SPC BENCHMARK 2™

EXECUTIVE SUMMARY

IBM CORPORATION
IBM SYSTEM STORAGE DS5300 *(RAID-5)*

SPC-2™ V1.2.1

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EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Revision Information and Key Dates

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SPC-2 Specification revision number	V1.2.1
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	September 25, 2008
Date FDR was submitted to the SPC	September 25, 2008
Date the TSC will be available for shipment to customers	September 5, 2008
Date the TSC completed audit certification	September 24, 2008

Tested Storage Product (TSP) Description

The System Storage DS5000 series disk system is IBM's midrange disk offering, specifically designed to meet the needs of midrange/departmental storage requirements, delivering high performance, advanced function, high availability, modular and scalable storage capacity, with SAN-attached 4 Gbps Fibre Channel (FC) connectivity, and support for RAID 0, 1, 3, 5, 6, and 10, with up to 256 TB physical storage capacity.

The DS5000 series represents the seventh-generation architecture within the midrange disk family.

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.

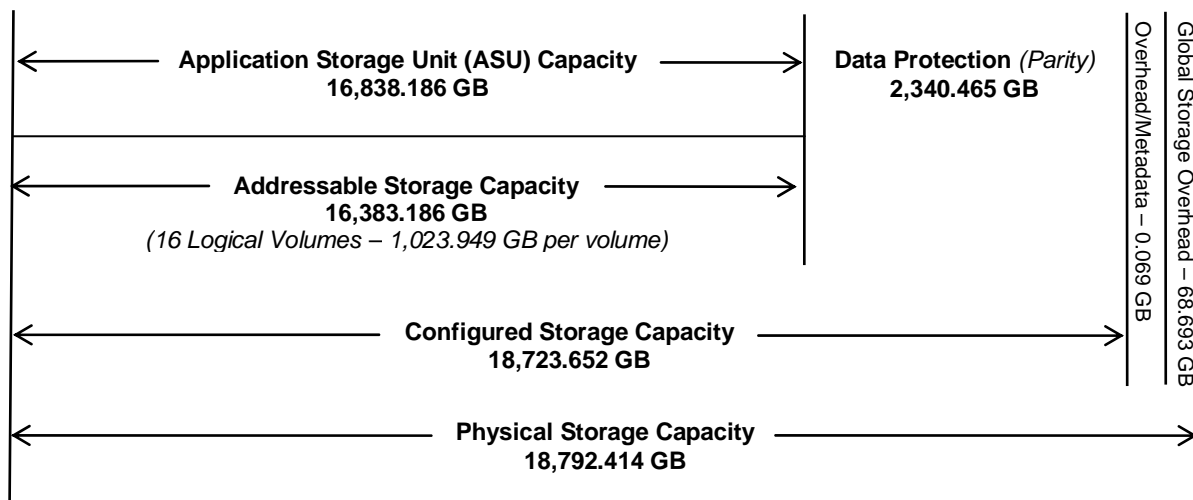| SPC-2 Reported Data				
IBM System Storage DS5300 *(RAID-5)*				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
4,818.43	$93.80	16,383.186	$451,986	RAID-5
The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: 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	4,987.30			$90.63
Write Only:				
1024 KiB Transfer	3,648.97	48	76.02	
256 KiB Transfer	3,638.54	48	75.80	
Read-Write:				
1024 KiB Transfer	4,960.35	48	103.34	
256 KiB Transfer	4,948.28	48	103.09	
Read Only:				
1024 KiB Transfer	6,368.09	48	132.67	
256 KiB Transfer	6,359.55	48	132.49	
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	5,457.17			$82.82
1024 KiB Transfer Size				
4 I/Os Outstanding	6,377.55	48	132.87	
1 I/O Outstanding	6,351.40	48	132.32	
64 KiB Transfer Size				
4 I/Os Outstanding	3,770.59	48	78.55	
1 I/O Outstanding	5,329.14	48	111.02	
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**
	4,010.82	5,100	0.79	$112.69

SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-2 benchmark.

A **Data Protection Level** of **RAID-5** provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

