

Lenovo ThinkServer TS450

Product Guide (withdrawn product)

The Lenovo ThinkServer TS450 is the ideal server for small and medium businesses, remote or branch offices, and retail environments. It features the latest Intel Xeon processor E3-1200 v5 product family with four cores and support for up to 64 GB of 2133 MHz DDR4 UDIMM memory. Also, it offers an integrated 1 GbE NIC and additional PCIe expansion slots for advanced RAID protection and network scalability, including 10 GbE network connectivity. Up to 96 TB of internal enterprise-class storage supports storage-intensive workloads, such as office applications, web, e-mail and file and print serving, and provides growth capacity.

The following figure shows the Lenovo ThinkServer TS450.



Figure 1. Lenovo ThinkServer TS450

Did you know?

The TS450 offers enterprise-class reliability features such as error correcting code (ECC), hot-swap components, and advanced RAID protection with flexible storage configurations at an affordable price.

Intel Active Management Technology (AMT) built into the TS450 offers easy-to-use, industry-standard management tools for remote monitoring, updates, and repairs.

The TS450 runs a wide range of server operating systems, and it also supports client OS capability.

Key features

The ThinkServer TS450 server is a tower server that has been optimized to provide enterprise-class features to growing small-to-medium-sized businesses, retail stores, and distributed enterprises.

Scalability and performance

The TS450 offers numerous features to boost performance, improve scalability, and reduce costs:

- The Intel Xeon processor E3-1200 v5 improves productivity by offering affordable single-socket system performance with 4-core processors with up to 3.7 GHz core speeds and up to 8 MB cache.
- Intelligent and adaptive system performance with Intel Turbo Boost Technology 2.0 allows processor cores to run at maximum speeds during peak workloads by temporarily going beyond processor thermal design power (TDP).
- Intel Hyper-Threading Technology boosts performance for multithreaded applications by enabling simultaneous multithreading within each processor core, up to two threads per core.
- Intel Virtualization Technology integrates hardware-level virtualization hooks that allow operating system vendors to better use the hardware for virtualization workloads.
- Up to four 2133 MHz DDR4 ECC UDIMMs provide speed and capacity of up to 64 GB.
- The server offers PCI Express 3.0 I/O expansion capabilities that increase the theoretical maximum bandwidth by almost 100% (8 GTps per link using 128b/130b encoding) compared to the PCI Express 2.0 (5 GTps per link using 8b/10b encoding).
- With Intel Integrated I/O Technology, the PCI Express 3.0 controller is integrated into the Intel Xeon processor E3-1200 v5 product family. Such integration reduces I/O latency and increases overall system performance.
- Up to 16x 2.5-inch, or 8x 3.5-inch, or a combination of 8x 2.5-inch and 4x 3.5-inch hot-swap (HS) drive bays, including support for 2.5-inch SSDs in a 3.5-inch conversion tray, provide flexible internal storage configurations and capacity.
- The use of solid-state drives (SSDs) instead of, or along with, traditional spinning drives (hard disk drives or HDDs) can significantly improve I/O performance.

Availability and serviceability

The TS450 provides many features to simplify serviceability and increase system uptime:

- The TS450 supports UDIMM memory with ECC protection which provides error correction not available in PC-class "servers" that use parity memory. Avoiding system crashes (and data loss) due to soft memory errors means greater system uptime.
- Tool-less cover removal provides easy access to upgrades and serviceable parts, such as memory and adapter cards.
- A choice of affordable onboard SATA RAID or advanced hardware RAID redundancy offers data protection and greater system uptime.
- The use of SSDs can provide better reliability than the use of traditional HDDs, for greater uptime.
- Built-in Active Management Technology continuously monitors system parameters, sends alerts, and enables administrators to perform remote recovery actions to minimize downtime.
- The ThinkServer EasyUpdate firmware update tool enables you to keep your server firmware up-to-date and helps you avoid unnecessary server outages.
- The ThinkServer Diagnostics software speeds up troubleshooting tasks to reduce service time.
- One-year or three-year customer-replaceable unit (CRU) and onsite limited warranty with next business day response. Optional service upgrades are available.

Manageability and security

Powerful systems management features simplify local and remote management of the TS450:

- Active Management Technology monitors server availability and enables administrators to perform remote management.
- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- The ThinkServer EasyStartup tool simplifies the process of configuring RAID and installing supported Microsoft Windows and Linux operating systems, VMware hypervisors, and device drivers on a ThinkServer system.
- Optional Trusted Cryptographic Module (TCM) (available only in China) enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Administrator's and power-on passwords help protect from unauthorized access to the server.
- Optional server locks such as a padlock, cable lock, or lockable front cover help prevent unauthorized access to the internal components of the server, and the intrusion switch (select models) informs about the removed or improperly installed server cover.

Energy efficiency

The TS450 offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to a green environment:

- Energy-efficient planar components help lower operational costs.
- 80 PLUS Platinum-certified or Gold-certified power supplies enable greater energy savings while providing flexibility to meet your business needs.
- Intelligent Cooling Engine (ICE) actively monitors component temperatures in real-time and optimally adjusts the speeds of the fans to keep the system cooler and quieter.
- The ThinkServer Power Planner tool provides information about the power consumption and electric current calculation for the different configurations of servers and other devices, which helps plan deployment of servers and devices in an efficient way.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed, to reduce power draw.

Components and connectors

The following figure shows the front of the TS450.

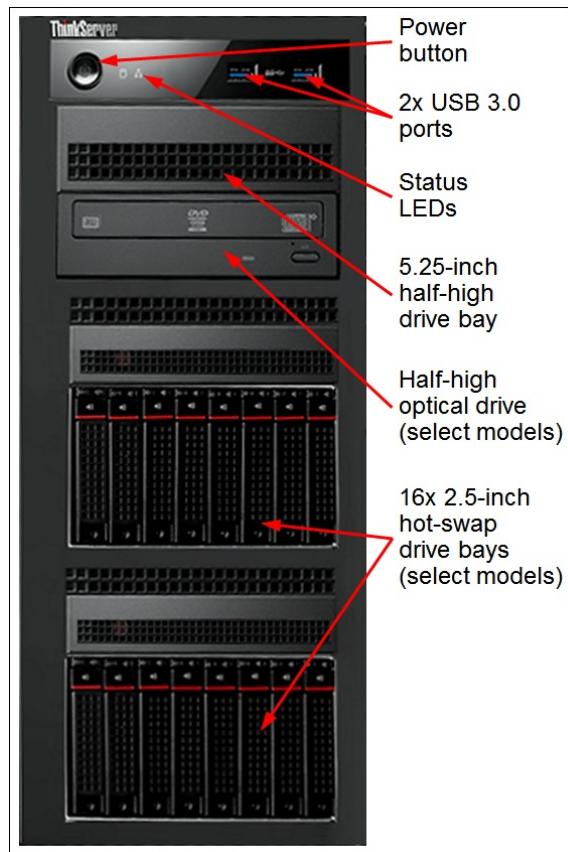


Figure 2. TS450 front view (with 16x 2.5-inch hot-swap drive bays)

The following figure shows the rear of the TS450.

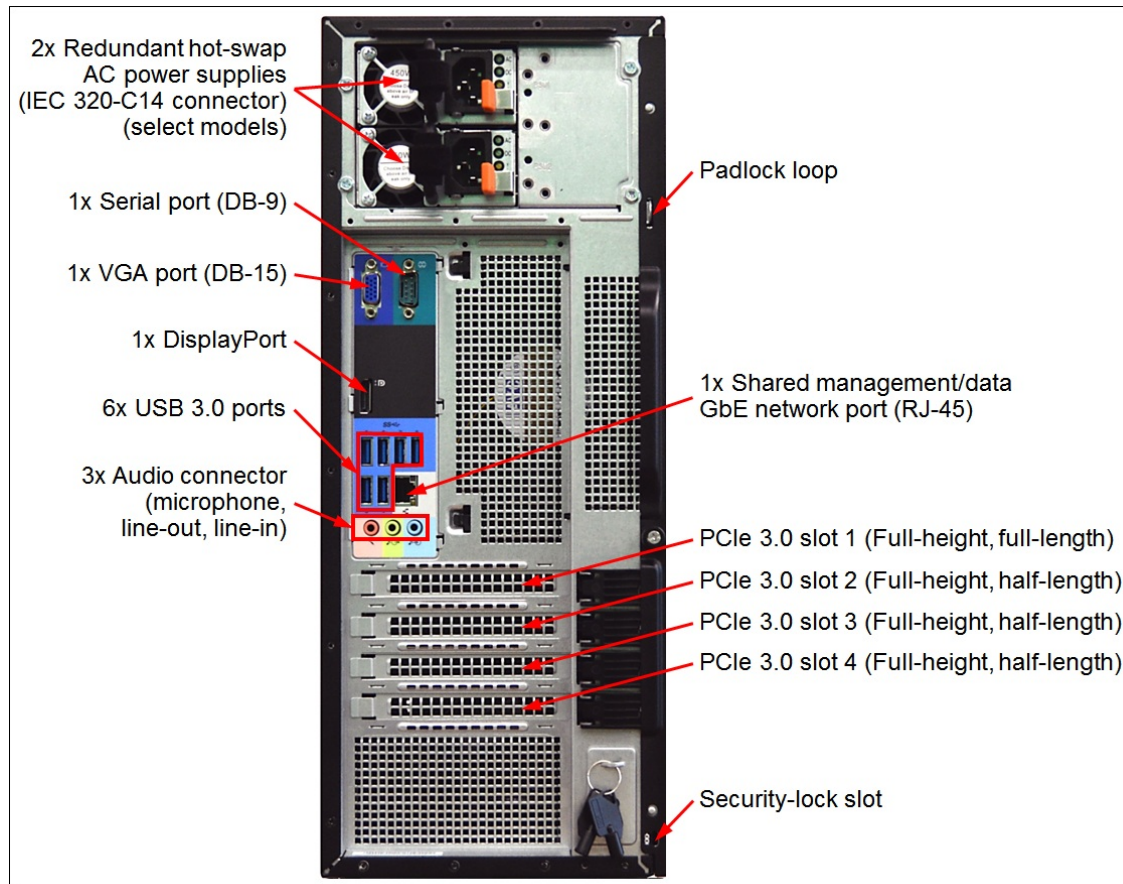


Figure 3. TS450 rear view

The following figure shows the internal components of the TS450.

