



**SPC BENCHMARK 2™
EXECUTIVE SUMMARY**

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

SPC-2™ V1.3

Submitted for Review: July 27, 2012

Submission Identifier: B00060

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Revision Information and Key Dates

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SPC-2 Specification revision number	V1.3
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	July 27, 2012
Date FDR was submitted to the SPC	July 27, 2012
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	July 26, 2012

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.

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 Reported Data				
Hitachi Virtual Storage Platform (VSP)				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
13,147.87	\$95.38	129,111.985	\$1,254,093.30	Protected (RAID-5)
<i>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)</i>				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	10,664.91			\$117.59
Write Only:				
1024 KiB Transfer	7,322.38	400	18.31	
256 KiB Transfer	7,317.11	400	18.29	
Read-Write:				
1024 KiB Transfer	9,977.15	400	24.94	
256 KiB Transfer	9,945.56	400	24.86	
Read Only:				
1024 KiB Transfer	14,489.20	400	36.22	
256 KiB Transfer	14,938.05	400	37.35	
<i>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).</i>				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	14,622.89			\$85.76
1024 KiB Transfer Size				
4 I/Os Outstanding	14,485.63	400	36.21	
1 I/O Outstanding	14,352.60	400	35.88	
64 KiB Transfer Size				
4 I/Os Outstanding	14,656.82	400	36.64	
1 I/O Outstanding	14,996.52	400	37.49	
<i>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).</i>				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	14,155.80	18,000	0.79	\$88.59

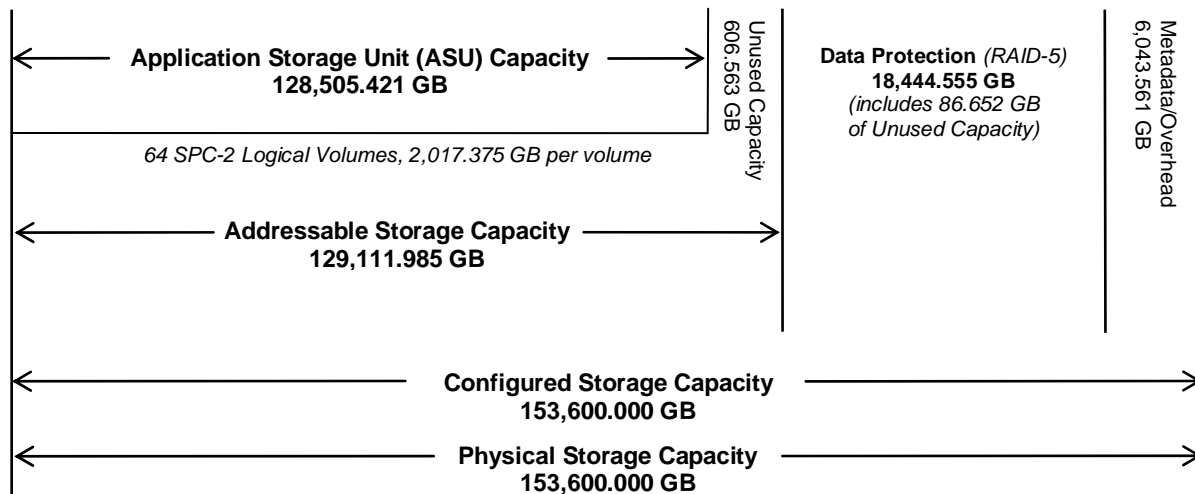
SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

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

A **Data Protection Level of Protected** using **RAID-5** provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

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	83.66%
Protected Application Utilization	95.61%
Unused Storage Ratio	0.45%

Application Utilization: Total ASU Capacity (*128,505.421 GB*) divided by Physical Storage Capacity (*153,600.00 GB*)

Protected Application Utilization: Total ASU Capacity (*128,505.421 GB*) plus total Data Protection Capacity (*18,444.555 GB*) minus unused Data Protection Capacity (*86.652 GB*) divided by Physical Storage Capacity (*128,505.421 GB*).

Unused Storage Ratio: Total Unused Capacity (*693.215 GB*) divided by Physical Storage Capacity (*128,505.421 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 Emulex blade HBAs and Brocade blade switches used in the TSC were replaced in the priced storage configuration by the non-blade versions of those products. Comparison testing, using the blade and non-blade version of the products, was completed with the TSC. That comparison testing confirmed that the choice of blade or non-blade versions of the two products had no impact on SPC-2 performance.

All other differences between the TSC and priced storage configuration were cosmetic packaging.

