Lenovo ThinkServer RD650 (E5-2600 v3)
Product Guide (withdrawn product)

The Lenovo® ThinkServer® RD650 is an enterprise class, 2U, two-socket server that features Intel® Xeon® E5-2600 v3 processors and supports up to 768 GB of DDR4 memory, 18 cores, and 36 threads per socket. With the capability to support mix and match internal hard disk drive (HDD) and solid-state drive (SSD) storage with up to 26 2.5-inch drive bays, 40 Gbps networking capability, up to 6 hot-swap dual rotor fans, hot-swap redundant power supplies, and a dedicated Gigabit Ethernet out-of-band management port, the ThinkServer RD650 provides leading features and capabilities.

Suggested uses: Server consolidation or virtualization, Heavy web traffic workloads, Data analytics, Line-of-business applications.

Figure 1 shows the Lenovo ThinkServer RD650.

Figure 1. Lenovo ThinkServer RD650

Did you know?

The next-generation ThinkServer RD650 delivers impressive compute power per watt and incorporates energy-smart features for minimized costs and efficient performance. The 80 PLUS Titanium power supply units (PSUs) can deliver 96% efficiency at 50% load and the server is designed to meet ASHRAE A4 standards.

The RD650 provides outstanding memory performance that is achieved by supporting two-RDIMMs-per-channel configurations at speeds up to 12% faster than the Intel specification, while still maintaining world-class reliability.

Key features

The RD650 is a versatile 2U two-socket business-critical server that offers improved performance and pay-as-you-grow flexibility along with new features that improve server management capability. This powerful system is designed for your most important business applications and cloud deployments.

Combining balanced performance and flexibility, the RD650 is a great choice for small and medium businesses up to the large enterprise. It can provide outstanding uptime to keep business-critical applications and cloud deployments running safely. Ease of use and comprehensive systems management tools help make deployment easier.

This storage-rich server provides up to 124 TB of storage capacity and features an industry-unique Lenovo AnyBay® design, which allows multiple storage types in the same drive bay. In addition to the standard 3.5- and 2.5-inch hard drive chassis, the RD650 offers a unique hybrid option with nine 3.5-inch and six 2.5-inch front-access drive bays in the front and two 2.5-inch drive bays in the back, which is ideal for creating a tiered storage environment. M.2 and SD card options are available, which enables flexible boot-drive choices.

The RD650 provides Lenovo AnyRAID® technology, which is a midplane RAID adapter design that connects directly to the drive backplane without the use of a PCIe slot. A comprehensive portfolio of AnyRAID controllers is available for various applications, which include software, IO Controller, and RAID on Chip-based controllers.

Up to eight PCIe slots provide room to expand, and Lenovo's distinctive AnyFabric® design provides an array of powerful HBA, CNA, and 1 Gbps and 10 Gbps Ethernet choices to address growing network bandwidth requirements without the use of a PCIe slot. Outstanding reliability, availability, and serviceability (RAS) and a high-efficiency design improve your business environment and help save operational costs.

The RD650 delivers impressive compute power per watt, featuring 80 PLUS Titanium and Platinum redundant power supplies. This server is designed to meet ASHRAE A4 standards, which enables customers to lower energy costs.

Scalability and performance

The RD650 offers the following features to boost performance, improve scalability, and reduce costs:

- Improves productivity by offering superior system performance with up to two processors each up to 18 cores, up to 45 MB of L3 cache, and up to 9.6 GTps QPI interconnect links.
- Supports up to two processors, 36 cores, and 72 threads, which maximize the concurrent execution of multi-threaded applications.
- Intelligent and adaptive system performance with energy efficient Intel Turbo Boost Technology allows CPU 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 utilize the hardware for virtualization workloads.
- Up to 2133 MHz memory speeds with two DIMMs per channel that are running at 2133 MHz to help maximize system performance.
- Up to 768 GB of memory capacity with 32 GB load-reduced DIMMs (LRDIMMs).
- The server features an industry-unique Lenovo AnyBay™ design, which allows a choice of SAS, SATA or PCIe interface drives in the same bay.

- The 12 Gbps SAS internal storage connectivity doubles the data transfer rate compared to 6 Gb SAS solutions to maximize performance of storage I/O-intensive applications.
- Flexible and scalable internal storage configurations provide for up to 124 TB of storage capacity in a 2U rack form factor.
- The use of SSDs instead of or along with traditional spinning drives (HDDs) can significantly improve I/O performance. An SSD can support up to 100 times more I/O operations per second (IOPS) than a typical HDD.
- Lenovo distinctive AnyFabric® design provides an array of powerful Host Bus Adapters (HBA), Converged Network Adapters (CNA), 1 GbE and 10 GbE choices to address growing network bandwidth requirements without the use of a PCI Express (PCIe) slot.
- The server offers up to eight PCIe 3.0 I/O expansion slots plus one AnyFabric mezzanine slot.
- The RD650 provides Lenovo AnyRAID® technology, which is a midplane RAID adapter that connects directly to the drive backplane without using a PCIe slot.
- With Intel Integrated I/O Technology, the PCI Express 3.0 controller is integrated into the Intel Xeon processor E5 family. This integration helps to dramatically reduce I/O latency and increase overall system performance.

Availability and serviceability

The RD650 provides the following features to simplify serviceability and increase system uptime:

- Tool-less cover removal provides easy access to upgrades and serviceable parts, such as processors, memory DIMMs, and adapters.
- The server offers hot-swap drives supporting RAID redundancy for data protection and greater system uptime.
- The server offers redundant hot-swap power supplies and hot-swap redundant fans to provide availability for business-critical applications.
- The new diagnostics LCD display panel simplifies servicing, speeds up problem resolution, and helps improve system availability.
- SSDs offer significantly better reliability than traditional mechanical HDDs for greater uptime.
- Built-in ThinkServer System Manager (TSM) continuously monitors system parameters and triggers alerts to minimize downtime.

Manageability and security

The following powerful systems management features simplify local and remote management of the RD650:

- The server includes TSM to monitor server availability and perform remote management.
- TSM Premium is an optional upgrade key that provides support for ThinkServer Energy Manager (TEM). TEM uses TSM to capture real-time power and temperature data from the server and provides automated controls to lower energy costs.
- Embedded ThinkServer Deployment Manager (TDM) provides a complete set of provisioning capabilities from a single interface, which automates many of the tasks that are associated with server provisioning.
- An optional Trusted Platform Modules (TPM) enables advanced cryptographic functionality, such as digital signatures and Windows BitLocker encryption, which is a Windows data protection feature.

Energy efficiency

The RD650 offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to the green environment:

- Energy-efficient planar components help lower operational costs.
- High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications. Titanium rated supplies are up to 96% efficient at high loads.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed to reduce power draw.
- Low-voltage Intel Xeon processors draw less energy to satisfy the demands of power and thermally constrained data centers and telecommunication environments.
- Low-voltage 1.2 V DDR4 memory DIMMs offer energy efficiency compared to 1.35 V DDR3 DIMMs.
- System power profiles can be configured in BIOS to optimize usage for maximum performance or energy efficiency.
- ThinkServer Energy Manager™ provides advanced data center power notification and management to help achieve lower heat output and reduced cooling needs.

Components and connectors

Figure 2 shows the front of the server. The ThinkServer RD650 is designed with simplicity and ease of use in mind. Flat fronts simplify the visual appearance and the work area. The vent pattern maximizes cooling airflow and provides visual synergy across the product family. Red accent points on the server identify touch points.
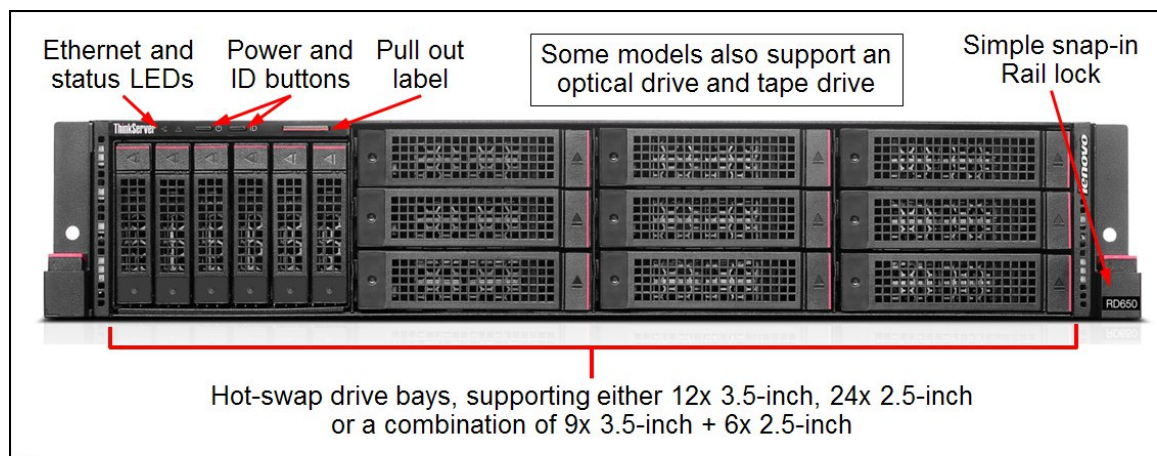

Figure 2. Front view of the ThinkServer RD650

Figure 3 shows the locations of key components at the rear of the server, including the AnyFabric mezzanine card slot and the optional 2.5-inch HDD bays in the rear of the system.
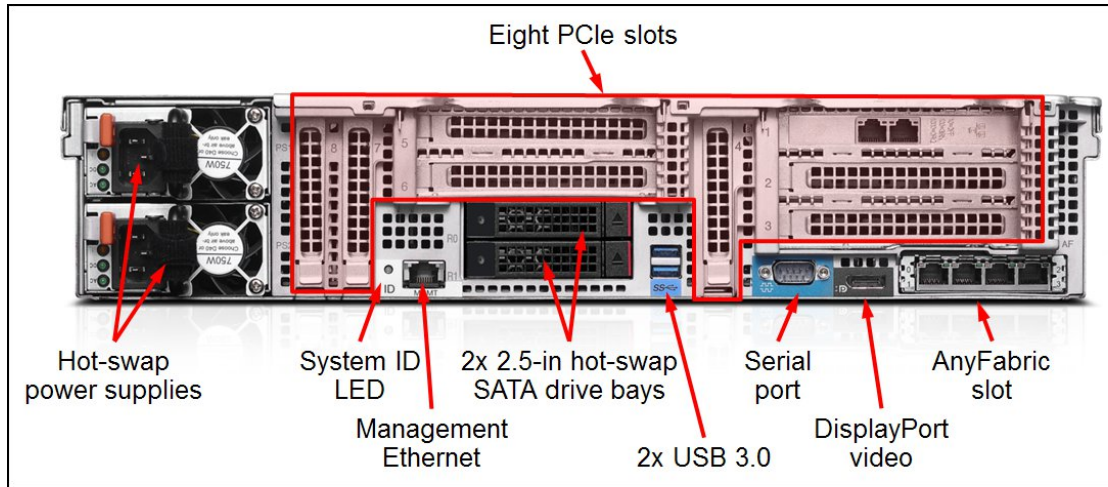

