



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**IBM CORPORATION
IBM SYSTEM STORAGE DS8870**

SPC-1 V1.12

**Submitted for Review: October 3, 2012
Submission Identifier: A00120**

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	IBM Corporation – http://www.ibm.com Bruce McNutt – bmcnutt@us.ibm.com IBM ARC 650 Harry Road San Jose, CA 95120 Phone: (408) 927-2717 FAX: (408) 927-2050
Test Sponsor Alternate Contact	IBM Corporation – http://www.ibm.com Davio Whitworth – davidw@us.ibm.com 11501 Burnet Rd. Austin, TX 78758 Phone: (512) 286-9218
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-1 Specification revision number	V1.12
SPC-1 Workload Generator revision number	V2.2.0
Date Results were first used publicly	October 3, 2012
Date the FDR was submitted to the SPC	October 3, 2012
Date the Priced Storage Configuration is available for shipment to customers	October 19, 2012
Date the TSC completed audit certification	September 28, 2012

Tested Storage Product (TSP) Description

The DS8870 represents the latest in this series of enterprise disk storage systems designed for high-performance, high-capacity and resiliency. New with the 8870 are a major upgrade of the processing complex and system bandwidth.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: IBM System Storage DS8870	
Metric	Reported Result
SPC-1 IOPS™	451,082.27
SPC-1 Price-Performance	\$10.81/SPC-1 IOPS™
Total ASU Capacity	56,232.000GB
Data Protection Level	Protected (<i>Mirroring</i>)
Total TSC Price (including three-year maintenance)	\$4,875,005.70

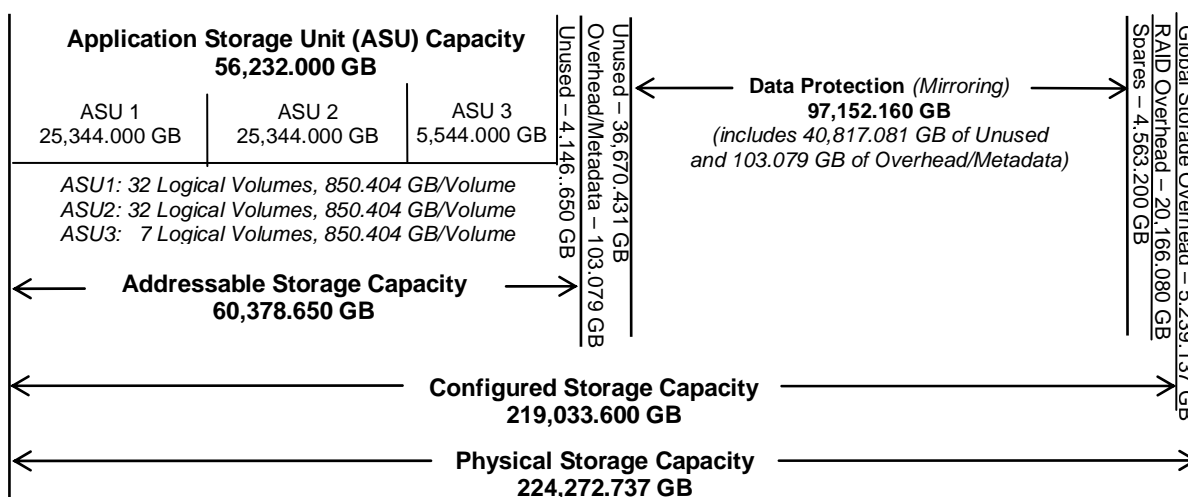
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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 **Protected (*Mirroring*)** configures two or more identical copies of user data.

Storage Capacities, Relationships, and Utilization

The following diagram and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.



SPC-1 Storage Capacity Utilization	
Application Utilization	25.07%
Protected Application Utilization	50.19%
Unused Storage Ratio	36.40%

Application Utilization: Total ASU Capacity (*56,232.000 GB*) divided by Physical Storage Capacity (*224,272.737 GB*)

Protected Application Utilization: Total ASU Capacity (*56,232.000 GB*) plus total Data Protection Capacity (*97.152.160 GB*) minus unused Data Protection Capacity (*40,817.081 GB*) divided by Physical Storage Capacity (*224,272.737 GB*)