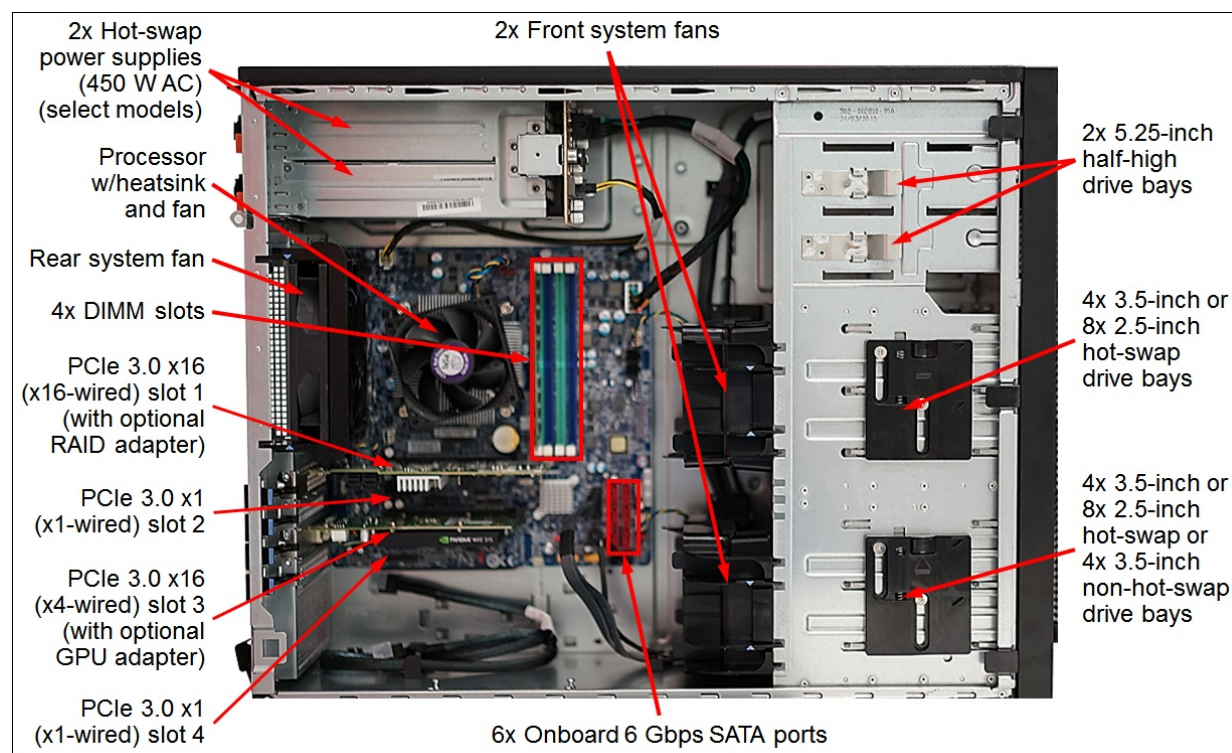


Figure 4. TS450 internal view

System specifications

The following table lists the system specifications.

Table 1. System specifications

Attribute	Specification
Form factor	Tower or 5U rack-mount (on a shelf)
Processor	One processor: <ul style="list-style-type: none"> Intel Xeon processor E3-1200 v5 product family with four cores up to 3.7 GHz, 8 MB cache, and up to 2133 MHz memory speed; or Intel Core i3 processor 6100/6300 product families with two cores up to 3.9 GHz, up to 4 MB cache, and 2133 MHz memory speed; or Intel Pentium processor G4400/G4500 product families with two cores up to 3.6 GHz, 3 MB cache, and up to 2133 MHz memory speed.
Chipset	Intel C236.
Memory	Four DIMM sockets. Support for ECC UDIMMs. DIMM speeds up to 2133 MHz.
Memory capacity	Up to 64 GB with four 16 GB UDIMMs.
Memory protection	Error-correcting code (ECC) memory.
Drive bays	<ul style="list-style-type: none"> 4x 3.5-inch non-hot-swap SATA drive bays 4x 3.5-inch (standard) + 4x 3.5-inch (optional) hot-swap SATA drive bays 8x 2.5-inch (standard) + 8x 2.5-inch (optional) hot-swap SATA drive bays 4x 3.5-inch (standard) + 8x 2.5-inch (optional) hot-swap SATA drive bays Optional 2x SD card slots.

Attribute	Specification
Drive types	<p>2.5-inch hot-swap drives:</p> <ul style="list-style-type: none"> • SAS HDDs up to 1.8 TB • Nearline (NL) SATA HDDs up to 2 TB • SAS SSDs up to 3.84 TB • SATA SSDs up to 3.84 TB <p>3.5-inch hot-swap drives:</p> <ul style="list-style-type: none"> • NL SAS HDDs up to 10 TB • NL SATA HDDs up to 12 TB • SAS SSDs (2.5-inch SSD in a 3.5-inch tray) up to 3.84 TB • SATA SSDs (2.5-inch SSD in a 3.5-inch tray) up to 3.84 TB <p>3.5-inch non-hot-swap drives:</p> <ul style="list-style-type: none"> • NL SATA HDDs up to 12 TB <p>SD cards up to 8 GB.</p> <p>Intermix of SAS/NL SAS and SATA HDDs and SSDs is supported within a system, but not within a RAID array.</p>
Internal storage capacity	<p>2.5-inch hot-swap drives:</p> <ul style="list-style-type: none"> • Up to 32 TB with 16x 2 TB NL SATA HDDs • Up to 28.8 TB with 16x 1.8 TB SAS HDDs • Up to 61.4 TB with 16x 3.84 TB SAS or SATA SSDs <p>3.5-inch hot-swap drives:</p> <ul style="list-style-type: none"> • Up to 80 TB with 8x 10 TB NL SAS HDDs • Up to 96 TB with 8x 12 TB NL SATA HDDs • Up to 30.7 TB with 8x 3.84 TB SAS or SATA SSDs <p>3.5-inch non-hot-swap drives:</p> <ul style="list-style-type: none"> • Up to 48 TB with 4x 12 TB NL SATA HDDs
RAID support	<ul style="list-style-type: none"> • Non-RAID with the integrated SATA controller. • RAID 0, 1, 10, and 5 with ThinkServer RAID 121i. • RAID 0, 1, 10 with ThinkServer RAID 520i. Optional RAID 5, 50 upgrade. • RAID 0, 1, 10, 5, 50 with ThinkServer RAID 720i. Optional RAID 6, 60 (with a cache upgrade).
Optical drive bays	Two without a backup drive or one with a backup drive. Support for DVD-ROM or DVD-RW.
Backup drive bays	One. Support for RDX or LTO-6 backup drive.
Network interfaces	One integrated Gigabit Ethernet (10/100/1000 Mbps) RJ-45 port (Intel I219LM): A shared port for management and data.
I/O expansion slots	<ul style="list-style-type: none"> • Slot 1: PCIe 3.0 x16 (x16-wired); full-height, full-length • Slot 2: PCIe 3.0 x1 (x1-wired); full-height, half-length • Slot 3: PCIe 3.0 x16 (x4-wired); full-height, half-length • Slot 4: PCIe 3.0 x1 (x1-wired); full-height, half-length
Ports	<ul style="list-style-type: none"> • Front: 2x USB 3.0 ports. • Rear: 6x USB 3.0 ports, 1x DisplayPort port, 1x DB-15 VGA port, 1x DB-9 serial port, 1x RJ-45 GbE network port, 3x audio connectors (line-in, line-out, microphone).
Cooling	Four fixed system fans with Intelligent Cooling Engine (ICE).
Power supply	One fixed 400 W AC (100 - 240 V) power supply (80 PLUS Platinum) or up to two redundant hot-swap 450 W AC (100 - 240 V) power supplies (80 PLUS Gold).
Hot-swap parts	HDDs and SSDs (select models), power supplies (select models).
Systems management	UEFI, system LEDs, ThinkServer EasyStartup, ThinkServer EasyUpdate, ThinkServer Power Planner, and ThinkServer Diagnostics, Intel Active Management Technology (AMT) 11.

Attribute	Specification
Security features	Power-on password, administrator's password, Intrusion Switch (select models), Trusted Cryptographic Module (TCM) (optional), lockable front door, security-lock slot, and padlock loop.
Video	<ul style="list-style-type: none"> Intel HD Graphics integrated into a processor (select models). NVS 315 Graphic Adapter by NVIDIA (select models). Maximum resolution is 1920x1200 at 60 Hz with 32 bits per pixel (16M colors).
Operating systems	Microsoft Windows 10; Microsoft Windows Server 2012, 2012 R2, and 2016; Red Hat Enterprise Linux (RHEL) Server 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; VMware vSphere (ESXi) 5.5 and 6.0.
Warranty	One-year or three-year (model dependent) customer-replaceable unit (CRU) and on-site limited warranty with 9x5 next business day (NBD).
Service and support	Optional service upgrades (country-specific) are available through Lenovo Services offerings: 8-hour or 4-hour response time, warranty extension up to 5 years, Priority Technical Support, and Keep Your Drive Multi-Drive.
Dimensions	Height: 430 mm (16.9 in.), width: 173 mm (6.8 in.), depth: 566 mm (22.3 in.)
Weight	Minimum: 18.0 kg (39.7 lb); maximum: 26.5 kg (57.3 lb)

Relationship models

TS450 relationship models are region-specific; that is, each region may define their own server models, and not all server models are available in every region.

For a list of the TS450 relationship models (Machine Types 70LY and 70M1), contact a Lenovo or Lenovo Business Partner representative in your region.

Product availability: TS450 server models are available in Asia Pacific (Hong Kong, Korea, Singapore, Taiwan, Thailand) and China.

The TS450 server models are shipped with the following items:

- *Electronic Publications* Flyer
- *ThinkServer EasyStartup Quick Start Guide* printed publication
- One (fixed power supply models) or two (hot-swap power supply models) line cords

TopSeller models

TS450 TopSeller models are region-specific; that is, each region may define their own server models, and not all server models are available in every region.

For a list of the TS450 TopSeller models (Machine Types 70M0 and 70M2), contact a Lenovo or Lenovo Business Partner representative in your region.

Product availability: TS450 server models are available in Asia Pacific (Hong Kong, Korea, Singapore, Taiwan, Thailand) and China.

The TS450 server models are shipped with the following items:

- *Electronic Publications* Flyer
- *ThinkServer EasyStartup Quick Start Guide* printed publication
- One (fixed power supply models) or two (hot-swap power supply models) line cords

Processors

The TS450 supports one processor. The following table lists the specifications of the processors that are available for the TS450.

