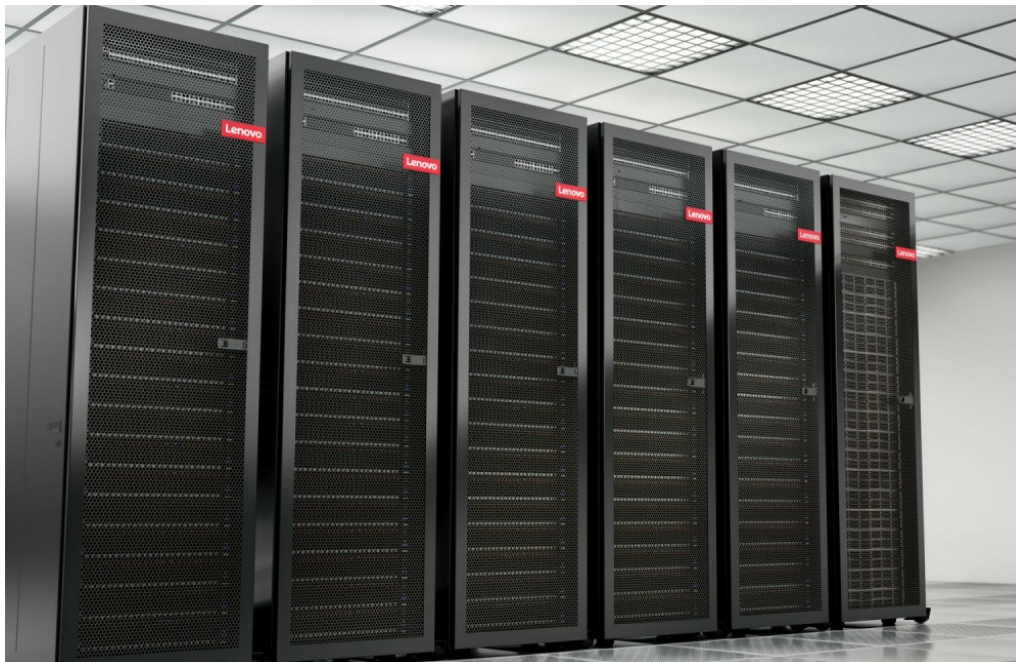


Lenovo Scalable Infrastructure (LeSI) Solutions

Product Guide

Lenovo Scalable Infrastructure (LeSI) is a framework for designing, manufacturing, integrating and delivering data center solutions, with a focus on High Performance Computing (HPC), Technical Computing, and Artificial Intelligence (AI) environments.



Benefits

Lenovo Scalable Infrastructure provides [Best Recipe](#) guides to warrant interoperability of hardware, software and firmware among a variety of Lenovo and third-party components.

Addressing specific needs in the data center, while also optimizing the solution design for application performance requires a significant level of effort and expertise. Customers need to choose the right hardware and software components, solve interoperability challenges across multiple vendors, and determine optimal firmware levels across the entire solution to ensure operational excellence, maximize performance, and drive best total cost of ownership.

LeSI reduces this burden on the customer by pre-testing and validating a large selection of Lenovo and third-party components, to create a “Best Recipe” of components and firmware levels that work seamlessly together as a solution. From this testing, customers can be confident that such a best practice solution will run optimally for their workloads, tailored to the client’s needs.

In addition to interoperability testing, LeSI hardware is pre-integrated, pre-cabled, pre-loaded with the best recipe and optionally an OS-image and tested at the rack level in manufacturing, to ensure a reliable delivery and minimize installation time in the customer data center.

With LeSI, customers can focus their efforts on maximizing their business value, instead of consuming valuable resources to design, optimize, install, and support the infrastructure required to meet business demands. Whether the need is for a small AI training solution, a mid-sized HPC cluster, or the world's largest supercomputers, customers can take advantage of the decades of Lenovo experience, innovation, and expertise in solution deployment with Lenovo Scalable Infrastructure. LeSI delivers optimized IT solutions to the customer pre-integrated, pre-loaded, and tested, and ready to install, increasing time-to-value and reducing deployment risk.

LeSI solutions are based on:

- Industry-leading Lenovo ThinkSystem servers, storage and networking
- Open source and OEM software
- Best-of-breed third-party components especially in high performance networking and acceleration.

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.

Hardware components

LeSI supports the following hardware components.

- [Lenovo Servers](#)
- [Lenovo Ethernet Networking](#)
- [Lenovo Storage Expansion Units and Arrays](#)
- [Rack Cabinets and Options](#)
- [Other Lenovo ThinkSystem Hardware](#)
- [HPC Acceleration](#)
- [InfiniBand Interconnects](#)
- [Omni-Path Architecture](#)

Servers

- ThinkSystem SD530

The Lenovo ThinkSystem SD530 is an ultra-dense and economical two-socket server in a 0.5U rack form factor. With four SD530 server nodes installed in the ThinkSystem D2 enclosure, and the ability to cable and manage up to seven D2 enclosures as one asset, you have an ideal high-density 2U four-node (2U4N) platform for performance-oriented enterprise and cloud workloads. Leveraging Lenovo Neptune liquid cooling technology within a Thermal Transfer Module it is the only dense system in the market supporting up to 205W TDP processors at 35°C (ASHRAE A2) ambient temperature without throttling. For more information, see the [SD530 product guide](#).

- ThinkSystem SD650

The ThinkSystem SD650 direct water-cooled server is a flexible and simple data center solution for users of high performance and technical computing, grid deployments, analytics workloads, and large-scale cloud infrastructures. The direct-to-node water cooled solution based on Lenovo Neptune liquid cooling technology, with up to 95% cooling efficiency, is designed to operate by using either cold or warm water, up to 50°C (122°F). Chillers are not needed for most customers, meaning even greater savings and a lower total cost of ownership. For more information, see the [SD650 product guide](#).

- ThinkSystem SR670

The Lenovo ThinkSystem SR670 is a purpose-built two-socket 2U node for GPU-accelerated workloads. Supporting the latest NVIDIA GPUs and Intel Xeon Scalable processors, the SR670 has been designed for optimal performance for high-end computation required by both Artificial Intelligence and High Performance Computing workloads, as well as high-end Virtual Desktop Infrastructure (VDI). The SR670 is key for Lenovo's AI strategy, delivering up to 4 double-wide or 8 single-wide GPUs per node and providing the optimal hardware for the LiCO platform. For more information, see the [SR670 product guide](#).

- ThinkSystem SR630

The Lenovo ThinkSystem SR630 is an ideal 2-socket 1U rack server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The SR630 server is designed to handle a wide range of workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), infrastructure security, systems management, enterprise applications, collaboration/email, streaming media, web, and HPC. For more information, see the [SR630 product guide](#).

- ThinkSystem SR650

The Lenovo ThinkSystem SR650 is an ideal 2-socket 2U rack server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The SR650 server is designed to handle a wide range of workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), enterprise applications, collaboration/email, and business analytics and big data. For more information, see the [SR650 product guide](#).

- ThinkSystem SR645

The Lenovo ThinkSystem SR645 is a 2-socket 1U server that features the AMD EPYC 7002 family of processors. With up to 64 cores per processor and support for the new PCIe 4.0 standard for I/O, the SR645 offers the ultimate in two-socket server performance in a space saving 1U form factor. For more information, see the [SR645 product guide](#).

- ThinkSystem SR655

The Lenovo ThinkSystem SR655 is a 1-socket 2U server that features the new AMD EPYC 7002 family of processors. With up to 64 cores per processor and support for the new PCIe 4.0 standard for I/O, the SR655 offers the ultimate in single-socket server performance. For more information, see the [SR655 product guide](#).

- ThinkSystem SR850

The Lenovo ThinkSystem SR850 is a 4-socket 2U rack server with a streamlined rack design that is optimized for price and performance, with best-in-class flexibility and expandability. Models of the SR850 are powered by up to four Intel Xeon Processor Scalable Family processors, each with up to 28 cores, for an efficient 4-socket solution. The ThinkSystem SR850's agile design provides rapid upgrades for processors and memory, and its large, flexible storage capacity helps to keep pace with data growth. For more information, see the [SR850 product guide](#).

- ThinkSystem SR860

The Lenovo ThinkSystem SR860 is a 4-socket server that features a 4U rack design with support for GPUs, and is optimized for price and performance and best-in-class expandability. Models of the SR860 are powered by up to four Intel Xeon Processor Scalable Family processors, each with up to 28 cores, for an efficient 4-socket solution. Using the same design as the 2U ThinkSystem SR850, the SR860's agile design provides rapid upgrades for processors and memory, and its large, flexible storage capacity helps to keep pace with data growth. For more information, see the [SR860 product guide](#).

Note: The ThinkSystem SR860 server is only available in EMEA and China.

- ThinkSystem SR950

The Lenovo ThinkSystem SR950 is Lenovo's flagship server, suitable for mission-critical applications that need the most processing power possible in a single server. The powerful 4U ThinkSystem SR950 can expand from two to as many as eight Intel Xeon Scalable Family processors. The modular design of SR950 speeds upgrades and servicing with easy front or rear access to all major subsystems that ensures maximum performance and maximum server uptime. For more information, see the [SR950 product guide](#).

The following table lists all the Lenovo ThinkSystem Servers that are supported by LeSI.