Figure 3. Rear view of the ThinkServer RD650

Looking inside the RD650, customer field-replaceable components have blue touch points; hot swappable components have orange touch points. Figure 4 shows the location of internal components.
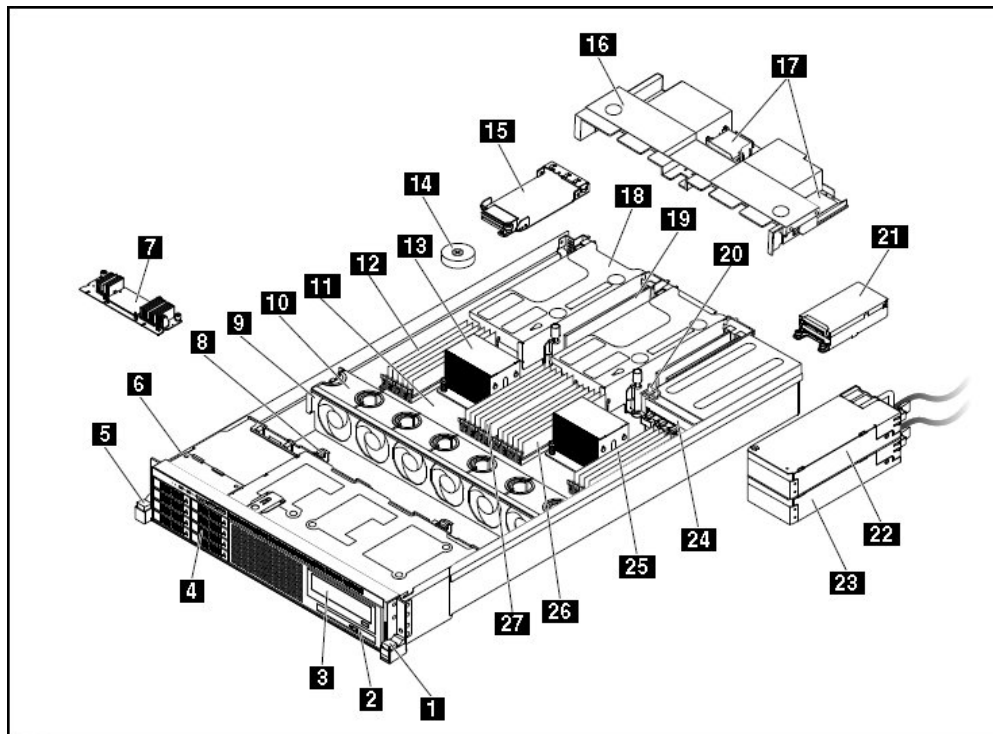

Figure 4. Inside view of the ThinkServer RD650

The following table identifies the items that are highlighted in Figure 4.

Table 1. RD650 internal component descriptions

ID	Description	ID	Description
1	Rack handle (right)	15	AnyFabric adapter (optional)
2	Slim optical drive (some models)	16	Cooling shroud
3	Internal tape drive (some models)	17	ThinkServer RAID Super Capacitor Module (some models)
4	2.5-inch-drive area	18	Riser card assembly
5	Rack handle (left)	19	PCIe card slot (available on some models)
6	Front panel board	20	Intrusion switch (available on some models)
7	AnyRAID adapter	21	Rear backplane/cage assembly (some models)
8	Front backplane	22	Power supply 1
9	System fan cage	23	Power supply 2 (some models)
10	System fan	24	Power distribution board
11	System board	25	CPU2 DIMMs (vary by model)
12	CPU1 DIMMs (vary by model)	26	CPU2 DIMMs (vary by model)
13	Heat sink	27	CPU1 DIMMs (vary by model)
14	Coin-cell battery	28	Server cover

The following figure shows the component locations on the system board.
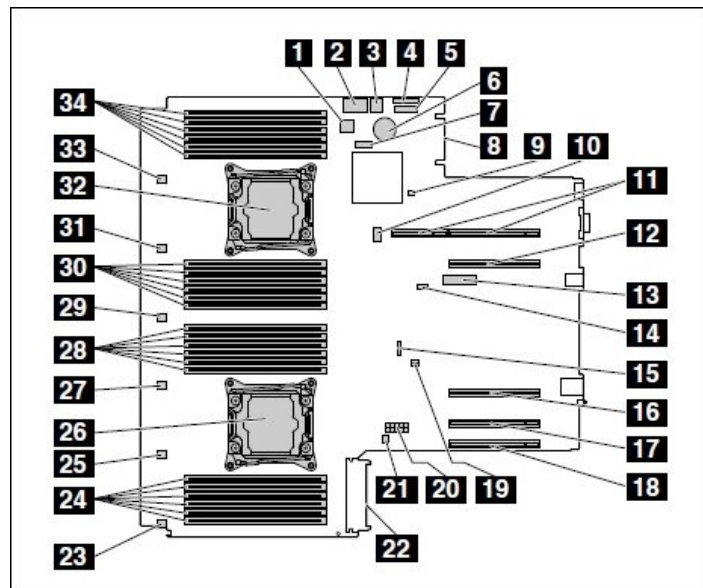

Figure 5. Internal Component Locations on the System Board

The following table identifies the items that are highlighted in Figure 5.

Table 2. RD650 System Board Components in Figure 5

ID	Description	ID	Description
1	SATA connector 1 (ports 4-7)	18	PCIe slot 8
2	AnyRAID connector 0-1	19	Rear-backplane power connector
3	SATA connectors 0 (ports 0-3)	20	Front-backplane power connector
4	Front panel connector 2	21	Intrusion switch connector
5	Front panel connector 1	22	Power-distribution-board connector
6	Coin-cell battery	23	System fan 6 connector
7	SATA connector (optical drive)	24	CPU 2 memory slots (6)
8	AnyFabric connector	25	System fan 5 connector
9	RAID upgrade key connector	26	CPU 2 socket
10	SD module connector	27	System fan 4 connector
11	Riser slot 1	28	CPU 2 memory slots (6)
12	PCIe slot 4	29	System fan 3 connector
13	TPM connector	30	CPU 1 memory slots (6)
14	TSM connector	31	System fan 2 connector
15	Rear-backplane power connector	32	CPU 1 socket
16	Riser slot 2	33	System fan 1 connector
17	PCIe slot 7	34	CPU 1 memory slots (6)

System specifications

The following table lists the system specifications of the ThinkServer RD650.

Table 3. System specifications

Attribute	Specification
Form Factor	2U Rack
Processor Support	Up to two Intel Xeon E5-2600 v3 Series CPUs, with up to 145W SKUs and up to 18 cores per CPU
Chipset	Intel C610 series chipset
Memory	Up to 24 DDR4 DIMM sockets (12 DIMMs per processor). RDIMMs and Load Reduced (LR)-DIMMs are supported. Memory speed up to 2133 MTps.
Maximum Capacities	LR-DIMM: 768 GB (24x 32 GB) RDIMM: 384 GB (24x 16 GB)
Memory RAS	ECC, Patrol Scrubbing, Demand Scrubbing, Sparing, Mirroring, and Lockstep Mode
Storage options	12x front 3.5-inch drive bays + 2 rear 2.5-inch drive bays[1] with up to 74 TB storage capacity 8/16/24x front 2.5-inch drive bays + 2 rear 2.5-inch bays with up to 30.8 TB storage capacity 9x front 3.5-inch + 6x front 2.5-inch + 2x rear 2.5-inch with up to 63.2 TB storage capacity - Supported Technologies: SATA HDD, SAS HDD (7.2 K, 10 K, 15 K), SATA SSD, SAS SSD, PCIe SSD, Dual Internal M.2 Flash[2] and SD card

Attribute	Specification
Media bays	• Slim optical drive in select 2.5-inch HDD chassis configurations • Internal LTO6 Tape drive available in 8x 2.5-inch chassis only
Storage controllers	• RAID110i 6 Gb SATA RAID 0/1/10 with optional RAID 5 • RAID510i 6 GB SAS & SATA RAID 0/1/10 with optional RAID 5/50 • RAID720i 12 Gb RAID 0/1/5/6/10/50/60 with optional 1 GB read-only cache; optional 1 GB, 2 GB or 4 GB R/W cache includes CacheVault/CacheCade/FastPath • RAID720ix 12 Gb RAID 0/1/5/6/10/50/60 with optional 1 GB read-only cache; optional 1 GB, 2 GB or 4 GB R/W cache includes CacheVault/CacheCade/FastPath
I/O expansion slots	• Up to eight PCIe slots; three slots on the system board, five (optional) slots on riser cards • One AnyFabric mezzanine slot
Network Interfaces	One 1 Gbps Ethernet dedicated for remote management. AnyFabric includes the following options: • 1 GbE mezzanine, quad-port, Base-T NIC • 10 GbE mezzanine, dual-port, Base-T NIC • 10 GbE mezzanine, dual-port, SFP+ CNA • 10 GbE mezzanine, quad-port, SFP+ CNA • 8 Gb mezzanine, quad-port FC HBA • 16 Gb mezzanine, dual-port FC HBA
I/O connectors	• USB ports: 2x v2.0 front[3], 2x v3.0 rear • Display Port: 1 front[4], 1 rear • Serial port: 1 rear
System cooling	• With 1x CPU: 4 system fans, Hot Swap Redundant • With 2x CPUs: 6 system fans, Hot Swap Redundant
Power supply	Up to two redundant hot-swap power supplies (Energy Star 2.0 and Climate Savers compliant): • 1+1 Redundant Power capable • 550 W, 750 W, 1100 W, or 1600 W 80 Plus Platinum PSU (100 - 127/200-240 V AC) • 750 W 80 Plus Titanium PSU (208 - 240 V AC)
Security	BIOS administrator's and user's passwords, Physical Security Intrusion Detection (optional), Cover Lock. Optional Trusted Platform Module (TPM) version 1.2 or 2.0.
Operating systems	Windows Server 2008 R2, 2012, 2012 R2 and 2016; SLES 11 and 12; RHEL 6 and 7; VMware ESXi 5.1, 5.5, and 6.0.
Systems management	• ThinkServer System Manager • ThinkServer System Manager Premium (optional) • ThinkServer Deployment Manager • ThinkServer Energy Manager (activated with ThinkServer System Manager Premium) • Partner Pack for Microsoft System Center Operations Manager • Partner Pack for VMware vCenter
Dimensions	• Width (with rack ears): 482 mm (19 in.) • Height: 87 mm (3.43 in.) • Depth (front panel to rear panel): 783 mm (30.83 in.)
Weight	Weight: 16 kg (35.27 lbs) – 32 kg (70.55 lbs)
Temperature	Operating: 5° - 45°C (41° - 113°F) Non-operating (no package): -10° - 60° C (14° - 140°F) Non-operating: (with package): -40° - 60°C (-40° - 140°F)

Attribute	Specification
Humidity	Operating: 8% - 90% (non-condensing) Non-operating: 8% - 90% (non-condensing)
Altitude	0 - 3048 m (0 - 10,000 ft)
Acoustics	Minimum configuration: LWAd: 3.6 bels (Idle)/3.8 bels (Operating), m: 22.1 dB (Idle)/25.5 dB (Operating) Maximum configuration: LWAd: 5.7 bels (Idle)/6.1 bels (Operating), m: 39 dB (Idle)/40.6 dB (Operating)
Limited warranty	One year or three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (depending on model)

[1] Rear drives are SATA only.
[2] M.2 internal drives are not supported with rear drive configuration.
[3] No front panel USB ports on 12x 3.5-inch and 6x 2.5-inch + 9x 3.5-inch HDD configurations.
[4] No front panel display port on 12x 3.5-inch and 6x 2.5-inch + 9x 3.5-inch HDD configurations.

Server models

For more information about the available models of the RD650, see this website:
http://psref.lenovo.com/Product/23

Processor options

The RD650 supports up to two Intel® Xeon® E5-2600 v3 series of processors. Xeon E5-2600 v3 improves on the older generation of processors in the following ways:

- Maximum core count is increased from 12 to 18 cores per processor.
- Single thread count is increased from 24 to 36.
- Maximum last level per-processor cache is increased from 30 MB to 45 MB.
- Intel Quick Path Interconnect speed increases from 8.0 GTps to 9.6 GTps.
- Supports DDR4 memory at up to 2133 MTps.
- Supports Trusted Execution Technology (TX).
- Supports Advanced Encryption Standard Instruction Set.

The following table lists the supported processor options and ordering information. Up to two processors are supported by the system.

