



# SPC BENCHMARK 1™

# EXECUTIVE SUMMARY

## IBM CORPORATION

## IBM SYSTEM STORAGE DS8700 RELEASE 5.1

*(EASY TIER AND SSDS)*

**SPC-1 V1.12**

**Submitted for Review: April 13, 2010**
**Submission Identifier: A00092**

# 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** | V1.12 |
| **SPC-1 Workload Generator revision number** | V2.1.0 |
| **Date Results were first used publicly** | April 13, 2010 |
| **Date the FDR was submitted to the SPC** | April 13, 2010 |
| **Date the priced storage configuration is available for shipment to customers** | May 21, 2010 |
| **Date the TSC completed audit certification** | April 12, 2010 |

## Tested Storage Product (TSP) Description

The IBM System Storage DS8000™ series encompasses the flagship disk enterprise storage products in the IBM System Storage portfolio. The DS8700 represents the latest in this series of enterprise disk storage systems designed for high-performance, high-capacity and resiliency. Major new capabilities include IBM POWER6 Processing technology and PCI-e I/O enclosures.

IBM System Storage Easy Tier feature of the DS8700 enables more effective storage consolidation by taking the guesswork out of deploying solid-state drives by automatically and dynamically moving the appropriate data to the appropriate drive tier in the system, based on ongoing performance monitoring. Such effective storage tiering will help ensure systems are optimized for solid-state technology from both a performance and cost perspective.

## Summary of Results

| SPC-1 Results | |
|---|---|
| **Tested Storage Configuration (TSC) Name:** IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs)* | |
| **Metric** | **Reported Result** |
| **SPC-1 IOPS™** | 32,998.24 |
| **SPC-1 Price-Performance** | $47.92/SPC-1 IOPS™ |
| **Total ASU Capacity** | 34,114.990 GB |
| **Data Protection Level** | Protected *(Mirroring, RAID-5)* |
| **Total TSC Price (including three-year maintenance)** | $1,581,207.60 |

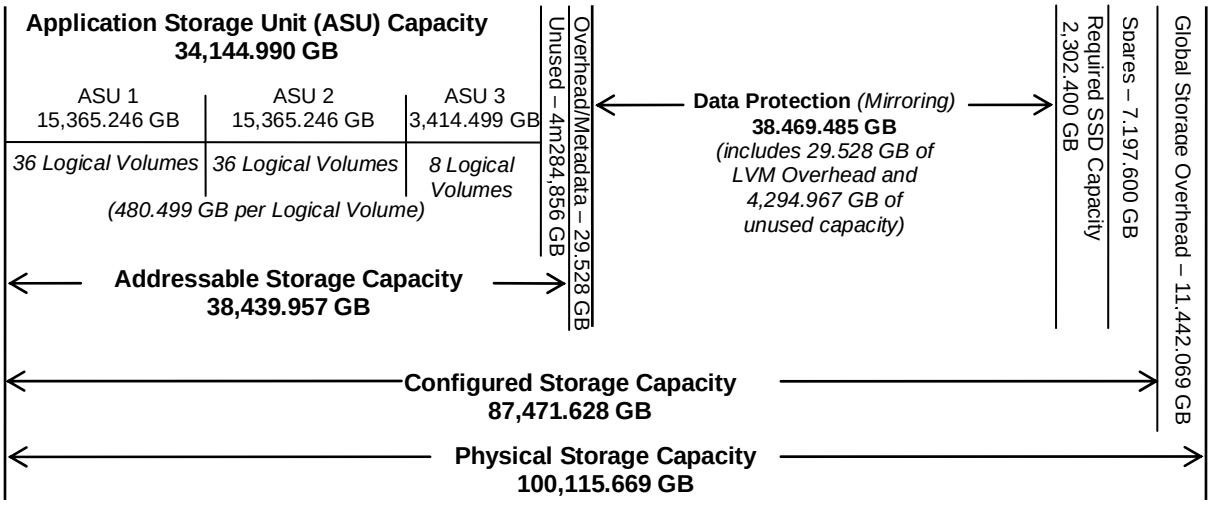
**SPC-1 IOPS™** represents the maximum I/O Request Throughput at the 100% load point.

