SPC BENCHMARK 1™
EXECUTIVE SUMMARY

TEXAS MEMORY SYSTEMS, INC.
TEXAS MEMORY SYSTEMS RAMSAN-400

SPC-1 V1.10.1

Submitted for Review: January 28, 2008
Submission Identifier: A00063

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Texas Memory Systems, Inc. – http://www.texmemsys.com/ Dan Scheel – dan.scheel@texmemsys.com 10777 Westheimer Road, Suite 600 Houston, TX 77042 Phone (713) 266-3200 FAX: (713) 266-0332
Test Sponsor Alternate Contact	Texas Memory Systems, Inc. – http://www.texmemsys.com/ Matt Key – matt.k@texmemsys.com 10777 Westheimer Road, Suite 600 Houston, TX 77042 Phone (713) 266-3200 FAX: (713) 266-0332
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	V1.10.1
SPC-1 Workload Generator revision number	V2.00.04a
Date Results were first used publicly	January 28, 2008
Date the FDR was submitted to the SPC	January 28, 2008
Date the TSC is available for shipment to customers	currently available
Date the TSC completed audit certification	January 25, 2008

Tested Storage Product (TSP) Description

The RamSan-400 is a scalable DDR RAM storage device ideal for storing performance-demanding data and accelerating application performance. It is equipped with up to 8 4Gb Fibre Channel ports or 4 4x InfiniBand ports and is recognized as any other storage device to the network. With a bandwidth of 3GB/s it is capable of over 400,000 IOPS with less than 15 microseconds of latency. With the RamSan-400's intuitive software, up to 1024 LUNs can be partitioned per system.

There is no tradeoff in reliability for all this performance. The RamSan-400 includes hot-swappable redundancies wherever physical wear is a factor, such as power supplies and backup hard disks. It also includes three independent internal UPS systems to ensure that no power loss or power supply failure will stop the RamSan from performing its internal backup procedures. Redundant cooling fans, redundant data ports and ChipKill protected memory are also part of the sophisticated design.

Summary of Results

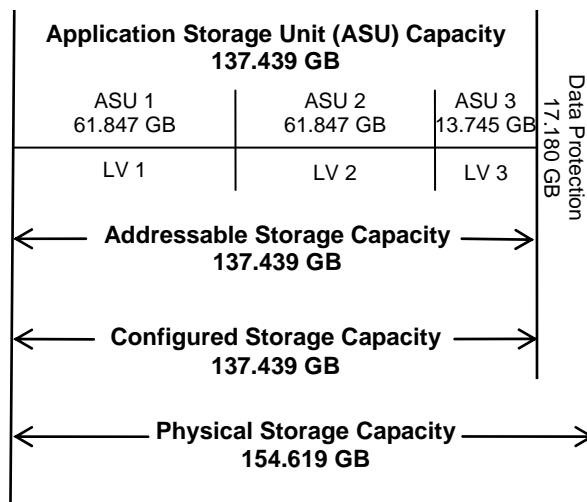| SPC-1 Results	
Tested Storage Configuration (TSC) Name: Texas Memory Systems RamSan-400	
Metric	**Reported Result**
SPC-1 IOPS™	291,208.58
SPC-1 Price-Performance	$0.67/SPC-1 IOPS™
Total ASU Capacity	137.439 GB
Data Protection Level	Other Data Protection
Total TSC Price (including three-year maintenance)	$194,785

SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level** of Other Protection Level was used. Data protection was accomplished with the use of Error Correction Code (ECC) and Chipkill layout. The ECC hardware stored an additional eight bits of parity data for every 64-bit word while the Chipkill layout allocates each bit to a separate memory chip. During read requests the hardware uses the parity data to detect data corruption. Any failure within a memory chip, or an entire chip failure, is seen as a single-bit error in ECC and is corrected at wire speed. If maintenance is unaddressed, and multiple chip failures occur, then this is seen as a multi-bit ECC error and is uncorrectable. Both levels of ECC events are reported upon occurrence. For more information regarding Chipkill, please see http://www-05.ibm.com/hu/termekismertetok/xseries/dn/chipkill.pdf..

Storage Capacities and Relationships

The following diagram documents the various storage capacities, used in this benchmark, and their relationships.

