



Sun StorageTek™ 6540 Array Release Notes

Release 6.4.1

Sun Microsystems, Inc.
www.sun.com

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Sun StorageTek 6540 Array Release Notes

This document contains important release information about the Sun StorageTek™ 6540 Array or information that was unavailable at the time the product documentation was published. Read this document so that you are aware of issues or requirements that can affect the installation and operation of the Sun StorageTek 6540 Array.

The release notes consist of the following sections:

- “About This Release” on page 2
- “Sun StorageTek 6540 Array Features” on page 3
- “Best Practices for Adding Expansion Modules” on page 4
- “System Requirements” on page 5
- “Upgrading Firmware” on page 18
- “Known Issues” on page 22
- “Release Documentation” on page 28
- “Notable Updates/Fixes in This Release” on page 29
- “Service Contact Information” on page 31
- “Third-Party Web Sites” on page 31

For Information About CAM

See the Sun StorageTek Common Array Manager software product page at:

http://www.sun.com/storage/management_software/resource_management/cam/index.xml

For information about the management software for the 6540 array, see the CAM documentation at:

<http://docs.sun.com/app/docs/prod/stortek.6140rohs-cam6.4?l=en#hic>

For Related Patch Information

Look for the latest patches pertaining to your environment at:

<http://sunsolve.sun.com/show.do?target=patchpage>

1. In the Search box in the masthead, enter 6540.

2. Filter Results By: Downloads > Patches.

A listing of available patches related to the array is listed.

About This Release

The following firmware versions are available for the Sun StorageTek 6540 Array. See [“Upgrading Firmware” on page 18](#) for details about upgrade paths.

Firmware Version	Includes	For More Information
06.60.22.10	Bug fixes	<ul style="list-style-type: none">• “Notable Updates/Fixes in This Release” on page 29
07.50.13.10	Bug fixes plus support for the following features: <ul style="list-style-type: none">• Portable volume groups• RAID 6• Virtual disks > 30• >2 TB LUNs (varies with OS)• Expanded host regions from 16 to 32	<ul style="list-style-type: none">• “Notable Updates/Fixes in This Release” on page 29• See CAM online help and “Release Documentation” on page 28 for information about the new features.

Sun StorageTek 6540 Array Features

The Sun StorageTek 6540 Array is a 4-Gb/2-Gb/1-Gb Fibre Channel (FC) array that offers both direct attached and storage attached network (SAN) access. The Sun StorageTek 6540 Array includes the following features:

- Eight FC host interfaces (four per controller)
- 4-Gbits/sec, 2-Gbits/sec, and 1-Gbit/sec host interface speed
- Dual redundant controllers
- FC and Serial Advanced Technology Attachment (SATA)-2 disk drive support
- Support for up to 14 expansion trays with one controller tray
- Switched drive tray (contains an FC switch)
- A maximum of 224 drives (14 trays with up to 16 drives each)
- Fault management support

The Sun StorageTek 6540 Array is available in a 4-Gbyte-cache, an 8-Gbyte-cache, and a 16-Gbyte-cache configuration, compared in [TABLE 1-1](#).

TABLE 1-1 Comparison of 4-Gbyte-cache, 8-Gbyte-cache, and 16-Gbyte-cache Array Configurations

	4 Gbyte Cache	8 Gbyte Cache	16 Gbyte Cache
Total cache size per array	2 Gbytes	4 Gbytes	16 Gbytes
Number of host ports (4 Gbits/sec) per array	8	8	8
Maximum number of drives supported	224	224	224
Maximum array configuration	1x15	1x15	1x15
Maximum RAW capacity (224 x 500 Gbytes)	112 Tbytes	112 Tbytes	112 Tbytes
Maximum storage domains supported	64	64	64

■ Auto Service Request

Auto Service Request (ASR) is a feature of the array management software that monitors the array system health and performance and automatically notifies the Sun Technical Support Center when critical events occur. Critical alarms generate an automatic Service Request case. The notifications enable Sun Service to respond faster and more accurately to critical on-site issues.

The Auto Service Request capability in Sun StorageTek Common Array Manager software allows you to register devices to participate in the ASR service. Refer to the *Sun StorageTek Common Array Manager Release Notes, Release 6.4.1* or higher, for more information.

- Array Expansion Module Support

Controller firmware 06.19.25.10 or higher allows tray mixing of 6540, 6140 and 6130 array controllers modules and the Sun StorageTek CSM100, CSM200, FLA200, FLC200, and FLA300 Expansion Modules.

Note – To add trays with data already on them, contact your service representative for assistance to avoid data loss.

Refer to [“Upgrading Firmware for Adding Expansion Trays”](#) in the Sun StorageTek Common Array Manager Release Notes, v.5.1.3 or higher, for more information on the procedure to upgrade trays without data. Also refer to [“Best Practices for Adding Expansion Modules”](#) on page 4

TABLE 1-2 lists the supported expansion modules.

TABLE 1-2 Supported Expansion Modules - 6540 Array

Array Controller	Original Supported Expansion Modules	Supported Expansion Modules with Controller Firmware 06.19.25.10 or higher
Sun StorageTek 6540 Array	CSM200	CSM100, CSM200, FLA200, FLC200, FLA300

Best Practices for Adding Expansion Modules

Only Sun Service should install expansion modules with data. Refer to the *Sun StorageTek Common Array Manager Release Notes, Release 6.2.1* or higher, for more information about supported expansion modules by array.

When you add a new CSM200 expansion module to an existing array in a production or active environment, it is best practice to cable and add the trays while the RAID controller module is powered on, in order to avoid a variety of issues including those listed below.

Before connecting any replacement drive or additional expansion module to an existing functioning array, it is best practice to contact Sun Microsystems Support Services. One reason for this is to avoid issues related to DACstore, the configuration and status database maintained by the array firmware, that stores its information on each of the disk drives.

