Lenovo ThinkEdge SE450 Edge Server
Product Guide

The Lenovo ThinkEdge SE450 is a single-socket server, with a 2U height and short depth case that can go almost anywhere. It can be mounted on a wall, placed on the floor like a tower server, or mounted in a rack. This rugged edge server can handle continuous operating temperatures from 5°C and 45°C; and some configurations are designed to meet NEBS Level-3 and ETSI requirements for 96 hours operating excursions from -5°C and 55°C as well as tolerance to locations with high-dust and vibration.

The ThinkEdge SE450 is based on the 3rd Gen Intel Xeon Scalable processor and is designed to virtualize traditional IT applications as well as new transformative AI systems, providing the processing power, storage, accelerator, and networking technologies required for today's edge workloads. Lenovo's innovation makes the ThinkEdge SE450 one of the most powerful, yet quiet servers on the market, allowing it to be deployed next to end users without disturbing the workplace.

Figure 1. Lenovo ThinkEdge SE450

Did you know?

Customers with remote locations have had to make a choice between underpowered IOT gateways and PCs, or overpowered and non-rugged data center servers. With the SE450, now they have an option: a compact edge server designed specifically to meet the needs of remote locations with the processing power to run AI workloads.

Key features

The ThinkEdge SE450 is a purpose-built server that is significantly shorter than a traditional server, making it ideal for deployment in tight spaces. It can be mounted on a wall, placed vertically in a floor stand, or mounted in a rack.

The ThinkEdge SE450 puts increased processing power, storage and network closer to where data is generated, allowing actions resulting from the analysis of that data to take place more quickly.

Since these edge servers are typically deployed outside of secure data centers, they include technology that encrypts the data stored on the device if it is tampered with, only enabling authorized users to access it.

Scalability and performance

The SE450 offers numerous features to boost performance, improve scalability and reduce costs:

- Support a single processor from the powerful Intel Xeon Scalable "Ice Lake" processor family.
  - Up to 36 cores
  - Core speeds of up to 3.0 GHz
  - TDP ratings of up to 205W
- Support for up to 8 TruDDR4 memory DIMMs an up to 1 TB of memory using 128 GB DIMMs
- DIMMs operate at up to 3200 MHz means you have the fastest available memory subsystem
- Supports the new Intel Optane Persistent Memory 200 Series for advanced in-memory database applications, dense-virtualization; up to 4 PMem Modules can be installed in conjunction with regular system memory.
- Supports up to four single-width GPUs or two double-wide GPUs, for substantial processing power in an edge system.
- Supports up to four Intel ACC100 Accelerator adapters to maximize the performance Network Function Virtualization (NFV) applications.
- Offers a choice of internal drive SSD bays supporting SATA or NVMe drives, or hot-swap front-accessible drive bays supporting SAS, SATA or NVMe drives.
- Supports M.2 drives for convenient operating system boot functions. Available M.2 adapters support either one M.2 drive or two M.2 drives, with optional RAID-1 with the use of VROC for performance and reliability.
- Supports 4x NVMe drives without oversubscription of PCIe lanes (1:1 connectivity). The use of NVMe drives maximizes drive I/O performance, in terms of throughput and latency.
- The server offers up to four PCIe 4.0 slots plus a slot dedicated to the OCP adapter.
- Support for up to four network adapters, up to 100 Gb Ethernet or HDR100 InfiniBand, for high-speed networking to back-end servers.

Availability and serviceability

The SE450 provides many features to simplify serviceability and increase system uptime:

- The server offers Single Device Data Correction (SDDC, also known as Chipkill), Adaptive Double-Device Data Correction (ADDDC, also known as Redundant Bit Steering or RBS), and memory mirroring for redundancy in the event of a non-correctable memory failure.
- The server offers hot-swap drives, supporting software RAID redundancy for data protection and greater system uptime.
- The M.2 adapter supports RAID-1 via Intel VROC which can enable two M.2 drives to be configured as a redundant pair.
- The server has up to two hot-swap redundant power supplies and up to six simple-swap N+1 redundant fans to provide availability for business-critical applications.
- Solid-state drives (SSDs) offer more reliability and performance than traditional mechanical HDDs for

greater uptime.

- Proactive Platform Alerts (including PFA and SMART alerts): Processors, voltage regulators, memory, internal storage (HDDs and SSDs, M.2 storage), fans, power supplies, RAID controllers, server ambient and subcomponent temperatures. Alerts can be surfaced through the XClarity Controller to managers such as Lenovo XClarity Administrator, VMware vCenter, and Microsoft System Center. These proactive alerts let you take appropriate actions in advance of possible failure, thereby increasing server uptime and application availability.

- The built-in XClarity Controller continuously monitors system parameters, triggers alerts, and performs recovery actions in case of failures to minimize downtime.

- Built-in diagnostics in UEFI, using Lenovo XClarity Provisioning Manager, speed up troubleshooting tasks to reduce service time.

- Lenovo XClarity Provisioning Manager supports diagnostics and can save service data to a USB key drive or remote CIFS share folder for troubleshooting and reduce service time.

- Auto restart in the event of a momentary loss of AC power (based on power policy setting in the XClarity Controller service processor)

- Offers a diagnostics port on the front of the server to allow you to attach an external diagnostics handset for enhanced systems management capabilities.

- Support for the XClarity Administrator Mobile app running on a supported smartphone or tablet and connected to the server through the service-enabled USB port, enables additional local systems management functions.

- Three-year or one-year customer-replaceable unit and onsite limited warranty (varies by geography), 9 x 5 next business day. Optional service upgrades are available.

Manageability and security

Systems management features simplify local and remote management of the SE450:

- The server includes an XClarity Controller (XCC) to monitor server availability. Optional upgrade to XCC Advanced to provide remote control (keyboard video mouse) functions. Optional upgrade to XCC Enterprise enables the additional support for the mounting of remote media files (ISO and IMG image files), boot capture, and power capping.

- Lenovo XClarity Administrator offers comprehensive hardware management tools that help to increase uptime, reduce costs and improve productivity through advanced server management capabilities.

- IT Administrators can securely claim and activate the SE450 remotely through the ThinkShield Key Vault Portal, available on the web. They can also manage and unlock their global IoT edge fleet for initial operation and in case of tamper. The ThinkShield Edge Mobile Management app enables Edge Users to securely claim and activate the ThinkEdge SE450 in an easy to use Web UI.

- UEFI-based Lenovo XClarity Provisioning Manager, accessible from F1 during boot, provides system inventory information, graphical UEFI Setup, platform update function, RAID Setup wizard, operating system installation function, and diagnostic functions.

- Support for Lenovo XClarity Energy Manager, which captures real-time power and temperature data from the server and provides automated controls to lower energy costs.

- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.

- Support for industry standard management protocols, IPMI 2.0, SNMP 3.0, Redfish REST API, serial console via IPMI

- An integrated hardware Trusted Platform Module (TPM) supporting TPM 2.0 enables advanced cryptographic functionality, such as digital signatures and remote attestation.

- Administrator and power-on passwords help protect from unauthorized access to the server.

- Supports Secure Boot to ensure only a digitally signed operating system can be used. Supported

with HDDs and SSDs, as well as M.2 drives.

- Industry-standard Advanced Encryption Standard (AES) NI support for faster, stronger encryption.
- Intel Execute Disable Bit functionality can prevent certain classes of malicious buffer overflow attacks when combined with a supported operating system.
- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, allowing an application to run in its own isolated space, protected from all other software running on a system.
- Additional physical security features are an available chassis intrusion switch and available lockable front bezel and top cover.

Energy efficiency

The SE450 offers the following energy-efficiency features to save energy, reduce operational costs, and increase energy availability:

- Energy-efficient system board components help lower operational costs.
- High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications
- Solid-state drives (SSDs) consume as much as 80% less power than traditional spinning 2.5-inch HDDs.
- Optional Lenovo XClarity Energy Manager provides advanced data center power notification, analysis, and policy-based management to help achieve lower heat output and reduced cooling needs.

Components and connectors

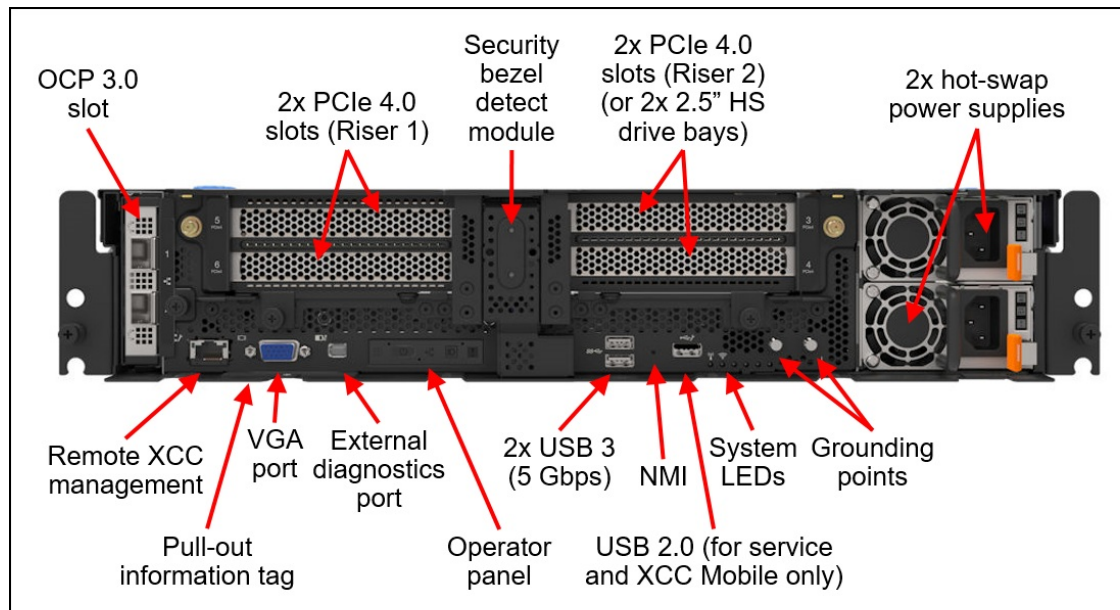The following figure shows the front view of the ThinkEdge SE450 server.

Figure 2. Front view of the ThinkEdge SE450

The following figure shows the rear of the SE450 server.
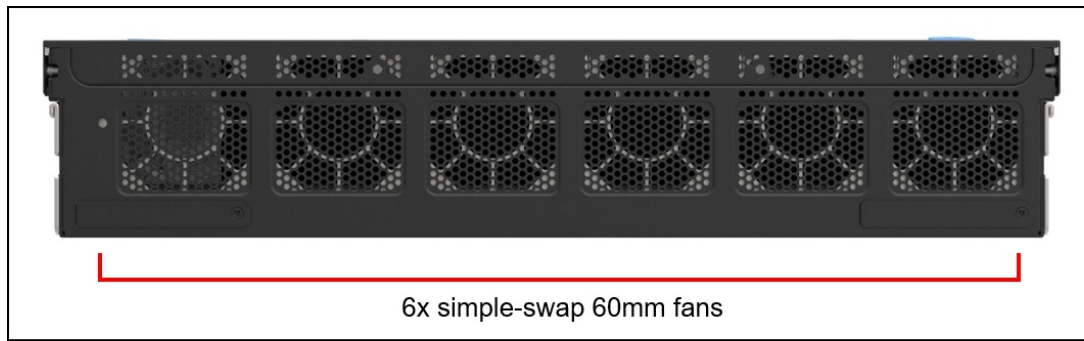

6x simple-swap 60mm fans

Figure 3. Rear view of the ThinkEdge SE450

The SE450 optionally supports a security bezel which helps restrict physical access to the front of the server while still allowing cables to be properly routed through side panels. The bezel also duplicates the system LEDs that would otherwise be covered up by the bezel. The following figure shows the server with the security bezel attached.
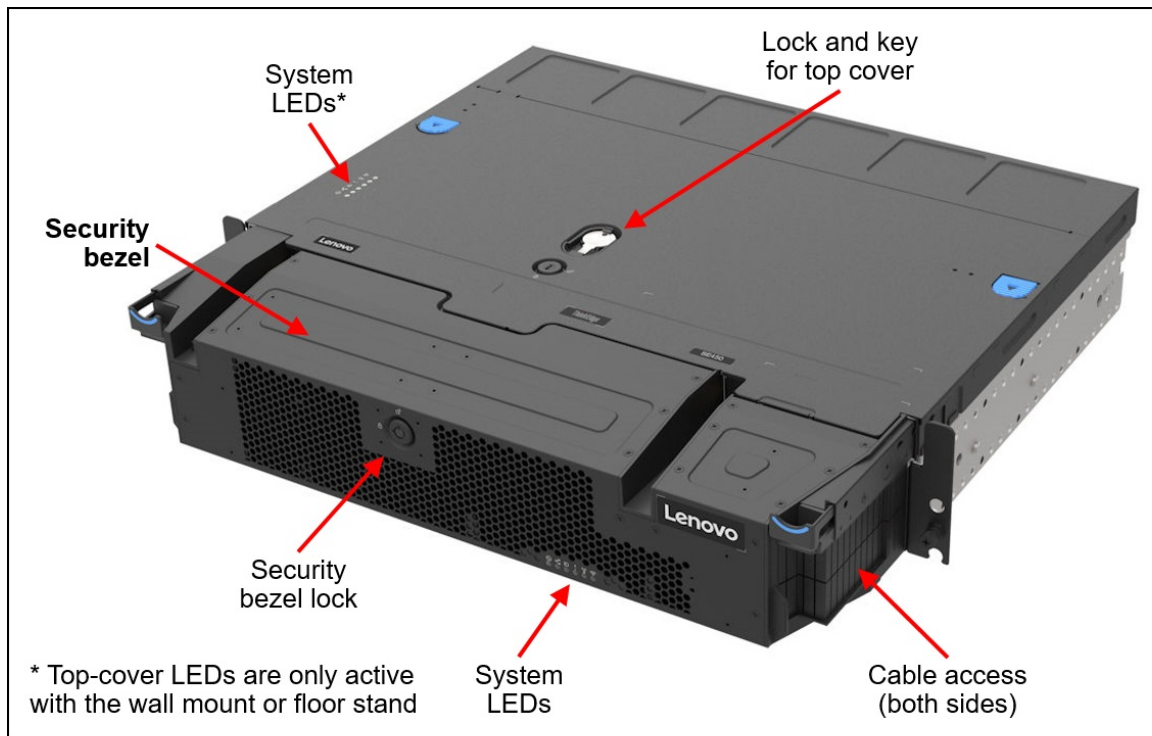

Figure 4. View of the ThinkEdge SE450 with security bezel attached

The following figure shows the locations of key components inside the server. The two riser cards and various brackets have been removed to show the components on the system board.
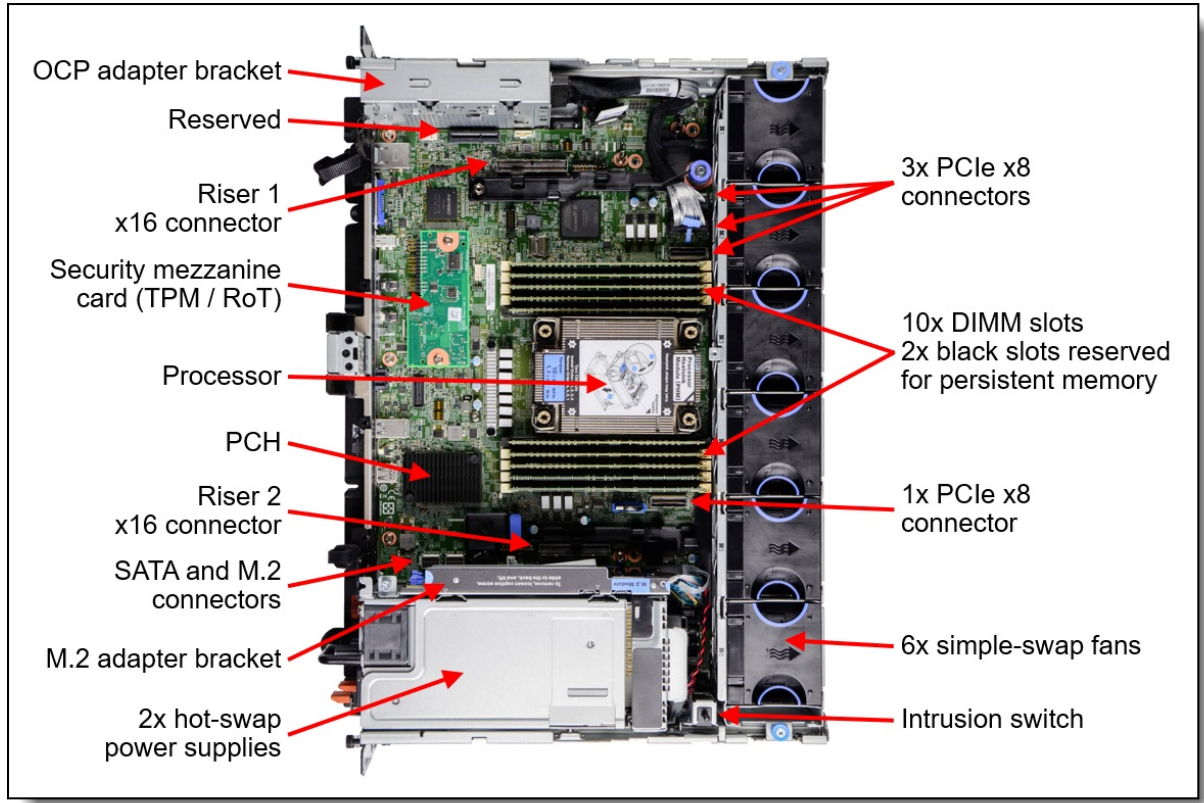
Figure 5. Internal view of the ThinkEdge SE450

System architecture

The following figure shows the architectural block diagram of the SE450 system, showing the major components and connections.

The processor offers 64 PCIe G4 lanes to devices and the SE450 presents those as a combination of PCIe slots, an OCP slot, and NVMe drives. As shown in the figure, PCIe lanes to slots 3 and 6 can instead be configured to be used with the OCP slot and/or NVMe drive connections. The specific combinations supported are listed in the Configurations section.

Tip: The wrench icons show where the local and remote management functions are enabled

Figure 6. SE450 architectural block diagram

Standard specifications

The following table lists the standard specifications of the SE450.
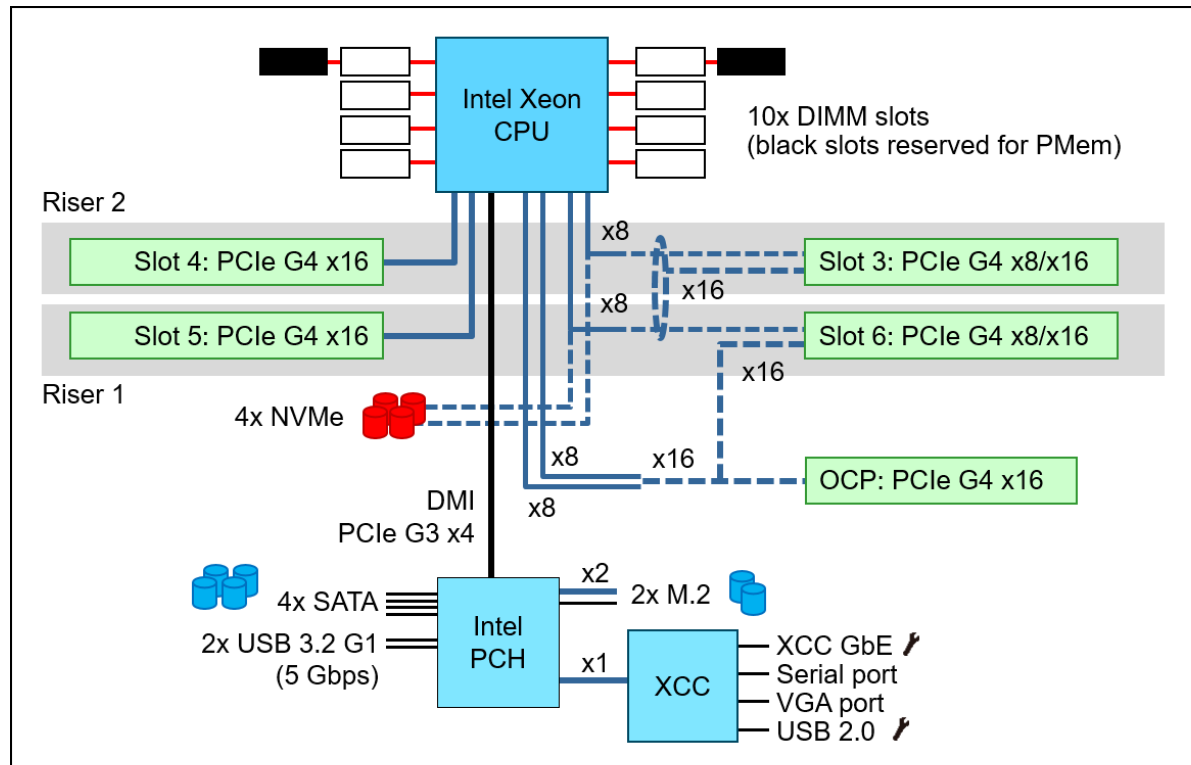
Table 1. Standard specifications

Components	Specification
Machine types	7D8T - 3 year warranty
Form factor	2U rack server, 300mm or 360mm depth
Processor	1x 3rd Gen Intel Xeon Scalable processor (formerly codenamed "Ice Lake"). Supports Silver, Gold and Platinum processors up to 36 cores, core speeds of up to 3.0 GHz, and TDP ratings of up to 205W.
Accelerators	Supports up to 4x Intel ACC100 Accelerating NFV adapters
Memory	10 DIMM slots, supporting the following combinations: • 1, 2, 4, 6 or 8x RDIMMs (no Persistent Memory modules) • 6x RDIMMs and 1x Persistent Memory module • 8x RDIMMs and 1x Persistent Memory module • 4x RDIMMs and 4x Persistent Memory modules The processor has 8 memory channels with 1 RDIMM per channel. In configurations with 8x RDIMMs + 1 PMem, the PMem is installed as a 2nd module on one of the channels. Lenovo TruDDR4 RDIMMs and 3DS RDIMMs are supported. DIMMs operate at up to 3200 MHz.
Persistent memory	Supports up to 4x Intel Optane Persistent Memory 200 Series modules installed in the DIMM slots. Persistent memory (PMem) is installed in combination with system memory DIMMs.
Memory maximum	With RDIMMs only: Up to 1TB with 8x 128GB 3DS RDIMMs With PMem: Up to 1.5TB with 4x 128GB 3DS RDIMMs + 4x 256GB PMem modules
Memory protection	ECC, SDDC (for x4-based memory DIMMs), ADDDC (for x4-based memory DIMMs, requires Platinum or Gold processors), and memory mirroring.
Drive bays	• Up to 4x internal SSD drive bays supporting non-hot-swap trayless NVMe or SATA SSD drives • Up to 2x 2.5-inch hot-swap drive bays, front accessible, supporting SAS or SATA SSD drives (mutually exclusive with slots 3 and 4 in Riser 2) • Up to 2x M.2 drives for boot functions, supporting SATA drives

Maximum data storage	• 2.5-inch hot-swap drives:
	  ○ 30.72TB using 2x 15.36TB 2.5-inch SATA SSDs
	• 7mm internal (trayless) drives:
	  ○ 30.72TB using 4x 7.68TB 7mm SATA SSDs
	  ○ 15.36TB using 4x 3.84TB 7mm NVMe SSDs
	• 15mm internal (trayless) drives:
	  ○ 7.68TB using 2x 3.84TB 15mm NVMe SSDs

Storage controller	• 4x Onboard SATA ports (Intel VROC SATA RAID, formerly known as Intel RSTe RAID) • Up to 4x Onboard NVMe ports (includes Intel VROC NVMe RAID, with optional license for non-Intel NVMe SSDs) • RAID adapter and HBA support for SAS and SATA drive connectivity
Optical drive bays	No internal optical drive. Supports external DVD-RW.