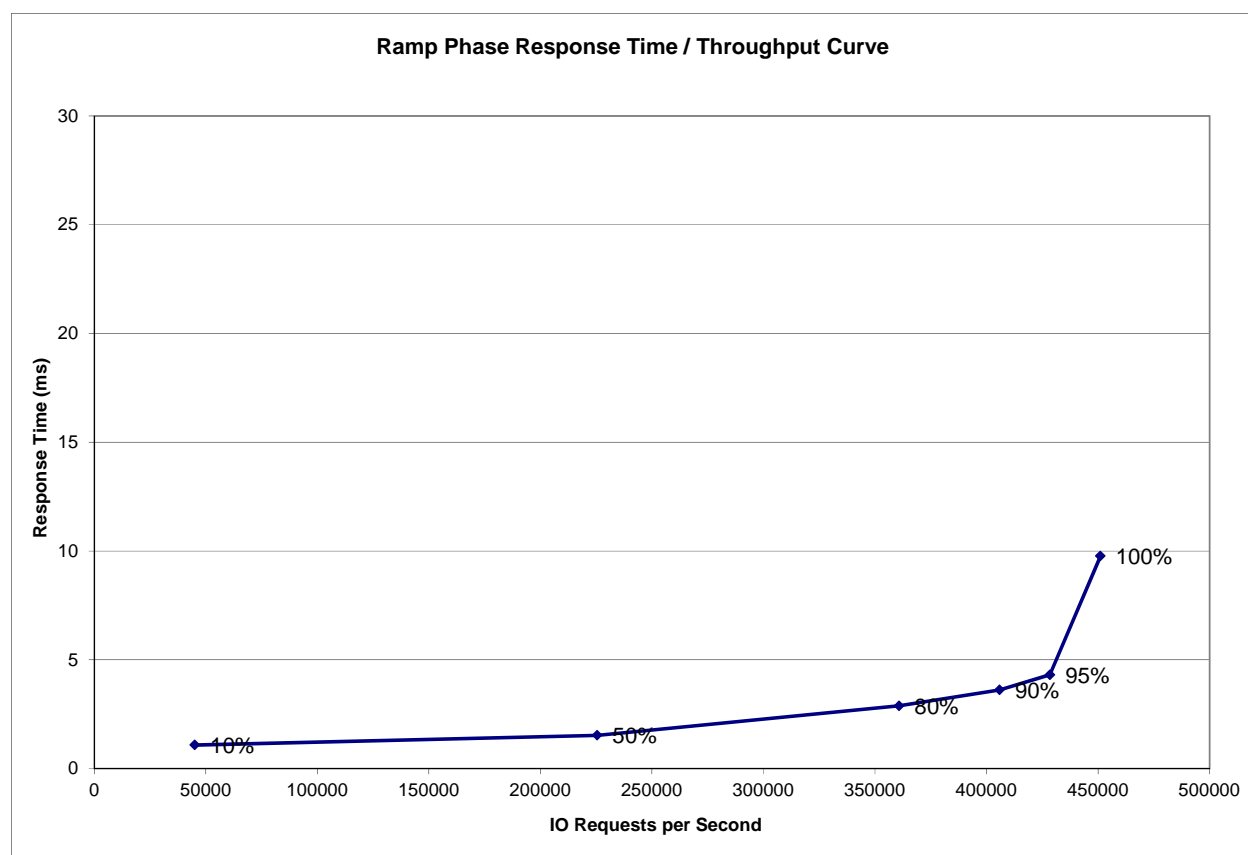
Unused Storage Ratio: Total Unused Capacity (*81,634.162 GB*) divided by Physical Storage Capacity (*224,272.737 GB*) and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 23-24 in the Full Disclosure Report.

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	45,089.86	225,493.94	360,839.78	405,899.16	428,462.79	451,082.27
Average Response Time (ms):						
All ASUs	1.08	1.53	2.88	3.61	4.31	9.77
ASU-1	1.43	1.95	2.85	3.49	4.12	5.18
ASU-2	1.17	1.62	2.51	3.14	3.79	4.86
ASU-3	0.31	0.60	3.11	4.09	4.95	21.65
Reads	2.31	3.04	4.27	5.05	5.74	6.89
Writes	0.29	0.54	1.98	2.68	3.38	11.64

