SPC BENCHMARK 1™

FULL DISCLOSURE REPORT

SUN MICROSYSTEMS, INC.
SUN STOREDGE™ 6920

SPC-1 V1.8

Submitted for Review: February 1, 2005
Submission Identifier: A00039
Accepted: April 2, 2005

First Edition – February 2005

Trademarks

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Notes

The following terms, used in this document, are defined as:

- Kilobyte (KB) is equal to 1,000 (10^3) bytes.

- Megabyte (MB) is equal to 1,000,000 (10^6) bytes.

- Gigabyte (GB) is equal to 1,000,000,000 (10^9) bytes.

- Terabyte (TB) is equal to 1,000,000,000,000 (10^{12}) bytes.

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AUDIT CERTIFICATION

Leah Schoeb
Sun Microsystems, Inc.
5300 Riata Park Court AUS08
Austin, TX 78721

February 1, 2005

The SPC Benchmark 1™ results listed below for the Sun StorEdge™ 6920 were produced in compliance with the SPC Benchmark 1™ V1.8 Onsite Audit requirements.

SPC Benchmark 1™ V1.8 Results	
Tested Storage Configuration (TSC) Name:	
Sun StorEdge™ 6920	
Metric	**Reported Result**
SPC-1 IOPS™	18,945.13
SPC-1 Price-Performance	$12.45/SPC-1 IOPS™
Total ASU Capacity	1,222.000 GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	$235,875.00

The following SPC Benchmark 1™ Onsite Audit requirements were reviewed and found compliant with V1.8 of the SPC Benchmark 1™ specification:

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items were verified by physical inspection and information supplied by Sun Microsystems, Inc.:
  - ✓ Physical Storage Capacity and requirements.
  - ✓ Configured Storage Capacity and requirements.
  - ✓ Addressable Storage Capacity and requirements.
  - ✓ Capacity of each Logical Volume and requirements.
  - ✓ Capacity of each Application Storage Unit (ASU) and requirements.

- An appropriate diagram of the Benchmark Configuration (BC)/Tested Storage Configuration (TSC).

- Physical verification of the components to mach the above diagram.

Storage Performance Council
643 Bair Island Road, Suite 103
Redwood City, CA 94062
AuditService@storageperformance.org
650.556.9384

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SPC-1 Audit Certification

- Listings and commands to configure the Benchmark Configuration/Tested Storage Configuration, including customer tunable parameters.

- Commands and parameters used to configure the SPC-1 Workload Generator.

- The following Host System requirements were verified by physical inspection and information supplied by Sun Microsystems, Inc.:

  ✓ The type of Host System including the number of processors and main memory.
  ✓ The presence and version number of the Workload Generator on the Host System.
  ✓ The TSC boundary within the Host System.

- The execution of each Test, Test Phase, and Test Run was observed and found compliant with all of the requirements and constraints of Clauses 4 and 5 of the SPC-1 Benchmark Specification.

- The Test Results Files and resultant Summary Results Files received for each of following were authentic, accurate, and compliant with all of the requirements and constraints of Clauses 4 and 5 of the SPC-1 Benchmark Specification:
  ✓ Data Persistence Test
  ✓ Sustainability Test Phase
  ✓ IOPS Test Phase
  ✓ Response Time Ramp Test Phase
  ✓ Repeatability Test

- There were no differences between the Tested Storage Configuration (TSC) used for the benchmark and Priced Storage Configuration.

- The final version of the pricing spreadsheet met all of the requirements and constraints of Clause 8 of the SPC-1 Benchmark Specification.

- The Full Disclosure Report (FDR) met all of the requirements in Clause 9 of the SPC-1 Benchmark Specification.

Audit Notes:

There were no additional audit notes or exceptions.

Respectfully,
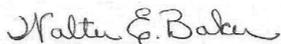
Walter E. Baker

Walter E. Baker
SPC Auditor

Storage Performance Council
643 Bair Island Road, Suite 103
Redwood City, CA 94062
AuditService@storageperformance.org
650.556.9384

LETTER OF GOOD FAITH

Date: 1/25/05

From: Kathleen Holmgren

To: Walter Baker

Subject: SPC-1 Letter of Good Faith for the StorEdge™ 6920

Sun Microsystems Inc. is the SPC-1 Test Sponsor for the above listed product. To the best of our knowledge and belief, the required SPC-1 benchmark results and materials we have submitted for that product are complete, accurate, and in full compliance with V1.8 of the SPC-1 benchmark specification.

In addition, we have reported any items in the Benchmark Configuration and execution of the benchmark that affected the reported results even if the items are not explicitly required to be disclosed by the SPC-1 benchmark specification.

Signed:

Kathleen Holmgren
Senior Vice President, Product Line Management Network Storage

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Sun Microsystems, Inc. – http://www.sun.com Leah Schoeb – leah.schoeb@sun.com 5300 Riata Park Court AUS08 Austin, TX 78721 Phone: (512) 401-1227 FAX: (512) 266-2523
Test Sponsor Alternate Contact	Sun Microsystems, Inc. – http://www.sun.com Jason Schaffer – jason.schaffer@sun.com 7777 Gateway Blvd 7, UNWK16 Newark, CA Phone: (510) 936-2979 FAX: (510) 936-2323
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	V1.8
SPC-1 Workload Generator revision number	V2.00.04a
Date Results were first used publicly	February 1, 2005
Date FDR was submitted to the SPC	February 1, 2005
Date the TSC is/was available for shipment to customers	July 23, 2004
Date the TSC completed audit certification	February 1, 2005

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: Sun StorEdge™ 6920	
Metric	**Reported Result**
SPC-1 IOPS™	18,945.13
SPC-1 Price-Performance	$12.45/SPC-1 IOPS™
Total ASU Capacity	1,222.000GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	$235,875.00

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 Mirroring configures two or more identical copies of user data.

Storage Capacities and Relationships

The following diagram documents the various storage capacities, used in this benchmark, and their relationships.
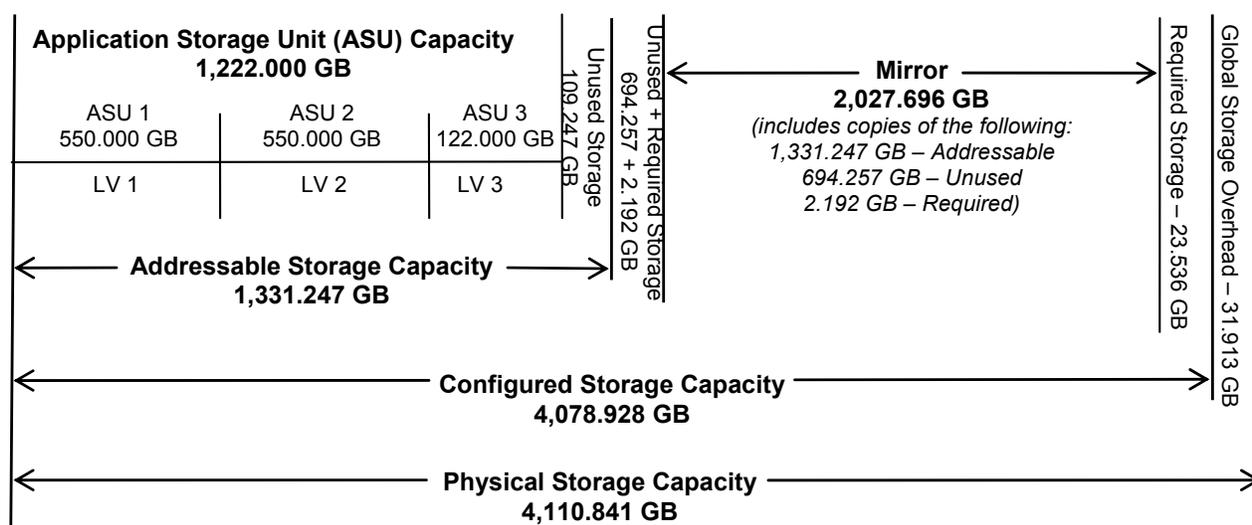
Response Time – Throughput Curve
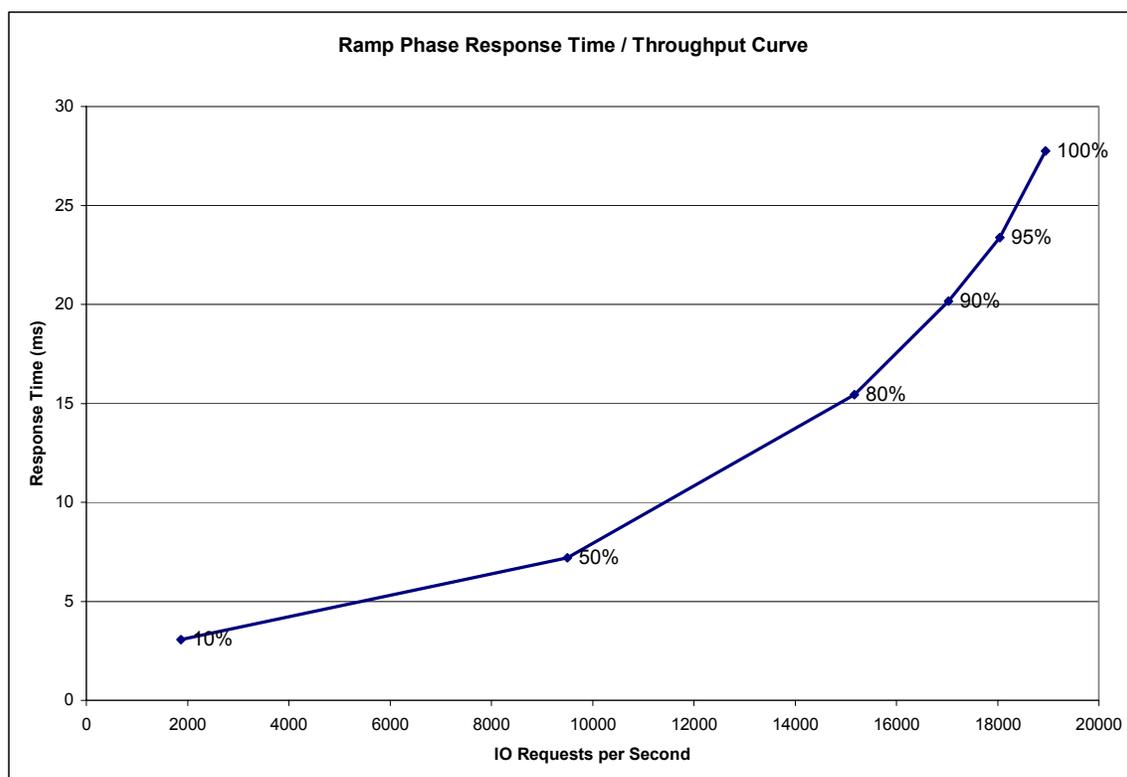
The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at 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	1,868.92	9,501.72	15,172.47	17,032.46	18,046.03	18,945.13
Average Response Time (ms):						
All ASUs	3.06	7.20	15.43	20.16	23.38	27.76
ASU-1	3.54	7.83	15.61	20.01	23.03	27.12
ASU-2	3.08	7.11	15.23	19.82	22.99	27.25
ASU-3	2.05	5.92	15.14	20.62	24.30	29.33
Reads	5.07	9.91	17.39	21.33	24.03	27.66
Writes	1.76	5.44	14.16	19.40	22.96	27.82

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Part Number	Description	Quantity	US List	Total		Ave. Price
TA6920-DSP-2F	Base system with 16 FC ports	1	$56,995	$56,995	32%	$38,757
TA6020M22A1S1008	Storage module with 28 36GB 15k rpm	4	$66,890	$267,560	32%	$181,941
XTA6920-SPM-UNLTB	Storage Pool Management	1	$9,200	$9,200	32%	$6,256
X6767A	2Gb PCI Singe FC Host Based Adapter	8	$1,560	$12,480	32%	$8,486
X9733A	5M LC to LC FC Optical Cable	8	$80	$640	32%	$435
Total				**$346,875**		**$235,875**

Three year "Gold Service" System Maintenance is included, which provides the following:

- 7 days per week, 24 hours per day coverage.

- Acknowledgement of new and existing problems within four hours.

- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component. In either of the two cases, the remedy will result in resumption of operation.

