



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**HEWLETT-PACKARD COMPANY
HP P6500 ENTERPRISE VIRTUAL ARRAY**

SPC-1 V1.12

**Submitted for Review: February 17, 2012
Submission Identifier: AE00005**

EXECUTIVE SUMMARY**Test Sponsor and Contact Information**

Test Sponsor and Contact Information	
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Revision Information and Key Dates

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SPC-1 Specification revision number	V1.12
SPC-1 Workload Generator revision number	V2.2.0
Date Results were first used publicly	February 17, 2012
Date the FDR was submitted to the SPC	February 17, 2012
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	February 16, 2012

Tested Storage Product (TSP) Description

The HP P6000 Enterprise Virtual Array is an easy to use, capacity enhanced storage system with built-in virtualization letting you to consolidate storage and simplify your IT. The P6000 EVA also offers high performance, high availability, and robust data protection. Combined with your favorite database, email, ERP or other applications, the P6000 EVA provides an integrated end-to-end solution that helps drive your business.

See improved storage density with built-in Thin Provisioning and a smaller footprint in your data center with 2.5-inch form factor storage devices. The P6000 EVA offers multi-protocol support to your SAN with 8 Gb/s Fibre Channel, 1 Gb/s iSCSI, and 10 Gb/s iSCSI/FCoE options.

It provides a better business value by eliminating stranded capacity and maximizing performance. P6000 EVA uses all the disks to send and retrieve data and can dynamically expand virtual disks as data grows.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: HP P6500 Enterprise Virtual Array	
Metric	Reported Result
SPC-1 IOPS™	20,003.03
SPC-1 Price-Performance	\$6.55/SPC-1 IOPS™
Total ASU Capacity	515.397 GB
Data Protection Level	Protected (<i>Mirroring</i>)
Total TSC Price (including three-year maintenance)	\$130,982.94

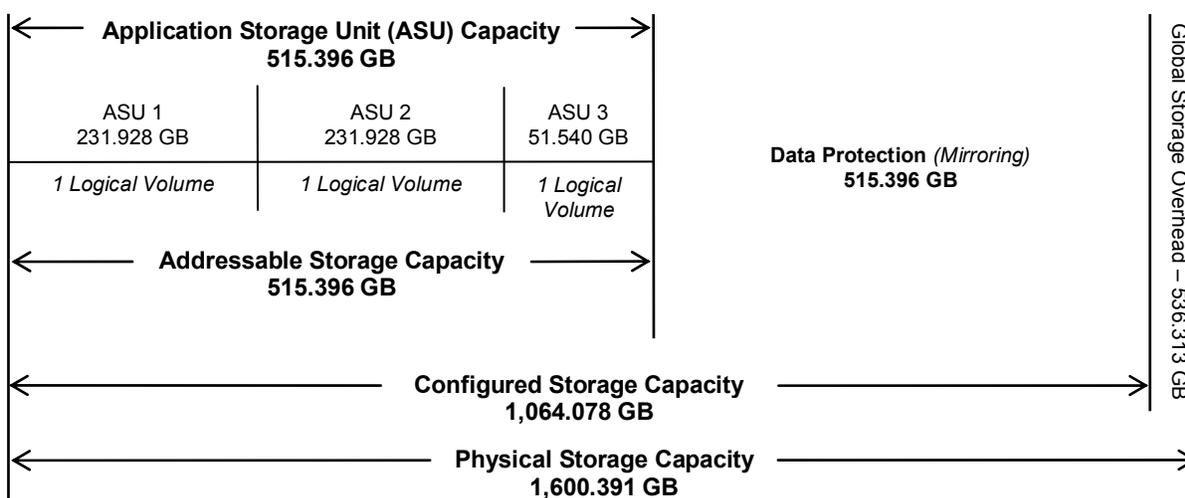
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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 (*Mirroring*)** 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	32.20%
Protected Application Utilization	64.41%
Unused Storage Ratio	2.08%

Application Utilization: Total ASU Capacity (515.396 GB) divided by Physical Storage Capacity (1600.391 GB).

Protected Application Utilization: Total ASU Capacity (515.396 GB) plus total Data Protection Capacity (515.396 GB) minus unused Data Protection Capacity (0.000 GB) divided by Physical Storage Capacity (1600.391 GB).

