Overview

The HP Smart Array P411 is HP's external connect only, PCI Express (PCIe) 2.0 Serial Attached SCSI (SAS) RAID controller for Integrity rack optimized servers. The low profile, half height card can support up to 8 external SAS physical links via 2 ports (2 x4port mini-SAS). The P411 is ideal for RAID 0, 1, 1+0, and 5.

What's New

- Boot from Tape

Models

HP Smart Array P411 Controller	HP Smart Array P411/256MB Controller	AM311A
	HP Smart Array P411/256MB Controller Factory Integrated	AM311A#0D1

Standard Features

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.

Key Features

- The SA-P411 Controller supports up to 100 drives.
- The SA-P411 Controller supports the HP StorageWorks D2600 Disk Enclosure, HP StorageWorks D2700 Disk Enclosure, HP StorageWorks 70 Modular Smart Array*, HP StorageWorks 60 Modular Smart Array* and HP StorageWorks MDS600.
- Seamless upgrades to current or next generation HP high performance and high capacity Serial Attached SCSI Smart Array controllers
- 6Gb/s SAS technology delivers high performance and data bandwidth
- x8 PCI Express host interface technology delivers high performance and up to 4 GB/s maximum bandwidth.
- Support for greater than 2TB in a single logical drive
- 256 MB 40-bit wide DDR2-800 MHz cache module
- Low-profile PCI Express form factor - ships with a full size bracket for deployment in either a low-profile or full sized slot
- Tape support including boot from tape

NOTES:

- AM311A has no write cache available as this card has no battery. Battery backup write cache is not supported as there is no provision to fasten the cache battery to the server chassis. The battery would be used to store "write data" on the cache during power failures thus preventing corruption. AM311A is meant to be a lower cost (low performance) solution, intended to replace the older SC44Ge SAS HBA. BCS does not intend the AM311A to be used as a RAID adapter. If the customer needs good performance then we recommend using the P812 card i.e. AM312A. This card has provision to install the battery on the card itself.
- Supports RAID or HBA mode for HP-UX only (no mixed mode). This can be configured through offline saupdate utility.
- Multi-initiator support (future)
- OLRAD is not supported
- *HP StorageWorks 70 Modular Smart Array and HP StorageWorks 60 Modular Smart Array are not supported with HP Integrity Superdome 2.
- Vpars with the card is not supported with rx7640, rx8640 and Superdome (sx2000). Vpars is supported with Superdome 2.

Standard Features

- Card supports either JBODs or Tape at one time with Superdome 2. Concurrent function is not supported.

Online Management Features	• Unlimited global online spare assignment • User selectable expand and rebuild priority • User selectable RAID level and stripe size

Ports

- Eight (8) SAS physical links distributed across 2 external x4 miniSAS connectors.

Performance

HP's High Performance Architecture sets new boundaries of industry performance expectations!

- 6Gb/s SAS (600MB/s bandwidth per physical link)
- 8x 6Gb/s SAS physical links
- x8 5Gb/s PCI Express host interface provides 4 GB/s maximum bandwidth during burst transfers

Capacity

Given the increasing need for high performance and rapid capacity expansion, the SA-P411 offers:

- Up to 57.6TB of external storage per PCIe slot with (8) HP StorageWorks D2600 Disk Enclosures or (8) HP StorageWorks 60 MSA and 96 x 600GB 3.5" SAS hard drives.
- Up to 60TB of external storage per PCIe slot with (4) HP StorageWorks D2700 Disk Enclosures or (4) HP StorageWorks 70 MSA and 100 x 600GB 3.5" SAS hard drives.

NOTE: Support for greater than 2TB in a single logical drive.

Availability

Provides increased server uptime by providing advanced storage functionality:

- Global Online Spare
- Pre-Failure Warranty

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) was first developed by HP which 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 remaps 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 fan speed and cabinet temperature of StorageWorks Modular Smart Array Enclosures and HP StorageWorks Disk Enclosures.

Standard Features

Fault Tolerance	**RAID 50 (RAID 5+0)** protects against failure of one drive (and failure of particular multiple drives). RAID 50 is a nested RAID method that uses RAID 0 striping across RAID 5 arrays. RAID 50 tolerates one drive failure in each spanned array without loss of data. RAID 50 requires less rebuild time than single RAID 5 arrays RAID 50 requires a minimum of six drives. **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. **(Striping)** RAID 0 provides no extra data protection. Data is striped across all drives in the array to increase performance. RAID 0 requires a minimum of one drive.