Components	Specification
Tape drive bays	No support
Network interfaces	Dedicated OCP 3.0 SFF slot with PCIe 4.0 x16 host interface (not available in all configurations based on PCIe lane availability). OCP slot supports a variety of 2-port and 4-port adapters with 1GbE, 10GbE or 25GbE network connectivity. One port can optionally be shared with the XClarity Controller (XCC) management processor for Wake-on-LAN and NC-SI support. Additional network adapters supported in the PCIe slots.
PCI Expansion slots	Up to 4x PCIe 4.0 slots, x16 or x8, depending on the configuration selected. 300mm chassis supports half-length (FHHL) adapters, 360mm chassis supports full-length (FHFL) adapters.
GPU support	Supports up to 4x single-wide GPUs or up to 2x double-wide GPUs
Ports	Front: 2x USB 3.2 G1 (5 Gb/s) ports, VGA port, USB 2.0 port for XCC local management only (not visible to the operating system), dedicated RJ-45 1GbE remote systems management port, External diagnostics port for local systems management, NMI pinhole
Cooling	6x simple-swap 60 mm dual-rotor fans (all standard), N+1 redundant in most configurations.
Power supply	Up to two hot-swap redundant power supplies ● 1100W Titanium or Platinum AC power supplies ● 1800W Platinum AC power supply ● 1100W -48V DC power supply Note: Power supplies are front-mounted so fan rotation is reversed compared to other ThinkSystem servers.
Video	G200 graphics with 16 MB memory with 2D hardware accelerator, integrated into the XClarity Controller. Maximum resolution is 1920x1200 32bpp at 60Hz.
Hot-swap parts	Drives (in hot-swap trays), power supplies
Systems management	Operator panel with status LEDs on the front of the server. Duplicate status LEDs on the top of the server. Optional External Diagnostics Handset with LCD display. XClarity Controller (XCC) embedded management based on ASPEED AST2600 management processor, XClarity Administrator centralized infrastructure delivery, XClarity Integrator plugins, and XClarity Energy Manager centralized server power management. Optional XClarity Controller Advanced and Enterprise to enable remote control functions. ThinkShield Edge Mobile Management mobile app and XClarity Mobile app for local onsite SE450 server management.
Security features	ThinkShield Key Vault Portal web site for security management. Trusted Platform Module, supporting TPM 2.0. Lockable top cover, optional front locking security bezel with duplicate status LEDs, intrusion detection, self-encrypting drive (SED) support, power-on password, administrator's password.
Operating systems supported	Microsoft Windows Server, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, VMware ESXi. See the Operating system support section for specifics.
Mounting options	Horizontal or vertical orientation. Floor mount (vertical), wall mount, or 2U short-depth rack mount. Available locking security bezel with dust filter.
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD).

Components	Specification
Service and support	Optional service upgrades are available through Lenovo Services: 4-hour or 2-hour response time, 6-hour fix time, 1-year or 2-year warranty extension, software support for Lenovo hardware and some third-party applications.
Dimensions	300mm chassis: Width: 445 mm (17.5 in.), height: 87 mm (3.4 in.), depth: 323 mm (12.7 in.) 360mm chassis: Width: 445 mm (17.5 in.), height: 87 mm (3.4 in.), depth: 383 mm (15.1 in.) See Physical and electrical specifications for details.
Volume	300mm chassis: 11.6 liters 360mm chassis: 13.9 liters
Weight	300mm chassis: 14.8 kg (32.7 lb) 360mm chassis: 17.4 kg (38.4 lb)

Models

ThinkEdge SE450 models can be configured by using the Lenovo Data Center Solution Configurator (DCSC).

Controlled GPU models: The "Controlled GPU" base CTO models listed in the table are the only models that support high-performance GPUs and accelerators. These models are classified under US Government ECCN regulations and have limited market and customer availability. All other base models do not support high-performance GPUs.

Preconfigured server models may also be available for the SE450, however these are region-specific; that is, each region may define their own server models, and not all server models are available in every region.

The following table lists the base CTO models of the ThinkEdge SE450 server.

Table 2. Base CTO models

Machine Type/Model	Description
7D8TCTO1WW	ThinkEdge SE450 - 3yr Warranty
7D8TCTOAWW	ThinkEdge SE450 - 3yr Warranty with Controlled GPU

Models of the SE450 are defined based on the depth of the chassis:

- 300mm depth chassis - supports half-length adapters only
- 360mm depth chassis - supports full-length adapters or half-length adapters

The feature codes for these chassis choices are as listed in the following table.

Table 3. Chassis base feature codes

Feature code	Description
BMHB	ThinkEdge SE450 Edge Server Chassis, 300mm
BMHC	ThinkEdge SE450 Edge Server Chassis, 360mm

Configurations

As shown in the System architecture section, PCIe lanes to slots 3 and 6 can instead be configured to be used with the OCP slot and/or NVMe drive connections. In addition, hot-swap drive bays are mutually exclusive with Riser 2 (slots 3 and 4). As a result, only certain combinations of slots, drive bays and drive types are supported.

The following table lists the supported combinations of server.

Serial port support: The serial port (COM port) installs in Slot 6 and is supported in any of the configurations listed that doesn't have Slot 6 enabled. The only exception to this is 360mm chassis configurations that have a double-wide GPU installed in Slot 5, since the GPU will also occupy Slot 6. For more information, see the Serial port section.

Table 4. Configurations

Config	Riser 1 Slot 5	Slot 6	Riser 2 Slot 3	Slot 4	OCP	Total NVMe drives	Hot-swap drive bays	Internal (non-hot-swap) drive bays	DW FL GPU	Description
Configurations using the 300mm chassis										
1	x16	x8	x8	x16	x16	None	No support	0 drives, or 2x 15mm SAS/SATA, or 4x 7mm SAS/SATA	No support	Standard config – 2x PCIe x16 slots + 2x PCIe x8 slots + OCP
2	x16	x16	x16	x16	No support	None	No support	0 drives, or 2x 15mm SAS/SATA, or 4x 7mm SAS/SATA	No support	Support for 4x PCI x16 slots
3	x16	No support	No support	x16	x16	4x NVMe	No support	0 drives, or 2x 15mm NVMe, or 4x 7mm NVMe	No support	Support for 4x 7mm internal NVMe drives
4	x16	x16	x8	x16	No support	2x NVMe	No support	0 drives, or 2x 15mm NVMe	No support	Support for 2x 15mm internal NVMe drives
5	x16	No support	No support	No support	x16	4x NVMe	2x AnyBay	0 drives, or 2x 15mm / 2x 7mm NVMe*, or 2x 15mm / 4x 7mm SATA	No support	Support for hot-swap drives using onboard controllers
6	x16	x16	No support	No support	No support	4x NVMe	2x AnyBay	0 drives, or 2x 15mm / 2x 7mm NVMe*, or 2x 15mm / 4x 7mm SAS/SATA	No support	Support for hot-swap drives using an HBA or RAID adapter
Configurations using the 360mm chassis										
1	x16	No support	No support	x16	x16	4x NVMe	No support	0 drives, or 4x 7mm NVMe/SATA, or 2x 15mm NVMe/SATA	2	GPU-rich config
2	x16	No support	No support	No support	x16	2x NVMe	2x AnyBay	0 drives, or 2x 15mm NVMe, or 2x 15mm / 4x 7mm SATA	1	GPU + hot-swap drives (onboard controllers)
3	x16	x16	x8	x16	No support	4x NVMe	No support	0 drives, or 2x 15mm / 2x 7mm NVMe*, or 2x 15mm / 4x 7mm SATA	No support	4x PCIe slots (no DW GPU support)
4	x16	x16	No support	x16	No support	2x NVMe	No support	0 drives, or 2x 15mm NVMe, or 2x 15mm / 4x 7mm SATA	1	GPU-ready config with 3x PCIe slots

* For configurations with hot-swap drive bays, only 2x internal (non-hot-swap) NVMe drives are supported; 4x internal NVMe drives are not supported

Processors

The SE450 supports a single processor in the 3rd Gen Intel Xeon Scalable processor family (formerly codenamed "Ice Lake").

In this section:

- Processor options
- Processor features
- UEFI operating modes

Processor options

The table below lists the processors that are supported.

Some processors include a suffix letter in the processor model number:

- M: Media Processing optimized
- N: NFV optimized
- P: High frequency-optimized for IaaS virtualization customers
- Q: Optimized for liquid cooling
- S: Large (512GB) SGX Enclave size
- T: High Tcase
- U: Single socket
- V: High density/low power-optimized for SaaS virtualization customers
- Y: Speed Select

Table 5. Processor options

Feature code	Description	Maximum quantity
BB34	Intel Xeon Silver 4310T 10C 105W 2.3GHz Processor	1
BB2Z	Intel Xeon Silver 4314 16C 135W 2.4GHz Processor	1
BB39	Intel Xeon Silver 4316 20C 150W 2.3GHz Processor	1
BB30	Intel Xeon Gold 5317 12C 150W 3.0GHz Processor	1
BB3E	Intel Xeon Gold 5318N 24C 150W 2.1GHz Processor	1
BB2Y	Intel Xeon Gold 5320T 20C 150W 2.3GHz Processor	1
BB4E	Intel Xeon Gold 6326 16C 185W 2.9GHz Processor	1
BB3H	Intel Xeon Gold 6330 28C 205W 2.0GHz Processor	1
BB3N	Intel Xeon Gold 6330N 28C 165W 2.2GHz Processor	1
BB3S	Intel Xeon Gold 6336Y 24C 185W 2.4GHz Processor	1
BB31	Intel Xeon Gold 6338N 32C 185W 2.2GHz Processor	1
BB33	Intel Xeon Gold 6338T 24C 165W 2.1GHz Processor	1
BB2U	Intel Xeon Gold 6354 18C 205W 3.0GHz Processor	1
BB2S	Intel Xeon Platinum 8352V 36C 195W 2.1GHz Processor	1
BB2V	Intel Xeon Platinum 8352Y 32C 205W 2.2GHz Processor	1

Processor features

Supported processors have the following features:

- Third-generation Intel Xeon Scalable processors (formerly codenamed "Ice Lake")
- 10 nm process technology
- 8x DDR4 memory channels

- 64x PCIe 4.0 I/O lanes available for PCIe and NVMe devices
- 1.25 MB L2 cache per core
- 1.5 MB or more L3 cache per core
- Intel Deep Learning Boost, which provides built-in Artificial Intelligence (AI) acceleration with the Vector Neural Network Instruction set (VNNI). DL Boost and VNNI are designed to deliver significant, more efficient Deep Learning (Inference) acceleration for high-performance AI workloads.
- Intel Hyper-Threading Technology, which boosts performance for multithreaded applications by enabling simultaneous multithreading within each processor core, up to two threads per core.
- Intel Turbo Boost Technology 2.0, which allows processor cores to run at maximum speeds during peak workloads by temporarily going beyond processor TDP.
- Intel Virtualization Technology (includes VT-x and VT-d), which integrates hardware-level virtualization hooks that allow operating system vendors to better use the hardware for virtualization workloads.
- Intel Speed Select Technology, supported on some processor models, enables increased core Turbo Boost frequency on specific individual cores to maximize application performance.
- Intel Advanced Vector Extensions 512 (AVX-512), to enable acceleration of enterprise-class workloads, including databases and enterprise resource planning (ERP).
- Up to two Intel AVX-512 Fused-Multiply Add (FMA) units
- Intel SGX (Software Guard Extensions) and Intel TME (Total Memory Encryption) security features

The following table compares the features of the supported third-generation Intel Xeon processors.

Abbreviations used in the table:

- TB: Turbo Boost 2.0
- UPI: Ultra Path Interconnect
- TDP: Thermal Design Power
- SGX: Software Guard Extensions
- PMem: Persistent Memory support

Table 6. Processor features

CPU model	Cores/ threads	Core speed (Base / TB max)	L3 cache*	Max memory speed	TDP	SGX Enclave Size	Pmem
4310T	10 / 20	2.3 GHz / 3.4 GHz	15 MB	2667 MHz	105W	8 GB	No
4314	16 / 32	2.4 GHz / 3.4 GHz	24 MB	2667 MHz	135W	8 GB	Yes
4316	20 / 40	2.3 GHz / 3.4 GHz	30 MB	2667 MHz	150W	8 GB	No
5317	12 / 24	3.0 GHz / 3.6 GHz	18 MB	2933 MHz	150W	64 GB	Yes
5318N	24 / 48	2.1 GHz / 3.4 GHz	36 MB	2667 MHz	150W	64 GB	Yes
5320T	20 / 40	2.3 GHz / 3.5 GHz	30 MB	2933 MHz	150W	64 GB	Yes
6326	16 / 32	2.9 GHz / 3.5 GHz	24 MB	3200 MHz	185W	64 GB	Yes
6330	28 / 56	2.0 GHz / 3.1 GHz	42 MB	2933 MHz	205W	64 GB	Yes
6330N	28 / 56	2.2 GHz / 3.4 GHz	42 MB	2667 MHz	165W	64 GB	Yes
6336Y	24 / 48	2.4 GHz / 3.6 GHz	36 MB	3200 MHz	185W	64 GB	Yes
6338N	32 / 64	2.2 GHz / 3.5 GHz	48 MB	2667 MHz	185W	64 GB	Yes
6338T	24 / 48	2.1 GHz / 3.4 GHz	36 MB	3200 MHz	165W	64 GB	Yes
6354	18 / 36	3.0 GHz / 3.6 GHz	39 MB*	3200 MHz	205W	64 GB	Yes
8352V	36 / 72	2.1 GHz / 3.5 GHz	54 MB	2933 MHz	195W	8 GB	Yes

CPU model	Cores/ threads	Core speed (Base / TB max)	L3 cache*	Max memory speed	TDP	SGX Enclave Size	Pmem
8352Y	32 / 64	2.2 GHz / 3.4 GHz	48 MB	3200 MHz	205W	64 GB	Yes

* L3 cache is 1.5 MB per core or larger. Processors with a larger L3 cache per core are marked with an *

UEFI operating modes

The SE450 offers preset operating modes that affect energy consumption and performance. These modes are a collection of predefined low-level UEFI settings that simplify the task of tuning the server to suit your business and workload requirements.

The following table lists the feature codes that allow you to specify the mode you wish to preset in the factory for CTO orders.

Table 7. UEFI operating mode presets in DCSC

Feature code	Description
BFYB	Operating mode selection for: "Maximum Performance Mode"
BFYC	Operating mode selection for: "Minimal Power Mode"
BFYD	Operating mode selection for: "Efficiency Favoring Power Savings Mode"
BFYE	Operating mode selection for: "Efficiency - Favoring Performance Mode"

The preset modes for the SE450 are as follows:

- **Maximum Performance Mode** (feature BFYB): Achieves maximum performance but with higher power consumption and lower energy efficiency.
- **Minimal Power Mode** (feature BFYC): Minimize the absolute power consumption of the system.
- **Efficiency Favoring Power Savings Mode** (feature BFYD): Maximize the performance/watt efficiency with a bias towards power savings. This is the favored mode for SPECpower benchmark testing, for example.
- **Efficiency Favoring Performance Mode** (feature BFYE): Maximize the performance/watt efficiency with a bias towards performance. This is the favored mode for Energy Star certification, for example.

For details about these preset modes, and all other performance and power efficiency UEFI settings offered in the SE450, see the paper "Tuning UEFI Settings for Performance and Energy Efficiency on Intel Xeon Scalable Processor-Based ThinkSystem Servers", available from https://lenovopress.lenovo.com/lp1477.

Memory options

The SE450 has 10 DIMM slots, supporting the following memory and persistent memory combinations:

- 1, 2, 4, 6 or 8x RDIMMs (no persistent memory modules)
- 6x RDIMMs and 1x persistent memory module
- 8x RDIMMs and 1x persistent memory module
- 4x RDIMMs and 4x persistent memory modules

The processor has 4 memory controllers and 8 memory channels; with all-memory configurations (that is, without persistent memory), the DIMMs are installed 1 RDIMM per channel. This corresponds to all the white DIMM slots on the system board. See the internal view of the server for the location of the DIMM slots.

Lenovo TruDDR4 RDIMMs and 3DS RDIMMs are supported. With 8x 128 GB 3DS RDIMMs installed, the SE450 supports a total of 1 TB of system memory.

The use of persistent memory is described in the Persistent Memory section.

Memory operates at up to 3200 MHz, depending on the processor selected. If the processor selected has a lower memory bus speed, then all DIMMs will operate at that lower speed. See the Processor features section for details.

Lenovo TruDDR4 memory uses the highest quality components that are sourced from Tier 1 DRAM suppliers and only memory that meets the strict requirements of Lenovo is selected. It is compatibility tested and tuned to maximize performance and reliability. From a service and support standpoint, Lenovo TruDDR4 memory automatically assumes the system warranty, and Lenovo provides service and support worldwide.

The following table lists the memory options that are available for the server.

Table 8. Memory options

Part number	Feature code	Description	Maximum supported
RDIMMs			
4X77A08632	B963	ThinkSystem 16GB TruDDR4 3200MHz (2Rx8 1.2V) RDIMM	8
4X77A08633	B964	ThinkSystem 32GB TruDDR4 3200MHz (2Rx4 1.2V) RDIMM	8
4X77A08634	B965	ThinkSystem 32GB TruDDR4 3200MHz (2Rx8 1.2V) RDIMM	8
4X77A08635	B966	ThinkSystem 64GB TruDDR4 3200MHz (2Rx4 1.2V) RDIMM	8
3DS RDIMMs			
4X77A08636	BA62	ThinkSystem 128GB TruDDR4 3200 MHz (2S2Rx4 1.2V) 3DS RDIMM	8

The following rules apply when selecting the memory configuration:

- In the SE450, the following DIMM quantities are supported: 1, 2, 4, 6, and 8. Other quantities are not supported.
- The server supports RDIMMs and 3DS RDIMMs; UDIMMs and LRDIMMs are not supported
- Mixing RDIMMs and 3DS RDIMMs is not supported
- Mixing x4 and x8 DIMMs is supported

For best performance, consider the following:

- Install 8 memory DIMMs so that all memory channels are used.
- Populate memory channels so they all have the same total memory capacity.
- Ensure all memory controllers on a processor socket have the same DIMM configuration.

The following memory protection technologies are supported:

- ECC
- SDDC (for x4-based memory DIMMs; look for "x4" in the DIMM description)
- ADDDC (for x4-based memory DIMMs)
- Memory mirroring

Note: Memory sparing is not supported

If memory channel mirroring is used, then DIMMs must be installed in pairs or sets of three (minimum of one pair or set of three), and all DIMMs in the pair or set of three must be identical in type and size. 50% of the installed capacity is available to the operating system.

Persistent Memory

The SE450 server supports Intel Optane Persistent Memory 200 Series, a new class of memory and storage technology explicitly architected for server usage. Persistent memory is an innovative technology that delivers a unique combination of affordable large memory capacity and persistence (non-volatility). It offers significantly lower latency than fetching data from SSDs, even NVMe SSDs, and offers higher capacities than system memory.

Persistent memory technology can help boost the performance of data-intensive applications such as in-memory analytics, databases, content delivery networks, and high performance computing (HPC), as well as deliver consistent service levels at scale with higher virtual machine and container density. When data is stored closer to the processor on nonvolatile media, applications can see significant overall improvement in performance.

The following table lists the ordering information for the supported persistent memory modules.

Table 9. Persistent memory module part numbers

Part number	Feature code	Description	Maximum supported
4ZC7A08732	B98B	ThinkSystem 128GB TruDDR4 3200MHz (1.2V) Intel Optane Persistent Memory	4
4ZC7A08734	B98A	ThinkSystem 256GB TruDDR4 3200MHz (1.2V) Intel Optane Persistent Memory	4

App Direct Mode and Memory Mode are supported. Mixed Mode is not supported.

The following table lists the supported combinations of memory (RDIMMs) and PMem in App Direct mode. The supported RDIMMs to PMem ratio must be between 1:1 and 1:8.

Table 10. Supported combinations in App Direct mode

Total RDIMMs	Total PMem	Total Available Memory*	Ratio (RDIMM: Pmem)†	Quantity of RDIMMs				Quantity of PMem modules	
				16GB	32GB	64GB	128GB	128GB PMem	256GB PMem
96 GB	128 GB	224 GB	1:1.33	6				1	
128 GB	128 GB	256 GB	1:1	8				1	
64 GB	512 GB	576 GB	1:8	4				4	
128 GB	512 GB	640 GB	1:4		4			4	
256 GB	512 GB	768 GB	1:2			4		4	
512 GB	512 GB	1 TB	1:1				4	4	
96 GB	256 GB	352 GB	1:2.67	6					1
192 GB	256 GB	448 GB	1:1.33		6				1
128 GB	256 GB	384 GB	1:2	8					1
256 GB	256 GB	512 GB	1:1		8				1
128 GB	1 TB	1.125 TB	1:8		4				4
256 GB	1 TB	1.25 TB	1:4			4			4
512 GB	1 TB	1.5 TB	1:2				4		4

* In App Direct Mode, the available memory is the sum of the installed RDIMMs + PMem. The actual user capacity of PMem modules is less than the stated amount. For example, a 128GB PMem module has 126.7GB usable storage.
† Density ratio of system memory to persistent memory, RDIMM:PMem; 2-Socket-capable third-generation Intel Xeon Scalable processors only support RDIMM:Pmem density ratios of between 1:1 and 1:8

The following table lists the supported combinations of RDIMMs and PMem in Memory mode. The supported RDIMMs to PMem ratio must be between 1:4 and 1:16.

