



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**IBM CORPORATION
IBM SYSTEM STORAGE DS5020 EXPRESS**

SPC-1 V1.10.1

Submitted for Review: August 25, 2009

Submission Identifier: A00081

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EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Revision Information and Key Dates

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.10.1
SPC-1 Workload Generator revision number	V2.00.04a
Date Results were first used publicly	August 25, 2009
Date the FDR was submitted to the SPC	August 25, 2009
Date revised FDR was submitted to the SPC Revised Total TSP Price and SPC-1 Price-Performance (page 3) Revised TSC/Priced Storage Configuration differences (page 5) Revised pricing (page 4) Revised TSC component table (page 7) (revisions highlighted in red on the above pages)	March 11, 2010
Revision History: October 9, 2009: Revised pricing (page 5)	
Date the TSC is available for shipment to customers	September 4, 2009
Date the TSC completed audit certification	August 24, 2009

Tested Storage Product (TSP) Description

The IBM DS5020 storage system is designed to provide midrange customer with the performance, reliability, and robust functionality enterprise customers are accustomed to – at an affordable price. Its core features and dynamic flexibility make it a great fit for a wide range of requirements, providing peace of mind and exceptional return on investment. The System Storage DS5020 Express disk system includes an industry leading 8 Gbps Fibre Channel (FC) as well as iSCSI host capability that seamlessly integrates into existing

and new infrastructures, while providing the balanced performance needed to satisfy the mixed workloads created by consolidation. Its modular architecture and efficiencies help lower acquisition and operational costs as performance and configuration requirements can be met with minimal raw capacity. And when it's time to expand, the DS5020 can add incremental capacity with no downtime.

Summary of Results

SPC-1 Results	
Tested Storage Product (TSP) Name: IBM System Storage DS5020 Express	
Metric	Reported Result
SPC-1 IOPS™	26,090.03
SPC-1 Price-Performance	\$8.46/SPC-1 IOPS™
Total ASU Capacity	5,145.060 GB
Data Protection Level	Mirroring
Total TSP Price (including three-year maintenance)	\$220,778

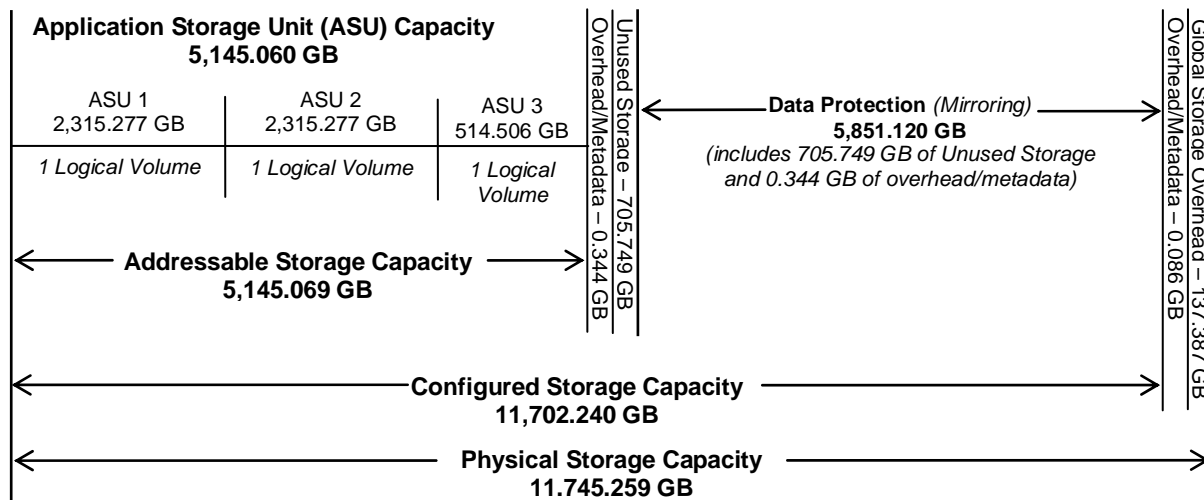
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) Capacity represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level of Mirroring** configures two or more identical copies of user data.

