



**SPC BENCHMARK 2™  
EXECUTIVE SUMMARY**

**IBM CORPORATION  
IBM SYSTEM STORAGE  
SAN VOLUME CONTROLLER**

**SPC-2™ V1.2.1**

**Submitted for Review: July 12, 2007  
Submission Identifier: B00024**

**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>	July 12, 2007
<b>Date FDR was submitted to the SPC</b>	July 12, 2007
<b>Date the TSC will be available for shipment to customers</b>	currently available
<b>Date the TSC completed audit certification</b>	July 11, 2007

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

The IBM System Storage SAN Volume Controller (SVC) enables a single point of control for disparate, heterogeneous storage resources to help support improved business application availability and greater resource utilization. SAN Volume Controller is designed to pool storage volumes from IBM and non-IBM storage systems into a single reservoir of capacity for centralized management.

SAN Volume Controller combines hardware and software into an integrated, modular solution. Using IBM System x™ server technology in clustered pairs, SAN Volume Controller is designed to avoid potential single points of failure. SAN Volume Controller software is designed to operate as a highly available cluster supporting high performance and ease of use.

SAN Volume Controller is highly scalable. An “I/O Group” is formed by combining a redundant pair of System x servers. Each server includes a four-port 4 Gbps-capable host bus adapter (HBA), designed to allow the SAN Volume Controller to connect and operate at up to 4 Gbps SAN fabric speed. Each I/O Group contains 8 GB of mirrored cache memory. Highly available I/O Groups are the basic configuration element of a SAN Volume Controller cluster. Adding I/O Groups to the cluster is designed to increase cluster performance and bandwidth.

SAN Volume Controller can scale out to support four I/O Groups, and it can scale up to support 1024 host servers. For every cluster, SAN Volume Controller support up to 4096 virtual disks.

## SPC-2 Reported Data

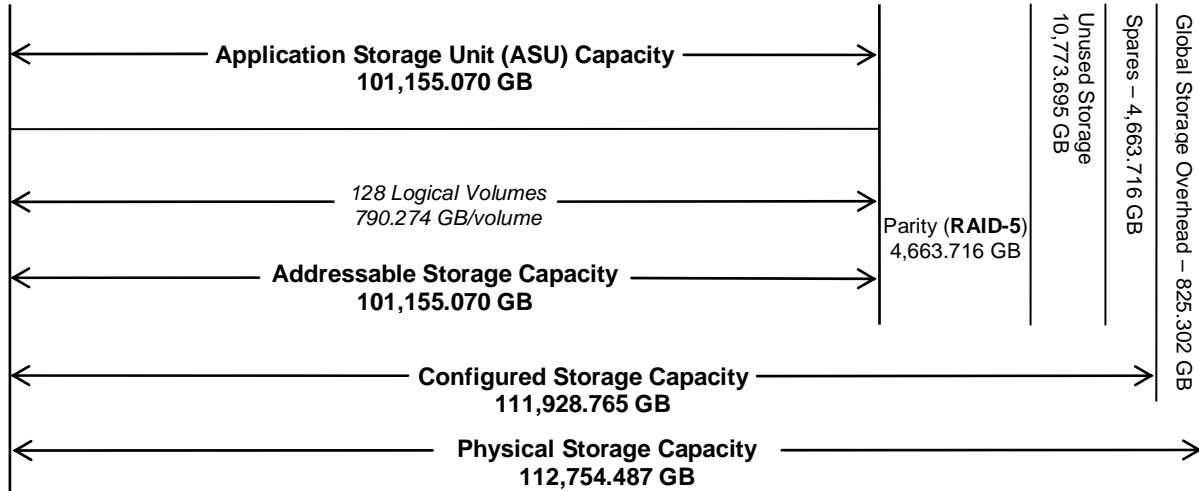
SPC-2 Reported Data consists of three groups of information:

