SPC BENCHMARK 1™
EXECUTIVE SUMMARY

HEWLETT-PACKARD COMPANY
HP P10000 3PAR V800 STORAGE SYSTEM

SPC-1™ V1.12

Submitted for Review: October 17, 2011
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EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Test Sponsor Primary Contact	Hewlett-Packard Company – http://www.hp.com Bill McCormack – bill.mccormack@hp.com 4609 Technology Drive Fremont, CA 94538 Phone: (510) 897-2784 FAX: (510) 413-5998
Test Sponsor Alternate Contact	Hewlett-Packard Company – http://www.hp.com Chuck Paridon – chuck.paridon@hp.com 8000 Foothills Blvd M/S 5785 Roseville, CA 95747-5785 Phone: (916) 785-5155 FAX: (916) 785-1648
Auditor	Storage Performance Council – http://www.storageperformance.org Walter E. Baker – AuditService@StoragePerformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

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SPC-1 Specification revision number	V1.12
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	October 17, 2011
Date the FDR was submitted to the SPC	October 17, 2011
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	October 17, 2011

Tested Storage Product (TSP) Description

The new Tier 1 storage for cloud computing, the new HP P10000 3PAR Storage Systems are designed to deliver enterprise IT as a utility service simply, efficiently, and flexibly. The arrays feature a tightly coupled clustered architecture, secure multi-tenancy, and mixed workload support to fuel enterprise-class virtual and cloud data centers. Use of unique thin technologies reduces acquisition and operational costs by up to 50% while autonomic management features improve administrative efficiency by up to tenfold. The HP 3PAR Gen4 ASIC in each of the system's controller nodes provides a hyper-efficient, silicon-based engine that drives on-the-fly storage optimization to maximize capacity utilization while delivering high service levels. The arrays are built from the ground up to enable agile and efficient response to the changing business needs present in today's most demanding data centers.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: HP P10000 3PAR V800 Storage System	
Metric	**Reported Result**
SPC-1 IOPS™	450,212.66
SPC-1 Price-Performance	$6.59/SPC-1 IOPS™
Total ASU Capacity	230,400.000GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$2,965,892

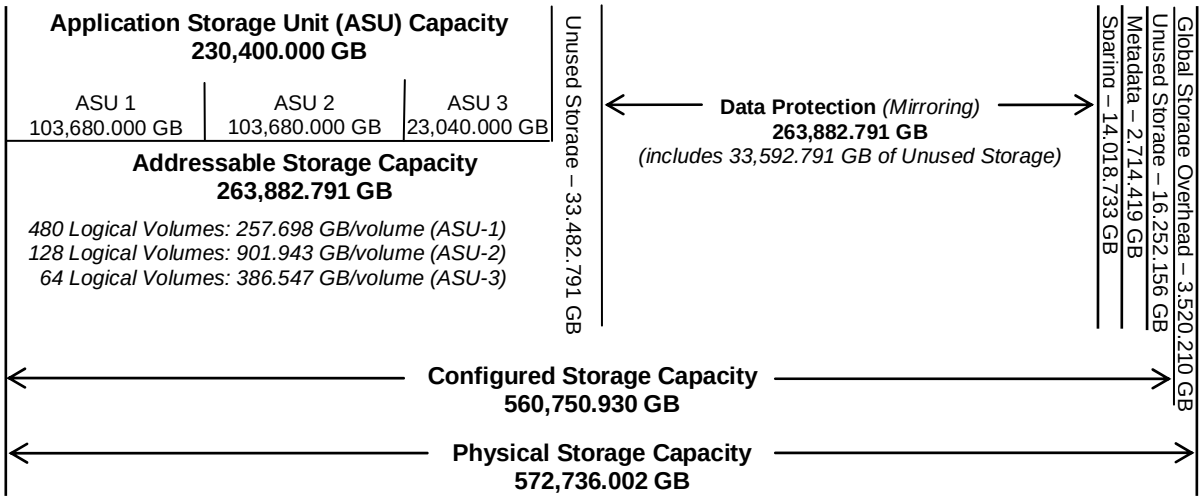
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level** of **Protected** configures two or more identical copies of user data.

