



**SPC BENCHMARK 2™
EXECUTIVE SUMMARY**

**HEWLETT-PACKARD COMPANY
HP P9500 XP DISK ARRAY**

SPC-2™ V1.3

**Submitted for Review: March 7, 2012
Submission Identifier: B00056**

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Revision Information and Key Dates

Revision Information and Key Dates	
SPC-2 Specification revision number	V1.3
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	March 7, 2012
Date FDR was submitted to the SPC	March 7, 2012
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	March 6, 2012

Tested Storage Product (TSP) Description

The HP P9500 XP Disk Array is bulletproof storage for mission-critical Converged Infrastructure where constant access to data is required—even in the event of a disaster. Designed for organizations that cannot afford any downtime, the P9500 combines a high-performance online scalable fully redundant hardware platform with unique data replication capabilities integrated with clustering solutions for complete business continuity.

The P9500 is the latest enterprise disk array product to come from HP's long-term, joint engineering and original equipment manufacturer relationship with Hitachi Limited of Japan.

SPC-2 Reported Data

SPC-2 Reported Data consists of three groups of information:

- The following SPC-2 Primary Metrics, which characterize the overall benchmark result:
 - SPC-2 MBPS™
 - SPC-2 Price Performance
 - Application Storage Unit (ASU) Capacity
- Supplemental data to the SPC-2 Primary Metrics.
 - Total Price
 - Data Protection Level
- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

SPC-2 Reported Data				
HP StorageWorks P9500 XP Disk Array				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
13,147.87	\$88.34	129,111.985	\$1,161,503.90	Protected (RAID-5)
<i>The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video On Demand (VOD)</i>				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	10,664.91			\$108.91
Write Only:				
1024 KiB Transfer	7,322.38	400	18.31	
256 KiB Transfer	7,317.11	400	18.29	
Read-Write:				
1024 KiB Transfer	9,977.15	400	24.94	
256 KiB Transfer	9,945.56	400	24.86	
Read Only:				
1024 KiB Transfer	14,489.20	400	36.22	
256 KiB Transfer	14,938.05	400	37.35	
<i>The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP Test Phases: (Write Only, Read-Write, and Read Only).</i>				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	14,622.89			\$79.43
1024 KiB Transfer Size				
4 I/Os Outstanding	14,485.63	400	36.21	
1 I/O Outstanding	14,352.60	400	35.88	
64 KiB Transfer Size				
4 I/Os Outstanding	14,656.82	400	36.64	
1 I/O Outstanding	14,996.52	400	37.49	
<i>The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ Test Phases: (1024 KiB and 64 KiB Transfer Sizes).</i>				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	14,155.80	18,000	0.79	\$82.05

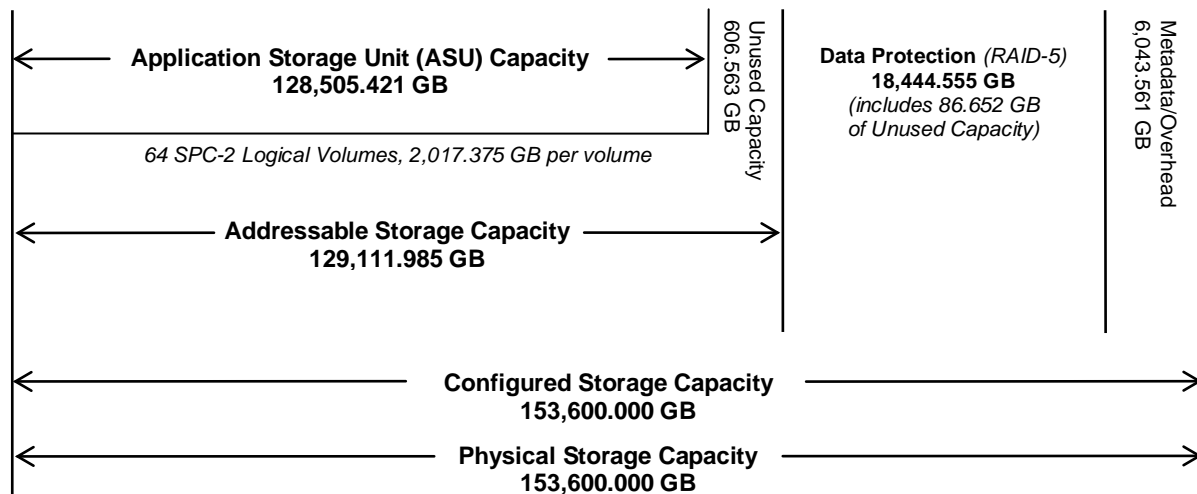
SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

ASU (Application Storage Unit) Capacity represents the total storage capacity read and written in the course of executing the SPC-2 benchmark.