Table 2. Processor specifications (Hyper-Threading [HT], Turbo Boost [TB], Virtualization Technology [VT])

Processor model	Core frequency (Base / TB Max)	Cores / Threads	Cache	Max DDR4 frequency	TDP	HT	TB	VT-x	VT-d	IG#	Mgmt*
Intel Xeon processors											
E3-1220 v5	3 / 3.5 GHz	4 / 4	8 MB	2133 MHz	80 W	No	Yes	Yes	Yes	No	AMT
E3-1225 v5	3.3 / 3.7 GHz	4 / 4	8 MB	2133 MHz	80 W	No	Yes	Yes	Yes	Yes	AMT
E3-1230 v5	3.4 / 3.8 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	No	AMT
E3-1240 v5	3.5 / 3.9 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	No	AMT
E3-1245 v5	3.5 / 3.9 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	Yes	AMT
E3-1270 v5	3.6 / 4 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	No	AMT
E3-1275 v5	3.6 / 4 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	Yes	AMT
E3-1280 v5	3.7 / 4 GHz	4 / 8	8 MB	2133 MHz	80 W	Yes	Yes	Yes	Yes	No	AMT
Intel Core processors											
i3-6100	3.7 GHz	2 / 4	3 MB	2133 MHz	51 W	Yes	No	Yes	Yes	Yes	ISM
i3-6100T	3.2 GHz	2 / 4	3 MB	2133 MHz	35 W	Yes	No	Yes	Yes	Yes	ISM
i3-6300	3.8 GHz	2 / 4	4 MB	2133 MHz	51 W	Yes	No	Yes	Yes	Yes	ISM
i3-6300T	3.3 GHz	2 / 4	4 MB	2133 MHz	35 W	Yes	No	Yes	Yes	Yes	ISM
i3-6320	3.9 GHz	2 / 4	4 MB	2133 MHz	51 W	Yes	No	Yes	Yes	Yes	ISM
Intel Pentium processors											
G4400	3.3 GHz	2 / 2	3 MB	2133 MHz	54 W	No	No	Yes	Yes	Yes	ISM
G4400T	2.9 GHz	2 / 2	3 MB	2133 MHz	35 W	No	No	Yes	Yes	Yes	ISM
G4500	3.5 GHz	2 / 2	3 MB	2133 MHz	51 W	No	No	Yes	Yes	Yes	ISM
G4500T	3 GHz	2 / 2	3 MB	2133 MHz	35 W	No	No	Yes	Yes	Yes	ISM
G4520	3.6 GHz	2 / 2	3 MB	2133 MHz	51 W	No	No	Yes	Yes	Yes	ISM

* Mgmt = Management

IG = Intel Integrated HD Graphics

Memory

Lenovo DDR4 memory is compatibility tested and tuned for optimal ThinkServer performance and throughput. From a service and support standpoint, Lenovo memory automatically assumes the system warranty, and Lenovo provides service and support worldwide.

The TS450 server has four DIMM slots, and it supports DDR4 UDIMMs with ECC memory protection. The processor has two memory channels and supports two DIMMs per channel.

The following rules apply when selecting the memory configuration:

- The TS450 server supports memory configurations with 1, 2, 3, or 4 UDIMMs.
- The TS450 server supports up to 2133 MHz memory speeds for one DIMM per channel and two DIMMs per channel configurations, provided that the processors support this memory speed (see the Processor options table in the Processors section for details).

The following table summarizes memory speeds and capacities that are supported by the TS450 server.

Table 3. TS450 maximum memory speeds and capacities

DIMMs per channel	UDIMM	
	Memory bus speed	Maximum capacity
1 DPC	2133 MHz	32 GB (2x 16 GB)
2 DPC	2133 MHz	64 GB (4x 16 GB)

The following table lists the memory options that are available for the TS450 server.

Table 4. Memory options

Description	Part number	Maximum supported
ThinkServer 4GB 1RX8 PC4-2133-E CL15 DDR4-2133 ECC-UDIMM	4X70G88315	4
ThinkServer 8GB 2RX8 PC4-2133-E CL15 DDR4-2133 ECC-UDIMM	4X70G88316	4
ThinkServer 16GB 2RX8 PC4-2133-E CL15 DDR4-2133 ECC-UDIMM	4X70G88317	4

Internal storage

The TS450 server supports the following internal storage configurations:

1. 4x 3.5-inch non-hot-swap drive bays + optical drive bay + optical or backup drive bay
2. 4x 3.5-inch + 4x 3.5-inch hot-swap drive bays + optical drive bay + optical or backup drive bay
3. 8x 2.5-inch + 8x 2.5-inch hot-swap drive bays + optical drive bay + optical or backup drive bay
4. 4x 3.5-inch + 8x 2.5-inch hot-swap drive bays + optical drive bay + optical or backup drive bay

These configurations are shown in the following figure.

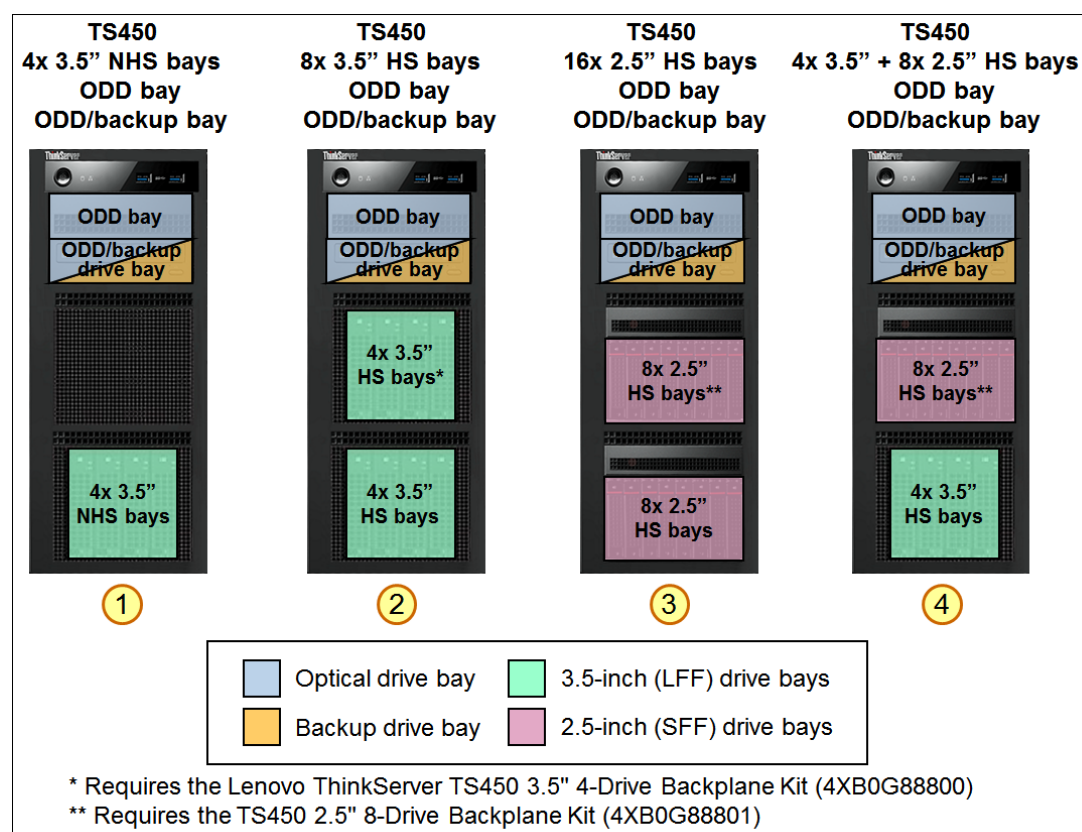


Figure 5. Internal storage configurations

The following table lists the internal storage expansion options that are available for the TS450 server.

Table 5. Internal storage expansion options

Description	Part number	Maximum supported
ThinkServer TS450 3.5" 4-Drive Backplane Kit	4XB0G88800	1
ThinkServer TS450 2.5" 8-Drive Backplane Kit	4XB0G88801	1
ThinkServer SDHC Flash Assembly Module	4XF0G88933	1

Configuration notes:

- The TS450 3.5" 4-Drive Backplane Kit adds 4x 3.5-inch hot-swap drive bays to the TS450 models with 4x 3.5-inch hot-swap drive bays for a total of eight drive bays.
- The TS450 2.5" 8-Drive Backplane Kit adds 8x 2.5-inch hot-swap drive bays to the following TS450 models:
 - Models with 8x 2.5-inch hot-swap drive bays for a total of 16 SFF drive bays.
 - Models with 4x 3.5-inch hot-swap drive bays for hybrid 4x LFF + 8x SFF storage configurations.
- The TS450 2.5" 8-Drive Backplane Kit requires the RAID Expander Card (4XC0G88843).
- The SDHC Flash Assembly Module adds support for the use of up to two SD cards in the server.

Controllers for internal storage

The following table lists the internal RAID controllers and the additional options that are used for the internal disk storage of the TS450 server.

Table 6. Controllers for internal storage

Description	Part number	Maximum supported
RAID controllers		
ThinkServer RAID 121i Controller	None#	1
ThinkServer RAID 520i PCIe Adapter	4XC0G88840	1
ThinkServer RAID 520i RAID 5 Upgrade	4XC0G88841	1
ThinkServer RAID 720i PCIe Adapter	4XC0G88831	1
ThinkServer RAID 720i 1GB Modular DRAM Upgrade	4XB0F28695	1
ThinkServer RAID 720i 1GB Modular Flash and Supercapacitor Upgrade	4XB0F28696	1
ThinkServer RAID 720i 2GB Modular Flash and Supercapacitor Upgrade	4XB0F28697	1
ThinkServer RAID 720i 4GB Modular Flash and Supercapacitor Upgrade	4XB0F28698	1
SAS expander adapters		
ThinkServer 12Gb RAID Expander Card	4XC0G88843	1

RAID 121i is an onboard hardware-assist RAID controller.

The RAID 121i is an onboard RAID controller that does *not* consume a PCIe slot. The RAID 520i and RAID 720i adapters are supported only in the PCIe slot 1. The RAID Expander Card is supported only in the PCIe slot 3.

Important: The RAID 121i controller is not supported by virtualization hypervisors, including VMware vSphere (ESXi), Linux KVM, Xen, and Microsoft Hyper-V.

The following table summarizes features of supported internal storage controllers.

Table 7. Internal storage controller features and specifications summary

Feature	RAID 121i	RAID 520i	RAID 720i
Part number	None	4XC0G88840	4XC0G88831
Form factor	Onboard	Low profile	Low profile
Controller chip	Not applicable*	LSI SAS3008	LSI SAS3108
Host interface	Not applicable*	PCIe 3.0 x8	PCIe 3.0 x8
Port interface	6 Gbps SATA	12 Gbps SAS	12 Gbps SAS
Number of internal drive ports	6**	8	8
Internal port connectors	6x L-shape SATA	2x Mini-SAS HD x4 (SFF-8643)	2x Mini-SAS HD x4 (SFF-8643)
Drive interface	SATA	SAS, SATA	SAS, SATA
Drive type	HDD, SSD	HDD, SSD	HDD, SSD
Non-hot-swap drive support	Yes	No†	No
Hot-swap drive support	Yes	Yes	Yes
Optical drive support	Yes	No	No
Maximum number of drives	6**	16#	16#
RAID levels	0/1/10/5	0/1/10, Optional 5/50 (4XC0G88841)	0/1/10/5/50, Optional 6/60 with a cache upgrade
JBOD mode	Yes	Yes	Yes (without cache)
Cache	None	None	Optional: <ul style="list-style-type: none"> • 1 GB non-backed (4XB0F28695) • 1 GB flash-backed (4XB0F28696) • 2 GB flash-backed (4XB0F28697) • 4 GB flash-backed (4XB0F28698)
Cache protection	None	None	Yes (with flash backup)
FastPath	None	None	Yes (with flash backup)
CacheCade Pro 2.0	None	None	Yes (with flash backup)

* The RAID 121i is a hardware-assist, software RAID feature (Intel Rapid Storage Technology Enterprise [RSTe]) integrated into the Intel C236 Platform Controller Hub (PCH).

** Up to four ports are used for SATA HDDs or SSDs, and the remaining two ports are used for optical drives; or up to five ports are used for SATA HDDs or SSDs, and the remaining port is used for an optical drive.