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

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

Benchmark Configuration/Tested Storage Configuration Diagram

SunFire 4800

HS-1

StorEdge 6920

SC-1

1 DSP (16 ports)
8 Controller Trays
112 36GB 15k rpm drives

8 2Gb PCI HBAs

SunFire 480

HS-2

SunFire V20z

HS-3

Dell 2650

HS-4

Fibre LC-LC 5M cables
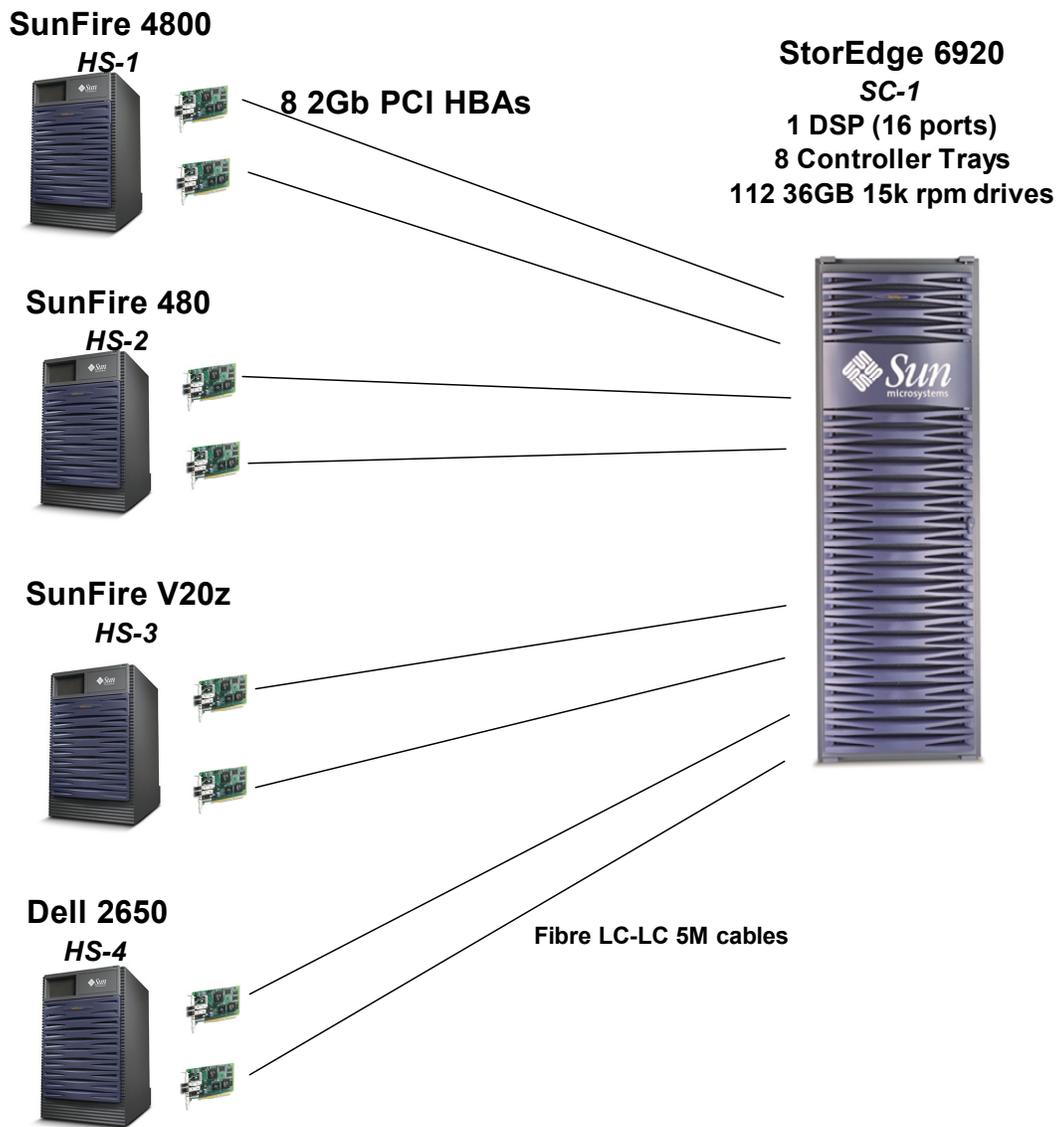
Benchmark Configuration/Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC):
UID=HS-1	8 – 2 Gbit PCI single FC HBAs *(2 per Host System)*
Sun Fire™ 4800	*UID=SC-1:*
4- UltraSPARC™ III 750 MHz CPUs each with 8 MB ECC external CPU	Sun StorEdge™ 6920: 8 – Controllers 1 GB cache per controller 1 tray with 14 disks per controller 16 – FC ports
4 GB main memory	
Solaris 9 update 7	
Solaris Volume Manager	112 – 36 GB 15K RPM disks
WG	
UID=HS-2	
Sun Fire ™ 480	
4 – UltraSPARC™ III 900 MHz CPUs each with 8 MB ECC external cache	
8 GB main memory	
Solaris 10 FCS	
Solaris Volume Manager (SVM)	
WG	
UID=HS-3	
Sun Fire ™ V20z	
2 – 1.8 MHz Opteron CPUs each with 1 MB L2 cache	
2 GB main memory	
Solaris 10 x86 FCS	
Solaris Volume Manager (SVM)	
WG	
UID=HS-4	
Dell 2650	
2 – 3.2 GHz Xeon CPUs each with 1 MB L2 cache	
2 GB main memory	
Window 2003	
WG	

CONFIGURATION INFORMATION

Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram

Clause 9.2.4.4.1

A one page Benchmark Configuration (BC)/Tested Storage Configuration (TSC) diagram shall be included in the Executive Summary…

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) is illustrated on page 13 *(Benchmark Configuration/Tested Storage Configuration Diagram).*

Storage Network Configuration

Clause 9.2.4.4.2

If a storage network is employed in the BC/TSC, the FDR shall contain a topology diagram… . This diagram should include, but is not limited to the following components:

1. *Storage Controller and Domain Controllers (see Clause 9.2.4.4.1)*
2. *Host Systems (see Clause 9.2.4.4.1)*
3. *Routers and Bridges*
4. *Hubs and Switches*
5. *HBAs to Host Systems and Front End Port to Storage Controllers*

Additionally the diagram shall:

- *Illustrate the physical connection between components.*
- *Describe the type of each physical connection.*
- *Describe the network protocol used over each physical connection.*
- *The maximum theoretical transfer rate of each class of interconnect used in the configuration.*
- *Correlate with the BC Configuration Diagram in Clause 9.2.4.4.1.*

The Test Sponsor shall additionally supply (referenced in an appendix) a wiring diagram of the physical connections and physical port assignments used in the storage network. The diagram should allow anyone to exactly replicate the physical configuration of the storage network.

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) was configured with local storage and, as such, did not employ a storage network.

Host System Configuration

Clause 9.2.4.4.3

The FDR shall minimally contain, for each Host System running the Workload Generator, a listing of the following:

1. *Number and type of CPUs.*
2. *Main memory capacity.*
3. *Cache memory capacity.*
4. *Number and type of disk controllers or Host Bus Adapters.*

The details of the Host System configuration may be found on page 13 *(Benchmark Configuration/Tested Storage Configuration Diagram).*

Customer Tunable Parameters and Options

Clause 9.2.4.5.1

All Benchmark Configuration (BC) components with customer tunable parameter and options that have been altered from their default values must be listed in the FDR. The FDR entry for each of those components must include both the name of the component and the altered value of the parameter or option.

"Appendix A: Customer Tunable Parameters and Options" on page 50 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Description

Clause 9.2.4.5.2

The FDR must include sufficient information to recreate the logical representation of the TSC. In addition to customer tunable parameters and options (Clause 4.2.4.5.3), that information must include, at a minimum, a diagram and/or description of the following:

- *All physical components that comprise the TSC. Those components are also illustrated in the Benchmark Configuration (BC) diagram in Clause 9.2.4.4.1 and, if applicable, the Storage Network Configuration Diagram in Clause 9.2.4.4.2.*

- *The logical representation of the TSC, configured from the above components that will be presented to the Workload Generator.*

In addition the FDR may include listings of scripts and/or commands used to configure the physical components that comprise the TSC.

"Appendix B: Tested Storage Configuration (TSC) Creation" on page 53 contains the detailed information that describes how to create and configure the logical TSC.

SPC-1 Workload Generator Storage Configuration

Clause 9.2.4.5.3

The FDR must include all SPC-1 Workload Generator storage configuration commands and parameters.

The SPC-1 Workload Generator storage configuration commands and parameters for this measurement appear in "Appendix C: SPC-1 Workload Generator Storage Commands and Parameters" on page 74.

DATA REPOSITORY

Definitions

Total ASU Capacity: The total storage capacity read and written in the course of executing the SPC-1 benchmark.

Application Storage Unit (ASU): The logical interface between the storage and SPC-1 Workload Generator. The three ASUs (Data, User, and Log) are typically implemented on one or more Logical Volume.

Logical Volume: The division of Addressable Storage Capacity into individually addressable logical units of storage used in the SPC-1 benchmark. Each Logical Volume is implemented as a single, contiguous address space.

Addressable Storage Capacity: The total storage (sum of Logical Volumes) that can be read and written by application programs such as the SPC-1 Workload Generator.

Configured Storage Capacity: This capacity includes the Addressable Storage Capacity and any other storage (parity disks, hot spares, etc.) necessary to implement the Addressable Storage Capacity.

Physical Storage Capacity: The formatted capacity of all storage devices physically present in the Tested Storage Configuration (TSC).

Data Protection Overhead: The storage capacity required to implement the ECC data protection.

Required Storage: The amount of Configured Storage Capacity required to implement the Addressable Storage Configuration, excluding the storage required for the three ASUs.

Global Storage Overhead: The amount of Physical Storage Capacity that is required for storage subsystem use and unavailable for use by application programs.

Total Unused Storage: The amount of storage capacity available for use by application programs but not included in the Total ASU Capacity.

Storage Capacities and Relationships

Two tables and an illustration documenting the storage capacities and relationships of the SPC-1 Storage Hierarchy (Clause 2.1) shall be included in the FDR.

SPC-1 Storage Capacities

SPC-1 Storage Capacities		
Storage Hierarchy Component	**Units**	**Capacity**
Total ASU Capacity	Gigabytes (GB)	1,222.000
Addressable Storage Capacity	Gigabytes (GB)	1,331.247
Configured Storage Capacity	Gigabytes (GB)	4,078.928
Physical Storage Capacity	Gigabytes (GB)	4,110.841
Data Protection Overhead (mirror)	Gigabytes (GB)	2,027.696
Required Storage	Gigabytes (GB)	27.920
Global Storage Overhead	Gigabytes (GB)	31.913
Total Unused Storage	Gigabytes (GB)	1,498.986

SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
Total ASU Capacity	91.79%	29.96%	29.73%
Required for Data Protection (Mirroring)		49.71%	49.33%
Addressable Storage Capacity		32.64%	32.38%
Required Storage		0.68%	0.68%
Configured Storage Capacity			99.22%
Global Storage Overhead			0.78%
Unused Storage:			
Addressable	8.21%		
Configured		34.07%	
Physical			0.00%

The Physical Storage Capacity consisted of 4,110.841 GB distributed over 112 disk drives each with a formatted capacity of 36.704 GB. There was 0.00 GB (0.0 %) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 31.913 GB (0.78%) of Physical Storage Capacity. There was 1,389.739 GB (34.07%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 91.79% of the Addressable Storage Capacity resulting in 109.247 GB (8.21%) of Unused Storage within the Addressable Storage Capacity.

SPC-1 Storage Capacities and Relationships Illustration

The various storage capacities configured in the benchmark result are illustrated below (not to scale).
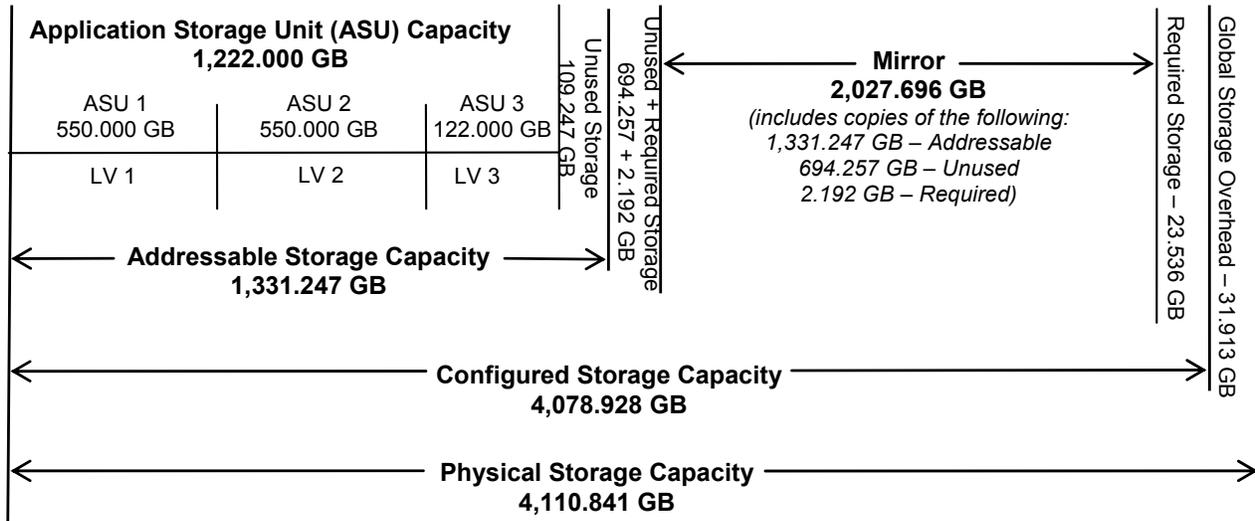
Logical Volume Capacity and ASU Mapping

Clause 9.2.4.6.2

A table illustrating the capacity of each ASU and the mapping of Logical Volumes to ASUs shall be provided in the FDR. Logical Volumes shall be sequenced in the table from top to bottom per its position in the contiguous address space of each ASU. The capacity of each Logical Volume shall be stated. … In conjunction with this table, the Test Sponsor shall provide a complete description of the type of data protection (see Clause 2.4.5) used on each Logical Volume.

Logical Volume Capacity and Mapping		
ASU-1 (550.000 GB)	ASU-2 (550.000GB)	ASU-3 (122.000 GB)
1 Logical Volume 601.253 GB per Logical Volume (550.000 GB used per Logical Volume)	1 Logical Volume 592.605 GB per Logical Volume (550.000 GB used per Logical Volume)	1 Logical Volume 137.389 GB per Logical Volume (122.000 GB used per Logical Volume)

The Data Protection Level used for all Logical Volumes was Mirroring as described on page 10. See "ASU Configuration" in the **IOPS Test Results File** for more detailed configuration information.

SPC-1 BENCHMARK EXECUTION RESULTS

Definitions

Average Response Time: *The sum of the Response Times for all Measured I/O Requests divided by the total number of Measured I/O Requests.*

I/O Request Throughput: *The total number of Measured I/O requests in an SPC-1 Test Run divided by the duration of the Measurement Interval in seconds.*

Measurement Interval: *The finite and contiguous time period, after the Tested Storage Configuration (TSC) has reached Steady State, when data is collected by a Test Sponsor to generate an SPC-1 test result or support an SPC-1 test result.*

Steady State: *The consistent and sustainable throughput of the TSC. During this period the load presented to the TSC by the Workload Generator is constant. Comment: Steady Stated is achieved only after caches in the TSC have filled and as a result the I/O Request throughput of the TSC has stabilized.*

Test: *A collection of Test Phases or Test Runs sharing a common objective.*

Test Phase: *A collection of one or more SPC-1 Test Runs sharing a common objective and intended to be run in a specific sequence.*

Test Run: *The execution of SPC-1 for the purpose of producing or supporting an SPC-1 test result. SPC-1 Test Runs may have a finite and measured Ramp-Up period, Start-Up period, Shut-Down period, and Ramp-Down period as illustrated in the Figure 5-1 below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.*

The SPC-1 benchmark consists of the following Tests, Test Phases, and Test Runs:

- **Data Persistence Test**
  - ➢ Data Persistence Test Run 1
  - ➢ Data Persistence Test Run 2

- **Primary Metrics Test**
  - ➢ Sustainability Test Phase and Test Run
  - ➢ IOPS Test Phase and Test Run
  - ➢ Response Time Ramp Test Phase
    - ○ 95% of IOPS Test Run
    - ○ 90% of IOPS Test Run
    - ○ 80% of IOPS Test Run
    - ○ 50% of IOPS Test Run
    - ○ 10% of IOPS Test Run (LRT)

- **Repeatability Test**
  - ➢ Repeatability Test Phase 1
    - ○ 10% of IOPS Test Run (LRT)
    - ○ IOPS Test Run
  - ➢ Repeatability Test Phase 2
    - ○ 10% of IOPS Test Run (LRT)
    - ○ IOPS Test Run

Each Test is an atomic unit that must be executed from start to finish before any other Test, Test Phase, or Test Run may be executed. The Tests may be executed in any sequence.

