

Lenovo ThinkSystem SD665-N V3 Neptune DWC Server

Product Guide

The ThinkSystem SD665-N V3 Neptune DWC node is the next-generation high-performance server based on the fifth generation Lenovo Neptune™ direct water cooling platform. With one or two 5th Gen AMD EPYC processors and four powerful NVIDIA H200 GPUs, the ThinkSystem SD665-N V3 server features the latest technology from AMD and NVIDIA, combined with Lenovo's market-leading water-cooling solution, which results in extreme performance in an extreme dense packaging, supporting your application from Exascale to Everscale™.

The direct water cooled solution is designed to operate by using warm water, up to 45°C (113°F) depending on the configuration. Chillers are not needed for most customers, meaning even greater savings and a lower total cost of ownership. The nodes are housed in the upgraded ThinkSystem DW612S enclosure, a 6U rack mount unit that fits in a standard 19-inch rack.

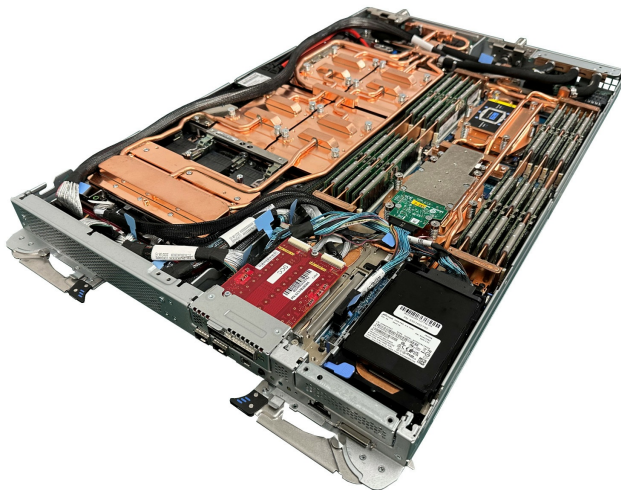


Figure 1. The ThinkSystem SD665-N V3 server tray with two AMD processors and four NVIDIA GPUs

[360° View](#)

[Full 3D Tour](#)

Did you know?

The ThinkSystem SD665-N V3 server tray and DW612S enclosure with direct water cooling provide the ultimate in data center cooling efficiencies and performance. The embedded networking chips allow for direct GPU-to-GPU communication without having to go through the CPU or PCIe switches. This enables ideal scaling, from a single rack with a single chassis and a single tray, all the way to a full sustained-Exaflop system realized in fewer than 200 racks and fewer than 6,000 nodes.

Key features

The Lenovo ThinkSystem SD665-N V3 server tray is designed for High Performance Computing (HPC), large-scale cloud, heavy simulations, and modeling. It implements Lenovo Neptune™ Direct Water Cooling (DWC) technology to optimally support workloads from technical computing, grid deployments, analytics, and is ideally suited for fields such as research, life sciences, energy, simulation, and engineering.

The unique design of ThinkSystem SD665-N V3 provides the optimal balance of serviceability, performance, and efficiency. By using a standard rack with the ThinkSystem DW612S enclosure equipped with patented stainless steel drip-less quick connectors, the SD665-N V3 provides easy serviceability and extreme density that is well suited for clusters ranging from small enterprises to the world's largest supercomputers.

The Lenovo Neptune™ direct liquid cooling doesn't use risky plastic retrofitting but instead custom-designed copper water loops, so you have peace of mind implementing a platform with liquid cooling at the core of the design.

Compared to other technology, the SD665-N V3 direct water cooling:

- Reduces data center energy costs by up to 40%
- Increases system performance by up to 10%
- Delivers up to 100% heat removal efficiency (depending on the environment)
- Creates a quieter data center with its fan-less design
- Enables data center growth without adding computer room air conditioning

Lenovo's direct water-cooled solutions are factory-integrated and are re-tested at the rack-level to ensure that a rack can be directly deployed at the customer site. This careful and consistent quality testing has been developed as a result of over a decade of experience designing and deploying DWC solutions to the very highest standards.

Scalability and performance

The ThinkSystem SD665-N V3 server tray and DW612S enclosure offer the following features to boost performance, improve scalability, and reduce costs:

- Each SD665-N V3 node supports two 5th Gen AMD EPYC processors, four NVIDIA H200 SXM GPUs, 24x TruDDR5 DIMMs, two OSFP 800G cages for high-speed I/O, and up to two drive bays, all in a 1U form factor.
- Up to 6x SD665-N V3 nodes are installed in the DW612S enclosure, occupying only 6U of rack space. It is a highly dense, scalable, and price-optimized offering.
- Supports one 5th Gen AMD EPYC 9005 series processors
 - Up to 160 cores and 320 threads
 - Nominal TDP ratings of up to 400W
- Supports two 4th Gen AMD EPYC 9004 processors
 - Up to 128 cores and 256 threads
 - Nominal TDP rating of up to 360 W, configurable TDP up to 400 W
- Supports four NVIDIA H200 or H100 GPUs
 - 700W SXM5 GPUs with configurable EDP (Electrical Design Point)
 - Up to 141 GB GPU memory per GPU
 - Interconnected using dual NVLink 4.0 connections
 - Up to 400 Gb/s NDR connectivity to each through four NVIDIA ConnectX-7 embedded network controllers
- Support for DDR5 memory DIMMs to maximize the performance of the memory subsystem:
 - Up to 24 DDR5 memory DIMMs, 12 DIMMs per processor
 - 12 memory channels per processor (1 DIMM per channel)
 - DIMM speeds up to 6400 MHz
 - Using 128GB 3DS RDIMMs, the node supports up to 3TB of system memory

- Supports high-speed GPU Direct networking with dual InfiniBand NDRx2 800Gb/s connections
 - Choice of two OSFP-DD or alternatively OSFP ports
 - Each port supports OSFP 800G (2x400 Gb/s) or OSFP 400G (400 Gb/s) connectivity
 - Direct connections to the GPUs - each OSFP port connects to two GPUs
- Supports up to two NVMe SSDs, as follows:
 - Two E3.S 1T NVMe SSDs, or
 - Two 7mm NVMe SSDs, or
 - One 15mm NVMe SSD
- Drives are NVMe to maximize I/O performance in terms of throughput, bandwidth, and latency.
- Supports a PCIe 4.0 x4 high-speed M.2 NVMe drive installed in an adapter for convenient operating system boot and internal storage functions.
- The node includes one Gigabit and two 25 Gb Ethernet onboard ports for cost effective networking.

Energy efficiency

The direct water cooled solution offers the following energy efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to a green environment:

- Water cooling eliminates power that is drawn by cooling fans in the enclosure and dramatically reduces the required air movement in the server room, which also saves power. In combination with an Energy Aware Runtime environment, savings as much as 40% are possible in the data center due to the reduced need for air conditioning.
- Water chillers may not be required with a direct water cooled solution. Chillers are a major expense for most geographies and can be reduced or even eliminated because the water temperature can now be 45°C instead of 18°C in an air-cooled environment.
- Up to 100% heat recovery is possible with the direct water cooled design, depending on water temperature chosen. Heat energy absorbed may be reused for heating buildings in the winter, or generating cold through Adsorption Chillers, for further operating expense savings.
- The processors and other microelectronics are run at lower temperatures because they are water cooled, which uses less power, and allows for higher performance through Turbo Mode.
- The processors and accelerators are run at uniform temperatures because they are cooled in parallel loops, which avoid thermal jitter and provides higher and more reliable performance at same power.
- Low-voltage 1.1V DDR5 memory offers energy savings compared to 1.2V DDR4 DIMMs, an approximately 20% decrease in power consumption
- 80 Plus Titanium power supplies ensure energy efficiency.
- There are power monitoring and management capabilities through the System Management Module in the DW612S enclosure.
- Lenovo power/energy meter based on TI INA226 measures DC power for the CPU and the GPU board at higher than 97% accuracy and 100 Hz sampling frequency to the XCC and can be leveraged both in-band and out-of-band using IPMI raw commands.
- Optional Lenovo XClarity Energy Manager provide advanced data center power notification, analysis, and policy-based management to help achieve lower heat output and reduced cooling needs.
- Optional Energy Aware Runtime provides sophisticated power monitoring and energy optimization on a job-level during the application runtime without impacting performance negatively.

Manageability and security

The following powerful systems management features simplify local and remote management of the SD665-N V3 server:

- The server includes an XClarity Controller 2 (XCC2) to monitor server availability. Optional upgrade to XCC Platinum to provide remote control (keyboard video mouse) functions, support for the mounting of remote media files, FIPS 140-3 security, enhanced NIST 800-193 support, boot capture, power capping, and other management and security features.

- Support for industry standard management protocols, IPMI 2.0, SNMP 3.0, Redfish REST API, serial console via IPMI
- Integrated Trusted Platform Module (TPM) 2.0 support enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Supports AMD Secure Root-of-Trust, Secure Run and Secure Move features to minimize potential attacks and protect data as the OS is booted, as applications are run and as applications are migrated from server to server.
- Supports Secure Boot to ensure only a digitally signed operating system can be used.
- Industry-standard Advanced Encryption Standard (AES) NI support for faster, stronger encryption.
- With the System Management Module (SMM) installed in the enclosure, only one Ethernet connection is needed to provide remote systems management functions for all SD665-N V3 servers and the enclosure.
- The SMM management module has two Ethernet ports which allows a single Ethernet connection to be daisy chained across 7 enclosures and 84 servers, thereby significantly reducing the number of Ethernet switch ports needed to manage an entire rack of SD665-N V3 servers and DW612S enclosures.
- The DW612S enclosure includes drip sensors that monitor the inlet and outlet manifold quick connect couplers; leaks are reported via the SMM.
- The server supports Lenovo XClarity suite software with Lenovo XClarity Administrator, Lenovo XClarity Provisioning Manager, and XClarity Energy Manager. They are described further in the Software section of this product guide.
- Lenovo HPC & AI Software Stack provides our HPC customers you with a fully tested and supported open-source software stack to enable your administrators and users with for the most effective and environmentally sustainable consumption of Lenovo supercomputing capabilities.
- Our Confluent management system and Lenovo Intelligent Computing Orchestration (LiCO) web portal provides an interface designed to abstract the users from the complexity of HPC cluster orchestration and AI workloads management, making open-source HPC software consumable for every customer.
- LiCO web portal provides workflows for both AI and HPC, and supports multiple AI frameworks, allowing you to leverage a single cluster for diverse workload requirements.

Availability and serviceability

The SD665-N V3 node and DW612S enclosure provide the following features to simplify serviceability and increase system uptime:

- Designed to run 24 hours a day, 7 days a week
- Depending on the configuration and node population, the DW612S enclosure supports N+1 power policies for its power supplies, which means greater system uptime.
- All supported power supplies are hot-swappable, including the water-cooled power supplies.
- Toolless cover removal on the trays provides easy access to upgrades and serviceable parts, such as adapters and memory.
- The server uses ECC memory and supports memory RAS features including Single Device Data Correction (SDDC, also known as Chipkill), Patrol/Demand Scrubbing, Bounded Fault, DRAM Address Command Parity with Replay, DRAM Uncorrected ECC Error Retry, On-die ECC, ECC Error Check and Scrub (ECS), and Post Package Repair.
- Proactive Platform Alerts (including PFA and SMART alerts): Processors, voltage regulators, memory, internal storage (HDDs and SSDs, NVMe SSDs, M.2 storage), fans, power supplies, and server ambient and subcomponent temperatures. Alerts can be surfaced through the XClarity Controller to managers such as Lenovo XClarity Administrator and other standards-based management applications. These proactive alerts let you take appropriate actions in advance of possible failure, thereby increasing server uptime and application availability.
- The XCC offers optional remote management capability and can enable remote keyboard, video, and

mouse (KVM) control and remote media for the node.

- Built-in diagnostics in UEFI, using Lenovo XClarity Provisioning Manager, speed up troubleshooting tasks to reduce service time.
- Lenovo XClarity Provisioning Manager supports diagnostics and can save service data to a USB key drive or remote CIFS share folder for troubleshooting and reduce service time.
- Auto restart in the event of a momentary loss of AC power (based on power policy setting in the XClarity Controller service processor)
- Virtual reseal is a supported feature of the System Management Module (SMM2) which simulates physically removing the node from A/C power and reconnecting the node to AC power from a remote location.
- There is a three-year customer replaceable unit and onsite limited warranty, with next business day 9x5 coverage. Optional warranty upgrades and extensions are available.
- With water cooling, system fans are not required. This results in significantly reduced noise levels on the data center floor, a significant benefit to personnel having to work on site.

Components and connectors

The front of the SD665-N V3 node is shown in the following figure.

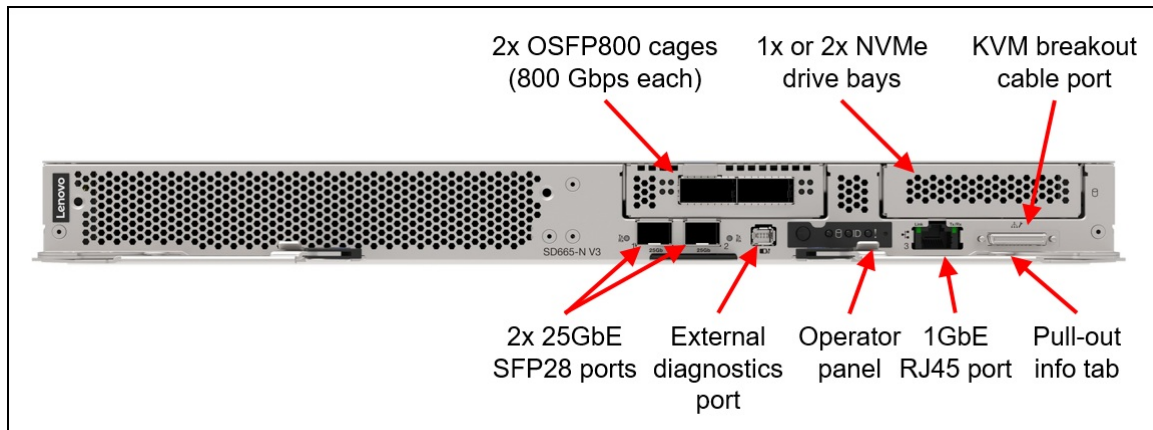


Figure 2. Front view of the ThinkSystem SD665-N V3 node

The following figure shows key components internal to the server tray.

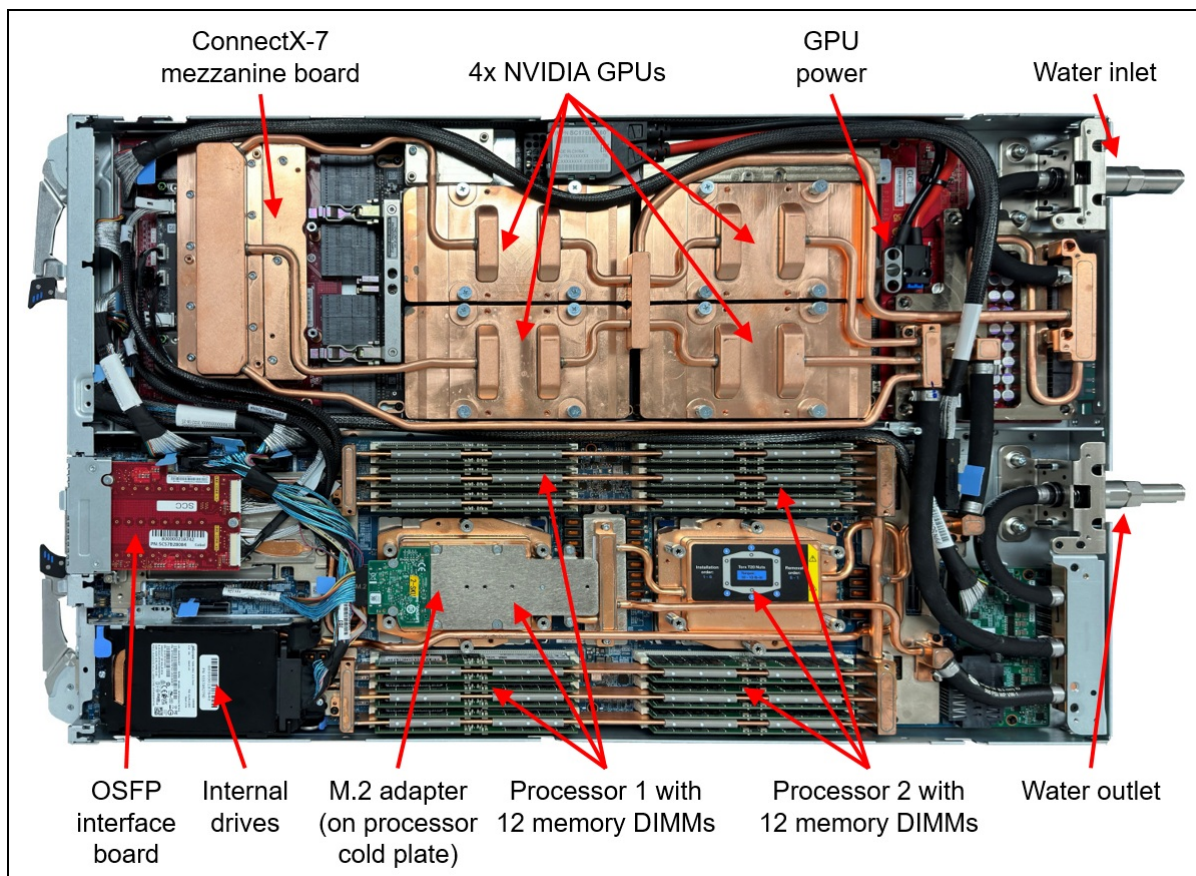


Figure 3. Inside view of the SD665-N V3 node in the water-cooled tray

The compute nodes are installed in the ThinkSystem DW612S enclosure, as shown in the following figure.

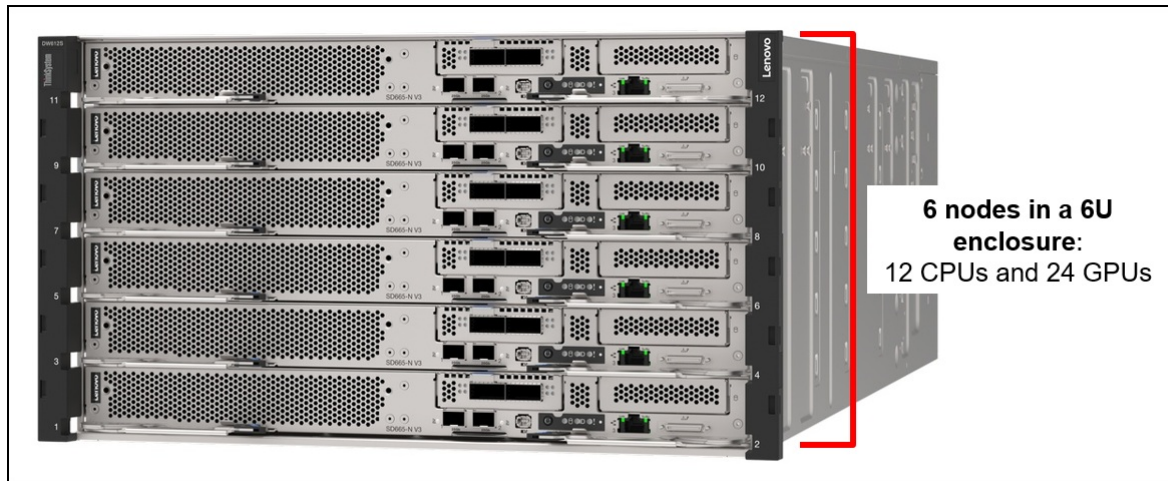


Figure 4. Front view of the DW612S enclosure

The rear of the DW612S enclosure contains the power supplies, cooling water manifolds, and the System Management Module. The following figure shows rear of the enclosure with 6x air-cooled power supplies.

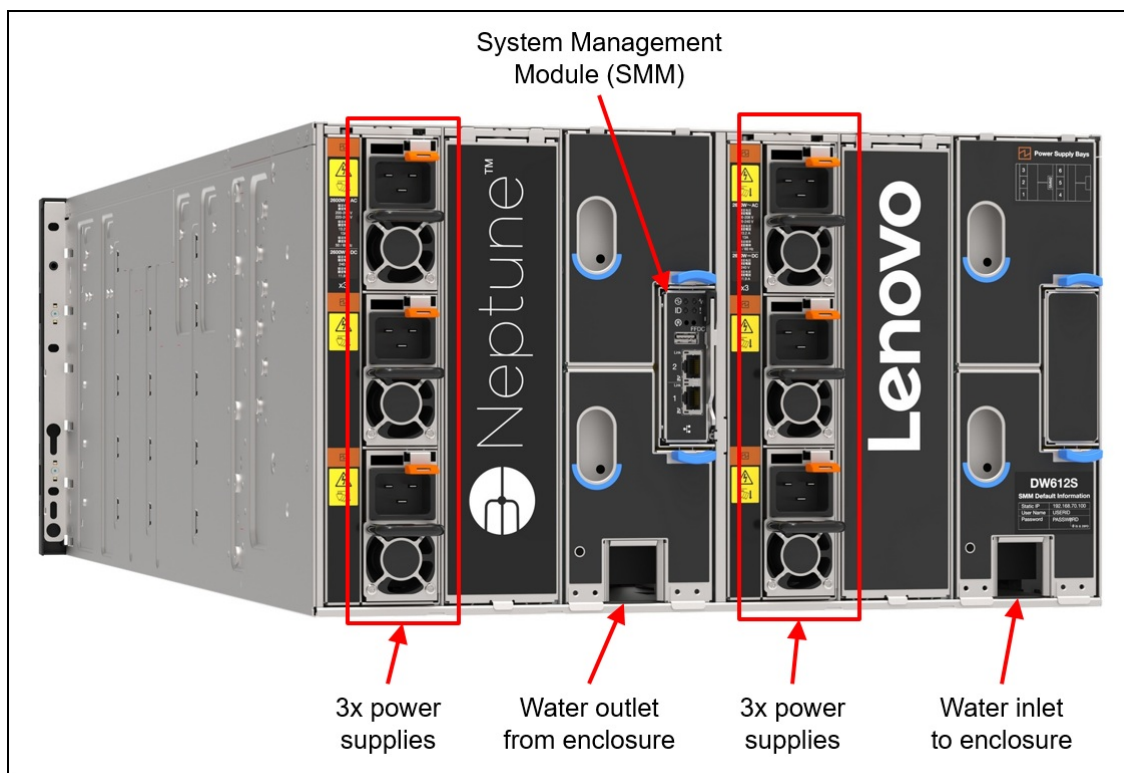


Figure 5. Rear view of the DW612S enclosure with 6 air-cooled power supplies

The also supports water-cooled power supplies for an increased level of heat removal using water. The following figure shows the enclosure with 3 water-cooled power supplies installed.

