

Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) on ThinkSystem V1

Product Guide

Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) is a software-defined storage (SDS) solution for dense scalable file and object storage suitable for high-performance and data-intensive environments. Enterprises or organizations running HPC, Big Data or cloud workloads will benefit the most from the DSS-G implementation.

DSS-G combines the performance of Lenovo ThinkSystem servers, Lenovo storage enclosures, and industry leading IBM Spectrum Scale software to offer a high performance, scalable building block approach to modern storage needs.

Lenovo DSS-G is delivered as a pre-integrated, easy-to-deploy rack-level engineered solution that dramatically reduces time-to-value and total cost of ownership (TCO).

There are two DSS-G solution types described in this product guide. The traditional storage enclosure based solution is built on Lenovo ThinkSystem SR650 servers, Lenovo Storage D1224 Drive Enclosures with high-performance 2.5-inch SAS solid-state drives, and Lenovo Storage D3284 High-Density Drive Enclosures with large capacity 3.5-inch NL SAS HDDs. The NVMe based solution is built on Lenovo ThinkSystem SR630 servers with internal NVMe solid state drives.

Combined with IBM Spectrum Scale (formerly IBM General Parallel File System, GPFS), an industry leader in high-performance clustered file system, you have an ideal solution for the ultimate file and object storage solution for HPC and Big Data.

Did you know?

Lenovo DSS-G can be licensed by the number of drives installed or alternatively the usable capacity, rather than the number of processor cores or the number of connected clients, so there are no added licenses for other servers or clients that mount and work with the file system.

Lenovo DSS-G with storage enclosures supports online enclosure expansion. This enables a customer to grow the number of enclosures in an existing DSS-G building block without bringing down the file system, maximizing flexibility to scale storage capacity based on need.

With available Lenovo Premier Support Services, Lenovo provides a single point of entry for supporting the entire DSS-G solution, including the IBM Spectrum Scale software, for quicker problem determination and minimized downtime.

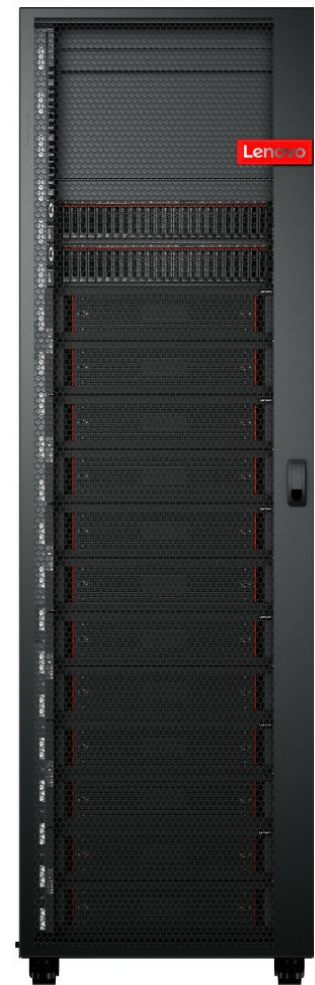


Figure 1. Lenovo DSS-G Model G260

Software features

IBM Spectrum Scale

IBM Spectrum Scale, based on IBM General Parallel File System (GPFS) technology, is a high-performance and highly scalable parallel file system with an extensive suite of enterprise class data management features.

Lenovo is a strategic alliance partner of IBM, and combines IBM Spectrum Scale software with Lenovo servers, storage and networking components for integrated and customized solutions.

IBM Spectrum Scale offers access to a single file system or set of filesystems from multiple nodes that can be SAN-attached, network attached or a mix of both or even in a shared nothing cluster configuration. It provides a global namespace, shared file system access among IBM Spectrum Scale clusters, simultaneous file access from multiple nodes, high recoverability and data availability through replication, the ability to make changes while a file system is mounted, and simplified administration even in large environments.

Lenovo DSS-G supports three editions of IBM Spectrum Scale:

- IBM Spectrum Scale Data Access Edition (DAE) provides base GPFS functions including Information Lifecycle Management (ILM), Active File Management (AFM), and Clustered NFS (CNFS) in Linux environments.
- IBM Spectrum Scale Data Management Edition (DME) provides all the features of the Data Access Edition plus advanced features like asynchronous multi-site disaster recovery, native encryption support, Transparent Cloud Tiering.
- IBM Spectrum Scale Erasure Code Edition (ECE) provides all the features of the Data Management Edition plus support for storage rich servers with network-dispersed erasure coding, distributing data and metadata across the internal disks of a cluster of servers.

Table 1. IBM Spectrum Scale feature comparison

| Feature | Data Access | Data Management | Erasure Code Edition |
|---|---|---|----------------------|
| Multi-protocol scalable file service with simultaneous access to a common set of data | Yes | Yes | Yes |
| Facilitate data access with a global namespace, massively scalable file system, quotas and snapshots, data integrity and availability, and filesets | Yes | Yes | Yes |
| Simplify management with GUI | Yes | Yes | Yes |
| Improved efficiency with QoS and compression | Yes | Yes | Yes |
| Create optimized tiered storage pools based on performance, locality, or cost | Yes | Yes | Yes |
| Simplify data management with Information Lifecycle Management (ILM) tools that include policy based data placement and migration | Yes | Yes | Yes |
| Enable worldwide data access using AFM asynchronous replication | Yes | Yes | Yes |
| Asynchronous multi-site Disaster Recovery | No | Yes | Yes |
| Transparent Cloud Tiering (TCT) | No | Yes | Yes |
| Protect data with native software encryption and secure erase, NIST compliant and FIPS certified | No | Yes* | Yes* |
| File audit logging | No | Yes | Yes |
| Watch folder | No | Yes | Yes |
| Erasure coding | DSS only | DSS only | Yes |
| Network-disperses erasure coding | No | No | Yes |
| Licensing | Per Disk Drive/Flash Device or per Capacity | Per Disk Drive/Flash Device or per Capacity | Per Capacity |

* Requires additional key management software to enable

Information about licensing is in the IBM Spectrum Scale licensing section.

For more information about IBM Spectrum Scale, see the following web pages:

- IBM Spectrum Scale product page:
<https://www.ibm.com/products/scale-out-file-and-object-storage>
- IBM Spectrum Scale FAQ:
<https://www.ibm.com/support/knowledgecenter/en/STXKQY/gpfsclustersfaq.html>

Spectrum Scale RAID on Data Access and Data Management Edition

IBM Spectrum Scale RAID integrates the functionality of an advanced storage controller into the GPFS NSD server. Unlike an external storage controller, where configuration, LUN definition, and maintenance are beyond the control of IBM Spectrum Scale, IBM Spectrum Scale RAID itself takes on the role of controlling, managing, and maintaining physical disks - hard disk drives (HDDs) and solid-state drives (SSDs).

Sophisticated data placement and error correction algorithms deliver high levels of storage reliability, availability, serviceability, and performance. IBM Spectrum Scale RAID provides a variation of the GPFS network shared disk (NSD) called a virtual disk, or vdisk. Standard NSD clients transparently access the vdisk NSDs of a file system using the conventional NSD protocol.

The features of IBM Spectrum Scale RAID include:

- **Software RAID**

IBM Spectrum Scale RAID, which runs on standard Serial Attached SCSI (SAS) disks in a dual-ported JBOD array, does not require external RAID storage controllers or other custom hardware RAID acceleration.

- **Declustering**

IBM Spectrum Scale RAID distributes client data, redundancy information, and spare space uniformly across all disks of a JBOD. This approach reduces the rebuild (disk failure recovery process) overhead and improves application performance compared to conventional RAID.

- **Pdisk-group fault tolerance**

In addition to declustering data across disks, IBM Spectrum Scale RAID can place data and parity information to protect against groups of disks that, based on characteristics of a disk enclosure and system, could possibly fail together due to a common fault. The data placement algorithm ensures that even if all members of a disk group fail, the error correction codes will still be capable of recovering erased data.

- **Checksum**

An end-to-end data integrity check, using checksums and version numbers, is maintained between the disk surface and NSD clients. The checksum algorithm uses version numbers to detect silent data corruption and lost disk writes.

- **Data redundancy**

IBM Spectrum Scale RAID supports highly reliable 2-fault-tolerant and 3-fault-tolerant Reed-Solomon-based parity codes and 3-way and 4-way replication.

- **Large cache**

A large cache improves read and write performance, particularly for small I/O operations.

- **Arbitrarily-sized disk arrays**

The number of disks is not restricted to a multiple of the RAID redundancy code width, which allows flexibility in the number of disks in the RAID array.

- **Multiple redundancy schemes**

One disk array can support vdisks with different redundancy schemes, for example Reed-Solomon and replication codes.

- **Disk hospital**

A disk hospital asynchronously diagnoses faulty disks and paths, and requests replacement of disks by using past health records.

- **Automatic recovery**

Seamlessly and automatically recovers from primary server failure.

- **Disk scrubbing**

A disk scrubber automatically detects and repairs latent sector errors in the background.

- **Familiar interface**

Standard IBM Spectrum Scale command syntax is used for all configuration commands, including maintaining and replacing failed disks.

- **Flexible hardware configuration**

Support of JBOD enclosures with multiple disks physically mounted together on removable carriers.

- **Journaling**

For improved performance and recovery after a node failure, internal configuration and small-write data are journaled to solid-state disks (SSDs) in the JBOD or to non-volatile random-access memory (NVRAM) that is internal to the IBM Spectrum Scale RAID servers.

For more information about IBM Spectrum Scale RAID see the following documents:

- [IBM Spectrum Scale RAID: Administration](#)
- [Lenovo DSS-G Declustered RAID Technology and Rebuild Performance](#)

Spectrum Scale Erasure Code Edition

Spectrum Scale Erasure Code Edition brings the IBM Spectrum Scale RAID functionality to the next level, supporting the creation of scale-out network-dispersed Spectrum Scale clusters on storage rich servers. You get the same benefits of IBM Spectrum Scale and IBM Spectrum Scale RAID without the need for storage enclosures:

- Reed-Solomon highly fault tolerant declustered RAID, protecting against drive and node failures.
- Disk Hospital to identify abnormal behavior and mitigate issues preventively.
- End-to-end checksum to identify and correct errors from the client over the network down to the block on the device.

DSS-G G100 models with IBM Spectrum Scale Erasure Code Edition use the same software and most of the same concepts that are used in DSS-G G2xx models with IBM Spectrum Scale Data Access or Data Management Edition. The G2xx models are a solution that consists of two I/O (storage) servers and between one and several JBOD disk enclosures, with each storage device (pdisk) attached to both servers. The G2xx models have two recovery groups (RGs). Each RG takes half of each enclosure among all enclosures. Under normal conditions, each I/O server supports one of the two RGs. If either I/O server fails, the remaining I/O server takes over and supports both RGs.

IBM Spectrum Scale Erasure Code Edition, in contrast, can have one or more recovery groups, but each RG is associated with 6 - 32 storage servers, and each storage server belongs to only one RG. All of the storage servers in a recovery group must have a matching configuration, including identical CPU, memory, network, and storage device configurations. The storage devices (pdisks) are directly attached to only one storage server. Each storage server typically serves 2 log groups and each log group manages one half of the virtual disks (vdisk NSDs) assigned to a server. If a storage server fails, the log groups (and vdisk NSDs) it was serving are distributed to the remaining storage servers; any storage server failure causes the remaining storage servers to serve at most one more log group.

In both G2xx models and G100 ECE models, the placement of data is topology aware using a failure domain hierarchy of rack, node, enclosure, and storage device (pdisk). The RAID code makes placement decisions to maximize fault tolerance, depending on the RAID level you choose. IBM Spectrum Scale Erasure Code Edition supports the following erasure codes and replication levels: 8+2p, 8+3p, 4+2p, 4+3p, 3WayReplication, and 4WayReplication.

With IBM Spectrum Scale Erasure Code Edition it is possible for either IBM Spectrum Scale Cluster Export Services with protocol software or customer applications to run directly on the storage servers if sufficient hardware resources are available. Customer applications must run in a constrained environment by using Linux cgroups or Docker containers. For protocol workloads with high-performance requirements, the Cluster Export Services must run on separate nodes.

