Overview

The Smart Array 6400 high performance Ultra320, PCI-X controller family provides maximum performance, flexibility, and reliable data protection for HP ProLiant servers, through its unique modular design and support for Advanced Data Guarding (RAID ADG). This new generation performance Smart Array controller again raises the standards of performance, introducing Double Data Rate (DDR) battery-backed write cache architecture and a new RAID engine.

Designed and tested with industry standard ProLiant Servers for greater reliability, this controller is ideal for workgroup and departmental servers. And like other Smart Array controllers, the SA-6400 features complete data compatibility with previous generation's Smart Array controllers for easy data migration from server to server and for controller upgradeability.

Models	Smart Array 6402/128 Controller	273915-B21
	Smart Array 6404/256 Controller	273914-B21

HP Smart Array 6400 Controller Feature List

- Advanced RAID level: Advanced Data Guarding
- High Performance Architecture
- Innovative modular design
  - Upgradeable cache for higher performance
  - Upgradeable from 2 to 4 SCSI channels
- High Capacity
  - 2 channel model supports up to 28 drives
  - 4 channel model supports up to 56 drives
- Multiple battery-backed cache options
  - 128 MB DDR-RAM
  - 256 MB DDR-RAM
  - 512 MB DDR-RAM

Key Features

- **Advanced Data Guarding** (RAID ADG) offers breakthrough level of fault protection of RAID volumes up to 2TB and a total of 28 disk drive in a RAID volume. RAID ADG provides fault protection greater than RAID 1 or RAID 5 and only consumes the capacity of 2 disk drives for distributed parity data. RAID ADG protects against any 2 disk drive failures. This higher level of protection is ideal to protect large logical volumes and with high capacity disk drives where a failed drive rebuild time may be significant.
- **Modular**, easy-to-upgrade design lets you optimize performance and increase capacity as needed from two to four channels and 128 MB to 512 MB battery-backed cache (BBWC).
- **High-performance**, Sixth generation architecture offers a new hardware RAID engine, and a new performance 266MHz DDR memory architecture for increased performance over previous controllers.
- **Recovery ROM** protects against a ROM failure or corruption.
- **Ultra320 SCSI** technology delivers high performance and data bandwidth up to 320 MB/s bandwidth per channel.
- **Mix-and-match** LVD SCSI compatibility protects your investments and lets you deploy drives as needed.
- **Battery-backed Cache** protects cached data in the event of a power outage, server failure or controller failure, and redundant, replaceable batteries take that protection even further. Maximum cache configuration is 512 MB of battery-backed cache.
- **64-bit, 133 MHz PCI-X** interface boosts bandwidth above 1GB/s burst transfer rate over PCI-X

bus

- 64-bit memory addressing supports servers with greater than 4 GB of memory.
- Online Management Features: Online Capacity Expansion, Online RAID Level Migration, Online Stripe Size Migration, Multiple Online Spares (Global), User Selectable Read/Write cache, User Selectable Expand and Rebuild Priority.

Product Highlights

The Smart Array Advantage

HP's innovative design and integration work of the Smart Array family of products creates customer value that is unmatched in the industry. Use of Smart Array products across multiple applications results in a much lower Total Cost of Ownership (TCO) than any other server storage RAID product. The HP Smart Array family brings an unparalleled return on investment through:

Data Compatibility among all models of Smart Array controllers allows simple and easy upgrades any time needs for higher performance, capacity, and availability increase. Even successive generations of Smart Array controllers understand the data format of other Smart Array Controllers.

Consistent Configuration and Management Tools. All Smart Array products utilize a standard set of management and utility software. These tools minimize Total Cost of Ownership (TCO) by reducing training requirements and technical expertise necessary to install and maintain the HP server storage.

Universal Hard Drive form factor is for use across multiple HP servers, disk enclosures and storage systems. With compatibility across many enterprise platforms, you are free to deploy and re-deploy these drives to quickly deliver increased storage capacity, migrate data between systems, and easily manage spare drives.

Pre-Failure Warranty means HP Insight Manager not only reports when a drive is going to fail but allows replacement of failing drives prior to actual failure. For complete details, consult the HP Support Center or refer to your HP Server documentation.

Performance

HP's new high-performance architecture sets new boundaries of industry performance expectations!

