SPC BENCHMARK 1™
EXECUTIVE SUMMARY

HITACHI DATA SYSTEMS CORPORATION
HITACHI VIRTUAL STORAGE PLATFORM *(VSP)*

SPC-1 V1.12

Submitted for Review: November 1, 2011
Submission Identifier: A00110

EXECUTIVE SUMMARY

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	V1.12
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	November 1, 2011
Date the FDR was submitted to the SPC	November 1, 2011
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	November 1, 2011

Tested Storage Product (TSP) Description

Hitachi Virtual Storage Platform is the only 3D scaling storage platform designed for all data types. The Hitachi Virtual Storage Platform flexibly adapts for performance, capacity and multi-vendor storage. Combined with unique Hitachi Command Suite management software, it transforms the data center.

Summary of Results

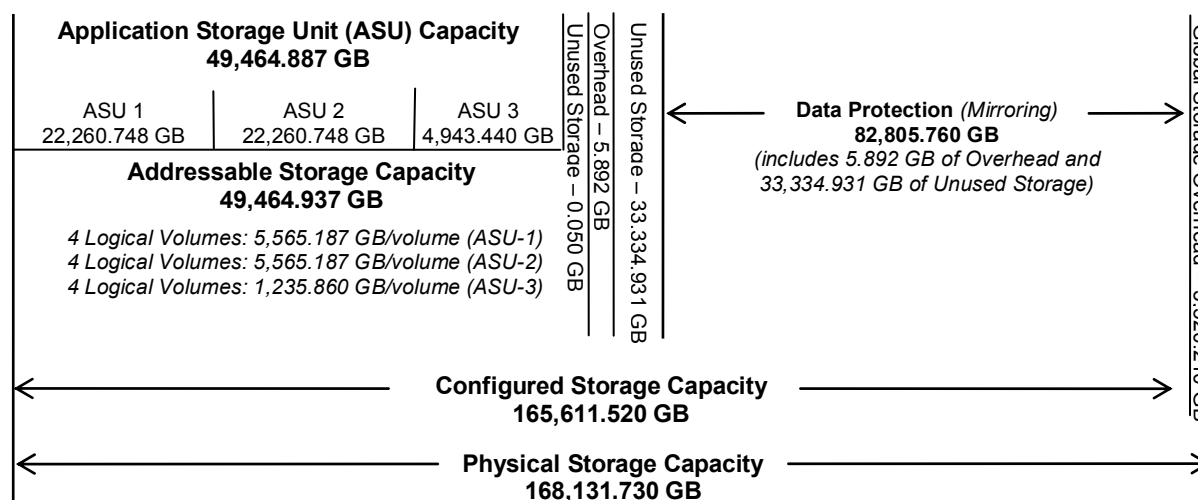| SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Hitachi Virtual Storage Platform *(VSP)*	
Metric	**Reported Result**
SPC-1 IOPS™	269,506.69
SPC-1 Price-Performance	$8.18/SPC-1 IOPS™
Total ASU Capacity	49,464.887GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$2,204,952.12

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

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

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

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	29.25%
Protected Application Utilization	58.50%
Unused Storage Ratio	39.42%

Application Utilization: Total ASU Capacity *(49,464.887 GB)* divided by Physical Storage Capacity *(169,131.730 GB)*

