SPC BENCHMARK 1™

EXECUTIVE SUMMARY

IBM CORPORATION
IBM TOTALSTORAGE® DS4300 WITH TURBO OPTION
(MIRRORED WRITE CACHE)

SPC-1 V1.7

Submitted for Review: August 26, 2003
Submission Identifier: A00017
Accepted: October 25, 2003
Revised: September 5, 2006

Executive Summary

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	IBM Corporation – www.ibm.com John Ponder ponder@us.ibm.com KBV/9062-2 9000 South Rita Road Tucson, AZ 85744 Phone: (520) 799-4388 FAX: (520) 799-5530
Test Sponsor Alternate Contact	IBM Corporation – 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 www.storageperformance.org Walter E. Baker AuditService@storageperformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063-2755 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.7
SPC-1 Workload Generator revision number	V2.00.03
Date Results were first used publicly	August 26, 2003
Date FDR was submitted to the SPC	August 26, 2003

Date revised FDR was submitted to the SPC
    Product name change from FASt600 to DS4300
    Pricing was revised to include the price of the Turbo option.
	September 5, 2005
	April 15, 2004

Date the TSC is/was available for shipment to customers	September 12, 2003
Date the TSC completed audit certification	August 26, 2003

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: IBM TotalStorage® DS4300 with Turbo Option *(mirrored write cache)*	
Metric	**Reported Result**
SPC-1 IOPS™	9,099.86
SPC-1 Price-Performance	$14.23/SPC-1 IOPS™
Total ASU Capacity	478.437GB
Data Protection Level	Mirroring
SPC-1 LRT™	2.30ms
Total TSC Price (including three-year maintenance)	$129,470

SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 benchmark. The Addressable Storage Capacity, which contains the Total ASU Capacity, was 478.437 GB. The Total ASU Capacity utilized 100% of the Addressable Storage Capacity. The actual Configured Storage Capacity was 956.874 GB, which included the multiple copies of user data required by a Data Protection Level of Mirroring. The Configured Storage Capacity utilized 52.54% of the priced Physical Storage Capacity of 1,821.003 GB.
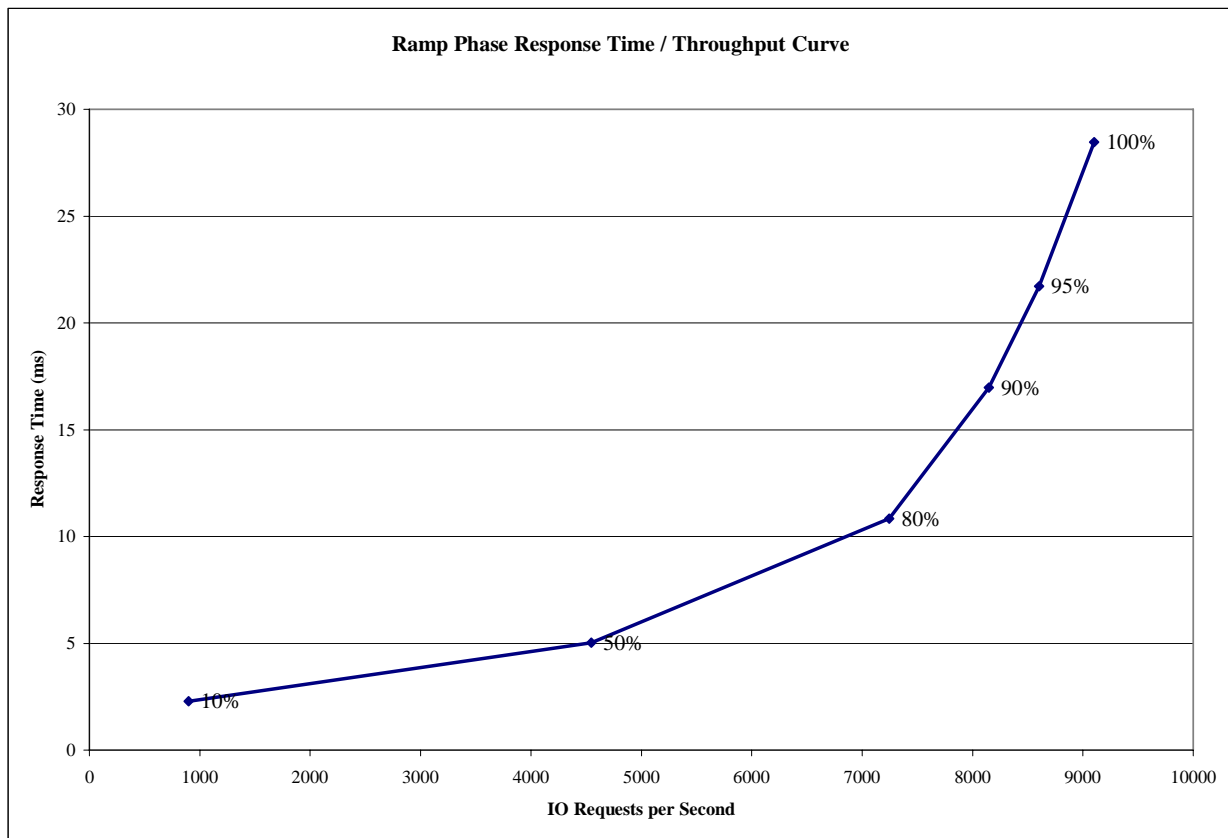
A **Data Protection Level** of Mirroring configures two or more identical copies of user data, maintained on separate disks.

