Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) (System x based) User Guide

Contents

Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) (System x based)

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 the Lenovo x3650 M5 servers, Lenovo D1224 and D3284 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 solution that dramatically reduces time-to-value and total cost of ownership (TCO). All DSS-G base offerings, except for the DSS-G100, are built on Lenovo System x3650 M5 servers with Intel Xeon E5-2600 v4 series processors, 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 DSS-G100 base offering uses the ThinkSystem SR650 as the server with up to eight NVMe drives and no storage enclosures.

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 BigData.

Did you know?

The DSS-G solution gives you the choice of shipping fully integrated into the Lenovo 1410 rack cabinet, or with the Lenovo Client Site Integration Kit, 7X74, which allows you to have Lenovo install the solution in a rack of your own choosing. In either case, the solution is tested, configured, and ready to be plugged in and turned on; it is designed to integrate into an existing infrastructure effortlessly, to dramatically accelerate time to value and reduce infrastructure maintenance costs.

Lenovo DSS-G is licensed by the number of drives installed, 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 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.

Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) (System x based) (withdrawn product)

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:

All DSS-G base models except DSS-G100:

- Two Lenovo System x3650 M5 servers
- Choice of direct-attach storage enclosures – either D1224 or D3284 enclosures
    - 1, 2, 4, or 6 Lenovo Storage D1224 Drive Enclosures each holding 24x 2.5-inch HDDs or SSDs
    - 2, 4, or 6 Lenovo Storage D3284 External High Density Drive Expansion Enclosure, each holding 84x 3.5-inch HDDs

DSS-G base model G100:

- One Lenovo ThinkSystem SR650
- A minimum of 4 and a maximum of 8x 2.5-inch NVMe drives
- Red Hat Enterprise Linux
- IBM Spectrum Scale for DSS Standard Edition for Flash or Data Management Edition for Flash

Installed and cabled in the factory in a 42U 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 an x3550 M5 server and RackSwitch G7028 Gigabit Ethernet switch

Figure 2. Lenovo System x3650 M5 (servers used in DSS-G solution only have two internal drives, for use as boot drives)

Lenovo System x3650 M5 servers have the following key features:

- Superior system performance with two Intel Xeon E5-2690 v4 processors, each with 14 cores, 35 MB cache and a core frequency of 2.6 GHz
- DSS-G configurations of 128 GB, 256 GB, or 512 GB memory using TruDDR4 RDIMMs operating at 2400 MHz
- Special High Performance I/O (HPIO) system board and riser cards to maximize bandwidth to the high-speed network adapters, with two PCIe 3.0 x16 slots and five PCIe 3.0 x8 slots.
- Choice of high-speed network connectivity: 100 GbE, 40 GbE, 10 GbE, FDR or EDR InfiniBand or 100 Gb Omni-Path Architecture (OPA).
- Connections to the D1224 or D3284 storage enclosures using 12Gb SAS host bus adapters (HBAs), with two SAS connections to every storage enclosure, forming a redundant pair.
- Integrated Management Module II (IMM2.1) service processor to monitor server availability and perform remote management.
- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Integrated Management Module with Advanced Upgrade to enable the remote presence and blue-screen capture features
- Integrated Trusted Platform Module (TPM) enables advanced cryptographic functionality such as digital signatures and remote attestation.
- High-efficiency power supplies with 80 PLUS Platinum and Energy Star 2.0 certifications.

For more information about the x3650 M5 server, see the Lenovo Press product guide:
https://lenovopress.com/lp0068

Lenovo Storage D1224 Drive Enclosures

Figure 3. 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 4. 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.

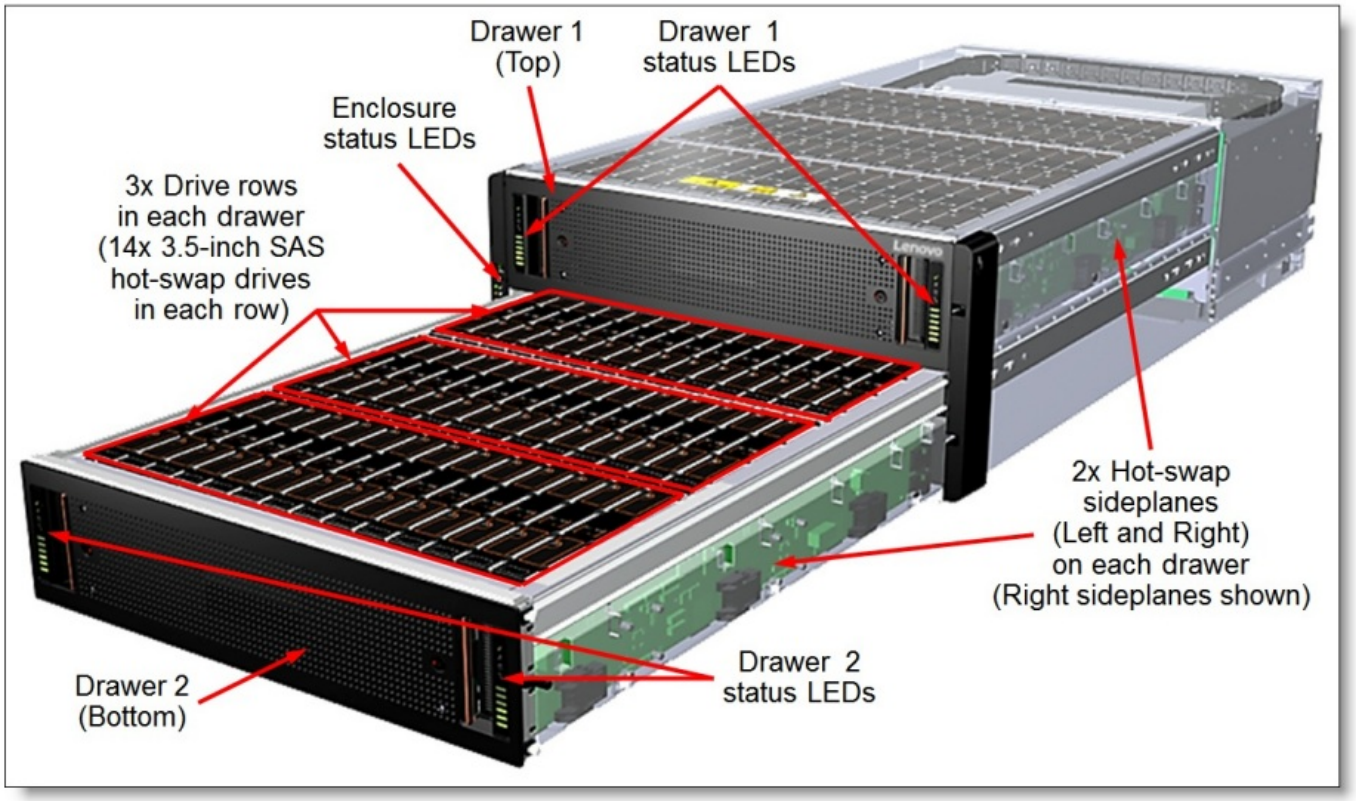


Figure 5. Front view of the D3284 drive enclosure

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 x3550 M5 server and RackSwitch G7028 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 Lenovo RackSwitch 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.