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            ┌─────────────────────────────────────────────────┬──────────────┐
            │   Application Storage Unit (ASU) Capacity         │ Data         │
            │              137.439 GB                           │ Protection   │
            ├──────────────┬──────────────┬─────────────────┤ 17.180 GB    │
            │   ASU 1       │   ASU 2      │   ASU 3          │              │
            │   61.847 GB   │   61.847 GB  │  13.745 GB       │              │
            ├──────────────┼──────────────┼─────────────────┤              │
            │   LV 1        │   LV 2       │   LV 3           │              │
            └──────────────┴──────────────┴─────────────────┘              │

            ←────────── Addressable Storage Capacity ──────────→
                               137.439 GB

            ←────────── Configured Storage Capacity ──────────→
                               137.439 GB

            ←──────────── Physical Storage Capacity ────────────→
                               154.619 GB
```

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.
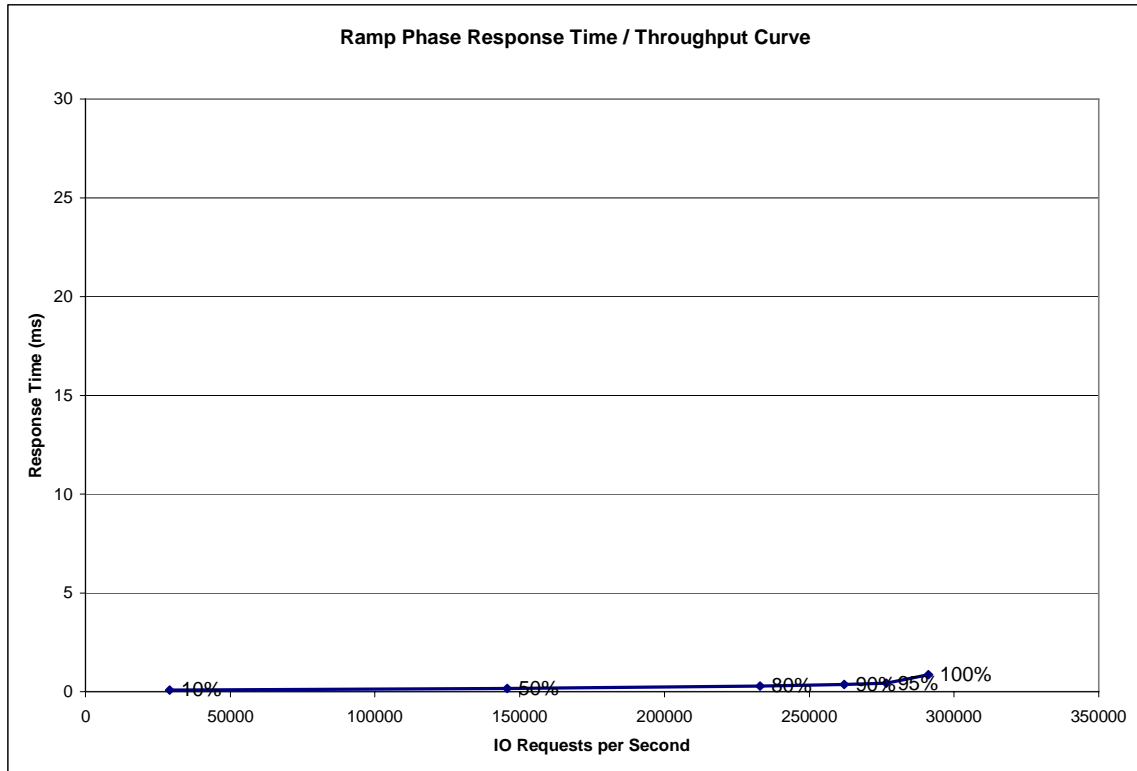
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	29,108.36	145,605.79	232,991.56	262,089.32	276,655.51	291,208.58
Average Response Time (ms):						
All ASUs	0.09	0.16	0.29	0.37	0.43	0.86
ASU-1	0.08	0.15	0.28	0.36	0.41	0.90
ASU-2	0.09	0.16	0.27	0.35	0.42	0.74
ASU-3	0.11	0.20	0.33	0.41	0.49	0.83
Reads	0.08	0.15	0.28	0.35	0.40	0.87
Writes	0.10	0.18	0.31	0.39	0.45	0.86

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

T M S
T E X A S   M E M O R Y   S Y S T E M S

Quote

10777 Westheimer Road, Suite 600, Houston, TX 77042
