Enterprise io3 PCIe Flash Adapters
Product Guide (withdrawn product)

Engineered for application acceleration, the Enterprise io3 PCIe Flash Adapters can help deliver higher performance than typical solid-state devices at a fraction of the cost and space, which makes them a perfect fit for a broad range of applications, including database and cloud applications, big data analytics, and hyperscale data center workloads.

Delivering high speed, low latency, and high efficiency, this new third-generation line of flash adapters brings scalable and optimized performance to distributed scale-out architectures at low cost. These adapters are designed primarily for servers and computing appliances to maximize compute efficiency while providing the added benefits of lower power and cooling costs, low management impact, and smaller storage footprints.

The Enterprise io3 PCIe Flash Adapters are shown in the following figure.

Figure 1. Enterprise io3 PCIe Flash Adapters

Did you know?

The Enterprise io3 PCIe Flash Adapters use flash memory as their storage medium. The adapters contain no moving parts and do not have the issues associated with vibration, noise, and mechanical failure. The adapters are built as block devices on a PCIe bus with advanced wear-leveling, ECC protection, and chip-level fault tolerance, which provides exceptional reliability and efficiency.

The Enterprise io3 PCIe Flash Adapters can provide lower operational expenditure (OPEX) and capital expenditure (CAPEX) in applications that require high storage I/O performance compared to solutions that use many hard disk drives and solid-state drives to achieve equivalent performance.

Rigorous testing of the Enterprise io3 PCIe Flash Adapters by Lenovo through the ServerProven® program ensures a high degree of confidence in storage subsystem compatibility and reliability. Providing another peace of mind, the adapters are covered under a Lenovo warranty.

Part number information

The following table lists the ordering part numbers and feature codes for the adapters.

Withdrawn: All adapters are now withdrawn from marketing.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
1000GB Enterprise io3 Flash Adapter	00AE995	ARYP
1300GB Enterprise io3 Flash Adapter	00AE998	ARYQ
2600GB Enterprise io3 Flash Adapter	00JY001	ARYR
5200GB Enterprise io3 Flash Adapter	00JY004	ARYS

The part numbers for the adapters include the following items:

- A PCIe Flash Adapter with full-height (3U) bracket attached
- Low-profile (2U) bracket (1000GB, 1300GB, and 2600GB adapters only)
- USB Key with documentation
- Quick Install Guide
- *Important Notices* document
- Warranty Flyer

Features

Based on the Fusion ioMemory PX600 adapter with silicon-based NAND clustering storage technology, the Enterprise io3 PCIe Flash Adapters offer cost-effective Multi-Level Cell (MLC) technology in standard PCIe form factors.

These adapters use NAND flash memory as the basic building block of solid-state storage and contain no moving parts, so they are less sensitive to issues that are associated with vibration, noise, and mechanical failure. These adapters are built as block devices on a PCIe bus with advanced wear-leveling, ECC and chip-level fault tolerance, which provides exceptional reliability and efficiency.

The Enterprise io3 PCIe Flash Adapters can deliver fast and scalable performance for mixed read- and write-intensive workloads at low latency required for webscale and cloud environments. The following typical applications require ultra-high I/O performance:

- Large-scale transaction processing
- Cloud computing
- Content distribution
- On-demand streaming
- Data warehousing
- Business intelligence and analytics
- Decision support

The Enterprise io3 PCIe Flash Adapters have the following features:

- Technology:
    - Up to 5.2 TB of solid-state storage in an industry-standard PCIe form factor.
    - High-density design with cost-effective MLC NAND technology reduces storage footprint.
    - Functions as a PCIe storage and controller device. The operating system sees a block device.

- Performance:
  - High-speed, low latency, consistent, and scalable I/O performance
  - Access latency can be as low as 15 µs
  - Up to 2.7 GBps/2.2 GBps of sustained sequential read/write throughput
  - Up to 330,000/375,000 random read/write IOPS that uses 4 KB data blocks
  - Integrates with host processor as a memory tier for direct parallel access to flash
- Reliability:
  - Advanced wear leveling
  - ECC protection
  - Adaptive Flashback redundancy for RAID-like chip protection with self-healing capabilities
- Monitoring and management:
  - Power consumption
  - Thermal information
  - Flash wear-out

Note: These adapters cannot be used as bootable devices.

Technical specifications

The following table lists the technical specifications for the Enterprise io3 PCIe Flash adapters.

