SPC BENCHMARK 1C™

EXECUTIVE SUMMARY

SEAGATE TECHNOLOGY LLC

SEAGATE 600GB 15K
12GBPS SAS 2.5"
ENTERPRISE TURBOBOOST™
HDD/ST600MX0082

SPC-1C™ V1.5

Submitted for Review: November 3, 2014
Submission Identifier: C00020

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 55379 Phone: (952) 402-2418
Test Sponsor Alternate Contact	Seagate Technology LLC – http://www.seagate.com Barbara Craig– barbara.j.craig@seagate.com 1280 Disc Drive Shakopee, MN 55379 Phone: (952) 402-2804
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	V1.5
SPC-1C Workload Generator revision number	V1.2.0
Date Results were first used publicly	November 3, 2014
Date the FDR was submitted to the SPC	November 3, 2014
Date the TSC is available for shipment to customers	currently available
Date the TSC completed audit certification	October 31, 2014

Tested Storage Product (TSP) Description

These drives provide high performance, high capacity data storage for a variety of systems including engineering workstations, network servers, mainframes, and supercomputers. The 12Gb Serial Attached SCSI interface is designed to meet next-generation computing demands for performance, scalability, flexibility and high-density storage requirements.

TurboBoost enhanced caching feature performance improvement is due to the addition of a solid state component that caches "hot" data for reads and provides enhanced write performance as well. This combination of improved random reads and writes provides performance not yet seen in traditional rotating storage - reducing latencies for significantly faster, predictable response times.

Summary of Results

SPC-1C Reported Data	
Tested Storage Product (TSP) Name: Seagate 600GB 15K 12Gbps SAS 2.5" Enterprise TurboBoost™ HDD/ST600MX0082	
Metric	**Reported Result**
SPC-1C Submission Identifier	C00020
SPC-1C IOPS™	9,995.05
Total ASU Capacity	7,194.852 GB
Data Protection Level	Protected 1 *(Mirroring)*
Total Price	$12.475.55
Pricing Currency	U.S. Dollars
Target Country for availability, sales and support	USA

SPC-1C Submission Identifier is the unique identifier assigned to this specific SPC-1C Result.

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 available to be read and written in the course of executing the SPC-1C benchmark.

A **Data Protection Level** of **Protected 1** using ***Mirroring*** configures two or more identical copies of user data.

> ***Protected 1:*** *The single point of failure of any* ***storage device*** *in the configuration will not result in permanent loss of access to or integrity of the SPC-1C Data Repository.*

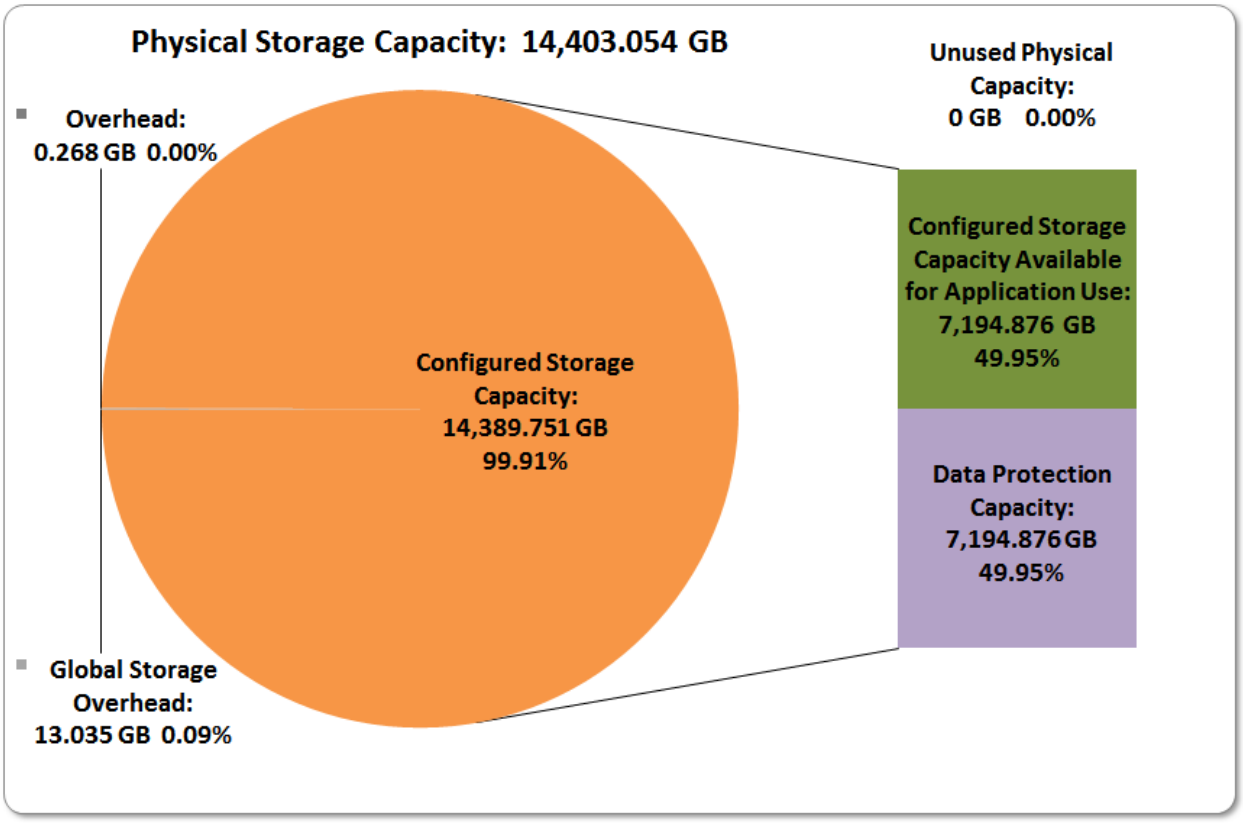
Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 7.

