SPC BENCHMARK 2™

EXECUTIVE SUMMARY

IBM CORPORATION
IBM TOTALSTORAGE® SAN VOLUME CONTROLLER 3.1

SPC-2™ V1.0

Submitted for Review: December 14, 2005

Submission Identifier: B00001

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

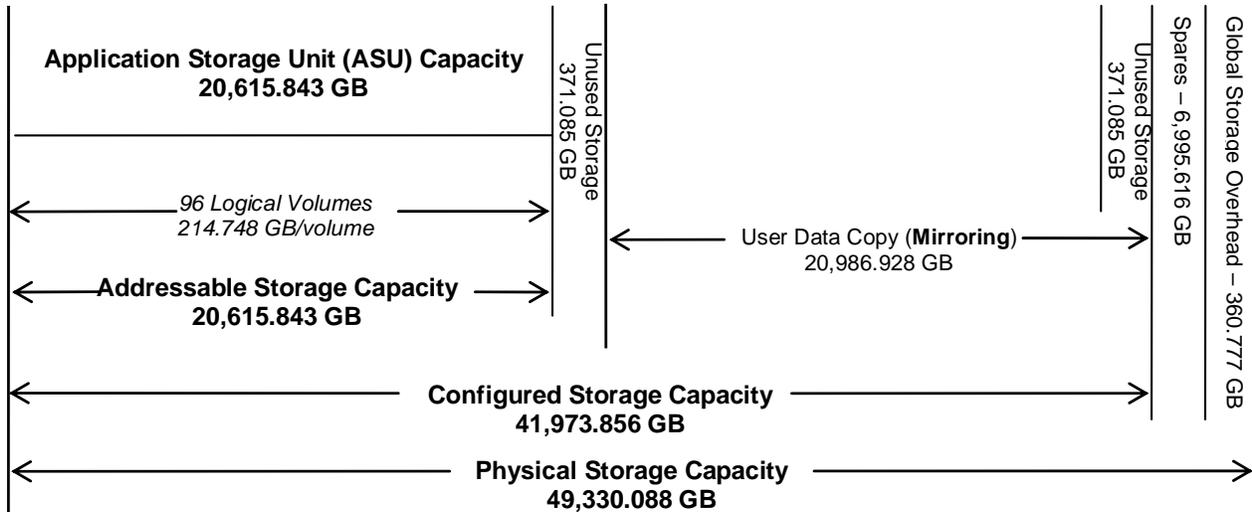| Revision Information and Key Dates	
SPC-2 Specification revision number	V1.0
SPC-2 Workload Generator revision number	spc2rc8j
Date Results were first used publicly	December 14, 2005
Date FDR was submitted to the SPC	December 14, 2005
Date the TSC will be available for shipment to customers	November 18, 2005
Date the TSC completed audit certification	December 5 2005

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 TotalStorage™ SAN Volume Controller 3.1				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
3,517.75	$563.93	20,615.843	$1,983,784.74	Mirroring
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	2,707.28			$732.76
Write Only:				
1024 KiB Transfer	1,295.21	96	13.49	
256 KiB Transfer	1,414.87	96	14.74	
Read-Write:				
1024 KiB Transfer	2,366.74	96	24.65	
256 KiB Transfer	2,502.02	96	26.06	
Read Only:				
1024 KiB Transfer	4,259.25	96	44.37	
256 KiB Transfer	4,405.58	96	45.89	
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	4,385.76			$452.32
1024 KiB Transfer Size				
4 I/Os Outstanding	4,257.44	96	44.35	
1 I/O Outstanding	4,394.06	96	45.77	
64 KiB Transfer Size				
4 I/Os Outstanding	4,455.87	96	46.42	
1 I/O Outstanding	4,435.66	96	46.20	
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**
	3,460.23	4,400	0.79	$573.31

Storage Capacities and Relationships

The following diagram documents the various storage capacities, used in this benchmark, and their relationships.


