SPC BENCHMARK 1™

EXECUTIVE SUMMARY

IBM CORPORATION

IBM SYSTEM STORAGE
DS4800 DISK STORAGE SYSTEM

SPC-1 V1.10.1

Submitted for Review: April 10, 2007
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EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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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	April 10, 2007
Date the FDR was submitted to the SPC	April 10, 2007
Date revised FDR was submitted to the SPC Revised pricing and SPC-1 Price-Performance	June 27, 2007
Date the TSC is available for shipment to customers	currently available
Date the TSC completed audit certification	April 10, 2007

Tested Storage Product (TSP) Description

Summary of Results

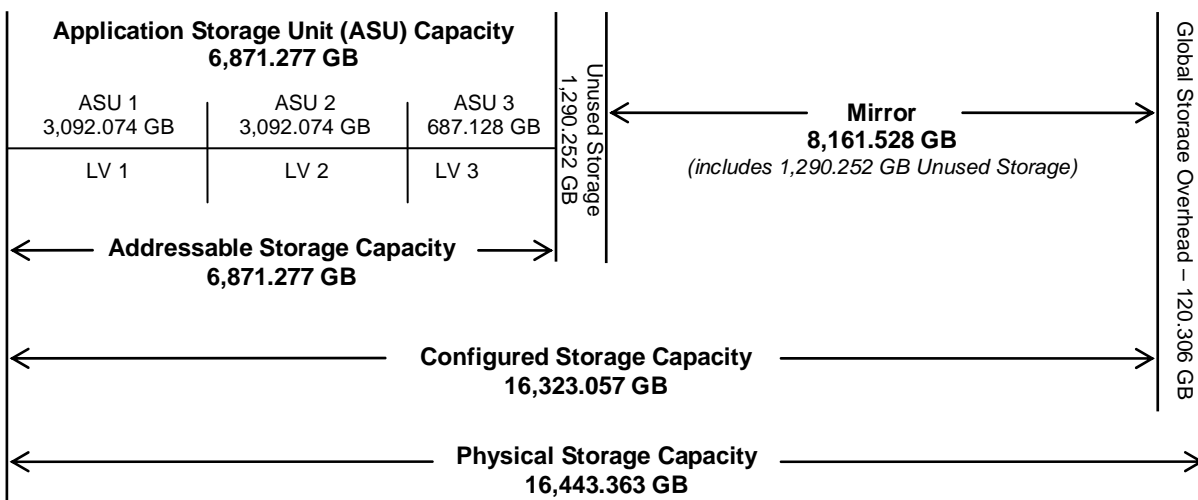| SPC-1 Results	
Tested Storage Configuration (TSC) Name: IBM System Storage DS4800 Disk Storage System	
Metric	**Reported Result**
SPC-1 IOPS™	45,014.81
SPC-1 Price-Performance	$13.94/SPC-1 IOPS™
Total ASU Capacity	6,871.277 GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	$627,538

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.

