



**SPC BENCHMARK 1C™
EXECUTIVE SUMMARY**

**SEAGATE TECHNOLOGY LLC
SEAGATE CONSTELLATION™ ST9500430SS**

SPC-1C™ V1.1

**Submitted for Review: January 29, 2009
Submission Identifier: C00009**

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

| Test Sponsor and Contact Information | |
|---|--|
| Test Sponsor Primary Contact | Seagate Technology LLC – http://www.seagate.com Craig Parris – Craig.Parris@seagate.com 1280 Disc Drive Shakopee, MN 55372 Phone: (952) 402-2418 FAX: (952) 402-2695 |
| Test Sponsor Alternate Contact | Seagate Technology LLC – http://www.seagate.com Tom McCaffrey – Tom.R.McCaffrey@seagate.com 1280 Disc Drive Shakopee, MN 55372 Phone: (952) 402-2629 FAX: (952) 402-2859 |
| 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

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|--|------------------|
| SPC-1C Specification revision number | V1.1 |
| SPC-1C Workload Generator revision number | V1.0 |
| Date Results were first used publicly | January 29, 2009 |
| Date the FDR was submitted to the SPC | January 29, 2009 |
| Date the TSC is available for shipment to customers | March 30, 2009 |
| Date the TSC completed audit certification | January 28, 2009 |

Tested Storage Product (TSP) Description

Seagate's Constellation is the industry's first 2.5" business critical enterprise hard drive. The Constellation model ST9500430SS packs 500GB of storage capacity into the 2.5" x 15mm form factor. Constellation accomplishes the amazing feat of being the lowest power enterprise drive while serving up blazing nearline performance with 7,200 RPM rotational speed and 6Gbps capable SAS. More host controllable options are available to further reduce idle power with PowerChoice™ from Seagate. Constellation has the enterprise class vibration resistance to intermix in a high density storage environment.

Summary of Results

| SPC-1C Results | |
|--|-----------------|
| Tested Storage Product: Seagate Constellation™ ST9500430SS | |
| Metric | Reported Result |
| SPC-1C IOPS™ | 1,001.58 |
| Total ASU Capacity | 2,250.484 GB |
| Data Protection Level | RAID-5 |
| Total Price – Priced Storage Configuration | \$8,347 |

SPC-1C 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-1C benchmark.

A **Data Protection Level** of “RAID-5” provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

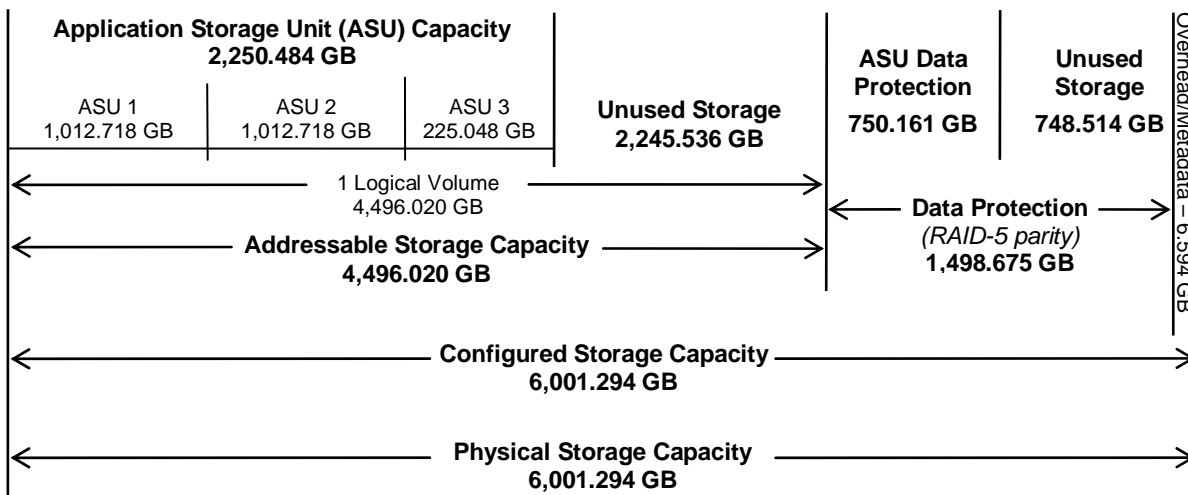
Storage Capacities and Relationships

The Tested Storage Configuration (TSC) must be configured so that there is either no Unused Storage or that the sum of Total ASU Capacity and storage required for data protection equals 50% (+-1 GiB) of the Physical Storage Capacity. This configuration meets the 50% requirement as documented below:

$$6,001.294 \text{ GB (Physical Storage Capacity)} * 0.5 = 3,000.647 \text{ GB}$$

$$2,250.484 \text{ GB (Total ASU Capacity)} + 750.161 \text{ GB (data protection)} = 3,000.645 \text{ GB}$$

