

Flex System Storage Expansion Node

Lenovo Press Product Guide

The Flex System™ Storage Expansion Node is a storage enclosure that attaches to a single half-wide compute node to provide that compute node with additional direct-attach local storage. The Storage Expansion Node provide flexible storage to match capacity, performance, and reliability needs.

Ideal workloads include distributed database, transactional database, NAS infrastructure, video surveillance and streaming solutions. For example, when coupled with third-party NAS software, the combined compute node and storage expansion node make for an ideal infrastructure platform for a network-attached storage (NAS) server.

Figure 1 shows the Flex System Storage Expansion Node attached to an Flex System x240 Compute Node.



Figure 1. Flex System Storage Expansion Node (right) attached to an x240 Compute Node (left)

Did you know?

The Storage Expansion Node adds 12 drive bays to the attached compute node and all bays in the expansion node are hot-swap. The drive bays slide out on an internal rail system; provided that a suitable RAID level is employed, a failed drive can be removed while the system is still running. With storage capacity of up to 14.4 TB, the Storage Expansion Node is ideal for applications that can use large amounts of additional local storage.

Part number information

Table 1. Ordering part number and feature code

Description	Part number	Feature code
Flex System Storage Expansion Node	68Y8588	A3JF*

* Feature code A3JF is for both the XCC (x-config) and AAS (e-config) ordering systems, however with AAS, this feature code is only selectable with the x220 Compute Node. You cannot order feature code A3JF with the x240 in the AAS ordering system.

The part number includes the following items:

- Flex System Storage Expansion Node
- Double-wide shelf
- Documentation CD that contains the *Installation and Service Guide*
- Warranty information and Safety flyer and Important Notices document

Supported servers

The Flex System Storage Expansion Node is supported when it is attached to the Flex System compute nodes listed in Table 2. Only one Expansion Node can be attached to each compute node.

Table 2. Supported servers

Description	Part number	x220 (7906)	x222 (7916)	x240 (8737)	x240 M5 (9532)	x440 (7917)	x440 (7917, E5-4600 v2)	p24L (1457)	p260 (7895)	p270 (7954)	p460 (7895)
Flex System Storage Expansion Node	68Y8588	Y*	N	Y*	N	N	N	N	N	N	N

* The Storage Expansion Node requires that both processors be installed in the x220 and x240.

The SEN is standard on one model of the x220 and the x240 as listed in the following table.

Table 3. Compute node models with the Storage Expansion Node standard

Model	Intel processor**	Memory	RAID	Disk bays	Disks	Embedded Ethernet	I/O slots
Flex System x220 7906-DBx	2x Xeon E5-2420 6C 1.9GHz 15 MB 1333 MHz 95W	2x 4GB	ServeRAID C105	2x 2.5-in internal† 12x 2.5-in with Storage Expansion Node	Open	1 GbE Standard	1 / 2‡
Flex System x240 8737-HBx	2x Xeon E5-2640 6C 2.5GHz 15MB 1333MHz 95W	2x 8 GB	LSI SAS2004	2x 2.5-in internal† 12x 2.5-in with Storage Expansion Node	Open	10 GbE Standard	1 / 2‡

** Processor details: Processor quantity and model, cores, core speed, L3 cache, memory speed, and power rating.

† The 2.5-inch drive bays in the compute nodes can be replaced and expanded with 1.8" solid-state drive bays and a ServeRAID M5115 RAID controller to support up to eight 1.8-inch SSDs.

‡ (Used / maximum) These models include an Embedded 1 Gb or 10 Gb Ethernet controller. Connections are routed to the chassis midplane using a Fabric Connector. The Fabric Connector precludes the use of an I/O adapter in I/O connector 1 (with the exception of the ServeRAID M5115 RAID controller).

The models in the previous table are Network Attached Storage (NAS)-optimized models that includes the compute node and the SEN connected together as a single unit at the factory. This single model number enables a simpler acquisition for both business partners and direct sales. The combination of the compute node and the SEN is certified with Windows Storage Server 2012 meaning that this configuration is an excellent platform for a low cost NAS solution. Windows Storage Server 2012 is available via the IBM Reseller Option Kit (ROK) program using part number 00Y6302. These models do not include drives giving you maximum flexibility when it comes to selecting drives, either SAS or SATA disk drives or high-performance SSDs.