Contact Sun Microsystems Support Services promptly upon experiencing any of the following symptoms:

- loss of management or data access
- inability to apply feature licenses
- inability to upgrade array firmware
- incorrect component details in the management tool
- host operating system reports the wrong product identifier
- array registration or discovery fails to complete
- persistent or unrecoverable multipathing failover

Note – Because corrective actions for a DACstore issue may require a configuration restoration, it is important to maintain a current image of the configuration using the `export` function in the CAM command line or GUI (as of CAM 6.2). It is always a best practice to maintain recoverable backups of your data.

System Requirements

The software and hardware products that have been tested and qualified to work with the Sun StorageTek 6540 Array are described in the following sections:

- [“Disk Drives and Tray Capacity” on page 6](#)
- [“Data Host Requirements” on page 6](#)

You must have Sun StorageTek Common Array Manager, v5.00 or later software. Current CAM Release 6.4.1, is recommended.

Disk Drives and Tray Capacity

TABLE 1-3 lists the size, speed, and tray capacity for the supported FC and SATA disk drives in the Sun StorageTek 6540 Array.

TABLE 1-3 Supported Disk Drives

Drive	Description
FC 73G15K	73-Gbyte 15,000-RPM FC drives (4 Gbits/sec); 1168 Gbytes per tray
FC 146G10K	146-Gbyte 10,000-RPM FC drives (2 Gbits/sec); 2044 Gbytes per tray
FC 146G15K	146-Gbyte 15,000-RPM FC drives (4 Gbits/sec); 2336 Gbytes per tray
FC 300G10K	300-Gbyte 10,000-RPM FC drives (2 Gbits/sec); 4800 Gbytes per tray
FC400G10K	400-Gbyte 10,000-RPM FC drives (4Gbits/sec); 6400 Gbytes per tray
SATA 2, 500G7.2K	500-Gbyte 7,200-RPM SATA drives (3 Gbits/sec); 8000 Gbytes per tray
SATA 2, 750G7.2K	750-Gbyte 7,200-RPM SATA drives (3 Gbits/sec); 12000 Gbytes per tray
SATA2, 1T7.2K	1-Tbyte7, 200-RPM SATA drives (3Gbits/sec); 16000 Gbytes per tray

Data Host Requirements

This section describes supported data host software, HBAs, and switches.

- [“Multipathing Software” on page 7](#)
- [“Supported Host Bus Adaptors \(HBAs\)” on page 9](#)
- [“Supported Enterprise Software” on page 17](#)
- [“Supported FC and Multilayer Switches” on page 18](#)

Multipathing Software

You must install multipathing software on each data host that communicates with the Sun Storage 6540 Array.

For Solaris OS 8 and 9 data hosts, the multipathing software is part of the Sun StorageTek SAN Foundation Software (SFS). Solaris OS 10 includes the multipathing software. For data hosts running the Solaris OS, follow the instructions in the *Sun StorageTek 6540 Array Hardware Installation Guide* to download and install the software from the Sun Download Center.

TABLE 1-4 lists supported multipathing software by operating system.

TABLE 1-4 6540 Multipathing Software

OS	Multipathing Software	Minimum Version	Latest Version	Host Type Setting	Notes
Solaris 8/9	STMS/MPxIO	SFK 4.4.10	SFK 4.4.13 (Solaris 8) 4.4.15 (Solaris 9)	Solaris with MPxIO	
Solaris 10	STMS/MPxIO	Update 6 Update 5 with patch 137137-09 (Sparc), 137138-09 (x64)	Kernel Jumbo Patch (KJP)	Solaris with MPxIO	
Solaris 8, 9	RDAC	09.10.02.01	9.10.02.01	Solaris with MPxIO	
Solaris 8,9,10 with DMP	Symantec Veritas Dynamic Multi-Pathing (DMP)	5.0	5.0MP3	Solaris with DMP	ASL (Array Support Library) is also required
Windows 2000/2003 Non-clustered	MPIO	01.03.0302.0013	01.03.0302.0110	Windows 2000/2003 Non-clustered	
Windows MSCS Cluster	MPIO	01.03.0302.0013	01.03.0302.0110	Windows 2000/2003 Clustered	You must use MPIO for 7.10 and above
Windows 2000/2003 Non-clustered with DMP	DMP	5.0	5.1	Windows 2000/Server 2003 Non-clustered (with Veritas DMP)	Pending vendor qualification, see Symantec's HCL ASL (Array Support Library) is also required

TABLE 1-4 6540 Multipathing Software (Continued)

OS	Multipathing Software	Minimum Version	Latest Version	Host Type Setting	Notes
Windows 2003 Clustered with DMP	DMP	5.0	5.1	Windows Server 2003 clustered (with Veritas DMP)	Pending vendor qualification, see Symantec's HCL ASL (Array Support Library) is also required
Windows 2008	MPIO	01.03.0302.0013	01.03.0302.0013	Windows 2000/Server 2003	Array must be at firmware level 06.60 and above
AIX 5.2	SUNdac Plugin	5.2.0.16	5.2.0.16	AIX	
AIX 5.3	SUNdac Plugin	5.3.0.16	5.3.0.16	AIX	
AIX 5.3, 6.1 with DMP	DMP	5.0	5.0MP3	AIX with DMP	Pending vendor qualification, see Symantec's HCL ASL (Array Support Library) is also required
Red Hat 4 SuSE 9/SuSE 10	RDAC/MPP	09.03.0B02.0013	09.03.0B02.0042	Linux	
Red Hat 5 SuSE 10 SP1	RDAC/MPP	09.03.0C02.0013	09.03.0C02.0042	Linux	
Red Hat SuSE with DMP	DMP	5.0MP3	5.0MP3	Linux with DMP	Pending vendor qualification, see Symantec's HCL ASL (Array Support Library) is also required
HPUX	Veritas DMP	5.0MP1	5.0MP1	HP-UX	Pending vendor qualification, see Symantec's HCL ASL (Array Support Library) is also required

Note – The multipathing driver for the IBM AIX platform is Veritas DMP, bundled in Veritas Volume Manager 3.x for the Sun StorageTek 6540 Array on AIX. Download the Array Support Library (ASL) from <http://support.veritas.com/>.

