SPC BENCHMARK 2™

EXECUTIVE SUMMARY

IBM CORPORATION

IBM SYSTEM STORAGE
DS4800 DISK STORAGE SYSTEM

SPC-2™ V1.2.1

Submitted for Review: April 10, 2007
Submission Identifier: B00023
Accepted: June 9, 2007
Revised: June 27, 2007

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Revision Information and Key Dates

Revision Information and Key Dates	
SPC-2 Specification revision number	V1.2.1
SPC-2 Workload Generator revision number	spc2rc9g
Date Results were first used publicly	April 10, 2007
Date FDR was submitted to the SPC	April 10, 2007
Date the TSC will be available for shipment to customers	currently available
Date revised FDR was submitted to the SPC Revised pricing and SPC-1 Price-Performance	June 27, 2007
Date the TSC completed audit certification	April 9, 2007

Tested Storage Product (TSP) Description
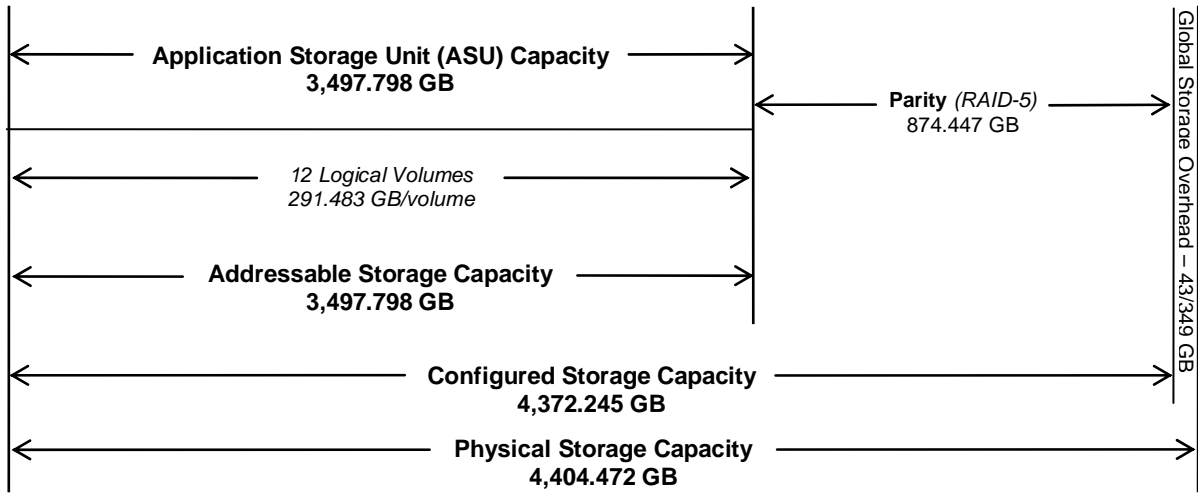
SPC-2 Reported Data

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				
IBM System Storage DS4800 Disk Storage System				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
1,381.67	$155.85	3,497.798	$215,329	RAID-5
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)				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	1,168.36			$184.30
Write Only:				
1024 KiB Transfer	1,187.05	32	37.10	
256 KiB Transfer	391.81	32	12.24	
Read-Write:				
1024 KiB Transfer	1,480.91	32	46.28	
256 KiB Transfer	648.32	32	20.26	
Read Only:				
1024 KiB Transfer	1,648.43	32	51.51	
256 KiB Transfer	1,653.65	32	51.68	
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).				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LDQ Composite	1,631.83			$131.96
1024 KiB Transfer Size				
4 I/Os Outstanding	1,627.64	32	50.86	
1 I/O Outstanding	1,635.20	32	51.10	
64 KiB Transfer Size				
4 I/Os Outstanding	1,632.03	32	51.00	
1 I/O Outstanding	1,632.46	32	51.01	
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).				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
	1,344.82	1,710	0.79	$160.12

Storage Capacities and Relationships

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

```
|<─────── Application Storage Unit (ASU) Capacity ───────>|                                    Global Storage Overhead – 43/349 GB
|                        3,497.798 GB                     |
|                                                         |<─────── Parity (RAID-5) ───────>|
|                                                         |             874.447 GB           |
|    |<──────────── 12 Logical Volumes ───────────>|      |
|                  291.483 GB/volume                      |
|    |<──────── Addressable Storage Capacity ──────>|     |
|                    3,497.798 GB                         |
|<──────────────── Configured Storage Capacity ────────────────────────────────────────>|
|                         4,372.245 GB                                                    |
|<──────────────── Physical Storage Capacity ──────────────────────────────────────────────>|
|                         4,404.472 GB                                                       |
```