Features

The System Expansion Node has the following features:

- Connects directly to supported compute nodes via a PCIe 3.0 interface to the compute node's interposer connector (also known as the ETE connector)
- Support for 12 hot-swap 2.5-inch drives, accessible via a sliding tray
- Support for 6 Gbps SAS and SATA drives, both HDDs and SSDs
- Based on an LSI SAS2208 6 Gbps RAID on Chip (ROC) controller
- Optional 512 MB or 1 GB cache with cache-to-flash super capacitor off-load
- Supports RAID 0, 1, 10 as standard. JBOD also supported. Optional RAID 5, 50 with cache upgrade. Additional RAID 6 and 60 option (requires cache upgrade) with a Features on Demand upgrade.
- Includes an expansion shelf to physically support the Storage Expansion Node and its compute node attached together
- Internal and external light path diagnostics
- Optional Feature on Demand upgrades for RAID 6, 60 support and SSD performance and caching enablers
- Optional support for SSD performance acceleration and SSD caching with Features on Demand upgrades
- Support for up to 64 virtual drives, up to 128 drive groups, up to 16 virtual drives per one drive group, and up to 32 physical drives per one drive group
- Support for logical unit number (LUN) sizes up to 64 TB
- Configurable stripe size up to 1 MB
- Compliant with Disk Data Format (DDF) configuration on disk (COD)
- S.M.A.R.T. support
- Managed through the IMMv2 management processor on the compute node and with the MegaRAID Storage Manager management software

Architecture

Figure 2 shows the architecture of the Storage Expansion Node when connected to a compute node.

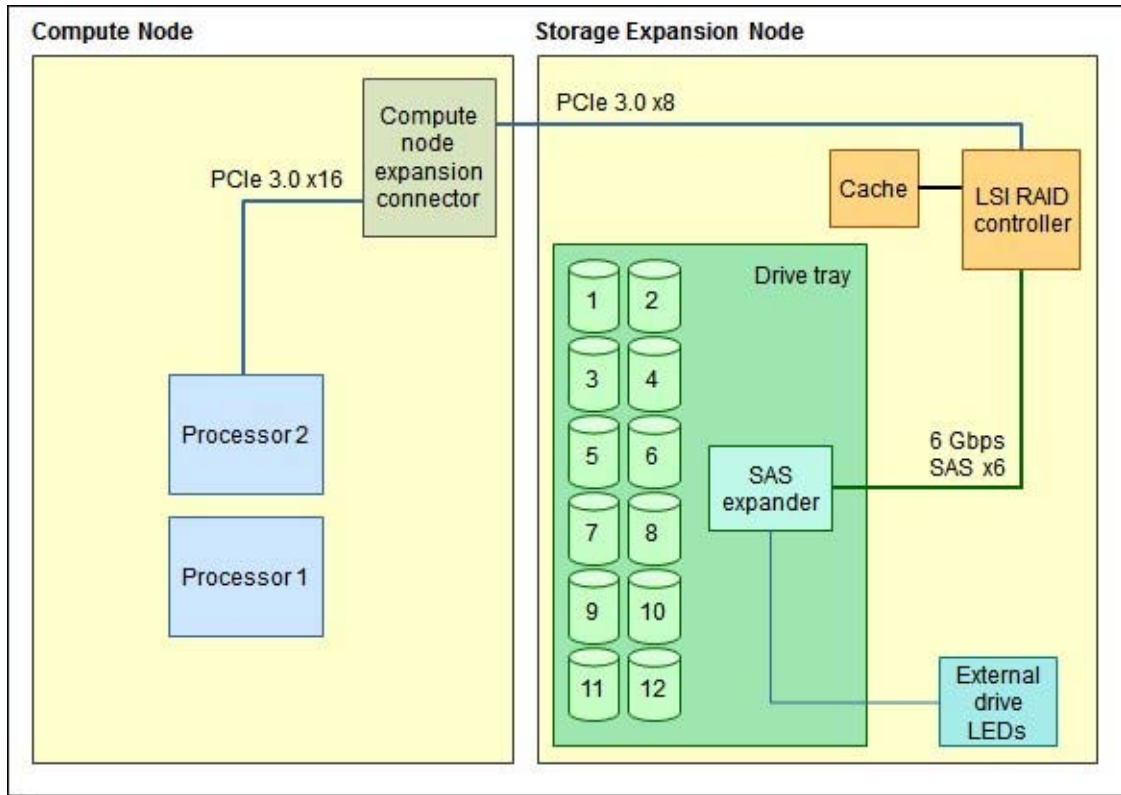


Figure 2. Architecture of the Storage Expansion Node

The Expansion Node connects to a standard-width compute node using the interposer cable, which plugs into the expansion connector on the compute node. This link forms a PCIe 3.0 x8 connection between Processor 2 on the compute node and the LSI RAID controller in the Expansion Node. The result is that the compute node sees the disks in the expansion node as locally attached. Management of the Storage Expansion Node is via the IMMv2 located on the compute node.