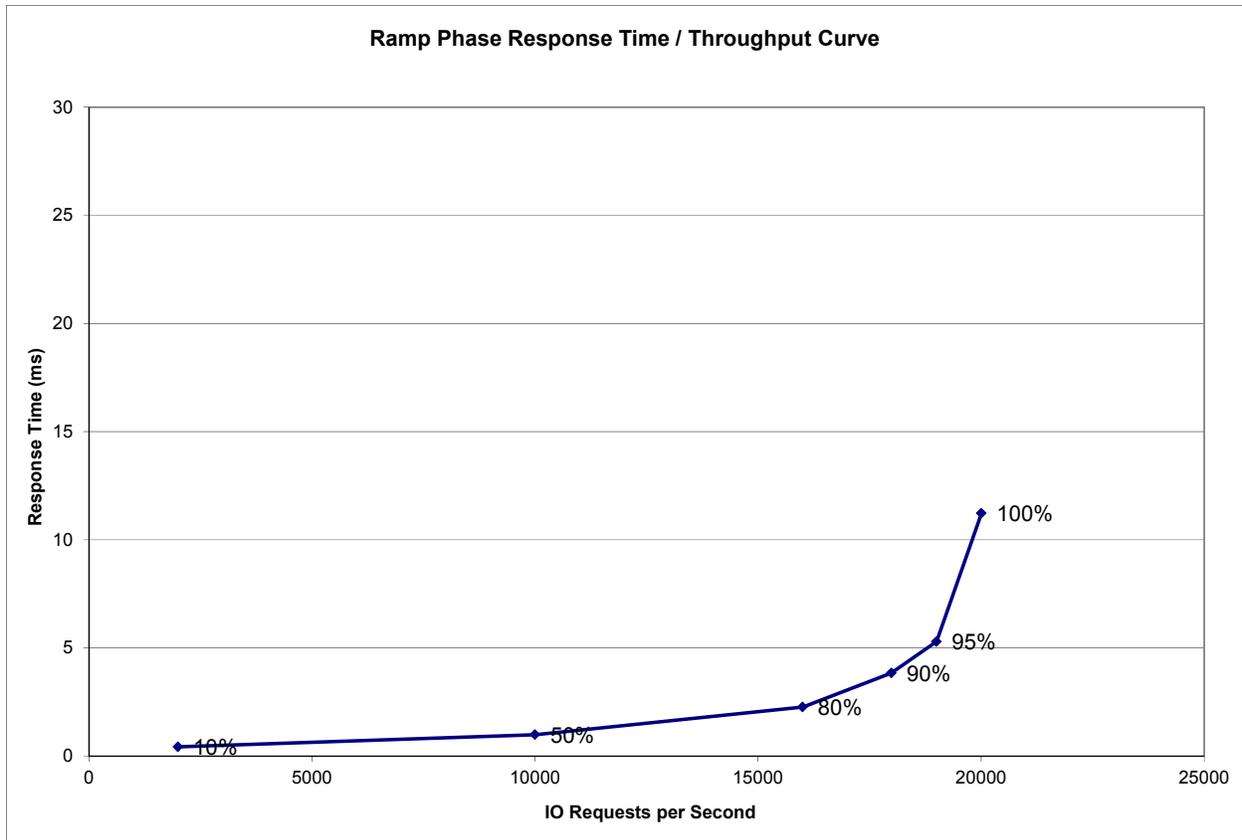
Unused Storage Ratio: Total unused capacity (33.286 GB) divided by Physical Storage Capacity (1600.391 GB). The Unused Storage Ratio cannot exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 25-26 in 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	1,999.26	9,999.41	15,999.52	17,990.02	18,998.58	20,003.66
Average Response Time (ms):						
All ASUs	0.43	0.99	2.27	3.85	5.30	11.23
ASU-1	0.43	1.02	2.33	3.90	5.36	12.24
ASU-2	0.40	0.88	2.08	3.59	5.00	10.38
ASU-3	0.45	0.99	2.23	3.84	5.29	9.46
Reads	0.42	1.01	2.38	3.91	5.36	12.94
Writes	0.43	0.98	2.20	3.80	5.25	10.11

SPC-1/E Reported Data

The initial SPC-1/E energy extension temperature, recorded during the first one minute of the Idle Test was 81.50F. The final SPC-1/E energy extension temperature, recorded during the last one minute of the Primary Metrics Test was 82.64F.

