SPC BENCHMARK 2™

EXECUTIVE SUMMARY

IBM CORPORATION

IBM SYSTEM STORAGE DS8700

SPC-2™ V1.3

Submitted for Review: November 30, 2009

Submission Identifier: B00049

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	V1.3
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	November 30, 2009
Date FDR was submitted to the SPC	November 30, 2009
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	November 27, 2009

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 DS8700 represents the latest in this series of enterprise disk storage systems designed for high-performance, high-capacity and resiliency. Major new capabilities include IBM POWER6 Processing technology and PCI-e I/O enclosures. This submission features the performance accelerator configuration option, which supports getting high I/O throughputs when deploying a limited number of disk drives.

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 DS8700				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
7,247.02	$277.22	32,641.751	$2,009,007	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	6,597.09			$304.53
Write Only:				
1024 KiB Transfer	4,317.47	192	22.49	
256 KiB Transfer	4,344.85	192	22.63	
Read-Write:				
1024 KiB Transfer	6,142.37	192	31.99	
256 KiB Transfer	6,134.44	192	31.95	
Read Only:				
1024 KiB Transfer	9,321.63	192	48.55	
256 KiB Transfer	9,321.80	192	48.55	
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	8,538.00			$235.30
1024 KiB Transfer Size				
4 I/Os Outstanding	8,735.95	192	45.50	
1 I/O Outstanding	8,968.88	192	46.71	
64 KiB Transfer Size				
4 I/Os Outstanding	8,035.59	192	41.85	
1 I/O Outstanding	8,411.57	192	43.81	
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**
	6,605.98	8,400	0.79	$304.12

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)* documents the various storage capacities, used in this benchmark, and their relationships.
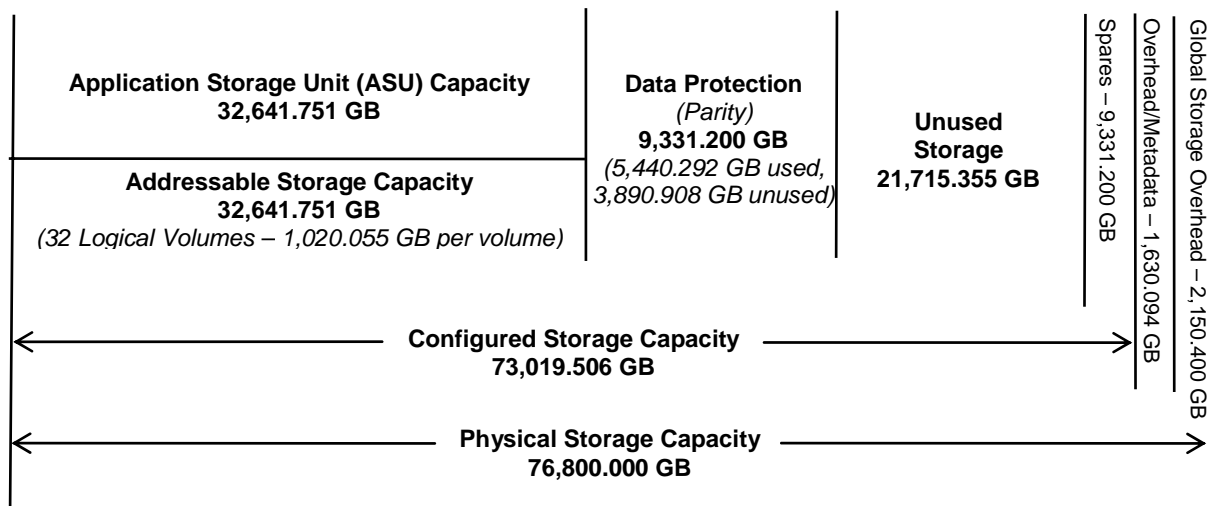
SPC-1 Storage Capacity Utilization	
Application Utilization	42.50%
Protected Application Utilization	49.59%
Unused Storage Ratio	33.34%

Application Utilization: Total ASU Capacity *(32,641.751 GB)* divided by Physical Storage Capacity *(76,800.000 GB)*

Protected Application Utilization: (Total ASU Capacity *(32,641.751 GB)* plus total Data Protection Capacity *(9,331.200 GB)* minus unused Data Protection Capacity *(3,890.908 GB)*) divided by Physical Storage Capacity *(76,800.000 GB)*

Unused Storage Ratio: Total Unused Capacity *(25,606.263 GB)* divided by Physical Storage Capacity *(76,800.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 in the Full Disclosure Report.