The **SPC-1 LRT™** metric is the Average Response Time measured at the 10% load point, as illustrated on the next page. SPC-1 LRT™ represents the Average Response Time measured on a lightly loaded Tested Storage Configuration (TSC).

Response Time – Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at the 100% load point cannot exceed 30 milliseconds or the benchmark measurement is invalid.

Ramp Phase Response Time / Throughput Curve

Response Time – Throughput Data

Response Time - Throughput						
	10% Load	**50% Load**	**80% Load**	**90% Load**	**95% Load**	**100% Load**
I/O Request Throughput	899.57	4548.09	7244.26	8147.33	8601.28	9099.86
Average Response Time (ms):						
All ASUs	2.30	5.03	10.84	16.97	21.72	28.46
ASU-1	2.91	5.83	12.05	17.50	21.56	26.85
ASU-2	2.30	5.21	9.42	14.79	19.14	25.99
ASU-3	1.01	3.27	8.88	16.81	23.20	32.97
Reads	4.38	8.10	13.34	17.22	19.97	23.60
Writes	0.95	3.03	9.21	16.81	22.86	31.63

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

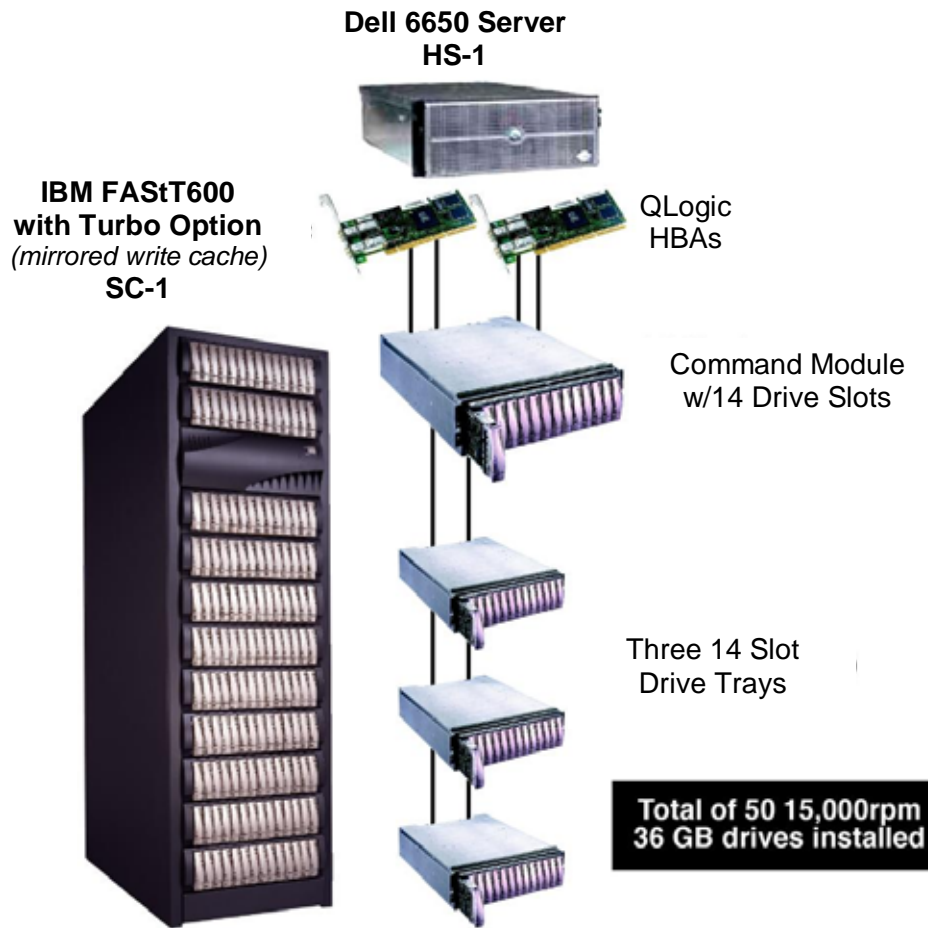| M/T/M	fc#	description	Qty	US List Prices Unit Price	US List Prices Aggregate Price	Total
1722-60U		IBM TotalStorage FAStT600 Storage Server	1	14,999	14,999	
	2000	FAStT600 Turbo feature	1	21,570	21,570	
	2104	FAStT FC-2/133 host bus adapter	4	1,485	5,940	
	2210	Shortwave SFP	6	499	2,994	
	5625	25 meter fiber optic cable	4	189	756	
	7109	FAStT Storage Manager v8.4 upgrade	1	2,999	2,999	
1740-1RU		IBM TotalStorage FAStT EXP700 Storage Expansion Unit	3	6,000	18,000	
	2210	Shortwave SFP	12	499	5,988	
	5211	FAStT 36.4GB/15K rpm 2Gb FC Disk Drive Module	50	1,115	55,750	
