



SPC BENCHMARK 1™
EXECUTIVE SUMMARY

HITACHI DATA SYSTEMS CORPORATION
HITACHI VIRTUAL STORAGE PLATFORM
(WITH HITACHI ACCELERATED FLASH)

SPC-1 V1.14

Submitted for Review: July 30, 2013
Submission Identifier: A00136
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	V1.14
SPC-1 Workload Generator revision number	V2.3.0
Date Results were first used publicly	July 30, 2013
Date the FDR was submitted to the SPC	July 30, 2013
Date revised FDR was submitted to the SPC Revised pricing (page 8) Revised price-related SPC-1 Reported Data (page 4) New third-party quote (page 92 in the Full Disclosure Report)	March 20, 2014
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	July 24, 2013

Tested Storage Product (TSP) Description

Hitachi Virtual Storage Platform is the only 3D scaling storage platform designed for all data types. It is the only enterprise storage architecture that flexibly adapts for performance, capacity and multivendor storage. Combined with unique [Hitachi Command Suite](#) management software, it transforms the data center.

- Scale up by dynamically adding resources to a control chassis to provide the highest performance for both open and mainframe environments.
- Scale out by dynamically combining multiple control chassis into a logical system with shared resources to support increased demand in virtualized server environments.
- Scale deep by dynamically virtualizing new and existing external storage systems to extend the advanced functions to multivendor storage, offloading less demanding data to external tiers.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Hitachi Virtual Storage Platform <i>(with Hitachi Accelerated Flash)</i>	
Metric	Reported Result
SPC-1 IOPS™	602,019.47
SPC-1 Price-Performance™	\$2.91/SPC-1 IOPS™
Total ASU Capacity	11,610.843 GB
Data Protection Level	Protected 2 <i>(Mirroring)</i>
Total Price	\$1,749,937.95
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 9.

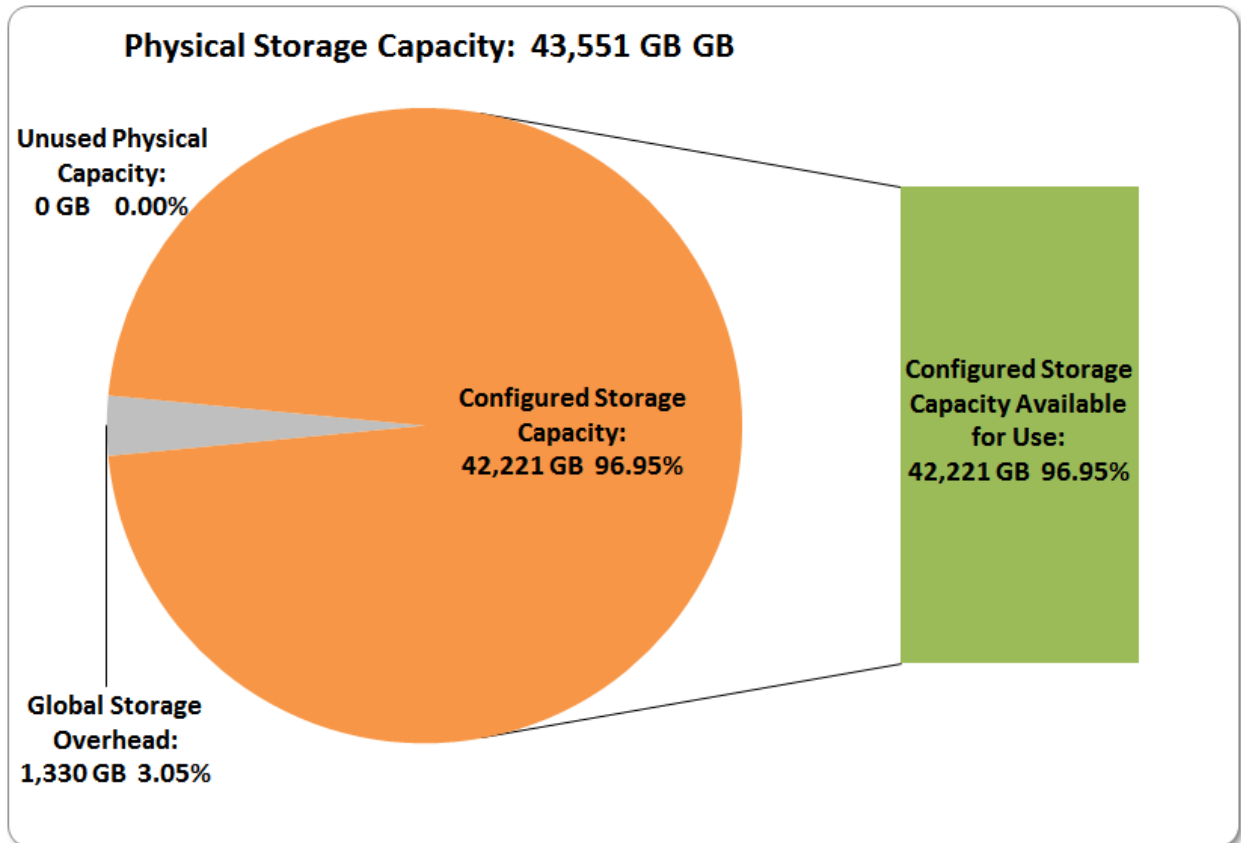
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country (*non-local currency*).

