



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**HEWLETT-PACKARD COMPANY
HP STORAGEWORKS XP24000 DISK ARRAY**

SPC-1 V1.10.1

**Submitted for Review: October 1, 2007
Submission Identifier: A00056**

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary 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
Test Sponsor Alternate Contact	Hewlett-Packard Company – http://www.hp.com James R. Wilson – james.r.wilson@hp.com 11311 Chinden Blvd. Boise, ID, 83714-0021 Phone: (208) 396-7822 FAX: (208) 396-5515
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

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.10.1
SPC-1 Workload Generator revision number	V2.00.04a
Date Results were first used publicly	October 1, 2007
Date the FDR was submitted to the SPC	October 1, 2007
Date the TSC is available for shipment to customers	May 14, 2007
Date the TSC completed audit certification	October 1, 2007

Tested Storage Product (TSP) Description

The HP StorageWorks XP24000/XP20000 Disk Arrays are large enterprise-class storage systems designed for organizations that simply cannot afford any downtime or tolerate any data loss. The XP mitigates the risk of business downtime by providing a bulletproof platform with complete hardware redundancies, hot-swappable components, and non-disruptive online upgrades. Data replication and tightly integrated clustering solutions, along with disaster recovery support, enable a multi-site disaster tolerant design to achieve complete business continuity. And with enhanced data protection and security features, you can decrease exposure to data loss.

The XP24000 offers four gigabit per second connection to disk drives and hosts, and supports up to 1,152 disk drives and 332 terabytes of capacity. The new array features an unprecedented peak performance range of up to 3.5 million input output operations from cache. It comes with newly enhanced and cost-reduced HP StorageWorks XP Array Manager software, which allows customers to easily configure, manage, partition and secure their data using a web-based interface. In addition, HP Services professionals worldwide can help with site preparation to ensure a smooth installation and start-up of the system.

The XP24000 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.

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: HP StorageWorks XP24000 Disk Array	
Metric	Reported Result
SPC-1 IOPS™	200,245.73
SPC-1 Price-Performance	\$17.96/SPC-1 IOPS™
Total ASU Capacity	26,000 GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	\$3,596,623

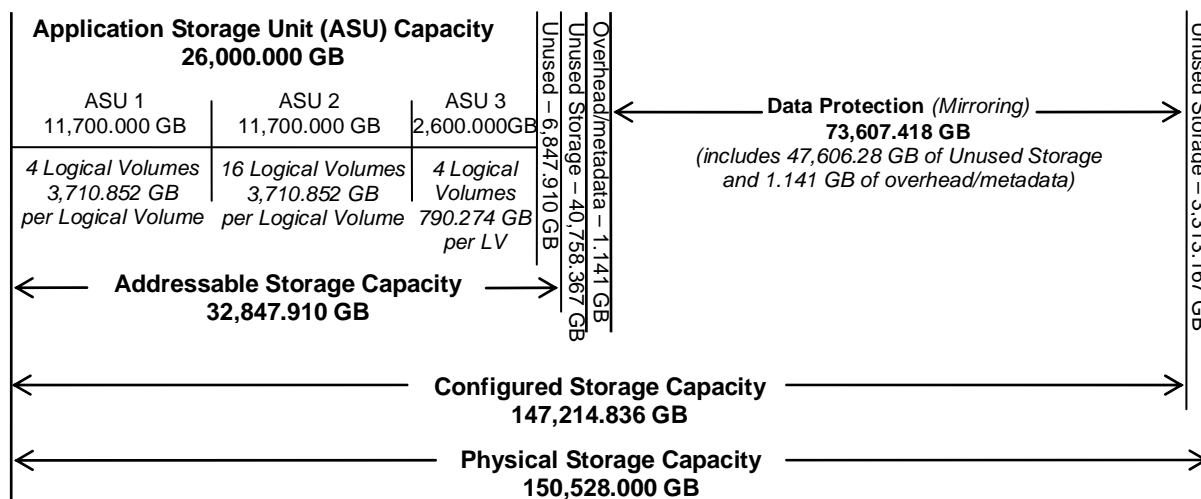
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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 Mirroring configures two or more identical copies of user data.