Supported Host Bus Adaptors (HBAs)

TABLE 1-5, TABLE 1-6, and TABLE 1-7 lists supported HBAs and other data host platform elements by operating system.

HBAs must be ordered separately from Sun or its respective manufacturers. Sun HBAs can be ordered from:

[/www.sun.com/storagetek/storage_networking/hba/](http://www.sun.com/storagetek/storage_networking/hba/)

You can download HBA drivers and other host software from the Sun Download Center, <http://www.sun.com/software/download/>.

Download operating system updates from the web site of the operating system company.

Note – You must install the multipathing software before you install any OS patches.

TABLE 1-5 Supported HBAs for Solaris Data Host Platforms

Operating System	Minimum OS Patches	Sun 2-Gb HBA	Sun 4-Gb HBA	Sun 8-Gb HBAs
Solaris 8	108974-49 or higher	SG-XPCI1FC-QL2 (6767A) SG-XPCI2FC-QF2 (6768A) SG-XPCI2FC-QF2-Z (6768A)	SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI2FC-EM4-Z SG-XPCI1FC-EM4-Z	N/A

TABLE 1-5 Supported HBAs for Solaris Data Host Platforms (Continued)

Operating System	Minimum OS Patches	Sun 2-Gb HBA	Sun 4-Gb HBA	Sun 8-Gb HBAs
Solaris 9	113277-44 or higher	SG-XPCI1FC-QL2 (6767A) SG-XPCI2FC-QF2-Z (6768A) SG-XPCI1FC-EM2 SG-XPCI2FC-EM2	SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI2FC-EM4-Z SG-XPCI1FC-EM4-Z	N/A
Solaris 10 SPARC	Update 6 or Update 5 with patch 137137-09	SG-XPCI1FC-QL2 (6767A) SG-XPCI2FC-QF2-Z (6768A) SG-XPCI1FC-EM2 SG-XPCI2FC-EM2	SG-XPCIE1FC-QF4 SG-XPCIE2FC-QF4 SG-XPCIE1FC-EM4 SG-XPCIE2FC-EM4 SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI1FC-EM4 SG-XPCI2FC-EM4 SG-XPCIE2FCGBE-Q-Z SG-XPCIE2FCGBE-E-Z	SG-XPCIE1FC-QF8-Z SG-XPCIE2FC-QF8-Z SG-XPCIE1FC-EM8-Z SG-XPCIE2FC-EM8-Z
Solaris 10 x64/x86	Update 6 or Update 5 with patch 137138-09	SG-XPCI1FC-QL2 (6767A) SG-XPCI2FC-QF2-Z (6768A) SG-XPCI1FC-EM2 SG-XPCI2FC-EM2	SG-XPCIE1FC-QF4 SG-XPCIE2FC-QF4 SG-XPCIE1FC-EM4 SG-XPCIE2FC-EM4 SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI1FC-EM4 SG-XPCI2FC-EM4 SG-XPCIE2FCGBE-Q-Z SG-XPCIE2FCGBE-E-Z	SG-XPCIE1FC-QF8-Z SG-XPCIE2FC-QF8-Z SG-XPCIE1FC-EM8-Z SG-XPCIE2FC-EM8-Z

TABLE 1-6 Supported HBAs for Microsoft Windows Data Host Platforms

Host OS / Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Microsoft Windows 2008 Server 32-bit / x86 (IA32) 64-bit / x64 (AMD) EM64T IA64	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
	QLogic QLE 246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
	QLogic QLA 2310F		SG-XPCI1FC-QF4	
	Emulex LPe12000/12002		SG-XPCI2FC-QF4	
	Emulex		SG-XPCI1FC-EM4	
	Lpe11000/LPe11002/LPe1150		SG-XPCI2FC-EM4	
	Emulex		SG-XPCIE2FCGBE-Q-Z	
	LP11000/LP11002/LP1150		SG-XPCIE2FCGBE-E-Z	
	Emulex LP9802/9802DC/982			
	Emulex			
	LP952/LP9002/LP9002DC			
	Emulex			
10000/10000DC/LP1050				
Microsoft Windows 2003 32-bit with SP1 R2 / x86 (IA32)	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
	QLogic QLE 246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
	QLogic QLA 2310F		SG-XPCI1FC-QF4	
	Emulex LPe12000/12002		SG-XPCI2FC-QF4	
	Emulex		SG-XPCI1FC-EM4	
	Lpe11000/LPe11002/LPe1150		SG-XPCI2FC-EM4	
	Emulex		SG-XPCIE2FCGBE-Q-Z	
	LP11000/LP11002/LP1150		SG-XPCIE2FCGBE-E-Z	
	Emulex LP9802/9802DC/982			
	Emulex			
	LP952/LP9002/LP9002DC			
	Emulex			
10000/10000DC/LP1050				

TABLE 1-6 Supported HBAs for Microsoft Windows Data Host Platforms *(Continued)*

Host OS / Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Microsoft Windows 2003 64-bit with SP1 R2 / x64 (AMD) EM64T IA64	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
	QLogic QLE 246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
	QLogic QLA 2310F		SG-XPCI1FC-QF4	
	Emulex LPe12000/12002		SG-XPCI2FC-QF4	
	Emulex Lpe11000/LPe11002/LPe1150		SG-XPCI1FC-EM4	
	Emulex LP11000/LP11002/LP1150		SG-XPCI2FC-EM4	
	Emulex LP9802/9802DC/982		SG-XPCIE2FCGBE-Q-Z	
	Emulex LP952/LP9002/LP9002DC		SG-XPCIE2FCGBE-E-Z	
	Emulex 10000/10000DC/LP1050			

TABLE 1-7 Supported HBAs for Linux Data Host Platforms

Host OS / Sun Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Linux SuSE 10 SP2	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
	QLogic QLE246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
	QLogic QLA 2310F		SG-XPCI1FC-QF4	
	Emulex LP982/LP9802/9802DC		SG-XPCI2FC-QF4	
	Emulex LP9002/LP9002DC/LP952		SG-XPCI1FC-EM4	
	Emulex LP10000/10000DC/LP1050		SG-XPCI2FC-EM4	
	Emulex LP11000/LP11002/LP1150		SG-XPCIE2FCGBE-Q-Z	
	Emulex LP11000/LPe11002/LPe1150		SG-XPCIE2FCGBE-E-Z	