Table 1. Lenovo Server Selection

Description	Machine Type-Model	Feature code	Summary
Rack Server			
ThinkSystem SR630	7X02CTOLWW	AUW0 (8 SFF) AUW1 (10 SFF) AUW2 (4 LFF)	2-Socket Mainstream 1U rack server
ThinkSystem SR650	7X06CTOLWW	AUVV (8/16/24 SFF) AUVW (8/12 LFF) AUVX (8/16 SFF)	2-Socket Mainstream 2U rack server
ThinkSystem SR645	7D2YCTOLWW 7D2XCTOLWW	B8N6 (8/10 SFF) B8N5 (4 LFF)	2-Socket Mainstream AMD 1U rack server
ThinkSystem SR655	7Y00CTOLWW 7Z01CTOLWW	B5VK (12 LFF) B5VJ (24 SFF)	1-Socket Mainstream AMD 2U rack server
ThinkSystem SR670	7Y37CTO1WW	B3XX (4x DW GPU) B3XY (8x SW GPU)	2-Socket Mainstream 4x-8x GPU 2U rack server
ThinkSystem SR850	7X19CTOLWW	AUPP	4-Socket High-End 2U rack server
ThinkSystem SR860	7X69CTOLWW	AXL6 (S 1+2) AUPY (S 3+4)	4-Socket High-End with GPU support 4U rack server
ThinkSystem SR950	7X12CTOLWW	AUNY (2-4S) AUKF (2-8S)	8-Socket High-End 4U rack server
Dense Server			
ThinkSystem D2 Enclosure	7X20CTOLWW	AUXM	2U4N chassis for SD530
ThinkSystem Modular Enclosure	7X22CTOLWW	AUXM	2U4N scalable chassis for SD530
ThinkSystem SD530	7X21CTOLWW	AUXN	2-Socket Dense 0.5U server
NeXtScale n1200 DWC Enclosure	5468-HC1	A5M3	6U12N direct water-cooled chassis for SD650
NeXtScale n1200 DWC Manifold	5469-HC1	A5MN (1-drop) A5N7 (2-drop) A5N8 (3-drop) A5N9 (4-drop) A5ML (5-drop) A5MM (6-drop)	Direct water-cooling manifold attached to n1200 enclosures.
ThinkSystem SD650	7X58CTO1WW	B15M	1U tray with two 2-Socket direct water cooled Dense servers

Ethernet Networking

Lenovo partners with NVIDIA Networking (formerly Mellanox) to provide Ethernet switches from the Spectrum Ethernet portfolio for LeSI. The Spectrum Ethernet switches are the most advanced on the market and are optimized for high-performance enterprise-class systems and storage. They offer a fully shared buffer to support fair bandwidth allocation and predictably low latency, as well as traffic flow prioritization and optimization technology. LeSI offers the NVIDIA Networking switches pre-installed with the NVIDIA Cumulus Linux Network Operating System, which provides rich routing and automation functionality for large scale applications.

- 1 Gb Ethernet

The AS4610-54T is a high-performance Gigabit Ethernet Layer 3 switch family featuring 54 ports; with 48 10/100/1000BASE-T ports, 4 x 10G SFP+ uplink ports, and 2 x 20G QSFP+ stacking ports (Stacking capability subject to NOS implementations). The AS4610-54T is ideal as a data center top-of-rack switch or IPMI switch. For more information, see the [AS4610-54T datasheet](#).

- 10 Gb Ethernet

The NVIDIA Networking SN2410B Spectrum Ethernet switch is a high-performance 10 Gigabit Ethernet Layer 3 switch family featuring 56 ports; with 48 x SFP28 ports running at 10Gb/s and 8 x QSFP28 ports running at 100Gb/s. The SN2410B is an ideal top-of-rack solution, allowing for maximum flexibility and predictable, high performance Ethernet switching. For more information, see the [SN2410B datasheet](#).

- 25 Gb Ethernet

The NVIDIA Networking Spectrum Ethernet portfolio is an ideal top-of-rack solution for HPC, hyperconverged, and storage fabric deployments. LeSI offers two 25GbE switches from this family: the SN2410, with 48 x QSFP28 ports running at 25Gb/s and 8 x QSFP28 ports running at 100Gb/s, and the half-wide SN2010, with 18 x QSFP28 ports running at 25Gb/s and 4 x QSFP28 ports running at 100Gb/s. The SN2410 is ideal for 25GbE fabrics and larger aggregation scenarios, while the SN2010 is more suited for storage and hyperconverged use cases, as well as small aggregation for HPC deployments. For more information, see the [SN2410 datasheet](#) and [SN2010 datasheet](#).

- 100 Gb Ethernet

The NVIDIA Networking SN3700C Spectrum-2 Ethernet Switch is a high performance 100 Gigabit Ethernet Layer 3 switch family featuring 32 ports; with 32 x QSFP28 ports running at 100Gb/s. The SN3700C also fully supports 4-to-1 breakout cables, enabling 128 ports running at 25Gb/s. The 3700C is ideal for high-performance Ethernet fabrics as well as 100G aggregation scenarios. For more information, see the [SN3700C datasheet](#).

The following table summarizes all the Lenovo Ethernet Switches that are supported by LeSI.

Table 2. NVIDIA Networking Ethernet Switch Selection

Description	Orientation	MTM	Summary
Mellanox AS4610 1GbE Managed Switch with Cumulus	Rear to Front (PSE)	7D5FCTO1WW	1U ToR L2/3 1Gbit Switch with 48 GBASE-T RJ45 and 4 10Gbit SFP+ ports
	Front to Rear (oPSE)	7D5FCTO2WW	
Mellanox SN2410 10GbE Managed Switch with Cumulus	Rear to Front (PSE)	7D5FCTO5WW	1U ToR L2/3 10Gbit Switch with 48 10Gbit SFP28 and 8 100Gbit QSFP28 ports
	Front to Rear (oPSE)	7D5FCTO6WW	
Mellanox SN2010 25GbE Managed Switch with Cumulus	Rear to Front (PSE)	7D5FCTO3WW	1U “half-wide” 25Gbit Switch with 18 25Gbit QSFP28 and 4 100Gbit QSFP28 ports
	Front to Rear (oPSE)	7D5FCTO4WW	
Mellanox SN2410 25GbE Managed Switch with Cumulus	Rear to Front (PSE)	7D5FCTO7WW	1U 25Gbit Switch with 48 25Gbit QSFP28 and 8 100Gbit QSFP28 ports
	Front to Rear (oPSE)	7D5FCTO8WW	
Mellanox SN3700C 100GbE Managed Switch with Cumulus	Rear to Front (PSE)	7D5FCTO9WW	1U 100Gbit Switch with 32 100Gbit QSFP28 ports
	Front to Rear (oPSE)	7D5FCTOAWW	

The following cable types can be purchased, with the lists of cables given in the tables below:

- [Cables for 10 GbE and 1 GbE RJ-45 adapters](#)
- [Cables for 10 GbE SFP+ adapters](#)
- [Cables for 25 GbE SFP28 adapters](#)
- [Cables for 100 GbE QSFP28 network adapters](#)
- [Cables for network transceivers](#)

The following table lists cables for the 10 GbE and 1 GbE RJ-45 adapters.

Table 3. Cables for 10 GbE and 1 GbE RJ-45 ports

Description	Part number	Feature code
UTP Category 5e cables (Blue) for 1 GbE RJ-45 ports		
0.6m Blue Cat5e Cable	40K5679	3801
0.75m Blue Cat5e Cable	00WE111	AVFT
1.0m Blue Cat5e Cable	00WE114	AVFU
1.25m Blue Cat5e Cable	00WE119	AVFV
1.5m Blue Cat5e Cable	40K8785	3802
3m Blue Cat5e Cable	40K5581	3803
10m Blue Cat5e Cable	40K8927	3804
25m Blue Cat5e Cable	40K8930	3805
UTP Category 5e cables (Green) for 1 GbE RJ-45 ports		
0.6m Green Cat5e Cable	40K5563	3796
0.75m Green Cat5e Cable	00WE099	AVFQ
1.0m Green Cat5e Cable	00WE103	AVFR
1.25m Green Cat5e Cable	00WE107	AVFS
1.5m Green Cat5e Cable	40K5643	3797
3m Green Cat5e Cable	40K5793	3798
10m Green Cat5e Cable	40K5794	3799
25m Green Cat5e Cable	40K8869	3800
UTP Category 5e cables (Yellow) for 1 GbE RJ-45 ports		
0.6m Yellow Cat5e Cable	40K8933	3791
1.5m Yellow Cat5e Cable	40K8951	3792
3m Yellow Cat5e Cable	40K8957	3793
10m Yellow Cat5e Cable	40K8801	3794
25m Yellow Cat5e Cable	40K8807	3795

The following table lists cables for 10 GbE SFP+ port connection.

Table 4. Cables for 10 GbE SFP+ ports

Description	Part number	Feature code
SFP+ passive direct-attach cables - 10 GbE		
Lenovo 0.5m Passive SFP+ DAC Cable	00D6288	A3RG
Lenovo 1m Passive SFP+ DAC Cable	90Y9427	A1PH
Lenovo 1.5m Passive SFP+ DAC Cable	00AY764	A51N
Lenovo 2m Passive SFP+ DAC Cable	00AY765	A51P
Lenovo 3m Passive SFP+ DAC Cable	90Y9430	A1PJ
Lenovo 5m Passive SFP+ DAC Cable	90Y9433	A1PK
Lenovo 7m Passive SFP+ DAC Cable	00D6151	A3RH
SFP+ active direct-attach cables - 10 GbE		
Lenovo 1m Active DAC SFP+ Cable	00VX111	AT2R
Lenovo 3m Active DAC SFP+ Cable	00VX114	AT2S
Lenovo 5m Active DAC SFP+ Cable	00VX117	AT2T
SFP+ active optical cables - 10 GbE		
Lenovo 1m SFP+ to SFP+ Active Optical Cable	00YL634	ATYX
Lenovo 3m SFP+ to SFP+ Active Optical Cable	00YL637	ATYY
Lenovo 5m SFP+ to SFP+ Active Optical Cable	00YL640	ATYZ
Lenovo 7m SFP+ to SFP+ Active Optical Cable	00YL643	ATZ0
Lenovo 15m SFP+ to SFP+ Active Optical Cable	00YL646	ATZ1
Lenovo 20m SFP+ to SFP+ Active Optical Cable	00YL649	ATZ2

The following table lists cables for 25 GbE SFP28 port connection.

Table 5. Cables for 25 GbE SFP28 ports

Description	Part number	Feature code
SFP28 passive direct-attach copper cables - 25 GbE		
Lenovo 1m Passive 25G SFP28 DAC Cable	7Z57A03557	AV1W
Lenovo 3m Passive 25G SFP28 DAC Cable	7Z57A03558	AV1X
Lenovo 5m Passive 25G SFP28 DAC Cable	7Z57A03559	AV1Y
SFP28 active optical cables - 25 GbE		
Lenovo 3m 25G SFP28 Active Optical Cable	7Z57A03541	AV1F
Lenovo 5m 25G SFP28 Active Optical Cable	7Z57A03542	AV1G
Lenovo 10m 25G SFP28 Active Optical Cable	7Z57A03543	AV1H
Lenovo 15m 25G SFP28 Active Optical Cable	7Z57A03544	AV1J
Lenovo 20m 25G SFP28 Active Optical Cable	7Z57A03545	AV1K

The following table lists cables for 100 GbE QSFP28 port connection.