Priced Storage Configuration Pricing

Part Number	Product Description	Qty	List Price	Ext. Price		
041-100065-01.P	Virtual Storage Platform Microcode Kit	1	\$0.00	\$0.00		
041-100066-01.P	Virtual Storage Platform Product Documentation Library	1	\$0.00	\$0.00		
043-991826-01.P	SVC VSP Installation Planning	1	\$5,000.00	\$5,000.00		
043-991828-01.P	SVC VSP Installation - Control Frame	2	\$6,500.00	\$13,000.00		
7846477.P	30A 208V, 7 x C13 outlets, 50/60Hz 3Phase PDU, L15-30P C	4	\$1,616.90	\$6,467.60		
DKC-F710I-16UFC.P	Fibre 16-Port HOST Adapter(8Gbps)	8	\$23,610.00	\$188,880.00		
DKC-F710I-300JCM.P	SFF 300GB Disk Drive 2.5inch	512	\$1,290.00	\$660,480.00		
DKC-F710I-APC.P	Additional Controller PS	2	\$7,990.00	\$15,980.00		
DKC-F710I-BCH.P	Bezel Kit - DKC	2	\$1,930.00	\$3,860.00		
DKC-F710I-BUC.P	DEV Cable from Controller to 1st Drive Chassis	2	\$3,110.00	\$6,220.00		
DKC-F710I-BUH.P	Drive Chassis Bezel - HDS	4	\$1,760.00	\$7,040.00		
DKC-F710I-C32G.P	Cache Memory Module (32GB)	16	\$7,690.00	\$123,040.00		
DKC-F710I-CPC.P	Cache Memory Adapter	2	\$80,030.00	\$160,060.00		
DKC-F710I-DECO.P	Decoration Panel - HDS	2	\$640.00	\$1,280.00		
DKC-F710I-ESW.P	PCI-Express Switch Adapter	2	\$27,420.00	\$54,840.00		
DKC-F710I-FIHT.P	Filler Panel	4	\$70.00	\$280.00		
DKC-F710I-HBUC.P	Device Interface Cable HBU	2	\$4,650.00	\$9,300.00		
DKC-F710I-HUB.P	Hub Kit	1	\$10,280.00	\$10,280.00		
DKC-F710I-HUUC.P	Device Interface Cable HUU	2	\$7,090.00	\$14,180.00		
DKC-F710I-MDEXC.P	Inter-Controller Connecting Kit	1	\$130,690.00	\$130,690.00		
DKC-F710I-MP.P	Processor Blade	2	\$42,690.00	\$85,380.00		
DKC-F710I-PBR1.P	PDU Bracket	2	\$490.00	\$980.00		
DKC-F710I-PHUC.P	DKU Power Cord Kit (USA)	4	\$660.00	\$2,640.00		
DKC-F710I-PLUC.P	DKC Power Cord Kit (USA)	2	\$660.00	\$1,320.00		
DKC-F710I-RK42.P	Rack - 42U	2	\$7,130.00	\$14,260.00		
DKC-F710I-SBX.P	SFF Drive Chassis	4	\$46,430.00	\$185,720.00		
DKC-F710I-SCA.P	Disk Adapter	4	\$15,230.00	\$60,920.00		
DKC-F710I-SCOV.P	Side Cover	1	\$1,630.00	\$1,630.00		
DKC-F710I-SVP.P	Service Processor	1	\$16,340.00	\$16,340.00		
DKC-F710I-UUC.P	Device Interface Cable UU	2	\$10,320.00	\$20,640.00		
DKC710I-CBXA.P	Primary Controller Chassis	1	\$74,010.00	\$74,010.00		
DKC710I-CBxB.P	Second Controller Chassis	1	\$255,870.00	\$255,870.00		
DT14GL.P	4GB USB memory stick with lanyard	1	\$0.00	\$0.00		
IP0662-14.P	LAN Cable 14ft	1	\$0.00	\$0.00		
IP0665-11.P	RJ-11 Modular In-Line Coupler 4 Conductor	1	\$2.50	\$2.50	Hardware	
IP0665-45.P	RJ-45 Modular In-Line Coupler 6 Conductor	1	\$4.00	\$4.00	Components	
DKC-F710I-BM128.P	Cache Flash Memory Module (128GB)	4	\$59,650.00	\$238,600.00	\$2,369,194.10	
	Product Description	Qty	List Price	Ext. Price		
044-230001-03.P	VSP Basic Operating System 20TB Base License	1	\$46,800.00	\$46,800.00	Software	
044-230001-04B.P	VSP Basic Operating System 100TB Block License	1	\$188,900.00	\$188,900.00	Components	
044-230001-100.P	VSP Basic Operating System 4-VSD Pair Base License	1	\$112,800.00	\$112,800.00	\$348,500.00	
				Ext. Total	Discount	Total
VSP-A0001.S	VSP Hardware			\$2,369,194.10	57.28%	\$1,012,119.72
	VSP Hardware Maintenance					
	- Includes 3 yrs Premium SVC (24x7x2 hr response) and installation					
043-991839-01.P		36	\$0.00	0	0	\$
HSCS-VSP-SW-PERP	VSP Software			\$348,500.00	39.00%	\$212,585.00
304-230001-04B.P	VSP Software Maintenance					
304-230001-100.P	- Includes 3 yrs SVC (24x7x2 hr response) and installation	36	\$0.00	0	0	
				Total		\$1,224,704.72
	Additional hardware					
HD-360-0008.P	Brocade 360 switch w/24 active port,FF,24 SWL 8Gb BR SFP	4	\$8,832.80	\$35,331.20		Additional
LPE12000-M8.P	HBA-8Gb PCIe 2.0 Smart Optics, RoHS	32	\$1,302.96	\$41,694.72		Components
JFFB3737025MFCI.P	50/125 LC/LC PLN 25M 2f round SB 10gig OM3	64	\$108.46	\$6,941.44		\$83,967.36
				\$83,967.36	65%	\$29,388.58
	Grand Total			\$2,801,661.46		\$1,254,093.30