The results from each Test, Test Phase, and Test Run are listed below along with a more detailed explanation of each component.

Primary Metrics Test – Sustainability Test Phase

Clause 5.4.2.1

The Sustainability Test Phase consists of one Test Run at the 100% load point with a Measurement Interval of three (3) hours. The intent is to demonstrate a sustained maximum I/O Request Throughput as well as insuring the Tested Storage Configuration (TSC) has reached steady state prior to measuring the maximum I/O Request Throughput (SPC-1™ IOPS).

The reported I/O Request Throughput of the Sustainability Test Run must be within 5% of the reported SPC-1™ IOPS primary metric. The Average Response Time measured in Sustainability Test Run cannot exceed thirty (30) milliseconds.

Clause 9.2.4.7.1

For the Sustainability Test Phase the FDR shall contain:

1. *A Data Rate Distribution (data table and graph).*
2. *I/O Request Throughput Distribution (data table and graph).*
3. *The human readable Test Run Results File produced by the Workload Generator.*
4. *A listing or screen image of all input parameters supplied to the Workload Generator.*
5. *The Measured Intensity Multiplier for each I/O stream.*
6. *The variability of the Measured Intensity Multiplier, as defined in Clause 5.3.13.3.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are listed below.

java metrics –b 381 –s 600

Sustainability Test Results File

A link to the test results file generated from the Sustainability Test Run is listed below.

Sustainability Test Results File

Sustainability – Data Rate Distribution Data *(MB/second)*

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	15:37:33	15:47:33	0-9	0:10:00
Measurement Interval	15:47:33	18:47:33	10-189	3:00:00

| Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	156.63	60.83	16.80	78.99	70	156.22	60.67	16.62	78.93	133	155.87	60.71	16.69	78.46
1	156.47	60.77	16.57	79.13	71	156.48	60.74	16.71	79.02	134	156.40	60.75	16.70	78.95
2	156.70	60.85	16.76	79.09	72	156.32	60.77	16.63	78.92	135	156.47	60.83	16.86	78.78
3	156.53	60.66	16.64	79.24	73	156.69	60.68	16.72	79.28	136	156.11	60.77	16.68	78.66
4	156.47	60.59	16.78	79.11	74	156.28	60.66	16.75	78.87	137	156.15	60.59	16.63	78.93
5	156.59	60.70	16.70	79.19	75	156.31	60.57	16.62	79.12	138	156.16	60.84	16.59	78.72
6	156.33	60.75	16.79	78.79	76	156.35	60.62	16.61	79.12	139	156.56	60.85	16.80	78.91
7	156.17	60.80	16.60	78.78	77	156.73	60.87	16.72	79.15	140	156.57	60.75	16.60	79.22
8	156.32	60.71	16.74	78.86	78	155.76	60.55	16.60	78.61	141	156.69	60.96	16.64	79.09
9	156.37	60.82	16.74	78.80	79	157.21	61.00	16.85	79.36	142	156.53	60.78	16.70	79.05
10	156.56	60.60	16.80	79.16	80	156.06	60.86	16.66	78.54	143	156.35	60.79	16.73	78.83
11	156.64	60.85	16.72	79.06	81	155.91	60.64	16.69	78.58	144	156.19	60.52	16.65	79.02
12	156.03	60.80	16.75	78.47	82	156.37	60.87	16.85	78.65	145	146.14	56.77	15.58	73.79
13	156.31	60.57	16.81	78.93	83	156.58	60.77	16.68	79.14	146	132.06	51.40	14.04	66.62
14	156.21	60.42	16.81	78.98	84	156.46	60.80	16.71	78.96	147	163.77	63.56	17.39	82.82
15	156.49	60.82	16.88	78.80	85	156.11	60.65	16.74	78.72	148	163.60	63.44	17.51	82.65
16	156.54	60.59	16.76	79.19	86	156.68	60.88	16.66	79.14	149	164.03	63.48	17.46	83.09
17	156.27	60.84	16.65	78.78	87	156.39	60.89	16.74	78.76	150	163.63	63.65	17.57	82.41
18	156.00	60.60	16.61	78.79	88	156.30	60.61	16.65	79.04	151	161.79	62.72	17.23	81.84
19	156.14	60.59	16.65	78.89	89	156.59	60.89	16.74	78.96	152	156.28	60.82	16.70	78.76
20	156.21	60.74	16.75	78.72	90	156.54	60.69	16.83	79.03	153	156.53	60.69	16.81	79.03
21	157.00	60.79	16.60	79.61	91	156.35	60.75	16.83	78.78	154	156.23	60.60	16.76	78.87
22	156.06	60.73	16.62	78.71	92	156.40	60.73	16.71	78.96	155	156.21	60.73	16.67	78.81
23	156.18	60.66	16.65	78.87	93	156.22	60.75	16.62	78.84	156	156.32	60.60	16.83	78.89
24	156.23	60.70	16.67	78.85	94	156.24	60.59	16.66	78.98	157	156.67	60.80	16.63	79.25
25	156.16	60.46	16.64	79.05	95	155.92	60.60	16.67	78.65	158	156.98	60.85	16.80	79.34
26	156.64	60.44	16.75	79.45	96	155.92	60.73	16.63	78.56	159	156.70	60.98	16.56	79.16
27	156.85	60.92	16.89	79.05	97	156.40	60.83	16.68	78.89	160	156.50	60.83	16.69	78.97
28	156.88	60.73	16.79	79.37	98	156.03	60.55	16.56	78.93	161	156.09	60.75	16.77	78.57
29	156.08	60.41	16.80	78.87	99	156.58	60.77	16.57	79.25	162	156.06	60.81	16.66	78.58
30	156.48	60.40	16.64	79.43	100	156.98	60.88	16.68	79.43	163	156.03	60.58	16.57	78.88
31	156.87	60.87	16.73	79.27	101	156.37	60.78	16.64	78.96	164	156.33	60.74	16.66	78.93
32	156.01	60.67	16.62	78.72	102	156.62	60.77	16.84	79.01	165	156.04	60.49	16.71	78.84
33	156.08	60.78	16.64	78.66	103	156.60	60.80	16.73	79.07	166	153.04	59.33	16.30	77.42
34	156.44	60.71	16.77	78.95	104	156.01	60.55	16.56	78.90	167	124.33	48.19	13.34	62.79
35	156.34	60.77	16.63	78.94	105	152.86	59.49	16.30	77.08	168	163.46	63.54	17.42	82.50
36	156.30	60.71	16.61	78.98	106	159.76	61.95	17.20	80.61	169	163.89	63.57	17.42	82.90
37	156.42	60.55	16.61	79.26	107	156.58	60.76	16.78	79.04	170	163.21	63.34	17.42	82.45
38	156.10	60.46	16.67	78.97	108	156.49	60.59	16.73	79.17	171	164.00	63.68	17.43	82.89
39	156.53	60.68	16.76	79.09	109	156.21	60.74	16.67	78.80	172	162.37	63.11	17.23	82.03
40	156.54	60.54	16.93	79.07	110	156.39	60.74	16.78	78.87	173	156.10	60.71	16.76	78.62
41	156.14	60.76	16.57	78.81	111	156.07	60.73	16.60	78.74	174	156.27	60.80	16.75	78.73
42	156.55	60.71	16.78	79.06	112	156.49	60.65	16.64	79.20	175	156.09	60.69	16.64	78.76
43	156.51	60.80	16.75	78.96	113	156.59	60.76	16.63	79.20	176	156.64	60.74	16.77	79.13
44	156.32	60.74	16.73	78.86	114	156.09	60.54	16.75	78.81	177	156.22	60.56	16.62	79.04
45	156.22	60.78	16.61	78.82	115	155.92	60.63	16.67	78.62	178	156.46	60.85	16.78	78.83
46	156.69	60.86	16.67	79.15	116	156.79	60.69	16.71	79.40	179	156.29	60.75	16.66	78.88
47	156.18	60.66	16.67	78.85	117	156.19	60.66	16.71	78.83	180	156.61	60.71	16.84	79.06
48	156.53	60.76	16.70	79.07	118	156.33	60.66	16.69	78.98	181	156.40	60.75	16.72	78.93
49	156.25	60.57	16.73	78.96	119	156.01	60.71	16.67	78.62	182	156.14	60.63	16.69	78.82
50	156.38	60.82	16.62	78.94	120	156.47	60.77	16.64	79.06	183	156.11	60.92	16.69	78.50
51	156.63	60.77	16.84	79.02	121	156.19	60.73	16.72	78.74	184	156.58	60.72	16.75	79.11
52	156.49	60.81	16.65	79.03	122	123.20	47.91	13.16	62.12	185	156.48	60.75	16.63	79.10
53	156.46	60.72	16.64	79.10	123	158.15	61.37	16.87	79.91	186	156.62	60.56	16.73	79.33
54	156.51	60.81	16.79	78.91	124	163.76	63.50	17.50	82.75	187	156.77	60.80	16.65	79.33
55	156.14	60.83	16.77	78.55	125	163.56	63.58	17.42	82.56	188	156.74	60.92	16.76	79.07
56	156.81	60.80	16.75	79.26	126	163.10	63.23	17.50	82.36	189	17.47	6.75	1.83	8.89
57	156.40	60.81	16.73	78.86	127	162.98	63.43	17.51	82.04					
58	156.15	60.71	16.56	78.88	128	158.89	61.52	16.89	80.48					
59	156.53	60.86	16.79	78.88	129	156.62	60.68	16.68	79.27					
60	156.53	60.78	16.77	78.98	130	156.65	60.76	16.71	79.18					
61	155.82	60.47	16.76	78.60	131	156.33	60.69	16.66	78.98					
69	156.46	60.69	16.62	79.15	132	156.32	60.78	16.79	78.75					