Note: The expansion connector in the x220 and x240 compute nodes is routed through processor 2. Therefore, processor 2 must be installed in the compute node.

Supported disk drives

The Storage Expansion Node is a PCIe 3.0 and a SAS 2.1 compliant enclosure supporting up to twelve 2.5-inch drives. The drives can be HDD or SSD, and both SAS or SATA. Drive modes supported are JBOD or RAID-0, 1, 5, 6, 10, 50, and 60 (upgrades required for RAID 5, 6, 50, 60 support).

The drives are accessed by opening the handle on the front of the Storage Expansion Node and sliding out the drive tray. Opening the drive tray can be done while it is operational. Figure 3 shows the Storage Expansion Node connected to an x240 compute node and with the drive tray extended part way out. With the drive tray extended, all twelve hot-swap drives can be accessed on the left side of the tray.

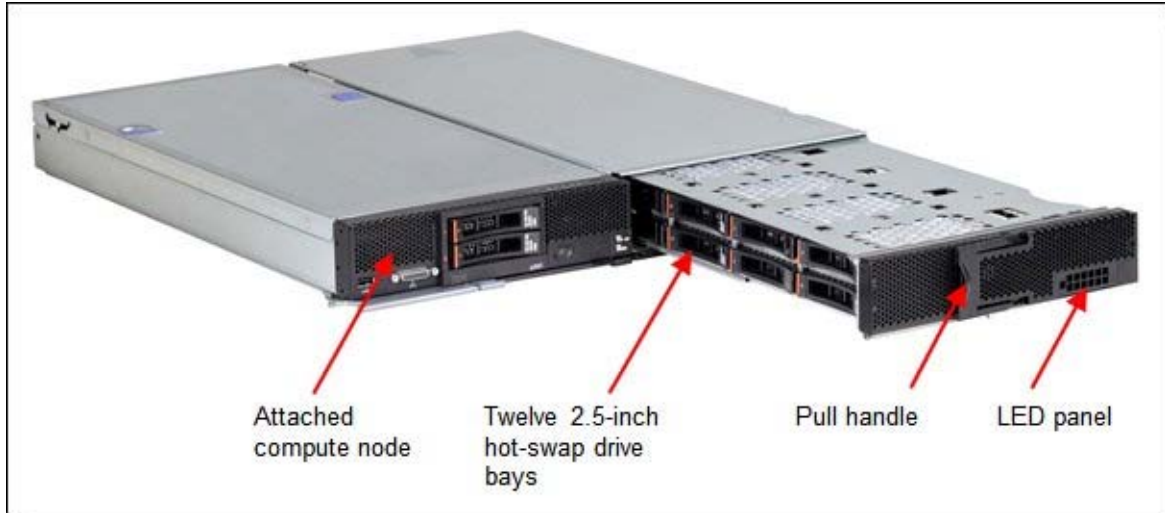


Figure 3. Storage Expansion Node with drive tray part way extended

The following table lists the hard disk drives (HDDs) and solid state drives (SSDs) supported within the Storage Expansion Node. Both SSDs and HDDs can be installed inside the unit at the same time. Preferred practice when creating logical drives is to use similar disk types. For example, for a RAID 1 pair, choose identical drive types, SSD or HDD.

Table 4. Supported drives (Part 1)

Part number	Feature code	Description	Maximum supported
10K SAS hard disk drives			
00AD075	A48S	1.2TB 10K 6Gbps SAS 2.5" G2HS HDD	12
81Y9650	A282	900 GB 10K 6 Gbps SAS 2.5" SFF HS HDD	12
90Y8872	A2XD	600GB 10K 6Gbps SAS 2.5" SFF G2HS HDD	12
90Y8877	A2XC	300GB 10K 6Gbps SAS 2.5" SFF G2HS HDD	12

Table 4. Supported drives (Part 2)