Protected Application Utilization: (Total ASU Capacity *(49,464.887 GB)* plus total Data Protection Capacity *(82,805.760 GB)* minus unused Data Protection Capacity *(33,334.931 GB)* divided by Physical Storage Capacity *(169,131.730 GB)*
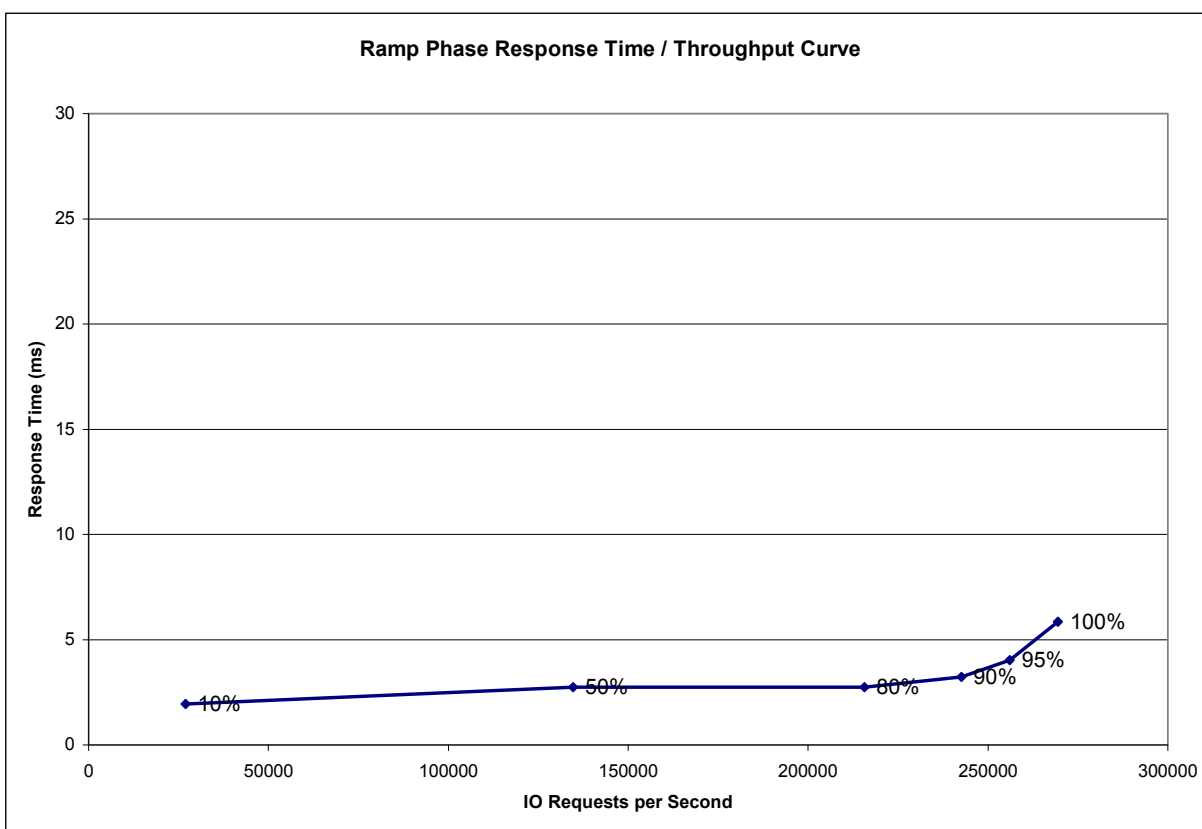
Unused Storage Ratio: Total Unused Capacity *(GB)* divided by Physical Storage Capacity *(169,131.730GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 21-22 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.

Ramp Phase Response Time / Throughput Curve

Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	26,952.98	134,724.06	215,600.25	242,567.41	255,982.12	269,506.69
Average Response Time (ms):						
All ASUs	1.95	2.75	2.75	3.23	4.02	5.85
ASU-1	2.47	3.44	3.69	4.23	5.05	6.87
ASU-2	2.06	2.82	3.15	3.71	4.49	5.89
ASU-3	0.81	1.24	0.57	0.89	1.64	3.69
Reads	3.76	5.21	6.08	6.82	7.76	9.43
Writes	0.77	1.14	0.58	0.88	1.59	3.53

