SPC BENCHMARK 2™
EXECUTIVE SUMMARY

HEWLETT-PACKARD COMPANY
HP STORAGEWORKS 1000 MODULAR SMART ARRAY

SPC-2™ V1.2.1

Submitted for Review: March 9, 2007
Submission Identifier: B00020

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	spc2rc9g
Date Results were first used publicly	March 9, 2007
Date FDR was submitted to the SPC	March 9, 2007
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	March 8, 2007

Tested Storage Product (TSP) Description

The HP StorageWorks 1000 Modular Smart Array (MSA1000) is a 2Gb Fibre Channel storage system for the entry-level to midrange storage area network (SAN). It provides the customer with a low-cost, scalable, high performance storage consolidation system with investment protection. It is designed to reduce the complexity and risk of SAN deployments. The powerful but easy to use management software makes it ideal for departmental and remote location SANs. The ability to easily move most data, disks, and enclosures currently directly attached to Ultra 320 Smart Array controllers (DAS) to a shared storage environment (SAN) will save the user both money and time. With the addition of two more drive enclosures, it can control up to 42 enterprise-class U320 SCSI drives allowing capacity of twelve terabytes. All configuration, management, and partitioning and licensing software come standard with no extra charges.
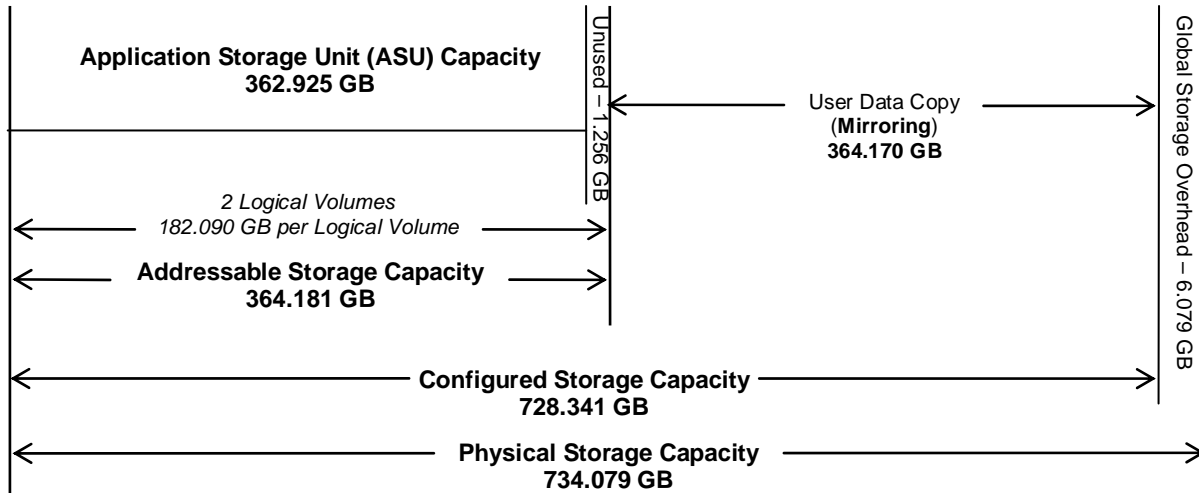
SPC-2 Reported Data

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				
HP StorageWorks 1000 Modular Smart Array				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
285.39	$73.12	362.925	$20,868	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	269.61			$77.40
Write Only:				
1024 KiB Transfer	222.94	28	7.96	
256 KiB Transfer	216.73	28	7.74	
Read-Write:				
1024 KiB Transfer	277.02	28	9.89	
256 KiB Transfer	243.25	28	8.69	
Read Only:				
1024 KiB Transfer	330.03	28	11.79	
256 KiB Transfer	327.70	28	11.70	
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	287.71			$72.53
1024 KiB Transfer Size				
4 I/Os Outstanding	330.20	28	11.79	
1 I/O Outstanding	329.91	28	11.78	
64 KiB Transfer Size				
4 I/Os Outstanding	271.97	28	9.71	
1 I/O Outstanding	218.77	28	7.81	
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**
	298.84	380	0.79	$69.83

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Storage Capacities and Relationships