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

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

Priced Storage Configuration Pricing

Product	Description	Qty	Unit Price	List Price	% disc't	Ext'd Price
2423-961	IBM System Storage DS8870	1	\$ 72,419.00	\$ 72,419.00	50%	\$ 36,209.50
1	9xE factory merge	3	\$ -	\$ -	50%	\$ -
100	Eligible for EU Shipment	1	\$ -	\$ -	50%	\$ -
201	Storage Enclosure Infrastructure	1	\$ -	\$ -	50%	\$ -
351	961 - 96E Position 1	1	\$ -	\$ -	50%	\$ -
352	961 - 96E Position 2	1	\$ -	\$ -	50%	\$ -
353	961 - 96E Position 3	1	\$ -	\$ -	50%	\$ -
700	OEL Indicator	1	\$ -	\$ -	50%	\$ -
713	IBM System Storage Easy Tier Indicator	1	\$ -	\$ -	50%	\$ -
840	200.1 to 250.0 TB capacity	1	\$ -	\$ -	50%	\$ -
900	Non-Standby CoD	1	\$ -	\$ -	50%	\$ -
1051	Battery Assembly	2	\$ 16,200.00	\$ 32,400.00	50%	\$ 16,200.00
1082	Line Cord (US/LA/AP/Canada)	1	\$ 7,000.00	\$ 7,000.00	50%	\$ 3,500.00
1120	Management Console - English Laptop Internal	1	\$ 9,160.00	\$ 9,160.00	50%	\$ 4,580.00
1241	Disk Enclosure Pair	5	\$ 20,000.00	\$ 100,000.00	50%	\$ 50,000.00
1242	HD STD Enclosure Indicator	5	\$ -	\$ -	50%	\$ -
1246	HD Disk Drive Cable Group 1	1	\$ 7,000.00	\$ 7,000.00	50%	\$ 3,500.00
1301	I/O Enclosure Pair PCIE	2	\$ 11,780.00	\$ 23,560.00	50%	\$ 11,780.00
1321	PCI-E Cable Group 2	1	\$ 4,100.00	\$ 4,100.00	50%	\$ 2,050.00
1731	DS8000 LMC R7.0	1	\$ 40,000.00	\$ 40,000.00	50%	\$ 20,000.00
5108	146 GB 15K Drive Set FDE	15	\$ 53,909.00	\$ 808,635.00	50%	\$ 404,317.50
3053	Device Adapter Pair I	4	\$ 15,000.00	\$ 60,000.00	50%	\$ 30,000.00
3153	8 Gb 4 port SW FCP/FICON Adapter PCIE	8	\$ 37,312.00	\$ 298,496.00	50%	\$ 149,248.00
4317	1TB Processor Memory (16-core)	1	\$ 926,280.00	\$ 926,280.00	50%	\$ 463,140.00
4404	16-core Processor Card	1	\$ 333,820.00	\$ 333,820.00	50%	\$ 166,910.00
7034	OEL - 25 TB	1	\$ -	\$ -	50%	\$ -
7045	OEL - 200 TB	1	\$ -	\$ -	50%	\$ -
7051	OEL - 1 Value Unit	1	\$ -	\$ -	50%	\$ -
7053	OEL - 10 Value Unit	1	\$ -	\$ -	50%	\$ -
7055	OEL - 50 Value Unit	1	\$ -	\$ -	50%	\$ -
7065	OEL - 200 Value Unit	2	\$ -	\$ -	50%	\$ -
7083	IBM System Storage Easy Tier indicator	1	\$ -	\$ -	50%	\$ -
2398-LFA	DS8000 Function Authorization	1	\$ -	\$ -	40%	\$ -
7034	OEL - 25 TB	1	\$ -	\$ -	40%	\$ -
7045	OEL - 200 TB	1	\$ -	\$ -	40%	\$ -
7051	OEL - 1 Value Unit	1	\$ 6,666.00	\$ 6,666.00	40%	\$ 3,999.60
7053	OEL - 10 Value Unit	1	\$ 53,659.00	\$ 53,659.00	40%	\$ 32,195.40
7055	OEL - 50 Value Unit	1	\$ 140,794.00	\$ 140,794.00	40%	\$ 84,476.40
7065	OEL - 200 Value Unit	2	\$ 429,677.00	\$ 859,354.00	40%	\$ 515,612.40
7083	IBM System Storage Easy Tier	1	\$ -	\$ -	40%	\$ -