Table 7. Cables for 100 GbE QSFP28 ports

Description	Part number	Feature code
QSFP28 passive direct-attach copper cables - 100 GbE		
Lenovo 1m Passive 100G QSFP28 DAC Cable	7Z57A03561	AV1Z
Lenovo 3m Passive 100G QSFP28 DAC Cable	7Z57A03562	AV20
Lenovo 5m Passive 100G QSFP28 DAC Cable	7Z57A03563	AV21
QSFP28 active optical cables - 100 GbE		
Lenovo 1m 100G QSFP28 Active Optical Cable	4Z57A10844	B2UZ
Lenovo 3m 100G QSFP28 Active Optical Cable	7Z57A03546	AV1L
Lenovo 5m 100G QSFP28 Active Optical Cable	7Z57A03547	AV1M
Lenovo 10m 100G QSFP28 Active Optical Cable	7Z57A03548	AV1N
Lenovo 15m 100G QSFP28 Active Optical Cable	7Z57A03549	AV1P
Lenovo 20m 100G QSFP28 Active Optical Cable	7Z57A03550	AV1Q
QSFP28 direct attach copper breakout cables - 100 GbE to 4x 25 GbE		
Lenovo 1m 100G QSFP28 to 4x25G SFP28 Breakout DAC Cable	7Z57A03564	AV22
Lenovo 3m 100G QSFP28 to 4x25G SFP28 Breakout DAC Cable	7Z57A03565	AV23
Lenovo 5m 100G QSFP28 to 4x25G SFP28 Breakout DAC Cable	7Z57A03566	AV24
QSFP28 active optical breakout cables - 100 GbE to 4x 25 GbE		
Lenovo 3m 100G to 4x25G Breakout Active Optical Cable	7Z57A03551	AV1R
Lenovo 5m 100G to 4x25G Breakout Active Optical Cable	7Z57A03552	AV1S
Lenovo 10m 100G to 4x25G Breakout Active Optical Cable	7Z57A03553	AV1T
Lenovo 15m 100G to 4x25G Breakout Active Optical Cable	7Z57A03554	AV1U
Lenovo 20m 100G to 4x25G Breakout Active Optical Cable	7Z57A03555	AV1V

The following table lists cables for 10 GbE SR SFP+, 25Gbit SR SFP28, 40Gb SR QSFP+ and 100Gb SR QSFP28 transceiver connections.

Table 8. Cables for network transceiver ports

Description	Part number	Feature code
OM3 optical cables for 10 GbE SR SFP+, 25 GbE SR SFP28, and 40 GbE SR QSFP+ BiDi transceivers		
Lenovo 0.5m LC-LC OM3 MMF Cable	00MN499	ASR5
Lenovo 1m LC-LC OM3 MMF Cable	00MN502	ASR6
Lenovo 3m LC-LC OM3 MMF Cable	00MN505	ASR7
Lenovo 5m LC-LC OM3 MMF Cable	00MN508	ASR8
Lenovo 10m LC-LC OM3 MMF Cable	00MN511	ASR9
Lenovo 15m LC-LC OM3 MMF Cable	00MN514	ASRA
Lenovo 25m LC-LC OM3 MMF Cable	00MN517	ASRB
Lenovo 30m LC-LC OM3 MMF Cable	00MN520	ASRC
OM3 optical cables for 40 GbE QSFP+ SR4/iSR4/eSR4 transceivers		
Lenovo 10m QSFP+ MPO-MPO OM3 MMF Cable	00VX003	AT2U
Lenovo 30m QSFP+ MPO-MPO OM3 MMF Cable	00VX005	AT2V
OM3 optical breakout cables for 40 GbE QSFP+ iSR4/eSR4 transceivers		
Lenovo 1m MPO-4xLC OM3 MMF Breakout Cable	00FM412	A5UA
Lenovo 3m MPO-4xLC OM3 MMF Breakout Cable	00FM413	A5UB
Lenovo 5m MPO-4xLC OM3 MMF Breakout Cable	00FM414	A5UC
OM4 optical cables for 10 GbE SR SFP+, 25 GbE SR SFP28, and 40 GbE SR QSFP+ BiDi transceivers		
Lenovo 0.5m LC-LC OM4 MMF Cable	4Z57A10845	B2P9
Lenovo 1m LC-LC OM4 MMF Cable	4Z57A10846	B2PA
Lenovo 3m LC-LC OM4 MMF Cable	4Z57A10847	B2PB
Lenovo 5m LC-LC OM4 MMF Cable	4Z57A10848	B2PC
Lenovo 10m LC-LC OM4 MMF Cable	4Z57A10849	B2PD
Lenovo 15m LC-LC OM4 MMF Cable	4Z57A10850	B2PE
Lenovo 25m LC-LC OM4 MMF Cable	4Z57A10851	B2PF
Lenovo 30m LC-LC OM4 MMF Cable	4Z57A10852	B2PG
OM4 Optical cables for 100 GbE QSFP28 SR4 transceivers		
Lenovo 5m MPO-MPO OM4 MMF Cable	7Z57A03567	AV25
Lenovo 7m MPO-MPO OM4 MMF Cable	7Z57A03568	AV26
Lenovo 10m MPO-MPO OM4 MMF Cable	7Z57A03569	AV27
Lenovo 15m MPO-MPO OM4 MMF Cable	7Z57A03570	AV28
Lenovo 20m MPO-MPO OM4 MMF Cable	7Z57A03571	AV29
Lenovo 30m MPO-MPO OM4 MMF Cable	7Z57A03572	AV2A
OM4 Optical breakout cables for 100 GbE QSFP28 SR4 transceivers		
Lenovo 1m MPO-4xLC Breakout OM4 MMF Cable	7Z57A03573	AV2B
Lenovo 3m MPO-4xLC Breakout OM4 MMF Cable	7Z57A03574	AV2C
Lenovo 5m MPO-4xLC Breakout OM4 MMF Cable	7Z57A03575	AV2D

Storage Expansion Units and Arrays

The Lenovo Expansion Units are designed to provide simplicity, speed, scalability, security, and high availability for small to large businesses. For more information on these products, see the product guides.

- **Lenovo Storage D1224 Drive Enclosure**
The Lenovo Storage D1224 delivers enterprise-class storage technology in a cost-effective solution with flexible drive configurations and RAID or JBOD (non-RAID) host connectivity. For more information, see the [D1224 product guide](#).
- **Lenovo Storage D3284 External High Density Drive Expansion Enclosure**
The Lenovo Storage D3284 High Density Expansion Enclosure delivers enterprise-class storage technology in a cost-effective dense solution with flexible drive configurations of up to 84 drives in 5U and RAID or JBOD (non-RAID) host connectivity or Lenovo ThinkSystem DS Series storage area network (SAN) array expansion. For more information, see the [D3284 product guide](#).

The following table lists all the Lenovo Storage Enclosures that are supported by LeSI.

Table 9. Lenovo Storage Enclosure selection

Description	Machine Type - Model	Feature Code	Summary
Lenovo Storage D1224 Drive Enclosure	4587-LC2	AU15	12Gb SAS 2U Enclosure for up to 24x 2.5-inch SFF SAS drives
Lenovo Storage D3284 External High Density Drive Expansion Enclosure	6413-LC1	AUDV	12G SAS 5U enclosure for up to 84x 3.5-inch LFF NL-SAS drives

In addition to the storage enclosures listed above, LeSI clusters may leverage the Lenovo ThinkSystem DE Series Storage arrays.

- **ThinkSystem DE Series All-Flash Storage Array**
The Lenovo ThinkSystem DE Series All-Flash Storage Arrays are designed to provide performance, simplicity, capacity, security, and high availability for customers. These storage arrays deliver enterprise-class storage management capabilities with a wide choice of host connectivity options, flexible drive configurations, and enhanced data management features. For more information, see the [DE Series All-Flash Storage Array datasheet](#).
- **ThinkSystem DE Series Hybrid Storage Array**
The Lenovo ThinkSystem DE Series Hybrid Storage Arrays are designed to provide high performance, simplicity, capacity security, and high availability for customers. These storage arrays deliver enterprise-class storage management capabilities in a performance-optimized system with a wide choice of host connectivity options, flexible drive configurations, and enhanced data management features. For more information, see the [DE Series Hybrid Flash Array datasheet](#).

The following table lists the DE Series Storage arrays for use with LeSI. These arrays are not fully tested within LeSI and are not part of the Best Recipe but may be used in conjunction with LeSI deployments.

Table 10. Lenovo ThinkSystem DE Series Storage Array selection

Description	Machine Type Model	Summary
Lenovo ThinkSystem DE4000F All Flash Storage Array	7Y76CTOLWW (2U24 SFF)	2U form factor storage systems supporting up to 192 SSDs
Lenovo ThinkSystem DE6000F All Flash Storage Array	7Y79CTOLWW (2U24 SFF)	2U form factor storage systems supporting up to 192 SSDs (higher IOPS, throughput)
Lenovo ThinkSystem DE2000H Hybrid Storage Array	7Y70CTOLWW (2U12 LFF) 7Y71CTOLWW (2U24 SFF)	2U form factor storage systems supporting up to 96 HDDs/SSDs
Lenovo ThinkSystem DE4000H Hybrid Storage Array	7Y74CTOLWW (2U12 LFF) 7Y75CTOLWW (2U24 SFF) 7Y77CTOLWW (4U60 LFF)	2U/4U form factor storage systems supporting up to 192 HDDs/120 SSDs
Lenovo ThinkSystem DE6000H Hybrid Storage Array	7Y78CTOLWW (2U24 SFF) 7Y80CTOLWW (4U60 LFF)	2U/4U form factor storage systems supporting up to 480 HDDs/120 SSDs

Rack Cabinets and Options

The Lenovo rack cabinets are industry-standard 19-inch server cabinets that are designed for high availability server environments. They are optimized to help maximize floor space, expedite installation, simplify cable management, and increase accessibility for improved serviceability. Lenovo also offers rack options, including accessories like a front extension to the rack, heat exchangers and console kits and a rear door heat exchanger, which is part of Lenovo Neptune liquid cooling technologies. These options improve thermal performance and simplify rack management.

The following table lists all the rack cabinets and rack options that are supported by LeSI.