Phone: 713-266-3200 | Fax: 713-266-0332 | sales@superssd.com

Quote #:	JB080109 A
Date	1/9/2008

Quote to: Contact:

Ln #	Qty	Part	Description	Unit Price	Ext. Price
HARDWARE					
1	1	U-RamSan-400/128GB	128-GB RamSan-400 Includes: 128-GB DDR RAM Storage (Upgradeable to 128-GB), One dual ported 4-Gb Fibre Channel controller (FC-400) or 1 single ported 4x InfiniBand controller (IB-900). Hot swappable hard disk drives and power supplies. Redundant battery and fans.	$ 81,200	$ 81,200
2	3	U-FC-400	Additional dual 4-Gb Fibre Channel link	$ 3,000	$ 9,000
3	1	U-Active Backup	Firmware feature that constantly writes data from memory to disk drives.	$ 4,000	$ 4,000
HARDWARE SUB-TOTAL				$	94,200
SUPPORT					
4	1	U-Critical-Year1	Advanced Parts Replacement with 7x24x4 onsite service for one year, which must run concurrent with first year of warranty. If this SKU is ordered, [24x7-Phone-Support] and [SparesKit-3U] must be ordered per site. Customer is responsible for shipping. Price and availability may vary based on location.	$4000/unit	$ 4,000
5	1	U-Critical-AddYr	Advanced Parts Replacement with 7x24x4 onsite service for one year. [24x7-Phone-Support] must be ordered per site. Customer is responsible for shipping. Price and availability may vary based on location. Maximum of two additional years of on-site service can be ordered. [$4000/unit + 5% of hardware list price]	$4000/unit + 5% of hardware list price	$ 8,710
6	1	U-Critical-AddYr	Advanced Parts Replacement with 7x24x4 onsite service for one year. [24x7-Phone-Support] must be ordered per site. Customer is responsible for shipping. Price and availability may vary based on location. Maximum of two additional years of on-site service can be ordered. [$4000/unit + 5% of hardware list price]	$4000/unit + 5% of hardware list price	$ 8,710