Table 4. Processor options (TB = Turbo Boost, VT = Virtualization Technology, HT = Hyper-Threading)

| Part number | SKU | Core speed | TDP | Cache | Cores / Threads | QPI Speed | DDR4 memory speed | | | TB | VT | HT |
							1600 MHz	1866 MHz	2133 MHz			
4XG0F28807	E5-2699 v3	2.3 GHz	145 W	45 MB	18/36	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28808	E5-2698 v3	2.6 GHz	135 W	40 MB	16/32	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28809	E5-2697 v3	2.6 GHz	145 W	35 MB	14/28	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28810	E5-2695 v3	2.3 GHz	120 W	35 MB	14/28	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28811	E5-2690 v3	2.6 GHz	135 W	30 MB	12/24	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28838	E5-2685 v3	2.6 GHz	120 W	30 MB	12/12	9.6 GTps	Yes	Yes	Yes	Yes	No	No
4XG0F28812	E5-2683 v3	2.0 GHz	120 W	35 MB	14/28	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28813	E5-2680 v3	2.5 GHz	120 W	30 MB	12/24	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28814	E5-2670 v3	2.3 GHz	120 W	30 MB	12/24	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28834	E5-2667 v3	3.2 GHz	135 W	20 MB	8/16	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28815	E5-2660 v3	2.6 GHz	105 W	25 MB	10/20	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28816	E5-2650 v3	2.3 GHz	105 W	25 MB	10/20	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28822	E5-2650L v3	1.8 GHz	65 W	30 MB	12/24	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28835	E5-2643 v3	3.4 GHz	135 W	20 MB	6/12	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28817	E5-2640 v3	2.6 GHz	90 W	20 MB	8/16	8.0 GTps	Yes	Yes	No	Yes	Yes	Yes
4XG0F28836	E5-2637 v3	3.5 GHz	135 W	15 MB	4/8	9.6 GTps	Yes	Yes	Yes	Yes	Yes	Yes
4XG0F28823	E5-2630L v3	1.8 GHz	55 W	20 MB	8/16	8.0 GTps	Yes	Yes	No	Yes	Yes	Yes
4XG0F28818	E5-2630 v3	2.4 GHz	85 W	20 MB	8/16	8.0 GTps	Yes	Yes	No	Yes	Yes	Yes
4XG0F28837	E5-2623 v3	3.0 GHz	105 W	10 MB	4/8	8.0 GTps	Yes	Yes	No	Yes	Yes	Yes
4XG0F28819	E5-2620 v3	2.4 GHz	85 W	15 MB	6/12	6.4 GTps	Yes	Yes	No	Yes	Yes	Yes
4XG0F28820	E5-2609 v3	1.9 GHz	85 W	15 MB	6/6	8.0 GTps	Yes	No	No	No	Yes	No
4XG0F28821	E5-2603 v3	1.6 GHz	85 W	15 MB	6/6	6.4 GTps	Yes	No	No	No	Yes	No

Memory options

The ThinkServer RD650 supports DDR4 memory. DDR4 memory offers many benefits over older generation DDR3 memory. DDR4 operates at a lower voltage than DDR3L (1.2 V versus 1.5 V) and as a result, it offers significant power savings. In addition, DDR4 memory has higher memory transfer speeds that are up to 2133 MTps, depending on the memory configuration.

Lenovo offers Registered DIMMs (RDIMM) and Load Reduced DIMMs (LR-DIMM) that use a buffer to reduce memory bus loading, which enables greater memory capacities to be achieved.

The server supports up to 12 DIMMs when one processor is installed and up to 24 DIMMs when two processors are installed. Each processor has four memory channels and there are three DIMMs supported per channel. The RD650 supports up to 768 GB of memory at speeds up to 1866 MTps when fully populated. The actual memory speed in the system is determined as the lowest of the memory speed that is supported by the specific CPU or the maximum operating speeds for the memory configuration that is based on the number of DIMMs per channel.

ThinkServer engineering tested and validated system designs that support memory speeds beyond Intel's original plan, which provides benefits for workloads that require memory speed and density. Lenovo ThinkServer memory is fully supported up to the rated speeds that are shown in the following table.

Table 5. RD650 Maximum Memory Capacities

DIMMs per channel	RDIMM		LRDIMM	
	Memory bus speed	Maximum capacity	Memory bus speed	Maximum capacity
1 DPC	2133 MHz	128 GB (8x 16 GB)	2133 MHz	256 GB (8x 32 GB)
2 DPC	2133 MHz	256 GB (16x 16 GB)	2133 MHz	512 GB (16x 32 GB)
3 DPC	1600 MHz	384 GB (24x 16 GB)	1866 MHz	768 GB (24x 32 GB)

Protection against data loss is provided through the following memory RAS features: ECC, Patrol and Demand Scrubbing, Sparing, Mirroring, and Lockstep Mode.

Configuration Guidelines

Memory can be configured to meet various needs and workloads subject to the following general rules:

- Mixing memory type (RDIMM, LR-DIMM) is not supported.
- DIMM capacities and rank can be mixed.

When you are populating for the various RAS modes the following rules apply:

- If memory mirroring or lockstep is used, DIMMs must be installed in pairs (minimum of one pair per each CPU), and both DIMMs in a pair must be identical in type, size, and rank.
- If memory sparing is used, one rank of a DIMM in each populated channel is reserved as spare memory; therefore, Single Rank DIMMs cannot be used. DIMMs in a pair must be identical in type, size, and rank.

Memory Optimization

The memory subsystem can be optimized for various factors, including performance, capacity, or power consumption. Refer to the following guidelines when you are selecting memory options:

- Guidelines for maximum memory performance:
    - Use all available memory channels (four per processor, eight total per system).
    - Use identical DIMM populations in size and speed across channels.
    - Populate both processors with equal amounts of memory.
    - Use the same number of ranks that are populated per channel.
    - Have at least two ranks available on each channel.

- Guidelines for lowest memory power consumption:
  - Use fewer, higher capacity DIMMs. For example, a 8x 16 GB DIMM configuration often has lower power requirements than that of a 16x 8 GB DIMM configuration.
  - Populating more DIMMs per channel and the use of less channels (opposite of the previous guidance) reduces overall system power, but at the cost of significant performance reduction.

The following table provides guidelines for selecting memory configurations that are based on performance or capacity. For example, to achieve optimal 2133 MHz performance at a specific capacity, populate up to 16 DIMMs (up to 8 per CPU). To achieve the maximum memory capacity with the highest performance, populate up to 24 sockets with LRDIMMs.

Table 6. Memory Configuration Guidelines

Desired system capacity	Number of processors	Number of DIMMs and size	Number of channels used	Recommended DIMM type	Operating frequency	Comments
4GB	1 CPU	1x 4 GB	1 channel	RDIMM	2133 MHz	Minimum configuration for 1 CPU
8GB	1 CPU	1x 8 GB	1 channel	RDIMM	2133 MHz	Cost optimized
16GB	1 CPU	2x 8 GB	2 channel	RDIMM	2133 MHz	Cost optimized
32GB	1 CPU	8x 4 GB	4 channels	RDIMM	2133 MHz	Best throughput with one CPU
64GB	1 CPU	8x 8 GB	4 channels	RDIMM	2133 MHz	
128GB	1 CPU	8x 1 6GB	4 channels	RDIMM	2133 MHz	
256GB	1 CPU	8x 32 GB	4 channels	RDIMM	2133 MHz	
384GB	1 CPU	12x 32 GB	4 channels	LRDIMM	1866 MHz	Highest 1 CPU capacity
32GB	2 CPU	8x 4 GB	4 channels	RDIMM	2133 MHz	Cost optimized
64GB	2 CPU	16x 4 GB	8 channels	RDIMM	2133 MHz	Best throughput with two CPUs
128GB	2 CPU	16x 8 GB	8 channels	RDIMM	2133 MHz	
192GB	2 CPU	8x 8 GB + 8x 16 GB	8 channels	RDIMM	2133 MHz	
256GB	2 CPU	16x 16 GB	8 channels	RDIMM	2133 MHz	
512GB	2 CPU	16x 32 GB	8 channels	LRDIMM	2133 MHz	Highest capacity at best throughput
768GB	2 CPU	24x 32 GB	8 channels	LRDIMM	1866 MHz	Highest Capacity

The following table lists the RD650 DDR4 memory options and ordering information.

Table 7. Memory Options

DIMM capacity	Type	Ranking	Voltage	Part number
4 GB	RDIMM	1R x 8	1.2 V	4X70F28588
8 GB	RDIMM	1R x 4	1.2 V	4X70F28589
16 GB	RDIMM	2R x 4	1.2 V	4X70F28590
32 GB	LRDIMM	4R x 4	1.2 V	4X70F28591

Internal storage

The ThinkServer RD650 implements a new chassis design that allows a greater number of drive bays, which support increased internal storage capacity. The system can be configured to meet exact workload requirements.

Lenovo AnyBay technology

The RD650 features an industry-unique Lenovo AnyBay design, which allows a choice of SATA, SAS, or PCIe interface drives in the same drive bay. This design enables the flexibility to configure some of the bays with high performance PCIe SSDs and still use the remaining bays for high capacity HDDs, which is an ideal solution for storage-tiering. The RD650 supports up to four AnyBay drive bays.

Note: Support for PCIe interface drives in the AnyBay design is planned.

Chassis features and functions

The RD650 supports three basic chassis types, including systems that support 2.5-inch drive bays, 3.5-inch drive bays, and a hybrid chassis that supports both 3.5-inch and 2.5-inch drive bays.

All chassis types optionally support two 2.5-inch hot-swap SATA drives in the rear of the server. When the two rear drives are used, the AnyRAID 720ix controller is required.

All chassis types also support enterprise M.2 SSD and SD memory cards, which can be used as boot drives. M.2 is a form factor of SSD with a small footprint. The RD650 supports two M.2 SSDs that can be configured as RAID-1 with the AnyRAID 110i or 720ix controllers. The RD650 supports two SD memory cards via an optional module that is connected to USB ports on the system board. SD memory cards can be configured redundantly by using the operating system. The SD cards are enabled via a USB port from the system board Platform Controller Hub (PCH) and do not require a RAID controller.

This section describes the base chassis configurations with varying numbers of drive bays and the key features of each configuration.

2.5-inch chassis

The 2.5-inch chassis supports configurations with up to 8, 16, or 24 hot-swap small form factor HDDs or SSDs. Figure 5 shows the RD650 2.5-inch chassis supporting 24 drives.

Figure 6. RD650 2.5-inch Chassis supporting 24 drives

The 24 drive bay configuration can also be configured to support four AnyBay drive bays or upgraded with the upgrade kit, as shown in Table 9.

One slim optional optical disk drive is available for the 2.5-inch chassis with up to 16 drives.

Additionally, one LTO6 half-height tape drive with support for 2.5 TB tape cartridges can be configured with the 8x 2.5-inch drive chassis. The following table shows the 2.5-inch chassis mechanical features of each drive bay configuration.

Table 8. 2.5-inch chassis mechanical features

Max number of front drive bays	Optical drive support	Internal tape support	AnyBay support available
8	Yes	Yes	No
16	Yes	No	No
24	No	No	Yes

An available option kit can be purchased to upgrade an 8-bay chassis to a 16-bay or 24-bay chassis (see Table 9).

3.5-inch chassis

The 3.5-inch chassis supports configurations with up to 6 or 12 hot-swap HDDs or SSDs. The following figure shows the RD650 3.5-inch drive bay chassis.

Figure 7. RD650 3.5-inch Drive Bay Chassis

Hybrid Chassis

The hybrid chassis supports nine 3.5-inch hot swap drive bays and six 2.5-inch drive bays. Four of the 2.5-inch drive bays are AnyBay drive bays and can support SATA or SAS HDDs, SSDs, and PCIe SSDs. The following figure shows the RD650 hybrid drive bay chassis.