Storage Capacities and Relationships

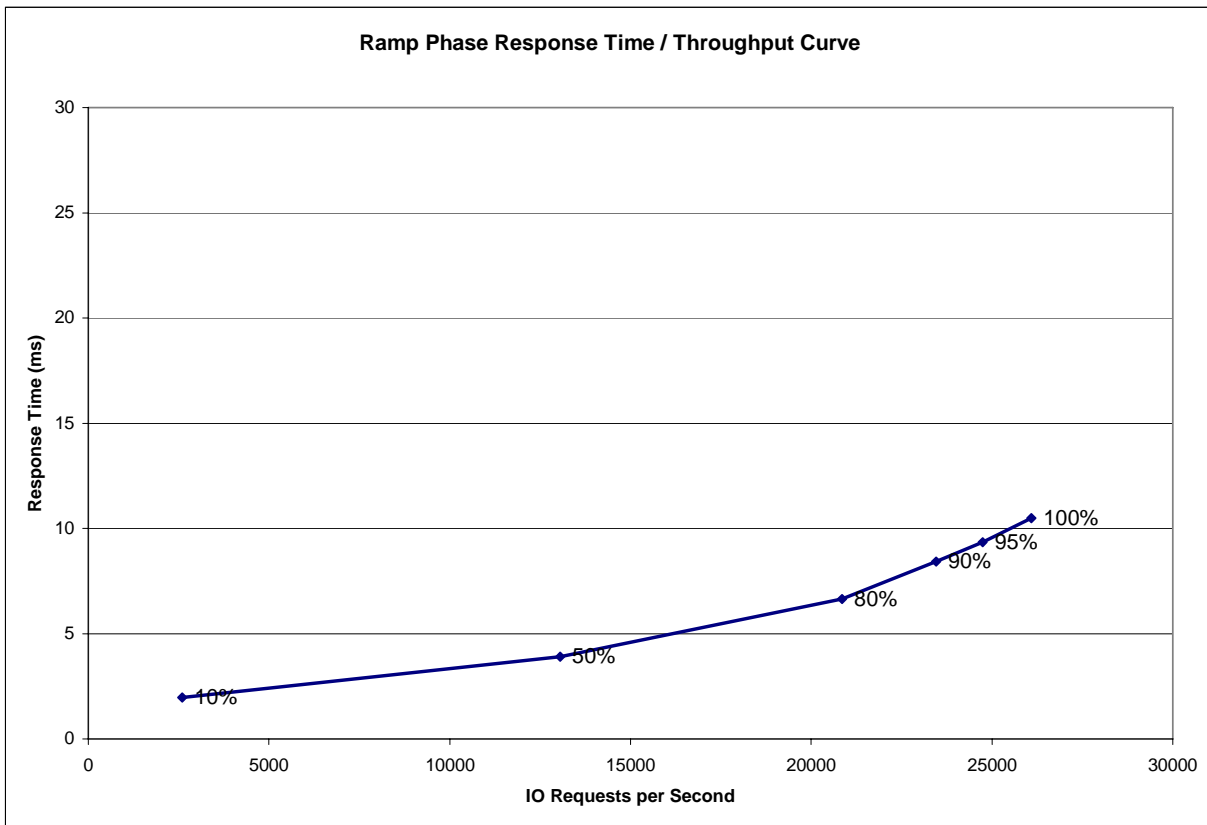
The following diagram documents the various storage capacities, used in this benchmark, and their relationships.



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 any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.



Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	2,602.65	13,053.24	20,850.35	23,457.23	24,747.16	26,090.03
Average Response Time (ms):						
All ASUs	1.97	3.91	6.64	8.44	9.35	10.49
ASU-1	2.63	5.09	8.13	9.95	10.82	11.91
ASU-2	2.40	5.20	11.59	16.58	19.09	21.99
ASU-3	0.38	0.83	1.32	1.65	1.98	2.45
Reads	4.47	8.71	14.92	18.97	20.82	23.02
Writes	0.34	0.78	1.26	1.57	1.89	2.33

Priced Storage Configuration Pricing

Description	Unit Price	Quantity	Extended Price
IBM DS5020 storage system			
DS5020 disk storage array (MTM 1814-20A) Note- this includes 1 GB RAM per controller, four 8 Gb FC host connections with SFPs , four 4 Gb FC drive connections with SFPs	\$ 22,500.00	1 \$	22,500.00
Feature #2080 -DS5020 two dual 8 Gbps host cards with SFPs	\$ 8,000.00	1 \$	8,000.00
Feature #7393 -DS5020 33-64 Disk Drive Att	\$4,000.00	1 \$	4,000.00
Feature #7394 -DS5020 65-112 Disk Drive Att	\$9,900.00	1 \$	9,900.00
Feature #2070 - DS5020 Additional 2GB Cache Memory	\$ 4,000.00	1 \$	4,000.00
Feature #7801 - DS5020 - Windows Host Kit	\$ 1,250.00	1 \$	1,250.00
Feature #8700 - DS5020 - 2 Storage Partitions - Plant	\$ 1,500.00	1 \$	1,500.00
Feature #3605 - 5m FC cable	\$ 129.00	12 \$	1,548.00
EXP520 expansion units (MTM 1814-52A) incl. 2 x 4 Gb SFPs	\$ 6,000.00	4 \$	24,000.00
Feature #2410 -DS5020 4 Gbps SFP pair	\$ 998.00	2 \$	1,996.00
Feature #4200 - DS5020 146.8GB/15K 4GB/S FC DDM	\$ 1,605.00	80 \$	128,400.00
HBA model 42D0501	\$ 1,299.00	4 \$	5,196.00
Maintenance (3 years, 24x7 with 4 hour response)	\$ 8,488.00	1 \$	8,488.00
			\$ 220,778.00

