SPC Benchmark 2™
Executive Summary

Hitachi Data Systems Corporation
Hitachi Unified Storage VM

SPC-2™ V1.5

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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-2 Specification revision number	V1.5
SPC-2 Workload Generator revision number	V1.2
Date Results were first used publicly	January 21, 2014
Date FDR was submitted to the SPC	January 21, 2014
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	December 16, 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.

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 9.

Data Protection Level of **Protected 2** using *RAID-5* by distributing check data corresponding to user data across multiple disk in the form of bit-by-bite parity.

> ***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.
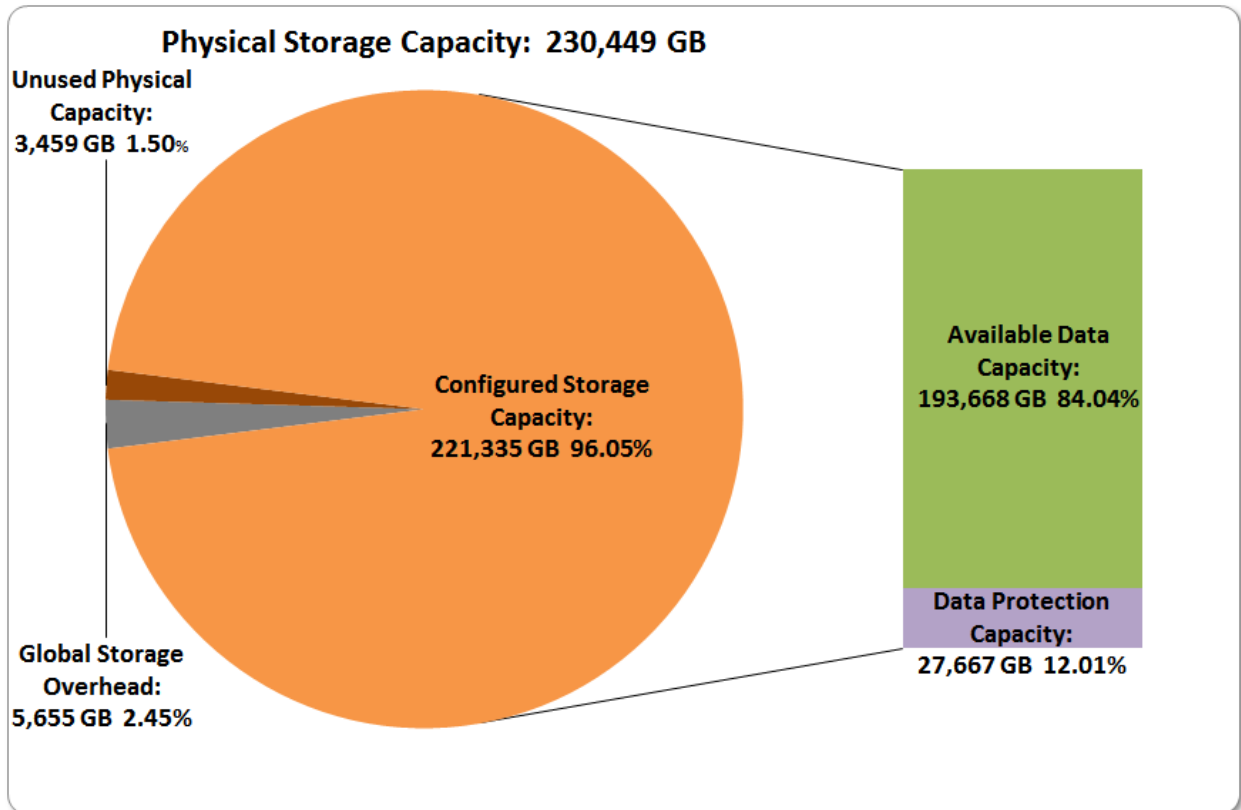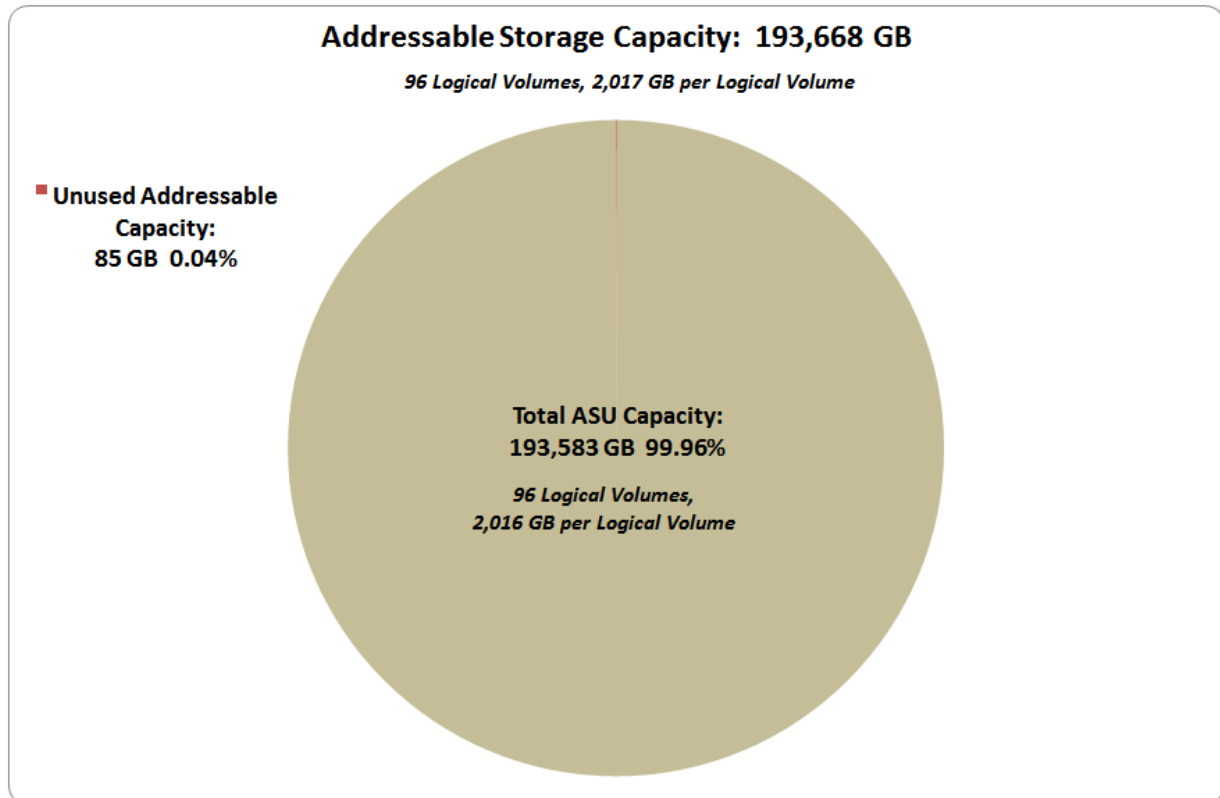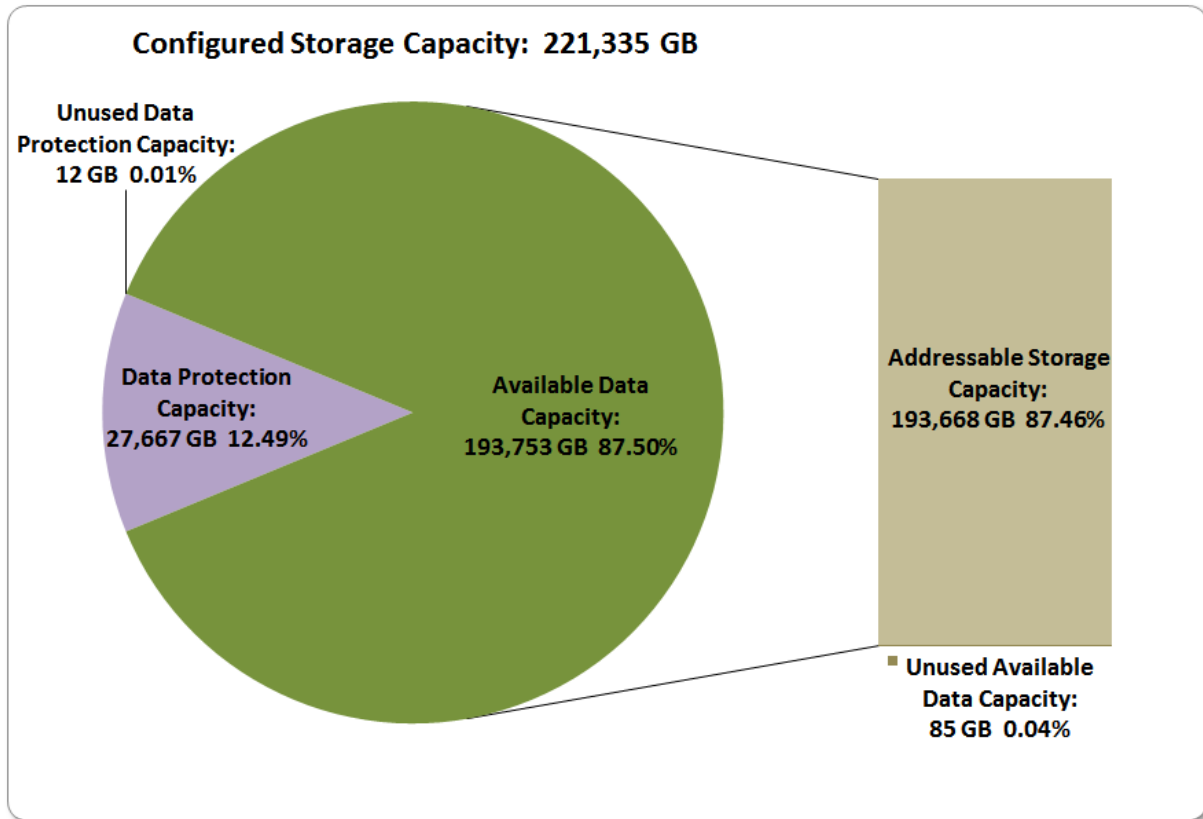
SPC-2 Reported Data *(continued)*