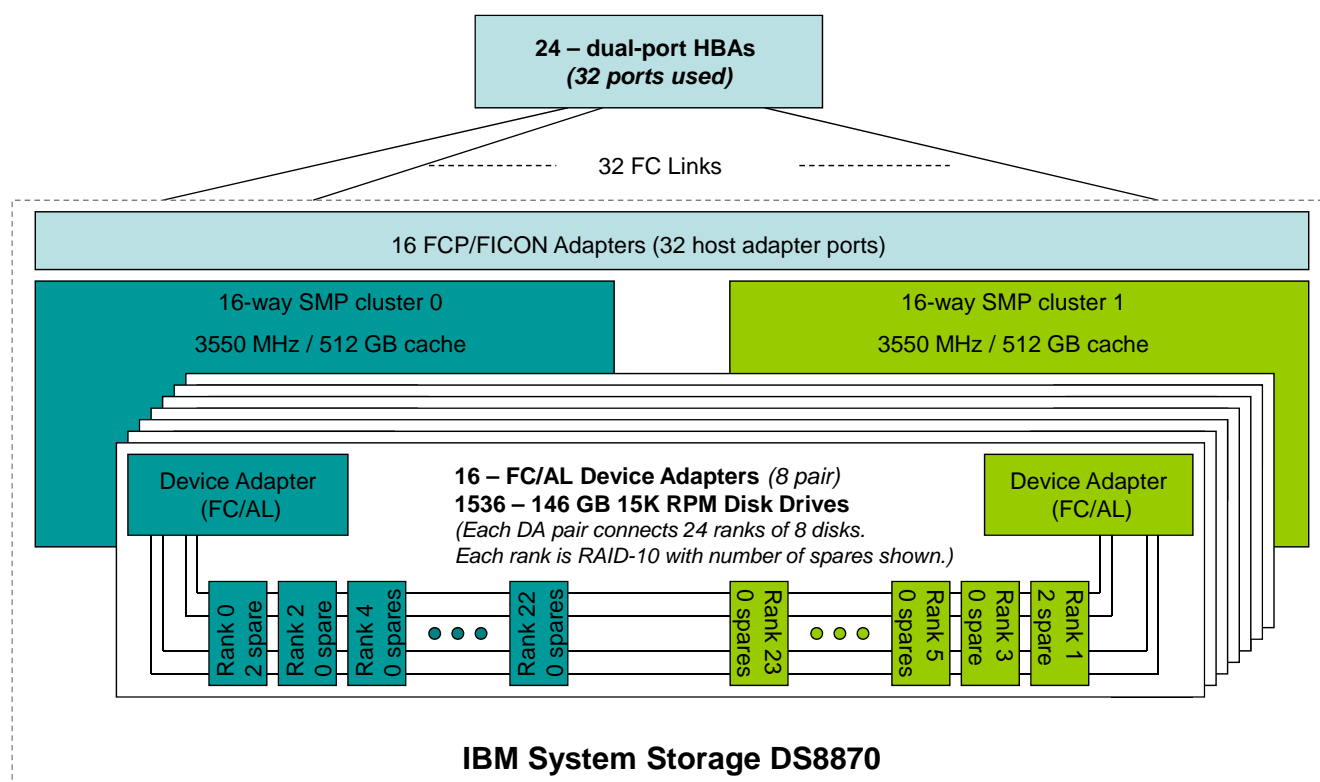
Priced Storage Configuration Pricing (continued)

