



**SPC BENCHMARK 2<sup>TM</sup>  
EXECUTIVE SUMMARY**

**IBM CORPORATION  
IBM SYSTEM STORAGE  
DS4700 EXPRESS MODEL 70 (RAID-6)**

**SPC-2<sup>TM</sup> V1.2.1**

**Submitted for Review: April 1, 2008  
Submission Identifier: B00029**

**EXECUTIVE SUMMARY****Test Sponsor and Contact Information**

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**Revision Information and Key Dates**

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<b>SPC-2 Specification revision number</b>	V1.2.1
<b>SPC-2 Workload Generator revision number</b>	spc2rc9g
<b>Date Results were first used publicly</b>	April 1, 2008
<b>Date FDR was submitted to the SPC</b>	April 1, 2008
<b>Date the TSC will be available for shipment to customers</b>	currently available
<b>Date the TSC completed audit certification</b>	March 31, 2008

## **Tested Storage Product (TSP) Description**

IBM System Storage DS4700 Express models 70 and 72 are members of the DS4000 series storage products that address the needs of midrange and departmental storage requirements. They are designed to deliver high performance with advanced function and high availability. These models employ sixth-generation architecture that delivers 4 Gbps FC connectivity directly to host servers, SAN fabric, and disk drive expansion enclosures.

DS4700 Express models provides end-to-end 4 Gbps support when using the new System p5 single-and dual-port 4 Gbps Fibre Channel HBAs available in both AIX 5L and Linux on POWER. The combination of System p5 and DS4700 Express can help maximize your infrastructure investment.

DS4700 Express models come in compact, 3U rack-mountable enclosures that contain dual intelligent, high-performance RAID controllers. They can accommodate up to 16 E-DDMs for up to 12 TB internal physical storage capacity. Model 70 comes with 2 GB of cache memory (1 GB per controller), while model 72 comes with 4 GB cache (2 GB per controller).

DS4700 Express models support disk arrays organized as RAID-10 (mirrored+striped), RAID-5 and RAID-6. Disk arrays with RAID-6 provide simultaneous drive failure protection. RAID 6 stripes both user data and redundancy data (parity) across the drives. RAID 6 uses the equivalent of the capacity of two drives (in a volume group) for redundancy data. RAID 6 protects against simultaneous failure of two volume group member drives by using two independent error-correction schemes.

## 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 DS4700 Express Model 70 (Other Data Protection: RAID-6)				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
802.61	\$130.51	1,748.874	\$104,747	Other Data Protection: RAID-6
<i>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)</i>				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	628.82			\$166.58
Write Only:				
1024 KiB Transfer	475.17	32	14.85	
256 KiB Transfer	235.71	32	7.37	
Read-Write:				
1024 KiB Transfer	767.51	32	23.98	
256 KiB Transfer	355.92	32	11.12	
Read Only:				
1024 KiB Transfer	973.03	32	30.41	
256 KiB Transfer	965.55	32	30.17	
<i>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).</i>				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	890.35			\$117.65
1024 KiB Transfer Size				
4 I/Os Outstanding	952.16	32	29.75	
1 I/O Outstanding	943.33	32	29.48	
64 KiB Transfer Size				
4 I/Os Outstanding	926.61	32	28.96	
1 I/O Outstanding	739.30	32	23.10	
<i>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).</i>				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	888.68	1,130	0.79	\$117.87

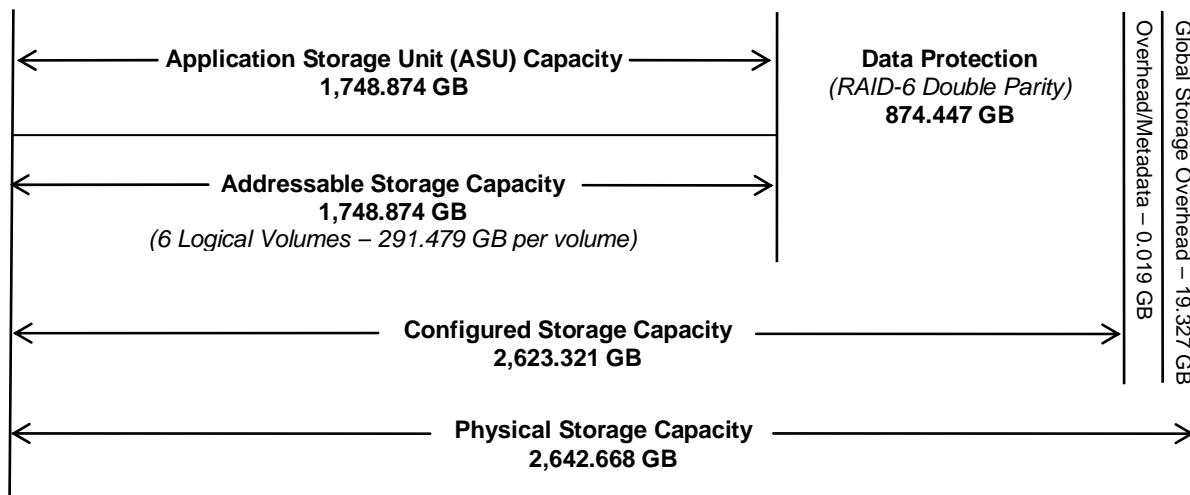
**SPC-2 MBPS™** represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

**ASU (Application Storage Unit) Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 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 documents the various storage capacities, used in this benchmark, and their relationships.