Average RMS Voltage:				Power Environment			
211.14				Average Power Factor:			
0.809							
Usage Profile							
	Hours of Use per Day			Nominal	Nominal	Nominal	Nominal
	Heavy	Moderate	Idle	Power, W	Traffic, IOPS	IOPS/W	Heat, BTU/hr
Low Daily Usage:	0	8	16	227.85	3333.14	14.63	777.44
Medium Daily Usage:	4	14	6	231.49	8499.58	36.72	789.87
High Daily Usage:	18	6	0	235.84	14499.49	61.48	804.72
Composite Metrics:				231.73	8,777.40	37.88	
Annual Energy Use, kWh:	2,029.93						
Energy Cost, \$/kWh:	\$ 0.12			Annual Energy Cost, \$:	\$ 243.59		

The above usage profile describes conditions in environments that respectively impose light (“low”), moderate (“medium”), and extensive (“high”) demands on the Tested Storage Configuration (TSC).

HEAVY SPC-1 Workload: 236.96W at 80% of maximum reported performance (*15,999.52 SPC-1 IOPS*).

MODERATE SPC-1 Workload: 232.48W at 50% of maximum reported performance (*9,999.41 SPC-1 IOPS*).

IDLE SPC-1 Workload: 225.53W at 0% of maximum reported performance (*0.00 SPC-1 IOPS*).

AVERAGE RMS VOLTAGE: The average supply voltage applied to the Tested Storage Product (TSP) as measured during the Measurement Intervals of the SPC-1/E Tests.

AVERAGE POWER FACTOR: The ratio of average real power, in watts, to the average apparent power, in volt-amperes flowing into the Tested Storage Product (TSP) during the Measurement Intervals of the SPC-1/E Tests.

NOMINAL POWER, W: The average power consumption over the course of a day (*24 hours*), taking into account hourly load variations.

NOMINAL TRAFFIC, IOPS: The average level of I/O requests over the course of a day (*24 hours*), taking into account hourly load variations.

NOMINAL IOPS/W: The overall efficiency with which I/O requests can be supported, reflected by the ratio of **NOMINAL TRAFFIC** versus the **NOMINAL POWER**.

NOMINAL HEAT, BTU/HR: The average amount of heat required to be dissipated over the course of a day (*24 hours*), taking into account hourly load variations. (*1 watt = 3.412 BTU/hr*)

COMPOSITE METRICS: The aggregated **NOMINAL POWER**, **NOMINAL TRAFFIC**, and **NOMINAL IOPS/W** for all three environments: **LOW**, **MEDIUM**, and **HIGH DAILY USAGE**.

ANNUAL ENERGY USE, KWH: An estimate of the average energy use across the three environments over the course of a year and computed as (**NOMINAL POWER** * 24 * 0.365).

ENERGY COST, \$/KWH: A standardized energy cost per kilowatt hour.

ANNUAL ENERGY COST: An estimate of the annual energy use across the three environments over the course of a year and computed as (**ANNUAL ENERGY USE** * **ENERGY COST**).

