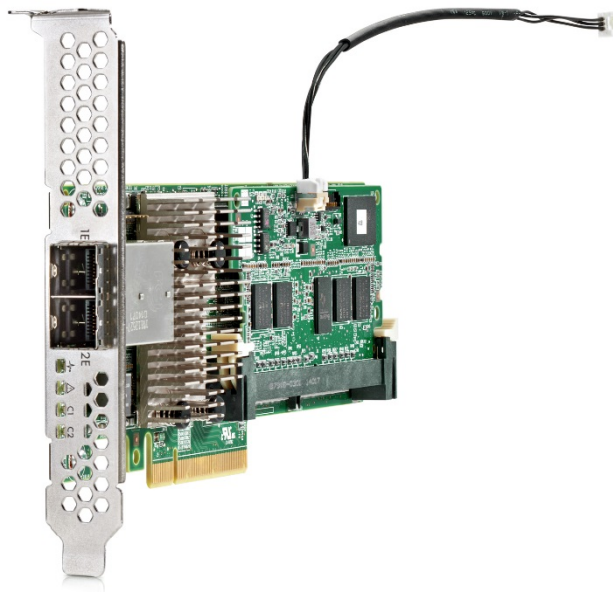


### Overview

#### HPE Smart Array P441 Controller

The HPE Smart Array P441 Controller is a low-profile, PCIe3 x8, 12Gb/s Serial Attached SCSI (SAS) RAID controller that provides enterprise-class storage performance, increased external scalability, and data protection for select HPE ProLiant Gen9 rack and tower servers, and Apollo systems. It features eight external physical links and delivers increased server uptime by providing advanced storage functionality, including online RAID level migration (between any RAID levels) with flash back write cache (FBWC), global online spare, and pre-failure warning. This controller includes transportable FBWC allowing the data in the cache to be migrated to a new controller.

The Gen9 family of controllers supports the HPE Smart Storage Battery. With HPE Smart Storage Battery, multiple Smart Array controllers are supported without needing additional backup power sources for each controller, resulting in simple upgrade process.



HPE Smart Array P441 Controller

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#### What's New

- Supports HPE D6020 Disk Enclosures

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#### Models

HPE Smart Array P441/4GB FBWC 12Gb 2-ports Ext SAS Controller

726825-B21

**NOTE:** HPE Smart Array P441/4GB FBWC controller option kit does not include the HPE Smart Storage Battery the backup power source necessary to protect the data on the Flash-backed Write Cache. HPE Smart Storage Battery is an item that has to be purchased separately if this is the first P-series Smart Array controller on your Gen9 server.

## Standard Features

### Key Features

- Storage interface (SAS/SATA)
  - 8 physical links across 2 x4 external ports
  - 12Gb/s SAS, 6Gb/s SATA technology
  - Mix-and-match SAS and SATA drives to the same controller
  - Support for SAS tape drives, SAS tape autoloaders and SAS tape libraries
- 4 GiBytes Flash-Backed Write Cache (FBWC)
- PCI Express Gen3 x8 link
- RAID 0, 1, 10, 5, 50, 6, 60, 10 ADM (Advanced Data Mirroring)
- RAID or HBA mode
- Legacy and UEFI boot operation
- Up to 200 physical drives
- Up to 64 logical drives
- Up to 8 daisy chained HPE D3600 Disk Enclosure and HPE D3700 Disk Enclosure in dual domain configuration
- HPE SmartCache (optional license)
- HPE Secure Encryption (optional license)
- HPE SSD Smart Path
- Rapid Parity Initialization (RPI)
- Rapid rebuild
- Drive Erase
- Performance Optimization-Degraded Reads and Read Coalescing
- Power Efficiency
- Seamless upgrades to and from other HPE Smart Array controllers
- Recovery ROM to protect against controller ROM corruption
- Low-profile standard PCI Express plug-in card
  - Dimension (excluding bracket): 7.5 in x 9.5 in x 2.25 in (19.05 cm x 24.13 cm x 5.72 cm)