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

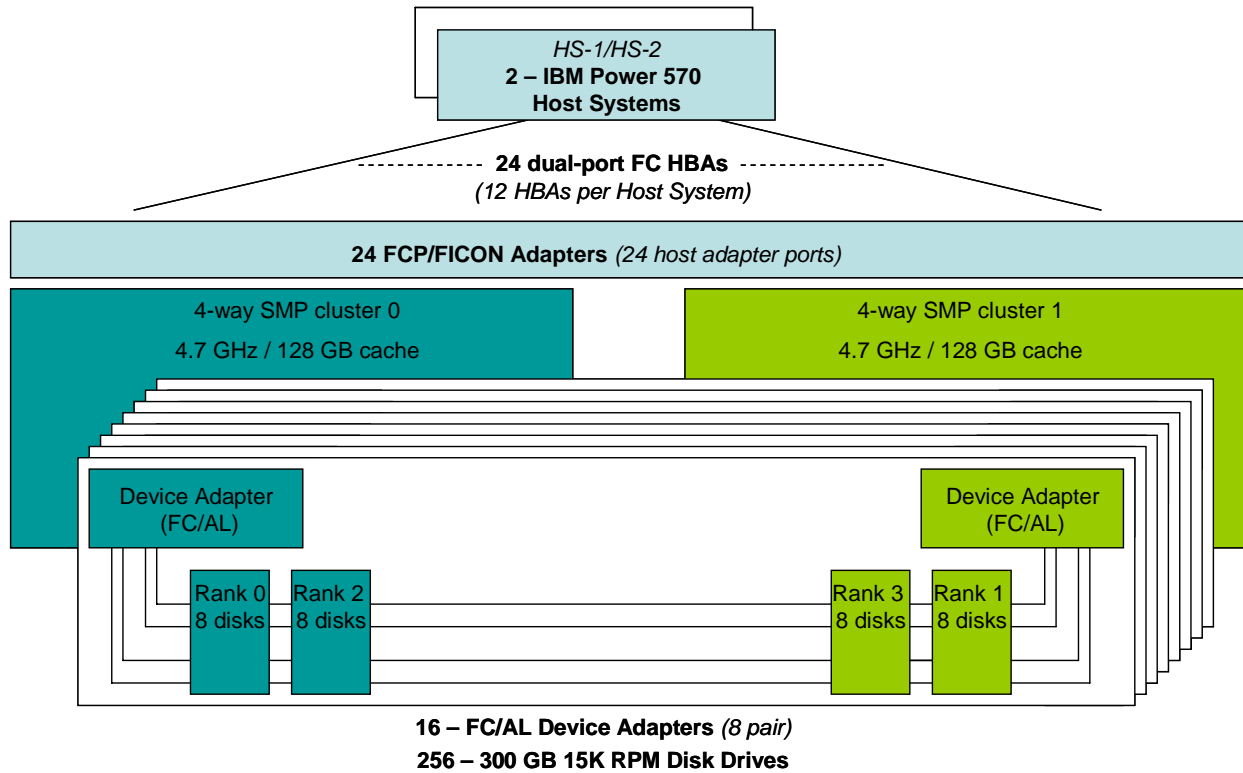There were no differences between the TSC and Priced Storage Configuration.

Tested Storage Configuration Pricing (Priced Storage Configuration)