TABLE 1-7 Supported HBAs for Linux Data Host Platforms (Continued)

Host OS / Sun Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Linux	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
SuSE 9.0 - IA 32, 2.6 kernel / x64	QLogic QLE246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
EM64T	QLogic QLA 2310F		SG-XPCI1FC-QF4	
x86 (IA32)	Emulex		SG-XPCI2FC-QF4	
IA64	LP982/LP9802/9802DC		SG-XPCI1FC-EM4	
	Emulex		SG-XPCI2FC-EM4	
	LP9002/LP9002DC/LP952		SG-XPCIE2FCGBE-Q-Z	
	Emulex		SG-XPCIE2FCGBE-E-Z	
	LP10000/10000DC/LP1050			
	Emulex			
	LP11000/LP11002/LP1150			
	Emulex			
	LPe11000/LPe11002/LPe1150			
Linux	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
SuSE 8.0*, 2.4 kernel / x64	QLogic QLE246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8
	QLogic QLA 234x	SG-XPCI1FC-QF2	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8
EM64T	QLogic QLA 2310F	SG-XPCI2FC-QF2-Z	SG-XPCI1FC-QF4	
x86 (IA32)	Emulex		SG-XPCI2FC-QF4	
IA64	LP982/LP9802/9802DC		SG-XPCI1FC-EM4	
	Emulex		SG-XPCI2FC-EM4	
	LP9002/LP9002DC/LP952		SG-XPCIE2FCGBE-Q-Z	
	Emulex			
	LP10000/10000DC/LP1050			
	Emulex			
	LP11000/LP11002/LP1150			
	Emulex			
	LPe11000/LPe11002/LPe1150			

TABLE 1-7 Supported HBAs for Linux Data Host Platforms (Continued)

Host OS / Sun Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Red Hat 5 Update 1, 2	QLogic QLE 256x QLogic QLE 246x QLogic QLA 246x	SG-XPCI1FC-EM2 SG-XPCI2FC-EM2 SG-XPCI1FC-QL2	SG-XPCIE1FC-QF4 SG-XPCIE2FC-QF4 SG-XPCIE1FC-EM4	SG-XPCIE1FC-QF8-Z SG-XPCIE2FC-QF8-Z SG-XPCIE1FC-EM8-Z
RHEL 5u1	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
RHEL 5u2	QLogic QLA 2310F Emulex LP982/LP9802/9802DC Emulex LP9002/LP9002DC/LP952 Emulex LP10000/10000DC/LP1050 Emulex Lpe11000/LPe11002/LPe1150 Emulex Lpe12000/LPe12002		SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI1FC-EM4-Z SG-XPCI2FC-EM4-Z SG-XPCIE2FCGBE-Q-Z SG-XPCIE2FCGBE-E-Z	
Red Hat 4 Update 6	QLogic QLE 256x QLogic QLE 246x	SG-XPCI1FC-EM2 SG-XPCI2FC-EM2	SG-XPCIE1FC-QF4 SG-XPCIE2FC-QF4	SG-XPCIE1FC-QF8-Z SG-XPCIE2FC-QF8-Z
RHEL 4u6	QLogic QLA 246x QLogic QLA 234x QLogic QLA 2310F Emulex LP982/LP9802/9802DC Emulex LP9002/LP9002DC/LP952 Emulex LP10000/10000DC/LP1050 Emulex Lpe11000/LPe11002/LPe1150 Emulex Lpe12000/LPe12002	SG-XPCI1FC-QL2 SG-XPCI2FC-QF2-Z	SG-XPCIE1FC-EM4 SG-XPCIE2FC-EM4 SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI1FC-EM4-Z SG-XPCI2FC-EM4-Z SG-XPCIE2FCGBE-Q-Z SG-XPCIE2FCGBE-E-Z	SG-XPCIE1FC-EM8-Z SG-XPCIE2FC-EM8-Z

TABLE 1-7 Supported HBAs for Linux Data Host Platforms (Continued)

Host OS / Sun Servers	HBAs	Sun 2-Gb HBAs	Sun 4-Gb HBAs	Sun 8-Gb HBAs
Red Hat Linux 4.0 [†] , 2.6 kernel / x64 EM64T x86 (IA32) IA64	QLogic QLE 256x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	SG-XPCIE1FC-QF8-Z
	QLogic QLE 246x	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	SG-XPCIE2FC-QF8-Z
	QLogic QLA 246x	SG-XPCI1FC-QL2	SG-XPCIE1FC-EM4	SG-XPCIE1FC-EM8-Z
	QLogic QLA 234x	SG-XPCI2FC-QF2-Z	SG-XPCIE2FC-EM4	SG-XPCIE2FC-EM8-Z
	QLogic QLA 2310F		SG-XPCI1FC-QF4	
	Emulex		SG-XPCI2FC-QF4	
	LP982/LP9802/9802DC		SG-XPCI1FC-EM4-Z	
	Emulex		SG-XPCI2FC-EM4-Z	
	LP9002/LP9002DC/LP952		SG-XPCIE2FCGBE-Q-Z	
	Emulex		SG-XPCIE2FCGBE-E-Z	
LP10000/10000DC/LP1050				
Emulex				
Lpe11000/LPe11002/LPe1150				
Emulex Lpe12000/LPe12002				
Red Hat Linux 3.0, 2.4 kernel / x64 EM64T x86 (IA32) IA64	QLogic QLA 246x	SG-XPCI1FC-EM2	SG-XPCIE1FC-QF4	N/A
	QLogic QLA 2342	SG-XPCI2FC-EM2	SG-XPCIE2FC-QF4	
	QLogic QLA 2340		SG-XPCIE1FC-EM4	
	QLogic QLA 2310F		SG-XPCIE2FC-EM4	
	Emulex			
	LP982/LP9802/9802DC			
	Emulex			
	LP9002/LP9002DC/LP952			
	Emulex			
	LP10000/10000DC/LP1050			
LSI 44929				
LSI 40919				