Lenovo ThinkSystem SR650 servers

Figure 6. Lenovo ThinkSystem SR650 servers
Lenovo System SR650 servers have the following key features needed for the DSS-G100 base configuration:

- 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.
- The SR650 server offers numerous features to boost performance, improve scalability, and reduce costs:
- 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 2666
- 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.
- Intelligent and adaptive system performance with energy efficient Intel Turbo Boost 2.0 Technology allows CPU cores to run at maximum speeds during peak workloads by temporarily going beyond processor thermal design power (TDP).
- Intel Hyper-Threading Technology boosts performance for multithreaded applications by enabling simultaneous multithreading within each processor core, up to two threads per core.
- Intel Virtualization Technology integrates hardware-level virtualization hooks that allow operating system vendors to better utilize the hardware for virtualization workloads.
- Intel Advanced Vector Extensions 512 (AVX-512) enable acceleration of enterprise-class and high performance computing (HPC) workloads.
- Helps maximize system performance for data intensive applications with up to 2666 MHz memory speeds and up to 1.5 TB of memory capacity (support for up to 3 TB is planned for the future).
- 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 flexibility to use SAS, SATA, or NVMe PCIe drives in the same drive bays with a unique AnyBay

design.

- 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.

IBM Spectrum Scale features

IBM Spectrum Scale, the follow-on to IBM GPFS, is a high-performance solution for managing data at scale with the distinctive ability to perform archive and analytics in place.
IBM Spectrum Scale has the following features:

- Uses Declustered RAID, where data and parity information as well as Spare Capacity is distributed across all disks
- Rebuilds with Declustered RAID are faster:
  - Traditional RAID would have one LUN fully busy resulting in slow rebuild and high impact overall
  - Declustered RAID rebuild activity spreads the load across many disks resulting in faster rebuild and less disruption to user programs
  - Declustered RAID minimizes critical data exposed to data loss in case of a second failure.
- 2-fault / 3-fault tolerance and mirroring: 2- or 3-fault-tolerant Reed-Solomon parity encoding as well as 3- or 4-way mirroring provides data integrity, reliability and flexibility
- End-to-end checksum:
  - Helps detect and correct off-track I/O and dropped writes
  - Disk surface to GPFS user/client provides information to help detect and correct write or I/O errors
- Disk hospital – asynchronous, global error diagnosis:
  - If there is a media error, information provided helps in verifying and restoring a media error. If there is a path problem, information can be used to attempt alternate paths.
  - Disk tracking information helps track disk service times, which is useful in finding slow disks so they can be replaced.
- Multipathing: Performed automatically by Spectrum Scale, so no multipath driver is needed. Supports a variety of file I/O protocols:
  - POSIX, GPFS, NFS v4.0, SMB v3.0
  - Big data and analytics: Hadoop MapReduce
  - Cloud: OpenStack Cinder (block), OpenStack Swift (object), S3 (object)
- Supports cloud object storage:
  - IBM Cloud Storage System (Cleversafe) Amazon S3
  - IBM SoftLayer Native Object OpenStack Swift
  - Amazon S3 compatible providers

Lenovo DSS-G supports two editions of IBM Spectrum Scale, RAID Standard Edition and Data Management Edition. A comparison of these two editions is shown in the following table.
Table 1. IBM Spectrum Scale feature comparison

Feature	DSS Standard Edition	DSS Data Management Edition
Erasure coding with disk hospital for efficient use of storage hardware	Yes	Yes
Multi-protocol scalable file service with simultaneous access to a common set of data	Yes	Yes
Facilitate data access with a global namespace, massively scalable file system, quotas and snapshots, data integrity & availability	Yes	Yes
Simplify management with GUI	Yes	Yes
Improved efficiency with QoS and Compression	Yes	Yes
Create optimized tiered storage pools by grouping disks based on performance, locality, or cost	Yes	Yes
Simplify data management with Information Lifecycle Management (ILM) tools that include policy based data placement and migration	Yes	Yes
Enable worldwide data access and empower global collaboration using AFM asynchronous replication	Yes	Yes
Asynchronous multi-site Disaster Recovery	No	Yes
Protect data with native encryption and secure erase, NIST compliant and FIPS certified.	No	Yes
Hybrid cloud storage stores cool data in low cost cloud storage while retaining metadata	No	Yes
Future non-HPC File and Object functions beginning with Spectrum Scale v4.2.3	No	Yes

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:**
- **http://ibm.com/systems/storage/spectrum/scale/**
- **IBM Spectrum Scale FAQ:**
- **https://www.ibm.com/support/knowledgecenter/en/STXKQY/gpfsclustersfaq.html**

Components

The following figure shows two of the configurations available, the G206 (2x x3650 M5 and 6x D1224) and the G240 (2x x3650 M5 and 4x D3284). See the Models section for all available configurations.