Figure 8. RD650 Hybrid Drive Bay Chassis

The following table shows the ordering information for RD650 backplane option kits.

Table 9. Chassis drive upgrade option kit part numbers

Description	Part Number
Front 2.5-inch backplane kit (8 drive)	4XF0G45883
Front 2.5-inch backplane kit (16-drive)	4XF0G45884
Rear 2.5-inch 2-drive rear backplane kit	4XF0G45877
RD650 2.5x24 Chassis AnyBay Enablement Kit	4XF0G88925
RD650 Hybrid Chassis AnyBay Enablement Kit	4XF0G88926

Controllers for internal storage

ThinkServer® AnyRAID is Lenovo's uniquely designed RAID portfolio that is available on the next-generation ThinkServer systems. AnyRAID cards are deployed in a midplane format and connected directly to the drive backplane, without the use of a PCIe slot.

With a comprehensive portfolio, Lenovo ThinkServer AnyRAID controllers are available for various applications and include software, I/O controller (IOC), and RAID-on-chip based (RoC) solutions.

Along with a broad RAID controller selection, Lenovo offers options, such as upgrade keys for software and IOC-based controllers, read-only and protected cache options, and advanced caching, and SSD acceleration software. To ensure investment protection, RAID configurations, data, and most options can transfer intact when you upgrade to a more advanced controller. ThinkServer AnyRAID options are common across the Lenovo ThinkServer next-generation portfolio.

Lenovo offers the following ThinkServer AnyRAID controllers to provide coverage for various business and technical requirements:

- Lenovo ThinkServer AnyRAID 110i is a software RAID controller that offers a low-cost solution for light workloads with limited users.
- Lenovo ThinkServer AnyRAID 510i is an IOC-based RAID card that offers an affordable hardware controller that delivers performance and reliability.
- Lenovo ThinkServer AnyRAID 720i is a RoC-based controller that offers advanced RAID configurations, protection, and software.
- Lenovo ThinkServer AnyRAID 720ix is similar to the AnyRAID 720i, but contains an onboard SAS expander to support up to 26 drives.

The following table summarizes the features and specifications of RAID controllers.

Table 10. RAID controller features and specifications summary

Feature	RAID 110i	RAID 510i	RAID 720i	RAID 720ix
Part number	None	4XB0F28691	4XC0G88838	4XC0G88839
Form factor	Onboard	AnyRAID	AnyRAID	AnyRAID
Controller chip	Not applicable	LSI SAS2008	LSI SAS3108	LSI SAS3108
Host interface	Not applicable	PCIe 2.0 x8	PCIe 3.0 x8	PCIe 3.0 x8
Port interface	6 Gbps SATA	6 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Drive interface	SATA	SAS, SATA	SAS, SATA	SAS, SATA
Drive type	HDD, SSD	HDD, SSD	HDD, SSD	HDD, SSD
Drive form factor	SFF, LFF, M.2	SFF, LFF	SFF, LFF	SFF, M.2
Number of drives	8*	8	8	26**
RAID levels	0/1/10, Optional 5 (4XB0F28690)	0/1/10, Optional 5/50 (4XB0F28692)	0/1/10/5/50, Optional 6/60 w/ cache upgrade	0/1/10/5/50/6/60 (cache upgrade required)
JBOD mode	Yes	Yes	Yes (without cache)	Yes (w/ non-backed cache)
Cache	None	None	1 GB non-backed (4XB0F28695) 1 GB flash-backed (4XB0F28696) 2 GB flash-backed (4XB0F28697) 4 GB flash-backed (4XB0F28698)	1 GB non-backed (4XB0F28695) 1 GB flash-backed (4XB0F28696) 2 GB flash-backed (4XB0F28697) 4 GB flash-backed (4XB0F28698)
FastPath	No	No	Yes (w/ flash backup)	Yes (w/ flash backup)
CacheCade Pro	No	No	Yes (w/ flash backup)	Yes (w/ flash backup)

* Up to 6 drives can be configured in a RAID array, and the remaining two drives operate in JBOD mode.
** Includes SAS Expander.

The following table lists RD650 chassis and AnyRAID controller compatibility.

Table 11. AnyRAID Compatibility Matrix

Chassis Type	RAID 110i	RAID 510i	RAID 720i	RAID 720ix
2.5-inch 8 bay	Yes	Yes	Yes	Yes
2.5-inch 16 bay	No	No	No	Yes
2.5-inch 24 bay	No	No	No	Yes
2.5-inch 24 bay (with AnyBay support)	No	No	No	Yes
3.5-inch 6 bay	Yes	Yes	Yes	Yes
3.5-inch 12 bay	No	No	No	Yes
Hybrid	No	No	No	Yes

Lenovo designed the AnyRAID offerings to grow with your requirements, which maximizes your investment. RAID volume configurations and data stay intact during controller upgrades throughout the portfolio, from the RAID 110i to the AnyRAID 720ix. Options can also be moved between cards wherever it provides a benefit. For example, the RAID 5 key for the RAID 110i also works with the RAID 510i controller. The cache options and software licenses for the AnyRAID 720i also transfer to the AnyRAID 720ix.

The following table shows the ordering information for AnyRAID adapters and upgrade options.

Table 12. AnyRAID Options

Description	Part Number
Lenovo ThinkServer RAID 110i RAID 5 Upgrade	4XB0F28690
Lenovo ThinkServer RAID 510i AnyRAID Adapter	4XB0F28691
Lenovo ThinkServer RAID 510i RAID 5 Upgrade	4XB0F28692
Lenovo ThinkServer RAID 720i AnyRAID Adapter	4XC0G88838
Lenovo ThinkServer RAID 720ix AnyRAID Adapter with Expander	4XC0G88839
Lenovo ThinkServer RAID 720i 1GB Modular DRAM Upgrade	4XB0F28695
Lenovo ThinkServer RAID 720i 1GB Modular Flash and Super Capacitor Upgrade	4XB0F28696
Lenovo ThinkServer RAID 720i 2GB Modular Flash and Super Capacitor Upgrade	4XB0F28697
Lenovo ThinkServer RAID 720i 4GB Modular Flash and Super Capacitor Upgrade	4XB0F28698

Drives for internal storage

The ThinkServer RD650 supports the drive options listed in the following table.

Table 13. Internal drive options (Part 1: 3.5-inch drives)

Description	Part number
3.5-inch hot-swap HDDs (2.5-inch HDDs in 3.5-inch drive trays) - 12 Gbps SAS	
ThinkServer Gen 5 2.5" 300GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88733
ThinkServer Gen 5 2.5" 300GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88740
ThinkServer Gen 5 2.5" 450GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88744
ThinkServer Gen 5 2.5" 600GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88761
ThinkServer Gen 5 2.5" 600GB 15K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88746
ThinkServer Gen 5 2.5" 900GB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88762

Description	Part number
ThinkServer Gen 5 2.5" 1.2TB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88763
ThinkServer Gen 5 2.5" 1.8TB 10K Enterprise SAS 12Gbps HS HDD in 3.5" tray	4XB0G88738
3.5-inch hot-swap HDDs - 12 Gbps NL SAS	
ThinkServer Gen 5 3.5" 1TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512N)	4XB0K12270
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512N)	4XB0K12278
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512E)	4XB0G88730
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512N)	4XB0K12279
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512E)	4XB0G88731
ThinkServer Gen 5 3.5" 6TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512E)	4XB0G88715
ThinkServer Gen 5 3.5" 8TB 7.2K Enterprise SAS 12Gbps Hot Swap HDD (512E)	4XB0K12254
ThinkServer Gen 5 3.5" 10TB 7.2K Enterprise SAS 12Gbps HS 512e HDD	4XB0K12312
3.5-inch hot-swap HDDs - 6 Gbps NL SATA	
ThinkServer Gen 5 3.5" 1TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0F28712
ThinkServer Gen 5 3.5" 2TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0F28713
ThinkServer Gen 5 3.5" 3TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0F28714
ThinkServer Gen 5 3.5" 4TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0G45715
ThinkServer Gen 5 3.5" 5TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0G88712
ThinkServer Gen 5 3.5" 6TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0G88713
ThinkServer Gen 5 3.5" 8TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0K12255
ThinkServer Gen 5 3.5" 10TB 7.2K Enterprise SATA 6Gbps HS 512e HDD	4XB0K12313
ThinkServer Gen 5 3.5" 12TB 7.2K Enterprise SATA 6Gbps HS 512e HDD	4XB0N68532
3.5-inch hot-swap SSDs - Enterprise Mainstream 12 Gbps SAS	
ThinkServer 3.5" 400GB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12261
ThinkServer 3.5" 800GB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12262
ThinkServer 3.5" 1.6TB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12263

Table 13. Internal drive options (Part 2: 2.5-inch drives)

Description	Part number
2.5-inch hot-swap HDDs - 12 Gbps SAS	
ThinkServer Gen 5 2.5" 300GB 10K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88732
ThinkServer Gen 5 2.5" 300GB 15K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88739
ThinkServer Gen 5 2.5" 450GB 15K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88743
ThinkServer Gen 5 2.5" 600GB 10K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88734
ThinkServer Gen 5 2.5" 600GB 15K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88765
ThinkServer Gen 5 2.5" 900GB 10K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88735
ThinkServer Gen 5 2.5" 1.2TB 10K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88736
ThinkServer Gen 5 2.5" 1.8TB 10K Enterprise SAS 12Gbps Hot Swap HDD	4XB0G88737
2.5-inch hot-swap HDDs - 6 Gbps NL SATA	
ThinkServer Gen 5 2.5" 1TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0G45721
ThinkServer Gen 5 2.5" 2TB 7.2K Enterprise SATA 6Gbps Hot Swap HDD	4XB0G88774
2.5-inch hot-swap SSDs - Enterprise Mainstream 12 Gbps SAS	
ThinkServer 2.5" 400GB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12258
ThinkServer 2.5" 800GB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12259
ThinkServer 2.5" 1.6TB PM1635 Enterprise Mainstream 12Gb SAS HS SSD	4XB0K12260
2.5-inch EasySwap NVMe SSDs for AnyBay - Enterprise Performance PCIe 3.0	
ThinkServer G5 2.5" 400GB Enterprise Perf. PCIe 3.0 Easy Swap SSD for AnyBay	4XB0G45748
ThinkServer G5 2.5" 800GB Enterprise Perf. PCIe 3.0 Easy Swap SSD for AnyBay	4XB0G45749
ThinkServer G5 2.5" 1.6TB Enterprise Perf. PCIe 3.0 Easy Swap SSD for AnyBay	4XB0G45750

Table 13. Internal drive options (Part 3: M.2 SSD and SD card options)

Description	Part number
M.2 SSDs	
ThinkServer M.2 80GB Value Read-Optimized SATA 6Gbps SSD	4XB0G88741
ThinkServer M.2 120GB Value Read-Optimized SATA 6Gbps SSD	4XB0F28656
Lenovo ThinkServer RD650 M.2 Enablement Kit to Motherboard	4XF0G45891
LTS M.2 Enablement Kit for RD550 3.5" Chassis or RD650 with RAID720ix	4XF0G45890
SD cards	
ThinkServer 8GB SD Card	4X70F28592
ThinkServer 32GB SD Card	4X70F28593
Lenovo ThinkServer SDHC Flash Assembly Module	4XF0G88933

Internal backup units

Models with the 2.5-inch drive chassis and with up to 8x 2.5-inch drive bays can be configured to include an internal LTO6 tape drive. Supported tape drives are listed in the following table.

