SPC BENCHMARK 1™
EXECUTIVE SUMMARY

HITACHI DATA SYSTEMS CORPORATION
HITACHI UNIFIED STORAGE 150

SPC-1 V1.13

Submitted for Review: March 26, 2013
Submission Identifier: A00128
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	March 26, 2013
Date the FDR was submitted to the SPC	March 26, 2013
Date revised FDR was submitted to the SPC Revised pricing *(page 6)* Revised price-related SPC-1 Reported Data *(page 4)* New third-party quote *(page 90 of the Full Disclosure Report)*	March 20, 2014
Date the Priced Storage Configuration is available for shipment to customers	April 24, 2012
Date the TSC completed audit certification	March 19,2013

Tested Storage Product (TSP) Description

Hitachi redefines unified storage with Hitachi Unified Storage. With trusted Hitachi reliability, it helps you meet application availability requirements and application latency requirements with lower investment. You will be able to deploy storage for all data types and easily grow to meet expanding requirements with software features like HDT and meet service level objectives for critical business applications. It simplifies operations with easy to use management and is part of a robust portfolio of storage solutions that can be managed from a single interface for optimal management efficiency. Combine all of this

with the solution portfolio for the HUS portfolio and customers will find that the HUS platform will address all of their data center needs.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Hitachi Unified Storage 150	
Metric	**Reported Result**
SPC-1 IOPS™	109,986.41
SPC-1 Price-Performance™	$4.45/SPC-1 IOPS™
Total ASU Capacity	76,245.000 GB
Data Protection Level	Protected 2 *(Mirroring)*
Total Price	$489,919.78
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.*

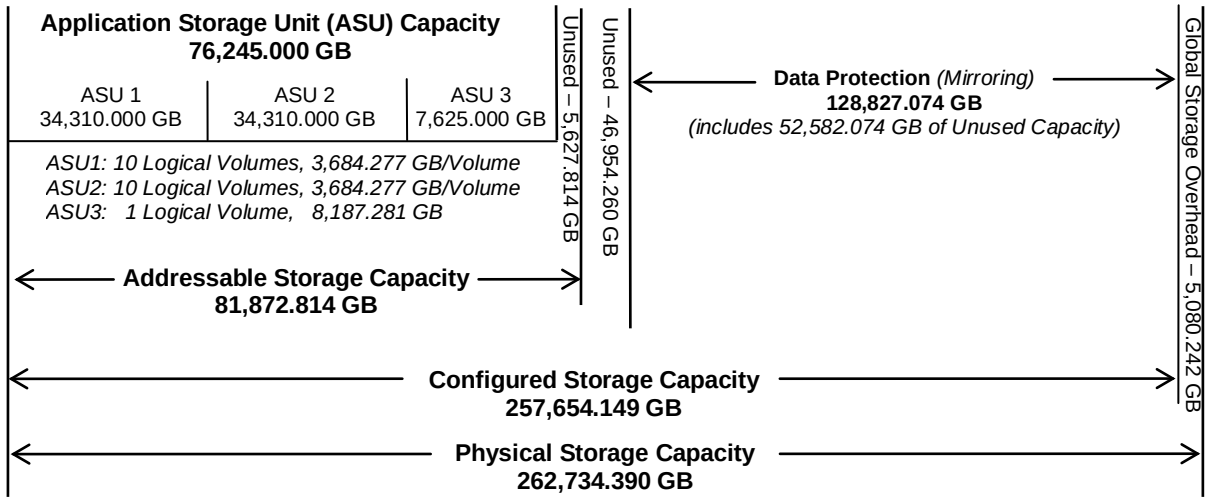
Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 7.

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	29.02%
Protected Application Utilization	58.04%
Unused Storage Ratio	40.03%

Application Utilization: Total ASU Capacity *(76,245.000 GB)* divided by Physical Storage Capacity *(262,734.390 GB)*.

Protected Application Utilization: Total ASU Capacity *(76,245.000 GB)* plus total Data Protection Capacity *(128,827.074 GB)* minus unused Data Protection Capacity *(52,582.074 GB)* divided by Physical Storage Capacity *(262,734.390 GB)*.