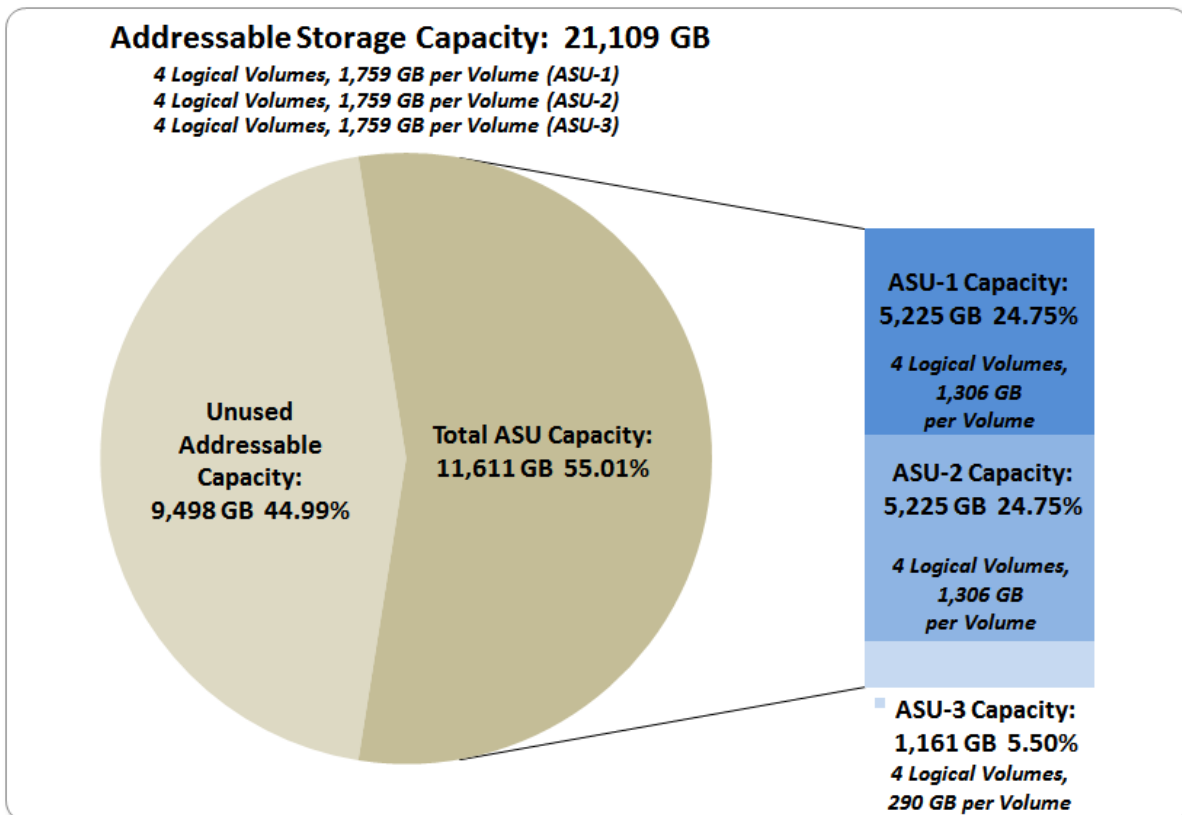
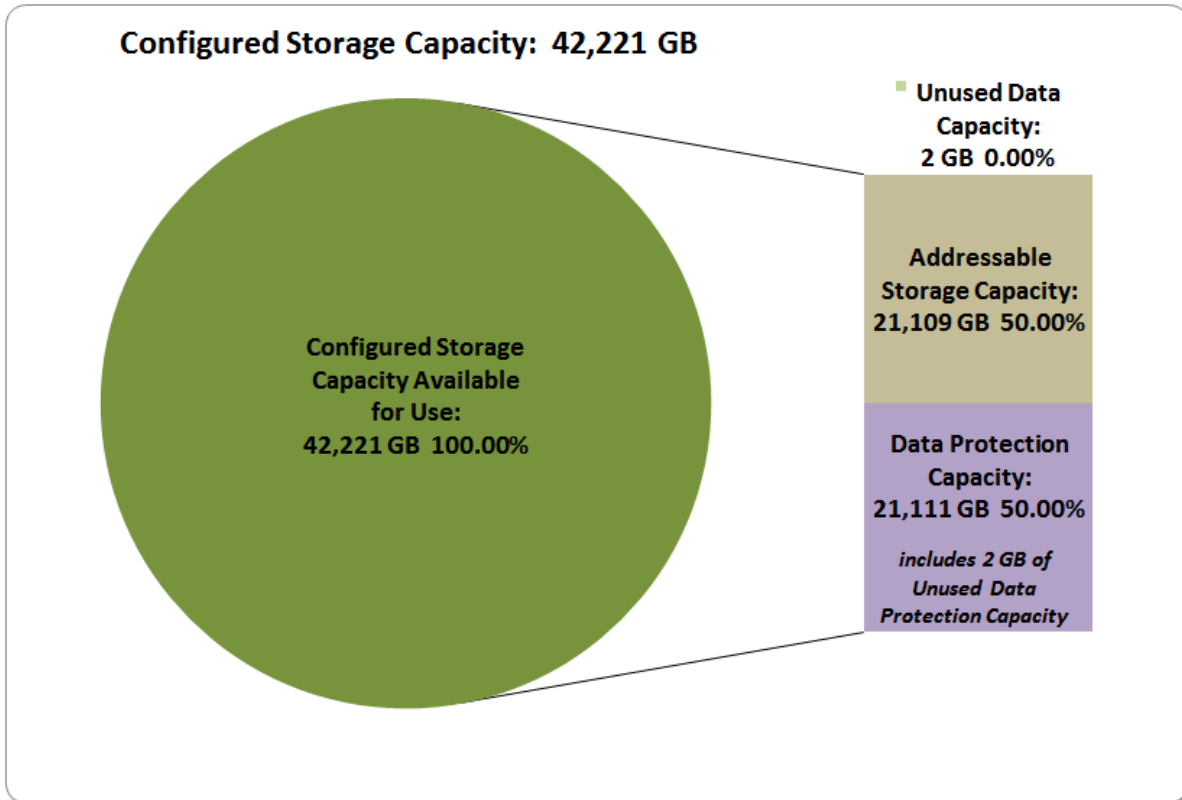
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