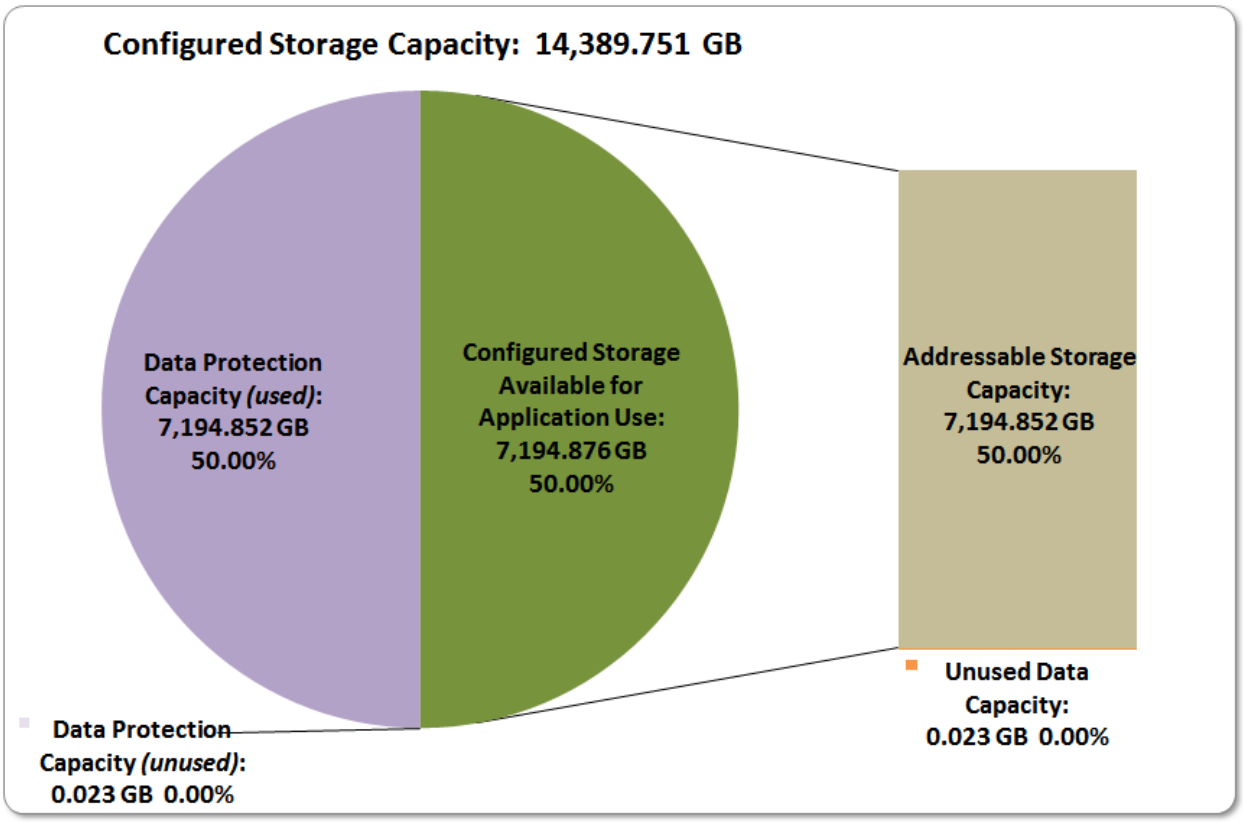
Pricing Currency is formal name for the currency used in calculating the **Total Price**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency).*