In both G2xx models and G100 ECE models the IBM Spectrum Scale file system, and file system features are independent of the storage configuration. A file system can be composed of NSDs provided by more than one recovery group, and the recovery groups can be from G2xx models or G100 ECE models or a combination of both. All of the IBM Spectrum Scale file system features can be used in a cluster with IBM Spectrum Scale Erasure Code Edition storage servers, but there are strict guidelines as to where the various components might run.

For more information about IBM Spectrum Scale Erase Code Edition please visit the [IBM Spectrum Scale Erasure Code Edition documentation](#).

DSS-G Model G100: As of the current release (DSS-G 4.0a), G100 with ECE is now offered as a fully enabled configuration including the ECE software. The G100 solution stack (or “tarball”) contains all the software needed for G100, including the ECE software.

Hardware features

Lenovo DSS-G is fulfilled through Lenovo Scalable Infrastructure (LeSI), which offers a flexible framework for the development, configuration, build, delivery and support of engineered and integrated data center solutions. Lenovo thoroughly tests and optimizes all LeSI components for reliability, interoperability and maximum performance, so clients can quickly deploy the system and get to work achieving their business goals.

The major hardware components of a DSS-G solution are:

- DSS-G G2xx models
 - 2x ThinkSystem SR650 servers
 - Choice of direct-attach storage enclosures - D1224 and D3284 enclosures
 - 1x-4x Lenovo Storage D1224 Drive Enclosures each holding 24x 2.5-inch SSDs (small form factor configuration DSS-G20x)
 - 1x-8x Lenovo Storage D3284 External High Density Drive Expansion Enclosure, each holding 84x 3.5-inch HDDs (large form factor configuration DSS-G2x0)
 - 1x-2x D1224 Enclosure plus 1x-7x D3284 Enclosure (max 8x enclosures total, hybrid configuration DSS-G2xx)
- DSS-G G100 models
 - 1x ThinkSystem SR630 server (minimum 6 per configuration for Erasure Code Edition)
 - Up to 8x 2.5-inch NVMe drives
 - Installed and cabled in the factory in a 42U or 48U rack cabinet, or shipped with the Client Site Integration Kit that provides Lenovo installation into the customer’s choice of rack
 - Optional management node and management network, for example a ThinkSystem SR630 server and Mellanox AS4610 Gigabit Ethernet switch

Lenovo ThinkSystem SR650 servers



Figure 2. Lenovo ThinkSystem SR650 servers

Lenovo System SR650 servers have the following key features:

- The SR650 server features a unique AnyBay design that allows a choice of drive interface types in the same drive bay: SAS drives, SATA drives, or U.2 NVMe PCIe drives.
- The SR650 server offers onboard NVMe PCIe ports that allow direct connections to the U.2 NVMe PCIe SSDs, which frees up I/O slots and helps lower NVMe solution acquisition costs. DSS-G100 utilizes the NVMe drives
- The SR650 server delivers impressive compute power per watt, featuring 80 PLUS Titanium and Platinum redundant power supplies that can deliver 96% (Titanium) or 94% (Platinum) efficiency at

50% load when connected to a 200 - 240 V AC power source.

- The SR650 server is designed to meet ASHRAE A4 standards (up to 45 °C or 113 °F) in select configurations, which enable customers to lower energy costs, while still maintaining world-class reliability.
- Improves productivity by offering superior system performance with the Intel Xeon Processor Scalable Family with up to 28-core processors, up to 38.5 MB of last level cache (LLC), up to 2933 MHz memory speeds, and up to 10.4 GT/s Ultra Path Interconnect (UPI) links.
- Support for up to two processors, 56 cores, and 112 threads allows to maximize the concurrent execution of multithreaded applications.
- Helps maximize system performance for data intensive applications with up to 2933 MHz memory speeds and up to 3.0 TB of memory capacity.
- Offers flexible and scalable internal storage in a 2U rack form factor with up to 24x 2.5-inch drives for performance-optimized configurations or up to 14x 3.5-inch drives for capacity-optimized configurations, providing a wide selection of SAS/SATA HDD/SSD and PCIe NVMe SSD types and capacities.
- Provides I/O scalability with the LOM slot, PCIe 3.0 slot for an internal storage controller, and up to six PCI Express (PCIe) 3.0 I/O expansion slots in a 2U rack form factor.
- Reduces I/O latency and increases overall system performance with Intel Integrated I/O Technology that embeds the PCI Express 3.0 controller into the Intel Xeon Processor Scalable Family.

Lenovo ThinkSystem SR630 servers



Figure 3. Lenovo ThinkSystem SR630

Lenovo ThinkSystem SR630 servers have the following key features:

- The SR630 server features a unique AnyBay design that allows a choice of drive interface types in the same drive bay: SAS drives, SATA drives, or U.2 NVMe PCIe drives.
- The SR630 server offers onboard NVMe PCIe ports that allow direct connections to the U.2 NVMe PCIe SSDs, which frees up I/O slots and helps lower NVMe solution acquisition costs.
- The SR630 server delivers impressive compute power per watt, featuring 80 PLUS Titanium and Platinum redundant power supplies that can deliver 96% (Titanium) or 94% (Platinum) efficiency at 50% load when connected to a 200 - 240 V AC power source.
- The SR630 server is designed to meet ASHRAE A4 standards (up to 45 °C [113 °F]) in select configurations, which enable customers to lower energy costs, while still maintaining world-class reliability.
- Improves productivity by offering superior system performance with the Intel Xeon Processor Scalable Family with up to 28-core processors, up to 38.5 MB of last level cache (LLC), up to 2933 MHz memory speeds, and up to 10.4 GT/s Ultra Path Interconnect (UPI) links.
- Support for up to two processors, 56 cores, and 112 threads allows to maximize the concurrent execution of multithreaded applications.
- Helps maximize system performance for data intensive applications with up to 2933 MHz memory speeds and up to 3 TB of memory capacity (with the processors that support 1.5 TB per socket).
- Offers flexible and scalable internal storage in a 1U rack form factor with up to 12x 2.5-inch drives for

performance-optimized configurations or up to 4x 3.5-inch drives for capacity-optimized configurations, providing a wide selection of SAS/SATA HDD/SSD and PCIe NVMe SSD types and capacities.

- Provides I/O scalability with the LOM slot, PCIe 3.0 slot for an internal storage controller, and up to three PCI Express (PCIe) 3.0 I/O expansion slots in a 1U rack form factor.

Lenovo Storage D1224 Drive Enclosures



Figure 4. Lenovo Storage D1224 Drive Enclosure

Lenovo Storage D1224 Drive Enclosures have the following key features:

- 2U rack mount enclosure with 12 Gbps SAS direct-attached storage connectivity, designed to provide simplicity, speed, scalability, security, and high availability
- Holds 24x 2.5-inch small form factor (SFF) drives
- Dual Environmental Service Module (ESM) configurations for high availability and performance
- Flexibility in storing data on high performance SAS SSDs, performance-optimized enterprise SAS HDDs, or capacity-optimized enterprise NL SAS HDDs; mixing and matching drive types and form factors on a single RAID adapter or HBA to perfectly meet performance and capacity requirements for various workloads
- Support multiple host attachments and SAS zoning for storage partitioning

For more information about the Lenovo Storage D1224 Drive Enclosure, see the Lenovo Press product guide: <https://lenovopress.com/lp0512>

Lenovo Storage D3284 External High Density Drive Expansion Enclosure



Figure 5. Lenovo Storage D3284 External High Density Drive Expansion Enclosure

Lenovo Storage D3284 Drive Enclosures have the following key features:

- 5U rack mount enclosure with 12 Gbps SAS direct-attached storage connectivity, designed for high performance and maximum storage density.
- Holds 84x 3.5-inch hot-swap drive bays in two drawers. Each drawer has three rows of drives, and each row has 14 drives.
- Supports high-capacity, archival-class nearline disk drives
- Dual Environmental Service Module (ESM) configurations for high availability and performance
- 12 Gb SAS HBA connectivity for maximum JBOD performance
- Flexibility in storing data on high performance SAS SSDs or capacity-optimized enterprise NL SAS HDDs; mixing and matching drive types on a single HBA to perfectly meet performance and capacity requirements for various workloads

The following figure show the D3284 drive expansion enclosure with the lower drawer open.

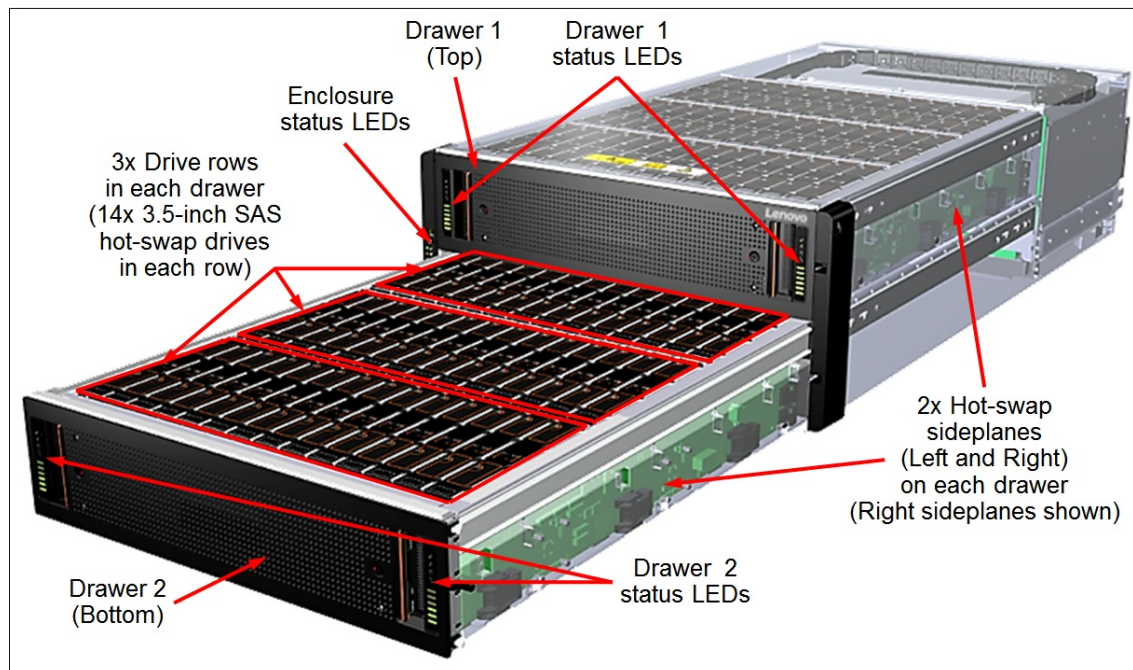


Figure 6. Front view of the D3284 drive enclosure

For more information about the Lenovo Storage Drive Expansion Enclosure, see the Lenovo Press product guide: <https://lenovopress.com/lp0513>

Infrastructure and rack installation

The solution arrives at the customer location installed in the Lenovo 1410 Rack, tested, components and cables labeled and ready to deploy for quick productivity.

- Factory-integrated, pre-configured ready-to-go solution that is delivered in a rack with all the hardware you need for your workloads: servers, storage, and network switches, plus essential software tools.
- IBM Spectrum Scale software is preinstalled on all servers.
- Optional ThinkSystem SR630 server and Mellanox AS4610 Gigabit Ethernet switch for xCAT cluster administration software and to act as the Spectrum Scale quorum.
- Designed for effortless integration into existing infrastructures, thereby reducing deployment time and saving money.

- Lenovo deployment services are available with the solution help get customers up and running quickly by allowing to begin deploying workloads in hours — not weeks — and realize substantial savings.
- Available NVIDIA Ethernet switches for a management network deliver exceptional performance and low latency, along with cost savings, and are designed to perform seamlessly with other vendors' upstream switches.
- All the components of the solution are available through Lenovo, which provides a single point of entry for all support issues that you might encounter with the server, networking, storage, and software used in the solution, for quicker problem determination and minimized downtime.

Components

The following figure shows two of the configurations available, the G204 (2x SR650 and 4x D1224) and the G260 (2x SR650 and 6x D3284). See the [Models](#) section for all available configurations.

