SPC BENCHMARK 1™
EXECUTIVE SUMMARY

DOT HILL SYSTEMS CORP.
DOT HILL ASSUREDSAN™ PRO 5000

SPC-1 V1.13

Submitted for Review: February 25, 2013
Submission Identifier: A00127

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	V1.13
SPC-1 Workload Generator revision number	V2.3.0
Date Results were first used publicly	February 25, 2013
Date the FDR was submitted to the SPC	February 25, 2013
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	February 22, 2013

Tested Storage Product (TSP) Description

Dot Hill's new AssuredSAN Pro 5000 Series adds automated tiered storage capabilities to a smart, simple, SAN storage line-up. Using the Pro 5000 Series with integrated RealStor™ management software, IT managers can improve data responsiveness, remove provisioning and allocation guesswork, and simplify storage management and expansion. RealStor, Dot Hill's unique, patent pending software takes tiered storage to a more advanced level - beyond batch data migration to Real-Time automated tiered storage, which continuously responds to user data demands by moving 'hot' data to a high-speed SSD tier – in real time – for maximum performance.

Additional features of the AssuredSAN Pro 500 Series include:

- RealTier™ Tiering Software
- RealPool™ Automatic Pooling
- RealThin™ Provisioning
- RealQuick™ Rebuild Function
- Smart, Simple Management
- Modular Expansion of Storage Tiers
- Rapid Data Hot Spot detection
- Maximum 384 TB raw capacity
- Up to 96 LFF drives or 240 SFF drives
- SSD Drive support – 200GB and 400GB
- HDD Drive support – 600GB 10K SAS, 1TB, 3TB, & 4TB NLSAS
- 8 x 8Gb FC or 8 x 10GbE iSCSI Host Interfaces

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Dot Hill AssuredSAN™ Pro 5000	
Metric	**Reported Result**
SPC-1 IOPS™	39,041.81
SPC-1 Price-Performance™	$2.96/SPC-1 IOPS™
Total ASU Capacity	17,801.966 GB
Data Protection Level	Protected 2 *(Mirroring)*
Total Price	$115,407.15
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.*
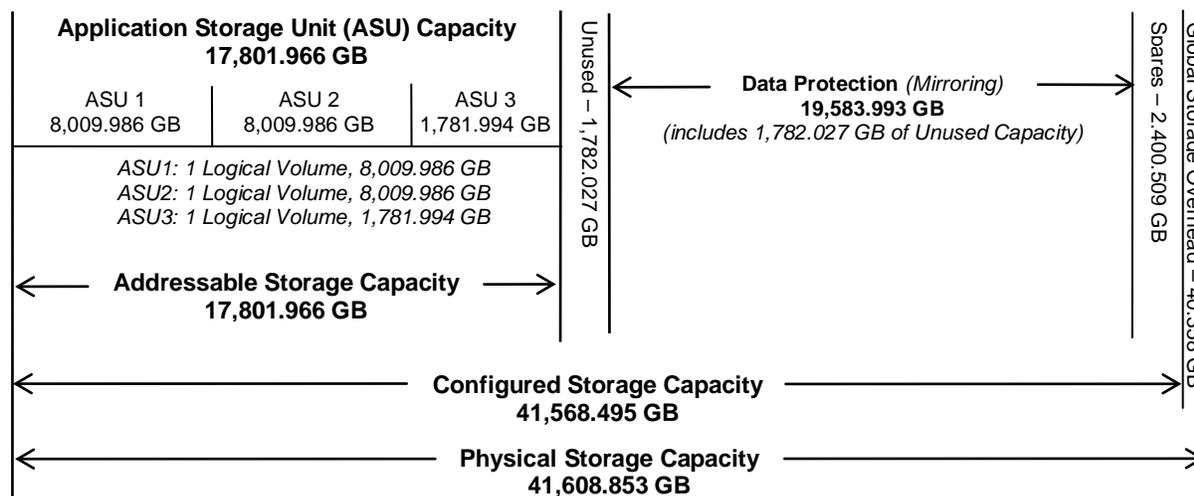
Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 7.

