SPC BENCHMARK 2™
EXECUTIVE SUMMARY

IBM CORPORATION
IBM SYSTEM STORAGE DCS3700
(WITH PERFORMANCE MODULES)

SPC-2™ V1.4

Submitted for Review: January 17, 2013
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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	V1.4
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	January 17, 2013
Date FDR was submitted to the SPC	January 17, 2013
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	January 14, 2013

Tested Storage Product (TSP) Description

The new IBM Performance Module feature provides new controller canisters for the DCS3700 with increased processor speeds, larger cache memory capacities, and double the scalability of the original offering. Designed for use with HPC computing environments, the DCS3700 with Performance Modules increases the processing capability and storage capacity for HPC uses in the oil and gas industries, media applications, and life sciences with installation in large corporate data centers and government labs.

Each performance module brings four 8Gb Fibre Channel (FC) host ports, dual gigabit Ethernet ports, and a 6Gb SAS expansion connection to the DCS3700. A slot is available for additional host interface cards, such as a new 4 port 8Gb FC host interface card (HIC). There are three slots for DDR3 memory DIMMs in 2, 4, and 8 GB capacities, for a total of up to 6, 12, or 24 GB of memory for the canister, for a total of up to 12, 24, or 48 GB for the DCS3700 system with Performance Modules.

In addition to the increased memory scalability, the DCS37000 outfitted with performance modules will have increased scalability in drive capacity, with two 6Gb SAS ports to redundantly connect to up to five EXP3700 expansion enclosures, doubling the current number of attached disks to 360. Using the 3 TB NL SAS drive options yields over 1 PB of raw disk capacity.

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 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).

SPC-2 Price-Performance™ is the ratio of **Total Price** to **SPC-2 MBPS™**.

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

Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page on page 17 of the corresponding Full Disclosure Report.

Data Protection Level of **Protected 2** using ***RAID-6***, which provides double-parity RAID protection against data loss.

> ***Protected 2:*** *The single point of failure of any* ***component*** *in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.*

Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-2 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency).*

The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

SPC-2 Reported Data				
IBM System Storage DCS3700 *(with Performance Modules)*				
SPC-2 MBPS™	**SPC-2 Price-Performance™**	**Total Price**	**ASU Capacity (GB)**	**Data Protection Level**
4,018.59	$34.96	$140,474.00	14,374.215	Protected 2 *(RAID-6)*
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)				
Currency Used: U.S. Dollars		**Target Country:** USA		

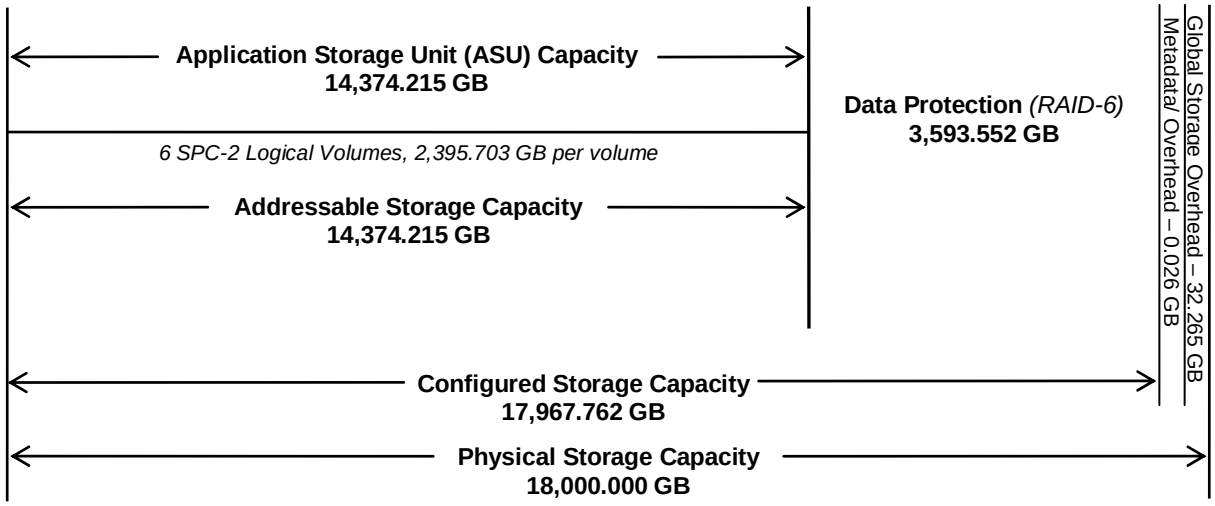
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	4,216.33			$3.41
Write Only:				
1024 KiB Transfer	2,930.31	48	61.05	
256 KiB Transfer	2,853.08	48	59.44	
Read-Write:				
1024 KiB Transfer	4,083.59	48	85.07	
256 KiB Transfer	4,161.85	48	86.71	
Read Only:				
1024 KiB Transfer	5,752.38	48	119.84	
256 KiB Transfer	5,516.80	48	114.93	
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	5,165.56			$2.78
1024 KiB Transfer Size				
4 I/Os Outstanding	5,829.90	48	121.46	
1 I/O Outstanding	5,793.68	48	120.70	
64 KiB Transfer Size				
4 I/Os Outstanding	4,050.95	48	84.39	
1 I/O Outstanding	4,987.70	48	103.91	
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**
	2,673.89	3,400	0.79	$5.38