SPC-2 Reported Data				
Hitachi Unified Storage VM				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
11,274.83	$32.64	193,667.977	$368,065.12	Protected 2 *(RAID-5)*
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)				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	8,885.68			$41.42
Write Only:				
1024 KiB Transfer	5,605.00	32	175.16	
256 KiB Transfer	5,602.82	32	175.09	
Read-Write:				
1024 KiB Transfer	8,148.26	200	40.74	
256 KiB Transfer	8,199.30	200	41.00	
Read Only:				
1024 KiB Transfer	12,886.38	200	64.43	
256 KiB Transfer	12,872.31	200	64.36	
The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP 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	12,749.20			$28.87
1024 KiB Transfer Size				
4 I/Os Outstanding	12,806.07	120	106.72	
1 I/O Outstanding	12,749.15	120	106.24	
64 KiB Transfer Size				
4 I/Os Outstanding	12,711.27	200	63.56	
1 I/O Outstanding	12,730.30	200	63.65	
The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ 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**
	12,189.61	15,500	0.79	$30.19

Storage Capacities and Relationships

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.

The capacity values in each of the following four charts are listed as integer values, for readability, rather than the decimal values listed elsewhere in this document.

Physical Storage Capacity: 230,449 GB

Unused Physical Capacity: 3,459 GB 1.50%

Configured Storage Capacity: 221,335 GB 96.05%

Global Storage Overhead: 5,655 GB 2.45%

Available Data Capacity: 193,668 GB 84.04%

Data Protection Capacity: 27,667 GB 12.01%

Configured Storage Capacity: 221,335 GB

Unused Data Protection Capacity:
12 GB 0.01%

Data Protection Capacity:
27,667 GB 12.49%

Available Data Capacity:
193,753 GB 87.50%

Addressable Storage Capacity:
193,668 GB 87.46%

Unused Available Data Capacity:
85 GB 0.04%

Addressable Storage Capacity: 193,668 GB

96 Logical Volumes, 2,017 GB per Logical Volume

Unused Addressable Capacity:
85 GB 0.04%

Total ASU Capacity:
193,583 GB 99.96%

*96 Logical Volumes,
2,016 GB per Logical Volume*

Total Unused Storage Capacity Ratio and Detail

Physical Storage Capacity:
230,449 GB

Total Unused Storage Capacity:
3,556 GB 1.54%

Unused Configured Capacity: 0 GB

Physical Storage Capacity Used: 226,905 GB 98.46%

Unused Physical Capacity: 3,459 GB

Unused Data Protection: 12 GB

Unused Addressable Capacity: 85 GB

SPC-2 Storage Capacity Utilization	
Application Utilization	84.00%
Protected Application Utilization	96.00%
Unused Storage Ratio	1.54%

Application Utilization: Total ASU Capacity *(193,582.766 GB)* divided by Physical Storage Capacity *(230,448.870 GB)*.