Priced Storage Configuration Pricing

Product Description	Qty	List Price		
Virtual Storage Platform Microcode Kit	1	$0.00		
Virtual Storage Platform Product Documentation Library	1	$0.00		
SVC VSP Installation Planning	1	$5,000.00		
SVC VSP Installation - Control Frame	2	$13,000.00		
Bezel Kit - DKC	2	$3,860.00		
Decoration Panel - HDS	4	$2,560.00		
Filler Panel	10	$700.00		
PDU Bracket 1-Phase	12	$5,880.00		
DKC Power Cord Kit (USA)	**4**	$2,640.00		
Rack - 42U	4	$28,520.00		
Disk Adapter	4	$60,920.00		
Side Cover	1	$1,630.00		
Primary Controller Chassis	1	$74,010.00		
4GB USB memory stick with lanyard	1	$0.00		
LAN Cable 14ft	1	$0.00		
RJ-11 Modular In-Line Coupler 4 Conductor	1	$0.00		
RJ-45 Modular In-Line Coupler 6 Conductor	1	$0.00		
Fibre 16-Port HOST Adapter(8Gbps)	4	$94,440.00		
DEV Cable from Controller to 1st Drive Chassis	2	$6,220.00		
Drive Chassis Bezel - HDS	9	$15,840.00		
DKU Power Cord Kit (USA)	9	$5,940.00		
SFF Drive Chassis	9	$417,870.00		
SVC VSP Installation - Storage Frame	2	$12,000.00		
PDU Kit, 30A, 250V, 8XC13R,NEMA L6-30P	12	$10,200.00		
SFF 146GB Disk Drive 2.5inch	1,152	$2,207,920.00		
Additional Controller PS	2	$15,980.00		
Cache Flash Memory Module (64GB)	8	$251,200.00		
Cache Memory Module (16GB)	32	$123,840.00		
Cache Memory Adapter	6	$480,180.00		
Device Interface Cable RLEXC	2	$16,260.00		
Device Interface Cable UU	5	$51,600.00		
Second Controller Chassis	1	$255,870.00		
Hub Kit	2	$20,560.00		
Processor Blade	2	$85,380.00		
PCI-Express Switch Adapter	2	$54,840.00		
Device Interface Cable HBU	2	$9,300.00		
Device Interface Cable HRLEX	2	$19,480.00	**Hardware**
Device Interface Cable HUU	5	$29,542.00	**Components**
Inter-Controller Connecting Kit	1	$130,690.00	**$4,513,872.00**

Product Description	Qty	List Price		
VSP Basic Operating System 10TB Block License	1	$25,700.00		
VSP Basic Operating System 20TB Block License	1	$46,800.00		
VSP Basic Operating System 20TB Base License	1	$46,800.00	**Software**
VSP Basic Operating System 100TB Block License	1	$188,900.00	**Components**
VSP Basic Operating System 4-VSD Pair Base License	1	$112,800.00	**$421,000.00**

	List	Discount	Total	
VSP Hardware	$4,513,872.00	57.28%		$1,928,326.12
VSP Hardware Maintenance	0	0	$	-
- Includes of 3 years Premium Service (24x7x2 hour response) and installation				
VSP Software	$421,000.00	39.00%	$	256,810.00
VSP Software Maintenance	0	0	$	-
- Includes 3-years of Service (24x7x2 hour response)				

Total			$2,185,136.12
Emulex LPe11002 HBAs @$1199		16	$19,184.00
LC-LC FC Cables@$19.75		32	$632.00
			$2,204,952.12