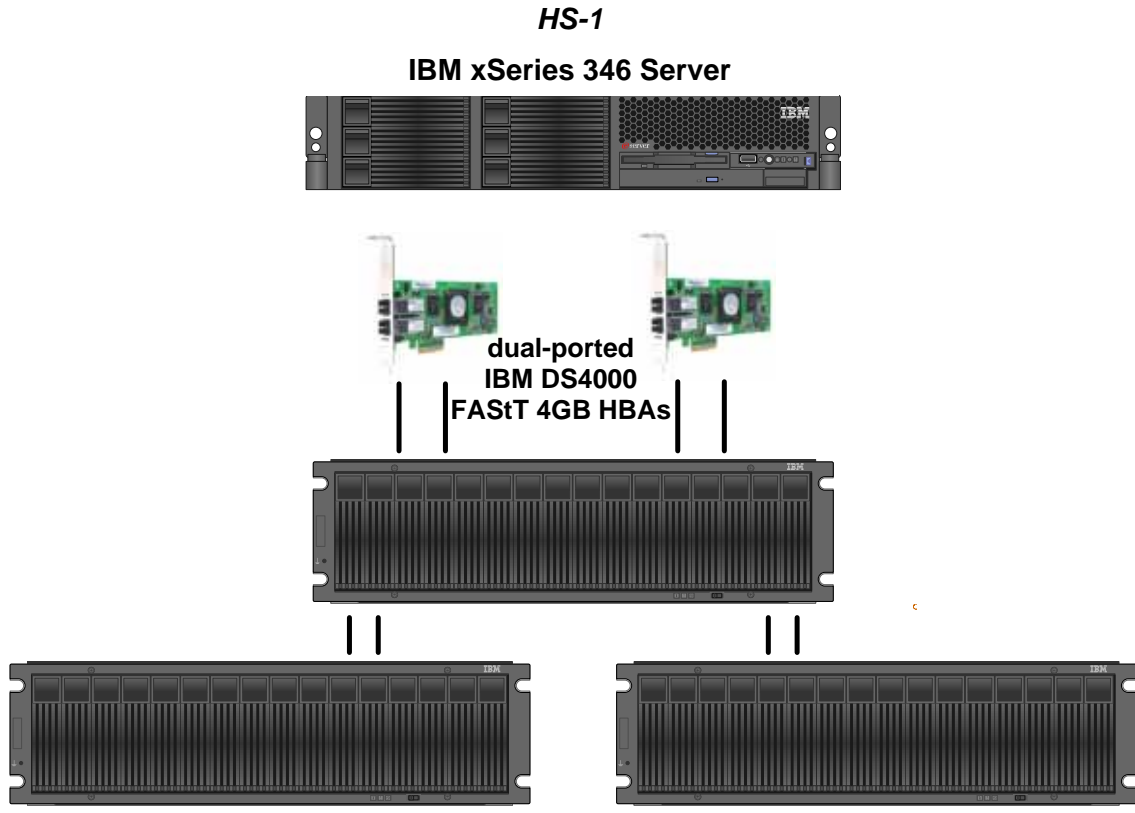
**Tested Storage Configuration Pricing (*Priced Storage Configuration*)**

Product	Quantity	List Price each	extended list price
IBM DS4700 Express Model 70 (equiv to 3992)	1	\$19,449 (2 GB cache, 1 GB per Cntrlr.+Windows Host Kit and 2 Storage Partitions)	\$19,449
EXP810 (equiv to FC4600)	2	\$6,000	\$12,000
Expansion license 1-3 EXP810's	1	\$7,600	\$7,600
39M5894 HBA's (equiv to QLA 2462)	2	\$2,485	\$4,970
73.4 GB x15K RPM disk drives	36	\$1,301	\$46,836
1m Fiber Optic Cable LC-LC	8	\$79	\$632
annual 24x7x4hr upgrade	3	\$4,420	\$13,260
<b>total</b>			<b>\$104,747</b>

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

The difference between the Tested Storage Configuration and Priced Storage Configuration is that each priced disk drive is mounted in an IBM drive carrier and is configured to self-identify as a DS4000 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



## Host System(s) and Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
<b>HS-1: IBM xSeries 346 Server</b>	2 – IBM DS4000/FAStT 4Gb Dual HBAs
2 – 3.4 GHz Xeon CPUs with 1 MB L2 cache per CPU	<b>SC-1/SC-2: IBM System Storage DS4700</b> 2 – dual-active controllers each with: 1 GB cache 2 – 4 Gb Fibre Channel host connections (4 total, 4 used) 2 – 4 Gb Fibre Channel drive connections (4 total, 2 used)
2 GB main memory	
Windows Server 2003 Enterprise Edition with SP1	
PCI-X	
WG:	
	2 – EXP810 expansion units
	36 – 73 GB 15K RPM disk drives