Sustainability – Data Rate Distribution Graph
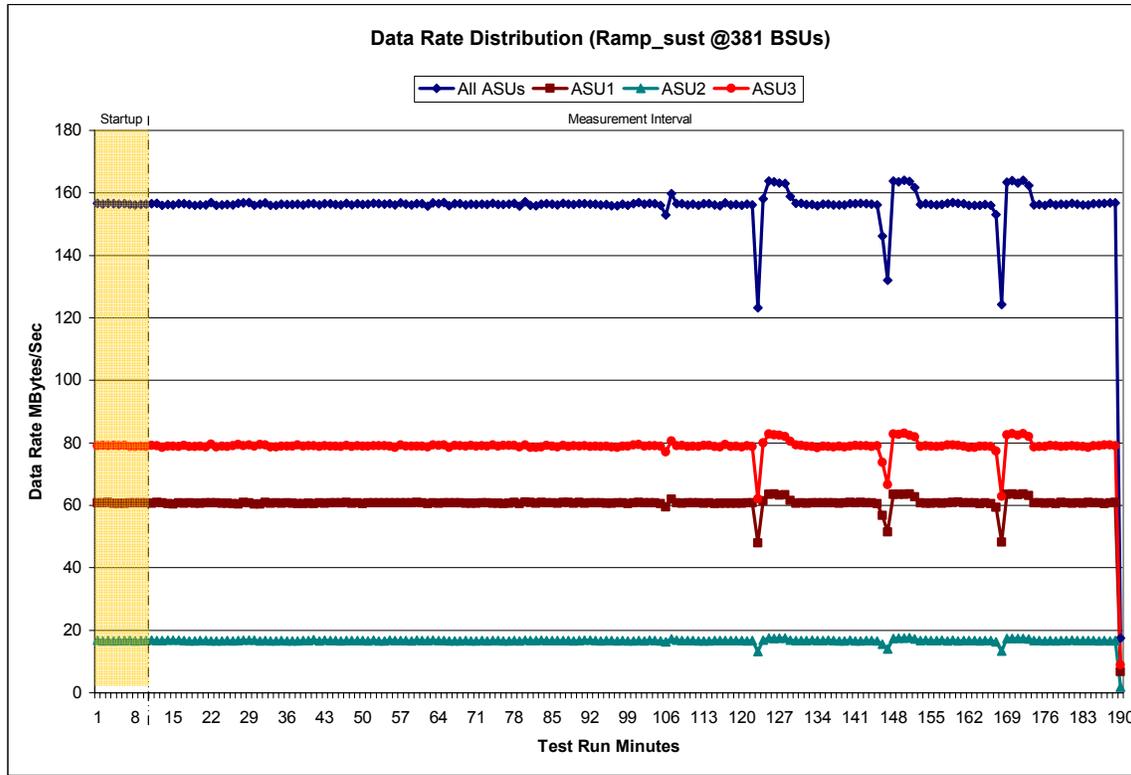
Sustainability – I/O Request Throughput Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	15:37:33	15:47:33	0-9	0:10:00
Measurement Interval	15:47:33	18:47:33	10-189	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	19,045.87	11,335.78	2,352.43	5,357.65	63	19,064.35	11,356.13	2,346.15	5,362.07	126	19,882.90	11,849.77	2,458.15	5,574.98
1	19,053.78	11,353.35	2,339.52	5,360.92	64	19,070.05	11,357.05	2,352.93	5,360.07	127	19,879.47	11,851.67	2,453.25	5,574.55
2	19,051.97	11,358.02	2,340.13	5,353.82	65	19,026.87	11,349.87	2,338.58	5,338.42	128	19,381.45	11,545.07	2,383.33	5,453.05
3	19,049.73	11,345.50	2,341.08	5,363.15	66	19,061.62	11,358.33	2,343.75	5,359.53	129	19,062.52	11,348.43	2,350.10	5,363.98
4	19,053.20	11,334.15	2,350.03	5,369.02	67	19,042.13	11,355.53	2,340.65	5,345.95	130	19,067.57	11,365.68	2,344.47	5,357.42
5	19,044.70	11,350.75	2,333.67	5,360.28	68	19,021.02	11,340.68	2,338.48	5,341.85	131	19,031.62	11,338.63	2,341.82	5,351.17
6	19,021.20	11,347.38	2,344.02	5,329.80	69	19,039.27	11,352.82	2,330.87	5,355.58	132	19,054.42	11,358.95	2,340.28	5,355.18
7	19,060.72	11,379.37	2,340.27	5,341.08	70	19,027.63	11,337.25	2,346.52	5,343.87	133	19,007.25	11,348.52	2,334.97	5,323.77
8	19,057.75	11,363.73	2,348.37	5,345.65	71	19,080.33	11,371.10	2,344.67	5,364.57	134	19,063.02	11,359.82	2,347.60	5,355.60
9	19,050.77	11,361.78	2,346.13	5,342.85	72	19,062.72	11,375.23	2,340.18	5,347.30	135	19,052.73	11,349.27	2,355.32	5,348.15
10	19,047.68	11,342.10	2,347.42	5,358.17	73	19,049.65	11,337.20	2,345.92	5,366.53	136	19,039.43	11,352.23	2,343.12	5,344.08
11	19,083.50	11,365.20	2,352.88	5,365.42	74	19,050.22	11,343.07	2,350.32	5,356.83	137	19,044.22	11,348.20	2,338.42	5,357.60
12	19,053.08	11,365.38	2,347.92	5,339.78	75	19,027.63	11,333.30	2,337.22	5,357.12	138	19,048.87	11,367.92	2,334.52	5,346.43
13	19,048.93	11,343.08	2,354.17	5,351.68	76	19,058.10	11,355.27	2,337.93	5,364.90	139	19,056.32	11,357.20	2,340.07	5,359.05
14	19,038.05	11,324.15	2,351.10	5,362.80	77	19,056.48	11,360.03	2,342.85	5,353.60	140	19,037.27	11,338.88	2,338.77	5,359.62
15	19,067.37	11,375.20	2,343.42	5,348.75	78	18,990.03	11,331.95	2,339.18	5,318.90	141	19,066.12	11,367.27	2,343.68	5,355.17
16	19,016.15	11,332.48	2,333.52	5,350.15	79	19,120.12	11,388.30	2,361.48	5,370.33	142	19,073.30	11,351.88	2,340.05	5,381.37
17	19,080.30	11,372.80	2,345.67	5,361.83	80	19,050.07	11,361.32	2,343.38	5,345.37	143	19,069.63	11,362.85	2,359.72	5,347.07
18	19,033.67	11,344.83	2,340.37	5,348.47	81	19,053.38	11,361.33	2,347.05	5,345.00	144	19,048.73	11,342.02	2,347.32	5,359.40
19	19,027.07	11,324.50	2,345.58	5,356.98	82	19,052.30	11,384.08	2,345.52	5,322.70	145	17,833.32	10,632.10	2,197.40	5,003.82
20	19,044.67	11,354.17	2,343.63	5,346.87	83	19,054.55	11,356.27	2,343.33	5,354.95	146	16,095.60	9,607.43	1,976.87	4,511.30
21	19,072.13	11,366.08	2,331.75	5,374.30	84	19,055.58	11,351.53	2,342.87	5,361.18	147	19,970.35	11,900.05	2,448.48	5,621.82
22	19,036.42	11,357.63	2,342.85	5,335.93	85	19,034.10	11,344.72	2,346.00	5,343.38	148	19,905.95	11,853.10	2,451.47	5,601.38
23	19,023.28	11,335.37	2,336.07	5,351.85	86	19,069.43	11,362.97	2,344.48	5,361.98	149	19,952.45	11,886.17	2,453.70	5,612.58
24	19,066.92	11,363.85	2,340.73	5,362.33	87	19,067.42	11,374.23	2,349.63	5,343.55	150	19,937.20	11,889.92	2,464.03	5,583.25
25	19,023.72	11,322.50	2,347.10	5,354.12	88	19,051.00	11,349.40	2,345.20	5,356.40	151	19,683.30	11,733.85	2,420.50	5,528.95
26	19,007.72	11,309.73	2,341.30	5,356.68	89	19,083.23	11,380.73	2,350.53	5,351.97	152	19,063.48	11,365.02	2,347.97	5,350.50
27	19,111.42	11,396.30	2,349.27	5,365.85	90	19,060.48	11,350.95	2,353.17	5,356.37	153	19,042.97	11,347.07	2,344.78	5,351.12
28	19,094.07	11,369.73	2,348.15	5,376.17	91	19,074.83	11,368.72	2,349.22	5,356.90	154	19,038.78	11,347.12	2,346.22	5,345.45
29	19,015.40	11,323.03	2,344.30	5,348.07	92	19,023.15	11,330.12	2,337.38	5,355.65	155	19,038.82	11,352.00	2,346.90	5,339.92
30	19,057.25	11,335.58	2,345.28	5,376.38	93	19,063.15	11,381.45	2,340.47	5,341.23	156	19,044.17	11,339.57	2,346.85	5,357.75
31	19,070.63	11,358.32	2,349.10	5,363.22	94	19,021.05	11,337.12	2,334.85	5,349.08	157	19,061.67	11,355.22	2,346.68	5,359.77
32	19,003.80	11,324.93	2,336.98	5,341.88	95	19,042.53	11,350.22	2,338.32	5,354.00	158	19,056.40	11,346.77	2,350.20	5,359.43
33	19,038.65	11,356.42	2,340.98	5,341.25	96	19,023.08	11,350.85	2,342.95	5,329.28	159	19,074.38	11,374.68	2,342.18	5,357.52
34	19,031.98	11,334.92	2,343.25	5,353.82	97	19,066.32	11,371.08	2,342.72	5,352.52	160	19,052.57	11,366.68	2,342.00	5,343.88
35	19,048.77	11,355.22	2,341.37	5,352.18	98	19,061.70	11,366.80	2,331.38	5,363.52	161	19,040.95	11,338.42	2,350.55	5,351.98
36	19,056.72	11,361.00	2,343.98	5,351.73	99	19,055.50	11,365.83	2,336.52	5,353.15	162	19,041.23	11,364.00	2,333.57	5,343.67
37	19,052.18	11,343.48	2,340.22	5,368.48	100	19,071.90	11,364.65	2,340.25	5,367.00	163	19,045.43	11,360.90	2,337.98	5,346.55
38	19,040.62	11,345.10	2,342.68	5,352.83	101	19,040.32	11,349.10	2,339.87	5,351.35	164	19,054.92	11,353.58	2,342.18	5,359.15
39	19,045.03	11,334.35	2,350.23	5,360.45	102	19,065.32	11,370.73	2,346.43	5,348.15	165	19,040.45	11,351.70	2,344.78	5,343.97
40	19,066.10	11,346.45	2,348.65	5,371.00	103	19,064.03	11,372.67	2,338.97	5,352.40	166	18,655.07	11,115.33	2,293.83	5,245.90
41	19,073.35	11,369.73	2,352.05	5,351.57	104	19,035.35	11,339.50	2,339.40	5,356.45	167	15,137.03	9,025.45	1,859.27	4,252.32
42	19,050.90	11,354.05	2,343.58	5,353.27	105	18,638.32	11,106.42	2,291.93	5,239.97	168	19,917.28	11,878.45	2,447.12	5,591.72
43	19,047.20	11,345.30	2,353.00	5,348.90	106	19,438.43	11,582.28	2,392.78	5,463.37	169	19,915.63	11,850.10	2,443.33	5,622.20
44	19,055.47	11,356.65	2,354.25	5,344.57	107	19,059.23	11,365.23	2,343.30	5,350.70	170	19,908.32	11,872.90	2,441.65	5,593.77
45	19,024.08	11,348.13	2,336.48	5,339.47	108	19,061.92	11,345.20	2,348.63	5,368.08	171	20,023.18	11,931.50	2,463.92	5,627.77
46	19,064.48	11,364.63	2,341.77	5,358.08	109	19,039.07	11,353.02	2,339.52	5,346.53	172	19,783.55	11,796.08	2,426.28	5,561.18
47	19,051.50	11,351.98	2,348.08	5,351.43	110	19,074.57	11,374.03	2,350.73	5,349.80	173	19,039.97	11,360.32	2,344.93	5,334.72
48	19,084.82	11,372.70	2,351.20	5,360.92	111	19,057.07	11,361.67	2,339.95	5,355.45	174	19,050.43	11,360.28	2,339.92	5,350.23
49	19,056.02	11,347.57	2,344.12	5,364.33	112	19,037.05	11,336.43	2,326.38	5,374.23	175	19,039.68	11,350.00	2,346.22	5,343.47
50	19,080.00	11,369.80	2,348.20	5,362.00	113	19,076.62	11,357.62	2,341.97	5,377.03	176	19,079.90	11,373.20	2,342.20	5,364.50
51	19,071.07	11,376.78	2,349.80	5,344.48	114	19,012.47	11,336.32	2,341.90	5,334.25	177	19,030.90	11,327.92	2,346.73	5,356.25
52	19,034.23	11,330.88	2,342.80	5,360.55	115	19,007.43	11,328.53	2,342.03	5,336.87	178	19,055.47	11,355.67	2,350.30	5,349.50
53	19,078.25	11,375.57	2,346.75	5,355.93	116	19,077.37	11,362.37	2,347.03	5,367.97	179	19,055.02	11,369.02	2,341.37	5,344.63
54	19,088.85	11,374.73	2,359.08	5,355.03	117	19,032.05	11,340.25	2,343.42	5,348.38	180	19,082.85	11,354.53	2,352.85	5,375.47
55	19,049.02	11,356.08	2,346.72	5,346.22	118	19,062.78	11,362.45	2,350.27	5,350.07	181	19,041.92	11,346.30	2,339.35	5,356.27
56	19,078.42	11,364.22	2,346.20	5,368.00	119	19,051.77	11,361.87	2,350.68	5,339.22	182	19,055.15	11,343.28	2,348.28	5,363.58
57	19,075.07	11,380.22	2,345.02	5,349.83	120	19,045.02	11,353.68	2,345.50	5,345.83	183	19,036.15	11,362.75	2,332.27	5,341.13
58	19,042.95	11,349.05	2,339.68	5,354.22	121	19,059.42	11,357.32	2,355.15	5,346.95	184	19,061.83	11,368.07	2,338.82	5,354.95
59	19,071.42	11,368.33	2,346.60	5,356.48	122	15,018.57	8,949.23	1,846.28	4,223.05	185	19,046.72	11,360.12	2,332.50	5,354.10
60	19,062.23	11,349.88	2,353.57	5,358.78	123	19,274.75	11,476.25	2,373.60	5,424.90	186	19,050.23	11,338.02	2,347.00	5,365.22
61	19,003.15	11,331.10	2,342.32	5,329.73	124	19,950.50	11,892.45	2,452.40	5,605.65	187	19,049.30	11,356.03	2,325.70	5,367.57
62	19,038.77	11,329.90	2,346.73	5,362.13	125	19,919.22	11,867.83	2,450.63	5,600.75	188	19,054.05	11,363.77	2,337.37	5,352.92
										189	2,121.07	1,262.32	260.10	598.65
										Average	18,957.21	11,297.85	2,332.34	5,327.03

Sustainability – I/O Request Throughput Distribution Graph
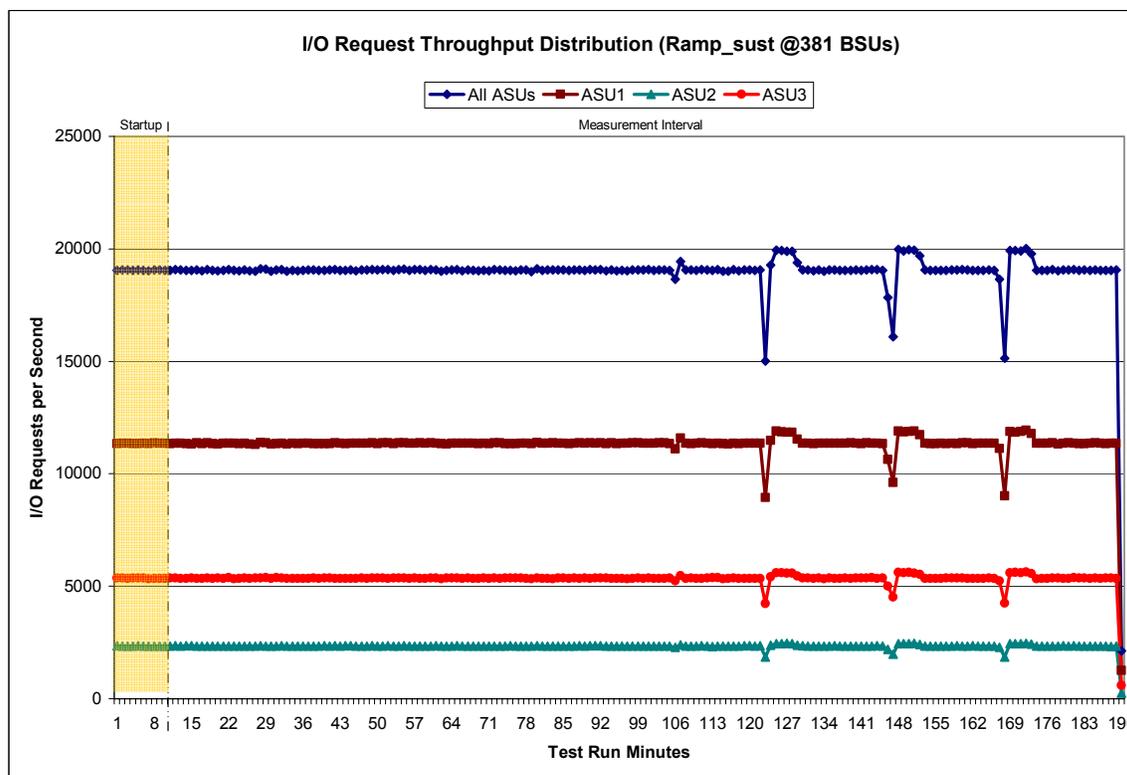
Sustainability – Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
MIM	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
COV	0.005	0.001	0.003	0.002	0.007	0.003	0.005	0.002

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

Primary Metrics Test – IOPS Test Phase

Clause 5.4.2.2

The IOPS Test Phase consists of one Test Run at the 100% load point with a Measurement Interval of ten (10) minutes. The IOPS Test Phase immediately follows the Sustainability Test Phase without any interruption or manual intervention.