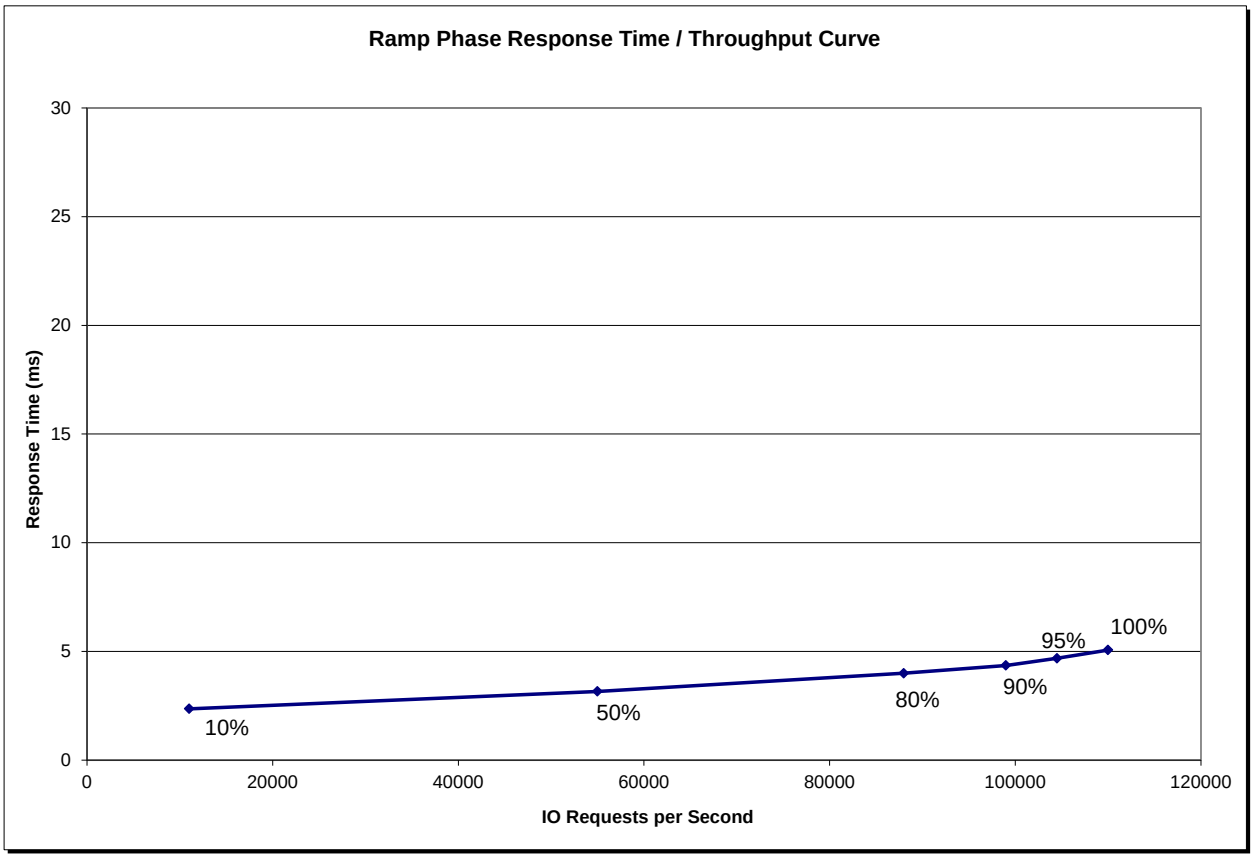
Unused Storage Ratio: Total Unused Capacity *(105,164.149 GB)* divided by Physical Storage Capacity *(262,734.390 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 22-23 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	11,001.91	54,997.50	87,985.49	98,995.38	104,511.53	109,986.41
Average Response Time (ms):						
All ASUs	2.36	3.16	3.99	4.35	4.68	5.06
ASU-1	3.09	4.00	4.98	5.39	5.75	6.16
ASU-2	3.26	4.54	5.70	6.23	6.62	7.26
ASU-3	0.40	0.76	1.15	1.34	1.57	1.77
Reads	5.41	6.92	8.48	9.13	9.66	10.32
Writes	0.37	0.71	1.07	1.24	1.44	1.64