Storage Capacities and Relationships

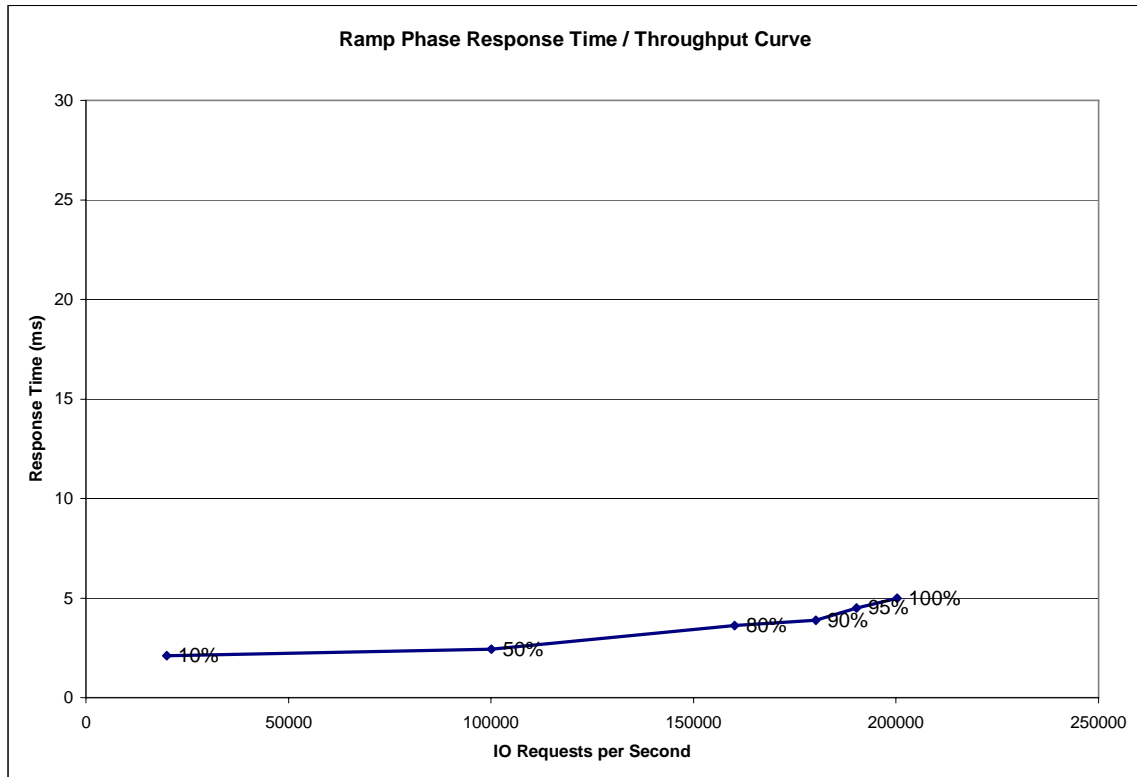
The following diagram documents the various storage capacities, used in this benchmark, and their relationships.



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	19,994.33	100,105.69	160,170.55	180,202.31	190,196.63	200,245.73
Average Response Time (ms):						
All ASUs	2.10	2.43	3.62	3.89	4.50	4.99
ASU-1	2.92	3.20	4.68	4.92	5.54	6.10
ASU-2	2.11	2.63	3.75	4.23	4.82	5.37
ASU-3	0.34	0.70	1.31	1.58	2.15	2.47
Reads	4.82	5.10	6.99	7.46	8.12	8.89
Writes	0.33	0.69	1.43	1.57	2.14	2.45

Tested Storage Configuration Pricing (Priced Storage Configuration)