† The RAID 520i does not support non-hot-swap HDDs and SSDs in the TS450 server; however, the RAID 520i might support non-hot-swap HDDs and SSDs in other servers (for example, in the TS150 server).

Support for up to 16 HDDs or SSDs requires the RAID Expander Card (4XC0G88843). Without the RAID Expander Card, up to eight HDDs or SSDs are supported.

The following table lists drive types and bay configurations supported by the internal storage controllers.

Table 8. Storage controllers, drive types, and internal drive bays

Storage controller	Drive type	4x 3.5" NHS	4x 3.5" HS	8x 3.5" HS	8x 2.5" HS	16x 2.5" HS	4x 3.5" + 8x 2.5" HS
RAID 121i	SAS/NL SAS HDD	No support	No support	No support	No support	No support	No support
	NL SATA HDD	Yes	Yes	No support	No support	No support	No support
	SATA SSD	Not applicable	Yes	No support	No support	No support	No support
RAID 520i	SAS/NL SAS HDD	No support	Yes	Yes	Yes	Yes*	Yes*
	NL SATA HDD	No support	Yes	Yes	Yes	Yes*	Yes*
	SATA SSD	No support	Yes	Yes	Yes	Yes*	Yes*
RAID 720i	SAS/NL SAS HDD	No support	Yes	Yes	Yes	Yes*	Yes*
	NL SATA HDD	No support	Yes	Yes	Yes	Yes*	Yes*
	SATA SSD	No support	Yes	Yes	Yes	Yes*	Yes*

* Support for more than eight drives requires the RAID Expander Card (4XC0G88843).

Drives for internal storage

The TS450 server supports the internal drive options listed in the following tables.

Table 9. Internal storage: 3.5-inch non-hot-swap drives

Description	Part number	Maximum supported
3.5-inch non-hot-swap HDDs - NL SATA 6 Gbps		
ThinkServer TS450 3.5" 500GB 7.2K Enterprise SATA 6Gbps Easy Swap Hard Drive	4XB0G88759	4
ThinkServer Gen 5 3.5" 1TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12282	4
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12283	4
ThinkServer Gen 5 3.5" 3TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12284	4
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12285	4
ThinkServer Gen 5 3.5" 5TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12280	4
ThinkServer Gen 5 3.5" 6TB 7.2K Enterprise SATA 6Gbps Non-Hot Plug Hard Drive	4XB0K12281	4
ThinkServer Gen 5 3.5" 12TB 7.2K Enterprise SATA 6Gbps NHS 512e HDD	4XB0N68535	4

Table 10. Internal storage: 3.5-inch hot-swap drives

Description	Part number	Maximum supported
3.5-inch hot-swap HDDs (2.5-inch HDD in 3.5-inch drive tray) - SAS 12 Gbps		
ThinkServer Gen5 2.5" 300GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88733	8
ThinkServer Gen5 2.5" 300GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88740	8
ThinkServer Gen5 2.5" 450GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88744	8
ThinkServer Gen5 2.5" 600GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88761	8
ThinkServer Gen5 2.5" 600GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88746	8
ThinkServer Gen5 2.5" 900GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88762	8
ThinkServer Gen5 2.5" 1.2TB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88763	8

Description	Part number	Maximum supported
ThinkServer Gen5 2.5" 1.8TB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88738	8
3.5-inch hot-swap HDDs - NL SAS 12 Gbps		
ThinkServer Gen 5 3.5" 1TB 7.2K Enterprise SAS 12Gbps HS HDD (512n)	4XB0K12270	8
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SAS 12Gbps HS HDD (512e)	4XB0G88730	8
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SAS 12Gbps HS HDD (512n)	4XB0K12278	8
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SAS 12Gbps HS HDD (512e)	4XB0G88731	8
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SAS 12Gbps HS HDD (512n)	4XB0K12279	8
ThinkServer Gen 5 3.5" 6TB 7.2K Enterprise SAS 12Gbps HS HDD (512e)	4XB0G88715	8
ThinkServer Gen 5 3.5" 10TB 7.2K Enterprise SAS 12Gbps 512e HS HDD	4XB0K12398	8
3.5-inch hot-swap HDDs - NL SATA 6 Gbps		
ThinkServer TS450 3.5" 500GB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G88799	8
ThinkServer Gen 5 3.5" 1TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0F28712	8
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0F28713	8
ThinkServer Gen 5 3.5" 3TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0F28714	8
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G45715	8
ThinkServer Gen 5 3.5" 5TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G88712	8
ThinkServer Gen 5 3.5" 6TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G88713	8
ThinkServer Gen 5 3.5" 10TB 7.2K Enterprise SATA 6Gbps 512e Hot Swap HDD	4XB0K12399	8
ThinkServer Gen 5 3.5" 12TB 7.2K Enterprise SATA 6Gbps Hot Swap 512e HDD	4XB0N68532	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - Enterprise Performance (SS300) 12 Gbps SAS		
ThinkServer Gen 5 3.5" 400GB Enterprise Performance SAS 12Gb HS SSD	4XB0K12412	8
ThinkServer Gen 5 3.5" 800GB Enterprise Performance SAS 12Gb HS SSD	4XB0K12413	8
ThinkServer Gen 5 3.5" 1.6TB Enterprise Performance SAS 12Gb HS SSD	4XB0K12414	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - 5100 Enterprise Mainstream SATA 6 Gbps		
ThinkServer Gen 5 3.5" 240GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12421	8
ThinkServer Gen 5 3.5" 480GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12423	8
ThinkServer Gen 5 3.5" 960GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12425	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - Enterprise Capacity 12 Gbps SAS		
ThinkServer 3.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	4XB0K12388	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - 5100 Enterprise Entry 6 Gbps SATA		
ThinkServer Gen 5 3.5" 480GB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0N68491	8
ThinkServer Gen 5 3.5" 960GB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0N68493	8
ThinkServer Gen 5 3.5" 1.92TB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0N68495	8
ThinkServer Gen 5 3.5" 3.84TB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0N68496	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - PM863a Enterprise Entry SATA 6 Gbps		
ThinkServer 3.5" 240GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12358	8
ThinkServer 3.5" 480GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12360	8
ThinkServer 3.5" 960GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12362	8
3.5-inch hot-swap SSDs (2.5-inch SSD in 3.5-inch drive tray) - S3520 Enterprise Entry SATA 6 Gbps		
ThinkServer Gen 5 3.5" 240GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12327	8
ThinkServer Gen 5 3.5" 480GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12330	8

Description	Part number	Maximum supported
ThinkServer Gen 5 3.5" 960GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12333	8

Table 11. Internal storage: 2.5-inch hot-swap drives

Description	Part number	Maximum supported
2.5-inch hot-swap HDDs - SAS 12 Gbps		
ThinkServer Gen 5 2.5" 300GB 10K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88732	16
ThinkServer Gen 5 2.5" 300GB 15K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88739	16
ThinkServer Gen 5 2.5" 450GB 15K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88743	16
ThinkServer Gen 5 2.5" 600GB 10K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88734	16
ThinkServer Gen 5 2.5" 600GB 15K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88765	16
ThinkServer Gen 5 2.5" 900GB 10K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88735	16
ThinkServer Gen 5 2.5" 1.2TB 10K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88736	16
ThinkServer Gen 5 2.5" 1.8TB 10K Enterprise SAS 12Gbps Hot Swap Hard Drive	4XB0G88737	16
2.5-inch hot-swap HDDs - NL SATA 6 Gbps		
ThinkServer Gen 5 2.5" 1TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G45721	16
ThinkServer Gen 5 2.5" 2TB 7.2K Enterprise SATA 6Gbps Hot Swap Hard Drive	4XB0G88774	16
2.5-inch hot-swap SSDs - Enterprise Performance (SS300) 12 Gbps SAS		
ThinkServer Gen 5 2.5" 400GB Enterprise Performance SAS 12Gb HS SSD	4XB0K12409	16
ThinkServer Gen 5 2.5" 800GB Enterprise Performance SAS 12Gb HS SSD	4XB0K12410	16
ThinkServer Gen 5 2.5" 1.6TB Enterprise Performance SAS 12Gb HS SSD	4XB0K12411	16
2.5-inch hot-swap SSDs - Enterprise Capacity 12 Gbps SAS		
ThinkServer 2.5" 3.84TB PM1633a Enterprise Capacity SAS 12Gbps HS SSD	4XB0K12387	16
2.5-inch hot-swap SSDs - 5100 Enterprise Mainstream SATA 6 Gbps		
ThinkServer Gen 5 2.5" 240GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12416	16
ThinkServer Gen 5 2.5" 480GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12417	16
ThinkServer Gen 5 2.5" 960GB 5100 Enterprise Mainstream SATA 6Gbps HS SSD	4XB0K12418	16
2.5-inch hot-swap SSDs - 5100 Enterprise Entry 6 Gbps SATA		
ThinkServer Gen 5 2.5" 480GB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0K12441	16
ThinkServer Gen 5 2.5" 960GB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0K12442	16
ThinkServer Gen 5 2.5" 1.92TB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0K12443	16
ThinkServer Gen 5 2.5" 3.84TB 5100 Enterprise Entry SATA 6Gbps HS SSD	4XB0K12444	16
2.5-inch hot-swap SSDs - PM863a Enterprise Entry SATA 6 Gbps		
ThinkServer 2.5" 240GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12357	16
ThinkServer 2.5" 480GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12359	16
ThinkServer 2.5" 960GB PM863a Enterprise Entry SATA 6Gbps HS SSD	4XB0K12361	16
2.5-inch hot-swap SSDs - S3520 Enterprise Entry SATA 6 Gbps		
ThinkServer Gen 5 2.5" 240GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12326	16
ThinkServer Gen 5 2.5" 480GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12329	16
ThinkServer Gen 5 2.5" 960GB S3520 Entry SATA 6Gbps Hot Swap SSD	4XB0K12332	16

Table 12. Internal storage: SD cards

Description	Part number	Maximum supported
SD cards		
ThinkServer 8GB SD Card	4X70F28592	2

Optical drives

The TS450 server supports the optical drive options listed in the following table.

Table 13. Optical drive options

Description	Part number	Maximum supported
ThinkServer Half High SATA DVD-RW Optical Disk Drive	4XA0F28605	2
ThinkServer Half High SATA DVD-ROM Optical Disk Drive	4XA0F28606	2

The SATA Optical Disk Drives support the following types of media: CD-R, CD-ROM, CD-RW, DVD-R, DVD-R (dual-layer recording), DVD-RW, DVD+R, DVD+R (dual-layer recording), and DVD+RW.

Configuration notes: If two optical drives are used, an internal backup unit is not supported.

Internal backup units

The TS450 server supports the internal backup unit options listed in the following table.