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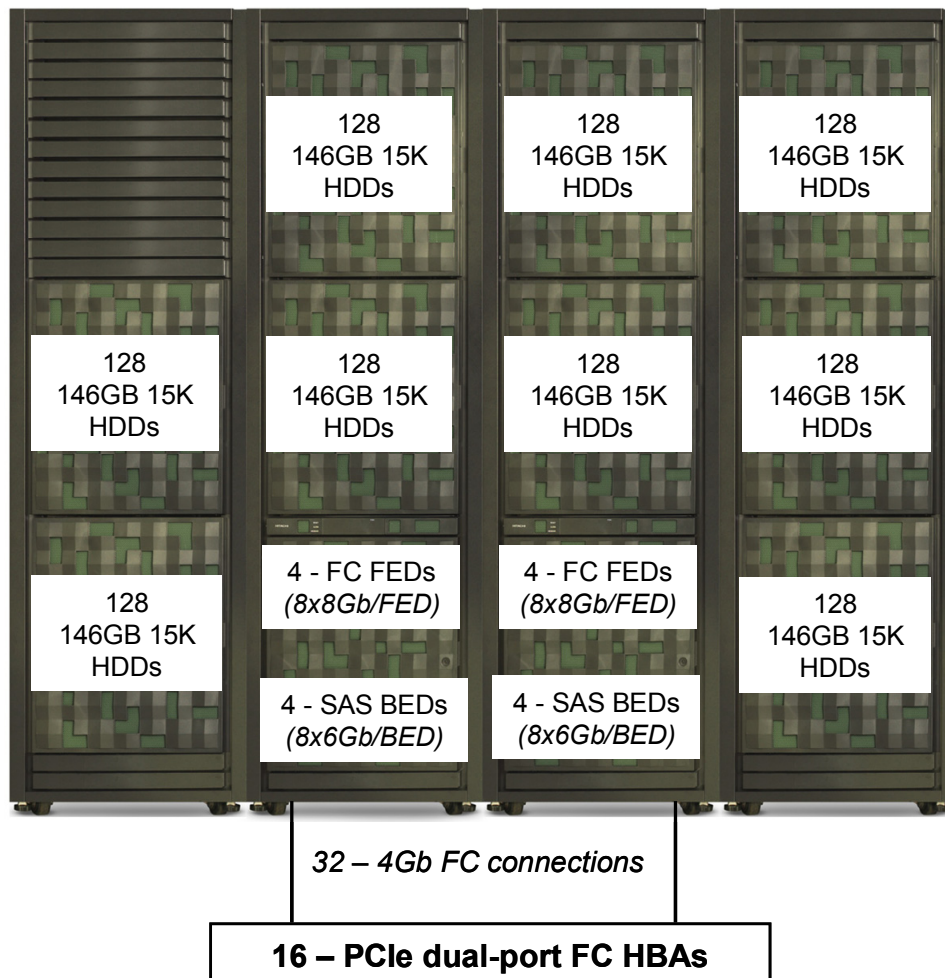
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

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

Priced Storage Configuration Diagram

Hitachi Virtual Storage Platform *(VSP)*

512 GB memory/cache, 512 GB backup flash
8 – Virtual Storage Directors
8 – 8 Gbps Front-end Director Boards *(FED)*
8 – 6 Gbps Backend Director Boards *(BED)*
1,152 – 2.5" 146 GB 15K RPM SAS disk drives

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146GB 15K
HDDs

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146GB 15K
HDDs

4 - FC FEDs
(8x8Gb/FED)

4 - FC FEDs
(8x8Gb/FED)

128
146GB 15K
HDDs

4 - SAS BEDs
(8x6Gb/BED)

4 - SAS BEDs
(8x6Gb/BED)

32 – 4Gb FC connections

16 – PCIe dual-port FC HBAs

Priced Storage Configuration Components

Priced Storage Configuration:
16 – Emulex LPe11002 4Gb PCI Express dual-port Fibre Channel HBAs

Hitachi Virtual Storage Platform (VSP)
    512 GB memory/cache, 512 GB flash back-up
    2 – Processor Blades
    2 – PCI-Express Switch Adapters
    8 – Virtual Storage Directors
    8 – 8 Gbps FC Front-end Director (FED) boards in 4 FED pairs
        (8 connections/FED, 64 total connections, 32 connections used)
    8 – 6 Gbps SAS Backend Director (BED) boards in 4 BED pairs
        (8 connections/BED, 64 total connections, 32 connections used)

1 – Primary Controller Chassis 1 – Second Controller Chassis
9 – SFF Drive Chassis
2 – Control Frames
2 – Storage Frames
1,152 – 2.5", 146 GB, 15K RPM, SAS disk drives