Part number	Feature code	Description	Maximum supported
NL SATA			
81Y9730	A1AV	1TB 7.2K 6 Gbps NL SATA 2.5" SFF HS HDD	12
81Y9726	A1NZ	500 GB 7.2K 6 Gbps NL SATA 2.5" SFF HS HDD	12
81Y9722	A1NX	250 GB 7.2K 6 Gbps NL SATA 2.5" SFF HS HDD	12
10K and 15K Self-encrypting drives (SED)			
00AD085	A48T	1.2TB 10K 6Gbps SAS 2.5" G2HS SED	12
SAS-SSD Hybrid drive			
00AD102	A4G7	600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	12
Solid-state drives - Enterprise			
49Y6195	A4GH	1.6TB SAS 2.5" MLC HS Enterprise SSD	12
49Y6139	A3F0	800GB SAS 2.5" MLC HS Enterprise SSD	12
49Y6134	A3EY	400GB SAS 2.5" MLC HS Enterprise SSD	12
49Y6129	A3EW	200GB SAS 2.5" MLC HS Enterprise SSD	12
41Y8341	A4FQ	S3700 800GB SATA 2.5" MLC HS Enterprise SSD	12
41Y8336	A4FN	S3700 400GB SATA 2.5" MLC HS Enterprise SSD	12
41Y8331	A4FL	S3700 200GB SATA 2.5" MLC HS Enterprise SSD	12
Solid-state drives - Enterprise Value			
00AJ015	A4KQ	S3500 800GB SATA 2.5" MLC HS Enterprise Value SSD	12
00AJ010	A4KP	S3500 480GB SATA 2.5" MLC HS Enterprise Value SSD	12
00AJ005	A4KN	S3500 240GB SATA 2.5" MLC HS Enterprise Value SSD	12
00AJ000	A4KM	S3500 120GB SATA 2.5" MLC HS Enterprise Value SSD	12
90Y8643	A2U3	256GB SATA 2.5" MLC HS Enterprise Value SSD	12

Feature upgrades

The Storage Expansion Node supports the upgrades listed in the following table.

Table 5. Supported adapter cards

Part number	Feature code	Description	Maximum supported
Cache upgrades (also adds support for RAID 5 and RAID 50)			
81Y4559	A1WY	ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade for System x®	1*
81Y4487	A1J4	ServeRAID M5100 Series 512MB Flash/RAID 5 Upgrade for System x	1*
Features on Demand upgrades (license only)			
90Y4410	A2Y1	ServeRAID M5100 Series RAID 6 Upgrade for Flex System	1**
90Y4447	A36G	ServeRAID M5100 Series SSD Caching Enabler for Flex System	1**
90Y4412	A2Y2	ServeRAID M5100 Series Performance Accelerator for Flex System	1**

* The cache upgrades are mutually exclusive.

** FoD upgrades require one of the cache upgrades also be ordered (81Y4559 or 81Y4487). FoD upgrades for ServeRAID are system-wide: If you have these features installed on the M5115 in the compute node they will automatically be activated on the LSI controller in the Storage Expansion Node.

ServeRAID M5100 Series 512MB and 1GB Flash Upgrade option part numbers include the following items:

- Cache module
- Flash power module
- Cable

The cache module is installed at the rear of the Storage Expansion Node and the power module is installed near the front of the expansion node. The provided cable is used to connect the cache module to the power module.

Figure 4 shows the flash-backed cache module, power module, and power cable.

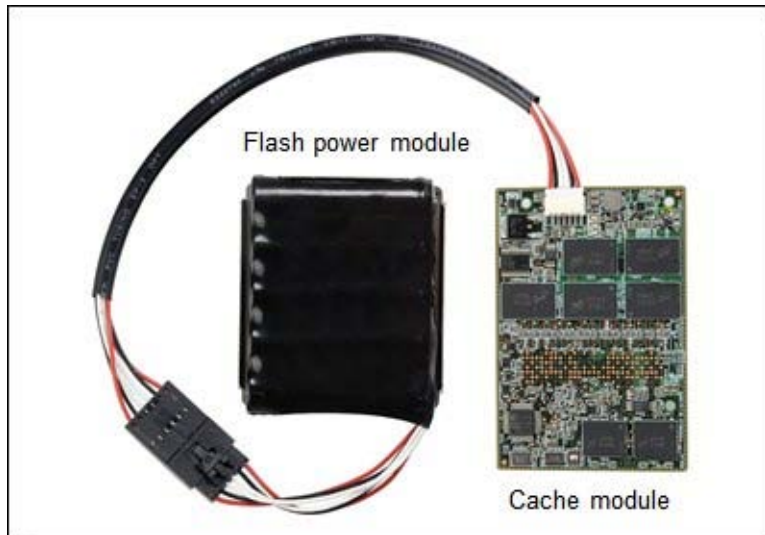


Figure 4. Flash-backed cache module, power module, and power cable

The following license-only Features on Demand upgrades are available;