Table 14. Optical drive options

Description	Part number
Lenovo ThinkServer External RDX Tape Drive	4XF0G88929
ThinkServer 1TB 3Gbps RDX Cartridge	4XB0F28660
ThinkServer 2TB SATA 3Gbps RDX Cartridge	4XB0G88711
Lenovo ThinkServer 2.5TB SAS 6Gbps LTO-6 Tape	4XB0F28689
Lenovo ThinkServer LTO-6 Linear Tape Drive Kit by Tandberg	4XF0G45866

Optical drives

Models with the 2.5-inch drive chassis and with up to 16x 2.5-inch drive bays support an internal optical drive and some models have a drive standard. See the Standard Models section for details. Where the optical drive is optional, the following table lists the supported options.

Table 15: Optical drive options

Description	Part number
Lenovo ThinkServer Slim SATA DVR-RW Optical Disk Drive	4XA0F28607
Lenovo ThinkServer Slim SATA DVR-ROM Optical Disk Drive	4XA0F28608

For models with 3.5-inch drives or combinations of 2.5-inch and 3.5-inch drives, the server does not support an internal optical drive option; however, you can connect an external USB optical drive. For information about available external optical drives from Lenovo, see this website:

http://support.lenovo.com/en/documents/pd011281

I/O expansion

The Lenovo RD650 offers various I/O options for ultimate flexibility, which provides support for the most demanding application requirements. The server provides a 1 Gb Ethernet port for management and I/O options are available in AnyFabric and standard PCIe adapter formats.

AnyFabric

Lenovo ThinkServer AnyFabric adapters are a collection of network interface controllers (NICs), HBAs, and CNAs that are offered in a mezzanine card format. Designed to provide various connectivity options while still allowing flexible expansion, AnyFabric adapters do not occupy a PCIe slot.

AnyFabric adapters operate by using a PCIe bus channel, which supports up to PCIe v3.0. Based on technology from industry leaders Intel and Emulex, these adapters provide world-class NIC, HBA, and CNA features. While they occupy minimal space in the server chassis that is similar to an onboard adapter, they allow flexibility that is not available with a built-in adapter. Any adapter easily can be swapped for another AnyFabric adapter.

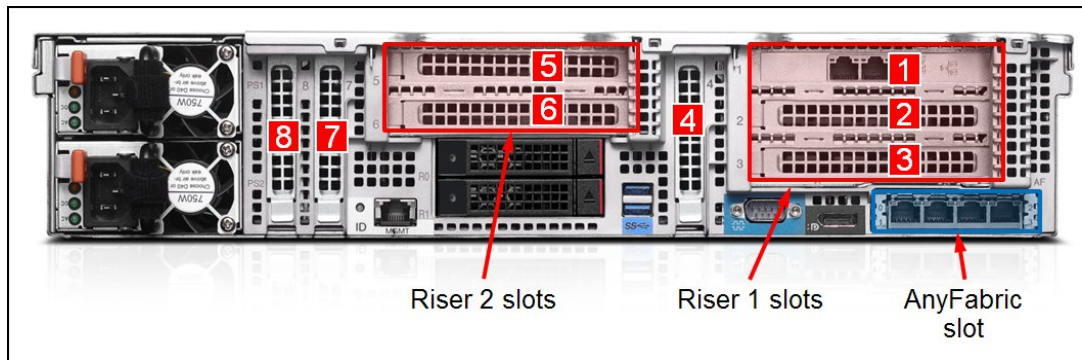The following figure shows the location of the AnyFabric slot in the RD650.

Figure 9. RD650 rear view showing the riser card expansion slots and AnyFabric slot

PCIe slots

The RD650 also provides up to eight PCIe 3.0 slots: three slots on the system planar and up to five more slots via two riser cards. The slots that are available for use depend on the following number of riser cards that are installed and whether processor 2 is installed:

- One CPU and no riser cards: No PCIe slots are available
- Two CPUs and no riser cards: Up to three PCIe slots are available (slots 4, 7, 8)
- One CPU and a single riser card in riser slot 1: Up to three PCIe slots are available (slots 1, 2, 3)
- Two CPUs and a single riser card in riser slot 2: Up to five PCIe slots are available (slots 4, 5, 6, 7, 8)
- Adding a second riser card with two CPUs: Up to eight PCIe slots are available (all slots)

The following table provides more information about the supported PCIe slots.

Table 16. RD650 PCIe slots

PCIe slot	Riser slot	Type	Processor required	Form factor	Bus width	Mechanical width
1	1	PCIe 3.0	CPU 1	FH/HL	x8	x16
2	1	PCIe 3.0	CPU 1	FH/HL	x8	x16
3	1	PCIe 3.0	CPU 1	FH/HL	x8	x16
4	Planar	PCIe 3.0	CPU 2	LP	x8	x16
5	2	PCIe 3.0	CPU 2	FH/HL	x8	x16
6	2	PCIe 3.0	CPU 2	FH/HL	x8	x16
7	Planar	PCIe 3.0	CPU 2	LP	x8	x16
8	Planar	PCIe 3.0	CPU 2	LP	x8	x16

The riser card that is used in both riser slot 1 and riser slot 2 is listed in the following table.

Table 17. RD650 riser card ordering information

Description	Part Number	Maximum Supported
RD650 x8/x8/x8 PCIe Riser Kit	4XF0G45881	2

Network adapters

Onboard networking in the RD650 is supplied using an AnyFabric mezzanine card. This mezzanine card is installed in a dedicated slot at the rear of the server as shown in the Location of key components and connectors section.

The following table lists the supported AnyFabric Ethernet adapters and Converted Networking adapters.

Table 18. AnyFabric networking adapters

Part number	Description	Transceiver part number
1 Gb Ethernet adapters		
4XC0F28740	ThinkServer I350-T4 AnyFabric 1Gb 4 Port Base-T Ethernet Adapter by Intel	Not required
10 Gb Ethernet adapters		
4XC0F28742	ThinkServer X520-DA2 AnyFabric 10Gb 2 Port SFP+ Ethernet Adapter by Intel	4XC0F28735
4XC0F28741	ThinkServer X540-T2 AnyFabric 10Gb 2 Port Base-T Ethernet Adapter by Intel	Not required
4XC0G88847	ThinkServer X710-DA2 AnyFabric 10Gb 2 port Ethernet Adapter by Intel	4XC0F28735
4XC0G88848	ThinkServer X710-DA4 AnyFabric 10Gb 4 port Ethernet Adapter by Intel	4XC0F28735
4XC0G88830	ThinkServer OCm14102-NX-L AnyFabric 10Gb 2 port SFP+ Ethernet Adapter by Emulex	4XC0F28737
10 Gb Converged Ethernet Adapters		
4XC0F28743	ThinkServer OCm14102-UX-L AnyFabric 10Gb 2 Port SFP+ Converged Network Adapter by Emulex	4XC0F28737
4XC0F28744	ThinkServer OCm14104-UX-L AnyFabric 10Gb 4 Port SFP+ Converged Network Adapter by Emulex	4XC0F28737

The RD650 also supports a range of PCIe Ethernet and Converged Ethernet adapters as listed in the following table.

Table 19. Network adapters

Part number	Description	Transceiver part number
1 Gb Ethernet		
4XC0F28730	ThinkServer I350-T2 PCIe 1Gb 2 Port Base-T Ethernet Adapter by Intel	Not required
4XC0F28731	ThinkServer I350-T4 PCIe 1Gb 4 Port Base-T Ethernet Adapter by Intel	Not required
10 Gb Ethernet		
4XC0F28733	ThinkServer X520-SR2 PCIe 10Gb 2 Port SFP+ Ethernet Adapter by Intel	Included
4XC0F28734	ThinkServer X520-DA2 PCIe 10Gb 2 Port SFP+ Ethernet Adapter by Intel	4XC0F28735
4XC0F28732	ThinkServer X540-T2 PCIe 10Gb 2 Port Base-T Ethernet Adapter by Intel	Not required
4XC0G88855	ThinkServer X550-T1 PCIe 10Gb 1 Port Base-T Ethernet Adapter by Intel	Not required
4XC0G88856	ThinkServer X550-T2 PCIe 10Gb 2 Port Base-T Ethernet Adapter by Intel	Not required
4XC0G88852	ThinkServer X710-DA2 PCIe 10Gb 2 port Ethernet Adapter by Intel	4XC0F28735
4XC0G88854	ThinkServer X710-DA4 PCIe 10Gb 4 port Ethernet Adapter by Intel	4XC0F28735
4XC0F28724	ThinkServer OCe14102-NX 10Gbps Dual Port Ethernet Adapter by Emulex	4XC0F28716
4XC0F28736	ThinkServer OCe14102-UX-L PCIe 10Gb 2 Port SFP+ Converged Network Adapter by Emulex	4XC0F28716
40 Gb Ethernet		
4XC0F28738	ThinkServer OCe14401-UX-L PCIe 40Gb 1 Port QSFP+ Converged Network Adapter by Emulex	4XC0F28739

Storage host bus adapters

The RD650 supports HBAs installed in PCIe slots or the AnyFabric mezzanine card slot or both. The mezzanine card slot is a dedicated slot at the rear of the server as shown in the Location of key components and connectors section.

The following table lists the supported AnyFabric Fibre Channel host bus adapters. Fibre Channel HBAs come standard with short-wave optics.

Table 20. AnyFabric host bus adapters

Part number	Description
4XB0F28706	ThinkServer LPm16002-M6-L AnyFabric 16Gb 2 Port Fibre Channel Adapter by Emulex
4XB0F28707	ThinkServer LPm15004-M8-L AnyFabric 8Gb 4 Port Fibre Channel Adapter by Emulex

The RD650 also supports a range of PCIe host bus adapters adapters, both for Fibre Channel and SAS connectivity, as listed in the following table. Fibre Channel HBAs come standard with short-wave optics.

Table 21. PCIe host bus adapters

Part number	Description
8 Gb Fibre Channel	
0C19476	ThinkServer LPe1250 Single Port 8Gb Fibre Channel HBA by Emulex
0C19478	ThinkServer LPe12002 Dual Port 8Gb Fibre Channel HBA by Emulex
4XB0F28652	ThinkServer LPe16000B Single Port 8Gb Fibre Channel HBA by Emulex
4XB0F28649	ThinkServer QLE2560 Single Port 8Gb Fibre Channel HBA by QLogic
0C19482	ThinkServer QLE2562 Dual Port 8Gb Fibre Channel HBA by QLogic
16 Gb Fibre Channel	
4XB0F28653	ThinkServer LPe16000B Single Port 16Gb Fibre Channel HBA by Emulex
4XB0F28704	ThinkServer LPe16002B-M8-L PCIe 8Gb 2 Port Fibre Channel Adapter by Emulex
4XB0F28705	ThinkServer LPe16002B-M6-L PCIe 16Gb 2 Port Fibre Channel Adapter by Emulex
4XB0F28654	ThinkServer QLE2670 Single Port 16Gb Fibre Channel HBA by QLogic
4XC0F28745	ThinkServer QLE2672 PCIe 16Gb 2 Port Fibre Channel Adapter by QLogic
6 Gb SAS	
4XB0F28699	ThinkServer 9286CV-8e PCIe 6Gb 8 Port External SAS RAID Adapter by LSI
12 Gb SAS	
4XB0G88727	ThinkServer 8885e PCIe 12Gb 8 port external SAS Adapter by PMC
4XB0F28703	ThinkServer 9300-8e PCIe 12Gb 8 Port External SAS Adapter by LSI

Flash storage adapters

The RD650 server supports the Flash storage adapters listed in the following table.

Table 22. Flash storage adapters

Description	Part number
LTS 1.6TB ioMemory SX350 Performance PCIe 2.0 SSD by Sandisk	4XB0G88747
LTS 3.2TB ioMemory SX350 Performance PCIe 2.0 SSD by Sandisk	4XB0G88748
1.6TB ioMemory SX300 Performance PCIe 2.0 SSD by FusionIO	4XB0F28661
3.2TB ioMemory SX300 Performance PCIe 2.0 SSD by FusionIO	4XB0F28662

GPU adapters

The RD650 server supports graphics processing units (GPUs) listed in the following table.