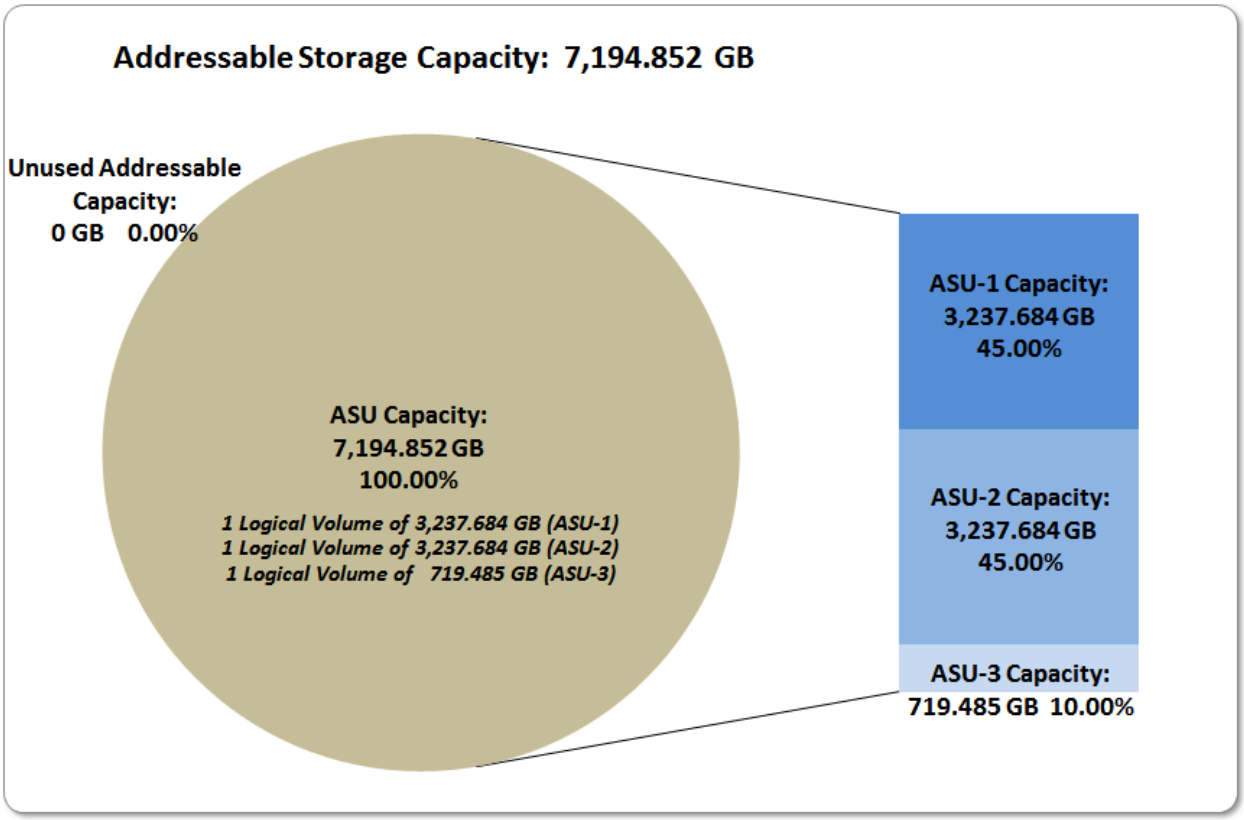
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

