



**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**

| Test Sponsor and Contact Information | |
|---|--|
| Test Sponsor Primary Contact | IBM Corporation – http://www.ibm.com Peter Leung – leungp@us.ibm.com 65S/9062-2 9000 South Rita Road Tucson, AZ 85744 Phone: (520) 799-2853 FAX: (520) 799-5530 |
| Test Sponsor Alternate Contact | IBM Corporation – http://www.ibm.com Bruce McNutt – bmcnutt@us.ibm.com KBV/9062-2 9000 South Rita Road Tucson, AZ 85744 Phone: (520) 799-2460 FAX: (520) 799-5530 |
| 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

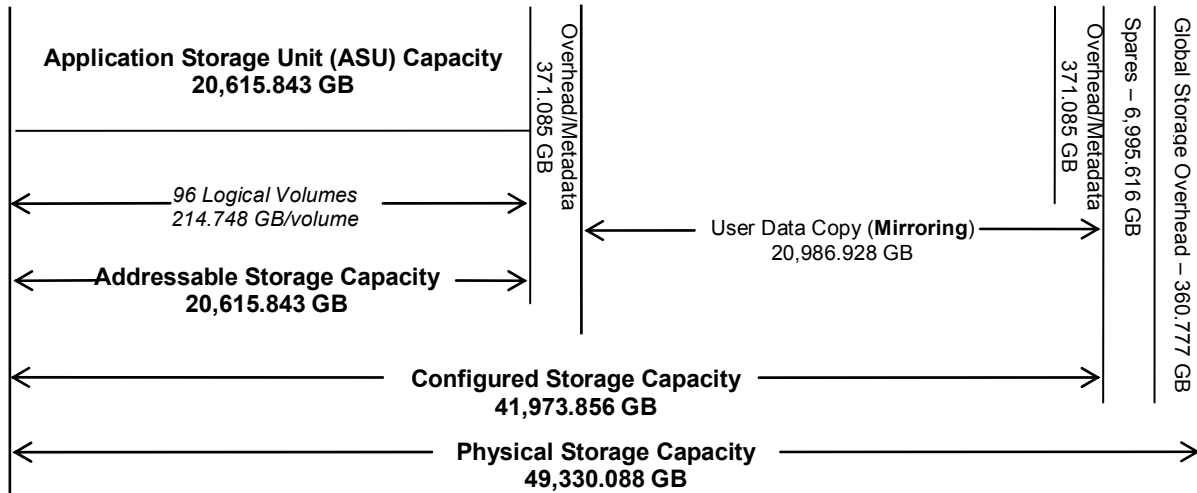
SPC-2 Reported Data consists of three groups of information:

- 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 |
| <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 | 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 | |
| <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 | 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 | |
| <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 |
| | 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.



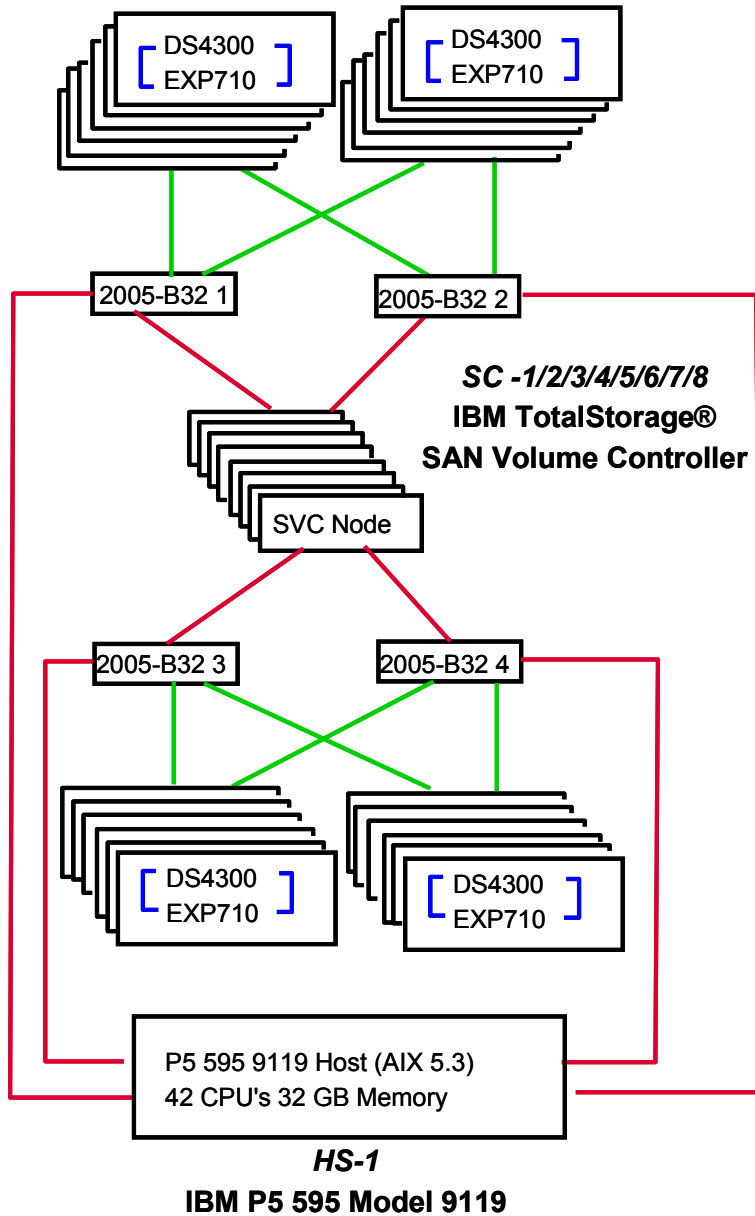
Tested Storage Configuration Pricing (*Priced Storage Configuration*)

| 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 zones 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: |
| 42 – 1.9 GHz CPUs – 2 CPUs/POWER5 chip 32 KB L1 cache, 960 KB L2 cache, and 18 MB L3 cache per CPU | 8 – TotalStorage® SAN Volume Controllers |
| 32 GB main memory | Per controller: |
| AIX 5.3 | xSeries 335 processor which contains: |
| PCI-X/RIO | 2 – 3.0 GHz Intel P4 CPUs |
| WG | 8 GB memory/cache |
| | 4 – 2 Gbit FC ports |
| | 4 – 32 port FC switches |
| | 3 – Ethernet switch |
| | 24 – DS4300 enclosures |
| | 24 – EXP710 enclosures |
| | 14 – 73 GB, 15K RPM disk drives per enclosure |
| | 5 – 19 inch racks |
| | 8 – UPS |