Table 11. Rack Cabinets and Options

Description	MTM / PN	Feature Code	Summary
Rack cabinets			
Scalable Infrastructure 42U 1100mm Enterprise V2 Dynamic Rack	1410-HPB	A2M8	Primary Rack for LeSI Solutions
	1410-HPB	AS9Y	RDHX ready Rack for LeSI Solutions
	1410-HEB	A2M9	Expansion Rack for LeSI Solutions
	1410-HEB	B27C	LeSI Rack with Enhanced Packaging
Scalable Infrastructure 42U 1200mm Deep Rack*	1410-HPA	A1MP	Deep Primary Rack for LeSI Solutions
	1410-HEA	A1MQ	Deep Expansion Rack for LeSI Solutions
Client Site Integration Kit	7X74-CTO1WW	B1EN	Virtual Rack for LeSI and DSS-G Solutions
Rack Options			
Rear Door Heat eXchanger V2 (RDHX)**	1756-HC1	A2FP	Rear Door Heat Exchanger for 30-40kW room neutral liquid cooling.
Rack Extension Kit*	00Y456	AUEE	Extension Kit for front cabling space
Other			
1U 18.5' Standard Console	1723-HC1	A3EK	Console kit for rack management
Local 1X8 Console Manager (LCM8)	1754-HC3/A1X	0725	8-port analog KVM switch
Local 2X16 Console Manager (LCM16)	1754-HC4/A2X	0725	16-port analog KVM switch
Global 2X2X16 Console Manager (GCM16)	1754-HC1/D1X	6694	16-port KVM supporting 2 remote users
Global 4X2X16 Console Manager (GCM32)	1754-HC2/D2X	6695	16-port KVM supporting 4 remote users
Rack Lift Tool	7D5Y	None	Genie Lift GL-8 material lift

* 1100mm racks with Rear Door Heat Exchangers and/or Rack Extension Kits require extended packaging (part of the AS9Y and B27C bill of materials). Additionally, 1200mm racks in any configuration also require extended packaging (part of the A1MP and A1MQ bill of materials).

** Rear Door Heat Exchangers are only available on Primary Racks.

Other Lenovo ThinkSystem hardware

While LeSI maintains a set of best recipe configurations guaranteeing interoperability, this does not mean that other ThinkSystem hardware is never used. Other Lenovo ThinkSystem hardware system and configurations outside of the defined stack may be compatible with LeSI, though not formally covered by interoperability warranty/support.

For example, the ThinkSystem DS6200 Storage Array may be part of the optimal hardware choices for a client use case. Because LeSI strives to offer the optimal data center solution to every client, a special bid process is available for incorporating these hardware options. For more information, please check with your Lenovo sales representative.

HPC Acceleration

LeSI solutions include GPUs from NVIDIA. For a summary of GPU features, see the [Lenovo ThinkSystem GPU Summary](#).

Click the links below to read the product briefs from NVIDIA:

- NVIDIA Tesla Series
 - [NVIDIA Tesla M10](#)
 - [NVIDIA A100](#)

- [NVIDIA A40](#)
- [NVIDIA Tesla V100](#)
- [NVIDIA Tesla V100S](#)
- [NVIDIA Tesla T4](#)
- **NVIDIA Quadro Series**
 - [NVIDIA Quadro P2200](#)
 - [NVIDIA Quadro P620](#)
 - [NVIDIA Quadro RTX4000](#)
 - [NVIDIA Quadro RTX5000](#)
 - [NVIDIA Quadro RTX6000](#)
 - [NVIDIA Quadro RTX8000](#)

The following table lists all the graphics processing units (GPU) acceleration options that are supported by LeSI.

Table 12. GPU adapters

Description	Part Number	Feature Code	SR630	SR650	SR655	SR670	SR850	SR860	SR950	SD530	SD650
NVIDIA Tesla GPUs											
NVIDIA A100 PCIe 40GB, PCIe (passive)	4X67A13135	BEL5	N	2	3	4	N	N	N	N	N
NVIDIA A40 48GB, PCIe (passive)	4X67A72593	BEL4	N	N	N	4	N	N	N	N	N
NVIDIA Tesla V100S 32GB GPU, PCIe (passive)	4X67A13124	BB65	N	2	N	4	N	N	N	N	N
NVIDIA Tesla V100 32GB GPU, PCIe (passive)	4X67A12088	B34S	N	2	3	4	N	2	N	2	N
NVIDIA Tesla V100 PCIe 16GB, PCIe (passive)	4C57A09498	B1JY	N	2	3	4	N	2	N	2	N
NVIDIA Tesla V100 FHHL 16GB GPU, PCIe (passive)	SBB7A09754	B32D	N	2	N	N	N	N	N	N	N
NVIDIA Tesla T4 16GB GPU, PCIe (passive)	4X67A14926	B4YB	2	N	6	8	N	N	N	N	N
NVIDIA Tesla M10 GPU, PCIe (passive)	7C57A02891	AX8L	N	2	N	N	N	N	N	2	N
	None	B0RK	N	N	N	N	N	N	N	2	N
	None	B15V	N	2	N	N	N	N	N	N	N
NVIDIA Quadro GPUs											
ThinkSystem NVIDIA Quadro RTX8000 48GB GPU, PCIe (passive)	4X67A65441	BCGR	N	N	N	4	N	N	N	N	N
ThinkSystem NVIDIA Quadro RTX6000 24GB GPU, PCIe (passive)	4X67A13125	BB64	N	N	N	4	N	N	N	N	N
ThinkSystem NVIDIA Quadro RTX5000 16GB GPU, PCIe (active)	4X67A17267	B6CH	N	2	N	N	N	N	N	N	N
ThinkSystem NVIDIA Quadro RTX4000 8GB GPU, PCIe (active)	4X67A14934	B6CG	N	2	N	N	N	N	N	N	N
ThinkSystem NVIDIA Quadro P2200 GPU, PCIe (active)	4X67A14935	B7JW	1	N	N	N	N	N	N	N	N
ThinkSystem NVIDIA Quadro P620 2GB GPU, PCIe (active)	4X67A11584	B31D	3	3	N	N	N	N	N	N	N

InfiniBand Interconnects

- Mellanox SB7800 Series

Built with NVIDIA Networking's Switch-IB 2 InfiniBand switch device, the SB7800 series provides up to 100Gb/s full bi-directional bandwidth per port. SB7800 smart network switch is designed to enable in-network computing through the Co-Design Scalable Hierarchical Aggregation Protocol (SHARP) technology. The Co-Design architecture enables the usage of all active data center devices to accelerate the communications frameworks using embedded hardware, resulting in significant applications performance improvements. For more information, see the product briefs below:

- [Mellanox SB7800](#) – 36-port Non-blocking Managed EDR 100Gb InfiniBand Smart Switch
- [Mellanox SB7890](#) – 36-port Non-blocking Externally-managed EDR 100Gb InfiniBand Smart Switch

- Mellanox QM8700 Series

Built with NVIDIA Networking's Quantum InfiniBand switch device, the QM8700 series provides up to 200Gb/s full bi-directional bandwidth per port. QM8700 is the world's smartest network switch, designed to enable in-network computing through the Co-Design Scalable Hierarchical Aggregation Protocol (SHARP) technology. The Co-Design architecture enables the usage of all active data center devices to accelerate the communications frameworks using embedded hardware, result in order of magnitude applications performance improvements. For more information, see the product briefs below:

- [Mellanox QM8700](#) – 40-port Non-blocking Managed HDR 200Gb InfiniBand Smart Switch
- [Mellanox QM8790](#) – 40-port Non-blocking Externally-managed HDR 200Gb InfiniBand Smart Switch

- Mellanox InfiniBand Adapters

Data centers, high scale storage systems and cloud computing require I/O services such as bandwidth, consolidation and unification, and flexibility. NVIDIA Networking InfiniBand adapters provide advanced levels of data center IT performance, efficiency and scalability. In addition, NVIDIA Networking's InfiniBand adapters support traffic consolidation and provides hardware acceleration for server virtualization as well as functioning as both InfiniBand and Ethernet adapters. For more information, see the product briefs below:

- [Mellanox ConnectX-4 EDR InfiniBand Adapter](#)
- [Mellanox ConnectX-4 Lx Ethernet Adapter \(EN only\)](#)
- [Mellanox ConnectX-5 EDR InfiniBand Adapter](#)
- [Mellanox ConnectX-6 HDR InfiniBand Adapter](#)

Note: The ConnectX-5 EDR InfiniBand adapters are only available to Lenovo customers through LeSI.

The following table lists all the InfiniBand switches that are supported by LeSI.

Table 13. InfiniBand switches

Description	Orientation	Part Number	Machine Type - Model	Feature Code	Summary
InfiniBand Switches					
Mellanox SB7800 EDR InfiniBand Switch	PSE	None	0724-HD3	AUPK	1U 36 Port Managed 100Gb/s Switch-IB2 InfiniBand Switch
	oPSE	None	0724-HD4	AUPL	
Mellanox SB7890 EDR InfiniBand Switch	PSE	None	0724-HD5	AUPM	1U 36 Port Unmanaged 100Gb/s Switch-IB2 InfiniBand Switch
	oPSE	None	0724-HD6	AUPN	
Mellanox QM8700 HDR InfiniBand Switch	PSE	None	0724-HD7	B4RH	1U 40 Port Managed 200Gb/s Quantum InfiniBand Switch
	oPSE	None	0724-HD8	B4RJ	
Mellanox QM8790 HDR InfiniBand Switch	PSE	None	0724-HD9	B4RK	1U 40 Port Unmanaged 200Gb/s Quantum InfiniBand Switch
	oPSE	None	0724-HEA	B4RL	
InfiniBand Switch Options					
Mellanox QM87xx RMK w/ Air Duct	PSE	4M27A16331	None	B5RV	Mounting kit with air duct for 1U HDR InfiniBand Switches
Mellanox QM87xx RMK for Recessed Mounting	oPSE	4M27A16332	None	B5RW	Recessed Mounting kit for 1U HDR InfiniBand Switches

The following table lists all InfiniBand adapters that are supported by LeSI.