* Oracle Real Application Clusters (RAC), SteelEye LifeKeeper Server Clustering

† SteelEye LifeKeeper Server Clustering

TABLE 1-8 Other Supported Data Host Platforms

Host OS	Host Servers	HBAs
Novell NetWare 6.0 (SP5)	x86 (IA32)	QLogic QLA 2342 QLogic QLA 2340 QLogic QLA 2310F
Novell NetWare 6.5 (SP7)	x86 (IA32)	QLogic QLA 2342 QLogic QLA 2340 QLogic QLA 2310F QLogic QLA 246x
Novell NetWare 6.5 (SP3)	x86 (IA32)	QLogic QLA 2342 QLogic QLA 2340 QLogic QLA 2310F QLogic QLA 246x
IRIX 6.5.26, 6.5.27, 6.5.28, 6.5.29	MIPS	QLogic QLA 2310
HP-UX 11.31	HP RISC	HP A6795A HP A6826A HP A6684A HP A6685A HP A5158A HP AB378A HP AB379A HP AD300A HP AD355A

TABLE 1-8 Other Supported Data Host Platforms (Continued)

HP-UX B11.11	HP RISC	HP A6795A HP A6826A HP A6684A HP A6685A HP A5158A
HP-UX B.11.23	HP RISC IA64	HP A6795A HP A6826A HP A9784A HP AB378A HP AB379A HP AD300A HP AD355A
IBM AIX 5.2, 5.3, 6.1	Power	IBM 5716 IBM 5758 IBM 5759 IBM 6228 IBM 6239

Supported Enterprise Software

The enterprise software applications listed in [TABLE 1-9](#) are compatible with the Solaris OS on the data host.

TABLE 1-9 Supported Enterprise Software

Software	Version
Legato NetWorker	7.3
Sun Cluster	3.0, 3.1
Sun StorageTek QFS software	4.0 minimum
Sun StorageTek SAM-FS software	4.0 minimum
Sun StorageTek Availability Suite	3.2 minimum
Sun StorageTek Enterprise Backup Software	7.3
Solstice DiskSuite	4.2.1 (in conjunction with the Solaris 8 OS)
Solaris Volume Manager	Embedded in the Solaris 9 and 10 OSs
Veritas Storage Foundation (VxVM/VxFS)	5.0

TABLE 1-9 Supported Enterprise Software (Continued)

Software	Version
Veritas Cluster Server (VCS)	5.0
Veritas NetBackup	6.0 or higher
Veritas Storage Foundation (VxVM/VxFS)	5.0

Supported FC and Multilayer Switches

The following FC fabric and multilayer switches are compatible for connecting data hosts and the Sun StorageTek 6540 Array:

- Sun StorEdge Network 2 Gb FC Switch - 8, 16, and 64
- Brocade SilkWorm 200E/300/4100/4900/5000/5100/5300/7500/48000/DCX
- Cisco 9124/9134/9216/9216i/9222i/9506/9509/9513
- McDATA 6140/i10K/QPM 4 Gb blade for 6140
- QLogic SANBox 5602/9000

Upgrading Firmware

Host management software upgrades are described in the *Sun StorageTek Common Array Manager 6.4.1 Release Notes*. This section describes release-specific steps for firmware and driver upgrades that you must perform:

- [“Upgrading Array Firmware” on page 18](#)
- [“Updating the SSD Driver for the Solaris OS” on page 20](#)

Upgrading Array Firmware

New firmware files are included in each release of the Sun StorageTek Common Array Manager software, currently Release 6.4.1. When you install new management software from DVD or web download and perform the Upgrade Firmware function, the software will detect older firmware versions and prompt you to upgrade to the new firmware versions required for this release. It is not necessary to uninstall the existing firmware.

If the software detects that there is no earlier version installed, it will perform a complete new installation. The software is available on the Sun StorageTek Common Array Manager CD, or in the package you obtain from http://www.sun.com/storagetek/management_software/resource_management/cam/get_it.html.

TABLE 1-10 lists the available firmware upgrade paths.

TABLE 1-10 Firmware Upgrade Paths

Current Firmware Revision	Upgrade to Revision	Upgrade Type	Upgrade Performed Using
06.xx	06.60.22.10	Online	CAM (See “To Upgrade the Firmware on the Array” on page 20)
06.14 (or higher)	07.50.13.10 (or higher)	Offline and Online	Requires a two-step process: 1. Upgrade 6.14 (or higher) to 7.15.11.17* using Sun StorageTek 6000 Series Upgrade Utility (See <i>Sun StorageTek 6000 Series Array Firmware Upgrade Guide</i>) 2. Upgrade 7.15.11.17 to 7.50.13.10 (or higher) using CAM (See “To Upgrade the Firmware on the Array” on page 20)
07.xx	07.50.13.10 (or higher)	Online	CAM (See “To Upgrade the Firmware on the Array” on page 20)

* Limited function version of the firmware for initial step in the controller firmware upgrade process

Note – The transition from 06.xx to 07.15.11.17 firmware is an offline upgrade and is customer installable. The *Sun StorageTek 6000 Series Array Firmware Upgrade Guide* describes how to upgrade the 6140 array to the controller firmware version 7.15.11.17 (a limited function version of the firmware) using the special upgrade utility. Once your array is at firmware version 7.15.11.17, you *must* then upgrade to the latest firmware revision using CAM.

Troubleshooting Upgrade Failures

If you receive a failure message from the Upgrade Utility going from 7.15.11.17 to 7.50 or going from 7.50.08.10 to 7.50.13.10 and any higher firmware revision using CAM or SANtricity, follow these steps:

1. Review the event log for true errors.
2. Save the event log.
3. You might need to clear the event log to move forward.

Contact your technical support representative if you need assistance in the reviewing the event log.



Caution – If your array is at firmware version 07.xx, you cannot downgrade to 6.xx. If you must downgrade to 6.xx, contact Sun support.

To Upgrade the Firmware on the Array

Using CAM, this procedure downloads the firmware binary on the management host to the array and upgrades the firmware running in the array.

