Lenovo ThinkSystem DE6000H Hybrid Storage Array

Product Guide

Lenovo ThinkSystem DE6000H is a scalable, hybrid mid-range storage system that is designed to provide high performance, simplicity, capacity, security, and high availability for medium to large businesses. The ThinkSystem DE6000H delivers 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. The ThinkSystem DE6000H is a perfect fit for a wide range of enterprise workloads, including big data and analytics, video surveillance, technical computing, backup and recovery, and other storage I/O-intensive applications.

ThinkSystem DE6000H models are available in a 2U rack form-factor with 24 small form-factor (2.5-inch SFF) drives (2U24 SFF) or a 4U rack form-factor with 60 LFF drives (4U60 LFF) and include two controllers, each with 16 GB or 64 GB system memory for a system total of 32 GB or 128 GB. Host interface cards provide 12 Gb SAS, 10/25 Gb iSCSI, 8/16/32 Gb FC or NVMe/FC, or 25/40/100 Gb NVMe/RoCE host connections.

The Lenovo ThinkSystem DE6000H 2U24 SFF and 4U60 LFF enclosures are shown in the following figure.

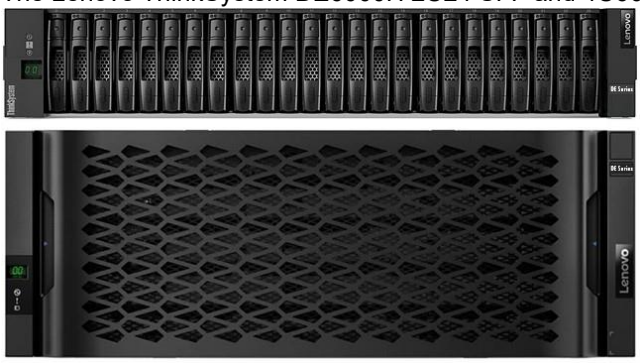

Figure 1. Lenovo ThinkSystem DE6000H 2U24 SFF (top) and 4U60 LFF (bottom) enclosures

Did you know?

The ThinkSystem DE6000H scales up to 4.3 PB of raw storage capacity in the base configuration or up to 8.64 PB with the optional Features on Demand upgrade.

The ThinkSystem DE6000H supports multiple storage connectivity protocols with a choice of SAS, iSCSI, Fibre Channel, NVMe over Fibre Channel, or NVMe over RoCE.

Key features

The ThinkSystem DE6000H Storage Array scales up to 240 (base configuration) or 480 (optional upgrade) drives with the attachment of Lenovo ThinkSystem DE240S 2U24 SFF, DE120S 2U12 LFF, and DE600S 4U60 LFF Expansion Enclosures. It also offers flexible drive configurations with the choice of 2.5-inch (SFF) and 3.5inch (LFF) form factors, 10 K rpm SAS and 7.2 K rpm NL SAS hard disk drives (HDDs), and SAS solid-state drives (SSDs).

The ThinkSystem DE6000H offers the following key features and benefits:

- Scalable, high performance mid-range hybrid storage with dual active/active controller configurations with 16 GB or 64 GB system memory per controller for high availability and performance.
- Faster application response times with support for NVMe over Fabrics.
- Improved performance and data protection with Dynamic Disk Pools (DDP) technology, as well as support for traditional RAID 0, 1, 3, 5, 6, and 10.
- Flexible storage protocols to match diverse client needs with support for 10 Gb iSCSI or 4/8/16 Gb FC and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC host connectivity, or 8/16/32 Gb NVMe/FC host connectivity, or 25/40/100 Gb NVMe/RoCE host connectivity.
- 12 Gb SAS drive-side connectivity with support for up to 24x 2.5-inch small form factor (SFF) drives in the 2U24 SFF enclosures, up to 12x 3.5-inch large form factor (LFF) drives in the 2U12 LFF enclosures, or up to 60x 3.5-inch LFF drives in the 4U60 LFF enclosures.
- Base scalability to up to 192 SFF or 240 LFF drives with the optional upgrade to increase the number of LFF drives to 480 by attaching ThinkSystem DE240S 2U24 SFF, DE120S 2U12 LFF, and DE600S 4U60 LFF expansion enclosures to satisfy growing needs for storage capacity and performance.
- Rich set of standard storage management functions available at no extra cost, including Dynamic Disk Pools, SSD read cache, snapshots, volume copy, thin provisioning, and encryption (requires optional FIPS drives).
- Optional licensed functions, including higher number of drives and snapshots for greater scalability and synchronous or asynchronous mirroring for continuous data availability.
- Intuitive, web-based GUI for easy system setup and management.
- Designed for 99.9999% availability with redundant hot-swap components, including controllers and I/O modules, power supplies, cooling modules (4U60 LFF enclosures only), proactive maintenance, and non-disruptive firmware upgrades.