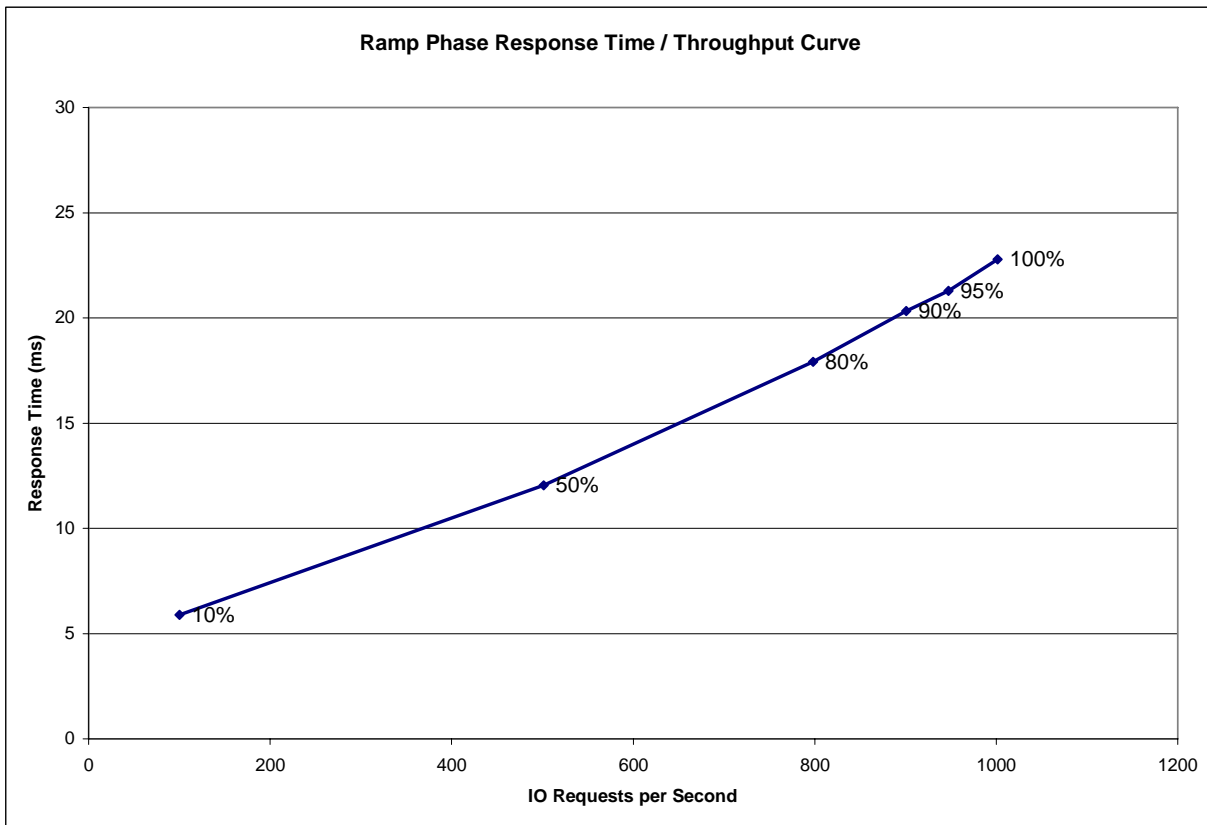
The following diagram documents the various storage capacities, used in this benchmark, and their relationships.



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 | 100.41 | 501.66 | 798.23 | 900.84 | 947.55 | 1,001.58 |
| Average Response Time (ms): | | | | | | |
| All ASUs | 5.88 | 12.04 | 17.92 | 20.32 | 21.28 | 22.78 |
| ASU-1 | 7.48 | 13.74 | 20.11 | 23.03 | 24.07 | 26.08 |
| ASU-2 | 7.08 | 14.92 | 22.35 | 25.75 | 26.61 | 27.94 |
| ASU-3 | 1.95 | 7.12 | 11.30 | 12.19 | 13.03 | 13.49 |
| Reads | 13.17 | 24.55 | 35.84 | 41.02 | 42.99 | 46.51 |
| Writes | 1.13 | 3.87 | 6.16 | 6.81 | 7.18 | 7.31 |

