SPC Benchmark 2™
Executive Summary

Silicon Graphics International Corp.
SGI® InfiniteStorage™ 5600

SPC-2™ V1.4

Submitted for Review: March 6, 2013
Submission Identifier: B00065

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Silicon Graphics International Corp. – http://www.sgi.com Floyd Christofferson – floydc@sgi.com 46600 Landing Parkway Fremont, CA 94538 Phone: (510) 933-5135 FAX: (270) 596-2924
Test Sponsor Alternate Contact	Silicon Graphics International Corp. – http://www.sgi.com Jerry Lohr – glohr@sgi.com 46600 Landing Parkway Fremont, CA 94538 Phone: (510) 933.5238
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-2 Specification revision number	V1.4
SPC-2 Workload Generator revision number	V1.2
Date Results were first used publicly	March 6, 2013
Date FDR was submitted to the SPC	March 6, 2013
Date the TSC will be available for shipment to customers	April 8, 2013
Date the TSC completed audit certification	February 27, 2013

Tested Storage Product (TSP) Description

The IS5600 storage system meets both demanding performance and capacity requirements of science and technology, simulation modeling, and decision support in the most efficient footprint with extreme simplicity, reliability, and scalability. This next generation storage system is unsurpassed at supporting high-performance file systems and bandwidth-intensive applications in the most efficient footprint. And its fully redundant I/O paths, advanced protection features, and proactive support monitoring and services provide the highest levels (99.999%) of availability, integrity, and security.

SPC-2 Tested Storage Configuration is the IS5600 generic version of the platform with settings documented in Appendix B.   The generic version is ideal for customers integrating the platform into heterogeneous environments. In addition the IS5600 is available with especially tuned firmware intended for SGI high-performance compute environments.

Versatility extends to the platform itself: The IS5600 comes with 6Gb/s SAS and three drive enclosure options supporting high performance and nearline SAS drives, self-encrypting drives (SEDs), and solid state disk (SSDs). All of the drive types and enclosures can be intermixed in a single system, which can be expanded to support up to 384 drives. The IS5600 controllers can be housed within the ultra-dense 4U 60-drive enclosures used here or in the available 12- and 24-drive enclosures.

IS5600 is based on a field-proven 7th generation architecture designed to provide continuous access to data with its redundant hot - swappable components, automated path failover, online administration, proactive drive monitoring, a highly serviceable design, and SGI's worldwide support.

SPC-2 Reported Data

SPC-2 Reported Data consists of three groups of information:

- The following SPC-2 Primary Metrics, which characterize the overall benchmark result:
  - SPC-2 MBPS™
  - SPC-2 Price Performance
  - Application Storage Unit (ASU) Capacity

- Supplemental data to the SPC-2 Primary Metrics.
  - Total Price
  - Data Protection Level

- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

SPC-2 Price-Performance™ is the ratio of **Total Price** to **SPC-2 MBPS™**.

ASU *(Application Storage Unit)* **Capacity** represents the total storage capacity available to be read and written in the course of executing the SPC-2 benchmark.

Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page on page 17 of the corresponding Full Disclosure Report.

Data Protection Level of **Protected 2** using *RAID-6*, which provides double-parity RAID protection against data loss.

> **Protected 2:** *The single point of failure of any* **component** *in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.*
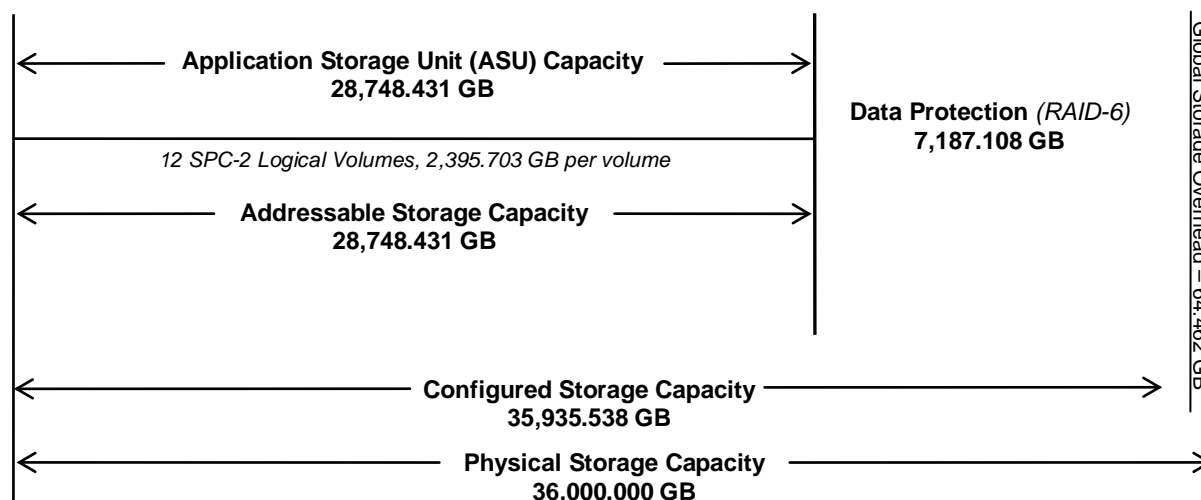
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-2 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency).*

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.