**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** using ***Mirroring*** configures two or more identical copies of user data. The SSD portion of the configuration utilized a **Data Protection Level** of ***RAID-5*** which provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

## Storage Capacities and Relationships

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 | 34.11% |
| Protected Application Utilization | 68.24% |
| Unused Storage Ratio | 9.78% |

**Application Utilization:** Total ASU Capacity *(34,144.990 GB)* divided by Physical Storage Capacity *(100,115.669 GB)*

**Protected Application Utilization:** (Total ASU Capacity *(34,114.990 GB)* plus total Data Protection Capacity *(38,469.485 GB)* minus unused Data Protection Capacity *(4,294.967 GB)* divided by Physical Storage Capacity *(100,115.669 GB)*

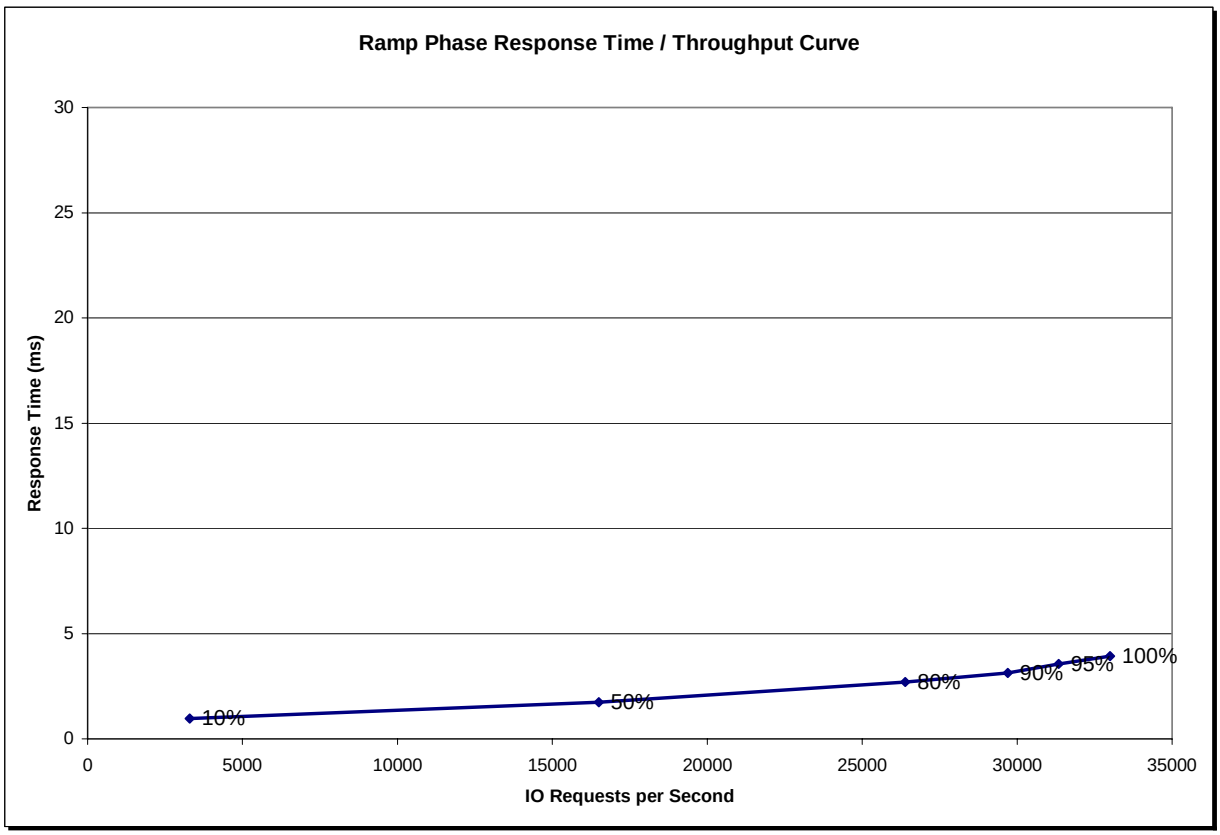
**Unused Storage Ratio:** Total Unused Capacity *(9,791.907 GB)* divided by Physical Storage Capacity *(100,115.669 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 19-20 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** | 3,302.53 | 16,493.73 | 26,394.28 | 29,697.92 | 31,335.75 | 32,998.24 |
| ***Average Response Time (ms):*** | | | | | | |
| **All ASUs** | 0.95 | 1.74 | 2.70 | 3.12 | 3.55 | 3.94 |
| **ASU-1** | 1.02 | 1.83 | 2.83 | 3.14 | 3.65 | 4.12 |
| **ASU-2** | 1.98 | 3.42 | 6.53 | 8.53 | 9.44 | 10.21 |
| **ASU-3** | 0.35 | 0.80 | 0.75 | 0.73 | 0.75 | 0.80 |
| **Reads** | 1.94 | 3.56 | 5.98 | 7.06 | 8.11 | 9.05 |
| **Writes** | 0.31 | 0.55 | 0.56 | 0.56 | 0.58 | 0.61 |