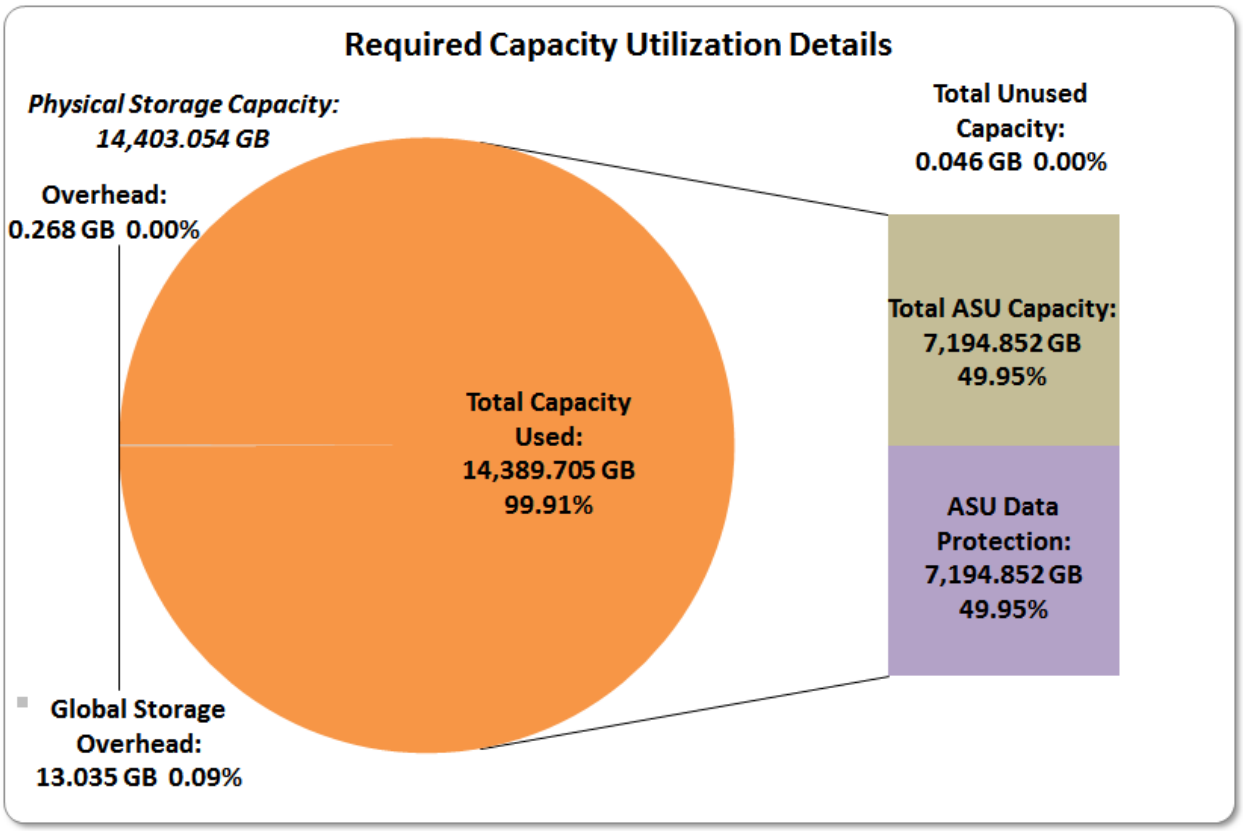
Storage Capacities, Relationships, and Utilization

The following four charts 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.




Configured Storage Capacity: 14,389.751 GB
Data Protection Capacity (used): 7,194.852 GB 50.00%
Configured Storage Available for Application Use: 7,194.876 GB 50.00%
Addressable Storage Capacity: 7,194.852 GB 50.00%
Unused Data Capacity: 0.023 GB 0.00%
Data Protection Capacity (unused): 0.023 GB 0.00%


Addressable Storage Capacity: 7,194.852 GB
Unused Addressable Capacity: 0 GB 0.00%
ASU Capacity: 7,194.852 GB 100.00%
1 Logical Volume of 3,237.684 GB (ASU-1)
1 Logical Volume of 3,237.684 GB (ASU-2)
1 Logical Volume of 719.485 GB (ASU-3)
ASU-1 Capacity: 3,237.684 GB 45.00%
ASU-2 Capacity: 3,237.684 GB 45.00%
ASU-3 Capacity: 719.485 GB 10.00%



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.