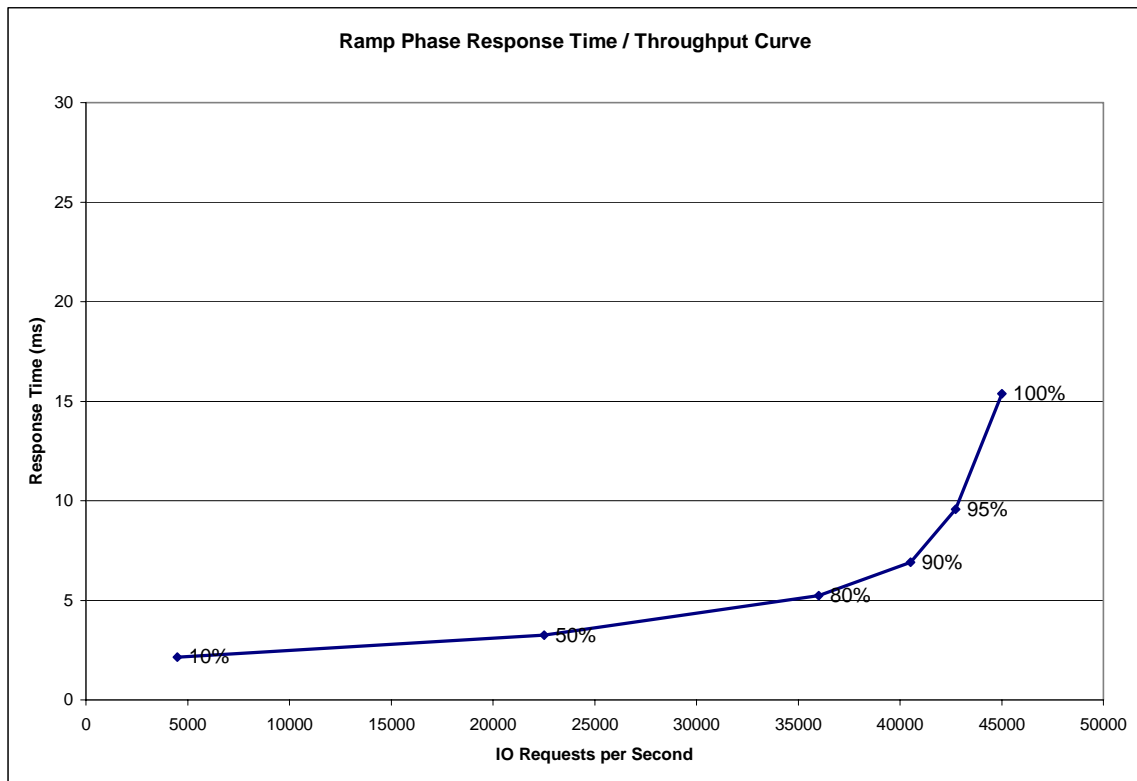## Storage Capacities and Relationships

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.

Ramp Phase Response Time / Throughput Curve

Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	4,495.18	22,506.70	36,003.23	40,513.86	42,734.00	45,014.81
Average Response Time (ms):						
All ASUs	2.15	3.26	5.24	6.91	9.56	15.39
ASU-1	2.81	4.16	6.26	7.82	10.16	15.14
ASU-2	3.13	4.89	8.32	10.82	13.83	19.97
ASU-3	0.32	0.63	1.72	3.27	6.41	13.90
Reads	5.02	7.36	10.70	12.58	14.50	17.84
Writes	0.28	0.59	1.68	3.22	6.34	13.79

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

		QTY	list price	extended
1815-82A	DS4800 Model 82	1	$53,995	$53,995
2104	DS4000 Host Bus Adapter	16	$1,485	$23,760
2410	SW 4Gbps SFP pairs	6	$998	$5,988
5605	5m Fiber Optic cable	16	$129	$2,064
7700	Windows Host Kit	1	$1,250	$1,250
8870	Eight Storage Partitions	1	$10,000	$10,000
9202	Field Integrate	1	n/c	n/c
9800	Group 1 Power Cords	1	n/c	n/c
	warranty upgrade to 24x7x4	1	$3,200	$3,200
1812-81A	DS4000 EXP810 Expansion Unit	14	$6,000	$84,000
2410	SW 4Gbps SFP pairs	14	$998	$13,972
5601	1m Fiber Optic cable	28	$79	$2,212
5625	25m Fiber Optic cable	8	$189	$1,512
5413	73GB/15K FC Disk Module	224	$1,679	$376,096
9018	Attach to DS4800	14	n/c	n/c
9800	Group 1 Power Cords	14	n/c	n/c
	warranty upgrade to 24x7x4	14	$760	$10,640
2005-B32	IBM TotalStorage SAN32B-2 4Gbps fabric switch with 16	1	$17,750	$17,750
2410	4 Gbps SW SFP Transceiver	32	$150	$4,800
5605	Fibre Cabe LC/LC 5M Multi	16	$105	$1,680
7510	B32 Ports 16-23 Activation	1	$9,000	$9,000
	Warranty upgrade for 3 years	1	$5,619	$5,619