Table 14. Internal backup unit options

Description	Part number	Maximum supported
Internal RDX backup unit (USB)		
ThinkServer Internal RDX Tape Drive	4XF0F28769	1
Cartridges for RDX backup unit		
ThinkServer 1TB SATA 3Gbps RDX Cartridge	4XB0F28660	1
ThinkServer 2TB SATA 3Gbps RDX Cartridge	4XB0G88711	1
Internal LTO-6 tape drive (SAS)		
ThinkServer LTO-6 Linear Tape Drive Kit by Tandberg	4XF0G45866	1
Cartridges for LTO-6 tape drive		
ThinkServer 2.5TB LTO-6 Tape	4XB0F28689	1

Configuration notes:

- If an internal backup unit is used, a maximum of one optical drive is supported.
- The LTO-6 tape drive requires the RAID 520i adapter.
- If the LTO-6 tape drive is used, the maximum number of internal drives is limited to four.

I/O expansion

The TS450 server has four I/O expansion slots:

- Slot 1: PCIe 3.0 x16 (x16-wired); full-height, full-length
- Slot 2: PCIe 3.0 x1 (x1-wired); full-height, half-length
- Slot 3: PCIe 3.0 x16 (x4-wired); full-height, half-length
- Slot 4: PCIe 3.0 x1 (x1-wired); full-height, half-length

The following adapter types are supported:

- RAID adapters (Refer to the Controllers for internal storage and External storage adapters sections)
- Network adapters (Refer to the Network adapters section)
- Host bus adapters (Refer to the External storage adapters section)

Network adapters

The TS450 server has one integrated Gigabit Ethernet port that is based on the Intel I219LM NIC (a shared port for operating system access and management network).

The onboard NIC has the following features:

- 1 Gb Ethernet IEEE 802.3, 802.3u, and 802.3ab PHY specifications compliant
- Integrated PHY for 10/100/1000 Mbps with speed and duplex auto-negotiation
- Energy Efficient Ethernet (IEEE 802.3az)
- Wake on LAN
- VLAN tagging (IEEE 802.1Q)
- Class of Service (CoS) priority (IEEE 802.1p) marking
- TCP/UDP checksum and segmentation offload (IPv4 and IPv6)
- Receive Side Scaling
- Jumbo Frames (up to 9K)
- Timing and Synchronization (IEEE 802.1as / IEEE 1588)
- Load balancing and failover teaming support:
 - Adapter fault tolerance (AFT)
 - Switch fault tolerance (SFT)
 - Adaptive load balancing (ALB)

The following table lists the network adapter options for the TS450 server.

Table 15. Network adapter options

Description	Part number	Maximum supported
ThinkServer I210-T1 PCIe 1Gb 1-Port Base-T Ethernet Adapter by Intel (1x RJ-45 port)	4XC0G88844	2
ThinkServer I350-T2 PCIe 1Gb 2 Port Base-T Ethernet Adapter by Intel (2x RJ-45 ports)	4XC0F28730	2
ThinkServer I350-T4 PCIe 1Gb 4 Port Base-T Ethernet Adapter by Intel (4x RJ-45 ports)	4XC0F28731	2
ThinkServer X540-T2 PCIe 10Gb 2 Port Base-T Ethernet Adapter by Intel (2x RJ-45 ports)	4XC0F28732	1*

* If the X540-T2 adapter is used, the RAID 520i, RAID 720i, 9300-8e, and 9380-8e adapters cannot be used.

SAS adapters for external storage

The following table lists the RAID adapter and HBA options that can be used for external storage attachments.

Table 16. RAID adapter and HBA options for external storage

Description	Part number	Maximum supported
RAID adapters - 12 Gb SAS		
ThinkServer 9380-8e PCIe 12Gb 8 port External SAS RAID Adapter by LSI-Avago (2x external Mini-SAS HD SFF-8644 connectors)	4XC0G88845	1
Options for RAID adapters		
Lenovo ThinkServer CacheVault Data Protection Upgrade II (Required for 4XC0G88845)	4XB0G45761	1
Host bus adapters - 12 Gb SAS		
ThinkServer 9300-8e PCIe 12Gb 8 Port External SAS Adapter by LSI (2x external Mini-SAS HD SFF-8644 connectors)	4XB0F28703	1

Configuration notes:

- Up to one adapter for external storage is supported in the server; that is, you can select only one of the adapters that are shown in the preceding table, if needed.
- If the RAID 520i, RAID 720i, or X540-T2 PCIe adapters are used in the server, the adapters for external storage cannot be used.

The following table summarizes features of supported SAS storage controllers.

Table 17. Drive controller features and specifications summary

Feature	9380-8e	9300-8e
Part number	4XB0F28645	4XB0F28703
Form factor	Low profile	Low profile
Controller chip	LSI SAS3108	LSI SAS3008
Host interface	PCIe 3.0 x8	PCIe 3.0 x8
Port interface	12 Gbps SAS	12 Gbps SAS
Number of external ports	8	8
External port connectors	2x Mini-SAS HD (SFF-8644)	2x Mini-SAS HD (SFF-8644)
Drive interface	SAS, SATA	SAS, SATA
Drive type	HDD, SSD	HDD, SSD
Maximum number of devices	240	1024
RAID levels	0/1/10/5/50/6/60	None
JBOD mode	No	Yes
Cache	1 GB	None
Cache protection	Flash backup required (4XB0G45761)	None
FastPath	Included	None
CacheCade Pro 2.0	None	None

GPU adapters

The TS450 server supports the GPU adapter options that are listed in the following table.

Note: A GPU adapter must be configured for server models that use processors without integrated graphics; a GPU adapter is optional for server models that use processors with integrated graphics.

Table 18. GPU adapter options

Description	Part number	Maximum supported
ThinkServer 1GB NVS 315 PCIe x16 Graphic Adapter by NVIDIA	4X60G88210	1

Power supplies

The TS450 server supports one 400 W AC (100-240 V) fixed power supply (80 PLUS Platinum) or up to two redundant hot-swap 450 W AC (100-240 V) power supplies (80 PLUS Gold). One (fixed power supply models) or two (hot-swap power supply models) line cords are included with the server.

The following table lists the hot-swap power supply options.

Table 19. Hot-swap power supply options

Description	Part number	Maximum supported
ThinkServer Gen 5 450W Gold Hot Swap Power Supply	4X20G87845	2

Systems management

The ThinkServer TS450 models with Intel Xeon E3-1200 v5 processors support Intel Active Management Technology (AMT) which provides out-of-band, hardware-based advanced system control, monitoring, alerting, and remote presence functions. The TS450 models with Intel Core i3 or Pentium processors support Intel Standard Manageability (ISM), which is a subset of the AMT features.

Both AMT and ISM offer the following features:

- Out-of-band management
- System health and status monitoring
- System event log and alerting
- Hardware inventory
- Boot device selection
- Remote power control
- Serial over LAN
- IDE/USB Redirect for mounting remote media

In addition, AMT supports KVM (keyboard, video, mouse) redirection (KVM redirection requires an Intel Xeon E3-1200 v5 processor with integrated graphics).

Important: Health monitoring, event log, alerts, hardware inventory, boot device selection, and remote power control features are accessible out-of-band with a web browser. Serial over LAN, IDE/USB Redirect, and KVM redirection features require third-party tools that are not supplied or supported by Lenovo.

AMT and ISM operate independently of the server and remain operational even if the server is powered off. Out-of-band management is performed through the Ethernet port 0, which is a shared port for data and management.

AMT and ISM support the following management protocols:

- DASH 1.1
- WS-MAN
- SNMP Platform Event Traps (PET)

AMT and ISM support the following management user interfaces:

- Web browser
- A third-party platform management software, including but not limited to the following tools:
 - RealVNC Viewer Plus (for remote KVM)
 - Intel Platform Solution Manager (for comprehensive support of AMT features)

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

- ThinkServer EasyStartup
The ThinkServer EasyStartup tool simplifies the process of configuring RAID and installing supported Microsoft Windows and Linux operating systems, VMware hypervisors, and device drivers on a ThinkServer system.
- ThinkServer EasyUpdate
The ThinkServer EasyUpdate firmware update tool enables you to maintain your server firmware up-to-date and helps you avoid unnecessary server outages.
- ThinkServer Diagnostics
The ThinkServer Diagnostics software speeds up troubleshooting tasks to reduce service time.

Security

The TS450 offers the following security features:

- Administrator's and power-on password
- Intrusion switch (select models)
- Trusted Cryptographic Module (TCM) (optional; available only in China)
- Lockable front cover
- Security-lock slot
- Padlock loop

The following table lists the TCM option.

Table 20. TCM option

Description	Part number	Maximum supported
ThinkServer Gen 5 Trusted Cryptographic Module	4XF0G45869	1

Rack installation

The ThinkServer TS450 can be mounted in a rack cabinet by using the tower to rack conversion kit that is listed in the following table. The tower to rack conversion kit includes a shelf on which the server is placed, sliding rails for mounting a shelf, and a cable management arm (CMA).

Table 21. Rack installation options

Description	Part number	Maximum supported
ThinkServer Tower to Rack Conversion Kit v2.0	4XF0G88937	1

Operating systems

The ThinkServer TS450 supports the following operating systems:

- Microsoft (client operating systems)
 - Windows 10 Professional (x64)
- Microsoft (server operating systems)
 - Windows Server 2016 Essentials, Standard, Hyper-V
 - Windows Storage Server 2016
 - Windows Server 2012 R2 Foundation, Essentials, Standard, Hyper-V
 - Windows Storage Server 2012 R2
 - Windows Server 2012 Foundation, Essentials, Standard, Hyper-V
 - Windows Multipoint Server 2012
- SUSE
 - SUSE Linux Enterprise Server 12 SP2
 - SUSE Linux Enterprise Server 12 SP1
 - SUSE Linux Enterprise Server 11 SP4 (x64)
- Red Hat
 - Red Hat Enterprise Linux Server 7.3
 - Red Hat Enterprise Linux Server 7.2
 - Red Hat Enterprise Linux Server 6.8 (x64)
 - Red Hat Enterprise Linux Server 6.7 (x64)
- VMware
 - VMware vSphere 6.5 (ESXi)
 - VMware vSphere 6.0 (ESXi) Update 3
 - VMware vSphere 6.0 (ESXi) Update 2
 - VMware vSphere 6.0 (ESXi) Update 1
 - VMware vSphere 5.5 (ESXi) Update 3

Important: The RAID 121i controller is not supported by virtualization hypervisors, including VMware vSphere (ESXi), Linux KVM, Xen, and Microsoft Hyper-V.

For the latest information about the specific versions and service levels that are supported and any other prerequisites, see the Operating System Interoperability Guide: <http://lenovopress.com/redposig>.