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	Price	Extended Price	Discount (%)	Disc. Price
2423-941	System Storage DS8700	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			
	340 941 - 94E Position 1	1	N/C			
	341 941 - 92E/94E Position 2	1	N/C			
	700 OEL Indicator	1	N/C			
	825 75.1 to 100.0 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
	1210 Disk Enclosure Pair	2	$ 10,000.00	$ 20,000.00	50.00%	$ 10,000.00
	1211 Disk Drive Cable Group 1	1	$ 1,000.00	$ 1,000.00	50.00%	$ 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)	48	$ 100.00	$ 4,800.00	50.00%	$ 2,400.00
	1711 Release 5 Bundle Family	1	$ 40,000.00	$ 40,000.00	50.00%	$ 20,000.00
	1980 Performance Accelerator	1	$ 4,750.00	$ 4,750.00	50.00%	$ 2,375.00
	2416 300 GB 15K Drive Set	4	$ 87,700.00	$ 350,800.00	50.00%	$ 175,400.00
	3043 Device Adapter Pair III	4	$ 10,000.00	$ 40,000.00	50.00%	$ 20,000.00
	3143 4Gb SW FCP/FICON Adapter PCIE w/ SFPs	12	$ 33,920.00	$ 407,040.00	50.00%	$ 203,520.00
	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				
	7031 OEL - 1 TB	2	N/C			
	7034 OEL - 25 TB	1	N/C			
	7035 OEL - 50 TB	1	N/C			
	7051 OEL - 1 Value Unit	3	$ 6,666.00	$ 19,998.00	40.00%	$ 11,998.80
	7060 OEL - 100 Value Unit	1	$ 226,588.00	$ 226,588.00	40.00%	$ 135,952.80
2423-94E	System Storage DS8700 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			
	341 941 - 92E/94E Position 2	1	N/C			
	1090 Line Cord (US/LA/AP/Canada)	1	$ 1,900.00	$ 1,900.00	50.00%	$ 950.00
	1210 Disk Enclosure Pair	2	$ 10,000.00	$ 20,000.00	50.00%	$ 10,000.00
	1214 Disk Drive Cable Group 4	1	$ 2,400.00	$ 2,400.00	50.00%	$ 1,200.00
	1980 Performance Accelerator	1	$ 4,750.00	$ 4,750.00	50.00%	$ 2,375.00
	2416 300 GB 15K Drive Set	4	$ 87,700.00	$ 350,800.00	50.00%	$ 175,400.00
2423-94E	System Storage DS8700 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			
	340 941 - 94E Position 1	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
	1210 Disk Enclosure Pair	4	$ 10,000.00	$ 40,000.00	50.00%	$ 20,000.00
	1212 Disk Drive Cable Group 2	1	$ 1,900.00	$ 1,900.00	50.00%	$ 950.00
	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)	48	$ 100.00	$ 4,800.00	50.00%	$ 2,400.00
	1980 Performance Accelerator	1	$ 4,750.00	$ 4,750.00	50.00%	$ 2,375.00
	2416 300 GB 15K Drive Set	8	$ 87,700.00	$ 701,600.00	50.00%	$ 350,800.00
	3043 Device Adapter Pair III	4	$ 10,000.00	$ 40,000.00	50.00%	$ 20,000.00
	3143 4Gb SW FCP/FICON Adapter PCIE w/ SFPs	12	$ 33,920.00	$ 407,040.00	50.00%	$ 203,520.00
9117-5759	4 Gb dual port FC	14	$ 3,308.00	$ 46,312.00	30.00%	$ 32,418.40
9117-5774	4 Gb PCI-e dual port FC	10	$ 3,308.00	$ 33,080.00	30.00%	$ 23,156.00
				$ 3,936,940.00		
	Total discounted price					**$ 2,009,007.00**

Tested Storage Configuration (TSC) /Priced Storage Configuration Diagram

HS-1/HS-2
2 – IBM Power 570
Host Systems

------------ **24 dual-port FC HBAs** --------------
(12 HBAs per Host System)

24 FCP/FICON Adapters *(24 host adapter ports)*

4-way SMP cluster 0	4-way SMP cluster 1
4.7 GHz / 128 GB cache	4.7 GHz / 128 GB cache

Device Adapter (FC/AL)

Device Adapter (FC/AL)

Rank 0 8 disks   Rank 2 8 disks

Rank 3 8 disks   Rank 1 8 disks

16 – FC/AL Device Adapters *(8 pair)*
256 – 300 GB 15K RPM Disk Drives

Tested Storage Configuration (TSC)/ Priced Configuration Components

Host System:	Tested Storage Configuration (TSC)/ Priced Storage Configuration:
HS-1/HS-2: IBM Power 570	14 – 4Gb dual port FC PCIe HBAs *(9117-5774)* *(7 HBAs per Host System)*
Two identically configured Host Systems each with:	10 – 4Gb dual port FC PCI-X HBAs *(9117-5759)* *(5 HBAs per Host System)*
16 – 4.4 GHz POWER6 processors *(2 processors per dual core module)* 8 MB L2 cache per dual core module 32 MB L3 cache per dual core module	**SC-1/SC-2: IBM System Storage DS8700** 2 – processing clusters: 4-way POWER6 SMP per cluster *(dual core, 4.7 GHz)* 128 GB memory/cache per cluster *(256 GB total)* 24 – 4Gb SW FCP/FICON Adapters 24 – 4 Gbps FC host connections 16 – FC/AL Device Adapters *(8 pairs)* 32 – 4 Gbps FC backend connections *(32 active, 32 available for failover)*
96 GB main memory AIX 6.1 TL 03 PCIe, PCI-X	
	2 – IBM System Storage DS8700 Expansion Units
	256 – 300 GB 15K RPM FC disk drives