A **Data Protection Level of Protected** using **RAID-5** provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

Storage Capacities and Relationships

The following diagram (*not to scale*) and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.



SPC-1 Storage Capacity Utilization	
Application Utilization	83.66%
Protected Application Utilization	95.61%
Unused Storage Ratio	0.45%

Application Utilization: Total ASU Capacity (*128,505.421 GB*) divided by Physical Storage Capacity (*153,600.00 GB*)

Protected Application Utilization: Total ASU Capacity (*128,505.421 GB*) plus total Data Protection Capacity (*18,444.555 GB*) minus unused Data Protection Capacity (*86.652 GB*) divided by Physical Storage Capacity (*128,505.421 GB*).

Unused Storage Ratio: Total Unused Capacity (*693.215 GB*) divided by Physical Storage Capacity (*128,505.421 GB*) and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 24-25 in the Full Disclosure Report.

Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

There were no differences between the TSC and Priced Storage Configuration.

Priced Storage Configuration Pricing

Qty	Part No.	Description	List Price	Ext. Price	Discount	Price
1	AV399A	HP P9500 Disk Array	\$1.00	\$1.00	50.00%	\$0.50
	1 AV400A	HP P9500 Disk Array DKC Module-0 Rack*	\$117,894.00	\$117,894.00	50.00%	\$58,947.00
2	AV404A	HP P9500 3-phase 24A 60Hz w/Cords PDU	\$1,850.00	\$3,700.00	50.00%	\$1,850.00
1	AV415A	HP P9500 60Hz DKC Jumper Cable Kit	\$495.00	\$495.00	50.00%	\$247.50
2	AV416A	HP P9500 60Hz DKU Jumper Cable Kit	\$495.00	\$990.00	50.00%	\$495.00
4	AV423A	HP P9500 16-port 2-8Gbps FC CHA	\$19,083.00	\$76,332.00	50.00%	\$38,166.00
1	AV440A	HP P9500 Processor Blade	\$30,333.00	\$30,333.00	50.00%	\$15,166.50
1	AV443A	HP P9500 2nd SVP High Reliability Kit	\$8,731.00	\$8,731.00	50.00%	\$4,365.50
3	AV444A	HP P9500 Cache Memory Adapter	\$62,187.00	\$186,561.00	50.00%	\$93,280.50
16	AV447A	HP P9500 16GB Cache Memory Module	\$2,445.00	\$39,120.00	50.00%	\$19,560.00
4	AV451A	HP P9500 64GB Cache Backup Memory Module	\$25,843.00	\$103,372.00	50.00%	\$51,686.00
2	AV455A	HP P9500 SAS DKA Drive Adapter	\$12,323.00	\$24,646.00	50.00%	\$12,323.00
1	AV458A	HP P9500 Express Switch Adapter	\$23,448.00	\$23,448.00	50.00%	\$11,724.00
1	AV413A	HP P9500 Drive Chassis SAS Switch Kit	\$9,120.00	\$9,120.00	50.00%	\$4,560.00
1	AV414A	HP P9500 Drive Chassis Drive Power Kit	\$2,116.00	\$2,116.00	50.00%	\$1,058.00
3	AV459A	HP P9500 Additional DKC-DKU Power Supply	\$6,536.00	\$19,608.00	50.00%	\$9,804.00
1	AV462A	HP P9500 Perf 1st Drive Chassis Cable	\$3,550.00	\$3,550.00	50.00%	\$1,775.00
1	AV463A	HP P9500 Standard Drive Chassis Cable	\$7,000.00	\$7,000.00	50.00%	\$3,500.00
1	AV464A	HP P9500 Performance Drive Chassis Cable	\$5,600.00	\$5,600.00	50.00%	\$2,800.00
256	AV474A	HP P9500 300GB SAS 10K 2.5in DP HDD	\$948.00	\$242,688.00	50.00%	\$121,344.00
	1 AV401A	HP P9500 Disk Array DKC Module-1 Rack*	\$146,256.00	\$146,256.00	50.00%	\$73,128.00
2	AV404A	HP P9500 3-phase 24A 60Hz w/Cords PDU	\$1,850.00	\$3,700.00	50.00%	\$1,850.00
