protect against personal injury. The doors will not support the weight of the device.

Statement 8

![warning triangle symbols]

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

![hazardous voltage label]

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.

Statement 9

![warning triangle symbol]

CAUTION:
Disconnect the hot-swap fan cables before removing the fan from the device to protect against personal injury.

Statement 10

![warning triangle symbol]

CAUTION:
The following label indicates a sharp-edge hazard.

![sharp-edge hazard symbol]

Statement 11

![warning triangle symbol]

CAUTION:
The following label indicates a potential heat hazard.

![heat hazard symbol]

Statement 12

DANGER

> Overloading a branch circuit is a potential fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch current ratings at the installation site.

Statement 13

CAUTION:
Ensure that the rack is secured properly to avoid tipping when the server unit is extended on the rails.

Statement 14

CAUTION:
Some accessory or option board outputs exceed Class 2 or limited power source limits. You must install the appropriate interconnecting cabling in accordance with your local electrical code requirements.

Statement 15

CAUTION:
The power-control button on the device may put the device in standby mode instead of turning off the device. In addition, the device might have multiple connections 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.
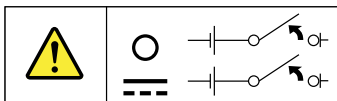
Statement 16

CAUTION:
To reduce the risk of electric shock or energy hazards:

- This equipment must be installed by trained service personnel in a restricted-access location, as defined by your local electrical code and the latest edition of IEC 60950.

- The branch circuit overcurrent protection must be rated in accordance with local electrical code requirements.

- Use 1.3 mm^2 or 16 American Wire Gauge (AWG) copper conductor only, not exceeding 3 meters in length.

- **Torque the wiring-terminal screws to 1.4 newton-meters or 12 inch-pounds.**
- **Provide a readily available, approved and rated disconnect device in the field wiring.**

Statement 17

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments.

Statement 18

CAUTION:
Do not place any object on top of rack-mounted products.

Statement 19

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.
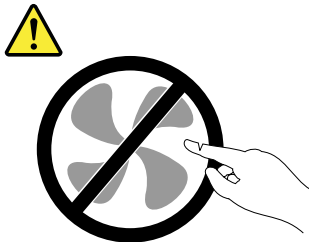
Statement 20

CAUTION:
A lithium ion battery is provided. To avoid possible explosion, do not burn the battery. Replace the battery only with the Lenovo-approved part. Recycle or discard the battery as instructed by local regulations.

Products that are not assessed

Typical products that are **not assessed** include but not limited to the following:

- Server and IT-rack components (for example, uninterruptible power supplies and current distribution systems)
- Devices in IT rooms (for example, bulk storage units and network products)

- Industrial low-voltage switchgear

Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-ThinkServer features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged Cathode Ray Tube (CRT) monitor or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

To determine whether there are any potentially unsafe conditions, use the following checklist at the beginning of every service task. Begin the checks with the power off, and the power cords disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the server. Disconnect the power cords.
3. Check the power cord for:
   a. A third-wire ground connector 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.
   b. The power cord should be the authorized type specified for your server. Go to: http://www.lenovo.com/serviceparts-lookup
   c. Insulation must not be frayed or worn.
4. Check for cracked or bulging batteries.
5. Remove the cover.
6. Check for any obvious non-ThinkServer alterations. Use good judgment as to the safety of any non-ThinkServer alterations.
7. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
8. Check for worn, frayed, or pinched cables.
9. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Grounding requirements

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.

Chapter 1. General information

This chapter contains the following items:

- "Introduction" on page 1
- "Server documentation" on page 2

Introduction

The following table lists the useful and important information about your server and where to obtain the information.

Information	Where to obtain
Lenovo Limited Warranty (LLW)	The LLW contains the warranty terms that apply to the product you purchased from Lenovo®. The LLW is available at: http://www.lenovo.com/warranty/llw_02 If you cannot obtain the LLW from the Lenovo Web site, contact your local Lenovo office or reseller to obtain a printed version, free of charge.
Worldwide Lenovo Support telephone list	Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available at: http://www.lenovo.com/support/phone If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.
Most up-to-date information about the server	http://www.lenovo.com/thinkserver
Latest technical information	http://www.lenovo.com/support
Instructions on how to register your server with Lenovo	Follow the instructions at: http://www.lenovo.com/register When you register your server, information is entered into a database, which enables Lenovo to contact you in case of a recall or other severe problem. After you register your server with Lenovo, you will receive quicker service when you call Lenovo for help. In addition, some locations offer extended privileges and services to registered users.
Product information label	Record information about your server in the following table. You will need the information if you ever need to have your server serviced. The product information label is attached on the chassis. See "Machine type, model, and serial number label" on page 12.

Product name   _____

Machine type and model (MT-M)   _____

Serial number (S/N)   _____

Date of purchase	_____

Server documentation

This topic provides a general description of each document for your server and instructions on how to obtain all the documents.

Printed documents

Your server package contains the following printed documents:

- *Read Me First*

  This is a multilingual document. It illustrates safety symbols and instructs you to read the complete safety, warranty, and support information provided on the Lenovo Web site before using the server. This document also tells you how to find the most up-to-date information on the Lenovo Support Web site. In addition, recycling, environmental, and legal notices are all included.

- A letter to customers

  This is a multilingual letter to customers, which tells customers that Lenovo is undertaking a paperless electronic documentation initiative to protect environment. This letter also provides information about how to contact Lenovo if you require a printed version of any electronic documents.

Electronic documents

- You can find the following electronic documents at https://support.lenovo.com/documents/LNVO-DOCS:

  - *Safety Information*

    This is a multilingual document that includes all the safety statements for your product. Ensure that you read and understand these safety statements before using the product.

  - *Lenovo Limited Warranty*

    This document includes the Lenovo terms and warranty statements.

  - *Lenovo License Agreement*

    This document includes the terms and conditions of the Lenovo License Agreement.

- You can find the following electronic documents from the Lenovo Support Web site. Go to http://www.lenovo.com/support, click **Documentation**, and follow the instructions on the screen to find the document you need.

  - *Safety, Warranty, and Support Information*

    This is a multilingual document that includes all the safety statements for your product in more than 30 languages. Ensure that you read and understand all the safety statements before using the product. This document also includes the Lenovo warranty statement, Customer Replaceable Units (CRUs) information, and information about how to contact the Lenovo Customer Support Center.

  - *User Guide and Hardware Maintenance Manual*

    This document provides detailed information to help you get familiar with your server and help you use, configure, and maintain your server.

  - *ThinkServer Management Module User Guide* (English only)

    This document provides information about server remote management.

  - *MegaRAID SAS Software User Guide* (English only)

This document provides information about Redundant Array of Independent Disks (RAID) and how to use the utility programs to configure, monitor, and maintain your server RAID and related devices.

Note: Refer to this document for hardware RAID information if the server has a required RAID card installed. See "RAID card" on page 18. For information about onboard software RAID, see "Configuring onboard SATA software RAID" on page 38.

– Other documents

You might find other documents for the Host Bus Adapter (HBA), Ethernet card, or other optional parts.

Chapter 2. Server setup road map

This chapter provides a general road map to guide you through setting up your server.

The server setup procedure varies depending on the configuration of the server when it was delivered. In some cases, the server is fully configured and you just need to connect the server to the network and an ac power source, and then you can turn on the server. In other cases, the server needs to have hardware devices installed, requires hardware and firmware configuration, and requires an operating system to be installed.

Server setup procedure

The following list is a general procedure for setting up your server:

1. Unpack the server package. See "In the box" on page 7.

2. Install any required hardware or server options. See the related topics in Chapter 5 "Replacing hardware" on page 43.

3. If you have a rail kit, you can install the server into a standard rack. See the documentation that comes with the rail kit.

4. Connect the Ethernet cables and power cords to the server. See "Rear view of the server" on page 14 to locate the connectors.

5. Turn on the server to verify operation. See "Turning on the server" on page 5.

6. Review the Unified Extensible Firmware Interface (UEFI) basic input/output system (BIOS) settings and customize as needed. See "Using the Setup Utility program" on page 27.

7. Configure RAID and install the operating system and device drivers. See "Using the ThinkServer EasyStartup program" on page 33 and "Configuring RAID" on page 35.

8. Install any additional drivers required for added features. Refer to the instructions that come with the hardware option.

9. Configure Ethernet settings in the operating system by referring to the operating system help. You can skip this step if the operating system was installed using the ThinkServer EasyStartup program.

10. Check for firmware updates. To update the firmware, do one of the following:

    - Go to http://www.lenovo.com/support and follow the instructions on the Web page to check for the latest level of firmware, such as the BIOS updates and device drivers.

    - Use the Firmware Updater program. See "ThinkServer EasyUpdate Firmware Updater" on page 10.

11. Install management applications and any other applications. Refer to the documentation that comes with the applications that you want to install.

Turning on the server

The server can be turned on in one of the following ways:

- After you finish unpacking and setting up the server, connect it to an ac power source. Press the power button on the front panel to turn on the server. See "Front panel" on page 13. The server needs about 90 seconds for the ThinkServer Management Module (TMM, also known as BMC) to initialize whenever you connect the server to an ac power source. If you press the power button on the front panel during this period, the server will not start immediately; it will start after the TMM initialization finishes.

- You also can use the related TMM feature to turn on the server remotely through the management LAN.

Turning off the server

CAUTION:
The power control button on the device and the power button 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.
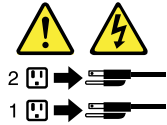
The server can be turned off in one of the following ways:

- Turn off the server from the operating system if your operating system supports this feature. After an orderly shutdown of the operating system, the server will turn off automatically. For instructions on how to shut down your specific operating system, refer to the related documentation or help system for the operating system.

- Press the power button on the front panel to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.

- If your server stops responding and you cannot turn it off, press and hold the power button on the front panel for four seconds or more. If you still cannot turn off the server, disconnect all power cords from the server.

- You also can use the related TMM feature to remotely turn off the server through the management LAN.

- The server might be turned off as an automatic response to a critical system failure.

Notes:

- When you turn off the server and leave it connected to an ac power source, the server also can respond to a remote request to turn on the server. To remove all power from the server, you must disconnect the server from the ac power source.

- For information about your specific operating system, refer to the related documentation or help system for the operating system.

Chapter 3. Product overview

This chapter contains the following items:

In the box

Your shipping box contains the following items:

- Server
- Rail kit
- Material box, including items such as power cords and printed documentation

Features and specifications of your server

This topic lists the features and specifications of your server, such as dimension and weight; hardware configurations; and reliability, availability, and serviceability (RAS) features. The RAS features include security features and basic system management features. The RAS features help you to ensure the integrity of the data stored on the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

Dimension and weight	- Width without rack handles: 438.5 mm (17.26 inches) - Depth: 393.7 mm (15.5 inches) - Height: 43.2 mm (1.7 inches) - Range of product weight without package: 6.2 kg (13.67 lb)–7.6 kg (16.76 lb)
Electrical input	Universal input: - Input range: 90–264 V ac - Input frequency range: 47–63 Hz
Microprocessor	Your server comes with one of the following microprocessors (internal cache size varies by model): - Intel® Celeron® - Intel Core™ i3 - Intel Pentium® - Intel Xeon® You can view the microprocessor information of your server in the Setup Utility program. See "Using the Setup Utility program" on page 27.
Memory	Your server has four memory slots. For more information, see "Memory module" on page 51.

Power supply	The server might come with one of the following power supply configurations: • One screw-secured, non-hot-swap 300-watt power supply assembly (compliant with 80 PLUS Gold) • One screw-secured, non-hot-swap 250-watt power supply assembly (compliant with 80 PLUS Bronze) **Note:** If you are using uninterruptible power supplies (UPS), ensure that you use only pure-sine UPS with your ThinkServer® server.
System fans	Your server comes with three fans to provide proper system cooling and airflow.

Internal drives	Internal drives are devices that your server uses to read and store data. The internal drives supported by your server vary by model.
	
	• Internal storage drive
	  – Up to two 3.5-inch SATA or SAS hard disk drives (HDDs)
	  – Up to four 2.5-inch SATA or SAS HDDs or SATA solid-state drives (SSDs)
	  – One M.2 SATA SSD
	
	Note: The term "2.5-inch HDDs" hereinafter refers to all the supported types of 2.5-inch HDDs and SSDs.
	
	• Optical drive
	  One slim SATA optical drive (available on some models)

Expansion slots	The server has one Peripheral Component Interconnect Express (PCIe) card slot on the riser card assembly. For more information, see "Rear view of the server" on page 14.

Input/Output (I/O) features	• Front panel:
	  – Two USB 2.0 connectors
	• Rear panel:
	  – Four USB 3.0 connectors
	  – Serial connector
	  – Video graphics array (VGA) connector
	  – Three RJ-45 Ethernet connectors (one for system management)
	To locate the connectors, refer to the related topics in "Component locations" on page 12.

Video subsystem	An integrated graphics controller is available in your server to support the VGA connector for connecting compatible video devices. The integrated graphics controller is located in the ThinkServer Management Module (TMM), which also is known as the Baseboard Management Controller (BMC) chip on the system board.
Ethernet connectivity	There are three RJ-45 Ethernet connectors on the rear panel with 10 megabits per second (Mbps), 100 Mbps, or 1000 Mbps network connectivity. For more information, see "Rear view of the server" on page 14.

Security features	• Supervisor password and user password to help protect unauthorized access to the server (see "Using passwords" on page 30)
	• ThinkServer Trusted Platform Module (TPM), which is a security chip, to help enhance server security
	• Remote monitoring or control by an administrator to provide protection or help
	• RAID configuration to help improve data storage reliability and fault tolerance (see "Configuring RAID" on page 35)
Basic system management features	• Ability to store the power-on self-test (POST) hardware test results
	• Setup Utility program
	The Setup Utility program helps you view the server information and configure the server in the pre-operating system environment. See "Using the Setup Utility program" on page 27.
	• TMM (also known as BMC) and Intelligent Platform Management Interface (IPMI) 2.0
	The system board platform management subsystem is based on the integrated TMM features. The TMM is a management chip that is integrated on the system board of your server. With the TMM, no matter what condition the server operating system is in and no matter if the server is on or off, as long as the server is connected to network and an ac power source, the interaction with the TMM-controlled servers can be achieved through system network. The user can obtain the server hardware health information and system event log (SEL), and is able to conduct the operations including turning on or off the server, restarting the server, and so on. This part of server management is independent of the operating system and is called out-of-band management.
	The system board platform management subsystem consists of the integrated TMM, communication buses, sensors, the BIOS, and server management firmware. The subsystem is responsible for error reporting, system power control, thermal monitoring, system fan control, and other management features. The TMM provides system management and monitoring features based on the IPMI 2.0 specification. IPMI helps lower the overall costs of server management. For more information about IPMI 2.0, go to the Intel Web site at: https://www-ssl.intel.com/content/www/us/en/servers/ipmi/ipmi-home.html
	The TMM also supports some non-IPMI features, such as the Dynamic Host Configuration Protocol (DHCP) and the Platform Environment Control Interface (PECI), to provide more system management functions.
	You can find the default user name, password, and other information for the TMM in the *ThinkServer Management Module User Guide*, which is available for download at: http://www.lenovo.com/support
	• Preboot Execution Environment (PXE)
	The Intel PXE technology enables you to start your servers, load an operating system, or deploy executable images from a remote server by using a network interface. The operation can be done independently of local data storage devices (such as HDDs) or installed operating systems.
	• RAID
	Your server supports onboard SATA software RAID. If a required RAID card is installed, your server also supports advanced SATA/SAS hardware RAID configurations. For more information, see "Configuring RAID" on page 35.
	• Status light-emitting diodes (LEDs) and diagnostic LEDs
	For more information about the LEDs for your server, refer to the related topics in "Component locations" on page 12.
	• Software programs

For more information about the software programs, see "Software programs" on page 10.

Operating environment

The following table provides information about the operating environment for your server.

Table 1. Operating environment

Air temperature (operating)	10–35°C (50–95°F)
Air temperature (storage)	-40–60°C (-40–140°F) in original shipping package
Humidity (operating)	8%–80% (non-condensing)
Humidity (storage)	10%–90% (non-condensing)
Altitude	0–3048 m (0–10 000 ft) in an unpressurized environment **Note:** When the altitude exceeds 3000 m (10 000 ft), the defined maximum dry-bulb temperature for operation becomes a dependent variable. The temperature value decreases by 1°C (1.8°F) per 300 m (984 ft) as the altitude increases.

Software programs

This topic provides information about the software programs that you can use to set up, use, and maintain the server.

To download the software programs, go to the Lenovo Support Web site at http://www.lenovo.com/support and follow the instructions on the Web page.

For more information about using a program, refer to the help system or user guide of the program.

ThinkServer EasyStartup

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported Microsoft® Windows® and Linux® operating systems and device drivers on your server. The program works with your Windows or Linux operating system installation disc to automate the process of installing the operating system and associated device drivers. You can download the ISO image for the ThinkServer EasyStartup program from the Lenovo Support Web site and burn it into a disc or a USB flash drive. For more information, see "Using the ThinkServer EasyStartup program" on page 33.

ThinkServer EasyUpdate Firmware Updater

The ThinkServer EasyUpdate Firmware Updater program (hereinafter referred to as Firmware Updater) enables you to maintain your server firmware up to date and helps you avoid unnecessary server outages. Firmware Updater is provided on the Lenovo Support Web site.

To update your system firmware using Firmware Updater, do the following:

Note: Before distributing firmware updates to a server, ensure that your server can restart successfully without encountering hardware problems.

1. Go to http://www.lenovo.com/support and follow the instructions on the Web page to locate Firmware Updater.
2. Download the ISO image for Firmware Updater and the TXT file that contains the installation instructions.

3. Use any CD, DVD, or USB flash drive burning software to create a bootable disc or bootable flash drive with the ISO image.

4. Print the TXT file and follow the instructions to use Firmware Updater to update your system firmware.

BIOS and TMM update utilities

The BIOS and TMM (also known as BMC) firmware keeps updating after the shipment of the server. Lenovo maintains pages on the Support Web site and provides the BIOS and TMM update utilities with instructions for download to help you update the BIOS and TMM firmware if needed. For more information, see "Updating or recovering the BIOS" on page 32 and Chapter 2 "Server setup road map" on page 5.

Lenovo ThinkServer Power Planner

The Lenovo ThinkServer Power Planner program provides information about the power consumption and electric current calculation based on the different configurations of servers and other devices. The program also helps to plan servers and devices deployment in an efficient way.

For more information about using the Lenovo ThinkServer Power Planner program, refer to the help system of the program.

RAID configuration utilities

Your server supports onboard SATA software RAID. If a required RAID card is installed, your server also supports advanced SATA/SAS hardware RAID configurations. For more information, see "Configuring RAID" on page 35.

Remote management software

The integrated TMM provides basic remote management features for the server.

For more information about the remote management software and server remote management, refer to the *ThinkServer Management Module User Guide*, which is available for download at:
http://www.lenovo.com/support

Lenovo ThinkServer Diagnostics

The Lenovo ThinkServer Diagnostics program enables you to diagnose server problems offline, perform some diagnostic tests, and collect system information. Examples of the system information include basic operating-system information, hardware information, SEL, RAID log, and so on. Your server comes with Lenovo ThinkServer Diagnostics Standalone Edition.

For more information about Lenovo ThinkServer Diagnostics, go to http://support.lenovo.com/us/en/lenovodiagnosticsolutions/downloads. Locate the **Lenovo ThinkServer Diagnostics** section at the bottom of the Web page. Then, click the desired link for more information.

Lenovo XClarity Essentials OneCLI

Lenovo XClarity Essentials OneCLI consists of individual application modules that utilize a command-line interface (CLI) to help you manage servers. With the inventory application module, Lenovo XClarity Essentials OneCLI enables you to get inventory and system information for ThinkServer servers.

For more information about Lenovo XClarity Essentials OneCLI, go to:
https://support.lenovo.com/solutions/HT116433?LinkTrack=Solr

Lenovo XClarity Administrator

Lenovo XClarity Administrator is a centralized, resource-management solution that simplifies infrastructure management, speeds responses, and enhances the availability of Lenovo server systems and solutions. It runs as a virtual appliance that automates discovery, inventory, tracking, monitoring, and provisioning for Lenovo servers in a secure environment. For more information, see "Using Lenovo XClarity Administrator" on page 41.

Component locations

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

Machine type, model, and serial number label

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

Locate the machine type, model, and serial number label on the server as shown in the following illustration.
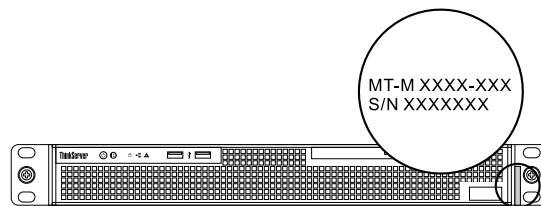

Figure 1. Machine type, model, and serial number label

Front view of the server

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.
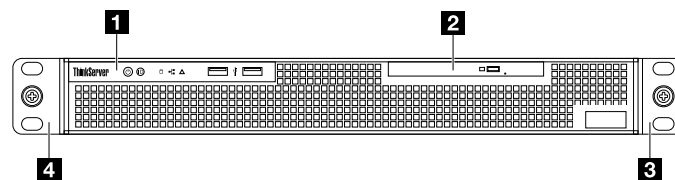

Figure 2. Front view of the server

Item	Description
1 Front panel	See "Front panel" on page 13.
2 Slim optical drive (available on some models)	Some server models come with a slim SATA optical drive.
3 **4** Rack handles	If your server is installed in a rack, you can use the rack handles to help you slide the server out of the rack. You also can use the rack handles and screws to secure the server in the rack so that the server cannot slide out, especially in vibration-prone areas. For more information, refer to the documentation that comes with your rail kit.

Front panel

The following illustrations show the controls, connectors, and LEDs on the front panel of the server.
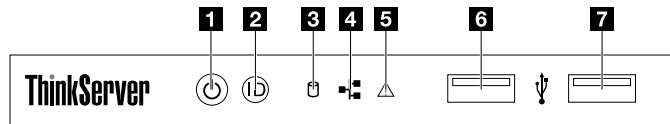

Figure 3. Front panel

1 Power button with power status LED	**2** System ID button with ID LED
3 HDD status LED	**4** Network status LED
5 System error LED	**6** **7** USB 2.0 connectors

1 Power button with power status LED

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

Status	Description
● Green	The server is on.
○ Off	The server is off.

2 System ID button with ID LED

When you press the ID button on the front panel, the ID LEDs on both the front and rear of the server are lit to help you locate the server among other servers. You also can turn on the ID LEDs using a remote management program for server presence detection.

Status	Description
● Blue	The server is identified.
○ Off	The ID LED is not in use or the server is not identified.

3 HDD status LED

This LED only indicates the status of the HDDs or SSDs that are connected to the system board. This LED does not indicate the status of the M.2 SSD, and the status of HDDs or SSDs connected to the RAID card.

Status	Description
○ Off	The HDD is not in use.
☀ Blinking green	The HDD is active and data is being transferred.

4 Network status LED

The network status LED indicates the LAN status for the Ethernet connector 1 and Ethernet connector 2 on the rear panel of the server.

Status	Description
● Green	The server is connected to a LAN.
○ Off	The server is disconnected from a LAN.
☀ Blinking green	The LAN is connected and active.

5 System error LED

The system error LED helps you to determine if there are any system errors.

Status	Description
● Yellow	The server has an error.
○ Off	The server is off or the server is on and working correctly.

6 7 USB 2.0 connectors (2)

Used to attach a USB-compatible device, such as a USB keyboard, mouse, scanner, or printer. If you have more than six USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.

Rear view of the server

This topic provides information to help you locate the connectors and components on the rear of your server.
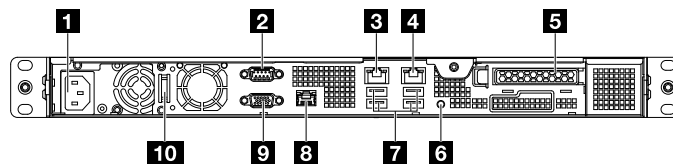

Figure 4. Rear view of the server

1 Power cord connector	**2** Serial connector
3 Ethernet connector 1 (RJ-45)	**4** Ethernet connector 2 (RJ-45)
5 PCIe card slot (for the card installed on the riser card assembly)	**6** ID LED
7 USB 3.0 connectors (4)	**8** Ethernet connector 0 for system management (RJ-45)
9 VGA connector (DB-15)	**10** Power cord retainer

1 Power cord connector

Used to connect the power cord.

2 Serial connector

Used to attach a device that uses a 9-pin serial connector.

3 Ethernet connector 1 (RJ-45)
4 Ethernet connector 2 (RJ-45)

Used to attach an Ethernet cable for a LAN. Each Ethernet connector has two status LEDs to help you identify the Ethernet connectivity, activity, and connection speed.
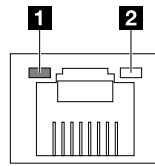
Figure 5. Ethernet status LEDs

Ethernet status LED	Status		Description
1 Link and activity	● Yellow		The server is connected to a LAN.
	○ Off		The server is disconnected from a LAN.
	☀ Blinking yellow		The LAN is connected and active.
2 Connection speed	● Green		The connection speed is 1000 Mbps.
	● Orange		The connection speed is 100 Mbps.
	○ Off		The connection speed is 10 Mbps.

8 Ethernet connector 0 for system management (RJ-45)

Used to attach an Ethernet cable for a LAN. Each Ethernet connector has two status LEDs to help you identify the Ethernet connectivity, activity, and connection speed.

Notes:

- The Ethernet connector 0 is marked with "MGMT". It is for system management by default.

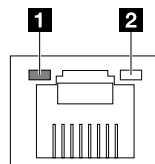- The Ethernet connector 0 does not support the Intel Virtualization Technology.

Figure 6. Ethernet status LEDs

Ethernet status LED	Status		Description
1 Link and activity	● Green		The server is connected to a LAN.
	○ Off		The server is disconnected from a LAN.
	☀ Blinking green		The LAN is connected and active.
2 Connection speed	● Yellow		The connection speed is 10 Mbps, 100 Mbps, or 1000 Mbps

5 PCIe card slot (for the card installed on the riser card assembly)

This slot is used to install a PCIe card, such as a RAID card or a ThinkServer Host Bus Adapter (HBA).

6 ID LED

When you press the ID button on the front panel, the ID LEDs on both the front and rear of the server are lit to help you locate the server among other servers. You also can turn on the ID LEDs using a remote management program for server presence detection.

Status	Description
● Blue	The server is identified.
○ Off	The ID LED is not in use or the server is not identified.

7 USB 3.0 connectors (4)

Used to attach a USB-compatible device, such as a USB keyboard, mouse, scanner, or printer. If you have more than six USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.

9 VGA connector (DB-15)

Used to attach a VGA-compatible video device, such as a VGA monitor.

10 Power cord retainer

Used to secure the power cord.