- 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 SAN Volume Controller 4.2				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
7,084.44	\$463.66	101,155.070	\$3,284,767	RAID-5
<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	6,489.75			\$506.15
Write Only:				
1024 KiB Transfer	4,030.87	128	31.49	
256 KiB Transfer	3,956.28	128	30.91	
Read-Write:				
1024 KiB Transfer	5,321.88	128	41.58	
256 KiB Transfer	5,404.57	128	42.22	
Read Only:				
1024 KiB Transfer	10,249.02	256	40.04	
256 KiB Transfer	9,975.89	256	38.97	
<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	9,651.75			\$340.33
1024 KiB Transfer Size				
4 I/Os Outstanding	9,513.75	256	37.16	
1 I/O Outstanding	10,005.11	256	39.08	
64 KiB Transfer Size				
4 I/Os Outstanding	9,647.76	256	37.69	
1 I/O Outstanding	9,440.40	256	36.88	
<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
	5,111.80	6,500	0.79	\$642.59

### 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*)**

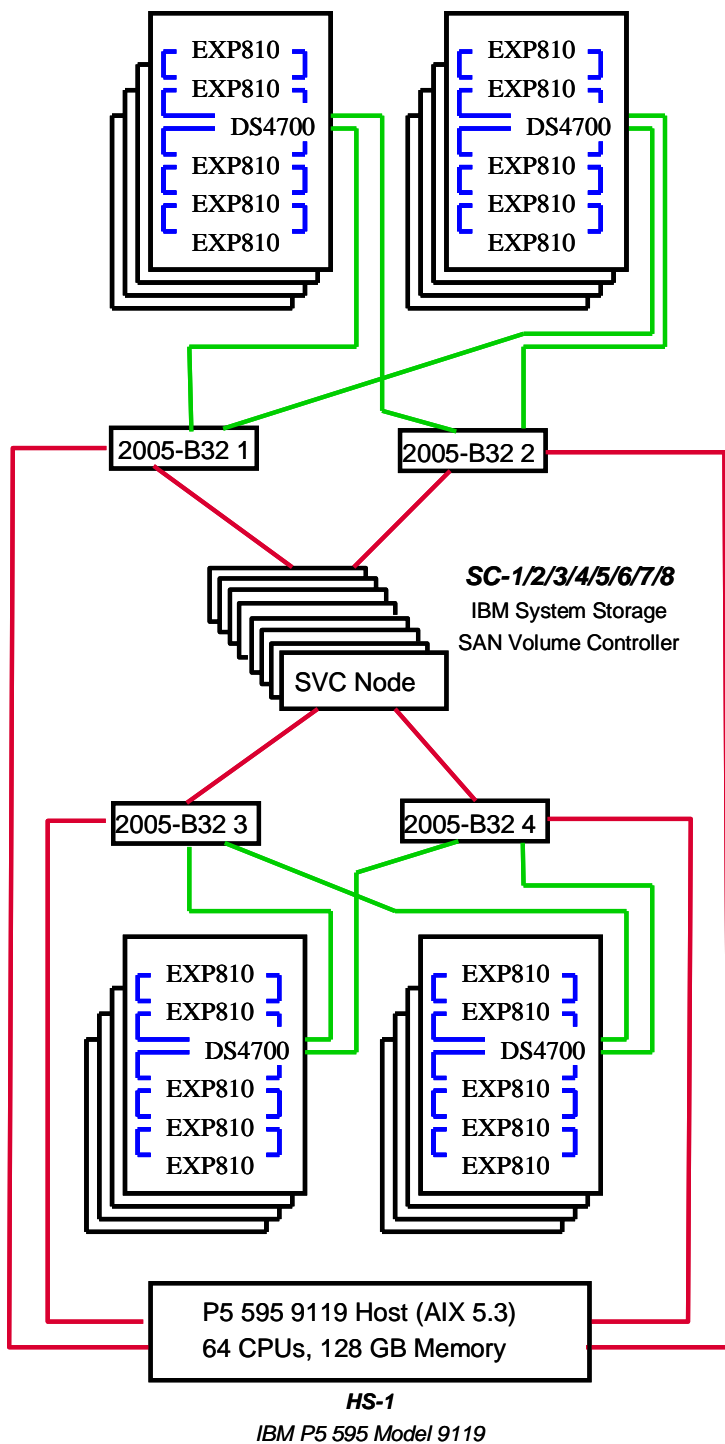
<b>Component</b>	<b>Comments</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Unit Maint</b>	<b>List w/ Maint</b>	<b>% discount</b>	<b>Total Price</b>
SVC 3550 Storage Engine		8	16,500.00	6,696.00	185,568.00	30	129,897.60
UPS		8	1,250.00	2,592.00	30,736.00	30	21,515.20
Master Console		1	7,499.00	3,816.00	11,315.00	30	7,920.50
SVC Software license	up to 100 virtualized TB	1	332,000.00	132,800.00	464,800.00	30	325,360.00
19 inch rack (7014-T42)		9	3,970.00	1,512.00	49,338.00	50	24,669.00
32 port fibre channel switch (2005-B32)	w/ 32 SFP, 32 ports enabled	4	38,573.00	2,657.00	164,920.00	20	131,936.00
DS 4700 with 16 15K RPM drives (73 GB)	w/ 4 SFP, 2 5m cables	16	43,563	13,950	920,208.00	37	579,731.04
EXP810 with 16 15K RPM drives (73 GB)	w/ 4 SFP, 2 1m cables	80	33,862	5,640	3,160,160.00	37	1,990,900.80
Ethernet switch (73P-2413)		2	135.99	30.00	331.98	42	192.55
Short wave fibre channel cable (5 m)		32	129		4,128.00	20	3,302.40
Short wave fibre channel cable (25 m)		32	189		6,048.00	20	4,838.40
Ethernet cable (7 feet)		8	6.99		55.92	0	55.92
Ethernet cable (25 feet)		32	14.99		479.68	0	479.68
4 Gbit P5 595 adapter (5758)		32	1,999.00		63,968.00	0	63,968.00
<b>Total Price</b>							<b>3,284,767.09</b>