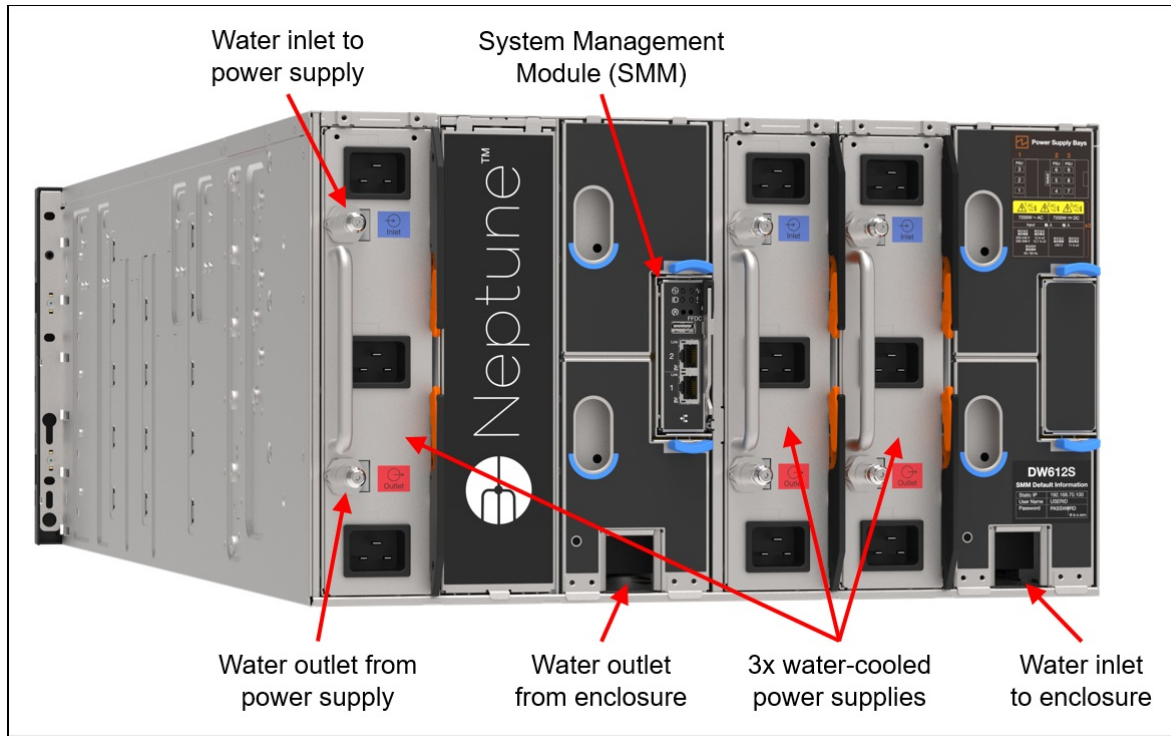


Figure 6. Rear view of the DW612S enclosure with 3 water-cooled power supplies

System architecture

The following figure shows the architectural block diagram of the SD665-N V3 with two processors installed. Each GPU is connected to a processor with a PCIe 5.0 x16 link.

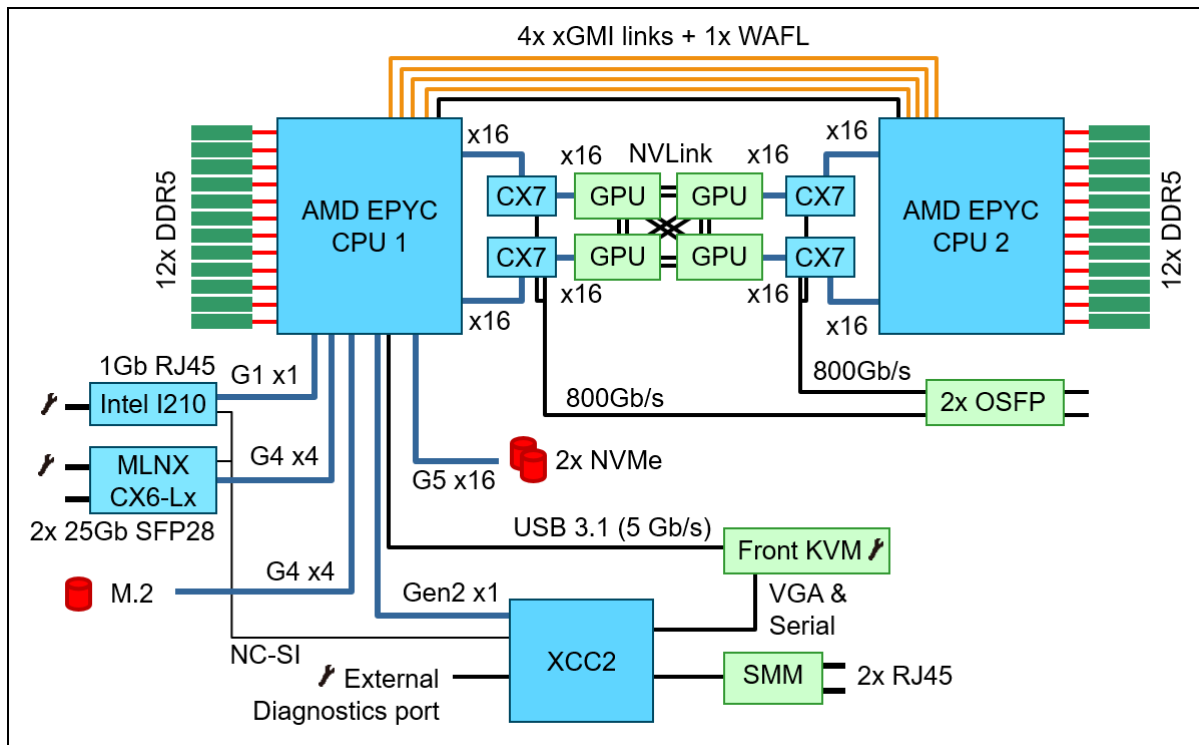


Figure 7. SD665-N V3 system architectural block diagram (2 processors)

The following figure shows the block diagram of the SD665-N V3 with one processor installed. Each GPU is connected to the processor with a PCIe 5.0 x8 link.

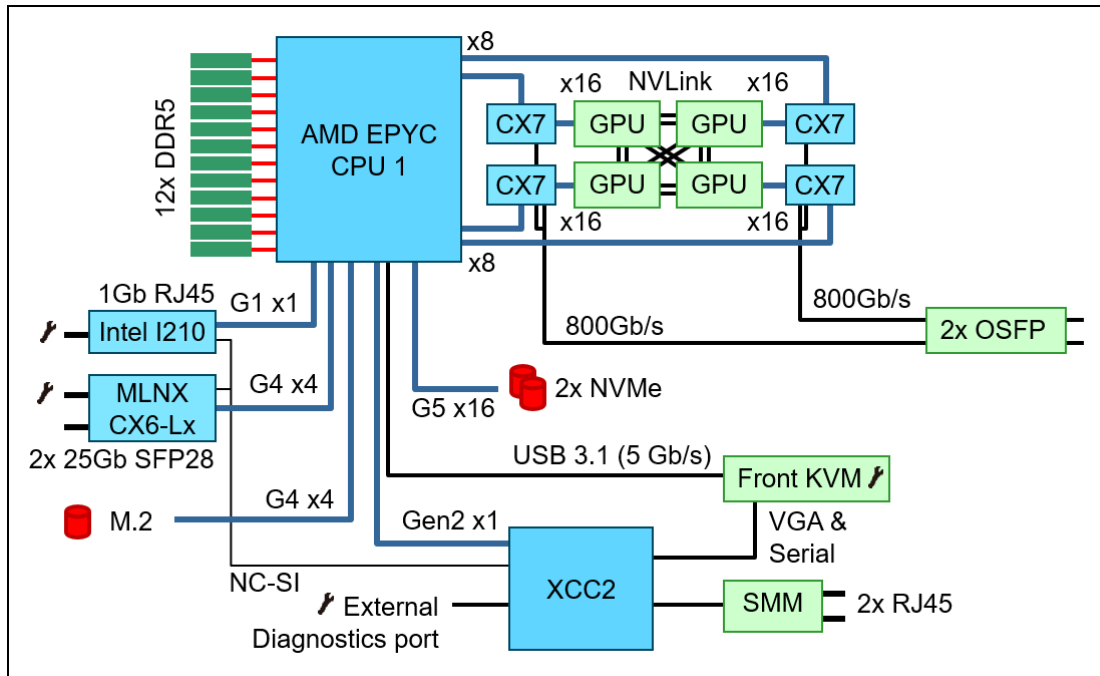


Figure 8. SD665-N V3 system architectural block diagram (1 processor)

Standard specifications - SD665-N V3 tray

The following table lists the standard specifications of the SD665-N V3 server tray.

Table 1. Standard specifications - SD665-N V3 tray

Components	Specification
Machine type	7DAZ - 3-year warranty
Form factor	1U server node mounted on a 1U water-cooled server tray
Enclosure support	ThinkSystem DW612S Neptune DWC Enclosure
Processor	Two 5th Gen AMD EPYC 9005 Series processors (formerly codenamed "Turin") or two 4th Gen AMD EPYC 9004 Series processors (formerly codenamed "Genoa") per node. Supports processors up to 160 cores and TDP ratings of up to 400W. Supports PCIe 5.0 for high performance I/O.
GPUs	NVIDIA HGX H200 or H100 4-GPU board - 4x GPUs interconnected using NVLink 4.0 links
Chipset	Not applicable (platform controller hub functions are integrated into the processor)
Memory	24 DIMM slots with two processors (12 DIMM slots per processor) per node. Each processor has 12 memory channels, with 1 DIMM per channel (DPC). Lenovo TruDDR5 RDIMMs, 3DS RDIMMs, and 9x4 RDIMMs are supported, up to 6400 MHz
Persistent memory	Not supported
Memory maximum	Up to 3TB per node with 24x 128GB 3DS RDIMMs
Memory protection	ECC, SDDC, Patrol/Demand Scrubbing, Bounded Fault, DRAM Address Command Parity with Replay, DRAM Uncorrected ECC Error Retry, On-die ECC, ECC Error Check and Scrub (ECS), Post Package Repair

Components	Specification
Disk drive bays	<p>Supports one of the following:</p> <ul style="list-style-type: none"> • 2x E3.S 1T drive bays supporting PCIe 5.0 NVMe drives • 2x 7mm 2.5-inch drive bays supporting PCIe 5.0 NVMe drives • 1x 15mm 2.5-inch drive bay supporting a PCIe 5.0 NVMe drive <p>The node also supports one high-speed M.2 NVMe SSD with a PCIe 4.0 x4 connection, installed on an M.2 adapter mounted on top of the front processor</p>
Maximum internal storage	<ul style="list-style-type: none"> • E3.S drives: 30.72TB using 2x 15.36TB E3.S NVMe SSDs • 7mm drives: 7.68TB using 2x 3.84TB 7mm NVMe SSDs • 15mm drives: 3.84TB using 1x 3.84TB 15mm NVMe SSDs
Storage controllers	2x Onboard NVMe ports (no hardware RAID available)
Optical drive bays	No internal bays; use an external USB drive.
Network interfaces	Optional 2x OSFP 800G connectors provide 800 Gb/s GPU Direct InfiniBand NDRx2 connectivity to four onboard NVIDIA ConnectX-7 controllers; 2x 25 Gb Ethernet SFP28 onboard connectors based on Mellanox ConnectX-6 Lx controller (support 10/25Gb); 1x 1 Gb Ethernet RJ45 onboard connector based on Intel I210 controller. Onboard 1Gb port and 25Gb port 1 can optionally be shared with the XClarity Controller 2 (XCC) management processor for Wake-on-LAN and NC-SI support.
PCIe slots	None.
Ports	External diagnostics port, console connector (for a breakout cable that provides one VGA port, one USB 3.1 (5 Gb/s) port and one DB9 serial port for local connectivity). Additional ports provided by the enclosure as described in the Enclosure specifications section.
Video	Embedded video graphics with 16 MB memory with 2D hardware accelerator, integrated into the XClarity Controller. Maximum resolution is 1920x1200 32bpp at 60Hz.
Security features	Power-on password, administrator's password, Trusted Platform Module (TPM), supporting TPM 2.0. In China only, optional Nationz TPM 2.0 plug-in module (support is planned).
Systems management	<p>Operator panel with status LEDs. Optional External Diagnostics Handset with LCD display. XClarity Controller 2 (XCC2) embedded management based on the ASPEED AST2600 baseboard management controller (BMC), XClarity Administrator centralized infrastructure delivery, XClarity Integrator plugins, and XClarity Energy Manager centralized server power management. Optional XCC Platinum to enable remote control functions and other features. Lenovo power/energy meter based on TI INA226 for 100Hz power measurements with >97% accuracy.</p> <p>System Management Module (SMM2) in the DW612S enclosure provides additional systems management functions.</p>
Operating systems supported	Red Hat Enterprise Linux, SUSE Linux Enterprise Server, and Ubuntu are Supported & Certified. Rocky Linux is Tested. See the Operating system support section for details and specific versions.
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD).
Service and support	Optional service upgrades are available through Lenovo Services: 4-hour or 2-hour response time, 6-hour fix time, 1-year or 2-year warranty extension, software support for Lenovo hardware and some third-party applications.
Dimensions	Width: 438 mm (17.2 inches), height: 41 mm (1.6 inches), depth: 714 mm (28.1 inches)
Weight	23.6 kg (52.0 lb)

Standard specifications - DW612S enclosure

The ThinkSystem DW612S enclosure provides shared high-efficiency power supplies. The SD665-N V3 servers connect to the midplane of the DW612S enclosure. This midplane connection is for power and control only; the midplane does not provide any I/O connectivity.

The following table lists the standard specifications of the enclosure.

Table 2. Standard specifications: ThinkSystem DW612S enclosure

Components	Specification
Machine type	7D1L - 3-year warranty
Form factor	6U rack-mounted enclosure.
Maximum number of SD665-N V3 nodes supported	Up to 6x nodes per enclosure in 6x SD665-N V3 server trays (1 node per tray).
Node support	The DW612S supports all ThinkSystem V3 and V2 water-cooled systems (systems can coexist in the same DW612S enclosure). When mixing, install in the following order, from the bottom up: SD665-N V3, SD650-N V3, SD665 V3, SD650-I V3, SD650-N V2, SD650 V3, SD650 V2
Enclosures per rack	Up to six DW612S enclosures per 42U rack and up to seven DW612S enclosures per 48U rack.
Midplane	Passive midplane provides connections to the nodes in the front to the power supplies and fans at the rear. Provides signals to control fan speed, power consumption, and node throttling as needed.
System Management Module (SMM)	<p>The hot-swappable System Management Module (SMM2) is the management device for the enclosure. Provides integrated systems management functions and controls the power and cooling features of the enclosure. Provides remote browser and CLI-based user interfaces for remote access via the dedicated Gigabit Ethernet port. Remote access is to both the management functions of the enclosure as well as the XClarity Controller (XCC) in each node.</p> <p>The SMM has two Ethernet ports which enables a single incoming Ethernet connection to be daisy chained across 7 enclosures and 84 nodes, thereby significantly reducing the number of Ethernet switch ports needed to manage an entire rack of SD665-N V3 nodes and enclosures.</p>
Ports	Two RJ45 port on the rear of the enclosure for 10/100/1000 Ethernet connectivity to the SMM for power and cooling management.
I/O architecture	None integrated. Use top-of-rack networking and storage switches.
Power supplies	6x or 9x air-cooled hot-swap power supplies, or 2x or 3x water-cooled hot-swap power supplies, depending on the power requirements of the installed server node trays. Power supplies installed at the rear of the enclosure. Single power domain supplies power to all nodes. Optional redundancy (N+1 or N+N) and oversubscription, depending on configuration and node population. Each power supply has an integrated fan. 80 PLUS Titanium or Platinum certified depending on the power supply. Built-in overload and surge protection.
Cooling	Direct water cooling supplied by water manifolds connected from the rear of the enclosure.
System LEDs	SMM has four LEDs: system error, identification, status, and system power. Each power supply has AC, DC, and error LEDs. Nodes have more LEDs.
Systems management	Browser-based enclosure management through an Ethernet port on the SMM at the rear of the enclosure. Integrated Ethernet switch provides direct access to the XClarity Controller (XCC) embedded management of the installed nodes. Nodes provide more management features.

Components	Specification
Temperature	<ul style="list-style-type: none"> Operating water temperature: <ul style="list-style-type: none"> 2°C to 45°C (35.6°F to 113°F) (ASHRAE W45 compliant) Operating air temperature: <ul style="list-style-type: none"> 10°C - 35°C (50°F - 95°F) (ASHRAE A2 compliant) <p>See Operating Environment for more information.</p>
Electrical power	200 V - 240 V ac input (nominal), 50 or 60 Hz
Power cords	One C19 AC power cord for each air-cooled power supply Three C19 AC power cords for each water-cooled power supply
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty with 9x5/NBD.
Dimensions	Width: 447 mm (17.6 in.), height: 264 mm (10.4 in.), depth: 933 mm (36.7 in.). See Physical and electrical specifications for details.
Weight	<ul style="list-style-type: none"> Empty enclosure (with midplane and cables): 24.3 kg (53.5 lb) Fully configured enclosure with 9x air-cooled power supplies and 6x SD665-N V3 server trays: 182.9 kg (403 lb) (without water manifold) Fully configured enclosure with 3x water-cooled power supplies and 6x SD665-N V3 server trays: 188.7 kg (416 lb) (without water manifold)

Models

There are no standard SD665-N V3 models; all servers must be configured by using the configure-to-order (CTO) process with the Lenovo Data Center Solution Configurator (DCSC) or the Lenovo Cluster Solutions configurator (x-config). The ThinkSystem SD665-N V3 machine type is 7DAZ.

The following table lists the base CTO model and base feature code

Table 3. Base CTO model

Machine Type/Model	Description	Feature code
7DAZCTOLWW	ThinkSystem SD665-N V3 Neptune DWC Tray (3-Year Warranty)	BQQS

Enclosure models

There are no standard models of the DW612S enclosure. All enclosures must be configured by using the CTO process. The machine type is 7D1L.

The following table lists the base CTO model and base feature code

Table 4. Base CTO model

Machine Type/Model	Description	Feature code
7D1LCTO2WW	ThinkSystem DW612S Neptune DWC Enclosure (3-Year Warranty)	BMCA

Manifold assembly

The manifold provides the water supply and return to the DW612S Enclosure. It can be connected through the Eaton Ball Valves (Stainless steel V2A, Type FD83-2046-16-16) to a water loop in the data center that is connected to a centralized coolant distribution unit (CDU) or be ordered with an in-rack CDU.

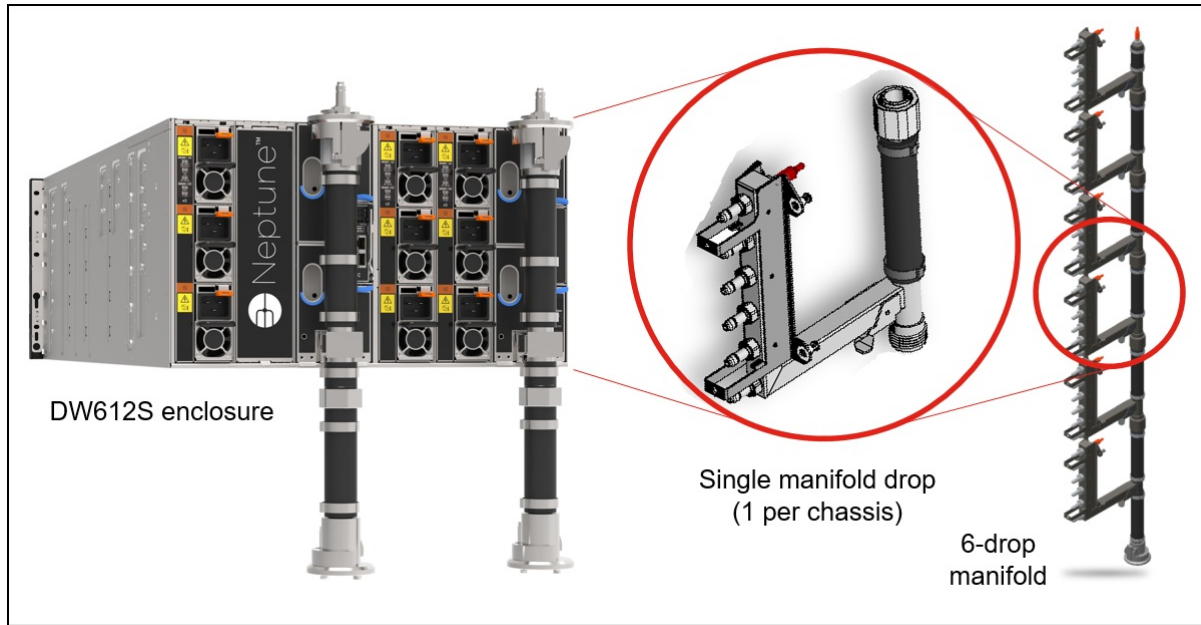


Figure 9. DW612S enclosure and manifold assembly

The manifold is ordered using the CTO process in the configurators using machine type 5469. The following table lists the base CTO model.