Table 11. Supported combinations in Memory Mode

Total RDIMMs	Total PMem	Total Available Memory*	Ratio (RDIMM: Pmem)†	Quantity of RDIMMs				Quantity of PMem modules	
				16GB	32GB	64GB	128GB	128GB PMem	256GB PMem
64 GB	512 GB	512 GB	1:8	4				4	
128 GB	512 GB	512 GB	1:4		4			4	
64 GB	1 TB	1 TB	1:16	4					4
128 GB	1 TB	1 TB	1:8		4				4
256 GB	1 TB	1 TB	1:4			4			4

* In Memory Mode, the available memory = persistent memory installed. The actual user capacity of PMem modules is less than the stated amount. For example, a 128GB PMem module has 126.7GB usable storage.
† Ratio of system memory to persistent memory, RDIMM:PMem; Memory Mode only supports DIMM:Pmem ratios of between 1:4 and 1:16

Persistent memory requirements:

- Some processors do not support PMem. See the Processor features section for details.
- App Direct Mode and Memory Mode are supported, however Mixed Mode is not supported.
- Only quantities of 1x or 4x PMem modules are supported as listed in the above tables. Other quantities are not supported.
- PMem modules operate at up to 3200 MHz, however if the processor selected has a lower memory bus speed, then PMem modules will operate at that lower speed.
- All installed PMem modules must be the same size. Mixing PMem modules of different capacities is not supported.
- Both interleaved and non-interleaved modes are supported.
- Memory mirroring is not supported with PMem modules installed

For additional details, see the Intel Optane Persistent Memory 200 Series product guide, https://lenovopress.com/LP1380.

Internal storage

The SE450 offers the following internal storage options:

- Up to 4x internal SSD drive bays supporting non-hot-swap trayless NVMe or SATA SSD drives
- Up to 2x 2.5-inch hot-swap drive bays, front accessible, supporting SAS or SATA SSD drives (mutually exclusive with slots 3 and 4 in Riser 2)
- Up to 2x M.2 drives for boot functions, supporting SATA or NVMe drives

In this section:

- Internal drive cage
- Hot-swap drive bays
- Supported drive bay combinations
- M.2 drives

Internal drive cage

The SE450 offers an internal drive cage which supports either of the following:

- Up to 4x 7mm trayless drives, either SATA or NVMe (zero drives also supported)
- Up to 2x 15mm trayless drives, either SATA or NVMe (zero drives also supported)

The internal drive cage is mounted at the front of the processor and DIMMs as shown in the following figure.
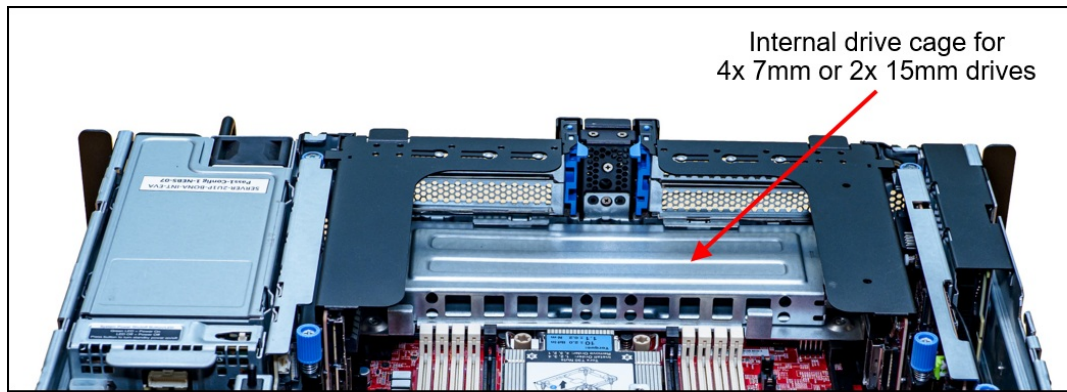

Figure 7. Location of the internal drive cage

The internal drive cage, feature BMGT, is a standard feature in all configurations, however the bays are only usable provided the cables are also installed, either CTO (NVMe or SATA cabling) or as a field upgrade (SATA cabling only).

Tip: 0, 1, 2, 3 or 4x internal trayless drives are supported.

Table 12. Internal drive cage

Feature code	Description
BMGT	ThinkEdge SE450 Internal HDD Cage

The SE450 supports field upgrades to enable SATA drives in the internal drive cage. The following part numbers are available for cables.

Note: NVMe drive bays are not supported as field upgrades, due to the complexity of the cabling required.

Table 13. Cables for SATA drive upgrades for the internal drive cage

Part number	Description	Purpose
4X97A90164	ThinkEdge SE450 Internal 2x1 SATA Cable	SATA cable to connect from system planar to 2x drives (7mm or 15mm), one in each bay. See SATA 2x1 cable flyer.
4X97A90165	ThinkEdge SE450 Internal 2x2 SATA Cable	SATA cable to connect from system planar to 4x drives (7mm), two in each bay. See SATA 2x2 cable flyer.
4X97A90161	ThinkEdge SE450 Internal RAID 2x1 SATA Cable	SATA cable to connect from RAID adapter or HBA to 2x drives (7mm or 15mm), one in each bay. See SATA RAID 1x2 cable flyer.
4X97A90162	ThinkEdge SE450 Internal RAID 2x2 SATA Cable	SATA cable to connect from RAID adapter or HBA to 4x drives (7mm), two in each bay. See SATA RAID 2x2 cable flyer.

Hot-swap drive bays

The SE450 supports 2x 2.5-inch hot-swap drive bays, mounted in place of Riser 2.
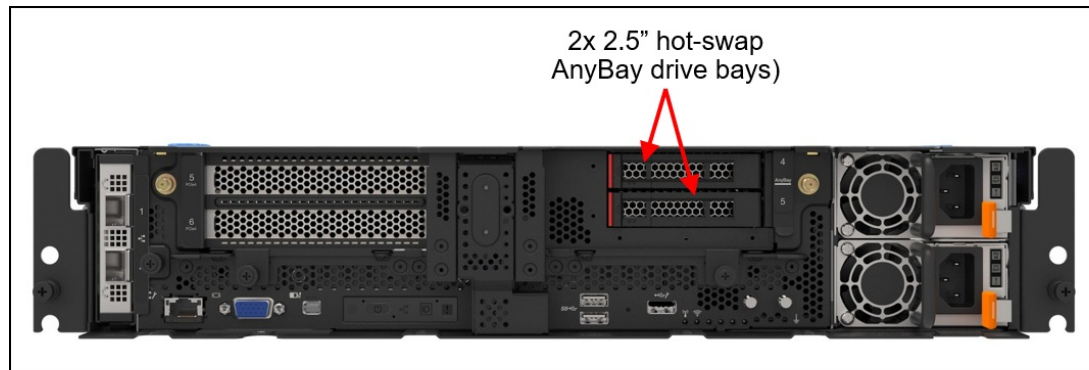

Figure 8. Location of the hot-swap drive bays

The drive cage is only available in preconfigured models or CTO. Field upgrades are not available.

Table 14. Hot-swap drive bays

Part number	Feature code	Description
CTO only	BMGN	ThinkEdge SE450 Front HDD Cage (includes 2-drive AnyBay backplane)

Configuration requirements:

- The hot-swap drive bays support 2.5-inch hot-swap drives, either SATA, NVMe or SAS. SAS drives require the use of a RAID adapter or SAS HBA.
- The hot-swap drive bays are mutually exclusive with Riser 2 (slots 3 and 4)
- The server supports a maximum of 4x NVMe drives, so if two NVMe drives are configured as hot-swap drives, then only two NVMe drives can be configured in the internal drive cage (trayless drives)
- The required cables are derived by the configurator; SATA and NVMe cables are configured based on the controller selected even if no drives are selected in DCSC.

DCSC tip: In order to select the hot-swap drive cage (feature BMGN), you must first select *two* controllers:

- The Onboard NVMe controller (BC4V); plus
- Either the onboard SATA controller (AVV0) or a RAID adapter/HBA.

You must select both NVMe and SATA/SAS controllers because the hot-swap drive bays have an AnyBay backplane. If you do not select one of each controller then BMGN will be unselectable. Once BMGN is selected, you will then need to deselect Riser 2 (feature BMGM) from the PCIe tab, since the hot-swap drive bays are installed in place of Riser 2.

For configurations with onboard SATA, it is supported to upgrade the controller to a RAID adapter or HBA. To do so, order the adapter as well as the RAID cable listed in the following table, 4X97A90160. Similarly, to remove a RAID adapter or HBA and reconfigure the server to use the onboard SATA controller instead, order the SATA cable listed, 4X97A90163.

Table 15. Cables for SATA hot-swap drive bay upgrades

Part number	Description	Purpose
4X97A90160	ThinkEdge SE450 RAID 1x2 SATA Cable For Backplane	SATA cable to connect from RAID adapter or HBA to hot-swap drive backplane. See cable flyer.
4X97A90163	ThinkEdge SE450 1x2 SATA Cable For Backplane	SATA cable to connect from system planar to hot-swap drive backplane. See cable flyer.

Supported drive bay combinations

The following drive bay combinations are supported:

- Up to 4x internal SATA drives + optional M.2 (no hot-swap drives)
- Up to 4x internal NVMe drives + optional M.2 (no hot-swap drives)
- Up to 4x internal SATA drives + up to 2x hot-swap SATA drives + optional M.2
- Up to 4x internal SATA drives + up to 2x hot-swap NVMe drives + optional M.2
- Up to 2x internal NVMe drives + up to 2x hot-swap SATA drives + optional M.2
- Up to 2x internal NVMe drives + up to 2x hot-swap NVMe drives + optional M.2
- M.2 drives only (no hot-swap drives, no internal drives)
- Up to 2x hot-swap drives + M.2 drives (no internal drives)

Configurations rules:

- Zero internal (trayless) drives can be selected (M.2 drive is not required)
- Hot-swap drive bays are not available if Riser 2 is installed. NVMe drives are not supported in some adapter slot configurations. See the Configurations section for details.
- For configurations with hot-swap drive bays, only 2x internal (non-hot-swap) NVMe drives are supported; 4x internal NVMe drives are not supported

Tip: The SE450 now offers greater flexibility in storage configurations:

- Internal (trayless) drives: 0, 1, 2, 3 or 4 drives
- Hot-swap drives: 0, 1 or 2 drives
- M.2 drives: 0, 1, or 2 drives

M.2 drives

The SE450 supports one or two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution. The M.2 drives install into an M.2 module which is mounted vertically in the SE450 in a bracket attached to the power supply cage. See the internal view of the server for the location.

> **Tip**: It is supported to have a configuration with M.2 drives but without any other internal drives (trayless or hot-swap)

Table 16. M.2 bracket

Part number	Feature code	Description
CTO only	BMH3	ThinkEdge SE450 SBS M.2 Adapter Bracket

There M.2 module supported in the SE450 are listed in the following table.

Table 17. M.2 modules

Part number	Feature code	Description	SATA drives	NVMe drives	RAID	Maximum supported
4Y37A09738	B5XJ	ThinkSystem M.2 SATA/NVMe 2-Bay Enablement Kit	Yes	Yes	Yes*	1

* RAID is supported via Intel VROC

Supported drives are listed in the Internal drive options section.

The M.2 SATA/NVMe 2-Bay Enablement Kit has the following features:

- Supports one or two M.2 drives, either SATA or NVMe
- When two drives installed, they must be either both SATA or both NVMe
- Support 42mm, 60mm, 80mm and 110mm drive form factors (2242, 2260, 2280 and 22110)
- JBOD native support; RAID can be enabled via Intel VROC
- Either 6Gbps SATA or PCIe 3.0 x1 interface to the drives depending on the drives installed
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools

Field upgrades

The SE450 supports M.2 field upgrades provided the system already has the M.2 Adapter Bracket (feature BMH3) installed. As well as adding the above M.2 adapter, you will also need to order the M.2 Adapter Cable as listed in the following table.

Table 18. M.2 adapter cable

Part number	Feature code	Description
4X97A84822	BMFZ	ThinkEdge SE450 M.2 Adapter Cable

For further details about M.2 components, see the *ThinkSystem M.2 Drives and M.2 Adapters* product guide:
https://lenovopress.com/lp0769-thinksystem-m2-drives-adapters

Controllers for internal storage

The drives of the SE450 are connected to controller on the system board:

- Onboard SATA ports with software RAID support (Intel VROC SATA RAID, formerly known as Intel RSTe)

- Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID)

The following table lists the adapters used for the internal storage of the server.

Table 19. Internal Storage adapter support

Part number	Feature code	Description
Onboard SATA - Intel VROC SATA RAID (Intel RSTe)		
None	AVV0	On Board SATA Software RAID Mode
Onboard NVMe - Intel VROC NVMe RAID for Internal and hot-swap drives		
None	B9X7	Intel VROC (VMD NVMe RAID) Intel SSD Only (Standard)
4L47A83669	BR9B	Intel VROC (VMD NVMe RAID) Standard (license upgrade - to enable RAID support for non-Intel NVMe SSDs)
4L47A39164	B96G	Intel VROC (VMD NVMe RAID) Premium (license upgrade - to enable RAID support for non-Intel NVMe SSDs)
Onboard NVMe - Intel VROC NVMe RAID for M.2 drives		
CTO only	BS7P	Intel VROC (VMD NVMe RAID) Intel SSD Only for M.2
CTO only	BS7M	Intel VROC (VMD NVMe RAID) Standard for M.2
CTO only	BS7N	Intel VROC (VMD NVMe RAID) Premium for M.2
SAS/SATA adapters		
CTO only	BJHH	ThinkSystem 4350-8i SAS/SATA 12Gb HBA
CTO only	BJHK	ThinkSystem RAID 5350-8i PCIe 12Gb Adapter

The onboard SATA controller has the following features:

- Controller integrated into the Intel PCH
- 6 Gbps SATA host interface
- Supports RAID-0, 1, 5, 10 (Intel VROC SATA RAID, previously known as RSTe)
- Supports JBOD

The onboard NVMe support has the following features:

- Controller integrated into the Intel processor
- Each drive has PCIe 4.0 x4 host interface
- Supports JBOD - Intel and non-Intel NVMe SSDs - no license required
- Supports RAID-0, 1, 5, 10 (Intel VROC NVMe RAID) - Intel NVMe SSDs only unless VROC Premium license is installed
- VROC Premium enabled RAID support on non-Intel drives

Intel VROC onboard RAID

Intel VROC (Virtual RAID on CPU) is a feature of the Intel processor that enables RAID support.

There are two separate functions of VROC in the SE450:

- Intel VROC SATA RAID, formerly known as Intel RSTe
- Intel VROC NVMe RAID

VROC SATA RAID (RSTe) is available and supported with all SATA drives. It offers a 6 Gb/s connection to each drive and on the SE450 implements RAID levels 0, 1, 5, and 10. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

VROC NVMe RAID offers RAID support for any NVMe drives directly connected to the ports on the server's system board. On the SE450, RAID levels implemented are based on the VROC feature selected as indicated in the following table. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

The SE450 supports the VROC NVMe RAID offerings listed in the following table. The VROC Intel SSD Only offering only supports RAID on Intel branded NVMe SSDs; non-Intel branded NVMe SSDs cannot be configured in a RAID array.

Tip: These feature codes and part numbers are only for VROC RAID using NVMe drives, not SATA drives

Table 20. Intel VROC NVMe RAID ordering information and feature support

Part number	Feature code	Description	Intel NVMe SSDs	Non-Intel NVMe SSDs	RAID 0	RAID 1	RAID 10	RAID 5
CTO only	B9X7	Intel VROC (VMD NVMe RAID) Intel SSD Only	Yes	No	Yes	Yes	Yes	Yes
4L47A83669	BR9B	Intel VROC (VMD NVMe RAID) Standard	Yes	Yes	Yes	Yes	Yes	No
4L47A39164	B96G	Intel VROC (VMD NVMe RAID) Premium	Yes	Yes	Yes	Yes	Yes	Yes

Configuration notes:

- If a feature code is ordered in a CTO build, the VROC functionality is enabled in the factory. For field upgrades, order a part number and it will be fulfilled as a Feature on Demand (FoD) license which can then be activated via the XCC management processor user interface.

Virtualization support: Virtualization support for Intel VROC is as follows:

- **VROC SATA RAID (RSTe)**: VROC SATA RAID is not supported by virtualization hypervisors such as ESXi, KVM, Xen, and Hyper-V. Virtualization is only supported on the onboard SATA ports in AHCI (non-RAID) mode.
- **VROC (VMD) NVMe RAID**: VROC (VMD) NVMe RAID is supported by ESXi, KVM, Xen, and Hyper-V. ESXi support is limited to RAID 1 only; other RAID levels are not supported. Windows and Linux OSes support VROC RAID NVMe, both for host boot functions and for guest OS function, and RAID-0, 1, 5, and 10 are supported. On ESXi, VROC is supported with both boot and data drives.

Internal drive options

The following tables list the drive options for internal storage of the server.

2.5-inch hot-swap drives:

- 2.5-inch hot-swap 24 Gb SAS SSDs
- 2.5-inch hot-swap 6 Gb SATA SSDs
- 2.5-inch hot-swap PCIe 4.0 NVMe SSDs

Trayless drives:

- 7mm 2.5-inch trayless 6 Gb SATA SSDs
- 7mm 2.5-inch trayless PCIe 4.0 NVMe SSDs
- 15mm 2.5-inch trayless PCIe 4.0 NVMe SSDs

M.2 drives:

- M.2 SATA drives
- M.2 PCIe 4.0 NVMe drives

M.2 drive support: The use of M.2 drives requires an additional adapter as described in the M.2 drives subsection.

SED support: The SE450 currently does not support SED functionality with NVMe drives. SED is supported with SATA drives as listed in the tables below, however with SED enabled, hot-add and hot-remove are not supported.

Table 21. 2.5-inch hot-swap 24 Gb SAS SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch hot-swap SSDs - 24 Gb SAS - Read Intensive/Entry/Capacity (<3 DWPD)				
4XB7A80319	BNWE	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Support	2
4XB7A80321	BP3E	ThinkSystem 2.5" PM1653 7.68TB Read Intensive SAS 24Gb HS SSD	Support	2
4XB7A80322	BP3J	ThinkSystem 2.5" PM1653 15.36TB Read Intensive SAS 24Gb HS SSD	Support	2

Table 22. 2.5-inch hot-swap 6 Gb SATA SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch hot-swap SSDs - 6 Gb SATA - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A90884	BYM2	ThinkSystem 2.5" Multi Vendor 480GB Mixed Use SATA 6Gb HS SSD v2	No	2
4XB7A90885	BYM4	ThinkSystem 2.5" Multi Vendor 960GB Mixed Use SATA 6Gb HS SSD v2	No	2
4XB7A90886	BYM5	ThinkSystem 2.5" Multi Vendor 1.92TB Mixed Use SATA 6Gb HS SSD v2	No	2
4XB7A90887	BYM6	ThinkSystem 2.5" Multi Vendor 3.84TB Mixed Use SATA 6Gb HS SSD v2	No	2
2.5-inch hot-swap SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
4XB7A90872	BYLQ	ThinkSystem 2.5" Multi Vendor 240GB Read Intensive SATA 6Gb HS SSD v2	No	2
4XB7A90873	BYLR	ThinkSystem 2.5" Multi Vendor 480GB Read Intensive SATA 6Gb HS SSD v2	No	2
4XB7A90874	BYLS	ThinkSystem 2.5" Multi Vendor 960GB Read Intensive SATA 6Gb HS SSD v2	No	2
4XB7A90875	BYLT	ThinkSystem 2.5" Multi Vendor 1.92TB Read Intensive SATA 6Gb HS SSD v2	No	2

Part number	Feature code	Description	SED support	Max Qty
4XB7A90876	BYLU	ThinkSystem 2.5" Multi Vendor 3.84TB Read Intensive SATA 6Gb HS SSD v2	No	2
4XB7A90877	BYLV	ThinkSystem 2.5" Multi Vendor 7.68TB Read Intensive SATA 6Gb HS SSD v2	No	2
4XB7A87524	BWKN	ThinkSystem 2.5" PM893a 480GB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A87525	BWKM	ThinkSystem 2.5" PM893a 960GB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A87526	BWKL	ThinkSystem 2.5" PM893a 1.92TB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A87527	BWKK	ThinkSystem 2.5" PM893a 3.84TB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82258	BQ1Q	ThinkSystem 2.5" 5400 PRO 240GB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82259	BQ1P	ThinkSystem 2.5" 5400 PRO 480GB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82260	BQ1R	ThinkSystem 2.5" 5400 PRO 960GB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82261	BQ1X	ThinkSystem 2.5" 5400 PRO 1.92TB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82262	BQ1S	ThinkSystem 2.5" 5400 PRO 3.84TB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A82263	BQ1T	ThinkSystem 2.5" 5400 PRO 7.68TB Read Intensive SATA 6Gb HS SSD	Support	2
4XB7A17072	B99D	ThinkSystem 2.5" S4520 240GB Read Intensive SATA 6Gb HS SSD	No	2
4XB7A17101	BA7G	ThinkSystem 2.5" S4520 480GB Read Intensive SATA 6Gb HS SSD	No	2
4XB7A17102	BA7H	ThinkSystem 2.5" S4520 960GB Read Intensive SATA 6Gb HS SSD	No	2
4XB7A17103	BA7J	ThinkSystem 2.5" S4520 1.92TB Read Intensive SATA 6Gb HS SSD	No	2
4XB7A17104	BK77	ThinkSystem 2.5" S4520 3.84TB Read Intensive SATA 6Gb HS SSD	No	2
4XB7A17105	BK78	ThinkSystem 2.5" S4520 7.68TB Read Intensive SATA 6Gb HS SSD	No	2

Table 23. 2.5-inch hot-swap PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A17129	BNEG	ThinkSystem 2.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
4XB7A17130	BNEH	ThinkSystem 2.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
4XB7A17133	BNEZ	ThinkSystem 2.5" U.2 P5620 6.4TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A13967	BNEJ	ThinkSystem 2.5" U.3 7450 MAX 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
4XB7A13970	BNEY	ThinkSystem 2.5" U.3 7450 MAX 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
4XB7A13971	BNEL	ThinkSystem 2.5" U.3 7450 MAX 6.4TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	No*	2
2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13941	BMGD	ThinkSystem 2.5" U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	No*	2
4XB7A13942	BMGE	ThinkSystem 2.5" U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	No*	2
2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A80377	BP25	ThinkSystem 2.5" U.3 7400 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	No	2
4XB7A80378	BP26	ThinkSystem 2.5" U.3 7400 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	No	2

* In the SE450, the SED functionality of this NVMe drive is not supported.

