SPC Benchmark 1™
Executive Summary

Hitachi Data Systems Corporation
Hitachi Unified Storage VM

SPC-1 V1.13

Submitted for Review: April 30, 2013
Submission Identifier: A00131
Revised: March 20, 2014

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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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	V1.13
SPC-1 Workload Generator revision number	V2.3.0
Date Results were first used publicly	April 30, 2013
Date the FDR was submitted to the SPC	April 30, 2013
Date revised FDR was submitted to the SPC Revised pricing (page 6) and resulting price-related Reported Data (page 4)	March 20, 2014
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	April 22, 2013

Tested Storage Product (TSP) Description

Hitachi Unified Storage VM can manage all of your existing storage and consolidate all of your data in a single, virtualized platform to ease the management of information. Hitachi Unified Storage VM is built with trusted Hitachi reliability for application availability, performance and lower cost of ownership. Delivering enterprise storage virtualization in a unified platform lets you manage information more efficiently.

HUS VM places emphasis on high availability with nondisruptive microcode and hardware upgrades, automatic failover architecture with redundant, hot-swappable components, dual data paths and dual control paths and nonvolatile backup of cache using a combination of battery and flash disk drives. Universal data replication can be provided for local and remote data protection across multiple data centers.

Intelligent, controller-based storage virtualization provides a platform for aggregating all storage services for multivendor storage systems. Host-transparent movement, copy and migration of data between storage is enabled with reduced interruption of applications. Hitachi Command Suite provides the software management platform for advanced data and storage management that helps improve administration, operations, provisioning, performance and resilience. Automated data placement enables higher performance and lower cost storage tiers, placing the right data in the right place, at the right time.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Hitachi Unified Storage VM	
Metric	**Reported Result**
SPC-1 IOPS™	181,492.24
SPC-1 Price-Performance™	$3.53/SPC-1 IOPS™
Total ASU Capacity	52,566.608 GB
Data Protection Level	Protected 2 *(Mirroring)*
Total Price	$639,914.24
Currency Used	U.S. Dollars
Target Country for availability, sales and support	USA

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

SPC-1 Price-Performance™ is the ratio of **Total Price** to **SPC-1 IOPS™**.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity available to be read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level** of **Protected 2** using *Mirroring* configures two or more identical copies of user data.

> **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-1 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.

Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 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.

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.
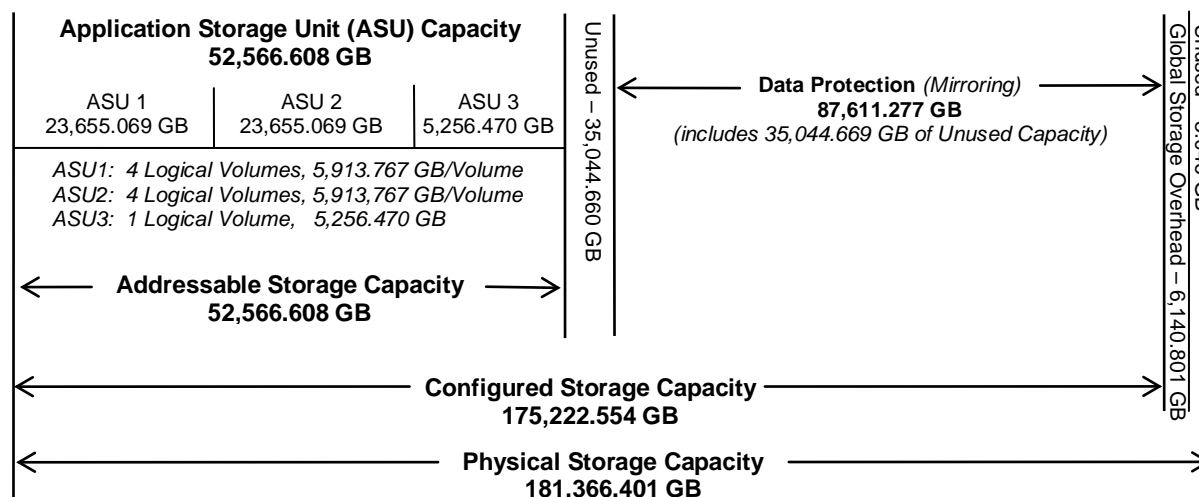
SPC-1 Storage Capacity Utilization	
Application Utilization	28.98%
Protected Application Utilization	57.97%
Unused Storage Ratio	38.65%

Application Utilization: Total ASU Capacity *(52,566.608 GB)* divided by Physical Storage Capacity *(181,366.401 GB).*

Protected Application Utilization: Total ASU Capacity *(52,566.608 GB)* plus total Data Protection Capacity *(87,611.277 GB)* minus unused Data Protection Capacity *(35,044.669 GB)* divided by Physical Storage Capacity *(181,366.401 GB).*