Table 5. Base CTO model

Machine Type/Model	Description
5469HC1	Lenovo Neptune DWC Node Manifold

The following table lists the base feature code for CTO configurations when connecting to a data center level water distribution. Select the correct feature code based on the number of enclosures installed in the rack. The feature code for the water-cooled power supplies (PSU) will be auto-derived when you select the PSUs in the configuration and is only supported with 6 Enclosures.

Table 6. Base feature code for CTO models

Feature code	Description
Water manifolds for DW612S enclosure with fixed length hose connection	
A5MN	Lenovo Neptune DWC Manifold Assembly for 1 Enclosure w/ 1.3m hose
A5N7	Lenovo Neptune DWC Manifold Assembly for 2 Enclosures w/ 1.3m hose
A5N8	Lenovo Neptune DWC Manifold Assembly for 3 Enclosures w/ 1.3m hose
A5N9	Lenovo Neptune DWC Manifold Assembly for 4 Enclosures w/ 1.3m hose
BEZX	Lenovo Neptune DWC Manifold Assembly for 5 Enclosures w/ 2.3m hose
BEZW	Lenovo Neptune DWC Manifold Assembly for 6 Enclosures w/ 2.3m hose
BJAK	Lenovo Neptune DWC Manifold Assembly for 7 Enclosures w/ 2.3m hose
Additional water manifold for water-cooled power supplies	
BN0S	Neptune DWC Manifold Assembly for water-cooled Power Supplies

The following table lists the base feature code for CTO configurations when connecting to the in-rack CDU.

Table 7. Base feature code for CTO models

Feature code	Description
Water manifolds for DW612S enclosure with configurable hose connection for use with in-rack CDU	
BRGP	Neptune DWC Manifold Assembly for 1 Enclosure
BRGN	Neptune DWC Manifold Assembly for 2 Enclosure
BY38	Neptune DWC Manifold Assembly for 3 Enclosure
BY39	Neptune DWC Manifold Assembly for 4 Enclosure
BRGM	Neptune DWC Manifold Assembly for 5 Enclosure
BRGL	Neptune DWC Manifold Assembly for 6 Enclosure
Additional water manifold for water-cooled power supplies for use with in-rack CDU	
BRGQ	Neptune DWC Manifold Assembly for water-cooled Power Supplies with in-rack CDU

To support the onsite setup for the direct water-cooled solution, a Commissioning Kit is available providing flow meter, bleed hose, pressure gauge and vent valve to Lenovo partners and customers.

Table 8. Commissioning Kit

Feature code	Description
4XF7A84654	Neptune DWC Manifold Commissioning Kit

For additional information, see the [Cooling](#) section.

In-rack CDU assembly

The RM100 In-Rack Coolant Distribution Unit (CDU) can provide 100kW cooling capacity within the rack cabinet. It is designed as a 4U high rack device installed at the bottom of the rack. The CDU is supported in the 42U and 48U Heavy Duty Rack Cabinets.

Rack support with the DW612S enclosure is as follows:

- 42U rack cabinet: In-Rack CDU with 5 enclosures; no support for water-cooled power supplies
- 48U rack cabinet: In-Rack CDU with 6 enclosures; supports water-cooled power supplies

For information about the 42U and 48U Heavy Duty Rack Cabinets, see the product guide:
<https://lenovopress.lenovo.com/lp1498-lenovo-heavy-duty-rack-cabinets>

The following figure shows the RM100 CDU.



Figure 10. RM100 In-Rack Coolant Distribution Unit

The CDU can be ordered using the CTO process in the configurators using machine type 7DBL. The following table lists the base CTO model and base feature code.

Table 9. RM100 ordering information

CTO model	Base feature	Description
7DBLCTOLWW	BRL4	Lenovo Neptune DWC RM100 In-Rack CDU

For details and exact specification of the CDU, see the In-Rack CDU Operation & Maintenance Guide:
https://pubs.lenovo.com/hdc_rackcabinet/rm100_user_guide.pdf

Professional Services: The factory integration of the In-Rack CDU requires Lenovo Professional Services review and approval for warranty and associated extended services. Before ordering CDU and manifold, contact the Lenovo Professional Services team (CDUsupport@lenovo.com).

The following table lists additional feature codes for CTO configurations. They will be auto-derived when you select the in-Rack CDU for the configuration.

Table 10. Base feature code for CTO models

Feature code	Description	Purpose
BRM4	Neptune DWC In-Rack CDU Connection Assembly for DWC Manifold	Assembly to connect in-rack CDUs to Enclosure and Power Supply Manifolds
BRM3	Neptune DWC In-Rack CDU 2.3m Primary Loop Connection Hose	Hose to connect in-rack CDU to the primary datacenter waterloop
BRL3	Neptune DWC In-Rack CDU Filler Kit	Hose to connect to the in-rack CDU for easy filling with water

Processors

The SD665-N V3 supports processors in the fourth-generation AMD EPYC family of processors. The node supports one or two processors.

Field upgrades from one processor to two processors are currently not supported.

Topics in this section:

- [Processor options](#)
- [Processor features](#)
- [UEFI operating modes](#)

Processor options

The SD665-N V3 supports the following processor families:

- 5th Gen AMD EPYC processors (formerly codenamed "Turin"):
 - Processors with Zen 5 architecture, with high per-core performance
 - Processors with Zen 5c architecture, with high core density and best power efficiency
- 4th Gen AMD EPYC processors:
 - 4th Gen AMD EPYC processors (formerly codenamed "Genoa")
 - 4th Gen AMD EPYC processors with AMD 3D V-Cache (formerly codenamed "Genoa-X"), with larger L3 caches, suitable for engineering workloads like EDA and CFD
 - 4th Gen AMD EPYC processors with Zen 4c architecture (formerly codenamed "Bergamo"), with higher core counts, suitable for workloads like cloud-native applications

All supported processors have the following characteristics:

- 12 DDR5 memory channels
- 128 PCIe 5.0 I/O lanes, 64 lanes available for PCIe and NVMe devices

Configuration notes:

- All 5th Gen processors support a 6400 MHz memory bus speed provided specific memory DIMMs are installed in the server and the latest system firmware is applied. See the table in the [Memory options](#) section to see which DIMMs support 6400 MHz. For all other DIMMs, the memory bus operates at 6000 MHz.

The following table lists the 5th Gen AMD EPYC processors supported by the SD665-N V3.

Table 11. 5th Gen AMD EPYC processor support

Feature code	SKU	Description	Quantity supported
5th AMD EPYC processors ("Turin") with Zen 5 architecture			
C2AK	9135	ThinkSystem AMD EPYC 9135 16C 200W 3.65GHz Processor	1 or 2
C2AR	9175F	ThinkSystem AMD EPYC 9175F 16C 320W 4.2GHz Processor	1 or 2
C2AP	9255	ThinkSystem AMD EPYC 9255 24C 200W 3.25GHz Processor	1 or 2
C2AT	9275F	ThinkSystem AMD EPYC 9275F 24C 320W 4.1GHz Processor	1 or 2
C2AQ	9335	ThinkSystem AMD EPYC 9335 32C 210W 3.0GHz Processor	1 or 2
C2AZ	9355	ThinkSystem AMD EPYC 9355 32C 280W 3.55GHz Processor	1 or 2
C2AV	9355P	ThinkSystem AMD EPYC 9355P 32C 280W 3.55GHz Processor	1
C2AM	9365	ThinkSystem AMD EPYC 9365 36C 300W 3.4GHz Processor	1 or 2
C2AJ	9375F	ThinkSystem AMD EPYC 9375F 32C 320W 3.8GHz Processor	1 or 2
C2ND	9455	ThinkSystem AMD EPYC 9455 48C 300W 3.15GHz Processor	1 or 2
C2NE	9455P	ThinkSystem AMD EPYC 9455P 48C 300W 3.15GHz Processor	1
C2A3	9475F	ThinkSystem AMD EPYC 9475F 48C 400W 3.65GHz Processor	1 or 2
C2AL	9535	ThinkSystem AMD EPYC 9535 64C 300W 2.4GHz Processor	1 or 2
C2AY	9555	ThinkSystem AMD EPYC 9555 64C 360W 3.2GHz Processor	1 or 2
C2AW	9555P	ThinkSystem AMD EPYC 9555P 64C 360W 3.2GHz Processor	1
C2AS	9565	ThinkSystem AMD EPYC 9565 72C 400W 3.15GHz Processor	1 or 2
C4H8	9575F	ThinkSystem AMD EPYC 9575F 64C 400W 3.3GHz Processor	1 or 2
C2AU	9655	ThinkSystem AMD EPYC 9655 96C 400W 2.6GHz Processor	1 or 2
C2AX	9655P	ThinkSystem AMD EPYC 9655P 96C 400W 2.6GHz Processor	1
5th AMD EPYC processors ("Turin") with Zen 5c architecture			
C2AN	9645	ThinkSystem AMD EPYC 9645 96C 320W 2.3GHz Processor	1 or 2
C2AE	9745	ThinkSystem AMD EPYC 9745 128C 400W 2.4GHz Processor	1 or 2
C2AH	9825	ThinkSystem AMD EPYC 9825 144C 390W 2.2GHz Processor	1 or 2
C2TD	9845	ThinkSystem AMD EPYC 9845 160C 390W 2.1GHz Processor	1 or 2

The following table lists the 4th Gen AMD EPYC processors supported by the SD665-N V3.

Table 12. 4th Gen AMD EPYC processor support

Feature code	SKU	Description	Quantity supported
4th Gen AMD EPYC processors ("Genoa")			
BREE	9124	ThinkSystem AMD EPYC 9124 16C 200W 3.0GHz Processor	1 or 2
BREJ	9174F	ThinkSystem AMD EPYC 9174F 16C 320W 4.1GHz Processor	1 or 2
BREH	9224	ThinkSystem AMD EPYC 9224 24C 200W 2.5GHz Processor	1 or 2
BRED	9254	ThinkSystem AMD EPYC 9254 24C 200W 2.9GHz Processor	1 or 2
BREF	9274F	ThinkSystem AMD EPYC 9274F 24C 320W 4.05GHz Processor	1 or 2
BREC	9334	ThinkSystem AMD EPYC 9334 32C 210W 2.7GHz Processor	1 or 2
BR30	9354	ThinkSystem AMD EPYC 9354 32C 280W 3.25GHz Processor	1 or 2
BREG	9354P	ThinkSystem AMD EPYC 9354P 32C 280W 3.25GHz Processor	1
BR32	9374F	ThinkSystem AMD EPYC 9374F 32C 320W 3.85GHz Processor	1 or 2
BREB	9454	ThinkSystem AMD EPYC 9454 48C 290W 2.75GHz Processor	1 or 2
BREM	9454P	ThinkSystem AMD EPYC 9454P 48C 290W 2.75GHz Processor	1
BR31	9474F	ThinkSystem AMD EPYC 9474F 48C 360W 3.6GHz Processor	1 or 2
BREA	9534	ThinkSystem AMD EPYC 9534 64C 280W 2.45GHz Processor	1 or 2
BPVJ	9554	ThinkSystem AMD EPYC 9554 64C 360W 3.1GHz Processor	1 or 2
BREL	9554P	ThinkSystem AMD EPYC 9554P 64C 360W 3.1GHz Processor	1
BR2Z	9634	ThinkSystem AMD EPYC 9634 84C 290W 2.25GHz Processor	1 or 2
BPVK	9654	ThinkSystem AMD EPYC 9654 96C 360W 2.4GHz Processor	1 or 2
BREK	9654P	ThinkSystem AMD EPYC 9654P 96C 360W 2.4GHz Processor	1
4th AMD EPYC processors with AMD 3D V-Cache ("Genoa-X")			
BXFT	9184X	ThinkSystem AMD EPYC 9184X 16C 320W 3.55GHz Processor	1 or 2
BW9V	9384X	ThinkSystem AMD EPYC 9384X 32C 320W 3.1GHz Processor	1 or 2
BW9U	9684X	ThinkSystem AMD EPYC 9684X 96C 400W 2.55GHz Processor	1 or 2
4th Gen AMD EPYC processors with Zen 4c architecture ("Bergamo")			
BW9S	9734	ThinkSystem AMD EPYC 9734 112C 340W 2.2GHz Processor	1 or 2
BW9T	9754	ThinkSystem AMD EPYC 9754 128C 360W 2.25GHz Processor	1 or 2

Processor features

The following table lists the features of the supported 5th Gen AMD EPYC processors.

6400 MHz memory support : The processors support memory up to 6400 MHz provided that specific memory DIMMs are installed in the server and the latest system firmware is applied. See the table in the [Memory options](#) section to see which DIMMs support 6400 MHz.

Table 13. Processor specifications - 5th Gen AMD EPYC processors

EPYC model**	Cores / Threads	Base Frequency	Max Boost Frequency†	L3 Cache	Memory channels	Memory bus	TDP
5th AMD EPYC processors ("Turin") with Zen 5 architecture							
9135	16 / 32	3.65 GHz	4.3 GHz	64 MB	12	6400 MHz	200W
9175F	16 / 32	4.2 GHz	5 GHz	512 MB	12	6400 MHz	320W
9255	24 / 48	3.25 GHz	4.3 GHz	128 MB	12	6400 MHz	200W

EPYC model**	Cores / Threads	Base Frequency	Max Boost Frequency†	L3 Cache	Memory channels	Memory bus	TDP
9275F	24 / 48	4.1 GHz	4.8 GHz	256 MB	12	6400 MHz	320W
9335	32 / 64	3 GHz	4.4 GHz	128 MB	12	6400 MHz	210W
9355	32 / 64	3.55 GHz	4.4 GHz	256 MB	12	6400 MHz	280W
9355P	32 / 64	3.55 GHz	4.4 GHz	256 MB	12	6400 MHz	280W
9365	36 / 72	3.4 GHz	4.3 GHz	192 MB	12	6400 MHz	300W
9375F	32 / 64	3.8 GHz	4.8 GHz	256 MB	12	6400 MHz	320W
9455	48 / 96	3.15 GHz	4.4 GHz	256 MB	12	6400 MHz	300W
9455P	48 / 96	3.15 GHz	4.4 GHz	256 MB	12	6400 MHz	300W
9475F	48 / 96	3.65 GHz	4.8 GHz	256 MB	12	6400 MHz	400W
9535	64 / 128	2.4 GHz	4.3 GHz	256 MB	12	6400 MHz	300W
9555	64 / 128	3.2 GHz	4.4 GHz	256 MB	12	6400 MHz	360W
9555P	64 / 128	3.2 GHz	4.4 GHz	256 MB	12	6400 MHz	360W
9565	72 / 144	3.15 GHz	4.3 GHz	384 MB	12	6400 MHz	400W
9575F	64 / 128	3.3 GHz	5 GHz	256 MB	12	6400 MHz	400W
9655	96 / 192	2.6 GHz	4.5 GHz	384 MB	12	6400 MHz	400W
9655P	96 / 192	2.6 GHz	4.5 GHz	384 MB	12	6400 MHz	400W
5th AMD EPYC processors ("Turin") with Zen5c architecture							
9645	96 / 192	2.3 GHz	3.7 GHz	256 MB	12	6400 MHz	320W
9745	128 / 256	2.4 GHz	3.7 GHz	256 MB	12	6400 MHz	400W
9825	144 / 288	2.2 GHz	3.7 GHz	384 MB	12	6400 MHz	390W
9845	160 / 320	2.1 GHz	3.7 GHz	320 MB	12	6400 MHz	390W

† The maximum single-core frequency that the processor is capable of operating

** Processors with a P suffix are single-socket capable processors; Processors with an F suffix are frequency-optimized processor

The following table lists the features of the supported 4th Gen AMD EPYC processors.

Table 14. Processor specifications - 4th Gen AMD EPYC processors

EPYC model**	Cores / Threads	Base Frequency	Max Boost Frequency†	L3 Cache	Memory channels	Memory bus	TDP
4th Gen AMD EPYC processors ("Genoa")							
9124	16 / 32	3.0 GHz	3.7 GHz	64 MB	12	4800 MHz	200W
9174F	16 / 32	4.1 GHz	4.4 GHz	256 MB	12	4800 MHz	320W
9224	24 / 48	2.5 GHz	3.7 GHz	64 MB	12	4800 MHz	200W
9254	24 / 48	2.9 GHz	4.15 GHz	128 MB	12	4800 MHz	200W
9274F	24 / 48	4.05 GHz	4.3 GHz	256 MB	12	4800 MHz	320W
9334	32 / 64	2.7 GHz	3.9 GHz	128 MB	12	4800 MHz	210W
9354	32 / 64	3.25 GHz	3.8 GHz	256 MB	12	4800 MHz	280W
9354P	32 / 64	3.25 GHz	3.8 GHz	256 MB	12	4800 MHz	280W
9374F	32 / 64	3.85 GHz	4.3 GHz	256 MB	12	4800 MHz	320W
9454	48 / 96	2.75 GHz	3.8 GHz	256 MB	12	4800 MHz	290W
9454P	48 / 96	2.75 GHz	3.8 GHz	256 MB	12	4800 MHz	290W

EPYC model**	Cores / Threads	Base Frequency	Max Boost Frequency†	L3 Cache	Memory channels	Memory bus	TDP
9474F	48 / 96	3.6 GHz	4.1 GHz	256 MB	12	4800 MHz	360W
9534	64 / 128	2.45 GHz	3.7 GHz	256 MB	12	4800 MHz	280W
9554	64 / 128	3.1 GHz	3.75 GHz	256 MB	12	4800 MHz	360W
9554P	64 / 128	3.1 GHz	3.75 GHz	256 MB	12	4800 MHz	360W
9634	84 / 168	2.25 GHz	3.7 GHz	384 MB	12	4800 MHz	290W
9654	96 / 192	2.4 GHz	3.7 GHz	384 MB	12	4800 MHz	360W
9654P	96 / 192	2.4 GHz	3.7 GHz	384 MB	12	4800 MHz	360W
4th AMD EPYC processors with AMD 3D V-Cache ("Genoa-X")							
9184X	16 / 32	3.55 GHz	4.20 GHz	768 MB	12	4800 MHz	320W
9384X	32 / 64	3.1 GHz	3.9 GHz	768 MB	12	4800 MHz	320W
9684X	96 / 192	2.55 GHz	3.7 GHz	1150 MB	12	4800 MHz	400W
4th Gen AMD EPYC processors with Zen 4c architecture ("Bergamo")							
9734	112 / 224	2.2 GHz	3.0 GHz	256 MB	12	4800 MHz	340W
9754	128 / 256	2.25 GHz	3.2 GHz	256 MB	12	4800 MHz	360W

† The maximum single-core frequency that the processor is capable of operating

** Processors with a P suffix are single-socket capable processors; Processors with an F suffix are frequency-optimized processor

UEFI operating modes

The SD665-N V3 offers preset operating modes that affect energy consumption and performance. These modes are a collection of predefined low-level UEFI settings that simplify the task of tuning the server to suit your business and workload requirements.

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

UK and EU customers: For compliance with the ERP Lot9 regulation, you should select feature BFYA. For some systems, you may not be able to make a selection, in which case, it will be automatically derived by the configurator.

Table 15. UEFI operating mode presets in DCSC

Feature code	Description
BFYA	Operating mode selection for: "Maximum Efficiency Mode"
BFYB	Operating mode selection for: "Maximum Performance Mode"

The preset modes for the SD665-N V3 are as follows:

- **Maximum Efficiency Mode** (feature BFYA): Maximizes performance/watt efficiency while maintaining reasonable performance
- **Maximum Performance Mode** (feature BFYB): Achieves maximum performance but with higher power consumption and lower energy efficiency.

Memory

The SD665-N V3 uses Lenovo TruDDR5 memory operating at up to 6400 MHz with 5th Gen AMD EPYC processors, and up to 4800 MHz with 4th Gen AMD EPYC processors. The server supports up to 24 DIMMs with 2 processors. The processors have 12 memory channels and support 1 DIMM per channel. The server supports up to 3TB of memory using 24x 128GB DIMMs and two processors.

Lenovo TruDDR5 memory uses the highest quality components that are sourced from Tier 1 DRAM suppliers and only memory that meets the strict requirements of Lenovo is selected. It is compatibility tested and tuned to maximize performance and reliability. From a service and support standpoint, Lenovo TruDDR5 memory automatically assumes the system warranty, and Lenovo provides service and support worldwide.

The following table lists the memory options supported in the SD665-N V3 with 5th Gen AMD EPYC processors. The table also lists the maximum memory bus speed each memory DIMM supports, either 6000 MHz or 6400 MHz.