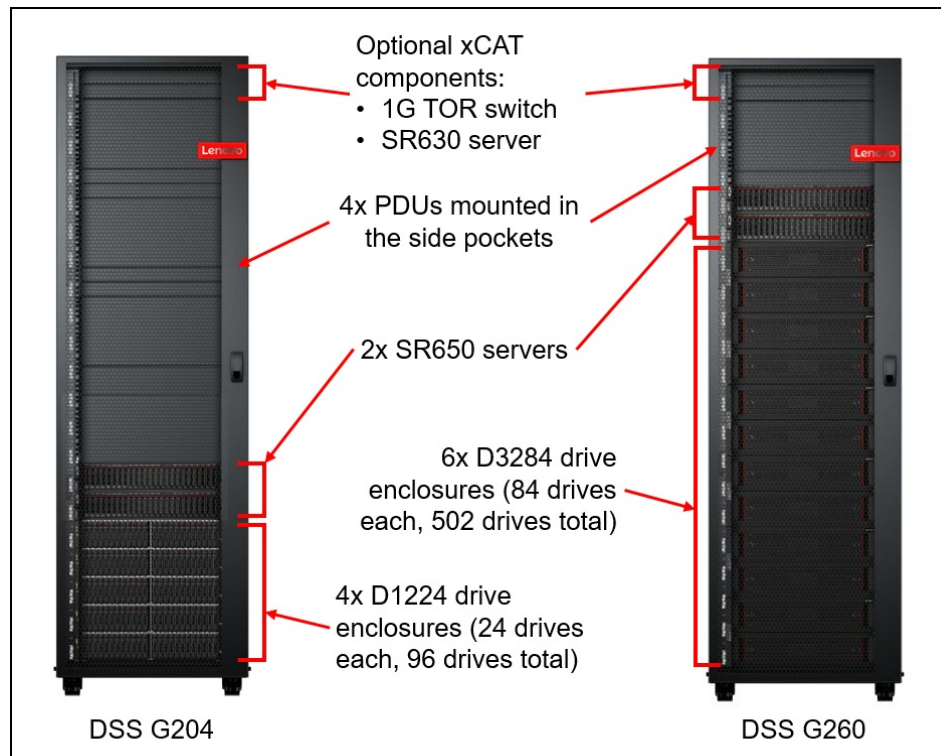


Figure 7. DSS-G components

Specifications

This section lists the system specifications of the components used in the Lenovo DSS-G offerings.

- [SR650 server specifications](#)
- [SR630 server specifications](#)
- [D1224 External Enclosure specifications](#)
- [D3284 External Enclosure specifications](#)
- [Rack cabinet specifications](#)
- [Optional management components](#)

SR650 server specifications

The following table lists the system specifications of the SR650 servers.

Table 2. SR650 system specifications

| Attribute | Specification |
|---------------------|--|
| Form factor | 2U rack-mount. |
| Processor | 2x Intel Xeon Gold 6240 18C 150W 2.6GHz Processor |
| Chipset | Intel C624 |
| Memory | Varies - see SR650 configuration section |
| Memory capacity | Up to 1.5 TB with 24x 64 GB LRDIMMs and two processors |
| Memory protection | Error correction code (ECC), SDDC (for x4-based memory DIMMs), ADDDC (for x4-based memory DIMMs, requires Intel Xeon Gold or Platinum processors), memory mirroring, memory rank sparing, patrol scrubbing, and demand scrubbing. |
| Drive bays | 8x 2.5-inch hot-swap drive bays at the front of the server as follows: <ul style="list-style-type: none"> • 4x SAS/SATA drive bays • 4x AnyBay drive bays for NVMe drives |
| Drives | 2x 2.5" 300GB 10K SAS 12Gb Hot Swap 512n HDD for boot drives, configured as a RAID-1 array |
| Storage controllers | <ul style="list-style-type: none"> • 1x ThinkSystem RAID 930-8i 2GB Flash PCIe 12Gb Adapter for boot drives • 4x ThinkSystem 430-16e SAS/SATA 12Gb HBA |
| Network interfaces | <ul style="list-style-type: none"> • 4-port 10GBaseT LOM adapter • Choice of adapter for cluster connectivity - see SR650 configuration section • 1x RJ-45 10/100/1000 Mb Ethernet systems management port. |
| I/O expansion slots | <ul style="list-style-type: none"> • Slot 1: PCIe 3.0 x8 full-height, half-length • Slot 2: PCIe 3.0 x8 full-height, half-length • Slot 3: PCIe 3.0 x8; full-height, half-length • Slot 4: PCIe 3.0 x8; low profile (vertical slot on system planar) • Slot 5: PCIe 3.0 x16; full-height, half-length • Slot 6: PCIe 3.0 x16; full-height, half-length • Slot 7: PCIe 3.0 x8 (dedicated to an internal RAID controller) |
| Ports | <ul style="list-style-type: none"> • Front: <ul style="list-style-type: none"> ◦ 1x USB 2.0 port with XClarity Controller access. ◦ 1x USB 3.0 port. ◦ 1x VGA port (optional). • Rear: 2x USB 3.0 ports and 1x VGA port. Optional 1x DB-9 serial port. |
| Cooling | Six hot-swap system fans with N+1 redundancy. |
| Power supply | Two redundant hot-swap 1100 W (100 - 240 V) High Efficiency Platinum AC power supplies |
| Video | Matrox G200 with 16 MB memory integrated into the XClarity Controller. Maximum resolution is 1920x1200 at 60 Hz with 16 bits per pixel. |
| Hot-swap parts | Drives, power supplies, and fans. |
| Systems management | XClarity Controller (XCC) Standard, Advanced, or Enterprise (Pilot 4 chip), proactive platform alerts, light path diagnostics, XClarity Provisioning Manager, XClarity Essentials, XClarity Administrator, XClarity Energy Manager. |
| Security features | Power-on password, administrator's password, secure firmware updates, Trusted Platform Module (TPM) 1.2 or 2.0 (configurable UEFI setting). Optional lockable front bezel. Optional Trusted Cryptographic Module (TCM) (available only in China). |
| Operating systems | Lenovo DSS-G uses Red Hat Enterprise Linux |

| Attribute | Specification |
|---------------------|--|
| Warranty | Three-year (7X06) customer-replaceable unit (CRU) and onsite limited warranty with 9x5 Next Business Day Parts Delivered. |
| Service and support | Optional service upgrades are available through Lenovo Services: 2-hour or 4-hour response time, 6-hour or 24-hour committed service repair, warranty extension up to 5 years, 1-year or 2-year post-warranty extensions, YourDrive Your Data, Microcode Support, Enterprise Software Support, and Hardware Installation Services. |
| Dimensions | Height: 87 mm (3.4 in), width: 445 mm (17.5 in), depth: 720 mm (28.3 in) |
| Weight | Minimum configuration: 19 kg (41.9 lb), maximum: 32 kg (70.5 lb) |

SR630 server specifications

The following table lists the system specifications for the SR630 server.

Table 3. SR630 system specifications

| Attribute | Specification |
|---------------------|--|
| Form factor | 1U rack-mount. |
| Processor | 2x Intel Xeon Gold 6240 18C 150W 2.6GHz Processor |
| Chipset | Intel C624. |
| Memory | Varies - see SR630 configuration section |
| Memory capacity | Up to 1.5 TB with 24x 64 GB LRDIMMs and two processors |
| Memory protection | Error correction code (ECC), SDDC (for x4-based memory DIMMs), ADDDC (for x4-based memory DIMMs, requires Intel Xeon Gold or Platinum processors), memory mirroring, memory rank sparing, patrol scrubbing, and demand scrubbing. |
| Drive bays | Model G100: <ul style="list-style-type: none"> 10x 2.5-inch hot-swap drive bays at the front of the server 8x AnyBay drive bays for NVMe drives, 2x AnyBay drive bays for boot drives |
| Drives | Model G100: <ul style="list-style-type: none"> 2x ThinkSystem M.2 5100 480GB non-hot swap SSD for boot drives, configured as a RAID-1 array Up to 8x NVMe drives for data - see SR630 configuration section |
| Storage controller | Model G100 (NVMe drives): <ul style="list-style-type: none"> 2x Onboard NVMe x8 ports for 4 NVMe drives 2x ThinkSystem 810-4P NVMe Switch Adapter for 4 NVMe drives |
| Network interfaces | <ul style="list-style-type: none"> 4-port 10GBaseT LOM adapter Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter for cluster connectivity - see SR630 configuration section 1x RJ-45 10/100/1000 Mb Ethernet systems management port. |
| I/O expansion slots | Model G100: <ul style="list-style-type: none"> Slot 1: ThinkSystem 810-4P NVMe Switch Adapter Slot 2: Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter Slot 3: Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter Slot 4: ThinkSystem 810-4P NVMe Switch Adapter |

| Attribute | Specification |
|---------------------|--|
| Ports | <ul style="list-style-type: none"> ● Front: <ul style="list-style-type: none"> ○ 1x USB 2.0 port with XClarity Controller access. ○ 1x USB 3.0 port. ○ 1x VGA port (optional). ● Rear: 2x USB 3.0 ports and 1x VGA port. Optional 1x DB-9 serial port. |
| Cooling | Seven (two processors) hot-swap system fans with N+1 redundancy. |
| Power supply | Up to two redundant hot-swap 1100 W (100 - 240 V) High Efficiency Platinum AC power supplies. |
| Video | Matrox G200 with 16 MB memory integrated into the XClarity Controller. Maximum resolution is 1920x1200 at 60 Hz with 16 bits per pixel. |
| Hot-swap parts | Drives, power supplies, and fans. |
| Systems management | XClarity Controller (XCC) Standard, Advanced, or Enterprise (Pilot 4 chip), proactive platform alerts, light path diagnostics, XClarity Provisioning Manager, XClarity Essentials, XClarity Administrator, XClarity Integrators for VMware vCenter and Microsoft System Center, XClarity Energy Manager. |
| Security features | Power-on password, administrator's password, secure firmware updates, Trusted Platform Module (TPM) 1.2 or 2.0 (configurable UEFI setting). Optional lockable front bezel. Optional Trusted Cryptographic Module (TCM) or Nationz TPM (available only in China). Optional Lenovo Business Vantage security software (available only in China). |
| Operating systems | Lenovo DSS-G uses Red Hat Enterprise Linux |
| Warranty | Three-year (7X06) customer-replaceable unit (CRU) and onsite limited warranty with 9x5 Next Business Day Parts Delivered. |
| Service and support | Optional service upgrades are available through Lenovo Services: 2-hour or 4-hour response time, 6-hour or 24-hour committed service repair, warranty extension up to 5 years, 1-year or 2-year post-warranty extensions, YourDrive Your Data, Enterprise Server Software Support, and Basic Hardware Installation Services. |
| Dimensions | Height: 43 mm (1.7 in), width: 434 mm (17.1 in), depth: 715 mm (28.1 in) |
| Weight | Minimum configuration: 11.9 kg (26.2 lb), maximum: 18.8 kg (41.4 lb) |

D1224 External Enclosure specifications

The following table lists the D1224 system specifications.