Server components

Your server comes with one of the following drive configurations:

- Four 2.5-inch HDDs or SSDs
- Two 3.5-inch HDDs

Note: Depending on the model, your server might look slightly different from the illustration in this topic.
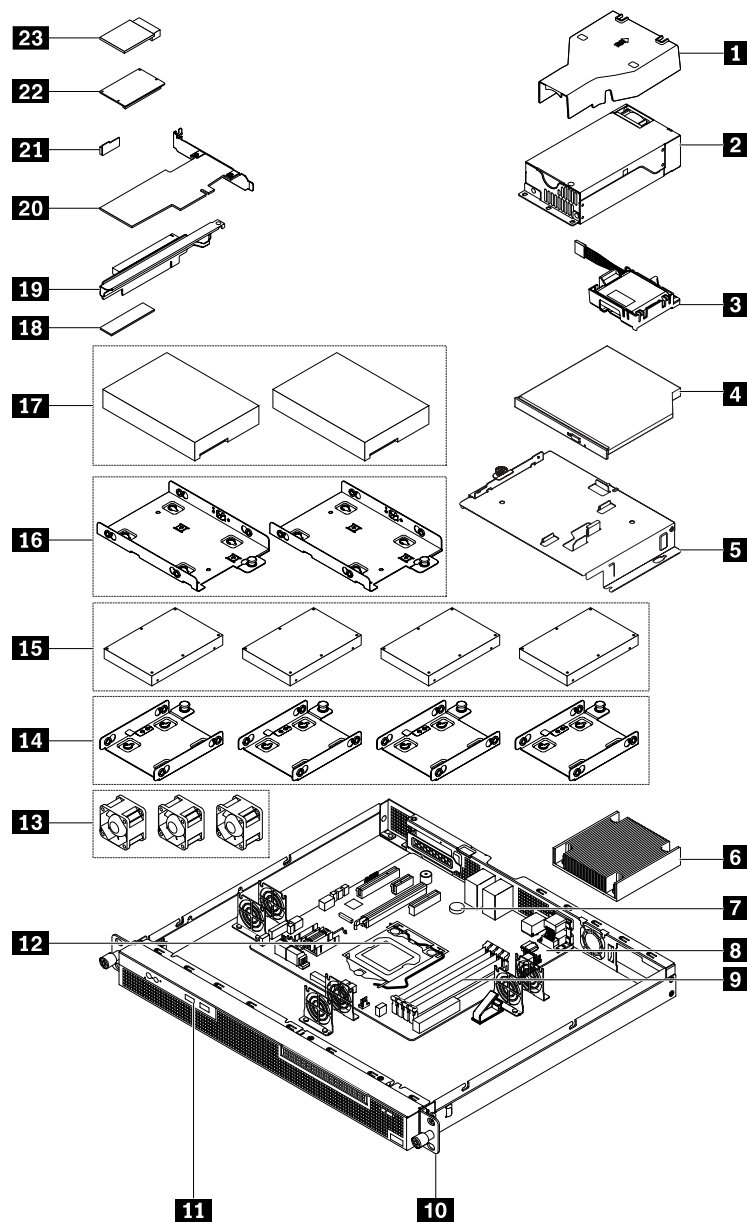
Figure 7. Server components

[1] Air baffle [1]	[2] Power supply assembly [3]
[3] ThinkServer RAID Super Capacitor Module* [3]	[4] Slim optical drive* [2]
[5] Slim-optical-drive bracket [2]	[6] Heat sink [2]
[7] Coin-cell battery [1]	[8] System board [3]
[9] Memory modules [1]	[10] Rack handle [1]
[11] Front panel board [2]	[12] Microprocessor [3]
[13] System fans [1]	[14] 2.5-inch HDD brackets* [2]
[15] 2.5-inch HDDs or SSDs* [2]	[16] 3.5-inch HDD brackets* [2]
[17] 3.5-inch HDDs* [2]	[18] M.2 SSD [2]

19 Riser card assembly [2]	**20** PCIe card* [1]
21 ThinkServer RAID 520i upgrade key* [1]	**22** ThinkServer RAID 720i Modular Flash or ThinkServer RAID 720i Modular DRAM Upgrade* [1]
23 ThinkServer Trusted Platform Module [1]	

Notes:

- * Available on some models
- [1] Self-service CRUs: Parts to be installed or replaced by customer themselves.
- [2] Optional CRUs: Parts can be installed or replaced by customers or by service technicians under certain terms of the applicable warranty service type for your country or region.
- [3] Non-CRUs: Parts must be installed or replaced only by trained service technicians.

Before servicing a Lenovo product, ensure that you read and understand "Read this first: safety information" on page iii. Use only parts provided by Lenovo for replacement. For a complete listing of FRU information, such as FRU part numbers and supported server models, go to:
http://www.lenovo.com/serviceparts-lookup

RAID card

This topic helps you locate the connectors on RAID cards. Your server supports the following RAID cards (supported type varies by server model):

- Lenovo ThinkServer RAID 520i PCIe Adapter (referred to as RAID 520i Adapter)
- Lenovo ThinkServer RAID 720i PCIe Adapter (referred to as RAID 720i Adapter)

Note: Depending on the configuration, the RAID card installed in your server might look slightly different from the illustrations in this topic.

Lenovo ThinkServer RAID 520i PCIe Adapter

The RAID 520i Adapter provides advanced SATA/SAS hardware RAID functions. The following illustration shows the connectors on the adapter.
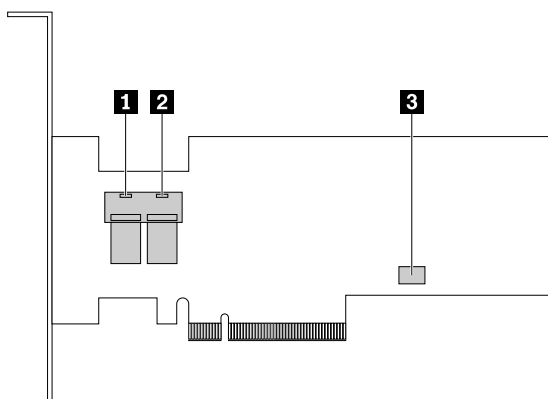

Figure 8. Lenovo ThinkServer RAID 520i PCIe Adapter

Connector	Description
1 Connector 0	Used to connect the mini-SAS signal cable.
2 Connector 1	Used to connect the mini-SAS signal cable.
3 J3 connector	Used to connect to a ThinkServer RAID 520i upgrade key.

Lenovo ThinkServer RAID 720i PCIe Adapter

The RAID 720i Adapter provides advanced SATA/SAS hardware RAID functions. The following illustration shows the connectors on the adapter.
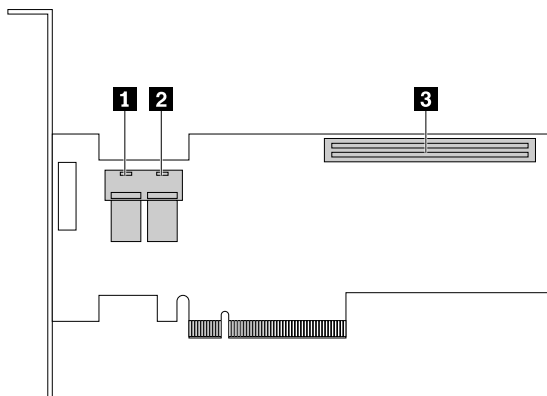

Figure 9. ThinkServer RAID 720i PCIe Adapter

Connector	Description
1 Connector 0	Used to connect the mini-SAS signal cable.
2 Connector 1	Used to connect the mini-SAS signal cable.
3 Thunderbolt Flash Module connector	Used to connect a Thunderbolt Memory Module.

Connecting the cables

This topic provides instructions to help you connect your HDDs and slim optical drive.

Note: Your server supports both SATA and SAS HDDs. For server models with SAS HDDs, a RAID card must be installed. For server models with SATA HDDs, you can connect the SATA HDDs to a RAID card or the SATA connectors on the system board. To locate each SATA connector on the system board, see "System board components" on page 24.

This topic contains the following items:

- "Connecting the 2.5-inch hard disk drives to the system board" on page 20
- "Connecting the 2.5-inch hard disk drives to the RAID card" on page 21
- "Connecting the 3.5-inch hard disk drives to the system board" on page 22
- "Connecting the 3.5-inch hard disk drives to the RAID card" on page 23
- "Connecting the slim optical drive" on page 24

Connecting the 2.5-inch hard disk drives to the system board

To connect the 2.5-inch HDDs to the system board, do the following:

1. Connect the four SATA cables for the 2.5-inch HDDs as shown.

   Note: For your convenience, connect the HDD 2 SATA connector first, and then connect the HDD 1 SATA connector.
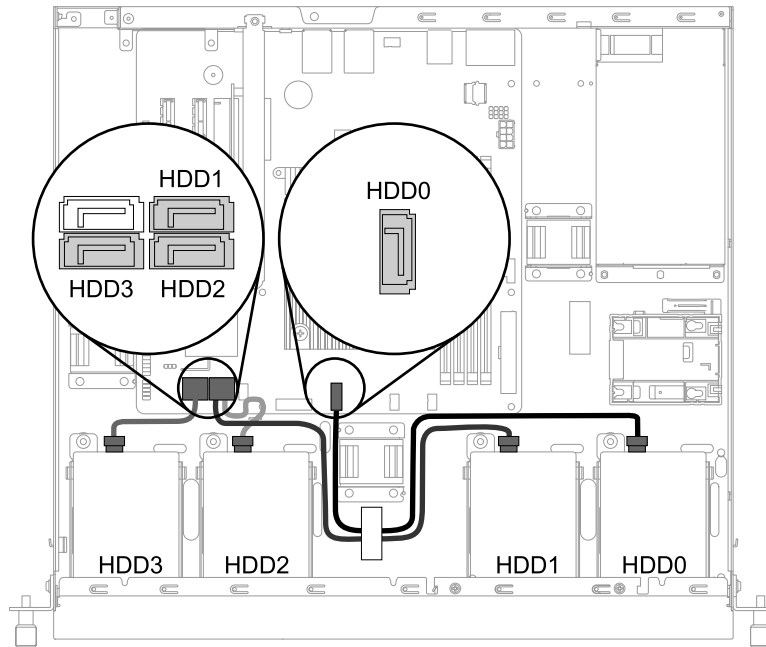

Figure 10. Connecting the SATA cables for the 2.5-inch HDDs

2. Connect the four power cable connectors to the power connectors at the rear of the HDDs as shown.
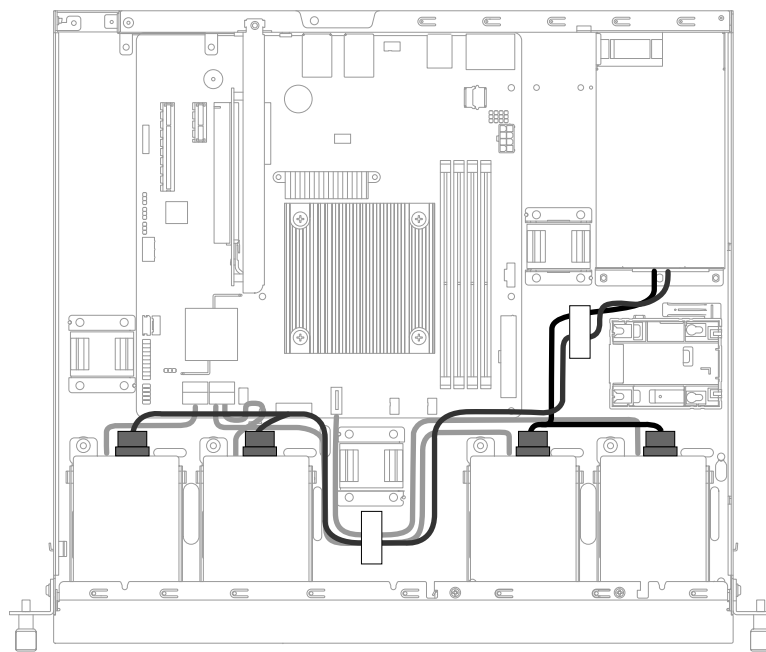

Figure 11. Connecting the power cables for the 2.5-inch HDDs

3. Route the cables using the cable clips or ties in the chassis.

Connecting the 2.5-inch hard disk drives to the RAID card

Note: If you are connecting the 2.5-inch HDDs to another type of ThinkServer HBA, the procedure is similar.

To connect the 2.5-inch HDDs to the RAID card, do the following:

1. Connect the following type of mini-SAS cable to the RAID card as shown.

   Note: In the illustration, connectors 0, 1, 2, and 3 will be connected to the corresponding signal connectors of HDD 0, HDD 1, HDD 2, and HDD 3. The remaining two connectors are power connectors and will be connected to the power cables from the power supply.
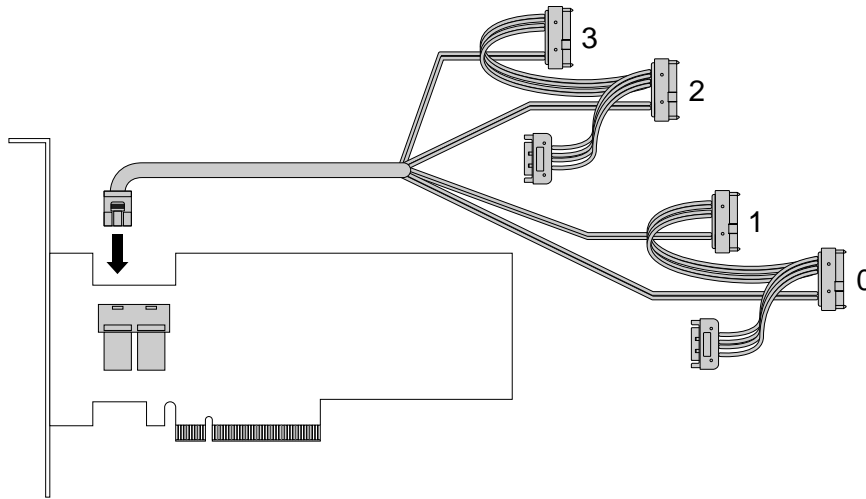

Figure 12. Connecting the mini-SAS cable to the RAID card

2. Install the RAID card to the riser card assembly. See "Installing the PCIe card" on page 55.
3. Connect the mini-SAS cable to the HDDs and any two of the power cable connectors as shown.
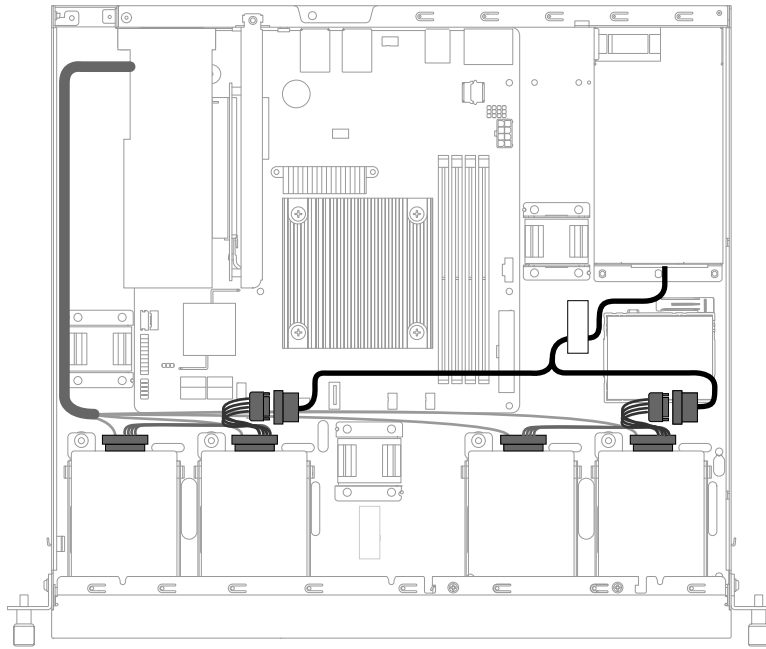
Figure 13. Connecting the mini-SAS cable to the HDDs and power cable connectors

4. Route the cables using the cable clips or ties in the chassis.

Connecting the 3.5-inch hard disk drives to the system board

To connect the 3.5-inch HDDs to the system board, do the following:

1. Connect the two SATA cables for the 3.5-inch HDDs and connect the two power cable connectors to the power connectors on the HDDs as shown.
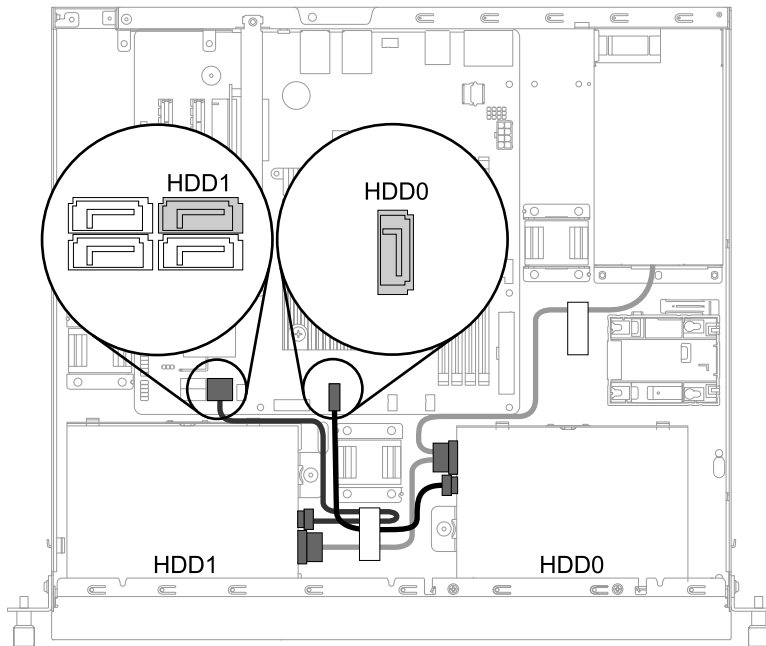

Figure 14. Connecting the SATA cables and power cable for the 3.5-inch HDDs

2. Route the cables using the cable clips or ties in the chassis.

Connecting the 3.5-inch hard disk drives to the RAID card

Note: If you are connecting the 3.5-inch HDDs to another type of ThinkServer HBA, the procedure is similar.

To connect the 3.5-inch HDDs to the RAID card, do the following:

1. Connect the following type of mini-SAS cable to the RAID card as shown.

   Note: In the illustration, connectors 0 and 1 will be connected to the corresponding signal connectors of HDD 0 and HDD 1. The remaining connector is the power connector and will be connected to the power cable from the power supply.
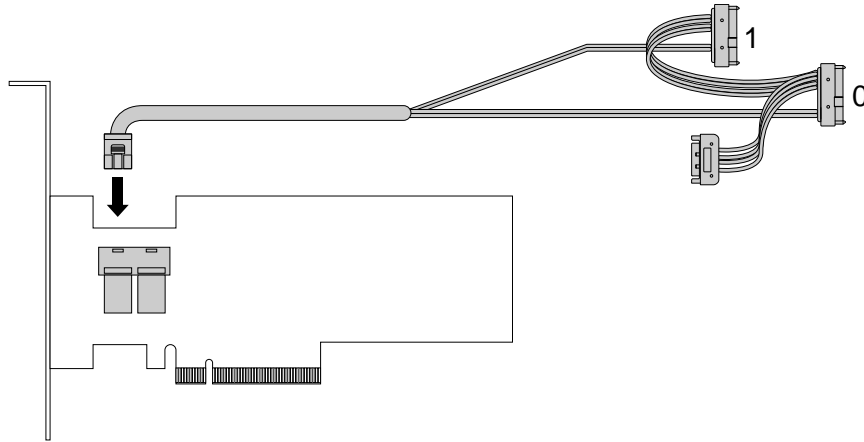

Figure 15. Connecting the mini-SAS cable to the RAID card

2. Install the RAID card to the riser card assembly. See "Installing the PCIe card" on page 55.
3. Connect the mini-SAS cable to the HDDs and any one of the power cable connectors as shown.
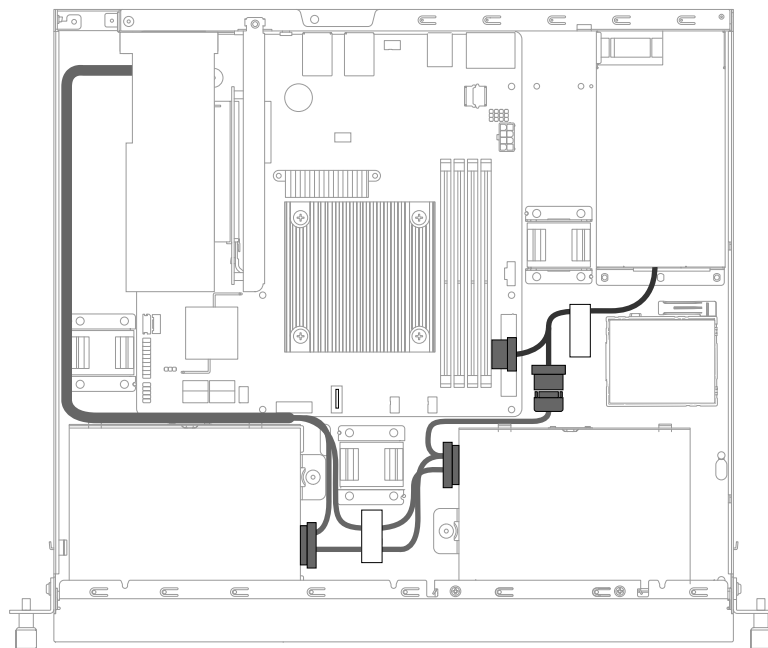

Figure 16. Connecting the mini-SAS cable to the HDDs and power cable connector

4. Route the cables using the cable clips or ties in the chassis.

Connecting the slim optical drive

Note: The slim optical drive is available on some models.

To connect the slim optical drive, do the following:

1. Connect the SATA cable and power cable for the slim optical drive as shown.

   Note: Depending on the configuration, the server might look slightly different from the following illustration.
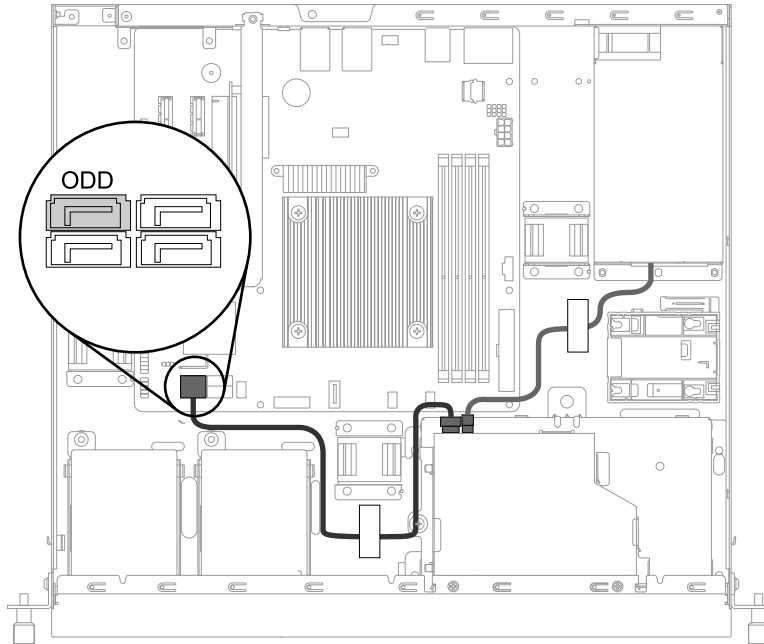

Figure 17. Connecting the slim optical drive

2. Route the cables using the cable clips or ties in the chassis.

System board components

The following illustration shows the component locations on the system board.
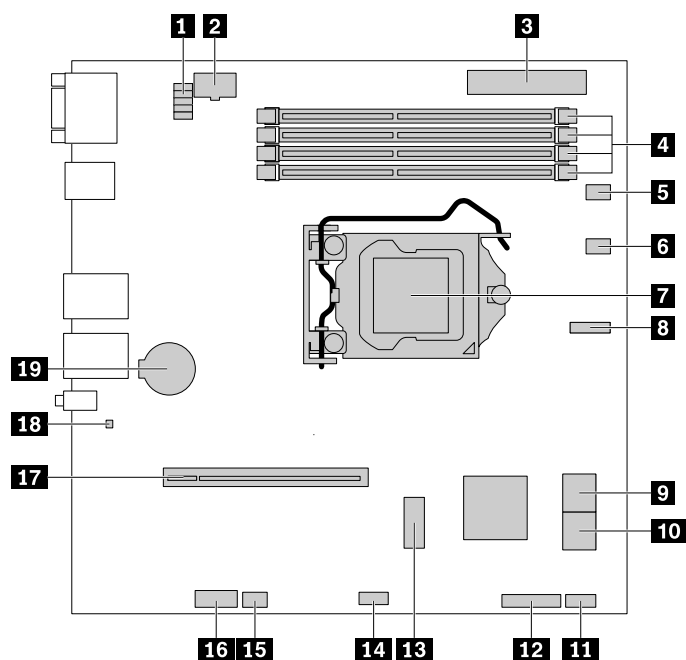
Figure 18. System board components

1 Manageability Engine (ME) recovery jumpers	**2** 8-pin power connector
3 24-pin power connector	**4** Memory slots
5 System fan 1 connector	**6** System fan 2 connector
7 Microprocessor socket	**8** SATA connector for HDD 0
9 SATA connector for HDD 1 (upper) and SATA connector for HDD 2 (lower)	**10** SATA connector for ODD (upper) and SATA connector for HDD 3 (lower)
11 Front panel connector 1	**12** Front panel connector 2
13 M.2 SSD connector	**14** USB 2.0 connector
15 System fan 3 connector	**16** TPM connector
17 Riser card assembly slot	**18** Clear CMOS jumper
19 Coin-cell battery socket	

1 ME recovery jumpers

Used to recover the manageability engines.

2 8-pin power connector

Used to connect the 8-pin power cable of the power supply.

3 24-pin power connector

Used to connect the 24-pin power cable of the power supply.

4 Memory slots

There are four memory slots on the system board. For more information, see "Memory module" on page 51.

5 6 15 System fan connector

Used to connect a system fan.

7 Microprocessor socket

Used to install the microprocessor.

8 9 10 SATA connector

Used to connect an HDD or a slim optical drive.

11 12 Front panel connector

Used to connect to the front panel board.

13 M.2 SSD connector

Used to install an M.2 SSD.

14 USB 2.0 connector

Used to connect the two USB connectors on the front panel.

16 TPM connector

Used to connect a TPM. TPM is a security chip that is used to enhance server security.

17 Riser card assembly slot

Used to install the riser card assembly.

18 Clear CMOS jumper

Used to clear CMOS and turn the BIOS settings into the factory default settings.

To clear CMOS, do the following:
1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Do one of the following:
    - Remove the coin-cell battery for a few minutes. Then, reinstall it. See "Coin-cell battery" on page 79.
    - Use the two levers of a tweezer to touch the two metal contacts of the jumper for a few seconds.
3. Reinstall the server cover and connect the power cords. See "Completing the parts replacement" on page 91.
4. Turn on the server. The clearing CMOS process is completed.

19 Coin-cell battery socket

Used to install the coin-cell battery. Your server has a special type of memory that maintains the date, time, and configuration information for built-in features. The coin-cell battery keeps the information active when you turn off the server.

Chapter 4. Configuring the server

This chapter provides the following information to help you configure the server:

- "Using the Setup Utility program" on page 27
- "Using the ThinkServer EasyStartup program" on page 33
- "Configuring RAID" on page 35
- "Configuring the Ethernet controllers" on page 41

Using the Setup Utility program

The Setup Utility program is part of the server firmware. You can use the Setup Utility program to view and change the configuration settings of your server, regardless of which operating system you are using. However, the operating system settings might override any similar settings in the Setup Utility program.

Starting the Setup Utility program

To start the Setup Utility program, do the following:

1. Connect the server to an ac power source and press the power button on the front panel to turn on the server. See "Turning on the server" on page 5.
2. Press the F1 key as soon as you see the logo screen. Then, wait for several seconds, and the Setup Utility program opens. If you have set a password, type the correct password to enter the Setup Utility program. For password information, see "Using passwords" on page 30.

Setup Utility program interface

Depending on the BIOS version of your server, some menu or item information might differ slightly from the information in this topic.

Notes:

- The default settings already are optimized for you. Use the default value for any item you are not familiar with. Do not change the value of unfamiliar items to avoid unexpected problems. If you consider changing the server configuration, proceed with extreme caution. Setting the configuration incorrectly might cause unexpected results. If you cannot turn on the server because of incorrect BIOS settings, use the Clear CMOS jumper to restore the BIOS settings to the factory default settings. See "System board components" on page 24.
- If you have changed any hardware in the server, you might need to upgrade the BIOS and the TMM firmware.