	5601	1 meter fiber optic cable	6	79	474	
	9006	Attach to FAStT600	8	0	0	

$ 129,470

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

The following are the differences between the TSC and Priced Storage Configuration:

- Four FAStT FC-2/133 HBAs (single port) were priced rather than the two QLogic 2342 dual channel HBAs used in the TSC.

- The priced disk drives have been configured to self-identify as a FAStT brand.

- The mounting of each drive is in an IBM drive carrier.

- The 'data scrubbing' option has a default setting of "off" in the TSC, but would need to be explicitly set to "off" in the Priced Storage Configuration.

- Twenty-five meter fiber optic cables were priced rather than the 30 meter cables used in the TSC.

The differences listed above, if applied to the TSC, would not have a negative performance impact on the reported SPC-1 performance.

Benchmark Configuration/Tested Storage Configuration Diagram

Dell 6650 Server
HS-1

IBM FAStT600
with Turbo Option
(mirrored write cache)
SC-1

QLogic
HBAs

Command Module
w/14 Drive Slots

Three 14 Slot
Drive Trays

Total of 50 15,000rpm
36 GB drives installed

Host System:	Tested Storage Configuration (TSC):
UID=HS-	UID=SC-1
1Dell 6650	Command Module
4 – Pentium 4 Xeon 2GHz with Hyperthreading Enabled	2 Qlogic 2342 dual-port fibre channel host bus adapters
3GB Main Memory	2 – Disk Array Controllers, 1GB RAM Each
Windows 2003, Service Pack 3	4 – 2gb Fibre Channel host connections
WG	2 – 2gb Fibre Channel drive connections
	3 – Drive Modules
	50 x 36GB 15K RPM Disk Drives