Table 4. System specifications

| Components | Specification |
|--------------------|---|
| Machine type | 4587-LC2 |
| Form factor | 2U rack mount |
| Number of ESMs | Two Environmental Service Modules (ESMs) |
| Expansion ports | 3x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) ports (A, B, C) per ESM |
| Drive bays | 24x SFF hot-swap drive bays |
| Drive technologies | SAS and NL SAS HDDs and SEDs; SAS SSDs. Intermix of HDDs, SEDs, and SSDs is supported within an enclosure, but not within a RAID array. |
| Drive connectivity | Dual-ported 12 Gb SAS drive attachment infrastructure. |
| Drives | SAS SSDs up to 7.68 TB - see the Drive Enclosure configuration section |

| Components | Specification |
|-----------------------|--|
| Storage capacity | Up to 184 TB (24x 7.68 TB 2.5" SSDs) |
| Cooling | Redundant cooling with two fans built into power and cooling modules (PCMs). |
| Power supply | Two redundant hot-swap 580 W AC power supplies built into PCMs. |
| Hot-swap parts | ESMs, drives, PCMs. |
| Management interfaces | SAS Enclosure Services, 10/100 Mb Ethernet for external management. |
| Security features | SAS zoning, self-encrypting drives (SEDs). |
| Warranty | Three-year customer-replaceable unit, parts delivered limited warranty with 9x5 next business day response. |
| Service and support | Optional warranty service upgrades are available through Lenovo: Technician installed parts, 24x7 coverage, 2-hour or 4-hour response time, 6-hour or 24-hour committed repair, 1-year or 2-year warranty extensions, YourDrive YourData, remote technical support, hardware installation. |
| Dimensions | Height: 88 mm (3.5 in), width: 443 mm (17.4 in), depth: 630 mm (24.8 in) |
| Maximum weight | 24 kg (52.9) lb |
| Power cords | 2x 16A/100-240V, C19 to IEC 320-C20 Rack Power Cable |

For more information about the Lenovo Storage D1224 Drive Enclosure, see the Lenovo Press product guide: <https://lenovopress.com/lp0512>

D3284 External Enclosure specifications

The following table lists the D3284 specifications.

Table 5. D3284 External Enclosure specifications

| Components | Specification |
|--------------------|---|
| Machine type | 6413-LC1 |
| Form factor | 5U rack mount |
| Number of ESMs | Two Environmental Service Modules (ESMs) |
| Expansion ports | 3x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) ports (A, B, C) per ESM |
| Drive bays | 84 3.5-inch (large form factor) hot-swap drive bays in two drawers. Each drawer has three drive rows, and each row has 14 drives. |
| Drive technologies | NL SAS HDDs and SAS SSDs. Intermix of HDDs and SSDs is supported within an enclosure/drawer, but not within a row. |
| Drive connectivity | Dual-ported 12 Gb SAS drive attachment infrastructure. |
| Drives | Choose 1 of the following drive capacities - see the Drive Enclosure configuration section: <ul style="list-style-type: none"> 4TB, 6TB, 8TB, 10TB, 12TB, 14TB, 16TB, or 18TB 7.2K rpm NL SAS HDDs |
| Storage capacity | Up to 1,476 TB (82x 18TB LFF NL SAS HDDs) |
| Cooling | N+1 redundant cooling with five hot-swap fans. |
| Power supply | Two redundant hot-swap 2214 W AC power supplies. |

| Components | Specification |
|-----------------------|--|
| Hot-swap parts | ESMs, drives, sideplanes, power supplies, and fans. |
| Management interfaces | SAS Enclosure Services, 10/100 Mb Ethernet for external management. |
| Warranty | Three-year customer-replaceable unit, parts delivered limited warranty with 9x5 next business day response. |
| Service and support | Optional warranty service upgrades are available through Lenovo: Technician installed parts, 24x7 coverage, 2-hour or 4-hour response time, 6-hour or 24-hour committed repair, 1-year or 2-year warranty extensions, YourDrive YourData, hardware installation. |
| Dimensions | Height: 221 mm (8.7 in), width: 447 mm (17.6 in), depth: 933 mm (36.7 in) |
| Maximum weight | 131 kg (288.8 lb) |
| Power cords | 2x 16A/100-240V, C19 to IEC 320-C20 Rack Power Cable |

For more information about the Lenovo Storage Drive Expansion Enclosure, see the Lenovo Press product guide: <https://lenovopress.com/lp0513>

Rack cabinet specifications

The DSS-G can be pre-installed and shipped in a 42U or 48U Lenovo EveryScale Heavy Duty Rack Cabinet. The specifications of the rack are in the following table.

Table 6. Rack cabinet specifications

| Component | 42U EveryScale Heavy Duty Rack Cabinet | 48U EveryScale Heavy Duty Rack Cabinet |
|----------------------------|--|--|
| Model | 1410-O42 (42U Black) 1410-P42 (42U White) | 1410-O48 (48U Black) 1410-P48 (48U White) |
| Rack U Height | 42U | 48U |
| Dimensions | Height: 2011 mm / 79.2 inches Width: 600 mm / 23.6 inches Depth: 1200 mm / 47.2 inches | Height: 2277 mm / 89.6 inches Width: 600 mm / 23.6 inches Depth: 1200 mm / 47.2 inches |
| Front & Rear Doors | Lockable, perforated, full doors (rear door is not split) Optional water-cooled Rear Door Heat Exchanger (RDHX) | |
| Side Panels | Removable and lockable side doors | |
| Side Pockets | 6 side pockets | 8 side pockets |
| Cable exits | Top cable exits (front & rear); Bottom cable exit (rear only) | |
| Stabilizers | Front & side stabilizers | |
| Ship Loadable | Yes | |
| Load Capacity for Shipping | 1600 kg / 3500 lb | 1800kg / 4000 lb |
| Maximum Loaded Weight | 1600 kg / 3500 lb | 1800kg / 4000 lb |

For more information about the EveryScale Heavy Duty Rack Cabinets, see the Lenovo Heavy Duty Rack Cabinets product guide, <https://lenovopress.com/lp1498>.

Besides shipping fully integrated into the Lenovo 1410 rack cabinet, DSS-G solution gives clients the choice of shipping with the Lenovo Client Site Integration Kit (7X74) which allows clients to have Lenovo or a business partner install the solution in a rack of their own choosing.

Optional management components

Optionally, the configuration can include a management node and Gigabit Ethernet switch. The management node will run the xCAT cluster administration software. If this node and switch are not selected as part of the DSS-G configuration, an equivalent customer-supplied management environment needs to be available.

A management network and xCAT management server are required and can be either configured as part of the DSS-G solution, or can be provided by the customer. The following server and network switch are configurations that are added by default in x-config but can be removed or replaced if an alternative management system is provided:

- Management node - Lenovo ThinkSystem SR630 (7X02):
 - 1U rack server
 - 2x Intel Xeon Silver 4215 8C 85W 2.5GHz Processor
 - 12x 8GB TruDDR4 2933 MHz (1Rx8 1.2V) RDIMM
 - 2x 2.5" 300GB 10K SAS 12Gb Hot Swap 512n HDD (configured as RAID-1)
 - 1x 550W (230V/115V) Platinum Hot-Swap Power Supply (2x 550W power supplies recommended)

For more information about the server see the Lenovo Press product guide:

<http://lenovopress.com/lp0643>

- Gigabit Ethernet switch - Mellanox AS4610:
 - 1U top-of-rack switch
 - 48x 10/100/1000BASE-T RJ-45 ports
 - 4x 10 Gigabit Ethernet SFP+ uplink ports
 - 2x fixed 150W AC (100-240V) power supplies

Models

Lenovo DSS-G is available in the configurations listed in the following table. Each configuration is installed in a 42U rack, although multiple DSS-G configurations can share the same rack.

Naming convention: The three numbers in the **Gxyz** configuration number represent the following:

- **x** = Number of servers (SR650 or SR630)
- **y** = Number of D3284 drive enclosures
- **z** = Number of D1224 drive enclosures

Table 7. Lenovo DSS-G configurations

| Configuration | SR630 servers | SR650 servers | D3284 drive enclosures | D1224 drive enclosures | Number of drives (max total capacity) | PDU's | SR630 (Mgmt) | AS4610 switch (for xCAT) |
|---------------|---------------|---------------|------------------------|------------------------|---|-------|--------------|--------------------------|
| DSS G201 | 0 | 2 | 0 | 1 | 24x 2.5" (184TB)* | 2 | 1 (optional) | 1 (optional) |
| DSS G202 | 0 | 2 | 0 | 2 | 48x 2.5" (369TB)* | 2 | 1 (optional) | 1 (optional) |
| DSS G203 | 0 | 2 | 0 | 3 | 72x 2.5" (553TB)* | 2 | 1 (optional) | 1 (optional) |
| DSS G204 | 0 | 2 | 0 | 4 | 96x 2.5" (737TB)* | 2 | 1 (optional) | 1 (optional) |
| DSS G211 | 0 | 2 | 1 | 1 | 24x 2.5" + 82x 3.5" (184TB + 1476TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G212 | 0 | 2 | 1 | 2 | 48x 2.5" + 82x 3.5" (369TB + 1476TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G221 | 0 | 2 | 2 | 1 | 24x 2.5" + 166x 3.5" (184TB + 2998TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G222 | 0 | 2 | 2 | 2 | 48x 2.5" + 166x 3.5" (369TB + 2998TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G231 | 0 | 2 | 3 | 1 | 24x 2.5" + 250x 3.5" (184TB + 4500TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G232 | 0 | 2 | 3 | 2 | 48x 2.5" + 250x 3.5" (369TB + 4500TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G241 | 0 | 2 | 4 | 1 | 24x 2.5" + 334x 3.5" (184TB + 6012TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G242 | 0 | 2 | 4 | 2 | 48x 2.5" + 334x 3.5" (369TB + 6012TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G251 | 0 | 2 | 5 | 1 | 24x 2.5" + 418x 3.5" (184TB + 7524TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G252 | 0 | 2 | 5 | 2 | 48x 2.5" + 418x 3.5" (369TB + 7524TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G261 | 0 | 2 | 6 | 1 | 24x 2.5" + 502x 3.5" (184TB + 9036TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G262 | 0 | 2 | 6 | 2 | 48x 2.5" + 502x 3.5" (369TB + 9036TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G271 | 0 | 2 | 7 | 1 | 24x 2.5" + 586x 3.5" (184TB + 10548TB)† | 2 | 1 (optional) | 1 (optional) |
| DSS G210 | 0 | 2 | 1 | 0 | 82x 3.5" (1476TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G220 | 0 | 2 | 2 | 0 | 166x 3.5" (2988TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G230 | 0 | 2 | 3 | 0 | 250x 3.5" (4500TB)** | 2 | 1 (optional) | 1 (optional) |

| Configuration | SR630 servers | SR650 servers | D3284 drive enclosures | D1224 drive enclosures | Number of drives (max total capacity) | PDU's | SR630 (Mgmt) | AS4610 switch (for xCAT) |
|---------------|---------------|---------------|------------------------|------------------------|---------------------------------------|-------|--------------|--------------------------|
| DSS G240 | 0 | 2 | 4 | 0 | 334x 3.5" (6012TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G250 | 0 | 2 | 5 | 0 | 418x 3.5" (7524TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G260 | 0 | 2 | 6 | 0 | 502x 3.5" (9036TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G270 | 0 | 2 | 7 | 0 | 586x 3.5" (10548TB)** | 2 | 1 (optional) | 1 (optional) |
| DSS G280 | 0 | 2 | 8 | 0 | 670x 3.5" (12060TB)** | 2 | 1 (optional) | 1 (optional) |

* Capacity is based on using 7.68TB 2.5-inch SSDs.

** Capacity is based on using 18TB 3.5-inch HDDs in all but 2 of the drive bays in the first drive enclosure; the remaining 2 bays must have 2x SSDs for Spectrum Scale internal use.

† These models are a hybrid configuration that combines HDDs and SSDs in one building block. The number of drives and capacities are given in terms of HDD and SSD count.

Configurations are built using the x-config configurator tool:

<https://lsc.lenovo.com/products/hardware/configurator/worldwide/bhui/asit/index.html>

The configuration process includes the following steps:

- Select the drive and drive enclosure, as listed in the previous table.
- Node configuration, as described in the next subsections:
 - Memory
 - Network adapter
 - Red Hat Enterprise Linux (RHEL) subscription
 - Enterprise Software Support (ESS) subscription
- xCAT management network selection
- IBM Spectrum Scale license selection
- Power distribution infrastructure selection
- Professional Services selection

The following sections provide information about these configuration steps.

Drive Enclosure configuration

All drives used in all the enclosures in a DSS-G configuration are identical. The only exception to this is a pair of 800 GB SSDs that are required in the *first* drive enclosure for any configuration using HDDs. These SSDs are for *logtip* use by the IBM Spectrum Scale software and are not for user data.

DSS-G100 configuration: The G100 does not include external drive enclosures. Instead, NVMe drives are installed locally into the server as described in the [SR630 configuration](#) section.