- Ultra320 SCSI (320-MB/s bandwidth) per channel
- High-performance 64-bit architecture, featuring a super-scalar RISC processor
- New RAID XOR engine
- Innovative dual processor, dual XOR engine design for the SA-6404
- New performance 266MHz DDR memory architecture providing for greater performance through greater bandwidth
- 64-bit, 133-MHz PCI-X bus (1-GB/s bandwidth)

Capacity

Given the need for rapid capacity expansion, the SA-6400 offers:

- Up to four Ultra320 SCSI channels, supporting up to 56 disk drives
- More than 16TB of storage per PCI slot

Availability

Provides increased server uptime by providing advanced storage functionality:

- Online RAID Level Migration (between any RAID level)
- Online Capacity Expansion
- Logical Drive Capacity Extension
- Global Online Spare
- Pre-Failure Warranty

Product Highlights

Fault Prevention

The following features offer detection of possible failures before they occur, allowing preventive action to be taken:

- S.M.A.R.T.: Self Monitoring Analysis and Reporting Technology first developed at Compaq detects possible hard disk failure before it occurs, allowing replacement of the component before failure occurs.
- Drive Parameter Tracking monitors drive operational parameters, predicting failure and notifying the administrator.
- Dynamic Sector Repairing continually performs background surface scans on the hard disk drives during inactive periods and automatically re-maps bad sectors, ensuring data integrity.
- Smart Array Cache Tracking monitors integrity of controller cache, allowing pre-failure preventative maintenance.
- Environment Tracking for External Storage System monitors.

Fault Tolerance

Keeps data available and server running while a failed drive is being replaced; several fault tolerance configurations are supported including:

- Advanced Data Guarding (RAID ADG): This is the highest level of fault tolerance. It allocates two sets of parity data across drives and allows simultaneous write operations. This level of fault tolerance can withstand two simultaneous drive failures without downtime or data loss. It is available standard with the SA-6400.
- Distributed Data Guarding (RAID 5): This allocates parity data across multiple drives and allows simultaneous write operations. It is recommended for up to 14 hard drives.
- Drive Mirroring (RAID 1, 1+0): This allocates half of the drive array to data and the other half to mirrored data, providing two copies of every file. It is a high-performance RAID configuration.

Fault Recovery

Minimizes downtime, reconstructs data, and facilitates a quick recovery from drive failure:

- Recovery ROM: provides a unique redundancy feature that protects from a ROM failure. A new version of firmware can be flashed to the ROM while the controller maintains the last know working version of firmware. If the firmware becomes corrupt, the controller will revert back to the previous version of firmware and continue operating. This reduces the risk of flashing firmware to the controller.
- On-Line Spares: Up to four spare drives can be installed prior to drive failure. If a failure occurs, recovery begins with an On-Line Spare and data is reconstructed automatically.
- ECC-Protected Cache Memory: Removable, battery-backed cache memory protects data, up to four days (three days with 256-MB Module, one day with 512-MB Module), in the event of power failure, server hardware failure or controller failure. In addition, HP provides an exclusive design that includes redundant and replaceable batteries for greater cache protection.

Ease of Use

Consistency and Upgradeability make the Smart Array family unique in the industry:

- GUI based configuration, management and diagnostic software tools
- Common data formatting between generations of products
- Data migration between servers and external storage enclosures

Product Highlights

Servers Compatibility

For up to date compatibility, please see the following URL for complete Smart Array 6400 compatibility and support information:
http://h18006.www1.hp.com/products/servers/proliantstorage/arraycontrollers/index.html

Operating Systems Compatibility

Microsoft® Windows® NT® 4.0, 2000
NOTE: NT 4.0 support for U320 Expansion Module for the SA-6402 will not be available at launch.
Windows Server 2003
Novell NetWare 5.x, 6
SCO UnixWare® 7.1.1, 7.1.3
SCO Unix® 5.0.6a, 5.0.7
Red Hat Enterprise Linux
SUSE Linux Enterprise Server
NOTE: For more Linux OS support & certification information, please visit our the ProLiant & BladeSystem Server Linux matrix: http://h18004.www1.hp.com/products/servers/linux/hplinuxcert.html

Configuration/ Diagnostic Utilities

- HP Array Configuration Utility (ACU)
  - Powerful Web based configuration utility for all Smart Array controllers
  - Easy to use Wizards for configuration
  - Provides a graphical view of HP drive array configurations
  - Allows for management of multiple arrays over a secure internet connection from anywhere in the world
  - Runs online on Windows 2000, Windows Server 2003 and Linux
- Options ROM Configuration for Arrays
  - Rapid configuration upon initial install of the OS

Software Suite

All Smart Array products share a common set of configuration, management and diagnostic tools, including Array Configuration Utility (ACU), Array Diagnostic Utility (ADU), and Insight Manager. This software consistency of tools reduces the cost of training for each successive generation of product and takes much of the guesswork out of troubleshooting field problems. These tools lower the total cost of ownership by reducing training and technical expertise necessary to install and maintain the HP server storage.