SPC-2 Reported Data				
SGI® InfiniteStorage™ 5600				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
8,855.70	$15.97	28,748.431	$141,392.86	Protected 2 *(RAID-6)*
The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video On Demand (VOD)				
Currency Used: U.S. Dollars		**Target Country:** USA		
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	9,415.61			$15.02
Write Only:				
1024 KiB Transfer	6,402.37	72	88.92	
256 KiB Transfer	6,025.72	72	83.69	
Read-Write:				
1024 KiB Transfer	10,413.54	72	144.63	
256 KiB Transfer	9,665.98	72	134.25	
Read Only:				
1024 KiB Transfer	12,090.54	72	167.92	
256 KiB Transfer	11,895.52	72	165.22	
Test Phases: (Write Only, Read-Write, and Read Only).				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LDQ Composite	11,253.22			$12.56
1024 KiB Transfer Size				
4 I/Os Outstanding	12,614.18	72	175.20	
1 I/O Outstanding	12,073.85	72	167.69	
64 KiB Transfer Size				
4 I/Os Outstanding	11,518.26	72	159.98	
1 I/O Outstanding	8,806.61	72	122.31	
Test Phases: (1024 KiB and 64 KiB Transfer Sizes).				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
	5,898.27	7,500	0.79	$23.97

SPC BENCHMARK 2™ V1.4
Silicon Graphics International Corp.
SGI® InfiniteStorage™ 5600

EXECUTIVE SUMMARY

Submitted for Review: MARCH 6, 2013
Submission Identifier: B00065

Storage Capacities and Relationships

The following diagram *(not to scale)* 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	79.86%
Protected Application Utilization	99.82%
Unused Storage Ratio	0.00%

Application Utilization: Total ASU Capacity *(28,748.431 GB)* divided by Physical Storage Capacity *(36,000.000 GB)*.

Protected Application Utilization: Total ASU Capacity *(28,748.431 GB)* plus total Data Protection Capacity *(7,187.108 GB)* minus unused Data Protection Capacity *(0.000 GB)* divided by Physical Storage Capacity *(36,000.000 GB)*.

Unused Storage Ratio: Total Unused Capacity *(0.000 GB)* divided by Physical Storage Capacity *(36,000.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 25-26 in the Full Disclosure Report.

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

The generic NVSRAM and modified settings on the TSC were replaced with the SGI HPC NVSRAM. That change if applied to the TSC would not result in a negative impact to the reported SPC-2 performance data. In addition, the SGI logo was installed on the appropriate faceplate.
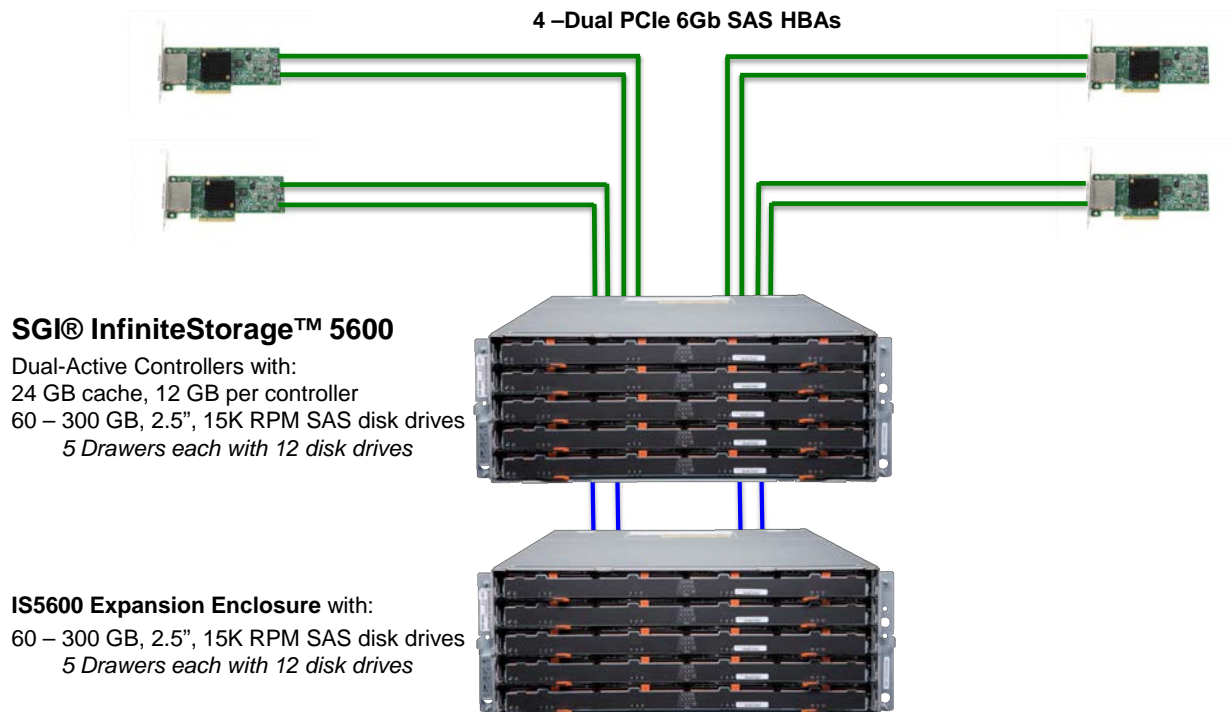
Priced Storage Configuration Pricing