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

Hitachi Virtual Storage Platform (VSP)

1 – Primary Controller Chassis

1 – Secondary Controller Chassis

512 GB memory/cache, 512 GB backup flash

8 – Virtual Storage Directors (VSDs)

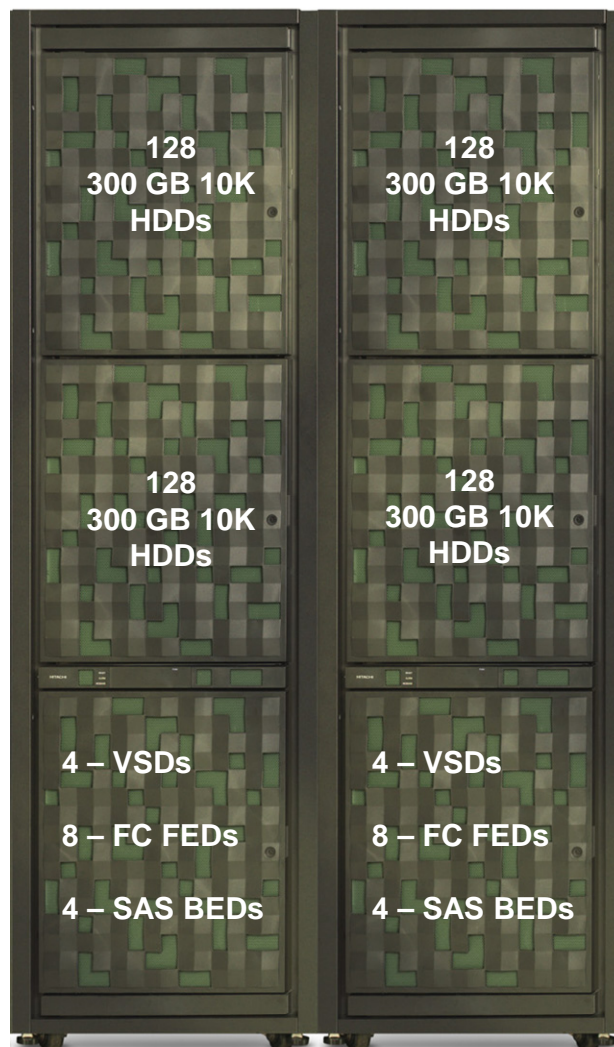
16 – 8 Gbps FC Front-end Directors (FEDs)

8 – 6 Gbps SAS Backend Directors (BEDs)

512 – 300 GB 10K RPM SAS disk drives (HDDs)

4 – Brocade 24-port 8 Gb switches

32 – dual-port FC HBAs



Priced Configuration Components

Priced Storage Configuration:
32 – dual port 8 Gb FC HBAs (64 ports total, 32 ports used)
4 – Brocade 24 Port, 8 Gb zoned switches with SFPs
Hitachi Virtual Storage Platform (VSP)
1 – Primary Controller Chassis*
1 – Secondary Controller Chassis**
8 – Virtual Storage Directors (4 pairs, 8 total, 1 – quad-core processor per director, 32 cores total)
16 – Cache Memory Modules (32 GB per module, 512 GB total)
8 – 16-port 8 Gbps FC Channel Host Adapters (FEDs) pairs \\ (16 adapters total, 16 – 8 Gbps ports per adapter, 256 ports total, 32 ports used)
4 – SAS Drive Adapter (BEDs) pairs (8 adapters total) (8 – 6 Gbps SAS connections per adapter, 64 total connections, 32 connections used)
4 – 128 GB Cache Flash Memory Modules (512 GB total)
512 – 300 GB 10K RPM disk drives (128 disk drives per disk chassis)

**Primary Controller Chassis includes:*

- 42U rack
- 1 – VSD pair (processor blades)
- 2 – Drive Chassis
- 1 – PCIe Switch
- 2 – Cache Memory Adapter
- 1 – Service Processor
- 2 – Additional Controller PS (power supply)
- Cabling to first Drive Chassis

***Secondary Controller Chassis includes:*

- 42U rack
- 1 – VSD pair (processor blades)
- 2 – Drive Chassis
- 1 – PCIe Switch
- 2 – Cache Memory Adapter
- 2 – Additional Controller PS (power supply)
- 1 – Hub kit
- Cabling to Primary Controller Chassis
- Cabling to first Drive Chassis