The ThinkSystem DE6000H supports the complete range of data storage requirements, from highly used applications to high-capacity, low usage applications.

The following drives are supported in the 2U24 SFF enclosures:

- Capacity-optimized SSDs (1 drive write per day [DWD]): 3.84 TB, 7.68 TB, and 15.36 TB
- High performance SSDs (3 DWD): 800 GB, 1.6 TB
- Performance-optimized, enterprise class HDDs: 1.2 TB and 1.8 TB 10K rpm
- Performance-optimized, enterprise class self-encrypting FIPS HDDs: 1.8 TB 10K rpm High
- performance self-encrypting FIPS SSDs (3 DWD): 1.6 TB

The following drives are supported in the 2U12 LFF enclosures:

- High-performance SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 800 GB
- High performance self-encrypting FIPS SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 1.6 TB
- High-capacity, archival-class nearline HDDs: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm High-
- capacity, archival-class nearline self-encrypting FIPS HDDs: 6 TB and 10 TB 7.2K rpm

The following drives are supported in the 4U60 LFF enclosures:

- High-performance SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 800 GB, 1.6 TB
- High-capacity, archival-class nearline HDDs: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm
- High-capacity, archival-class nearline self-encrypting FIPS HDDs: 10 TB 7.2K rpm
- High performance self-encrypting FIPS SSDs (3 DWD): 1.6 TB

All drives are dual-port and hot-swappable. Drives of the same form factor can be intermixed within the appropriate enclosure, which provides the flexibility to address performance and capacity needs within a single enclosure.

Up to seven ThinkSystem DE240S 2U24 SFF or ThinkSystem DE120S 2U12 LFF, or up to three ThinkSystem DE600S 4U60 LFF, or a combination of the ThinkSystem DE240S 2U24 SFF, DE120S 2U12 LFF, and DE600S 4U60 LFF expansion enclosures for a maximum of 240 drives per system (including a controller enclosure) are supported by a single ThinkSystem DE6000H storage array in the base configuration.

With the optional Features on Demand (FoD) upgrade, the DH6000H supports attachment of up to seven ThinkSystem DE600S 4U60 LFF, or a combination of the DE240S 2U24 SFF, DE120S 2U12 LFF, and DE600S 4U60 LFF expansion enclosures for a total of eight enclosures (one controller enclosure and up to seven expansion enclosures) and up to 480 drives per system.

Customers can intermix 2U24 SFF, 2U12 LFF, and 4U60 LFF expansion enclosures behind a 2U24 SFF or 4U60 LFF controller enclosure. This configuration delivers the added flexibility to mix 3.5-inch and 2.5-inch drives within a single system.

More drives and expansion enclosures are designed to be dynamically added with virtually no downtime, which helps to quickly and seamlessly respond to ever-growing capacity demands.

The ThinkSystem DE6000H offers high levels of system and data availability with the following technologies:

- Dual-active controller modules with automatic load balancing and failover
- Mirrored data cache with flash backup (battery-backed destaging to flash)
- Dual-port SAS HDDs and SSDs with automatic drive failure detection and rebuild with global hot spares
- Redundant, hot-swappable and customer replaceable hardware components, including SFP/SFP+ transceivers, controller and I/O modules, power supplies, cooling modules (4U60 LFF only), and drives
- Automated path failover support for the data path between the host and the drives with multipathing software
- Non-disruptive controller and drive firmware upgrades

System specifications

The following table lists the ThinkSystem DE6000H storage system specifications.