Marketing Code	Description	Quantity	Unit List Price	Product Ext Price	Maintenance Unit Price	Maintenance Ext Price	Extended Price
PCIE-SAS-9207-8E	HBA 6Gb SAS PCie3 2extx4 SFF8088 Mini SAS ports, LP, supports up to 1024 drives, JBOD	4	$751.00	$3,004.00	$0.00	$0.00	$3,004.00
X-SAS-2M-Z	2 meter SAS cable, MiniSAS to MiniSAS	8	$170.00	$1,360.00	$0.00	$0.00	$1,360.00
5660-24-S8	IS5600, 4U 60bay, 24GB cache, Duplex, Eight 6Gb SAS Host Ports	1	$91,978.00	$91,978.00	$4,089.00	$4,089.00	$96,067.00
IS-DMODULE60-SAS	60 bay drive enclosure for IS5000 Family	1	$18,610.00	$18,610.00	$1,620.00	$1,620.00	$20,230.00
IS-D300-I60-G-10	300GB 15K SAS 2.5" PI&FDE 60bay 10 pack for IS5000/IS5000 SP Family	12	$8,317.00	$99,804.00	$0.00	$0.00	$99,804.00
SC7-ISSM-EE-10	Media DVD ISSM EE 10.84 for Windows for IS5500	1	$1,888.00	$1,888.00	$900.00	$900.00	$2,788.00
IS-DATA	RAID sw impl for up to 1/2 rack storage system, includes knowledge transfer & documentation	1	$1,800.00	$1,800.00	$0.00	$0.00	$1,800.00
IS-HWINST-STOR	Base hardware deployment of up to 2 racks of SGI storage system	1	$1,200.00	$1,200.00	$0.00	$0.00	$1,200.00
IS-DENSE-STOR-UPG	Installation of dense storage expansion and drive package	1	$1,800.00	$1,800.00	$0.00	$0.00	$1,800.00
	Totals without discount			$221,444.00		$6,609.00	$228,053.00
	Package discount of 38%						$86,660.14
	Final Total						**$141,392.86**

The following pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.

- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.

Priced Storage Configuration Diagram

4 –Dual PCIe 6Gb SAS HBAs

SGI® InfiniteStorage™ 5600

Dual-Active Controllers with:
24 GB cache, 12 GB per controller
60 – 300 GB, 2.5", 15K RPM SAS disk drives
   5 Drawers each with 12 disk drives

IS5600 Expansion Enclosure with:
60 – 300 GB, 2.5", 15K RPM SAS disk drives
   5 Drawers each with 12 disk drives

Priced Configuration Components

Priced Storage Configuration:
4 – dual port 6 Gb SAS PCIe HBAs
ISSM EE 10.84 for Windows for IS5500

SGI® InfiniteStorage 5600
 	
Dual-Active Controllers with:
 	
   24 GB cache , 12 GB per controller
 	
   8 – 6 Gb x4 SAS host connections,
       4 ports per controller *(8 ports used)*
 	
   2 – 6 Gb x4 SAS drive connections,
       5 per controller, *(10 ports used)*

1 – IS5600 Expansion Enclosure

120 – 300 GB, 2.5", 15K RPM SAS disk drives
 	
   60 disk drives in the controller enclosure
   60 disk drives in the IS5600 Expansion Enclosure