Product	Description	Qty	Unit Price	List Price	% disc't	Ext'd Price
2423-96E	IBM System Storage DS8870 Expansion Unit	1	\$ 73,500.00	\$ 73,500.00	50%	\$ 36,750.00
1	9xE factory merge	1	\$ -	\$ -	50%	\$ -
100	Eligible for EU Shipment	1	\$ -	\$ -	50%	\$ -
201	Storage Enclosure Infrastructure	1	\$ -	\$ -	50%	\$ -
353	961 - 96E Position 3	1	\$ -	\$ -	50%	\$ -
840	200.1 to 250.0 TB capacity	1	\$ -	\$ -	50%	\$ -
1082	Line Cord (US/LA/AP/Canada)	1	\$ 7,000.00	\$ 7,000.00	50%	\$ 3,500.00
1241	Disk Enclosure Pair	10	\$ 20,000.00	\$ 200,000.00	50%	\$ 100,000.00
1242	HD STD Enclosure Indicator	10	\$ -	\$ -	50%	\$ -
1249	HD Disk Drive Cable Group 5	1	\$ 12,000.00	\$ 12,000.00	50%	\$ 6,000.00
1831	DS8000 LMC R7.0 indicator	1	\$ -	\$ -	50%	\$ -
5108	146 GB 15K Drive Set FDE	30	\$ 53,909.00	\$ 1,617,270.00	50%	\$ 808,635.00
2423-96E	IBM System Storage DS8870 Expansion Unit	1	\$ 73,500.00	\$ 73,500.00	50%	\$ 36,750.00
1	9xE factory merge	1	\$ -	\$ -	50%	\$ -
100	Eligible for EU Shipment	1	\$ -	\$ -	50%	\$ -
201	Storage Enclosure Infrastructure	1	\$ -	\$ -	50%	\$ -
352	961 - 96E Position 2	1	\$ -	\$ -	50%	\$ -
840	200.1 to 250.0 TB capacity	1	\$ -	\$ -	50%	\$ -
1082	Line Cord (US/LA/AP/Canada)	1	\$ 7,000.00	\$ 7,000.00	50%	\$ 3,500.00
1241	Disk Enclosure Pair	10	\$ 20,000.00	\$ 200,000.00	50%	\$ 100,000.00
1242	HD STD Enclosure Indicator	10	\$ -	\$ -	50%	\$ -
1248	HD Disk Drive Cable Group 4	1	\$ 12,000.00	\$ 12,000.00	50%	\$ 6,000.00
1831	DS8000 LMC R7.0 indicator	1	\$ -	\$ -	50%	\$ -
5108	146 GB 15K Drive Set FDE	30	\$ 53,909.00	\$ 1,617,270.00	50%	\$ 808,635.00
2423-96E	IBM System Storage DS8870 Expansion Unit	1	\$ 73,500.00	\$ 73,500.00	50%	\$ 36,750.00
1	9xE factory merge	1	\$ -	\$ -	50%	\$ -
100	Eligible for EU Shipment	1	\$ -	\$ -	50%	\$ -
201	Storage Enclosure Infrastructure	1	\$ -	\$ -	50%	\$ -
351	961 - 96E Position 1	1	\$ -	\$ -	50%	\$ -
840	200.1 to 250.0 TB capacity	1	\$ -	\$ -	50%	\$ -
1051	Battery Assembly	2	\$ 16,200.00	\$ 32,400.00	50%	\$ 16,200.00
1082	Line Cord (US/LA/AP/Canada)	1	\$ 7,000.00	\$ 7,000.00	50%	\$ 3,500.00
1241	Disk Enclosure Pair	7	\$ 20,000.00	\$ 140,000.00	50%	\$ 70,000.00
1242	HD STD Enclosure Indicator	7	\$ -	\$ -	50%	\$ -
1247	HD Disk Drive Cable Group 2	1	\$ 9,000.00	\$ 9,000.00	50%	\$ 4,500.00
1301	I/O Enclosure Pair PCIE	2	\$ 11,780.00	\$ 23,560.00	50%	\$ 11,780.00
1322	PCIE Cable Group 3	1	\$ 5,000.00	\$ 5,000.00	50%	\$ 2,500.00
1831	DS8000 LMC R7.0 indicator	1	\$ -	\$ -	50%	\$ -
5108	146 GB 15K Drive Set FDE	21	\$ 53,909.00	\$ 1,132,089.00	50%	\$ 566,044.50
3053	Device Adapter Pair I	4	\$ 15,000.00	\$ 60,000.00	50%	\$ 30,000.00
3153	8 Gb 4 port SW FCP/FICON Adapter PCIE	8	\$ 37,312.00	\$ 298,496.00	50%	\$ 149,248.00
9117-5735	8 Gbps dual port FC adapter	24	\$ 4,583.00	\$ 109,992.00	30%	\$ 76,994.40
TOTAL						\$ 4,875,005.70

The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.

Priced Storage Configuration Diagram



Priced Storage Configuration Components

Priced Storage Configuration:
24 – 8 Gbps dual port FC HBAs
IBM System Storage DS8870
2 –SMP processing clusters
Each cluster contains:
16 – processor cores
512 GB – processor memory (1024 GB total)
16 – 8 Gb, 4 port SW FCP/FICON adapter pairs (128 host port front-end connections, 32 used)
8 – 8 Gb, 4 port FC-AL device adapter pairs (4 adapter pair/cluster) (64 backend connections, 64 used)
1 – Management Console (internal laptop)
3 – DS8870 Expansion Units
32 – Disk Enclosure pairs (48 disk drives per enclosure pair)
1,536 – 146 GB, 15K RPM, 2.5" disk drives