total
$627,538

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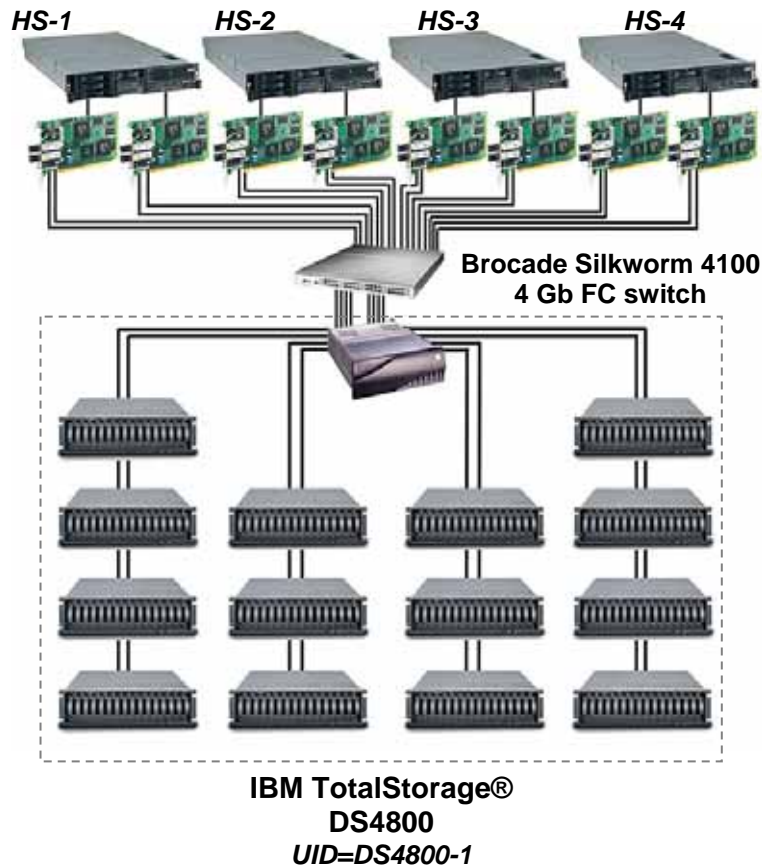
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

The following are the differences between the TSC and Priced Storage Configuration:

- The priced disk drives have been configured to self-identify as FAStT brand.

- The mounting in each drive is in an IBM drive carrier.

- The 'data scrubbing' option has a default setting of "off" in the TSC, but would need to explicitly set to "off" in the Priced Storage Configuration.

- The IBM TotalStorage SAN Switch 2005-B32 is an IBM relabeled version of the Brocade Silkworm 4100 Switch, which is identical to the component used in the TSC.

The differences listed above, if applied to the TSC, would not have a negative performance impact on the reported SPC-1 performance.

Benchmark Configuration/Tested Storage Configuration Diagram

HS-1   HS-2   HS-3   HS-4

**Brocade Silkworm 4100
4 Gb FC switch**

**IBM TotalStorage®
DS4800
UID=DS4800-1**

Benchmark Configuration/Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC)
UID=HS-1, HS-2, HS-3, HS-4:	SANtricity Storage Manager v9.
4 – IBM x346 Servers, each configured with: 2 – 3.2 GHz Xeon CPUs, 1 MB L2/CPU 2 GB main memory Windows 2003 Enterprise Edition PCI-X WG	8 – Qlogic 2342 HBAs (2 per Host System)
	1 – Brocade Silkworm 4100 switch – 32 ports, 4 Gb
	UID=DS4800-1:
	IBM TotalStorage® DS4800 which includes: 2 – disk array controllers with 2 GB RAM per controller 8 – 4 Gb Fibre Channel host connections 8 – 4 Gb Fibre Channel drive connections
	14 – DS4000 EXP810 Expansion Units
	224 – 73 GB 15K RPM Disk Drives