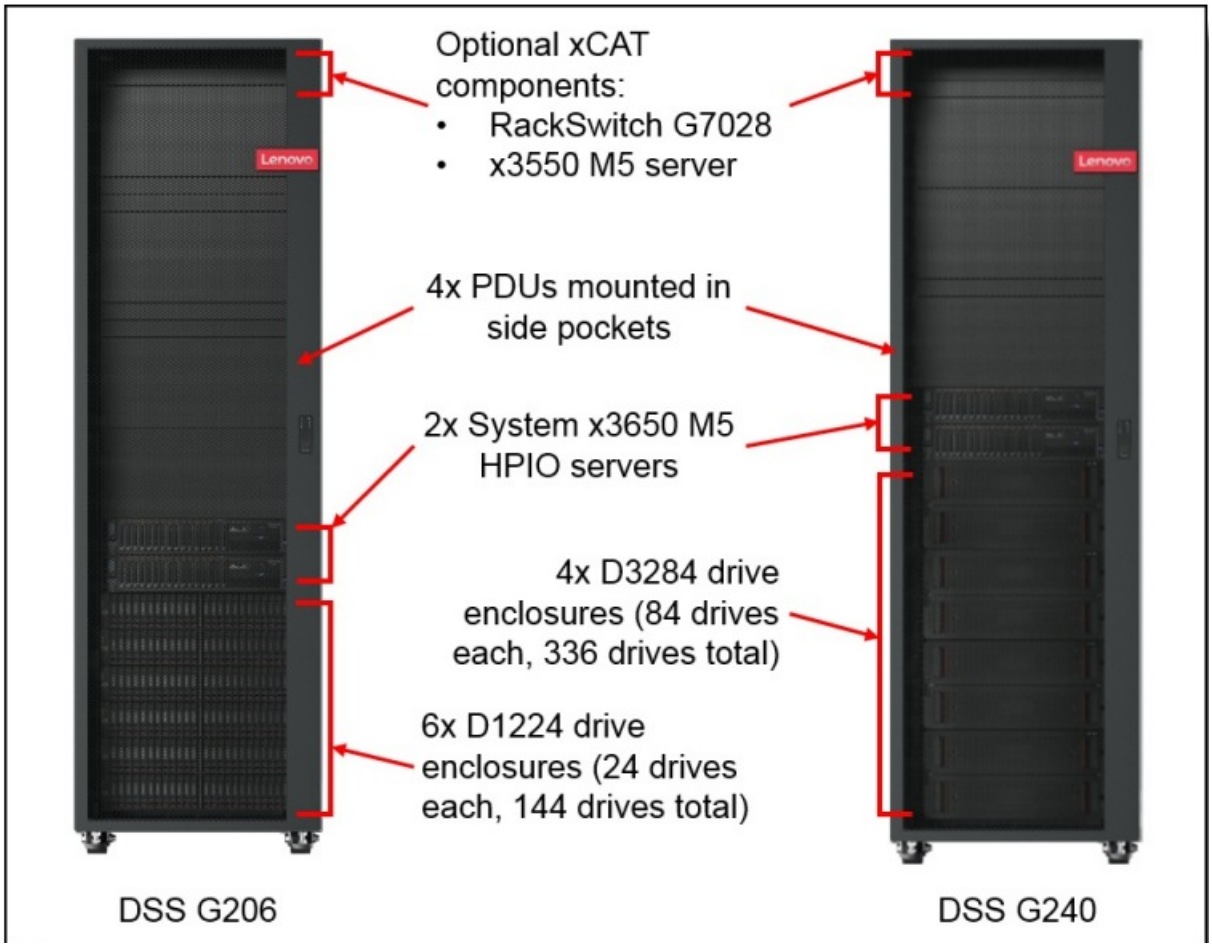


Figure 7. DSS-G components

Specifications

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

- x3650 M5 server specifications
- SR650 server specifications
- D1224 External Enclosure specifications D3284 External Enclosure specifications Rack cabinet specifications
- Optional management components

x3650 M5 server specifications
The following table lists the system specifications for the x3650 M5 servers used in the DSS-G configurations.

Table 2. System specifications – x3650 M5 servers

Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers

Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers

Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers
Table 2. System specifications – x3650 M5 servers	Table 2. System specifications – x3650 M5 servers

Components	**Specification**
I/O expansion slots	Eight slots active with two processors installed. Slots 4, 5, and 9 are the fixed slots on the system planar, and the remaining slots are located on the riser cards installed. Slot 2 is not present. The slots are as follows: Slot 1: PCIe 3.0 x16 (networking adapter) Slot 2: *Not present* Slot 3: PCIe 3.0 x8 (unused) Slot 4: PCIe 3.0 x8 (networking adapter) Slot 5: PCIe 3.0 x16 (networking adapter) Slot 6: PCIe 3.0 x8 (SAS HBA) Slot 7: PCIe 3.0 x8 (SAS HBA) Slot 8: PCIe 3.0 x8 (SAS HBA) Slot 9: PCIe 3.0 x8 (M5210 RAID controller) **Note**: The DSS-G uses a High-Performance I/O (HPIO) system board where Slot 5 is a PCIe 3.0 x16 slot. Standard x3650 M5 servers have a x8 slot for Slot 5.
External storage HBAs	3x N2226 quad-port 12Gb SAS HBA
Ports	Front: 3x USB 2.0 ports Rear: 2x USB 3.0 and 1x DB-15 video ports. Optional 1x DB-9 serial port. Internal: 1x USB 2.0 port (for embedded hypervisor), 1x SD Media Adapter slot (for embedded hypervisor).
Cooling	Calibrated Vectored Cooling with six single-rotor redundant hot-swap fans; two fan zones with N+1 fan redundancy.
Power supply	2x 900W High Efficiency Platinum AC Power Supplies

Video	Matrox G200eR2 with 16 MB memory integrated into the IMM2.1. Maximum resolution is 1600 ×1200 at 75 Hz with 16 M colors.
Hot-swap part s	Hard drives, power supplies, and fans.
Systems man agement	UEFI, Integrated Management Module II (IMM2.1) based on Renesas SH7758, Predictive Fail ure Analysis, light path diagnostics (no LCD display), Automatic Server Restart, ToolsCenter, X Clarity Administrator, XClarity Energy Manager. IMM2.1 Advanced Upgrade software feature is included for remote presence (graphics, keyboard and mouse, virtual media).
Security featur es	Power-on password, administrator's password, Trusted Platform Module (TPM) 1.2 or 2.0 (con figurable UEFI setting). Optional lockable front bezel.
Operating syst ems	Lenovo DSS-G uses Red Hat Enterprise Linux 7.2
Warranty	Three-year customer-replaceable unit and onsite limited warranty with 9×5 next business day.
Service and s upport	Optional service upgrades are available through Lenovo Services: 4-hour or 2-hour response ti me, 6-hour fix time, 1-year or 2-year warranty extension, software support for System x hardw are and some System x third-party applications.
Dimensions	Height: 87 mm (3.4 in), width: 434 mm (17.1 in), depth: 755 mm (29.7 in)
Weight	Minimum configuration: 19 kg (41.8 lb), maximum: 34 kg (74.8 lb)
Power cords	2x 13A/125-10A/250V, C13 to IEC 320-C14 Rack Power Cables

D1224 External Enclosure specifications
The following table lists the D1224 system specifications.

Table 4. System specifications

Attribute	**Specification**
Form factor	2U rack-mount.
Processor	2x Intel Xeon Gold 6142 16C 150W 2.6GHz Processor
Chipset	Intel C624
Memory	192 GB in base model – seeSR650 configuration section
Memory capacity	Up to 768 GB with 24x 32 GB RDIMMs and two processors
Memory prot ection	Error correction code (ECC), SDDC (for x4-based memory DIMMs), ADDDC (for x4-based mem ory DIMMs, requires Intel Xeon Gold or Platinum processors), memory mirroring, memory rank sparing, patrol scrubbing, and demand scrubbing.
Drive bays	16x 2.5-inch hot-swap drive bays at the front of the server 8x SAS/SATA drive bays 8x 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 arr ay Up to 8x NVMe drives for data – seeSR650 configuration section
Storage contr ollers	ThinkSystem RAID 930-8i 2GB Flash PCIe 12Gb Adapter for boot drives 2x Onboard NVMe x8 ports for 4 NVMe drives ThinkSystem 1610-4P NVMe Switch Adapter for 4 NVMe drives
Network inter faces	4-port 10GBaseT LOM adapter Choice of adapter for cluster connectivity – seeSR650 configuration section 1x RJ-45 10/100/10 00 Mb Ethernet systems management port.
I/O expansion sl ots	The G100 configuration includes riser cards that enable the following slots: Slot 1: PCIe 3.0 x16 full-height, half-length double-wide Slot 2: Not present 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	Front: 1x USB 2.0 port with XClarity Controller access. 1x USB 3.0 port. 1x DB-15 VGA port (optional). Rear: 2x USB 3.0 ports and 1x DB-15 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

Attribute	Specification
Video	Matrox G200 with 16 MB memory integrated into the XClarity Controller. Maximum resolution is 1920×1200 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 7.2
Warranty	Three-year (7X06) customer-replaceable unit (CRU) and onsite limited warranty with 9×5 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)

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-HC1
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. **Note**: Daisy-chaining of drive enclosures is currently not supported.
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 theDrive Enclosure configuration section: 4 TB, 6 TB, 8 TB, or 10 TB 7.2K rpm NL SAS HDDs
Storage capacity	Up to 820 TB (82x 10 TB LFF NL SAS HDDs)

Components	Specification

Cooling	N+1 redundant cooling with five hot-swap fans.
Power supply	Two redundant hot-swap 2214 W AC power supplies.
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 9×5 next business day response.
Service and support	Optional warranty service upgrades are available through Lenovo: Technician installed parts, 24×7 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 ships pre-installed in a Lenovo Scalable Infrastructure 42U 1100mm Enterprise V2 Dynamic Rack. The specifications of the rack are in the following table.