- RAID 6 Upgrade (90Y4410)
Adds support for RAID 6 and RAID 60. This is a Feature on Demand license. Requires one of the cache upgrades also be ordered (81Y4559 or 81Y4487).
- Performance Upgrade (90Y4412)
The Performance Upgrade for Flex System (implemented using the LSI MegaRAID FastPath software) provides high performance I/O acceleration for SSD-based virtual drives by using an extremely low latency I/O path to increase the maximum I/O per second (IOPS) capability of the controller. This feature boosts the performance of applications with a highly random data storage access pattern, such as transactional databases. Part number 90Y4412 is a Feature on Demand license. Requires one of the cache upgrades also be ordered (81Y4559 or 81Y4487).
- SSD Caching Enabler for traditional hard drives (90Y4447)
The SSD Caching Enabler for Flex System (implemented using the LSI MegaRAID CacheCade Pro 2.0) is designed to accelerate the performance of hard disk drive (HDD) arrays with only an incremental investment in solid-state drive (SSD) technology. The feature enables the SSDs to be configured as a dedicated cache to help maximize the I/O performance for transaction-intensive applications, such as databases and web serving. The feature tracks data storage access patterns and identifies the most frequently accessed data. The hot data is then automatically stored on the SSDs that are assigned as a dedicated cache pool on the ServeRAID controller. Part number 90Y4447 is a Feature on Demand license. This feature requires that at least one SSD drive is installed. Requires one of the cache upgrades also be ordered (81Y4559 or 81Y4487).

FoD upgrades are system-wide: The FoD upgrades are the same ones as used with the ServeRAD M5115 available for use internally in the x220 and x240 compute nodes. If you have an M5115 installed in the attached compute node and have installed any of these upgrades, the upgrades will automatically be activated on the LSI controller in the Storage Expansion Node. You do not need to purchase the FoD upgrades separately for the expansion node.

LED indicators

The Storage Expansion Node has a number of LEDs on the lower right front for identification and status purposes, as shown in Figure 5.

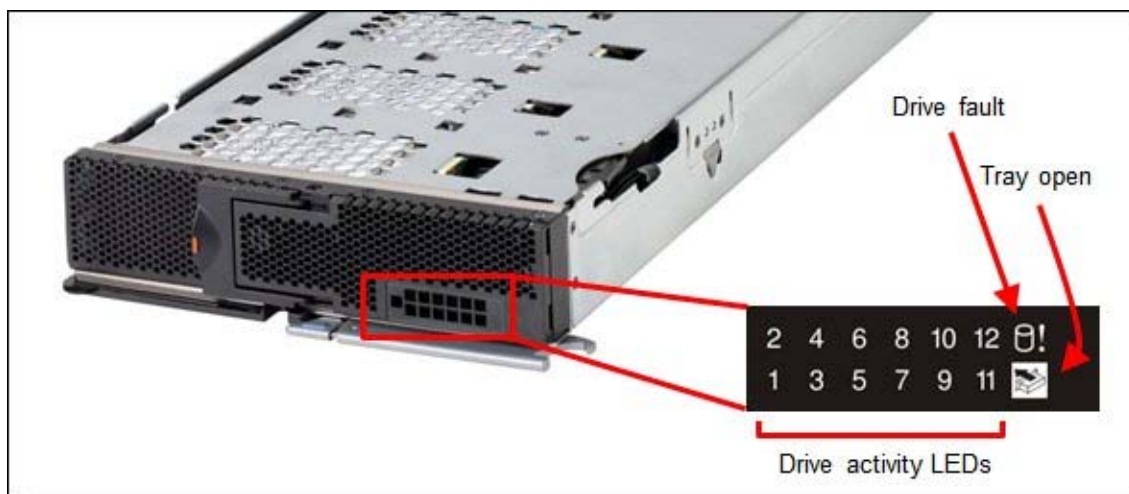


Figure 5. LEDs on the front of the Storage Expansion Node

The following table identifies the meanings of the LEDs.