Storage Capacities and Relationships

The following diagram *(not to scale)* documents the various storage capacities, used in this benchmark, and their relationships.
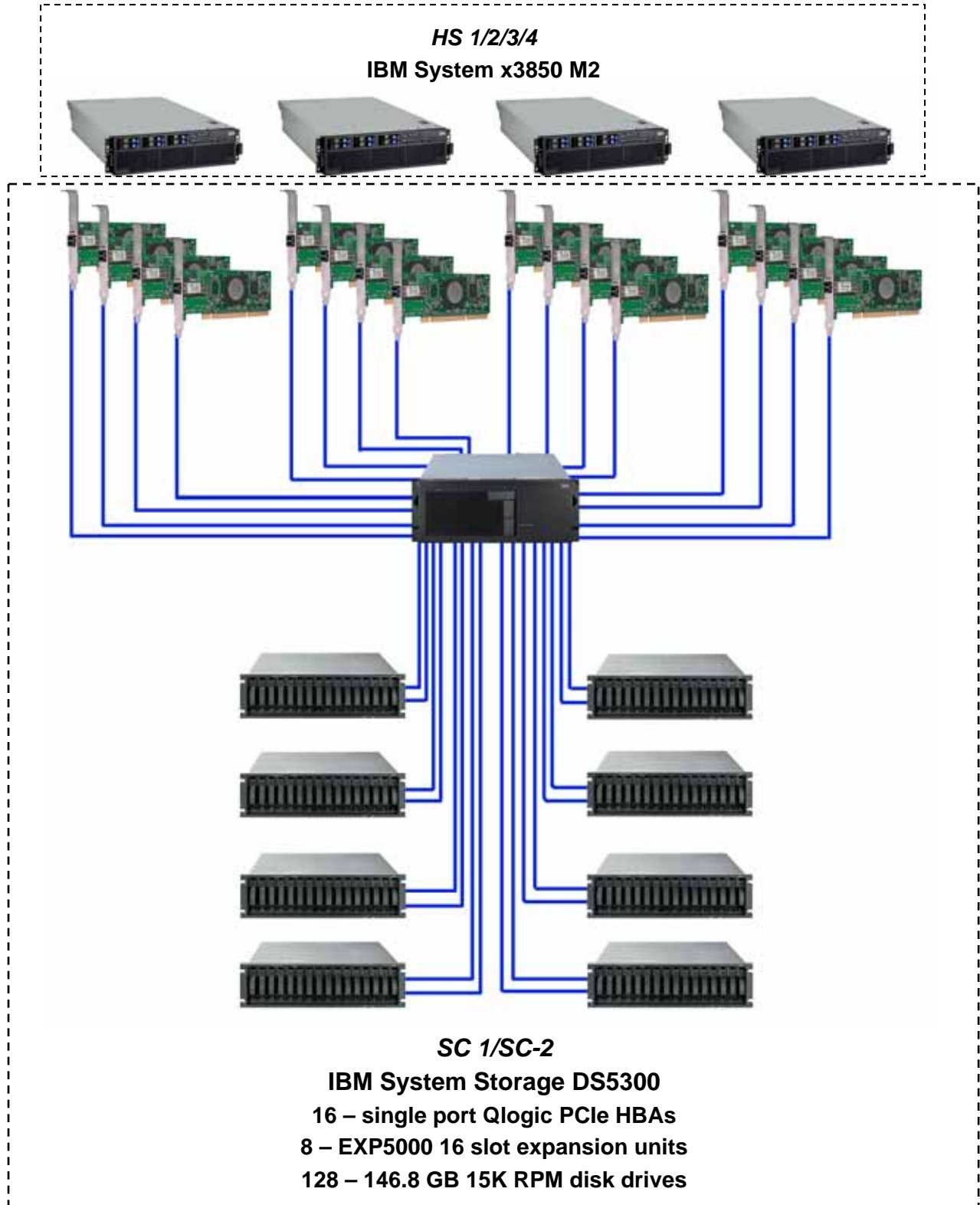
Application Storage Unit (ASU) Capacity	Data Protection (Parity)
16,838.186 GB	2,340.465 GB

Addressable Storage Capacity
16,383.186 GB
(16 Logical Volumes – 1,023.949 GB per volume)

Configured Storage Capacity
18,723.652 GB

Overhead/Metadata – 0.069 GB

Global Storage Overhead – 68.693 GB

Physical Storage Capacity
18,792.414 GB

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Model Type / Feature		Description	List Price	QTY	Extended Price
1818-53A		DS5300 Dual Controller Disk System	$80,000.00	1	$80,000.00
1818-D1A		EXP5000 16 slot Expansion unit	$6,000.00	8	$48,000.00
	2031	16GB Cache Memory	$32,000.00	1	$32,000.00
	2050	Two Quad 4 Gbps FC Host Port Cards	$10,000.00	2	$20,000.00
	2412	Short Wave 4Gbps SFP Transceiver Pair	$998.00	8	$7,984.00
	5605	5M LC-LC FIBER OPTIC CABLE	$129.00	32	$4,128.00
	7720	DS5000 WINDOWS HOST KIT	$1,250.00	1	$1,250.00
	8900	DS5000 8 STG PARTITION-IP0	$10,000.00	1	$10,000.00
	5530	16-Pak 146.8 GB/15K DDM	$22,544.00	8	$180,352.00
39R6525		single port Qlogic PCIe - 4GbFC	$1,225	16	$19,600.00
			Total List		$403,314.00
		Std warranty 1 year 24x7x4hr response		incl	
		addtl 2 years 24x7x4			$48,672
			Grand Total		**$451,986.00**

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

The only difference between the Tested Storage Configuration and Priced Storage Configuration is that the priced disk drives are mounted in an IBM drive carrier and each disk drive is configured to self-identify as a DS5000 brand. That difference, if applied to the TSC, would not have a negative impact on the reported SPC-1 performance.

Benchmark Configuration/Tested Storage Configuration Diagram

HS 1/2/3/4

IBM System x3850 M2

SC 1/SC-2

IBM System Storage DS5300

16 – single port Qlogic PCIe HBAs

8 – EXP5000 16 slot expansion units

128 – 146.8 GB 15K RPM disk drives

Host System(s) and Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
HS-1/2/3/4: IBM System x3850 M2	16 – single port Qlogic PCIe HBAs *(39R6525)*
Each Host System with:	**SC-1/SC-2: IBM System Storage DS5300**
2 – 2.93 GHz Quad Xeon Processors with 8 MB L2 cache	**2 – dual-active controllers with:**
8 GB main memory	16 GB cache
Windows Server 2003 Enterprise Edition 32-bit with SP2	2 – Two Quad 4 Gbps FC Host Port Cards 16 – 4 Gb Fibre Channel front-end connections
PCIe:	16 – 4 Gb Fibre Channel backend connection
WG	8 – EXP5000 16 slot expansion units
	128 – 146.8 GB 15K RPM disk drives