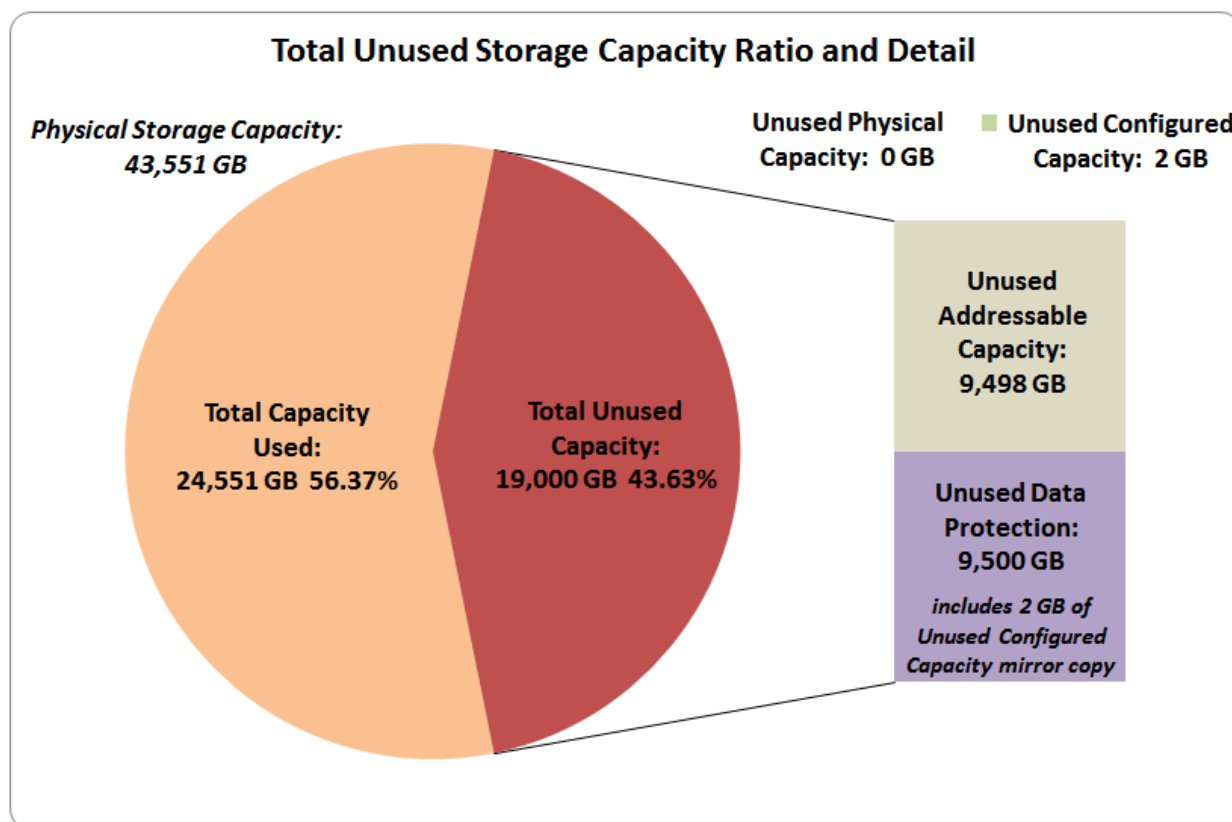
Storage Capacities, Relationships, and Utilization