The drive requirement are as follows:

- For configurations that use HDDs (D3284 only), two 800GB logtip SSDs must also be selected in the *first* drive enclosure in the DSS-G configuration.
- All subsequent enclosures in HDD-based DSS-G configuration do not require these logtip SSDs.
- Configurations using SSDs do not require the pair of logtip SSDs.
- Only one drive size & type is selectable per DSS-G configuration.
- All drive enclosures must be fully populated with drives. Partially filled enclosures are not supported.

The following table lists the drives available for selection in a D1224 enclosure. D1224 configurations are all SSDs and do not require separate logtip drives.

Table 8. SSD selections for the D1224 enclosures

| Feature code | Description |
|--------------|---|
| AU1U | Lenovo Storage 800GB 3DWD SSD 2.5" SAS |
| AUDH | Lenovo Storage 800GB 10DWD 2.5" SAS SSD |
| AU1T | Lenovo Storage 1.6TB 3DWD SSD 2.5" SAS |
| AUDG | Lenovo Storage 1.6TB 10DWD 2.5" SAS SSD |
| AVPA | Lenovo Storage 3.84TB 1DWD 2.5" SAS SSD |
| AVP9 | Lenovo Storage 7.68TB 1DWD 2.5" SAS SSD |

The following table lists the drives available for selection in a D3284 enclosure.

Table 9. Drive selections for the D3284 enclosures

| Feature code | Description |
|-------------------------------|---|
| D3284 External Enclosure HDDs | |
| AUDS | Lenovo Storage 3.5" 4TB 7.2K NL-SAS HDD (14 pack) |
| AUK2 | Lenovo Storage 3.5" 4TB 7.2K NL-SAS HDD |
| AUDT | Lenovo Storage 3.5" 6TB 7.2K NL-SAS HDD (14 pack) |
| AUK1 | Lenovo Storage 3.5" 6TB 7.2K NL-SAS HDD |
| AUDU | Lenovo Storage 3.5" 8TB 7.2K NL-SAS HDD (14 pack) |
| AUK0 | Lenovo Storage 3.5" 8TB 7.2K NL-SAS HDD |
| AUE4 | Lenovo Storage 3.5" 10TB 7.2K NL-SAS HDD (14 pack) |
| AUJZ | Lenovo Storage 3.5" 10TB 7.2K NL-SAS HDD |
| B106 | Lenovo Storage 3.5" 12TB 7.2K NL-SAS HDD (14 pack) |
| B107 | Lenovo Storage 3.5" 12TB 7.2K NL-SAS HDD |
| B4T6 | Lenovo Storage 3.5" 14TB 7.2K NL-SAS HDD (14 pack) |
| B4DU | Lenovo Storage 3.5" 14TB 7.2K NL-SAS HDD |
| BAVN | Lenovo Storage 3.5" 16TB 7.2K NL-SAS HDD (14 pack) |
| BAVM | Lenovo Storage 3.5" 16TB 7.2K NL-SAS HDD |
| BKCX | Lenovo Storage 3.5" 18TB 7.2K NL-SAS HDD (14 pack) |
| BKCY | Lenovo Storage 3.5" 18TB 7.2K NL-SAS HDD |
| D3284 External Enclosure SSDs | |
| BAVK | Lenovo Storage 800GB 2.5" 3DWD Hybrid Tray SSD (logtip drive) |

D3284 configurations are all HDDs, as follows:

- First D3284 enclosure in a configuration: 82 HDDs + 2x 800GB SSDs (BAVK)
- Subsequent D3284 enclosures in a configuration: 84x HDDs

Guaranteed Quality: Lenovo DSS-G is working exclusively with Enterprise grade drives. Where common drives are only rated at up to 180 TB/year, the Lenovo Enterprise drives are always warranted to up to 550TB/year.

SR650 configuration

The Lenovo DSS-G configurations described in this product guide use the ThinkSystem SR650 server, which features the Intel Xeon Scalable Family processors. Details about the configurations are in the [Specifications](#) section.

Memory

The DSS-G offerings allow four different memory configurations for the SR650 servers

- 192 GB using 12x 16 GB TruDDR4 RDIMMs (6 DIMMs per CPU, 1 DIMM per memory channel)
- 384 GB using 12x 32 GB TruDDR4 RDIMMs (6 DIMMs per CPU, 1 DIMM per memory channel)
- 768 GB using 24x 32 GB TruDDR4 RDIMMs (12 DIMMs per CPU, 2 DIMMs per memory channel)
- 1536 GB using 24x 64 GB TruDDR4 RDIMMs (12 DIMMs per CPU, 2 DIMMs per memory channel)

The following tables indicate memory requirements on the DSS-G configurations containing D3284 enclosures for different drive capacities. This table assumes a 1MB block size and RAID level of 8+2P. If your use configuration deviates from these parameters, please check with your Lenovo sales representative for the required memory.

Table 10. G210, G211, G212, G220, and G221, G222, G230, G231, G232, G240

| NL-SAS Drive Size | Required Memory |
|-------------------|-----------------|
| 4 TB | 192 GB |
| 6 TB | 192 GB |
| 8 TB | 384 GB |
| 10 TB | 384 GB |
| 12 TB | 384 GB |
| 14 TB | 384 GB |
| 16 TB | 384 GB |
| 18 TB | 384 GB |

Table 11. G241, G242, G250, G251, G252, G260 and G261, G262, G270, G271, G280

| NL-SAS Drive Size | Required Memory |
|-------------------|-----------------|
| 4 TB | 384 GB |
| 6 TB | 384 GB |
| 8 TB | 384 GB |
| 10 TB | 768 GB |
| 12 TB | 768 GB |
| 14 TB | 768 GB |
| 16 TB | 768 GB |
| 18 TB | 768 GB |

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

Table 12. Memory selection

| Memory selection | Quantity | Feature code | Description |
|------------------|----------|--------------|---|
| 192 GB | 12 | B4H2 | ThinkSystem 16GB TruDDR4 2933 MHz (2Rx8 1.2V) RDIMM |
| 384 GB | 12 | B4H3 | ThinkSystem 32GB TruDDR4 2933 MHz (2Rx4 1.2V) RDIMM |
| 768 GB | 24 | B4H3 | ThinkSystem 32GB TruDDR4 2933 MHz (2Rx4 1.2V) RDIMM |
| 1536 GB | 24 | B4H4 | ThinkSystem 64GB TruDDR4 2933 MHz (4Rx4 1.2V) RDIMM |

Internal storage

The SR650 servers have two internal hot-swap drives, configured as a RAID-1 pair and connected to a RAID 930-8i adapter with 2GB of flash-backed cache.

Table 13. Internal drive bay configurations

| Feature code | Description | Quantity |
|--------------|---|----------|
| AUNJ | ThinkSystem RAID 930-8i 2GB Flash PCIe 12Gb Adapter | 1 |
| AULY | ThinkSystem 2.5" 300GB 10K SAS 12Gb Hot Swap 512n HDD | 2 |

Network adapter

The following table lists the adapters that are available for use for cluster fabric.

Table 14. Network adapter options

| Part number | Feature code | Port count and speed | Description |
|-------------|--------------|----------------------|--|
| 01GR250 | AUAJ | 2x 25 GbE | Mellanox ConnectX-4 Lx 2x25GbE SFP28 Adapter |
| 7ZT7A00500 | AUVG | 2x 40 GbE/FDR | Mellanox ConnectX-4 PCIe FDR 2-Port QSFP VPI Adapter |
| 4C57A14178 | B4RA | 2x 100 GbE/HDR100 | Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter |
| 00WE027 | AU0B | 1x 100 Gb OPA | Intel OPA 100 Series Single-port PCIe 3.0 x16 HFA |

For details about these adapters, see the following product guides:

- Mellanox ConnectX-4 Adapter, <https://lenovopress.com/lp0098>
- Intel Omni-Path Architecture 100 Series HFA, <https://lenovopress.com/lp0550>

The transceivers and optical cables, or the DAC cables needed to connect the adapters to the customer-supplied network switches can be configured together with the system in x-config. Consult the product guides for the adapters for details.

SR630 configuration

The Lenovo DSS-G configurations described in this product guide use the ThinkSystem SR630 server, which features the Intel Xeon Scalable Family processors. Details about the configurations are in the [Specifications](#) section.

Memory

The DSS-G offerings allow four different memory configurations for the SR630 servers

- 192 GB using 12x 16 GB TruDDR4 RDIMMs (6 DIMMs per CPU, 1 DIMM per memory channel)
- 384 GB using 12x 32 GB TruDDR4 RDIMMs (6 DIMMs per CPU, 1 DIMM per memory channel)
- 768 GB using 24x 32 GB TruDDR4 RDIMMs (12 DIMMs per CPU, 2 DIMMs per memory channel)
- 1536 GB using 24x 64 GB TruDDR4 RDIMMs (12 DIMMs per CPU, 2 DIMMs per memory channel)

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

Table 15. Memory selection

| Memory selection | Quantity | Feature code | Description |
|------------------|----------|--------------|--|
| 192 GB | 12 | B4H2 | ThinkSystem 16GB TruDDR4 2933 MHz (2Rx8 1.2V) RDIMM |
| 384 GB | 12 | B4H3 | ThinkSystem 32GB TruDDR4 2933 MHz (2Rx4 1.2V) RDIMM |
| 768 GB | 24 | B4H3 | ThinkSystem 32GB TruDDR4 2933 MHz (2Rx4 1.2V) RDIMM |
| 1536 GB | 24 | B4H4 | ThinkSystem 64GB TruDDR4 2933 MHz (4Rx4 1.2V) LRDIMM |

Internal storage

DSS-G base model G100 also supports up to eight NVMe drives for local storage. The following table lists the NVMe drives that are supported in the G100 configuration.

Table 16. Supported NVMe drives in the SR630 (Model G100)

| Feature code | Description | Quantity supported |
|---|---|--------------------|
| 2.5-inch hot-swap SSDs - Performance U.2 NVMe PCIe | | |
| AUMJ | ThinkSystem U.2 Intel P4800X 375GB Performance NVMe PCIe 3.0 x3 HS SSD | Up to 8 |
| B2ZJ | ThinkSystem U.2 Intel P4800X 750GB Performance NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| 2.5-inch hot-swap SSDs - Mainstream U.2 NVMe PCIe | | |
| AUUY | ThinkSystem 2.5" PX04PMB 960GB Mainstream 2.5" NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| AUMF | ThinkSystem 2.5" PX04PMB 1.92TB Mainstream 2.5" NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B589 | ThinkSystem U.2 Intel P4610 1.6TB Mainstream NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58A | ThinkSystem U.2 Intel P4610 3.2TB Mainstream NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58B | ThinkSystem U.2 Intel P4610 6.4TB Mainstream NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| 2.5-inch hot-swap SSDs - Entry U.2 NVMe PCIe | | |
| B34N | ThinkSystem U.2 PM983 1.92TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B34P | ThinkSystem U.2 PM983 3.84TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B4D3 | ThinkSystem U.2 PM983 7.68TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58F | ThinkSystem U.2 Intel P4510 1TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58G | ThinkSystem U.2 Intel P4510 2TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58H | ThinkSystem U.2 Intel P4510 4TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |
| B58J | ThinkSystem U.2 Intel P4510 8TB Entry NVMe PCIe 3.0 x4 HS SSD | Up to 8 |

Network adapter

The SR630 server for the DSS-G100 configuration has the following Ethernet interfaces:

- Two or four 1 and 10 GbE ports with RJ-45 connectors (10GbBaseT) or 10GbE with SFP+ connectors

via a LOM adapter

- One 10/100/1000 Mb Ethernet systems management port with an RJ-45 connector

In addition, the following table lists the adapters that are available for use for cluster traffic.

Table 17. Network adapter options

| Part number | Feature code | Port count and speed | Description |
|--------------------|---------------------|-----------------------------|--|
| 4C57A14178 | B4RA | 2x 100 GbE/HDR100 | Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter |

The transceivers and optical cables, or the DAC cables needed to connect the adapters to the customer-supplied network switches can be configured together with the system in x-config. Consult the product guides for the adapters for details.