Table 24. 7mm 2.5-inch trayless 6 Gb SATA SSDs

Part number	Feature code	Description	SED support	Max Qty
7mm 2.5-inch trayless SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
CTO only	BS2X	ThinkSystem 2.5" 7mm 5400 PRO 240GB Read Intensive SATA 6Gb Trayless SSD	Support	4
CTO only	BS2W	ThinkSystem 2.5" 7mm 5400 PRO 480GB Read Intensive SATA 6Gb Trayless SSD	Support	4
CTO only	BS2V	ThinkSystem 2.5" 7mm 5400 PRO 960GB Read Intensive SATA 6Gb Trayless SSD	Support	4
CTO only	BS2U	ThinkSystem 2.5" 7mm 5400 PRO 1.92TB Read Intensive SATA 6Gb Trayless SSD	Support	4
CTO only	BS2T	ThinkSystem 2.5" 7mm 5400 PRO 3.84TB Read Intensive SATA 6Gb Trayless SSD	Support	4
CTO only	BS2S	ThinkSystem 2.5" 7mm 5400 PRO 7.68TB Read Intensive SATA 6Gb Trayless SSD	Support	4
4XB7A77056	BKST	ThinkSystem Intel S4520 2.5" 7mm 240GB Entry SATA 6Gb Non-Hot Swap SSD Trayless	No	4
4XB7A77057	BKSU	ThinkSystem Intel S4520 2.5" 7mm 480GB Entry SATA 6Gb Non-Hot Swap SSD Trayless	No	4
4XB7A77058	BKSV	ThinkSystem 2.5" 7mm S4520 960GB Read Intensive SATA 6Gb Trayless SSD	No	4
4XB7A77059	BKSW	ThinkSystem 2.5" 7mm S4520 1.92TB Read Intensive SATA 6Gb Trayless SSD	No	4
4XB7A78627	BM1D	ThinkSystem 2.5" 7mm S4520 3.84TB Read Intensive SATA 6Gb Trayless SSD	No	4
4XB7A78628	BM1E	ThinkSystem 2.5" 7mm S4520 7.68TB Read Intensive SATA 6Gb Trayless SSD	No	4

Table 25. 7mm 2.5-inch trayless PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
7mm 2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A90115	BXME	ThinkSystem 2.5" U.2 7mm PM9A3 960GB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4
4XB7A90116	BXMD	ThinkSystem 2.5" U.2 7mm PM9A3 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4
4XB7A90117	BXMC	ThinkSystem 2.5" U.2 7mm PM9A3 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4
4XB7A13975	BKSQ	ThinkSystem 2.5" 7mm U.3 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4
4XB7A13976	BKWR	ThinkSystem 2.5" 7mm U.3 7450 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4
4XB7A13977	BKWS	ThinkSystem 2.5" 7mm U.3 7450 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	4

* In the SE450, the SED functionality of this NVMe drive is not supported.

Table 26. 15mm 2.5-inch trayless PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
15mm 2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A76781	BKT5	ThinkSystem 2.5" 15mm U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	No*	2
4XB7A76782	BKT6	ThinkSystem 2.5" 15mm U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	No*	2
15mm 2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A76780	BKT4	ThinkSystem 2.5" 15mm U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	2
4XB7A17124	BA7P	ThinkSystem 2.5" 15mm U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No*	2
4XB7A71355	BFPM	ThinkSystem 2.5" 15mm U.2 P5500 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	No	2

* In the SE450, the SED functionality of this NVMe drive is not supported.

Table 27. M.2 SATA drives

Part number	Feature code	Description	SED support	Max Qty
M.2 SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
4XB7A89422	BYF7	ThinkSystem M.2 ER3 240GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A90049	BYF8	ThinkSystem M.2 ER3 480GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A90230	BYF9	ThinkSystem M.2 ER3 960GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A82286	BQ1Z	ThinkSystem M.2 5400 PRO 240GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A82287	BQ1Y	ThinkSystem M.2 5400 PRO 480GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A82288	BQ20	ThinkSystem M.2 5400 PRO 960GB Read Intensive SATA 6Gb NHS SSD	Support	2
7N47A00130	AUUV	ThinkSystem M.2 128GB SATA 6Gbps Non-Hot Swap SSD	No	2
4XB7A17073	B919	ThinkSystem M.2 5300 480GB SATA 6Gbps Non-Hot Swap SSD	No	2
4XB7A17212	BCP0	ThinkSystem M.2 5300 480GB SATA 6Gbps Non-Hot Swap SSD SED	Support	2
4XB7A17074	B8JJ	ThinkSystem M.2 5300 960GB SATA 6Gbps Non-Hot Swap SSD	No	2

Table 28. M.2 PCIe 4.0 NVMe drives

Part number	Feature code	Description	SED support	Max Qty
M.2 SSDs - PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A84603	BS2Q	ThinkSystem M.2 7450 MAX 800GB Mixed Use NVMe PCIe 4.0 x4 NHS SSD	No*	2
M.2 SSDs - PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A90102	BXMH	ThinkSystem M.2 PM9A3 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A90103	BXMG	ThinkSystem M.2 PM9A3 1.92TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A90104	BXMF	ThinkSystem M.2 PM9A3 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A82636	BS2P	ThinkSystem M.2 7450 PRO 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A13999	BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A14000	BKSS	ThinkSystem M.2 7450 PRO 1.92TB Read Intensive Entry NVMe PCIe 4.0 x4 NHS SSD	No*	2
4XB7A84604	BS2R	ThinkSystem M.2 7450 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	No*	2

* In the SE450, the SED functionality of this NVMe drive is not supported.

Optical drive

The server supports the external USB optical drive listed in the following table.

Table 29. External optical drive

Part number	Feature code	Description
7XA7A05926	AVV8	ThinkSystem External USB DVD RW Optical Disk Drive

The drive is based on the Lenovo Slim DVD Burner DB65 drive and supports the following formats: DVD-RAM, DVD-RW, DVD+RW, DVD+R, DVD-R, DVD-ROM, DVD-R DL, CD-RW, CD-R, CD-ROM.

I/O expansion

The SE450 has PCIe slots for adapters:

- Riser 1:
  - Slot 5: PCIe G4 x16
  - Slot 6: PCIe G4 x16 (PCIe x8 or not connected in some configurations)
- Riser 2:
  - Slot 3: PCIe G4 x16 (PCIe x8 or not connected in some configurations)
  - Slot 4: PCIe G4 x16
- OCP slot 7: PCIe G4 x16 (not connected in some configurations)

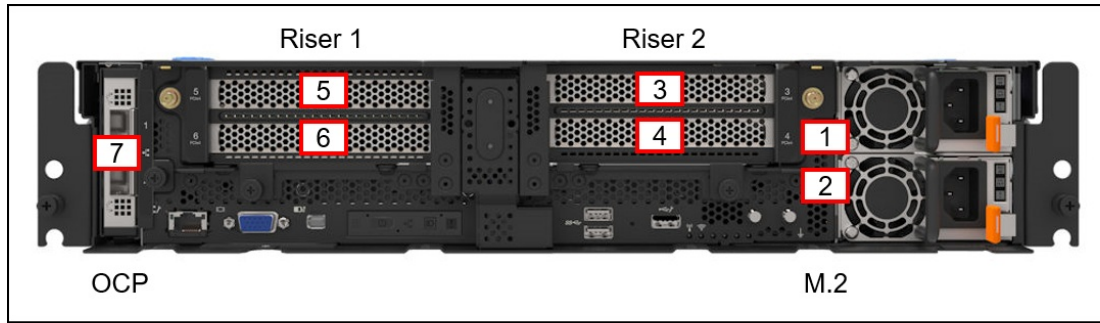Specific support for these slots is listed in the Configurations section.

Figure 9. Slot numbering

Ordering information for the Risers and OCP bracket are listed in the following table. For M.2, see the M.2 drives section.

Table 30. I/O expansion

Part number	Feature code	Description
CTO only	BMGR	ThinkEdge SE450 OCP Cage
CTO only	BMGL	ThinkEdge SE450 Riser 1 (slots 5 & 6)
CTO only	BMGM	ThinkEdge SE450 Riser 2 (slots 3 & 4)

As described in the Models section, there are two chassis depths available with the SE450:

- 360mm chassis: Supports all adapters
- 300mm chassis: Supports all adapters except full-length adapters like double-wide GPUs

Serial port

The SE450 optionally supports a RS-232 serial port by adding a COM port bracket to a PCIe slot. The bracket is only supported in slot 6. Ordering information is shown in the following table.

Table 31. Serial port

Part number	Feature code	Description	Maximum supported	Slots supported
4Z17A80446	BMNJ	ThinkSystem COM Port Upgrade Kit v2	1	6

The bracket is shown in the following figure.
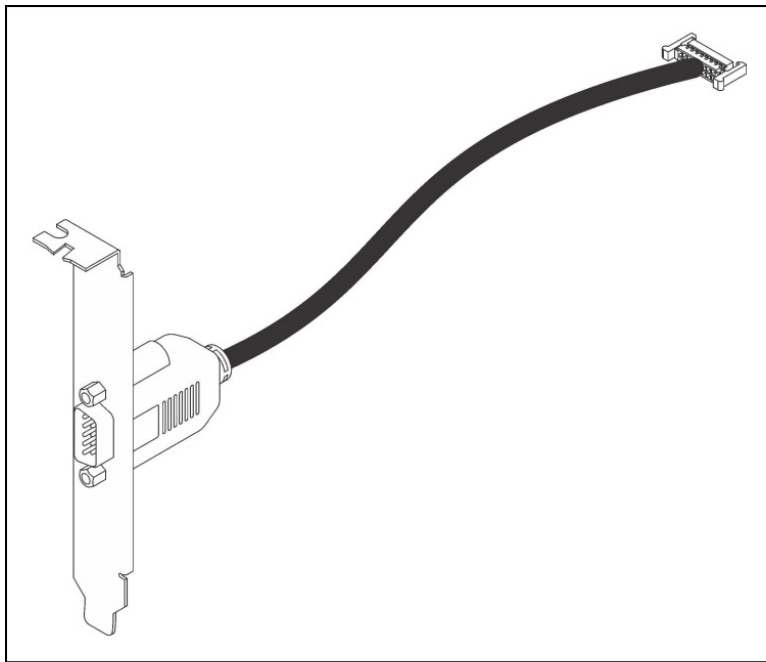
Figure 10. ThinkSystem COM Port Upgrade Kit v2

Accelerators

The SE450 supports the FPGA accelerator listed in the following table.

> **Limited configuration access**: The ACC100 accelerator is primarily for telecom customers and requires special considerations. To enable this adapter in the DCSC configurator, you will need access to the "Telecom Specific" mode. Contact the DCSC support team at salesconfig@lenovo.com for information.

Table 32. Accelerators

Part number	Feature code	Description	Maximum supported	300mm chassis	360mm chassis
4XC7A81119	BMHJ	Lenovo ThinkSystem Intel ACC100 Accelerating NFV PCIe Gen3	4	Yes	Yes

The use of these adapters also requires power cables which are included in the option part numbers or are derived by the configurator for CTO orders. When two adapters are installed in the same Riser, use the included Y-cable which provides power to both adapters.

Network adapters

The server has a dedicated OCP 3.0 SFF slot with PCIe 4.0 x16 host interface. See Figure 3 for the location of the OCP slot. One port can optionally be shared with the XCC management processor for Wake-on-LAN and NC-SI support.

The following table lists the supported OCP adapters. These adapters are CTO only and not available as field upgrades.

> **Internal lock mechanism**: The OCP adapters used in the SE450 use the OCP internal lock mechanism instead of the pull-tab and thumbscrew combination used with other ThinkSystem OCP adapters.

Table 33. OCP network adapters

Part number	Feature code	Description	Maximum supported
1 Gb Ethernet			
CTO only	BMHE	ThinkEdge Intel I350 1GbE RJ45 4-port Internal Lock OCP Ethernet Adapter	1
10 Gb Ethernet			
CTO only	BMHF	ThinkEdge Intel X710-T2L 10GBASE-T 2-port Internal Lock OCP Ethernet Adapter	1
25 Gb Ethernet			
CTO only	BMHG	ThinkEdge Intel E810-DA2 10/25GbE SFP28 2-Port Internal Lock OCP Ethernet Adapter	1
CTO only	BMHD	ThinkEdge Mellanox CX6 Lx 10/25GbE SFP28 2-Port Internal Lock OCP Ethernet Adapter	1

If the server ships with an OCP slot but you do not have an OCP adapter installed, then a filler should be installed in place of the adapter. Ordering information is shown in the following table.

Table 34. Filler for OCP adapter slot

Part number	Description
4XF7A90167	ThinkEdge SE450 OCP Filler

The following table lists additional supported network adapters that can be installed in the regular PCIe slots. All adapters are supported in both 300mm and 360mm chassis.

Table 35. PCIe network adapters

Part number	Feature code	Description	Maximum supported
1 Gb Ethernet			
7ZT7A00484	AUZV	ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter	4
7ZT7A00535	AUZW	ThinkSystem I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter	4
10 Gb Ethernet			
7ZT7A00496	AUKP	ThinkSystem Broadcom 57416 10GBASE-T 2-Port PCIe Ethernet Adapter	4
4XC7A08245	B5SU	ThinkSystem Broadcom 57454 10GBASE-T 4-port PCIe Ethernet Adapter	4
25 Gb Ethernet			
4XC7A08295	BCD6	ThinkSystem Intel E810-DA2 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	4
7XC7A05523	B0WY	ThinkSystem Intel XXV710-DA2 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	4
4XC7A62580	BE4U	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	4
100 Gb Ethernet / InfiniBand			
4XC7A08248	B8PP	ThinkSystem Mellanox ConnectX-6 Dx 100GbE QSFP56 2-port PCIe Ethernet Adapter	4
4C57A14178	B4RA	ThinkSystem Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter	4
4C57A81478	BN37	Mellanox ConnectX-6 HDR100 IB/100GbE VPI 2-Port x16 PCIe 3.0 HCA Adapter	4

For more information, including the transceivers and cables that each adapter supports, see the list of Lenovo Press Product Guides in the Networking adapters category:
https://lenovopress.com/servers/options/ethernet

GPU adapters

The following table lists the supported GPUs. The use of full-length GPUs requires the 360mm chassis - see Models for ordering information.

Table 36. Supported GPUs

Part number	Feature code	Description	Controlled GPU	Form factor	Maximum supported	300mm chassis	360mm chassis
4X67A84823	BT87	ThinkSystem NVIDIA L40 48GB PCIe Gen4 Passive GPU	Yes	DW	2	No	Yes
4X67A72593	BQZQ	ThinkSystem NVIDIA A40 48GB PCIe Gen4 Passive GPU w/o CEC	Yes	DW	2	No	Yes
4X67A76581	BQZR	ThinkSystem NVIDIA A30 24GB PCIe Gen4 Passive GPU w/o CEC	Yes	DW	2	No	Yes
4X67A86131	BU01	ThinkSystem Intel Flex 170 16GB Gen4 Passive GPU	No	SW FHFL	1	No	Yes
4X67A84824	BS2C	ThinkSystem NVIDIA L4 24GB PCIe Gen4 Passive GPU	Yes	SW	4	Yes	Yes
4X67A81547	BQZT	ThinkSystem NVIDIA A2 16GB PCIe Gen4 Passive GPU w/o CEC	No	SW	4	Yes	Yes
4X67A84009	BS49	ThinkSystem Qualcomm Cloud AI 100	Yes	SW	4	Yes	Yes

Configuration notes:

- The Controlled GPU column indicates the required CTO model. See the Models section for information.
  - Controlled GPUs require CTO model 7D8TCTOAWW. This CTO model is not available in some markets.
  - GPUs that are not controlled require CTO model 7D8TCTO1WW.
- GPUs that require the 360mm chassis must use Base feature code BMHC. See the Models section for information.
- Installed GPUs must be identical
- Full-length GPUs such as the Intel Flex 170, NVIDIA L40, A30, and A40 are only supported with the following processors that have a 1U heatsink:
  - Intel Xeon Gold 6330N
  - Intel Xeon Gold 5318N
  - Intel Xeon Gold 5317
  - Intel Xeon Silver 4316
  - Intel Xeon Silver 4314
  - Intel Xeon Silver 4310T
- When the NVIDIA A40 GPU is installed, the maximum ambient temperature is 40°C (104°F).
- The use of the double-wide GPUs requires an auxiliary power cable as listed in the following table. For CTO orders, power cables are automatically derived by the configurator.
- Some NVIDIA A Series GPUs are available as two feature codes, one with a CEC chip and one without a CEC chip (ones without the CEC chip have "w/o CEC" in the name). The CEC is a secondary Hardware Root of Trust (RoT) module that provides an additional layer of security, which can be used by customers who have high regulatory requirements or high security standards. NVIDIA uses a multi-layered security model and hence the protection offered by the primary Root of Trust embedded in the GPU is expected to be sufficient for most customers. The CEC defeatured products still offer Secure Boot, Secure Firmware Update, Firmware Rollback Protection, and In-Band Firmware Update Disable. Specifically, without the CEC chip, the GPU does not support Key Revocation or Firmware Attestation. CEC and non-CEC GPUs of the same type of GPU can be mixed in field upgrades.

Table 37. GPU Auxiliary power cable

Part number	Feature code	Description	Maximum supported	GPUs supported
4X97A89288	BVVG	ThinkEdge NVIDIA L40 GPU Power Cable Kit	2*	NVIDIA L40
4X97A81810	BMHY	ThinkEdge SE450 GPU Power Cable	2	NVIDIA A30, A40
4X97A90159	BYBK	ThinkEdge SE450 Intel Flex 170 GPU Power Cable	2	Intel Flex 170

* For field upgrades, the option part number contains two power cables, so only one needs to be ordered for two GPUs

For information about the GPU, see the ThinkSystem GPU Summary, available at:
https://lenovopress.com/lp0768-thinksystem-thinkagile-gpu-summary

Cooling

The SE450 server has six 60 mm dual-rotor simple-swap fans.

All six are standard and support N+1 rotor redundancy.

Power supplies

The SE450 supports one or two hot-swap power supplies, installed at the front of the server. When two are installed, they are redundant in most configurations. Ordering information is listed in the following table.

Table 38. Power options

Part number	Feature code	Description	Maximum supported
AC power supply units			
4P57A78281	BMH8	ThinkEdge 1100W 230V/115V Platinum Hot-Swap Power Supply	2
4P57A78358	BRH9	ThinkEdge 1100W 230V Titanium Hot-Swap Power Supply	2
4P57A78282	BMH9	ThinkEdge 1800W 230V Platinum Hot-Swap Power Supply	2
DC power supply unit			
4P57A78283	BMHA	ThinkEdge 1100W -48V DC Hot-Swap Power Supply	2

Configuration requirements:

- If two power supplies are installed, they must be identical.
- To determine the power supply needed for your configuration, use Lenovo Capacity Planner as described in the Capacity Planner section.
- Power supplies from other ThinkSystem servers have fans that operate in the opposite direction and are not supported.

Power supply LEDs

The supported hot-swap power supplies have the following LEDs:

- Power input LED:
    - Green: The power supply is connected to the AC power source
    - Off: The power supply is disconnected from the AC power source or a power problem has occurred

- Power output LED:
  - Green: The server is on and the power supply is working normally
  - Blinking green: The power supply is in Zero-output/Standby mode (see below)
  - Off: The server is powered off, or the power supply is not working properly
- Power supply error LED:
  - Off: The power supply is working normally
  - Yellow: The power supply has failed

Zero-output mode: When Zero-output mode (also known as Standby mode or Cold Redundancy mode) is configured in XCC and the server power load is sufficiently low, one of the installed power supplies enters into the Standby state while the other one delivers entire load. When the power load increases, the standby power supply will switch to Active state to provide sufficient power to the server. Zero-output mode can be enabled or disabled in the XClarity Controller web interface, Server Configuration > Power Policy. If you select Disable, then both power supplies will be in the Active state.

Power cords

Line cords and rack power cables with C13 connectors can be ordered as listed in the following table.

> **110V customers**: If you plan to use the 1100W power supply with a 110V power source, select a power cable that is rated above 10A. Power cables that are rated at 10A or below are not supported with 110V power.

Table 39. Power cords

Part number	Feature code	Description
Rack cables - C13 to C14		
SL67B08593	BPHZ	0.5m, 10A/100-250V, C13 to C14 Jumper Cord
00Y3043	A4VP	1.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08367	B0N5	1.0m, 13A/100-250V, C13 to C14 Jumper Cord
39Y7937	6201	1.5m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08368	B0N6	1.5m, 13A/100-250V, C13 to C14 Jumper Cord
4L67A08365	B0N4	2.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08369	6570	2.0m, 13A/100-250V, C13 to C14 Jumper Cord
4L67A08366	6311	2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08370	6400	2.8m, 13A/100-250V, C13 to C14 Jumper Cord
39Y7932	6263	4.3m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08371	6583	4.3m, 13A/100-250V, C13 to C14 Rack Power Cable
Rack cables - C13 to C14 (Y-cable)		
00Y3046	A4VQ	1.345m, 2X C13 to C14 Jumper Cord, Rack Power Cable
00Y3047	A4VR	2.054m, 2X C13 to C14 Jumper Cord, Rack Power Cable
Rack cables - C13 to C20		
39Y7938	6204	2.8m, 10A/100-250V, C13 to IEC 320-C20 Rack Power Cable
Rack cables - C13 to C20 (Y-cable)		
47C2491	A3SW	1.2m, 16A/100-250V, 2 Short C13s to Short C20 Rack Power Cable
47C2492	A3SX	2.5m, 16A/100-250V, 2 Long C13s to Short C20 Rack Power Cable
47C2493	A3SY	2.8m, 16A/100-250V, 2 Short C13s to Long C20 Rack Power Cable
47C2494	A3SZ	4.1m, 16A/100-250V, 2 Long C13s to Long C20 Rack Power Cable

Part number	Feature code	Description
Line cords		
39Y7930	6222	2.8m, 10A/250V, C13 to IRAM 2073 (Argentina) Line Cord
81Y2384	6492	4.3m 10A/220V, C13 to IRAM 2073 (Argentina) Line Cord
39Y7924	6211	2.8m, 10A/250V, C13 to AS/NZ 3112 (Australia/NZ) Line Cord
81Y2383	6574	4.3m, 10A/230V, C13 to AS/NZS 3112 (Aus/NZ) Line Cord
69Y1988	6532	2.8m, 10A/250V, C13 to NBR 14136 (Brazil) Line Cord
81Y2387	6404	4.3m, 10A/250V, C13 - 2P+Gnd (Brazil) Line Cord
39Y7928	6210	2.8m, 220-240V, C13 to GB 2099.1 (China) Line Cord
81Y2378	6580	4.3m, 10A/220V, C13 to GB 2099.1 (China) Line Cord
39Y7918	6213	2.8m, 10A/250V, C13 to DK2-5a (Denmark) Line Cord
81Y2382	6575	4.3m, 10A/230V, C13 to DK2-5a (Denmark) Line Cord
39Y7917	6212	2.8m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord
81Y2376	6572	4.3m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord
39Y7927	6269	2.8m, 10A/250V, C13(2P+Gnd) (India) Line Cord
81Y2386	6567	4.3m, 10A/240V, C13 to IS 6538 (India) Line Cord
39Y7920	6218	2.8m, 10A/250V, C13 to SI 32 (Israel) Line Cord
81Y2381	6579	4.3m, 10A/230V, C13 to SI 32 (Israel) Line Cord
39Y7921	6217	2.8m, 220-240V, C13 to CEI 23-16 (Italy/Chile) Line Cord
81Y2380	6493	4.3m, 10A/230V, C13 to CEI 23-16 (Italy/Chile) Line Cord
46M2593	A1RE	2.8m, 12A/125V, C13 to JIS C-8303 (Japan) Line Cord
4L67A08362	6495	4.3m, 12A/200V, C13 to JIS C-8303 (Japan) Line Cord
39Y7926	6335	4.3m, 12A/100V, C13 to JIS C-8303 (Japan) Line Cord
39Y7922	6214	2.8m, 10A/250V, C13 to SABS 164 (S Africa) Line Cord
81Y2379	6576	4.3m, 10A/230V, C13 to SABS 164 (South Africa) Line Cord
39Y7925	6219	2.8m, 220-240V, C13 to KETI (S Korea) Line Cord
81Y2385	6494	4.3m, 12A/220V, C13 to KSC 8305 (S. Korea) Line Cord
39Y7919	6216	2.8m, 10A/250V, C13 to SEV 1011-S24507 (Swiss) Line Cord
81Y2390	6578	4.3m, 10A/230V, C13 to SEV 1011-S24507 (Sws) Line Cord
23R7158	6386	2.8m, 10A/125V, C13 to CNS 10917-3 (Taiwan) Line Cord
81Y2375	6317	2.8m, 10A/240V, C13 to CNS 10917-3 (Taiwan) Line Cord
81Y2374	6402	2.8m, 13A/125V, C13 to CNS 60799 (Taiwan) Line Cord
4L67A08363	AX8B	4.3m, 10A 125V, C13 to CNS 10917 (Taiwan) Line Cord
81Y2389	6531	4.3m, 10A/250V, C13 to 76 CNS 10917-3 (Taiwan) Line Cord
81Y2388	6530	4.3m, 13A/125V, C13 to CNS 10917 (Taiwan) Line Cord
39Y7923	6215	2.8m, 10A/250V, C13 to BS 1363/A (UK) Line Cord
81Y2377	6577	4.3m, 10A/230V, C13 to BS 1363/A (UK) Line Cord
90Y3016	6313	2.8m, 10A/120V, C13 to NEMA 5-15P (US) Line Cord
46M2592	A1RF	2.8m, 10A/250V, C13 to NEMA 6-15P Line Cord
00WH545	6401	2.8m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord
4L67A08359	6370	4.3m, 10A/125V, C13 to NEMA 5-15P (US) Line Cord
4L67A08361	6373	4.3m, 10A/250V, C13 to NEMA 6-15P (US) Line Cord

Part number	Feature code	Description
4L67A08360	AX8A	4.3m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord

-48V DC power cord

For the -48V DC Power Supply, the following power cable is supported.