Systems Insight Manager

- Powerful server and server options/storage manager tool
- Monitors over 1200 server parameters

Service and Support, HP Care Pack, and Warranty Information

Available Software Product Services	Standalone telephone support Rights to new license version Media and documentation updates
Available Hardware Product Services	Installation services On-site maintenance (includes warranty support) Response time upgrades during the warranty period Post-warranty coverage RAID setup and performance consulting via statement of work For additional hardware installation and maintenance information, please refer to the URL listed below: http://www.hp.com/hps/
Warranty Upgrade Options	Response – Upgrade on-site response from next business day to same day 4 hours Coverage – Extend hours of coverage from 9 hours x 5 days to 24 hours x 7 days Duration – Select duration of coverage for a period of 1, 3, or 5 years
Warranty Upgrade Options	HP Care Pack is defined as an upgrade to the product warranty attribute, available for a specific duration and hours of coverage. HP Care Pack is not available for less than the product's warranty duration. HP Care Pack is available for sale anytime during the warranty period for most products, but the commencement date will be the same as the Warranty Start Date (delivery date to end user customer). Proof of purchase may be required. HP Care Pack services are prepaid. For additional HP Care Pack (hardware & software) information, as well as orderable part numbers, please refer to the URL http://www.hp.com/hps/. NOTE: HP Care Packs are not sold with the server they are not sold with the Option Card.

Options

NOTE: This is a list of supported options. Some options may be discontinued.

Controller Upgrade Options	Ultra320 Expansion Module for SA-6402	273911-B21
	512 MB Battery-Backed Cache Upgrade	372538-B21
Disk Drive Enclosures	HP StorageWorks Modular Smart Array 30 SB NOTE: Rack-mountable 14 drive enclosure with single bus, redundant power supplies.	302969-001
	HP StorageWorks Modular Smart Array 30 DB NOTE: Rack-mountable 14 drive enclosure with dual bus, redundant power supplies.	302970-001
	StorageWorks Enclosure 4314T	190210-001
	StorageWorks Enclosure 4314T (Int'l)	190210-B31
	StorageWorks Enclosure 4314T (Japan)	190210-291
	StorageWorks Enclosure 4314R	190209-001
	StorageWorks Enclosure 4314R (Int'l)	190209-B31
	StorageWorks Enclosure 4314R (Japan)	190209-291
	StorageWorks Enclosure 4354R	190211-001
	StorageWorks Enclosure 4354R (Int'l)	190211-B31
	StorageWorks Enclosure 4354R (Japan)	190211-291
Hard Drives	*Ultra320 - Universal Hot Plug*	
	HP 300GB U320 10K Universal HDD	350964-B22
	HP 146GB U320 10K Universal HDD	286716-B22
	HP 72GB U320 10K Universal HDD	286714-B22
	HP 300GB U320 15K Universal HDD	411089-B22
	HP 146GB U320 15K Universal HDD	286713-B22
	HP 72GB U320 15K Universal HDD	286778-B22
	HP 36GB U320 15K Universal HDD	286776-B22
	NOTE: Please see the Hard Drive QuickSpecs for Technical Specifications such as capacity, height, width, interface, transfer rate, seek time, physical configuration, and operating temperature: http://h18000.www1.hp.com/products/quickspecs/11531_div/11531_div.HTML (Worldwide)	
	NOTE: All U320 Universal Hard Drives are backward compatible to U2 or U3 speeds. U320 drives require an optional U320 Smart Array Controller or U320 SCSI HBA to support U320 transfer rates.	
Universal Hot Plug Tape Drives	HP StorageWorks DAT 40 SCSI Hot-plug Tape Drive (Carbon)	Q1546A
	HP StorageWorks DAT 72 SCSI Hot-plug Tape Drive (Carbon)	Q1529A

Family Information

This is a brief overview and comparison of the Smart Array family of PCI RAID controllers.