Table 23. GPU adapters

Description	Part number
ThinkServer 16GB Tesla M60 GPU_A Adapter by NVIDIA	4X60G88212

Configuration notes:

- The NVIDIA GPU adapter can be installed only as a field upgrade option (not available as a factory-installed component).
- The NVIDIA GPU adapter is supported only in the PCIe slot 1 and requires a PCIe x16 riser card that is available only as a factory-installed component (not available as a field upgrade option; see "I/O expansion" for details).

Power supplies

Power Supplies that are available for the RD650 are highly efficient with Energy Star 80 Plus Platinum and Titanium supplies. Several power supply options are available and can be selected to match the workload and configuration of the server for even greater efficiencies. All power supplies that are used in the RD650 are common across the ThinkServer next-generation server portfolio, which simplifies management across large installations. Power supplies are auto-sensing and feature a line-cord retention mechanism to prevent unintended disconnects.

The following table lists the power supply options that are available for RD650, including their operating characteristics, efficiency ratings, and ordering information.

Table 24. Power supply options

Part number	Power Rating	80 PLUS rating	Voltage range	Efficiency at Percentage of PSU rated load					
				115 V AC			230 V AC		
				20%	50%	100%	20%	50%	100%
4X20F28579	550 W	Platinum	100 - 240 V AC	90%	92%	89%	90%	94%	91%
4X20F28575	750 W	Platinum	100 - 240 V AC	90%	92%	89%	90%	94%	91%
4X20F28576	750 W	Titanium	200 - 240 V AC	N/A	N/A	N/A	94%	96%	91%
4X20F28577	1100 W	Platinum	100 - 240 V AC	90%	92%	89%	90%	94%	91%
4X20F28578	1600 W	Platinum	200 - 240 V AC	N/A	N/A	N/A	90%	94%	91%

In China only, 240 V DC is also supported by the power supplies for the RD650.

Supported configurations

The RD650 supports several configurations that can be selected based on the wanted server configuration, workload, or reliability requirements.

The server can be ordered with a single power supply or with two power supplies for 1 + 1 redundancy in the unlikely event of a power supply failure. Active-active and active-passive forms of redundancy are supported, which are configurable through IPMI (command-line interface).

Installing two different wattage power supplies is not supported; the lower wattage power supply is disabled, which eliminates redundancy.

The size of the power supply should be chosen based on the system configuration. If an installed power supply is smaller than the demand that is placed on it, power usage is capped with a potential impact on system performance.

If a UPS is used with the RD650, the output of the UPS should be of a pure sine wave.

Ordering information for world-wide power cords is shown in the following table.

Table 25. World-wide power cord part numbers

Description	Part number
ThinkServer C13-C14 WW 250V 10A 1.8m Jumper Cord	4X90F92980
ThinkServer C13-C14 WW 250V 10A 1.8m Jumper Cord	4X90F92964
ThinkServer C13-BS_1363A UK 250V 10A 1.8m Power Cord	4X90F92970
ThinkServer C13-DK_2.5A Denmark 250V 10A 1.8m Power Cord	4X90F92971
ThinkServer C13-CEE_7.7 Europe 250V 10A 1.8m Power Cord	4X90F92974
ThinkServer C13-CE123_50 Italy 250V 10A 1.8m Power Cord	4X90F92975
ThinkServer C13-NRB_14136 Brazil 250V 10A 1.8m Power Cord	4X90F92976
ThinkServer C13-IRAM_2073 LA 250V 10A 1.8m Power Cord	4X90F92977

Systems management

A significant factor in the total cost of a server's ownership is the processes that are used for administering the system hardware, software, and support over the life of the server. Lenovo's ThinkServer system management offerings are based on industry standards, which enable integration into existing IT environments. Lenovo's tools emphasize provisioning and operational management, which is a large portion of the system cost. Optional upgrades provide more management capabilities to optimize performance and usage of the servers.

Deployment

Embedded within every Lenovo next-generation ThinkServer system, ThinkServer Deployment Manager is a tools suite that provides a complete set of provisioning capabilities from a single interface. ThinkServer Deployment Manager automates many of the tasks that are associated with server provisioning, including hardware configuration, operating system deployment, device driver (for operating system installation), firmware updates, and server cloning. Because ThinkServer Deployment Manager is integrated into the UEFI pre-boot environment, the tools operate independently of the server and are available regardless of system's operational state. Formatting a system drive or reinstalling the operating system does not remove the tools, and there are no CDs or DVDs to retrieve or store, which affects user experience or productivity.

Remote Systems Management

ThinkServer System Manager (TSM) is Lenovo's integrated systems management technology is standard on all next-generation ThinkServer systems. TSM operates independently of the server. It provides hardware-based, out-of-band remote access and management to ThinkServer systems, regardless of the server's power state or the condition of the operating system.

TSM is a fully featured management solution that is built on open industry standards that can help reduce related IT expenses by increasing a server administrator's productivity. TSM provides important health and status information to systems administrators. It also enables administrators to remotely perform most functions that otherwise require a visit to the server.

TSM can be used as part of any server systems management infrastructure and is well-suited for customers who are deploying servers in remote branches, limited-access data centers, and where one-on one remote-control capability is required. Lenovo's design advancements address key system management concerns. In particular, TSM is a low-cost solution that supports heterogeneous environments, provides full remote management capability, and supports remote deployment.

TSM offers the following choices in management Ethernet connections that are configurable in BIOS or the TSM:

- Shared:
    - Port zero on any Ethernet AnyFabric mezzanine card is supported
    - VLANs supported to provide separation between in-band network and TSM
    - 10 Mbps maximum TSM bandwidth on 1 GbE mezzanine cards
    - 100 Mbps maximum TSM bandwidth on 10 GbE mezzanine cards

- Dedicated:
    - Uses separate network port
    - Provides complete physical separation between Mezzanine 0 and TSM
    - 1 Gbps maximum TSM bandwidth

TSM provides the following key features:

- Remote server management through the following industry standard interfaces:
    - Secure HTML5 web browser GUI that is suitable for today's mobile devices and tablets
    - IPMI 2.0
    - DCMI 1.0
    - WS-MAN
    - SMASH-CLP
    - SNMP v3 (Gets only)

- A PowerShell CLI provides increased flexibility and scripting capabilities

- Automatic out-of-band notification and alerts from:
    - SNMP Traps
    - SMTP (email)
    - CIM indications

- Configurable via web and PowerShell CLI, IPMI, WS-Man, and SMASH-CLI interfaces

ThinkServer System Manager Premium, which is available as an optional hardware upgrade key, enables the following advanced features:

- A remote console that provides complete remote control of the server. A video viewer enables graphical console, keyboard, and mouse redirection of the server.
- Remote media capability that enables the attachment of local CD-ROMs, DVD-ROMs, USB mass storage devices, ISO images, and IMG images (which are created from local folders) to the remote server.
- Support for power monitoring and management with the separately available ThinkServer Energy Manager tool. Energy Manager is a stand-alone, web-based, power management console that enables you to observe, plan, and manage server power usage to decrease power and cooling needs, which helps to lower your total cost of ownership. Energy Manager uses TSM to capture real-time power and temperature data from the ThinkServer system, which analyzes the data to optimize server power consumption and workload placement and provides controls to limit the maximum server power that is used.

The following table lists ThinkServer System Manager Premium ordering information.

Table 26. ThinkServer System Manager Premium

Description	Part number	Maximum supported
Lenovo ThinkServer System Manager Premium	4XF0G45867	1

ThinkServer Energy Manager

Lenovo ThinkServer Energy Manager (TEM) provides power management for servers, which enables server density and data center capacity to be increased through use of power capping.

TEM is an agent-less, web-based console that tracks and analyzes real-time power usage and thermal data for servers and other supported devices in the data center. With this data, administrators can plan and manage server power and cooling. By using built-in intelligence, TEM identifies power usage trends, ideal power settings, and cooling analysis so that you can develop power-saving usage policies that adjust server power caps that are based on server utilization, business conditions, and power usage trends.

When a user-defined power or temperature threshold is reached, an alert can be generated to inform you of the event. An emergency feature can automatically help maintain business continuity; when power outages or temperature events occur, TEM can dynamically cap power to shed load and distribute remaining power to servers that are prioritizing business-critical workloads.

With the ability to monitor, analyze, and control the power and cooling of Lenovo and non-Lenovo servers, TEM enables you to take control of power management and reduce operational costs.

A single TEM license is included with all next-generation servers with TSM Premium. Licenses are available for next-generation servers without TSM, selected fourth generation ThinkServer systems, and certain third-party servers via Node License Packs, as shown in the following table. Users of Lenovo Smart Grid can upgrade to TEM at no charge.

Table 27. ThinkServer System Manager Premium

Description	Part number	Maximum supported
Lenovo ThinkServer Energy Manager Node License	4L40E51621	1 node
Lenovo ThinkServer Energy Manager Node License Pack	4L40E51622	5 nodes
Lenovo ThinkServer Energy Manager Node License Pack	4L40E51623	50 nodes

ThinkServer Partner Pack for VMware vCenter

The Lenovo Partner Pack for vSphere vCenter Server provides detailed system information about Lenovo ThinkServer hosts in a VMware virtualized environment, including extended inventory and status information about processors, memory, fans, temperature sensors, and more. It also enables actions, such as starting a remote console or the Think Server Management Module (TMM) interface.

The Partner Pack integrates into vCenter by using the open plug-in architecture and allows "one pane of glass" management for the virtualized environment, so administrators can continue to use familiar tools.

Unlike options from other server providers, the Lenovo Partner Pack integrates into vCenter and does not require the installation of extra consoles or software.

ThinkServer Partner Pack for Microsoft System Center Operations Manager

Microsoft System Center Operations Manager (SCOM) is part of the Microsoft Systems Center suite and provides the operational management functions, such as health monitoring, performance data collection, and administrator-initiated or automated actions.

Implemented as a Management Pack for SCOM, the Partner Pack is integrated into SCOM by using the native Management Pack interface, which allows IT administrators to manage ThinkServer systems by using familiar tools and "one pane of glass" management.

The Lenovo Partner Pack for SCOM automatically discovers and provides detailed system information about the Lenovo ThinkServer managed servers, including component inventory and component and sensor status. The Partner Pack also enables actions, such as restarting or powering off the ThinkServer, accessing the Remote Desktop Console via RDP, and accessing the TMM interface.

The Partner Pack uses "In-Band" management to manage ThinkServer systems that are running Microsoft Windows Operating Systems with the System Center Agent installed.

Unlike options from other server providers, the Lenovo Partner Pack integrates into SCOM and does not require the installation of extra consoles or software.