Tested Storage Configuration Pricing (*Priced Storage Configuration*)

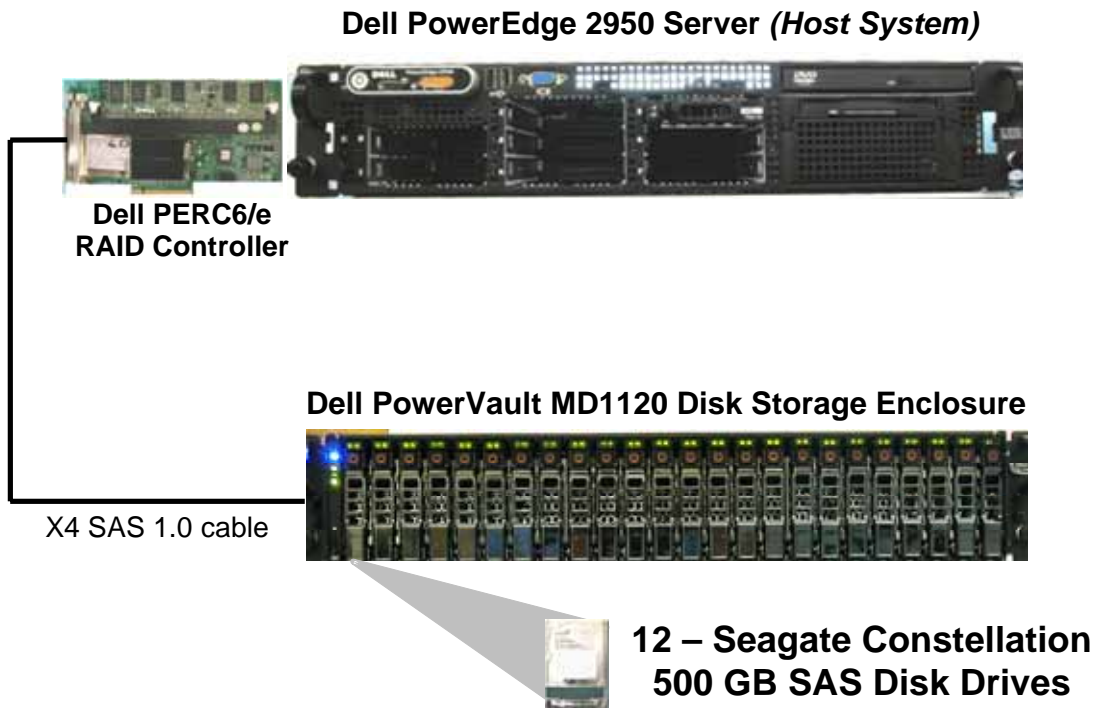
| Description | Part Numbers | Qty | Price | Extended Price |
|----------------------------------|--------------|-----|--------------|----------------|
| 500GB SAS 2.5" 7200RPM HDD | ST9500430SS | 12 | \$220 | \$2,640 |
| 2U 24 bay External Storage Array | MD1120 | 1 | \$5,707 | \$5,707 |
| incl PERC 6/e RAID controller | | | | |
| incl 2 73GB 10K RPM SAS disks | | | | |
| incl 2 SAS -1M Cables | | | | |
| incl 24 drive trays | | | | |
| incl 3 year hardware support | | | | |
| | | | Total | \$8,347 |

Each Dell MD1120 Disk Storage Enclosure order is required to include a minimum of two (2) disk drives. Those two drives were removed from the enclosure and replaced by the twelve (12) priced disk drives.

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

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

Benchmark Configuration/Tested Storage Configuration Diagram



Benchmark Configuration/Tested Storage Configuration Components

| Host System: | Tested Storage Configuration (TSC): |
|--|---|
| Dell PowerEdge 2950 Server 2 – 2.00 GHz Intel Xeon E5405 processors 2 x 6144 KB L2 cache | 1 – Dell PERC 6e SAS external RAID controller with: 512 MB cache 1 - x8 PCIe 1.0 host connect 2 - x8 3 Gb/s SAS 1.0 disk connect |
| 2 GB main memory | |
| Windows 2003 Standard Edition SP2 | |
| PCIe 1.0 | 1 – Dell PowerVault MD1120 Disk Storage Enclosure |
| | 12 – Seagate Constellation™ 500 GB SAS disks |
| | 1 – x4 1m external SAS cable |