The IOPS Test Run generates the SPC-1 IOPS™ primary metric, which is computed as the I/O Request Throughput for the Measurement Interval of the IOPS Test Run.

The Average Response Time is computed for the IOPS Test Run and cannot exceed 30 milliseconds. If the Average Response Time exceeds the 30 millisecond constraint, the measurement is invalid.

Clause 9.2.4.7.2

For the IOPS Test Phase the FDR shall contain:

1. *I/O Request Throughput Distribution (data and graph).*
2. *A Response Time Frequency Distribution.*
3. *An Average Response Time Distribution.*
4. *The human readable Test Run Results File produced by the Workload Generator.*
5. *A listing or screen image of all input parameters supplied t the Workload Generator.*
6. *The total number of I/O Requests completed in the Measurement Interval as well as the number of I/O Requests with a Response Time less than or equal to 30 milliseconds and the number of I/O Requests with a Response Time greater than 30 milliseconds.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are are listed below.

java metrics –b 381 –s 600

IOPS Test Results File

A link to the test results file generated from the IOPS Test Run is listed below.

IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:47:50	18:57:51	0-9	0:10:01
Measurement Interval	18:57:51	19:07:51	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	19,035.73	11,347.02	2,332.70	5,356.02
1	19,047.70	11,358.57	2,327.85	5,361.28
2	18,846.55	11,242.07	2,323.57	5,280.92
3	19,250.52	11,469.02	2,362.67	5,418.83
4	19,029.87	11,342.02	2,345.58	5,342.27
5	19,039.47	11,354.38	2,344.48	5,340.60
6	18,863.12	11,245.80	2,320.50	5,296.82
7	19,191.45	11,434.27	2,367.57	5,389.62
8	19,050.30	11,362.50	2,347.42	5,340.38
9	19,041.63	11,353.10	2,345.97	5,342.57
10	18,983.73	11,308.10	2,325.28	5,350.35
11	19,108.33	11,390.33	2,349.75	5,368.25
12	19,011.57	11,333.07	2,334.50	5,344.00
13	19,026.73	11,340.67	2,335.50	5,350.57
14	19,039.95	11,346.57	2,334.20	5,359.18
15	19,058.92	11,378.82	2,335.28	5,344.82
16	19,037.55	11,369.27	2,330.42	5,337.87
17	19,052.38	11,359.72	2,352.52	5,340.15
18	19,071.87	11,360.75	2,347.02	5,364.10
19	18,060.25	10,753.28	2,221.13	5,085.83
Average	**18,945.13**	**11,294.06**	**2,326.56**	**5,324.51**

IOPS Test Run – I/O Request Throughput Distribution Graph
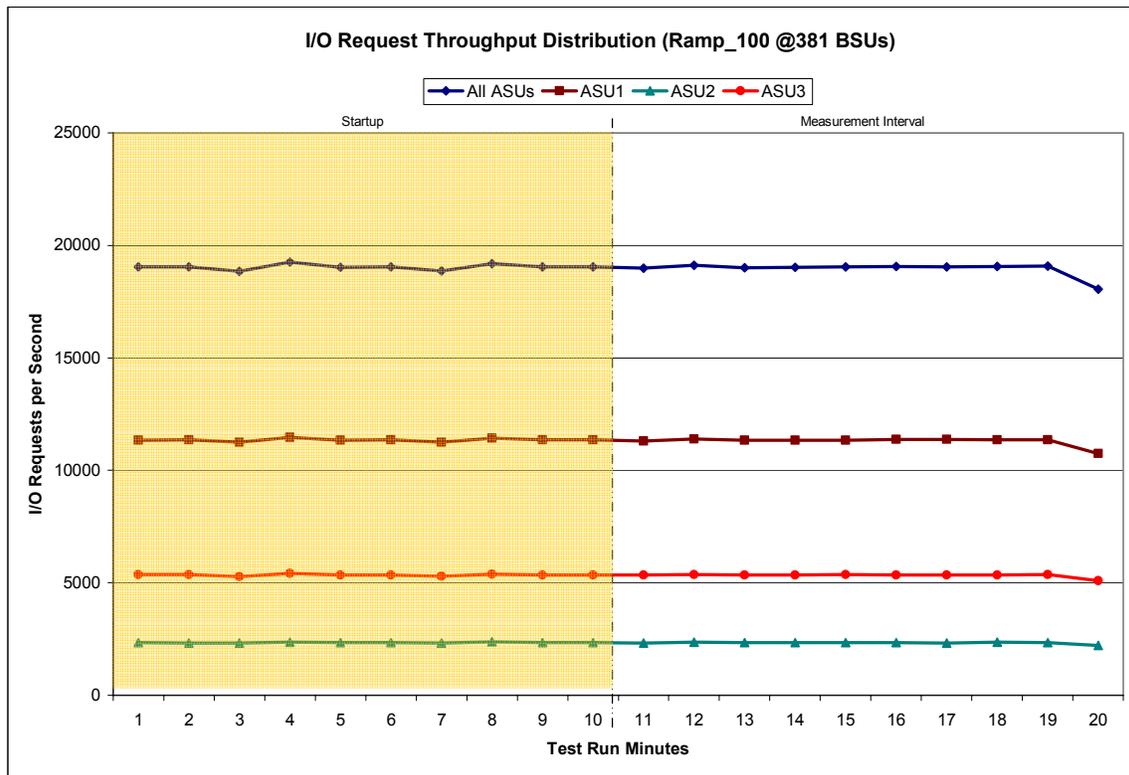
IOPS Test Run – Response Time Frequency Distribution Data

Response Time (ms)	0-0.25	>0.25-0.5	>0.5-0.75	>0.75-1.0	>1.0-1.25	>1.25-1.5	>1.5-1.75	>1.75-2.0
Read	0	-	2,143	16,141	25,731	29,814	27,973	22,626
Write	0	-	-	-	86	5,597	17,686	28,148
All ASUs	0	-	2,143	16,141	25,817	35,411	45,659	50,774
ASU1	0	-	1,624	11,751	18,684	24,923	30,215	31,730
ASU2	0	-	519	4,390	7,127	9,388	10,643	10,348
ASU3	0	-	-	-	6	1,100	4,801	8,696
Response Time (ms)	**>2.0-2.5**	**>2.5-3.0**	**>3.0-3.5**	**>3.5-4.0**	**>4.0-4.5**	**>4.5-5.0**	**>5.0-6.0**	**>6.0-7.0**
Read	32,343	21,032	16,819	15,664	17,900	22,756	64,569	94,772
Write	82,486	102,735	108,066	101,922	97,503	96,783	179,838	170,288
All ASUs	114,829	123,767	124,885	117,586	115,403	119,539	244,407	265,060
ASU1	67,579	68,573	66,894	62,044	60,911	64,037	137,843	160,152
ASU2	19,649	18,980	17,639	16,031	15,065	15,208	29,737	31,587
ASU3	27,601	36,214	40,352	39,511	39,427	40,294	76,827	73,321
Response Time (ms)	**>7.0-8.0**	**>8.0-9.0**	**>9.0-10.0**	**>10.0-15.0**	**>15.0-20.0**	**>20.0-25.0**	**>25.0-30.0**	**>30.0**
Read	118,542	126,650	101,857	627,287	526,197	512,083	406,356	1,652,590
Write	164,762	157,159	125,961	822,419	712,257	724,477	585,838	2,601,215
All ASUs	283,304	283,809	227,818	1,449,706	1,238,454	1,236,560	992,194	4,253,805
ASU1	178,559	181,833	144,775	909,600	765,406	751,586	596,435	2,441,277
ASU2	33,535	34,361	28,257	175,063	146,980	145,201	115,652	510,575
ASU3	71,210	67,615	54,786	365,043	326,068	339,773	280,107	1,301,953

IOPS Test Run –Response Time Frequency Distribution Graph
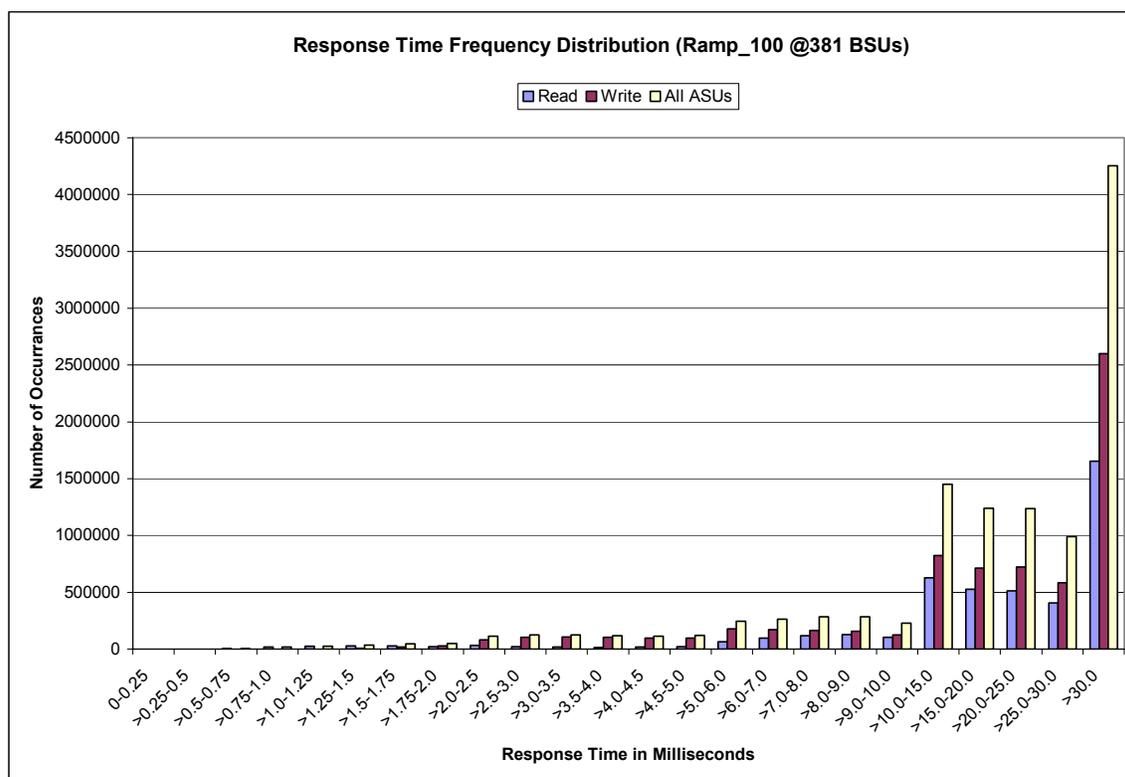
IOPS Test Run – Average Response Time (ms) Distribution Data

381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:47:50	18:57:51	0-9	0:10:01
Measurement Interval	18:57:51	19:07:51	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	25.89	25.46	25.38	27.03
1	27.86	27.23	27.35	29.41
2	26.83	26.36	26.36	28.05
3	28.62	27.92	28.05	30.35
4	27.98	27.33	27.39	29.63
5	27.51	26.94	26.93	28.95
6	27.66	27.01	27.12	29.27
7	28.69	28.07	28.09	30.27
8	27.23	26.63	26.68	28.75
9	27.65	27.08	27.16	29.05
10	28.77	28.02	28.18	30.61
11	28.09	27.45	27.65	29.64
12	27.35	26.74	26.73	28.92
13	27.49	26.84	27.05	29.05
14	28.90	28.18	28.31	30.66
15	27.39	26.82	26.90	28.83
16	27.00	26.44	26.52	28.40
17	26.88	26.34	26.54	28.20
18	28.15	27.43	27.48	29.96
19	27.55	26.93	27.10	29.05
Average	**27.76**	**27.12**	**27.25**	**29.33**

IOPS Test Run – Average Response Time (ms) Distribution Graph
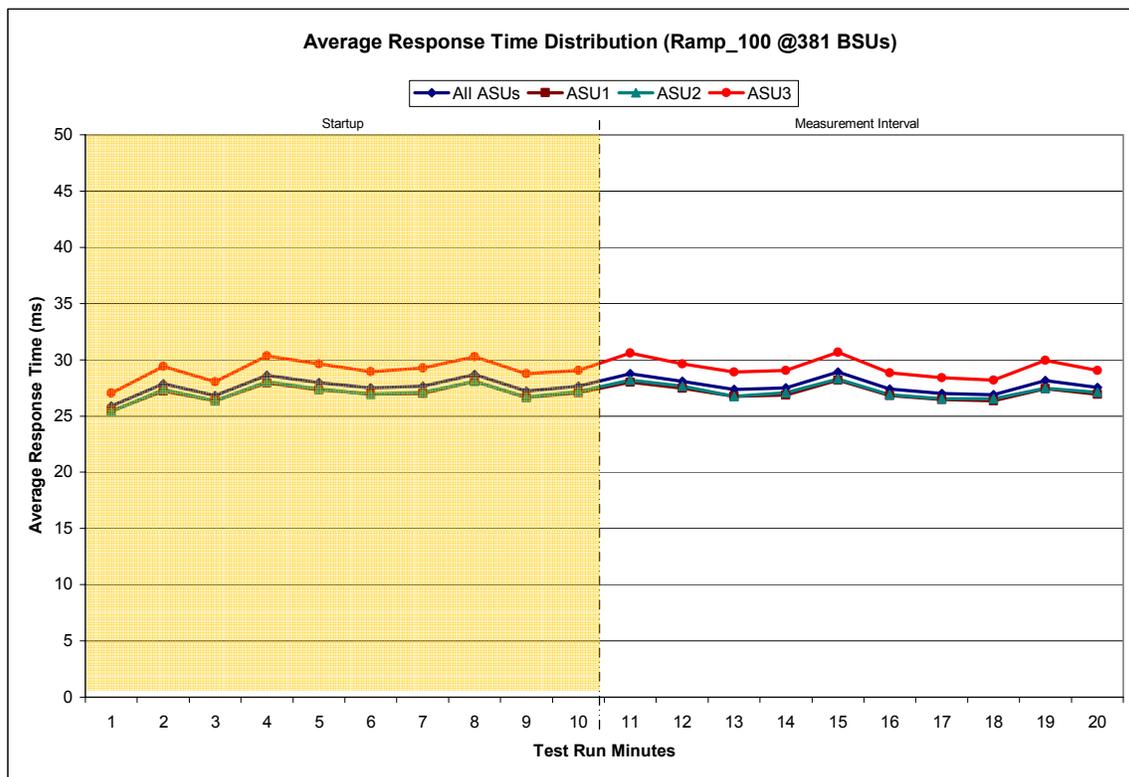
IOPS Test Run – I/O Request Information

I/O Requests Completed in the Measurement Interval	I/O Requests Completed with Response Time = or < 30 ms	I/O Requests Completed with Response Time > 30 ms
11,367,071	7,113,266	4,253,805

IOPS Test Run – Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
MIM	0.0350	0.2810	0.0701	0.2101	0.0179	0.0699	0.0350	0.2810
COV	0.005	0.002	0.004	0.002	0.005	0.004	0.004	0.002

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

Primary Metrics Test – Response Time Ramp Test Phase

Clause 5.4.2.3

The Response Time Ramp Test Phase consists of five Test Runs, one each at 95%, 90%, 80%, 50%, and 10% of the load point (100%) used to generate the SPC-1 IOPS™ primary metric. Each of the five Test Runs has a Measurement Interval of ten (10) minutes. The Response Time Ramp Test Phase immediately follows the IOPS Test Phase without any interruption or manual intervention.