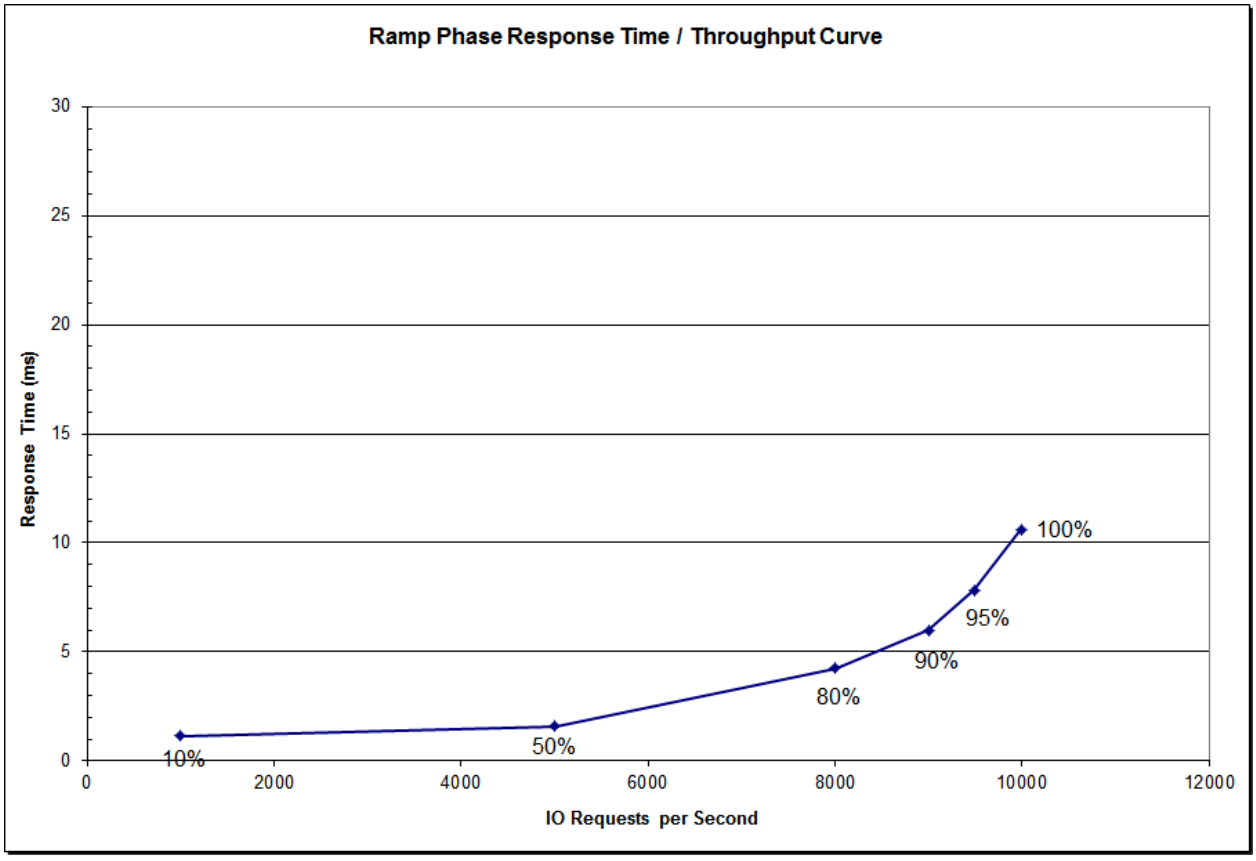
The TSC met the "100% utilization" requirement since it did not include any Unused Storage.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 of the corresponding SPC-1C 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	999.89	5,001.86	8,002.55	9,004.20	9,486.75	9,995.05
Average Response Time (ms):						
All ASUs	1.15	1.59	4.24	5.98	7.84	10.63
ASU-1	1.47	2.06	5.42	7.51	9.68	12.87
ASU-2	1.52	2.05	6.90	10.67	15.05	22.11
ASU-3	0.29	0.40	0.59	0.70	0.76	0.85
Reads	2.48	3.45	9.88	14.13	18.72	25.66
Writes	0.28	0.38	0.58	0.68	0.75	0.83