The following menus are listed on the **BIOS Setup Utility** screen:

- "Main menu" on page 28.
- "Advanced menu" on page 28.
- "Boot menu" on page 28.
- "Security menu" on page 29.
- "Server Mgmt menu" on page 29
- "Exit menu" on page 29.

Main menu

After entering the Setup Utility program, you can see the **Main** menu, which lists basic information about the BIOS, total memory size, and system date and time.

Advanced menu

You can view or change various server component settings on the **Advanced** menu in the Setup Utility program.

The **Advanced** menu contains the following items. Some items are displayed on the menu only if the server supports the corresponding features. For more information, enter the corresponding items and refer to the instructions on the screen.

Menu item	Description
CPU Configuration	View and set microprocessor configuration parameters.
Memory Configuration	View information about the installed memory modules and set memory configuration parameters.
Chipset Configuration	View and set chipset configuration parameters.
Storage Configuration	View and set storage device configuration parameters.
ACPI Configuration	View and set Advanced Configuration and Power Interface (ACPI) configuration parameters.
USB Configuration	View and set USB configuration parameters.
WHEA Configuration	View and set Windows Hardware Error Architecture (WHEA) configuration parameters.
Intel Server Platform Services	View Intel Server Platform Services (SPS) information.
Super IO Configuration	View and set super I/O configuration parameters.
Serial Port Console Redirection	View and set Serial Port Console Redirection configuration parameters.
H/W Monitor	View the status of the hardware on your server.
Trust Computing	View and set TPM configuration parameters.
Intel TXT Information	View and set the Intel Trusted Execution Technology (TXT) support parameters.

Boot menu

The **Boot** menu in the Setup Utility program lists all the bootable devices installed in your server and the listed items vary depending on your server configuration. You can view or change the server startup options, including the startup sequence and boot priority for various devices.

The **Boot** menu contains the following items. For more information, enter the corresponding items and refer to the instructions on the screen.

Menu item	Description
Boot Option #1	Select a device as the first startup device.
Boot Option #2	Select a device as the second startup device.
Boot Option #3	Select a device as the third startup device.

Menu item	Description
Boot from onboard LAN	Enable or disable the server to start from the onboard LAN.
Setup Prompt Timeout	Set the time-out seconds after you press the power button so that you can press F1 to enter the Setup Utility program or press F12 to enter the boot menu during this time period.
Bootup Num-Lock	Enable or disable the numeric lock function during the booting process.
Boot Beep	Enable or disable the server beep during the booting process.
Full screen logo	Enable or disable the Original Equipment Manufacturer (OEM) logo.
AddOn ROM Display	Enable or disable the AddOn ROM display.
CSM Parameters	View and set the Compatibility Support Module (CSM) parameters.

Security menu

You can set passwords on the **Security** menu in the Setup Utility program.

The **Security** menu contains the following main items:

Menu item	Description
Supervisor Password	Set a supervisor password to protect against unauthorized access to your server.
User Password	Set a user password to protect against unauthorized access to your server.

For more information about the difference between a supervisor password and a user password, see "Using passwords" on page 30.

Server Mgmt menu

You can view or change event log and BMC settings on the **Server Mgmt** menu in the Setup Utility program. Some items are displayed on the menu only if the server supports the corresponding features.

The **Server Mgmt** menu contains the following items. For more information, enter the corresponding items and refer to the instructions on the screen.

Menu item	Description
System Event Log	View and set system event log parameters.
BMC Network Configuration	View and set BMC configuration parameters.

Exit menu

After you finish viewing or changing settings in the Setup Utility program, you can choose a desired action from the **Exit** menu to save changes, discard changes, or load default values, and then exit the program. Press Enter to select the item on the **Exit** menu, and then select **Yes** when prompted to confirm the action. For information about exiting the Setup Utility program, see "Exiting the Setup Utility program" on page 32.

The **Exit** menu contains the following items:

Menu item	Description
Save Changes and Exit	Save changes and exit the Setup Utility program.
Discard Changes and Exit	Discard changes, load previous values, and then exit the Setup Utility program.
Discard Changes	Discard changes and load previous values.
Load UEFI Defaults	Restore the user default values for all the items.

Using passwords

By using the Setup Utility program, you can set a password to prevent unauthorized access to your server.

You do not have to set a password to use your server. However, using a password improves computing security. If you decide to set a password, read the following topics.

Setup Utility program password types

The following types of passwords are available in the Setup Utility program:

- **Supervisor password**

  Setting a supervisor password deters unauthorized users from changing configuration settings. If you are responsible for maintaining the configuration settings of several servers, you might want to set a supervisor password. When a supervisor password is set, you are prompted to type a valid password each time you try to access the Setup Utility program. The Setup Utility program cannot be accessed until a valid password is typed in.

- **User password**

  The user password has the following two options:

  - **Setup**

    When **Setup** is selected, you are prompted to type a valid password each time you try to access the Setup Utility program. The Setup Utility program cannot be accessed until a valid password is typed in.

    Note: If **Setup** is selected and the supervisor password is set, the supervisor password has higher authority.

  - **Always**

    When **Always** is selected, the server cannot be used until a valid password is typed in.

Note: If both the supervisor password and user password are set, you can type either password to use the server. However, you must use your supervisor password to change any configuration settings.

Password considerations

For security reasons, it is recommended that you use a strong password that cannot be easily compromised.

Notes:

1. The Setup Utility program passwords are case sensitive.
2. The server supports Setup Utility program passwords that consist of up to eight characters.

To set a strong password, use the following guidelines:

- Have at least three characters in length
- Contain at least one alphabetic character and one numeric character
- Not be your name or your user name

- Not be a common word or a common name
- Be significantly different from your previous passwords

Besides the alphabetic characters (a-z) and numeric characters (0-9), the server also supports characters typed using special keys on the keyboard for a password. Refer to the help message on the screen when setting a password to determine the valid special characters.

Setting, changing, or deleting a password

This topic provides instructions on how to set, change, or delete a password in the Setup Utility program.

To set, change, or delete a password in the Setup Utility program, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 27.
2. On the **Security** menu, select **Supervisor Password** to set a supervisor password or select **User Password** to set a user password.
3. See "Password considerations" on page 30. Then, follow the instructions on the screen to set or change a password.
4. If you want to delete a password, type your current password. Press Enter when you are prompted to type a new password. Then, press Enter to confirm the new password. The previous password will be cleared.

   Note: For security reasons, it is recommended that you always set a password for your server.
5. Press F10 to save settings and exit the Setup Utility program.

If you have forgotten the password, you can use the Clear CMOS jumper on the system board to erase the password. See "System board components" on page 24. Then, set a new password for the server.

Configuring the TPM function

The TPM chip is integrated on the system board and works as a hardware security solution to help you to encrypt data and protect the server.

To enable the TPM function in the Setup Utility program, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 27.
2. On the **Advanced** menu, select **Trust Computing ➙ Security device support**. Ensure that **Security device support** is set to **Enable**.
3. When **Security device support** is set to **Enabled**, the **TPM State** item is displayed. Set **TPM State** to **Enabled**.
4. Press F10 to save settings and exit the Setup Utility program. The server will restart in order to enable the TPM function.

Selecting a startup device

If your server does not start up from a desired device such as the disc or HDD as expected, do one of the following to select the startup device you want:

Note: Not all discs, HDDs, or other removable devices are bootable.

- To select a temporary startup device, do the following:

  Note: Selecting a startup device using the following method does not permanently change the startup sequence.

  1. Turn on or restart your server.

2. When you see the logo screen, press F12 to display the boot menu. The boot device selection window opens.

3. In the boot device selection window, use the up and down arrow keys on the keyboard to switch between the selections. Press Enter to select the device of your choice. Then, the server will start up from the selected device.

- To view or permanently change the configured startup device sequence, do the following:

  1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 27.

  2. On the **Boot** menu, follow the instructions on the screen to set the startup device depending on your needs. You also can set the boot priority for various devices. See "Boot menu" on page 28.

  3. Press F10 to save settings and exit the Setup Utility program. The server will follow the startup device sequence you have set each time you turn on the server.

Exiting the Setup Utility program

After you finish viewing or changing settings, press Esc to return to the Setup Utility program main interface. If you are on a nested submenu, press Esc repeatedly until you reach the main interface. To exit the Setup Utility program, you also can do the following:

- Press F10 to save the new settings and exit the Setup Utility program.

- Press F9 to return to the default settings.

For more information about the **Exit** menu in the Setup Utility program, see "Exit menu" on page 29.

Updating or recovering the BIOS

This topic provides instructions on how to update the BIOS and how to recover from a POST and BIOS update failure.

System programs are the basic layer of software built into your server. System programs include the POST, the UEFI BIOS, and the Setup Utility program. The POST is a set of tests and procedures that are performed each time you turn on your server. The UEFI BIOS is a layer of software that translates instructions from other layers of software into electrical signals that the server hardware can execute. You can use the Setup Utility program to view or change the configuration settings of your server. See "Using the Setup Utility program" on page 27.

Lenovo might make changes and enhancements to the BIOS and TMM firmware. When updates are released, they are available for download on the Lenovo Web site at http://www.lenovo.com/support. You can update the server firmware by downloading an update package and following the instructions on the Web page.

You also can use the Firmware Updater program to help you keep the server firmware up-to-date. See "Server setup procedure" on page 5.

Updating (flashing) the BIOS

This topic provides instructions on how to update (flash) the BIOS.

Notes:

- Update the BIOS on your server only if the newer BIOS version specifically solves a problem you have. We do not recommend BIOS updates for servers that do not need them. You can view the updated information for the new BIOS version in the installation instructions for the BIOS update utility program.

- Downgrading the BIOS to an earlier version is not recommended and might not be supported. An earlier BIOS version might not contain the support for the latest system configurations.

- If the power to your server is interrupted while the POST and BIOS are being updated, your server might not restart properly. Ensure that you perform the BIOS update procedure in an environment with a steady power supply. Besides, ensure that your server can restart successfully without encountering hardware problems.
- If you have updated the BIOS firmware, all the BIOS settings become the default settings of the updated BIOS version. You need to check and reconfigure the BIOS settings for your specific needs.

To update (flash) the BIOS, do the following:
1. Go to http://www.lenovo.com/support and follow the instructions on the Web page to locate the BIOS update package.
2. Download the BIOS update package and the TXT file that contains installation instructions.
3. Print the TXT file and follow the instructions to update (flash) the BIOS.
4. Check and reconfigure the BIOS settings for your specific needs based on your note or refer to "Using the Setup Utility program" on page 27 after the BIOS update process is completed.

Recovering from a BIOS update failure

If the power to your server is interrupted while the BIOS is being updated, your server might not restart correctly. Perform the following procedure to recover from the BIOS update failure.

To recover from a BIOS update failure, do the following:
1. Go to http://www.lenovo.com/support and follow the instructions on the Web page to download the BIOS recovery package.
2. Put the ROM file to a bootable USB flash drive.
3. Insert the USB flash drive to the server.
4. Reconnect the server to an ac power source.
5. Press the power button to turn on the server. The recovery process starts automatically. To prevent permanent damage, do not turn off the server during the recovery process. When the recovery process is completed, the server turns on automatically.
6. Check and configure the BIOS settings for your specific needs. See "Using the Setup Utility program" on page 27.
7. If the operating system of your server is installed under EFI mode, reinstall the operating system after recovering the BIOS.

Note: If you cannot recover the BIOS after using the instructions in this topic, the BIOS read-only memory (ROM) might be damaged. You must replace the system board. Contact the Lenovo Customer Support Center. See "Calling for service" on page 102.

Using the ThinkServer EasyStartup program

The ThinkServer EasyStartup program simplifies the process of configuring RAID and installing supported Windows and Linux operating systems and device drivers on your server. The program works with your Windows or Linux operating system installation disc to automate the process of installing the operating system and associated device drivers.

To download the ThinkServer EasyStartup program image and burn it into a disc or a USB flash drive, do the following:
1. Go to http://www.lenovo.com/support and follow the instructions on the Web page to locate the ThinkServer EasyStartup program.

2. Download the ISO package for the ThinkServer EasyStartup program. The ISO package contains the ISO image and a utility for burning the ISO image into a USB flash drive.

3. Download the readme file and read it carefully. The readme file contains important information about the program.

4. Do one of the following:

   • Use an optical drive and any CD or DVD burning software to create a bootable disc with the ISO image.

   • Use an empty USB flash drive and the utility in the ISO package to create a bootable USB flash drive with the ISO image.

For instructions on how to use the ThinkServer EasyStartup program, view the user guide from the main interface of the program.

Features of the ThinkServer EasyStartup program

The ThinkServer EasyStartup program has the following features:

• Easy-to-use, language-selectable interface

• Integrated help system and user guide

• Automatic hardware detection

• RAID configuration utility

• Device drivers provided based on the server model and detected devices

• Selectable partition size and file system type

• Support for multiple operating systems

• Ability to install the operating system and device drivers in an unattended mode to save time

• Ability to create a reusable response file that can be used with similarly configured Lenovo servers to make future installations even faster

Starting the ThinkServer EasyStartup program

This topic provides instructions on how to start the ThinkServer EasyStartup program. After you start the program and enter the main interface, click **User Guide** for more information about using this program to help you configure the server and install an operating system.

To start the ThinkServer EasyStartup program, do the following:

1. Insert the disc or USB flash drive with the ThinkServer EasyStartup ISO image into your server, and set the optical drive with the disc or USB flash drive as the first startup device. Then, start your server from the disc or USB flash drive. See "Selecting a startup device" on page 31.

2. Wait for the program to load. Then, select the language for the program and keyboard layout when prompted.

   Note: The supported languages and keyboard layouts for the ThinkServer EasyStartup program are Dutch, English, French, German, Italian, Japanese, Russian, Spanish, and Turkish.

3. After selecting the language and keyboard layout, click **OK**. Then, you will see one or more messages about configuring storage devices. Click **Next** when you are prompted with the Lenovo License Agreement. Read the Lenovo License Agreement carefully. In order to continue, you must agree those terms by clicking **Agree**. Then, the Date and time window opens.

4. Set the current date and time and click **OK**. The Start option window opens.

5. The Start option window provides the following selections:

- Continue to the main interface.
- Install the operating system using a pre-existing response file.
- Configure RAID using a pre-existing response file.

Read the explanations on the screen and select a desired option. Then, follow the instructions on the screen. If this is the first time you are using the ThinkServer EasyStartup program, select the option to continue to the main interface and view the compatibility notes and user guide.

Notes:

- Functionality and supported operating systems vary depending on the version of the ThinkServer EasyStartup program. From the main interface of the program, click **Compatibility notes** to view the information about the RAID controllers, operating systems, and server configurations supported by the specific version of the program. Click **User Guide** to view the various functions and learn how to use the program.
- Before using the ThinkServer EasyStartup program to install an operating system, ensure that any external storage devices and fiber channels are configured correctly.

The ThinkServer EasyStartup program main interface provides the following menus on the left pane of the screen.

Menu item	Description
Home	Provide general information about the program.
Compatibility notes	Provide information about the operating systems and server configurations supported by the version of the program you are using.
User Guide	Provide information about the features of the program and instructions on how to use the program.
Hardware list	Display a list of hardware devices detected by the program.
Configure RAID	Instruct you to configure RAID or view the current RAID configuration and make changes if needed.
Install operating system	Display a series of choices and prompts to collect information required for operating system installation, prepare the hard disk drive for installation, and then initiate the installation process using your operating system installation disc.
Driver download	Provide the supported device drivers for download.
About	Provide the version information and legal notices.

Configuring RAID

This topic provides information about RAID and the utility programs that are available for you to configure RAID.

This topic contains the following items:

- "About RAID" on page 36
- "RAID for your server" on page 37
- "Configuring onboard SATA software RAID" on page 38
- "Configuring advanced SATA or SAS hardware RAID" on page 40

About RAID

RAID, an acronym for Redundant Array of Independent Disks, is a technology that provides increased storage functions and reliability through redundancy. This is achieved by combining multiple HDDs into a logical unit, where data is distributed across the drives in one of several ways called RAID levels.

When a group of independent physical HDDs are set up to use RAID technology, they are in a RAID array. This array distributes data across multiple HDDs, but the array appears to the host server as one single storage unit. Creating and using RAID arrays provides high performance, such as the expedited I/O performance, because several drives can be accessed simultaneously.

RAID drive groups also improve data storage reliability and fault tolerance compared with single-drive storage systems. Data loss resulting from a drive failure can be prevented by reconstructing missing data from the remaining drives.

The following list describes some of the most commonly used RAID levels:

- **RAID 0**: block-level striping without parity or mirroring

  Simple stripe sets are normally referred to as RAID 0. RAID 0 uses striping to provide high data throughput, especially for large files in an environment that does not require fault tolerance. RAID 0 has no redundancy and it provides improved performance and additional storage without fault tolerance. Any drive failure destroys the array and the likelihood of failure increases with more drives in the array. RAID 0 does not implement error checking, so any error is uncorrectable. More drives in the array means higher bandwidth, but greater risk of data loss.

  RAID 0 requires a minimum number of one HDD.

- **RAID 1**: mirroring without parity or striping

  RAID 1 uses mirroring so that data written to one drive is simultaneously written to another drive. This is good for small databases or other applications that require small capacity but complete data redundancy. RAID 1 provides fault tolerance from disk errors or failures and continues to operate as long as at least one drive in the mirrored set is functioning. With appropriate operating system support, there can be increased read performance and only a minimal write performance reduction.

  RAID 1 requires a minimum number of two HDDs.

- **RAID 5**: block-level striping with distributed parity

  RAID 5 uses disk striping and parity data across all drives (distributed parity) to provide high data throughput, especially for small random access. RAID 5 distributes parity along with the data and requires all drives but one to be present to operate; drive failure requires replacement, but the array is not destroyed by a single drive failure. Upon drive failure, any subsequent read operations can be calculated from the distributed parity so that the drive failure is masked from the end user. The array will have data loss in the event of a second drive failure and is vulnerable until the data that was on the failing drive is rebuilt onto a replacement drive. A single drive failure in the set will result in reduced performance of the entire set until the failing drive has been replaced and rebuilt.

  RAID 5 requires a minimum number of three HDDs.

- **RAID 6**: block-level striping with distributed parity

  RAID 6 uses distributed parity, with two independent parity blocks per stripe, and disk striping. A RAID 6 virtual drive can survive the loss of any two drives without losing data. A RAID 6 drive group is similar to a RAID 5 drive group. Blocks of data and parity information are written across all drives. The parity information is used to recover the data if one or two drives fail in the drive group.

  RAID 6 requires a minimum number of three HDDs.

- **RAID 10**: a combination of RAID 0 and RAID 1

  RAID 10 consists of striped data across mirrored spans. A RAID 10 drive group is a spanned drive group that creates a striped set from a series of mirrored drives. RAID 10 allows a maximum of eight spans. You

must use an even number of drives in each RAID virtual drive in the span. The RAID 1 virtual drives must have the same stripe size. RAID 10 provides high data throughput and complete data redundancy but uses a larger number of spans.

RAID 10 requires a minimum number of four HDDs and also requires an even number of drives, for example, six HDDs or eight HDDs.

- **RAID 50**: a combination of RAID 0 and RAID 5

RAID 50 uses distributed parity and disk striping. A RAID 50 drive group is a spanned drive group in which data is striped across multiple RAID 5 drive groups. RAID 50 works best with data that requires high reliability, high request rates, high data transfers, and medium-to-large capacity.

Note: Having virtual drives of different RAID levels, such as RAID 0 and RAID 5, in the same drive group is not allowed. For example, if an existing RAID 5 virtual drive is created out of partial space in an array, the next virtual drive in the array has to be RAID 5 only.

RAID 50 requires a minimum number of six HDDs.

- **RAID 60**: a combination of RAID 0 and RAID 6

RAID 60 uses distributed parity, with two independent parity blocks per stripe in each RAID set, and disk striping. A RAID 60 virtual drive can survive the loss of two drives in each of the RAID 6 sets without losing data. RAID 60 works best with data that requires high reliability, high request rates, high data transfers, and medium-to-large capacity.

RAID 60 requires a minimum number of six HDDs.

For more information about RAID, refer to "Introduction to RAID" in the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

RAID for your server

Note: Before configuring RAID for your server, ensure that you use HDDs that are of the same type (SATA or SAS) and have the same capacity within a single RAID array.

Your server supports the following two types of RAID configurations:

- **Onboard SATA software RAID configuration**

The onboard SATA software RAID controller is integrated on the Intel C232 chip on the system board. If your server has SATA HDDs that are connected to the system board, you can use the Intel Rapid Storage Technology enterprise program to configure RAID. By default, your server supports onboard SATA software RAID levels 0, 1, 5, and 10. The onboard RAID is a software RAID instead of a hardware RAID.

For more information, see "Configuring onboard SATA software RAID" on page 38.

- **Advanced SATA/SAS hardware RAID configuration (requires a RAID card)**

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You also can purchase the RAID card from Lenovo and install it into server models that support the RAID card to get advanced SATA/SAS hardware RAID functions. See "RAID card" on page 18 and "PCIe card" on page 54 for more information.

The RAID card provides the WebBIOS Configuration Utility program to help you configure RAID independently of the operating system. You also can install the MegaRAID Storage Manager program and the StorCLI Configuration Utility program to help you manage the RAID array and RAID controller in an operating system environment. The supported RAID levels are RAID 0, 1, and 10 for ThinkServer RAID 520i PCIe Adapter by default. To activate RAID 5 level, install a RAID 520i upgrade key on the RAID card. The supported RAID levels are RAID 0, 1, 5, and 10 for ThinkServer RAID 720i PCIe Adapter by default. To activate RAID 6 level, you need to install a Thunderbolt Memory Module on the RAID card.

For more information, see "Configuring advanced SATA or SAS hardware RAID" on page 40.

Notes:

- For server models with SAS hard disk drives, a RAID card must be installed.
- The ThinkServer EasyStartup program simplifies the process of configuring supported RAID and installing supported operating systems and device drivers.

Before configuring RAID for your server, observe the following precautions:

1. Use HDDs that have the same capacity within a single RAID array.
2. Use HDDs that are of the same type (SATA or SAS) within a single RAID array.
3. Depending on the operating system, the primary RAID might be limited to 2 TB total drive capacity.

Configuring onboard SATA software RAID

- "Enabling the onboard SATA RAID functionality" on page 38
- "Creating RAID volumes" on page 38
- "Deleting RAID volumes" on page 39
- "Resetting disks to non-RAID" on page 39
- "Marking disks as spare" on page 39

Note: When the HDDs are connected to the system board, HDD 0, HDD 1, HDD 2, and HDD 3 will be displayed as physical devices 1, 2, 3, and 5 respectively in the main menu of the Intel Rapid Storage Technology enterprise option ROM configuration utility.

Enabling the onboard SATA RAID functionality

Note: Use the arrow keys on the keyboard to make selections.

To enable onboard SATA RAID functionality, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 27.
2. Select **Advanced ➙ Storage Configuration**.
3. Select **SATA Mode Selection** and press Enter.
4. Select **RAID** and press Enter.
5. Press F10 to save changes and exit the Setup Utility program.

Creating RAID volumes

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to create RAID volumes.

To create RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.
2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID volume name in the **Name** field.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Enter.
5. If appropriate, press Enter in the **Disks** field, a menu is displayed. Use the arrow keys to scroll through the list of available disks and press the space key to select disks. Then, press Enter.
6. If appropriate, use the arrow keys to select a stripe size in the **Stripe Size** field and press Enter.
7. Type a volume size in the **Capacity** field and press Tab.
8. Press Enter to initiate volume creation.

9. When prompted, press Y to accept the warning message and create the volume.

10. If desired, return to step 2 to create additional RAID volumes.

11. When finished, select **Exit** and press Enter.

Deleting RAID volumes

This section describes how to use the Intel Rapid Storage Technology enterprise option ROM configuration utility to delete RAID volumes.

To delete RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.

2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.

3. Use the arrow keys to select the RAID volume to be deleted and press Delete.

4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the HDDs to non-RAID.

5. After deleting a RAID volume, you can:

   - Return to step 2 to delete additional RAID volumes.

   - See "Creating RAID volumes" on page 38 for RAID volume creation.

   - Use the up and down arrow keys to select **Exit** and press Enter.

Resetting disks to non-RAID

This section describes how to reset your HDDs to non-RAID.

To reset your HDDs to non-RAID, do the following:

1. Press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility during system startup.

2. Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.

3. Use the arrow keys and the space key to mark individual physical HDDs to be reset, and then press Enter to complete the selection.

4. When prompted, press Y to confirm the reset action.

5. After resetting the HDDs to non-RAID, you can:

   - See "Deleting RAID volumes" on page 39 for RAID volume deletion.

   - See "Creating RAID volumes" on page 38 for RAID volume creation.

   - Use the up and down arrow keys to select **Exit** and press Enter.

Marking disks as spare

To mark HDDs as spare drives, do the following:

1. During the system startup, press Ctrl+I when prompted to enter the Intel Rapid Storage Technology enterprise option ROM configuration utility.

2. Use the up and down arrow keys to select **Mark Disks as Spare** and press Enter.

3. Use the arrow keys to locate an HDD and press the space key to select or deselect the HDD. You can select multiple HDDs if required. Then, press Enter to complete the selection.

4. When prompted, press Y to confirm the operation.

   Note: Marking an HDD as a spare drive will remove all data on the drive.

5. When finished, select **Exit** and press Enter.

Notes: If your server has one of the following Linux operating systems installed, continue with the corresponding actions:

- For the Redhat Enterprise Linux 6 and Redhat Enterprise Linux 7 operating systems, add the following line to the end of the `/etc/mdadm.conf` file and restart the operating system.
  ```
  POLICY domain=DOMAIN path=* metadata=imsm action=spare-same-slot
  ```

- For the SUSE Linux Enterprise Server 11 and SUSE Linux Enterprise Server 12 operating systems, do the following:

  1. Add the following line to the end of the `/etc/mdadm.conf` file.
     ```
     POLICY domain=DOMAIN path=* metadata=imsm action=spare-same-slot
     ```

  2. Run the following commands as a root user.
     ```
     # chkconfig –s mdadmd on
     # /etc/init.d/mdadmd start
     ```

Configuring advanced SATA or SAS hardware RAID

Some server models come with a required RAID card to provide advanced SATA/SAS hardware RAID functions to the server. You also can purchase the RAID card from Lenovo and install it into server models that support the RAID card to get advanced SATA/SAS hardware RAID functions. See "RAID card" on page 18 and "PCIe card" on page 54 for more information.

Note: For server models with SAS HDDs, a RAID card must be installed.

Programs for configuring SATA/SAS hardware RAID

Lenovo provides the following programs to help you configure advanced SATA/SAS hardware RAID:

- ThinkServer EasyStartup program to configure RAID
  See "Using the ThinkServer EasyStartup program" on page 33 and view the user guide from the main interface of the program.

- WebBIOS Configuration Utility program (configuring RAID independently of the operating system)
  To use the program, follow the instructions on the booting screen.

- MegaRAID Storage Manager program and the StorCLI Configuration Utility program (configuring RAID in an operating system environment)
  To install and use the MegaRAID Storage Manager program, refer to the following chapters in the *MegaRAID SAS Software User Guide*:

  Note: Some information in these chapters might be intended for the advanced SATA/SAS hardware RAID configurations and might not apply to the onboard SATA software configurations.

  – "MegaRAID Storage Manager Overview and Installation"

  – "MegaRAID Storage Manager Window and Menus"

  – "Monitoring System Events and Storage Devices"

  – "Maintaining and Managing Storage Configurations"

To download the *MegaRAID SAS Software User Guide* and the installation packages of the programs, go to http://www.lenovo.com/support, and then follow the instructions on the Web page.