SPC BENCHMARK 2™ V1.2.1   **EXECUTIVE SUMMARY**   **Accepted: JUNE 9, 2007**
IBM Corporation   **Submission Identifier: B00023**
IBM System Storage DS4800 Disk Storage System   **Revised: June 27, 2007**

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

		QTY	list price	extended
1815-82A	DS4800 Model 82	1	$53,995	$53,995
2106	DS4000 Host Bus Adapter	4	$2,485	$9,940
2410	SW 4Gbps SFP pairs	2	$998	$1,996
5605	5m Fiber Optic cable	8	$129	$1,032
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	4	$6,000	$24,000
2410	SW 4Gbps SFP pairs	4	$998	$3,992
5601	1m Fiber Optic cable	8	$79	$632
5625	25m Fiber Optic cable	8	$189	$1,512
5413	73GB/15K FC Disk Module	60	$1,679	$100,740
9018	Attach to DS4800	4	n/c	n/c
9800	Group 1 Power Cords	4	n/c	n/c
	warranty upgrade to 24x7x4	4	$760	$3,040

total
$215,329

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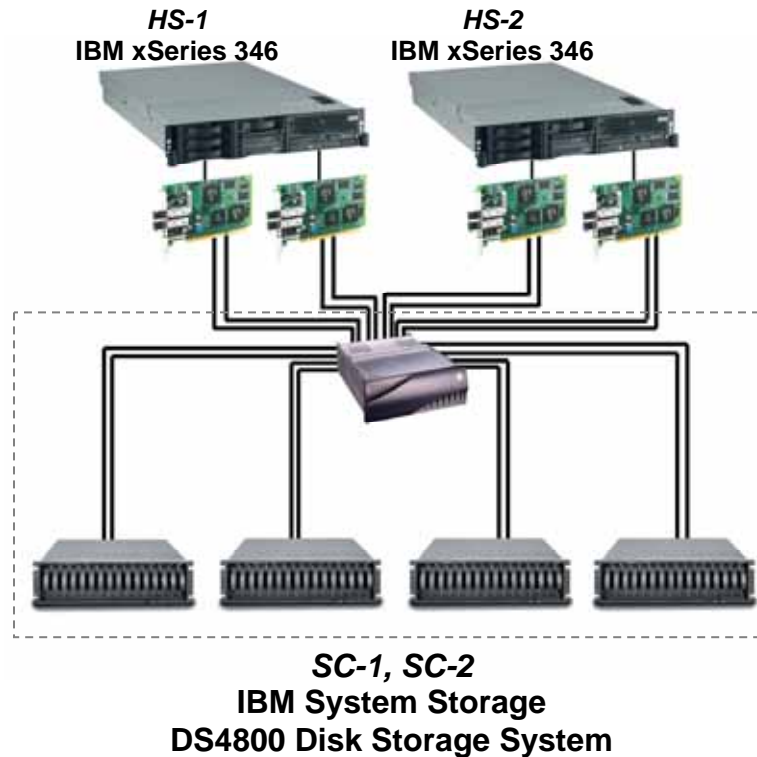
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

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 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
IBM xSeries 346

HS-2
IBM xSeries 346

SC-1, SC-2
IBM System Storage
DS4800 Disk Storage System

Host System(s) and Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
UID=HS-1	4 – QLogic 2462 HBAs
IBM xSeries 346 2 – Intel Xeon 3.4 GHz CPUs, HT enabled 1 MB L2 cache per CPU	**UID=SC-1, SC-2:** **IBM System Storage** **DS4800 Disk Storage System**
2 GB main memory	Dual active RAID Controller 2 GB RAM per controller
Windows 2003 Enterprise Edition SP1	8 – 4 Gb Fibre Channel host connections
PCI-X	8 – 4 Gb Fibre Channel drive connections
WG	4 – DS4000 EXP810 Expansion Unit
	60 – 73.4 GB, 15K RPM disk drives