1. **Log in to the management host.**
2. **On the Java Web Console page, click Sun StorageTek Common Array Manager.**
3. **Go to the Storage System Summary page and select the arrays to be upgraded.**
4. **Click the Upgrade Firmware button.**
5. **Follow the prompts.**

Updating the SSD Driver for the Solaris OS

After installing software for the data hosts, go to SunSolve (<http://www.sun.com/sunsolve>) and download the SSD driver for data hosts running the Solaris 8 or 9 OS.

To Update the SSD Driver for the Solaris 8 OS

Note – Patch 108974-49 or higher requires patch 108528-29 or higher. If needed, apply patch 108528-29 or higher first.

1. Download the 108974-49 or higher patch from SunSolve.

2. Unpack the patch:

```
unzip 108974-49.zip
```

3. Read the README file:

```
108974-49/README.108974-49
```

4. Apply the patch with the `patchadd` command:

```
patchadd 108974-49
```

5. Reboot your system.

```
reboot -- -r
```

Note – Patch 113277-44 or higher requires patches 112233-02 and 112834-02, which are already included in most versions of the Solaris 9 OS. If they are needed, apply patches 112233-02 and 112834-02 first.

1. Download the 113277-44 or higher patch from SunSolve.

2. Unpack the patch:

```
unzip 113277-44.zip
```

3. Read the README file:

```
113277-44/README.113277-44
```

4. Apply the patch with the `patchadd` command.

```
patchadd 113277-44
```

5. Reboot your system.

```
reboot -- -r
```

Known Issues

The following sections provide information about known issues and bugs filed against this product release:

- [“Installation and Initial Configuration Issues” on page 22](#)
- [“Hardware and Firmware Issues” on page 23](#)
- [“Documentation Issues” on page 25](#)
- [“Operational Information” on page 26](#)

If a recommended workaround is available for a bug, it follows the bug description.

Installation and Initial Configuration Issues

This section describes known issues and bugs related to installing and initially configuring the Sun StorageTek 6540 Array.

2 and 4 Gbps Drive Trays Cannot Be Mixed on the Same Tray Group

CSM200 expansion trays can hold either 2 or 4 Gbps drives, but not within the same tray. Mixing 2 and 4 Gbps drive trays in the same tray group (drive channel) will run all drives at the lower speed.

Trays Groups that must run at the same drive speed:

- Trays Groups 00 and 20 (tray IDs begin with 0x or 2x)
- Trays Groups 10 and 30 (tray IDs begin with 1x or 3x)

Figure 2.4 from the *Sun StorageTek 6540 Array Hardware Installation Guide* shows 4 tray groups. If you have 2 Gbps drive trays to mix with 4 Gbps drive trays, you could add all the 2Gbps drives to trays with IDs of X0 and X2. The 4 Gbps drive trays could go in trays with IDs of X1 and X3.

This does not apply to new trays consisting of all 4 Gbps drives.

Auto-Negotiation of Ethernet Switches Must be Set to On

The Ethernet ports of the array auto-negotiate for standard 10 and 100 Mb/s full duplex connectivity. The ethernet switch that the array's management path connects with must have auto-negotiation turned on. If it is not set, the array will eventually lose visibility from the management host.

Hardware and Firmware Issues

This section describes general issues related to the Sun StorageTek 6540 Array hardware and firmware.

System Cabinet Doors Must Be Closed



Caution – The front and back doors of the system cabinet must be closed for compliance to domestic and international EMI regulations as well as proper equipment cooling.

Do not block or cover the openings of the system cabinet.

Cabinet airflow is from front to back. Allow at least 30 inches (76.2 cm) in front of the cabinet, and at least 24 (60.96 cm) inches behind the cabinet, for service clearance, proper ventilation, and heat dissipation.

CSM200 Requirements

When you add a new CSM200 expansion tray to an existing array in a production or active environment, you must cable and add the trays while the RAID controller module is powered on.

Unit Identified As IOM Is Labeled ESM

Bug 6438824 – There is a module on the array, physically labeled ESM, that is identified by Sun StorageTek Common Array Manager software as an input/output module (IOM).

Replacing Failed Disk Drives From Another Array Can Cause Volume Problems

If a volume failure on a Sun StorageTek 6540 Array results from failed disk drives and you introduce replacement drives that were part of a volume in use by another Sun StorageTek 6540 Array, the array might incorrectly initiate a volume migration process with the replacement drives.

Workaround - Perform one of the following tasks:

- Verify that the volume on the Sun StorageTek 6540 Array with the failed disk drives has not been deleted. You should leave the volume in a Failed state and not delete the volume.

- Verify that the disk drives being taken from the inactive Sun StorageTek 6540 Array are not part of an active virtual disk. If the disk drives are part of an active virtual disk, delete all volumes residing on that virtual disk before removing the disk drives.

Power Up the System Before Connecting the Modem Power Cord

The patch panel modem power cord is not connected to the cabinet power strip from the factory. To use the modem, power up the system *before* connecting the modem power cord to the cabinet power strip.

Status Codes

The following is a list of the meanings of the status and diagnostic codes that may display on the numerical LEDs on the controller and expansion modules.