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 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	42.78%
Protected Application Utilization	85.57%
Unused Storage Ratio	8.57%

Application Utilization: Total ASU Capacity *(17,801.966 GB)* divided by Physical Storage Capacity *(41,608.853 GB)*

Protected Application Utilization: Total ASU Capacity *(17,801.966 GB)* plus total Data Protection Capacity *(19,583.993 GB)* minus unused Data Protection Capacity *(1,782.027 GB)* divided by Physical Storage Capacity *(41,608.853 GB)*
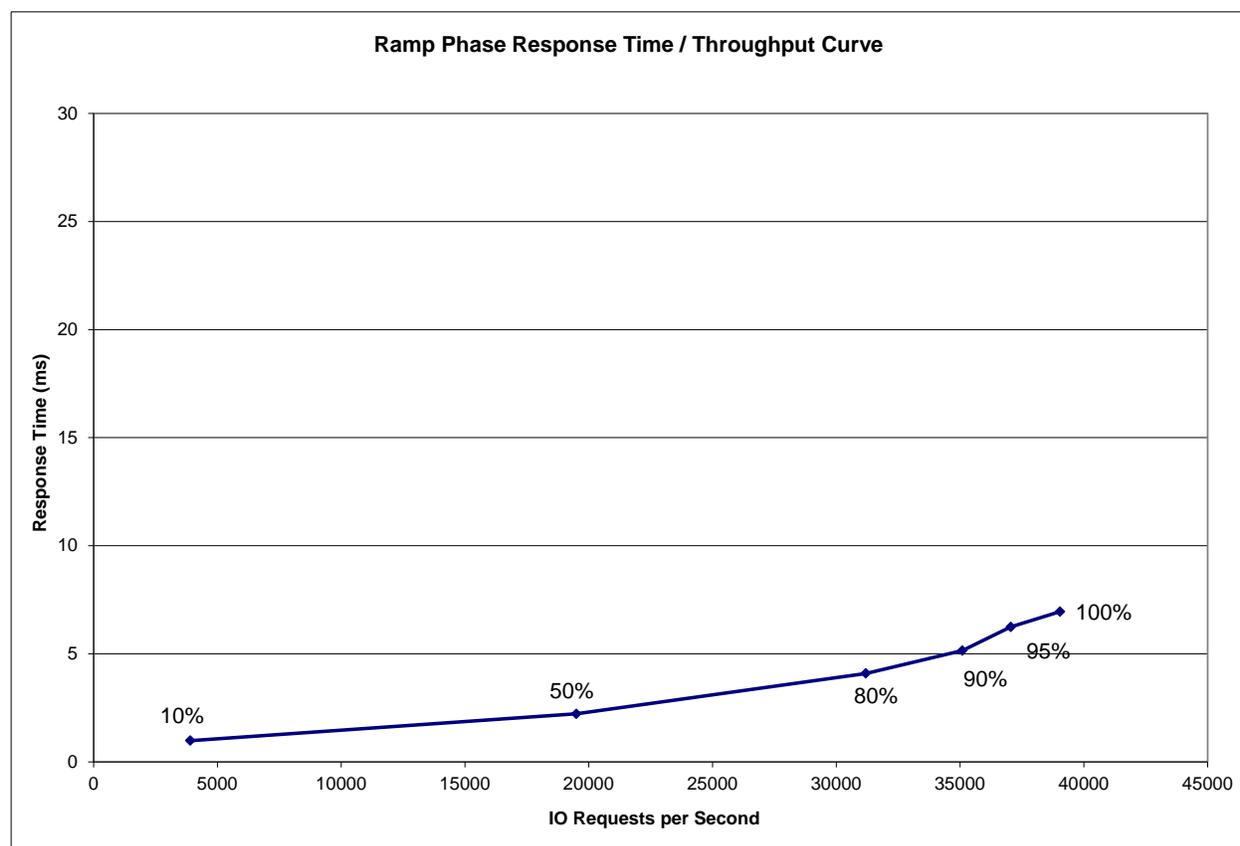
Unused Storage Ratio: Total Unused Capacity *(3,563.986 GB)* divided by Physical Storage Capacity *(41,608.853 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 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	3,901.45	19,502.29	31,195.29	35,099.05	37,054.24	39,041.81
Average Response Time (ms):						
All ASUs	0.98	2.22	4.09	5.15	6.24	6.95
ASU-1	0.95	2.27	4.21	5.25	6.36	7.00
ASU-2	2.42	5.59	10.61	13.55	15.61	17.77
ASU-3	0.41	0.64	0.98	1.26	1.89	2.12
Reads	1.85	4.67	8.89	11.17	13.10	14.53
Writes	0.41	0.63	0.96	1.23	1.77	2.02