Unused Storage Ratio: Total Unused Capacity *(70,092.384 GB)* divided by Physical Storage Capacity *(181,366.401 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.
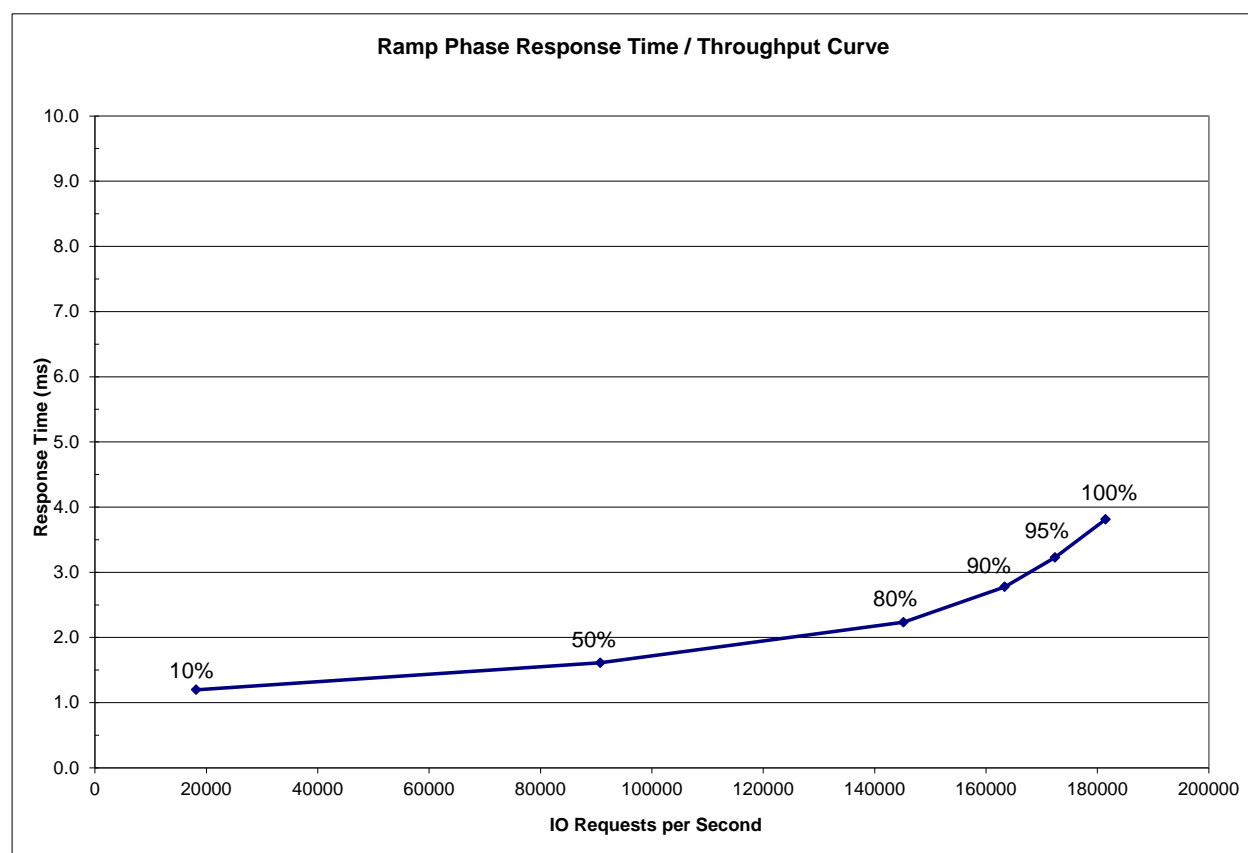
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	18,153.64	90,749.00	145,203.04	163,360.54	172,412.62	181,491.24
Average Response Time (ms):						
All ASUs	1.20	1.61	2.23	2.78	3.23	3.81
ASU-1	1.70	2.28	3.12	3.85	4.48	5.18
ASU-2	1.10	1.49	2.15	2.71	3.17	3.75
ASU-3	0.17	0.25	0.38	0.52	0.60	0.95
Reads	2.78	3.72	5.09	6.27	7.29	8.25
Writes	0.16	0.24	0.37	0.50	0.58	0.92