Physical specifications

The TS450 has the following dimensions and weight (approximate):

- Height:
 - Without foot stands: 430 mm (16.9 in.)
 - With foot stands: 444 mm (17.5 in.)
- Width: 173 mm (6.8 in.)
- Depth: 566 mm (22.3 in.) including the front bezel
- Weight:
 - Minimum: 18.0 kg (39.7 lb)
 - Maximum: 26.5 kg (57.3 lb)

Operating environment

The TS450 server is supported in the following environment:

- Air temperature:
 - Operating: 10 °C - 35 °C (50 °F - 95 °F)
 - Storage: -40 °C - 60 °C (-40 °F - 140 °F) in the original shipping package
- Altitude: 0 m - 3,048 m (0 ft - 10,000 ft) in an unpressurized environment
- Humidity:
 - Operating: 8% - 80% (non-condensing)
 - Storage: 10% - 90% (non-condensing)
- Electrical:
 - 100 - 127 (nominal) V AC; 50 Hz or 60 Hz
 - 200 - 240 (nominal) V AC; 50 Hz or 60 Hz

Regulatory compliance

The TS450 server conforms to the following regulations:

- RoHS
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, Class A
- EU Council Directive 2004/108/EC
- European Standard EN55022, Class A
- Korea Class A compliance
- Taiwan Class A compliance
- Japan VCCI, Class A

Warranty

The ThinkServer TS450 has a three-year or one-year warranty (model dependent) with 24x7 standard call center support and 9x5 next business day onsite coverage. Lenovo offers warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, and length of service coverage.

The Lenovo QuickPick tool helps locate compatible accessories and services and warranty information. Services offered may vary by geographic location. Access the tool via the following URL:

<http://lenovoquickpick.com>

The following table explains warranty service definitions in more detail.

Table 22. Warranty service definitions

Term	Description
On-site service	A service technician will go to the client's location for equipment service.
24x7x4 hour	A service technician is scheduled to arrive at the client's location within four hours after remote problem determination is completed. Lenovo provides service around the clock, every day, including Lenovo holidays.
24x7x8 hour	A service technician is scheduled to arrive at the client's location within eight hours after remote problem determination is completed. Lenovo provides service around the clock, every day, including Lenovo holidays.
9x5x4 hour	A service technician is scheduled to arrive at the client's location within four business hours after remote problem determination is completed. Lenovo provides service 8:00 am - 5:00 pm in the client's local time zone, Monday-Friday, excluding Lenovo holidays. For example, if a customer reports an incident at 3:00 pm on Friday, the technician will arrive by 10:00 am the following Monday.
9x5 next business day	A service technician is scheduled to arrive at the client's location on the business day after remote problem determination is completed. Lenovo provides service 8:00 am - 5:00 pm in the client's local time zone, Monday - Friday, excluding Lenovo holidays. Calls received after 4:00 pm local time require an extra business day for service dispatch.

The following Lenovo warranty service upgrades are available:

- Warranty and maintenance service upgrades:
 - Three, four, or five years of 9x5 or 24x7 service coverage
 - Onsite response time from next business day to 4 hour same-day
 - Warranty extension of up to 5 years
 - Post warranty extensions offered in 1-year increments
- Priority Technical Support
Lenovo's Priority Support Offering enhances our award-winning call center support to provide top priority queue assignment to specialized Lenovo technicians. Priority support accelerates call center troubleshooting to get your problems resolved quickly, and includes other value-added support for Lenovo provided software tools. Priority support can be purchased stand alone to match the base warranty of your system or in convenient bundles with our same-day response services.
- Keep Your Drive Multi-Drive
Lenovo's Keep Your Drive Multi-Drive service is a multi-drive hard drive retention offering that ensures your data is always under your control, regardless of the number of hard drives that are installed in your Lenovo server. In the unlikely event of a hard drive failure, you retain possession of your hard drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. Keep Your Drive Multi-Drive covers multiple drives and multiple failures with one service offering at one value price. This service can be purchased stand-alone to match the base warranty of your system or in convenient bundles with our same-day response services.

External drive enclosures

The following table lists the relationship models of the 12 Gbps SAS external drive enclosures that are offered by Lenovo that can be used with the ThinkServer TS450 for storage expansion.

Table 23. D1212 and D1224 relationship models

Description	Part number
LFF models	
D1212 LFF Chassis, Dual 3-port ESMs (US English documentation)	4587A11*
D1212 LFF Chassis, Dual 3-port ESMs (Simplified Chinese documentation)	4587A1C^
D1212 LFF Chassis, Dual 3-port ESMs (Japanese documentation)	4587A1J**
SFF models	
D1224 SFF Chassis, Dual 3-port ESMs (US English documentation)	4587A31*
D1224 SFF Chassis, Dual 3-port ESMs (Simplified Chinese documentation)	4587A3C^
D1224 SFF Chassis, Dual 3-port ESMs (Japanese documentation)	4587A3J**

* Available worldwide (except China and Japan)

^ Available only in China

** Available only in Japan

The following table lists the TopSeller models of the 12 Gbps SAS external drive enclosures that are offered by Lenovo that can be used with the ThinkServer TS450 for storage expansion.

Table 24. D1212 and D1224 TopSeller models

Description	Part number
LFF models - North America (NA) and Europe, Middle East, and Africa (EMEA)	
Lenovo Storage D1212 LFF Dual ESM Disk Expansion Enclosure (US English documentation)	4587E11
LFF models - Brazil and Latin America	
D1212 LFF Chassis, Dual 3-port ESMs, 4x 2TB 3.5" HDDs, 4x 0.5m SAS cables	4587EAU
D1212 LFF Chassis, Dual 3-port ESMs, 4x 4TB 3.5" HDDs, 4x 0.5m SAS cables	4587EBU
D1212 LFF Chassis, Dual 3-port ESMs, 4x 6TB 3.5" HDDs, 4x 0.5m SAS cables	4587ECU
D1212 LFF Chassis, Dual 3-port ESMs, 4x 8TB 3.5" HDDs, 4x 0.5m SAS cables	4587EDU
D1212 LFF Chassis, Dual 3-port ESMs, 8x 2TB 3.5" HDDs, 4x 0.5m SAS cables	4587EEU
D1212 LFF Chassis, Dual 3-port ESMs, 8x 4TB 3.5" HDDs, 4x 0.5m SAS cables	4587EFU
D1212 LFF Chassis, Dual 3-port ESMs, 8x 6TB 3.5" HDDs, 4x 0.5m SAS cables	4587EGU
D1212 LFF Chassis, Dual 3-port ESMs, 8x 8TB 3.5" HDDs, 4x 0.5m SAS cables	4587EHU
D1212 LFF Chassis, Dual 3-port ESMs, 12x 2TB 3.5" HDDs, 4x 0.5m SAS cables	4587EIU
D1212 LFF Chassis, Dual 3-port ESMs, 12x 4TB 3.5" HDDs, 4x 0.5m SAS cables	4587EJU
D1212 LFF Chassis, Dual 3-port ESMs, 12x 6TB 3.5" HDDs, 4x 0.5m SAS cables	4587EKU
D1212 LFF Chassis, Dual 3-port ESMs, 12x 8TB 3.5" HDDs, 4x 0.5m SAS cables	4587ELU
SFF models - North America (NA) and Europe, Middle East, and Africa (EMEA)	
Lenovo Storage D1224 SFF Dual ESM Disk Expansion Enclosure (US English documentation)	4587E31
SFF models - Brazil and Latin America	
D1224 SFF Chassis, Dual 3-port ESMs, 9x 1.2TB 10K HDDs, 4x 0.5m SAS cables	4587E6U
D1224 SFF Chassis, Dual 3-port ESMs, 9x 1.2TB 10K HDDs, 2x 400GB SSDs, 4x 0.5m SAS cables	4587E2U

Description	Part number
D1224 SFF Chassis, Dual 3-port ESMs, 9x 1.2TB 10K HDDs, 4x 400GB SSDs, 4x 0.5m SAS cables	4587E4U
D1224 SFF Chassis, Dual 3-port ESMs, 18x 1.2TB 10K HDDs, 1x 0.5m SAS cable	4587E5U
D1224 SFF Chassis, Dual 3-port ESMs, 18x 1.2TB 10K HDDs, 2x 400GB SSDs, 4x 0.5m SAS cables	4587E1U
D1224 SFF Chassis, Dual 3-port ESMs, 18x 1.2TB 10K HDDs, 4x 400GB SSDs, 4x 0.5m SAS cables	4587E3U

For details about supported drives, adapters, and cables for the Lenovo Storage D1212 and D1224, see the Lenovo Press Product Guide:

<http://lenovopress.com/lp0512>

External storage systems

The TS450 can be attached to external storage systems using the following connectivity protocols:

- 12 Gb SAS with a supported external SAS HBA
- 1 Gb or 10 Gb Ethernet (NAS storage or S3 object storage)
- 1 Gb or 10 Gb iSCSI with an iSCSI software initiator in the operating system

The following table lists the external storage systems that are offered by Lenovo that can be used with the TS450.

Table 25. External storage systems

Description	Part number
Lenovo ThinkSystem DS Series Storage (SAS connectivity)	
Lenovo ThinkSystem DS2200 LFF SAS Dual Controller Unit (US English documentation)	4599A41*
Lenovo ThinkSystem DS2200 LFF SAS Dual Controller Unit (Simplified Chinese documentation)	4599A4C^
Lenovo ThinkSystem DS2200 LFF SAS Dual Controller Unit (Japanese documentation)	4599A4J**
Lenovo ThinkSystem DS2200 SFF SAS Dual Controller Unit (US English documentation)	4599A21*
Lenovo ThinkSystem DS2200 SFF SAS Dual Controller Unit (Simplified Chinese documentation)	4599A2C^
Lenovo ThinkSystem DS2200 SFF SAS Dual Controller Unit (Japanese documentation)	4599A2J**
Lenovo ThinkSystem DS4200 LFF SAS Dual Controller Unit (US English documentation)	4617A41*
Lenovo ThinkSystem DS4200 LFF SAS Dual Controller Unit (Simplified Chinese documentation)	4617A4C^
Lenovo ThinkSystem DS4200 LFF SAS Dual Controller Unit (Japanese documentation)	4617A4J**
Lenovo ThinkSystem DS4200 SFF SAS Dual Controller Unit (US English documentation)	4617A21*
Lenovo ThinkSystem DS4200 SFF SAS Dual Controller Unit (Simplified Chinese documentation)	4617A2C^
Lenovo ThinkSystem DS4200 SFF SAS Dual Controller Unit (Japanese documentation)	4617A2J**
Lenovo ThinkSystem DS6200 SFF SAS Dual Controller Unit (US English documentation)	4619A21*
Lenovo ThinkSystem DS6200 SFF SAS Dual Controller Unit (Simplified Chinese documentation)	4619A2C^
Lenovo ThinkSystem DS6200 SFF SAS Dual Controller Unit (Japanese documentation)	4619A2J**
Lenovo ThinkSystem DS Series Storage (iSCSI connectivity)	
Lenovo ThinkSystem DS2200 LFF FC/iSCSI Dual Controller Unit (US English documentation)	4599A31*
Lenovo ThinkSystem DS2200 LFF FC/iSCSI Dual Controller Unit (Simplified Chinese documentation)	4599A3C^
Lenovo ThinkSystem DS2200 LFF FC/iSCSI Dual Controller Unit (Japanese documentation)	4599A3J**
Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit (US English documentation)	4599A11*
Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit (Simplified Chinese documentation)	4599A1C^