The above pricing provides maintenance/support for 24 hours per day, 7 days per week for three years with four hour acknowledgement and four hour subsequent response (support engineer onsite or customer replaceable part available).

### **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.

### Benchmark Configuration/Tested Storage Configuration Diagram



Notes:

All storage is managed by each node (single image).

Each EXP810 and DS4700 has 16 disks (total of 1536). Disks are 73 GB, 15K RPM.

Each switch has one zone for node-to-storage traffic, two zones for node-to-host traffic (even nodes to half of fcs's, odd nodes to half of fcs's).

- Represents 1 FC path per line drawn
- Represents 4 FC paths per line drawn
- Represents 8 FC paths per line drawn

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

Host Systems:	Tested Storage Configuration (TSC):	
<i>UID=HS-1</i>	32 – 4 Gbit P5 595 HBAs	
IBM P5 595 Model 9119	<b><i>UID=SC-1/2/3/4/5/6/7/8:</i></b> 8 – TotalStorage® SAN Volume Controllers per controller: 2 – 2.333 GHz Intel Xeon Dual-Core CPUs 864 MiB data cache 160 MiB processor cache 4 – 4 Gbit FC ports	
64 – 1.9 GHz CPUs – 2 CPUs/POWER5 chip 32 KB L1 cache, 960 KB L2 cache, and 18 MB L3 cache per CPU		
128 GB main memory		
AIX 5.3		
PCI-X/RIO		4 – 32 port FC switches
WG		2 – Ethernet switch
	16 – DS4700 enclosures	
	80 – EXP810 enclosures	
	16 – 73 GB, 15K RPM disk drives per enclosure	
	9 – 19 inch racks	
	8 – UPS	