Table 2. Enterprise io3 PCIe Flash Adapter technical specifications

Specification	**1000 GB**	**1300 GB**	**2600 GB**	**5200 GB**
Part number	00AE995	00AE998	00JY001	00JY004
Interface	PCIe 2.0 x8	PCIe 2.0 x8	PCIe 2.0 x8	PCIe 2.0 x8
Form factor	Half height, half length	Half height, half length	Full height, half length	Full height, half length
Capacity	1000 GB	1300 GB	2600 GB	5200 GB
Endurance	12 PB TBW	16 PB TBW	32 PB TBW	64 PB TBW
Random read IOPS (4 KB blocks)	196,000	235,000	330,000	276,000
Random write IOPS (4 KB blocks)	320,000	370,000	375,000	375,000
Sequential read throughput	2.7 GBps	2.7 GBps	2.7 GBps	2.7 GBps
Sequential write throughput	1.5 GBps	1.7* GBps	2.2 GBps*	2.1 GBps*
Read access latency	92 µs	92 µs	92 µs	92 µs
Write access latency	15 µs	15 µs	15 µs	15 µs
Power requirements	25 W	25 W	25 W	25 W

* Write throughput is achieved with the optional high power mode. Maximum write throughput of 1.6 GBps can be achieved within 25 W power limit.

Enterprise and Enterprise Value solid-state devices have comparable read and write IOPS and throughput performance, but the key difference between them is their endurance (or lifetime); that is, how long they can perform write operations because solid-state devices have a finite number of program/erase (P/E) cycles. Enterprise PCIe Flash Adapters have better endurance and higher IOPS/GB ratio but also a higher cost/IOPS ratio compared to Enterprise Value PCIe Flash adapters. Because of this fact, the Enterprise PCIe Flash Adapters are targeted for mixed read- and write-intensive workloads, and the Enterprise Value PCIe Flash Adapters are targeted for read-intensive workloads. Solid-state device write endurance often is measured by the number of P/E cycles that the drive incurs over its lifetime, which is listed as the total bytes of written (TBW) data in the device specification.

The TBW value that is assigned to a solid-state device is the total bytes of written data (based on the number of P/E cycles) that a device can be guaranteed to complete (the percentage of remaining P/E cycles is equal to the percentage of remaining TBW). The Lenovo warranty for the solid-state storage is limited to devices that have not reached the maximum guaranteed number of program/erase cycles. Solid-state storage that reaches this limit might fail to operate according to its specifications. Because of such behavior by solid-state devices, careful planning must be done to use solid-state storage in the application environments to ensure that the TBW of the device is not exceeded before the end of the required life expectancy.

Writes are tracked and reported by the adapter's management utility and might be affected by application writes, data patterns, and maintenance designed to maximize data integrity.

Server support

The following tables list the server compatibility information for the Enterprise io3 PCIe Flash Adapters.

Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Table 3. Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Part number	Description	x3250 M6 (3943)	x3250 M6 (3633)	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5-2600 v4)	sd350 (5493)
00AE995	1000GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00AE998	1300GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00JY001	2600GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00JY004	5200GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	N

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for System x and dense servers with Intel Xeon v3 processors

Table 4. Support for System x servers with Intel Xeon v3 processors

Part number	Description	x3100 M5 (5457)	x3250 M5 (5458)	x3500 M5 (5464)	x3550 M5 (5463)	x3650 M5 (5462)	x3850 X6/x3950 X6 (6241, E7 v3)	nx360 M5 (5465)
00AE995	1000GB Enterprise io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00AE998	1300GB Enterprise io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00JY001	2600GB Enterprise io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00JY004	5200GB Enterprise io3 Flash Adapter	N	N	N	Y*	Y*	Y*	Y*

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for System x and dense servers with Intel Xeon v2 processors

Table 5. Support for System x servers with Intel Xeon v2 processors

Part number	Description	x3500 M4 (7383, E5-2600 v2)	x3530 M4 (7160, E5-2400 v2)	x3550 M4 (7914, E5-2600 v2)	x3630 M4 (7158, E5-2400 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 BD (5466)	x3650 M4 HD (5460)	x3750 M4 (8752)	x3750 M4 (8753)	x3850 X6/x3950 X6 (3837)	x3850 X6/x3950 X6 (6241, E7 v2)	dx360 M4 (E5-2600 v2)	nx360 M4 (5455)
00AE995	1000GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00AE998	1300GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00JY001	2600GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00JY004	5200GB Enterprise io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y*	N	N	Y*	Y*	N	N

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for Flex System compute nodes

Table 6. Support for Flex System servers

Part number	Description	x220 (7906)	x222 (7916)	x240 (8737, E5-2600)	x240 (8737, E5-2600 v2)	x240 (7162)	x240 M5 (9532)	x440 (7917)	x440 (7167)	x880/x480/x280 X6 (7903)	x280/x480/x880 X6 (7196)
00AE995	1000GB Enterprise io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00AE998	1300GB Enterprise io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00JY001	2600GB Enterprise io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00JY004	5200GB Enterprise io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N

† Supported with installed in an attached PCIe Expansion Node

See the following ServerProven website for the latest compatibility information for System x servers:
http://www.lenovo.com/us/en/serverproven/

For further information about server compatibility, see this support page:
https://support.lenovo.com/us/en/documents/serv-io3

Supported operating systems

The Enterprise io3 PCIe Flash Adapters support the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 7
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 12
- SUSE Linux Enterprise Server 12 with XEN
- VMware vSphere 5.1 (ESXi)
- VMware vSphere 5.5 (ESXi)
- VMware vSphere 6.0 (ESXi)

For more information about the specific supported versions and service packs, see the following ServerProven web page:
http://www.lenovo.com/us/en/serverproven/xseries/storage/mcmatrix.shtml

On the ServerProven page, click the check mark that is associated with the server in question to see more information about the operating system support.