Priced Storage Configuration Pricing

Product Description	Qty	Unit List Price	Product List Price
Dummy Drive for SFF (2U) Trays	16	$0.00	$0.00
AMS 19 in rack Americas MIN	3	$5,427.00	$16,281.00
HUS 300GB SAS 10K RPM HDD SFF for CBSS/DBS-Base	896	$590.00	$528,640.00
HUS 150 8GB Cache Module	4	$1,930.00	$7,720.00
HUS 150 Controller, including (2) SAS IOC processors	2	$15,200.00	$30,400.00
HUS Drive Box - SFF 2U x 24	38	$5,890.00	$223,820.00
HUS 150 4x8Gbps FC Interface Adapter	4	$2,850.00	$11,400.00
Hitachi Unified Storage SAS Cable 5m	16	$760.00	$12,160.00
HUS 150 Base Controller Box	1	$7,600.00	$7,600.00
50/125 LC/LC PLN 5M 2f round SB 10gig OM3	16	$81.00	$1,296.00
12 outlet, single phase 208V/30AMP, NEMA, 10 ft cord	12	$735.00	$8,820.00
Hardware Components:		---	**$848,137.00**
HUS 150 Base Operating System Security Extension License	1	$400.00	$400.00
HUS 150 Base Operating System E Lic	1	$9,600.00	$9,600.00
Software Components:		---	**$10,000.00**
HUS 150 Installation Support	**1**	$2,750.00	$2,750.00
HUS 150 Hardware Maintenance Support - Includes 3 years of Standard Support (24 x 7 x 4 hour response)	**1**	$75,425.76	$75,425.76
HUS 150 Storage Software Support - Includes 3 years of Standard Support	1	$2,745.00	$2,745.00
Installation and Support:		---	**$80,920.76**
Brocade 360 switch with 24 active ports, Full Fabric, 24 SWL 8Gb BR SFPs, Fixed Rack Mount	2	$4,827.00	$9,654.00
3 Year Support	1	$320.00	$320.00
13 mos Maintenance	1	$107.00	$107.00
Fibre Channel Cables	4	$21.25	$85.00
EMC LightPulse Dual Port Fibre Channel Host Bus Adapter LPE12002-E	2	$1,295.00	$2,590.00
Third Party Components:		---	**$12,756.00**

Hardware Components	**$848,137.00**	**54%**	**$390,143.02**
Software Components	**$10,000.00**	**39%**	**$6,100.00**
Installation & Support	**$80,920.76**	**0%**	**$80,920.76**
Third Party Components	**$12,756.00**	**0%**	**$12,756.00**
	Total:		**$489,919.78**

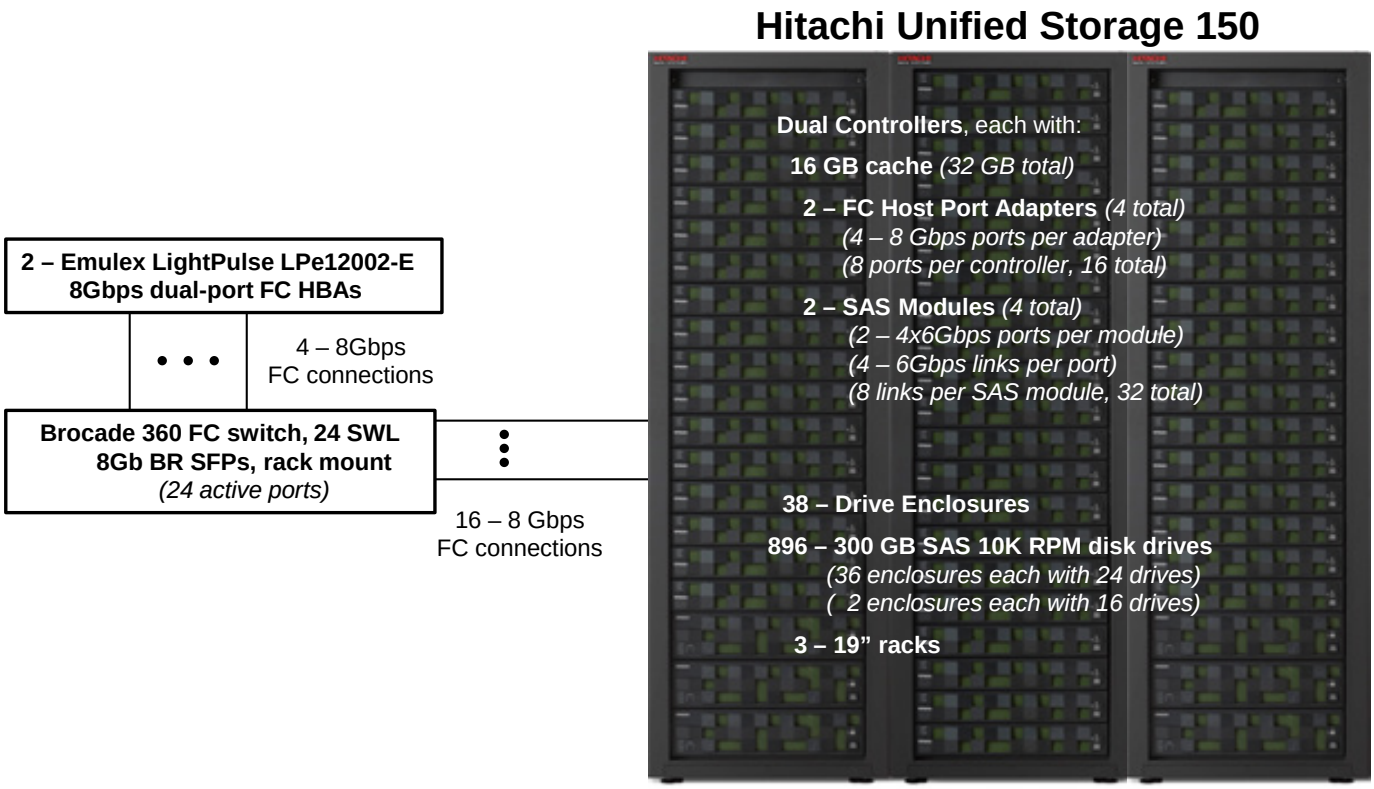
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