Table 6. Rack cabinet specifications

Component	Specification
Model	1410-HPB (primary cabinet) 1410-HEB (expansion cabinet)
Rack U Height	42U
Height	Height: 2009 mm / 79.1 inches Width: 600 mm / 23.6 inches Depth: 1100 mm / 43.3 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
Cable exits	Top cable exits (front & rear) Bottom cable exit (rear only)
Stabilizers	Front & side stabilizers
Ship Loadable	Yes
Load Capacity for Shipping	953 kg / 2100 lb
Maximum Loaded Weight	1121 kg / 2472 lb

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 x3550 M5 (8869):

- 1U rack server
- 2x Intel Xeon Processor E5-2650 v4 12C 2.2GHz 30MB Cache 2400MHz 105W
- 8x 8GB (64GB) TruDDR4 memory
- 2x 300GB 10K 12Gbps SAS 2.5″ G3HS HDD (configured as RAID-1)
- ServeRAID M5210 SAS/SATA Controller
- 1x 550W High Efficiency Platinum AC Power Supply (2x 550W power supplies recommended)

For more information about the server see the Lenovo Press product guide: http://lenovopress.com/lp0067

Gigabit Ethernet switch – Lenovo RackSwitch G7028:

- 1U top-of-rack switch
- 24x 10/100/1000BASE-T RJ-45 ports
- 4x 10 Gigabit Ethernet SFP+ uplink ports
- 1x fixed 90 W AC (100-240 V) power supply with IEC 320-C14 connector (optional external power supply unit for redundancy)

For more information about the switch see the Lenovo Press product guide: https://lenovopress.com/tips1268For more information about the switch see the Lenovo Press product guide: **https://lenovopress.com/tips1268**

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 x3650 M5 or SR650 servers
- **y =** Number of D3284 drive enclosures
- z = Number of D1224 drive enclosures

Table 7. Lenovo DSS-G configurations

Configuration	x3650 M5 servers	SR650 servers	D3284 drive enclosures	D1224 drive enclosures	Number of drives (max total capacity)	PDUs	x3550 M5 (xCAT)	G7028 switch (for xCAT)
DSS G100	0	1	0	0	4x-8x NVMe drives	2	1 (optional)	1 (optional)
DSS G201	2	0	0	1	24x 2.5″ (44 TB)*	2	1 (optional)	1 (optional)
DSS G202	2	0	0	2	48x 2.5″ (88 TB)*	4	1 (optional)	1 (optional)
DSS G204	2	0	0	4	96x 2.5″ (176 TB)*	4	1 (optional)	1 (optional)
DSS G206	2	0	0	6	144x 2.5″ (264 TB)*	4	1 (optional)	1 (optional)
DSS G220	2	0	2	0	168x 3.5″ (1660 TB)**	4	1 (optional)	1 (optional)
DSS G240	2	0	4	0	336x 3.5″ (3340 TB)**	4	1 (optional)	1 (optional)
DSS G260	2	0	6	0	504x 3.5″ (5020 TB)**	4	1 (optional)	1 (optional)

Capacity is based on using 2TB 2.5-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.
Capacity is based on using 10TB 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.
Configurations are built using the x-config configurator tool:
https://lesc.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 400 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 customer 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 SR650 configuration section.

The drive requirement are as follows:

- For configurations that use HDDs, two 400GB 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. Table 8. Drive selections for the D1224 enclosures

Part number	Feature code	Description
D1224 External Enclosure HDDs		
01DC442	AU1S	Lenovo Storage 1TB 7.2K 2.5″ NL-SAS HDD
01DC437	AU1R	Lenovo Storage 2TB 7.2K 2.5″ NL-SAS HDD
01DC427	AU1Q	Lenovo Storage 600GB 10K 2.5″ SAS HDD
01DC417	AU1N	Lenovo Storage 900GB 10K 2.5″ SAS HDD
01DC407	AU1L	Lenovo Storage 1.2TB 10K 2.5″ SAS HDD
01DC402	AU1K	Lenovo Storage 1.8TB 10K 2.5″ SAS HDD
01DC197	AU1J	Lenovo Storage 300GB 15K 2.5″ SAS HDD
01DC192	AU1H	Lenovo Storage 600GB 15K 2.5″ SAS HDD
D1224 External Enclosure SSDs		
01DC482	AU1V	Lenovo Storage 400GB 3DWD SSD 2.5″ SAS (logtip drive type)
01DC477	AU1U	Lenovo Storage 800GB 3DWD SSD 2.5″ SAS
01DC472	AU1T	Lenovo Storage 1.6TB 3DWD SSD 2.5″ SAS

D1224 configurations can be as follows:

- HDD configurations require logtip SSDs in the first enclosure:
  - First D1224 enclosure in a configuration: 22x HDDs + 2x 400GB SSD (AU1V)
  - Subsequent D1224 enclosures in a configuration: 24x HDDs
- SSD configurations do not require separate logtip drives:
  - All D1224 enclosures: 24x SSDs

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

Table 9. Drive selections for the D3284 enclosures

Part number	Feature code	Description
D3284 External Enclosure HDDs		
01CX814	AUDS	Lenovo Storage 3.5″ 4TB 7.2K NL-SAS HDD (14 pack)
01GT910	AUK2	Lenovo Storage 3.5″ 4TB 7.2K NL-SAS HDD
01CX816	AUDT	Lenovo Storage 3.5″ 6TB 7.2K NL-SAS HDD (14 pack)
01GT911	AUK1	Lenovo Storage 3.5″ 6TB 7.2K NL-SAS HDD
01CX820	AUDU	Lenovo Storage 3.5″ 8TB 7.2K NL-SAS HDD (14 pack)
01GT912	AUK0	Lenovo Storage 3.5″ 8TB 7.2K NL-SAS HDD
01CX778	AUE4	Lenovo Storage 3.5″ 10TB 7.2K NL-SAS HDD (14 pack)
01GT913	AUJZ	Lenovo Storage 3.5″ 10TB 7.2K NL-SAS HDD
4XB7A09919	B106	Lenovo Storage 3.5″ 12TB 7.2K NL-SAS HDD (14 pack)
4XB7A09920	B107	Lenovo Storage 3.5″ 12TB 7.2K NL-SAS HDD
D3284 External Enclosure SSDs		
01CX780	AUE3	Lenovo Storage 400GB 2.5″ 3DWD Hybrid Tray SSD (logtip drive)

D3284 configurations are all HDDs, as follows:

- First D3284 enclosure in a configuration: 82 HDDs + 2x 400GB SSDs (AUE3)
- Subsequent D3284 enclosures in a configuration: 84x HDDs

x3650 M5 configuration
The Lenovo DSS-G configurations (except for DSS-G100) use the x3650 M5 server, which features the Intel Xeon processor E5-2600 v4 product family.
See the Specifications section for details about the servers.

DSS-G100 configuration: See the SR650 configuration section.