ORG	Product Number	Description	Qty	Unit Price	Ext Price	Net Dscnt	Net Price
HW	AE130A	HP StorageWorks XP24000 Disk Array	1	\$ -	\$ -	37%	\$ -
HW	AE131A	HP XP24000 DKC Disk Control Frame	1	\$ 95,622	\$ 95,622	37%	\$ 60,242
HW		Remote Web Console (included with array frame)	1	\$ -	\$ -	37%	\$ -
HW	AE131A#001	3-PHASE 30A/60Hz FOR XP24000 DKC	1	\$ 1,850	\$ 1,850	37%	\$ 1,166
HW							
HW	AE136A	HP XP24000 16 Port 4 Gb FC CHA	8	\$ 46,137	\$ 369,096	37%	\$ 232,530
HW				\$ -	\$ -	37%	\$ -
HW				\$ -	\$ -	37%	\$ -
HW	AE150A	HP XP24000 12V DKC Power Supply	2	\$ 2,450	\$ 4,900	37%	\$ 3,087
HW	AE152A	HPXP24000 8GB Cache Memory	32	\$ 36,918	\$ 1,181,376	37%	\$ 744,267
HW	AE151A	HP XP24000 Cache Memory Adapter	4	\$ 1,660	\$ 6,640	37%	\$ 4,183
HW	AE160A	HP XP24000 DKC 12V Battery	3	\$ 2,750	\$ 8,250	37%	\$ 5,198
HW	AE161A	HP XP24000 DKC/DKU 56V Battery		\$ 5,500	\$ -	37%	\$ -
HW	AE157A	HP XP24000 4 GB Shared Memory	5	\$ 18,168	\$ 90,840	37%	\$ 57,229
HW	AE155A	HP XP24000 Shared Memory Adapter	2	\$ 3,330	\$ 6,660	37%	\$ 4,196
HW	AE162A	HP XP24000 Cache Switch	3	\$ 22,500	\$ 67,500	37%	\$ 42,525
HW	AE164A	HP XP24000 DKA Disk Adapter Set	4	\$ 60,183	\$ 240,732	37%	\$ 151,661
HW	AE168A	HP XP24000 DKU R1 Base Cable Set	1	\$ 615	\$ 615	37%	\$ 387
HW	AE169A	HP XP24000 DKU R1 Expansion Cable Set	1	\$ 615	\$ 615	37%	\$ 387
HW	AE170A	HP XP24000 DKU L1 Base Cable Set	1	\$ 615	\$ 615	37%	\$ 387
HW	AE171A	HP XP24000 DKU L1 Expansion Cable Set	1	\$ 615	\$ 615	37%	\$ 387
HW	AE172A	HP XP24000 DKU R2 or L2 Cable Set	4	\$ 510	\$ 2,040	37%	\$ 1,285
HW	AE173A	HP XP24000 DKU Disk Unit Frame	4	\$ 55,249	\$ 220,996	37%	\$ 139,227
HW				\$ -	\$ -	37%	\$ -
HW	AE173A#001	3P/30A/60Hz 3760PDG/115J-AP8508 2 Cords	4	\$ 1,850	\$ 7,400	37%	\$ 4,662
HW				\$ -	\$ -	37%	\$ -
HW	AE174A	HP XP24000 DKU Disk Expansion Kit	4	\$ 7,650	\$ 30,600	37%	\$ 19,278
HW	AE177A	XP24000 146GB 15K Array Group (4 disks)	256	\$ 8,531	\$ 2,183,936	37%	\$ 1,375,880
HW	AE177AS	XP24000 146GB 15K Spare Disk	1	\$ 2,100	\$ 2,100	37%	\$ 1,323
SW	T5214AA	HP XP Array Manager Base License	1	\$ 16,150	\$ 16,150	37%	\$ 10,175
SW	T5214AG	HP XP Array Manager 1TB 128-255TB LTU	147	\$ 1,280	\$ 188,160	37%	\$ 118,541
SW	T5281AA	HP XP Command View AE Base License	1	\$ 4,000	\$ 4,000	37%	\$ 2,520
SW	T5281AG	HP XP Command View AE 1TB 128-255TB LTU	147	\$ 1,400	\$ 205,800	37%	\$ 129,564

	Ext Price	Net Price
HW	\$ 4,522,998	\$ 2,849,489
SW	\$ 414,110	\$ 260,889

\$ 3,110,378

Support

HA110A3#7H8	XP24000 DKC Support, 3-yr	1	\$ 4,264	\$ 4,264	37%	\$ 2,686
HA110A3#7HR	XP24K/20K 16-port 4Gb FC CHA support, 3-yr	8	\$ 3,179	\$ 25,432	37%	\$ 16,022
HA110A3#7HX	XP24K 12V DKC Power Supply support, 3-yr	2	\$ 180	\$ 360	37%	\$ 227
HA110A3#7J1	XP24K/20K 8GB Cache Memory support, 3-yr	32	\$ 2,700	\$ 86,400	37%	\$ 54,432
HA110A3#7HZ	XP24K/20K Cache Memory Adapter support, 3-yr	4	\$ 120	\$ 480	37%	\$ 302
HA110A3#7JB	XP24/20K DKC 12V Battery Supp, 3-yr	3	\$ 210	\$ 630	37%	\$ 397
HA110A3#7J9	XP24K 4 GB Shared Memory Supp, 3-yr	5	\$ 1,320	\$ 6,600	37%	\$ 4,158
HA110A3#7J5	XP24/20K Shared Memory Adapter Supp	2	\$ 240	\$ 480	37%	\$ 302
HA110A3#7JF	XP24K Cache Switch Supp	3	\$ 1,650	\$ 4,950	37%	\$ 3,119
HA110A3#7JH	XP24K DKA Disk Adapter Set Supp	4	\$ 4,139	\$ 16,556	37%	\$ 10,430
HA110A3#7JK	XP24K DKU Disk Unit Frame Supp	4	\$ 4,049	\$ 16,196	37%	\$ 10,203
HA110A3#7JM	XP24K DKU Disk Expansion Kit Supp	4	\$ 670	\$ 2,680	37%	\$ 1,688
HA110A3#7JR	XP24/20K 146/300GB Array Group Supp	256	\$ 960	\$ 245,760	37%	\$ 154,829
HA110A3#7JW	XP24/20K 146/300GB Spare Disk Supp	1	\$ 240	\$ 240	37%	\$ 151
HA110A3#88N	XP Array Manager Base License Supp, 3-yr	1	\$ 4,280	\$ 4,280	37%	\$ 2,696
HA110A3#88U	XP Array Manager 1TB 128-255TB LTU Supp	147	\$ 502	\$ 73,794	37%	\$ 46,490
HA110A3#79D	XP Command View AE Base License Supp, 3-yr	1	\$ 133	\$ 133	37%	\$ 84
HA110A3#79K	XP CV AE 1TB 128-255TB LTU Supp, 3-yr	147	\$ 549	\$ 80,703	37%	\$ 50,843