Note: The supported hardware options, software features, and interoperability listed in this product guide are based on the software version 11.60. For details about specific software releases that introduced support for certain hardware options and software features, refer to the Release notes of the particular software release for the ThinkSystem DE6000H that can be found at: http://datacentersupport.lenovo.com

Table 1. ThinkSystem DE6000H system specifications

Attribute	Specification
Form factor	• DE6000H 2U24 SFF controller enclosure (Machine Type 7Y78): 2U rack mount. • DE6000H 4U60 LFF controller enclosure (Machine Type 7Y80): 4U rack mount. • DE240S 2U24 SFF expansion enclosure (Machine Type 7Y68): 2U rack mount. • DE120S 2U12 LFF expansion enclosure (Machine Type 7Y63): 2U rack mount. • DE600S 4U60 LFF expansion enclosure (Machine Type 7Y69): 4U rack mount.
Controller configuration	Dual active-active controller configuration with automatic load balancing.
RAID levels	RAID 0, 1, 3, 5, 6, and 10; Dynamic Disk Pools. **Note:** RAID 3 can be configured only through the CLI.
Controller system memory	32 GB or 128 GB per system (16 GB or 64 GB per controller). Cache mirroring between the controllers. Flash-backed cache protection (includes battery for destaging to flash).
Expansion enclosure support	• DE6000H 2U24 SFF controller: 7x DE120S, 7x DE240S or 7x DE600S* • DE6000H 4U60 LFF controller: 7x DE120S, 7x DE240S or 7x DE600S* • Expansion enclosures may be mixed up to a maximum of 7 expansion enclosures * Support of up to 7x DE600S requires feature B597 be included in the order. Without B597, the maximum number of DE600S enclosures supported is 3. See Software section for details.

Drive bays	Up to 8 enclosures per system: • Up to 240 LFF hot-swap drive bays (Up to 4x 4U60 LFF enclosures in the base configuration). • Up to 480 LFF hot-swap drive bays (Up to 8x 4U60 LFF enclosures with the optional FoD upgrade). • Up to 192 SFF hot-swap drive bays (Up to 8x 2U24 LFF enclosures). Intermix of 2U24 SFF, 2U12 LFF, and 4U60 LFF enclosures is supported.
Drive technology	• 12 Gb SAS and NL SAS HDDs and FIPS HDDs, 12 Gb SAS SSDs and FIPS SSDs. • Intermix of HDDs and SSDs is supported within a system. • Intermix of HDDs and SSDs is *not* supported within a volume group or disk pool. • A maximum of 120 SAS SSDs is supported. • Intermix of FIPS drives and non-FIPS drives is supported within a system. • Intermix of FIPS drives and non-FIPS drives is *not* supported within a volume group or disk pool.
Drive expansion connectivity	• 2x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two controllers in the controller enclosure for the attachment of the expansion enclosures. • 4x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two I/O modules in the expansion enclosure for the attachment to the controller enclosure and daisy chaining of the expansion enclosures.

Attribute	**Specification**
Drives	2U24 SFF drives: • 10K rpm SAS HDDs • 10K rpm SAS FIPS HDDs • SAS SSDs (1 DWD) • SAS SSDs (3 DWD) • SAS FIPS SSDs (3 DWD) • 2U12 LFF drives: • 7.2K rpm NL SAS HDDs • 7.2K rpm NL SAS FIPS HDDs • SAS SSDs (3 DWD) SAS FIPS SSDs (3 DWD) • • 4U60 LFF drives: • 7.2K rpm NL SAS HDDs • 7.2K rpm NL SAS FIPS HDDs SAS SSDs (3 DWD) SAS FIPS SSDs (3 DWD)
Storage capacity	• Base configuration (DE6000H 4U60 + 3x DE600S enclosures): 4.2 PB (240x 18 TB SAS HDDs). • FoD upgrade (DE6000H 4U60 + 7x DE600S enclosures): 8.4 PB (480x 18 TB SAS HDDs).
Storage protocols	SAN (Block access): SAS, iSCSI, FC, NVMe/FC, NVMe/RoCE.