SPC-1/E Power/Performance Profile

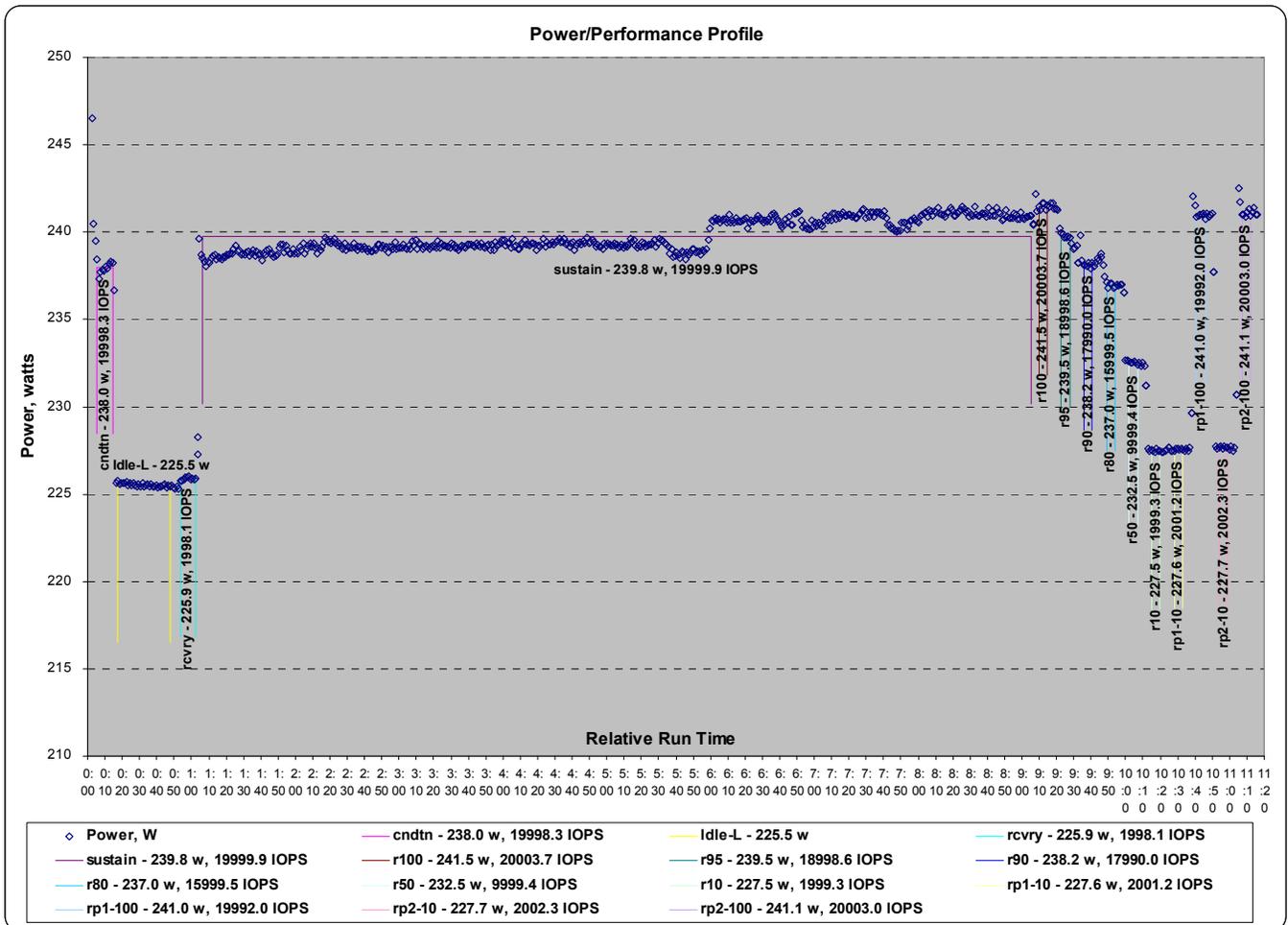
The SPC-1/E Power/Performance Profile chart provides a complete “at a glance” illustration and report for each SPC-1/E execution component. The power consumption at each step is reported and, where appropriate the measured SPC-1 performance (*SPC-1 IOPS™*) is also reported.

The **Load Level** value in the table represents the percentage of the maximum, specified offered load that was used for a specific execution component. Each **Execution Component** entry includes the acronym, in parenthesis, which is used in the corresponding chart to identify the execution component.

SPC-1/E Power/Performance Profile Data

Execution Component	Load Level	SPC-1 IOPS™	Power (W)
Pre-Idle (<i>cndtn</i>)	100%	19,998.32	237.98
Idle (<i>Idle-L</i>)	0%	0.00	225.53
Post-Idle (<i>rcvry</i>)	10%	1,998.11	225.88
Sustainability (<i>sustain</i>)	100%	19,999.92	239.78
IOPS (<i>r100</i>)	100%	20,003.66	241.49
Ramp95 (<i>r95</i>)	95%	18,998.58	239.54
Ramp90 (<i>r90</i>)	90%	17,990.02	238.18
Ramp80 (<i>r80</i>)	80%	15,999.52	236.96
Ramp50 (<i>r50</i>)	50%	9,999.41	232.48
Ramp10 (<i>r19</i>)	10%	1,999.26	227.48
Repeat1 LRT (<i>rp1-10</i>)	10%	2,001.16	227.56
Repeat1 IOPS (<i>rp1-100</i>)	100%	19,991.99	240.97
Repeat2 LRT (<i>rp2-10</i>)	10%	2,002.29	227.65
Repeat2 IOPS (<i>rp2-100</i>)	100%	20,003.03	241.08