Memory

The DSS-G offerings allow three different memory configurations for the x3650 M5 servers

- 128 GB using 8x 16 GB TruDDR4 RDIMMs
- 256 GB using 16x 16 GB TruDDR4 RDIMMs
- 512 GB using 16x 32 GB TruDDR4 RDIMMs

Each of the two processor has four memory channels, with three DIMMs per channel:

- With 8 DIMMs installed, each memory channel has 1 DIMM installed, operating at 2400 MHz With 16 DIMMs installed, each memory channel has 2 DIMMs installed, operating at 2400 MHz

- The following memory protection technologies are supported:
- ECC

Chipkill

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

Table 10. Memory selection

Memory selection	Quantity	Feature code	Description
128 GB	8	ATCA	16GB TruDDR4 (2Rx4, 1.2V) PC4-19200 CL17 2400MHz LP RDIMM
256 GB	16	ATCA	16GB TruDDR4 (2Rx4, 1.2V) PC4-19200 CL17 2400MHz LP RDIMM
512 GB	16	ATCB	32GB TruDDR4 (2Rx4, 1.2V) PC4-19200 CL17 2400MHz LP RDIMM

Internal storage
The x3650 M5 servers in the DSS-G have two internal hot-swap drives, configured as a RAID-1 pair and connected to a RAID controller with 1GB of flash-backed cache.
Table 11. Internal drive bay configurations

Feature code	Description	Quantity
A3YZ	ServeRAID M5210 SAS/SATA Controller	1
A3Z1	ServeRAID M5200 Series 1GB Flash/RAID 5 Upgrade	1
AT89	300GB 10K 12Gbps SAS 2.5″ G3HS HDD	2

Network adapter
The x3650 M5 server has four integrated RJ-45 Gigabit Ethernet ports (BCM5719 chip), which can be used for management purposes. However, for data, the DSS-G configurations use one of the network adapters listed in the following table for cluster traffic.

Table 12. Network adapter options

Part number	Feature code	Port count and speed	Description
00D9690	A3PM	2x 10 GbE	Mellanox ConnectX-3 10GbE Adapter
01GR250	AUAJ	2x 25 GbE	Mellanox ConnectX-4 Lx 2x25GbE SFP28 Adapter
00D9550	A3PN	2x FDR (56 Gbps)	Mellanox ConnectX-3 FDR VPI IB/E Adapter
00MM960	ATRP	2x 100 GbE, or 2x EDR	Mellanox ConnectX-4 2x100GbE/EDR IB QSFP28 VPI Adapter
00WE027	AU0B	1x OPA (100 Gbps)	Intel OPA 100 Series Single-port PCIe 3.0 x16 HFA

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

- Mellanox ConnectX-3 Adapters, **https://lenovopress.com/tips0897**
- Mellanox ConnectX-4 Adapter, **https://lenovopress.com/lp0098**
- Intel Omni-Path Architecture 100 Series HFA, **https://lenovopress.com/lp0550**

The DSS-G configurations support two or three network adapters, in one of the combinations listed in the following table.

Table 13. Network adapter configurations

Configuration	Adapter combination (see previous table)
Config 1	2x FDR InfiniBand
Config 2	3x 10Gb Ethernet
Config 3	2x 40Gb Ethernet
Config 4	2x FDR InfiniBand and 1x 10Gb Ethernet
Config 5	1x FDR InfiniBand and 2x 10Gb Ethernet
Config 6	3x FDR InfiniBand
Config 7	3x 40Gb Ethernet
Config 8	2x OPA
Config 9	2x OPA and 1x 10Gb Ethernet
Config 10	2x OPA and 1x 40Gb Ethernet
Config 11	2x EDR InfiniBand
Config 12	2x EDR InfiniBand and 1x 40Gb Ethernet
Config 13	2x EDR InfiniBand and 1x 10Gb Ethernet

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.

SR650 configuration
The Lenovo DSS-G100 configuration uses the ThinkSystem SR650 server.
Memory
The G100 configuration has either 192 GB or 384 GB of system memory running at 2666 MHz:

- 192 GB: 12x 16 GB DIMMs (6 DIMMs per processor, 1 DIMM per memory channel)
- 384 GB: 24x 16 GB DIMMs (12 DIMMs per processor, 2 DIMMs per memory channel)

The table lists the ordering information.
Table 14. G100 memory configuration

Feature code	Description	Maximum
AUNC	ThinkSystem 16GB TruDDR4 2666 MHz (2Rx8 1.2V) RDIMM	24

Internal storage
The SR650 server in the G100 configuration has 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 15. 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

The following table lists the NVMe drives that are supported in the SR650 when used in the DSS-G100 configuration.
Table 16. Supported NVMe drives in the SR650

Part number	Feature code	Description	Quantity supported
2.5-inch hot-swap SSDs – Performance U.2 NVMe PCIe			
7XB7A05923	AWG6	ThinkSystem U.2 PX04PMB 800GB Performance 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8
7XB7A05922	AWG7	ThinkSystem U.2 PX04PMB 1.6TB Performance 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8
2.5-inch hot-swap SSDs – Mainstream U.2 NVMe PCIe			
7N47A00095	AUUY	ThinkSystem 2.5″ PX04PMB 960GB Mainstream 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8
7N47A00096	AUMF	ThinkSystem 2.5″ PX04PMB 1.92TB Mainstream 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8
2.5-inch hot-swap SSDs – Entry U.2 NVMe PCIe			
7N47A00984	AUVO	ThinkSystem 2.5″ PM963 1.92TB Entry 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8
7N47A00985	AUUU	ThinkSystem 2.5″ PM963 3.84TB Entry 2.5” NVMe PCIe 3.0 x4 HS SSD	4-8

Network adapter
The SR650 server for the DSS-G100 configuration has the following Ethernet interfaces:

- Four 10 GbE ports with RJ-45 connectors (10GBaseT) via a LOM adapter (feature code AUKM) 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
4C57A08980	B0RM	2x 100 GbE/EDR	Mellanox ConnectX-5 EDR IB VPI Dual-port x16 PCIe 3.0 HCA
01GR250	AUAJ	2x 25 GbE	Mellanox ConnectX-4 Lx 2x25GbE SFP28 Adapter
00MM950	ATRN	1x 40 GbE	Mellanox ConnetX-4 Lx 1x40GbE QSFP+ Adapter
00WE027	AU0B	1x 100 Gb OPA	Intel OPA 100 Series Single-port PCIe 3.0 x16 HFA
00MM960	ATRP	2x 100 GbE/EDR	Mellanox ConnctX-4 2x100GbE/EDR IB QSFP28 VPI Adapter