Cluster network

The Lenovo DSS-G offering connects as a storage block to the customer's Spectrum Scale cluster network using the high-speed network adapters installed in the servers. Each pair of servers has two or three network adapters, which are either Ethernet, InfiniBand or Omni-Fabric Architecture (OPA). Each DSS-G storage block connects to the cluster network.

In concert with the cluster network is the xCAT management network. In lieu of a customer-supplied management network, the Lenovo DSS-G offering includes a ThinkSystem SR630 server running xCAT and a Mellanox AS4610 48-port Gigabit Ethernet switch.

These components are shown in the following figure.

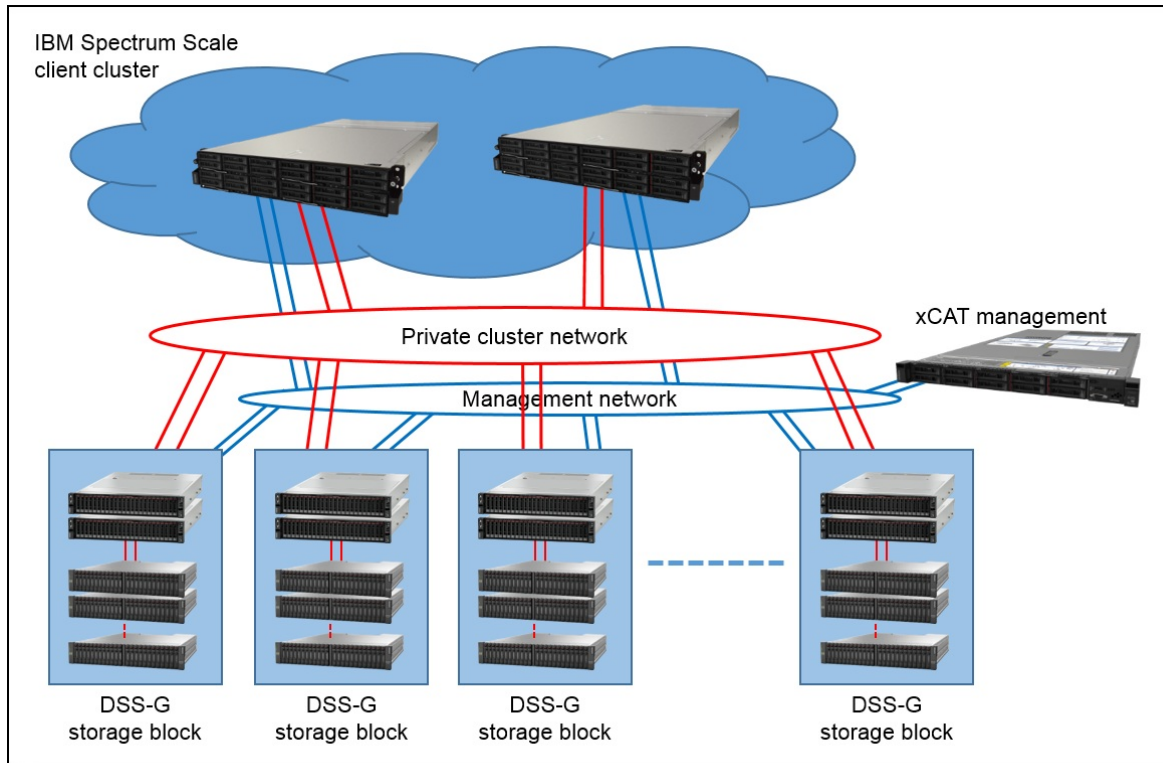


Figure 8. Lenovo DSS-G storage blocks in a Spectrum Scale client network

Red Hat Enterprise Linux

The SR650 and SR630 servers run Red Hat Enterprise Linux which is preinstalled on the RAID-1 pair of 300 GB drives installed in the servers.

Each server requires a Lenovo RHEL Premium Support subscription. The subscription provides Level 1 and Level 2 support, with 24x7 for Severity 1 situations.

Table 18. Operating system licensing

| Part number | Feature code | Description |
|---------------------|--------------|---|
| Lenovo RHEL Support | | |
| 7S0F0004WW | S0N8 | RHEL Server Physical or Virtual Node, 2 Skt Premium Subscription w/Lenovo Support 1Yr |
| 7S0F0005WW | S0N9 | RHEL Server Physical or Virtual Node, 2 Skt Premium Subscription w/Lenovo Support 3Yr |
| 7S0F0006WW | S0NA | RHEL Server Physical or Virtual Node, 2 Skt Premium Subscription w/Lenovo Support 5Yr |

IBM Spectrum Scale licensing

DSS-G can be configured with two types of license models:

- Per Disk/Flash Drive
The number of licenses needed is based on the total number of HDDs and SSDs in the drive enclosures (excluding the logTip SSDs) and will be derived automatically by the configurator.

This License model is available for the Data Access Edition and the Data Management Edition.
- Per managed capacity
The number of licenses needed is based on the storage capacity being managed in an IBM Spectrum Scale cluster and will also be derived automatically by the configurator based on the selection of parity level made. The storage capacity to be licensed is the capacity in Tebibytes (TiB) from all Network Shared Disk (NSDs) in the IBM Spectrum Scale cluster after applying IBM Spectrum Scale RAID. The capacity to be licensed is not affected by using functions such as replication or compression or by doing tasks such as creating or deleting files, file systems, or snapshots.

This License model is available for the Data Access Edition, the Data Management Edition, and the Erasure Code Edition.

Each of these is offered in 1, 3, 4 and 5-year support periods. The total number of Spectrum Scale licenses needed will be split between the two DSS-G servers. Half will appear on one server and half will appear on the other server. The license however relates to the total solution and storage drives/capacity within.

Table 19. IBM Spectrum Scale licensing

| Description | Part number | Feature code |
|---|-------------|--------------|
| IBM Spectrum Scale -- licensed per Disk/Flash Drive | | |
| Spectrum Scale for Lenovo Storage Data Management Edition per Disk Drive w/1Yr S&S | None | AVZ7 |
| Spectrum Scale for Lenovo Storage Data Management Edition per Disk Drive w/3Yr S&S | None | AVZ8 |
| Spectrum Scale for Lenovo Storage Data Management Edition per Disk Drive w/4Yr S&S | None | AVZ9 |
| Spectrum Scale for Lenovo Storage Data Management Edition per Disk Drive w/5Yr S&S | None | AVZA |
| Spectrum Scale for Lenovo Storage Data Management Edition per Flash Drive w/1Yr S&S | None | AVZB |
| Spectrum Scale for Lenovo Storage Data Management Edition per Flash Drive w/3Yr S&S | None | AVZC |
| Spectrum Scale for Lenovo Storage Data Management Edition per Flash Drive w/4Yr S&S | None | AVZD |
| Spectrum Scale for Lenovo Storage Data Management Edition per Flash Drive w/5Yr S&S | None | AVZE |
| Spectrum Scale for Lenovo Storage Data Access Edition per Disk Drive w/1Yr S&S | None | S189 |
| Spectrum Scale for Lenovo Storage Data Access Edition per Disk Drive w/3Yr S&S | None | S18A |
| Spectrum Scale for Lenovo Storage Data Access Edition per Disk Drive w/4Yr S&S | None | S18B |
| Spectrum Scale for Lenovo Storage Data Access Edition per Disk Drive w/5Yr S&S | None | S18C |
| Spectrum Scale for Lenovo Storage Data Access Edition per Flash Drive w/1Yr S&S | None | S18D |
| Spectrum Scale for Lenovo Storage Data Access Edition per Flash Drive w/3Yr S&S | None | S18E |
| Spectrum Scale for Lenovo Storage Data Access Edition per Flash Drive w/4Yr S&S | None | S18F |
| Spectrum Scale for Lenovo Storage Data Access Edition per Flash Drive w/5Yr S&S | None | S18G |
| IBM Spectrum Scale -- licensed per managed capacity | | |
| Spectrum Scale Data Management Edition per TiB w/1Yr S&S | None | AVZ3 |
| Spectrum Scale Data Management Edition per TiB w/3Yr S&S | None | AVZ4 |
| Spectrum Scale Data Management Edition per TiB w/4Yr S&S | None | AVZ5 |
| Spectrum Scale Data Management Edition per TiB w/5Yr S&S | None | AVZ6 |
| Spectrum Scale Data Access Edition per TiB w/1Yr S&S | None | S185 |
| Spectrum Scale Data Access Edition per TiB w/3Yr S&S | None | S186 |
| Spectrum Scale Data Access Edition per TiB w/4Yr S&S | None | S187 |
| Spectrum Scale Data Access Edition per TiB w/5Yr S&S | None | S188 |
| Spectrum Scale Erasure Code Edition per TiB w/1Yr S&S | None | S2D0 |
| Spectrum Scale Erasure Code Edition per TiB w/3Yr S&S | None | S2D1 |
| Spectrum Scale Erasure Code Edition per TiB w/4Yr S&S | None | S2D2 |
| Spectrum Scale Erasure Code Edition per TiB w/5Yr S&S | None | S2D3 |

Additional licensing information:

- No additional licenses (for example, client or server) are needed for Spectrum Scale for DSS. Only licenses based on the number of drives (non-logtip) or capacity in TebiBytes (TiB) after applying IBM

Spectrum Scale RAID are needed.

- Capacity licensing is measured on Binary format (1 TiB = 2^{40} Bytes), which means that you must multiply the nominal Decimal format (1TB = 10^{12} Bytes) chosen by drive vendors with 0.9185 to get to the actual capacity to be licensed. For DSS-G the Lenovo configurator will take care of that for you.
- For non-DSS Lenovo storage in the same Cluster (for example, separated metadata on traditional controller-based storage), you have the same options of capacity-based per Disk/Flash drive or per TiB licenses.
- It is not supported to mix Data Access Edition and Data Management Edition licensing within a cluster.
- You can expand a Data Access Edition or a Data Management Edition cluster with Erasure Code Edition systems. The limitations of Data Access Edition features apply if expanding a Data Access Edition cluster.
- Disk/Flash drive-based Spectrum Scale licenses can only be transferred from the existing Lenovo storage solution that is being decommissioned and re-used on its equivalent future or replacement Lenovo storage solution.
- Existing capacity licenses through for example an Enterprise License Agreement with IBM can be applied to Lenovo DSS-G after providing Proof of Entitlement. While Lenovo provides the solution level support, software support needs to be requested from IBM directly in such a case.

LeSI factory integration for DSS-G

Lenovo manufacturing implements a robust testing and integration program to insure LeSI components are fully operational when shipped out of the factory. In addition to the standard component level validation performed on all hardware components produced by Lenovo, LeSI performs rack level testing to verify that the LeSI cluster operates as a solution. The rack level testing and validation includes the following:

- Performing a power on test. Assure device power is present, with no error indicators
- Set up RAID (when required)
- Set up storage devices and verify functionality
- Validate network connectivity and functionality
- Verify functionality of server hardware, network infrastructure, and server configuration correctness. Verify health of components
- Configure all devices per Best Recipe software settings
- Perform stress testing of server CPU and memory via software and power cycling
- Data collection for quality records and test results

LeSI onsite installation for DSS-G

Lenovo experts will manage the physical installation of your pre-integrated Racks so you can quickly benefit from your investment. Working at a time convenient to you, the technician will unpack and inspect the systems at your site, finalize the cabling, verify operation, and dispose of the packaging at the on-site location.

Any racked EveryScale solution comes with this basic Lenovo Hardware Installation services included, automatically sized and configured based on the solution scope detailed in the [Lenovo EveryScale Hardware Installation Statement of Work](#).

Table 20. Lenovo EveryScale onsite installation

| Part number | Description | Purpose |
|-------------|--|--|
| 5AS7B07693 | Lenovo EveryScale Rack Setup Services | Base service per rack |
| 5AS7B07694 | Lenovo EveryScale Basic Networking Services | Service per device cabled out of the rack with 12 or less cables |
| 5AS7B07695 | Lenovo EveryScale Advanced Networking Services | Service per device cabled out of the rack with more than 12 cables |

Customized installation services beyond the basic Lenovo Hardware Installation services are also available to meet the specific needs of the client and for solutions with Client Site Integration Kit.