TABLE 1-11 Tray ID Display Status Codes

Value	Description
FF	IOM boot diagnostic executing
88	This IOM is being held in Reset by the other IOM
AA	IOM-A application is booting up
bb	IOM-B application is booting up
H1	SFP speed mismatch (2 Gbit/sec SFP installed when operating at 4 Gbit/sec)
H2	Invalid/incomplete configuration
H3	Maximum reboot attempts exceeded
H4	Cannot communicate with other IOM
H5	Midplane harness failure
H6	Firmware failure
H7	Current enclosure fibre channel rate different than rate switch
H8	SFP(s) present in currently unsupported slot (2A or 2B)

TABLE 1-12 Tray ID Display Diagnostic Codes

Value	Controller State	Description
L0	Suspended	Mismatched controller types
L1	Suspended	Missing interconnect canister
L2	Suspended	Persistent memory errors
L3	Suspended	Persistent hardware errors
L4	Suspended	Persistent data protection errors
L5	Suspended	ACS failure
L6	Suspended	Unsupported host card
L7	Suspended	Sub-model identifier not set or mismatched
L8	Suspended	Memory configuration error
L9	Suspended	Link speed mismatch
LA	Suspended	Reserved
Lb	Suspended	Host card configuration error
LC	Suspended	Persistent cache backup configuration error
Ld	Suspended	Mixed cache memory DIMMs
LE	Suspended	Uncertified cache memory DIMM Sizes
LF	Suspended	Lockdown with limited SYMbol support
LH	Suspended	Controller firmware mismatch

Documentation Issues

The *Sun StorageTek 6540 Array Site Preparation Guide* (819-6524-nn) incorrectly cites the following information in Chapter 2 under cabinet Power Requirements:

Current	32A (2 x 16A) maximum
---------	-----------------------

This should state the following:

Current	Four 20 Amp circuits are required for the 6540 cabinet to insure full redundancy. (UL allows the planned use of only 16A from each of those 20A circuits.)
---------	--

All components in the cabinet should operate on only two of the 20A circuits (16A loaded each), but in this case no AC redundancy would be in place (power only A0/A1 or B0/B1).

With all four 20A circuits powered (A0, A1, B0, B1), the cabinet will draw a maximum total of 32A from the four circuits. If the system were to draw more than that 32A, then full AC redundancy cannot be present.

The Sun Rack 1000-38 cabinet power distribution systems work at 180-264VAC only. Internal components will never be operated below 180V (200V nominal) when in this cabinet.

Operational Information

This section provides useful operational information not documented elsewhere.

Batteries Alert: Transitioning to an Unknown State

If you power off, remove, or experience a failure of either of the power cooling units, the system generates battery alerts for both batteries as “transitioning to an unknown state.”

Even though the batteries are listed as being in an unknown state, they are still providing protection in the event of a cache failure. No workaround is required.

Removal of Power Fan Unit Causes Batteries to Switch to Unknown State

If you power off, remove, or experience a failure of either of the power cooling units (which also house the controller’s battery packs), the system generates battery alerts for both batteries as “transitioning to an unknown state.”

Workaround – You should not lose data unless the batteries fail, or unless you do not have adequate charges remaining in the batteries for cached data to finish being written to disk.

Controller Tray ID Numbering Is Unrestricted

Controller tray IDs can be set to any number between 0 and 99. Expansion trays use the values 0 to 79. Controller trays should use the values 80 to 99 (except 85) to avoid duplicate tray IDs.

If tray IDs are duplicated, the array will not be able to detect the drives on one of the two trays that have the same ID (which one is arbitrary). Do not use ID 85 for the controller tray, as this number is the default setting that indicates everything is operating as expected.

When Performing an Array Import, Do Not Modify Management Objects

If you create management objects while an “import array” job is running, it might interfere with the import. Be sure that everyone who uses the destination array does not modify or create any objects (including volumes, initiators, mappings, and so on) while the import is in progress.

Using a Volume Before It Is Fully Initialized

When you create a volume and label it, you can start using the volume before it is fully initialized.

Controller Tray Battery Information

During bootup, the battery light might flash for an extended period. The battery charger performs a series of battery qualification tests before starting a battery charge cycle. This series of tests occurs at subsystem power-up. The tests are automatically reinitialized by a timer approximately every 25 hours.

Each controller tray contains a hot-pluggable lithium ion battery pack for cache backup in case of power loss. The on-board battery is capable of holding a 2-Gbyte cache for up to three days (72 hours). The service life of the battery pack is three years, at the end of which the battery pack must be replaced (it is field-replaceable).

Erroneous Data Host Format Command Output

The Solaris `data host format` command might render one or more of the following listings:

STK-FLEXLINE380-0616 and STK-UniversalXport-0616

These are not data volumes and should be ignored.

Release Documentation

The following is a list of documents related to the Sun StorageTek 6540 Array.

Documentation for this product is available online at

<http://docs.sun.com/app/docs/prod/stortek.6540rohs#hic>

You can also search for additional documentation at

<http://www.sun.com/documentation>

Application	Title	Part Number
Site planning information	<i>Sun StorageTek 6540 Array Site Preparation Guide</i>	819-6524
Regulatory and safety information	<i>Sun StorageTek 6540 Array Regulatory and Safety Compliance Manual</i>	819-6520
Installation and initial configuration instructions	<i>Sun StorageTek 6540 Array Hardware Installation Guide</i>	819-6461
Software installation instructions	<i>Sun StorageTek Common Array Manager Software Installation Guide, v6.2.0 (or higher)</i>	819-5747
Instructions for installing the Sun StorEdge Expansion cabinet	<i>Sun StorEdge Expansion Cabinet Installation and Service Manual</i>	805-3067
Instructions for installing the Sun Rack 900/1000 cabinets	<i>Sun Rack Installation Guide</i>	816-6386
Instructions for installing the Sun Fire cabinet	<i>Sun Fire Cabinet Installation and Reference Manual</i>	806-2942
Upgrade controller firmware from 6.x to 7.x	<i>Sun StorageTek 6000 Series Array Firmware Upgrade Guide</i>	820-7197
Solaris OS 8 and 9 multipathing software information	<i>SAN Foundation Software Release Notes</i>	819-5604-15
Multipath failover guide for Linux OS platforms	<i>Sun StorageTek RDAC Multipath Failover Driver Installation Guide For Linux OS</i>	820-4738

Application	Title	Part Number
Multipath failover guide for Windows OS platforms	<i>Sun StorageTek MPIIO Device Specific Module Installation Guide For Microsoft Windows OS</i>	820-4737
Release-specific information for the Sun StorageTek Common Array Manager	<i>Sun StorageTek Common Array Manager Release Notes, v. 6.4.1 (or higher)</i>	820-7920
Information about the Common Array Manager CLI	<i>Sun StorageTek Common Array Manager CLI Guide</i>	820-6662