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**

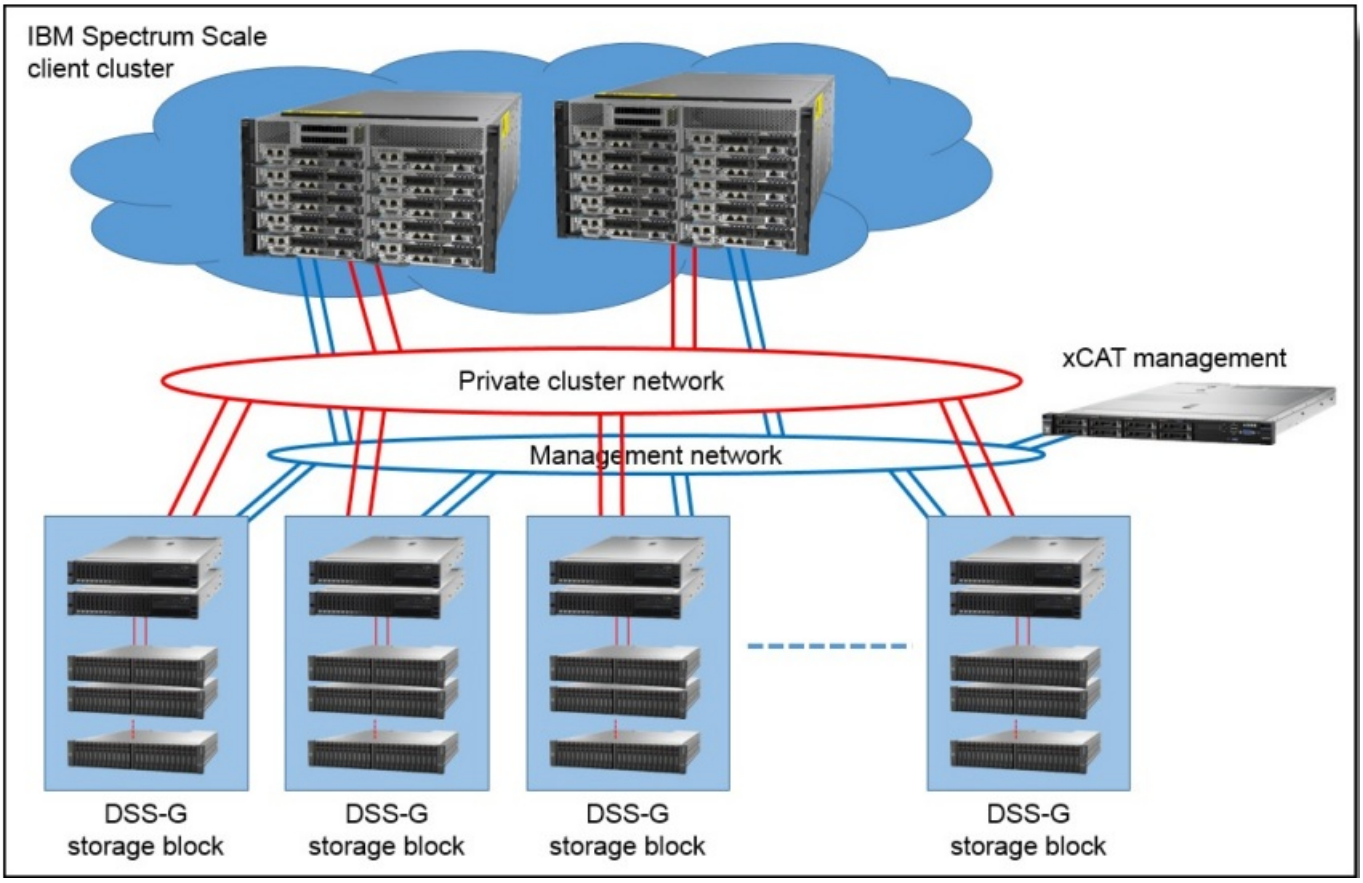
-

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.

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 an x3550 M5 server running xCAT and a RackSwitch G7028 24-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



Power distribution

Power distribution units (PDUs) are used to distribute power from an uninterruptible power supply (UPS) or utility power to the equipment within the DSS-G rack cabinet and to provide fault-tolerant power redundancy for high availability.

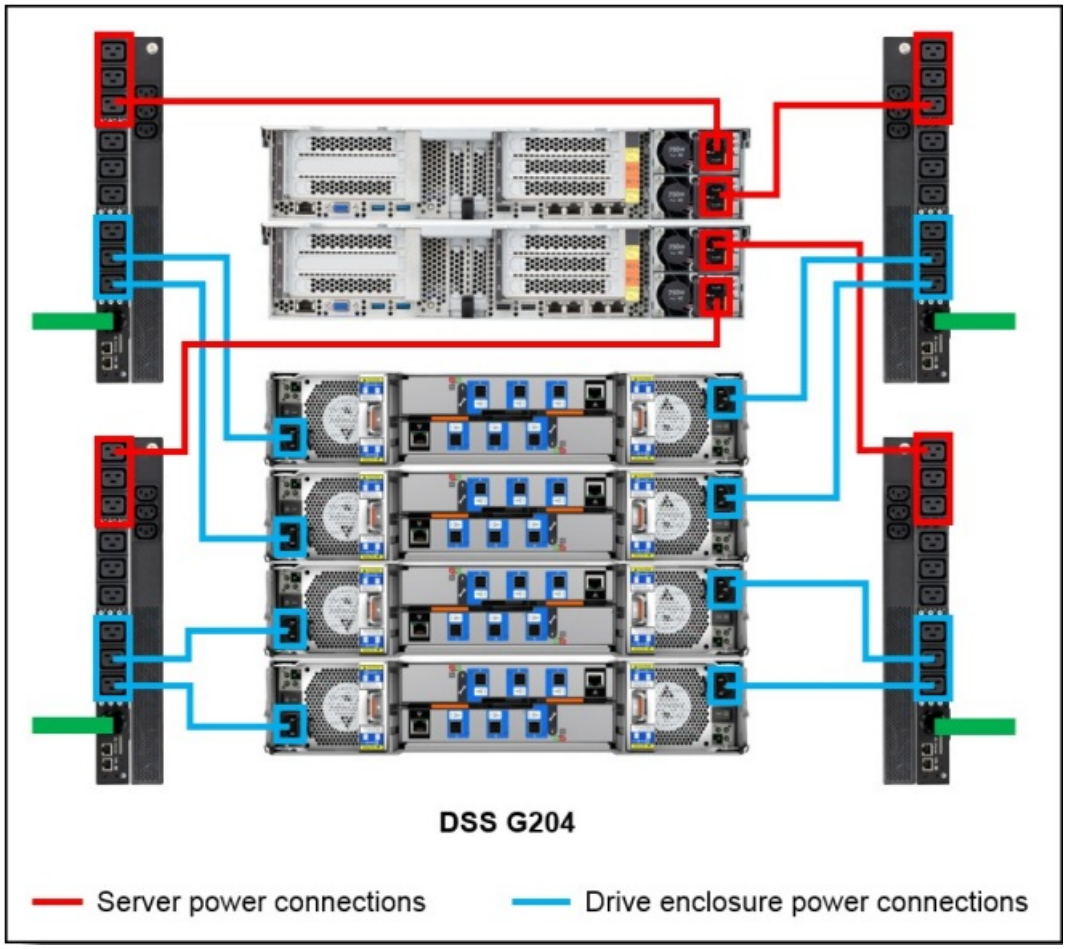
Four PDUs are selected for each DSS-G configuration (except for the G201 configuration which uses two PDUs). The PDUs can be one of the PDUs listed in the following table.

Table 18. PDU selection

Part number	Feature code	Description	Quantity
46M4002	5896	1U 9 C19/3 C13 Switched and Monitored DPI PDU	4*
71762NX	N/A	1U Ultra Density Enterprise C19/C13 PDU	4*

As an example, the power distribution topology for the G204 (two servers, four drive enclosures) is illustrated in the following figure. Note that the actually PDU connections may vary in the shipped configuration.

Figure 9. Power distribution topology Configuration notes:



- Only one type of PDUs is supported in the DSS-G rack cabinet; different PDU types cannot be mixed within the rack.
- Power cables lengths are derived based on the configuration selected.
- PDUs have detachable power cords (line cords) and are country dependent.

The following table summarizes the PDU specifications.