Table 14. InfiniBand adapters

Description	Part Number	Feature Code	SR630	SR650	SR655	SR670	SR850	SR860	SR950	SD530	SD650
EDR Adapters											
Mellanox ConnectX-4 EDR IB VPI Single-port x16 PCIe 3.0 HCA	00KH924	ASWQ	Y	Y	N	N	Y	Y	Y	Y	N
Mellanox ConnectX-4 2x100GbE/EDR IB QSFP28 VPI Adapter	00MM960	ATRP	Y	Y	N	Y	Y	Y	Y	Y	N
Mellanox ConnectX-5 1x100GbE / EDR IB QSFP28 VPI Adapter *	4C57A08979	B0RL	Y	Y	N	N	Y	Y	Y	Y	N
Mellanox ConnectX-5 2x100GbE / EDR IB QSFP28 VPI Adapter *	4C57A08980	B0RM	Y	Y	N	Y	Y	Y	Y	Y	N
ThinkSystem SD650 DWC Mellanox ConnectX-5 EDR 1-port Adapter *	CTO only	B1C2	N	N	N	N	N	N	N	N	Y
Specialized FDR / EDR Adapters											
Lenovo ThinkSystem SharedIO ConnectX-5 Adapter*	CTO only	B3RZ	N	N	N	N	N	N	N	Y	N
Mellanox ConnectX-5 Socket-Direct EDR IB/100GbE Adapter Kit *	4C57A09506	B1DD	N	Y	N	N	N	N	Y	N	N
HDR Adapters											
Mellanox ConnectX-6 HDR100 IB Single-port x16 PCIe 3.0 HCA	4C57A14177	B4R9	Y	Y	Y	Y	Y	Y	Y	Y	N
Mellanox ConnectX-6 HDR100 IB Dual-port x16 PCIe3.0 HCA	4C57A14178	B4RA	Y	Y	Y	Y	Y	Y	Y	Y	N
ThinkSystem Mellanox ConnectX-6 HDR/200GbE QSFP56 1-port PCIe Adapter	4C57A15326	B4RC	Y	Y	Y	Y	N	N	Y	N	N
ThinkSystem Mellanox ConnectX-6 HDR/200GbE QSFP56 1-port PCIe Adapter SharedIO SD650*	CTO only	B4RG	N	N	N	N	N	N	N	N	Y
ThinkSystem Mellanox HDR IB 2x PCIe Aux Kit	4C57A14179	B4RB	N	N	N	N	N	N	N	N	Y

* Note: These InfiniBand Adapters are only available to Lenovo customers through LeSI.

The following table lists all the InfiniBand cables that are supported by LeSI.

Table 15. InfiniBand cables

Description	Part number	Feature code
QSFP to 10Gb Ethernet (SFP+) Conversion		
Mellanox QSFP to SFP+ adapter	00D9676	ARZH
QSFP28 EDR InfiniBand Passive Copper Cables		
0.5m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP516	ASQT
0.75m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP520	ASQU
1m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP524	ASQV
1.25m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP528	ASQW
1.5m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP532	ASQX
2m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP536	ASQY

Description	Part number	Feature code
3m Mellanox EDR IB Passive Copper QSFP28 Cable	00MP560	ASRM
QSFP28 EDR InfiniBand Active Optical Cables		
3m Mellanox EDR IB Optical QSFP28 Cable	00MP563	ASRN
5m Mellanox EDR IB Optical QSFP28 Cable	00MP540	ASQZ
10m Mellanox EDR IB Optical QSFP28 Cable	00MP544	ASR0
15m Mellanox EDR IB Optical QSFP28 Cable	00MP548	ASR1
20m Mellanox EDR IB Optical QSFP28 Cable	00MP552	ASR2
30m Mellanox EDR IB Optical QSFP28 Cable	00MP556	ASR3
50m Mellanox EDR IB Optical QSFP28 Cable	00MP566	ASRP
QSFP56 HDR InfiniBand Passive Copper Cables		
0.5m Mellanox HDR IB Passive Copper QSFP56 Cable	4Z57A14182	B4QQ
1m Mellanox HDR IB Passive Copper QSFP56 Cable	4Z57A14183	B4QR
1.5m Mellanox HDR IB Passive Copper QSFP56 Cable	4Z57A14184	B4QS
2m Mellanox HDR IB Passive Copper QSFP56 Cable	4Z57A14185	B4QT
QSFP56 HDR to 2x HDR100 InfiniBand Passive Copper Splitter Cables		
1m Mellanox HDR IB Passive Copper Splitter QSFP56 Cable	4Z57A14193	B4R1
1.5m Mellanox HDR IB Passive Copper Splitter QSFP56 Cable	4Z57A14194	B4R2
2m Mellanox HDR IB Passive Copper Splitter QSFP56 Cable	4Z57A11477	B68L
QSFP56 HDR InfiniBand Active Optical Cables		
3m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A14188	B4QW
5m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A14189	B4QX
10m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A14190	B4QY
15m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A14191	B4QZ
20m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A14192	B4R0
30m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A16016	B68P
50m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A16017	B68N
100m Mellanox HDR IB Active Optical QSFP56 Cable	4Z57A16018	B68M
QSFP56 HDR to 2x HDR100 InfiniBand Active Optical Splitter Cables		
3m Mellanox HDR IB Active Optical Splitter QSFP56 Cable	4Z57A14196	B4R4
5m Mellanox HDR IB Active Optical Splitter QSFP56 Cable	4Z57A14197	B4R5
10m Mellanox HDR IB Active Optical Splitter QSFP56 Cable	4Z57A14198	B4R6
15m Mellanox HDR IB Active Optical Splitter QSFP56 Cable	4Z57A14199	B4R7
20m Mellanox HDR IB Active Optical Splitter QSFP56 Cable	4Z57A14214	B4R8

Omni-Path Architecture

- Intel Omni-Path Fabric Edge Switches 100 Series

Intel Omni-Path Edge Switches deliver 100Gb port bandwidth with low latency at scale. These switches can lower fabric acquisition costs by as much as 50%, while simultaneously reducing space and power requirements. With these savings, you can achieve higher total cluster performance within the same hardware budget to expand and accelerate your research. For more information, see the Intel product brief below:

- [Intel OPA 100 Series](#) 24-port and 48-port switches

- OPA Adapters

Intel Omni-Path adapters are designed specifically for high performance computing. These adapters use an advanced connectionless design that delivers performance that scales with high node and core counts, making it an ideal choice for most demanding applications. The Omni-Path adapters support 100Gb per port, which means each port can deliver up to 25Gb per port of bi-directional bandwidth. The same ASIC utilized in the Omni-Path adapters will also be integrated into future Intel Xeon processors and used in third-party products. For more information, see the Intel product brief below:

- [Intel Omni-Path 100 Series Host Fabric Interface Adapter](#)

The following table lists all the Omni-Path switches that are supported by LeSI.

Table 16. OPA switches

Description	Orientation	Part Number	Machine Type - Model	Feature Code	Summary
OPA Switches					
Intel OPA 100 Series 24-port Unmanaged Edge Switch	PSE	None	0449-HCP	AU06	1U 24 Port Unmanaged 100Gb/s OPA Switch
	oPSE	None	0449-HCQ	AU07	
Intel OPA 100 Series 48-port Unmanaged Edge Switch	PSE	None	0449-HCR	AU08	1U 48 Port Unmanaged 100Gb/s OPA Switch
	oPSE	None	0449-HCS	AU09	
OPA Switch Options					
Intel OPA 100 Series Edge Switch Management Card	Not applicable	00WE075	None	AU0C	Management Card for 1U 24P / 48P OPA Switch
Intel 1U Switch Air Duct Kit for Enterprise Racks	Not applicable	00WE079	None	AU0D	Air duct for recessed 1U 24P / 48P OPA Switch

The following table lists all Omni-Path adapters that are supported by LeSI.

Table 17. OPA adapters

Description	Part Number	Feature Code	SR630	SR650	SR655	SR670	SR850	SR860	SR950	SD530	SD650
Intel OPA 100 Series Single-port PCIe 3.0 x8 HFA	00WE023	AU0A	Y	Y	N	N	Y	Y	Y	Y	N
Intel OPA 100 Series Single-port PCIe 3.0 x16 HFA	00WE027	AU0B	Y	Y	N	Y	Y	Y	Y	Y	Y
Intel OPA 100 Series Single-port PCIe 3.0 x16 HFA for SD650 DWC	SBB7A08433	B21S	N	N	N	N	N	N	N	N	Y

The following table lists all the Omni-Path cables that are supported by LeSI.

Table 18. OPA cables

Description	Part number	Feature code
QSFP28 OPA Passive Copper Cables		
0.5m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE031	AU0E
0.75m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE035	AU0F
1m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE039	AU0G
1.25m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE043	AU0H
1.5m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE047	AU0J
2m Intel OPA 100 Series Passive Copper QSFP28 Cable	00WE051	AU0K
QSFP28 OPA Active Optical Cables		
5m Intel OPA 100 Series Active Optical QSFP28 Cable	00WE059	AU0M
15m Intel OPA 100 Series Active Optical QSFP28 Cable	00WE067	AU0P
20m Intel OPA 100 Series Active Optical QSFP28 Cable	00WE071	AU0Q
QSFP28 OPA Active Optical Low Power Cables		
5m Intel OPA 100 Series Active Optical QSFP28 Low Power Cable	4X97A11034	B22J
10m Intel OPA 100 Series Active Optical QSFP28 Low Power Cable	4X97A11035	B22K
15m Intel OPA 100 Series Active Optical QSFP28 Low Power Cable	4X97A11036	B22L
20m Intel OPA 100 Series Active Optical QSFP28 Low Power Cable	4X97A11037	B22M

Software components

LeSI best recipe supports the following software components. The licenses are usually packaged with 3 years subscription and/or support, with the option to extend the license coverage to 5 years. For additional years or renewal of existing licenses bought through Lenovo, please contact your Lenovo Services sales representative.

- SUSE Linux Enterprise Server

SUSE Linux Enterprise Server (SLES) is a world-class, secure open source server operating system, built to power physical, virtual and cloud-based mission-critical workloads. The operating system further raises the bar in helping organizations to accelerate innovation, enhance system reliability, meet tough security requirements and adapt to new technologies. For more information, see the [SLES Product Features](#) web page.
- Red Hat Enterprise Linux Server

Red Hat Enterprise Linux Server (RHEL) is the world's leading enterprise Linux platform. Red Hat Enterprise Linux Server orchestrates the hardware resources that fulfill the infrastructure's basic computing requirements such as CPU, memory, networking, and storage. For more information, see the [RHEL product page](#).
- CentOS

CentOS is a stable, predictable, manageable and reproducible Linux distribution derived from the sources of Red Hat Enterprise Linux. CentOS provides a development framework for cloud providers, the hosting community, and scientific data processing. For more information, see the [CentOS Project Wiki](#).