Before installation, the client should complete the following steps to ensure the hardware will be successfully installed:

- Backing up the data being migrated to the new hardware
- Ensuring the new hardware is available and in place
- Assign a technical lead to act as liaison with Lenovo, who can coordinate access to other resources if required
- Designated data center location has the required power and cooling in place to support purchased solution
- Providing a safe workspace and appropriate access for the technician

Once the client is ready, an expert technician will perform the basic Lenovo Hardware Installation services. This process will include the following:

- Verify receipt and condition of all rack(s) and components
- Verify the client environment is ready for consequent installation
- Unpack and visually inspect hardware for damage
- Place rack(s) and complete installation and inter-rack cabling as specified by the solution configuration
- Connect the equipment to customer-supplied power
- Ensure the equipment is operational: Power on equipment, check for green lights and obvious issues
- Remove packaging and other waste materials to the customer designated dumpster
- Provide completion form for customer to authorize
- If a hardware failure occurs during the installation, service call will be opened.

Additional client requirements beyond the basic Lenovo Hardware Installation services scope, can be offered with customized installation services sized specifically to the client's needs.

To get operational a final onsite software installation and configuration for the specific environment is required. Lenovo can also provide comprehensive onsite configuration of software, including integration and validation for operating systems and software, virtualization and high-availability configurations.

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

Client Site Integration Kit onsite installation

Besides shipping fully integrated into the Lenovo 1410 rack cabinet, DSS-G solution gives clients the choice of shipping with the Lenovo Client Site Integration Kit (7X74) which allows clients to have Lenovo or a business partner install the solution in a rack of their own choosing. The Lenovo Client Site Integration Kit enables clients to gain the interoperability warranty benefit of an integrated DSS-G solution while also providing them flexibility in custom-fitting into the client datacenter.

With the Lenovo Client Site Integration Kit, the DSS-G solution is built and tested at the rack level in Lenovo manufacturing just like described for factory integration above. Afterwards it is disassembled again, and Servers, switches and other items are packaged in individual boxes with a ship group box for cables, publications, labeling, and other rack documentation. Clients are required to purchase installation services from Lenovo or a business partner for the physical setup. The installation team will install the solution at the customer site into the customer provided rack per racking diagrams and point-to-point instructions.

To get operational a final onsite software installation and configuration for the specific environment is required. Lenovo can also provide comprehensive onsite configuration of software, including integration and validation for operating systems and software, virtualization and high-availability configurations.

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

Operating environment

Lenovo Distributed Storage Solution for Spectrum Scale does fully comply with ASHRAE class A2 specifications for the air-cooled data center. Please find more details in the product guides of the individual components.

- Air temperature:
 - Operating:
 - ASHRAE Class A2: 10 °C - 35 °C (50 °F - 95 °F); for altitudes above 900 m (2,953 ft), decrease the maximum ambient temperature by 1 °C for every 300-m (984-ft) increase in altitude
 - Non-operating: 5 °C - 45 °C (41 °F - 113 °F)
 - Storage: -40 °C - +60 °C (-40 °F - 140 °F)
- Maximum altitude: 3,050 m (10,000 ft)
- Humidity:
 - Operating:
 - ASHRAE Class A2: 8% - 80% (non-condensing); maximum dew point: 21 °C (70 °F)
 - Storage: 8% - 90% (non-condensing)
- Electrical:
 - 100 - 127 (nominal) V AC; 50 Hz / 60 Hz
 - 200 - 240 (nominal) V AC; 50 Hz / 60 Hz

Regulatory compliance

Lenovo Distributed Storage Solution for Spectrum Scale adopts the conformity of its individual components to international standards, which for the server and storage enclosures are listed below:

SR650 / SR630

- United States: FCC Part 15, Class A; UL 60950-1
- Canada: ICES-003/NMB-03, Class A; CAN/CSA-C22.2 60950-1
- Mexico: NOM-19
- Argentina: IEC60950-1
- European Union: CE Mark (EN55022 Class A, IEC/EN60950-1, EN55024, EN61000-3-2, EN61000-3-3)
- Germany: TUV-GS (IEC/EN 60950-1, EK1-ITB2000)
- Russia, Kazakhstan, Belarus: EAC (TR CU 004/2011, TR CU 020/2011)
- China: CCC GB4943.1, GB9254 Class A, GB17625.1
- India: BIS
- Japan: VCCI, Class A
- Taiwan: BSMI CNS13438, Class A; CNS14336-1
- Korea: KN22, Class A; KN24
- Australia/New Zealand: AS/NZS CISPR 22 Class A
- Reduction of Hazardous Substances (ROHS)
- Energy Star 3.0 (excluding configurations with Bronze 3204, Gold 5222, or Platinum 8256 processors)

D1224 / D3284

- BSMI CNS 13438, Class A; CNS 14336 (Taiwan)
- CCC GB 4943.1, GB 17625.1, GB 9254 Class A (China)
- CE Mark (European Union)
- CISPR 22, Class A
- EAC (Russia)
- EN55022, Class A
- EN55024
- FCC Part 15, Class A (United States)
- ICES-003/NMB-03, Class A (Canada)
- IEC/EN60950-1
- D1224: KC Mark (Korea); D3284: MSIP (Korea)
- NOM-019 (Mexico)
- D3284: RCM (Australia)
- Reduction of Hazardous Substances (ROHS)
- UL/CSA IEC 60950-1
- D1224: VCCI, Class A (Japan); D3284: VCCI, Class B (Japan)

Find more details on the regulatory compliance for the individual components in their respective product guides.

Warranty

LeSI exclusive components (Machine Types 1410, 7X74, 0724, 0449, 7D5F; for the other Hardware and Software components configured within LeSI their respective warranty terms apply) have a three-year customer replaceable unit (CRU) and onsite limited (for field-replaceable units (FRUs) only) warranty with standard call center support during normal business hours and 9x5 Next Business Day Parts Delivered.

Some markets might have different warranty terms and conditions than the standard warranty. This is due to local business practices or laws in the specific market. Local service teams can assist in explaining market-specific terms when needed. Examples of market-specific warranty terms are second or longer business day parts delivery or parts-only base warranty.

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

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

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

- **Premier Support**

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

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

- **Warranty Upgrade (Preconfigured Support)**

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

- 3, 4, or 5 years of service coverage
- 1-year or 2-year post-warranty extensions
- **Foundation Service:** 9x5 service coverage with next business day onsite response. YourDrive YourData is an optional extra (see below).
- **Essential Service:** 24x7 service coverage with 4-hour onsite response or 24-hour committed repair (available only in select markets). Bundled with YourDrive YourData.
- **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select markets). Bundled with YourDrive YourData.

- **Managed Services**

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

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

- **Technical Account Management (TAM)**

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

- **Enterprise Server Software Support**

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

- **YourDrive YourData**

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

- **Health Check**

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

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

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

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

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

- Service part numbers in Lenovo Data Center Solution Configurator (DCSC):
<http://dcsc.lenovo.com/#!/services>
- Lenovo Services Availability Locator
<http://lenovocator.com/>

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

- [Lenovo Statement of Limited Warranty for Infrastructure Solutions Group \(ISG\) Servers and System Storage](http://pcsupport.lenovo.com/us/en/solutions/ht503310)
- [Lenovo Data Center Services Agreement](http://support.lenovo.com/us/en/solutions/ht116628)

The following tables list the warranty upgrade part numbers for each DSS-G component:

- [DSS-G NSD Server \(7X06\)](#)
- [D3284 Enclosure \(6413\)](#)
- [D1224 Enclosure \(4587\)](#)
- [1410 Rack \(1410\)](#)
- [Client Site Integration Kit \(7X74\)](#)
- [DSS-G Management Server \(7X02\)](#)
- [DSS-G Ethernet Management Switch \(7D5F\)](#)

Table 21. Warranty Upgrade Part Numbers – DSS-G NSD Server (7X06)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| DSS-G NSD Server (7X06) | | |
| Foundation Service w/Next Business Day Response, 3Yr + YourDriveYourData | 5PS7A01549 | 5PS7A35366 |
| Foundation Service w/Next Business Day Response, 4Yr + YourDriveYourData | 5PS7A01551 | 5PS7A35367 |
| Foundation Service w/Next Business Day Response, 5Yr + YourDriveYourData | 5PS7A01553 | 5PS7A35368 |
| Essential Service w/24x7 4Hr Response, 3Yr + YourDriveYourData | 5PS7A01558 | 5PS7A35386 |
| Essential Service w/24x7 4Hr Response, 4Yr + YourDriveYourData | 5PS7A01560 | 5PS7A35387 |
| Essential Service w/24x7 4Hr Response, 5Yr + YourDriveYourData | 5PS7A01562 | 5PS7A35388 |
| Advanced Service w/24x7 2Hr Response, 3Yr + YourDriveYourData | 5PS7A01576 | 5PS7A35416 |
| Advanced Service w/24x7 2Hr Response, 4Yr + YourDriveYourData | 5PS7A01578 | 5PS7A35417 |
| Advanced Service w/24x7 2Hr Response, 5Yr + YourDriveYourData | 5PS7A01580 | 5PS7A35418 |

Table 22. Warranty Upgrade Part Numbers – DSS-G G100 and DSS-G Management Server (7X02)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| DSS-G NSD Server and DSS-G Management Server (7X02) | | |
| Foundation Service w/Next Business Day Response, 3Yr | 5WS7A01486 | 5PS7A07808 |
| Foundation Service w/Next Business Day Response, 4Yr | 5WS7A01488 | 5PS7A07847 |
| Foundation Service w/Next Business Day Response, 5Yr | 5WS7A01490 | 5PS7A07910 |
| Essential Service w/24x7 4Hr Response, 3Yr + YourDriveYourData | 5PS7A01504 | 5PS7A06895 |
| Essential Service w/24x7 4Hr Response, 4Yr + YourDriveYourData | 5PS7A01506 | 5PS7A06990 |
| Essential Service w/24x7 4Hr Response, 5Yr + YourDriveYourData | 5PS7A01508 | 5PS7A07084 |
| Advanced Service w/24x7 2Hr Response, 3Yr + YourDriveYourData | 5PS7A01522 | 5PS7A06581 |
| Advanced Service w/24x7 2Hr Response, 4Yr + YourDriveYourData | 5PS7A01524 | 5PS7A06628 |
| Advanced Service w/24x7 2Hr Response, 5Yr + YourDriveYourData | 5PS7A01526 | 5PS7A06672 |

Table 23. Warranty Upgrade Part Numbers – D3284 Enclosure (6413)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| DSS-G D3284 Enclosure (6413) | | |
| Foundation Service w/Next Business Day Response, 3Yr + YourDriveYourData | 01JY529 | 5PS7A07844 |
| Foundation Service w/Next Business Day Response, 4Yr + YourDriveYourData | 01JY537 | 5PS7A07907 |
| Foundation Service w/Next Business Day Response, 5Yr + YourDriveYourData | 01JY545 | 5PS7A07974 |
| Essential Service w/24x7 4Hr Response, 3Yr + YourDriveYourData | 01JY533 | 5PS7A06966 |
| Essential Service w/24x7 4Hr Response, 4Yr + YourDriveYourData | 01JY541 | 5PS7A07054 |
| Essential Service w/24x7 4Hr Response, 5Yr + YourDriveYourData | 01JY549 | 5PS7A07151 |
| Advanced Service w/24x7 2Hr Response, 3Yr + YourDriveYourData | 01JY531 | 5PS7A06607 |
| Advanced Service w/24x7 2Hr Response, 4Yr + YourDriveYourData | 01JY539 | 5PS7A06651 |
| Advanced Service w/24x7 2Hr Response, 5Yr + YourDriveYourData | 01JY547 | 5PS7A06698 |