Table 19. PDU specifications

Feature	1U 9 C19/3 C13 Switched and Monitored DPI PDU	1U Ultra Density Enterprise C19/C13 PDU
Part number	46M4002	71762NX
Line cord	Order separately – see the following table	Order separately – see the following table
Input	200-208VAC, 50-60 Hz	200-208VAC, 50-60 Hz
Input phase	Single phase or 3-phase Wye depending on the line cord selected	Single phase or 3-phase Wye depending on the line cord selected
Input current maximum	Varies by line cord	Varies by line cord
Number of C13 outlets	3 (on rear of unit)	3 (on rear of unit)
Number of C19 outlets	9	9
Circuit breakers	9 double-pole branch rated circuit breakers rated at 20 amps	9 double-pole branch rated circuit breakers rated at 20 amps
Management	10/100 Mb Ethernet	No

The line cords that are available for the PDUs are listed in the following table. Table 20. Line cord part numbers and feature codes

Part number	Feature code	Description	Maximum input current (Amps)
North America, Mexico, Saudi Arabia, Japan, Philippines, some of Brazil			
40K9614	6500	DPI 30a Line Cord (NEMA L6-30P)	24 A (30 A derated)
40K9615	6501	DPI 60a Cord (IEC 309 2P+G)	48 A (60 A derated)
Europe, Africa, most of the Middle East, most of Asia, Australia, New Zealand, most of South America			
40K9612	6502	DPI 32a Line Cord (IEC 309 P+N+G)	32 A
40K9613	6503	DPI 63a Cord (IEC 309 P+N+G)	63 A
40K9617	6505	DPI Australian/NZ 3112 Line Cord	32 A
40K9618	6506	DPI Korean 8305 Line Cord	30 A
40K9611	6504	DPI 32a Line Cord (IEC 309 3P+N+G) (3-phase)	32 A

For more information about the PDUs, see the following Lenovo Press documents:

- Lenovo PDU Quick Reference Guide – North America **https://lenovopress.com/redp5266**
- Lenovo PDU Quick Reference Guide – International https://lenovopress.com/redp5267

Red Hat Enterprise Linux
The servers (including the x3550 M5 xCAT management servers, if selected) run Red Hat Enterprise Linux 7.2

which is preinstalled on the RAID-1 pair of 300 GB drives installed in the servers.
Each server requires a RHEL operating system subscription and a Lenovo Enterprise Software Support

(ESS) subscription. The Red Hat subscription will provide 24×7 Level 3 support. The Lenovo ESS subscription provides Level 1 and Level 2 support, with 24×7 for Severity 1 situations.
Part numbers of services subscriptions vary by country. The x-config configurator will offer the part numbers available for your location.

Table 21. Operating system licensing

Part number	Description
Red Hat Enterprise Linux Support	
Varies by country	RHEL Server Physical or Virtual Node, 2 Sockets Premium Subscription 1 Year
Varies by country	RHEL Server Physical or Virtual Node, 2 Sockets Premium Subscription 3 Year
Varies by country	RHEL Server Physical or Virtual Node, 2 Sockets Premium Subscription 5 Year
Lenovo Enterprise Software Support (ESS)	
Varies by country	1 Year Enterprise Software Support Multi-Operating Systems (2P Server)
Varies by country	3 Year Enterprise Software Support Multi-Operating Systems (2P Server)
Varies by country	5 Year Enterprise Software Support Multi-Operating Systems (2P Server)

IBM Spectrum Scale licensing
IBM Spectrum Scale licensing part numbers are listed in the following table. Licenses for DSS-G are based on the number and type of drives in the configuration and are offered in differing periods of support.
The core offerings available are:

- For configurations with HDDs:
  - IBM Spectrum Scale for DSS Data Management Edition for Disk per Disk Drive
  - IBM Spectrum Scale for DSS Standard Edition for Disk Per Disk Drive
  - **Tip:** The two mandatory SSDs needed for HDD configurations are not counted in the licensing.
- For configurations with SSDs:
  - IBM Spectrum Scale for DSS Data Management Edition for Flash per Disk Drive
  - IBM Spectrum Scale for DSS Standard Edition for Flash per Disk Drive

Each of these is offered in 1, 3, 4 and 5-year support periods.
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 by the x-config configurator. 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.

Table 22. IBM Spectrum Scale licensing

Part number	Feature (5641-DSS)	Description
01GU924	AVZ7	IBM Spectrum Scale for DSS Data Management for Disk per Disk Drive with 1 Year S&S
01GU925	AVZ8	IBM Spectrum Scale for DSS Data Management for Disk per Disk Drive with 3 Year S&S
01GU926	AVZ9	IBM Spectrum Scale for DSS Data Management for Disk per Disk Drive with 4 Year S&S
01GU927	AVZA	IBM Spectrum Scale for DSS Data Management for Disk per Disk Drive with 5 Year S&S
01GU928	AVZB	IBM Spectrum Scale for DSS Data Management for Flash per Disk Drive with 1 Year S&S
01GU929	AVZC	IBM Spectrum Scale for DSS Data Management for Flash per Disk Drive with 3 Year S&S
01GU930	AVZD	IBM Spectrum Scale for DSS Data Management for Flash per Disk Drive with 4 Year S&S
01GU931	AVZE	IBM Spectrum Scale for DSS Data Management for Flash per Disk Drive with 5 Year S&S
01GU932	AVZF	IBM Spectrum Scale for DSS Standard Edition for Disk per Disk Drive with 1 Year S&S
01GU933	AVZG	IBM Spectrum Scale for DSS Standard Edition for Disk per Disk Drive with 3 Year S&S
01GU934	AVZH	IBM Spectrum Scale for DSS Standard Edition for Disk per Disk Drive with 4 Year S&S
01GU935	AVZJ	IBM Spectrum Scale for DSS Standard Edition for Disk per Disk Drive with 5 Year S&S
01GU936	AVZK	IBM Spectrum Scale for DSS Standard Edition for Flash per Disk Drive with 1 Year S&S
01GU937	AVZL	IBM Spectrum Scale for DSS Standard Edition for Flash per Disk Drive with 3 Year S&S
01GU938	AVZM	IBM Spectrum Scale for DSS Standard Edition for Flash per Disk Drive with 4 Year S&S
01GU939	AVZN	IBM Spectrum Scale for DSS Standard Edition for Flash per Disk Drive with 5 Year S&S

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) are needed.
- For non-DSS storage in the same Cluster (for example, separated metadata on traditional controller-based storage), you have the option of socket-based licenses (Standard Edition only) or capacity-
- based (per TB) licenses (Data Management Edition only).

- It is possible to mix traditional GPFS/Spectrum Scale storage licensed per socket and new Spectrum Scale storage licensed per drive, however the drive-based license is only available with DSS-G.
- As long as a Spectrum Scale client accesses storage that is licensed per socket (either cross-
- cluster/remote or locally), it will also require a socket based client/server license.
- It is not supported to mix Standard Edition and Data Management Edition licensing within a cluster.
- Drive-based Spectrum Scale for DSS licenses are not transferrable from one DSS-G configuration to another. The license is attached to the storage/machine it is sold with.

Installation services

Three 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.
Services are tailored to the customer need and typically include:

- Conduct a preparation and planning call
- Configure xCAT on the x3550 M5 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
- Integrated Management Modules (IMM2) on the x3650 M5 and x3550 M5 servers Red Hat Enterprise Linux on the x3650 M5, SR650 and x3550 M5 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

Warranty

The system has a three-year customer-replaceable unit (CRU) and onsite (for field-replaceable units (FRUs) only) limited warranty with standard call center support during normal business hours and 9×5 Next Business Day Parts Delivered.