Application Storage Unit (ASU) Capacity
20,615.843 GB

Unused Storage 371.085 GB

96 Logical Volumes
214.748 GB/volume

User Data Copy (**Mirroring**)
20,986.928 GB

Unused Storage 371.085 GB

Spares – 6,995.616 GB

Global Storage Overhead – 360.777 GB

Addressable Storage Capacity
20,615.843 GB

Configured Storage Capacity
41,973.856 GB

Physical Storage Capacity
49,330.088 GB

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Component	Comments	Quantity	Unit Price	Unit Maint	List w/ Maint	% discount	Total Price
SVC Storage Engine		8	13,750.00	3,564.00	138,512.00	30	96,958.40
UPS		8	1,250.00	2,268.00	28,144.00	30	19,700.80
Master Console		1	7,499.00	3,312.00	10,811.00	30	7,567.70
SVC Software license	up to 48 virtualized TB	1	212,000.00	84,800.00	296,800.00	10	267,120.00
19 inch rack (7014-T42)		5	8,660.00	888.00	47,740.00	50	23,870.00
32 port fibre channel switch (2005-B32)	32 of 32 ports enabled	4	36,475.00	4,200.00	162,700.00	20	130,160.00
Ethernet switch (22P-8743)		3	380.00	100.00	1,440.00	42	835.20
DS4300 with 14 15K RPM drives (73 GB)	w/ 6 SFP, 4 5m cables	24	47,895.00	2,499.00	1,209,456.00	37	761,957.28
EXP710 with 14 15K RPM drives (73 GB)	w/ 4 SFP, 2 1m cables	24	37,640.00	760.00	921,600.00	37	580,608.00
SFP (4 pack)		4	550.00		2,200.00	20	1,760.00
Short wave 2Gbit fibre channel cable (25 m)		32	210.00		6,720.00	20	5,376.00
Ethernet cable (7 feet)		16	6.99		111.84	0	111.84
Ethernet cable (25 feet)		48	14.99		719.52	0	719.52
2 Gbit P5 595 adapter (5716)		32	2,720.00		87,040.00	0	87,040.00

Total Price   **$ 1,983,784.74**

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

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

Benchmark Configuration/Tested Storage Configuration Diagram
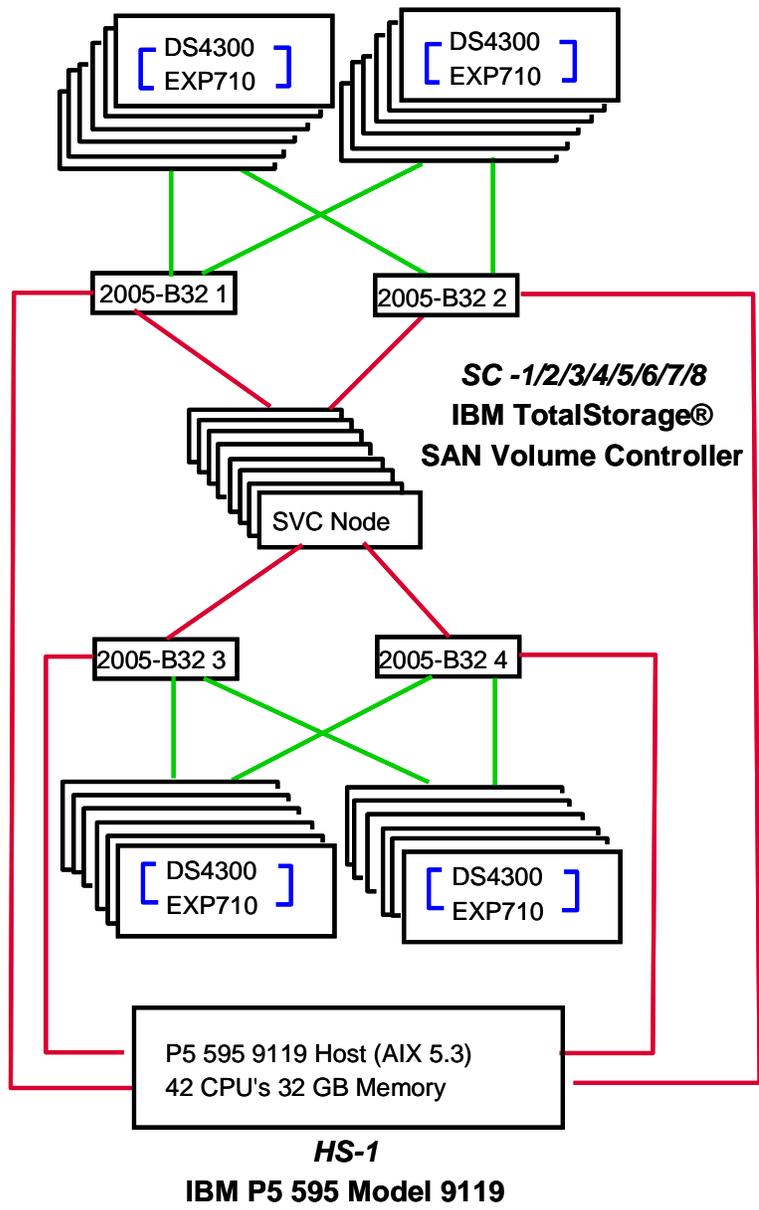
Notes:

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

Each DS4300 and EXP710 has 14 disks (total of 672). 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 even fcs's, odd nodes to odd fcs's).

1 FC path per line drawn
6 FC paths per line drawn
8 FC paths per line drawn

Host System(s) and Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC):
UID=HS-1	32 – 2 Gbit P5 595 HBAs
IBM P5 595 Model 9119	*UID=SC-1/2/3/4/5/6/7/8:* 8 – TotalStorage® SAN Volume Controllers Per controller:

42 – 1.9 GHz CPUs – 2 CPUs/POWER5 chip
    32 KB L1 cache, 960 KB L2 cache,
    and 18 MB L3 cache per CPU
	xSeries 335 processor which contains:
	    2 – 3.0 GHz Intel P4 CPUs
	8 GB memory/cache

32 GB main memory	4 – 2 Gbit FC ports
AIX 5.3	
PCI-X/RIO	4 – 32 port FC switches
WG	3 – Ethernet switch
	24 – DS4300 enclosures 24 – EXP710 enclosures 14 – 73 GB, 15K RPM disk drives per enclosure
	5 – 19 inch racks
	8 – UPS