- IBM Spectrum Scale

IBM Spectrum Scale is a cluster file system that provides concurrent access to a single file system or a set of file systems from multiple nodes. The nodes can be SAN attached, network attached, a mixture of SAN and network attached, or in a shared nothing cluster configuration. This enables high performance access to this common set of data to support a scale-out solution or to provide a high availability platform. For more information, see the [IBM Spectrum Scale product documentation](#).

- xCAT/Confluent

xCAT enables users to easily manage large number of servers for any type of technical computing workload. xCAT is known for exceptional scaling, wide variety of supported hardware and operating systems, virtualization platforms, and complete “day 0” setup capabilities. Confluent is an easy-to-use adaptation of xCAT with faster performance for larger solutions. For more information, see the [xCAT/Confluent product documentation](#).

- LiCO (Lenovo Intelligent Computing Orchestration)

Lenovo Intelligent Computing Orchestration (LiCO) is a Lenovo-developed software solution that simplifies the management and use of distributed clusters for High Performance Computing (HPC) and Artificial Intelligence (AI) environments. LiCO provides a consolidated Graphical User Interface (GUI) for monitoring and usage of LeSI cluster resources, allowing you to easily run both HPC and AI workloads across a choice of Lenovo infrastructure, including both CPU and GPU solutions to suit varying application requirements. For more information, see the [LiCO product guide](#).

- Excelero

Excelero delivers low-latency distributed block storage for web-scale applications. NVMesh enables shared NVMe network and supports any local or distributed file systems. The solution features an intelligent management layer that abstracts underlying hardware with CPU offload, creates logical volumes with redundancy, and provides centralized intelligent management and monitoring. Applications can enjoy the latency, throughput, and IOPs of a local NVMe device with the convenience of centralized storage while avoiding proprietary hardware lock-in and reducing the overall storage TCO. For more information, see the [Excelero NVMesh2 datasheet](#).

- WekaIO

WekaIO Matrix software is the industry’s first flash-native parallel file system that delivers unmatched performance to the most demanding applications, scaling to massive amounts of data in a single namespace. The software-only solution is an NVMe-native, fully parallel and distributed, POSIX compliant file system designed from the ground up to scale to thousands of compute nodes and petabytes of storage. For more information, see the [WekaIO file system datasheet](#).

- VAST Data

VAST’s disaggregated, shared-everything architecture (DASE) is a purpose-built storage cluster architecture designed to scale to petabytes, give tier-1 all-flash performance, while selling for a price point equivalent to what customers pay for archive storage. VAST leverages NVMe over Fabrics, QLC Flash, and 3D XPoint persistent memory to provide the performance of a parallel file system with the simplicity of a modern NAS platform. For more information, see the [VAST Universal Storage datasheet](#).

The following table lists the HPC versions of all the commercial operating systems that are supported by LeSI. Other versions are supported as well, but would exceed the limits of documentation here.

Table 19. Commercial Operating Systems

Description	Part number	Feature code
SUSE Linux Enterprise Server (SLES) – Single Server and HPC only listed, others available		
SLES X86 2 Socket Standard Subscription w/Lenovo Support 1Yr	7S0G0007WW	S0LM

Description	Part number	Feature code
SLES X86 2 Socket Standard Subscription w/Lenovo Support 3Yr	7S0G0008WW	S0LN
SLES X86 2 Socket Standard Subscription w/Lenovo Support 5Yr	7S0G0009WW	S0LP
SLES X86 2 Socket Priority Subscription w/Lenovo Support 1Yr	7S0G0024WW	S4N7
SLES X86 2 Socket Priority Subscription w/Lenovo Support 3Yr	7S0G0025WW	S4N8
SLES X86 2 Socket Priority Subscription w/Lenovo Support 5Yr	7S0G0026WW	S4N9
SUSE Linux Enterprise HPC Standard SUSE Support 1 Year (US/CA/AP)	00YC039	1860
SUSE Linux Enterprise HPC Standard SUSE Support 1 Year (EMEA/LA)	00YC149	1860
SUSE Linux Enterprise HPC Standard SUSE Support 3 Years (US/CA/AP)	00YC040	1861
SUSE Linux Enterprise HPC Standard SUSE Support 3 Years (EMEA/LA)	00YC150	1861
SUSE Linux Enterprise HPC Standard SUSE Support 5 Years (US/CA/AP)	00YC041	1859
SUSE Linux Enterprise HPC Standard SUSE Support 5 Years (EMEA/LA)	00YC151	1859
SUSE Linux Enterprise HPC Priority SUSE Support 1 Year (US/CA/AP)	00YC042	1856
SUSE Linux Enterprise HPC Priority SUSE Support 1 Year (EMEA/LA)	00YC152	1856
SUSE Linux Enterprise HPC Priority SUSE Support 3 Years (US/CA/AP)	00YC043	1857
SUSE Linux Enterprise HPC Priority SUSE Support 3 Years (EMEA/LA)	00YC153	1857
SUSE Linux Enterprise HPC Priority SUSE Support 5 Years (US/CA/AP)	00YC044	1858
SUSE Linux Enterprise HPC Priority SUSE Support 5 Years (EMEA/LA)	00YC154	1858
Red Hat Enterprise Linux (RHEL) – Single Server and HPC only listed, others available		
RHEL Server Physical or Virtual Node, 2 Skt Std Sub w/ Lenovo Sup 1Yr	7S0F0001WW	S0N5
RHEL Server Physical or Virtual Node, 2 Skt Std Sub w/ Lenovo Sup 3Yr	7S0F0002WW	S0N6
RHEL Server Physical or Virtual Node, 2 Skt Std Sub w/ Lenovo Sup 5Yr	7S0F0003WW	S0N7
RHEL Server Physical or Virtual Node, 2 Skt Prem Sub w/ Lenovo Sup 1Yr	7S0F0004WW	S0N8
RHEL Server Physical or Virtual Node, 2 Skt Prem Sub w/ Lenovo Sup 3Yr	7S0F0005WW	S0N9
RHEL Server Physical or Virtual Node, 2 Skt Prem Sub w/ Lenovo Sup 5Yr	7S0F0006WW	S0NA
RHEL for HPC Head Node Sub w/ Lenovo Std Sup 1Yr	7S0F002AWW	S4ML
RHEL for HPC Head Node Sub w/ Lenovo Std Sup 3Yr	7S0F002BWW	S4MM
RHEL for HPC Head Node Sub w/ Lenovo Std Sup 5Yr	7S0F002CWW	S4MN
RHEL for HPC Head Node Sub w/ Lenovo Prem Sup 1Yr	7S0F0027WW	S4MH
RHEL for HPC Head Node Sub w/ Lenovo Prem Sup 3Yr	7S0F0028WW	S4MJ
RHEL for HPC Head Node Sub w/ Lenovo Prem Sup 5Yr	7S0F0029WW	S4MK
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 1Yr	7S0F002DWW	S4MP
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 3Yr	7S0F002EWW	S4MQ
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 5Yr	7S0F002FWW	S4MR
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 1Yr EUS	7S0F002GWW	S4MS
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 3Yr EUS	7S0F002HWW	S4MT
RHEL for HPC Compute Node Sub w/ RedHat L3 only Sup 5Yr EUS	7S0F002JWW	S4MU

The following table lists all Orchestration software available with LeSI. Only LiCO is being fully tested within LeSI and part of the Best Recipe. The other packages are supported by the respective software vendor for use within LeSI.

Table 20. Orchestration Software

Description	Part number	Feature code
Lenovo Intelligent Computing Orchestration (LiCO) HPC AI version		
Lenovo HPC AI LiCO Software 90 Day Evaluation License	7S090004WW	B1YC
Lenovo HPC AI LiCO Software w/1 yr S&S	7S090001WW	B1Y9
Lenovo HPC AI LiCO Software w/3 yr S&S	7S090002WW	B1YA
Lenovo HPC AI LiCO Software w/5 yr S&S	7S090003WW	B1YB
Lenovo Intelligent Computing Orchestration (LiCO) Kubernetes version		
Lenovo K8S AI LiCO Software Evaluation License (90 days)	7S090006WW	S21M
Lenovo K8S AI LiCO Software 4GPU w/1Yr S&S	7S090007WW	S21N
Lenovo K8S AI LiCO Software 4GPU w/3Yr S&S	7S090008WW	S21P
Lenovo K8S AI LiCO Software 4GPU w/5Yr S&S	7S090009WW	S21Q
Lenovo K8S AI LiCO Software 16GPU upgrade w/1Yr S&S	7S09000AWW	S21R
Lenovo K8S AI LiCO Software 16GPU upgrade w/3Yr S&S	7S09000BWW	S21S
Lenovo K8S AI LiCO Software 16GPU upgrade w/5Yr S&S	7S09000CWW	S21T
Lenovo K8S AI LiCO Software 64GPU upgrade w/1Yr S&S	7S09000DWW	S21U
Lenovo K8S AI LiCO Software 64GPU upgrade w/3Yr S&S	7S09000EWW	S21V
Lenovo K8S AI LiCO Software 64GPU upgrade w/5Yr S&S	7S09000FWW	S21W
IBM Spectrum LSF (not tested within LeSI / no Solution Interoperability Support)		
Spectrum LSF Suite for HPC per Inst w/1Yr S&S	7S0A0001WW	B1YW
Spectrum LSF Suite for HPC per Inst w/3Yr S&S	7S0A0002WW	B1YX
Spectrum LSF Suite for HPC per Inst w/4Yr S&S	7S0A0003WW	B1YY
Spectrum LSF Suite for HPC per Inst w/5Yr S&S	7S0A0004WW	B1YZ
Spectrum LSF Suite for Enterprise per Inst w/1Yr S&S	7S0A0005WW	B1Z0
Spectrum LSF Suite for Enterprise per Inst w/3Yr S&S	7S0A0006WW	B1Z1
Spectrum LSF Suite for Enterprise per Inst w/4Yr S&S	7S0A0007WW	B1Z2
Spectrum LSF Suite for Enterprise per Inst w/5Yr S&S	7S0A0008WW	B1Z3
Spectrum LSF Suite for Workgroup per Inst w/1Yr S&S	7S0A0009WW	B1Z4
Spectrum LSF Suite for Workgroup per Inst w/3Yr S&S	7S0A000AWW	B1Z5
Spectrum LSF Suite for Workgroup per Inst w/4Yr S&S	7S0A000BWW	B1Z6
Spectrum LSF Suite for Workgroup per Inst w/5Yr S&S	7S0A000CWW	B1Z7
Spectrum LSF Suite per Server w/1Yr S&S	7S0A000HWW	B1ZC
Spectrum LSF Suite per Server w/3Yr S&S	7S0A000JWW	B1ZD
Spectrum LSF Suite per Server w/4Yr S&S	7S0A000KWW	B1ZE
Spectrum LSF Suite per Server w/5Yr S&S	7S0A000LWW	B1ZF
Spectrum LSF Suite per User w/1Yr S&S	7S0A000DWW	B1Z8
Spectrum LSF Suite per User w/3Yr S&S	7S0A000EWW	B1Z9
Spectrum LSF Suite per User w/4Yr S&S	7S0A000FWW	B1ZA
Spectrum LSF Suite per User w/5Yr S&S	7S0A000GWW	B1ZB

The following table lists the storage software available with LeSI. Only IBM Spectrum Scale file system software is being fully tested within LeSI and part of the Best Recipe. The other packages are supported by the respective software vendor for use within LeSI.