Fault Recovery	Minimizes downtime, reconstructs data, and facilitates a quick recovery from drive failure - Recovery ROM: This new feature provides a unique redundancy feature that protects from a ROM image corruption. A new version of firmware can be flashed to the ROM while the controller maintains the last known 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: There is no limit to the number of spare drives that can be installed prior to drive failure. If a failure occurs, recovery begins with an On-Line Spare and data is reconstructed automatically. - DRAM ECC corrects against single bit data and address corruption.

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 format between generations of products - Data migration between servers and external HP StorageWorks Modular Smart Array enclosures and HP StorageWorks Disk Enclosures

Compatibility

Server Support	Integrity rx2660 Integrity rx2800 i2 Integrity rx3600 Integrity rx6600 Integrity rx7640 Integrity rx8640 Integrity Superdome Integrity Superdome 2

Operating Systems

HP-UX 11iv3

Microsoft Windows 2008 SP2 for Integrity

Microsoft Windows 2008 R2 for Integrity

OpenVMS v8.4 (HP Integrity rx2800 i2 only)

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 Systems Insight Manager. These software tools reduce 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 HP server storage.

Systems Insight Manager
- Powerful server and server options/storage manager tool
- Monitors over 1200 system wide parameters
- Configuration/Diagnostic Utilities

HP Array Configuration Utility (ACU)
- Powerful Web based configuration utility for all Smart Array controllers
- 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
- Easy to use Wizards for configuration

HP Option ROM Configuration for Arrays (ORCA)
- An alternative method for easily viewing, creating, and deleting multiple arrays and logical volumes during system power up.
- For advanced array configurations use ACU

NOTE: For advanced array configurations use ACU.

HP Array Diagnostic Utility (ADU)
- In depth diagnostic and reporting utility for all Smart Array controllers

Service and Support, HP Care Pack, and Warranty Information

Warranty	The warranty for this device is 3 years parts only. **Pre-Failure Warranty**: Drives attached to the Smart Array Controller and monitored under Insight Manager are supported by a Pre-Failure (replacement) Warranty. For complete details, consult the HP Support Center or refer to your HP Server Documentation.
Software Product Services	Standalone telephone support Rights to new license version Media and documentation updates
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 **NOTE:** For additional hardware installation and maintenance information, please refer to the URL: http://www.hp.com/hps/hardware/
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 can come in the form of Care Packs, which are sold at the HP System level this product attaches too.
HP Care Pack Information	HP Care Pack is defined as an upgrade to the product warranty attribute, available for a specific duration and hours of coverage. Care Packs for this option is sold at the system level this option attaches too. 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. **NOTE:** For additional HP Care Pack (hardware & software) information, as well as orderable part numbers, please refer to the URL: http://www.hp.com/hps/carepack/

Related Options

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

Hard Drives

NOTE: The components of a storage subsystem (e.g. the drive, the HBA/controller, firmware, and the server backplane) should operate at the same data transfer rate or the system bandwidth will be negotiated down to an acceptable level for all components.

NOTE: Hard drives have either a one year or three year warranty; refer to the specific hard drive QuickSpecs for details.

SAS Hot Plug SFF Enterprise (ENT) Drives

HP 900GB 6G SAS 10K SFF DP ENT HDD	619291-B21
HP 600GB 6G SAS 10K SFF DP ENT HDD	581286-B21
HP 450GB 6G SAS 10K SFF DP ENT HDD	581284-B21
HP 300GB 6G SAS 10K SFF DP ENT HDD	507127-B21
HP 300GB 3G SAS 10K SFF DP ENT HDD	492620-B21
HP 146GB 6G SAS 15K SFF DP ENT HDD	512547-B21
HP 146GB 3G SAS 15K SFF DP ENT HDD	504062-B21
HP 146GB 6G SAS 10K SFF DP ENT HDD	507125-B21
HP 146GB 3G SAS 10K SFF DP ENT HDD	418367-B21
HP 72GB 6G SAS 15K SFF DP ENT HDD	512545-B21
HP 72GB 3G SAS 15K SFF DP ENT HDD	418371-B21
HP 72GB 3G SAS 10K SFF DP ENT HDD	384842-B21
HP 36GB 3G SAS 15K SFF DP ENT HDD	418369-B21

SAS Non-Hot Plug SFF Enterprise (ENT) Drives

HP 600GB 6G SAS 10K SFF DP NHP ENT HDD	590698-B21
HP 300GB 6G SAS 10K SFF DP NHP ENT HDD	537809-B21
HP 146GB 6G SAS 10K SFF DP NHP ENT HDD	537807-B21
HP 72GB 6G SAS 15K SFF DP NHP ENT HDD	537805-B21