Table 40. -48V DC power cable

Part number	Feature code	Description
4X97A59831	BE4V	2.5m, -48VDC Interconnecting Cable

Systems management

The SE450 contains an integrated service processor, XClarity Controller (XCC), which provides advanced control, monitoring, and alerting functions. The XCC is based on the ASPEED AST2600 baseboard management controller (BMC).

Topics in this section:

- Activation
- Local management
- External Diagnostics Handset
- System status with XClarity Mobile
- Remote management
- Lenovo XClarity Provisioning Manager
- Lenovo XClarity Administrator
- Lenovo XClarity Integrators
- Lenovo XClarity Essentials
- Lenovo XClarity Energy Manager
- Lenovo Capacity Planner

Activation

Activation is an optional security feature of the SE450 that ensures that the system delivered from the factory is only used by its intended recipient and that all data and applications remains secure. Activation is enabled on a factory order when the Security Pack Enabled feature code (feature BLZ2) is selected as described in the Security Pack section.

Enabled by default : Activation is enabled by default for new CTO orders. Activation can be disabled in the factory order as described in the Security Pack section.

If Activation is enabled, the system is delivered in system lockdown and will require activation before operation. There are three ways the server can be activated:

- Using a mobile device (iOS or Android) connect to the server to the USB management port on the front of the server and running the ThinkShield Edge Mobile Management app .
- Connecting the system to the Internet via the XCC management port on the front of the server and accessing the ThinkShield Key Vault Portal from a web browser on another system.
- In a disconnected mode, where neither a mobile device or an internet connection to the SE450 are available.

Details of the activation process are described in the following documents:

- Activation Guide (2-page flyer that is included with the server)
- SE450 Setup Guide, Chapter 5

These documents are available from:
https://thinksystem.lenovofiles.com/help/topic/se450/pdf_files.html?cp=2_1_0

For further information on activation and the use of the ThinkShield Edge Mobile Management app, including videos and tours, see this support page:
https://support.lenovo.com/us/en/solutions/ht509033

Local management

The SE450 offers a front operator panel with key controls and status indicators, as shown in the following figure.
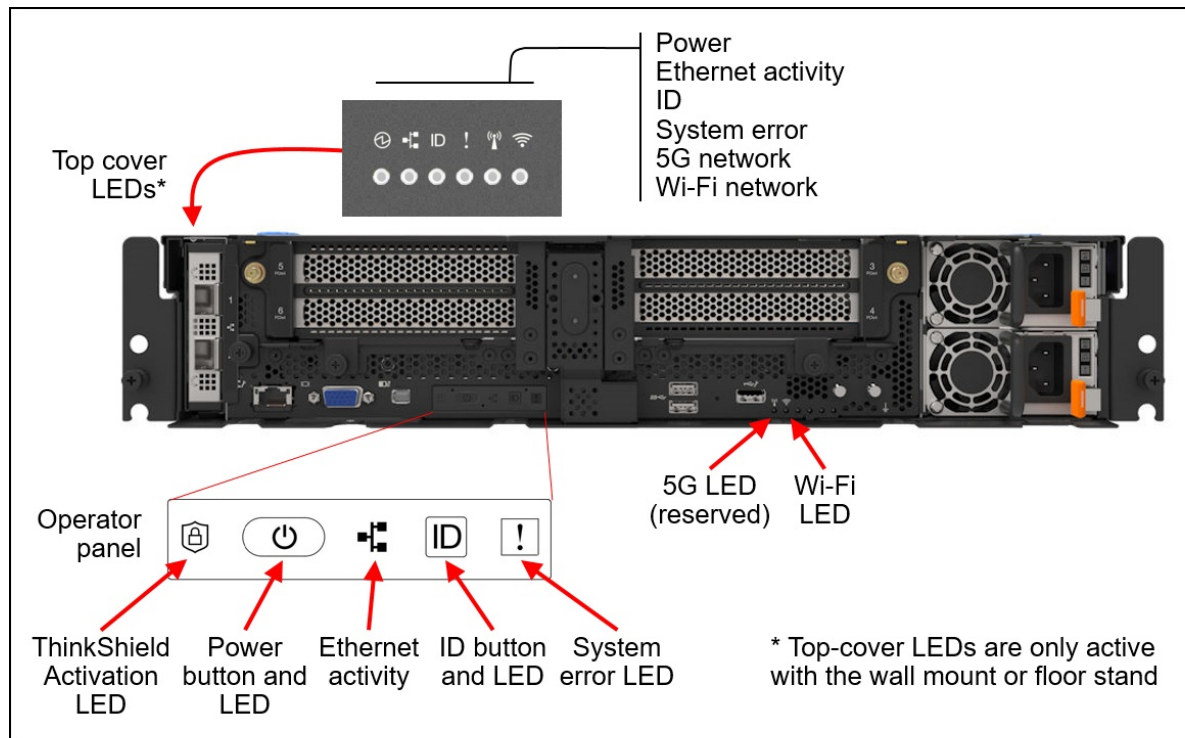

Figure 11. Front operator panel and system LEDs

No support for 5G as a client: The SE450 does not offer any 5G or LTE Wireless client support. The 5G network LEDs are non-operational.

The buttons on the front of the server:

- Power button
- ID (identification) button - turns on the LED housed within the button as well as passing the signal to the XCC for display remotely in XClarity Administrator

The LEDs on the front of the server are as follows:

- ThinkShield Activation LED (green) - indicates the state of server activation
  - On - Activation process has been completed
  - Blinking - Activation is required before the server can be used
  - Off - Activation is disabled on this system
- Power LED (green) - indicates power status, as follows:
  - Off - Server does not have power applied
  - Fast flash (4 times per second) - The server has just had power applied and is not ready to be powered on yet
  - Slow flash (once per second) - Server is ready to be powered on
  - On solid - Server is powered on
- Ethernet network activity - indicates when the Ethernet adapter installed in the OCP slot has activity
- Identification LED (blue) - lights when the button is pressed or when the function is activated remotely in XClarity Controller.

- System error LED (yellow)
- 5G network LED - not used (no support for 5G or LTE as a client)
- Wireless LAN (WLAN) network LED (green) - not used (no support for WLAN)

The system LEDs are duplicated on the top of the server. The same LEDs are also duplicated on the front of the security bezel as shown in the Security section.

External Diagnostics Handset

The SE450 also has a port to connect an External Diagnostics Handset as shown in the following figure. The External Diagnostics Handset has the same functions as the Integrated Diagnostics Panel but has the advantages of not consuming space on the front of the server plus it can be shared amongst many servers in your data center. The handset has a magnet on the back of it to allow you to easily mount it on a convenient place on any rack cabinet.
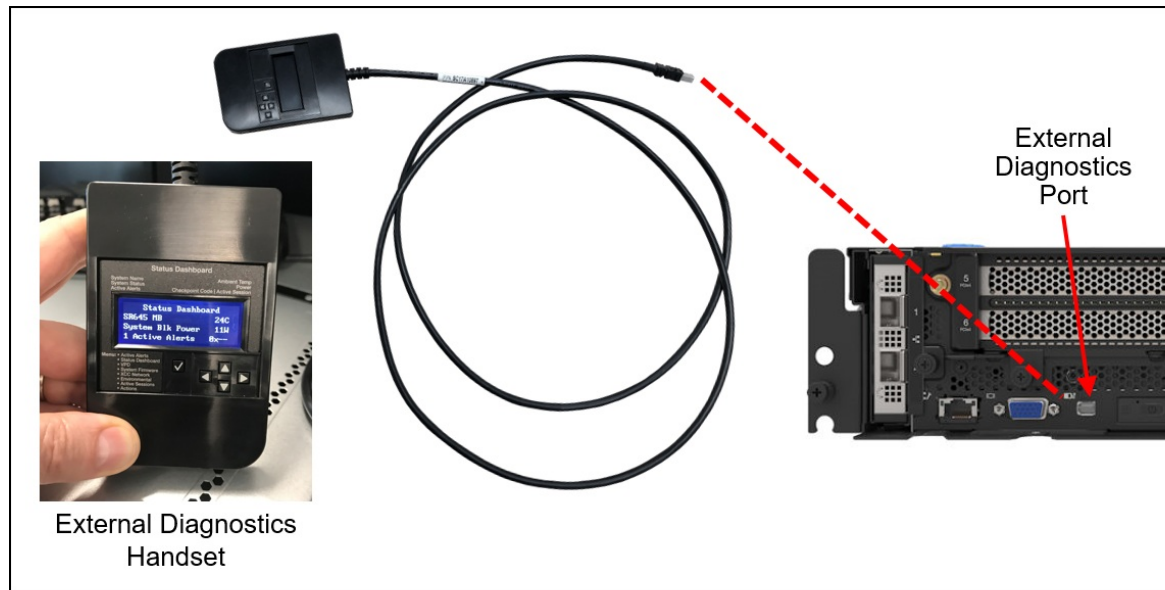
Figure 12. External Diagnostics Handset

Ordering information for the External Diagnostics Handset with is listed in the following table.

Field upgrade only: The External Diagnostics Handset is only available as an option for field upgrades. Not available in CTO orders.

Table 41. External Diagnostics Handset ordering information

Part number	Feature code	Description
4TA7A64874	BEUX	ThinkSystem External Diagnostics Handset

System status with XClarity Mobile

The XClarity Mobile app includes a tethering function where you can connect your Android or iOS device to the server via USB to see the status of the server.

The steps to connect the mobile device are as follows:

1. Enable USB Management on the server, by holding down the ID button for 3 seconds (or pressing the dedicated USB management button if one is present)

2. Connect the mobile device via a USB cable to the server's USB port with the management symbol

3. In iOS or Android settings, enable Personal Hotspot or USB Tethering

4. Launch the Lenovo XClarity Mobile app

Once connected you can see the following information:

- Server status including error logs (read only, no login required)
- Server management functions (XClarity login credentials required)

Remote management

Remote server management is provided through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3 (no SET commands; no SNMP v1)
- Common Information Model (CIM-XML)
- Representational State Transfer (REST) support
- Redfish support (DMTF compliant)
- Web browser - HTML 5-based browser interface (Java and ActiveX not required) using a responsive design (content optimized for device being used - laptop, tablet, phone) with NLS support

Remote management is available via the following connections:

- Via the dedicated Ethernet port for management. See the Components and connectors section for the location of these ports.
- Via Port 1 of the OCP adapter (if installed), which supports NC-SI to allow sharing of the Ethernet port between the operating system and remote management.

The front of the server houses an pull-out information tab (also known as the network access tag). A label on the tab shows the network information (MAC address and other data) to remotely access the service processor. See the Components and connectors section for the location of this pull-out tab.

There are two XClarity Controller upgrades available for the server, Advanced and Enterprise.

XCC Advanced Upgrade adds the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- International keyboard mapping support
- Syslog alerting
- Redirecting serial console via SSH
- Component replacement log (Maintenance History log)
- Access restriction (IP address blocking)
- Lenovo SED security key management
- Displaying graphics for real-time and historical power usage data and temperature

XCC Enterprise Upgrade enables the following additional features:

- Boot video capture and crash video capture
- Virtual console collaboration - Ability for up to 6 remote users to be log into the remote session simultaneously
- Remote console Java client
- Mapping the ISO and image files located on the local client as virtual drives for use by the server
- Mounting the remote ISO and image files via HTTPS, SFTP, CIFS, and NFS

- Power capping
- System utilization data and graphic view
- Single sign on with Lenovo XClarity Administrator
- Update firmware from a repository
- License for XClarity Energy Manager

For configure-to-order (CTO), you can enable the required XCC functionality by selecting the appropriate XCC feature codes listed in the following table:

- XCC Standard - select neither feature listed in the table
- XCC Advanced - select feature AVUT
- XCC Enterprise - select feature AUPW

Table 42. XClarity Controller upgrades for configure-to-order

Feature code	Description
AVUT	ThinkSystem XClarity Controller Standard to Advanced Upgrade
AUPW	ThinkSystem XClarity Controller Standard to Enterprise Upgrade

For systems with XCC Standard or XCC Advanced installed, field upgrades are available as listed in the following table.

Table 43. XClarity Controller field upgrades

Part number	Description
4L47A09132	ThinkSystem XClarity Controller Standard to Advanced Upgrade (for servers that have XCC Standard)
4L47A09133	ThinkSystem XClarity Controller Advanced to Enterprise Upgrade (for servers that have XCC Advanced)

Lenovo XClarity Provisioning Manager

Lenovo XClarity Provisioning Manager (LXPM) is a UEFI-based application embedded in ThinkSystem servers and accessible via the F1 key during system boot.

LXPM provides the following functions:

- Graphical UEFI Setup
- System inventory information and VPD update
- System firmware updates (UEFI and XCC)
- RAID setup wizard
- OS installation wizard (including unattended OS installation)
- Diagnostics functions

Lenovo XClarity Administrator

Lenovo XClarity Administrator is a centralized resource management solution designed to reduce complexity, speed response, and enhance the availability of Lenovo systems and solutions. It provides agent-free hardware management for ThinkSystem servers, in addition to ThinkServer, System x, and Flex System servers. The administration dashboard is based on HTML 5 and allows fast location of resources so tasks can be run quickly.

Because Lenovo XClarity Administrator does not require any agent software to be installed on the managed endpoints, there are no CPU cycles spent on agent execution, and no memory is used, which means that up to 1GB of RAM and 1 - 2% CPU usage is saved, compared to a typical managed system where an agent is required.

Lenovo XClarity Administrator is an optional software component for the SE450. The software can be downloaded and used at no charge to discover and monitor the SE450 and to manage firmware upgrades.

If software support is required for Lenovo XClarity Administrator, or premium features such as configuration management and operating system deployment are required, Lenovo XClarity Pro software subscription should be ordered. Lenovo XClarity Pro is licensed on a per managed system basis, that is, each managed Lenovo system requires a license.

The following table lists the Lenovo XClarity software license options.

Table 44. Lenovo XClarity Pro ordering information

Part number	Feature code	Description
00MT201	1339	Lenovo XClarity Pro, per Managed Endpoint w/1 Yr SW S&S
00MT202	1340	Lenovo XClarity Pro, per Managed Endpoint w/3 Yr SW S&S
00MT203	1341	Lenovo XClarity Pro, per Managed Endpoint w/5 Yr SW S&S
7S0X000HWW	SAYV	Lenovo XClarity Pro, per Managed Endpoint w/6 Yr SW S&S
7S0X000JWW	SAYW	Lenovo XClarity Pro, per Managed Endpoint w/7 Yr SW S&S

Lenovo XClarity Administrator offers the following standard features that are available at no charge:

- Auto-discovery and monitoring of Lenovo systems
- Firmware updates and compliance enforcement
- External alerts and notifications via SNMP traps, syslog remote logging, and e-mail
- Secure connections to managed endpoints
- NIST 800-131A or FIPS 140-2 compliant cryptographic standards between the management solution and managed endpoints
- Integration into existing higher-level management systems such as cloud automation and orchestration tools through REST APIs, providing extensive external visibility and control over hardware resources
- An intuitive, easy-to-use GUI
- Scripting with Windows PowerShell, providing command-line visibility and control over hardware resources

Lenovo XClarity Administrator offers the following premium features that require an optional Pro license:

- Pattern-based configuration management that allows to define configurations once and apply repeatedly without errors when deploying new servers or redeploying existing servers without disrupting the fabric
- Bare-metal deployment of operating systems and hypervisors to streamline infrastructure provisioning

For more information, refer to the Lenovo XClarity Administrator Product Guide:
http://lenovopress.com/tips1200

Lenovo XClarity Integrators

Lenovo also offers software plug-in modules, Lenovo XClarity Integrators, to manage physical infrastructure from leading external virtualization management software tools including those from Microsoft and VMware.

These integrators are offered at no charge, however if software support is required, a Lenovo XClarity Pro software subscription license should be ordered.

Lenovo XClarity Integrators offer the following additional features:

- Ability to discover, manage, and monitor Lenovo server hardware from VMware vCenter or Microsoft System Center
- Deployment of firmware updates and configuration patterns to Lenovo x86 rack servers and Flex System from the virtualization management tool
- Non-disruptive server maintenance in clustered environments that reduces workload downtime by dynamically migrating workloads from affected hosts during rolling server updates or reboots
- Greater service level uptime and assurance in clustered environments during unplanned hardware events by dynamically triggering workload migration from impacted hosts when impending hardware failures are predicted

For more information about all the available Lenovo XClarity Integrators, see the Lenovo XClarity Administrator Product Guide: https://lenovopress.com/tips1200-lenovo-xclarity-administrator

Lenovo XClarity Essentials

Lenovo offers the following XClarity Essentials software tools that can help you set up, use, and maintain the server at no additional cost:

- Lenovo Essentials OneCLI

  OneCLI is a collection of server management tools that uses a command line interface program to manage firmware, hardware, and operating systems. It provides functions to collect full system health information (including health status), configure system settings, and update system firmware and drivers.

- Lenovo Essentials UpdateXpress

  The UpdateXpress tool is a standalone GUI application for firmware and device driver updates that enables you to maintain your server firmware and device drivers up-to-date and help you avoid unnecessary server outages. The tool acquires and deploys individual updates and UpdateXpress System Packs (UXSPs) which are integration-tested bundles.

- Lenovo Essentials Bootable Media Creator

  The Bootable Media Creator (BOMC) tool is used to create bootable media for offline firmware update.

For more information and downloads, visit the Lenovo XClarity Essentials web page: http://support.lenovo.com/us/en/documents/LNVO-center

Lenovo XClarity Energy Manager

Lenovo XClarity Energy Manager (LXEM) is a power and temperature management solution for data centers. It is an agent-free, web-based console that enables you to monitor and manage power consumption and temperature in your data center through the management console. It enables server density and data center capacity to be increased through the use of power capping.

LXEM is a licensed product. A single-node LXEM license is included with the XClarity Controller Enterprise upgrade as described in the Remote Management section. If your server does not have the XCC Enterprise upgrade, Energy Manager licenses can be ordered as shown in the following table.

Table 45. Lenovo XClarity Energy Manager

Part number	Description
4L40E51621	Lenovo XClarity Energy Manager Node License (1 license needed per server)

For more information about XClarity Energy Manager, see the following resources:

- Lenovo Support page:
  https://datacentersupport.lenovo.com/us/en/solutions/lnvo-lxem
- Lenovo Information Center:
  https://sysmgt.lenovofiles.com/help/topic/LXEM/lxem_overview.html?cp=4

Lenovo Capacity Planner

Lenovo Capacity Planner is a power consumption evaluation tool that enhances data center planning by enabling IT administrators and pre-sales professionals to understand various power characteristics of racks, servers, and other devices. Capacity Planner can dynamically calculate the power consumption, current, British Thermal Unit (BTU), and volt-ampere (VA) rating at the rack level, improving the planning efficiency for large scale deployments.

For more information, refer to the Capacity Planner web page:
http://datacentersupport.lenovo.com/us/en/solutions/lnvo-lcp

Security

Topics in this section:

- Security features
- Intrusion switch
- Firmware and TPM 2.0 Security Module
- Security bezel
- Security Pack
- Intel Transparent Supply Chain

Security features

The SE450 offers a number of security features, both electronic and physical.

Physical security features:

- Intrusion detection (optional, CTO only).
- Front security bezel with key lock (optional, available as a field upgrade, but requires the bezel detect module added in the factory)
- EIA mounting flange with security key (optional, CTO only)

  Available EIA bracket that uses a security screw to attach the server to the front flange of the rack cabinet. See EIA bracket with security screw for more information.

Electronic security features include:

- Automatic actions on tamper detection

  In the event of an intrusion or movement, the server can be configured in XCC to perform actions, including server shutdown and disabling remote access to the XCC from the network ports (referred to as the BMC network bridge).

- Self-encrypting (SED) drives that ensure data is secured when the drives are powered off
- Administrator password and a power-on password in UEFI
- Trusted Platform Module (TPM) supporting TPM 2.0, implemented on a mezzanine card, enables advanced cryptographic functionality in the operating system and applications. (not available for customers in PRC)
- Optional support for a secure manufacturing supply chain using Intel Transparent Supply Chain

The server is NIST SP 800-147B compliant.

Intrusion switch

The server supports an intrusion switch that rests against the top cover. In the event that the cover is removed, a Warning event is recorded in XClarity Controller and actions can be taken to secure the server. In addition, if you have configured the server with the Security Pack enabled (feature BLZ2), then the system will automatically lock down the system if top cover removed. See the Security Pack section for information.

The intrusion switch is optional but is only available via CTO orders, not as a field upgrade. See the Internal view of the server for the location of this component.

Table 46. Intrusion switch

Part number	Feature code	Description
CTO only	BMGW	ThinkEdge SE450 Intrusion Switch

Firmware and TPM 2.0 Security Module

The SE450 includes a security mezzanine card that plugs into the system board as shown in the Internal view of the server. The module has the following functions:

- Contains the following components:
    - Trusted Platform Module 2.0 (TPM 2.0) chip
    - Non-volatile storage for configuration data
- Allows field recovery of a firmware-corrupted system without requiring planar replacement
- Allows field replacement of system planar while maintaining customer code levels and configuration settings

Ordering information is listed in the following table.