Table 16. Memory options for 5th Gen AMD EPYC processors

Part number	Feature code	Description	Maximum speed	DRAM technology
x4 RDIMMs				
4X77A93528	C0CK	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM-A	6000 MHz	16Gb
4X77A93533	C0CP	ThinkSystem 96GB TruDDR5 6400MHz (2Rx4) RDIMM-A	6000 MHz	24Gb
4X77A93529	C0CL	ThinkSystem 128GB TruDDR5 6400MHz (2Rx4) RDIMM-A	6000 MHz	32Gb
4X77B07420	CA1L	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM-A v2	6400 MHz	16Gb
4X77B07424	CA1Q	ThinkSystem 96GB TruDDR5 6400MHz (2Rx4) RDIMM-A v2	6400 MHz	24Gb
4X77B07421	CA1M	ThinkSystem 128GB TruDDR5 6400MHz (2Rx4) RDIMM-A v2	6400 MHz	32Gb
x8 RDIMMs				
4X77A93527	C0CJ	ThinkSystem 32GB TruDDR5 6400MHz (2Rx8) RDIMM-A	6000 MHz	16Gb
4X77A93532	C0CN	ThinkSystem 48GB TruDDR5 6400MHz (2Rx8) RDIMM-A	6000 MHz	24Gb
4X77B07419	CA1K	ThinkSystem 32GB TruDDR5 6400MHz (2Rx8) RDIMM-A v2	6400 MHz	16Gb
4X77B07423	CA1P	ThinkSystem 48GB TruDDR5 6400MHz (2Rx8) RDIMM-A v2	6400 MHz	24Gb

* Memory DIMM is currently CTO only. Option part numbers for field upgrades are planned.

The following table lists the memory options supported in the SD665-N V3 with 4th Gen AMD EPYC processors.

Table 17. Memory options for 4th Gen AMD EPYC processors

Part number	Feature code	Description	Maximum speed	DRAM technology
9x4 RDIMMs				
4X77A81442	BQ36	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 9x4 RDIMM-A	4800 MHz	16Gb
10x4 RDIMMs				
4X77A81441	BQ3D	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM-A	4800 MHz	16Gb
4X77A81448	BUVV	ThinkSystem 96GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM-A	4800 MHz	24Gb
4X77A96982	C467	ThinkSystem 128GB TruDDR5 5600MHz (2Rx4) RDIMM-A	4800 MHz	32Gb
x8 RDIMMs				
4X77A81437	BQ3C	ThinkSystem 16GB TruDDR5 4800MHz (1Rx8) RDIMM-A	4800 MHz	16Gb
4X77A81440	BQ37	ThinkSystem 32GB TruDDR5 4800MHz (2Rx8) RDIMM-A	4800 MHz	16Gb
4X77A81447	BUVU	ThinkSystem 48GB TruDDR5 4800MHz (2Rx8) RDIMM-A	4800 MHz	24Gb
10x4 3DS RDIMMs				
4X77A81443	BQ3A	ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM-A v2	4800 MHz	16Gb

9x4 RDIMMs (also known as Optimized or EC4 RDIMMs) are a lower-cost DDR5 memory option supported in ThinkSystem V3 servers. 9x4 DIMMs offer the same performance as standard RDIMMs (known as 10x4 or EC8 modules), however they support lower fault-tolerance characteristics. Standard RDIMMs and 3DS RDIMMs support two 40-bit subchannels (that is, a total of 80 bits), whereas 9x4 RDIMMs support two 36-bit subchannels (a total of 72 bits). The extra bits in the subchannels allow standard RDIMMs and 3DS RDIMMs to support Single Device Data Correction (SDDC), however 9x4 RDIMMs do not support SDDC. Note, however, that all DDR5 DIMMs, including 9x4 RDIMMs, support Bounded Fault correction, which enables the server to correct most common types of DRAM failures.

For more information on DDR5 memory, see the Lenovo Press paper, *Introduction to DDR5 Memory*, available from <https://lenovopress.com/lp1618>.

The following rules apply when selecting the memory configuration:

- Memory rated at 4800 MHz is only supported with 4th Gen processors. Memory rated at 6400 MHz memory is only supported with 5th Gen processors (and operates at 6000 MHz or 6400 MHz as indicated in the table).
- The SD665-N V3 only supports quantities of 8 or 12 DIMMs per processor; other quantities not supported
- 128GB DIMMs require a water inlet temperature of 32°C or less
- The server supports four types of DIMMs: 9x4 RDIMMs, 10x4 RDIMMs, x8 RDIMMs and 3DS RDIMMs
 - UDIMMs and LRDIMMs are not supported
- All memory DIMMs must be identical part numbers
- Memory operates at the speed of the memory bus of the processor - see the [Processor features](#) section for specifics

Note: Memory mirroring and memory rank sparing are not supported.

For best performance, consider the following:

- Ensure the memory installed is at least the same speed as the memory bus of the selected processor.
- Populate all 12 memory channels with identical DIMMs (same Lenovo part number)

The following memory protection technologies are supported:

- ECC detection/correction
- Bounded Fault detection/correction
- SDDC (for x4-based memory DIMMs; look for "x4" in the DIMM description. Not supported with 9x4 RDIMMs)
- Patrol/Demand Scrubbing
- DRAM Address Command Parity with Replay
- DRAM Uncorrected ECC Error Retry
- On-die ECC
- ECC Error Check and Scrub (ECS)
- Post Package Repair

GPU accelerators

A key feature of the SD665-N V3 is the integration of a 4x SXM4 GPU complex on the left half of the server as shown in the [Components and connectors](#) section. The server supports four NVIDIA HGX GPU modules that are connected together using high-speed fourth-generation NVLink interconnects.

The GPUs supported are listed in the following table.

Table 18. GPU ordering information

Feature code	Description
C3V2	ThinkSystem NVIDIA HGX H200 141GB 700W 4-GPU Board
BUBB	ThinkSystem NVIDIA H100 SXM5 700W 94G HBM2e GPU Board
BQQV	ThinkSystem NVIDIA H100 SXM5 700W 80G GPU Board

The NVIDIA H200 and H100 Tensor Core GPUs deliver unprecedented performance, scalability and security to every data center and includes NVIDIA AI Enterprise software suite for streamlined AI development and deployment.

Table 19. GPU specifications

Specification	H200	80GB H100	94GB H100
Form Factor	SXM	SXM	SXM
FP64	34 teraFLOPS	34 teraFLOPS	34 teraFLOPS
FP64 Tensor Core	67 teraFLOPS	67 teraFLOPS	67 teraFLOPS
FP32	67 teraFLOPS	67 teraFLOPS	67 teraFLOPS
TF32 Tensor Core	989 teraFLOPS*	989 teraFLOPS*	989 teraFLOPS*
BFLOAT16 Tensor	1,979 teraFLOPS*	1,979 teraFLOPS*	1,979 teraFLOPS*
FP16 Tensor Core	1,979 teraFLOPS*	1,979 teraFLOPS*	1,979 teraFLOPS*
FP8 Tensor Core	3,958 teraFLOPS*	3,958 teraFLOPS*	3,958 teraFLOPS*
INT8 Tensor Core	3,958 TOPS*	3,958 TOPS*	3,958 TOPS*
GPU Memory	141 GB HBM3e	80 GB HBM3	94GB HBM2e
GPU Memory Bandwidth	4.8 TB/s	3.35 TB/s	2.40 TB/s
Total Graphics Power (TGP) or Continuous Electrical Design Point (EDPc)	700W	700W	700W
Multi-Instance GPUs	Up to 7 MIGS @ 10 GB	Up to 7 MIGS @ 10 GB	Up to 7 MIGS @ 10 GB
Interconnect	NVLink: 900 GB/s, PCIe Gen5: 128 GB/s	NVLink: 900 GB/s, PCIe Gen5: 128 GB/s	NVLink: 900 GB/s, PCIe Gen5: 128 GB/s

The NVIDIA H200 and H100 support granular power management by using the Total Graphics Power (TGP) setting. This setting determines what the maximum power each GPU can use, and in turn will dictate how many nodes can be installed in the enclosure and how hot the inlet water can be to properly cool all nodes.

Lenovo supports pre-set TGP of 500W, 600W and 700W. With full 400W processor configuration and the GPUs at 700W up to 35°C system inlet water temperature can be supported based on 4 lpm flow rate per tray. With 600W set on the GPUs 40°C are supported and with 500W the full 45°C. The supported trays per chassis are shown in the [Power supplies](#) section.

The desired TGP setting is executed in the factory by specifying the matching feature code in the configurator. The following table lists the feature codes that can be selected.

Table 20. Feature codes for TGP setting

TGP Setting	Feature code	Description
700W	BS3P	ThinkSystem SD665-N, SD650-N V3 700W GPU Maximum Performance Mode
600W	BS3Q	ThinkSystem SD665-N, SD650-N V3 600W GPU Performance Optimized Mode
500W	BS3R	ThinkSystem SD665-N, SD650-N V3 500W GPU Power Efficiency Optimized Mode

Tip: Total Graphics Power (TGP) is also called Continuous Electrical Design Point (EDPc). The peak EDP (EDPp) of the GPU can be as much as 80% higher than the EDPc. When adjusting the EDPc, the related EDPp is also adjusted in the same ratio. On top of changing the EDPc, the NVIDIA H100 supports setting a programmable EDP which is limiting the EDP peak to a minimum of 44% above the set EDPc.

Internal storage

The SD665-N V3 node supports one or two SSDs drives internally in the node. These are internal drives that are not front accessible and are not hot-swap. See the [Components and connectors](#) section for the location of the drives.

The SD665-N V3 supports either:

- 2x E3.S 1T drives
- 2x 2.5-inch 7mm drives
- 1x 2.5-inch 15mm drive

Configuration notes:

- The node only supports NVMe drives; SATA and SAS drives are not supported
- The drives are connected to onboard controllers; No RAID support
- NVMe drives are connected to CPU 1 in all configurations
- When 2x 7mm or 2x E3.S drives are installed in a node, they are numbered drive 2 (bottom) and 3 (top). When 1x 15mm drive is installed, it is numbered 2.

In addition, the SD665-N V3 node a single high-performance M.2 NVMe drive, installed in an adapter mounted on top of the front processor. For details, see the [M.2 drive](#) section.

The feature codes to select the appropriate storage cage are listed in the following table:

Tip: SATA drives are currently not supported in the SD665-N V3.

Table 21. Drive cage feature codes

Feature code	Description
BZU2	ThinkSystem SD665, SD665-N V3 1x E3.S 1T Storage Cage
BU9S	ThinkSystem SD665, SD665-N V3 2x E3.S 1T Storage Cage
BYU4	ThinkSystem SD665, SD665-N V3 1x2.5" 7mm NVMe Storage Cage
BYAU	ThinkSystem SD665, SD665-N V3 2x2.5" 7mm NVMe Storage Cage
BPZA	ThinkSystem SD665, SD665-N V3 2x2.5" 7mm SATA Storage Cage
BPZB	ThinkSystem SD665, SD665-N V3 1x2.5" 15mm NVMe Storage Cage

The necessary storage cables are auto-derived by the configurator.

To upgrade systems installed in the field with storage options, there are separate kits available that contain both the cage and the necessary cables. The option part numbers of the upgrade kits are listed in the following table.

Table 22. Drive cage field upgrades

Part number	Description
4XF7A85263	ThinkSystem SD665-N V3 NVMe Storage Option Upgrade Kit
4XF7A86739	ThinkSystem SD665-N V3 E3.S 1T Storage option upgrade kit

M.2 drive

The SD665-N V3 supports one M.2 form-factor NVMe drive for use as an operating system boot solution. The M.2 drive installs into an M.2 adapter which is mounted on top of the front processor in the node. See the internal view of the node in the [Components and connectors](#) section for the location of the M.2 drive.

PCIe x4 interface: In the SD665-N V3, the M.2 drive is connected to the processor using a PCIe x4 connection, which enables the M.2 drive to operate at the highest performance.

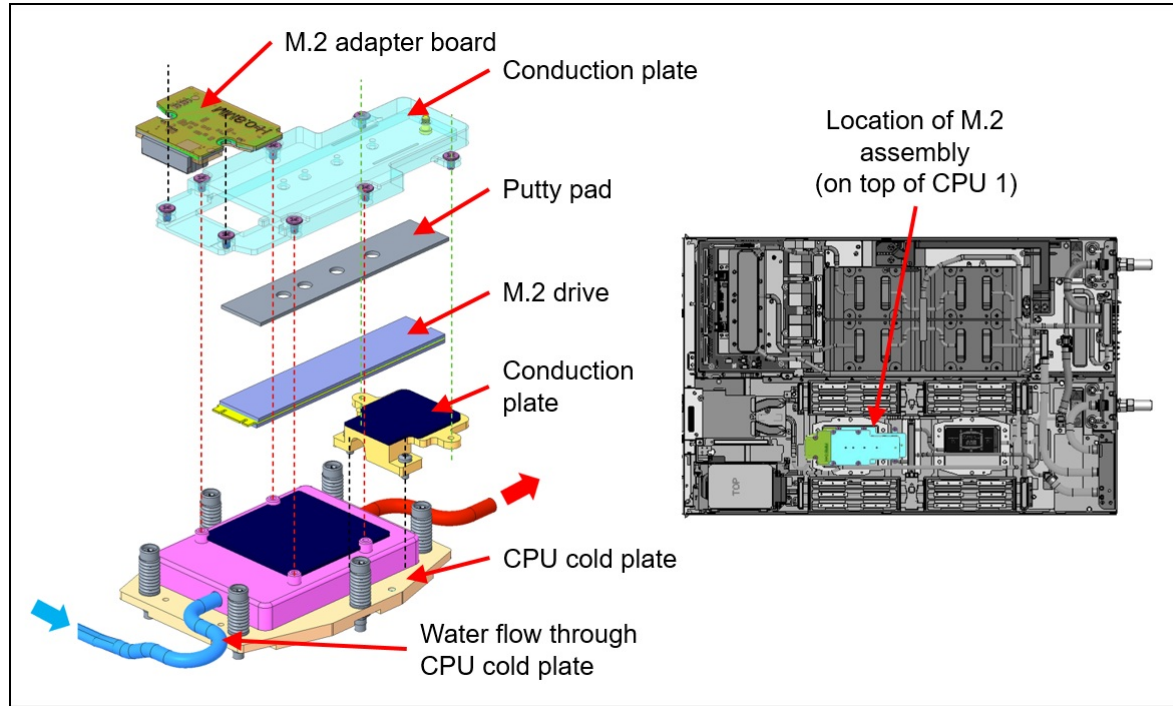


Figure 11. Components and location of the M.2 enablement kit

The ordering information of the M.2 adapter is listed in the following table. Supported drives are listed in the [Internal drive options](#) section.

Table 23. M.2 adapter

Part number	Feature code	Description	Maximum supported
CTO only	BPZF	ThinkSystem SD665, SD665-N V3 DWC M.2 Enablement Kit	1

Note: In the SD665-N V3, the M.2 adapter only supports NVMe drives. SATA M.2 drives are not supported

The M.2 enablement kit has the following features:

- Supports one NVMe M.2 drive
- Supports 80mm and 110mm drive form factors (2280 and 22110)
- PCIe 4.0 x4 NVMe interface to the drive
- Connects to CPU 1 via onboard NVMe connector
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools
- Water-cooled via the attached cold plate

Controllers for internal storage

The drives of the SD665-N V3 are connected to CPU 1 using PCIe 4.0 x4 connections.

The node hardware does not provide any RAID functionality. RAID support is provided by the operating system.

Internal drive options

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

Trayless drives:

- [E3.S EDSFF trayless PCIe 5.0 NVMe SSDs](#)
- [7mm 2.5-inch trayless PCIe 4.0 NVMe SSDs](#)
- [15mm 2.5-inch trayless PCIe 5.0 NVMe SSDs](#)
- [15mm 2.5-inch trayless PCIe 4.0 NVMe SSDs](#)

M.2 drives:

- [M.2 PCIe 4.0 NVMe drives](#)

M.2 drive support: The use of M.2 drives requires an additional adapter as described in the [M.2 drives](#) subsection.

SED support: The tables include a column to indicate which drives support SED encryption. The encryption functionality can be disabled if needed. Note: Not all SED-enabled drives have "SED" in the description.

Table 24. E3.S EDSFF trayless PCIe 5.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
E3.S trayless SSDs - PCIe 5.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A93367	C67G	ThinkSystem E3.S PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A93368	C67H	ThinkSystem E3.S PM9D3a 3.84TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A93369	C67J	ThinkSystem E3.S PM9D3a 7.68TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A93370	C67K	ThinkSystem E3.S PM9D3a 15.36TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A88775	BWS1	ThinkSystem E3.S PM1743 1.92TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A88776	BWS2	ThinkSystem E3.S PM1743 3.84TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A88777	BWS3	ThinkSystem E3.S PM1743 7.68TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2
4XB7A88778	BWS4	ThinkSystem E3.S PM1743 15.36TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	2

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

Part number	Feature code	Description	SED support	Max Qty
7mm 2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13975	BKSQ	ThinkSystem 2.5" 7mm U.3 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	2
4XB7A13976	BKWR	ThinkSystem 2.5" 7mm U.3 7450 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	2
4XB7A13977	BKWS	ThinkSystem 2.5" 7mm U.3 7450 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	2

Table 26. 15mm 2.5-inch trayless PCIe 5.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
15mm 2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A82609	BW8Q	ThinkSystem 2.5" 15mm U.3 PM1743 1.92TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	1
4XB7A82411	BW8R	ThinkSystem 2.5" 15mm U.3 PM1743 3.84TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	1
4XB7A88392	BW8S	ThinkSystem 2.5" 15mm U.3 PM1743 7.68TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	1
4XB7A88393	BW8T	ThinkSystem 2.5" 15mm U.3 PM1743 15.36TB Read Intensive NVMe PCIe 5.0 x4 Trayless SSD	Support	1

Table 27. 15mm 2.5-inch trayless PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
15mm 2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7B01887	C7P5	ThinkSystem 2.5" 15mm U.2 Solidigm P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7B01888	C7P6	ThinkSystem 2.5" 15mm U.2 Solidigm P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7B01889	C7P7	ThinkSystem 2.5" 15mm U.2 Solidigm P5620 6.4TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7A76781	BKT5	ThinkSystem 2.5" 15mm U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 Trayless SSD	Support	1
15mm 2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7B01876	C7P2	ThinkSystem 2.5" 15mm U.2 Solidigm P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7B01877	C7P3	ThinkSystem 2.5" 15mm U.2 Solidigm P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7B01878	C7P4	ThinkSystem 2.5" 15mm U.2 Solidigm P5520 7.68TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	1
4XB7A76780	BKT4	ThinkSystem 2.5" 15mm U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 Trayless SSD	Support	1

Table 28. M.2 PCIe 4.0 NVMe drives

Part number	Feature code	Description	SED support	Max Qty
M.2 SSDs - PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13999	BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	Support	1
4XB7A14000	BKSS	ThinkSystem M.2 7450 PRO 1.92TB Read Intensive Entry NVMe PCIe 4.0 x4 NHS SSD	Support	1

Optical drives

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

Table 29. External optical drive

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

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

I/O expansion options

The SD665-N V3 offers I/O expansion in the form of high-speed GPU Direct connections to the four NVIDIA GPUs in the system. These InfiniBand NDR connections with OSFP cages are in addition to two onboard 25 GbE ports with SRP28 cages.

The location of these ports is shown in the following figure.

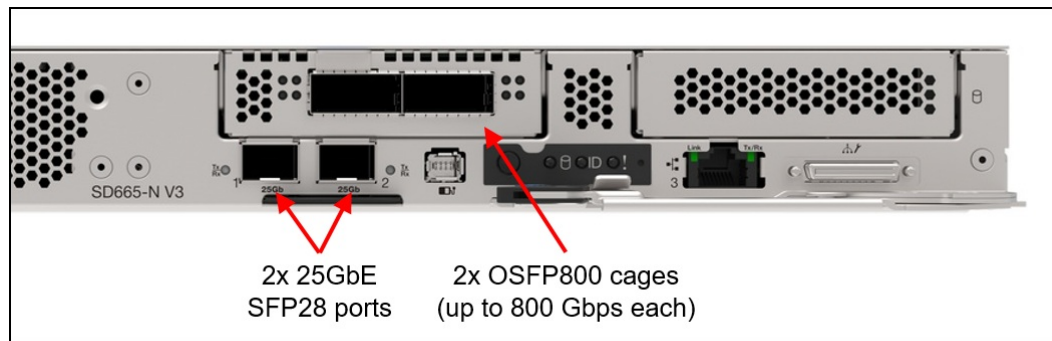


Figure 12. SD665-N V3 networking

Network adapters

The SD665-N V3 has five network ports, one 1Gb, two 25Gb, and two 800Gb ports. There is no support for PCIe network adapters.

Topics in this section:

- [Onboard 25Gb and 1Gb ports](#)
- [OSFP800 ports](#)

Onboard 25Gb and 1Gb ports

The SD665-N V3 has three onboard network ports:

- 2x 25GbE ports, connected to an onboard Mellanox ConnectX-6 Lx controller, implemented with SFP28 cages for optical or copper connections. Supports 1Gb, 10Gb and 25Gb connections.
- 1x 1GbE port, connected to an onboard Intel I210 controller, implemented with an RJ45 port for copper cabling

Locations of these ports is shown in the [Components and connectors](#) section. The 1GbE port and 25GbE Port 1 both support NC-SI for remote management. For factory orders, to specify which ports should have NC-SI enabled, use the feature codes listed in the [Remote Management](#) section. If neither is chosen, both ports will have NC-SI disabled by default.

For the specifications of the 25GbE ports including the supported transceivers and cables, see the Mellanox ConnectX-6 Lx product guide:

<https://lenovopress.lenovo.com/lp1364-thinksystem-mellanox-connectx-6-lx-25gbe-sfp28-ethernet-adapters>

OSFP800 ports

The SD665-N V3 includes an I/O mezzanine board containing four NVIDIA ConnectX-7 VPI network controllers. The board is automatically included in the order.

Table 30. Networking mezzanine board

Part number	Feature code	Description
CTO only	BQQU	ThinkSystem NVIDIA ConnectX-7 4-chip VPI PCIe Gen5 Mezz Controller

The mezzanine board has two connectors where an OSFP board is attached via cables as shown in the following figure. The server makes use of OSFP-DD (double-density) connections to double the bandwidth from 400 Gb/s to 800 Gb/s per physical port.