Protected Application Utilization: Total ASU Capacity *(193,582.766 GB)* plus total Data Protection Capacity *(27,666.954 GB)* minus unused Data Protection Capacity *(12.173 GB)* divided by Physical Storage Capacity *(230,448.870 GB)*.

Unused Storage Ratio: Total Unused Capacity *(3,556.153 GB)* divided by Physical Storage Capacity *(230,448.870 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 27-28 in the Full Disclosure Report.

Priced Storage Configuration Pricing

Product Description	Qty	Unit List Price	Product List Price
Power Cable 250VAC 10A IEC320-C14	34	$39.00	$1,326.00
Methode Mounting Bracket for PDU-221112F10 (1 per PDU)	4	$67.00	$268.00
Baying kit external	4	$5.90	$23.60
Solution 19 in rack ROW MIN	1	$8,110.00	$8,110.00
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)	16	$6,765.00	$108,240.00
HUS VM Controller Chassis	1	$74,000.00	$74,000.00
HUS VM 600GB SAS 10K RPM HDD SFF for CBSS/DBS-Base	384	$1,095.00	$420,480.00
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	4	$1,236.00	$4,944.00
Universal rail kit includes left and right rails	17	$154.00	$2,618.00
HUS VM Cache Flash Memory Module (supports 160GB)	1	$9,888.00	$9,888.00
HUS VM 8GB Cache Module	16	$2,504.00	$40,064.00
Hitachi Unified Storage VM Microcode Kit	1	$0.00	$0.00
Hitachi Unified Storage VM Product Documentation Library	1	$0.00	$0.00
Hardware Components:		---	**$701,673.60**
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	$36,333.36	$36,333.36
HUS VM Storage Software Support - Includes 3 years of Standard Support	1	$37,305.00	$37,305.00
Installation and Support:		---	**$76,388.36**
Emulex LightPulse Dual Port Fibre Channel Host Bus Adapter LPE12002-M8	12	$1,380.00	$16,560.00
Fibre Channel Cables	24	$21.50	$516.00
Third Party Components:		---	**$17,076.00**

		Discount		
Hardware Components		*$701,673.60*	*65%*	*$245,585.76*
Software Components		*$82,900.00*	*65%*	*$29,015.00*
Installation & Support		*$76,388.36*	*0%*	*$76,388.36*
Third Party Components		*$17,076.00*	*0%*	*$17,076.00*

Total: **$368,065.12**

The above 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.

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

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

Priced Storage Configuration Diagram

12-Emulex LPe12002 dual-port 8 Gb FC

• • • | 24 - *8 Gbps FC connections*
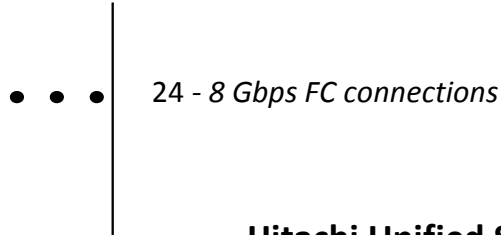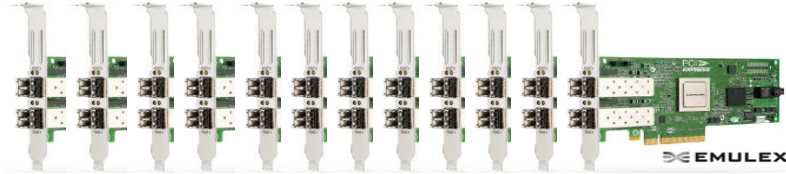
Hitachi Unified Storage VM

1 HiStar-based storage controller with:
 2 Main blades with:
    64 GB cache per blade *(128 GB total)*
    80 GB flash per blade for cache backup *(160 GB 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)
   (32 ports total)

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

16 -Drive Enclosures

384 -600 GB SAS 10K RPM disk drives
   (16 enclosures each with 24 drives)

1-19" Rack with 4 PDUs

Priced Storage Configuration Components

Priced Storage Configuration
12 – Emulex LightPulse LPe12002-M8 8Gbps dual port FC HBAs

Hitachi Unified Storage VM
 1 HiStar-based storage controller with:
  2 Main blades each with:
    64 GB cache per blade *(128 GB total)*
    80 GB flash for cache backup per blade *(160 GB total)*
    1 flash battery *(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)
      (12 ports used per controller, 24 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)

16 – Drive Enclosures
384 – 600 GB SAS 10K RPM disk drives   *(24 disk drives per drive enclosure)*
1 – 19" rack with 4 PDUs