SPC-1/E Power/Performance Profile Chart



Priced Storage Configuration Pricing

Quan	Product Number	Description	List Price	Ext Price	Discount	Ext. Net Price
1	AF002A	HP Universal Rack 10642 G2 Shock Rack	1,489.00	1,489.00	27%	1,086.97
1	AF002A 001	Factory Express Base Racking	300.00	300.00	27%	219.00
1	AJ938A	HP P6500 EVA Dual Controller FC Array	18,500.00	18,500.00	27%	13,505.00
1	AJ938A 0D1	Factory integrated	-	-	27%	-
2	AJ840A	HP M6625 2.5-inch SAS Drive Enclosure	4,326.00	8,652.00	27%	6,315.96
2	AJ840A 0D1	Factory integrated	-	-	27%	-
8	QK757A	HP M5524 6G 200GB SAS SFF SSD	9,800.00	78,400.00	27%	57,232.00
8	QK757A 0D1	Factory integrated	-	-	27%	-
2	252663-D72	HP 24A High Voltage US/JP Modular PDU	299.00	598.00	27%	436.54
2	252663-D72 0D2	Factory horizontal mount of PDU	-	-	27%	-
1	AF062A	HP 10K G2 600mm Stabilizer Kit	229.00	229.00	27%	167.17
1	AF062A B01	Include with complete system	-	-	27%	-
1	AF054A	HP 10642 G2 Sidepanel Kit	359.00	359.00	27%	262.07
1	AF054A 0D1	Factory integrated	-	-	27%	-
1	T5494GAE	HP P6000 CV V9.4 RSM V5.3 E-Media Kit	125.00	125.00	27%	91.25
1	TA811AAE	HP P6500 Command View SW E-LTU	22,200.00	22,200.00	27%	16,206.00
1	HK777A3	HP 3Y Critical Advantage L3 Service	-	-	27%	-
1	HK777A3 Q1Y	Command View P6500 EVA Unlimited SW Sup	8,030.00	8,030.00	27%	5,861.90
1	HK777A3 Q24	P6500 EVA Dual Controller Array JW Supp	8,524.00	8,524.00	27%	6,222.52
2	HK777A3 Q25	P6300/P6500 Drive Enclosure JW Supp	2,050.00	4,100.00	27%	2,993.00
8	HA104A3 WSK	P6300/P6500 SSD Support HW Supp	780.00	6,240.00	27%	4,555.20
2	456972 B21	HP BLc Emulex LPe1205 8Gb FC HBA Opt	849.00	1,698.00	12%	1,494.24
2	AJ716A	HP 8Gb Shortwave B-series FC SFP	199.00	398.00	12%	350.24
2	AJ821A	Brocade HPB series 8/24c Blade SAN Switch	9,285.00	18,570.00	27%	13,556.10
2	AJ836A	HP 5m Multi-mode OM3 LC/LC FC Cable	95.00	190.00	27%	138.70
4	AJ706A	HP EVA Loopback Connector	99.00	396.00	27%	289.08
Totals				178,998.00		130,982.94

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 Priced Storage Configuration.

Priced Storage Configuration Diagram

**HP ProLiant
BL460c G6 Server
HP BladeSystem
c7000 Enclosure
2 – 24 Port 8 Gb zoned
Blade Enclosure Switches**



**2 – Dual Port 8 Gb FC HBAs
2 – 8 Gb Shortwave SFPs
2 –LC-LC cables**



HP P6500 Enterprise Virtual Array

Dual Controllers with 8 GB cache/controller

8 –200 GB Solid State Devices (SSDs)

Priced Storage Configuration Components

Priced Storage Configuration:
2 – Dual Port 8 Gb FC HBAs
2 – 8 Gb Shortwave FC SFPs
2 –24 Port, 8 Gb zoned Blade Enclosure switches
HP P6500 Enterprise Virtual Array Dual Controllers with 8 GB cache/controller (<i>16 GB total</i>) dual power supplies for each controller (<i>4 total</i>) 2 – 8 Gb FC front-end physical connection, both used 2 – SAS backend physical connections, both used
1 – HP Universal Rack
2 – HP SAS Drive Enclosures dual power supplies for each drive enclosure (<i>4 total</i>)
8 –200 GB FC Solid State Devices (<i>SSDs</i>)
HP StorageWorks Command View EVA