Warranty

The Enterprise io3 PCIe Flash Adapters carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported Lenovo server, these adapters assume the system's base warranty and any warranty upgrade.

Physical specifications

The 1000GB, 1300GB, and 2600GB Enterprise io3 PCIe Flash Adapters have the following physical specifications:

Dimensions and weight (approximate):

- Height: 17 mm (0.7 in.)
- Width: 69 mm (2.7 in.)
- Depth: 167 mm (6.6 in.)
- Weight: 152 g (0.3 lb)

Shipping dimensions and weight (approximate):

- Height: 65 mm (2.6 in.)
- Width: 245 mm (9.6 in.)
- Depth: 225 mm (8.9 in.)
- Weight: 421 g (0.9 lb)

The 5200GB Enterprise io3 PCIe Flash Adapter has the following physical specifications:

Dimensions and weight (approximate):

- Height: 17 mm (0.7 in.)
- Width: 112 mm (4.4 in.)
- Depth: 167 mm (6.6 in.)
- Weight: 212 g (0.5 lb)

Shipping dimensions and weight (approximate):

- Height: 65 mm (2.6 in.)
- Width: 245 mm (9.6 in.)
- Depth: 225 mm (8.9 in.)
- Weight: 481 g (1.1 lb)

Operating environment

The Enterprise io3 PCIe Flash Adapters are supported in the following environment:

- Temperature (operational): 0 - 55 °C (32 - 131 °F) at 0 - 3,048 m (0 - 10,000 ft)
- Relative humidity: 5 - 95% (non-condensing)
- Maximum altitude (operational): 3,048 m (10,000 ft)

Agency approvals

The Enterprise io3 PCIe Flash Adapters conform to the following regulations:

- FCC Title 47, Part 15 Subpart B, Class A
- CAN ICES-3 (A) NMB-3 (A)
- EN 55022: 2010
- EN 61000-3-2: 2006 plus A1:2009 and A2:2009
- EN 61000-3-3: 2008
- EN 55024: 2010
- VCCI V-3/2013.04 Class A & EN 55022: 2010 Class A
- ANSI C63.4: 2009
- BSMI CNS 13438: 2006 Class A
- EN 55022 (2006)A1 (2007) Class A
- AS/NZS CISPR 22: 2009 plus A1:2010
- MSIP-REM-FIO-ioScale3
- EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 and IEC 60950-1:2005 A1:2009
- DIRECTIVE 2011/65/EU
- MIL-STD-810

Related publications and links

For more information, see the following documents:

- Flash Adapters product page
  http://shop.lenovo.com/us/en/systems/servers/options/systemx/storage/solid-state/flash-adapters/
- US Announcement Letter
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS114-138
- io3 Flash Adapter configuration information and requirements
  https://support.lenovo.com/us/en/documents/serv-io3
- ioMemory VSL 4.1.2 io3 Flash Adapter Hardware Installation Guide (PDF)
  https://support.lenovo.com/us/en/docs/UM104182
- ioMemory VSL 4.1.2 Release Notes (PDF)
  https://support.lenovo.com/us/en/docs/UM104183
- ioMemory VSL 4.1.2 User Guide for Linux (PDF)
  https://support.lenovo.com/us/en/docs/UM104184
- ioMemory VSL 4.1.2 User Guide for Microsoft Windows (PDF)
  https://support.lenovo.com/us/en/docs/UM104185
- ioMemory VSL 4.1.2 User Guide for VMware ESXi (PDF)
  https://support.lenovo.com/us/en/docs/UM104186
- Flash Management Console 3.15.0 Installation Guide (PDF)
  https://support.lenovo.com/us/en/docs/UM104178
- Flash Management Console 3.15.0 Release Notes (PDF)
  https://support.lenovo.com/us/en/docs/UM104179
- Flash Management Console 3.15.0 Tools Guide (PDF)
  https://support.lenovo.com/us/en/docs/UM104180
- Flash Management Console 3.15.0 User Guide (PDF)
  https://support.lenovo.com/us/en/docs/UM104181
- System x Configuration and Options Guide
  https://support.lenovo.com/us/en/documents/SCOD-3ZVQ5W
- ServerProven
  http://www.lenovo.com/us/en/serverproven/

Related product families

Product families related to this document are the following:

- PCIe Flash Adapters

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