The five Response Time Ramp Test Runs, in conjunction with the IOPS Test Run (100%), demonstrate the relationship between Average Response Time and I/O Request Throughput for the Tested Storage Configuration (TSC) as illustrated in the response time/throughput curve on page 11.

In addition, the Average Response Time measured during the 10% Test Run is the value for the SPC-1 LRT™ primary metric. That value represents the Average Response Time of a lightly loaded TSC.

Clause 9.2.4.7.3

The following content shall appear in the FDR for the Response Time Ramp Phase:

1. *A Response Time Ramp Distribution.*
2. *The human readable Test Run Results File produced by the Workload Generator for each Test Run within the Response Time Ramp Test Phase.*
3. *For the 10% Load Level Test Run (SPC-1 LRT™ metric) an Average Response Time Distribution.*
4. *A listing or screen image of all input parameters supplied to the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are are listed below.

java metrics –b 381 –s 600

Response Time Ramp Test Results File

A link to each test result file generated from each Response Time Ramp Test Run list listed below.

95% Load Level

90% Load Level

80% Load Level

50% Load Level

10% Load Level

Response Time Ramp Distribution (IOPS) Data

The five Test Runs that comprise the Response Time Ramp Phase are executed at 95%, 90%, 80%, 50%, and 10% of the Business Scaling Unit (BSU) load level used to produce the SPC-1 IOPS™ primary metric. The 100% BSU load level is included in the following Response Time Ramp data tables and graphs for completeness.

100% Load Level - 381 BSUs	Start	Stop	Interval	Duration	95% Load Level - 361 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:47:50	18:57:51	0-9	0:10:01	Start-Up/Ramp-Up	19:07:59	19:18:00	0-9	0:10:01
Measurement Interval	18:57:51	19:07:51	10-19	0:10:00	Measurement Interval	19:18:00	19:28:00	10-19	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3	(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	19,035.73	11,347.02	2,332.70	5,356.02	0	18,048.90	10,742.90	2,224.10	5,081.90
1	19,047.70	11,358.57	2,327.85	5,361.28	1	18,068.12	10,775.72	2,216.08	5,076.32
2	18,846.55	11,242.07	2,323.57	5,280.92	2	18,079.22	10,790.52	2,219.47	5,069.23
3	19,250.52	11,469.02	2,362.67	5,418.83	3	18,049.18	10,750.85	2,227.08	5,071.25
4	19,029.87	11,342.02	2,345.58	5,342.27	4	18,047.63	10,757.90	2,226.80	5,062.93
5	19,039.47	11,354.38	2,344.48	5,340.60	5	18,044.78	10,759.23	2,215.45	5,070.10
6	18,863.12	11,245.80	2,320.50	5,296.82	6	18,049.10	10,759.15	2,217.07	5,072.88
7	19,191.45	11,434.27	2,367.57	5,389.62	7	18,066.08	10,783.17	2,213.22	5,069.70
8	19,050.30	11,362.50	2,347.42	5,340.38	8	18,057.47	10,769.23	2,220.37	5,067.87
9	19,041.63	11,353.10	2,345.97	5,342.57	9	18,023.38	10,750.45	2,221.68	5,051.25
10	18,983.73	11,308.10	2,325.28	5,350.35	10	18,044.82	10,755.60	2,218.52	5,070.70
11	19,108.33	11,390.33	2,349.75	5,368.25	11	18,059.53	10,763.23	2,216.55	5,079.75
12	19,011.57	11,333.07	2,334.50	5,344.00	12	18,003.90	10,737.07	2,212.73	5,054.10
13	19,026.73	11,340.67	2,335.50	5,350.57	13	18,060.53	10,758.37	2,223.55	5,078.62
14	19,039.95	11,346.57	2,334.20	5,359.18	14	18,045.97	10,744.37	2,229.42	5,072.18
15	19,058.92	11,378.82	2,335.28	5,344.82	15	17,910.45	10,678.42	2,199.32	5,032.72
16	19,037.55	11,369.27	2,330.42	5,337.87	16	18,170.58	10,822.80	2,237.75	5,110.03
17	19,052.38	11,359.72	2,352.52	5,340.15	17	17,804.70	10,596.83	2,194.78	5,013.08
18	19,071.87	11,360.75	2,347.02	5,364.10	18	18,311.82	10,919.83	2,249.08	5,142.90
19	18,060.25	10,753.28	2,221.13	5,085.83	19	18,048.03	10,768.23	2,212.03	5,067.77
Average	18,945.13	11,294.06	2,326.56	5,324.51	Average	18,046.03	10,754.48	2,219.37	5,072.19

90% Load Level - 342 BSUs	Start	Stop	Interval	Duration	80% Load Level - 304 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:28:13	19:38:14	0-9	0:10:01	Start-Up/Ramp-Up	19:48:22	19:58:23	0-9	0:10:01
Measurement Interval	19:38:14	19:48:14	10-19	0:10:00	Measurement Interval	19:58:23	20:08:23	10-19	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3	(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	17,110.23	10,193.70	2,096.42	4,820.12	0	15,197.83	9,048.35	1,887.95	4,261.53
1	17,081.73	10,176.07	2,102.32	4,803.35	1	15,186.97	9,056.70	1,866.22	4,264.05
2	17,097.47	10,182.00	2,113.67	4,801.80	2	15,191.27	9,047.60	1,865.15	4,278.52
3	17,094.33	10,179.92	2,106.67	4,807.75	3	15,185.18	9,051.52	1,859.87	4,273.80
4	17,109.60	10,200.28	2,104.15	4,805.17	4	15,203.85	9,061.18	1,867.60	4,275.07
5	17,069.52	10,176.38	2,103.90	4,789.23	5	15,198.98	9,058.73	1,878.58	4,261.67
6	17,072.33	10,174.17	2,096.80	4,801.37	6	15,214.52	9,054.80	1,876.02	4,283.70
7	17,067.42	10,175.43	2,094.93	4,797.05	7	15,193.97	9,056.22	1,867.45	4,270.30
8	17,096.63	10,198.45	2,100.00	4,798.18	8	15,232.20	9,070.90	1,875.32	4,285.98
9	17,101.97	10,194.07	2,100.57	4,807.33	9	15,214.42	9,060.95	1,873.20	4,280.27
10	17,089.08	10,192.75	2,099.25	4,797.08	10	15,204.50	9,058.90	1,875.55	4,270.05
11	17,151.73	10,218.17	2,113.75	4,819.82	11	15,160.87	9,044.25	1,863.70	4,252.92
12	17,135.48	10,210.52	2,107.65	4,817.32	12	15,178.85	9,038.25	1,868.78	4,271.82
13	17,117.45	10,198.68	2,111.02	4,807.75	13	15,237.38	9,096.32	1,870.63	4,270.43
14	17,092.75	10,195.82	2,104.58	4,792.35	14	15,160.27	9,047.43	1,867.48	4,245.35
15	17,088.23	10,192.63	2,097.25	4,798.35	15	15,178.98	9,044.50	1,868.63	4,265.85
16	17,057.45	10,175.17	2,097.22	4,785.07	16	15,195.13	9,069.88	1,860.23	4,265.02
17	17,098.78	10,191.27	2,108.92	4,798.60	17	15,208.78	9,063.88	1,877.78	4,267.12
18	17,105.70	10,194.78	2,098.27	4,812.65	18	15,201.77	9,063.25	1,865.97	4,272.55
19	16,387.88	9,764.28	2,016.40	4,607.20	19	14,998.13	8,950.65	1,844.32	4,203.17
Average	17,032.46	10,153.41	2,095.43	4,783.62	Average	15,172.47	9,047.73	1,866.31	4,258.43

50% Load Level - 190 BSUs	Start	Stop	Interval	Duration	10% Load Level - 38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:08:31	20:18:32	0-9	0:10:01	Start-Up/Ramp-Up	20:28:39	20:38:40	0-9	0:10:01
Measurement Interval	20:18:32	20:28:32	10-19	0:10:00	Measurement Interval	20:38:40	20:48:40	10-19	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3	(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	9,502.97	5,666.82	1,175.85	2,660.30	0	1,899.03	1,131.20	232.13	535.70
1	9,516.37	5,659.43	1,178.53	2,678.40	1	1,897.82	1,130.50	232.18	535.13
2	9,502.75	5,665.62	1,170.58	2,666.55	2	1,897.73	1,129.60	235.37	532.77
3	9,519.22	5,665.62	1,181.92	2,671.68	3	1,902.68	1,136.87	231.80	534.02
4	9,518.75	5,660.87	1,178.58	2,679.30	4	1,905.18	1,135.28	234.35	535.55
5	9,503.82	5,656.43	1,171.03	2,676.35	5	1,903.85	1,131.97	236.37	535.52
6	9,498.73	5,660.90	1,163.27	2,674.57	6	1,898.58	1,126.08	235.50	537.00
7	9,487.73	5,656.78	1,168.22	2,662.73	7	1,897.87	1,132.43	231.38	534.05
8	9,508.62	5,671.17	1,167.78	2,669.67	8	1,891.72	1,125.17	230.65	535.90
9	9,512.77	5,657.48	1,178.70	2,676.58	9	1,898.75	1,134.65	232.17	531.93
10	9,502.28	5,666.38	1,175.93	2,659.97	10	1,905.00	1,135.17	234.77	535.07
11	9,508.68	5,669.23	1,167.72	2,671.73	11	1,897.22	1,133.32	232.45	531.45
12	9,504.55	5,662.93	1,171.67	2,669.95	12	1,910.88	1,141.93	234.40	534.55
13	9,519.23	5,674.12	1,175.60	2,669.52	13	1,901.83	1,131.43	234.10	536.30
14	9,518.13	5,673.87	1,167.42	2,676.85	14	1,890.83	1,125.05	233.03	532.75
15	9,489.82	5,661.95	1,169.42	2,658.45	15	1,896.13	1,127.48	236.63	532.02
16	9,502.75	5,663.55	1,168.45	2,670.75	16	1,903.40	1,131.48	233.28	538.63
17	9,481.78	5,650.95	1,167.75	2,663.08	17	1,904.88	1,137.00	233.47	534.42
18	9,503.37	5,658.05	1,169.15	2,676.17	18	1,897.77	1,128.22	233.38	536.17
19	9,486.60	5,654.23	1,160.37	2,672.00	19	1,581.28	939.43	194.03	447.82
Average	9,501.72	5,663.53	1,169.35	2,668.85	Average	1,868.92	1,113.05	229.96	525.92

Response Time Ramp Distribution (IOPS) Graph
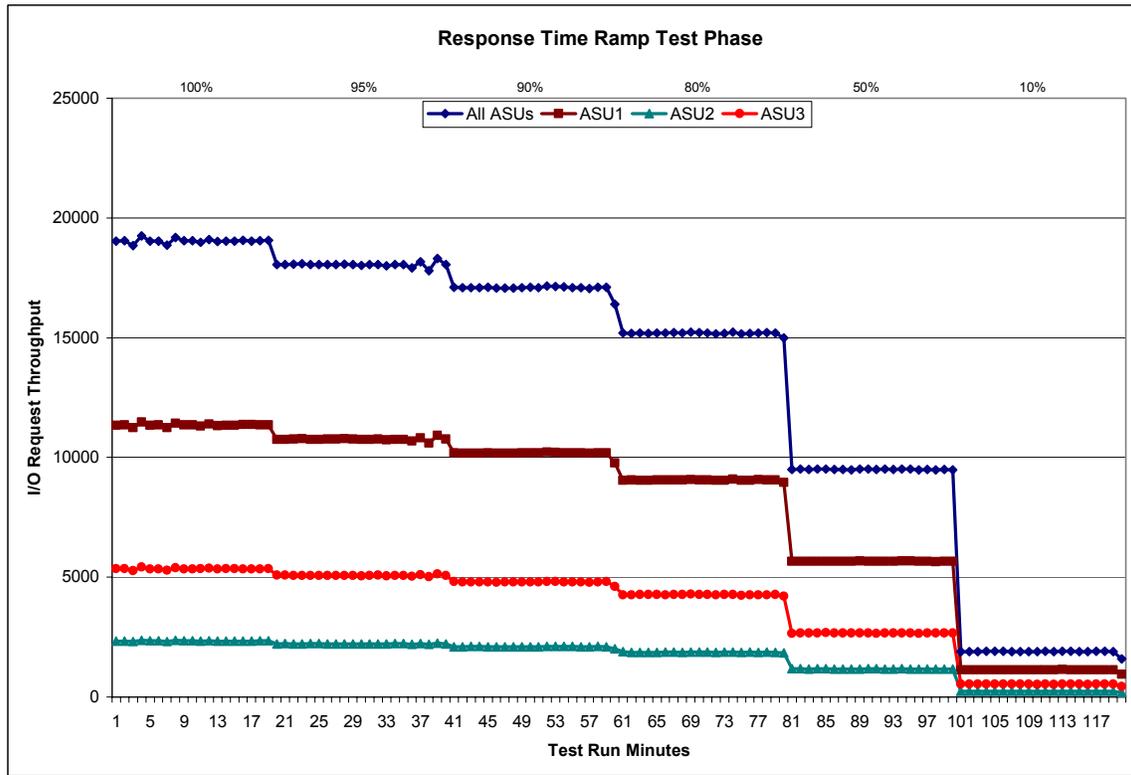
SPC-1 LRT™ Average Response Time (ms) Distribution Data