No RoT support: This module does not support Root of Trust and Platform Firmware Resiliency (PFR) functionality. RoT and PFR are planned to be supported in a future version of this module.

Ordering information is listed in the following table.

Table 47. Firmware and TPM 2.0 Security Module

Part number	Feature code	Description	Markets
CTO only	BMGY	ThinkEdge SE450 Firmware and TPM 2.0 Security Module	All markets except China
CTO only	BN21	ThinkEdge SE450 Firmware Module for PRC (Does not contain the TPM functionality)	China only

Security bezel

The security bezel is an optional component that mounts on the front of the server that restricts access to networking connectors on the front of the server.

The following figure shows the SE450 with security bezel installed.
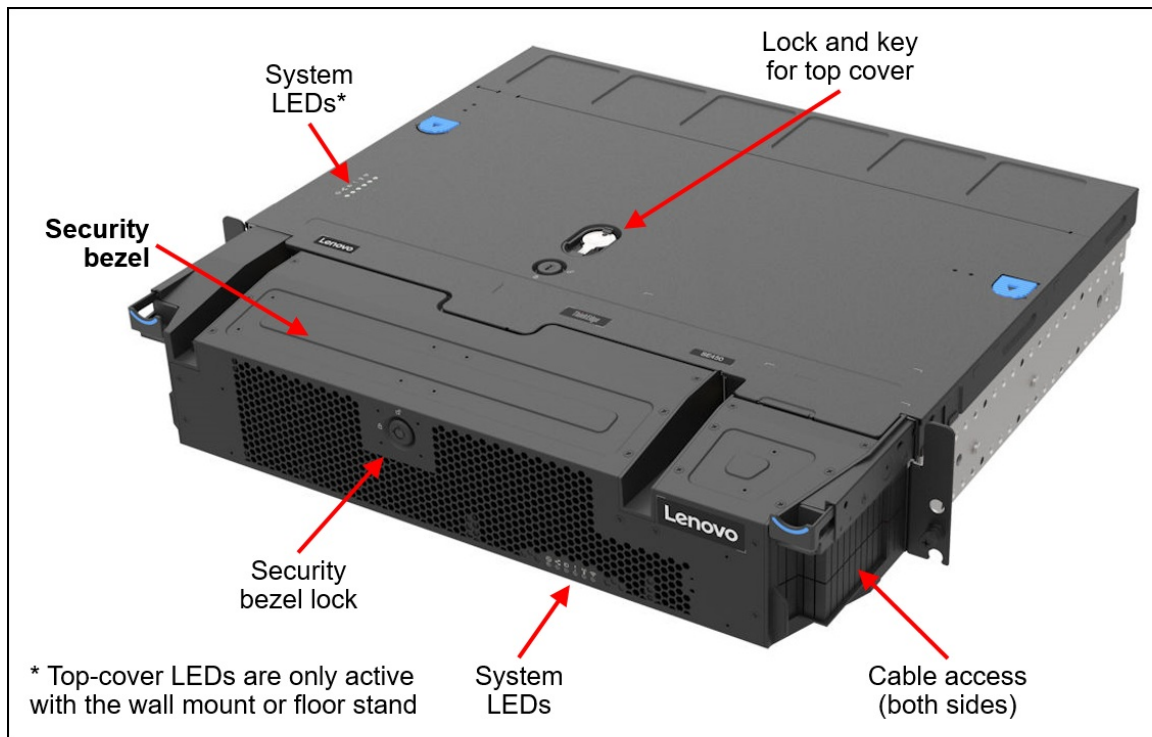
Figure 13. SE450 with security bezel installed

The security bezel is only available as an option part number and cannot be ordered as part of a CTO order, however the security bezel requires the security bezel detect module in order for the bezel to be recognized as installed by the server and for the LEDs on the security bezel to function. The security bezel detect module is only available CTO by selecting feature BR1K in DCSC.

Tip: It is not possible to install the security bezel without first having the bezel detect module installed.

Table 48. Security bezel ordering information

Part number	Feature code	Description	Purpose
CTO only	BR1K	Security-Bezel-ready Chassis	Ensures that the security bezel detect module is installed and enabled in the factory. See the Front view for the location of the security bezel detect module.
4B37A81735	Option only	ThinkEdge SE450 Security Bezel	Includes a key for the lock and a dust filter. See the Operating environment section. For full functionality, requires the bezel detect module be installed.

The security bezel also duplicates the system LEDs. The layout of the LEDs is identical to the LED grouping on top of the server. See the Local management section for information about the LEDs.

The security bezel also supports the installation of a dust filter as described in the Operating environment section.

Security Pack

The Security Pack is the collection of security and activation features of the SE450:

- Enablement of local Self-encrypting (SED) authentication key (AK) management

- Mandatory claiming and activation process to identify the owner of SE450 when the server is first delivered/powered on

To enable the Security Pack features, select feature BLZ2. If you do not wish to have the features of the Security Pack enabled in the SE450, it can be physically removed from the system board by using feature BU0C.

Table 49. Security Pack ordering information

Feature code	Description
BLZ2	ThinkEdge Security Pack Enabled
BU0C	ThinkEdge Security Pack Depopulated

Notes:

- The Security Pack features setting cannot be changed after the system leaves the factory. For example, if you select feature BLZ2 to enable the Security Pack features, then the system will *require* activation before it can be first used. Similarly, if your system was configured with the Security Pack depopulated (physically removed from the system board), it cannot later be added.
- Customers can use the ThinkShield Portal to determine which of their systems have Security Pack enabled or disabled (you will see "Standard" if the system has Security Pack disabled).

Intel Transparent Supply Chain

Add a layer of protection in your data center and have peace of mind that the server hardware you bring into it is safe authentic and with documented, testable, and provable origin.

Lenovo has one of the world's best supply chains, as ranked by Gartner Group, backed by extensive and mature supply chain security programs that exceed industry norms and US Government standards. Now we are the first Tier 1 manufacturer to offer Intel® Transparent Supply Chain in partnership with Intel, offering you an unprecedented degree of supply chain transparency and assurance.

To enable Intel Transparent Supply Chain for the Intel-based servers in your order, add the following feature code in the DCSC configurator, under the Security tab.

Table 50. Intel Transparent Supply Chain ordering information

Feature code	Description
BB0P	Intel Transparent Supply Chain

For more information on this offering, see the paper *Introduction to Intel Transparent Supply Chain on Lenovo ThinkSystem Servers*, available from https://lenovopress.com/lp1434-introduction-to-intel-transparent-supply-chain-on-thinksystem-servers.

Rack installation

The SE450 server can be installed in a rack cabinet, either 2-post, 4-post long, or 4-post short.

In this section:

- Rail kits
- EIA bracket with security screw
- EIA bracket adjustment

Rail kits

The following table lists the available rail kits. Each kit includes the left and right rails plus mounting hardware.

Table 51. Rail kits

Part number	Feature code	Description	300mm chassis	360mm chassis
4XF7A81940	BMH0*	ThinkEdge 1000mm Friction Rail Kit	Yes	Yes
4XF7A81942	BMH2	ThinkEdge 600mm Ball Bearing Rail Kit	Yes	Yes
4XF7A81943	BMH5	ThinkEdge SE450 550mm Ball Bearing Rail Kit	Yes	No
4XF7A81941	BMH1	ThinkEdge 2-Post Friction Rail Kit	Yes	Yes

* 1000mm rail kit and CTO orders: The 1000mm rail kit can only be included in CTO orders provided that the server is installed and shipped in a rack cabinet from the factory. If the order does not include factory installation into a rack cabinet, then the rail kit will need to be ordered separately using the option part number.

The following table summarizes the specifications of the available rail kits

Table 52. Specifications of the SE450 rail kits

Specification	ThinkEdge 1000mm Friction Rail Kit	ThinkEdge 600mm Ball Bearing Rail Kit	ThinkEdge SE450 550mm Ball Bearing Rail Kit	ThinkEdge 2-Post Friction Rail Kit
Part number	4XF7A81940	4XF7A81942	4XF7A81943	4XF7A81941
SE450 chassis support	300 mm, 360 mm	300 mm, 360 mm	300 mm only	300 mm, 360 mm
CMA	No	No	No	No
Rail length	751 mm (29.56 in)	454 mm (17.87 in)	315 mm (14.40 in)	484 mm (19.06 in)
Rail type	Full-out slide rail (friction)	Full-out slide rail (ball bearing)	Full-out slide rail (ball bearing)	Half-out slide rail (friction)
Slide travel	480 mm (18.9 in)	485 mm (19.1 in)	375 mm (14.8 in)	270 mm (10.6 in)
Tool-less installation	Yes	Yes	Yes	No (screw-in)
In-rack server maintenance	Yes	Yes	Yes	No
1U PDU support	Yes	Yes	Yes	Yes
0U PDU support	Yes	Not applicable	Not applicable	Not applicable
Rack type	Four-post IBM and Lenovo standard rack	Four-post 600 mm depth standard rack	Four-post custom cabinet	2-post rack
Mounting holes	Square or round	Square or round	Square or round	Square, round, or threaded
Mounting flange thickness	2 - 3.3 mm (0.08 - 0.13 in)	2 - 3.3 mm (0.08 - 0.13 in)	2 - 3.3 mm (0.08 - 0.13 in)	76 - 279 mm (3 - 11 in)
Supported distance between front and rear mounting flanges	610 - 864 mm (24 - 34 in)	400 - 500mm (15.7 - 19.7 in)	270 - 310 mm (10.6 - 12.2 in)	Not applicable

For details on the installation of these kits, see each of the ThinkEdge SE450 rack installation guides, available from the Information Center, https://thinksystem.lenovofiles.com/help/index.jsp

For information on supported rack cabinets, see the Rack cabinets section.

EIA bracket with security screw

The SE450 offers two types of EIA brackets (also known as ear brackets or ears):

- Standard EIA bracket - uses thumbscrews to secure the server to the front flange of the cabinet
- Security EIA bracket - uses security screws and key to secure the server to the front flange of the cabinet

The use of the security bracket and key (the key is included with the brackets) aids in preventing unauthorized personnel from removing the server from the rack.

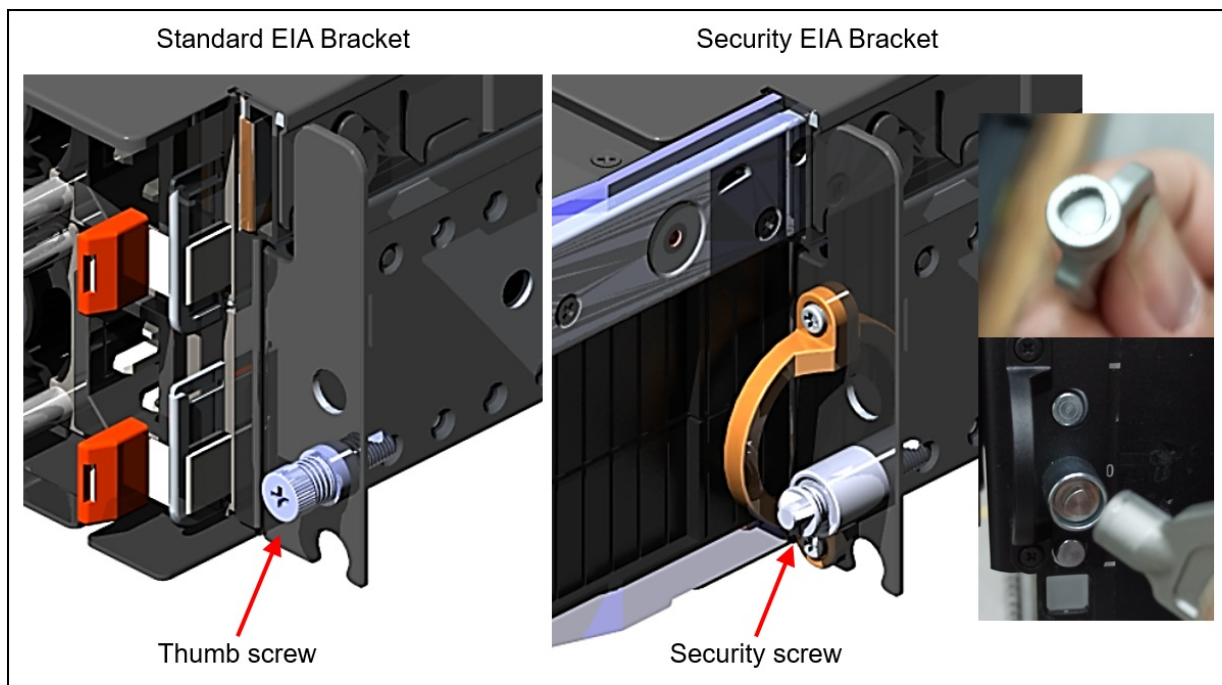The following figure shows the two EIA bracket types.

Figure 14. EIA brackets for the SE450

Ordering information is listed in the following table.

Table 53. EIA bracket choices

Part number	Feature code	Description
CTO only	BMGV	ThinkEdge SE450 EIA - Security
CTO only	BMGU	ThinkEdge SE450 EIA - Standard

EIA bracket adjustment

When installed in a rack cabinet, the EIA brackets on either side of the SE450 chassis can be adjusted to best fit the front cabling and clearance needs of your environment. The EIA brackets can be in one of six different positions as shown in the following figure.

Position 1 locates the server as far back into the rack cabinet as possible, such that the front of the security bezel is flush with the front flange of the cabinet. The distance between positions 1, 2, 3, 4, and 5 is 12.5 mm. Position 6 positions the server as far forward as possible, and is an additional 37.5 mm from position 5, for a total of 100 mm difference between positions 1 and 6.
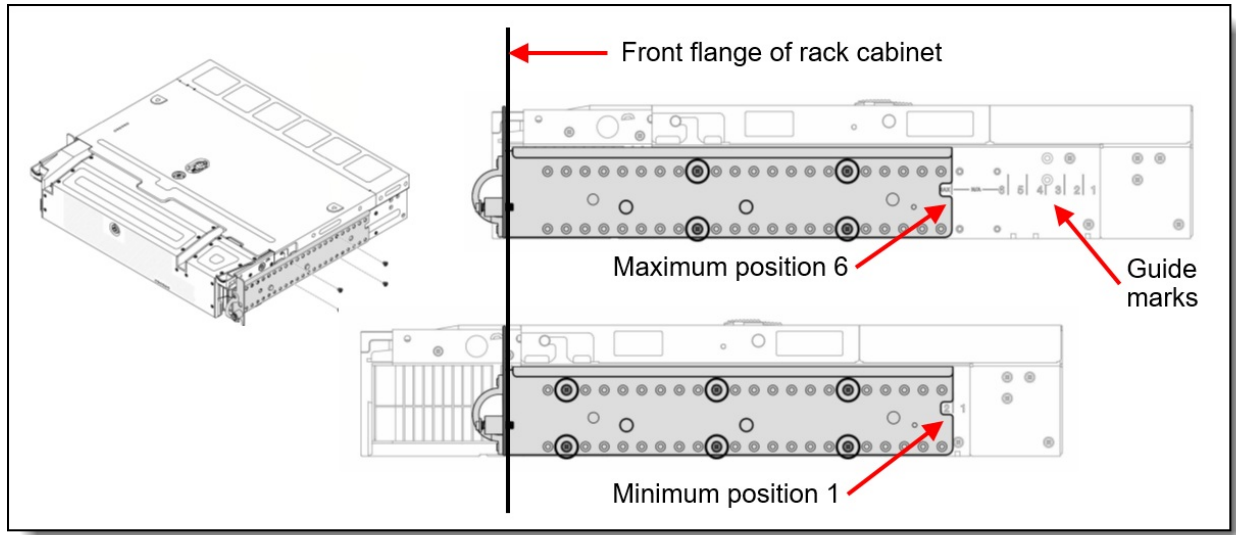

Figure 15. Adjusting the locations of the EIA brackets on the sides of the server

Floor stand

The SE450 supports being installed in a floor stand in a vertical orientation, as shown in the following figure. The floor stand supports both the 300mm or 360mm chassis, and with or without the security bezel.

Figure 16. SE450 installed in the floor stand kit

The dimensions of the floor stand base are as follows:

- Width: 305 mm (12 inches)
- Depth: 488 mm (19.2 inches)
- Height of the floor stand base: 303 mm (11.9 inches)
- Height of the server installed in the floor stand (to the top of the handle):
  - 300 mm chassis: 584 mm (23 inches)
  - 360 mm chassis: 594 mm (23.4 inches)

Ordering information for the floor stand kit is listed in the following table. The floor stand kit is only available as an option part number and cannot be included in a CTO factory order.

Table 54. Floor stand

Part number	Feature code	Description
4XF7A81739	Option only	ThinkEdge SE450 Floor Stand Kit , contains: • Floor stand base • Top cover, with integrated handle and lightpipes to surface the system LEDs • Bottom cover • Mounting hardware

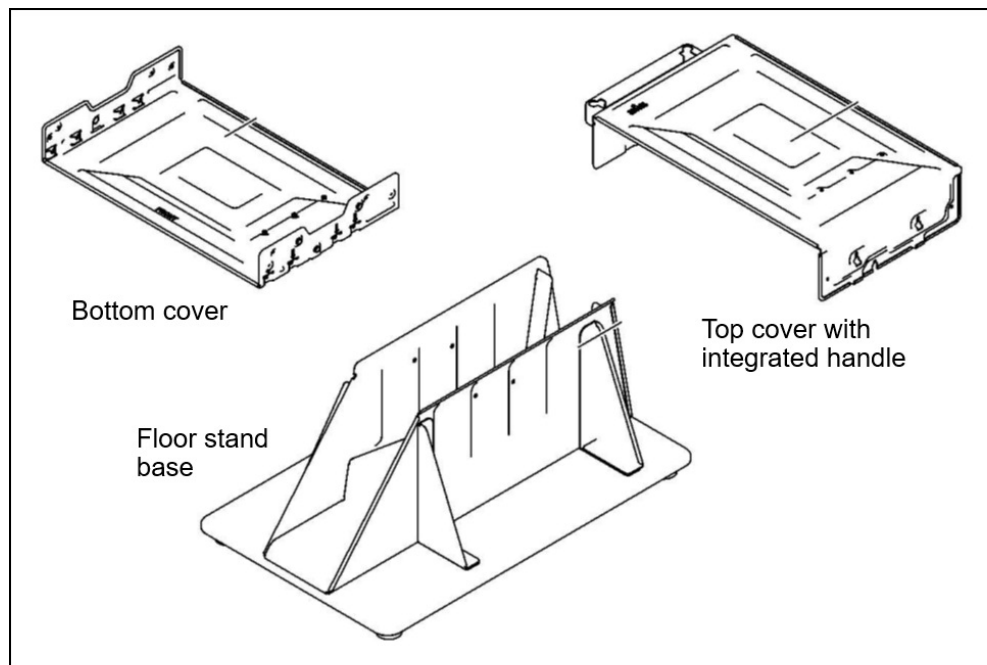The contents of the floor stand kit is shown in the following figure.

Figure 17. Contents of the SE450 floor stand kit

For details on the components in the kit and the installation process, see the ThinkEdge SE450 Floor-standing Configuration Guide, available from the Information Center, https://thinksystem.lenovofiles.com/help/index.jsp

Wall mount installation

The SE450 can be mounted on a wall in a vertical orientation. The server can face either left or right, and supports both the 300mm or 360mm chassis, with and without the security bezel.

The wall mount kit includes a base plate. The base plate is mounted to the wall and then the server is attached to the base plate using the top cover, bottom brackets, and side brackets. The dimensions of the base plate are:

- Width: 693 mm (27.3 inches)
- Height: 532 mm (20.9 inches)

The width of the base plate is to allow the support of the standard wall stud spacing in Europe (600mm, 23.6 inches) and in USA (16 inches, 406mm).

Note: The maximum weight of the server and wall mount assembly is 30 Kg (66 lbs).

The following figure shows the SE450 installed on a wall in a manufacturing environment.

Figure 18. SE450 installed on a wall in a manufacturing environment

Ordering information for the Wall Mount Kit is listed in the following table.

The wall mount kit is only available as an option part number and cannot be included in a CTO factory order.

Table 55. Wall mount

Part number	Feature code	Description
4XF7A81738	Option only	ThinkEdge SE450 Wall Mount Kit , contains: ● Wall-mount base plate ● Top cover, with four integrated handles and lightpipes to surface the system LEDs ● Two bottom brackets to enable mounting the server to the base plate ● Two L-shaped brackets for left and right sides of the server ● Mounting hardware

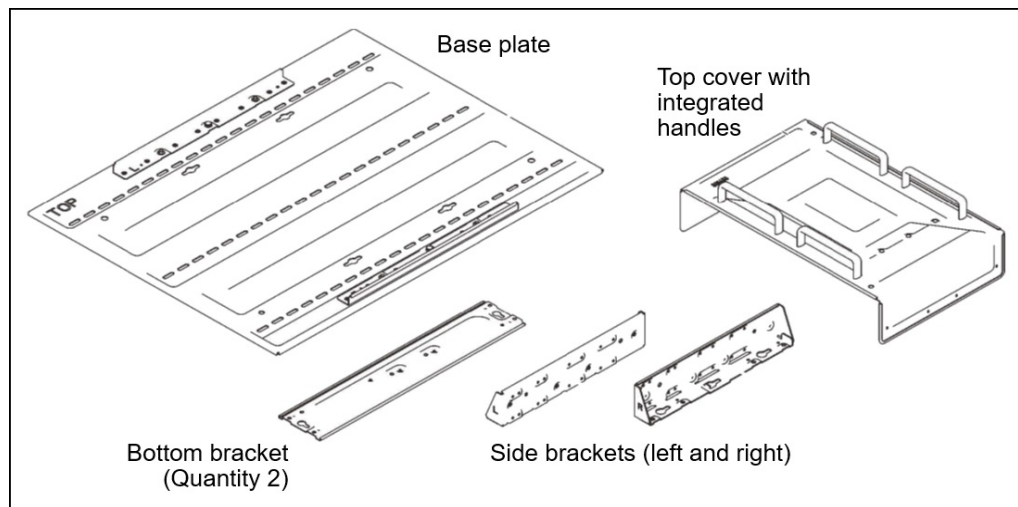The contents of the wall mount kit is shown in the following figure.

Figure 19. ThinkEdge SE450 Wall Mount Kit

The brackets are attached to the server and then the unit is then mounted to the wall plate, as shown in the following figure.