SAS Hot Plug 3.5" Enterprise (ENT) Drives

HP 600GB 6G SAS 15K 3.5" DP ENT HDD	516828-B21
HP 450GB 6G SAS 15K 3.5" DP ENT HDD	516816-B21
HP 450GB 3G SAS 15K 3.5" DP ENT HDD	454232-B21
HP 300GB 6G SAS 15K 3.5" DP ENT HDD	516814-B21
HP 300GB 3G SAS 15K 3.5" DP ENT HDD	416127-B21
HP 146GB 3G SAS 15K 3.5" DP ENT HDD	384854-B21
HP 72GB 3G SAS 15K 3.5" DP ENT HDD	384852-B21

SAS Non-Hot Plug 3.5" Enterprise (ENT) Drives

HP 600GB 6G SAS 15K NHP 3.5" DP ENT HDD	516830-B21
HP 450GB 6G SAS 15K NHP 3.5" DP ENT HDD	516826-B21
HP 450GB 3G SAS 15K NHP 3.5" DP ENT HDD	454234-B21
HP 300GB 6G SAS 15K NHP 3.5" DP ENT HDD	516824-B21
HP 300GB 3G SAS 15K NHP 3.5" DP ENT HDD	417950-B21
HP 146GB 3G SAS 15K NHP 3.5" DP ENT HDD	417855-B21

6G SAS Hot Plug Enterprise Performance Solid State Drives

HP 200GB 6G SAS SLC SFF Enterprise Performance Solid State Drive	632492-B21
HP 400GB 6G SAS SLC SFF Enterprise Performance Solid State Drive	632494-B21

6G SAS Hot Plug Enterprise Mainstream Solid State Drives

HP 200GB 6G SAS MLC SFF (2.5-inch) Enterprise Mainstream Solid State Drive	632502-B21

Related Options

	HP 400GB 6G SAS MLC SFF (2.5-inch) Enterprise Mainstream Solid State Drive	632504-B21
	HP 800GB 6G SAS MLC SFF (2.5-inch) Enterprise Mainstream Solid State Drive	632506-B21

NOTE: Please see the QuickSpecs for Technical Specifications and additional information:
http://h18000.www1.hp.com/products/quickspecs/13415_div/13415_div.html (Worldwide)

Disk Enclosures

Modular Storage Arrays

HP StorageWorks 60 Modular Smart Array	418408-B21

NOTE: Supports 12 SFF drives, and SAS 3 Gb/s

HP Storage Works 70 Modular Smart Array	418800-B21

NOTE: Supports 25 SFF drives, and SAS 3 Gb/s
NOTE: Please see the QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at:
http://h18000.www1.hp.com/products/quickspecs/12627_div/12627_div.html (MSA60)
http://h18000.www1.hp.com/products/quickspecs/12652_div/12652_div.html (MSA70)

HP StorageWorks D2600 Disk Enclosure	AJ940A

NOTE: Supports 12 LFF drives, and SAS 6 Gb/s.

HP StorageWorks D2700 Disk Enclosure	AJ941A

NOTE: Supports 25 SFF drives, and SAS 6 Gb/s.
NOTE: Please see the QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at:
http://h18000.www1.hp.com/products/quickspecs/13404_div/13404_div.html (D2000 Disk Enclosures)

HP MDS600 with two Dual Port I/O Module System	AJ866A

NOTE: Please see the QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at:
http://h18000.www1.hp.com/products/quickspecs/13257_div/13257_div.html (600 Modular Disk System)

Tape Solutions

SAS Tape Enclosures

HP StorageWorks 1U SAS Rack-Mount Kit	AE459A

NOTE: The 1U SAS Rack-Mount Kit can support up to (2) half-height tape drives.

HP StorageWorks 3U SAS Rack-mount Kit	AG576A

NOTE: The 3U Rack-mount Kit can support up to (2) full-height or (4) half-height tape drives.

SAS Tape Drives

HP Storage Works DAT 320 SAS External Tape Drive	AJ828A
HP StorageWorks DAT 160 SAS External Tape Drive	Q1588A
HP StorageWorks LTO-5 Ultrium 3280 SAS Full-Height External Tape Drive	EH900A
HP StorageWorks LTO-5 Ultrium 3000 SAS Half-Height External Tape Drive	EH958A
HP StorageWorks LTO-4 Ultrium 1840 SAS Full-Height External Tape Drive	EH861A
HP StorageWorks LTO-4 Ultrium 1760 SAS Half-Height External Tape Drive	EH920A
HP StorageWorks LTO-3 Ultrium 920 SAS External Tape Drive	EH848A
HP StorageWorks LTO-2 Ultrium 448 SAS External Tape Drive	DW086A