Description	Part number
Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit (Japanese documentation)	4599A1J**
Lenovo ThinkSystem DS4200 LFF FC/iSCSI Dual Controller Unit (US English documentation)	4617A31*
Lenovo ThinkSystem DS4200 LFF FC/iSCSI Dual Controller Unit (Simplified Chinese documentation)	4617A3C^
Lenovo ThinkSystem DS4200 LFF FC/iSCSI Dual Controller Unit (Japanese documentation)	4617A3J**
Lenovo ThinkSystem DS4200 SFF FC/iSCSI Dual Controller Unit (US English documentation)	4617A11*
Lenovo ThinkSystem DS4200 SFF FC/iSCSI Dual Controller Unit (Simplified Chinese documentation)	4617A1C^
Lenovo ThinkSystem DS4200 SFF FC/iSCSI Dual Controller Unit (Japanese documentation)	4617A1J**
Lenovo ThinkSystem DS6200 SFF FC/iSCSI Dual Controller Unit (US English documentation)	4619A11*
Lenovo ThinkSystem DS6200 SFF FC/iSCSI Dual Controller Unit (Simplified Chinese documentation)	4619A1C^
Lenovo Storage S Series (SAS connectivity)	
Lenovo Storage S2200 LFF Chassis SAS Single Controller, Rack Kit, 9x5NBD	64112B1
Lenovo Storage S2200 LFF Chassis SAS Dual Controller, Rack Kit, 9x5NBD	64112B2
Lenovo Storage S2200 SFF Chassis SAS Single Controller, Rack Kit, 9x5NBD	64112B3
Lenovo Storage S2200 SFF Chassis SAS Dual Controller, Rack Kit, 9x5NBD	64112B4
Lenovo Storage S3200 LFF Chassis SAS Single Controller, Rack Kit, 9x5NBD	64113B1
Lenovo Storage S3200 LFF Chassis SAS Dual Controller, Rack Kit, 9x5NBD	64113B2
Lenovo Storage S3200 SFF Chassis SAS Single Controller, Rack Kit, 9x5NBD	64113B3
Lenovo Storage S3200 SFF Chassis SAS Dual Controller, Rack Kit, 9x5NBD	64113B4
Lenovo Storage S Series (iSCSI connectivity)	
Lenovo Storage S2200 LFF Chassis FC/iSCSI Single Controller, Rack Kit, 9x5NBD	64114B1
Lenovo Storage S2200 LFF Chassis FC/iSCSI Dual Controller, Rack Kit, 9x5NBD	64114B2
Lenovo Storage S2200 SFF Chassis FC/iSCSI Single Controller, Rack Kit, 9x5NBD	64114B3
Lenovo Storage S2200 SFF Chassis FC/iSCSI Dual Controller, Rack Kit, 9x5NBD	64114B4
Lenovo Storage S3200 LFF Chassis FC/iSCSI Single Controller, Rack Kit, 9x5NBD	64116B1
Lenovo Storage S3200 LFF Chassis FC/iSCSI Dual Controller, Rack Kit, 9x5NBD	64116B2
Lenovo Storage S3200 SFF Chassis FC/iSCSI Single Controller, Rack Kit, 9x5NBD	64116B3
Lenovo Storage S3200 SFF Chassis FC/iSCSI Dual Controller, Rack Kit, 9x5NBD	64116B4
Lenovo Storage V Series (SAS or iSCSI connectivity)	
Lenovo Storage V3700 V2 LFF Control Enclosure	6535C1D
Lenovo Storage V3700 V2 LFF Control Enclosure (TopSeller)	6535EC1
Lenovo Storage V3700 V2 SFF Control Enclosure	6535C2D
Lenovo Storage V3700 V2 SFF Control Enclosure (TopSeller)	6535EC2
Lenovo Storage V3700 V2 XP LFF Control Enclosure	6535C3D
Lenovo Storage V3700 V2 XP LFF Control Enclosure (TopSeller)	6535EC3
Lenovo Storage V3700 V2 XP SFF Control Enclosure	6535C4D
Lenovo Storage V3700 V2 XP SFF Control Enclosure (TopSeller)	6535EC4
Lenovo Storage V5030 LFF Control Enclosure 3Yr S&S	6536C12
Lenovo Storage V5030 LFF Control Enclosure 5Yr S&S	6536C32
Lenovo Storage V5030 SFF Control Enclosure 3Yr S&S	6536C22
Lenovo Storage V5030 SFF Control Enclosure 5Yr S&S	6536C42
Lenovo Storage V5030F SFF Control Enclosure 3Yr S&S	6536B1F

Description	Part number
Lenovo Storage V5030F SFF Control Enclosure 5Yr S&S	6536B2F
IBM Storwize for Lenovo (SAS [except V7000] or iSCSI connectivity)	
IBM Storwize V3500 3.5-inch Dual Control Storage Controller Unit	6096CU2^
IBM Storwize V3500 2.5-inch Dual Control Storage Controller Unit	6096CU3^
IBM Storwize V3700 3.5-inch Storage Controller Unit	6099L2C
IBM Storwize V3700 2.5-inch Storage Controller Unit	6099S2C
IBM Storwize V7000 SFF Control Enclosure, 3YR SWMA	6195C32†
IBM Storwize V7000 SFF Control Enclosure, 3YR SWMA, LA	6195C3L‡
IBM Storwize V7000 SFF Control Enclosure, 5YR SWMA	6195C52†
IBM Storwize V7000 SFF Control Enclosure, 5YR SWMA, LA	6195C5L‡
Lenovo Storage DX8200 Series (NAS or iSCSI connectivity)	
Lenovo Storage DX8200D Storage Virtualization Entry, 4TB, 3yr SW S&S	5135A2x#
Lenovo Storage DX8200D Storage Virtualization Entry, 4TB, 4yr SW S&S	5135J2x#
Lenovo Storage DX8200D Storage Virtualization Entry, 4TB, 5yr SW S&S	51351Vx#
Lenovo Storage DX8200D Storage Virtualization Mid, 16TB, 3yr SW S&S	5135B2x#
Lenovo Storage DX8200D Storage Virtualization Mid, 16TB, 4yr SW S&S	5135L2x#
Lenovo Storage DX8200D Storage Virtualization Mid, 16TB, 5yr SW S&S	51352Vx#
Lenovo Storage DX8200D Storage Virtualization High, 64TB, 3yr SW S&S	5135C3x#
Lenovo Storage DX8200D Storage Virtualization High, 64TB, 4yr SW S&S	5135M3x#
Lenovo Storage DX8200D Storage Virtualization High, 64TB, 5yr SW S&S	51353Wx#
Lenovo Storage DX8200D ServerSAN Entry, 8TB, 3yr SW S&S	5135D2x#
Lenovo Storage DX8200D ServerSAN Entry, 8TB, 4yr SW S&S	5135N2x#
Lenovo Storage DX8200D ServerSAN Entry, 8TB, 5yr SW S&S	51354Vx#
Lenovo Storage DX8200D ServerSAN Mid, 16TB, 3yr SW S&S	5135F2x#
Lenovo Storage DX8200D ServerSAN Mid, 16TB, 4yr SW S&S	5135P2x#
Lenovo Storage DX8200D ServerSAN Mid, 16TB, 5yr SW S&S	51355Vx#
Lenovo Storage DX8200D ServerSAN High, 32TB, 3yr SW S&S	5135G3x#
Lenovo Storage DX8200D ServerSAN High, 32TB, 4yr SW S&S	5135Q3x#
Lenovo Storage DX8200D ServerSAN High, 32TB, 5yr SW S&S	51356Wx#
Lenovo Storage DX8200N with 1x N2226 HBA (Requires a supported external drive enclosure)	5128C1x#
Lenovo Storage DX8200N with 2x N2226 HBAs (Requires a supported external drive enclosure)	5128C2x#
Lenovo Storage DX8200C Series (S3 cloud storage)	
Lenovo Storage DX8200C 56TB (14x 4TB HDDs) with Cloudian HyperStore - 3yr HW/SW S&S	5120C1x#
Lenovo Storage DX8200C 84TB (14x 6TB HDDs) with Cloudian HyperStore - 3yr HW/SW S&S	5120C3x#
Lenovo Storage DX8200C 112TB (14x 8TB HDDs) with Cloudian HyperStore - 3yr HW/SW S&S	5120C2x#
Lenovo Storage DX8200C 140TB (14x 10TB HDDs) with Cloudian HyperStore - 3yr HW/SW S&S	5120C4x#

* Available worldwide (except China and Japan).

^ Available only in China.

** Available only in Japan.

† Available worldwide except Latin America.

‡ Available only in Latin America.

x represents a geo-specific letter (for example: U = North America, G = EMEA). Ask a Lenovo representative for specifics.

For more information, see the list of Product Guides in the following categories:

- Lenovo DS Series, S Series, and V Series storage:
<http://lenovopress.com/storage/san/lenovo?rt=product-guide>
- IBM Storwize for Lenovo storage:
<http://lenovopress.com/storage/san/ibm?rt=product-guide>
- Lenovo Cloud storage:
<http://lenovopress.com/storage/cloud>
- Lenovo NAS storage:
<http://lenovopress.com/storage/nas>

External backup units

The TS450 server can be attached to external backup units via SAS (by using the 9300-8e external SAS adapter) or USB interfaces. The following table lists the external backup options that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 26. External backup options

Description	Part number
External SAS tape backup drives	
IBM TS2250 Tape Drive Model H5S	6160S5E
IBM TS2260 Tape Drive Model H6S	6160S6E
IBM TS2270 Tape Drive Model H7S	6160S7E
External SAS tape backup autoloaders	
IBM TS2900 Tape Autoloader w/LTO5 HH SAS	6171S5R
IBM TS2900 Tape Autoloader w/LTO6 HH SAS	6171S6R
IBM TS2900 Tape Autoloader w/LTO7 HH SAS	6171S7R
External tape backup libraries	
IBM TS3100 Tape Library Model L2U	61732UL
IBM TS3200 Tape Library Model L4U	61734UL
SAS backup drives for TS3100 and TS3200 Tape Libraries	
6173 LTO Ultrium 5 SAS Drive Sled	00NA109
6173 LTO Ultrium 5 Half High SAS Drive Sled	00NA111
6173 LTO Ultrium 6 Half High SAS Drive Sled	00NA117
6173 LTO Ultrium 7 Half High SAS Drive Sled	00WF767

For more information, see the list of Product Guides in the Backup Units category:

<http://lenovopress.com/servers/options/backup>

Ethernet LAN switches

The following table lists the top-of-rack Ethernet switches that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 27. Ethernet LAN switches

Description	Part number
1 Gb Ethernet switches	
Juniper EX2300-C PoE Switch	7165H1X
Juniper EX2300-24p PoE Switch	7165H2X
Lenovo RackSwitch G7028 (Rear to Front)	7159BAX
Lenovo RackSwitch G7052 (Rear to Front)	7159CAX
Lenovo RackSwitch G8052 (Rear to Front)	7159G52
10 Gb Ethernet switches	
Lenovo ThinkSystem NE1032 RackSwitch (Rear to Front)	7159A1X
Lenovo ThinkSystem NE1032T RackSwitch (Rear to Front)	7159B1X
Lenovo ThinkSystem NE1072T RackSwitch (Rear to Front)	7159C1X
Lenovo RackSwitch G8124E (Rear to Front)	7159BR6
Lenovo RackSwitch G8264 (Rear to Front)	7159G64
Lenovo RackSwitch G8264CS (Rear to Front)	7159DRX
Lenovo RackSwitch G8272 (Rear to Front)	7159CRW
Lenovo RackSwitch G8296 (Rear to Front)	7159GR6
25 Gb Ethernet switches	
Lenovo ThinkSystem NE2572 RackSwitch (Rear to Front)	7159E1X
40 Gb Ethernet switches	
Lenovo RackSwitch G8332 (Rear to Front)	7159BRX
100 Gb Ethernet switches	
Lenovo ThinkSystem NE10032 RackSwitch (Rear to Front)	7159D1X