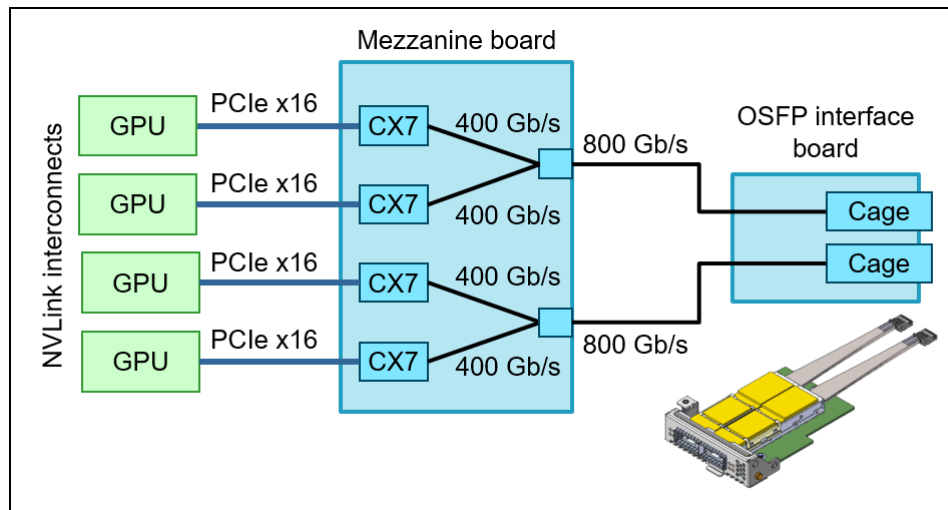


Figure 13. GPU Direct connectivity in the SD665-N V3

The SD665-N V3 supports OSFP boards with either two double-400 Gb/s interfaces or two 400 Gb/s interfaces, resulting in full NDR InfiniBand or NDR200 InfiniBand bandwidth per GPU. The choices areas listed in the following table.

Table 31. OSFP interfaces

Part number	Feature code	Description	Max Qty	Bandwidth per cage	Supported transceivers
CTO only	BRK8	ThinkSystem SD665-N, SD650-N V3 4x NDR Infiniband Interface (contains 2 cages)	1	2x400 Gb/s	BQMJ
CTO only	BRK9	ThinkSystem SD665-N, SD650-N V3 4x NDR200 Infiniband Interface (contains 2 cages)	1	400 Gb/s	None

The following table lists the transceiver supported by ThinkSystem SD665-N, SD650-N V3 4x NDR Infiniband Interface (BRK8).

Table 32. Transceivers for OSFP cages

Part number	Feature code	Description	Max Qty	Supported OSFP interface
4TC7A83365	BQMJ	ThinkSystem NDRx2 OSFP800 IB Multi Mode Twin-Transceiver Flat Top	2	BRK8

For the specifications of the OSFP ports including the supported transceivers and cables, see the NVIDIA ConnectX-7 product guide:

<https://lenovopress.lenovo.com/lp1692-thinksystem-nvidia-connectx-7-ndr-infiniband-osfp400-adapters>

The following table lists the supported cables for ThinkSystem SD665-N, SD650-N V3 4x NDR Infiniband Interface, BRK8.

Table 33. Cables for ThinkSystem SD665-N, SD650-N V3 4x NDR Infiniband Interface, BRK8

Part number	Feature code	Description
Mellanox NDR Multi Mode Fibre Cables (requires transceiver 4TC7A83365)		
4X97A81748	BQJN	Lenovo 3M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81749	BQJP	Lenovo 5M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81750	BQJQ	Lenovo 7M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81751	BQJR	Lenovo 10M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81752	BQJS	Lenovo 20M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A85349	BSN6	Lenovo 30M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
Mellanox NDRx2 OSFP800 Finned to NDRx2 OSFP800 Flat Copper Cable		
4X97A84581	BRKC	Lenovo 1M NVIDIA NDRx2 OSFP800 Finned to NDRx2 OSFP800 Flat Top Passive Copper Cable
4X97A84582	BRKD	Lenovo 1.5M NVIDIA NDRx2 OSFP800 Finned to NDRx2 OSFP800 Flat Top Passive Copper Cable
4X97A84583	BRKE	Lenovo 2M NVIDIA NDRx2 OSFP800 Finned to NDRx2 OSFP800 Flat Top Passive Copper Cable
4X97A84584	BRKF	Lenovo 3M NVIDIA NDRx2 OSFP800 Finned to NDRx2 OSFP800 Flat Top Active Copper Cable

The following table lists the supported cables for ThinkSystem SD665-N, SD650-N V3 4x NDR200 Infiniband Interface, BRK9.

Table 34. Cables for ThinkSystem SD665-N, SD650-N V3 4x NDR200 Infiniband Interface, BRK9

Part number	Feature code	Description
Mellanox NDRx2 OSFP800 to 2x NDR OSFP400 Splitter Copper Cables		
4X97A81827	BQJV	Lenovo 1M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable
4X97A81828	BQJW	Lenovo 1.5M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable
4X97A81829	BQJX	Lenovo 2M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable

Storage host bus adapters

The SD665-N V3 does not support storage host bus adapters.

Flash storage adapters

The SD665-N V3 does not support Flash storage adapters.

Cooling

One of the most notable features of the ThinkSystem SD665-N V3 offering is direct water cooling. Direct water cooling (DWC) is achieved by circulating the cooling water directly through cold plates that contact the CPU thermal case, DIMMs, and other high-heat-producing components in the node.

One of the main advantages of direct water cooling is the water can be relatively warm and still be effective because water conducts heat much more effectively than air. Depending on the server and power supply configuration as well as environmental factors like water and air temperature, effectively 100% of the heat can be removed by water cooling; in configurations that stay slightly below that, the rest can be easily managed by a standard computer room air conditioner. Measured data at a customer data center shows 98% heat capture at 45°C water inlet temperature and 99% heat capture at 40°C water inlet temperature and 26.6°C ambient temperature with insulated racks using the SD650-N V2.

Allowable inlet temperatures for the water can be as high as 45°C (113°F) with the SD665-N V3. In most climates, water-side economizers can supply water at temperatures below 45°C for most of the year. This ability allows the data center chilled water system to be bypassed thus saving energy because the chiller is the most significant energy consumer in the data center. Typical economizer systems, such as dry-coolers, use only a fraction of the energy that is required by chillers, which produce 6-10 °C (43-50 °F) water. The facility energy savings are the largest component of the total energy savings that are realized when the SD665-N V3 is deployed.

The advantages of the use of water cooling over air cooling result from water's higher specific heat capacity, density, and thermal conductivity. These features allow water to transmit heat over greater distances with much less volumetric flow and reduced temperature difference as compared to air.

For cooling IT equipment, this heat transfer capability is its primary advantage. Water has a tremendously increased ability to transport heat away from its source to a secondary cooling surface, which allows for large, more optimally designed radiators or heat exchangers rather than small, inefficient fins that are mounted on or near a heat source, such as a CPU.

The ThinkSystem SD665-N V3 offering uses the benefits of water by distributing it directly to the highest heat generating node subsystem components. By doing so, the offering realizes 7% - 10% direct energy savings when compared to an air-cooled equivalent. That energy savings results from the removal of the system fans and the lower operating temp of the direct water-cooled system components.

The direct energy savings at the enclosure level, combined with the potential for significant facility energy savings, makes the SD665-N V3 an excellent choice for customers that are burdened by high energy costs or with a sustainability mandate.

Water is delivered to each of the nodes from a coolant distribution unit (CDU) via the water manifold. As shown in the following figure, each manifold section attaches to an enclosure and connects directly to the water inlet and outlet connectors for each compute node to deliver water safely and reliably to and from each server tray.

The DWC Manifold is modular and is available in multiple configurations that are based on the number of enclosure drops that are required in a rack. The Manifold scales to support up to six Enclosures in a single rack, as shown in the following figure. Ordering information for the water manifold is in the [Manifold assembly](#) section.

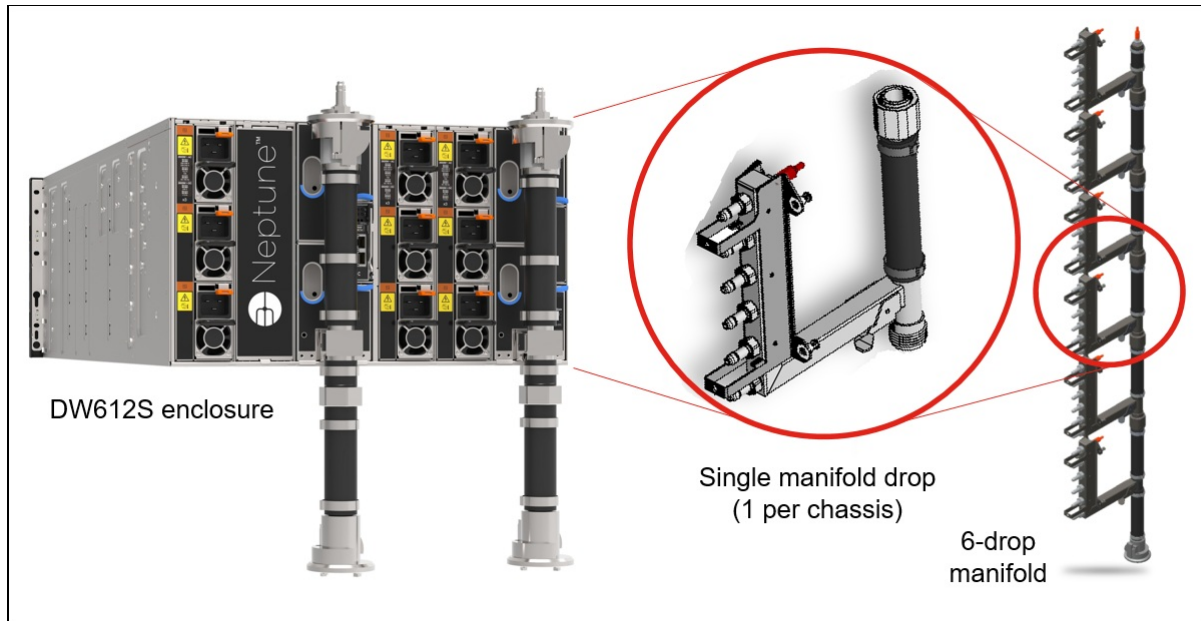


Figure 14. DW612S enclosure and manifold assembly

The water flows through the SD665-N V3 tray to cool all major heat-producing components. The inlet water is split into two parallel paths, one for each node in the tray. Each path is then split further to cool the processors, memory, drives (including the M.2 drive) and adapters.

When the DW612S is configured with water-cooled power supplies, an additional water manifold is used to supply water to each of the three power supplies, as shown in the following figure. Ordering information for the manifold is in the [Manifold assembly](#) section.

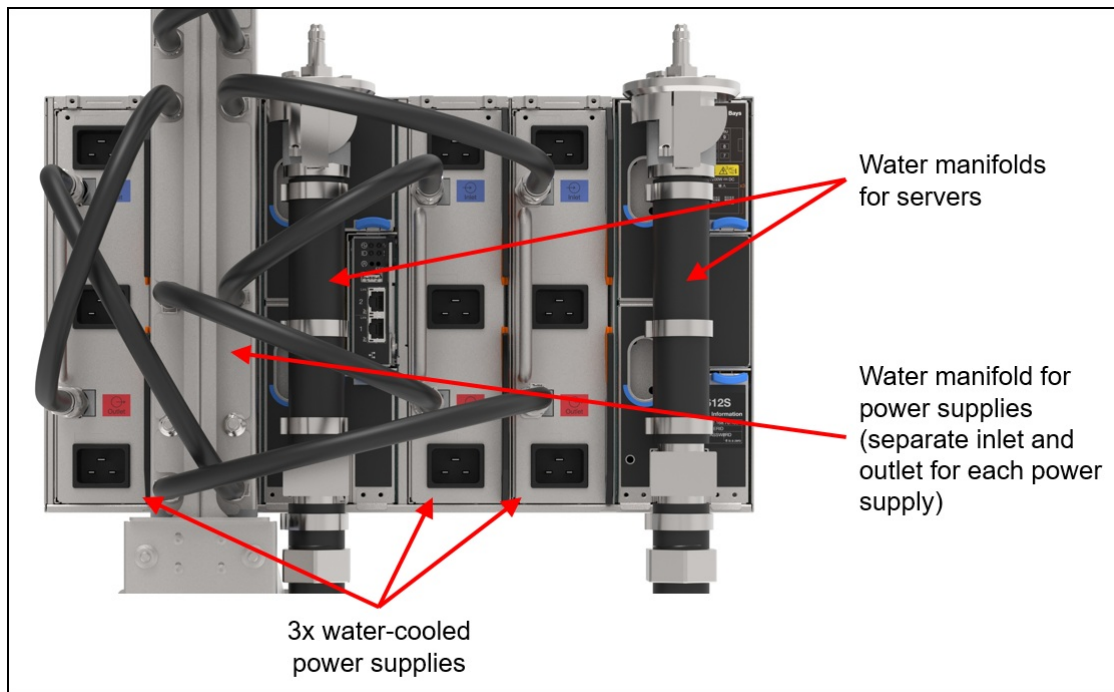


Figure 15. DW612S enclosure with water-cooled power supplies and manifold

During the manufacturing and test cycle, Lenovo's water-cooled nodes are pressure tested with Helium according to ASTM E499 / E499M – 11 (Standard Practice for Leaks Using the Mass Spectrometer Leak Detector in the Detector Probe Mode) and later again with Nitrogen to detect micro-leaks which may be undetectable by pressure testing with water and/or a water/glycol mixture as Helium and Nitrogen have smaller molecule sizes.

This approach also allows Lenovo to ship the systems pressurized without needing to send hazardous antifreeze-components to our customers.

Onsite the materials used within the water loop from the CDU to the nodes should be limited to copper alloys with brazed joints, Stainless steels with TIG and MIG welded joints and EPDM rubber. In some instances, PVC might be an acceptable choice within the facility.

The water the system is filled with must be reasonably clean, bacteria-free water (< 100 CFU/ml) such as de-mineralized water, reverse osmosis water, de-ionized water, or distilled water. It must be filtered with in-line 50 micron filter. Biocide and Corrosion inhibitors ensure a clean operation without microbiological growth or corrosion.

Lenovo Data Center Power and Cooling Services can support you in the design, implementation and maintenance of the facility water-cooling infrastructure.

Power supplies

The DW612S enclosure supports air-cooled or water-cooled power supplies. The use of water-cooled power supplies enables an even greater amount of heat can be removed from the data center using water instead of air-conditioning.

The DW612S with SD665-N V3 servers installed support the following power supply quantities:

- 9x air-cooled power supplies, each with one power connector
- 3x water-cooled power supplies, each with three power connectors

Tip: Use Lenovo Capacity Planner to determine the power needs for your rack installation. See the [Lenovo Capacity Planner](#) section for details.

The power supplies provide N+1 redundancy (water-cooled power supplies each count as 3), depending on population and configuration of the node trays. Power policies with no redundancy also are supported. Water-cooled power supply units contain 3 discreet power supplies, which means that with 3 water-cooled power supply units, 8+1 redundancy is supported.

Topics in this section:

- [Power supply layout](#)
- [Power supply ordering information](#)
- [Power output](#)
- [Limitations based on GPU power requirements](#)
- [Power cables](#)

Power supply layout

Power supplies are implemented in the DW612S enclosure in vertical cages, with three air-cooled power supplies or one water-cooled power supply in each cage. The following figure shows nine air-cooled power supplies installed in three cages.

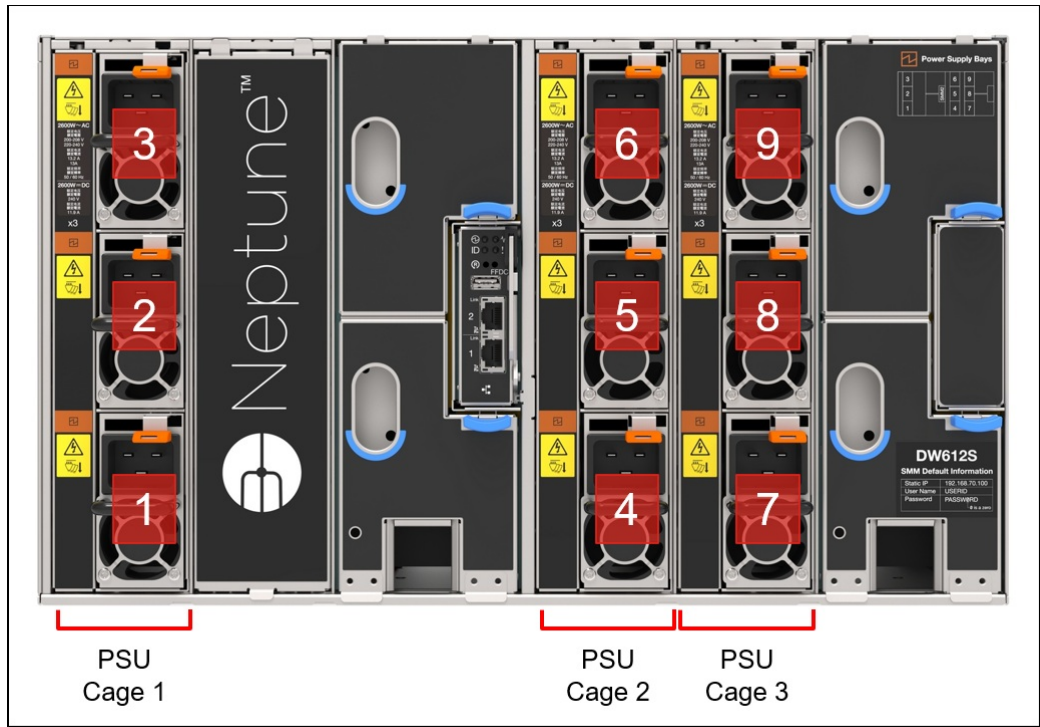


Figure 16. Power supplies and cages in the DW612S enclosure (shown with 9 air-cooled power supplies)
 The following figure shows the DW612S with three water-cooled power supplies installed.

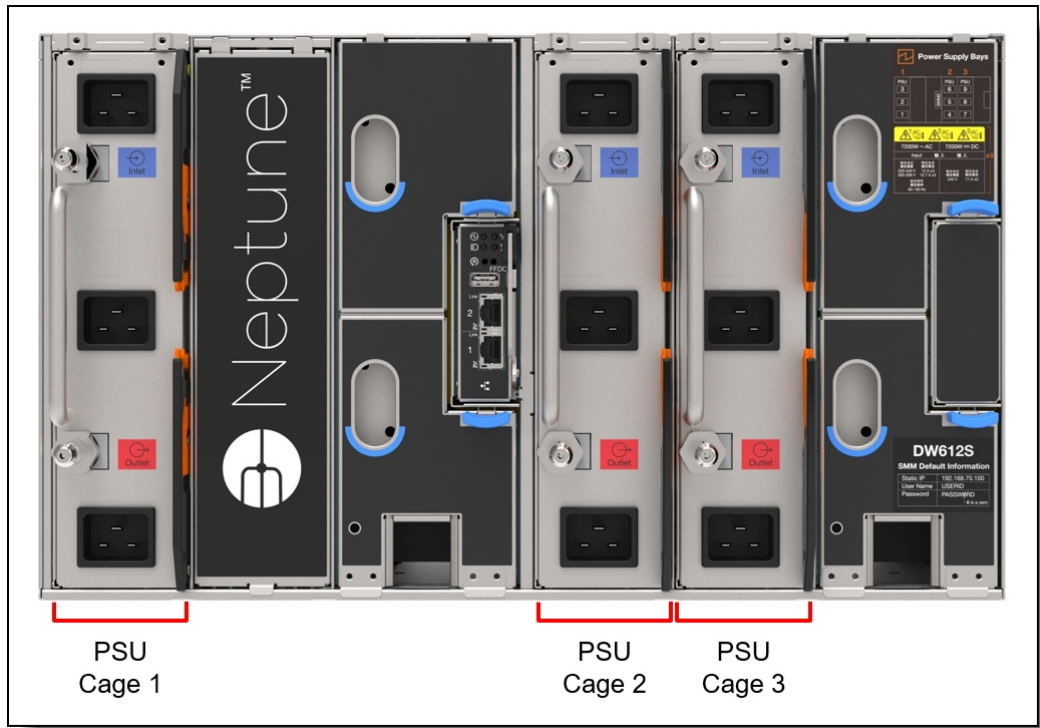


Figure 17. Power supplies and cages in the DW612S enclosure (shown with 3 water-cooled power supplies)

Power supply ordering information

The following table lists the supported power supplies for use in the DW612S enclosure with SD665-N V3 nodes installed. Mixing of power supply capacities (different part number) is not supported.

Table 35. Power supply options

Part number	Feature	Description	Connector	Quantity support	80 PLUS	110V AC	220V AC	277V AC HVAC	240V DC China only
Air cooled 220V power supplies									
4P57A72667	BKTJ	ThinkSystem 2600W 230V Titanium Hot-Swap Gen2 Power Supply v4	1x C19	9	Titanium	No	Yes	No	Yes
Air cooled HVAC power supplies									
CTO only	C5PL*	ThinkSystem 2600W HVAC Titanium Hot-Swap Gen2 Power Supply	1x RF-203-HP	6, 9	Titanium	No	No	Yes	No
Water cooled 220V power supplies									
4P57A72669	BKTK	ThinkSystem DW612S 7200W 230V Titanium Gen2 Power Supply	3x C19	3	Titanium	No	Yes	No	Yes

* Only offered in USA; not available in other markets

The power supply units have the following features:

- 80 PLUS Platinum or Titanium certified as listed in the table above
- Supports N+1 power redundancy or non-redundant power configurations:
 - For air-cooled power supplies: 8+1
 - For water-cooled power supplies: 8+1
- Power management configured through the SMM
- Integrated 2500 RPM fan
- Built-in overload and surge protection
- Supports high-range voltage only: 200-240 V

Power output

The power rating of each power supply (2600W) is dependent on the voltage of the input supply. A 208V supply will be able to generate less power than a 240V supply for example. You will need to take this into consideration when determining your power needs. The following table provides the details for each supported power supply unit. A yellow cell indicates lower power availability than the rated power.