	Smart Array 6402/6404	Smart Array 5312	Smart Array 5302/5304
Introduction Date	June/September 2003	April 2002	July 2000
SCSI Protocols Supported	Ultra320, Ultra3, Ultra2	Ultra3, Ultra2	Ultra3, Ultra2, Wide-Ultra
Maximum Channel Transfer Rate (MB/s)	1280 total 320 per channel	320 total 160 per channel	640 total 160 per channel
Channels	2, 4	2	2, 4
SCSI Ports (external/internal)	2 channel model: 2/2 4 channel model: 4/2	2/2	2 channel model: 2/2 4 channel model: 4/2
Maximum Drives	56*	28*	56*
Cache	128-, 256-, 512-MB read-write	128-MB read-write	256-, 128-, 64- or 32-MB read-write
Battery-backed, Removable Cache	Yes, Redundant, Replaceable Batteries	Yes, Redundant Replaceable Batteries	Yes, Redundant Replaceable Batteries
Upgradeable Cache	Yes	Yes	Yes
Recovery ROM	Yes	Yes	Yes
RAID Support	0,1,1+0,5, Advanced Data Guarding	0,1,1+0,5	0,1,1+0,5, Advanced Data Guarding**
Configuration Tool(s)	ACU ORCA	ACU ORCA	ACU ORCA
Management and Diagnostic Tools	IM ADU	IM ADU	IM ADU
Maximum Volumes	32	32	32
Drive Roaming	Yes	Yes	Yes
Online Expansion	Yes	Yes	Yes
Online & Offline Configuration	Yes	Yes	Yes
Logical Drive Extension	Yes	Yes	Yes
Stripe Set Migration	Yes	Yes	Yes
RAID Level Migration	Yes	Yes	Yes
Online Spare Support	Yes	Yes	Yes
Capacity Extension	Yes	Yes	Yes
SAN Access Module	No	No	Yes
PCI Bus	64-bit, 133-MHz PCI-X	64-bit, 133-MHz PCI-X	64-bit, 66-MHz

* Based on use of MSA30 Enclosure family (14 drives enclosure)

** RAID ADG is a standard feature of SA-6404, SA-6402 and SA-5304, and available as an option on the SA-5302 RAID ADG requires a minimum of 64-MB battery-backed cache.

Technical Specifications

Dimensions (H x W x D)	12.3 x 4.2 x .7 in (31.2 x 10.7 x 1.8 cm)	
Weight	Smart Array 6402/128	3.12 lb (1.42 kg)
	Smart Array 6404/256	4.22 lb (1.91 kg)
Electrical Interface	LVD (Low Voltage Differential)	
Protocol Support	Ultra320 SCSI (320 MB/s per channel)	
SCSI Ports	2 channel model: 2 external/2 internal shared	
	4 channel model: 4 external/2 internal shared	
Drives Supported	2 channel model: up to 28 drives	
	4 channel model: up to 56 drives	
Maximum Capacity	2 channel model: 8.40TB (28 drives x 300GB)	
	4 channel model: 16.80TB (56 drives x 300GB)	
PCI	PCI-X and 3.3 volt PCI compatibility only NOTE: The SA-6400 is not supported in 5 volt PCI slots.	
PCI Bus Speed	64-bit/133-MHz PCI-X (1 GB/s maximum bandwidth)	
Logical Drives	Up to 32 logical drives	
	Up to 2 TB per Logical Drive	
RAID Support	RAID ADG (Advanced Data Guarding)	
	RAID 5 (Distributed Data Guarding)	
	RAID 1+0 (Striping & Mirroring)	
	RAID 0 (Striping)	
Cache Memory	128-, 256-, 512-MB Read/Write	
	ECC protection, battery-backed, and removable	
Cache Batteries	Up to 4 days of redundant battery life, removable for easy replacement (3days with 256-MB Module, 1 day with 512-MB Module)	
Upgradeable Firmware	2-MB flashable ROM	
Disk Drive and Enclosure Protocol Support	Ultra320, Wide Ultra 3, Wide Ultra 2	
Memory Addressing	64-bit, supporting servers memory greater than 4 GB	

Environment-friendly Products and Approach	End-of-life Management and Recycling	Hewlett-Packard offers end-of-life HP product return, trade-in, and recycling programs in many geographic areas. For trade-in information, please go to http://www.hp.com/go/green. To recycle your product, please go to: http://www.hp.com/go/green or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner. The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: http://www.hp.com/go/green. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.

For hard drives, 1 GB = 1 billion bytes. Actual formatted capacity is less.