7	3	U-24x7-Phone-Support	One-year 24x7 technical support by phone per site.	$ 1,000	$ 3,000
8	1	U-SparesKit-3U	Includes 1 Power Supply, 1 Disk Drive, 1 Fan Bank.	$ 1,150	$ 1,150
SUPPORT SUB-TOTAL				$	25,570
ADDITIONAL ITEMS					
9	16	U-QLE2462-CK	QLogic 4 Gbit PCI-X HBA, Dual Ported	$ 2,795	$ 44,720
10	3	U-SB5600-20A-E	Qlogic Fibre Channel Switch (16) 4Gb & (4) 10Gb Ports, (16) SFPs, (1) power supply.	$ 9,325	$ 27,975
11	40	U-LC/LC-Dupl-50/125-Riser-5M	5M Fibre Channel Cables	$ 53	$ 2,120
ADDITIONAL ITEMS SUB-TOTAL				$	74,815
12	1	Shipping	Overnight courier service	$200	$ 200

TOTAL PURCHASE PRICE $ 194,785

Quote is valid until 02/08/2008
Delivery is within 30 days after order is placed.   Texas Memory Systems Quote – Page 1 of 1
Payment terms: Net 30 (1.5% penalty per month late)

Quote provided by: Jamon Bowen
jamon.b@ramsan.com
Purchase orders can be faxed to: 713-266-0332

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

There were no differences between the Tested Storage Configuration and the Priced Storage Configuration.

Benchmark Configuration/Tested Storage Configuration Diagram

RamSan-400 contains 4 dual-port 4Gbps fibre controllers. All 8 ports used in testing.
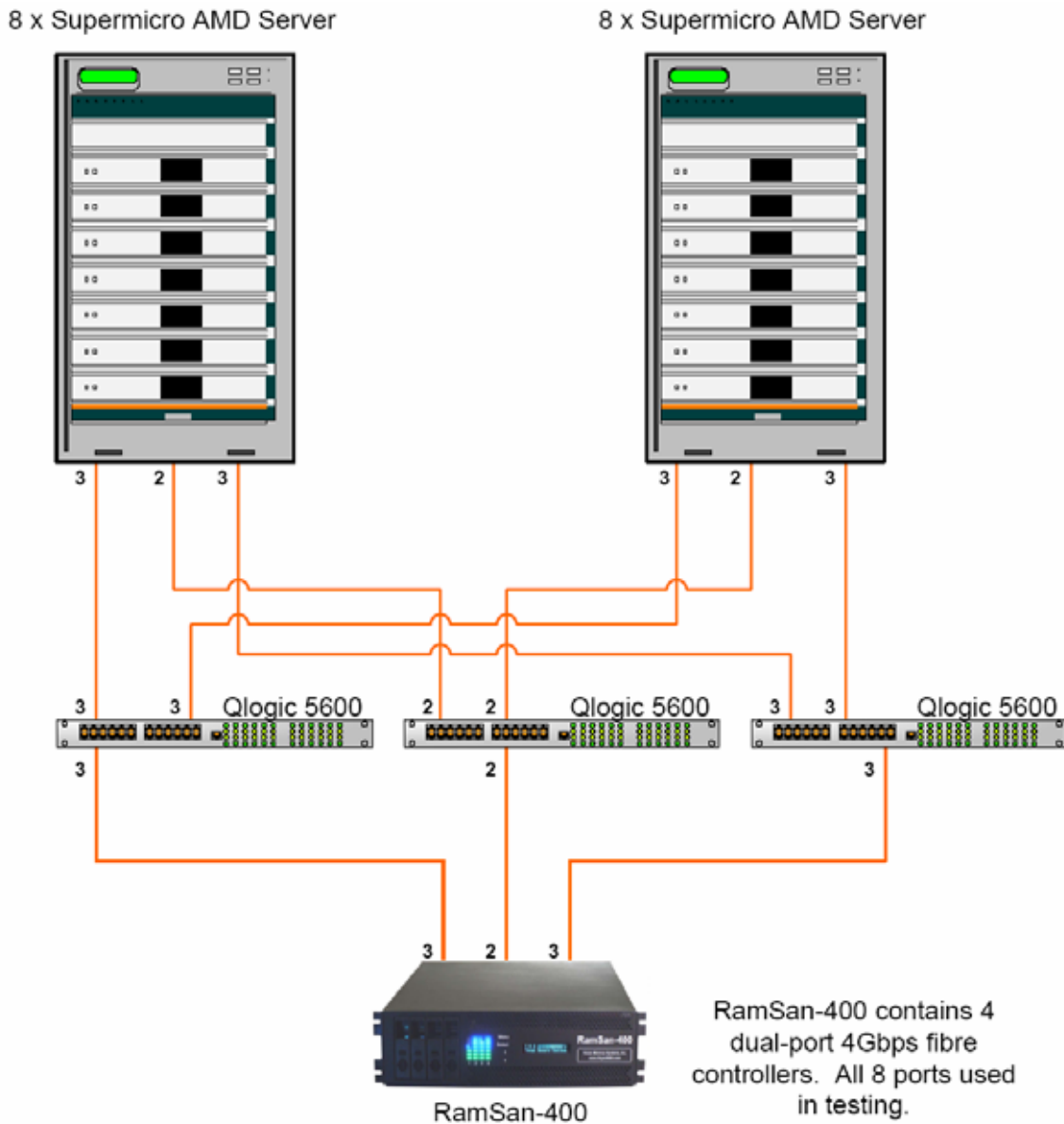
Benchmark Configuration/Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
16 – Supermicro AMD Opteron Servers, each with:	16 – Qlogic QLE2462 4Gb dual-port PCIe HBAs
2 – AMD Opteron Model 275 dual core 2.2 GHz CPUs	3 – Qlogic 5600 Switches
2 x 1024 KB L2 cache per CPU	**Texas Memory Systems RamSan-400**
4 GB main memory	4 – dual port 4Gbps fibre controllers
Windows Server 2003 Enterprise Edition with SP2	8 – 4Gb FC ports
PCIe	4 – hot swappable RAID-3 backup disks
WG	