Operating systems

The RD650 supports the following operating systems:

- Microsoft
    - Windows Server 2008 R2 x64 SP1 Foundation, Standard, Enterprise, Datacenter, Hyper-V
    - Windows Small Business Server 2011 Essentials, Standard, Premium Add-on
    - Windows Server 2012 Foundation, Essentials, Standard, Datacenter, Hyper-V
    - Windows Storage Server 2012 Standard
    - Windows Server 2012 R2 Foundation, Essentials, Standard, Datacenter, Hyper-V
    - Windows Storage Server 2012 R2 Standard
    - Windows Server 2016 Essentials, Standard, Datacenter, Hyper-V
    - Windows Storage Server 2016 Standard, Workgroup

- SUSE
    - SUSE Linux Enterprise Server 11 for x86 SP3
    - SUSE Linux Enterprise Server 11 for AMD64/EM64T SP3
    - SUSE Linux Enterprise Server 11 for x86 SP4
    - SUSE Linux Enterprise Server 11 for AMD64/EM64T SP4
    - SUSE Linux Enterprise Server 12
    - SUSE Linux Enterprise Server 12 SP1
    - SUSE Linux Enterprise Server 12 SP2

- Red Hat
    - Red Hat Enterprise Linux Server 6.5 (x86 and x64)
    - Red Hat Enterprise Linux Server 6.6 (x86 and x64)
    - Red Hat Enterprise Linux Server 6.7 (x86 and x64)
    - Red Hat Enterprise Linux Server 6.8 (x86 and x64)
    - Red Hat Enterprise Linux Server 7.0
    - Red Hat Enterprise Linux Server 7.1
    - Red Hat Enterprise Linux Server 7.2
    - Red Hat Enterprise Linux Server 7.3

- VMware
    - VMware ESXi 5.1
    - VMware ESXi 5.5 Update 2
    - VMware ESXi 5.5 Update 3
    - VMware ESXi 6.0
    - VMware ESXi 6.0 Update 1
    - VMware ESXi 6.0 Update 2
    - VMware ESXi 6.5

- Citrix
    - XenServer 6.5
    - XenServer 6.5.1

Important:

- SD cards support installation and booting of the VMware ESXi hypervisor only; other operating systems and hypervisors cannot be installed on an SD card.

- VMware ESXi and other hypervisor support requires a RAID 510i/720i/720ix adapter. The onboard RAID 110i controller is not supported by VMware ESXi and other hypervisors.

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.

Thermal specifications

The RD650 can run at 45°C continuously without time restrictions, which is an industry first. This ability provides value in data centers that can or intend to use new energy efficient cooling technologies and organizations that install their servers in segregated (or less-controlled) environments.

Lenovo carefully designed and tested the RD650 to address concerns about long-term reliability. Specifically, the following measures were taken:

- Stringent component temperature and voltage de-rating requirements were adopted to insure reliable operation across all supported environments.
- Components are placed in the system for optimal airflow. With advanced thermal control, temperatures of critical components are often lower at higher ambient temperatures than in normal environments.
- The system design was thoroughly tested across the entire A4 temperature range.

The following table shows system environmental specifications for the RD650.

Table 28. Temperature, humidity and altitude specifications

Feature	Specification
Operating ambient temperature	5°C - 45°C (41°F - 113°F)
Transit ambient temperature	-40°C - +60°C (-40°F - 140°F)
Operating Humidity	8% - 90% RH, non-condensing
Transit humidity	8% - 90% RH, non-condensing
Operating altitude	0 - 3048 m (0 - 10,000 ft)
Transit altitude	7620 m (25,000 ft)

Maximum allowable ambient temperatures must be de-rated at altitudes above 950 m (3100 ft), as shown in the following figure. Allowable ambient temperatures 35°C - 40°C are reduced 1°C for every 175 m (575 ft) above 950 m, and 1°C for every 125 m (410 ft) above 950 m for ambient temperatures 40°C - 45°C.

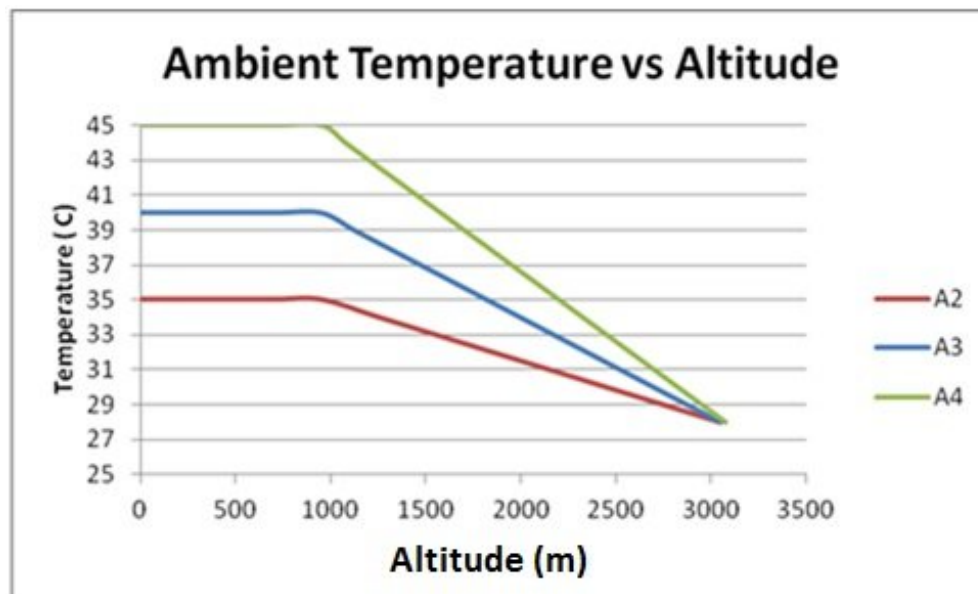The maximum rate of temperature change that is allowed is 20 °C/hr.

Figure 10. Ambient temperature vs altitude

Acoustic specifications

The following table lists sound pressure levels for idle and operational modes. Listed are the declared A-Weighted sound power levels (LWAd), declared average bystander position A-Weighted sound pressure levels (LpAm), and declared operator position A-Weighted sound pressure levels (m) when the product is operating in a 23° ± 2°C ambient environment.

Noise emissions measurements are made in accordance with ISO 7779 (Acoustics-Measurement of Airborne Noise Emitted by Computer and Business Equipment – EECMA 074), and are reported in conformance with ISO 9296 (Acoustics-Declared Noise Emission Values of Computer and Business Equipment – ECMA 109). The declared sound power levels indicate an upper limit below which a larger proportion of machines operate as determined according to ISO 9296.

Sound pressure levels are reference quantities that might exceed the stated values in customer locations because of room reflections and other nearby noise. The listed sound levels apply only to the configuration that is described. Other options can result in increased sound levels.

Consider the following points about the following table:

- LWAd: Declared (upper limit) A-weighted sound power levels for a random sample of machines, in bels.
- m: Mean value of A-weighted sound pressure levels that are averaged over four bystander positions (for a random sample of machines) in dB. The four bystander positions are 1 m from each side of the system unit.
- Oper: Indicates operating condition (hard disk drive is randomly seeking, all other subsystems idle).
- Idle: Indicates idle condition (system is powered on, but no disk activity).

Table 29. Sound power levels

Configuration	Description	LWAd		m	
		Idle	Oper	Idle	Oper
Minimum	8x 2.5-inch HDD Chassis 1x 85 W 6C E5-2609 v3 CPU 1x 8 GB DIMM - Intel 4x 1 GbE AnyFabric Card - No PCIe Adapters installed 1x 550 W PSU 1x 2.5-inch 7.2K SATA HDD	3.6 bels	3.8 bels	22.1 dB	25.5 dB
Typical	12x 3.5-inch HDD Chassis 2x 105 W E5-2660 v3 CPU 8x 8 GB DIMMs - R720i AnyRAID Adapter - Intel 10GbE RJ45 AnyFabric Card - Intel 1GbE 4- port PCIe Adapter installed 2x 550 W PSUs 4x 3.5-inch 7.2K SATA HDDs	4.0 bels	4.1 bels	24.2 dB	25.6 dB
Maximum	24x 2.5 HDD Chassis with 2x 2.5-inch Rear HDDs 2x 135 W 8C E5-2667 v3 CPU 24x 32 Gb DIMMs - R720ix AnyRAID Adapter - Emulex 2x 10GbE RJ45 AnyFabric Card 8x PCIe Adapters installed 2x 1100W PSUs 26x 2.5-inch 15K SAS	5.7 bels	6.1 bels	39.0 dB	40.6 dB

Security

The RD650 provides the following security features:

- Optional TPM hardware security module
- TSM hardware security
- An optional chassis intrusion lock
- Server cover lock

The RD650 provides an optional TPM to securely store the passwords, certificates, and encryption keys that can be used to authenticate the platform. TPM is a hardware-based system security feature that supports Trusted Computing Group (TCG) 1.2. TPM supports Windows BitLocker Drive encryption, which is a Windows data protection feature. BitLocker uses the TPM to protect user data and to ensure that a Windows server was not tampered with. Ordering information is listed in the following table.

Table 30. TPM ordering information

Description	Part number
Lenovo ThinkServer Gen 5 Trusted Platform Module v1.2	4XF0G45868
Lenovo ThinkServer Trusted Platform Module v2.0	4XF0G88938

TSM Security

TSM provides the following security features:

- User authentication through LDAP/Active Directory, or local hardware-stored user accounts and passwords
- Role-based authorization that enables administrators to configure specific privileges for each user
- Interface Security:
    - Session time-out: Provides automatic session time-out for inactivity (Web, Telnet, SSH, and KVM)
    - Firewall configurable to block network traffic that is based on IP address or network port
- Configurable Network Service ports that allow customization of ports that are used by TSM services
- Security settings configurable through the Web interface, PowerShell CLI, and IPMI
- Encryption secured with 256-bit Secure Sockets Layer (SSL):
    - Secure Web-server (HTTPS)
    - Secure LDAP (LDAPS)
    - Supports Virtual Console and Virtual Media encryption
- Supports terminal connections to clients that are using SSH version 2.0: SSH uses user ID and password pairs stored in local user accounts or AD/LDAP server
- VLAN support:
    - Enables management traffic to be in a private "management VLAN" in dedicated and shared network modes
    - VLAN groups can be used to limit network access to devices that are subscribed to the VLAN group

Rack installation

The following table lists the ordering information for the RD650 rail kits.

Table 31. Rail system ordering information

Description	Part number
4-Post Slide Rail Kit	4XF0G45872
4-Post Static Rail Kit	4XF0G45873
Cable Management Arm	4XF0G45875
Cable Management Bar	4XF0G45876

The following table summarizes the rail kit features and specifications.

Table 32. Rail kit features and specifications summary

Feature	ThinkServer Gen 5 2U 4-Post Slide Rail Kit	ThinkServer Gen 5 4-Post Static Rail Kit
Part number	4XF0G45872	4XF0G45873
Rail type	Ball bearing slide rail with stop latches	Friction rail
Toolless installation	Yes	No
CMA/CMB support	Yes (4XF0G45875)	Yes (4XF0G45876)
In-rack server maintenance	Yes	No
1U PDU support	Yes	Yes
0U PDU support	Limited*	Limited*
Rack type	Lenovo 4-post, IEC standard-compliant	Lenovo 4-post, IEC standard-compliant
Mounting holes	Square or round (unthreaded)	Square or round (unthreaded)
Mounting flange thickness	2 mm (0.08 in.) – 3.18 mm (0.125 in.)	2 mm (0.08 in.) – 3.18 mm (0.125 in.)
Distance between front and rear mounting flanges	460 mm (18.11 in.) – 900 mm (35.43 in.)	610 mm (24 in.) – 900 mm (35.43 in.)
Rail length**	840 mm (33.07 in.)	728.1 mm (28.66 in.)

* The rack must be at least 42U 1200 mm (47.24 in.) deep if a CMA/CMB is used.
** Measured when mounted on the rack, from the front surface of the front mounting flange to the rear most point of the rail.

Note: ThinkServer rail kits are not supported in rack cabinets with the threaded mounting holes.

Warranty

The server 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 services 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 33. 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.

Regulatory compliance

The server conforms to the following regulations:

- Energy Star V2.0
- FCC class A: USA FCC 47 CFR Part 15-Subpart B; ANSI C63.4
- ICES class A: Canada ICES-003 Issue 5
- CB
- UL/cTUVus
- Germany GS
- Russia EAC
- Argentina AR-S
- Mexico NOM
- EU CE: EN55022; EN55024; EN61000-3-2;EN61000-3-3;
- International: CISPR22; CISPR 24
- Brazil (voluntary)
- China CCC: GB 9254
- CECP
- CELP
- Green Guard

External drive enclosures

The RD650 server can be connected to external storage expansion enclosures, such as the Lenovo Storage E1000 series, by using supported RAID adapters and HBAs that are listed in the following table.