Table 21. File System Software

Description	Part number	Feature code
IBM Spectrum Scale		
Spectrum Scale Data Management Edition per Disk Drive w/1Yr S&S	None	AVZ7
Spectrum Scale Data Management Edition per Disk Drive w/3Yr S&S	None	AVZ8
Spectrum Scale Data Management Edition per Disk Drive w/4Yr S&S	None	AVZ9
Spectrum Scale Data Management Edition per Disk Drive w/5Yr S&S	None	AVZA
Spectrum Scale Data Management Edition per Flash Drive w/1Yr S&S	None	AVZB
Spectrum Scale Data Management Edition per Flash Drive w/3Yr S&S	None	AVZC
Spectrum Scale Data Management Edition per Flash Drive w/4Yr S&S	None	AVZD
Spectrum Scale Data Management Edition per Flash Drive w/5Yr S&S	None	AVZE
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 Disk Drive w/1Yr S&S	None	S189
Spectrum Scale Data Access Edition per Disk Drive w/3Yr S&S	None	S18A
Spectrum Scale Data Access Edition per Disk Drive w/4Yr S&S	None	S18B
Spectrum Scale Data Access Edition per Disk Drive w/5Yr S&S	None	S18C
Spectrum Scale Data Access Edition per Flash Drive w/1Yr S&S	None	S18D
Spectrum Scale Data Access Edition per Flash Drive w/3Yr S&S	None	S18E
Spectrum Scale Data Access Edition per Flash Drive w/4Yr S&S	None	S18F
Spectrum Scale Data Access Edition per Flash Drive w/5Yr S&S	None	S18G
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

The following table lists the available Exceero block storage software.

Table 22. Excelero Block Storage Software

Description	Part number	Feature code
Excelero NVMesh (not tested within LeSI / no solution interoperability support)		
Excelero NVMesh, Per User w/1Yr Premium Support	7S0H0001WW	S0EF
Excelero NVMesh, Per User w/3Yr Premium Support	7S0H0002WW	S0EG
Excelero NVMesh, Per User w/4Yr Premium Support	7S0H0003WW	S0EH
Excelero NVMesh, Per User w/5Yr Premium Support	7S0H0004WW	S0EJ
Excelero NVMesh, Per User w/1Yr Mission Critical Support	7S0H0005WW	S0EK
Excelero NVMesh, Per User w/3Yr Mission Critical Support	7S0H0006WW	S0EL
Excelero NVMesh, Per User w/4Yr Mission Critical Support	7S0H0007WW	S0EM
Excelero NVMesh, Per User w/5Yr Mission Critical Support	7S0H0008WW	S0EN
Excelero NVMesh, Per NVMe Drive w/1Yr Premium Support	7S0H0009WW	S0EP
Excelero NVMesh, Per NVMe Drive w/3Yr Premium Support	7S0H000AWW	S0EQ
Excelero NVMesh, Per NVMe Drive w/4Yr Premium Support	7S0H000BWW	S0ER
Excelero NVMesh, Per NVMe Drive w/5Yr Premium Support	7S0H000CWW	S0ES
Excelero NVMesh, Per NVMe Drive w/1Yr Mission Critical Support	7S0H000DWW	S0ET
Excelero NVMesh, Per NVMe Drive w/3Yr Mission Critical Support	7S0H000EWW	S0EU
Excelero NVMesh, Per NVMe Drive w/4Yr Mission Critical Support	7S0H000FWW	S0EV
Excelero NVMesh, Per NVMe Drive w/5Yr Mission Critical Support	7S0H000GWW	S0EW
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/1Yr Premium Support	7S0H000HWW	S0EX
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/3Yr Premium Support	7S0H000JWW	S0EY
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/4Yr Premium Support	7S0H000KWW	S0EZ
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/5Yr Premium Support	7S0H000LWW	S0F0
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/1Yr Mission Critical Support	7S0H000MWW	S0F1
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/3Yr Mission Critical Support	7S0H000NWW	S0F2
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/4Yr Mission Critical Support	7S0H000PWW	S0F3
Excelero NVMesh, Client Inclusive, Per NVMe Drive w/5Yr Mission Critical Support	7S0H000QWW	S0F4
Excelero Remote, NVMesh General Professional Services , Per Day	7S0H000RWW	S0F5
Excelero Remote, Webinar-based, NVMesh Training Services, Per Day	7S0H000SWW	S0F6

For more information about Excelero NVMesh, see the datasheet:
<https://www.excelero.com/wp-content/uploads/2018/10/NVMesh2-Data-Sheet.pdf>

The following table lists the available WekaIO MatrixFS software.

Table 23. WekaIO MatrixFS software

Description	Part Number	Feature Code
Weka MatrixFS (not tested within LeSI / no solution interoperability support)		
WekaIO Matrix SW License for Flash SSD Tier Per TB, 1Yr	7SZZ101589	V27G
WekaIO Matrix SW License for Flash SSD Tier Per TB, 3Yr	7SZZ101590	V27H
WekaIO Matrix SW License for Flash SSD Tier Per TB, 5Yr	7SZZ101591	V27J
WekaIO Matrix SW License for Object Tier Per TB Usable, 1Yr	7SZZ101592	V27K
WekaIO Matrix SW License for Object Tier Per TB Usable, 3Yr	7SZZ101593	V27L
WekaIO Matrix SW License for Object Tier Per TB Usable, 5Yr	7SZZ101594	V27M

Public Cloud partnerships

LeSI partners with premier cloud providers to provide optimal solutions to customers that need to expand their on-premise HPC capabilities with off-premise resources. Especially for customers that have seasonal HPC requirements that go above and beyond their baseline need, pairing an LeSI cluster with public cloud compute capacity provides a superior Lenovo solution. Customers can also use the cloud provider to prototype workloads on technology for which they may not have business justification.

LeSI partners with cloud provider, Nimbix Cloud. Nimbix is a leading provider of purpose-built cloud computing for machine learning, AI and HPC applications. Powered by JARVICE, the Nimbix Cloud provides high-performance software as a service, dramatically speeding up data processing; customers select their preferred containerized application and server configuration along with the required cluster capacity. Applications run on bare-metal servers within Nimbix's data centers. The Nimbix cloud offers high speed, low latency network connectivity with no virtualization and access to more than 1,000 application workflows. For more information, see the Nimbix web site.

The following table lists the public cloud offerings available with LeSI. They are supported by the respective cloud vendor for use with LeSI.

Table 24. Public cloud offerings

Description	Part number	Feature code
Nimbix HPC Cloud		
Nimbix HPC Cloud Compute Unit	7SZZ100819	N/A
Nimbix HPC Cloud Block Storage Per TB /Per Month	7SZZ100820	N/A
Nimbix HPC Cloud SSD Storage – 1000 IOPs – Per TB /Per Month	7SZZ100821	N/A
Nimbix HPC Cloud SSD Storage – 5000 IOPs – Per TB /Per Month	7SZZ100822	N/A
Nimbix HPC Cloud SSD Storage – 10000 IOPs – Per TB /Per Month	7SZZ100823	N/A

For more information, see the Nimbix web site:

<https://www.nimbix.net/platform/>

LeSI factory integration

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

Lenovo experts can 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, install them, verify operation, and dispose of the packaging at the on-site location. Any LeSI solution is eligible for the basic Lenovo Hardware Installation services. Customized installation services are also available to meet the specific needs of the client.

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
- Designating a representative who is available and able to assist the technician with access, approvals,
- Providing a safe workspace and appropriate access for the technician

Once the client is ready, an expert technician will perform the installation. This process will include the following:

- Initial removal of the product from packaging, including inspection for damage
- Physical installation of the product per the associated documentation
- Physical connection and powering on of hardware
- Consolidation of all packaging materials and disposal within your site

Lenovo can also provide comprehensive onsite configuration of software, including integration and validation for operating systems and software, virtualization and high-availability configurations.

Client Site Integration Kit onsite installation

Besides shipping fully integrated into the Lenovo 1410 rack cabinet, LeSI 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 a LeSI solution while also providing them flexibility in custom-fitting into the client datacenter.

With the Lenovo Client Site Integration Kit, the LeSI solution is tested at the component level in Lenovo manufacturing, with integration and validation performed on-site by Lenovo Professional Services or the Business Partner. 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. The installation team will install the solution at the customer site into the customer provided rack per racking diagrams and point-to-point instructions.

Professional Services

Lenovo offers a wide variety of services designed to get the most value and effectiveness out of your data center.