Instructions for configuring SATA/SAS hardware RAID

For instructions on how to configure and manage the advanced SATA or SAS hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

Using Lenovo XClarity Administrator

The initial setup of Lenovo XClarity Administrator includes the following:

- Preparing the network
- Installing and configuring the Lenovo XClarity Administrator virtual appliance
- Managing systems
- Setting up automatic problem notification optionally

To manage systems based on the network topology that is implemented in your environment, there are a number of different ways to connect manageable systems to the network and to set up the Lenovo XClarity Administrator. If you plan to use Lenovo XClarity Administrator to manage the server, you must check for the latest applicable Lenovo XClarity Administrator updates.

To download the Lenovo XClarity Administrator full image and the Lenovo XClarity Administrator updates, go to:
https://support.lenovo.com/documents/LNVO-LXCAUPD

The full image includes all features of Lenovo XClarity Administrator. For operating-system deployment and configuration management features, there is a free, 90-day trial period. After the trial period, you are required to purchase a license.

Configuring the Ethernet controllers

Two Ethernet controllers are integrated on the system board. They provide two ports for connecting to a 10 Mbps, 100 Mbps, or 1000 Mbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network.

You do not have to set any jumpers or configure the Ethernet controllers. However, it is better to install the latest device driver for best performance.

The device drivers for onboard Ethernet controllers are available for download at:
http://www.lenovo.com/support

Chapter 5. Replacing hardware

This chapter provides instructions on how to remove and install hardware for your server.

This chapter contains the following items:

- "Purchasing ThinkServer options" on page 43
- "Getting familiar with important guidelines" on page 43
- "Preparing your server in advance" on page 45
- "Removing and installing hardware" on page 46
- "Completing the parts replacement" on page 91

Note: In most areas of the world, Lenovo requires the return of the defective CRU. Information about this will come with the CRU or will come a few days after the CRU arrives.

Purchasing ThinkServer options

You can purchase the supported options from Lenovo and install them in your server to enable desired functions. For a list of ThinkServer options, go to:
http://lenovoquickpick.com/usa/home/thinkserver/rack-and-tower-server

Note: The option kit is designed for different types of servers and might contain additional cables that are not required for your server.

Getting familiar with important guidelines

This topic provides some guidelines that you should read and understand before using your server.

Precautions

Before using the server, ensure that you read and understand the following precautions:

- Before using the product, ensure that you read and understand the multilingual safety instructions and the Lenovo Limited Warranty (LLW) on the Lenovo Web site at https://support.lenovo.com/documents/LNVO-DOCS. Reading and understanding the safety instructions reduces the risk of personal injury and damage to your product.

- When you install your new server, take the opportunity to download and apply the most recent firmware updates. This step will help to ensure that any known issues are addressed and that your server is ready to function at maximum levels of performance. To download firmware updates for your server, go to http://www.lenovo.com/support and follow the instructions on the Web page.

- Before you install optional hardware devices, ensure that the server is working correctly. If the server is not working correctly, see Chapter 6 "Troubleshooting and diagnostics" on page 95 to do basic troubleshooting. If the problem cannot be solved, see Chapter 7 "Getting information, help, and service" on page 101.

- Observe good housekeeping in the area where you are working. Put removed covers and other parts in a safe place.

- If you must turn on the server while the server cover is removed, ensure that no one is near the server and that no tools or other objects have been left inside the server.

- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:

- Ensure that you can stand safely 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.

- Ensure 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 to drives.

- Have a small flat-blade screwdriver available.

- To view the LEDs on the system board and internal components, leave the server connected to power.

- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.

Handling static-sensitive devices

Attention: Do not open the static-protective package that contains the new part until the defective part has been removed from the server and you are ready to install the new part. Static electricity, although harmless to you, can seriously damage server components and parts.

When you handle server parts and components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.

- The use of a grounding system is recommended. For example, it is recommended to wear an electrostatic discharge (ESD) wrist strap, if one is available. Ensure that you work in an ESD-safe area.

- Always carefully handle the parts and other components (such as PCI cards, memory modules, system boards, and microprocessors) by edges or frame. Do not touch solder joints, pins, or exposed circuitry.

- Do not leave the device where others can handle and possibly damage the device.

- Before you replace a new part, touch the static-protective package containing the new part to an unpainted metal part of the server for at least two seconds. This reduces static electricity from the package and your body.

- Remove the new part from the static-protective package and directly install it in the server without placing it on any other surface. If it is hard for you to do this in your specific situation, place the static-protective package of the new part on a smooth, level surface, and then place the new part on the static-protective package.

- Do not place the part on the server cover or other metal surface.

- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

System reliability guidelines

To help ensure proper cooling and system reliability, strictly follow these guidelines:

- All drive bays and PCI card slots are either occupied by drives and cards or covered by electromagnetic interference (EMI) protective panels or EMI shields. When you install an internal drive or a PCI card, save the EMI shield or dummy tray from the drive bay or save the PCI card slot bracket in case you later remove the device.

  Attention: An unoccupied drive bay or PCI card slot without a cover, shield, dummy tray, filler, or any other protection might impact the EMI integrity and cooling of the server, which might result in overheating or component damage.

- Leave adequate space around the server to ensure that the server cooling system works well. Leave approximately 50 mm (2 inches) of open space around the front and rear of the server. Do not place objects in front of the fans.
- For proper cooling and airflow, install the server cover before you turn on the server. Operating the server with the server cover removed might damage server components.
- Properly route the cables. For some options, such as PCI cards, follow the cabling instructions that come with the options in addition to the instructions in this manual.
- Do not remove the air baffle while the server is running. Operating the server without the air baffle might cause the microprocessor to overheat.
- Ensure that you replace a failing fan as soon as you remove the old one.

Preparing your server in advance

> **CAUTION:**
> **Do not open your server or attempt any repair before reading and understanding "Read this first: safety information" on page iii and "Getting familiar with important guidelines" on page 43.**

- "Removing or extending the server from the rack" on page 45
- "Removing the server cover" on page 45

Removing or extending the server from the rack

If the server is installed in a rack, remove or extend the server from the rack before removing or installing hardware. Depending on the rail type, do one of the following:

- If the server is installed in a rack using static rails, turn off the server and remove it from the rack. Place the server on a flat, clean, and static-protective surface. See the documentation that comes with the rail kit.
- If the server is installed in a rack using slide rails, press the rack handles to extend the server from the rack. However, if the working environment, cabling configuration, or the server location in the rack still makes your operation difficult to proceed, turn off the server and remove it from the rack. See the documentation that comes with the rail kit.

Removing the server cover

To remove the server cover, do the following:

1. Remove all external media from the drives. Then, turn off all attached devices and the server.
2. Disconnect all power cords from electrical outlets.
3. Disconnect all cables that are connected to the server.
4. If the server is installed in a rack, remove or extend the server from the rack. See "Removing or extending the server from the rack" on page 45.
5. Loosen the thumbscrew that secures the server cover. Slide the server cover to the rear until it is disengaged from the chassis. Then, lift the server cover off the chassis and set it aside.

   Notes:

   - It is recommended that you wait several minutes to let the server cool before removing the cover.
   - The thumbscrew is an integrated part of the server cover. Do not try to remove the thumbscrew from the server cover.
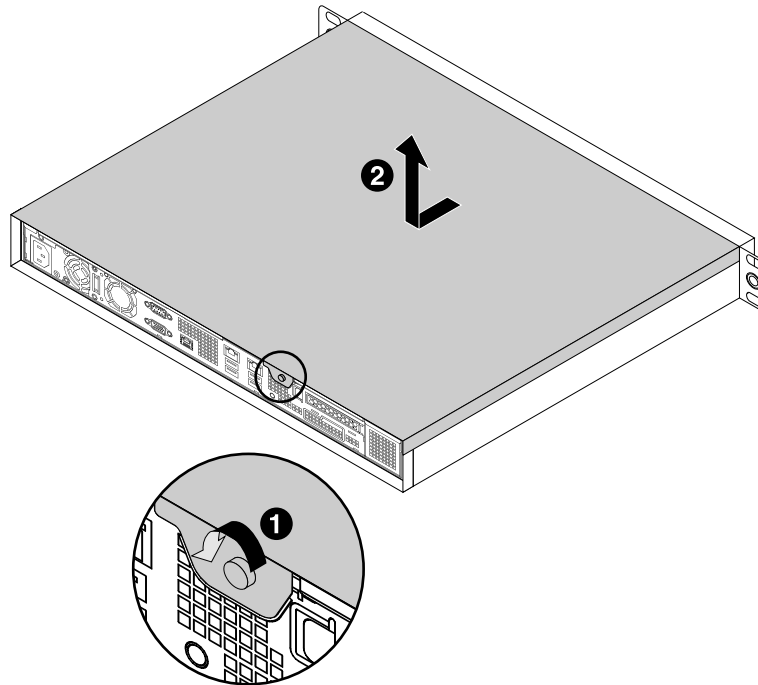
Figure 19. Removing the server cover

To install the server cover, see "Completing the parts replacement" on page 91.

Attention: For proper cooling and airflow, install the server cover before turning on the server. Operating the server with the server cover removed for more than 30 minutes might damage server components.

Removing and installing hardware

This topic provides instructions on how to remove and install hardware for your server. You can expand the capabilities of your server by adding new hardware devices, such as memory modules, PCIe card, or other server options, and maintain your server by replacing the failing hardware devices.

If you are handling a server option, refer to the appropriate installation or removal instructions in this topic along with the instructions that come with the option.

Notes:

- Use only parts provided by Lenovo.
- Depending on the model, your server might look slightly different from the illustrations in this topic.

Rack handles

- "Removing the rack handles" on page 46
- "Installing the rack handles" on page 47

Removing the rack handles

To remove the rack handles, do the following:

1. If the server is installed in a rack, remove the server from the rack. See "Removing or extending the server from the rack" on page 45.

2. On each side of the server, remove the two screws ◼ that secure the rack handle and then remove the rack handle from the chassis.
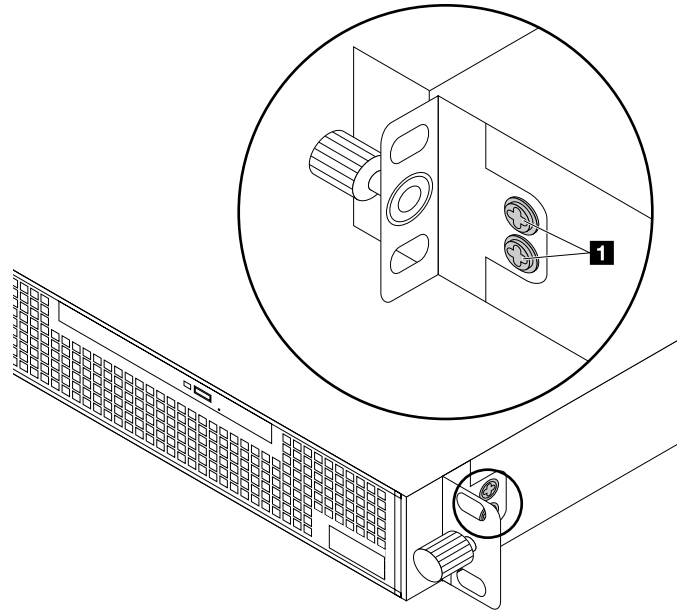
Figure 20. Removing the rack handles

Installing the rack handles

To install the rack handles, do the following:

1. Align the screw holes in the rack handle with the corresponding holes in the chassis. Then, install the two screws ◼ to secure the rack handle on each side of the server.
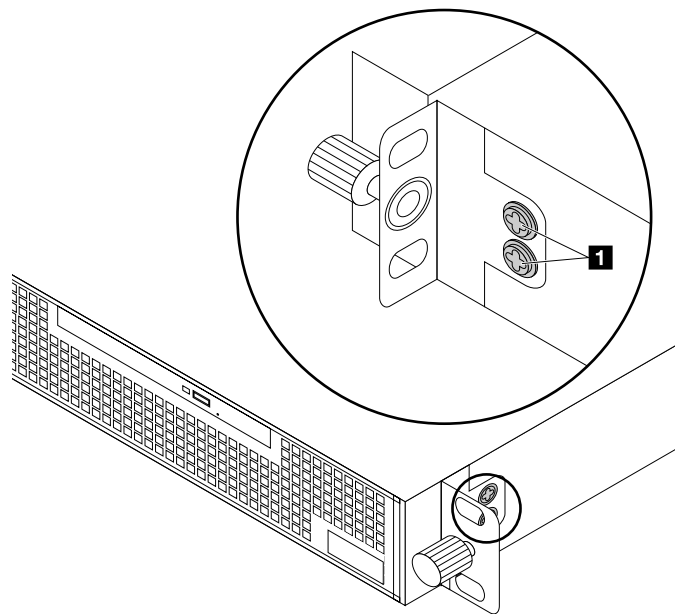
Figure 21. Installing the rack handles

2. Install the server into the rack if necessary.

Air baffle

To access some server components on the system board, you must remove the air baffle. To ensure proper cooling and airflow, you must reinstall the air baffle before turning on the server.

- "Removing the air baffle" on page 48
- "Installing the air baffle" on page 49

Removing the air baffle

To remove the air baffle, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate the air baffle in the server and lift it out of the server.
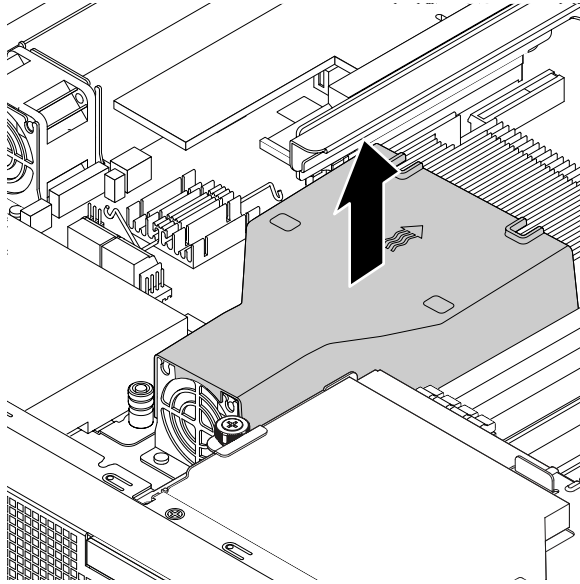
Figure 22. Removing the air baffle

Installing the air baffle

Note the orientation of the air baffle and place it above the heat sink. Then, lower the air baffle into the chassis until it is secured into position.
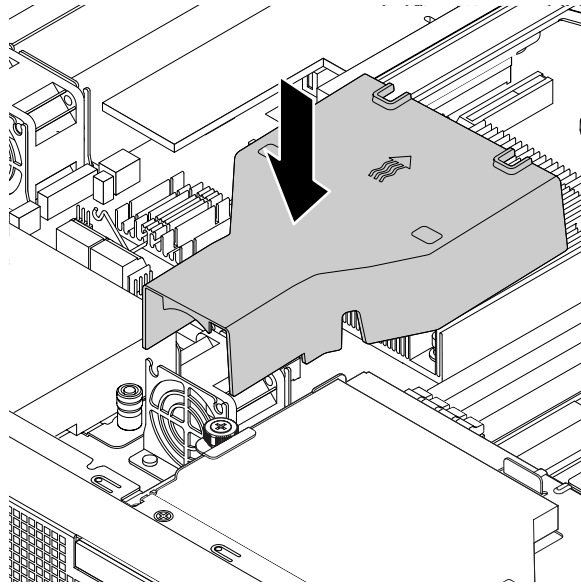
Figure 23. Installing the air baffle

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Heat sink

- "Removing the heat sink" on page 50
- "Installing the heat sink" on page 50

CAUTION:

⚠️ 🔥

The heat sink might be very hot. Turn off the server and wait three to five minutes to let the server cool before removing the server cover.

Removing the heat sink

To remove the heat sink, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Remove the air baffle. See "Removing the air baffle" on page 48.

3. Locate the heat sink and remove the four screws that secure the heat sink. It is recommended that you carefully remove the four screws from the system board using the following method to avoid any possible damage to the system board.

    a. Partially remove screw **1**, then completely remove screw **2**, and then return to screw **1** and completely remove it.

    b. Partially remove screw **3**, then completely remove screw **4**, and then return to screw **3** and completely remove it.

    Note: The four screws are integrated parts of the heat sink. Do not try to remove the four screws from the heat sink.
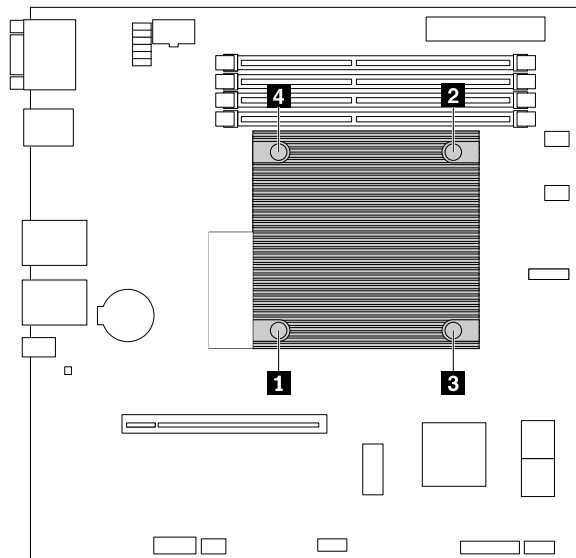
Figure 24. Removing the screws that secure the heat sink

4. Gently twist the heat sink to free it from the microprocessor, lift the heat sink off the system board, and then lay it down by its side. Do not touch the thermal grease on the bottom of the heat sink.

5. If you are instructed to return the old heat sink, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the heat sink

To install the heat sink, do the following:

1. Touch the static-protective package that contains the new heat sink to any unpainted surface on the outside of the server. Then, remove the heat sink from the package.

Note: Before installing the new heat sink, use the cleaning pad that comes with the heat sink to wipe the thermal grease from the top of the microprocessor. Dispose of the cleaning pad after all thermal grease is removed from the microprocessor.

2. Remove any protective cover that protects the thermal grease on the bottom of the heat sink. Do not touch the thermal grease.

3. Place the heat sink on the system board so that the four screws on the heat sink are inserted into the corresponding holes in the system board.

4. Install the four screws to secure the heat sink on the system board. It is recommended that you carefully install the four screws using the following method to avoid any possible damage to the system board.

   a. Partially tighten screw **1**, then firmly tighten screw **2**, and then return to screw **1** and firmly tighten it. Do not over-tighten the screws.

   b. Partially tighten screw **3**, then firmly tighten screw **4**, and then return to screw **3** and firmly tighten it. Do not over-tighten the screws.
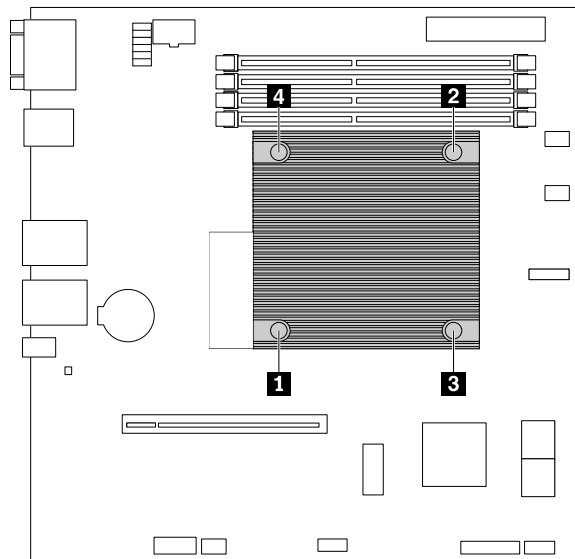
Figure 25. Installing the screws to secure the heat sink

5. Reinstall the air baffle. See "Installing the air baffle" on page 49.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Memory module

- "Removing the memory module" on page 53
- "Installing the memory module" on page 53

Features

- Your server has four memory slots. Each slot supports 4 GB, 8 GB, and 16 GB double data rate 4 (DDR4) unbuffered dual inline memory modules (UDIMMs) with Error Checking and Correcting (ECC) technology.
- The minimum system memory is 4 GB.
- The maximum system memory is 64 GB (one 16 GB memory module installed in each of the four memory slots).

Guidelines

- All memory modules to be installed must be the same type with the same voltage.
- If your server comes with one of the following microprocessors, both 2133 MHz and 2400 MHz memory modules are supported. However, the data rate of your memory modules is limited to 2133 MHz:
  - Intel Celeron G3900/G3900T/G3920
  - Intel Core i3-6100/6300/6320
  - Intel Pentium G4400/G4500/G4520
  - Intel Xeon E3-1200 v5 series
- If your server comes with one of the following microprocessors, only 2400 MHz memory modules are supported, and the data rate of your memory modules is 2400 MHz:
  - Intel Core i3-7100/7100T/7300/7300T/7320
  - Intel Pentium G4560/G4560T/G4600/G4600T/G4620
  - Intel Xeon E3-1200 v6 series
- If your server comes with one of the following microprocessors, only 2400 MHz memory modules are supported. However, the data rate of your memory modules is limited to 2133 MHz:
  - Intel Celeron G3930
  - Intel Celeron G3930T
  - Intel Celeron G3950
- If you mix memory modules with different frequencies in the same server, all the memory modules run at the speed of the memory module with the lowest frequency.
- When you install memory modules with different capacity, install the memory module that has the highest capacity first.

Installation order

The following illustration shows the installation order for the four memory slots. Install memory modules in the numerical order as shown.
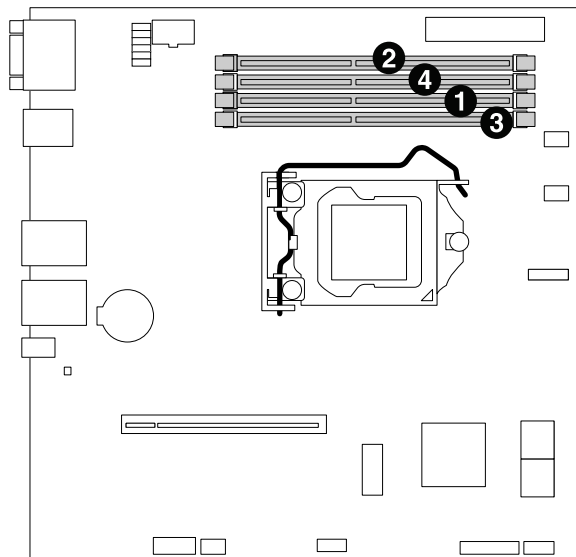
Figure 26. Memory module installation order

Removing the memory module

Note: The memory modules are extremely sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 44 first and carefully perform the operation.

To remove a memory module, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate and remove the memory module. Open the retaining clips and gently pull the memory module out of the memory slot.
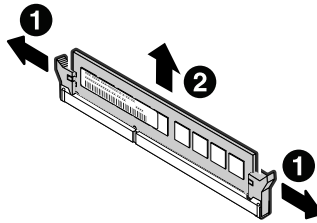
Figure 27. Removing a memory module

3. If you are instructed to return the old memory module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the memory module

Note: The memory modules are extremely sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 44 first and carefully perform the operation.

To install a memory module, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate an appropriate memory slot on the system board by referring to the memory module installation rules in "Memory module" on page 51. If a filler is installed in the slot, remove the filler.
3. Touch the static-protective package that contains the new memory module to any unpainted surface on the outside of the server. Then, take the new memory module out of the package.

   Note: Carefully handle the memory module by its edges.
4. Open the retaining clips and install the memory module into the slot until the retaining clips are completely closed.
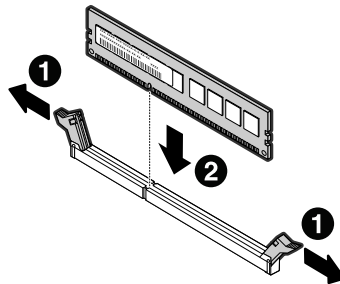
Figure 28. Installing the memory module

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

PCIe card

This topic provides instructions on how to install or remove a PCIe card, such as a RAID card, an Ethernet card, a Host Bus Adapter, and any other supported PCIe cards.

Notes:

*   The PCIe card is sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 44 first and carefully perform the operation.
*   Depending on the specific type, the PCIe card might look different from the illustrations in this topic.

Removing the PCIe card

To remove the PCIe card, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Remove the plastic holder that secures the PCIe card to the riser card assembly. Then, grasp the PCIe card by its edges and carefully pull it out of the PCIe card slot on the riser card.

    Note: The PCIe card might fit tightly into the PCIe card slot. If necessary, alternate moving each side of the PCIe card a small and equal amount until it is completely removed from the slot.
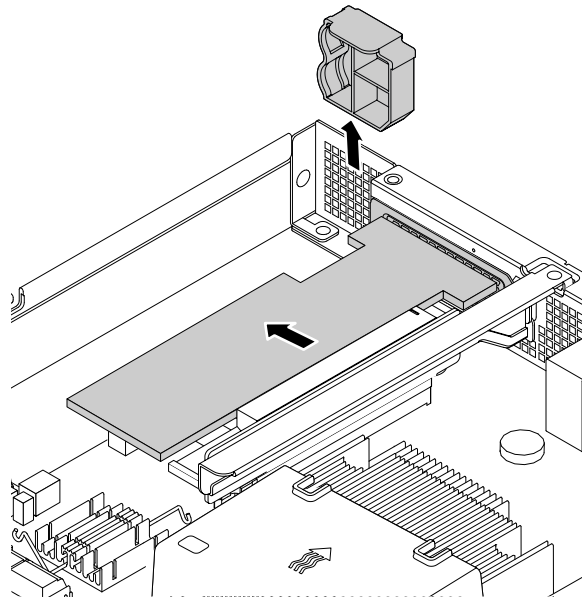
Figure 29. Removing the PCIe card

3. Disconnect any cables from the PCIe card.
4. Install a new PCIe card to replace the old one or install a PCIe-card-slot bracket to cover the place. See "Installing the PCIe card" on page 55.
5. If you are instructed to return the old PCIe card, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the PCIe card

To install the PCIe card, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Do one of the following:

    • If the server is installed with a PCIe card, remove the card. See "Removing the PCIe card" on page 54.

    • If the server is installed with a PCIe-card-slot bracket, remove the plastic holder that secures the bracket and then remove the bracket from the chassis. Store it in case you later remove the PCIe card and need the bracket to cover the place.
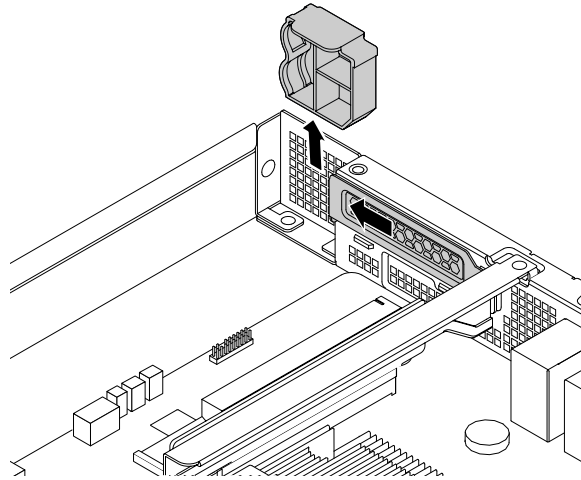
Figure 30. Removing the PCIe-card-slot bracket

3. Touch the static-protective package that contains the new PCIe card to any unpainted surface on the outside of the server. Then, take the new PCIe card out of the package.

    Note: Carefully handle the PCIe card by its edges.