## Priced Storage Configuration Pricing

| Product | Description | Qty | Price | Extended Price | Discount (%) | Disc. Price |
|---|---|---|---|---|---|---|
| 2423-941 | System Storage DS8700 | 1 | $ 72,419.00 | $ 72,419.00 | 50.00% | $ 36,209.50 |
| 100 | Eligible for EU Shipment | 1 | N/C | | | |
| 700 | OEL Indicator | 1 | N/C | | | |
| 825 | 75.1 to 100.0 TB capacity | 1 | N/C | | | |
| 900 | Non-Standby CoD | 1 | N/C | | | |
| 932 | IBM System p Indicator | 1 | N/C | | | |
| 1050 | Battery Assembly | 3 | 1,700.00 | $ 5,100.00 | 50.00% | $ 2,550.00 |
| 1090 | Line Cord (US/LA/AP/Canada) | 1 | 1,900.00 | $ 1,900.00 | 50.00% | $ 950.00 |
| 1120 | Management Console - English Laptop Internal | 1 | 9,160.00 | $ 9,160.00 | 50.00% | $ 4,580.00 |
| 1210 | Disk Enclosure Pair | 4 | 10,000.00 | $ 40,000.00 | 50.00% | $ 20,000.00 |
| 1211 | Disk Drive Cable Group 1 | 1 | 1,000.00 | $ 1,000.00 | 50.00% | $ 500.00 |
| 1301 | I/O Enclosure Pair PCIE | 2 | 11,780.00 | $ 23,560.00 | 50.00% | $ 11,780.00 |
| 1321 | PCI-E Cable Group 2 | 1 | 4,100.00 | $ 4,100.00 | 50.00% | $ 2,050.00 |
| 1420 | 9 um Fibre Cable (LC) | 12 | 100.00 | $ 1,200.00 | 50.00% | $ 600.00 |
| 1711 | Release 5 Bundle Family | 1 | 40,000.00 | $ 40,000.00 | 50.00% | $ 20,000.00 |
| 2816 | 1 TB 7.2K SATA Drive Set *(16 drives per set)* | 6 | 89,780.00 | $ 538,680.00 | 50.00% | $ 269,340.00 |
| 2999 | Disk Enclosure Filler | 1 | 100.00 | $ 100.00 | 50.00% | $ 50.00 |
| 3043 | Device Adapter Pair III | 2 | 10,000.00 | $ 20,000.00 | 50.00% | $ 10,000.00 |
| 3143 | 4Gb SW FCP/FICON Adapter PCIE | 6 | 33,920.00 | $ 203,520.00 | 50.00% | $ 101,760.00 |