Table 36. Power availability based on the voltage of the supply

Description	2600W 230V Titanium Power Supply	7200W 230V Titanium Power Supply
Power Rating	2600W	7200W
Output with 200-208Vac supply	2400W	6900W
Output with 220-240Vac supply	2600W	7200W

Limitations based on GPU power requirements

The following table shows the power limits based on the configured Peak EDP (EDPp) setting for a high-end dual-socket configuration (2x 360W CPU e.g. 9554 64C 3.1GHz, 24x 64GB Memory, 2x NVMe, 1x M.2).

Table 37. Number of trays supported based on GPU EDPp and available power - dual-processors nodes

Description	Feature code	Power consumption per tray	3x 6900W output or 9x 2400W (3x DWC power supplies at 208V supply)	3x 7200W and 9x 2600W output (230V supply)
Maximum available chassis power			18400W DC	20800W DC
700W GPU Maximum Performance Mode	BS3P	4170W	4 trays	4 trays
600W GPU Performance Optimized Mode	BS3Q	3761W	4 trays	5 trays
500W GPU Power Efficiency Optimized Mode	BS3R	3353W	No support	6 trays

The following table shows the power limits based on the configured EDPp setting for a high-end single-socket configuration (1x 360W CPU e.g. 9554 64C 3.1GHz, 12x 64 GB Memory, no local storage).

Table 38. Number of trays supported based on GPU EDPp and available power - single-processors nodes

Description	Feature code	Power consumption per tray	3x 6900W output or 9x 2400W (3x DWC power supplies at 208V supply)	3x 7200W and 9x 2600W output (230V supply)
Maximum available chassis power			18400W DC	20800W DC
700W GPU Maximum Performance Mode	BS3P	3600W	4 trays	4 trays
600W GPU Performance Optimized Mode	BS3Q	3191W	4 trays	5 trays
500W GPU Power Efficiency Optimized Mode	BS3R	2783W	No support	6 trays

Power cables

The power supplies in the DW612S enclosure have C19 connectors and support the following rack power cables.

Table 39. C19 rack power cables

Part number	Feature code	Description
4L67A86677	BPJ0	0.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86678	B4L0	1.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86679	B4L1	1.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86680	B4L2	2.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
39Y7916	6252	2.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86681	B4L3	4.3m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable

For the HVAC power supply, the rack power cable listed in the following table is supported.

Table 40. DW612S power cords

Part number	Feature code	Description
CTO only	C63P	1M, 15A/200-277V HVAC, RF203 to Anderson 2316G Jumper Cord

System Management

The SD665-N V3 contains an integrated service processor, XClarity Controller 2 (XCC), which provides advanced control, monitoring, and alerting functions. The XCC2 is based on the AST2600 baseboard management controller (BMC) using a dual-core ARM Cortex A7 32-bit RISC service processor running at 1.2 GHz.

Topics in this section:

- [Local console](#)
- [External Diagnostics Handset](#)
- [System status with XClarity Mobile](#)
- [Remote management](#)
- [XCC2 Platinum](#)
- [Remote management using the SMM](#)
- [Lenovo HPC & AI Software Stack](#)
- [Lenovo XClarity Provisioning Manager](#)

- [Lenovo XClarity Essentials](#)
- [Lenovo XClarity One](#)
- [Lenovo XClarity Administrator](#)
- [Lenovo XClarity Integrators](#)
- [Lenovo XClarity Energy Manager](#)
- [Lenovo Capacity Planner](#)

Local console

The SD665-N V3 node supports a local console with the use of a console breakout cable. The cable connects to the port on the front of the node as shown in the following figure.

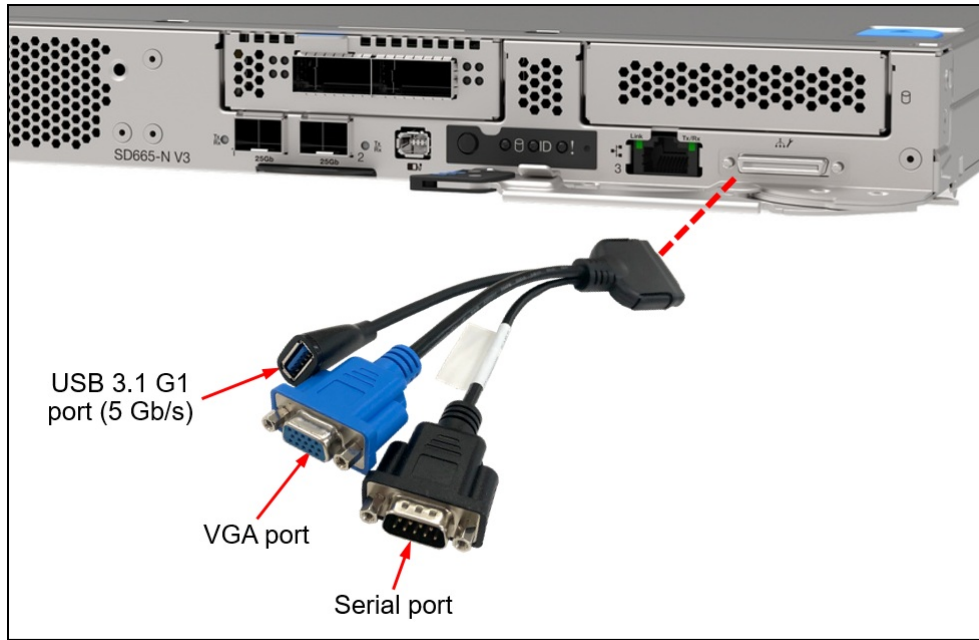


Figure 18. Console breakout cable

The cable has the following connectors:

- VGA port
- Serial port
- USB 3.1 Gen 1 (5 Gb/s) port

Tip: USB 3.0 was renamed to USB 3.1 Gen 1 by the USB Implementers Forum. The terms "USB 3.0" and "USB 3.1 Gen 1" are used interchangeably - both offer a 5 Gb/s USB connection.

As well as local console functions, the USB port on the breakout cable also supports the use of the XClarity Mobile app as described in the next section.

Ordering information for the cable is listed in the following table.

Table 41. Console breakout cable ordering information

Part number	Feature code	Description
4X97A83213	1410 BMJB	ThinkSystem USB 3.0 Console Breakout Cable for Dense Systems v2

External Diagnostics Handset

The SD665-N V3 has a port to connect an External Diagnostics Handset as shown in the following figure.

The External Diagnostics Handset allows quick access to system status, firmware, network, and health information. The LCD display on the panel and the function buttons give you access to the following information:

- Active alerts
- Status Dashboard
- System VPD: machine type & mode, serial number, UUID string
- System firmware levels: UEFI and XCC firmware
- XCC network information: hostname, MAC address, IP address, DNS addresses
- Environmental data: Ambient temperature, CPU temperature, AC input voltage, estimated power consumption
- Active XCC sessions
- System reset action

The handset has a magnet on the back of it to allow you to easily mount it on a convenient place on any rack cabinet.

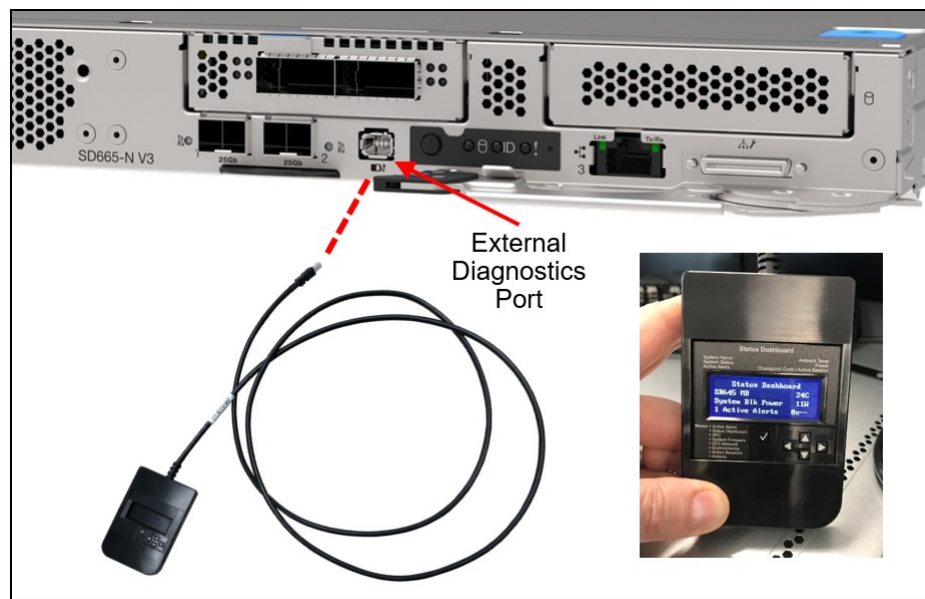


Figure 19. SD665-N V3 External Diagnostics Handset

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

Table 42. External Diagnostics Handset ordering information

Part number	Feature code	Description
4TA7A64874	1410 BEUX	ThinkSystem External Diagnostics Handset

System status with XClarity Mobile

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

The steps to connect the mobile device are as follows:

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

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



3. In iOS or Android settings, enable Personal Hotspot or USB Tethering
4. Launch the Lenovo XClarity Mobile app

Once connected you can see the following information:

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

Remote management

The 1Gb onboard port and one of the 25Gb onboard ports (port 1) on the front of the SD665-N V3 offer a connection to the XCC for remote management. This shared-NIC functionality allows the ports to be used both for operating system networking and for remote management.

Remote server management is provided through industry-standard interfaces:

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

The 1Gb port and 25Gb Port 1 support NC-SI. You can enable NC-SI in the factory using the feature codes listed in the following table. If neither feature code is selected, both ports will have NC-SI disabled.

Table 43. Enabling NC-SI on the embedded network ports

Feature code	Description
BEXY	ThinkSystem NC-SI enabled on SFP28 Port (Port 1)
BEXZ	ThinkSystem NC-SI enabled on RJ45 Port

IPMI via the Ethernet port (IPMI over LAN) is supported, however it is disabled by default. For CTO orders you can specify whether you want the feature enabled or disabled in the factory, using the feature codes listed in the following table.

Table 44. IPMI-over-LAN settings

Feature code	Description
B7XZ	Disable IPMI-over-LAN (default)
B7Y0	Enable IPMI-over-LAN

XCC2 Platinum

The XCC2 service processor in the SD665-N V3 supports an upgrade to the Platinum level of features. Compared to the XCC functions of ThinkSystem V2 and earlier systems, Platinum adds the same features as Enterprise and Advanced levels in ThinkSystem V2, plus additional features.

XCC2 Platinum adds the following Enterprise and Advanced functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, regardless of the system state

- Remotely accessing the server using the keyboard and mouse from a remote client
- International keyboard mapping support
- Syslog alerting
- Redirecting serial console via SSH
- Component replacement log (Maintenance History log)
- Access restriction (IP address blocking)
- Lenovo SED security key management
- Displaying graphics for real-time and historical power usage data and temperature
- Boot video capture and crash video capture
- Virtual console collaboration - Ability for up to 6 remote users to be log into the remote session simultaneously
- Remote console Java client
- Mapping the ISO and image files located on the local client as virtual drives for use by the server
- Mounting the remote ISO and image files via HTTPS, SFTP, CIFS, and NFS
- Power capping
- System utilization data and graphic view
- Single sign on with Lenovo XClarity Administrator
- Update firmware from a repository
- License for XClarity Energy Manager

XCC2 Platinum also adds the following features that are new to XCC2:

- System Guard - Monitor hardware inventory for unexpected component changes, and simply log the event or prevent booting
- Enterprise Strict Security mode - Enforces CNSA 1.0 level security
- Neighbor Group - Enables administrators to manage and synchronize configurations and firmware level across multiple servers

Ordering information is listed in the following table. XCC2 Platinum is a software license upgrade - no additional hardware is required.

Table 45. XCC2 Platinum license upgrade

Part number	Feature code	Description
7S0X000KWW	SBCV	Lenovo XClarity Controller 2 (XCC2) Platinum Upgrade

With XCC2 Platinum, for CTO orders, you can request that System Guard be enabled in the factory and the first configuration snapshot be recorded. To add this to an order, select feature code listed in the following table. The selection is made in the Security tab of the DCSC configurator.

Table 46. Enable System Guard in the factory (CTO orders)

Feature code	Description
BUT2	Install System Guard

For more information about System Guard, see https://pubs.lenovo.com/xcc2/NN1ia_c_systemguard

Remote management using the SMM

The DW612S enclosure includes a System Management Module 2 (SMM), installed in the rear of the enclosure. See [Enclosure rear view](#) for the location of the SMM. The SMM provides remote management of both the enclosure and the individual servers installed in the enclosure. The SMM can be accessed through a web browser interface and via Intelligent Platform Management Interface (IPMI) 2.0 commands.

The SMM provides the following functions:

- Remote connectivity to XCC controllers in each node in the enclosure
- Node-level reporting and control (for example, node virtual reseal/reset)
- Enclosure power management
- Enclosure thermal management
- Enclosure inventory

The following figure shows the LEDs and connectors of the SMM.

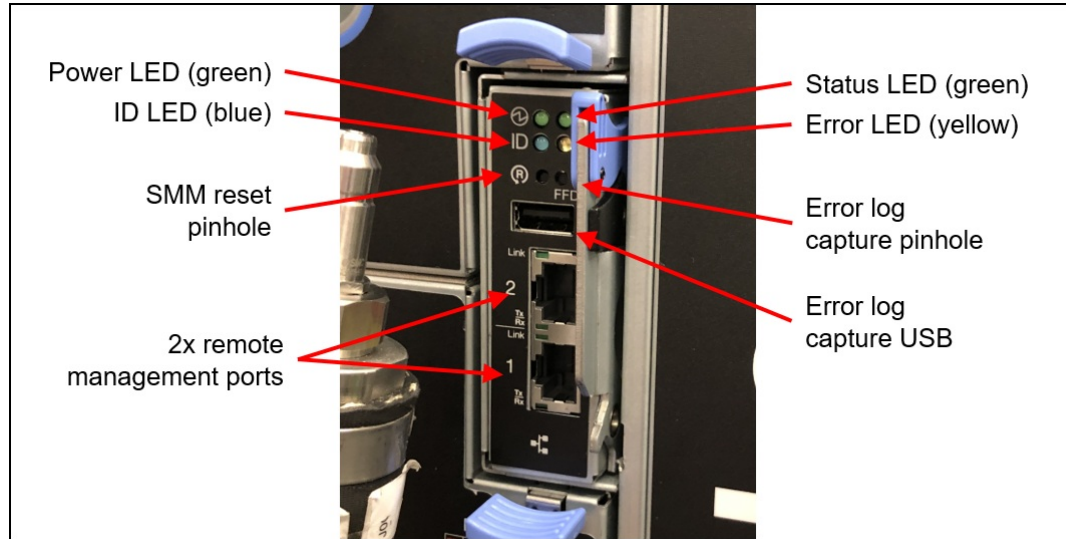


Figure 20. System management module in the DW612S enclosure

The SMM has the following ports and LEDs:

- 2x Gigabit Ethernet RJ45 ports for remote management access
- USB port and activation button for service
- SMM reset button
- System error LED (yellow)
- Identification (ID) LED (blue)
- Status LED (green)
- System power LED (green)

The USB service button and USB service port are used to gather service data in the event of an error. Pressing the service button copies First Failure Data Collection (FFDC) data to a USB key installed in the USB service port. The reset button is used to perform an SMM reset (short press) or to restore the SMM back to factory defaults (press for 4+ seconds).

The use of two RJ45 Ethernet ports enables the ability to daisy-chain the Ethernet management connections thereby reducing the number of ports you need in your management switches and reducing the overall cable density needed for systems management. With this feature you can connect the first SMM to your management network and the SMM in a second enclosure connects to the first SMM. The SMM in the third enclosure can then connect to the SMM in the second enclosure.

Up to 7 enclosures can be connected in a daisy-chain configuration and all servers in those enclosures can be managed remotely via one single Ethernet connection.

Notes:

- If you are using IEEE 802.1D spanning tree protocol (STP) then at most 6 enclosures can be connected together
- Do not form a loop with the network cabling. The dual-port SMM at the end of the chain should not be connected back to the switch that is connected to the top of the SMM chain.

Lenovo HPC & AI Software Stack

The Lenovo HPC & AI Software Stack combines open-source with proprietary best-of-breed Supercomputing software to provide the most consumable open-source HPC software stack embraced by all Lenovo HPC customers.

It provides a fully tested and supported, complete but customizable HPC software stack to enable the administrators and users in optimally and environmentally sustainable utilizing their Lenovo Supercomputers.

The Lenovo HPC & AI Software Stack is built on the most widely adopted and maintained HPC community software for orchestration and management. It integrates third party components especially around programming environments and performance optimization to complement and enhance the capabilities, creating the organic umbrella in software and service to add value for our customers.

The key open-source components of the software stack are as follows:

- **Confluent Management**
Confluent is Lenovo-developed open-source software designed to discover, provision, and manage HPC clusters and the nodes that comprise them. Confluent provides powerful tooling to deploy and update software and firmware to multiple nodes simultaneously, with simple and readable modern software syntax.
- **SLURM Orchestration**
Slurm is integrated as an open source, flexible, and modern choice to manage complex workloads for faster processing and optimal utilization of the large-scale and specialized high-performance and AI resource capabilities needed per workload provided by Lenovo systems. Lenovo provides support in partnership with SchedMD.
- **LiCO Webportal**
Lenovo Intelligent Computing Orchestration (LiCO) is a Lenovo-developed consolidated Graphical User Interface (GUI) for monitoring, managing and using cluster resources. The webportal provides workflows for both AI and HPC, and supports multiple AI frameworks, including TensorFlow, Caffe, Neon, and MXNet, allowing you to leverage a single cluster for diverse workload requirements.
- **Energy Aware Runtime**
EAR is a powerful European open-source energy management suite supporting anything from monitoring over power capping to live-optimization during the application runtime. Lenovo is collaborating with Barcelona Supercomputing Centre (BSC) and EAS4DC on the continuous development and support and offers three versions with differentiating capabilities.

For more information and ordering information, see the Lenovo HPC & AI Software Stack product guide: <https://lenovopress.com/lp1651>

Lenovo XClarity Provisioning Manager

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

LXPM provides the following functions:

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

Lenovo XClarity Essentials

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

- **Lenovo Essentials OneCLI**

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

- **Lenovo Essentials UpdateXpress**

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

- **Lenovo Essentials Bootable Media Creator**

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

For more information and downloads, visit the Lenovo XClarity Essentials web page:

<http://support.lenovo.com/us/en/documents/LNVO-center>

Lenovo XClarity One

Lenovo XClarity One is a hybrid cloud-based unified Management-as-a-Service (MaaS) platform, built for growing enterprises. XClarity One is powered by Lenovo Smarter Support, a powerful AI-driven platform that leverages predictive analytics to enhance the performance, reliability, and overall efficiency of Lenovo servers.

XClarity One is the next milestone in Lenovo's portfolio of systems management products. Now you can leverage the benefits of a true next-generation, hybrid cloud-based solution for the deployment, management, and maintenance of your infrastructure through a single, centralized platform that delivers a consistent user experience across all Lenovo products.

Key features include:

- **AI-powered Automation**

Harnesses the power of AI and predictive analytics to enhance the performance and reliability of your infrastructure with proactive protection.

- **AI-Powered Predictive Failure Analytics** - predict maintenance needs before the failure occurs, with the ability to visualize aggregated actions in customer dashboard.
- **AI-Powered Call-Home** - A Call-Home serviceable event opens a support ticket automatically, leveraging AI technology for problem determination and fast resolution.
- **AI-Powered Premier Support with Auto CRU** - uses AI to automatically dispatch parts and services, reducing service costs and minimizing downtime.

- **Secure Management Hub**

Lenovo's proprietary Management Hub is an on-premises virtual appliance that acts as the bridge between your infrastructure and the cloud.

- **On-Premises Security with Cloud Flexibility** - your infrastructure has no direct connection to the cloud, greatly reducing your attack surface from external threats while still having the deployment benefits, flexibility, and scalability of a cloud solution.
- **Authentication and Authorization** - built on a Zero Trust Architecture and requiring OTP Application authentication for all users to handle the support of all customers' servers and client devices. Role-based access controls help define and restrict permissions based on user roles.

- **AI-Powered Management**

Go beyond standard system management leveraging AI algorithms to continuously learn from data patterns to optimize performance and predict potential issues before they impact operations.

- **AI Customizable Insights and Reporting** - Customize AI-generated insights and reports to align with specific business objectives, enabling data-driven decision-making and strategic planning.
- **AI-driven scalability and flexibility** - Guided with AI-driven predictions, the platform supports dynamic scaling of resources based on workload demands.
- **Monitor and Change** - AI Advanced analytics capabilities providing deep insights into server performance, resource utilization, and security threats, to detect anomalies and suggest optimizations in real-time. NLP capabilities enabling administrators to interact with the platform using voice commands or text queries.
- **Upward Integration** - Integrated with Lenovo Open Cloud Automation (LOC-A), Lenovo Intelligent Computer Orchestration (LiCO) and AIOps engines providing an end-to-end management architecture across Lenovo infrastructure and devices solutions.
- **Cross-Platform Compatibility** - Compatibility across different server types and cloud environments

Lenovo XClarity One is an optional management component. License information for XClarity One is listed in the following table.