4. Connect any cables to the PCIe card if necessary. See "Connecting the cables" on page 19.

5. Align the PCIe card with the PCIe card slot on the riser card assembly. Then, carefully press the PCIe card into the slot until it is securely seated and its bracket also is secured to the rear of the server. Then, install the plastic holder to secure the PCIe card to the riser card assembly.
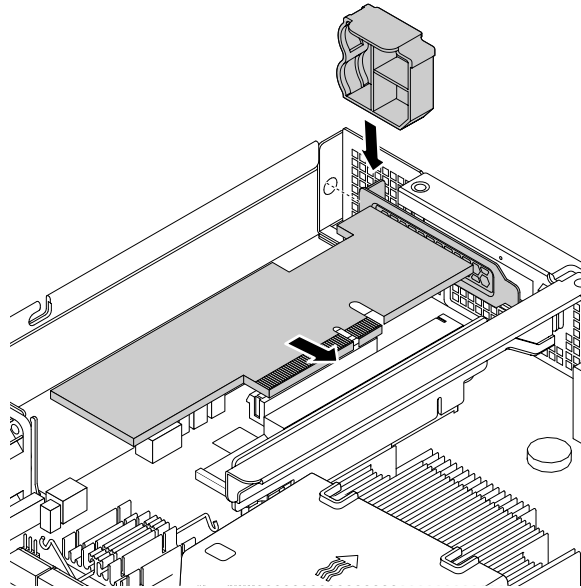
Figure 31. Installing the PCIe card

6. Connect cables to other components depending on your specific server configuration. See "Connecting the cables" on page 19.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

To install a required device driver for the PCIe card, go to the Lenovo Support Web site at http://www.lenovo.com/support. Download the PCIe card driver and the readme file, and follow the instructions in the readme file to install the driver.

Riser card

- "Removing the riser card" on page 56
- "Installing the riser card" on page 57

Removing the riser card

To remove the riser card, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. If there is a PCIe card installed on the riser card assembly, remove the PCIe card. See "Removing the PCIe card" on page 54.
3. Remove the screw that secures the riser card assembly. Then, grasp the riser card assembly by its edges and carefully lift it out of the chassis.
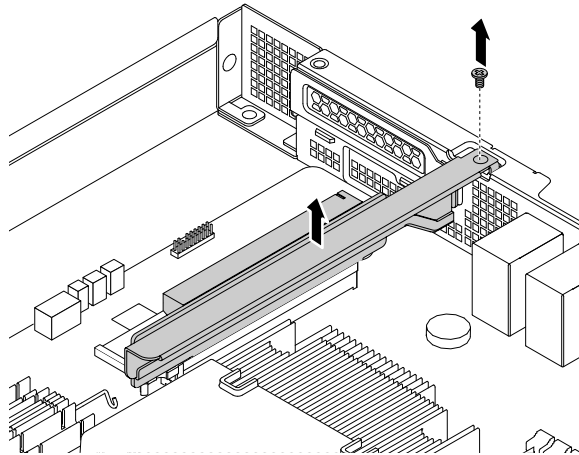
Figure 32. Removing the riser card assembly

4. Remove the two screws that secure the riser card to the bracket. Then, remove the riser card.
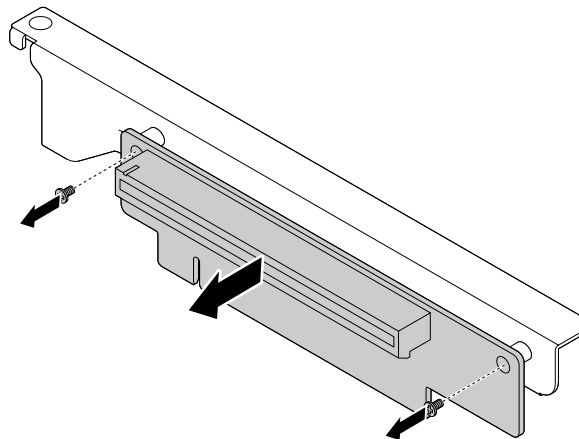
Figure 33. Removing the riser card

5. If you are instructed to return the old riser card, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the riser card

To install a new riser card, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. If there is a PCIe card installed on the old riser card assembly, remove the PCIe card. See "Removing the PCIe card" on page 54.
3. Remove the old riser card. See "Removing the riser card" on page 56.
4. Touch the static-protective package that contains the new riser card to any unpainted surface on the outside of the server. Then, remove the new riser card from the package.

5. Align the screw holes in the new riser card with the corresponding ones in the bracket. Then, install the two screws to secure the riser card to the bracket.
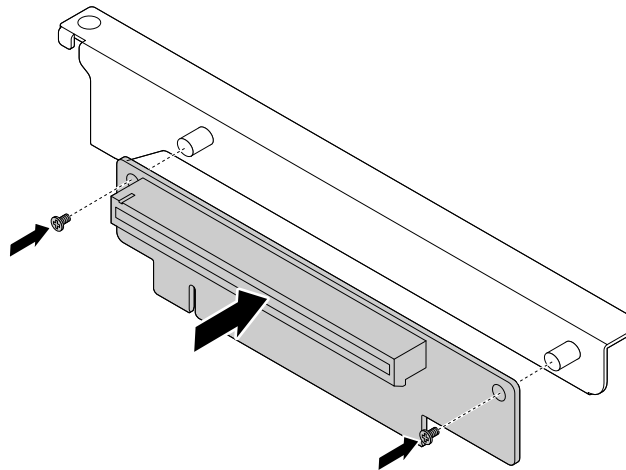
Figure 34. Installing the riser card

6. Position the riser card assembly on the chassis and align it with the riser card assembly slot on the system board. Align the screw hole in the riser card assembly with the corresponding hole in the chassis. Then, carefully press the riser card assembly straight down into the slot until it is fully seated. Then, install the screw to secure the riser card assembly to the chassis.
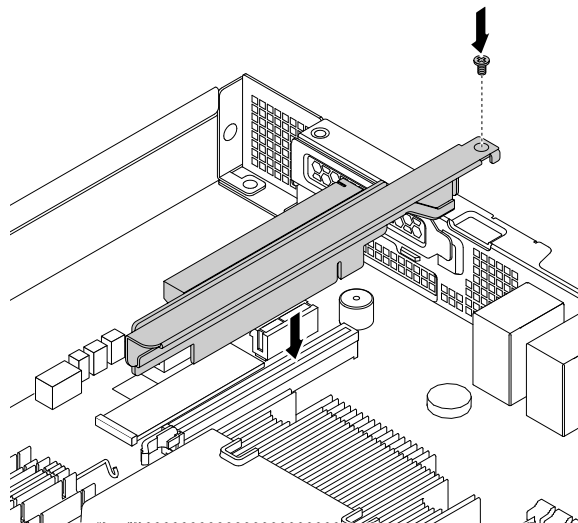
Figure 35. Installing the riser card assembly

7. Reinstall the PCIe card to the riser card assembly if necessary. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Slim optical drive

- "Removing the slim optical drive" on page 59

- "Installing the slim optical drive" on page 60

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**

- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

⚠️**DANGER**

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Removing the slim optical drive

To remove the slim optical drive, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Disconnect the cables from the rear of the slim optical drive.

3. Loosen the thumbscrew **1** that secures the slim-optical-drive retainer and then remove the retainer from the chassis. Then, slide the slim optical drive out of the front of the server.

   Note: The thumbscrew is an integrated part of the slim-optical-drive retainer. Do not try to remove the thumbscrew from the retainer.
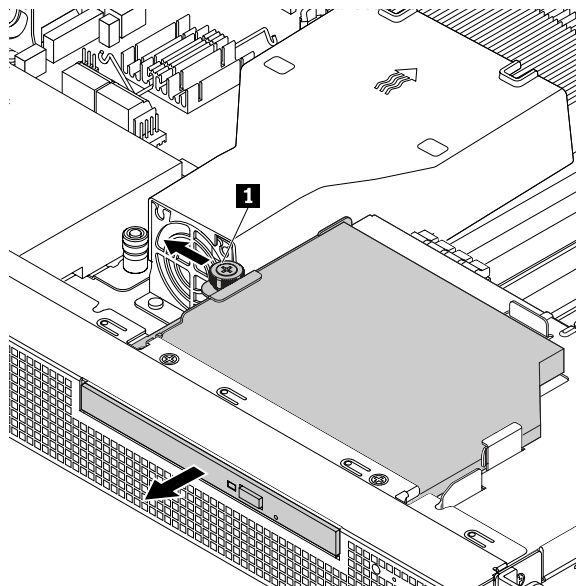
Figure 36. Removing the slim optical drive

4. Install a new slim optical drive or a metal bezel to protect the drive bay. See "Installing the slim optical drive" on page 60.

5. If you are instructed to return the old slim optical drive, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the slim optical drive

To install the slim optical drive, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Do one of the following:

   - If the server is installed with an old slim optical drive, remove the drive. See "Removing the slim optical drive" on page 59.

   - If the slim-optical-drive bay is protected with a metal bezel, do the following:

     a. Remove the two screws that secure the metal bezel. Then, remove the metal bezel from the front of the server. Store the metal bezel in case you later remove the slim optical drive and need the metal bezel to cover the place.
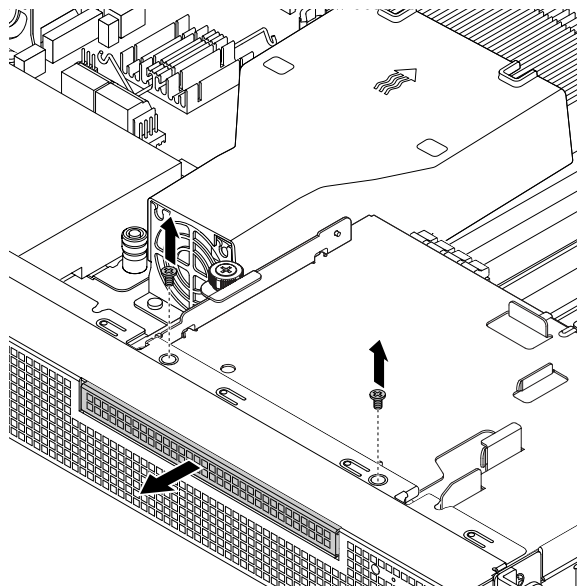
Figure 37. Removing the optical-drive-bay metal bezel

   b. Loosen the thumbscrew **1** that secures the slim-optical-drive retainer and then remove the retainer from the chassis.

   Note: The thumbscrew is an integrated part of the slim-optical-drive retainer. Do not try to remove the thumbscrew from the retainer.
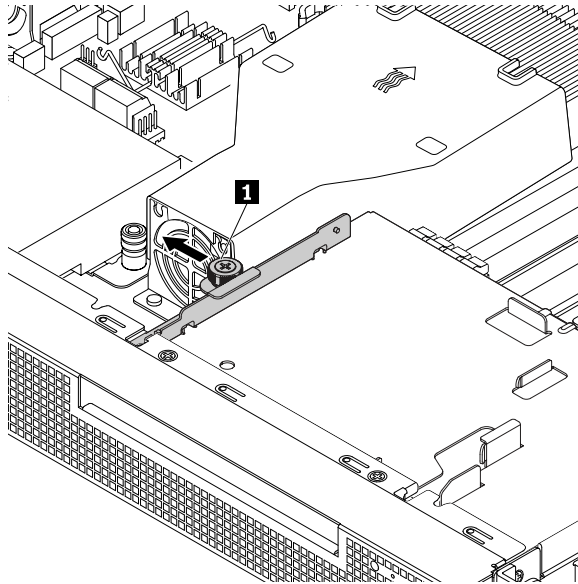
Figure 38. Removing the slim-optical-drive retainer

3. Touch the static-protective package that contains the slim optical drive to any unpainted surface on the outside of the server. Then, take the slim optical drive out of the package.

4. Slide the slim optical drive into the chassis from the front of the server.
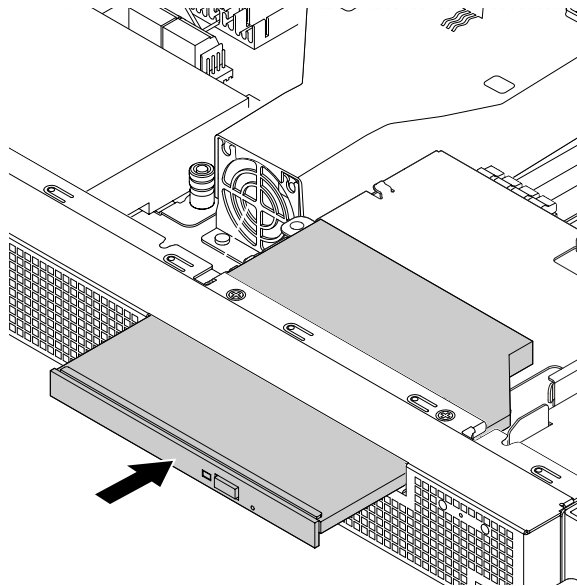
Figure 39. Installing the slim optical drive

5. Attach the slim-optical-drive retainer to the side of the slim optical drive. Then, tighten the thumbscrew **1** to secure the slim-optical-drive retainer.
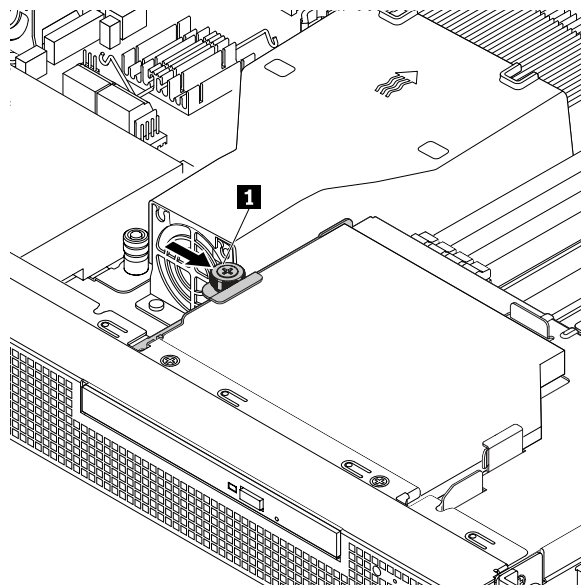
Figure 40. Installing the slim-optical-drive retainer

6. Connect the cables to the rear of the slim optical drive. See "Connecting the slim optical drive" on page 24.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

M.2 solid-state drive

*   "Removing the M.2 solid-state drive" on page 62
*   "Installing the M.2 solid-state drive" on page 63

Removing the M.2 solid-state drive

To remove the M.2 solid-state drive (SSD), do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. If the server is installed with a PCIe card, remove the card. See "Removing the PCIe card" on page 54.
3. Locate the M.2 SSD and remove the screw that secures it. Then, lift it up to remove it from the system board.
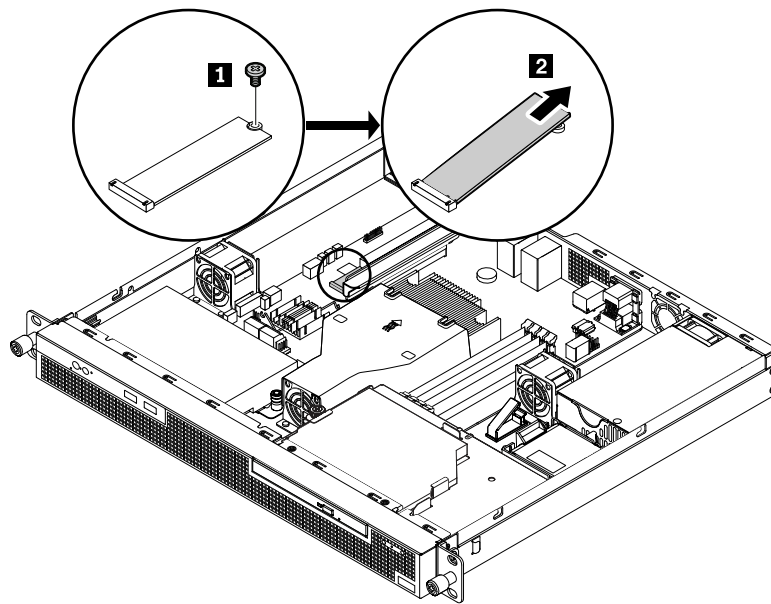
Figure 41. Removing the M.2 SSD

4. Reinstall the PCIe card if you have removed it. See "Installing the PCIe card" on page 55.

5. If you are instructed to return the old M.2 SSD, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the M.2 solid-state drive

To install the M.2 SSD, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. If the server is installed with a PCIe card, remove the card. See "Removing the PCIe card" on page 54.

3. If the server comes with an old M.2 SSD, remove the old M.2 SSD. See "Removing the M.2 solid-state drive" on page 62.

4. Touch the static-protective package that contains the new M.2 SSD to any unpainted surface on the outside of the server. Then, take the M.2 SSD out of the package.

   Note: Carefully handle the M.2 SSD by its edges.

5. Insert the notched end of the M.2 SSD into the drive slot. Then, install the screw to secure the M.2 SSD.
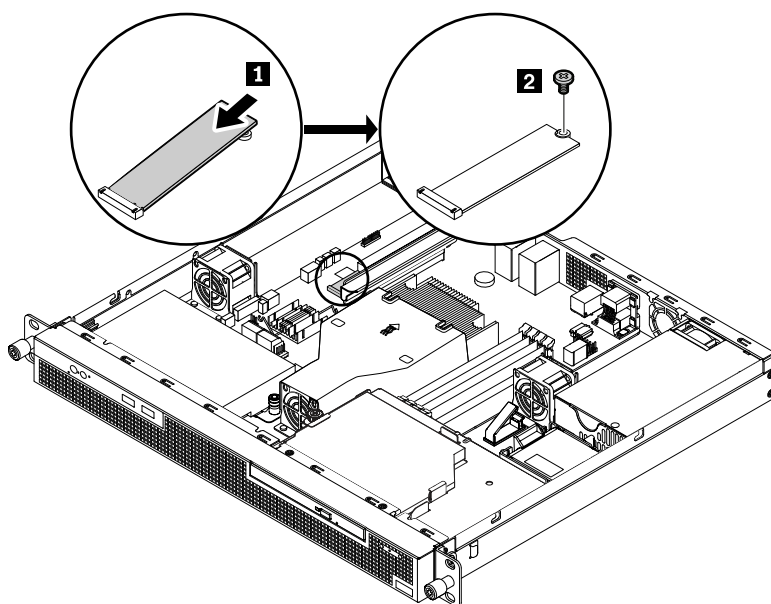
Figure 42. Installing the M.2 SSD

6. Reinstall the PCIe card if you have removed it. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Lenovo ThinkServer RAID 520i upgrade key

The Lenovo ThinkServer RAID 520i upgrade key (hereinafter referred to as RAID 520i key) activates the RAID 5 level for advanced SATA or SAS hardware RAID. If your server has the Lenovo ThinkServer RAID 520i PCIe Adapter installed, you can purchase a RAID 520i key and install it to the J3 connector on the RAID card. For information about connectors on the RAID card, see "RAID card" on page 18.

- "Removing the RAID 520i key" on page 64
- "Installing the RAID 520i key" on page 65

Removing the RAID 520i key

Notes:

- If you remove the RAID 520i key, the hardware RAID 5 will be disabled.
- Removing the RAID 520i key might impact your RAID configurations. Back up your data before you begin to avoid any data loss due to a RAID configuration change.

To remove the RAID 520i key, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Remove the Lenovo ThinkServer RAID 520i PCIe Adapter. See "Removing the PCIe card" on page 54.
3. Remove the RAID 520i key from the Lenovo ThinkServer RAID 520i PCIe Adapter.
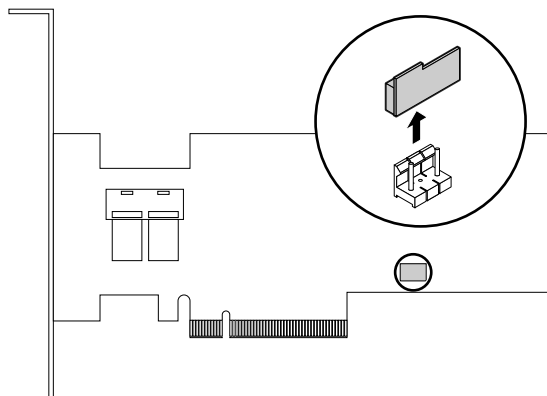
Figure 43. Removing the RAID 520i key

4. If you are instructed to return the old RAID 510i key, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

5. Reinstall the Lenovo ThinkServer RAID 520i PCIe Adapter. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

The hardware RAID 5 is not available without the RAID 520i key. Therefore, you might need to reconfigure RAID for your server. For information about configuring hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

Installing the RAID 520i key

To install the RAID 520i key, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Remove the Lenovo ThinkServer RAID 520i PCIe Adapter. See "Removing the PCIe card" on page 54.

3. Touch the static-protective package that contains the RAID 520i key to any unpainted surface on the outside of the server. Then, take the RAID 520i key out of the package.

   Note: Carefully handle the RAID 520i key by its edges.

4. Insert the RAID 520i key into the J3 connector on the Lenovo ThinkServer RAID 520i PCIe Adapter. Ensure that the RAID 520i key is securely seated on the RAID card.
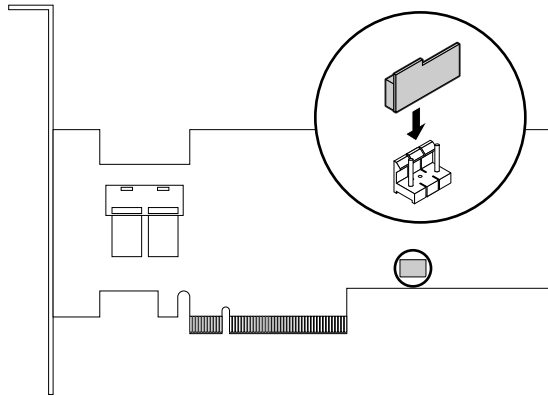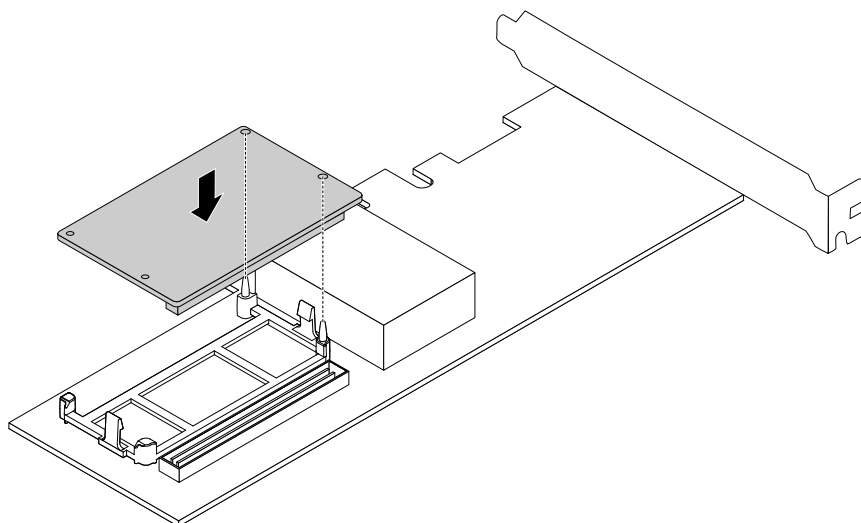
Figure 44. Installing the RAID 520i key

5. Reinstall the Lenovo ThinkServer RAID 520i PCIe Adapter. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

After installing the RAID 520i key, you might need to configure RAID to activate RAID 5 for your server. Back up your data before you begin to avoid any data loss due to a RAID configuration change. For information about configuring hardware RAID, refer to the *MegaRAID SAS Software User Guide*. This guide is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

Thunderbolt Memory Module

- "Removing the Thunderbolt Memory Module" on page 66
- "Installing the Thunderbolt Memory Module" on page 67

This topic applies only to Lenovo ThinkServer RAID 720i PCIe Adapter that supports the Thunderbolt Memory Module. The Thunderbolt Memory Module works as the cache memory of the installed Lenovo ThinkServer RAID 720i PCIe Adapter. There are two types of Thunderbolt Memory Module:

- ThinkServer RAID 720i Modular Flash
- ThinkServer RAID 720i Modular DRAM Upgrade

Removing the Thunderbolt Memory Module

To remove the Thunderbolt Memory Module, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Remove the Lenovo ThinkServer RAID 720i PCIe Adapter. See "Removing the PCIe card" on page 54.
3. Pivot the two release tabs **1** outward and lift the Thunderbolt Memory Module straight up and out of the Lenovo ThinkServer RAID 720i PCIe Adapter.
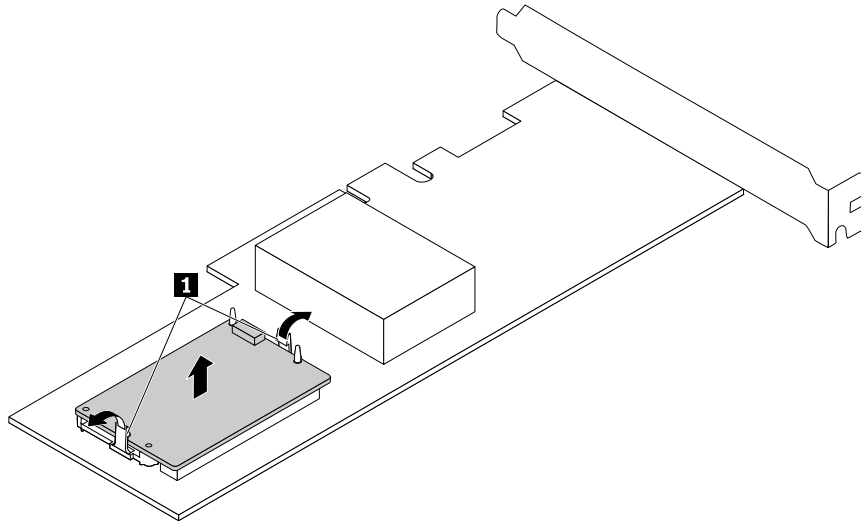
Figure 45. Removing the Thunderbolt Memory Module

4. If you are instructed to return the old Thunderbolt Memory Module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

5. Reinstall the Lenovo ThinkServer RAID 720i PCIe Adapter. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the Thunderbolt Memory Module

To install the Thunderbolt Memory Module, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Remove the Lenovo ThinkServer RAID 720i PCIe Adapter. See "Removing the PCIe card" on page 54

3. Position the Thunderbolt Memory Module above the Lenovo ThinkServer RAID 720i PCIe Adapter and align the two holes in the Thunderbolt Memory Module with the two pins on the adapter. Then, lower the Thunderbolt Memory Module straight down until it is seated in position and secured by the tabs.