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### Ports

- External: 8 SAS/SATA physical links across 2 x4 port

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### Performance

- 12Gb/s SAS (1200 MB/s theoretical bandwidth per physical lane)
- 6Gb/s SATA (600 MB/s theoretical bandwidth per physical lane)
- PCI Express Gen3 x8 link width
- 4 GiBytes 72-bit wide DDR3-1866 Flash Back Write Cache provides up to 14.9GB/s maximum cache bandwidth
- Read ahead caching
- Write-back caching

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### Online Management Features

- Online array expansion
- Online capacity expansion
- Online logical drive extension
- Online RAID level migration
- Online stripe size migration
- Online mirror split, recombine, and rollback
- Online active drive replacement
- Online drive firmware upgrade
- Online and high performance offline Rapid Parity Initialization (RPI)
- Unlimited global online spares assignment
- User selectable expand and rebuild priority
- User selectable RAID level and stripe size
- User selectable read and write cache sizes
- Supports Predictive Spare Activation

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## Standard Features

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### 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 HPE 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.

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### Fault Recovery

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

- Recovery ROM: This feature protects the user from a firmware image corruption by storing a redundant copy of the firmware image. If the active firmware image becomes corrupt, the controller will use the redundant firmware image and continue operating.
- 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 detects and corrects data bit errors

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### HPE SmartCache

The HPE SmartCache feature is a controller-based read and write caching solution in a DAS environment that caches the most frequently accessed data ("hot" data) onto lower latency SSDs to dynamically accelerate application workloads. The HPE SmartCache architecture is flexible and supports any HPE ProLiant Gen9 supported HDD for bulk storage and any HPE ProLiant Gen9 supported SSD as an accelerator. HPE SmartCache is deployed and managed using the HPE Smart Storage Administrator (HPE SSA). HPE SmartCache is an optional license (see Related Options for more information on the license).

For more information please visit: <http://www.hpe.com/servers/smartcache>.

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### HPE Secure Encryption

HPE Secure Encryption is a Smart Array controller-based data encryption solution for ProLiant Gen9 servers that protects sensitive, mission critical data. This is an enterprise-class encryption solution for data at rest on any bulk storage attached to the HPE Smart Array controllers including data on the cache memory of the controller. HPE Secure Encryption is an optional license per server requiring encryption enablement (see Related Options for more information on the license).

The solution is available for both local and remote key management mode deployments. Local Key Management Mode is focused on single server deployment where there is one Master key per controller that is managed by the user. Remote Key Management Mode is for enterprise wide deployments from just a few servers to thousands of servers.

#### FIPS 140-2 Cryptographic Module Validation

FIPS provides a security assurance level validation for cryptographic modules. HPE Smart Array P441 controller has completed FIPS 140-2 Level 1 validation (certificate #2506). The validation for this controller has recently moved to the Historical List. HPE is actively engaged in activities to return this controllers to the Validated Modules List. The National Institute of Standards and Technology (NIST) issued the FIPS 140-2 requirements and standards for cryptography modules that include both hardware and software components.

For more information on please visit: <http://www.hpe.com/servers/secureencryption>

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## Standard Features

### HPE SSD Smart Path

The HPE SSD Smart Path feature included in the Smart Array software stack improves Solid State Disk (SSD) read performance. With up to 4x better SSD read performance, HPE SSD Smart Path chooses the optimum path to the SSD and accelerates reads for all RAID levels and RAID 0 writes. HPE SSD Smart Path requires updated firmware, drivers, and configuration utility available at: <http://www.hpe.com/servers/ssa>. HPE SSD Smart Path is ideal for read intensive workloads and is included as a base feature on HPE Smart Array P-series controllers.

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### 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 HPE Support Center or refer to your HPE Server Documentation.