1	AV415A	HP P9500 60Hz DKC Jumper Cable Kit	\$495.00	\$495.00	50.00%	\$247.50
2	AV416A	HP P9500 60Hz DKU Jumper Cable Kit	\$495.00	\$990.00	50.00%	\$495.00
4	AV424A	HP P9500 16-port 2-8Gbps FC CHA	\$19,083.00	\$76,332.00	50.00%	\$38,166.00
1	AV440A	HP P9500 Processor Blade	\$30,333.00	\$30,333.00	50.00%	\$15,166.50
1	AV442A	HP P9500 DKC Hub Kit	\$13,196.00	\$13,196.00	50.00%	\$6,598.00
3	AV444A	HP P9500 Cache Memory Adapter	\$62,187.00	\$186,561.00	50.00%	\$93,280.50
16	AV447A	HP P9500 16GB Cache Memory Module	\$2,445.00	\$39,120.00	50.00%	\$19,560.00
4	AV451A	HP P9500 64GB Cache Backup Memory Module	\$25,843.00	\$103,372.00	50.00%	\$51,686.00
2	AV455A	HP P9500 SAS DKA Drive Adapter	\$12,323.00	\$24,646.00	50.00%	\$12,323.00
1	AV458A	HP P9500 Express Switch Adapter	\$23,448.00	\$23,448.00	50.00%	\$11,724.00
1	AV413A	HP P9500 Drive Chassis SAS Switch Kit	\$9,120.00	\$9,120.00	50.00%	\$4,560.00
1	AV414A	HP P9500 Drive Chassis Drive Power Kit	\$2,116.00	\$2,116.00	50.00%	\$1,058.00
3	AV459A	HP P9500 Additional DKC-DKU Power Supply	\$6,536.00	\$19,608.00	50.00%	\$9,804.00
1	AV460A	HP P9500 Inter-controller Cable	\$7,600.00	\$7,600.00	50.00%	\$3,800.00
1	AV462A	HP P9500 Perf 1st Drive Chassis Cable	\$3,550.00	\$3,550.00	50.00%	\$1,775.00
1	AV463A	HP P9500 Standard Drive Chassis Cable	\$7,000.00	\$7,000.00	50.00%	\$3,500.00
1	AV464A	HP P9500 Performance Drive Chassis Cable	\$5,600.00	\$5,600.00	50.00%	\$2,800.00
256	AV474A	HP P9500 300GB SAS 10K 2.5in DP HDD	\$948.00	\$242,688.00	50.00%	\$121,344.00
1	AE242A	HP P9500/XP No Remote Device Access Supp	\$1.00	\$1.00	50.00%	\$0.50
2	TB502A	HP P9000 Inter-Controller Cable LTU	\$63,011.00	\$126,022.00	50.00%	\$63,011.00
1	TB514AA	HP P9000 Array Manager SW Base LTU	\$309.00	\$309.00	50.00%	\$154.50
1	HA114A1	HP Installation and Startup Service			50.00%	\$0.00
1	Opt. 55U	HP Startup P9000 Array DKC Mod-0 SVC	\$19,250.00	\$19,250.00	50.00%	\$9,625.00
1	Opt. 55V	HP Startup P9000 Array DKC/DKU Exp SVC	\$1,550.00	\$1,550.00	50.00%	\$775.00
8	Opt. 55W	HP Startup P9000 Array Expansion SVC	\$775.00	\$6,200.00	50.00%	\$3,100.00
1	Opt. 5PK	HP Startup P9000 Software Type 1 SVC 0.00 1	\$1,325.00	\$1,325.00	50.00%	\$662.50
116	TB514AE	HP P9000 Array Mgr SW 1TB 101-250TB LTU	\$1,498.00	\$173,768.00	50.00%	\$86,884.00
1	HA110A3	HP 3y Support Plus 24 SVC	\$0.00	\$0.00	50.00%	\$0.00
116	Opt. 2LG	P9000 Array Mgr 1TB 101-250TB LTU SWSupp	\$397.00	\$46,052.00	50.00%	\$23,026.00
		Totals		\$2,225,513.00	50.00%	\$1,112,756.50
		Additional Hardware				
32	221692-B23	Storage Works LC/LC 15m Cable	\$135.00	\$4,320.00	35.00%	\$2,808.00
32	456972-B21	HP BLc Emulex LPe1205 8Gb FC HBA Opt	\$849.00	\$27,168.00	35.00%	\$17,659.20
4	AJ821A	Brocade HPB series 8/24c Blade SAN Switch	\$9,285.00	\$37,140.00	35.00%	\$24,141.00
32	AJ716A	HP 8Gb Shortwave B-series FC SFP	\$199.00	\$6,368.00	35.00%	\$4,139.20
		Grand Totals		\$2,300,509.00		\$1,161,503.90

The following pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.