Figure 46. Installing the Thunderbolt Memory Module

4. Reinstall the Lenovo ThinkServer RAID 720i PCIe Adapter. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Slim-optical-drive bracket

- • "Removing the slim-optical-drive bracket" on page 68
- • "Installing the slim-optical-drive bracket" on page 68

Removing the slim-optical-drive bracket

To remove the slim-optical-drive bracket, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. If there is a slim optical drive installed, remove it from the server. See "Removing the slim optical drive" on page 59.
3. Lift the release pin **1** on the slim-optical-drive bracket. Meanwhile, slide the bracket to the rear of the server as shown to release the bracket from the chassis. Then, lift the slim-optical-drive bracket out of the chassis.
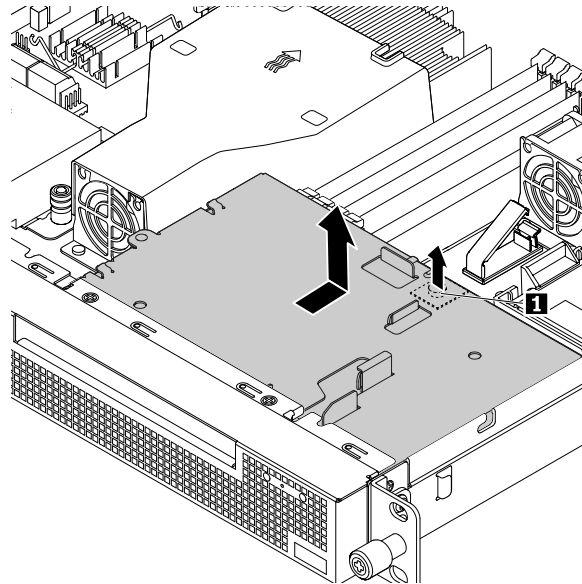
Figure 47. Removing the slim-optical-drive bracket

Installing the slim-optical-drive bracket

To install the slim-optical-drive bracket, do the following:

1. Position the bracket in the chassis, align the four slots in the bracket with the mounting studs on the chassis, and then slide the bracket to the front of the server until the pin **1** is snapped into position.
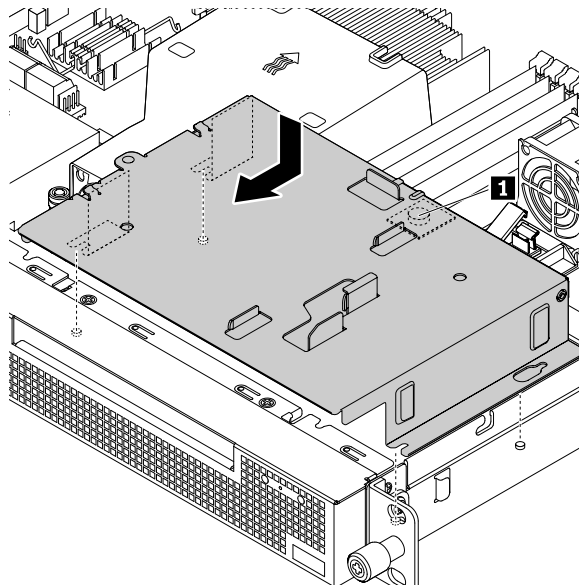
Figure 48. Installing the slim-optical-drive bracket

2. Reinstall the slim optical drive if you have removed it. See "Installing the slim optical drive" on page 60.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Hard disk drive (2.5-inch)

- "Removing a 2.5-inch hard disk drive" on page 69
- "Installing a 2.5-inch hard disk drive" on page 70
- "Installing a 2.5-inch hard disk drive into a 3.5-inch hard disk drive bracket" on page 72

This topic provides instructions on how to remove and install a 2.5-inch hard disk drive (HDD). If you are removing or installing a 2.5-inch SSD, the procedure is the same.

Before you begin, review the following HDD installation rules:

- Follow the order of the HDD bays when installing an HDD.
- For RAID configuration, the HDDs must be the same type with the same capacity if they are within a single RAID array. For more information, see "Configuring RAID" on page 35.
- For HDDs with different capacities, install the HDD by following the order of the HDD bays as well as the order from the lowest capacity to the highest capacity.

Removing a 2.5-inch hard disk drive

To remove a 2.5-inch HDD, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate the appropriate 2.5-inch HDD that you want to remove. If you want to remove the 2.5-inch HDDs that are installed under the slim-optical-drive bracket, remove the slim-optical-drive bracket first. See "Removing the slim-optical-drive bracket" on page 68.
3. Disconnect the cables from the 2.5-inch HDD that you want to remove.
4. Lift the release pin **1** on the 2.5-inch HDD bracket. Meanwhile, slide the 2.5-inch HDD and its bracket to the rear of the server to release the bracket from the server. Then, lift the 2.5-inch HDD and its bracket out of the chassis.
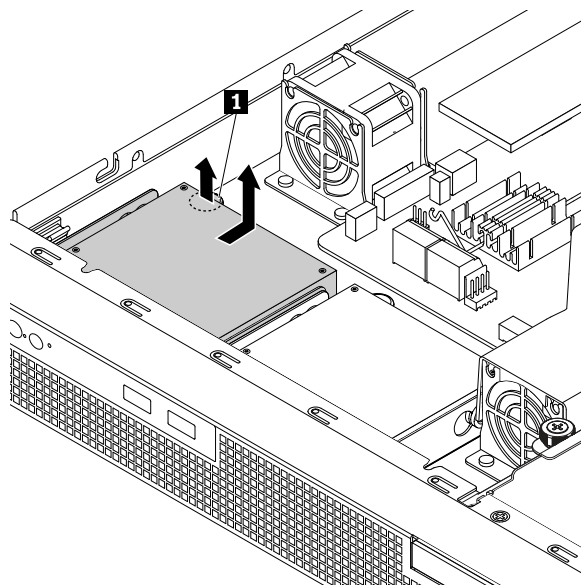
Figure 49. Removing a 2.5-inch HDD and its bracket

5. Remove the four screws that secure the 2.5-inch HDD to the bracket. Then, lift the 2.5-inch HDD up to remove it from the bracket.
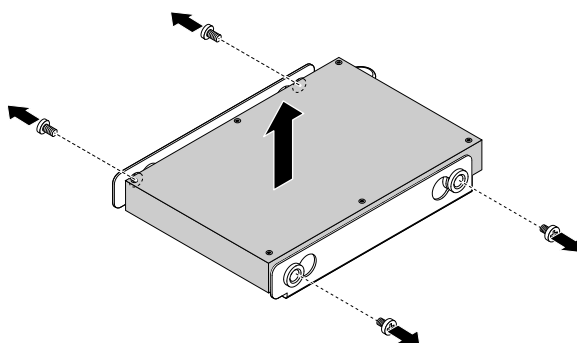
Figure 50. Removing the 2.5-inch HDD from the bracket

6. If you are instructed to return the old HDD, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

7. Reinstall the slim-optical-drive bracket if you have removed it. See "Installing the slim-optical-drive bracket" on page 68.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing a 2.5-inch hard disk drive

To install a 2.5-inch HDD, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. If you want to install a 2.5-inch HDD under the slim-optical-drive bracket, remove the slim-optical-drive bracket first. See "Removing the slim-optical-drive bracket" on page 68.

3. Remove the old 2.5-inch HDD in your server if necessary. See "Removing a 2.5-inch hard disk drive" on page 69.

4. Install the new 2.5-inch HDD into the bracket.
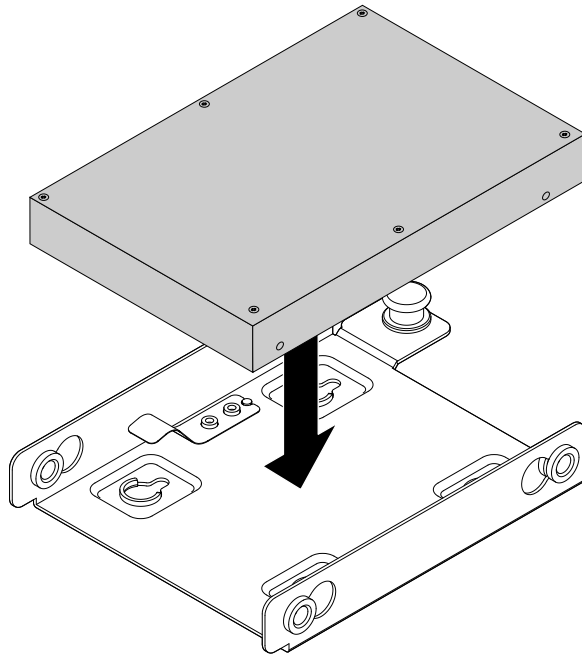
Figure 51. Installing the 2.5-inch HDD into the bracket

5. Align the four screw holes in the HDD with the corresponding holes in the bracket. Then, install the four screws to secure the HDD to the bracket.
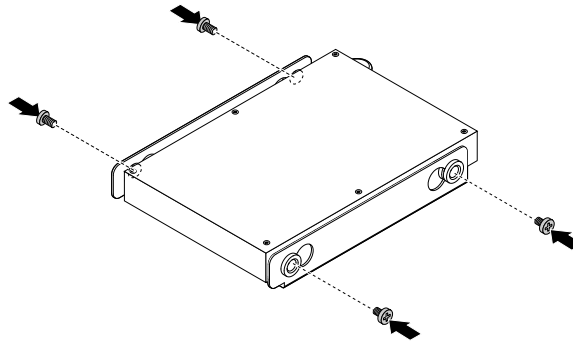
Figure 52. Installing the screws to secure the 2.5-inch HDD to bracket

6. Align the four slots in the bracket with the mounting studs on the chassis. Position the 2.5-inch HDD and its bracket into the server. Then, slide the drive to the front of the server until the pin **1** snaps into place.
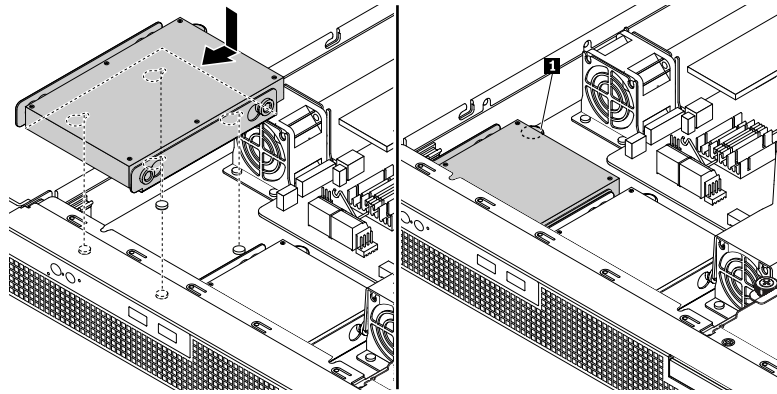
Figure 53. Installing the 2.5-inch HDD and its bracket

7. Connect the cables for the 2.5-inch HDD. See "Connecting the cables" on page 19.
8. Reinstall the slim-optical-drive bracket if you have removed it. See "Installing the slim-optical-drive bracket" on page 68.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing a 2.5-inch hard disk drive into a 3.5-inch hard disk drive bracket

To install a 2.5-inch HDD into a 3.5-inch HDD bracket, align the four screw holes at the bottom of the 2.5-inch HDD with the corresponding ones in the 3.5-inch HDD bracket, then, install four screws to secure the 2.5-inch HDD to the 3.5-inch bracket.
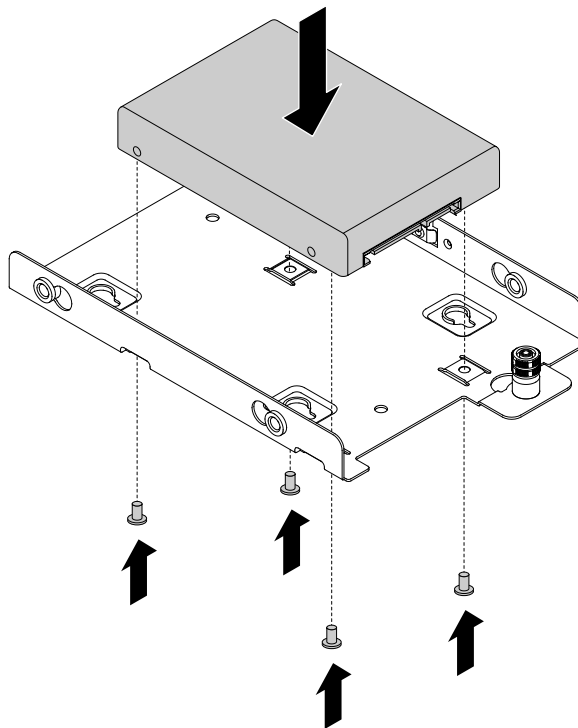
Figure 54. Installing a 2.5-inch HDD into a 3.5-inch HDD bracket

To install or remove a 2.5-inch HDD with 3.5-inch HDD bracket, refer to "Installing a 3.5-inch hard disk drive" on page 74 and "Removing a 3.5-inch hard disk drive" on page 73.

Hard disk drive (3.5-inch)

- "Removing a 3.5-inch hard disk drive" on page 73
- "Installing a 3.5-inch hard disk drive" on page 74

Before you begin, review the following hard disk drive (HDD) installation rules:

- Follow the order of the HDD bays when installing an HDD.
- For RAID configuration, the HDDs must be the same type with the same capacity if they are within a single RAID array. For more information, see "Configuring RAID" on page 35.
- For HDDs with different capacities, install the HDD by following the order of the HDD bays as well as the order from the lowest capacity to the highest capacity.

Removing a 3.5-inch hard disk drive

To remove a 3.5-inch HDD, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate the appropriate 3.5-inch HDD that you want to remove. If you want to remove the 3.5-inch HDD that is installed under the slim-optical-drive bracket, remove the slim-optical-drive bracket first. See "Removing the slim-optical-drive bracket" on page 68
3. Disconnect the cables from the 3.5-inch HDD that you want to remove.
4. Lift the release pin **1** on the 3.5-inch HDD bracket. Meanwhile, slide the 3.5-inch HDD and its bracket as shown to release the bracket from the server. Then, lift the 3.5-inch HDD and its bracket out of the chassis.
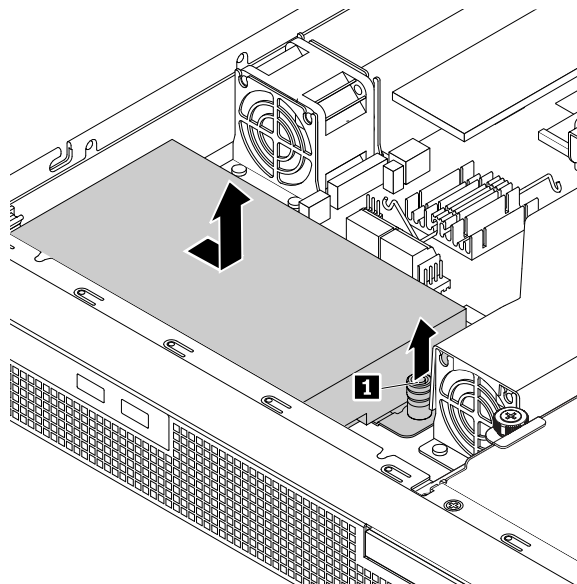
Figure 55. Removing a 3.5-inch HDD and its bracket

5. Remove the four screws that secure the 3.5-inch HDD to the bracket. Then, lift the 3.5-inch HDD up to remove it from the bracket.
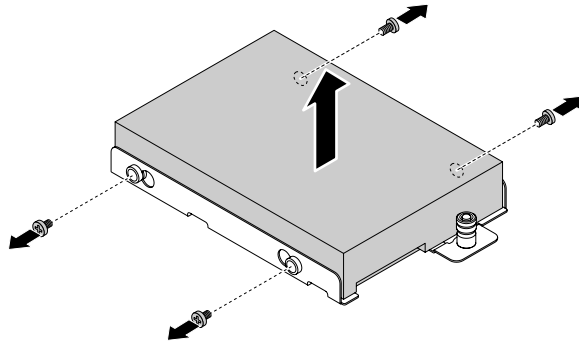
Figure 56. Removing the 3.5-inch HDD from the bracket

6. If you are instructed to return the old HDD, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

7. Reinstall the slim-optical-drive bracket if you have removed it. See "Installing the slim-optical-drive bracket" on page 68.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing a 3.5-inch hard disk drive

To install a 3.5-inch HDD, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. If you want to install a 3.5-inch HDD under the slim-optical-drive bracket, remove the slim-optical-drive bracket first. See "Removing the slim-optical-drive bracket" on page 68.

3. Remove the old 3.5-inch HDD in your server. See "Removing a 2.5-inch hard disk drive" on page 69.

4. Install the new 3.5-inch HDD into the bracket.
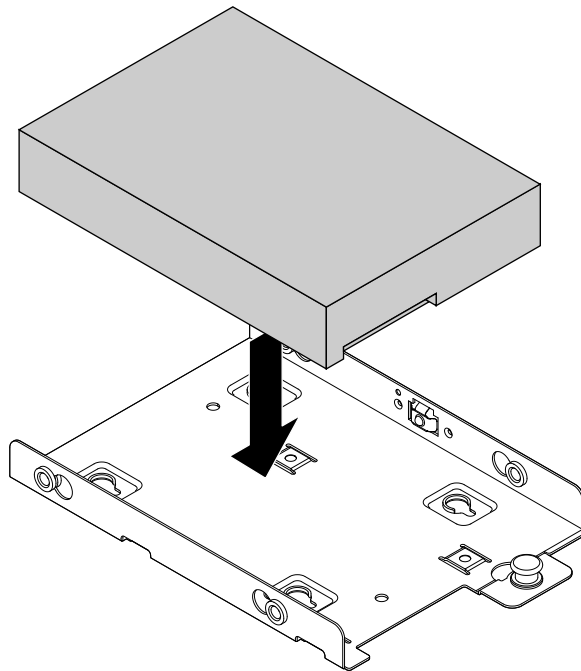
Figure 57. Installing the 3.5-inch HDD into the bracket

5. Align the four screw holes in the HDD with the corresponding holes in the bracket. Then, install the four screws to secure the HDD to the bracket.
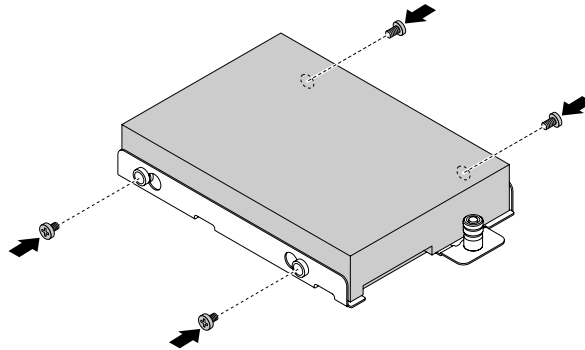
Figure 58. Installing the screws to secure the 3.5-inch HDD to bracket

6. Align the four slots in the bracket with the mounting studs on the chassis. Position the 3.5-inch HDD and its bracket into the server. Then, slide the drive as shown until the pin **1** snaps into place.
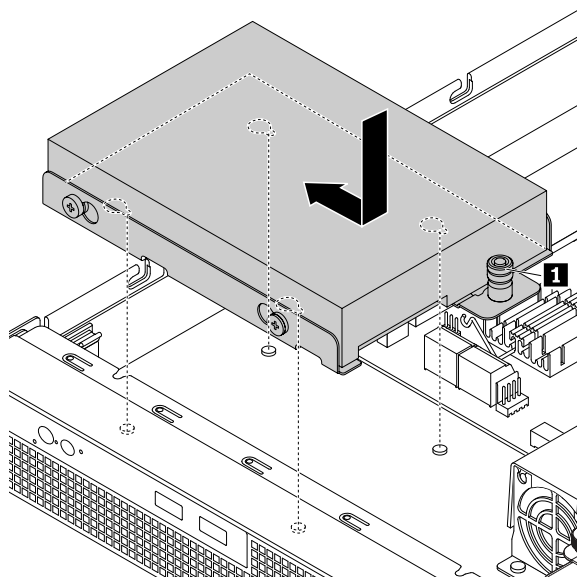
Figure 59. Installing the 3.5-inch HDD and its bracket

7. Connect the cables for the 3.5-inch HDD. See "Connecting the cables" on page 19.

8. Reinstall the slim-optical-drive bracket if you have removed it. See "Installing the slim-optical-drive bracket" on page 68.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

System fan

- "Removing a system fan" on page 76
- "Installing a system fan" on page 76

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.
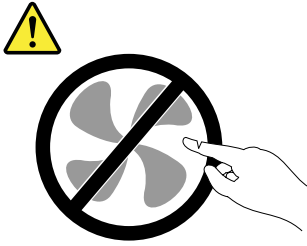
Removing a system fan

To remove a system fan, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Locate the system fan that you want to remove.

3. Remove the air baffle if necessary. See "Removing the air baffle" on page 48.

4. Disconnect the system fan cable from the system board. See "System board components" on page 24.

5. Press the four plastic rivets on the top of the system fan with your fingers and then lift the system fan out of the server.
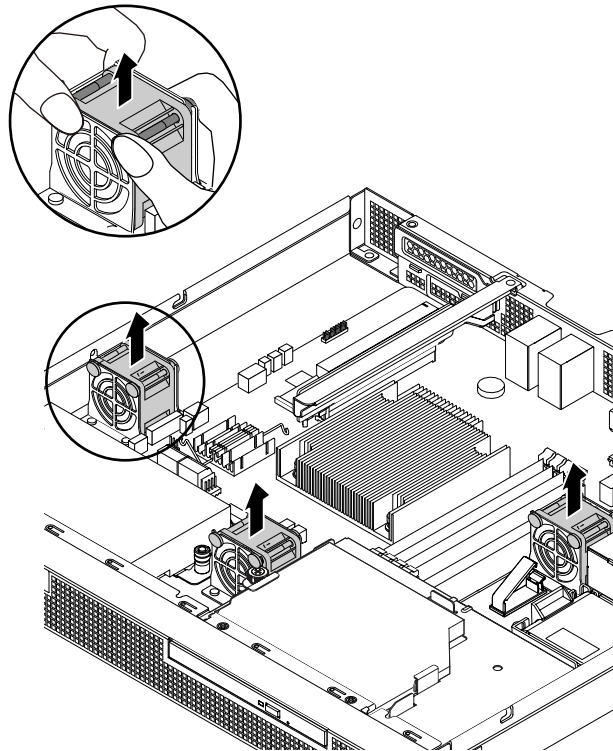
Figure 60. Removing the system fan

6. Install a new system fan. See "Installing a system fan" on page 76.
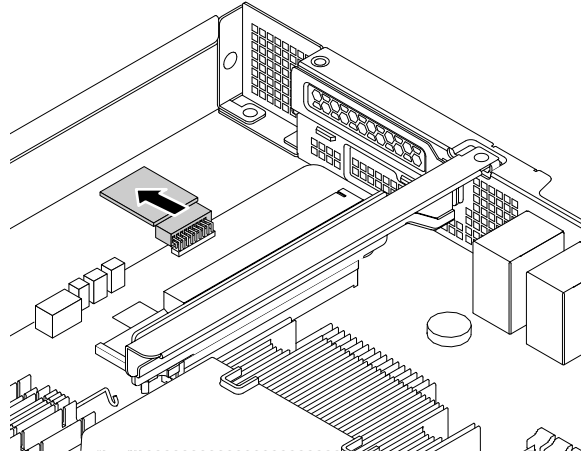
7. If you are instructed to return the old system fan, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing a system fan

To install a system fan, do the following:

1. Touch the static-protective package that contains the new system fan to any unpainted surface on the outside of the server. Then, remove the new system fan from the package.

2. Press the new system fan straight down until it is seated into place.

   Note: Ensure that you install the system fan in the correct direction as shown.
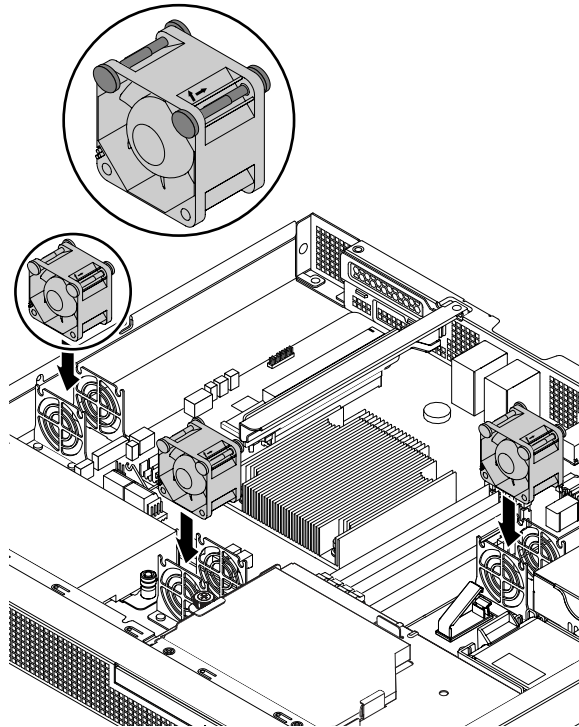
Figure 61. Installing the system fan

3. Connect the system fan cable to the system board. See "System board components" on page 24.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

ThinkServer Trusted Platform Module

The ThinkServer Trusted Platform Module (TPM) is a security chip designed by the Trusted Computing Group (TCG) to provide a hardware method of data encryption. It stores passwords, encryption keys, and digital certificates to help provide security solutions and protect the server.

- "Removing the TPM" on page 77
- "Installing the TPM" on page 78

Removing the TPM

To remove the TPM, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Locate the TPM connector on the system board. See "System board components" on page 24.

3. If there is a PCIe card installed, it might block your access to the TPM connector. In this case, remove the PCIe card. See "Removing the PCIe card" on page 54.

4. Pull the TPM outward horizontally and remove it from the system board.

   Note: Carefully handle the TPM by its edges.

Figure 62. Removing the TPM

5. If you are instructed to return the old TPM, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

6. Reinstall the PCIe card if you have removed it. See "Installing the PCIe card" on page 55.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Installing the TPM

To install the TPM, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. If there is a PCIe card installed, it might block your access to the TPM connector. In this case, remove the PCIe card. See "Removing the PCIe card" on page 54.

3. If there is an old TPM installed, remove the old TPM. See "Removing the TPM" on page 77.

4. Touch the static-protective package that contains the TPM to any unpainted surface on the outside of the server. Then, take the TPM out of the package.

   Note: Carefully handle the TPM by its edges.

5. Insert the TPM horizontally into the TPM connector on the system board.
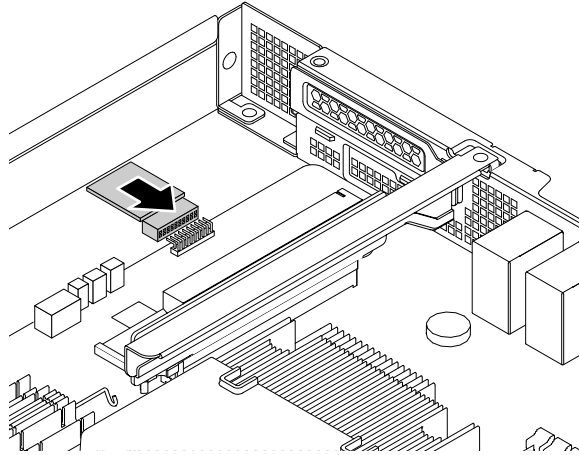
Figure 63. Installing the TPM

6. Reinstall the PCIe card if you have removed it. See "Installing the PCIe card" on page 55

To complete the parts replacement, go to "Completing the parts replacement" on page 91. Then, you can configure the TPM function in the Setup Utility program. See "Configuring the TPM function" on page 31.

Coin-cell battery

Your server has a special type of memory that maintains the date, time, and configuration information for built-in features. The coin-cell battery keeps the information active when you turn off the server. The coin-cell battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the coin-cell battery fails, the date, time, and configuration information, including passwords, are lost and an error message is displayed when you turn on the server.

- "Removing the coin-cell battery" on page 80
- "Installing the coin-cell battery" on page 80

⚠️**DANGER**

Danger of explosion if battery is improperly replaced.

When replacing the lithium coin-cell battery, use only the same or an equivalent type that is recommended by the 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.

The following statement applies to users in the state of California, U.S.A.

California Perchlorate Information:

Products containing manganese dioxide lithium coin-cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See http://www.dtsc.ca.gov/hazardouswaste/perchlorate

Removing the coin-cell battery

To remove the coin-cell battery, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Locate the coin-cell battery. See "System board components" on page 24.
3. Remove the coin-cell battery.
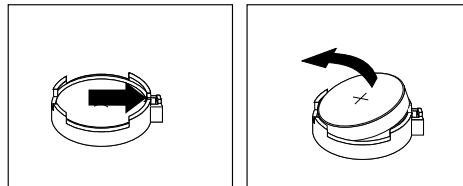
Figure 64. Removing the coin-cell battery

4. Install a new coin-cell battery. See "Installing the coin-cell battery" on page 80.
5. Dispose of the failing battery as required by local ordinances or regulations.

