SPC BENCHMARK 2™

EXECUTIVE SUMMARY

IBM CORPORATION

IBM SYSTEM STORAGE® DS8800

SPC-2™ V1.3

Submitted for Review: December 1, 2010
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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

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SPC-2 Specification revision number	**Error! Unknown document property name.**
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	December 1, 2010
Date FDR was submitted to the SPC	December 1, 2010
Date the TSC will be available for shipment to customers	November 19, 2010
Date the TSC completed audit certification	November 24, 2010

Tested Storage Product (TSP) Description

The IBM System Storage DS8000® series encompasses the flagship disk enterprise storage products in the IBM System Storage portfolio. The DS8800 represents the latest in this series of enterprise disk storage systems designed for high-performance, high-capacity and resiliency. Major new capabilities include higher density packaging through deployment of 2.5 inch disk drives, faster disk attachment bandwidth and support for 8 Gbps fibre channel infrastructure for host attachment.

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 DS8800				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
9,705.74	$270.38	71,536.975	$2,624,257.00	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	8,985.67			$292.05
Write Only:				
1024 KiB Transfer	6,779.74	192	35.31	
256 KiB Transfer	6,725.53	192	35.03	
Read-Write:				
1024 KiB Transfer	8,536.08	192	44.46	
256 KiB Transfer	8,529.39	192	44.42	
Read Only:				
1024 KiB Transfer	11,690.25	192	60.89	
256 KiB Transfer	11,653.04	192	60.69	
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	11,480.61			$228.58
1024 KiB Transfer Size				
4 I/Os Outstanding	11,614.03	192	60.49	
1 I/O Outstanding	11,589.55	192	60.36	
64 KiB Transfer Size				
4 I/Os Outstanding	11,254.13	192	58.62	
1 I/O Outstanding	11,464.73	192	59.71	
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**
	8,650.92	11,000	0.79	$303.35

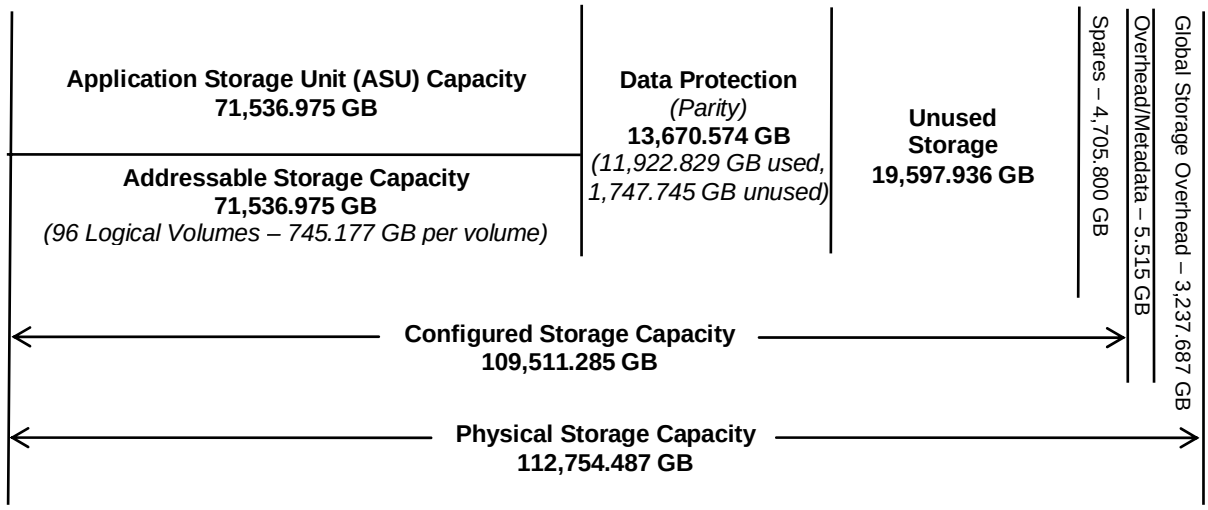
SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

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 **Protected** using ***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)* 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	63.44%
Protected Application Utilization	74.02%
Unused Storage Ratio	18.93%

Application Utilization: Total ASU Capacity *(71,536.975 GB)* divided by Physical Storage Capacity *(112,754.487 GB)*

Protected Application Utilization: (Total ASU Capacity *(71,536.975 GB)* plus total Data Protection Capacity *(13,670.574 GB)* minus unused Data Protection Capacity *(1,747.745 GB)*) divided by Physical Storage Capacity *(112,754.487 GB)*.

Unused Storage Ratio: Total Unused Capacity *(21,345.681 GB)* divided by Physical Storage Capacity *(112,754.487 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 21-22 in the Full Disclosure Report.