Support	\$ 569,938	\$ 359,061
---------	------------	------------

A5750A #014	15M LC/LC FC cable, 50/125 micron, multi	64	\$ 140	\$ 8,960	37%	\$ 5,645
Third-party quote	IBM HBAs	64				\$ 121,539

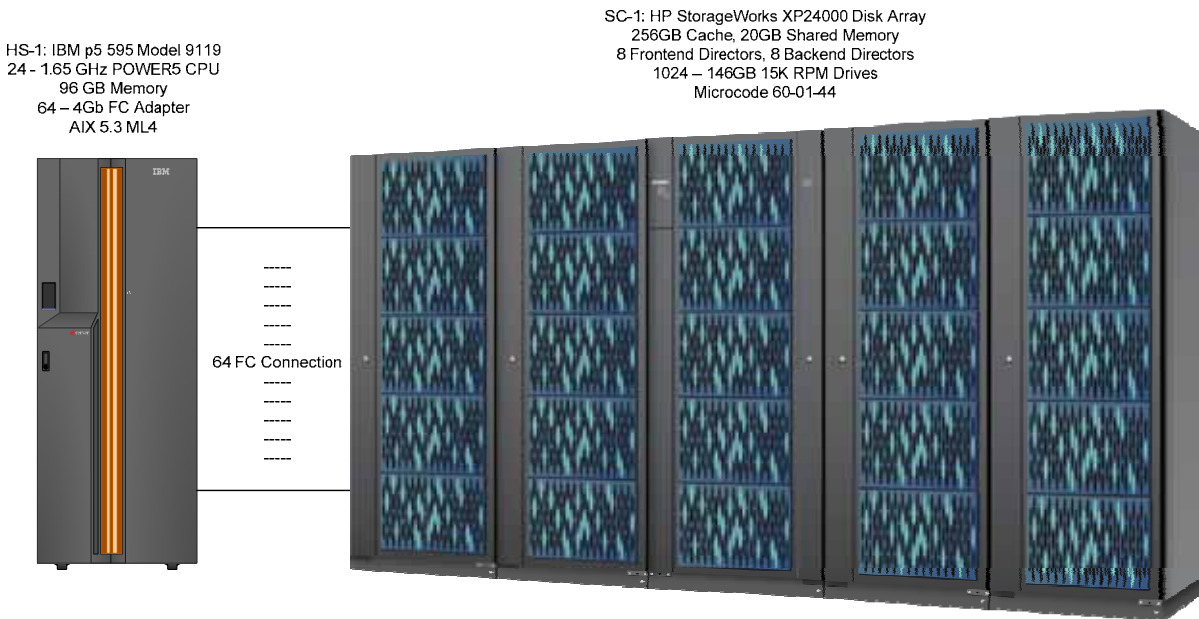
Total \$ 3,596,623

The above pricing provides maintenance/support for 24 hours per day, 7 days per week for three years with four hour acknowledgement and four hour subsequent response (support engineer onsite or customer replaceable part available).

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

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

Benchmark Configuration/Tested Storage Configuration Diagram



HS-1: IBM p5 595 Model 9119
 24 - 1.65 GHz POWER5 CPU
 96 GB Memory
 64 - 4Gb FC Adapter
 AIX 5.3 ML4

SC-1: HP StorageWorks XP24000 Disk Array
 256GB Cache, 20GB Shared Memory
 8 Frontend Directors, 8 Backend Directors
 1024 - 146GB 15K RPM Drives
 Microcode 60-01-44

Benchmark Configuration/Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
UID=HS-1 IBM P5 595 Model 9119	64 - 4 Gb P5 595 FC PCI-X 2.0 DDR Adapters
24 - 1.65 GHz CPUs - 2 CPUs/POWER5 chip 32 KB L1 cache, 960 KB L2 cache, and 18 MB L3 cache per CPU	UID=SC-1: HP StorageWorks XP24000 Disk Array
96 GB main memory	256 GB cache (<i>data</i>), 22 GB shared memory (<i>metadata</i>)
AIX 5.3 ML4	
PCI-X/RIO	8 pair (<i>16 ports/pair</i>) 4 Gb FC Front-End Directors (<i>128 ports total, 64 ports used</i>)
WG	9 pair 4 Gb Backend Directors supporting 64 FC disk loops
	1024 - 146 GB 15K RPM disk drives