Installing the coin-cell battery

To install a new coin-cell battery and configure the server, do the following:

1. Install the new coin-cell battery to the server.
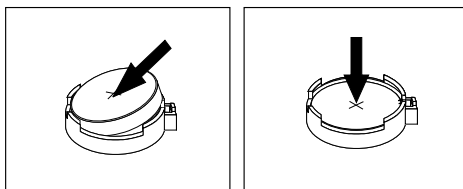
Figure 65. Installing the coin-cell battery

2. Complete the parts replacement. See "Completing the parts replacement" on page 91.

3. Turn on the server and all attached devices.

   Note: When the server is turned on for the first time after a new coin-cell battery is installed, an error message might be displayed. This is normal after installing a new coin-cell battery.

4. Use the Setup Utility program to set the date, time, and any passwords. See "Using the Setup Utility program" on page 27.

Front panel board

- "Removing the front panel board" on page 81
- "Installing the front panel board" on page 82

Removing the front panel board

Note: The front panel board is sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 44 first and carefully perform the operation.

To remove the front panel board, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Locate the front panel board. See "Server components" on page 16.

3. If necessary, remove the HDDs behind the front panel board. See "Removing a 2.5-inch hard disk drive" on page 69 and "Removing a 3.5-inch hard disk drive" on page 73.

4. Remove the two screws that secure the front panel board. Then, carefully remove the front panel board from the chassis.
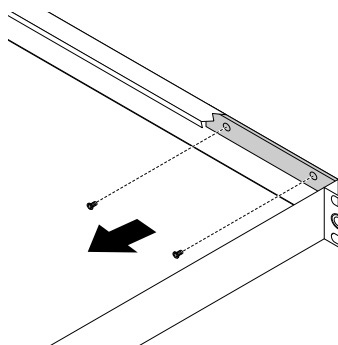
Figure 66. Removing the front panel board

5. Record the cable routing and cable connections. Then, disconnect all the cables from the front panel board.

6. If you are instructed to return the old front panel board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

Installing the front panel board

Note: The front panel board is sensitive to ESD. Ensure that you read and understand "Handling static-sensitive devices" on page 44 first and carefully perform the operation.

To install the front panel board, do the following:

1. Touch the static-protective package that contains the new front panel board to any unpainted surface on the outside of the server. Then, take the new front panel board out of the package.

   Note: Carefully handle the front panel board by its edges.

2. Connect all the cables to the new front panel board.

3. Carefully position the new front panel board so that the two screw holes in the front panel board are aligned with the corresponding holes in the chassis. Then, install the screws to secure the front panel board in place.
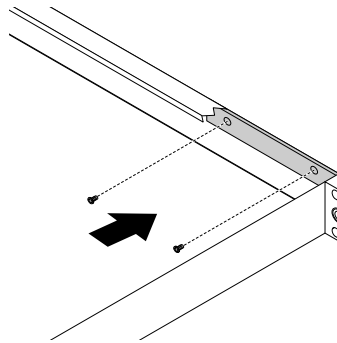
Figure 67. Installing the front panel board

4. Reinstall the HDDs in the server if you have removed them. See "Installing a 2.5-inch hard disk drive" on page 70 and "Installing a 3.5-inch hard disk drive" on page 74.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

For service technician only: replacing the ThinkServer RAID Super Capacitor Module

The ThinkServer RAID Super Capacitor Module protects the cache memory on the installed ThinkServer RAID card.

To replace the ThinkServer RAID Super Capacitor Module, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Disconnect the cable of the ThinkServer RAID Super Capacitor Module.

3. Gently press the tab on the ThinkServer RAID Super Capacitor Module bracket as shown and remove the ThinkServer RAID Super Capacitor Module from the bracket at the same time.
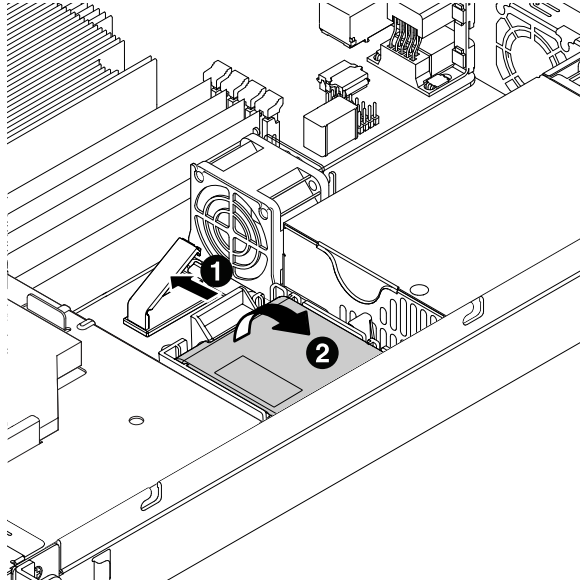
Figure 68. Removing the ThinkServer RAID Super Capacitor Module from the bracket

4. Gently press the two tabs on the ThinkServer RAID Super Capacitor Module bracket and remove the bracket at the same time.

   Note: Skip this step if you are just installing a new ThinkServer RAID Super Capacitor Module instead of both the ThinkServer RAID Super Capacitor Module and its bracket.
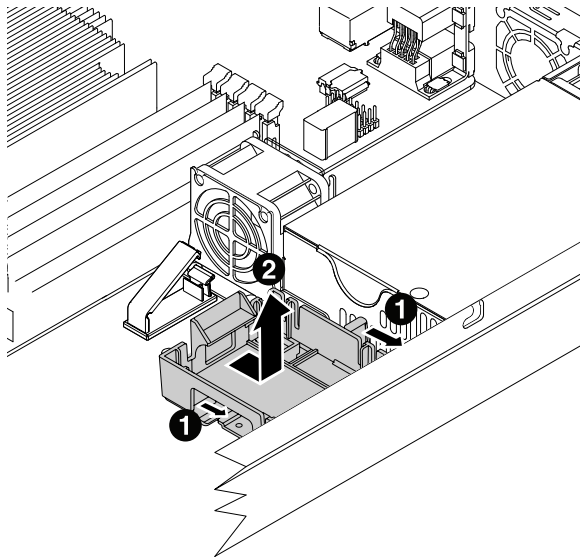

Figure 69. Removing the ThinkServer RAID Super Capacitor Module bracket from the chassis

5. Touch the static-protective package that contains the new ThinkServer RAID Super Capacitor Module to any unpainted surface on the outside of the server. Then, take the ThinkServer RAID Super Capacitor Module out of the package.

6. Position the new ThinkServer RAID Super Capacitor Module bracket on the chassis so that the mounting studs on the chassis pass through the corresponding holes in the bracket. Then, move the bracket as shown until it is secured on the chassis.
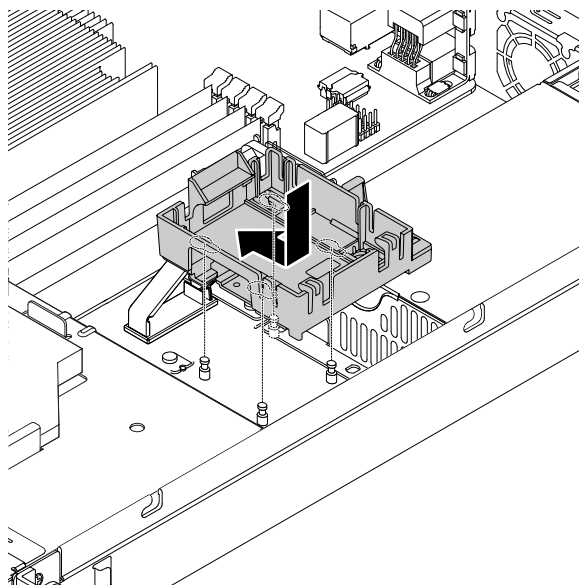
Figure 70. Installing the ThinkServer RAID Super Capacitor Module bracket into the chassis

7. Note the orientation of the ThinkServer RAID Super Capacitor Module and then install it into the bracket.
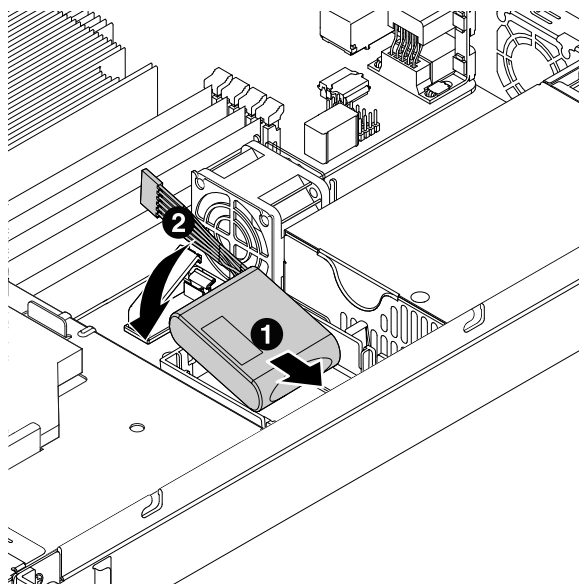
*Figure 71. Installing the ThinkServer RAID Super Capacitor Module into the bracket*

8. Connect the ThinkServer RAID Super Capacitor Module to the RAID card.

9. If you are instructed to return the old ThinkServer RAID Super Capacitor Module, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

For service technician only: replacing the power supply assembly

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.
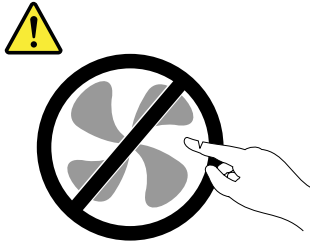
CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

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.

To replace the power supply assembly, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Disconnect the power cables from the system board and other components.
3. Remove the five screws that secure the power supply assembly.
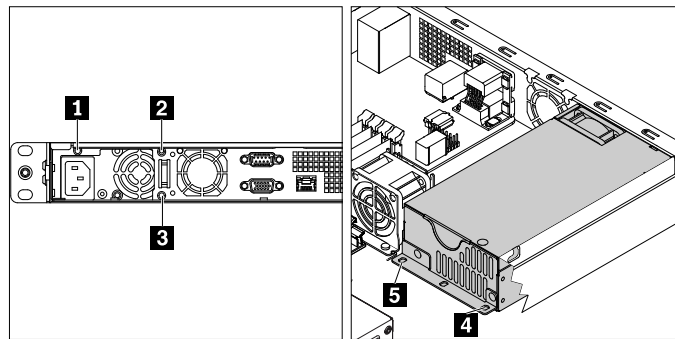
Figure 72. Removing the screws that secure the power supply assembly

4. Lift the power supply assembly out of the chassis.
5. Touch the static-protective package that contains the new power supply assembly to any unpainted surface on the outside of the server. Then, remove the new power supply assembly from the package.
6. Note the orientation of the new power supply assembly and then position it into the chassis. Ensure that the five screw holes in the new power supply assembly are aligned with the corresponding holes in the chassis. Then, install the five screws to secure the new power supply assembly.
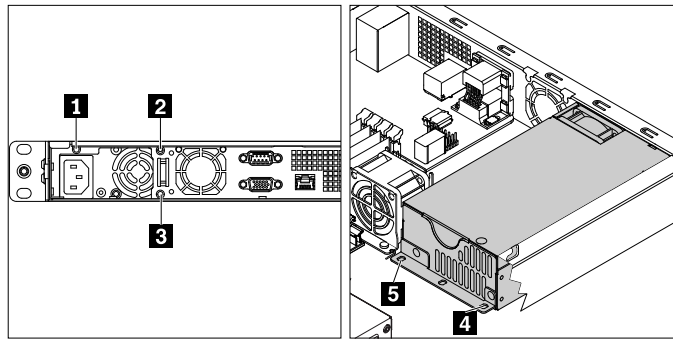
Figure 73. Installing the screws to secure the new power supply assembly

7. Connect the power cables to the system board and other components. See "System board components" on page 24 and "Connecting the cables" on page 19.

8. If you are instructed to return the old power supply assembly, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

For service technician only: replacing the microprocessor

CAUTION:

The heat sink and the microprocessor might be very hot. Turn off the server and wait three to five minutes to let the server cool before removing the server cover.

Notes:

- Ensure that the new microprocessor is the correct type your server supports. See "Features and specifications of your server" on page 7.

- Your microprocessor, socket, and socket cover might look slightly different from the illustrations in this topic.

To replace the microprocessor, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.

2. Remove the air baffle. See "Removing the air baffle" on page 48.

3. Remove the heat sink. See "Removing the heat sink" on page 50.

4. Remove the microprocessor from the microprocessor socket.

   ❶ Release the handle as shown.

   ❷ Lift the handle upward until the handle and the microprocessor retainer are in the fully open position.

   ❸ Hold the microprocessor by its sides and carefully lift it straight up and out of the microprocessor socket.

   Notes:

   - Do not touch the gold contacts on the bottom of the microprocessor.

- Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.
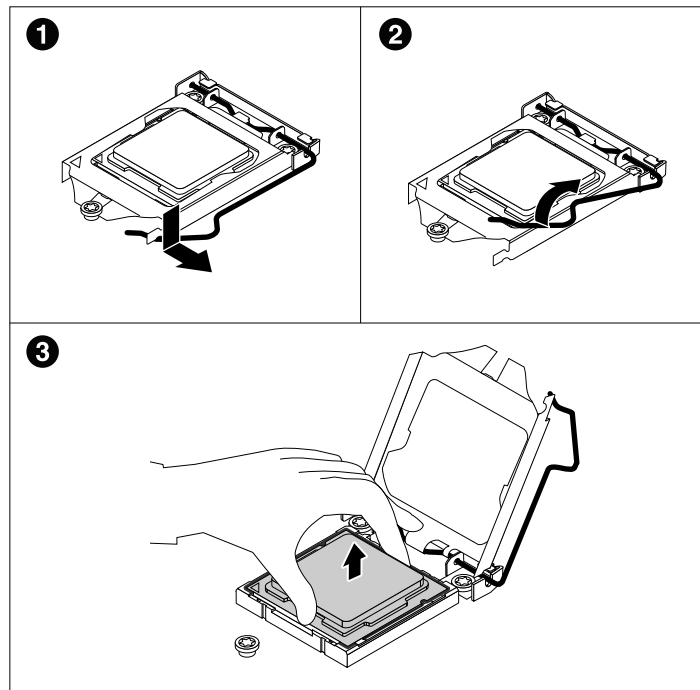

Figure 74. Removing the microprocessor

5. Touch the static-protective package that contains the new microprocessor to any unpainted surface on the outside of the server. Then, remove the new microprocessor from the package.

6. Remove the protective cover that protects the gold contacts on the bottom of the new microprocessor.

   Note: Do not touch the pins on the microprocessor socket and the gold contacts on the bottom of the new microprocessor.

7. Hold the new microprocessor by its sides, align the notches **1** with the tabs **2**, and align the small triangle **3** with the beveled corner **4**. Then, carefully lower the microprocessor straight down into the microprocessor socket.
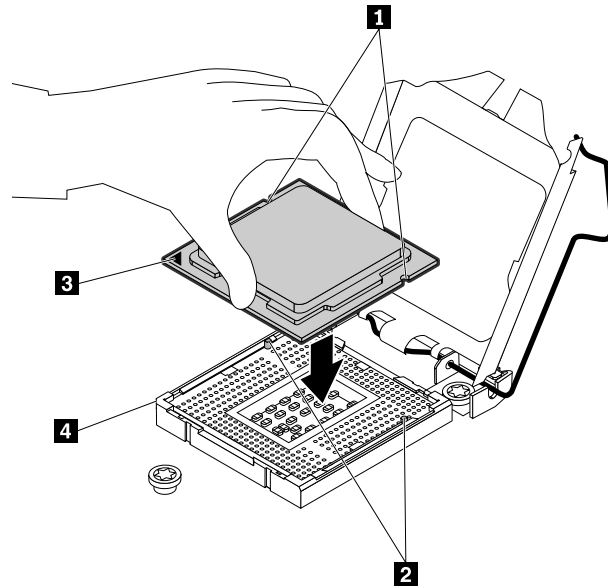
Figure 75. Installing the microprocessor

8. Gently close the microprocessor retainer. Press down the handle, and then push the handle inward to lock the retainer into position and secure the new microprocessor in the socket.
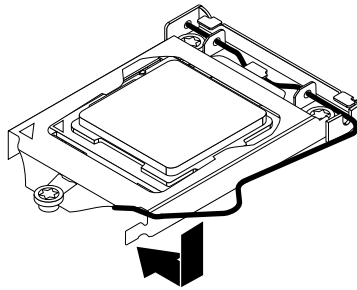

*Figure 76. Securing the microprocessor in the socket*

9. Reinstall the heat sink. See "Installing the heat sink" on page 50.
10. Reinstall the air baffle. See "Installing the air baffle" on page 49.
11. If you are instructed to return the old microprocessor, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

For service technician only: replacing the system board

CAUTION:
Hazardous moving parts. Keep fingers and other body parts away.
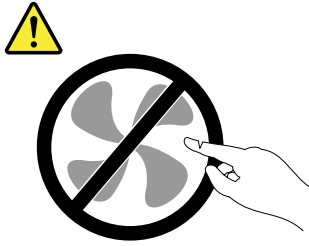
CAUTION:

The heat sink and microprocessor might be very hot. Turn off the server and wait several minutes to let the server cool before removing the server cover.

To replace the system board, do the following:

1. Prepare your server. See "Preparing your server in advance" on page 45.
2. Record the component locations, cable connections, and cable routing in the server. Then, disconnect all cables from the system board.
3. To access the system board, remove the following components in order:
   a. "Removing the air baffle" on page 48
   b. "Removing the heat sink" on page 50
   c. "Removing the memory module" on page 53
   d. "Removing the PCIe card" on page 54
   e. "Removing the riser card" on page 56
   f. "Removing the TPM" on page 77
   g. "Removing the coin-cell battery" on page 80
4. Remove the eight screws that secure the system board by following the recommended numerical sequence as shown. Then, carefully remove the system board out of the chassis.
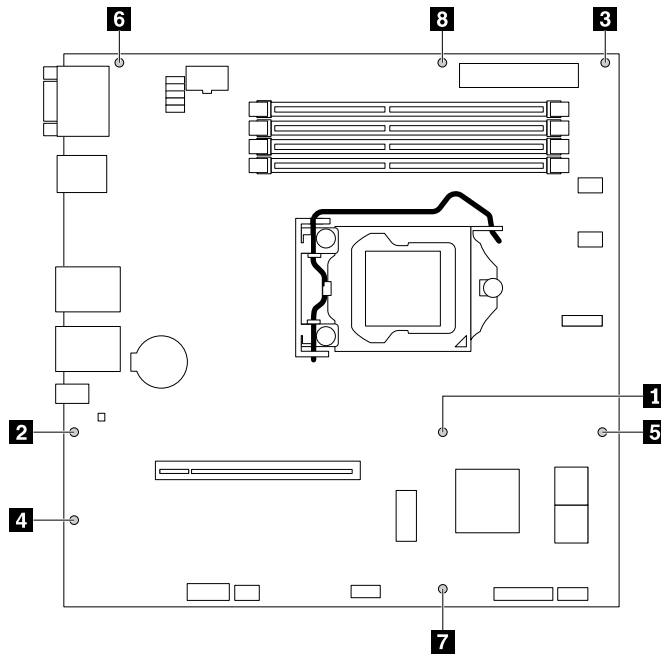
Figure 77. Removing the system board

5. Place the old system board on a flat, clean, and static-protective surface.

6. 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.

7. Note the orientation of the new system board and carefully place it into the chassis. Ensure that the rear connectors on the system board are inserted into the corresponding holes in the rear panel. Then, align the eight screw holes in the system board with those in the chassis, and install the eight screws in the reverse sequence as you remove them.

8. Pivot the microprocessor socket cover as shown to remove it from the new system board.

   Note: Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.
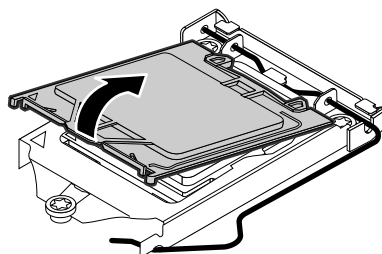

Figure 78. Removing the microprocessor socket cover

9. Remove the microprocessor from the old system board and install it on the new system board. See "For service technician only: replacing the microprocessor" on page 86.

10. Use a cleaning pad to wipe the thermal grease from the heat sink and the top of the microprocessor. Dispose of the cleaning pad after all of the thermal grease is removed.

11. Apply appropriate amount of thermal grease to the top of the microprocessor in the shape of either a cross or a circle as shown.

Notes:

- Do not touch the thermal grease.
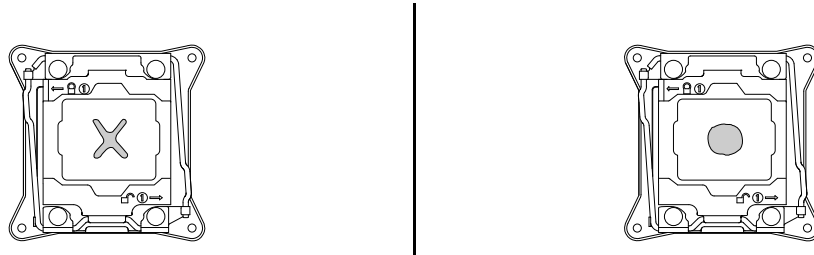- Keep the thermal grease off the system board.

Figure 79. Applying the thermal grease to the top of the microprocessor

12. Reinstall all parts that you have removed one by one in the reverse sequence as you remove them. See "Removing and installing hardware" on page 46.

13. Connect all cables to the system board.

14. If you are instructed to return the old system board, follow all packaging instructions and use any packaging materials that are supplied to you for shipping.

The old system board must be returned with a microprocessor socket cover to protect the pins during shipping and handling. To install a microprocessor socket cover on the old system board, do the following:

1. After you have removed the microprocessor from the old system board, close the microprocessor retainer, press down the handle, and then push the handle inward to lock the retainer into position.

2. Note the orientation of the socket cover, and install one side of the socket cover into the microprocessor socket as shown. Then, carefully press the other side of the socket cover downward until it snaps into position.
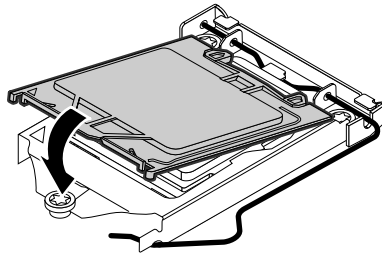

Figure 80. Installing the microprocessor socket cover

3. Carefully check the four corners of the socket cover to ensure that the cover is seated securely.

To complete the parts replacement, go to "Completing the parts replacement" on page 91.

Completing 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. Ensure that all internal cables are connected and routed correctly and secured by any cable clips or ties in the server. Keep cables clear of the hinges and sides of the chassis to avoid interference with reinstalling the air baffle and the server cover. The following illustration shows an example of the cable

routing in the chassis with two 3.5-inch HDDs. For instructions on connecting cables for HDDs, slim optical drive, and RAID card, see "Connecting the cables" on page 19.
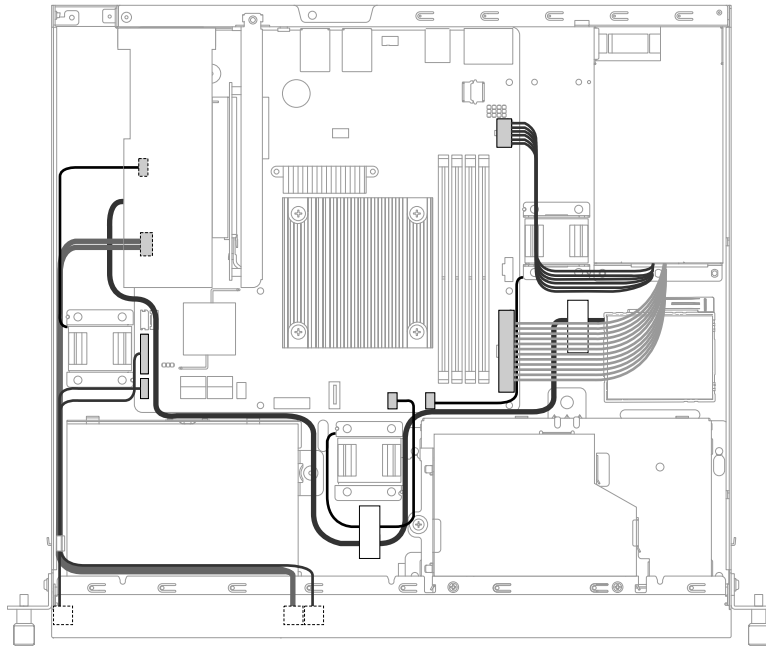

Figure 81. An example of cable routing (server models with two 3.5-inch HDDs)

3. If you have removed the air baffle, reinstall it. See "Installing the air baffle" on page 49.

4. Place the server cover above the chassis and then lower the server cover onto the chassis. Ensure that both sides of the server cover engage the guides on both sides of the chassis. Slide the server cover to the front of the chassis until the server cover snaps into position. Tighten the thumbscrew to secure the server cover.
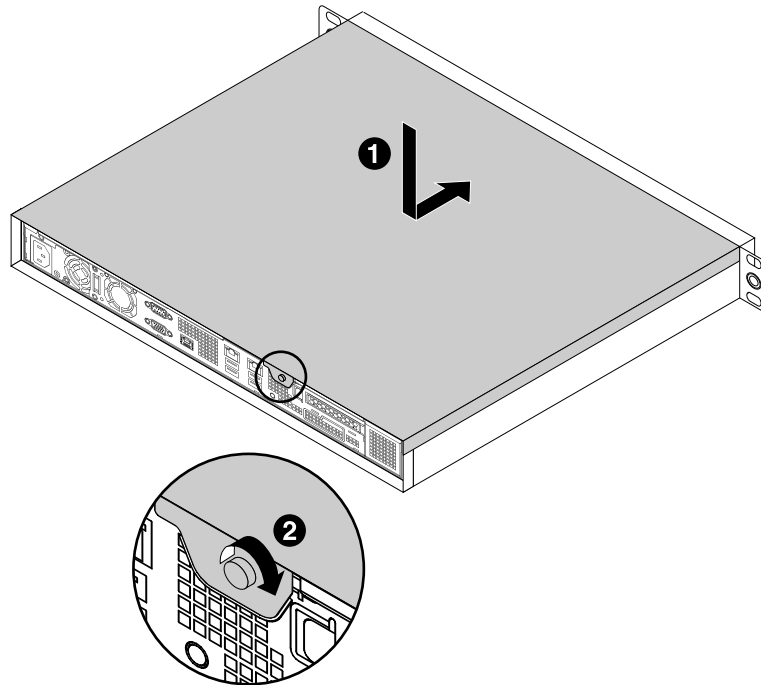
Figure 82. Installing the server cover

5. If you have a rail kit, install the server into the rack. See the documentation that comes with the rail kit.

6. Reconnect external cables and power cords to the server. See "Rear view of the server" on page 14 to identify the connectors on the rear panel of the server.

   Attention: To avoid component damage, connect the power cords last.

7. Update the server configuration.

   • Download and install the latest device drivers: http://www.lenovo.com/support

   • Update the BIOS configuration: "Using the Setup Utility program" on page 27

   • Update the RAID configuration: "Configuring RAID" on page 35

   • Update the system firmware: Chapter 2 "Server setup road map" on page 5

Chapter 6. Troubleshooting and diagnostics

This chapter provides information about basic troubleshooting and diagnostic methods to help you solve problems that might occur in the server.

If you cannot diagnose and correct a problem by using the information in this chapter, see Chapter 7 "Getting information, help, and service" on page 101 for additional troubleshooting resources.