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

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

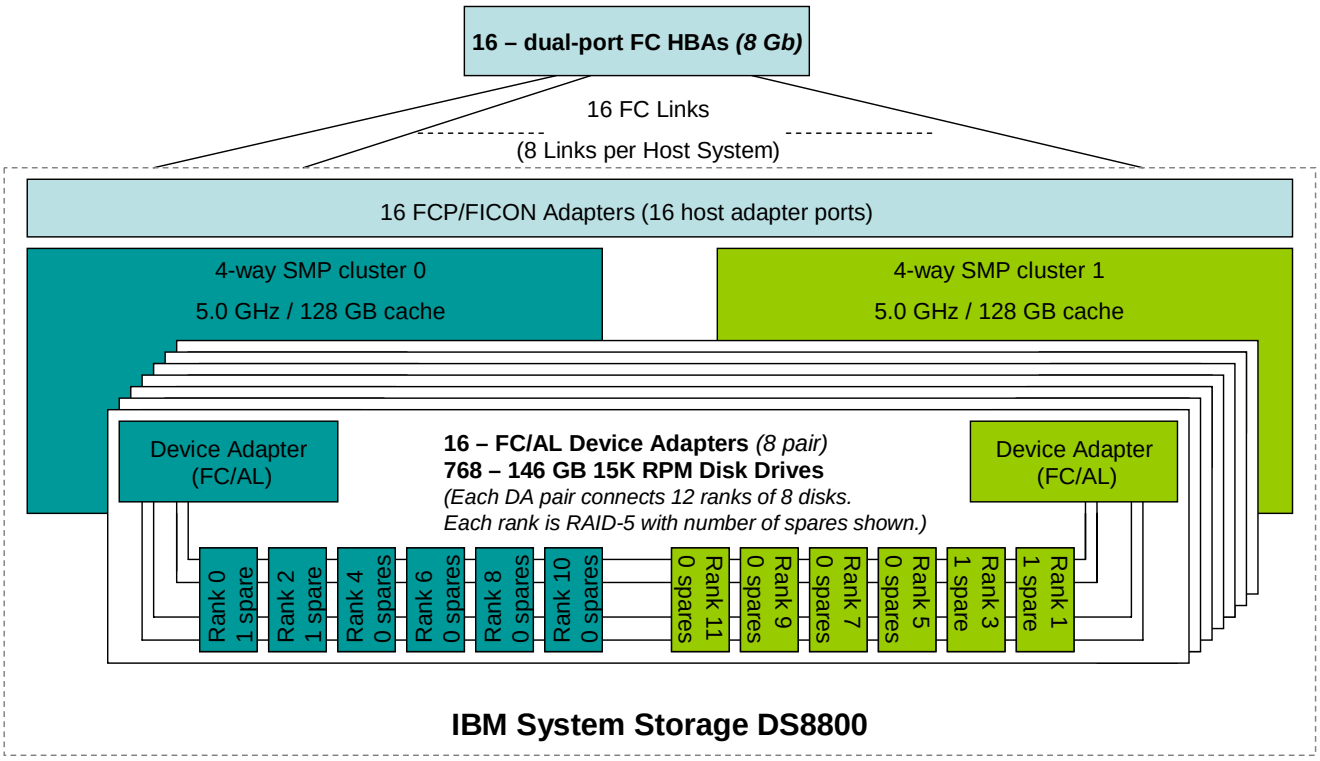
Priced Storage Configuration Pricing

The following pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.
- Standard IBM field delegation discounts.