Table 6. External LED status table

LED	Color	Meaning
Activity light (each drive bay)	Green	<ul style="list-style-type: none"> Blinks with Activity, displaying drive number.
Fault/Locate	Amber	<ul style="list-style-type: none"> Solid: Indicates a fault on one of the drives Blink: One of the drives is set to "identify"
Tray Open	Amber	<ul style="list-style-type: none"> Flash/beep 15 sec interval: Drawer is not fully closed. Flash/beep 5 sec interval: Drawer has been opened to long, close drawer immediately Flash/beep .25 sec interval: Expansion node has reached thermal threshold. Close door immediately to avoid drive damage.

In addition to the lights described in the previous table, there are LEDs locally on each of the drive trays. These lights can be observed when the drive tray is extended and the unit is operational. A green LED indicates disk activity and an amber LED indicates a drive fault.

With the Storage Expansion Node removed from the Flex System chassis and its cover removed, there are additional LEDs visible. If there is a fault detected then the relevant LED will light:

- Flash/RAID adapter: RAID Cache card fault.
- Control panel: LED panel card not present
- Temperature: A temperature event has occurred
- Storage expansion: Fault on the storage expansion unit
- Light path: Verify that the light path diagnostic function, including the battery, is operating properly

Physical specifications

Dimensions and weight (approximate):

- Height: 56 mm (2.2 in.)
- Depth: 504 mm (19.8 in.)
- Width: 229 mm (9.2 in.)
- Maximum weight: 5.9 kg (13 lb)

Shipping dimensions and weight (approximate):

- Height: 240 mm (9.5 in.)
- Depth: 680 mm (26.8 in.)
- Width: 601 mm (23.7 in.)
- Weight: 9.5 kg (21 lb)

Operating environment

When the unit is powered on, it is supported in the following environment:

- Temperature: 5° C to 40° C (41° F to 104° F)
- Humidity, non-condensing: -12° C dew point (10° F) and 8% - 85% relative humidity
- Maximum dew point: 24° C (75° F)
- Maximum altitude: 3048 m (10,000 ft)
- Maximum rate of temperature change: 5° C/hr (41° F/hr)

Regulatory compliance

The unit conforms to the following standards:

- ASHRAE Class A3
- FCC - Verified to comply with Part 15 of the FCC Rules Class A
- Canada ICES-004, issue 3 Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1
- NOM-019
- Argentina IEC 60950-1
- Japan VCCI, Class A
- IEC 60950-1 (CB Certificate and CB Test Report)
- China CCC (GB4943); (GB9254, Class A); (GB17625.1)
- Taiwan BSMI CNS13438, Class A; CNS14336
- Australia/New Zealand AS/NZS CISPR 22, Class A
- Korea KN22, Class A, KN24
- Russia/GOST ME01, IEC 60950-1, GOST R 51318.22, GOST R 51318.249, GOST R 51317.3.2, GOST R 51317.3.3
- IEC 60950-1 (CB Certificate and CB Test Report)
- CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, EN61000-3-3)
- CISPR 22, Class A
- TUV-GS (EN60950-1/IEC 60950-1, EK1-ITB2000)

Related publications

For more information, see the following resources:

- US Announcement Letter
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-185>
- Flex System product page
<http://ibm.com/systems/flex>
- Flex System Interoperability Guide
<http://www.redbooks.ibm.com/fsig/>
- Flex System Information Center
<http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>
- ServerProven hardware compatibility page for Flex System
<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/>
- Product Guides for the Flex System compute nodes:
<http://www.redbooks.ibm.com/portals/flexsystem?Open&page=pg&cat=nodes>
- *ServeRAID M5115 SAS/SATA Controller for Flex System*
<http://www.redbooks.ibm.com/abstracts/tips0884.html?Open>

Notices

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

*Lenovo (United States), Inc.
1009 Think Place - Building One
Morrisville, NC 27560
U.S.A.
Attention: Lenovo Director of Licensing*

LENOVO PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. Lenovo may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

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

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

© Copyright Lenovo 2012-2014. All rights reserved.

This document was created or updated on December 4, 2014.

Send us your comments in one of the following ways:

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

This document is available online at <http://www.ibm.com/redbooks/abstracts/tips0914.html> .

Trademarks

Lenovo, For Those Who Do and the Lenovo logo are trademarks or registered trademarks of Lenovo in the United States, other countries, or both. These and other Lenovo trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by Lenovo at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of Lenovo trademarks is available on the Web at <http://www.lenovo.com/legal/copytrade.html>.

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

Flex System™
Lenovo®
Lenovo(logo)®
ServeRAID™
ServerProven®
System x®

The following terms are trademarks of other companies:

Intel, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

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