#### 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 HPE System level to which this product attaches.

## Compatibility

### Server Support

HPE ProLiant DL20 Gen9	HPE ProLiant ML30 Gen9
HPE ProLiant DL80 Gen9	HPE ProLiant ML110 Gen9
HPE ProLiant DL120 Gen9	HPE ProLiant ML150 Gen9
HPE ProLiant DL180 Gen9	HPE ProLiant ML350 Gen9
HPE ProLiant DL360 Gen9	
HPE ProLiant DL380 Gen9	Apollo 4200
HPE ProLiant DL560 Gen9	Apollo 4500
	Apollo 6000

### Disk Enclosure Support

HPE D2600 Disk Enclosure	HPE D6000 Disk Enclosure
HPE D2700 Disk Enclosure	HPE D6020 Disk Enclosure
HPE D3600 Disk Enclosure	
HPE D3700 Disk Enclosure	HPE MSA 2040 SAN Storage

### Operating Systems

Microsoft Windows Server  
 Microsoft Windows Hyper-V Server  
 VMware vSphere ESXi  
 Red Hat Enterprise Linux (RHEL)  
 SUSE Linux Enterprise Server (SLES)  
 Oracle Solaris  
 Oracle Linux  
 Canonical Ubuntu  
 CentOS  
 Wind River  
 Citrix XenServer

**NOTE:** For more information on HPE's Certified and Supported ProLiant Servers for OS and Virtualization Software, please visit our Support Matrix at: <http://www.hpe.com/info/ossupport>

### Storage Management Software Suite

#### **HPE Smart Storage Administrator (HPE SSA)**

Comprehensive management for HPE Smart Storage products with advanced scripting and diagnostic features and simplified and intuitive interface and functionality. For more information please visit: <http://www.hpe.com/servers/ssa>

#### **HPE Systems Insight Manager**

Powerful server and server options/storage manager tool with configuration/diagnostic utilities

#### **HPE Storage Management Utility**

Offers the simplest method for configuring the storage system via Initial System Configuration Wizard

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## Service and Support

### HPE Support Services

#### **Protect your business beyond warranty with HPE Support Services**

HPE Pointnext provides a comprehensive portfolio including Advisory and Transformational, Professional, and Operational Services to help accelerate your digital transformation. From the onset of your transformation journey, Advisory and Transformational Services focus on designing the transformation and creating a solution roadmap. Professional Services specializes in creative configurations with flawless and on-time implementation, and on-budget execution. Finally, operational services provides innovative new approaches like Flexible Capacity and Datacenter Care, to keep your business at peak performance. HPE is ready to bring together all the pieces of the puzzle for you, with an eye on the future, and make the complex simple.

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### Recommended Support

#### **HPE Proactive Care\* with 24x7 coverage, three year Support Service**

HPE Proactive Care gives customers an enhanced call experience. When your products are connected to HPE, Proactive Care helps prevent problems and maintains IT stability by utilizing personalized proactive reports with recommendations and advice. This Service combines three years proactive reporting and advice with our 24x7 coverage, four hour hardware response time when there is a problem. This service also includes collaborative software support for Independent Software Vendors (ISVs), (Red Hat, VMWare, Microsoft, etc.) running on your HPE servers.

<https://www.hpe.com/h20195/v2/GetPDF.aspx/4AA3-8855ENW.pdf>

#### **HPE Proactive Care\* with 6 hour call-to-repair commitment, three year Support Service**

HPE Proactive Care gives customers an enhanced call experience. When your products are connected to HPE, Proactive Care helps prevent problems and maintains IT stability by utilizing personalized proactive reports with recommendations and advice. This Service combines three years' proactive reporting and advice with our highest level of hardware support - HPE's 24x7, six hour hardware call-to-repair. HPE is the only leading manufacturer who makes this level of coverage available as a standard service offering for your most valuable servers. This service also includes collaborative software support for Independent Software Vendors (ISVs), (Red Hat, VMWare, Microsoft, etc.) running on your HPE servers.

<https://www.hpe.com/h20195/v2/GetPDF.aspx/4AA3-8855ENW.pdf>

\*HPE Proactive Care and HPE Proactive Care Advanced require that the customer connect their devices to make the most of these services and receive all the deliverables.