The following 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.







SPC-1 Storage Capacity Utilization	
Application Utilization	26.66%
Protected Application Utilization	53.32%
Unused Storage Ratio	43.63%

Application Utilization: Total ASU Capacity (11,610.843 GB) divided by Physical Storage Capacity (43,550.927 GB).

Protected Application Utilization: Total ASU Capacity (11,610.843 GB) plus total Data Protection Capacity (21,110.600 GB) minus unused Data Protection Capacity (9,499.757 GB) divided by Physical Storage Capacity (43,550.927 GB).

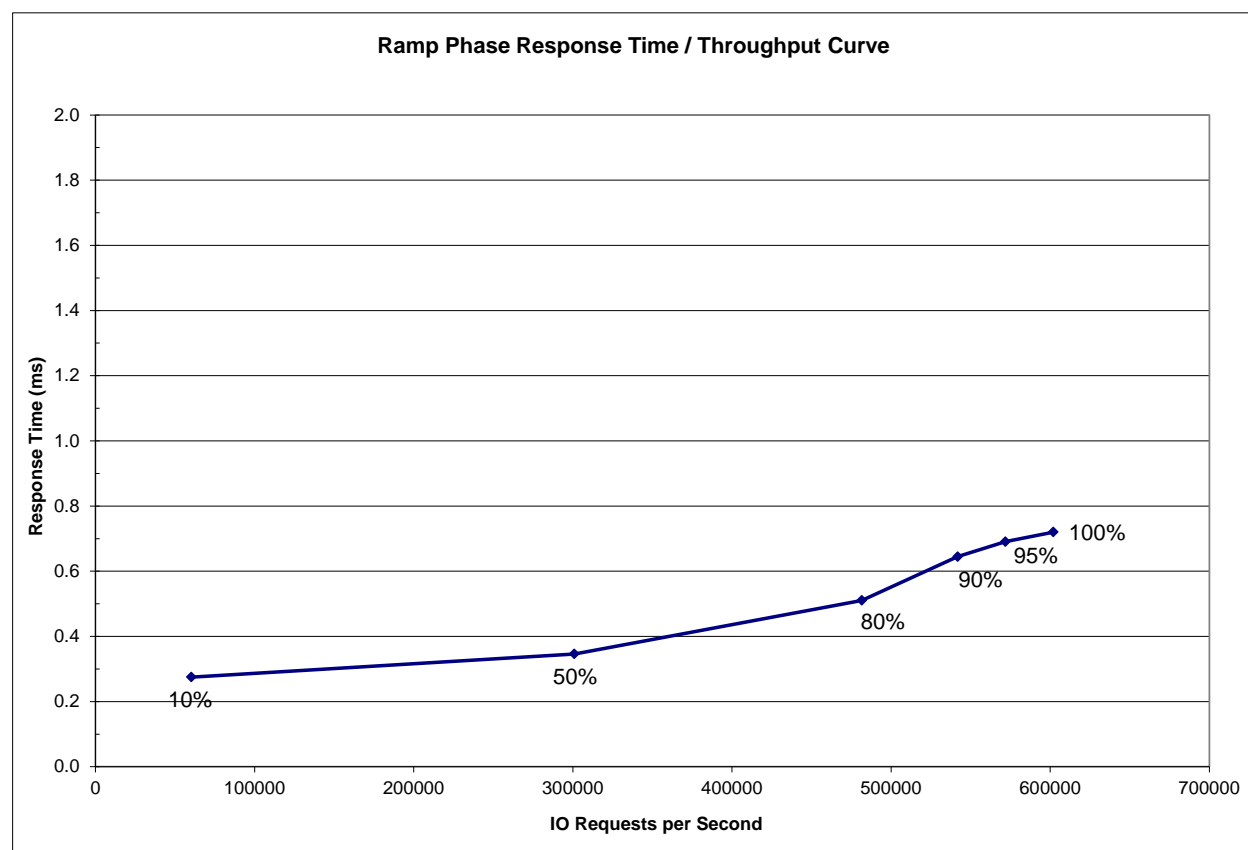
Unused Storage Ratio: Total Unused Capacity (18,999.514 GB) divided by Physical Storage Capacity (43,550.927 GB) and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 24-25 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	60,202.66	301,004.02	481,596.47	541,844.78	571,915.98	602,019.47
Average Response Time (ms):						
All ASUs	0.28	0.35	0.51	0.64	0.69	0.72
ASU-1	0.29	0.29	0.46	0.60	0.65	0.68
ASU-2	0.27	0.36	0.65	0.88	0.96	1.02
ASU-3	0.25	0.47	0.56	0.64	0.67	0.67
Reads	0.35	0.30	0.57	0.77	0.85	0.90
Writes	0.23	0.37	0.47	0.56	0.59	0.61