Table 47. XClarity One license information

Part number	Description
7S0X000LWW	XClarity One - Managed Device, Per Endpoint w/1 Yr SW S&S
7S0X000MWW	XClarity One - Managed Device, Per Endpoint w/3 Yr SW S&S
7S0X000NWW	XClarity One - Managed Device, Per Endpoint w/5 Yr SW S&S

For more information, see these resources:

- Lenovo XClarity One datasheet:
<https://lenovopress.lenovo.com/ds0188-lenovo-xclarity-one>
- Lenovo XClarity One product guide:
<https://lenovopress.lenovo.com/lp1992-lenovo-xclarity-one>

Lenovo XClarity Administrator

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

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

Lenovo XClarity Administrator is an optional software component for the SD665-N V3. The software can be downloaded and used at no charge to discover and monitor the SD665-N V3 and to manage firmware upgrades.

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

The following table lists the Lenovo XClarity software license options.

Table 48. Lenovo XClarity Pro ordering information

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

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

- Auto-discovery and monitoring of Lenovo systems
- Firmware updates and compliance enforcement
- External alerts and notifications via SNMP traps, syslog remote logging, and e-mail
- Secure connections to managed endpoints
- NIST 800-131A or FIPS 140-3 compliant cryptographic standards between the management solution and managed endpoints
- Integration into existing higher-level management systems such as cloud automation and orchestration tools through REST APIs, providing extensive external visibility and control over hardware resources
- An intuitive, easy-to-use GUI
- Scripting with Windows PowerShell, providing command-line visibility and control over hardware resources

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

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

For more information, refer to the Lenovo XClarity Administrator Product Guide:

<http://lenovopress.com/tips1200>

Lenovo XClarity Integrators

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

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

Lenovo XClarity Integrators offer the following additional features:

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

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

Lenovo XClarity Energy Manager

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

LXEM is a licensed product. A single-node LXEM license is included with the XClarity Controller Platinum upgrade as described in the [XCC2 Platinum](#) section. If your server does not have the XCC Platinum upgrade, Energy Manager licenses can be ordered as shown in the following table.

Table 49. Lenovo XClarity Energy Manager

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

Note: The SD665-N V3 does not support the following Energy Manager functions:

- Power capping
- Policy-based management

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

- Lenovo Support page:
<https://datacentersupport.lenovo.com/us/en/solutions/Invo-lxem>
- User Guide for XClarity Energy Manager:
<https://pubs.lenovo.com/lxem/>

Lenovo Capacity Planner

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

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

Security

Topics in this section:

- [Security features](#)

- [Platform Firmware Resiliency - Lenovo ThinkShield](#)
- [Security standards](#)

Security features

The server offers the following electronic security features:

- System Guard (part of [XCC Platinum](#)) - Proactive monitoring of hardware inventory for unexpected component changes
- Administrator and power-on password
- Trusted Platform Module (TPM) supporting TPM 2.0 (no support for TPM 1.2)
- Support for an optional Nationz TPM 2.0, available only in China (CTO only)

The server is NIST SP 800-147B compliant.

The following table lists the security options for the SD665-N V3.

Table 50. Security features

Part number	Feature code	Description
CTO only	BQQT	ThinkSystem NationZ PRC TPM 2.0 for SD665 V3/SD665-N V3 (China customers only)

Platform Firmware Resiliency - Lenovo ThinkShield

Lenovo's ThinkShield Security is a transparent and comprehensive approach to security that extends to all dimensions of our data center products: from development, to supply chain, and through the entire product lifecycle.

The ThinkSystem SD665-N V3 includes Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) which enables the system to be NIST SP800-193 compliant. This offering further enhances key platform subsystem protections against unauthorized firmware updates and corruption, to restore firmware to an integral state, and to closely monitor firmware for possible compromise from cyber-attacks.

PFR operates upon the following server components:

- UEFI image – the low-level server firmware that connects the operating system to the server hardware
- XCC image – the management “engine” software that controls and reports on the server status separate from the server operating system
- FPGA image – the code that runs the server’s lowest level hardware controller on the motherboard

The Lenovo Platform Root of Trust Hardware performs the following three main functions:

- Detection – Measures the firmware and updates for authenticity
- Recovery – Recovers a corrupted image to a known-safe image
- Protection – Monitors the system to ensure the known-good firmware is not maliciously written

These enhanced protection capabilities are implemented using a dedicated, discrete security processor whose implementation has been rigorously validated by leading third-party security firms. Security evaluation results and design details are available for customer review – providing unprecedented transparency and assurance.

The SD665-N V3 includes support for Secure Boot, a UEFI firmware security feature developed by the UEFI Consortium that ensures only immutable and signed software are loaded during the boot time. The use of Secure Boot helps prevent malicious code from being loaded and helps prevent attacks, such as the installation of rootkits. Lenovo offers the capability to enable secure boot in the factory, to ensure end-to-end protection. Alternatively, Secure Boot can be left disabled in the factory, allowing the customer to enable it themselves at a later point, if desired.

The following table lists the relevant feature code(s).

Table 51. Secure Boot options

Part number	Feature code	Description	Purpose
CTO only	B0MK	Enable TPM 2.0	Configure the system without Secure Boot enabled. Customers can enable Secure Boot later if desired.
CTO only	C1GD	ST45 V3 TPM 2.0 for WW	

Tip: If Secure Boot is not enabled in the factory, it can be enabled later by the customer. However once Secure Boot is enabled, it cannot be disabled.

Security standards

The SD665-N V3 supports the following security standards and capabilities:

- **Industry Standard Security Capabilities**

- AMD CPU Enablement
 - AES-NI (Advanced Encryption Standard New Instructions)
 - GMET (Guest Mode Execute Trap)
 - Hardware-based side channel attack resilience enhancements
 - NX (No eXecute)
 - PSB (Platform Secure Boot)
 - Shadow Stack
 - SEV (Secure Encrypted Virtualization)
 - SEV-ES (Encrypted State register encryption)
 - SEV-SNP (Secure Nested Paging)
 - SVM (Secure Virtual Machine)
 - SME (Secure Memory Encryption)
 - UMIP (User Mode Instruction Prevention)
- Microsoft Windows Security Enablement
 - Credential Guard
 - Device Guard
 - Host Guardian Service
- TCG (Trusted Computing Group) TPM (Trusted Platform Module) 2.0
- UEFI (Unified Extensible Firmware Interface) Forum Secure Boot

- **Hardware Root of Trust and Security**

- Independent security subsystem providing platform-wide NIST SP800-193 compliant Platform Firmware Resilience (PFR)
- Host domain RoT supplemented by AMD Platform Secure Boot (PSB)
- Management domain RoT supplemented by the Secure Boot features of XCC

- **Platform Security**

- Boot and run-time firmware integrity monitoring with rollback to known-good firmware (e.g., “self-healing”)
- Non-volatile storage bus security monitoring and filtering
- Resilient firmware implementation, such as to detect and defeat unauthorized flash writes or SMM (System Management Mode) memory incursions
- Patented IPMI KCS channel privileged access authorization (USPTO Patent# 11,256,810)
- Host and management domain authorization, including integration with CyberArk for enterprise password management

- KMIP (Key Management Interoperability Protocol) compliant, including support for IBM SKLM and Thales KeySecure
- Reduced “out of box” attack surface
- Configurable network services
- FIPS 140-3 (in progress) validated cryptography for XCC
- CNSA Suite 1.0 Quantum-resistant cryptography for XCC
- Lenovo System Guard

For more information on platform security, see the paper “How to Harden the Security of your ThinkSystem Server and Management Applications” available from <https://lenovopress.com/lp1260-how-to-harden-the-security-of-your-thinksystem-server>.

- **Standards Compliance and/or Support**

- NIST SP800-131A rev 2 “Transitioning the Use of Cryptographic Algorithms and Key Lengths”
- NIST SP800-147B “BIOS Protection Guidelines for Servers”
- NIST SP800-193 “Platform Firmware Resiliency Guidelines”
- ISO/IEC 11889 “Trusted Platform Module Library”
- Common Criteria TCG Protection Profile for “PC Client Specific TPM 2.0”
- European Union Commission Regulation 2019/424 (“ErP Lot 9”) “Ecodesign Requirements for Servers and Data Storage Products” Secure Data Deletion
- Optional FIPS 140-2 validated Self-Encrypting Disks (SEDs) with external KMIP-based key management

- **Product and Supply Chain Security**

- Suppliers validated through Lenovo’s Trusted Supplier Program
- Developed in accordance with Lenovo’s Secure Development Lifecycle (LSDL)
- Continuous firmware security validation through automated testing, including static code analysis, dynamic network and web vulnerability testing, software composition analysis, and subsystem-specific testing, such as UEFI security configuration validation
- Ongoing security reviews by US-based security experts, with attestation letters available from our third-party security partners
- Digitally signed firmware, stored and built on US-based infrastructure and signed on US-based Hardware Security Modules (HSMs)
- TAA (Trade Agreements Act) compliant manufacturing, by default in Mexico for North American markets with additional US and EU manufacturing options
- US 2019 NDAA (National Defense Authorization Act) Section 889 compliant

Operating system support

The SD665-N V3 with 5th Gen AMD EPYC processors supports the following operating systems:

- Red Hat Enterprise Linux 8.10
- Red Hat Enterprise Linux 9.4
- SUSE Linux Enterprise Server 15 SP6
- Ubuntu 24.04 LTS 64-bit

The SD665-N V3 with 4th Gen AMD EPYC processors supports the following operating systems:

- Red Hat Enterprise Linux 8.6
- Red Hat Enterprise Linux 8.8
- Red Hat Enterprise Linux 8.10
- Red Hat Enterprise Linux 9.0
- Red Hat Enterprise Linux 9.2
- Red Hat Enterprise Linux 9.4
- SUSE Linux Enterprise Server 15 SP4
- SUSE Linux Enterprise Server 15 SP5
- SUSE Linux Enterprise Server 15 SP6
- SUSE Linux Enterprise Server 15 Xen SP4
- SUSE Linux Enterprise Server 15 Xen SP5
- Ubuntu 20.04 LTS 64-bit
- Ubuntu 22.04 LTS 64-bit
- Ubuntu 24.04 LTS 64-bit

The server is also certified or tested with the following operating systems:

- Ubuntu
- Rocky Linux
- AlmaLinux

For a complete list of supported, certified and tested operating systems, plus additional details and links to relevant web sites, see the Operating System Interoperability Guide:

- 5th Gen AMD EPYC: <https://lenovopress.lenovo.com/osig#servers=sd665-n-v3-5th-gen-epyc-7daz&support=all>
- 4th Gen AMD EPYC: <https://lenovopress.lenovo.com/osig#servers=sd665-n-v3-4th-gen-epyc-7daz&support=all>

Also review the latest LeSI Best Recipe to see the operating systems that are supported via Lenovo Scalable Infrastructure (LeSI):

<https://support.lenovo.com/us/en/solutions/HT505184#5>

Physical and electrical specifications

Six SD665-N V3 server trays are installed in the DW612S enclosure. Each SD665-N V3 tray has the following dimensions:

- Width: 438 mm (17.2 inches)
- Height: 41 mm (1.6 inches)
- Depth: 714 mm (28.1 inches) (769 mm, including the water connections at the rear of the server)

The DW612S enclosure has the following overall physical dimensions, excluding components that extend outside the standard chassis, such as EIA flanges, front security bezel (if any), and power supply handles:

- Width: 447 mm (17.6 inches)
- Height: 264 mm (10.4 inches)
- Depth: 933 mm (36.7 inches)

The following table lists the detailed dimensions. See the figure below for the definition of each dimension.

Table 52. Detailed dimensions

Dimension	Description
483 mm	X_a = Width, to the outsides of the front EIA flanges
447 mm	X_b = Width, to the rack rail mating surfaces
447 mm	X_c = Width, to the outer most chassis body feature
264 mm	Y_a = Height, from the bottom of chassis to the top of the chassis
916 mm	Z_a = Depth, from the rack flange mating surface to the rearmost I/O port surface
916 mm	Z_b = Depth, from the rack flange mating surface to the rearmost feature of the chassis body
972 mm	Z_c = Depth, from the rack flange mating surface to the rearmost feature such as power supply handle
17 mm	Z_d = Depth, from the forwardmost feature on front of EIA flange to the rack flange mating surface
17 mm	Z_e = Depth, from the front of security bezel (if applicable) or forwardmost feature to the rack flange mating surface

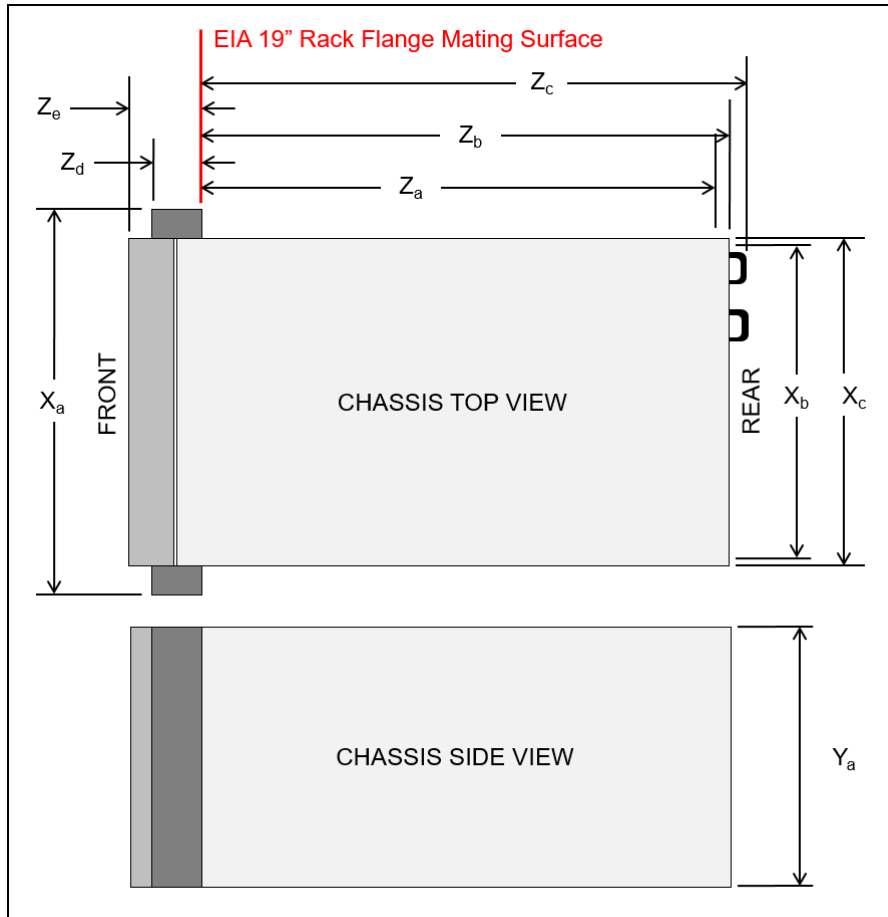


Figure 21. Enclosure dimensions

The SD665-N V3 tray has the following maximum weight:

- 23.6 kg (52.0 lb)

The DW612S enclosure has the following weight:

- Empty enclosure (with midplane and cables): 24.3 kg (53.5 lb)
- Fully configured enclosure:
 - With 9x air-cooled power supplies and 6x SD665-N V3 server trays (6 nodes): 182.9 kg (403 lb) (without water manifold)
 - with 3x water-cooled power supplies and 6x SD665-N V3 server trays (6 nodes): 188.7 kg (416 lb) (without water manifold)

The enclosure has the following electrical specifications for AC input power supplies:

- Input voltage:
 - 200 to 240 (nominal) Vac, 50 Hz or 60 Hz
 - 180 to 300 Vdc (China only)
- Max current for 2600W power supplies:
 - 200-208V AC: 13.2A
 - 220-240V AC: 13A
 - 240V DC: 11.9A (China only)
- Max current for 7200W power supplies (each of 3 inputs):
 - 200-208V AC: 12.7A
 - 220-240V AC: 12A

- 240V DC: 11A (China only)

Operating environment

The SD665-N V3 server trays and DW612S enclosure are supported in the following environment:

Water requirements

7200W (220-240 Vac and 240 Vdc) DWC power supply:

- Water temperature:
 - ASHRAE class W+: up to 50°C (122°F)
- Maximum pressure: 4.4 bars
- Minimum water flow rate: 1.5 liters per minute per power supply
 - For inlet water temperatures up to 45°C (113°F), 1.5 liters per minute per power supply
 - For inlet water temperatures between 45°C - 50°C (113°F - 122°F), 2.0 liters per minute per power supply

SD665-N V3 tray and DW612S enclosure are supported in the following environment:

- Water requirements
 - Water temperature: up to 45°C (113°F) (5 l/m per tray) (liters per minute)
 - CPUs up to 400W TDP
 - DIMMs up to 96GB capacity
 - GPUs up to 700W TDP
 - NVIDIA network card up to 800Gb/sec
 - Water temperature: up to 40°C (104°F) (4 l/m per tray)
 - CPUs up to 400W TDP
 - DIMMs up to 96GB capacity
 - GPUs up to 700W TDP
 - NVIDIA network card up to 800Gb/sec
- Water requirement exceptions:
 - Water temperature: ASHRAE W32, up to 32°C (89.6°F)
 - 128 GB DIMMs
 - Water temperature: up to 40°C (104°F) with 5 l/m with 4 trays
 - AMD EPYC 4th Gen: 9554 64C and 9554P 64C processors.
 - AMD EPYC 5th Gen: 9555 64C, 9555P 64C, 9575F 64C, 9565 72C
 - Water temperature: up to 35°C (95°F) with 5 l/m with 4 trays
 - AMD EPYC 4th Gen: AMD EPYC 9374F 32C, 9274F 24C, 9174F 16C, and 9474F 48C processors.
 - AMD EPYC 5th Gen: 9375F 32C, 9475F 48C, 9175F, 16C
- Maximum pressure: 4.4 bars
- Water flow rates (1 tray consists of 1 compute node and 1 GPU node):
 - Water flow rate for 45°C (113°F): 20 liters per minute (lpm) per enclosure, assuming 5.0 liters per tray with 4 trays per enclosure.
 - Water flow rate for 40°C (104°F): 16 liters per minute (lpm) per enclosure, assuming 4.0 liters per tray with 4 trays per enclosure.
 - Water flow rate for 35°C (95°F): 17.5 liters per minute (lpm) per enclosure, assuming 3.5 liters per tray with 5 trays per enclosure.
 - Water flow rate for 35°C (95°F): 21 liters per minute (lpm) per enclosure, assuming 3.5 liters per tray with 6 trays per enclosure.

Note: The water required to initially fill the system side cooling loop must be reasonably clean, bacteria-free water (<100 CFU/ml) such as de-mineralized water, reverse osmosis water, de-ionized water, or distilled water. The water must be filtered with an in-line 50 micron filter (approximately 288 mesh). The water must be treated with anti-biological and anti-corrosion measures. The water quality must be maintained over the lifetime of the system to receive warranty and support on the water-bearing components.

Air temperature requirements

- Operating: ASHRAE A2: 10°C to 35°C (50°F to 95°F); when the altitude exceeds 900 m (2953 ft), the maximum ambient temperature value decreases by 1°C (1.8°F) with every 300 m (984 ft) of altitude increase.
- Powered off: 5°C to 45°C (41°F to 113°F)
- Shipping/storage: -40°C to 60°C (-40°F to 140°F)

Relative humidity (non-condensing)

- Operating: ASHRAE Class A2: 8% - 80%, maximum dew point: 21°C (70°F)
- Shipment/storage: 8% - 90%

Particulate contamination

Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might damage the system that might cause the system to malfunction or stop working altogether.