Storage Capacities, Relationships, and Utilization

The following diagram 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	40.23%
Protected Application Utilization	80.46%
Unused Storage Ratio	14.53%

Application Utilization: Total ASU Capacity *(230,400.000 GB)* divided by Physical Storage Capacity *(572,736.002 GB)*

Protected Application Utilization: (Total ASU Capacity *(230,400.000 GB)* plus total Data Protection Capacity *(263,882.791 GB)* minus unused Data Protection Capacity *(33,482.791 GB)* divided by Physical Storage Capacity *(572,736.002 GB)*

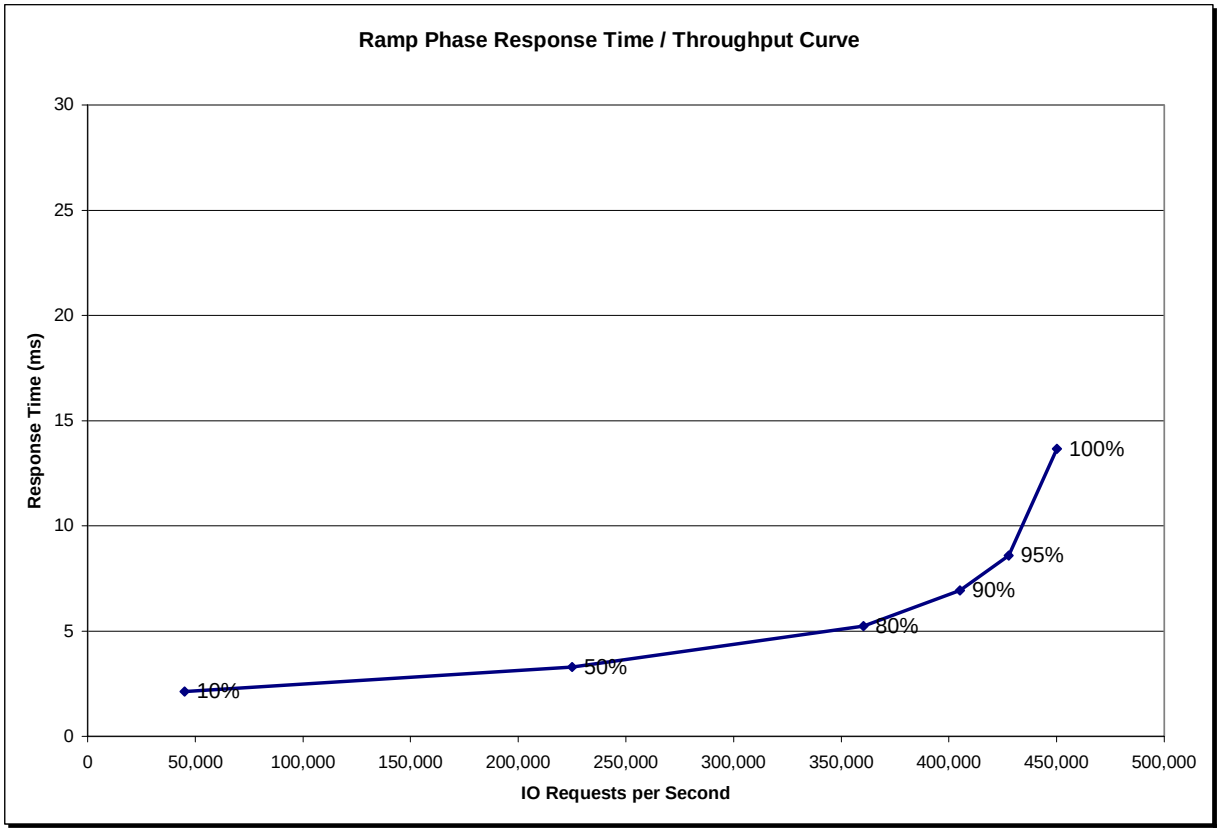
Unused Storage Ratio: Total Unused Capacity *(GB)* divided by Physical Storage Capacity *(572,736.002 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 21-22 of the Full Disclosure Report.

Response Time – Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at the any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.



Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	45,007.73	225,079.30	360,223.53	405,200.83	427,742.15	450,212.66
Average Response Time (ms):						
All ASUs	2.12	3.29	5.23	6.94	8.60	13.67
ASU-1	2.62	4.13	6.00	7.17	8.17	11.68
ASU-2	2.19	5.10	8.33	10.17	11.23	13.99
ASU-3	1.01	0.71	2.24	5.03	8.36	17.73
Reads	4.23	7.42	10.83	12.57	13.63	16.99
Writes	0.74	0.60	1.58	3.27	5.32	11.50