Troubleshooting procedure

Use the following information as a general procedure for diagnosing and troubleshooting problems you experience with your server:

1. Verify that the power cords and the cables for all attached devices are connected correctly and securely.
2. Verify that the server and all attached devices that require ac power are connected to properly grounded, functioning electrical outlets.
3. Verify that all installed hardware and attached devices are enabled in the BIOS settings of your server. For more information about accessing and changing the BIOS settings, see "Using the Setup Utility program" on page 27.
4. View the status and diagnostic LEDs to identify the system and device status and diagnose problems. See "Viewing the status and diagnostic LEDs" on page 95.
5. If the server is not working after you have added new software, installed a new optional device, or replaced a piece of hardware, remove or reinstall the software or device to see if the problem could be solved.
6. View the system event log to diagnose problems. See "Viewing the system event log" on page 96.
7. Turn on the server and press Esc as soon as you see the logo screen to view any diagnostic messages.
8. Download and use a diagnostic program to diagnose problems. See "Lenovo ThinkServer Diagnostics" on page 11.
9. Refer to "Basic troubleshooting tables" on page 96 and follow the instructions for the type of problem you are experiencing. If the basic troubleshooting information does not help you resolve a problem, continue with the next step.
10. Try using a previous server configuration to see if a recent change to hardware or software settings has caused a problem. Before restoring your previous configuration, capture your current configuration in case the older configuration settings do not solve the problem or have adverse effect.
11. Use an antivirus program to see if your server has been infected by a virus. If the program detects a virus, remove the virus.
12. If none of these actions solve the problem, seek technical assistance. See Chapter 7 "Getting information, help, and service" on page 101.

Viewing the status and diagnostic LEDs

Your server has status and diagnostic LEDs on the front panel, the rear panel, and the optical drive (if supported). The various LEDs help you easily identify the system and device status and diagnose problems. For information about the LEDs, refer to the related topics in "Component locations" on page 12.

Viewing the system event log

The system event log (SEL) contains information about all the POST and system management interrupt (SMI) events. You can view the SEL to diagnose system problems.

The TMM implements the SEL as specified in the IPMI 2.0 specification. The SEL is accessible regardless of the system power state through the TMM in-band and out-of-band interfaces.

For more information about viewing the SEL, refer to the *ThinkServer Management Module User Guide*, which is available for download at:
http://www.lenovo.com/support

Basic troubleshooting tables

Use the basic troubleshooting information to find solutions to problems that have definite symptoms.

Follow the suggested actions for the corresponding symptom in the order in which they are listed until the problem is solved. If none of these actions solve the problem, see "Troubleshooting procedure" on page 95 for the subsequent steps you should check after using the information in this topic. If the problem still cannot be solved, seek technical assistance. See Chapter 7 "Getting information, help, and service" on page 101.

Notes:

- If you are instructed to remove, install, or replace any CRUs, refer to the related procedure in Chapter 5 "Replacing hardware" on page 43.
- If an action step is preceded by "(Trained service technician only)," this action step is reserved for a trained service technician and must be performed only by a trained service technician.

ThinkServer EasyStartup program problems

Symptom	Action

The disc with the ThinkServer EasyStartup ISO image does not start.	1. Ensure that:
	
	  • The server supports the ThinkServer EasyStartup program and has a bootable optical drive installed or a bootable external optical drive attached.
	
	  • You have set the optical drive with the disc as the first startup device. See "Selecting a startup device" on page 31.
	
	2. Verify if the optical drive or the disc has problems. See "Optical drive problems" on page 97.

The USB flash drive with the ThinkServer EasyStartup ISO image does not start.	1. Ensure that:
	
	  • The server supports the ThinkServer EasyStartup program.
	
	  • You have set the USB flash drive as the first startup device. See "Selecting a startup device" on page 31.
	
	2. Verify if the USB flash drive has problems. See "USB device and mouse problems" on page 99.

Symptom	Action
The operating system installation program continuously loops.	Make more space available on the HDD.
The ThinkServer EasyStartup program cannot start the operating system media.	• Ensure that the operating system media is supported by the ThinkServer EasyStartup program version your are using. For a list of the supported operating systems, refer to the user guide and compatibility notes for the ThinkServer EasyStartup program through the program main interface. See "Starting the ThinkServer EasyStartup program" on page 34. • Verify if the optical drive or the disc has problems. See "Optical drive problems" on page 97.

Optical drive problems

Symptom	Action

The optical drive is not recognized.	1. Ensure that:
	    • The related cables and connectors are not damaged and the connector pins are not bent.
	    • The optical drive is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See "Using the Setup Utility program" on page 27.
	    • All cables and jumpers (if any) are installed correctly.
	    • The correct device driver is installed for the optical drive.
	2. Run any optical drive diagnostic programs if you have.
	3. Reinstall the optical drive and reconnect cables.
	4. Replace the signal cable for the optical drive.
	5. Replace the power cable for the optical drive.
	6. Replace the optical drive.
	7. (Trained service technician only) Replace the system board.

A disc is not working correctly.	1. Ensure that the disc is in the optical drive with the shiny side facing down. 2. Ensure that the disc surface is clean and not scratched. 3. Check the disc or package for regional coding. You might need to purchase a disc with coding for the region where you are using the product. 4. Restart the disc player program. 5. Restart the server. 6. Run any optical drive diagnostic programs if you have. 7. Reinstall the optical drive and reconnect cables. 8. Replace the signal cable for the optical drive. 9. Replace the optical drive.

Hard disk drive problems

Symptom	Action

A newly installed HDD is not recognized.	1. Ensure that:
	
	   • The signal cable and connector are not damaged.
	
	   • The HDD is securely connected to the correct SATA connector on the system board and the SATA connector is enabled in the Setup Utility program. See "Using the Setup Utility program" on page 27.
	
	   • All cables and jumpers (if any) are installed correctly.
	
	2. If you have any diagnostic programs, run the diagnostic programs to test the HDD.
	
	3. Reinstall the HDD and reconnect cables.
	
	4. Replace the signal cable for the HDD.
	
	5. Replace the HDD.

Multiple HDDs fail.	1. If you have any diagnostic programs, run the diagnostic programs to test the HDD. 2. Ensure that the cable connection is correct. 3. Reconnect the power cable(s). 4. Reconnect the signal cable(s). 5. Replace the affected signal cable(s).

Memory module problems

Symptom	Action

The amount of system memory that is displayed is less than the total capacity of the installed physical memory modules and you suspect a memory module problem.	1. Ensure that:
	
	   • All memory modules are the correct type supported by the server. See "Memory module" on page 51.
	
	   • You followed the memory module installation rules. See "Memory module" on page 51.
	
	   • All memory modules are seated correctly and securely.
	
	   • The system firmware is up-to-date.
	
	2. If you have any diagnostic programs, run the diagnostic programs to test the memory modules.
	
	3. Reinstall the memory modules.
	
	4. Replace the suspect memory modules.
	
	5. (Trained service technician only) Replace the system board.

USB device and mouse problems

Symptom	Action
A USB device does not work.	1. Ensure that: • The USB cable is securely connected to the server. If the USB device is connected to a USB hub, disconnect the device from the hub and connect it directly to the server. • The device drivers are installed properly. • The USB controller is enabled in the Setup Utility program. See "Using the Setup Utility program" on page 27. 2. Restart the server. 3. Replace the USB device.
For server models installed with SUSE Linux Enterprise Server 11.4 operating system, if you use the TMM feature to control the server remotely through the management LAN and you are using JViewer (a remote console utility), two mouse pointers might be displayed on the interface.	To display only one mouse pointer, on the JViewer menu bar, click **Mouse → Mouse Mode** and select **Other mouse mode**. **Note:** You can press Alt+C to switch between the menu bar and the main interface.

Chapter 7. Getting information, help, and service

This chapter contains information about help, service, and technical assistance for products manufactured by Lenovo and where to go for additional information about Lenovo and Lenovo products.

Information resources

You can use the information in this topic to access useful resources relating to your needs when using the product.

Using the documentation

To get the information about your Lenovo system, optional devices, and installed software, if any, go to the Lenovo Support Web site at http://www.lenovo.com/support.

For more information about your server documentation, see "Server documentation" on page 2.

If you suspect a software problem, refer to the documentation, including readme files and online help, that comes with the operating system or software program.

ThinkServer Web site

The ThinkServer Web site provides up-to-date information and services to help you buy, use, upgrade, and maintain your server. You can visit the ThinkServer Web site at:
http://www.lenovo.com/thinkserver

Lenovo Support Web site

Technical support information is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

This Web site is updated with the latest support information such as the following:

- Drivers and software
- Diagnostic solutions
- Product and service warranty
- Product and parts details
- User guides and manuals
- Knowledge base and frequently asked questions

Help and service

This topic contains information about obtaining help and service.

Before you call

Before you call, do the following to try to solve the problem by yourself:

- Check all cables to ensure that they are connected.
- Check the power switches to ensure that the system and optional devices are turned on.

- Use the troubleshooting information in this manual. Go to Chapter 6 "Troubleshooting and diagnostics" on page 95.
- Check for the updated information, new device drivers, and hints and tips on the Lenovo Support Web site at:
  http://www.lenovo.com/support
- Download the diagnostic program from the Lenovo Web site, and then run it. See "Lenovo ThinkServer Diagnostics" on page 11.

If possible, be at your product when you call. Have the following information available:

- Machine type and model
- Serial numbers of your Lenovo hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

Calling for service

During the warranty period, you can get help and information by telephone through the Customer Support Center.

The following services are available during the warranty period:

- **Problem determination** - Trained service personnel are available to assist you with determining a hardware problem and deciding what action is necessary to fix the problem.
- **Hardware repair** - If the problem is caused by hardware under warranty, trained service personnel are available to provide the applicable level of service.
- **Engineering Change management** - There might be changes that are required after a product has been sold. Lenovo or your reseller will make selected Engineering Changes (ECs) that apply to your hardware available.

The warranty does not cover the following:
- Replacement or use of parts not manufactured for or by Lenovo or non-warranted Lenovo parts
- Identification of software problem sources
- Configuration of the (UEFI) BIOS as part of an installation or upgrade
- Changes, modifications, or upgrades to device drivers
- Installation and maintenance of network operating systems (NOS)
- Installation and maintenance of programs

For the warranty type and duration for your product, go to http://www.lenovo.com/warranty. You must retain your proof of purchase to obtain warranty service.

For warranty service, consult the worldwide Lenovo Support telephone list. Telephone numbers are subject to change without notice. The most up-to-date telephone list for Lenovo Support is always available on the Web site at http://www.lenovo.com/support/phone. If the telephone number for your country or region is not listed, contact your Lenovo reseller or Lenovo marketing representative.

Using other services

If you relocate your server to a country where your server machine type is sold, your server might be eligible for International Warranty Service, which automatically entitles you to obtain warranty service throughout the warranty period. Service will be performed by service providers authorized to perform warranty service.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your computer is eligible for International Warranty Service and to view a list of the countries where service is available, go to http://www.lenovo.com/support, click **Warranty & Repair**, and follow the instructions on the screen.

For technical assistance with the installation of or questions related to Service Packs for your installed Windows product, refer to the Microsoft Product Support Services Web site at http://support.microsoft.com/directory or you can contact the Customer Support Center. Some fees might apply.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for hardware, operating systems, and programs; network setup and configuration services; upgraded or extended hardware repair services; and custom installation services. Service availability and service names might vary by country or region. For more information about these services, go to the Lenovo Web site at: http://www.lenovo.com

Appendix A. Regulatory information

The latest compliance information is available at http://www.lenovo.com/compliance.

Export classification notice

This product is subject to the United States Export Administration Regulations (EAR) and has an Export Classification Control Number (ECCN) of 5A992.c. It can be re-exported except to any of the embargoed countries in the EAR E1 country list.

Electronic emission notices

Federal Communications Commission (FCC) Supplier's Declaration of Conformity (SDoC) - United States

The following information refers to the Lenovo ThinkServer machine types 70TD, 70TE, 70TF, and 70TG.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Lenovo is not responsible for any radio or television interference caused by using other than specified or recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:
Lenovo (United States) Incorporated
7001 Development Drive
Morrisville, NC 27560
U.S.A.
Email: FCC@lenovo.com

Industry Canada Compliance Statement

CAN ICES-3(A)/NMB-3(A)

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union - Compliance to the Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. Lenovo cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the installation of option cards from other manufacturers. This product has been tested and found to comply with the limits for Class A equipment according to European Standards harmonized in the Directives in compliance. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Lenovo, Einsteinova 21, 851 01 Bratislava, Slovakia

ϵ

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

German Class A compliance statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU Richtlinie zur Elektromagnetischen Verträglichkeit
Dieses Produkt entspricht den Schutzanforderungen der EU Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der Klasse A der Norm gemäß Richtlinie.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der Lenovo empfohlene Kabel angeschlossen werden. Lenovo übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der Lenovo verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der Lenovo gesteckt/eingebaut werden.

Deutschland:

Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Betriebsmitteln
Dieses Produkt entspricht dem „Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln" EMVG (früher „Gesetz über die elektromagnetische Verträglichkeit von Geräten"). Dies ist die Umsetzung der EMV EU Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln, EMVG vom 20. Juli 2007 (früher Gesetz über die elektromagnetische Verträglichkeit von Geräten), bzw. der EMV EU Richtlinie 2014/30/EU, für Geräte der Klasse A.

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung nach Paragraf 5 des EMVG ist die Lenovo (Deutschland) GmbH, Meitnerstr. 9, D-70563 Stuttgart.

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55032 Klasse A.

Nach der EN 55032: „Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen."

Nach dem EMVG: „Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind." (Auszug aus dem EMVG, Paragraph 3, Abs. 4). Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Anmerkung: Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den Handbüchern angegeben, zu installieren und zu betreiben.

Korea Class A compliance statement

A급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다

Russia Electromagnetic Interference (EMI) Class A statement

ВНИМАНИЕ!

Настоящее изделие относится к оборудованию класса А. При использовании в бытовой обстановке это оборудование может нарушать функционирование других технических средств в результате создаваемых индустриальных радиопомех. В этом случае от пользователя может потребоваться принятие адекватных мер.

Taiwan Class A compliance statement

警告使用者
此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

Lenovo product service information for Taiwan

委製商/進口商名稱: 台灣聯想環球科技股份有限公司
進口商地址: 台北市南港區三重路 66 號 8 樓
進口商電話: 0800-000-702

Japanese electromagnetic compatibility statements

Japan VCCI Class A statement

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。　　　　　ＶＣＣＩ－Ａ

Japanese electrical appliance and material safety law statement (for detachable AC power cord)

本製品およびオプションに電源コード・セット付属する場合は、
それぞれ専用のものになっていますので他の電気機器には使用しないでください。

JEITA harmonics guideline - Japanese statement for AC power consumption (W)

定格入力電力表示

（社）電子情報技術参照委員会 家電・汎用品高調波抑制対策ガイドライン
　　　実行計画書に基づく定格入力電力値：　W

お手持ちのユニットの定格入力電力値（W）はユニットの電源装置に貼付されている電源仕様ラベルを
ご参照下さい

JEITA harmonics guideline - Japanese statement of compliance for products less than or equal to 20A per phase

日本の定格電流が 20A/相 以下の機器に対する高調波電流規制
高調波電流規格 JIS C 61000-3-2 適合品

JEITA harmonics guideline - Japanese statement of compliance for products more than 20A

本製品は、1相当たり2OAを超える機器ですが、個々のユニットガ「高調波電流規格 JIS C
61000-3-2適合品」であり、
本製品はその組み合わせであるため、「高調波電流規格 JIS C 61000-3-2適合品」としてい
ます。

Eurasian compliance mark

Appendix B. WEEE and recycling information

Lenovo encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. Lenovo offers a variety of programs and services to assist equipment owners in recycling their IT products. For information on recycling Lenovo products, go to http://www.lenovo.com/recycling. The latest environmental information about our products is available at http://www.lenovo.com/ecodeclaration.

Important WEEE information
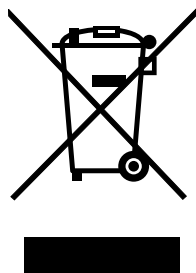
The WEEE marking on Lenovo products applies to countries with WEEE and e-waste regulations (for example, the European WEEE Directive, India E-Waste Management & Handling Rules, 2011). Appliances are labeled in accordance with local regulations concerning waste electrical and electronic equipment (WEEE). These regulations determine the framework for the return and recycling of used appliances as applicable within each geography. This label is applied to various products to indicate that the product is not to be thrown away, but rather put in the established collection systems for reclaiming these end of life products.

Users of electrical and electronic equipment (EEE) with the WEEE marking must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to them for the return, recycle, and recovery of WEEE and to minimize any potential effects of EEE on the environment and human health due to the presence of hazardous substances. Lenovo electrical and electronic equipment (EEE) may contain parts and components, which at end-of-life might qualify as hazardous waste.

EEE and waste electrical and electronic equipment (WEEE) can be delivered free of charge to the place of sale or any distributor that sells electrical and electronic equipment of the same nature and function as the used EEE or WEEE.

For additional WEEE information, go to:
http://www.lenovo.com/recycling

WEEE information for Hungary

Lenovo, as a producer, bears the cost incurred in connection with the fulfillment of Lenovo's obligations under Hungary Law No. 197/2014 (VIII.1.) subsections (1)-(5) of section 12.

Recycling information for Japan

Collecting and recycling a disused Lenovo computer or monitor

If you are a company employee and need to dispose of a Lenovo computer or monitor that is the property of the company, you must do so in accordance with the Law for Promotion of Effective Utilization of Resources. Computers and monitors are categorized as industrial waste and should be properly disposed of by an

industrial waste disposal contractor certified by a local government. In accordance with the Law for Promotion of Effective Utilization of Resources, Lenovo Japan provides, through its PC Collecting and Recycling Services, for the collecting, reuse, and recycling of disused computers and monitors. For details, visit the Lenovo Web site at http://www.lenovo.com/recycling/japan. Pursuant to the Law for Promotion of Effective Utilization of Resources, the collecting and recycling of home-used computers and monitors by the manufacturer was begun on October 1, 2003. This service is provided free of charge for home-used computers sold after October 1, 2003. For details, visit the Lenovo Web site at http://www.lenovo.com/recycling/japan.

Disposing of Lenovo computer components

Some Lenovo computer products sold in Japan may have components that contain heavy metals or other environmental sensitive substances. To properly dispose of disused components, such as a printed circuit board or drive, use the methods described above for collecting and recycling a disused computer or monitor.

Disposing of disused lithium batteries from Lenovo computers

A button-shaped lithium battery is installed inside your Lenovo computer to provide power to the computer clock while the computer is off or disconnected from the main power source. If you need to replace it with a new one, contact your place of purchase or contact Lenovo for service. If you need to dispose of a disused lithium battery, insulate it with vinyl tape, contact your place of purchase or an industrial-waste-disposal operator, and follow their instructions. Disposal of a lithium battery must comply with local ordinances and regulations.

Recycling information for Brazil

Declarações de Reciclagem no Brasil

Descarte de um Produto Lenovo Fora de Uso

Equipamentos elétricos e eletrônicos não devem ser descartados em lixo comum, mas enviados à pontos de coleta, autorizados pelo fabricante do produto para que sejam encaminhados e processados por empresas especializadas no manuseio de resíduos industriais, devidamente certificadas pelos orgãos ambientais, de acordo com a legislação local.

A Lenovo possui um canal específico para auxiliá-lo no descarte desses produtos. Caso você possua um produto Lenovo em situação de descarte, ligue para o nosso SAC ou encaminhe um e-mail para: reciclar@lenovo.com, informando o modelo, número de série e cidade, a fim de enviarmos as instruções para o correto descarte do seu produto Lenovo.

Battery recycling information for Taiwan

廢電池請回收

Battery recycling information for the European Union

EU
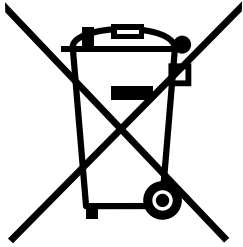
Notice: This mark applies only to countries within the European Union (EU).

Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union. This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury, and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances.

Before placing electrical and electronic equipment (EEE) in the waste collection stream or in waste collection facilities, the end user of equipment containing batteries and/or accumulators must remove those batteries and accumulators for separate collection.

Disposing of lithium batteries and battery packs from Lenovo products

A coin-cell type lithium battery might be installed inside your Lenovo product. You can find details about the battery in the product documentation. If the battery needs to be replaced, contact your place of purchase or contact Lenovo for service. If you need to dispose of a lithium battery, insulate it with vinyl tape, contact your place of purchase or a waste-disposal operator, and follow their instructions.

Disposing of battery packs from Lenovo products

Your Lenovo device might contain a lithium-ion battery pack or a nickel metal hydride battery pack. You can find details on the battery pack in the product documentation. If you need to dispose of a battery pack, insulate it with vinyl tape, contact Lenovo sales, service, or your place of purchase, or a waste-disposal operator, and follow their instructions. You also can refer to the instructions provided in the user guide for your product

For proper collection and treatment, go to:
http://www.lenovo.com/lenovo/environment

Battery recycling information for the United States and Canada

This product may contain a lithium or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal or batteries outside the United States, go to http://www.lenovo.com/recycling or contact your local waste disposal facility.

US & Canada Only

Requirement for batteries containing perchlorate

The following statement applies to users in the state of California, U.S.A.

California Perchlorate Information:

Products containing manganese dioxide lithium coin cell batteries may contain perchlorate.

Perchlorate Material - special handling may apply, See
www.dtsc.ca.gov/hazardouswaste/perchlorate

Appendix C. Restriction of Hazardous Substances (RoHS) Directive

This topic provides statements about the Restriction of Hazardous Substances (RoHS) Directive . The latest environmental information is available at http://www.lenovo.com/ecodeclaration.

European Union RoHS

This Lenovo product, with included parts (cables, cords, and so on) meets the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment ("RoHS recast" or "RoHS 2").

For more information about Lenovo worldwide compliance on RoHS, go to: http://www.lenovo.com/social_responsibility/us/en/RoHS_Communication.pdf

Turkish RoHS

The Lenovo product meets the requirements of the Republic of Turkey Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (EEE).

Türkiye AEEE Yönetmeliğine Uygunluk Beyanı

Bu Lenovo ürünü, T.C. Çevre ve Orman Bakanlığı'nın "Atık Elektrik ve Elektronik Eşyalarda Bazı Zararlı Maddelerin Kullanımının Sınırlandırılmasına Dair Yönetmelik (AEEE)" direktiflerine uygundur.

AEEE Yönetmeliğine Uygundur.

Ukraine RoHS

Цим підтверджуємо, що продукція Леново відповідає вимогам нормативних актів України, які обмежують вміст небезпечних речовин

India RoHS

RoHS compliant as per E-Waste (Management) Rules.

China RoHS

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
机架	O	O	O	O	O	O
外部盖板	O	O	O	O	O	O
机械 组合件	X	O	O	O	O	O
空气传动 设备	X	O	O	O	O	O
冷却 组合件	X	O	O	O	O	O
内存模块	X	O	O	O	O	O
处理器 模块	X	O	O	O	O	O
键盘	X	O	O	O	O	O
调制 解调器	X	O	O	O	O	O
监视器	X	O	O	O	O	O
鼠标	X	O	O	O	O	O
电缆 组合件	X	O	O	O	O	O
电源	X	O	O	O	O	O
存储设备	X	O	O	O	O	O
电池匣 组合件	X	O	O	O	O	O
电池	X	O	O	O	O	O
有mech的 电路卡	X	O	O	O	O	O
无mech的 电路卡	X	O	O	O	O	O
激光器	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制。
○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。
注：表中标记"×"的部件，皆因全球技术发展水平限制而无法实现有害物质的替代。

环保使用期限（EPUP）的免责条款：EPUP 规定的具体期限仅为符合中华人民共和国的相应的法律规定，并非代表 Lenovo 向客户提供保证或负有任何义务。EPUP 中假定客户按照操作手册在正常情况下使用本产品。对于本产品中配备的某些组合件（例如，装有电池的组合件）的 EPUP，其效力可能低于本产品的 EPUP。

Environmental Protection Use Period (EPUP) Disclaimer: The number provided as the EPUP is provided solely to comply with applicable laws of the People's Republic of China. It does not create any warranties or liabilities on behalf of Lenovo to customer. The EPUP assumes that the product will be used under normal conditions in accordance with the Lenovo operating manual. Certain assemblies inside this product (for example, assemblies that contain a battery) may have an EPUP which is lower than the EPUP on this product.

Taiwan BSMI RoHS declaration

單元 Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (PB)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr^{+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	−	○	○	○	○	○
電路卡	−	○	○	○	○	○
光碟機	−	○	○	○	○	○

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.

Appendix D. Additional statements

Important notes

Processor speed indicates the internal clock speed of the CPU; 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 storage 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 storage drive capacities assume the replacement of any standard storage drives and population of all 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.

Lenovo makes no representations or warranties with respect to non-Lenovo products. Support (if any) for the non-Lenovo products is provided by the third party, not Lenovo.

Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

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 server 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 server 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 server, Lenovo may condition provision of repair or replacement of servers or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 2. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] 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.

[3] 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.

German Ordinance for Work gloss statement

The product is not suitable for use with visual display work place devices according to clause 2 of the German Ordinance for Work with Visual Display Units.

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Appendix E. Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service.

Lenovo may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

Lenovo (United States), Inc.
1009 Think Place - Building One
Morrisville, NC 27560
U.S.A.
Attention: Lenovo Director of Licensing

LENOVO PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. Lenovo may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

The products described in this document are not intended for use in implantation or other life support applications where malfunction may result in injury or death to persons. The information contained in this document does not affect or change Lenovo product specifications or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Lenovo or third parties. All information contained in this document was obtained in specific environments and is presented as an illustration. The result obtained in other operating environments may vary.

Lenovo may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Any references in this publication to non-Lenovo Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this Lenovo product, and use of those Web sites is at your own risk.

Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Trademarks

LENOVO and THINKSERVER are trademarks of Lenovo.

Celeron, Intel, Intel Core, Pentium, and Xeon are trademarks of Intel Corporation or its subsidiaries in the U. S. and/or other countries.

Internet Explorer, Microsoft, and Windows are trademarks of the Microsoft group of companies.

Linux is a registered trademark of Linus Torvalds.

All Other trademarks are the property of their respective owners. © 2018 Lenovo

Appendix F. Abbreviations and acronyms

The following table lists major abbreviations and acronyms used in this document together with their full terms.

Abbreviation or acronym	Full term
ACPI	Advanced Configuration and Power Interface
BIOS	basic input/output system
BMC	Baseboard Management Controller
CPU	central processing unit
CRT	Cathode Ray Tube
CRU	Customer Replaceable Unit
CSM	Compatibility Support Module
DDR4	double data rate 4
DHCP	Dynamic Host Configuration Protocol
ECC	Error Checking and Correcting
EMI	electromagnetic interference
ESD	electrostatic discharge
GPGPU	general-purpose computing on graphics processing units
GUI	graphical user interface
HBA	Host Bus Adapter
HDD	hard disk drive
HII	Human Interface Infrastructure
HTML	Hypertext Markup Language
IPMI	Intelligent Platform Management Interface
I/O	Input/Output
LED	light-emitting diode
LLW	Lenovo Limited Warranty
LRDIMM	load reduction dual inline memory module
Mbps	megabits per second
NOS	network operating system
NVMe	Non-Volatile Memory Express
OEM	Original Equipment Manufacturer
PCIe	PCI Express

Abbreviation or acronym	Full term
PDA	personal digital assistant
PDF	Portable Document Format
PECI	Platform Environment Control Interface
POST	power-on self-test
PXE	Preboot Execution Environment
RAID	Redundant Array of Independent Disks
RAS	Reliability, availability, and serviceability
RDIMM	registered dual inline memory module
ROM	read-only memory
SAS	Serial Attached SCSI (Small Computer System Interface)
SATA	Serial Advanced Technology Attachment
SCCM	System Center Configurations Management
SD	Secure digital
SEL	system event log
SMI	system management interrupt
SSD	solid-state drive
StorCLI	Storage Command Line Tool
TCG	Trusted Computing Group
TMM	ThinkServer Management Module
TPM	ThinkServer Trusted Platform Module
UEFI	Unified Extensible Firmware Interface
UPS	uninterruptible power supply
VGA	video graphics array

Index

T

U