| 4225 | 256 GB Processor Memory (4-Way) | 1 | 784,640.00 | $ 784,640.00 | 50.00% | $ 392,320.00 |
| 4302 | 4 Way Processor Card Pair | 1 | 80,893.00 | $ 80,893.00 | 50.00% | $ 40,446.50 |
| 6116 | 146 GB SSD Drive Set *(16 SSDs per set)* | 1 | 923,552.00 | $ 923,552.00 | 50.00% | $ 461,776.00 |
| 7040 | OEL - 100 TB | 1 | N/C | | | |
| 7051 | OEL - 1 Value Unit | 1 | N/C | | | |
| 7054 | OEL - 25 Value Unit | 1 | N/C | | | |
| 7055 | OEL - 50 Value Unit | 1 | N/C | | | |
| 8S1027 | SSD System Order | 1 | N/C | | | |
| | | | | | | |
| 2398-LFA | DS8000 Function Authorization | 1 | N/C | | | |
| 932 | IBM System p Indicator | 1 | N/C | | | |
| 7040 | OEL - 100 TB | 1 | N/C | | | |
| 7053 | OEL - 10 Value Unit | 1 | $ 53,659.00 | $ 53,659.00 | 40.00% | $ 32,195.40 |
| 7054 | OEL - 25 Value Unit | 1 | $ 85,397.00 | $ 85,397.00 | 40.00% | $ 51,238.20 |
| 7055 | OEL - 50 Value Unit | 1 | $ 140,794.00 | $ 140,794.00 | 40.00% | $ 84,476.40 |
| | | | | | | |
| 2805-MC4 | System Storage Productivity Center | 1 | $ 4,200.00 | $ 4,200.00 | 50.00% | $ 2,100.00 |
| 18 | IBM Tivoli Storage Productivity Center via AAS/eConfig | 1 | N/C | | | |
| 1170 | Power Cord, Standard Rack | 2 | N/C | | | |
| 1810 | Dual Power Supply Option | 1 | $ 199.00 | $ 199.00 | 50.00% | $ 99.50 |
| 9100 | Console Keyboard/Display/Drawer | 1 | $ 1,794.00 | $ 1,794.00 | 50.00% | $ 897.00 |
| | | | | | | |
| 9117-MMB | | | | | | |
| 5735 | 8 Gb PCI-e Dual Port FC HBA | 11 | $ 4,583.00 | $ 50,413.00 | 30.00% | $ 35,289.10 |
| | | | | | | |
| | **Total discounted price** | | | | | **$1,581,207.60** |