Product	Description	Qty	List Price	Extended Price	Discount (%)	Disc. Price
2423-951	IBM System Storage DS8800	1	$ 72,419.00	$ 72,419.00	50.00%	$ 36,209.50
1	9xE factory merge	2	N/C			
100	Eligible for EU Shipment	1	N/C			
351	951 - 95E Position 1	1	N/C			
352	951 - 95E Position 2	1	N/C			
700	OEL Indicator	1	N/C			
830	100.1 to 150.0 TB capacity	1	N/C			
900	Non-Standby CoD	1	N/C			
1050	Battery Assembly	3	$ 1,700.00	$ 5,100.00	50.00%	$ 2,550.00
1090	Line Cord (US/LA/AP/Canada)	1	$ 1,900.00	$ 1,900.00	50.00%	$ 950.00
1120	Management Console - English Laptop Internal	1	$ 9,160.00	$ 9,160.00	50.00%	$ 4,580.00
1241	HD Disk Enclosure Pair	5	$ 20,000.00	$ 100,000.00	50.00%	$ 50,000.00
1246	HD Disk Drive Cable Group 1	1	$ 7,000.00	$ 7,000.00	50.00%	$ 3,500.00
1301	I/O Enclosure Pair PCIE	2	$ 11,780.00	$ 23,560.00	50.00%	$ 11,780.00
1321	PCI-E Cable Group 2	1	$ 4,100.00	$ 4,100.00	50.00%	$ 2,050.00
1410	50 um Fibre Cable (LC)	32	$ 100.00	$ 3,200.00	50.00%	$ 1,600.00
1721	DS8000 Licensed Machine Code R6.0	1	$ 40,000.00	$ 40,000.00	50.00%	$ 20,000.00
2208	146 GB 15K Drive Set, 16 disk drives per set	15	$ 46,076.00	$ 691,140.00	50.00%	$ 345,570.00
3053	Device Adapter Pair I	4	$ 15,000.00	$ 60,000.00	50.00%	$ 30,000.00
3153	8 Gb 4 port SW FCP/FICON Adapter PCIE	8	$ 37,312.00	$ 298,496.00	50.00%	$ 149,248.00
4225	256 GB Processor Memory (4-Way)	1	$ 784,640.00	$ 784,640.00	50.00%	$ 392,320.00
4302	4 Way Processor Card	1	$ 80,893.00	$ 80,893.00	50.00%	$ 40,446.50
2398-LFA	DS8000 Function Authorization	1	N/C			
7031	OEL - 1 TB	3	N/C			
7033	OEL - 10 TB	1	N/C			
7040	OEL - 100 TB	1	N/C			
7051	OEL - 1 Value Unit	1	$ 6,666.00	$ 6,666.00	40.00%	$ 3,999.60
7052	OEL - 5 Value Unit	1	$ 26,829.00	$ 26,829.00	40.00%	$ 16,097.40
7054	OEL - 25 Value Unit	1	$ 85,397.00	$ 85,397.00	40.00%	$ 51,238.20
7065	OEL - 200 Value Unit	1	$ 429,677.00	$ 429,677.00	40.00%	$ 257,806.20
2423-95E	IBM System Storage DS8800 Expansion Unit	1	$ 73,500.00	$ 73,500.00	50.00%	$ 36,750.00
1	9xE factory merge	1	N/C			
100	Eligible for EU Shipment	1	N/C			
351	951 - 95E Position 1	1	N/C			
830	100.1 to 150.0 TB capacity	1	N/C			
1050	Battery Assembly	2	$ 1,700.00	$ 3,400.00	50.00%	$ 1,700.00
1090	Line Cord (US/LA/AP/Canada)	1	$ 1,900.00	$ 1,900.00	50.00%	$ 950.00
1241	HD Disk Enclosure Pair	7	$ 20,000.00	$ 140,000.00	50.00%	$ 70,000.00
1247	HD Disk Drive Cable Group 2	1	$ 9,000.00	$ 9,000.00	50.00%	$ 4,500.00
1301	I/O Enclosure Pair PCIE	2	$ 11,780.00	$ 23,560.00	50.00%	$ 11,780.00
1322	PCIE Cable Group 3	1	$ 5,000.00	$ 5,000.00	50.00%	$ 2,500.00
1410	50 um Fibre Cable (LC)	32	$ 100.00	$ 3,200.00	50.00%	$ 1,600.00
2208	146 GB 15K Drive Set, 16 disk drives per set	21	$ 46,076.00	$ 967,596.00	50.00%	$ 483,798.00
3053	Device Adapter Pair I	4	$ 15,000.00	$ 60,000.00	50.00%	$ 30,000.00
3153	8 Gb 4 port SW FCP/FICON Adapter PCIE	8	$ 37,312.00	$ 298,496.00	50.00%	$ 149,248.00
2423-95E	IBM System Storage DS8800 Expansion Unit	1	$ 73,500.00	$ 73,500.00	50.00%	$ 36,750.00
1	9xE factory merge	1	N/C			
100	Eligible for EU Shipment	1	N/C			
352	951 - 95E Position 2	1	N/C			
830	100.1 to 150.0 TB capacity	1	N/C			
1090	Line Cord (US/LA/AP/Canada)	1	$ 1,900.00	$ 1,900.00	50.00%	$ 950.00
1241	HD Disk Enclosure Pair	4	$ 20,000.00	$ 80,000.00	50.00%	$ 40,000.00
1248	HD Disk Drive Cable Group 4	1	$ 12,000.00	$ 12,000.00	50.00%	$ 6,000.00
2208	146 GB 15K Drive Set, 16 disk drives per set	12	$ 46,076.00	$ 552,912.00	50.00%	$ 276,456.00
9117-577D	8 Gb PCI-e dual port FC	16	$ 4,583.00	$ 73,328.00	30.00%	$ 51,329.60
	Total discounted price……					**$ 2,624,257.00**

Priced Storage Configuration Diagram



Priced Configuration Components

Priced Storage Configuration:
16 – 8 Gb dual port FC PCIe HBAs
IBM System Storage DS8800: 2 – 4-way SMP processing clusters 128 GB memory/cache per cluster *(256 GB total)* 16 – 8 Gb FCP/FICON Adapters 64 – 8 Gbps FC host connections, 4 per FCP/FICON Adapter, *(16 connections used, 1 per adapter)* 16 – FC/AL Device Adapters *(8 pairs)* 64 – 8 Gbps FC backend connections, 4 per FC/AL Device Adapter *(64 connections used)*
1 – Management Console *(English laptop internal)*
2 – IBM System Storage DS8800 Expansion Units
768 – 146 GB 15K RPM FC disk drives