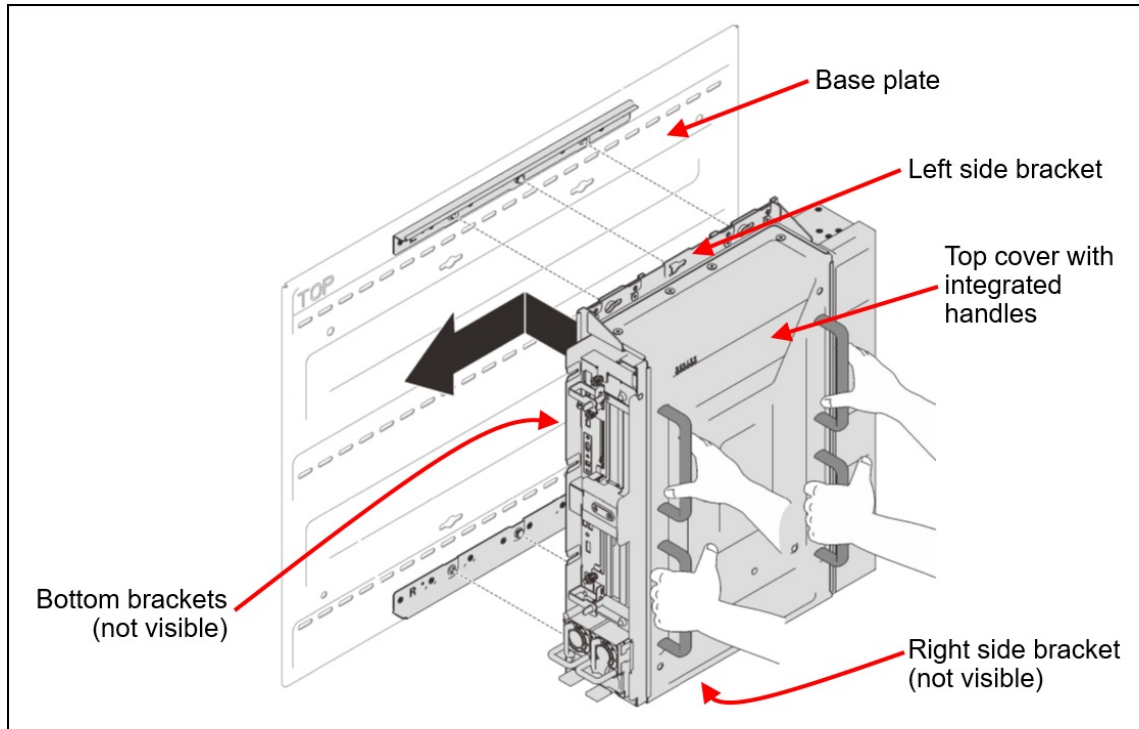**Tip**: The integrated handles cannot be removed.

Figure 20. Using the ThinkEdge SE450 Wall Mount Kit

For details on the components in the kit and the installation process, see the ThinkEdge SE450 Wall-mounting Configuration Guide, available from the Information Center, https://thinksystem.lenovofiles.com/help/index.jsp

Operating system support

The SE450 supports the following operating systems:

- Microsoft Windows Server 2019
- Microsoft Windows Server 2022
- Red Hat Enterprise Linux 7.9
- Red Hat Enterprise Linux 8.4
- Red Hat Enterprise Linux 8.5
- Red Hat Enterprise Linux 8.6
- Red Hat Enterprise Linux 8.7
- Red Hat Enterprise Linux 8.8
- Red Hat Enterprise Linux 8.9
- Red Hat Enterprise Linux 9.0
- Red Hat Enterprise Linux 9.1
- Red Hat Enterprise Linux 9.2
- Red Hat Enterprise Linux 9.3
- SUSE Linux Enterprise Server 15 SP4
- SUSE Linux Enterprise Server 15 SP5
- SUSE Linux Enterprise Server 15 Xen SP4
- SUSE Linux Enterprise Server 15 Xen SP5
- Ubuntu 18.04 LTS 64-bit
- Ubuntu 20.04 LTS 64-bit
- Ubuntu 22.04 LTS 64-bit
- VMware ESXi 7.0 U3
- VMware ESXi 8.0
- VMware ESXi 8.0 U1
- VMware ESXi 8.0 U2

For a complete list of supported, certified and tested operating systems, plus additional details and links to relevant web sites, see the Operating System Interoperability Guide:
https://lenovopress.com/osig#servers=se450-7d8t

For configure-to-order configurations, the server can be preloaded with VMware ESXi on M.2 cards installed in an M.2 Module. Ordering information is listed in the following table.

Table 56. VMware ESXi preload

Part number	Feature code	Description
CTO only	BMEY	VMware ESXi 7.0 U3 (Factory Installed)
CTO only	BMT5	VMware ESXi 8.0 (Factory Installed)
CTO only	BQ8S	VMware ESXi 8.0 U1 (Factory Installed)
CTO only	BYC7	VMware ESXi 8.0 U2 (Factory Installed)

Hyperconverged infrastructure support

Lenovo ThinkEdge systems can be used in hyperconverged solutions either as part of a Lenovo configured and optimized Lenovo ThinkAgile solution, or as a user-configured system.

Refer to the following links for full details.

VMware vSAN

SE450 supports vSAN OSA. For more information refer to this page:
vSAN Original Storage Architecture (OSA)

SE450 supports vSAN ESA. For more information refer to this page:
vSAN Express Storage Architecture (ESA) ReadyNode Configurator

Microsoft Azure Stack HCI

SE450 is the base hardware for the ThinkAgile MX450 Edge Integrated System. For more information refer to the product guide:
https://lenovopress.lenovo.com/lp1875-thinkagile-mx450-edge-integrated-system

SE450 supports Azure Stack HCI solution. For more information refer to the following Solution Brief:
https://lenovopress.lenovo.com/lp1597-microsoft-azure-stack-hci-solutions-on-lenovo-thinkedge-se450-edge-servers.

SE450 is listed in Microsoft Azure Stack HCI catalog. For more information refer to this page:
https://azurestackhcisolutions.azure.microsoft.com/#/catalog/details/7e93eff8-2d45-492d-a180-bebc75f8fad3

Sunlight

SE450 is supported by Sunlight HyperConverged Edge. For more information refer to this page:
https://sunlight.io/products/thinkedgethinksystem

Physical and electrical specifications

The SE450 has the following overall physical dimensions, excluding components that extend outside the standard chassis, such as EIA flanges, front security bezel (if any), and power supply handles:

300mm chassis:

- Width: 445 mm (17.5 inches)
- Height: 87 mm (3.4 inches)
- Depth: 323 mm (12.7 inches)

360mm chassis:

- Width: 445 mm (17.5 inches)
- Height: 87 mm (3.4 inches)
- Depth: 383 mm (15.1 inches)

The following table lists the detailed dimensions.

For dimensions of the wall mount plate and the floor stand kit, see the following sections:

- Floor stand
- Wall mount installation

Table 57. Detailed dimensions

300mm chassis	360mm chassis	Description
481 mm	481 mm	X_a = Width, to the outsides of the front EIA flanges
435 mm	435 mm	X_b = Width, to the rack rail mating surfaces
445 mm	445 mm	X_c = Width, to the outer most chassis body feature
87 mm	87 mm	Y_a = Height, from the bottom of chassis to the top of the chassis
299 mm	359 mm	Z_a = Depth, from the rack flange mating surface to the rearmost I/O port surface
299 mm	359 mm	Z_b = Depth, from the rack flange mating surface to the rearmost feature of the chassis body
299 mm	359 mm	Z_c = Depth, from the rack flange mating surface to the rearmost feature
25 mm	25 mm	Z_d = Depth, from the forwardmost feature on front of EIA flange to the rack flange mating surface
109 mm	109 mm	Z_e = Depth, from the front of security bezel (if applicable) or forwardmost feature to the rack flange mating surface

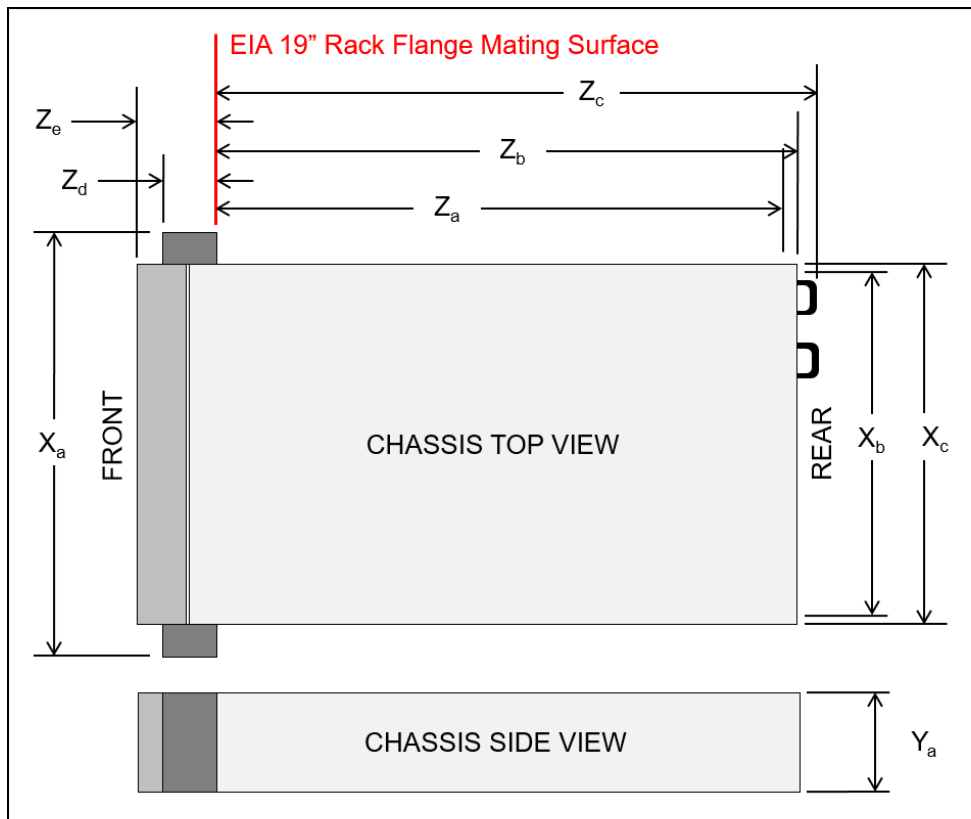The figure below shows the definition of each dimension.

Figure 21. Server dimensions

The shipping dimensions (cardboard packaging) of the SE450 are as follows:

- Width: 586 mm (23.1 inches)
- Height: 257 mm (10.1 inches)
- Depth: 555 mm (21.9 inches)

The server has the following maximum weight:

- 300mm chassis: 14.8 kg (32.7 lb)
- 360mm chassis: 17.4 kg (38.4 lb)

Electrical specifications for AC input power supplies:

- Input voltage:
    - 100 to 127 (nominal) Vac, 50 Hz or 60 Hz
    - 200 to 240 (nominal) Vac, 50 Hz or 60 Hz
    - 240 Vdc (input range: 180-300 V dc) (China only)
- Inlet current:
    - 100-127 V:
        - 1100W power supply: 12 A*
        - 1800W power supply: Not supported
    - 200-240 V:
        - 1100W power supply: 6.0 A
        - 1800W power supply: 10 A

* In China, this power supply cannot exceed 10 A current.

Electrical specifications for DC input power supply:

- Input voltage: -44 to -54 Vdc
- Inlet current (1100W power supply): 26 A

Grounding cable

The SE450 includes two grounding lugs on the front of the server to enable the connection of a grounding cable. The table below lists the ordering information for the supported cable.

Field upgrade only: The Grounding Cable is only available as an option for field upgrades. Not available in CTO orders.

Table 58. Grounding cable

Part number	Feature code	Description	Maximum supported
4X97A84041	BMG0	ThinkEdge Grounding Cable with Lug (2500mm, 6 AWG)	1

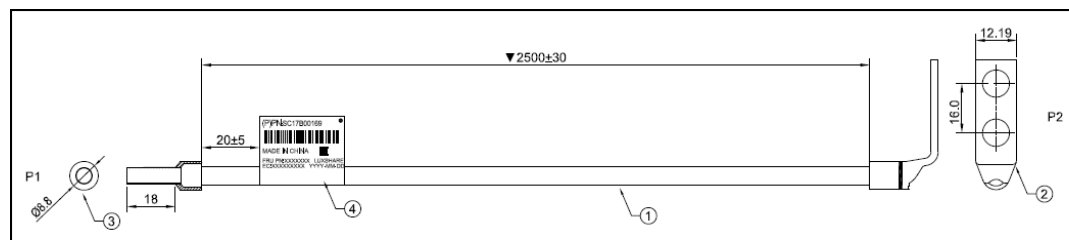The following figure shows the cable.

Figure 22. SE450 grounding cable

Operating environment

The SE450 server complies with ASHRAE Class A3 specifications with most configurations, and depending on the hardware configuration, also complies with ASHRAE Class A4 specifications.

Topics in this section:

- Configuration requirements
- Temperature and humidity
- NEBS support
- Acoustical noise emissions
- Shock and vibration
- Particulate contamination
- Dust filter

Configuration requirements

Components installed in the SE450 have the following ambient temperature requirements:

- Persistent Memory is supported up to 40°C ambient temperature

- The following trayless drive is supported up to 35°C ambient temperature:
    - ThinkSystem 2.5" 7mm U.3 7400 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD, 4XB7A80376

- The following hot-swap drive is supported up to 40°C ambient temperature:
    - ThinkSystem 2.5" U.3 7400 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD, 4XB7A80378

- 360mm chassis config 3 (see Configurations section) is only supported up to 40°C ambient temperature if both of the following are installed:
    - 3 or fewer low profile PCIe adapters
    - 8x 128GB DIMMs installed
  Note: If 4 low profile PCIe adapters are installed, there are no thermal restrictions and the server can operate up to 45°C ambient temperature.

Temperature and humidity

The server is supported in the following environment:

- Air temperature:
    - Operating:
        - ASHRAE A2: 10°C to 35°C (50°F to 95°F); the maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft).
        - ASHRAE A3: 5°C to 40°C (41°F to 104°F); the maximum ambient temperature decreases by 1°C for every 175 m (574 ft) increase in altitude above 900 m (2,953 ft).
        - ASHRAE A4: 5°C to 45°C (41°F to 113°F); the maximum ambient temperature decreases by 1°C for every 125 m (410 ft) increase in altitude above 900 m (2,953 ft).
    - Server off: -5°C to 55°C (23°F to 131°F)
    - Shipment/storage: -40°C to 70°C (-40°F to 158°F)

- Maximum altitude: 3,050 m (10,000 ft)

- Relative Humidity (non-condensing):
    - Operating
        - ASHRAE Class A2: 8% to 80%; maximum dew point: 21°C (70°F)
        - ASHRAE Class A3: 8% to 85%; maximum dew point: 24°C (75°F)
        - ASHRAE Class A4: 8% to 90%; maximum dew point: 24°C (75°F)
    - Shipment/storage: 8% to 90%

NEBS support

The server supports NEBS Level 3:

- Operating temperature: 5°C to 40°C.
- High altitude operating temperature (1829m to 3960m, 6000ft to 13,000ft): 5°C to 35°C
- Short term operating temp*: -5°C to 55°C
- Humidity: 5% to 85% RH, Non-condensing.
- Maximum rate of change(°C /hr) should ≤ 20 Humidity transition rate should ≤10%/hr.

* Short-term conditions: A period of no more than 96 consecutive hours and a total of not more than 15 days in 1 year. A total of 360 hours in any given year, but no more than 15 occurrences during a 1-year period.

NEBS configuration supported:

- Chassis: 300mm chassis
- Processor: 28-core 165W with standard 2U heat sink
- Memory: 8x 64GB 3200MHz RDIMMs
- M.2: Two 480GB M.2 drives with SATA-RAID M.2 adapter
- Internal storage: 4x 960GB SATA drives
- PCIe adapters: Intel E810-DA2 (Slot 5), Intel ACC100 (Slot 3, 4, 6)
- No OCP
- 2x 1100W -48VDC power supplies

Acoustical noise emissions

The server has the following acoustic noise emissions declaration:

- Sound pressure level (L $_{pAm}$):
  - Idling: 43.3 dBA (Minimal), 47.4 dBA (Typical), 47.4 dBA (GPU rich)
  - Operating: 55.3 dBA (Minimal), 55.3 dBA (Typical), 65.2 dBA (GPU rich)

Notes:

- These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.

- The declared acoustic sound levels are based on the following configurations, which may change depending on configuration/conditions
  - Minimal: 300mm Chassis, 1x 185W/32cores CPU, 8x 16GB RDIMM, 4x 960G SATA SSD, 2x M.2 5300 480GB SATA, 2x Intel E810-DA2, 2 x 1100W PSU
  - Typical: 300mm Chassis, 185W/32 cores CPU, 8x 16GB RDIMM, 2x U.2 P5500 1.92TB NVMe, 2x M.2 5300 480GB SATA, 2x NVIDIA A2 16GB PCIe Gen4 Passive GPU, 1x Mellanox CX6 LX 10/25G, 2x 1100W PSU
  - GPU rich: 360mm Chassis, 165W/28 cores CPU, 8x 16GB RDIMM, 2x U.2 P5500 1.92TB NVMe, 2x M.2 5300 480GB SATA, 2x NVIDIA A30 24GB PCIe Gen4 Passive GPU, 1x Mellanox CX6 LX 10/25G, 2x 1800W PSU

Shock and vibration

The server has the following vibration and shock limits:

- Vibration:
    - Operating: 0.21 G rms at 5 Hz to 500 Hz for 15 minutes across 3 axes
    - Non-operating (in packaging): 1.04 G rms at 2 Hz to 200 Hz for 15 minutes across 6 surfaces
- Shock:
    - Operating: 15 G for 3 milliseconds in each direction (positive and negative X, Y, and Z axes)
    - Non-operating (12 kg to 23 kg, in packaging): 762mm drop height for 1 corner 3 edge 6 surface
- NEBS GR-63:
    - Office vibration: 0.21 G rms at 5 Hz to 100 Hz for 30 minutes across 3 axes
    - Earthquake test: GR63 earthquake zone 4

Particulate contamination

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 damage the system that might cause the system to malfunction or stop working altogether.

The following specifications indicate the limits of particulates that the system can tolerate:

- Reactive gases:
    - The copper reactivity level shall be less than 200 Angstroms per month (Å/month)
    - The silver reactivity level shall be less than 200 Å/month
- Airborne particulates:
    - The deliquescent relative humidity of the particulate contamination should be more than 60% RH
    - Environment must be free of zinc whiskers

For additional information, see the Specifications section of the documentation for the server, available from the Lenovo Documents site, https://pubs.lenovo.com/

Dust filter

The SE450 supports the use of a dust filter which is installed inside the security bezel. The dust filter has a Minimum Efficiency Rating Value (MERV) of 2, per ASHRAE Standard 52.2-2017.

A single dust filter is included with the security bezel as described in the Security section.

Ordering information for additional dust filters is listed in the following table.

Table 59. Replacement dust filter

Part number	Description
4XF7A90166	ThinkEdge SE450 Bezel Dust Filter with Frame (dust filter)

The dust filter is installed inside the security bezel as shown in the following figure.
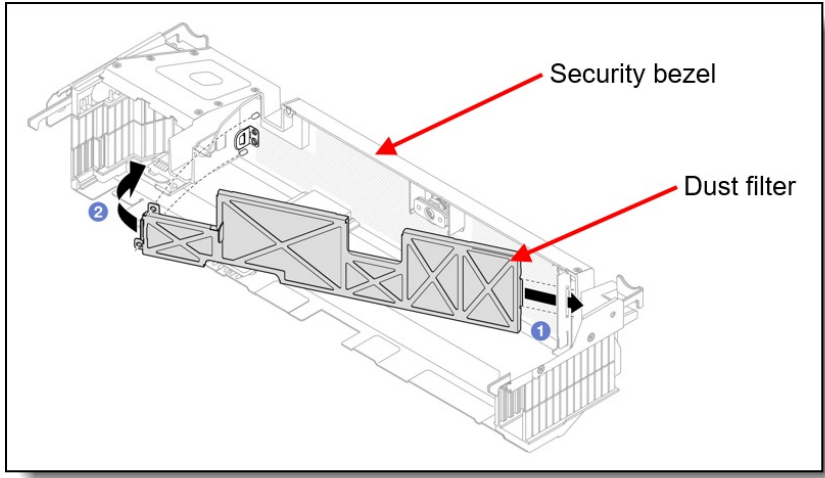
Figure 23. Dust filter

Warranty and Support

The ThinkEdge SE450 has a 3-year warranty:

- 7D8T - 3 year warranty

The standard warranty terms are customer-replaceable unit (CRU) and onsite (for field-replaceable units FRUs only) with standard call center support during normal business hours and 9x5 Next Business Day Parts Delivered.

Lenovo's additional support services provide a sophisticated, unified support structure for your data center, with an experience consistently ranked number one in customer satisfaction worldwide. Available offerings include:

- **Premier Support**

  Premier Support provides a Lenovo-owned customer experience and delivers direct access to technicians skilled in hardware, software, and advanced troubleshooting, in addition to the following:

    - Direct technician-to-technician access through a dedicated phone line
    - 24x7x365 remote support
    - Single point of contact service
    - End to end case management
    - Third-party collaborative software support
    - Online case tools and live chat support
    - On-demand remote system analysis

- **Warranty Upgrade (Preconfigured Support)**

  Services are available to meet the on-site response time targets that match the criticality of your systems.

    - 3, 4, or 5 years of service coverage
    - 1-year or 2-year post-warranty extensions
    - **Foundation Service**: 9x5 service coverage with next business day onsite response. YourDrive YourData is an optional extra (see below).
    - **Essential Service:** 24x7 service coverage with 4-hour onsite response. Bundled with YourDrive YourData.

- **Managed Services**

  Lenovo Managed Services provides continuous 24x7 remote monitoring (plus 24x7 call center availability) and proactive management of your data center using state-of-the-art tools, systems, and practices by a team of highly skilled and experienced Lenovo services professionals.

  Quarterly reviews check error logs, verify firmware & OS device driver levels, and software as needed. We'll also maintain records of latest patches, critical updates, and firmware levels, to ensure you systems are providing business value through optimized performance.

- **Technical Account Management (TAM)**

  A Lenovo Technical Account Manager helps you optimize the operation of your data center based on a deep understanding of your business. You gain direct access to your Lenovo TAM, who serves as your single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time. In addition, your TAM will help proactively make service recommendations and manage your service relationship with Lenovo to make certain your needs are met.

- **Enterprise Server Software Support**

  Enterprise Software Support is an additional support service providing customers with software support on Microsoft, Red Hat, SUSE, and VMware applications and systems. Around the clock availability for critical problems plus unlimited calls and incidents helps customers address challenges fast, without incremental costs. Support staff can answer troubleshooting and diagnostic questions, address product comparability and interoperability issues, isolate causes of problems, report defects to software vendors, and more.

- **YourDrive YourData**

  Lenovo's YourDrive YourData is a multi-drive retention offering that ensures your data is always under your control, regardless of the number of drives that are installed in your Lenovo server. In the unlikely event of a drive failure, you retain possession of your drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. The YourDrive YourData service can be purchased in convenient bundles and is optional with Foundation Service. It is bundled with Essential Service and Advanced Service.