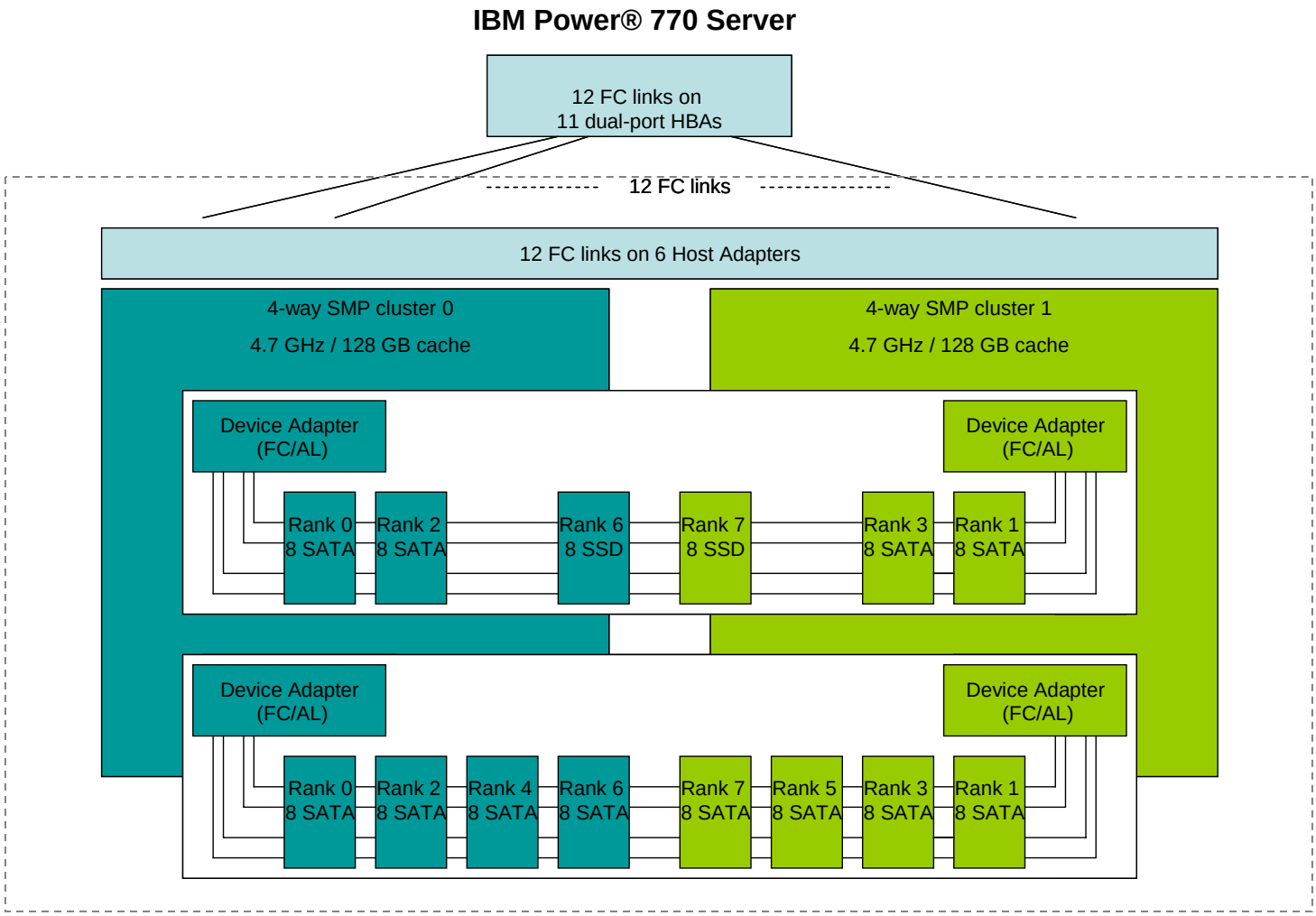
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite present 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 Price Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.

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

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

## Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Diagram




**IBM System Storage DS8700 Version 5.1 *(Easy Tier and SSDs)***

## Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Components

| Host System: | Tested Storage Configuration (TSC)/ Priced Storage Configuration: |
|---|---|
| **IBM Power® 770 *(P770-9119-MMB)*** | 11 – 8 Gb PCIe dual port FC HBAs |
| 64 cores in:<br>8 – 3.1 GHz POWER7 processor modules<br>8 cores per processor module<br>256 KB L2 cache per core<br>4 MB L3 cache per core *(eDRAM)* | **IBM System Storage DS8700**<br>256 GB memory/cache<br>12 – 4 Gbps front-end physical connections<br>*(2 per FCP/FICON Adapter)*<br>16 – 2 Gbps backend physical connections<br>*(4 per Device Adapter)* |
| 256 GB main memory | 1 – 4 Way Processor Card Pair |
| AIX 6.1 TL 01 | 6 – 4 Gb SW FCP/FICON Adapter PCIe |
| PCIe | 2 – Device Adapter Pair III |
| | 1 – Management Console |
| | 96 – 1 TB 7.2K RPM SATA disk drive |
| | 16 – 146 GB SSDs |