Table 34. RAID adapters and HBAs for external storage expansion

Description	Part number
External RAID adapters	
Lenovo ThinkServer 9286CV-8e PCIe 6Gb 8 Port External SAS RAID Adapter by LSI	4XB0F28699
Lenovo ThinkServer RAID CacheCade Pro 2.0 Key (for 9286CV-8e)	4XB0F28702
External SAS HBAs	
Lenovo ThinkServer 9300-8e PCIe 12Gb 8 Port External SAS Adapter by LSI	4XB0F28703
Lenovo ThinkServer 8885e PCIe 12Gb 8 port external SAS Adapter by PMC	4XB0G88727

The following table summarizes features of supported external drive controllers.

Table 35. External drive controller features and specifications summary

Feature	9286CV-8e	9300-8e	8885e*
Part number	4XB0F28699	4XB0F28703	4XB0G88727
Form factor	Low profile	Low profile	Low profile
Controller chip	LSI SAS2208	LSI SAS3008	PMC PM8063
Host interface	PCIe 3.0 x8	PCIe 3.0 x8	PCIe 3.0 x8
Port interface	6 Gbps SAS	12 Gbps SAS	12 Gbps SAS
Number of external SAS ports	8	8	8
External port connectors	2x Mini-SAS (SFF-8088)	2x Mini-SAS HD (SFF-8644)	2x Mini-SAS HD (SFF-8644)
Drive interface	SAS, SATA	SAS, SATA	SAS, SATA
Drive type	HDD, SSD	HDD, SSD	HDD, SSD

Feature	9286CV-8e	9300-8e	8885e*
Maximum number of devices	240	1024	256
Maximum number of expansion units	8	8	8
RAID levels	0/1/10/5/50/6/60	None	None
JBOD mode	No	Yes	Yes
Cache	1 GB	None	1 GB
Cache protection	CacheVault flash backup (included)	None	None
CacheCade	Optional (4XB0F28702)	None	None

* In addition to eight external ports, the ThinkServer 8885e adapter has eight internal ports.

The following table lists the 6 Gbps SAS external drive enclosures that are offered by Lenovo that can be used with the RD650 for storage expansion.

Table 36. E1012 and E1024 external drive enclosure models

Description	Part number
Lenovo Storage E1012 LFF Disk Expansion Single SAS IO Module, Rail Kit, 9x5 NBD	64111B1
Lenovo Storage E1012 LFF Disk Expansion Dual SAS IO Module, Rail Kit, 9x5 NBD	64111B2
Lenovo Storage E1024 SFF Disk Expansion Single SAS IO Module, Rail Kit, 9x5 NBD	64111B3
Lenovo Storage E1024 SFF Disk Expansion Dual SAS IO Module, Rail Kit, 9x5 NBD	64111B4

For details about supported drives and cables for the Lenovo Storage E1012 and E1024, see the Lenovo Press Product Guide:
http://lenovopress.com/lp0043

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 RD650 for storage expansion.

Table 37. 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 RD650 for storage expansion.

Table 38. 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
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 and cables for the Lenovo Storage D1212 and D1224, see the Lenovo Press Product Guide:
http://lenovopress.com/lp0512

External storage systems

The following table lists the external storage systems that are currently offered by Lenovo that can be used with the RD650 in IT solutions.

Table 39. 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**

Description	Part number
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 or FC 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^
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 or FC 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

Description	Part number
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, iSCSI, or FC 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
Lenovo Storage V5030F SFF Control Enclosure 5Yr S&S	6536B2F
IBM Storwize for Lenovo (SAS [except V7000], iSCSI, or FC 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; optional FC 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#

Description	Part number
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 following table lists the external backup options that are offered by Lenovo that can be used in RD650 solutions.

Table 40. External backup options

Description	Part number
External RDX unit	
ThinkServer External RDX Tape Drive	4XF0G88929
RDX cartridges	
ThinkServer 1TB 3Gbps RDX Cartridge	4XB0F28660
ThinkServer 2TB SATA 3Gbps RDX Cartridge	4XB0G88711
External SAS tape backup units	
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
Fibre Channel tape backup drives for TS3100 and TS3200 Tape Libraries	
6173 LTO Ultrium 5 Fibre Channel Drive	00NA107
6173 LTO Ultrium 5 Half High Fibre Drive Sled	00NA113
6173 LTO Ultrium 6 Fibre Channel Drive	00NA115
6173 LTO Ultrium 6 Half High Fibre Drive Sled	00NA119
6173 LTO Ultrium 7 Fibre Channel Drive	00WF765
6173 LTO Ultrium 7 Half High Fibre Drive Sled	00WF769
SAS tape 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 Ethernet LAN switches that are offered by Lenovo that can be used with the RD650 server in IT solutions.

Table 41. 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

Fibre Channel SAN switches

The following table lists currently available Fibre Channel SAN switches that are offered by Lenovo that can be used with the RD650 in IT solutions.

Table 42. Fibre Channel SAN switches

Description	Part number
8 Gb FC	
Lenovo B300, 8 ports activated, 8x 8Gb SWL SFPs, 1 PS, Rail Kit	3873AR3
Lenovo B6505, 12 ports activated, 12x 8Gb SWL SFPs, 1 PS, Rail Kit	3873AR4
Lenovo B6510, 24 ports activated, 24x 8Gb SWL SFPs, 2 PS, Rail Kit	3873BR2
16 Gb FC	
Lenovo ThinkSystem DB610S, 8 ports activated, 8x 16Gb SWL SFPs, 1 PS, Rail Kit	6559D2Y
Lenovo ThinkSystem DB610S, 24 ports activated, 24x 16Gb SWL SFP, Enterprise SW, 1 PS, Rail Kit	6559D1Y
Lenovo B6505, 12 ports activated w/ 16Gb SWL SFPs, 1 PS, Rail Kit	3873AR5
Lenovo B6510, 24 ports activated w/ 16Gb SWL SFPs, 2 PS, Rail Kit	3873BR3
32 Gb FC	
Lenovo ThinkSystem DB610S, 8 ports activated, 1 PS, Rail Kit	6559D3Y
Lenovo ThinkSystem DB620S, 24 Ports Activated, 24x 32Gb SWL SFPs, 2 PS, Rail Kit	6415G11
Lenovo ThinkSystem DB620S, 48 Ports Activated, 48x 32Gb SWL SFPs, 2 PS, Rail Kit	6415G2A
Lenovo ThinkSystem DB400D 32Gb FC Director, up to 192 ports, 8U, Enterprise SW	6684B2A
Lenovo ThinkSystem DB800D 32Gb FC Director, up to 384 ports, 14U, Enterprise SW	6682B1A

For more information, see the list of Product Guides in the Rack SAN Switches category:
http://lenovopress.com/storage/switches/rack#rt=product-guide

Uninterruptible power supply units

The server supports attachments to the uninterruptible power supply (UPS) units that are listed in the following table.

Table 43. Uninterruptible power supply units

Description	Part number
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 Lenovo Press Product Guides in the UPS category at this web page: http://lenovopress.com/servers/options/ups

Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo that can be used in RD650 solutions.

Table 44. 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
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

Description	Part number
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

Rack cabinets

The following table lists the rack cabinets that are offered by Lenovo that can be used in RD650 solutions.

Table 45. Rack cabinets

Description	Part number
25U S2 Standard Rack	93072RX
25U Static S2 Standard Rack	93072PX
42U S2 Standard Rack	93074RX
42U 1100mm Enterprise V2 Dynamic Rack	93634PX
42U 1100mm Enterprise V2 Dynamic Expansion Rack	93634EX
42U 1200mm Deep Dynamic Rack	93604PX
42U 1200mm Deep Static Rack	93614PX
42U Enterprise Rack	93084PX
42U Enterprise Expansion Rack	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 server supports the rack console switches, monitor kits, and management gateways that are listed in the following table.

Table 46. KVM switch and console options

Description	Part number
Consoles	
1U 18.5" Standard Console (without keyboard)	17238BX
Console keyboards	
Lenovo UltraNav Keyboard USB - US Eng	00MW310
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

Lenovo Financial Services

Lenovo Financial Services reinforces Lenovo's commitment to deliver pioneering products and services that are recognized for their quality, excellence, and trustworthiness. Lenovo Financial Services offers financing solutions and services that complement your technology solution anywhere in the world.

We are dedicated to delivering a positive finance experience for customers like you who want to maximize your purchase power by obtaining the technology you need today, protect against technology obsolescence, and preserve your capital for other uses.

We work with businesses, non-profit organizations, governments and educational institutions to finance their entire technology solution. We focus on making it easy to do business with us. Our highly experienced team of finance professionals operates in a work culture that emphasizes the importance of providing outstanding customer service. Our systems, processes and flexible policies support our goal of providing customers with a positive experience.

We finance your entire solution. Unlike others, we allow you to bundle everything you need from hardware and software to service contracts, installation costs, training fees, and sales tax. If you decide weeks or months later to add to your solution, we can consolidate everything into a single invoice.

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.

For your region specific offers please ask your Lenovo sales representative or your technology provider about the use of Lenovo Financial Services. For more information, see the following Lenovo website: http://www.lenovofs.com

Related publications and links

For more information, see the following resources:

- ThinkServer RD650 product page:
  http://shop.lenovo.com/us/en/servers/thinkserver/racks/rd650/
- ThinkServer RD650 Pre-Sales Advisor:
  https://thinkserver.presalesadvisor.com/Family/Family.aspx?mrt=vM1oV/e1tAOIGhN1xh/MvA==
- ThinkServer RD650 Users Guide:
  http://download.lenovo.com/ibmdl/pub/pc/pccbbs/thinkservers/rd650ughmm_en.pdf
- PSREF:
  http://psref.lenovo.com

Related product families

Product families related to this document are the following:

- 2-Socket Rack Servers

Notices

Lenovo may not offer the products, services, or features discussed in this document in all countries. Consult your local Lenovo representative for information on the products and services currently available in your area. Any reference to a Lenovo product, program, or service is not intended to state or imply that only that Lenovo product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any Lenovo intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any other product, program, or service. Lenovo may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

Lenovo (United States), Inc.
8001 Development Drive
Morrisville, NC 27560
U.S.A.
Attention: Lenovo Director of Licensing

LENOVO PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. Lenovo may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

The products described in this document are not intended for use in implantation or other life support applications where malfunction may result in injury or death to persons. The information contained in this document does not affect or change Lenovo product specifications or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Lenovo or third parties. All information contained in this document was obtained in specific environments and is presented as an illustration. The result obtained in other operating environments may vary. Lenovo may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Any references in this publication to non-Lenovo Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this Lenovo product, and use of those Web sites is at your own risk. Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

This document, TIPS1247, was created or updated on September 12, 2017.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
  https://lenovopress.lenovo.com/TIPS1247

- Send your comments in an e-mail to:
  comments@lenovopress.com

This document is available online at https://lenovopress.lenovo.com/TIPS1247.

Trademarks

Lenovo and the Lenovo logo are trademarks or registered trademarks of Lenovo in the United States, other countries, or both. A current list of Lenovo trademarks is available on the Web at https://www.lenovo.com/us/en/legal/copytrade/.

The following terms are trademarks of Lenovo in the United States, other countries, or both:
Lenovo®
AnyBay®
ThinkServer®
ThinkSystem®
UltraNav®

The following terms are trademarks of other companies:

Intel® and Xeon® are trademarks of Intel Corporation or its subsidiaries.

Linux® is the trademark of Linus Torvalds in the U.S. and other countries.

Microsoft®, Active Directory®, BitLocker®, Hyper-V®, PowerShell, Windows Server®, and Windows® are trademarks of Microsoft Corporation in the United States, other countries, or both.

IBM®, Interconnect®, and Storwize® are trademarks of IBM in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.