The following diagram documents the various storage capacities, used in this benchmark, and their relationships.
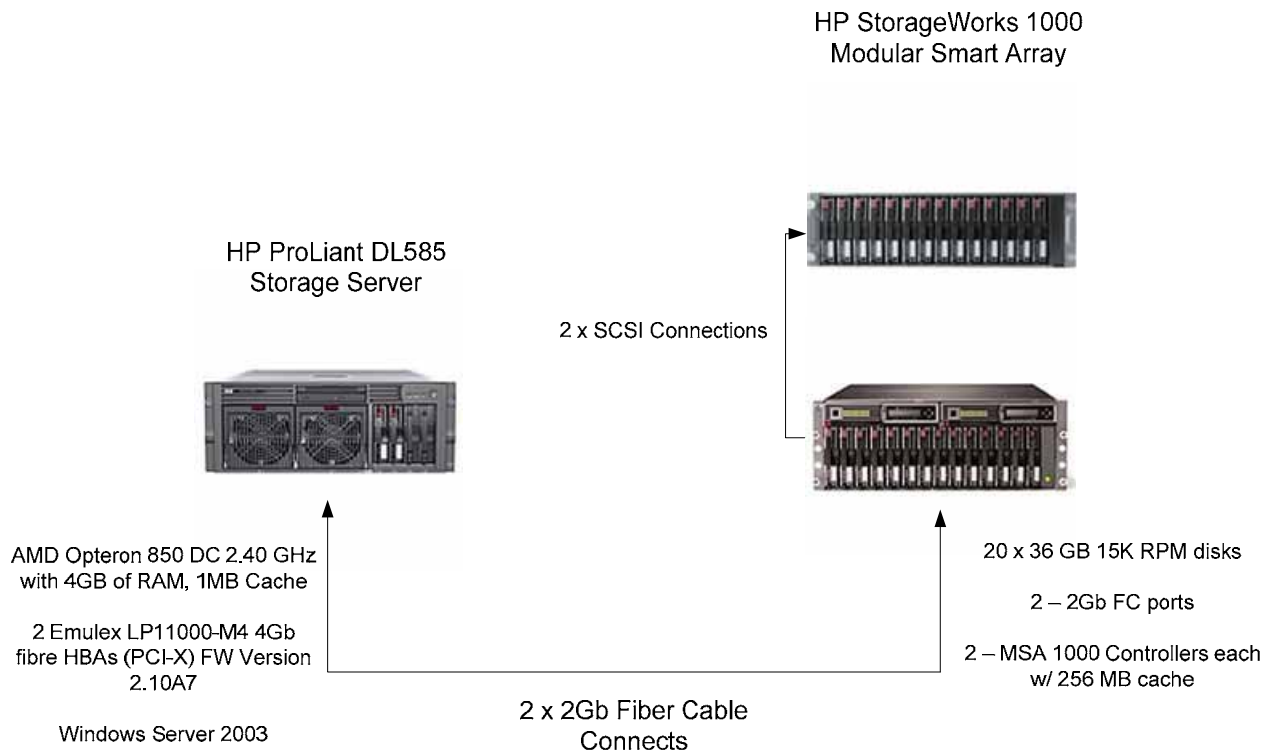
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┌                                          Unused – 1.256 GB                        Global Storage Overhead – 6.079 GB
│        Application Storage Unit (ASU) Capacity
│                    362.925 GB                           ◄─── User Data Copy ───►
│                                                              (Mirroring)
│                                                              364.170 GB
│  ◄──────── 2 Logical Volumes ────────►
│        182.090 GB per Logical Volume
│  ◄──── Addressable Storage Capacity ────►
│                364.181 GB
│
│  ◄──────────── Configured Storage Capacity ────────────►
│                        728.341 GB
│  ◄──────────────── Physical Storage Capacity ────────────────►
│                          734.079 GB
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Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Part Number	Description	List Price	Quantity	Ext. Price	Discount	Final Price
AD510A	MSA1000 Controller/enclosure	6,995.00	1	6,995.00	21.00%	5,526.05
218231-B22	HP MSA1000/1500 2nd Controller	4,290.00	1	4,290.00	21.00%	3,389.10
371534-B21	36GB U320 15K Hot Plug Hard Drive	249.00	20	4,980.00	21.00%	3,934.20
218960-B21	2nd FC IO Module	375.00	1	375.00	21.00%	296.25
302969-B21	2nd SCSI Disk Enclosure	2,829.00	1	2,829.00	21.00%	2,234.91
HA104A3 8PM	MSA1000 enclosure support	3,403.00	1	3,403.00	30.00%	2,382.10
H104A3 7GT	2nd SCSI Disk Enclosure support	1,827.00	1	1,827.00	30.00%	1,278.90
281541-B21	2 Gb FC Single Port HBA	1,450.00	2	2,900.00	45.00%	1,595.00
313374-003	SCSI Cable	60.76	2	121.52	21.00%	96.00
263895-004	15 M FC Cable	86.00	2	172.00	21.00%	135.88
				$ 27,892.52		**$ 20,868.39**

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

The Tested Storage Configuration (TSC) was configured with 4 Gb single port HBAs and in the Priced Storage Configuration those HBAs were replaced with 2 Gb single port HBAs. The host (front-end) ports on the MSA1000 are 2 Gb ports so the would have been no performance difference if the 2 Gb HBAs had been used in the TSC.

Benchmark Configuration/Tested Storage Configuration Diagram

HP StorageWorks 1000
Modular Smart Array

HP ProLiant DL585
Storage Server

2 x SCSI Connections

AMD Opteron 850 DC 2.40 GHz
with 4GB of RAM, 1MB Cache

2 Emulex LP11000-M4 4Gb
fibre HBAs (PCI-X) FW Version
2.10A7

Windows Server 2003

2 x 2Gb Fiber Cable
Connects

20 x 36 GB 15K RPM disks

2 – 2Gb FC ports

2 – MSA 1000 Controllers each
w/ 256 MB cache

Host System(s) and Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC):
UID=HS-1	2 – Emulex LP11000-MA 4 Gb FC HBAs

1 – HP ProLiant DL585 Storage Server
   1 – AMD Opteron 80 DualCore 2.4 GHz
     processor with 1 MB cache
	UID=SC-1/2:
	  HP StorageWorks 1000 Modular Smart Array
	  2 controllers with 256 MB cache per controller

4 GB main memory	2 – 2 Gb FC front-end ports, 1 per controller
Windows Server 2003	2 – backend SCSI connections *(U320)*
PCI-X	1 – SCSI disk enclosure, in addition to 1 standard
WG	20 – 36 GB 15K RPM disk drives