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### HPE Education Services

Keep your IT staff trained making sure they have the right skills to deliver on your business outcomes. Book on a class today and learn how to get the most from your technology investment.

<http://www.hpe.com/ww/learn>

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### HPE Support Center

The HPE Support Center is a personalized online support portal with access to information, tools and experts to support HPE business products. Submit support cases online, chat with HPE experts, access support resources or collaborate with peers.

Learn more <http://www.hpe.com/support/hpesc>

HPE's Support Center Mobile App\* allows you to resolve issues yourself or quickly connect to an agent for live support. Now, you can get access to personalized IT support anywhere, anytime. HPE Insight Remote Support and HPE Support Center are available at no additional cost with a HPE warranty, HPE Support Service or HPE contractual support agreement.

\*HPE Support Center Mobile App is subject to local availability

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## Service and Support

### Parts and materials

HPE will provide HPE-supported replacement parts and materials necessary to maintain the covered hardware product in operating condition, including parts and materials for available and recommended engineering improvements.

Parts and components that have reached their maximum supported lifetime and/or the maximum usage limitations as set forth in the manufacturer's operating manual, product quick-specs, or the technical product data sheet will not be provided, repaired, or replaced as part of these services.

The defective media retention service feature option applies only to Disk or eligible SSD/Flash Drives replaced by HPE due to malfunction.

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### Related Services

#### **HPE Server Hardware Installation**

Provides for the basic hardware installation of HPE branded servers, storage devices and networking options to assist you in bringing your new hardware into operation in a timely and professional manner.

<https://www.hpe.com/h20195/V2/GetPDF.aspx/5981-9356EN.pdf>

**HPE Installation and Startup Service** provides for the installation and startup of HPE technology including BladeSystems, C-Class enclosure, HPE ProLiant c-Class and Integrity server blades, storage blades, SAN switch blades, HPE Virtual Connect modules (Ethernet and Fibre Channel), Ethernet network interconnects, and InfiniBand, as well as the installation of one supported operating system type (Windows® or Linux).

**NOTE:** This controller is covered under the HPE Service Contract applied to the HPE ProLiant Server. No separate HPE support services need to be purchased.

- Warranty and Support Services will extend to include HPE options configured with your server or storage device. The price of support service is not impacted by configuration details. HPE sourced options that are compatible with your product will be covered under your server support at the same level of coverage allowing you to upgrade freely. Installation for HPE options is available as needed. To keep support costs low for everyone, some high value options will require additional support. Additional support is only required on select high value workload accelerators, fibre switches, InfiniBand and UPS batteries over 12KVA. See the specific high value options that require additional support [HERE](#).