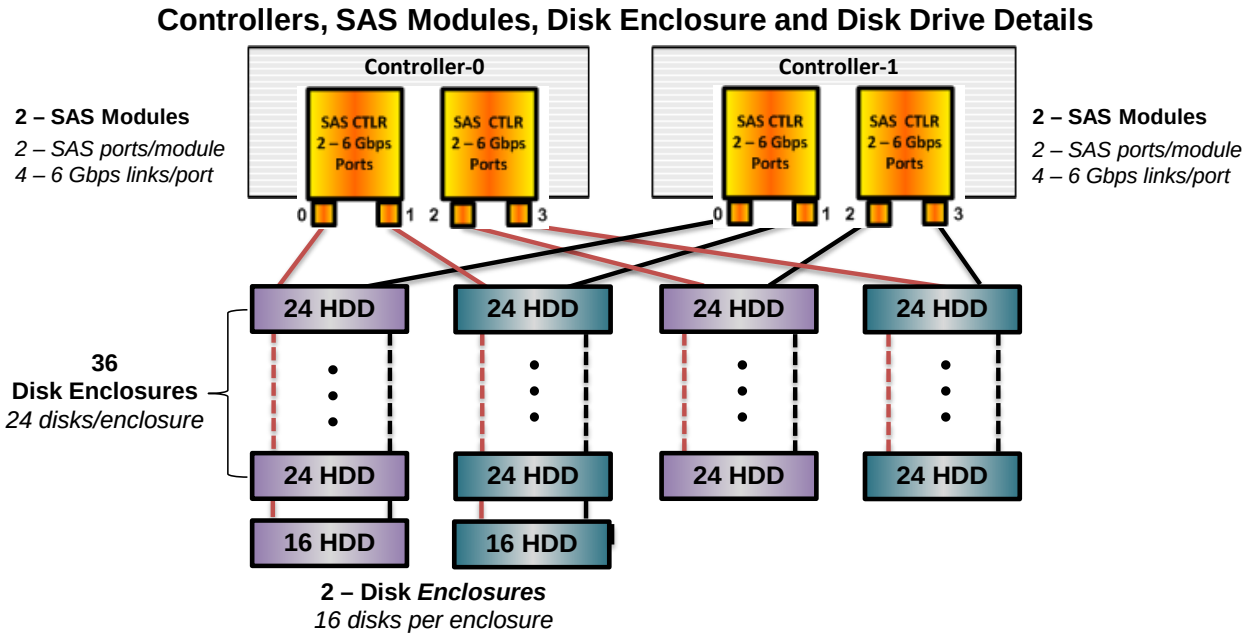
- Acknowledgement of new and existing problems with four (4) hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration 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**.

Priced Storage Configuration Diagram





Priced Storage Configuration Components

Priced Storage Configuration:
2 – Emulex LightPulse LPe12002-E 8Gbps dual port FC HBAs
2 – Brocade 360 FC switches, 24 active ports, 24 8Gb SFPs *(second switch used as a spare)*
Hitachi Unified Storage 150 Dual Active-Active Controllers, each with 16 GB cache *(32 GB total)* 2 – FC Host Port Adapters *(4 total)* *(4 – 8 Gbps ports adapter)* *(8 ports per controller, 16 total, 16 used)* 2 – SAS Modules *(4 total)* *(2 – 8x6Gbps ports per module)* *(4 ports per module, 8 total, 8 used)* *(4 – 8x6Gbps links per port)* *(8 links per module, 32 total, 32 used)*
38 – Drive Enclosures
896 – 300 GB SAS 10K RPM disk drives *(36 Drive Enclosures each with 24 disk drives)* *(2 Drive Enclosures each with 16 disk drives)*
3 – 19” racks, each with 4 PDUs