Deployment Services

From basic hardware installation to more complex optimization and configuration, Lenovo Deployment Services provide everything you need to get up and running, increasing time to value. Deployment services are instrumental in the integration, migration, or expansion of your datacenter. Lenovo can provide comprehensive onsite configuration of hardware and software, including:

- Basic Hardware Installation – Lenovo experts unpack and configure systems, update firmware, and conduct final operation verification, with post-installation documentation for reference
- Integration, Migration, and Expansion – move or scale IT resources intelligently and cost-effectively, including tuning validation, and documenting ongoing run processes
- Customized HPC Deployment Services – besides providing basic hardware installation, Application experts can tune the performance and provide benchmark for LeSI clusters or offer education and training for the solution and its components

Data Center Infrastructure Services

Lenovo offers a wide variety of services designed to get the most value and effectiveness out of your data center. These reach from the assessment over planning and finally the implementation of your Data Center infrastructure:

- Data Center Best Practices Workshop – attend a one-day, onsite interactive workshop to review power, cooling, and energy efficiency associated with IT systems and data center infrastructure
- Assessment – examine the thermal and electrical health of your data center with help from Lenovo experts; understand your Power Usage Effectiveness (PUE) and compare with the industry
- Planning – design your data center with state-of-the-art insight into best practices in power, cooling, and energy efficiency, towards a best-in-class PUE and future-proof for the next decade of IT equipment
- Installing – put your power and cooling plans into action with Lenovo installation services, from traditional air-cooled environments, to leveraging chilled water in e.g. Rear Door Heat Exchangers or In-Row Coolers to the most modern environments with hot water cooling and adsorption chillers maximizing the Energy Reuse Efficiency (ERE)

Premium and Managed Services

For the relevant systems and workloads, consider advanced services, ranging from Enterprise Software Support over Premier System Support to Managed Services, managing your solution remotely or onsite:

- Lenovo Enterprise Software Support – provides comprehensive support covering server operating systems and business applications.
 - Single-source enterprise software support
 - Additional software support beyond hardware break/fix
 - Reduced problem resolution time and reduced cost to address technical issues and increased uptime
 - Unlimited access to technical experts, fast precise answers from highly trained call center experts
- Lenovo Premier Support Services – provides prioritized call queuing direct to Level 2 technicians for select systems.
 - Direct technician-to-technician access to ensure faster, accurate resolution
 - Live answer, with a simple process through a single point of contact

- End-to-end ownership of cases for a seamless support experience
- Lenovo Managed Services for HPC Clusters – provides 24x7 monitoring and technical system management for your cluster. This can include:
 - Ongoing monitoring of infrastructure hardware and software
 - Resolving Lenovo hardware and solution-specific, software-related problems
 - Reporting support problems that require your attention
 - Facilitating quarterly meetings as part of ongoing administration and management
 - Designating a client-care manager to interface between you and Lenovo

For more information on Lenovo Services, please contact your Lenovo sales representative.

Warranty options

LeSI exclusive components (Machine Types 1410, 7X74, 0724, 0449; 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 countries might have different warranty terms and conditions than the standard warranty. This is due to local business practices or laws in the specific country. Local service teams can assist in explaining country-specific terms when needed. Examples of country-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.

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.

The following warranty upgrades are available:

Table 25. Warranty upgrades

Foundation	The Foundation support level provides: <ul style="list-style-type: none"> • Next-business-day onsite response during normal business hours, 5 days per week • Base warranty upgrade covering onsite installation of all replacement parts
Essential	The Essential support level provides all the benefits of Foundation services, plus: <ul style="list-style-type: none"> • Four-hour onsite response, 24 hours per day, 7 days per week • YourDrive YourData
Advanced	The Advanced support level provides all the benefits of Essential services, plus: <ul style="list-style-type: none"> • Two-hour onsite response, 24 hours per day, 7 days per week

The following recommended additions are available to the warranty upgrades:

- Extend services with coverages up to 5 years
- Basic hardware installation services
- Enterprise server software support
- 24 hour committed service repair
- YourDrive YourData (Foundation)

The YourDrive YourData service allows you to retain possession and dispose of failed drives. Otherwise, failed drives under warranty must be returned to Lenovo upon replacement. This service is essential for organizations that must keep their data secure on premises, such as medical, retail, insurance, education, financial and technology sectors.

Table 26. Warranty upgrade part numbers – 1410/7X74 Rack

Description	Option Part Number
Scalable Infrastructure 42U 1100mm Enterprise V2 Dynamic Rack (1410-HPB, -HEB, -HPA, -HEA, 7X74)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A17328
Foundation Service w/Next Business Day Response, 4Yr	5WS7A17332
Foundation Service w/Next Business Day Response, 5Yr	5WS7A17336
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A17348
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A17351
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A17354

Table 27. Warranty upgrade part numbers – Mellanox InfiniBand Switches

Description	Option Part Number
Mellanox SB7800 EDR InfiniBand Switch (0724-HD3, -HD4)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A17583
Foundation Service w/Next Business Day Response, 4Yr	5WS7A17587
Foundation Service w/Next Business Day Response, 5Yr	5WS7A17591
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A17603
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A17606
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A17609
Advanced Service w/24x7 2Hr Response, 3Yr	5WS7A17618
Advanced Service w/24x7 2Hr Response, 4Yr	5WS7A17621
Advanced Service w/24x7 2Hr Response, 5Yr	5WS7A17624
Mellanox SB7890 EDR InfiniBand Switch (0724-HD5, -HD6)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A17683
Foundation Service w/Next Business Day Response, 4Yr	5WS7A17687
Foundation Service w/Next Business Day Response, 5Yr	5WS7A17691
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A17703
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A17706
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A17709
Advanced Service w/24x7 2Hr Response, 3Yr	5WS7A17718
Advanced Service w/24x7 2Hr Response, 4Yr	5WS7A17721
Advanced Service w/24x7 2Hr Response, 5Yr	5WS7A17724

Description	Option Part Number
Mellanox QM8700 HDR InfiniBand Switch (0724-HD7, -HD8)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A30560
Foundation Service w/Next Business Day Response, 4Yr	5WS7A30574
Foundation Service w/Next Business Day Response, 5Yr	5WS7A30588
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A30568
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A30582
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A30596
Mellanox QM8790 HDR InfiniBand Switch (0724-HD9, -HEA)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A30700
Foundation Service w/Next Business Day Response, 4Yr	5WS7A30714
Foundation Service w/Next Business Day Response, 5Yr	5WS7A30728
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A30708
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A30722
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A30736

Table 28. Warranty upgrade part numbers – Intel Omni-Path Switches

Description	Option Part Number
Intel OPA 100 Series 24-port Edge Switch (0449-HCP, -HCQ)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A17433
Foundation Service w/Next Business Day Response, 4Yr	5WS7A17437
Foundation Service w/Next Business Day Response, 5Yr	5WS7A17441
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A17453
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A17456
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A17459
Advanced Service w/24x7 2Hr Response, 3Yr	5WS7A17468
Advanced Service w/24x7 2Hr Response, 4Yr	5WS7A17471
Advanced Service w/24x7 2Hr Response, 5Yr	5WS7A17474
Intel OPA 100 Series 48-port Edge Switch (0449-HCR, -HCS)	
Foundation Service w/Next Business Day Response, 3Yr	5WS7A17483
Foundation Service w/Next Business Day Response, 4Yr	5WS7A17487
Foundation Service w/Next Business Day Response, 5Yr	5WS7A17491
Essential Service w/24x7 4Hr Response, 3Yr	5WS7A17503
Essential Service w/24x7 4Hr Response, 4Yr	5WS7A17506
Essential Service w/24x7 4Hr Response, 5Yr	5WS7A17509
Advanced Service w/24x7 2Hr Response, 3Yr	5WS7A17518
Advanced Service w/24x7 2Hr Response, 4Yr	5WS7A17521
Advanced Service w/24x7 2Hr Response, 5Yr	5WS7A17524

Solution Interoperability Support

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.

Operating Environment

Lenovo Scalable Infrastructure does fully comply with ASHRAE class A2 specifications for the air-cooled data center, with ASHRAE class W4 for direct to node water cooling for the LeSI exclusive Lenovo ThinkSystem SD650.

Depending on the hardware configuration, some server models comply with ASHRAE class A3 and class A4 specifications, however the server performance might be impacted when the operating temperature is outside the ASHRAE A2 specifications. 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
 - 180 - 300 V DC (HVDC; supported in China only)

Regulatory compliance

Lenovo Scalable Infrastructure adopts the conformity of its individual components to international standards, as minimum however

- UL/IEC / CSA C22.2 No. 60950-1
- United States FCC Part 15, Class A
- Canada ICES-003, Class A
- Europe CE Mark (EN55032 Class A, EN60950-1, EN55024, EN61000-3-2, EN61000-3-3)
- New Zealand/Australia CISPR 22, Class A
- Russia/GOST ME01; IEC-60950-1; GOST R 51318.22, 51317.3.2, and 51317.3.3
- Japan VCCI, Class A
- China CCC Class A
- CISPR 22, Class A

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

LeSI solution - DSS-G

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 ThinkSystem SR650 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.

For more information, see the [DSS-G product guide](#).

Case studies and references

These customers have already implemented LeSI solutions. Click the links to review the customer case studies.

- [Barcelona Supercomputing Center](#)

Climate change. Energy security. Fighting disease. Air quality. To help scientists turn mountains of data into accurate models of our complex world, Barcelona Supercomputing Center (BSC) has powered up a Lenovo supercomputer with Intel processors capable of performing trillions of computations per second.

- [Mark III Systems](#)

The Artificial Intelligence AI revolution is here, and it has the power to transform everything from daily life to the production line. With support from the Lenovo AI Innovation Center and access to ThinkSystem servers, Mark III Systems is leading the way, helping its clients to harness the power of AI to improve manufacturing quality and efficiency.

- [Umeå University](#)

Satisfying researchers' appetite for bigger, better, faster computing resources is never easy. With its new Lenovo supercomputer, High Performance Computing Center North (HPC2N) at Umeå University can deliver on these demands – boosting performance fivefold to support innovative computational and data-intensive research.

- [Leibniz Supercomputing Centre](#)

Leibniz Supercomputing Centre (LRZ) wanted to remain a leading hub within the HPC community, which means providing compute resources that combine industry-leading performance and energy efficiency. The organization implemented its SuperMUC Phase 2 supercomputer based on 3,072 Lenovo NeXtScale nx360 M5 WCT compute nodes.



LeSI installation in the Barcelona Supercomputing Center

Related publications and links

For more information, see these resources:

- LeSI product page:
<https://www.lenovo.com/us/en/data-center/servers/high-density/Lenovo-Scalable-Infrastructure/p/WMD00000276>
- LeSI support page:
<https://datacentersupport.lenovo.com/us/en/solutions/ht505184>
- 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>
- LiCO website:
<https://www.lenovo.com/us/en/data-center/software/Lenovo-Intelligent-Computing-Orchestration/p/WMD00000356>
- Lenovo HPC website:
<https://www.lenovo.com/us/en/data-center/solutions/hpc/>
- x-config configurator:
<https://lesc.lenovo.com/products/hardware/configurator/worldwide/bhui/asit/x-config.jnlp>
- Best recipe index:
<https://support.lenovo.com/us/en/solutions/HT505184#5>

Related product families

Product families related to this document are the following:

- [Artificial Intelligence](#)
- [High Performance Computing](#)

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