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### Additional Info

<http://www.hpe.com/services>

## Related Options

<b>HPE SmartCache</b>	HPE Smart Array SR SmartCache (Single Key/Single Server) LTU	D7S26A
	<p><b>Single-Server License</b> Used to purchase a license for one server. Contains one license per server, a printed license entitlement certificate, end user license agreement, and license key installation card <b>delivered via physical shipment</b>. The license entitlement certificate must be redeemed online or via fax in order to obtain the license activation key(s). Include one year of 24x7 HPE Software Technical Support Services.</p>	
	HPE Smart Array SR SmartCache (Single Key/Multiple Servers) LTU	D7S27A
	<p><b>Flexible-Quantity License</b> Used to purchase multiple licenses with a single activation key. Contains license(s) for a customer defined quantity of servers, a license entitlement certificate for the quantity of licenses purchased, end user license agreement, and license key installation card <b>delivered via physical shipment</b>. The license entitlement certificate must be redeemed online or via fax in order to obtain the license activation key(s). Include one year of 24x7 HPE Software Technical Support Services.</p>	
	HPE Smart Array SR SmartCache (Single Key/Multiple Servers) E-LTU	D7S27AAE
	<p><b>Flexible-Quantity Electronic License</b> Used to purchase multiple licenses with a single activation key. Contains license(s) for a customer defined quantity of servers, a license entitlement certificate for the quantity of licenses purchased, end user license agreement, and license key installation information <b>delivered via e-mail</b>. The license entitlement certificate must be redeemed online or via fax in order to obtain the license activation key(s). Include one year of 24x7 HPE Software Technical Support Services. For more information please visit: <a href="http://www.hpe.com/servers/smrtcache">http://www.hpe.com/servers/smrtcache</a></p>	
<b>HPE Smart Array SR Secure Encryption</b>	HPE Smart Array SR Secure Encryption (Data at Rest Encryption/per Server Entitlement) E-LTU	Q2F26AAE
	<p><b>NOTE:</b> HPE Smart Array SR Secure Encryption licensing is based on the number of servers requiring encryption for direct attached storage. <b>NOTE:</b> For more information visit: <a href="http://www.hpe.com/servers/secureencryption">http://www.hpe.com/servers/secureencryption</a></p>	
<b>HPE Smart Storage Battery</b>	HPE 96W Smart Storage Battery (up to 20 Devices) with 145mm Cable Kit	P01366-B21
	<p><b>NOTE:</b> HPE 96W Smart Storage Battery provides backup power for up to 16 HPE Smart Array controllers or other devices.</p>	
<b>HPE External Cable Options</b>	<b>Cable options to be used with HP D3600 and D3700 Disk Enclosures</b>	
	HPE External 0.5m (1ft) Mini-SAS HD 4x to Mini-SAS HD 4x Cable	691968-B21
	HPE External 1.0m (3ft) Mini-SAS HD 4x to Mini-SAS HD 4x Cable	716195-B21
	HPE External 2.0m (6ft) Mini-SAS HD 4x to Mini-SAS HD 4x Cable	716197-B21
	HPE External 4.0m (13ft) Mini-SAS HD 4x to Mini-SAS HD 4x Cable	716199-B21
	<b>Cable options to be used with D6000 and D6020 Disk Enclosures</b>	
	HPE 0.5m External Mini SAS High Density to Mini SAS Cable	691971-B21
	HPE 1.0m External Mini SAS High Density to Mini SAS Cable	716189-B21
	HPE 2.0m External Mini SAS High Density to Mini SAS Cable	716191-B21
	HPE 4.0m External Mini SAS High Density to Mini SAS Cable	716193-B21



## Related Options

### **Environment friendly Products and Approach - End-of life Management and Recycling**

Hewlett Packard Enterprise offers end-of-life **product return, trade-in, and recycling programs**, in many geographic areas, for our products. Products returned to Hewlett Packard Enterprise will be recycled, recovered or disposed of in a responsible manner.

The EU WEEE Directive (2012/19/EU) 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 Enterprise web site**. These instructions may be used by recyclers and other WEEE treatment facilities as well as Hewlett Packard Enterprise OEM customers who integrate and re-sell Hewlett Packard Enterprise equipment.

## Summary of Changes

Date	Version History	Action	Description of Change
15-Oct-2018	Version 8	Changed	Service and Support Section was updated
4-Jun-2018	Version 7	Changed	Updated FIPS
5-Feb-2018	Version 6	Changed	Replaced Secure Encryption SKU C9A82AAE with Q2F26AAE. Updated Service and Support. Replaced HPE Smart Storage Battery SKU.
23-Oct-2017	Version 5	Added	Care Pack naming and Service and Support- Parts and Materials updated.
19-Aug-2016	Version 4	Changed	Overview, Standard Features, Compatibility, and Related Options were revised.
11-Dec-2014	Version 3	Added	Added note to endorse the HPE Smart Array P441/4GB FBWC controller option kit does not include the HPE Smart Storage Battery.  HPE Smart Storage Battery was added to Related Options.
29-Oct-2014	Version 2	Removed	MSA2040 has been removed from SA P441 controller's QuickSpecs.
09-Sep-2014	Version 1	New	Initial version.



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