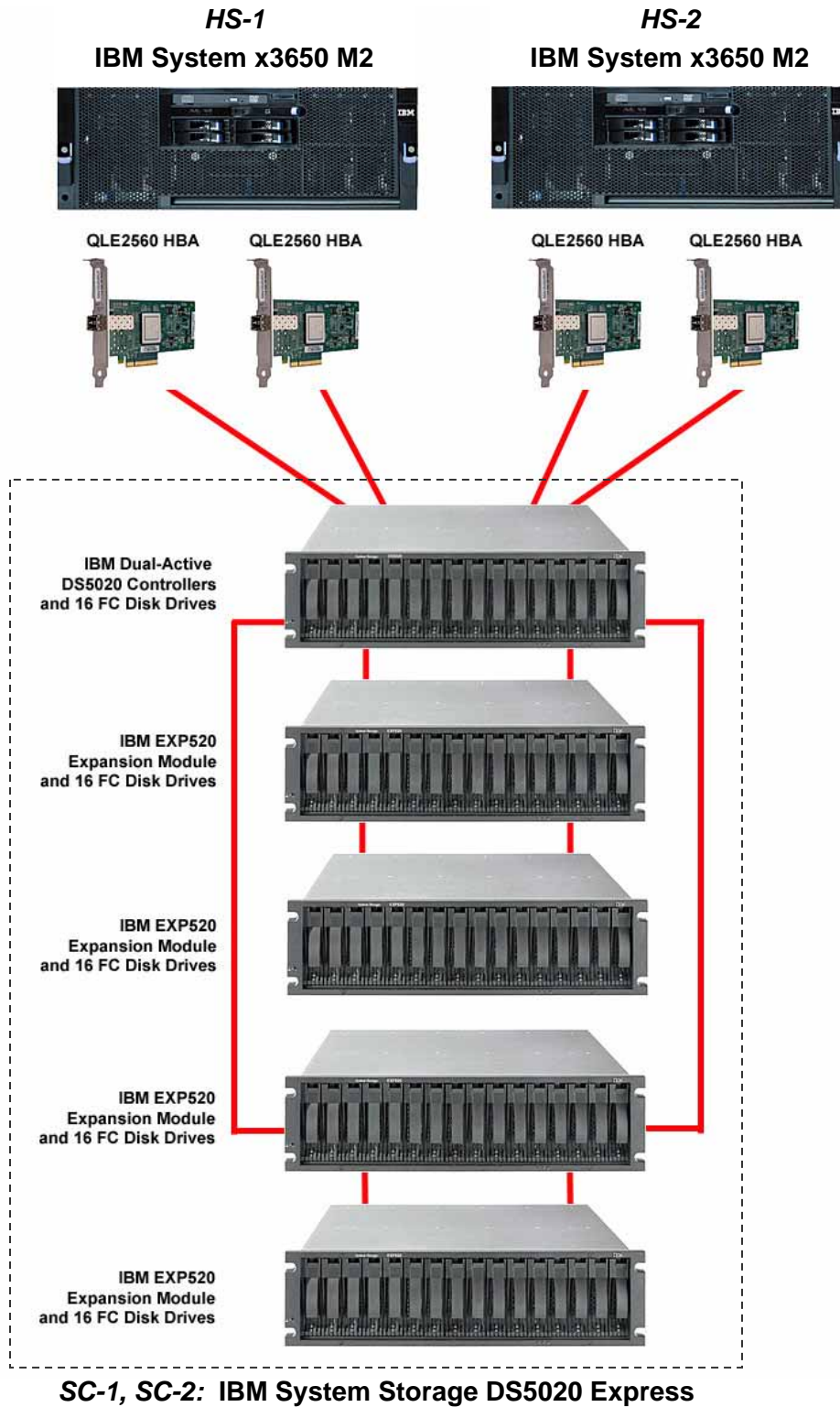
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

The differences between the TSC and Priced Storage Configuration consisted of the following:

- The priced disk drives are mounted in an IBM drive carrier and each disk drive is configured to self-identify as a DS5020 brand.
- **The TSC was configured with 20 4Gbps SFPs, of which 16 were used. The Priced Storage Configuration included only the required 16 SFPs.**

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

Benchmark Configuration/Tested Storage Configuration Diagram



Benchmark Configuration/Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC):
HS-1, HS-2: IBM System x3650 M2	4 –Qlogic single-port QLE25620 HBAs (<i>42D0501</i>)
Each Host System with:	SC-1/SC-2: IBM System Storage DS5020 2 – dual-active controllers with: 4 GB cache total, 2 GB per controller 2 – dual 8 Gbps host port cards with SFPs 8 – 8 Gb Fibre Channel front-end connections 4 per controller (<i>4 used, 2 per controller</i>) 8 – 4 Gb Fibre Channel backend connections 4 per controller (<i>4 used, 2 per controller</i>)
1 – 2.4 GHz Quad Xeon Processor with 8 MB L2 cache/CPU	
8 GB main memory	
Windows Server 2003 Enterprise Edition (32-bit) with SP2	
PCIe:	
WG	2 – 4 Gbps SFP pairs
	4 – IBM EXP520 Expansion Modules with 2 SFPs (4 Gbps) per expansion module
	80 – 146 GB, 15K RPM, 15K.6 disk drives