38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:28:39	20:38:40	0-9	0:10:01
Measurement Interval	20:38:40	20:48:40	10-19	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	3.23	3.77	3.16	2.10
1	3.11	3.61	3.08	2.05
2	3.10	3.60	3.10	2.04
3	3.15	3.64	3.12	2.10
4	3.12	3.60	3.12	2.09
5	3.11	3.61	3.08	2.06
6	3.06	3.55	3.01	2.05
7	3.10	3.58	3.11	2.07
8	3.11	3.61	3.12	2.05
9	3.09	3.58	3.10	2.04
10	3.07	3.55	3.07	2.05
11	3.06	3.53	3.05	2.04
12	3.06	3.51	3.13	2.06
13	3.08	3.56	3.09	2.05
14	3.07	3.55	3.07	2.05
15	3.06	3.54	3.07	2.04
16	3.06	3.53	3.08	2.06
17	3.07	3.53	3.10	2.07
18	3.07	3.54	3.11	2.04
19	3.06	3.55	3.05	2.06
Average	3.06	3.54	3.08	2.05

SPC-1 LRT™ Average Response Time (ms) Distribution Graph
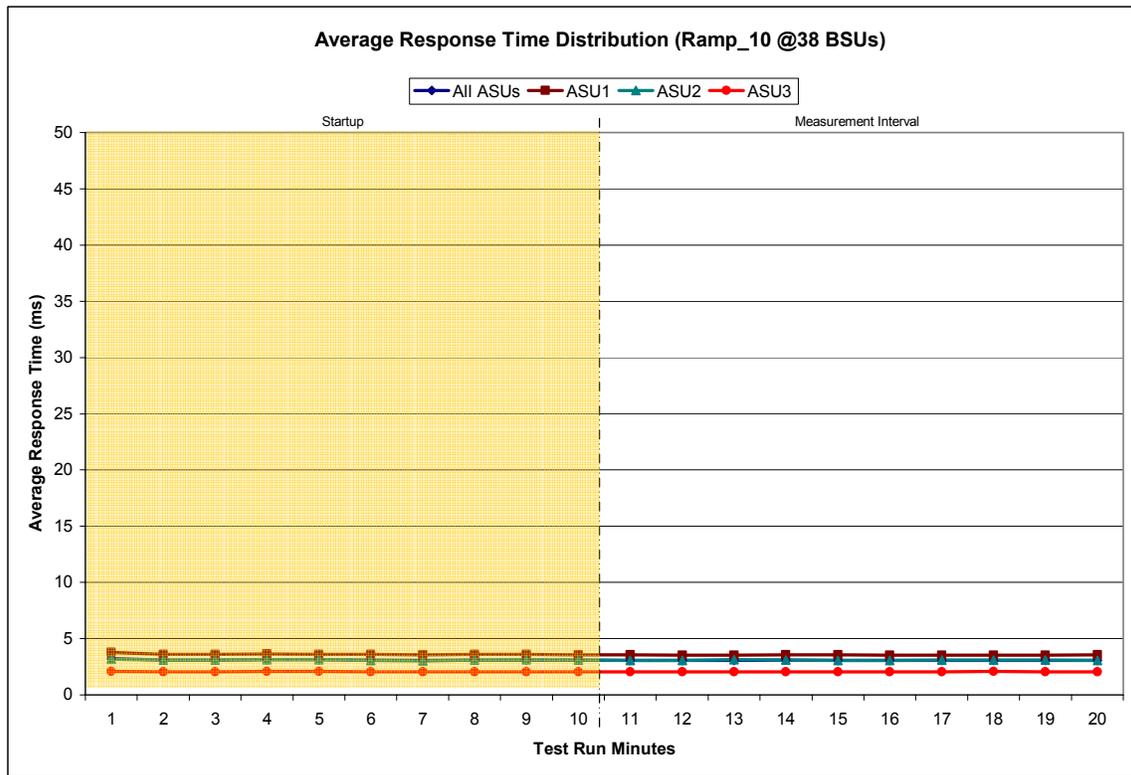
SPC-1 LRT™ (10%) – Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
MIM	0.0349	0.2808	0.0699	0.2100	0.0182	0.0697	0.0351	0.2814
COV	0.023	0.006	0.010	0.007	0.017	0.007	0.012	0.004

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

Repeatability Test

Clause 5.4.3

The Repeatability Test demonstrates the repeatability and reproducibility of the SPC-1 IOPS™ and SPC-1 LRT™ primary metrics generated in earlier Test Runs.

There are two identical Repeatability Test Phases. Each Test Phase contains two Test Runs. Each of the Test Runs will have a Measurement Interval of no less than ten (10) minutes. The two Test Runs in each Test Phase will be executed without interruption or any type of manual intervention.

The first Test Run in each Test Phase is executed at the 10% load point. The Average Response Time from each of the Test Runs is compared to the SPC-1 LRT™ primary metric. Each Average Response Time value must be less than the SPC-1 LRT™ primary metric plus 5%.

The second Test Run in each Test Phase is executed at the 100% load point. The I/O Request Throughput from the Test Runs is compared to the SPC-1 IOPS™ primary metric. Each I/O Request Throughput value must be greater than the SPC-1 IOPS™ primary metric minus 5%. In addition, the Average Response Time for each Test Run cannot exceed 30 milliseconds.

If any of the above constraints are not met, the benchmark measurement is invalid.

Clause 9.2.4.7.3

The following content shall appear in the FDR for each Test Run in the two Repeatability Test Phases:

1. *A table containing the results of the two Repeatability Test Phases. The content, appearance, and format of the table are specified in Table 9-11.*
2. *An I/O Request Throughput Distribution (data and graph).*
3. *An Average Response Time Distribution (data and graph).*
4. *The human readable Test Run Results File produced by the Workload Generator.*
5. *A listing or screen image of all input parameters supplied to the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Repeatability Test Runs are are listed below.

java repeat1 –b 381 –s 600

java repeat2 –b 381 –s 600

Repeatability Test Results File

The values for the SPC-1 IOPS™, SPC-1 LRT™, and the Repeatability Test measurements are listed below.

	SPC-1 IOPS™	SPC-1 LRT™
Primary Metrics	*18,945.13*	*3.06*
Repeatability Test Phase 1	18,937.18	3.08
Repeatability Test Phase 2	18,646.17	3.13

A link to the test result file generated from each Repeatability Test Run list is listed below.

Repeatability Test Phase 1, Test Run 1 (LRT)
Repeatability Test Phase 1, Test Run 2 (IOPS)
Repeatability Test Phase 2, Test Run 1 (LRT)
Repeatability Test Phase 2, Test Run 2 (IOPS)

Repeatability 1 LRT – I/O Request Throughput Distribution Data

38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:28:27	21:38:27	0-9	0:10:00
Measurement Interval	21:38:27	21:48:27	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1,894.08	1,131.52	231.12	531.45
1	1,899.92	1,132.05	231.22	536.65
2	1,904.27	1,132.37	234.40	537.50
3	1,891.70	1,127.38	231.80	532.52
4	1,901.10	1,135.48	233.77	531.85
5	1,893.63	1,129.55	233.98	530.10
6	1,903.67	1,133.72	234.45	535.50
7	1,885.00	1,122.92	230.07	532.02
8	1,899.27	1,128.23	233.97	537.07
9	1,901.67	1,130.87	237.68	533.12
10	1,898.20	1,130.17	233.70	534.33
11	1,899.60	1,133.98	230.28	535.33
12	1,901.13	1,133.25	234.78	533.10
13	1,900.20	1,133.70	232.63	533.87
14	1,900.47	1,129.78	233.37	537.32
15	1,891.00	1,127.32	230.37	533.32
16	1,896.77	1,132.78	232.08	531.90
17	1,895.00	1,132.77	232.72	529.52
18	1,889.95	1,128.50	230.97	530.48
19	1,575.60	939.48	196.77	439.35
Average	**1,864.79**	**1,112.17**	**228.77**	**523.85**

Repeatability 1 LRT – I/O Request Throughput Distribution Graph
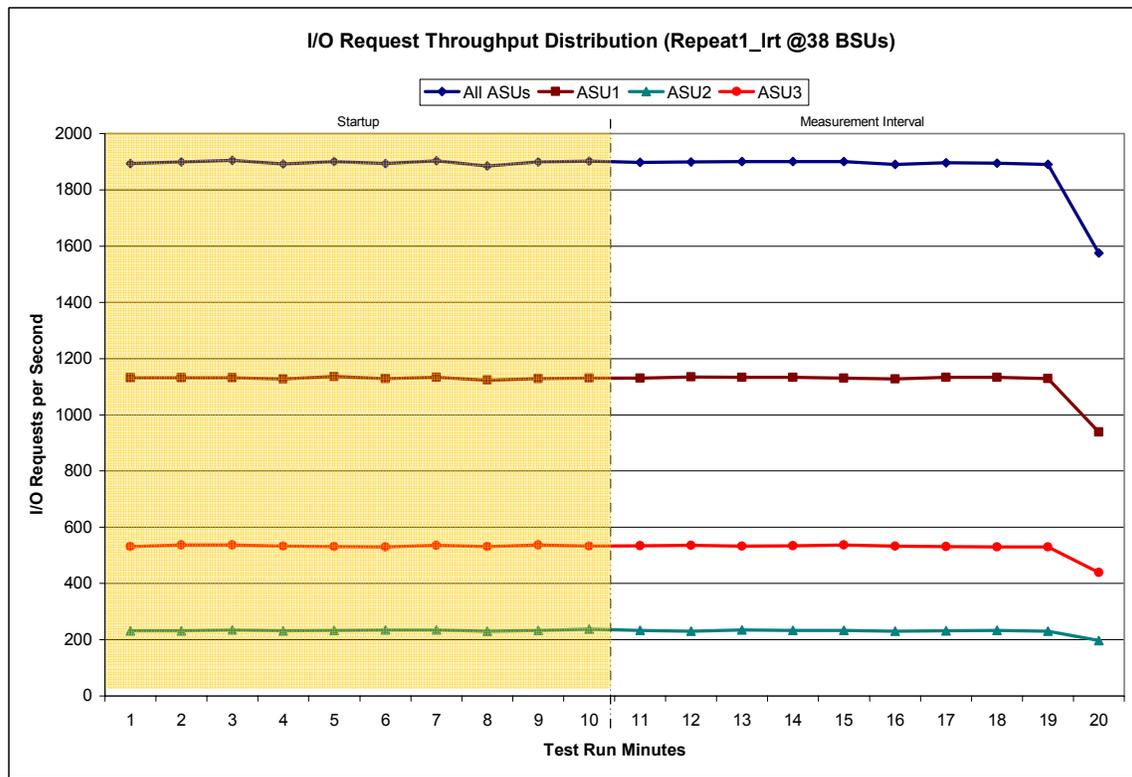
Repeatability 1 LRT –Average Response Time (ms) Distribution Data

38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:28:27	21:38:27	0-9	0:10:00
Measurement Interval	21:38:27	21:48:27	10-19	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	3.19	3.75	3.14	2.04
1	3.11	3.61	3.07	2.05
2	3.08	3.57	3.05	2.06
3	3.09	3.57	3.11	2.04
4	3.09	3.57	3.13	2.05
5	3.09	3.58	3.09	2.06
6	3.14	3.62	3.18	2.09
7	3.10	3.59	3.09	2.07
8	3.11	3.60	3.10	2.09
9	3.09	3.57	3.09	2.06
10	3.08	3.58	3.03	2.06
11	3.07	3.55	3.05	2.04
12	3.11	3.59	3.14	2.08
13	3.06	3.53	3.07	2.06
14	3.07	3.54	3.10	2.07
15	3.08	3.56	3.10	2.06
16	3.09	3.58	3.08	2.04
17	3.08	3.56	3.08	2.05
18	3.08	3.57	3.07	2.03
19	3.09	3.60	3.08	2.00
Average	3.08	3.57	3.08	2.05