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

- Reactive gases:
 - The copper reactivity level shall be less than 200 Angstroms per month (Å/month)
 - The silver reactivity level shall be less than 200 Å/month
- Airborne particulates:
 - The room air should be continuously filtered with MERV 8 filters.
 - Air entering a data center should be filtered with MERV 11 or preferably MERV 13 filters.
 - The deliquescent relative humidity of the particulate contamination should be more than 60% RH
 - Environment must be free of zinc whiskers

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

Regulatory compliance

The SD665-N V3 conforms to the following standards:

- ANSI/UL 62368-1
- IEC 62368-1 (CB Certificate and CB Test Report)
- CSA C22.2 No. 62368-1
- Mexico NOM-019
- Brazil INMETRO
- South Africa NRCS LOA
- Ukraine UkrCEPRO
- Morocco CMIM Certification (CM)
- Russia, Belorussia and Kazakhstan, TP EAC 037/2016 (for RoHS)
- CE, UKCA Mark (EN55032 Class A, EN62368-1, EN55035, EN61000-3-11, EN61000-3-12, (EU) 2019/424, and EN IEC 63000 (RoHS))
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 7, Class A
- CISPR 32, Class A, CISPR 35
- Korea KN32, Class A, KN35
- Japan VCCI, Class A
- Taiwan BSMI CNS15936, Class A; Section 5 of CNS15663
- Australia/New Zealand AS/NZS CISPR 32, Class A; AS/NZS 62368.1
- SGS, VOC Emission
- [Energy Star 4.0](#)
- EPEAT (NSF/ ANSI 426) Bronze
- Japanese Energy-Saving Act
- EU2019/424 Energy Related Product (ErP Lot9)
- China CELP certificate, HJ 2507-2011

The DW612S conforms to the following standards:

- ANSI/UL 62368-1
- IEC 62368-1 (CB Certificate and CB Test Report)
- CSA C22.2 No. 62368-1
- Argentina IEC 60950-1
- Mexico NOM-019
- Brazil INMETRO
- South Africa NRCS LOA
- Ukraine UkrCEPRO
- Morocco CMIM Certification (CM)
- Russia, Belorussia and Kazakhstan, TP EAC 037/2016 (for RoHS)
- Russia, Belorussia and Kazakhstan, EAC: TP TC 004/2011 (for Safety); TP TC 020/2011 (for EMC)
- CE, UKCA Mark (EN55032 Class A, EN62368-1, EN55035, EN61000-3-11, EN61000-3-12, (EU) 2019/424, and EN IEC 63000 (RoHS))
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 7, Class A
- CISPR 32, Class A, CISPR 35
- Korea KN32, Class A, KN35
- Japan VCCI, Class A
- Australia/New Zealand AS/NZS CISPR 32, Class A; AS/NZS 62368.1
- SGS, VOC Emission
- China CELP certificate, HJ 2507-2011

Warranty upgrades and post-warranty support

The server and enclosure have the following warranty:

- Lenovo ThinkSystem SD665-N V3 (7DAZ) - 3-year warranty
- Lenovo ThinkSystem DW612S Enclosure (7D1L) - 3-year warranty
- Lenovo Neptune DWC Node Manifold (5469) - 3-year warranty
- Lenovo Neptune DWC RM100 In-Rack CDU (7DBL) - 1-year warranty through the vendor (Cooltera)
- Genie Lift GL-8 Material Lift (7D5Y) - 3-year warranty

Our global network of regional support centers offers consistent, local-language support enabling you to vary response times and level of service to match the criticality of your support needs:

- **Standard Next Business Day** – Best choice for non-essential systems requiring simple maintenance.
- **Premier Next Business Day** – Best choice for essential systems requiring technical expertise from senior-level Lenovo engineers.
- **Premier 24x7 4-Hour Response** – Best choice for systems where maximum uptime is critical.
- **Premier Enhanced Storage Support 24x7 4-Hour Response** – Best choice for storage systems where maximum uptime is critical.

For more information, consult the brochure [Lenovo Operational Support Services for Data Centers Services](#).

Services

Lenovo Data Center Services empower you at every stage of your IT lifecycle. From expert advisory and strategic planning to seamless deployment and ongoing support, we ensure your infrastructure is built for success. Our comprehensive services accelerate time to value, minimize downtime, and free your IT staff to focus on driving innovation and business growth.

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

In this section:

- [Lenovo Advisory Services](#)
- [Lenovo Plan & Design Services](#)
- [Lenovo Deployment, Migration, and Configuration Services](#)
- [Lenovo Support Services](#)
- [Lenovo Managed Services](#)
- [Lenovo Sustainability Services](#)

Lenovo Advisory Services

Lenovo Advisory Services simplify the planning process, enabling customers to build future-proofed strategies in as little as six weeks. Consultants provide guidance on projects including VM migration, storage, backup and recovery, and cost management to accelerate time to value, improve cost efficiency, and build a flexibly scalable foundation.

- **Assessment Services**

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

- **Design Services**

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

Lenovo Plan & Design Services

Unlock faster time to market with our tailored, strategic design workshops to align solution approaches with your business goals and technical requirements. Leverage our deep solution expertise and end-to-end delivery partnership to meet your goals efficiently and effectively.

Lenovo Deployment, Migration, and Configuration Services

Optimize your IT operations by shifting labor-intensive functions to Lenovo's skilled technicians for seamless on-site or remote deployment, configuration, and migration. Enjoy peace of mind, faster time to value, and comprehensive knowledge sharing with your IT staff, backed by our best-practice methodology.

- **Deployment Services for Storage and ThinkAgile**

A comprehensive range of remote and onsite options tailored specifically for your business needs to ensure your storage and ThinkAgile hardware are fully operational from the start.

- **Hardware Installation Services**

A full-range, comprehensive setup for your hardware, including unpacking, inspecting, and positioning components to ensure your equipment is operational and error-free for the most seamless and efficient installation experience, so you can quickly benefit from your investments.

- **DM/DG File Migration Services**

Take the burden of file migration from your IT's shoulders. Our experts will align your requirements and business objectives to the migration plans while coordinating with your team to plan and safely execute the data migration to your storage platforms.

- **DM/DG/DE Health Check Services**

Our experts perform proactive checks of your Firmware and system health to ensure your machines are operating at peak and optimal efficiency to maximize up-time, avoid system failures, ensure the security of IT solutions and simplify maintenance.

- **Factory Integrated Services**

A suite of value-added offerings provided during the manufacturing phase of a server or storage system that reduces time to value. These services aim at improving your hardware deployment experience and enhance the quality of a standard configuration before it arrives at your facility.

Lenovo Support Services

In addition to response time options for hardware parts, repairs, and labor, Lenovo offers a wide array of additional support services to ensure your business is positioned for success and longevity. Our goal is to reduce your capital outlays, mitigate your IT risks, and accelerate your time to productivity.

- **Premier Support for Data Centers**

Your direct line to the solution that promises the best, most comprehensive level of support to help you fully unlock the potential of your data center.

- **Premier Enhanced Storage Support (PESS)**

Gain all the benefits of Premier Support for Data Centers, adding dedicated storage specialists and resources to elevate your storage support experience to the next level.

- **Committed Service Repair (CSR)**

Our commitment to ensuring the fastest, most seamless resolution times for mission-critical systems that require immediate attention to ensure minimal downtime and risk for your business. This service is only available for machines under the Premier 4-Hour Response SLA.

- **Multivendor Support Services (MVS)**

Your single point of accountability for resolution support across vast range of leading Server, Storage, and Networking OEMs, allowing you to manage all your supported infrastructure devices seamlessly from a single source.

- **Keep Your Drive (KYD)**

Protect sensitive data and maintain compliance with corporate retention and disposal policies to ensure your data is always under your control, regardless of the number of drives that are installed in your Lenovo server.

- **Technical Account Manager (TAM)**

Your single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time, ensuring smooth operations and optimized performance as your business grows.

- **Enterprise Software Support (ESS)**

Gain comprehensive, single-source, and global support for a wide range of server operating systems and Microsoft server applications.

For more information, consult the brochure [Lenovo Operational Support Services for Data Centers](#).

Lenovo Managed Services

Achieve peak efficiency, high security, and minimal disruption with Lenovo's always-on Managed Services. Our real-time monitoring, 24x7 incident response, and problem resolution ensure your infrastructure operates seamlessly. With quarterly health checks for ongoing optimization and innovation, Lenovo's remote active monitoring boosts end-user experience and productivity by keeping your data center's hardware performing at its best.

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

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

Lenovo Sustainability Services

- **Asset Recovery Services**

Lenovo Asset Recovery Services (ARS) provides a secure, seamless solution for managing end-of-life IT assets, ensuring data is safely sanitized while contributing to a more circular IT lifecycle. By maximizing the reuse or responsible recycling of devices, ARS helps businesses meet sustainability goals while recovering potential value from their retired equipment. For more information, see the [Asset Recovery Services offering page](#).

- **CO2 Offset Services**

Lenovo's CO2 Offset Services offer a simple and transparent way for businesses to take tangible action on their IT footprint. By integrating CO2 offsets directly into device purchases, customers can easily support verified climate projects and track their contributions, making meaningful progress toward their sustainability goals without added complexity.

- **Lenovo Certified Refurbished**

Lenovo Certified Refurbished offers a cost-effective way to support IT circularity without compromising on quality and performance. Each device undergoes rigorous testing and certification, ensuring reliable performance and extending its lifecycle. With Lenovo's trusted certification, you gain peace of mind while making a more sustainable IT choice.

- **Data Center Power and Cooling Services**

The Data Center Infrastructure team will provide solution design and implementation services to support the power and cooling needs of the multi-node chassis and multi-rack solutions. This includes designing for various levels of power redundancy and integration into the customer power infrastructure. The Infrastructure team will work with site engineers to design an effective cooling strategy based on facility constraints or customer goals and optimize a cooling solution to ensure high efficiency and availability. The Infrastructure team will provide the detailed solution design and complete integration of the cooling solution into the customer data center. In addition, the Infrastructure team will provide rack and chassis level commissioning and stand-up of the water-cooled solution which includes setting and tuning of the flow rates based on water temperature and heat recovery targets. Lastly, the Infrastructure team will provide cooling solution optimization and performance validation to ensure the highest overall operational efficiency of the solution.

Lenovo TruScale

Lenovo TruScale XaaS is your set of flexible IT services that makes everything easier. Streamline IT procurement, simplify infrastructure and device management, and pay only for what you use – so your business is free to grow and go anywhere.

Lenovo TruScale is the unified solution that gives you simplified access to:

- The industry's broadest portfolio – from pocket to cloud – all delivered as a service
- A single-contract framework for full visibility and accountability
- The global scale to rapidly and securely build teams from anywhere
- Flexible fixed and metered pay-as-you-go models with minimal upfront cost
- The growth-driving combination of hardware, software, infrastructure, and solutions – all from one single provider with one point of accountability.

For information about Lenovo TruScale offerings that are available in your region, contact your local Lenovo sales representative or business partner.

Rack cabinets

The DW612S enclosure is supported in the following racks:

- Lenovo EveryScale 42U Onyx Heavy Duty Rack Cabinet, model 1410-O42
- Lenovo EveryScale 42U Pearl Heavy Duty Rack Cabinet, model 1410-P42
- Lenovo EveryScale 48U Onyx Heavy Duty Rack Cabinet, model 1410-O48
- Lenovo EveryScale 48U Pearl Heavy Duty Rack Cabinet, model 1410-P48

Considering the weight of the trays in the enclosure, an onsite material lift is required to allow service by a single person. If you do not already have a material lift available, Lenovo offers the Genie Lift GL-8 material lift as configurable option to the rack cabinets. Ordering information is listed in the following table.

Table 53. Genie Lift GL-8 ordering information

Model	Description
4XF7B02087	Genie Lift GL-8 (Standard Base) Material Lift Option Kit

Lenovo Financial Services

Why wait to obtain the technology you need now? No payments for 90 days and predictable, low monthly payments make it easy to budget for your Lenovo solution.

- **Flexible**
Our in-depth knowledge of the products, services and various market segments allows us to offer greater flexibility in structures, documentation and end of lease options.
- **100% Solution Financing**
Financing your entire solution including hardware, software, and services, ensures more predictability in your project planning with fixed, manageable payments and low monthly payments.
- **Device as a Service (DaaS)**
Leverage latest technology to advance your business. Customized solutions aligned to your needs. Flexibility to add equipment to support growth. Protect your technology with Lenovo's Premier Support service.
- **24/7 Asset management**
Manage your financed solutions with electronic access to your lease documents, payment histories, invoices and asset information.

- **Fair Market Value (FMV) and \$1 Purchase Option Leases**

Maximize your purchasing power with our lowest cost option. An FMV lease offers lower monthly payments than loans or lease-to-own financing. Think of an FMV lease as a rental. You have the flexibility at the end of the lease term to return the equipment, continue leasing it, or purchase it for the fair market value. In a \$1 Out Purchase Option lease, you own the equipment. It is a good option when you are confident you will use the equipment for an extended period beyond the finance term. Both lease types have merits depending on your needs. We can help you determine which option will best meet your technological and budgetary goals.

Ask your Lenovo Financial Services representative about this promotion and how to submit a credit application. For the majority of credit applicants, we have enough information to deliver an instant decision and send a notification within minutes.

Seller training courses

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

1. **Family Portfolio: Storage Controller Options**

2025-03-03 | 25 minutes | Employees and Partners

This course covers the storage controller options available for use in Lenovo servers. The classes of storage controller are discussed, along with a discussion of where they are used, and which to choose.

After completing this course, you will be able to:

- Describe the classes of storage controllers
- Discuss where each controller class is used
- Describe the available options in each controller class

Tags: Sales, Storage

Published: 2025-03-03

Length: 25 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1111r2

2. **ThinkSystem Rack and Tower Introduction for ISO Client Managers**

2024-12-10 | 20 minutes | Employees Only

In this course, you will learn about Lenovo's Data Center Portfolio, its ThinkSystem Family and the key features of the Rack and Tower servers. It will equip you with foundational knowledge which you can then expand upon by participating in the facilitated session of the curriculum.

Course Objectives:

- By the end of this course, you should be able to:
- Identify Lenovo's main data center brands.
- Describe the key components of the ThinkSystem Family servers.
- Differentiate between the Rack and Tower servers of the ThinkSystem Family.
- Understand the value Rack and Tower servers can provide to customers.

Tags: Server, ThinkSystem

Published: 2024-12-10

Length: 20 minutes

Start the training:

Employee link: Grow@Lenovo

Course code: DSRT0101r2

3. **Partner Technical Webinar - Server Update with Mark Bica**

2024-11-26 | 60 minutes | Employees and Partners

In this 60-minute replay, Mark Bica, Lenovo Product Manager gave an update on the server portfolio. Mark presented on the new V4 Intel servers with Xeon 6 CPUs. He reviewed where the new AMD 5th Gen EPYC CPUs will be used in our servers. He followed with a review of the GPU dense servers including SR680, SR680a, SR575 and SR780a. Mark concluded with a review of the SC777 and SC750 that were introduced at TechWorld.

Tags: Server

Published: 2024-11-26

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: 112224

4. **Partner Technical Webinar - LenovoPress updates and LPH Demo**
2024-11-13 | 60 minutes | Employees and Partners

In this 60-minute replay, we had 3 topics. First, David Watts, Lenovo Sr Manager LenovoPress, gave an update on LenovoPress and improvements to finding Seller Training Courses (both partner and Lenovo). Next, Ryan Tuttle, Lenovo LETS Solution Architect, gave a demo of Lenovo Partner Hub (LPH) including how to find replays of Partner Webinars in LPL. Finally, Joe Murphy, Lenovo Sr Manager of LETS NA, gave a quick update on the new Stackable Warranty Options in DCSC.

Tags: Technical Sales

Published: 2024-11-13

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: 110824

5. **Virtual Facilitated Session - ThinkSystem Rack and Tower Primer for ISO Client Managers**
2024-10-31 | 90 minutes | Employees Only

In this Virtual Instructor-Led Training Session, ISO Client Managers will be able to build on the knowledge gained in Module 1 (eLearning) of the ThinkSystem Rack and Tower Server Primer for ISO Client Managers curriculum.

IMPORTANT! Module 1 (eLearning) must be completed to be eligible to participate in this session. Please note that places are subject to availability. If you are selected, you will receive the invite to this session via email.

Tags: Sales, Server, ThinkSystem

Published: 2024-10-31

Length: 90 minutes

Start the training:

Employee link: Grow@Lenovo

Course code: DSRT0102

6. **Family Portfolio - Supercomputing Servers Powered by AMD**
2024-10-09 | 15 minutes | Employees and Partners

This course is designed to give Lenovo sales and partner representatives a foundation for the Supercomputing Servers Powered by AMD course! After completing this course, you should be able to identify products and characteristics within the family, describe innovative features used in the family, and recognize when a specific server should be selected.

Tags: Server

Published: 2024-10-09

Length: 15 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2521

7. **Q3 Solutions Launch AMD EPYC Gen5 Quick Hit**

2024-10-09 | 6 minutes | Employees and Partners

Lenovo announces upgrades to a wide range of ThinkSystem V3 servers powered by AMD processors. Support for the AMD EPYC 9005 Series processors and faster DDR5 memory will enhance the performance and power efficiency of these servers as well as the ThinkAgile systems based on them

Tags: Artificial Intelligence (AI), Lowdown2025ep3, Server, ThinkAgile, ThinkSystem

Published: 2024-10-09

Length: 6 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1216r9a

8. **Partner Technical Webinar - OneIQ**

2024-07-15 | 60 minutes | Employees and Partners

In this 60-minute replay, Peter Grant, Field CTO for OneIQ, reviewed and demo'd the capabilities of OneIQ including collecting data and analyzing. Additionally, Peter and the team discussed how specific partners (those with NA Channel SA coverage) will get direct access to OneIQ and other partners can get access to OneIQ via Distribution or the NA LETS team.

Tags: Technical Sales

Published: 2024-07-15

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: 071224

9. **SAP Webinar for Lenovo Sellers: Lenovo Portfolio Update for SAP Landscapes**

2024-06-04 | 60 minutes | Employees Only

Join Mark Kelly, Advisory IT Architect with the Lenovo Global SAP Center of Competence as he discusses:

- Challenges in the SAP environment
- Lenovo On-premise Solutions for SAP
- Lenovo support resources for SAP solutions

Tags: SAP, ThinkAgile, ThinkEdge, ThinkSystem

Published: 2024-06-04

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Course code: DSAPF101

10. **Lenovo Data Center Product Portfolio**
2024-05-29 | 20 minutes | Employees and Partners

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

Tags: Advanced DataCenter, DataCenter Products, ThinkAgile, ThinkEdge, ThinkSystem

Published: 2024-05-29

Length: 20 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1110r7

11. **VTT Cloud Architecture: NVIDIA Using Cloud for GPUs and AI**
2024-05-22 | 60 minutes | Employees Only

Join JD Dupont, NVIDIA Head of Americas Sales, Lenovo partnership and Veer Mehta, NVIDIA Solution Architect on an interactive discussion about cloud to edge, designing cloud Solutions with NVIDIA GPUs and minimizing private\hybrid cloud OPEX with GPUs. Discover how you can use what is done at big public cloud providers for your customers. We will also walk through use cases and see a demo you can use to help your customers.

Tags: Artificial Intelligence (AI), Cloud, Nvidia, Software Defined Infrastruture (SDI), Technical Sales

Published: 2024-05-22

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Course code: DVCLD212

12. **Partner Technical Webinar - ISG Portfolio Update**
2024-04-15 | 60 minutes | Employees and Partners

In this 60-minute replay, Mark Bica, NA ISG Server Product Manager reviewed the Lenovo ISG portfolio. He covered new editions such as the SR680a \ SR685a, dense servers, and options that are strategic for any workload.

Tags: ThinkSystem

Published: 2024-04-15

Length: 60 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: 041224

13. Family Introduction ThinkSystem Supercomputing Servers

2024-02-21 | 10 minutes | Employees and Partners

After completing this introductory course about the supercomputing server family, the learner will be able to define the characteristics of high-density servers, describe the supercomputing servers, recognize when a product from the supercomputing server family might be used, and identify keywords or buzzwords that indicate opportunities to introduce customers to the supercomputing server family products.

Tags: Artificial Intelligence (AI), DataCenter Products, High-Performance Computing (HPC), Server, ThinkSystem

Published: 2024-02-21

Length: 10 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2526

14. Introduction to DDR5 Memory

2022-08-23 | 10 minutes | Employees and Partners

This course introduces DDR5 memory, describes new features of this memory generation, and discusses the advantages to customers of this new memory generation.

Tags: Server, Technology solutions

Published: 2022-08-23

Length: 10 minutes

Start the training:

Employee link: Grow@Lenovo

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2502

Related publications and links

For more information, see these resources:

- ThinkSystem SD665-N V3 product page
<https://www.lenovo.com/us/en/p/servers-storage/servers/high-density/thinksystem-sd665-n-v3/len21ts0011>
- ThinkSystem SD665 V3 datasheet
<https://lenovopress.com/DS0153>
- Interactive 3D Tour of the ThinkSystem SD665-N V3:
<https://lenovopress.lenovo.com/lp1633-thinksystem-sd665-n-v3-interactive-3d-tour>
- ThinkSystem SD665-N V3 drivers and support
<http://datacentersupport.lenovo.com/products/servers/thinksystem/sd665nv3/7daz/downloads>
- Lenovo Hardware Installation & Removal Videos on the ThinkSystem DW612S Enclosure:
<https://www.youtube.com/playlist?list=PLYV5R7hVcs-A9Ws8PYIbxz9Jblrq1zoYd>
- Lenovo ThinkSystem SD665-N V3 product publications:
<https://pubs.lenovo.com/sd665-n-v3/>
 - User Guide
 - Rack Installation Guide
 - Messages and Codes Reference
 - UEFI Manual
- Lenovo ThinkSystem DW612S product publications:
https://pubs.lenovo.com/dw612s_neptune_enclosure/
 - User Guide
 - Rack Installation Guide
 - SMM2 Messages and Codes Reference
- ServerProven hardware compatibility:
<http://www.lenovo.com/us/en/serverproven>
- Data Center Solution Configurator (DCSC)
<https://dcsc.lenovo.com>
- Lenovo Cluster solutions configurator (x-config)
<https://lesc.lenovo.com/products/hardware/configurator/worldwide/bhui/asit/index.html>

Related product families

Product families related to this document are the following:

- [Artificial Intelligence](#)
- [High Performance Computing](#)
- [Supercomputing Servers](#)
- [ThinkSystem SD665-N V3 Server](#)

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.

© Copyright Lenovo 2025. All rights reserved.

This document, LP1613, was created or updated on April 22, 2025.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
<https://lenovopress.lenovo.com/LP1613>
- Send your comments in an e-mail to:
comments@lenovopress.com

This document is available online at <https://lenovopress.lenovo.com/LP1613>.

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®
from Exascale to Everyscale®
Neptune®
ServerProven®
ThinkAgile®
ThinkShield®
ThinkSystem®
XClarity®

The following terms are trademarks of other companies:

AMD, AMD 3D V-Cache™, and AMD EPYC™ are trademarks of Advanced Micro Devices, Inc.

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®, ActiveX®, PowerShell, Windows PowerShell®, and Windows® are trademarks of Microsoft Corporation in the United States, other countries, or both.

SPECpower® is a trademark of the Standard Performance Evaluation Corporation (SPEC).

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