HP P9500 Disk Array DKC Module Enumerated Part List (*)

The HP P9500 Disk Array DKC Module, DKC-0 (*part number AV400A*), consists of a DKC-0 Rack Assembly with:

- 19" 42U custom rack
- Controller Chassis
- Processor Blade
- Express Switch Adapter
- Cache Memory Adapter
- Service Process (SPV-0)
- One Drive Chassis equipped to support up to 128 drives
- One Drive Chassis without DKUPS, SSWs and HDDPWR
- Std Performance Device I/F cabling to first Disk Chassis

The HP P9500 Disk Array DKC Module, DKC-1 (*part number AV401A*), consists of a DKC-1 Rack Assembly with:

- 19" 42U custom rack
- Controller Chassis
- Processor Blade
- Express Switch Adapter
- Cache Memory Adapter
- Hub kit
- One Drive Chassis equipped to support up to 128 drives
- One Drive Chassis without DKUPS, SSWs and HDDPWR
- Std Performance Device I/F cabling to first Disk Chassis
- Std Performance inter-controller cable to connect to the DKC Module-0 rack

DKC-0 and DKC-1 are independently configurable with HW. SW is configured at the system level (*DKC-0 and DKC-1 combined*).

Priced Storage Configuration Diagram

HP P9500 Disk Array

4 – drive chassis (2 base chassis plus 2 chassis)

128 – 300 GB 10K RPM disk drives per chassis

(512 disk drives total)



front view

2 – HP P9500 Disk Array DKC Modules (DKC-0 and DKC-1)

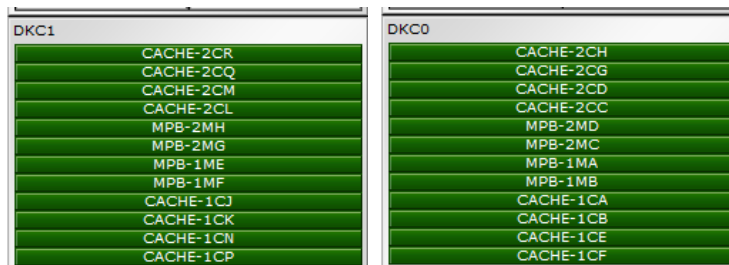
32 – HP BLc Emulex dual-port 8 Gb FC HBAs (64 ports total, 32 used)

4 – Brocade HPB series 8/24c Blade SAN Switches

8 – HP P9500 Channel Host Adapters (CHA) pairs (16 adapters total)

(16 – 8 Gbps ports per adapter, 256 ports total, 32 ports used)

4 – HP P9500 SAS Drive Adapters (DKA) pairs (8 adapters total)



rear view

4 – HP P9500 Processor Blade (MPB) pairs (8 blades total)

(1 – quad-core processor per blade, 32 cores total)

8 – HP P9500 Cache Memory Adapter pairs (16 adapters total)

(2 cache modules per adapter, 32 modules total, 16 GB per module, 512 GB total)

Priced Configuration Components

Priced Storage Configuration:
32 – dual port 8 Gb FC HBAs (<i>64 ports total, 32 ports used</i>)
32 – 8 Gb Shortwave FC SFPs
4 – Brocade 24 Port, 8 Gb zoned Blade Enclosure switches
HP P9500 Disk Array
8 – HP P9500 Processor Blade (MPB) pairs (<i>8 blades total, 1 – quad-core processor per blade, 32 cores total</i>)
8 – HP9500 Cache Memory Adapter pairs (<i>16 adapters total, 2 cache modules per adapter, 32 modules total, 16 GB per module, 512 GB total</i>)
2 – HP P9500 Disk Array DKC Modules (<i>DKC-0 and DKC-1</i>) <u>(enumerated parts list)</u>
8 – HP P9500 16-port 8 Gbps FC Channel Host Adapters (CHA) pairs (<i>16 adapters total, 16 – 8 Gbps ports per adapter, 256 ports total, 32 ports used</i>)
4 – HP P9500 SAS Drive Adapter (DKA) pairs (<i>8 adapters total, 8 – 8 Gbps FC-over-Copper connections per adapter, 64 total connections, 32 connections used</i>)
8 – HP P9500 64 GB Cache Backup Memory Modules (<i>512 GB total</i>)
512 – 300 GB 10K RPM disk drives (<i>128 disk drives per disk chassis</i>)