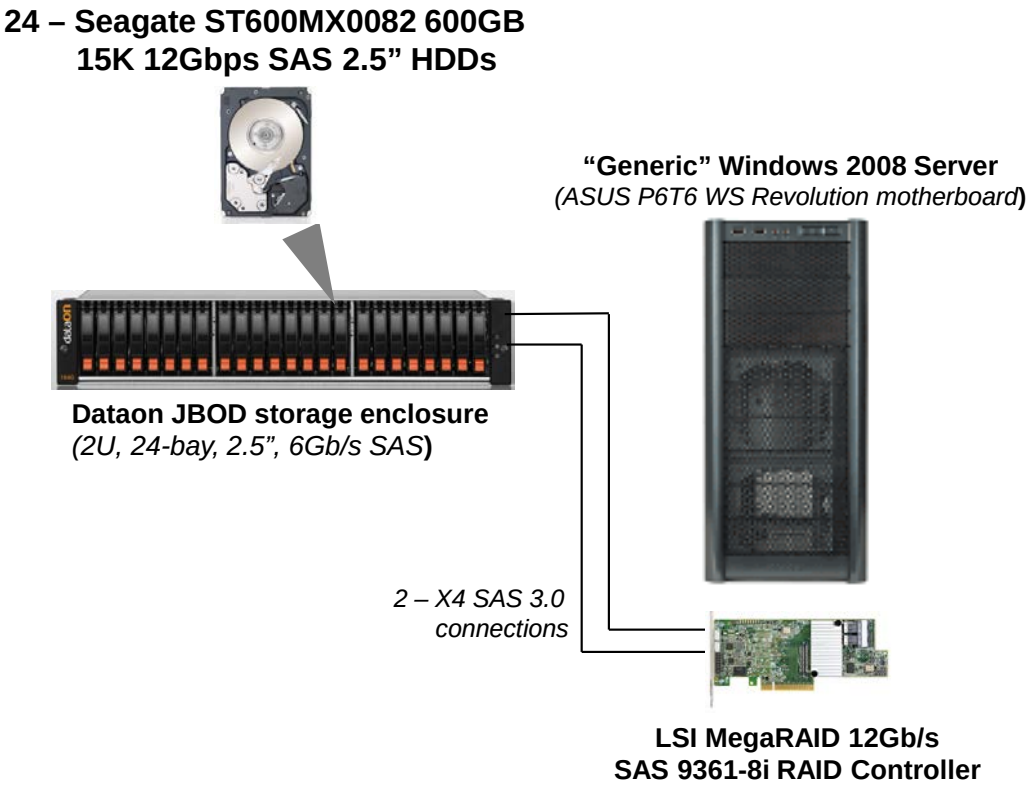
Priced Storage Configuration Pricing

Description	Part Numbers	Qty	Price	Extended Price
600GB SAS 2.5" SSHD	ST600MX00082	24	$330.00	7,920.00
12Gb SAS RAID Controller	LSI SAS 9361-8i	1	$592.55	592.55
Storage Enclosure JBOD	DNS-1640D	1	$3,850.00	3,850.00
SAS 3.0 1M Cable	MiniSAS	2	$56.50	113.00
			Total	**12,475.55**

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

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

Benchmark Configuration/Tested Storage Configuration Diagram



Host System and Tested Storage Configuration Components

Host System	Tested Storage Configuration (TSC)
"Generic" Windows 2008 Server ASUS P6T6 WS Revolution motherboard 1 – Intel® Xeon® Processor X5570 4 Cores, 2.93 GHz, 8 MB Intel® Smart Cache	1 – LSI MegaRAID 12Gb SAS 9361-8i RAID controller with 1 GB cache
	1 – PCIe 2.0 x8 front-end connection
6 GB main memory	2 – 12Gb SAS backend connections *(load balance mode)* *(4 lanes/connection,2 connections used)*
Windows Server 2008 R2	
PCIe 2.0	**24 – Seagate 600GB 15K 12Gbps SAS 2.5" Enterprise TurboBoost™ HDD/ST600MX0082 HDDs**
	1 – Dataon DNS-1640 (JBOD) storage enclosure *(2U 24-bay 2.5" 6Gb/s SAS)*
	2 –SAS 3.0 1m cables