- **Health Check**

  Having a trusted partner who can perform regular and detailed health checks is central to maintaining efficiency and ensuring that your systems and business are always running at their best. Health Check supports Lenovo-branded server, storage, and networking devices, as well as select Lenovo-supported products from other vendors that are sold by Lenovo or a Lenovo-Authorized Reseller.

Examples of region-specific warranty terms are second or longer business day parts delivery or parts-only base warranty.

If warranty terms and conditions include onsite labor for repair or replacement of parts, Lenovo will dispatch a service technician to the customer site to perform the replacement. Onsite labor under base warranty is limited to labor for replacement of parts that have been determined to be field-replaceable units (FRUs). Parts that are determined to be customer-replaceable units (CRUs) do not include onsite labor under base warranty.

If warranty terms include parts-only base warranty, Lenovo is responsible for delivering only replacement parts that are under base warranty (including FRUs) that will be sent to a requested location for self-service. Parts-only service does not include a service technician being dispatched onsite. Parts must be changed at customer's own cost and labor and defective parts must be returned following the instructions supplied with the spare parts.

Lenovo Service offerings are region-specific. Not all preconfigured support and upgrade options are available in every region. For information about Lenovo service upgrade offerings that are available in your region, refer to the following resources:

- Service part numbers in Lenovo Data Center Solution Configurator (DCSC):
  http://dcsc.lenovo.com/#/services

- Lenovo Services Availability Locator
  http://lenovolocator.com/

For service definitions, region-specific details, and service limitations, please refer to the following documents:

- Lenovo Statement of Limited Warranty for Infrastructure Solutions Group (ISG) Servers and System Storage
  http://pcsupport.lenovo.com/us/en/solutions/ht503310

- Lenovo Data Center Services Agreement
  http://support.lenovo.com/us/en/solutions/ht116628

Services

Lenovo Services is a dedicated partner to your success. Our goal is to reduce your capital outlays, mitigate your IT risks, and accelerate your time to productivity.

Note: Some service options may not be available in all markets or regions. For more information, go to https://www.lenovo.com/services. For information about Lenovo service upgrade offerings that are available in your region, contact your local Lenovo sales representative or business partner.

Here's a more in-depth look at what we can do for you:

- **Asset Recovery Services**

  Asset Recovery Services (ARS) helps customers recover the maximum value from their end-of-life equipment in a cost-effective and secure way. On top of simplifying the transition from old to new equipment, ARS mitigates environmental and data security risks associated with data center equipment disposal. Lenovo ARS is a cash-back solution for equipment based on its remaining market value, yielding maximum value from aging assets and lowering total cost of ownership for your customers. For more information, see the ARS page, https://lenovopress.com/lp1266-reduce-e-waste-and-grow-your-bottom-line-with-lenovo-ars.

- **Assessment Services**

  An Assessment helps solve your IT challenges through an onsite, multi-day session with a Lenovo technology expert. We perform a tools-based assessment which provides a comprehensive and thorough review of a company's environment and technology systems. In addition to the technology based functional requirements, the consultant also discusses and records the non-functional business requirements, challenges, and constraints. Assessments help organizations like yours, no matter how large or small, get a better return on your IT investment and overcome challenges in the ever-changing technology landscape.

- **Design Services**

  Professional Services consultants perform infrastructure design and implementation planning to support your strategy. The high-level architectures provided by the assessment service are turned into low level designs and wiring diagrams, which are reviewed and approved prior to implementation. The implementation plan will demonstrate an outcome-based proposal to provide business capabilities through infrastructure with a risk-mitigated project plan.

- **Basic Hardware Installation**

  Lenovo experts can seamlessly manage the physical installation of your server, storage, or networking hardware. Working at a time convenient for you (business hours or off shift), the technician will unpack and inspect the systems on your site, install options, mount in a rack cabinet, connect to power and network, check and update firmware to the latest levels, verify operation, and dispose of the packaging, allowing your team to focus on other priorities.

- **Deployment Services**

  When investing in new IT infrastructures, you need to ensure your business will see quick time to value with little to no disruption. Lenovo deployments are designed by development and engineering teams who know our Products & Solutions better than anyone else, and our technicians own the process from delivery to completion. Lenovo will conduct remote preparation and planning, configure & integrate systems, validate systems, verify and update appliance firmware, train on administrative tasks, and provide post-deployment documentation. Customer's IT teams leverage our skills to enable IT staff to transform with higher level roles and tasks.

- **Integration, Migration, and Expansion Services**

  Move existing physical & virtual workloads easily, or determine technical requirements to support increased workloads while maximizing performance. Includes tuning, validation, and documenting ongoing run processes. Leverage migration assessment planning documents to perform necessary migrations.

Regulatory compliance

The SE450 conforms to the following standards:

- ANSI/UL62368-1
- IEC 62368-1 (CB Certificate and CB Test Report)
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 7, Class A
- CSA C22.2 No. 62368-1
- CISPR 32, Class A, CISPR 35
- Argentina IEC 62368-1: 2018
- Japan VCCI, Class A
- Taiwan BSMI CNS15936, Class A; CNS15598-1; Section 5 of CNS15663
- CE, UKCA Mark (EN55032 Class A, EN62368-1, EN55024, EN55035, EN61000-3-2, EN61000-3-3, (EU) 2019/424, and EN IEC 63000 (RoHS))
- Korea KN32, Class A, KN35
- Russia, Belorussia and Kazakhstan, TP EAC 037/2016 (for RoHS)
- Russia, Belorussia and Kazakhstan, EAC: TP TC 004/2011 (for Safety); TP TC 020/2011 (for EMC)
- EAC Russia, Belorussia and Kazakhstan, TR CU 020/2011 and TR CU 004/2011
- Australia/New Zealand AS/NZS CISPR 32, Class A; AS/NZS 62368.1
- UL Green Guard, UL2819
- Energy Star 4.0
- EPEAT (NSF/ ANSI 426) Bronze
- China CCC certificate, GB17625.1; GB4943.1; GB/T9254.1
- China CECP certificate, CQC3135
- China CELP certificate, HJ 2507-2011
- Japanese Energy-Saving Act
- Mexico NOM-019
- TUV-GS (EN62368-1, and EK1-ITB2000)
- India BIS 13252 (Part 1)
- Germany GS
- Brazil INMETRO
- South Africa NRCS LOA
- Ukraine UkrCEPRO
- Morocco CMIM Certification (CM)
- EU2019/424 Energy Related Product (ErP Lot9)
- NEBS 3

Uninterruptible power supply units

The following table lists the uninterruptible power supply (UPS) units that are offered by Lenovo.

Table 60. Uninterruptible power supply units

Part number	Description
55941AX	RT1.5kVA 2U Rack or Tower UPS (100-125VAC)
55941KX	RT1.5kVA 2U Rack or Tower UPS (200-240VAC)
55942AX	RT2.2kVA 2U Rack or Tower UPS (100-125VAC)
55942KX	RT2.2kVA 2U Rack or Tower UPS (200-240VAC)
55943AX	RT3kVA 2U Rack or Tower UPS (100-125VAC)
55943KX	RT3kVA 2U Rack or Tower UPS (200-240VAC)
55945KX	RT5kVA 3U Rack or Tower UPS (200-240VAC)
55946KX	RT6kVA 3U Rack or Tower UPS (200-240VAC)
55948KX	RT8kVA 6U Rack or Tower UPS (200-240VAC)
55949KX	RT11kVA 6U Rack or Tower UPS (200-240VAC)
55948PX	RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55949PX	RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55943KT†	ThinkSystem RT3kVA 2U Standard UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55943LT†	ThinkSystem RT3kVA 2U Long Backup UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55946KT†	ThinkSystem RT6kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)
5594XKT†	ThinkSystem RT10kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)

† Only available in China and the Asia Pacific market.

For more information, see the list of Product Guides in the UPS category:
https://lenovopress.com/servers/options/ups

Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo.

Table 61. Power distribution units

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
0U Basic PDUs															
00YJ776	ATZY	0U 36 C13/6 C19 24A 1 Phase PDU	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	N
0U Switched and Monitored PDUs															
00YJ783	AU04	0U 12 C13/12 C19 Switched and Monitored 48A 3 Phase PDU	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N
00YJ781	AU03	0U 20 C13/4 C19 Switched and Monitored 24A 1 Phase PDU	N	N	Y	N	Y	N	Y	N	N	Y	Y	Y	N
1U Switched and Monitored PDUs															
4PU7A81117	BNDV	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - ETL	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77467	BLC4	1U 18 C19/C13 Switched and Monitored 80A 3P Delta PDU	N	N	N	N	N	N	N	N	N	Y	N	Y	N
4PU7A77469	BLC6	1U 12 C19/C13 switched and monitored 60A 3P Delta PDU	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77468	BLC5	1U 12 C19/C13 switched and monitored 32A 3P WYE PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
4PU7A81118	BNDW	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - CE	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
1U Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)															
71763NU	6051	Ultra Density Enterprise C19/C13 PDU 60A/208V/3PH	N	N	Y	N	N	N	N	N	N	Y	Y	Y	N
71762NX	6091	Ultra Density Enterprise C19/C13 PDU Module	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U C13 Enterprise PDUs (12x IEC 320 C13 outlets)															
39Y8941	6010	DPI C13 Enterprise PDU Module (WW)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U Front-end PDUs (3x IEC 320 C19 outlets)															
39Y8938	6002	DPI Single-phase 30A/120V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8939	6003	DPI Single-phase 30A/208V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8934	6005	DPI Single-phase 32A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8940	6004	DPI Single-phase 60A/208V Front-end PDU (US)	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N
39Y8935	6006	DPI Single-phase 63A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U NEMA PDUs (6x NEMA 5-15R outlets)															
39Y8905	5900	DPI 100-127V NEMA PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Line cords for 1U PDUs that ship without a line cord															

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
40K9611	6504	4.3m, 32A/380-415V, EPDU/IEC 309 3P+N+G 3ph wye (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9612	6502	4.3m, 32A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9613	6503	4.3m, 63A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9614	6500	4.3m, 30A/208V, EPDU to NEMA L6-30P (US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9615	6501	4.3m, 60A/208V, EPDU to IEC 309 2P+G (US) Line Cord	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N
40K9617	6505	4.3m, 32A/230V, Souriau UTG Female to AS/NZ 3112 (Aus/NZ) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9618	6506	4.3m, 32A/250V, Souriau UTG Female to KSC 8305 (S. Korea) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

For more information, see the Lenovo Press documents in the PDU category:

https://lenovopress.com/servers/options/pdu

Rack cabinets

The following table lists the supported Lenovo rack cabinets. The 300mm and 360mm SE450 chassis are both supported, with and without the security bezel.

Table 62. Supported Lenovo rack cabinets

MTM	Description	Qty of SE450	Comment
9363-4PX, 4EX, RC4, LC4	42U 1100mm Enterprise V2 Dynamic Rack	21	Require Extension kit (L1 00YE457) and Rail kit (SBB7A50505)
1410-PRB, ERB, HPB, HEB1	Intelligent Cluster 42U 1100mm Enterprise V2 Rack Family	21	Require Extension kit (L1 00YE457) and Rail kit (SBB7A50505)
9307-4RX	S2 42U Static Standard Rack (1000mm depth)	21	The front door may need to be removed to support some cabling configurations of the SE450
9307-2RX	S2 25U Dynamic Standard Rack (1000mm depth)	12	The front door may need to be removed to support some cabling configurations of the SE450

For information about these rack cabinets, see the Lenovo Rack Cabinet Reference:
https://lenovopress.com/lp1287-lenovo-rack-cabinet-reference

The SE450 is also supported in 3rd-party rack cabinets, as listed in the following table. Note that some of mounting position may interfere with the front door latch of the cabinet.

Table 63. Third-party rack cabinets

Rack cabinet:	nVent 600mm rack	2 post rack	Delta racks**	Barcelona 550mm
Rail kit:	600mm rail kit	2-post rail kit	600mm rail kit	550mm rail kit
300mm chassis	Supported	Supported	Supported	Supported†
300mm chassis+Bezel	Supported	Supported	Supported	No
360mm chassis	Supported	Supported	Supported	No
360mm chassis+Bezel	Supported*	Supported	No	No

* For use in the nVent 600mm rack cabinet, you may need to adjust the placement of the front posts of the cabinet
† Security bezel not supported in Barcelona 550mm rack
** Supported Delta racks are the following:

- Delta Type 3798100778 ODPS 3000-48-5 1.8M HVA/C 3/1 PH ES.
- Delta Type 3799515500 ODPS 2900-48-3 1.8M HVA/C [VF ES]
- Delta Type 3798100727 ODPS 3000-48-5 1.5M HVA/C 3/1 PH ES

For more information about rail kits, see the Rack installation section.

KVM console options

The following table lists the supported KVM consoles.

Table 64. KVM console

Part number	Description
4XF7A84188	ThinkSystem 18.5" LCD Console (with US English keyboard)

The following table lists the available KVM switches and the options that are supported with them.

Table 66. KVM switches and options

Part number	Description
KVM Console switches	
1754D2X	Global 4x2x32 Console Manager (GCM32)
1754D1X	Global 2x2x16 Console Manager (GCM16)
1754A2X	Local 2x16 Console Manager (LCM16)
1754A1X	Local 1x8 Console Manager (LCM8)
Cables for GCM and LCM Console switches	
46M5383	Virtual Media Conversion Option Gen2 (VCO2)
46M5382	Serial Conversion Option (SCO)

For more information, see the list of Product Guides in the KVM Switches and Consoles category:
http://lenovopress.com/servers/options/kvm

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Our Premier Client services provide large accounts with special handling services to ensure these complex transactions are serviced properly. As a premier client, you have a dedicated finance specialist who manages your account through its life, from first invoice through asset return or purchase. This specialist develops an in-depth understanding of your invoice and payment requirements. For you, this dedication provides a high-quality, easy, and positive financing experience.

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https://www.lenovo.com/us/en/landingpage/lenovo-financial-services/

Seller training courses

The following sales training courses are offered for employees and partners (login required). Courses are listed in date order.

1. **Business Problems Addressed with Lenovo Data & Analytics Solutions**
   2024-01-31 | 20 minutes | Employees and Partners

   Data is the quantities, characters, or symbols on which operations are performed by a computer, which is then stored and transmitted in the form of electrical signals and recorded on magnetic, optical, solid state, or mechanical recording media. All different types of organizations rely more and more on their data to gain valuable insights and improve their business. As expected, they will have challenges with gaining this insight. In this course we will discuss those challenges and problems our customers face and describe how Lenovo Data and Analytics Solutions can help customers solve each problem.

   After completing this training, you will be able to define the following common problems for databases and big data and describe how Lenovo can help customers solve each problem: scalability, management, performance, protection, security, knowledge/skill, and technology evolution.

   After completing this training, you will be able to define the following common problems for databases and big data and describe how Lenovo can help customers solve each problem: scalability, management, performance, protection, security, knowledge/skill, and technology evolution.

   Published: 2024-01-31
   Length: 20 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DSOLP200

2. **Family Introduction: Edge Servers**
   2024-01-22 | 18 minutes | Employees and Partners

   This course introduces the concept of edge servers. Edge servers are used at the edge of an IoT environment, where they perform pre-processing of data, and data forwarding to core environments.
   Course Objectives:
   • Describe the Internet of Things (IoT)
   • Define an edge server
   • Discuss edge server features

   Published: 2024-01-22
   Length: 18 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: SXXW1105

3. **Partner Technical Webinar - Tech World 23 Review**
   2023-12-22 | 60 minutes | Employees and Partners

   In this 60-minute replay, Kenny James, Lenovo Channel Sales Engineering Director, joined us to give a Channel CTO's perspective on this year's Tech World 2023 conference where the theme was AI for All.

   Published: 2023-12-22
   Length: 60 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: 121523

4. **Basics of the Edge Ecosystem for Sellers**
   2023-12-15 | 20 minutes | Employees and Partners

   The purpose of this learning module is to familiarize Lenovo field sales, inside sales and partners with the Edge ecosystem and how Lenovo fits into the Edge space.

   • Explain the basics of an Edge Ecosystem
   • Articulate the inherent challenges of Edge Computing
   • Present how Lenovo fits in the Edge Ecosystem

   Published: 2023-12-15
   Length: 20 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DTEF101

5. **The 10-minute Edge conversation for Lenovo Sellers**
   2023-12-14 | 20 minutes | Employees and Partners

   The purpose of this course is to enable sellers to have a 10 to 15-minute customer conversation addressing the relevancy of Edge solutions to the customer business.

   Learning Objectives:

   • Prepare for the initial customer conversation
   • Hold a 10-minute Edge Operational Technology (OT) conversation
   • Take the appropriate steps to progress the sale

   Published: 2023-12-14
   Length: 20 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DTEF103

6. **VTT: Lenovo in the Era of the Edge-June 2023**
   2023-12-04 | 60 minutes | Employees and Partners

   Join Richard Jenkins from the Lenovo Edge Computing Business Development group as he discusses how Lenovo fits in the era of the Edge. Topics covered in this VTT session include:
   - customer use cases at the Edge
   - the needed consortium to build an Edge Solution
   - Lenovo edge portfolio
   - The advantages of LOC-A and XClarity at the Edge

   Published: 2023-12-04
   Length: 60 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DVEDG201

7. **Intro to Edge: 3Ws of Edge Computing for Lenovo Sellers**
   2023-09-14 | 13 minutes | Employees and Partners

   This course provides fundamental concepts and a learning foundation for those who are new to the data center and to computing at the Edge. It defines where is the Edge, identifies what are the business drivers for edge computing, and discusses why is edge computing important to Lenovo. September 2023

   Published: 2023-09-14
   Length: 13 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DTEF100

8. **Lenovo Solutions for the Edge - Who Are the Customers?**
   2023-09-14 | 25 minutes | Employees and Partners

   This course is focused on enabling sellers to identify opportunities for Lenovo Edge and Edge AI Solutions. Topics include a general overview of the Lenovo Edge portfolio and recognizing how edge computing can benefit customers.

   Course Objectives:
   • Identify Lenovo Edge Opportunities
   • Recognize how an Edge solution would benefit your customer
   • Provide a general overview of Lenovo solutions at the Edge
   • Identify key points for your customer Edge conversation

   Published: 2023-09-14
   Length: 25 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: DTEF102

9. **Family Portfolio - Edge**
   2023-09-12 | 15 minutes | Employees and Partners

   This course introduces edge environments, and the roles played by Lenovo edge servers and edge clients in those environments. It looks briefly at use cases for these edge devices.
   When you have completed this course, you should be able to list the edge solutions in the Lenovo portfolio, describe the features of each solution, and determine which solution is best suited to a specific environment.

   Published: 2023-09-12
   Length: 15 minutes
   Employee link: Grow@Lenovo
   Partner link: Lenovo Partner Learning
   Course code: SXXW2513r2

10. **Lenovo Data Center Product Portfolio**
    2023-07-21 | 15 minutes | Employees and Partners

    This course introduces the Lenovo data center portfolio, and covers servers, storage, storage networking, and software-defined infrastructure products. After completing this course about Lenovo data center products, you will be able to identify product types within each data center family, describe Lenovo innovations that this product family or category uses, and recognize when a specific product should be selected.

    Published: 2023-07-21
    Length: 15 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: SXXW1110r6

11. **Lenovo XClarity Management Hub for Edge Server Devices**
    2023-06-08 | 50 minutes | Employees and Partners

    This course offers a comprehensive overview and demonstration of the enhanced capability to manage ThinkEdge Server Devices through Lenovo XClarity Management Hub in Lenovo XClarity Orchestrator (LXCO).

    Published: 2023-06-08
    Length: 50 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: DXCO201

12. **Lenovo XClarity Management Hub for Edge Client Devices**
    2023-06-08 | 50 minutes | Employees and Partners

    This course offers a comprehensive overview and demonstration of the enhanced capability to manage ThinkEdge Client Devices through Lenovo XClarity Management Hub in Lenovo XClarity Orchestrator (LXCO).

    Published: 2023-06-08
    Length: 50 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: DXCO202

13. **Family Portfolio: Intel Edge Servers**
    2023-06-07 | 15 minutes | Employees and Partners

    This course introduces two new Lenovo ThinkEdge servers: the ThinkEdge SE350 V2 and ThinkEdge SE360 V2.
    After completing this course, you will be able to list the Intel edge servers in the Lenovo portfolio, describe the features of each server and determine which server is best suited to a specific environment.

    Published: 2023-06-07
    Length: 15 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: SXXW2510r2

14. **Family Portfolio: Edge Solutions**
    2022-12-06 | 10 minutes | Employees and Partners

    This course describes the Lenovo edge solutions. Edge servers, such as the Lenovo ThinkSystem SE350 and ThinkEdge SE450, are used at the edge of an IoT environment, and may be part of an edge solution. Solutions such as those using software from Scale Computing typically use more traditional Lenovo servers.
    After completing this course, you will be able to list the edge solutions in the Lenovo portfolio, describe the features of each solution and determine which solution is best suited to a specific environment.

    Published: 2022-12-06
    Length: 10 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: SXXW1108r4

15. **Technical Champions Webinar: Lenovo Edge Solutions: Unleash the Power of AI Solutions at the Edge**
    2022-10-13 | 60 minutes | Employees and Partners

    View this Technical Champions Webinar (recorded October 10, 2022) to learn about Lenovo's Edge solutions. Join Alejandro Perez Quintero as he discusses the elements of Edge computing, the growth of the Edge and the connection with AI.

    This webinar covers:
    - Drivers for Edge Technology
    - Lenovo Edge Solutions
    - Customer use cases

    Published: 2022-10-13
    Length: 60 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: DEDGP100

16. **Family Portfolio Edge Solutions - SE450 Quick Hit - Video**
    2022-02-11 | 3 minutes | Employees and Partners

    This video Quick Hit introduces the Lenovo ThinkEdge SE450, an edge server ideally suited to AI at the edge because of its processing power and support for GPUs.

    Published: 2022-02-11
    Length: 3 minutes
    Employee link: Grow@Lenovo
    Partner link: Lenovo Partner Learning
    Course code: SXXW1108r3v

Related publications and links

For more information, see these resources:

- Lenovo ThinkEdge SE450 product page:
  https://www.lenovo.com/us/en/p/data-center/servers/edge/thinkedge-se450-edge-server/len21te0002
- Interactive 3D Tour of the ThinkEdge SE450:
  https://lenovopress.com/lp1550
- ThinkEdge SE450 drivers and support
  https://datacentersupport.lenovo.com/products/servers/thinksystem/se450/7d8t/downloads
- Lenovo ThinkEdge SE450 product publications:
  https://pubs.lenovo.com/se450/
  - Quick Start Guide
  - Setup Guide
  - Maintenance Manual
  - Messages and Codes Reference
  - UEFI Manual
  - Rack installation guide (standard 1200mm rack)
  - Rack installation guide (550/600mm rack)
  - Rack installation guide (Two-post rack)
  - Wall-mounting configuration guide
  - Floor-standing configuration guide
- ServerProven hardware compatibility:
  http://www.lenovo.com/us/en/serverproven

Related product families

Product families related to this document are the following:

- Edge Computing and Internet of Things (IoT)
- Edge Servers
- ThinkEdge SE450 Edge Server

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