Priced Storage Configuration Pricing

description	unit price	qty	extended gross price	discount	extended net price
HP P10000 3PAR V800 NEMA Base	$ 219,037	1	$ 219,037	50%	$ 109,519
HP P10000 3PAR V800 Controller Nodes	$ 66,994	6	$ 401,964	50%	$ 200,982
HP P10000 3PAR 2M Expansion NEMA Rack	$ 11,550	6	$ 69,300	50%	$ 34,650
HP P10000 3PAR 4-Port FC Adapter	$ 9,660	24	$ 231,840	50%	$ 115,920
HP P10000 3PAR 4-Port FC Adapter	$ 9,660	24	$ 231,840	50%	$ 115,920
HP P10000 3PAR 40-drive chassis	$ 9,128	48	$ 438,144	50%	$ 219,072
HP P10000 3PAR 4x300GB 15K FC magazine	$ 4,599	480	$ 2,207,520	50%	$ 1,103,760
3PAR 10M 50/125 (LC-LC) Fiber Cable	$ 214	32	$ 6,848	50%	$ 3,424
3PAR 50M 50/125 (LC-LC) Fiber Cable	$ 352	96	$ 33,792	50%	$ 16,896
3PAR MPIO for Microsoft Windows SW	$ 1	1	$ 1	50%	$ 1
HP 3PAR InForm V800/4x300GB 15K Mag LTU	$ 3,425	480	$ 1,644,000	50%	$ 822,000
HP 3y Support Plus 24 SVC					
P10000 3PAR V800 Base Supp	$ 15,328	1	$ 15,328	50%	$ 7,664
P10000 3PAR V800 Controller Nodes Supp	$ 4,687	6	$ 28,122	50%	$ 14,061
For HP 3PAR Internal Entitlement Purpose	$ -	6	$ -	50%	$ -
P10000 3PAR 4-Port FC Adapter Supp	$ 674	24	$ 16,176	50%	$ 8,088
P10000 3PAR 4-Port FC Adapter Supp	$ 674	24	$ 16,176	50%	$ 8,088
P10000 3PAR 40-drive chassis Supp	$ 641	48	$ 30,768	50%	$ 15,384
P10000 3PAR 4x300GB 15K FC mag Supp	$ 357	480	$ 171,360	50%	$ 85,680
3PAR InForm V800/4x300GB Mag LTU Supp	$ 1,214	41	$ 49,774	50%	$ 24,887
HP Technical Installation Startup SVC					
HP Startup 3PAR T/V-Class 8 Node SVC	$ 19,250	1	$ 19,250	43%	$ 10,973
HP B-series 8/24c BladeSystem SAN Switch	$ 9,285	4	$ 37,140	8%	$ 34,169
HP BLc Emulex LPe1205 8Gb FC HBA Opt	$ 849	16	$ 13,584	12%	$ 11,954
HP 8Gb Shortwave B-series FC SFP+ 1 Pack	$ 199	16	$ 3,184	12%	$ 2,802
	TOTAL		$ 5,885,148		$ 2,965,892

The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.

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

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

Priced Storage Configuration Diagram

HP P10000 3PAR V800 Storage System *(8 nodes)*

64 GB data cache per node
32 GB control cache per node
3 – 8 Gb quad-port FC front-end adapters per node
3 – 8 Gb quad-port FC backend adapters per node
1,920 – 300 GB, 15K RPM FC disk drives

32 FC connections

4 – HP B-series 8/24c BladeSystem SAN switches
(8 FC connections per switch, 32 total)
(4 FC connections per 3PAR V800 node)

32 FC connections

16 – 8 Gb dual-port FC PCIe HBAs

Priced Storage Configuration Components

Priced Storage Configuration Components:
3PAR MPIO for Microsoft Windows
4 – HP B-series 8/24c BladeSystem SAN switches *(includes 4 SFPs per switch, 16 total)* 16 – HP 8Gb Shortwave B-series FC SFPs
16 – 8 Gb dual-port FC PCIe HBAs
HP P10000 3PAR V800 Storage System with 8 nodes 64 GB data cache per node *(512 GB total)* 32 GB control cache per node *(256 GB total)* 3 – 8 Gb quad-port FC front-end adapters per node *(24 adapters total, 96 total front-end connections, 32 used)* 3 – 8 Gb quad-port FC backend adapters per node *(24 adapters total, 96 total backend connections, 96 used)*
48 – HP P10000 3PAR 40-drive chassis
6 – HP P10000 3PAR 2M Expansion NEMA racks
480 – HP P10000 3PAR 4x300GB 15K FC magazines *(1,920 – 300 GB 15K RPM FC disk drives)*

Note: All front-end and backend FC adapters include the required number of SFPs.