Notable Updates/Fixes in This Release

TABLE 1-13 Array Firmware Updates/Fixes in This Release

CR ID	Description
2170590	False impending failure alerts. Related to PFA. Failure alerts are migrating to other drives
2172381 6799705	RVM deletion operation staying queued and causing loss-of-management.
6572039	SYMBOL is returning 0 for FLX280 Ethernet port speed
6588535 6714375	750GB drives report check conditions and DDE's in MajorEventLog and makes MEL unusable
6593771	Shell command component of DDC data is not present
6612020	Controller B continues to reboot
6663985	Exception log corrupted when watchdog suspended and "I" issued
66765184	6540 reports Temperature Exceeded on a few trays if running firmware (07.10.25.10)
66803561	SYMBOL is configuring the Java logger such that it interferes with management application logging
6680647	Large data replication block size causes controller reboot
6703791	SPM database corruption causes boot loop; Mapset numbers don't match between the two controllers
6719611	CSM200 drive tray has fault LED turned on even when the tray and the whole array is optimal
6734964	Array IP address not discovered when queried
6747153	Controller cache memory size displays 0

TABLE 1-13 Array Firmware Updates/Fixes in This Release *(Continued)*

CR ID	Description
6754351	Controller reboot with out-of-band management
6755642	Snapshot status incorrect
6755990	Controllers enter reboot loop after data replication pairs are restored
6757957	Auto code sync feature can fail during controller replacement
6767241	After a controller reboot, loss of path redundancy might be reported on some internal drives
6768200	Controller reset during volume (vmware_vmfs_3) build
6790533	Controller reset due to Ancient IO
6792398	After upgrading to latest crystal firmware, customer encounters controller reboots when running full I/O load
6797173	6140/6540 report degraded path to drive(s) that isn't degraded
6799705	RVM deletion operation staying queued and causing loss-of-management
6804830	PANIC: sasDoTargetCmd: Cannot allocate mirror buffer on Controller B
6810115	RVM remained synchronized on odd volumes but was not synchronized on even volumes after cables were pulled
6810118	Data corruption when changing RVM mode from Asynchronous to Asynchronous with Consistency mode
6812994	DDC data not collecting traces in b.dq
6821655	(LBA) truncation issue on greater than 2TB volumes
6821654	
6822129	
6823965	Controller Panic with (iconMgr2): PANIC: Already freed memory block at 0x10a374a0
6824635	6140 controller panic reboot ?PANIC: StateChangeMgr::incGenerationNumberAlt?
697188	SATA drives may fail further to a 06/3f/01 during drive code update

Service Contact Information

If you need help installing or using this product, go to:

<http://www.sun.com/service/contacting>

Third-Party Web Sites

Sun is not responsible for the availability of third-party web sites mentioned in this document. Sun does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Sun will not be responsible or liable for any actual or alleged damage or loss caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Disk Drive Insertion

This appendix describes how to properly insert a disk drive into a controller or expansion tray.

The correct way to insert a disk drive into the tray is as follows:

1. Push the disk drive into the chassis by slowly pushing against the drive housing until the drive handle engages with the chassis.
2. When the handle starts to move itself downwards, push the disk drive handle down. This will crank the disk drive the rest of the way into the chassis.

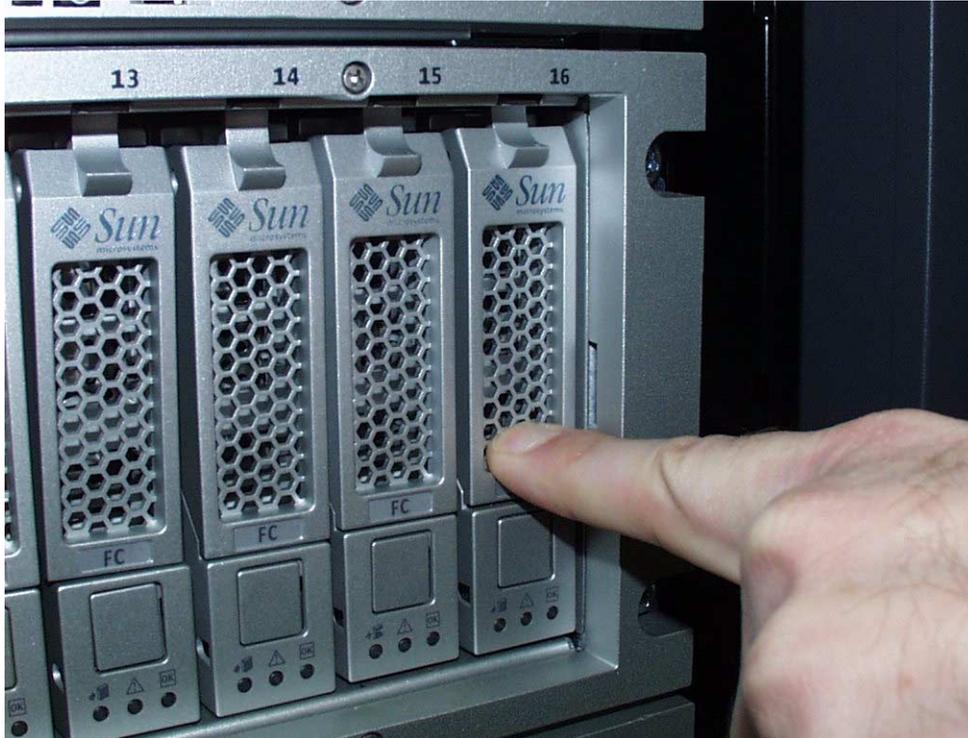
[FIGURE A-1](#) shows a drive being inserted into the chassis the correct way.

FIGURE A-1 Inserting a Disk Drive



When the drive is completely installed, the drive and handle will be flush with the others, as shown in [FIGURE A-2](#).

FIGURE A-2 Successfully Inserted Disk Drive



[FIGURE A-3](#) shows the wrong way to insert the drive.



Caution – Do not insert a disk drive into a tray by pushing on its housing until it is all the way in. This can cause the handle to be stuck in the “up” position so it is unable to close.

FIGURE A-3 Incorrect Method of Inserting a Hard Drive



