HITACHI
DATA SYSTEMS

SPC BENCHMARK 2™

EXECUTIVE SUMMARY

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HITACHI UNIVERSAL STORAGE PLATFORM V

SPC-2™ V1.2.1

Submitted for Review: September 8, 2008
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EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Revision Information and Key Dates

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SPC-2 Specification revision number	V1.2.1
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	September 8, 2008
Date FDR was submitted to the SPC	September 8, 2008
Date the TSC will be available for shipment to customers	May 14, 2007
Date the TSC completed audit certification	September 5, 2008

Tested Storage Product (TSP) Description

The Hitachi Universal Storage Platform™ V, the world's most advanced storage services platform, provides the foundation for Hitachi Services Oriented Storage Solutions, a new architecture that enables IT departments to tailor and offer a wide range of storage services based on the value to the business. With its powerful controller-based platform, Hitachi Data Systems is in a unique position to package and deliver storage services across heterogeneous storage assets, whether file, object or block-based. Powered by an enhanced Hitachi Universal Star Network™ V crossbar switch architecture with faster internal processors, 4Gb/sec host ports, 4Gb/sec disks, and 4Gb/sec switched-loop back-end directors, it provides 40% more system performance and further extends the scalability and enterprise-class functionality introduced with its predecessor, the Hitachi Universal Storage Platform. This massive-capacity, mega-scalable system assists storage managers in their mission to simplify storage administration, improve performance, and reduce overall costs.

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 Universal Storage Platform V				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
8,724.67	$187.49	18,401.385	$1,635,770	Mirroring
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	7,656.90			$213.63
Write Only:				
1024 KiB Transfer	5,267.71	200	26.34	
256 KiB Transfer	5,277.99	200	26.39	
Read-Write:				
1024 KiB Transfer	7,361.95	200	36.81	
256 KiB Transfer	7,318.51	200	36.59	
Read Only:				
1024 KiB Transfer	11,555.87	200	57.78	
256 KiB Transfer	9,159.40	200	45.80	
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	10,652.81			$153.55
1024 KiB Transfer Size				
4 I/Os Outstanding	10,506.49	200	52.53	
1 I/O Outstanding	11,372.42	200	56.86	
64 KiB Transfer Size				
4 I/Os Outstanding	9,553.10	200	47.77	
1 I/O Outstanding	11,179.22	200	55.90	
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**
	7,864.31	10,000	0.79	$208.00

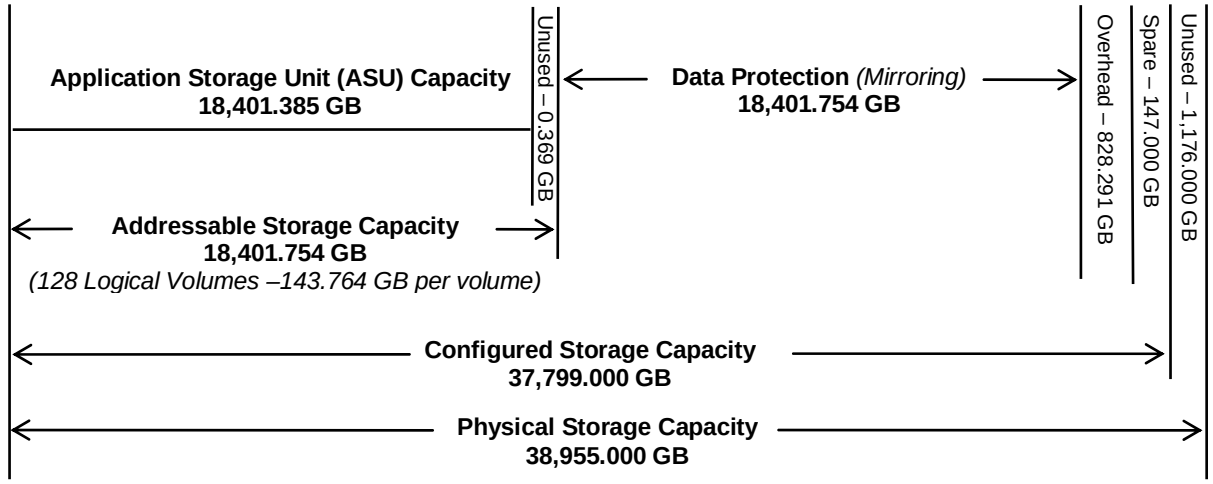
SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

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 "Mirroring" configures two or more identical copies of user data.

Storage Capacities and Relationships

The following diagram *(not to scale)* documents the various storage capacities, used in this benchmark, and their relationships.



Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Description	Qty	List	List EXT	List MMC	List MMC Ext
USP V / USP VM Product Documentation Library-HDS	1	0	0	0	0
USP V / USP VM Microcode Kit	1	0	0	0	0
SVC-USP V-Control Frame - Installation	1	0	0	0	0
SVC-USP V - CF5-Yr-A Warranty/Standard 1mo	36	0	0	0	0
SVC-USP V - CF5-Premium 1 Mo Upg Yr-A	36	0	0	0	0
SVC-USP V - CA16port-Installation	8	0	0	0	0
SVC-USP V-Array Frame - Installation	2	0	0	0	0
SVC-USP V - AKT-Installation	2	0	0	0	0
SVC-USP V - HDD146KS-Installation	257	0	0	0	0
SVC-USP V - HDD146KS-Yr-A Warranty/Stndrd 1mo	9252	0	0	0	0
SVC-USP V - HDD146KS-Premium 1 Mo Upg Yr-A	9252	0	0	0	0
1 HDD Canister (DKS2F-K146FC)	264	3,260	860,653	0	0
1 HDD Canister (DKS2F-K146FC)	1	3,260	3,260	0	0
Disk Array Frame	2	33,801	67,601	0	0
DKU Expansion Kit	2	14,200	28,400	0	0
DKU Door Kit for HDS	2	0	0	0	0
DEV Interface Cable (DKU-DKU)	2	500	1,000	0	0
Fibre 16-Port Adapter(4Gbps)	8	30,300	242,404	0	0
AC Box Kit (3 Phase 30A)	3	800	2,400	0	0
Power Cable Kit (3Phase 30A for USA)	3	600	1,800	0	0
Additional Battery-1	3	2,600	7,800	0	0
Additional Power Supply	2	2,100	4,200	0	0
Cache Memory Module (8GB)	16	32,601	521,608	0	0
Data Path Expansion Kit	3	26,900	80,701	0	0
Cache Memory Adapter	4	2,000	8,000	0	0
DKC Door Kit for HDS	1	0	0	0	0
Disk Adapter	4	24,100	96,401	0	0
Modem Card Kit	1	500	500	0	0
Device Interface Cable (DKC to DKU-R1	1	500	500	0	0
Device Interface Cable (DKC to DKU-R1	1	500	500	0	0
Shared Memory Module (4GB)	2	21,200	42,401	0	0
Shared Memory Adapter	2	2,300	4,600	0	0
Disk Control Frame	1	55,001	55,001	0	0
1GB USB memory stick	1	0	0	0	0
LAN Cable 14ft	1	0	0	0	0
Phone Cable 12ft	1	0	0	0	0
RJ-11 Modular In-Line Coupler 4 Conductor	1	0	0	0	0
RJ-45 Modular In-Line Coupler 6 Conductor	1	0	0	0	0
HiCommand Sales					
USP V Basic Operating System Bundle Media Kit	1	0	0	0	0
USP V Basic Operating System Bundle License Base	1	7,200	7,200	0	0
USP V Basic Optg Sys Bndl 1TB (Above 50TB) Lic	74	2,500	185,003	0	0
SVC Mo USP V Basic Operating System Bundle License Base	36	0	0	72	2,592
SVC Mo USP V Basic Optg Sys Bndl 1TB (Above 50TB) Lic	2664	0	0	25	66,600
Additional Hardware					
LC/LC 15m Cable	64	135	**8,640**		
QLogic QMH2462 FC HBA Opt Kit	32	749	**23,968**		
Cisco MDS 9124e 24 port Fabric Switch	8	9,500	**76,000**		
4GB SW Single Pack SFP Transceiver	64	199	**12,736**		

			List	Discount	Total
USP V Hardware			$2,029,731	**33.0%**	$1,359,920
USP V Hardware Maintenance			$0		$0
-- includes 3 yrs Maintenance and Installation					$0
USP V Software			$192,203	**33.0%**	$128,776
USP V Software Maintenance			$69,192	**33.0%**	$46,359
-- includes 3 yrs Maintenance and Installation					$0
Additional Hardware			$121,344	**17.0%**	$100,716
		Total			$1,635,770

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

The Priced Storage Configuration included an additional battery and substituted two 4 GB shared memory modules in place of the four 2 GB modules in the TSC. The differences, applied either individually or collectively to the TSC, would not have any impact on the reported performance.

Priced Storage Configuration Diagram

Hitachi Universal Storage Platform V

Priced Storage Configuration Components

Priced Storage Configuration:
32 – Qlogic QMH2462 4Gb FC HBAs
Hitachi Universal Storage Platform V 8 – 16 Port 4Gb FC Adapters 8 GB shared memory 128 GB cache 64 – 4Gb FC front-end physical connections 64 – 4Gb FC-over-Copper connections
8 – Cisco MDS 9124e 24-Port Fabric Switches
265 – 146 GB, 15K RPM disk drives