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	79.86%
Protected Application Utilization	99.82%
Unused Storage Ratio	0.00%

Application Utilization: Total ASU Capacity *(14,374.215 GB)* divided by Physical Storage Capacity *(18,000.000 GB)*

Protected Application Utilization: Total ASU Capacity *(14,374.215 GB)* plus total Data Protection Capacity *(3,593.552GB)* minus unused Data Protection Capacity *(0.000 GB)* divided by Physical Storage Capacity *(18,000.000 GB)*.

Unused Storage Ratio: Total Unused Capacity *(0.000 GB)* divided by Physical Storage Capacity *(18,000.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 23-24 in the Full Disclosure Report.

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

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

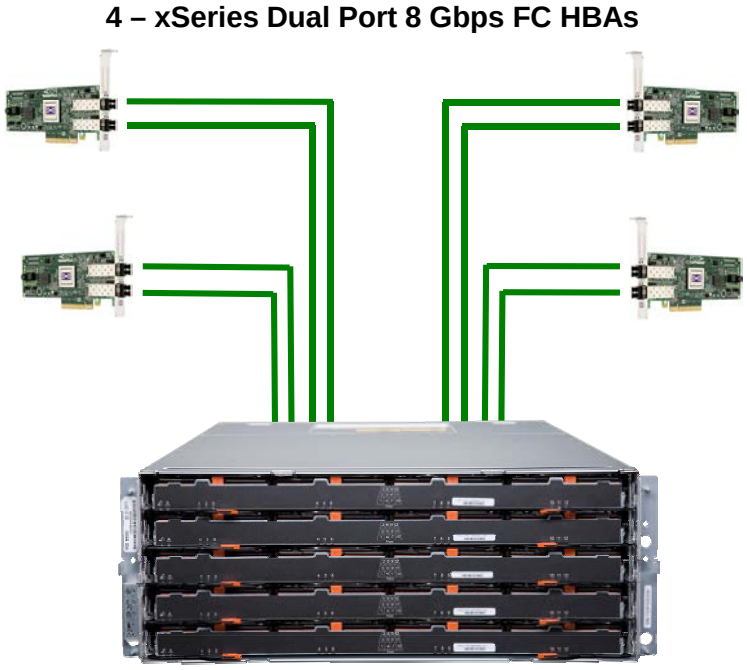
Priced Storage Configuration Pricing

Product	Description	Qty	Unit Price	Ext. Price
1818-80C	DCS3700 Storage System	1	$41,990.00	$41,990.00
3100	Performance Module Controller pair	1	$34,000.00	$34,000.00
3110	12GB Cache each PM Controller	1	incl.	
5601	1m Fiber Cable (LC-LC)	8	$79.00	$632.00
3400	300GB 15K SAS HDD 10 Pack	6	$7,760.00	$46,560.00
42D0494	xSeries Dual Port 8 Gbps FC HBA	4	$1,623.00	$6,492.00
	1 year warranty 24x7x4hr response		incl.	
	monthly maint 24x7x4hr	24	$450.00	$10,800.00
	Total price			**$140,474.00**

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.

Priced Storage Configuration Diagram



Priced Configuration Components

Priced Storage Configuration:
4 – xSeries Dual Port 8 Gbps FC HBAs
DS Storage Manager
IBM System Storage DCS3700 *(with Performance Modules)* Dual-Active Controllers with: 24 GB cache , 12 GB per controller 8 – 8 Gb FC host ports, 4 ports per controller 4 – 6 Gb SAS connections, 2 per controller 60 – 300 GB, 2.5", 15K RPM SAS disk drives