Priced Storage Configuration Pricing

Product	Product Description	Qty	List Price	Extended 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	VSP Installation Planning	1	\$5,000.00	\$5,000.00
043-991828-01.P	VSP Installation - Control Frame	2	\$6,500.00	\$13,000.00
900-1115-C.P	Americas VSP Universal PDU Mounting Bracket Kit	8	\$655.00	\$5,240.00
DKC-F710I-16UFC.P	Front End Director Pair (Fibre 16-Port HOST Adapter--8Gbps)	8	\$23,610.00	\$188,880.00
DKC-F710I-1R6FM.P	1.6TB Flash Module Drive	24	\$48,760.00	\$1,170,240.00
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-BFC.P	Device Interface Cable BF	2	\$5,800.00	\$11,600.00
DKC-F710I-BFH.P	Flash Module Drive Chassis Bezel	2	\$2,030.00	\$4,060.00
DKC-F710I-BM128.P	Cache Flash Memory Module (128GB)	8	\$59,650.00	\$477,200.00
DKC-F710I-C32G.P	Cache Memory Module (32GB)	32	\$7,690.00	\$246,080.00
DKC-F710I-CPC.P	Cache Memory Adapter Pair (CMA)	6	\$80,030.00	\$480,180.00
DKC-F710I-DECO.P	Decoration Panel - HDS	2	\$640.00	\$1,280.00
DKC-F710I-ESW.P	PCI-Express Switch Adapter (Grid Switch Pair)	2	\$27,420.00	\$54,840.00
DKC-F710I-FBX.P	Flash Module Drive Chassis	2	\$87,000.00	\$174,000.00
DKC-F710I-FIHT.P	Filler Panel	40	\$70.00	\$2,800.00
DKC-F710I-HBFC.P	Device Interface Cable HBF	1	\$11,600.00	\$11,600.00
DKC-F710I-HUB.P	Hub Kit	1	\$10,280.00	\$10,280.00
DKC-F710I-MDEXC.P	Inter-Controller Connecting Kit	1	\$130,690.00	\$130,690.00
DKC-F710I-MP.P	Processor Blade (Virtual Storage Director Pair)	2	\$42,690.00	\$85,380.00
DKC-F710I-PFUC.P	DKU (FBX) Power Cord Kit (1-phase 10A for USA)	2	\$2,030.00	\$4,060.00
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-SCA.P	Back End Director (BED Pair)	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
DKC710I-CBXA.P	Primary Controller Chassis (1 Grid Switch Pair, 1 VSD Pair, and 1 CMA Pair Bundled)	1	\$74,010.00	\$74,010.00
DKC710I-CBXB.P	Second Controller Chassis (1 Grid Switch Pair, 1 VSD Pair, and 1 CMA Pair Bundled)	1	\$255,870.00	\$255,870.00
DTI4GL.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
IP0665-45.P	RJ-45 Modular In-Line Coupler 6 Conductor	1	\$4.00	\$4.00
PDU-121112F10.P	PDU ORU 12xC13 1Phase 208V 30A NEMA L6-30P	8	\$735.00	\$5,880.00

	Ext. Total	Discount	Total
Total VSP Hardware	\$3,526,486.50	58	\$1,481,124.33

Priced Storage Configuration Pricing (continued)

	Product Description	Qty	List Price	Ext. Price
044-230001-010.P	VSP Basic Operating System 10TB Block License	1	\$25,700.00	\$25,700.00
044-230001-03.P	VSP Basic Operating System 20TB Base License	1	\$46,800.00	\$46,800.00
044-230001-04B.P	VSP Basic Operating System 4-VSD Pair Base License	1	\$112,800.00	\$112,800.00
304-230001-010.P	VSP BOS 10TB Block License - 36 Month Software Support	36	\$321.25	\$11,565.00
304-230001-03.P	VSP BOS 20TB Base License - 36 Month Software Support	36	\$585.00	\$21,060.00
304-230001-04B.P	VSP BOS 4-VSD Pair Base - 36 Month Software Support	36	\$1,410.00	\$50,760.00
044-230043-03.P	VSP Flash Acceleration License	1	\$28,500.00	\$28,500.00
304-230043-03.P	VSP Flash Acceleration License - 36 Month SW Support	36	\$356.25	\$12,825.00

	Ext. Total	Discount	Total
Total VSP License	\$310,010.00	39	\$189,106.10
Total VSP			\$1,670,230.43

	Third-Party Product Description - External	Qty	List Price	Ext. Price
HD-5320-0008-M	Brocade 5320 w/ 48 active ports + SFPs, rack mount	2	\$19,621.00	\$39,242.00
XBR-MENTPOD8-01	Port on Demand 16port Upgrade, 16 SWL 8GB BR SFPs	2	\$6,965.00	\$13,930.00
HD-5320-0008-M	13 Mos Maintenance	1	\$1,731.00	\$1,731.00
HD-5320-0008-M	3 year Brocade support	1	\$5,193.00	\$5,193.00
LPE12002-E	Emulex LP12002-E Dual-Port FC Host Bus Adapter	16	\$1,161.28	\$18,580.48
2-LCLC-Z50RT-010F	FC Cables 2-LCLC-Z50RT-010F - 10FR LC - LC MM - 50	64	\$16.11	\$1,031.04

	Ext. Total	Discount	Total
Total Third-Party	\$79,707.52	0	\$79,707.52
Grand Total	\$3,916,204.02		\$1,749,937.95

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:

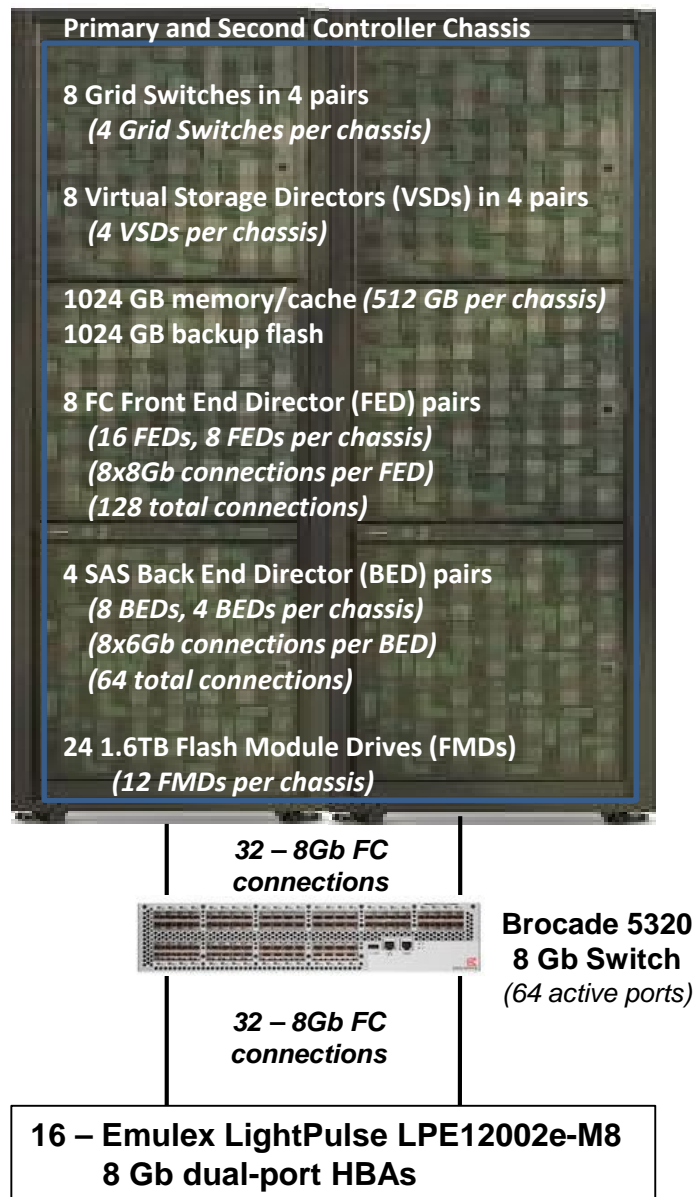
- Acknowledgement of new and existing problems with four (4) hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration 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 64-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

Hitachi Virtual Storage Platform (with Hitachi Accelerated Flash)



Priced Storage Configuration Components

Priced Storage Configuration:
16 – Emulex LightPulse LPE12002e-M8 8 Gb dual-port HBAs
2 – Brocade 5320 8 Gb Switches with SFPs (64 active ports) (the second switch is included as a spare)
Hitachi Virtual Storage Platform (VSP) Primary and Second Controller Chassis 8 Grid Switches in 4 pairs (4 Grid Switches per chassis) 8 Virtual Storage Directors (VSDs) in 4 pairs (4 VSDs per chassis) 16 Cache Memory Adapters (CMAs) in 8 pairs (8 CMAs per chassis) 32 Cache Memory Modules (32 GB per module) (1024 GB memory/cache, 512 GB per chassis) 8 Cache Flash Memory Modules (128 GB per module) (1024 GB backup flash) 8 FC Front End Director (FED) pairs (16 FEDs, 8 FEDs per chassis) (8x8Gb connections per FED, 128 total connections) (32 connections used) 4 SAS Back End Director (BED) pairs (8 BEDs, 4 BEDs per chassis) (8x6Gb connections per BED, 64 total connection) (64 connections used)
1 – Additional Controller PS
2 – Flash Module Drive Chassis
24 – 1.6 TB Flash Module Drives (FMDs) (12 FMDs per chassis)
1 – Service Processor
8 – 1Phase 208V 30A PDUs
2 – 42U racks

Storage Network Configuration Diagram