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 Pricing

Part Number	Description	Qty	MSRP	Effective Discount from MSRP	Extended Price
D57202428010MA	5420B,04x400,44x600-10,A 2U24 Controller Enclosure with 2 controllers, 8 total 8Gb FChost ports with SFPs, 2 SAS 6Gb expansion ports, 4 x 400 GB SSD and 20 x 600GB 10K HDD 2U24 Expansion Enclosure with 24 x 600GB 10K HDD	1	103,906.00	47.2%	54,862.00
D51200213610MA	5120B,04x400,20x600-10,A 2U24 Expansion Enclosure with 2 SAS 6Gb expansion ports (2 in & 2 out) includes 4 x 400GB SSD & 20 x 600GB 10K HDD and necessary SAS expansion cables	1	53,915.12	47.2%	28,467.00
SW-ATS-R010-5000	Req. RealStore base SW for Pro5000	1	17,217.63	47.2%	9,090.00
SW-ATS-R010-5K-M3	RealStor,1.0,3-Yr.Maint Ext,Pro5000	1	9,555.79	47.2%	5,045.00
DS-7x24x4-B2-3Y-A-U	On Site, 7X24x4, SFF RAID, 3 YEAR, UPG for PN D57202428010MA	1	18,898.00	47.2%	9,978.00
DS-7x24x4-J2-3Y-A-U	On Site, 7X24x4, SFF JBOD, 3 YEAR, UPG for PN D51200213610MA	1	8,319.00	47.2%	4,392.00
CBL-FC-MLC-MLC-R03	Cable Pkg,FC,MLC-MLC,3 M,R	4	107.00	47.2%	225.98
QLE2564 (Third-Party)	Qlogic QLE2564 4 port 8Gb FC PCIe HBA	1	3,347.17	N/A	3,347.17
	Total				115,407.15

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.

Priced Storage Configuration Diagram

Qlogic QLE2564 quad-port 8Gb/s FC HBA

Dot Hill AssuredSAN™ Pro 5000
Dual-Active Controllers with:
4 GB cache, 2 GB per controller
20 – 600GB 2.5" 10K SAS disk drives
 4 – 400GB 2.5" SSD SAS disk drives

Expansion Enclosure
20 – 600GB 2.5" 10K SAS disk drives
 4 – 400GB 2.5" SSD SAS disk drives

Expansion Enclosure
24 – 600GB 2.5" 10K SAS disk drives

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Dot Hill AssuredSAN™ Pro 5000

Priced Storage Configuration Components

Priced Storage Configuration:
RealStore for Pro5000
1 – Qlogic QLE2564 4-port 8Gb PCIe FC HBA

Dot Hill AssuredSAN™ Pro 5000
  2U24 Controller Enclosure
  Dual-Active Controllers each with:
      2 GB cache *(4 GB total)*
      4 – 8 Gb FC host ports *(includes SFPs)*
          (8 ports total, 4 used)
      1 – 6 Gb SAS connection *(2 connections total, 2 used)*

2 – 2U24 Expansion Enclosures

64 – 600 GB 10K RPM SAS disk drives
        20 disk drives in the Controller Enclosure
        20 disk drives in the first Expansion Enclosure
        24 disk drives in the second Expansion Enclosure

8 – 400 GB SSDs
        4 – SSDs in the Controller Enclosure
        4 – SSDs in the first Expansion Enclosure