Priced Storage Configuration Pricing

Product Description	Qty	Unit List Price	Product List Price
Power Cable 250VAC 10A IEC320-C14	58	$39.00	$2,262.00
Dummy Drive for SFF (2U) Trays	64	$0.00	$0.00
Baying kit external	4	$5.90	$23.60
Solution 19 in rack ROW MIN	2	$8,110.00	$16,220.00
4GB USB memory stick with lanyard	1	$0.00	$0.00
HUS VM B/E I/O Module	4	$1,393.00	$5,572.00
HUS VM Drive Box (SFF)	28	$6,765.00	$189,420.00
HUS VM Controller Chassis	1	$74,000.00	$74,000.00
HUS VM 300GB SAS 15K RPM HDD SFF for CBSS/DBS-Base	608	$1,720.00	$1,045,760.00
HUS VM 4x8Gbps FC Interface Adapter	8	$3,267.00	$26,136.00
LAN Cable 14ft	1	$0.00	$0.00
RJ-45 Modular In-Line Coupler 6 Conductor	1	$4.00	$4.00
PDU 0RU 22xC13 1Phase 208V 30A NEMA L6-30P	2	$1,236.00	$2,472.00
PDU 0RU 12xC13 1Phase 208V 30A NEMA L6-30P	2	$735.00	$1,470.00
Universal rail kit includes left and right rails	29	$154.00	$4,466.00
HUS VM Cache Flash Memory Module (supports 160GB)	1	$9,888.00	$9,888.00
HUS VM 16GB Cache Module	8	$4,295.00	$34,360.00
Hardware Components:		---	**$1,412,053.60**
HUS VM Hitachi Base Operating System Base License (20TB)	1	$27,000.00	$27,000.00
HUS VM Hitachi Base Operating System 60TB Block License	1	$55,900.00	$55,900.00
Software Components:		---	**$82,900.00**
HUS VM Service Installation	1	$2,750.00	$2,750.00
HUS VM Hardware Maintenance Support - Includes 3 years of Standard Support (24 x 7 x 4 hour response)	1	$60,594.48	$60,594.48
HUS VM Storage Software Support - Includes 3 years of Standard Support	1	$37,305.00	$37,305.00
Installation and Support:		---	**$100,649.48**
Brocade 360 switch w/ 24 active ports, Full Fabric, 24 SWL 8Gb BR SFPs, Fixed Rack Mount plus 3 year support	1	$5,147.00	$5,147.00
Brocade 360 switch w/ 24 active ports, Full Fabric, 24 SWL 8Gb BR SFPs, Fixed Rack Mount plus 13 months maintenance (spare)	1	$4,934.00	$4,934.00
Emulex LightPulse Dual Port Fibre Channel Host Bus Adapter LPE12002-M8	4	$1,380.00	$5,520.00
Fibre Channel Cables	20	$21.50	$430.00
Third Party Components:		---	**$16,031.00**

Hardware Components	$1,412,053.60	65%	$494,218.76
Software Components	$82,900.00	65%	$29,015.00
Installation & Support	$100,649.48	0%	$100,649.48
Third Party Components	$16,031.00	0%	$16,031.00

Total: **$639,914.24**

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.

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

A second 24-port FC switch was included in the Priced Storage Configuration as a spare to fulfill one of the requirements for a data protection level of **Protected 2**.

The switch used in the TSC was a Brocade 5120 switch. A Brocade 360 switch was substituted for the Brocade 5120 in the Priced Storage Configuration due to EOL of the 5120. The Brocade 360 switch provides equivalent functionality and performance as the Brocade 5120 for the SPC-1 benchmark measurements.

Priced Storage Configuration Diagram

4 - Emulex LPe12002 dual-port 8 Gb FC HBAs

8 - 8 Gbps FC connections

Brocade 360 24-port 8 Gb FC Switch

16 - 8 Gbps FC connections

Hitachi Unified Storage VM

2 Virtual Storage Controllers with:

2 cache blades, 1 per controller, with:
64 GB cache per blade *(128 GB total)*
80 GB flash per blade for cache
backup *(160 GB total)*

2 processor blades, 1 per controller,
with 8 GB of local memory per blade
(16 GB total)

8 - FC Host Port Adapters, 4 per controller
(4 - 8 Gbps ports per adapter)
(32 ports total)

4 - SAS I/O Modules, 2 per controller
(2 - 4x6 Gbps ports per module)
(4 - 6 Gbps links per port)
(8 links per SAS I/O module, 32 total)

28 - Drive Enclosures

608 - 300 GB SAS 15K RPM disk drives
(24 enclosures each with 24 drives)
(4 enclosures each with 8 drives)

2 - 19" Racks with PDUs

Priced Storage Configuration Components

Priced Storage Configuration:
4 – Emulex LightPulse LPe12002-M8 8Gbps dual port FC HBAs
1 – Brocade 360 FC switch, 24 active ports, 24 8Gb SFPs   *(a second switch was included to serve as a spare)*

Hitachi Unified Storage VM
 1 HiStar-based storage controller with:
  2 Main blades with:
    64 GB cache per blade *(128 GB total)*
    80 GB flash for cache backup per blade *(160 GB total)*
    1 flash battery per blade *(2 total)*
  2 Microprocessor blades with
    8 GB of local memory per blade *(16 GB total)*
  8 – FC Host Port Adapters
    (4 – 8 Gbps ports per adapter)
    (16 ports per controller, 32 ports total)
    (8 ports used per controller, 16 total used)
  4 – SAS I/O Modules
    (2 – 8x6Gbps ports per module)
    (4 ports per controller, 8 ports total, 8 ports used)
    (4 – 8x6Gbps links per port)
    (8 links per module, 32 total links, 32 links used)

28 – Drive Enclosures

608 – 300 GB SAS 15K RPM disk drives
    (24 disk enclosures each with 24 disk drives)
    (4 disk enclosures each with 8 disk drives)

2 – 19" racks with PDUs

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