Table 24. Warranty Upgrade Part Numbers – D1224 Enclosure (4587)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| D1224 Enclosure (4587) | | |
| Foundation Service w/Next Business Day Response, 3Yr + YourDriveYourData | 01JY572 | 5PS7A07837 |
| Foundation Service w/Next Business Day Response, 4Yr + YourDriveYourData | 01JY582 | 5PS7A07900 |
| Foundation Service w/Next Business Day Response, 5Yr + YourDriveYourData | 01JY592 | 5PS7A07967 |
| Essential Service w/24x7 4Hr Response, 3Yr + YourDriveYourData | 01JR78 | 5PS7A06959 |
| Essential Service w/24x7 4Hr Response, 4Yr + YourDriveYourData | 01JR88 | 5PS7A07047 |
| Essential Service w/24x7 4Hr Response, 5Yr + YourDriveYourData | 01JR98 | 5PS7A07144 |
| Advanced Service w/24x7 2Hr Response, 3Yr + YourDriveYourData | 01JR76 | 5PS7A06603 |
| Advanced Service w/24x7 2Hr Response, 4Yr + YourDriveYourData | 01JR86 | 5PS7A06647 |
| Advanced Service w/24x7 2Hr Response, 5Yr + YourDriveYourData | 01JR96 | 5PS7A06694 |

Table 25. Warranty Upgrade Part Numbers – 1410 Rack (1410)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| Scalable Infrastructure Rack Cabinets (1410-O42, -P42) | | |
| Foundation Service w/Next Business Day Response, 3Yr | 5WS7A92764 | 5WS7A92814 |
| Foundation Service w/Next Business Day Response, 4Yr | 5WS7A92766 | 5WS7A92816 |
| Foundation Service w/Next Business Day Response, 5Yr | 5WS7A92768 | 5WS7A92818 |
| Essential Service w/24x7 4Hr Response, 3Yr | 5WS7A92779 | 5WS7A92829 |
| Essential Service w/24x7 4Hr Response, 4Yr | 5WS7A92781 | 5WS7A92831 |
| Essential Service w/24x7 4Hr Response, 5Yr | 5WS7A92783 | 5WS7A92833 |
| Advanced Service w/24x7 2Hr Response, 3Yr | 5WS7A92794 | 5WS7A92844 |
| Advanced Service w/24x7 2Hr Response, 4Yr | 5WS7A92796 | 5WS7A92846 |
| Advanced Service w/24x7 2Hr Response, 5Yr | 5WS7A92798 | 5WS7A92848 |
| Scalable Infrastructure Rack Cabinets (1410-O48, -P48) | | |
| Foundation Service w/Next Business Day Response, 3Yr | 5WS7A92864 | 5WS7A92914 |
| Foundation Service w/Next Business Day Response, 4Yr | 5WS7A92866 | 5WS7A92916 |
| Foundation Service w/Next Business Day Response, 5Yr | 5WS7A92868 | 5WS7A92918 |
| Essential Service w/24x7 4Hr Response, 3Yr | 5WS7A92879 | 5WS7A92929 |
| Essential Service w/24x7 4Hr Response, 4Yr | 5WS7A92881 | 5WS7A92931 |
| Essential Service w/24x7 4Hr Response, 5Yr | 5WS7A92883 | 5WS7A92933 |
| Advanced Service w/24x7 2Hr Response, 3Yr | 5WS7A92894 | 5WS7A92944 |
| Advanced Service w/24x7 2Hr Response, 4Yr | 5WS7A92896 | 5WS7A92946 |
| Advanced Service w/24x7 2Hr Response, 5Yr | 5WS7A92898 | 5WS7A92948 |

Table 26. Warranty Upgrade Part Numbers – Client Site Integration Kit (7X74)

| Description | Option Part Number | |
|---|--------------------|-----------------|
| | Standard Support | Premier Support |
| Client Site Integration Kit (7X74) | | |
| Premier Support Service - 3Yr Integration Kit (DSS-G) | Not available | 5WS7A35451 |
| Premier Support Service - 4Yr Integration Kit (DSS-G) | Not available | 5WS7A35452 |
| Premier Support Service - 5Yr Integration Kit (DSS-G) | Not available | 5WS7A35453 |

Table 27. Warranty Upgrade Part Numbers – DSS-G Ethernet Management Switch (7D5FCTO1WW)

| Description | Option Part Number | |
|--|--------------------|-----------------|
| | Standard Support | Premier Support |
| Mellanox AS4610 1GbE Managed Switch (7D5F-CTO1WW, -CTO2WW) | | |
| Foundation Service w/Next Business Day Response, 3Yr | 5WS7A87780 | 5WS7A87830 |
| Foundation Service w/Next Business Day Response, 4Yr | 5WS7A87782 | 5WS7A87832 |
| Foundation Service w/Next Business Day Response, 5Yr | 5WS7A87784 | 5WS7A87834 |
| Essential Service w/24x7 4Hr Response, 3Yr | 5WS7A87795 | 5WS7A87845 |
| Essential Service w/24x7 4Hr Response, 4Yr | 5WS7A87797 | 5WS7A87847 |
| Essential Service w/24x7 4Hr Response, 5Yr | 5WS7A87799 | 5WS7A87849 |
| Advanced Service w/24x7 2Hr Response, 3Yr | 5WS7A87810 | 5WS7A87860 |
| Advanced Service w/24x7 2Hr Response, 4Yr | 5WS7A87812 | 5WS7A87862 |
| Advanced Service w/24x7 2Hr Response, 5Yr | 5WS7A87814 | 5WS7A87864 |

LeSI Interoperability Support for DSS-G

On top of their individual warranty and maintenance scope or support entitlement, LeSI offers solution-level interoperability support for HPC and AI configurations based on the above selection of Lenovo ThinkSystem portfolio and OEM components.

The extensive testing results in a “Best Recipe” release of software and firmware levels Lenovo warrants to work seamlessly together as a fully integrated data center solution instead of a collection of individual components at the time of implementation.

To see the latest Best Recipe for Scalable Infrastructure at Lenovo, see the following link:
<https://support.lenovo.com/us/en/solutions/HT505184#5>

The Solution Support is engaged by opening a hardware ticket based on the LeSI Rack (Model 1410) or LeSI Client Site Integration Kit (Model 7X74). The LeSI Support team then will triage the issue and recommend next steps for you, including potentially to open tickets with other components of the solution.

For issues that require debugging beyond hardware and firmware (Driver, UEFI, IMM/XCC) an additional ticket will have to be opened with the software vendor (e.g. Lenovo SW Support or 3rd party SW vendor) to assist working towards a fix. The LeSI Support team will then work with the SW Support team in isolating root cause and fixing the defect.

For more information about opening tickets, as well as the scope of support for different LeSI components, see the [Lenovo Scalable Infrastructure Support Plan information page](#).

When a cluster ships the most recent Best Recipe is its compliant version, which is always defined exactly for that specific Scalable Infrastructure release and the cluster is delivered as a solution of that specific release. Using a Support call clients can request a review if their solution is also compatible with a newer Best Recipe release and if it is, are able to upgrade to that while maintaining solution interoperability support.

As long as a cluster (Model 1410, 7X74) is under Lenovo warranty or maintenance entitlement, full solution interoperability support will be provided for the original Best Recipes. Even when newer Best Recipes are available the previous Recipe will remain valid and supported.

Of course, any client is free to choose to not adhere to the Best Recipe and instead deploy different software and firmware versions or integrate other components that were not tested for interoperability. While Lenovo cannot warrant interoperability with those deviations from the tested scope, a client continues to receive full break & fix support for the components based on the individual warranty and maintenance entitlement of the components. This is comparable to the level of support clients will receive when not buying it as a LeSI solution, but building the solution from individual components – so-called “roll your own” (RYO).

In those cases, to minimize risk we suggest still staying as close as possible to the Best Recipe even when deviating. We also suggest when deviating first to test it on a small portion of the cluster and only roll it out completely if this test was stable.

For clients who need to upgrade the firmware or software of a component – for example due to OS entitlement support issues or Common Vulnerabilities and Exposures (CVE) fixes – that is part of the best recipe, a support call should be placed on the 1410/7X74 rack and serial number. Lenovo product engineering will review the proposed changes, and advise the client on the viability of an upgrade path. If an upgrade can be supported and is performed, LeSI will note the change in the support records for the solution.

Services

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

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

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

- **Asset Recovery Services**

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

- **Assessment Services**

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

- **Design Services**

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

- **Basic Hardware Installation**

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

- **Deployment Services**

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

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

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

- **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.

Installation Services

To get operational a final onsite software installation and configuration for the specific environment is required. Five days of Lenovo Professional Services are included by default with the DSS-G solutions to get customers up and running quickly. This selection can be removed if so desired when for example an experienced channel partner of Lenovo will provide those services.

Services are tailored to the customer need and typically include:

- Conduct a preparation and planning call
- Configure xCAT on the SR630 quorum/management server
- Verify, and update if needed, firmware and software versions to implement the DSS-G
- Configure the network settings specific to the customer environment for
 - XClarity Controller (XCC) service processors on the SR650 and SR630 servers
 - Red Hat Enterprise Linux on the SR650 and SR630 servers
- Configure IBM Spectrum Scale on the DSS-G servers
- Create file and exporting systems from the DSS-G storage
- Provide skills transfer to customer personnel
- Develop post-installation documentation describing the specifics of the firmware/software versions and network and file system configuration work that was done

Table 28. HPC Professional Services Part Numbers

| Part number | Description |
|------------------------------|--|
| Lenovo Professional Services | |
| 5MS7A85671 | HPC Technical Consultant Hourly Unit (Remote) |
| 5MS7A85672 | HPC Technical Consultant Labor Unit (Remote) |
| 5MS7A85673 | HPC Technical Consultant Hourly Unit (Onsite) |
| 5MS7A85674 | HPC Technical Consultant Labor Unit (Onsite) |
| 5MS7A85675 | HPC Principal Consultant Hourly Unit (Remote) |
| 5MS7A85676 | HPC Principal Consultant Labor Unit (Remote) |
| 5MS7A85677 | HPC Principal Consultant Hourly Unit (Onsite) |
| 5MS7A85678 | HPC Principal Consultant Labor Unit (Onsite) |
| 5MS7A85679 | HPC Technical Consultant Services Bundle (Small) |
| 5MS7A85680 | HPC Technical Consultant Services Bundle (Medium) |
| 5MS7A85681 | HPC Technical Consultant Services Bundle (Large) |
| 5MS7A85682 | HPC Technical Consultant Services Bundle (Extra Large) |

Lenovo Financial Services

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

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

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

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

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

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

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

Related publications and links

For more information, see these resources:

- Lenovo DSS-G product page
<https://www.lenovo.com/us/en/data-center/servers/high-density/Distributed-Storage-Solution-for-IBM-Spectrum-Scale/p/WMD00000275>
- Lenovo high-density offerings page
<https://www.lenovo.com/us/en/c/data-center/servers/high-density>
- Paper, "DSS-G Declustered RAID Technology and Rebuild Performance"
<https://lenovopress.com/lp1227-dss-g-declustered-raid-technology-and-rebuild-performance>
- ThinkSystem SR650 Product Guide
<https://lenovopress.com/LP0644>
- Thinksystem SR630 Product Guide
<https://lenovopress.com/LP0643>
- x-config configurator:
<https://lesc.lenovo.com/products/hardware/configurator/worldwide/bhui/asit/index.html>
- Lenovo DSS-G datasheet:
<https://lenovopress.com/DS0026>

Related product families

Product families related to this document are the following:

- [2-Socket Rack Servers](#)
- [Direct-Attached Storage](#)
- [High Performance Computing](#)
- [IBM Alliance](#)
- [Software-Defined Storage](#)

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 2024. All rights reserved.

This document, LP0837, was created or updated on November 29, 2021.

Send us your comments in one of the following ways:

- Use the online Contact us review form found at:
<https://lenovopress.lenovo.com/LP0837>
- Send your comments in an e-mail to:
comments@lenovopress.com

This document is available online at <https://lenovopress.lenovo.com/LP0837>.

Trademarks

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

The following terms are trademarks of Lenovo in the United States, other countries, or both:

Lenovo®
AnyBay®
Lenovo Services
ThinkSystem®
TruDDR4
XClarity®

The following terms are trademarks of other companies:

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

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

Microsoft® is a trademark of Microsoft Corporation in the United States, other countries, or both.

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