For more information, see the list of Product Guides in the Top-of-rack Switches category:

<http://lenovopress.com/servers/options/switches#rt=product-guide>

Rack cabinets

The following table lists the rack cabinets that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 28. Rack cabinets

Description	Part number
25U S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072RX
25U Static S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072PX
42U S2 Standard Rack (1000 mm deep; 6 sidewall compartments)	93074RX
42U 1100mm Enterprise V2 Dynamic Rack (6 sidewall compartments)	93634PX
42U 1100mm Enterprise V2 Dynamic Expansion Rack (6 sidewall compartments)	93634EX
42U 1200mm Deep Dynamic Rack (6 sidewall compartments)	93604PX
42U 1200mm Deep Static Rack (6 sidewall compartments)	93614PX
42U Enterprise Rack (1105 mm deep; 4 sidewall compartments)	93084PX
42U Enterprise Expansion Rack (1105 mm deep; 4 sidewall compartments)	93084EX

For more information, see the list of Product Guides in the Rack Cabinets category:
<http://lenovopress.com/servers/options/racks>

KVM switches and consoles

The following table lists the KVM switches and consoles that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 29. KVM switch and console options

Description	Part number
Consoles	
1U 18.5" Standard Console (without keyboard)	17238BX
Console keyboards	
Keyboard w/ Int. Pointing Device USB - US Eng 103P RoHS v2	46W6712
Keyboard w/ Int. Pointing Device USB - Arabic 253 RoHS v2	46W6713
Keyboard w/ Int. Pointing Device USB - Belg/UK 120 RoHS v2	46W6714
Keyboard w/ Int. Pointing Device USB - Chinese/US 467 RoHS v2	46W6715
Keyboard w/ Int. Pointing Device USB - Czech 489 RoHS v2	46W6716
Keyboard w/ Int. Pointing Device USB - Danish 159 RoHS v2	46W6717
Keyboard w/ Int. Pointing Device USB - Dutch 143 RoHS v2	46W6718
Keyboard w/ Int. Pointing Device USB - French 189 RoHS v2	46W6719
Keyboard w/ Int. Pointing Device USB - Fr/Canada 445 RoHS v2	46W6720
Keyboard w/ Int. Pointing Device USB - German 129 RoHS v2	46W6721
Keyboard w/ Int. Pointing Device USB - Greek 219 RoHS v2	46W6722
Keyboard w/ Int. Pointing Device USB - Hebrew 212 RoHS v2	46W6723
Keyboard w/ Int. Pointing Device USB - Hungarian 208 RoHS v2	46W6724
Keyboard w/ Int. Pointing Device USB - Italian 141 RoHS v2	46W6725
Keyboard w/ Int. Pointing Device USB - Japanese 194 RoHS v2	46W6726
Keyboard w/ Int. Pointing Device USB - Korean 413 RoHS v2	46W6727

Description	Part number
Keyboard w/ Int. Pointing Device USB - LA Span 171 RoHS v2	46W6728
Keyboard w/ Int. Pointing Device USB - Norwegian 155 RoHS v2	46W6729
Keyboard w/ Int. Pointing Device USB - Polish 214 RoHS v2	46W6730
Keyboard w/ Int. Pointing Device USB - Portugese 163 RoHS v2	46W6731
Keyboard w/ Int. Pointing Device USB - Russian 441 RoHS v2	46W6732
Keyboard w/ Int. Pointing Device USB - Slovak 245 RoHS v2	46W6733
Keyboard w/ Int. Pointing Device USB - Spanish 172 RoHS v2	46W6734
Keyboard w/ Int. Pointing Device USB - Swed/Finn 153 RoHS v2	46W6735
Keyboard w/ Int. Pointing Device USB - Swiss F/G 150 RoHS v2	46W6736
Keyboard w/ Int. Pointing Device USB - Thai 191 RoHS v2	46W6737
Keyboard w/ Int. Pointing Device USB - Turkish 179 RoHS v2	46W6738
Keyboard w/ Int. Pointing Device USB - UK Eng 166 RoHS v2	46W6739
Keyboard w/ Int. Pointing Device USB - US Euro 103P RoHS v2	46W6740
Keyboard w/ Int. Pointing Device USB - Slovenian 234 RoHS v2	46W6741
Console switches	
Global 4x2x32 Console Manager (GCM32)	1754D2X
Global 2x2x16 Console Manager (GCM16)	1754D1X
Local 2x16 Console Manager (LCM16)	1754A2X
Local 1x8 Console Manager (LCM8)	1754A1X
Console cables	
Single Cable USB Conversion Option (UCO)	43V6147
USB Conversion Option (4 Pack UCO)	39M2895
Virtual Media Conversion Option Gen2 (VCO2)	46M5383
Serial Conversion Option (SCO)	46M5382

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

Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 30. Power distribution units

Description	Part number
0U Basic PDUs	
0U 36 C13/6 C19 24A/200-240V 1 Phase PDU with NEMA L6-30P line cord	00YJ776
0U 36 C13/6 C19 32A/200-240V 1 Phase PDU with IEC60309 332P6 line cord	00YJ777
0U 21 C13/12 C19 32A/200-240V/346-415V 3 Phase PDU with IEC60309 532P6 line cord	00YJ778
0U 21 C13/12 C19 48A/200-240V 3 Phase PDU with IEC60309 460P9 line cord	00YJ779
Switched and Monitored PDUs	
0U 20 C13/4 C19 Switched and Monitored 24A/200-240V/1Ph PDU w/ NEMA L6-30P line cord	00YJ781
0U 20 C13/4 C19 Switched and Monitored 32A/200-240V/1Ph PDU w/ IEC60309 332P6 line cord	00YJ780

Description	Part number
0U 18 C13/6 C19 Switched / Monitored 32A/200-240V/346-415V/3Ph PDU w/ IEC60309 532P6 cord	00YJ782
0U 12 C13/12 C19 Switched and Monitored 48A/200-240V/3Ph PDU w/ IEC60309 460P9 line cord	00YJ783
1U 9 C19/3 C13 Switched and Monitored DPI PDU (without line cord)	46M4002
1U 9 C19/3 C13 Switched and Monitored 60A 3Ph PDU with IEC 309 3P+Gnd cord	46M4003
1U 12 C13 Switched and Monitored DPI PDU (without line cord)	46M4004
1U 12 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord	46M4005
Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)	
Ultra Density Enterprise C19/C13 PDU Module (without line cord)	71762NX
Ultra Density Enterprise C19/C13 PDU 60A/208V/3ph with IEC 309 3P+Gnd line cord	71763NU
C13 Enterprise PDUs (12x IEC 320 C13 outlets)	
DPI C13 Enterprise PDU+ (without line cord)	39M2816
DPI Single Phase C13 Enterprise PDU (without line cord)	39Y8941
C19 Enterprise PDUs (6x IEC 320 C19 outlets)	
DPI Single Phase C19 Enterprise PDU (without line cord)	39Y8948
DPI 60A 3 Phase C19 Enterprise PDU with IEC 309 3P+G (208 V) fixed line cord	39Y8923
Front-end PDUs (3x IEC 320 C19 outlets)	
DPI 30amp/125V Front-end PDU with NEMA L5-30P line cord	39Y8938
DPI 30amp/250V Front-end PDU with NEMA L6-30P line cord	39Y8939
DPI 32amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8934
DPI 60amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8940
DPI 63amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8935
Universal PDUs (7x IEC 320 C13 outlets)	
DPI Universal 7 C13 PDU (with 2 m IEC 320-C19 to C20 rack power cord)	00YE443
NEMA PDUs (6x NEMA 5-15R outlets)	
DPI 100-127V PDU with fixed NEMA L5-15P line cord	39Y8905
Line cords for PDUs that ship without a line cord	
DPI 30a Line Cord (NEMA L6-30P)	40K9614
DPI 32a Line Cord (IEC 309 P+N+G)	40K9612
DPI 32a Line Cord (IEC 309 3P+N+G)	40K9611
DPI 60a Cord (IEC 309 2P+G)	40K9615
DPI 63a Cord (IEC 309 P+N+G)	40K9613
DPI Australian/NZ 3112 Line Cord (32A)	40K9617
DPI Korean 8305 Line Cord (30A)	40K9618

For more information, see the list of Product Guides in the Power Distribution Units category:
<http://lenovopress.com/servers/options/pdu>

Uninterruptible power supply units

The following table lists the uninterruptible power supply (UPS) units that are offered by Lenovo that can be used in ThinkServer TS450 solutions.

Table 31. Uninterruptible power supply units

Description	Part number
Tower UPS units	
T1kVA Tower UPS (100-125VAC)	55951AX
T1kVA Tower UPS (200-240VAC)	55951KX
T1.5kVA Tower UPS (100-125VAC)	55952AX
T1.5kVA Tower UPS (200-240VAC)	55952KX
Rack or Tower UPS units	
RT1.5kVA 2U Rack or Tower UPS (100-125VAC)	55941AX
RT1.5kVA 2U Rack or Tower UPS (200-240VAC)	55941KX
RT2.2kVA 2U Rack or Tower UPS (100-125VAC)	55942AX
RT2.2kVA 2U Rack or Tower UPS (200-240VAC)	55942KX
RT3kVA 2U Rack or Tower UPS (100-125VAC)	55943AX
RT3kVA 2U Rack or Tower UPS (200-240VAC)	55943KX
RT5kVA 3U Rack or Tower UPS (200-240VAC)	55945KX
RT6kVA 3U Rack or Tower UPS (200-240VAC)	55946KX
RT8kVA 6U Rack or Tower UPS (200-240VAC)	55948KX
RT11kVA 6U Rack or Tower UPS (200-240VAC)	55949KX
RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)	55948PX
RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)	55949PX

For more information, see the list of Product Guides in the Uninterruptible Power Supply Units category:

<http://lenovopress.com/servers/options/ups>

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<http://www.lenovofs.com>

Related publications and links

For more information, see these resources:

- ThinkServer TS450 User Guide and Hardware Maintenance Manual
https://download.lenovo.com/pccbbs/thinkservers/ts450ughmm_en.pdf
- Lenovo Support for ThinkServer TS450
<http://datacentersupport.lenovo.com/us/en/products/servers/thinkserver/ts450>
- ThinkServer Power Planner
<http://support.lenovo.com/us/en/downloads/ds101155>
- Lenovo Press Product Guides for servers and options (filter by the Product Guide resource type)
<http://lenovopress.com>

Related product families

Product families related to this document are the following:

- [1-Socket Tower Servers](#)

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