Host connectivity	Host connectivity ports provided using host interface cards (HICs) (per controller enclosure with two controllers): • 8x 12 Gb SAS host ports (Mini-SAS HD, SFF-8644) (4 ports per controller) • 8x 10/25 Gb iSCSI SFP28 host ports (DAC or SW fiber optics, LC) (4 ports per controller) • 8x 8/16/32 Gb FC SFP+ host ports (SW fiber optics, LC) (4 ports per controller) • 4x 25/40/100 Gb NVMe/RoCE QSFP28 host ports (DAC cable or SW fiber optics, MPO) (2 ports per controller) **Note:** Two host interface cards are required for selection (one per controller). The controllers no longer offers base ports. Host connectivity is provided via the HICs.
Host operating systems	Microsoft Windows Server; Red Hat Enterprise Linux (RHEL); SUSE Linux Enterprise Server (SLES); VMware vSphere. **Note:** NVMe/FC is supported with RHEL 8 and SLES 15, and NVMe/RoCE is supported with SLES 12 only (reference LSIC for specific Operating System details).
Standard software features	Dynamic Disk Pools, SSD read cache, snapshots (up to 1024 targets), volume copy, thin provisioning (DDP only), encryption (requires optional FIPS drives), and data assurance.
Optional software features	Snapshots (up to 2048 targets), scalability to 480 drives, synchronous mirroring, and asynchronous mirroring.
Performance*	• Up to 1 000 000 random read IOPS (4 KB blocks). • Up to 390 000 random write IOPS (4 KB blocks). • Up to 21 GBps sequential read throughput (64 KB blocks), up to 22GBps (256KB blocks). • Up to 7 GBps sequential write throughput (64 KB blocks), up to 8.5GBps (256KB blocks).
Attribute	**Specification**

Configuration maximums**	• Maximum storage capacity: 3.84 PB (base) / 7.68 PB (optional FoD upgrade)
	• Maximum number of logical volumes: 2048
	• Maximum logical volume size: 4 PB
	• Maximum thin-provisioned logical volume size (DDP only): 256 TB
	• Maximum number of drives in a RAID volume group:
	  ◦ RAID 0, 1/10: 240 (base) / 480 (optional FoD upgrade)
	  ◦ RAID 3, 5, 6: 30
	• Maximum number of DDP arrays: 20
	• Maximum number of drives in a DDP array: 240 (base) / 480 (optional FoD upgrade); (11 drives minimum)
	• Maximum SSD read cache size: 5 TB
	• Maximum number of hosts: 512
	• Maximum number of snapshots: 1024 (base) / 2048 (optional FoD upgrade)
	• Maximum number of mirroring pairs: 128 (requires an optional license)

Cooling	Redundant cooling with two cooling modules (4U60 LFF) or with the fans that are built into power supplies (2U24 SFF).
Power supply	Two redundant hot-swap 913 W (100 - 240 V) (2U24 enclosures) or 2325 W (200 - 240 V) (4U60 enclosures) Platinum AC power supplies.
Hot-swap parts	Controllers, I/O modules, drives, power supplies, cooling modules (4U60 LFF only), and SFP+/SFP28/QSFP28 transceivers.
Management ports	• 1x 1 GbE port (UTP, RJ-45) per controller for out-of-band management. • 2x Serial console ports (RJ-45 and Micro-USB) for system configuration. • In-band management via I/O path.
Management interfaces	System Manager web-based GUI; SAN Manager standalone GUI; SSH CLI; Serial console CLI; SNMP, email, and syslog alerts; optional Lenovo XClarity.

Security features	Secure Socket Layer (SSL), Secure Shell (SSH), user level security, role-based access control (RBAC), LDAP authentication.		
Warranty and support	Three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD) parts delivered. Also available are 9x5 NBD onsite response, 24x7 coverage with 2-hour or 4-hour onsite response, or 6-hour or 24-hour committed repair (select areas), YourDrive YourData, Premier Support, and 1-year or 2-year post-warranty extensions.		
Software maintenance	Included in the base warranty and any Lenovo warranty extensions.		
Dimensions	2U24 SFF enclosure: • Height: 85 mm (3.4 • in.) Width: 449 mm • (17.7 in.) Depth: 553 mm (21.8 in.)	2U12 LFF enclosure: • Height: 85 mm (3.4 in.) • Width: 447 mm (17.6 in.) • Depth: 483 mm (19.0 in.)	4U60 LFF enclosure: • Height: 174 mm (6.9 • in.) Width: 449 mm (17.7 • in.) Depth: 922 mm (36.3 in.)
Weight	• DE6000H 2U24 SFF controller enclosure (7Y78): 25.07 kg (55.3 lb) • DE6000H 4U60 LFF controller enclosure (7Y80): 108.49 kg (239.2 lb) • DE240S 2U24 SFF expansion enclosure (7Y68): 27.44 kg (60.5 lb) • DE120S 2U12 LFF expansion enclosure (7Y63): 27.12 kg (59.8 lb) • DE600S 4U60 LFF expansion enclosure (7Y69): 112.2 kg (247.4 lb)		

* Estimated performance based on internal measurements.
** For more specific configuration performance please use Lenovo sizing tool or contact Lenovo representative: https://storagesizing.tools.lenovo.com/