Also available are Lenovo Services warranty maintenance upgrades and post-warranty maintenance agreements, with a predefined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

Lenovo warranty service upgrade offerings are region-specific. Not all warranty service upgrades are available in every region. For more information about Lenovo warranty service upgrade offerings that are available in your region, go to the Data Center Advisor and Configurator website **http://dcsc.lenovo.com**, then do the following:

1. In the Customize a Model box in the middle of the page, select the Services option in the Customization Option dropdown menu
2. Enter the machine type & model of the system
3. From the search results, you can click either Deployment Services or Support Services to view the offerings

The following table explains warranty service definitions in more detail.

Table 23. Warranty service definitions

Term	Description
Onsite Service	If a problem with your product cannot be resolved via telephone, a Service Technician will be dispatched to arrive at your location.
Parts Delivered	If a problem with your product cannot be resolved via telephone and a CRU part is required, Lenovo will send a replacement CRU to arrive at your location. If a problem with your product cannot be resolved via telephone and a FRU part is required, a Service Technician will be dispatched to arrive at your location.
Technician Installed Parts	If a problem with your product cannot be resolved via telephone, a Service Technician will be dispatched to arrive at your location.

Term	Description
Hours of coverage	9×5: 9 hours/day, 5 days/week, during normal business hours, excluding local public & national holidays 24×7: 24 hours per day, 7 days per week, 365 days per year.
Response time target	2 hours, 4 hours, or Next Business Day: The time period from when the telephone based troubleshooting is completed and logged, to the delivery of the CRU or arrival of a Service Technician and part at the Customer's location for repair.
Committed Repair	6 hours: The time period between the service request registration in Lenovo's call management system and the restoration of the product to conformance with its specification by a Service Technician.

The following Lenovo warranty service upgrades are available:

- **Warranty extension of up to 5 years**
  - Three, four, or five years of 9×5 or 24×7 service coverage
  - Parts delivered or technician installed parts from next business day to 4 or 2 hours Committed repair service
  - Warranty extension of up to 5 years
  - Post warranty extensions
- Committed Repair Services enhances the level of Warranty Service Upgrade or Post Warranty/Maintenance Service offering associated with the selected systems. Offerings vary and are available in select countries.
  - Priority handling to meet defined time frames to restore the failing machine to good working condition
  - 24x7x6 committed repair: Service performed 24 hours per day, 7 days per week, within 6 hours
- **YourDrive YourData**
  Lenovo's YourDrive YourData service 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 with Lenovo warranty upgrades and extensions.
- **Microcode Support**

Keeping microcode current helps prevent hardware failures and security exposure. There are two levels of service: analysis of the installed base and analysis and update where required. Offerings vary by region and can be bundled with other warranty upgrades and extensions.

- **Enterprise Software Support**
  Lenovo Enterprise Server Software Support can help you troubleshoot your entire server software stack. Choose support for server operating systems from Microsoft, Red Hat, SUSE, and VMware; Microsoft server applications; or both operating systems and applications. Support staff can help answer troubleshooting and diagnostic questions, address product compatibility and interoperability issues, isolate causes of problems, report defects to software vendors, and more.
  In addition, you can access hardware “how to” support for System x servers. Staff can help resolve hardware problems not covered under warranty, refer you to the right documentation and publications, provide corrective service information for known defects, and transfer you to a hardware support call center if needed.Warranty and maintenance service upgrades:
- **Hardware Installation Services**
  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. Your new systems will be configured and ready for your software installation.

Operating environment

Lenovo DSS-G is supported in the following environment:

- Air temperature: 5 °C – 40 °C (41 °F – 104 °F)
- Humidity: 10% to 85% (non-condensing)

Related publications and links

For more information, see these resources:

Lenovo DSS-G product page
http://www3.lenovo.com/us/en/data-center/servers/high-density/Lenovo-Distributed-Storage-Solution-for-IBM-Spectrum-Scale/p/WMD00000275
x-config configurator:
https://lesc.lenovo.com/products/hardware/configurator/worldwide/bhui/asit/index.html
Lenovo DSS-G datasheet:
https://lenovopress.com/datasheet/ds0026-lenovo-distributed-storage-solution-for-ibm-spectrum-scale

Related product families

Product families related to this document are the following:

- IBM Alliance
- 2-Socket Rack Servers
- Direct-Attached Storage

- Software-Defined Storage
- High Performance Computing

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

- Lenovo (United States), Inc.
- 8001 Development Drive
- Morrisville, NC 27560

U.S.A.
Attention: Lenovo Director of Licensing
LENOVO PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.
This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. Lenovo may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

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

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

This document, LP0626, was created or updated on May 11, 2018.
Send us your comments in one of the following ways:

Use the online Contact us review form found at: **https://lenovopress.lenovo.com/LP0626**
Send your comments in an e-mail to: **comments@lenovopress.com**

This document is available online at https://lenovopress.lenovo.com/LP0626.

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
- RackSwitch
- ServeRAID
- System x®
- ThinkSystem®
- ToolsCenter
- 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.

Documents / Resources

	Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) (System x based) [pdf] User Guide Distributed Storage Solution for IBM Spectrum Scale DSS-G System x based, Distributed Storage, Solution for IBM Spectrum Scale DSS-G System x based, IBM Spectrum Scale DSS-G System x based, DSS-G System x based

References

- DCSC - Data Center Solution Configurator
- IT Infrastructure | IBM
- Lenovo System x3550 M5 (Machine Type 8869) Product Guide (withdrawn product) > Lenovo Press
- Distributed Storage Solution for IBM Spectrum Scale | Lenovo US
- Lenovo Distributed Storage Solution for IBM Spectrum Scale Datasheet > Lenovo Press
- Lenovo Distributed Storage Solution for IBM Spectrum Scale Datasheet > Lenovo Press
- Lenovo System x3650 M5 (Machine Type 8871) Product Guide (withdrawn product) > Lenovo Press
- Mellanox ConnectX-4 Adapters Product Guide > Lenovo Press
- Lenovo Storage D1212 and D1224 Drive Enclosures Product Guide > Lenovo Press
- Lenovo Storage D3284 External High Density Drive Expansion Enclosure Product Guide > Lenovo Press

- Intel Omni-Path Architecture OPA 100 Series Host Fabric Adapters Product Guide > Lenovo Press
- Lenovo PDU Quick Reference Guide - North America > Lenovo Press
- Lenovo PDU Quick Reference Guide – International > Lenovo Press
- Mellanox ConnectX-3 and ConnectX-3 Pro Adapters Product Guide (withdrawn product) > Lenovo Press
- Lenovo RackSwitch G7028 Product Guide (withdrawn product) > Lenovo Press
- Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G) (System x based) Product Guide (withdrawn product) > Lenovo Press
- 2-Socket Rack Servers > Lenovo Press
- IBM Alliance > Lenovo Press
- High Performance Computing > Lenovo Press
- Direct-Attached Storage > Lenovo Press
- Software-Defined Storage > Lenovo Press
- System x and Cluster Solutions configurator (x-config)
- IBM Documentation
- Copyright and Trademark Information | Lenovo US | Lenovo US