Related Options

Tape Autoloaders	
HP StorageWorks 1/8 G2 LTO-5 Ultrium 3000 SAS Autoloader	BL536A
HP StorageWorks 1/8 G2 LTO-4 Ultrium 1760 SAS Autoloader	AK377A
HP StorageWorks 1/8 G2 LTO-3 Ultrium 920 SAS Autoloader	AH558A
Tape Libraries	
HP StorageWorks MSL2024 1 LTO-5 Ultrium 3000 SAS Drive Library	BL537A
HP StorageWorks MSL2024 1 LTO-4 Ultrium 1760 SAS Drive Library	AK378A
HP StorageWorks MSL2024 1 LTO-3 Ultrium 920 SAS Drive Library	AH559A
HP StorageWorks MSL4048 2 LTO-5 Ultrium 3000 SAS Drive Library	BL538A
HP StorageWorks MSL4048 2 LTO-4 Ultrium 1760 SAS Drive Library	AK380A
HP StorageWorks MSL4048 1 LTO-3 Ultrium 920 SAS Drive Library	AH560A
HP StorageWorks MSL8096 2 LTO-5 Ultrium 3000 SAS Drive Library	BL539A
HP StorageWorks MSL8096 2 LTO-4 Ultrium 1760 SAS Drive Library	AK382A
HP StorageWorks MSL8096 2 LTO-3 Ultrium 920 SAS Drive Library	AH561A
SAS Cables for Tape Drives	
2 meter external Mini-SAS (SFF8088) to Mini-SAS (SFF8088) 1x SAS cable NOTE: Use this cable to connect HP StorageWorks SAS external tape devices to HP SAS controllers with external Mini-SAS (SFF8088) connectors.	AE470A
4 meter external Mini-SAS (SFF8088) to Mini-SAS (SFF8088) 1x SAS cable NOTE: Use this cable to connect HP StorageWorks SAS external tape devices to HP SAS controllers with external Mini-SAS (SFF8088) connectors.	AE465A
2 meter external mini-SAS (SFF8088), split to 4x mini-SAS (SFF8088) cable NOTE: One cable is required for every four drives. Use this cable to connect HP StorageWorks MSL SAS Tape Libraries to Mini-SAS (SFF8088) ports.	AN975A
4 meter external mini-SAS (SFF8088), split to 4x mini-SAS (SFF8088) cable NOTE: One cable is required for every four drives. Use this cable to connect HP StorageWorks MSL SAS Tape Libraries to Mini-SAS (SFF8088) ports.	AN976A

SAS to Mini SAS Cables		
	Mini-SAS to Mini-SAS, 8.00"	496012-B21
	Mini-SAS to Mini-SAS, 12.75" & 18.00"	496029-B21
	Mini-SAS to Mini-SAS, 25.50" & 28.00"	496013-B21
	Mini-SAS to Mini-SAS, 33.00"	496014-B21
	Mini-SAS to SFF8484, 18.00"	496015-B21
	Mini-SAS to SFF8484, 24.00"	496015-B21
	Mini-SAS to SFF8484, 32.00"	496016-B21
	Mini-SAS to SFF8484, 35.00"	496016-B21

Technical Specifications

Dimensions (excluding bracket)	Low Profile PCIe Form Factor 19.05 cm x 24.13 cm x 5.72 cm (7.5 in x 9.5 in x 2.25 in)
Disk Drive and Enclosure Protocol Support - Transfer rate	6Gb/s SAS (Serial Attached SCSI)
SAS Connectors	2 external (Mini SAS) x8 wide port connectors
Data Transfer Method	x8 5G PCIe 2.0 Express (4 GB/s maximum bandwidth)
Memory Bus Speed	DDR2-800 MHz with 40 bit or 72-bit wide bus provides up to 4.2 GB/s maximum bandwidth
PCI	PCIe Express Gen 2.0
Simultaneous Drive Transfer Ports	2 x4 Wide SAS Ports
SAS Port Link Rate	24 Gb/s per x4 wide port connector (4 x 6 Gb/s)
Software upgradeable Firmware	Yes
Cache Memory	40-bit 256 MB Read/Write ECC protected cache
Logical Drives Supported	Up to 64 logical drives
Maximum Capacity	100TB (100 x 1TB) NOTE: Support for greater than 2TB in a single logical drive.
Memory Addressing	64-bit, supporting servers memory space greater than 4 GB
RAID Support	RAID 0 (Striping) RAID 1 (Drive Mirroring) RAID 1+0 (Striping and Mirroring) RAID 5 (Distributed Data Guarding)
Upgradeable Firmware	Upgradeable Firmware with Recovery ROM feature

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.