Repeatability 1 LRT –Average Response Time (ms) Distribution Graph
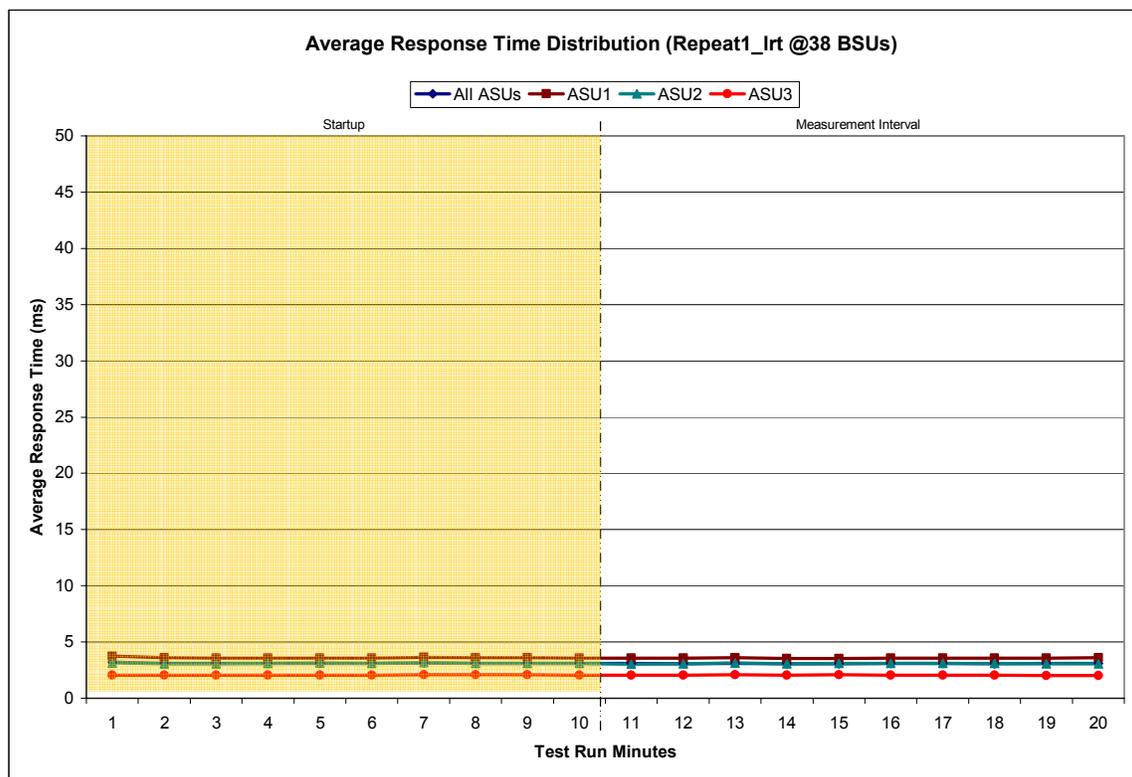
Repeatability 1 IOPS – I/O Request Throughput Distribution Data

| 381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:48:35	21:58:36	0-9	0:10:01
Measurement Interval	21:58:36	22:08:36	10-19	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	19,083.33	11,380.55	2,349.83	5,352.95
1	19,063.98	11,359.60	2,334.78	5,369.60
2	19,045.52	11,342.13	2,343.93	5,359.45
3	19,044.93	11,349.47	2,351.92	5,343.55
4	19,045.20	11,347.35	2,342.40	5,355.45
5	19,041.32	11,347.40	2,348.38	5,345.53
6	19,023.13	11,342.37	2,339.82	5,340.95
7	19,072.35	11,356.68	2,357.28	5,358.38
8	19,054.83	11,366.53	2,343.17	5,345.13
9	19,047.72	11,349.33	2,353.05	5,345.33
10	19,066.68	11,360.50	2,344.18	5,362.00
11	19,017.27	11,333.35	2,328.05	5,355.87
12	19,053.70	11,351.70	2,351.32	5,350.68
13	19,052.62	11,366.25	2,342.90	5,343.47
14	19,034.32	11,353.50	2,345.17	5,335.65
15	19,040.95	11,345.50	2,333.78	5,361.67
16	19,038.42	11,326.13	2,351.07	5,361.22
17	18,815.93	11,210.73	2,325.73	5,279.47
18	19,291.48	11,500.25	2,370.95	5,420.28
19	17,960.42	10,715.48	2,206.45	5,038.48
Average	18,937.18	11,286.34	2,329.96	5,320.88

Repeatability 1 IOPS – I/O Request Throughput Distribution Graph
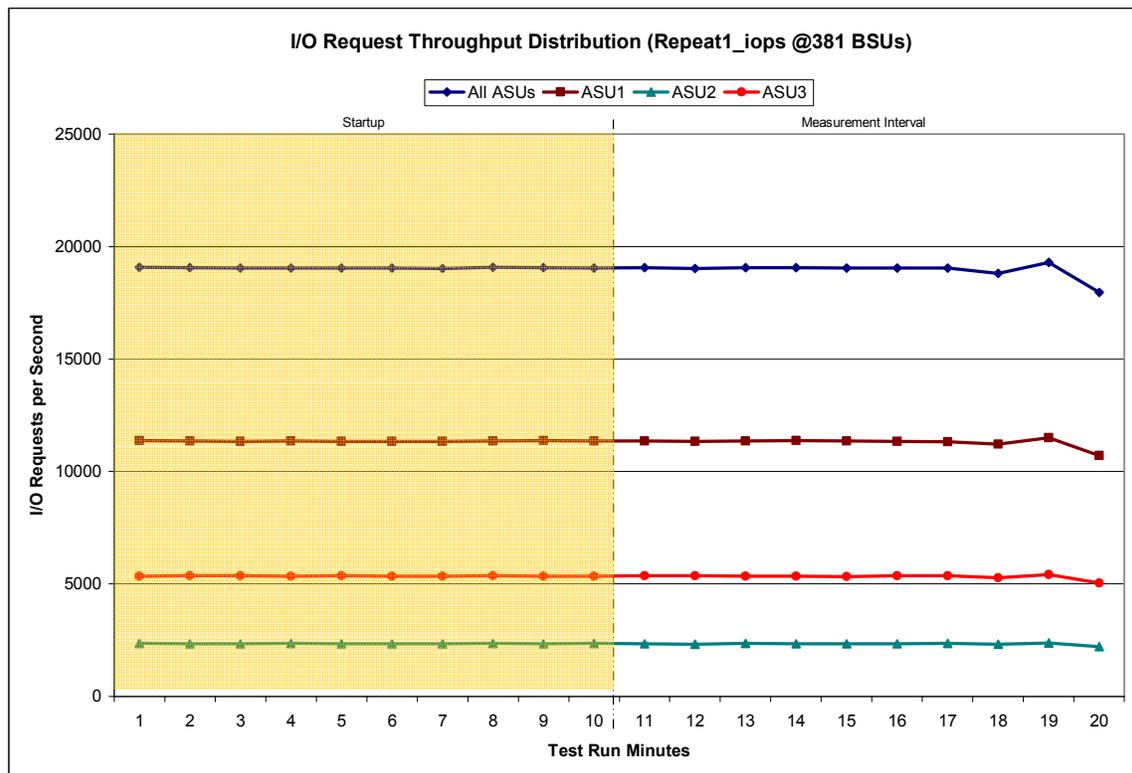
Repeatability 1 IOPS –Average Response Time (ms) Distribution Data

| 381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:48:35	21:58:36	0-9	0:10:01
Measurement Interval	21:58:36	22:08:36	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	28.74	28.22	28.01	30.18
1	31.33	30.54	30.48	33.36
2	29.97	29.18	29.28	31.95
3	28.45	27.86	27.91	29.92
4	27.90	27.24	27.37	29.54
5	28.63	27.89	28.07	30.45
6	29.00	28.21	28.49	30.91
7	28.93	28.04	28.35	31.09
8	28.01	27.28	27.36	29.84
9	28.63	27.82	27.94	30.64
10	28.27	27.49	27.72	30.16
11	27.88	27.10	27.11	29.86
12	29.37	28.57	28.70	31.36
13	28.02	27.28	27.52	29.82
14	27.40	26.73	27.01	29.00
15	27.35	26.71	26.85	28.93
16	26.93	26.33	26.51	28.40
17	27.10	26.48	26.59	28.66
18	28.60	27.97	28.18	30.12
19	27.23	26.56	26.74	28.86
Average	**27.82**	**27.12**	**27.29**	**29.52**

Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph
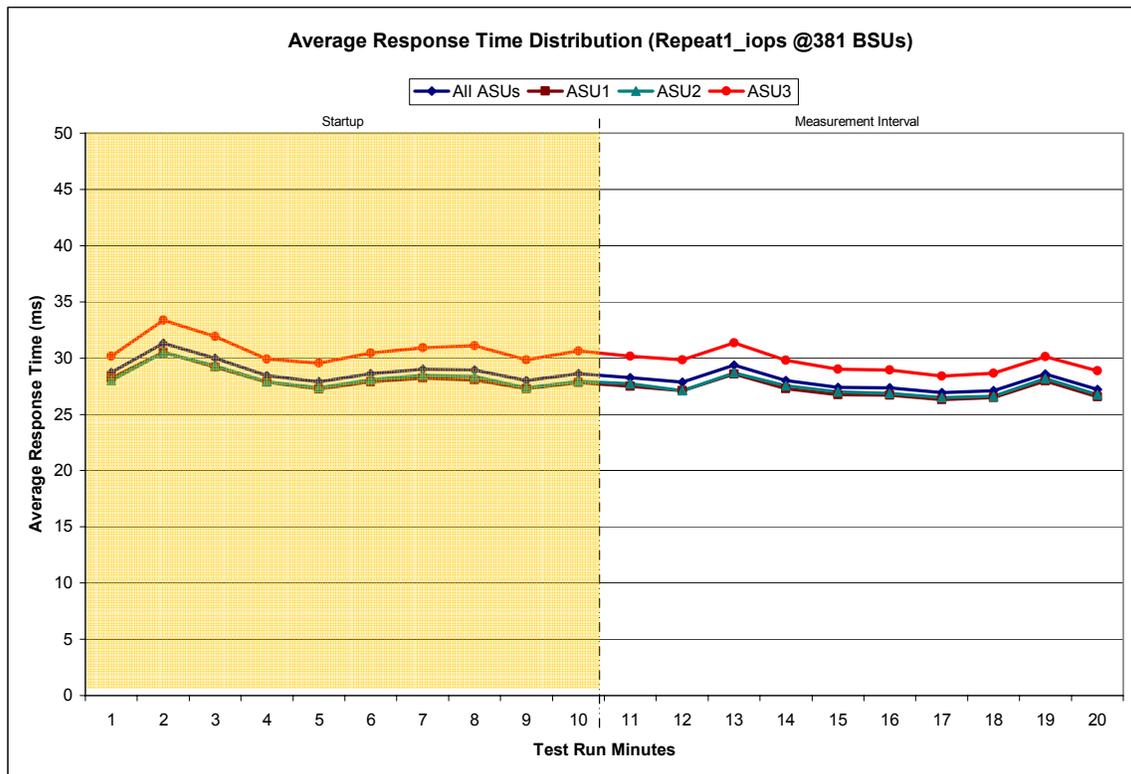
Repeatability 2 LRT – I/O Request Throughput Distribution Data

| 38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:23:41	22:33:41	0-9	0:10:00
Measurement Interval	22:33:41	22:43:41	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1,897.27	1,130.30	235.33	531.63
1	1,900.58	1,132.47	237.40	530.72
2	1,905.95	1,134.18	234.12	537.65
3	1,900.28	1,129.80	233.65	536.83
4	1,900.73	1,133.63	231.48	535.62
5	1,912.43	1,141.40	233.27	537.77
6	1,903.33	1,130.35	238.08	534.90
7	1,896.20	1,127.95	233.98	534.27
8	1,890.43	1,126.40	231.28	532.75
9	1,898.55	1,134.00	233.48	531.07
10	1,899.38	1,126.22	234.68	538.48
11	1,900.32	1,133.03	233.20	534.08
12	1,896.73	1,128.90	233.53	534.30
13	1,896.90	1,131.13	234.70	531.07
14	1,904.97	1,138.32	232.20	534.45
15	1,903.58	1,136.02	230.37	537.20
16	1,900.73	1,138.00	230.65	532.08
17	1,902.40	1,133.20	230.80	538.40
18	1,903.28	1,135.37	234.17	533.75
19	1,551.47	924.58	192.90	433.98
Average	**1,865.98**	**1,112.48**	**228.72**	**524.78**

Repeatability 2 LRT – I/O Request Throughput Distribution Graph
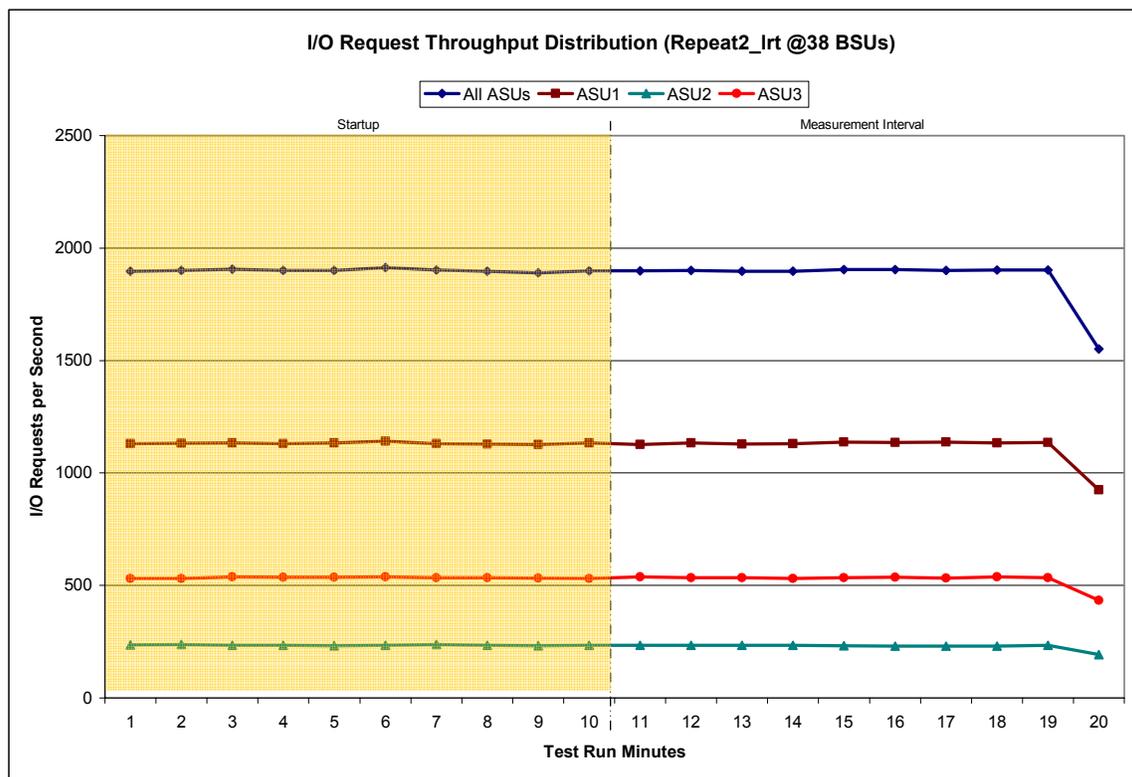
Repeatability 2 LRT –Average Response Time (ms) Distribution Data

38 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:23:41	22:33:41	0-9	0:10:00
Measurement Interval	22:33:41	22:43:41	10-19	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	3.21	3.78	3.08	2.04
1	3.13	3.65	3.10	2.04
2	3.06	3.56	3.04	2.03
3	3.06	3.55	3.09	2.03
4	3.06	3.55	3.04	2.03
5	3.07	3.56	3.04	2.03
6	3.07	3.56	3.08	2.03
7	3.12	3.63	3.08	2.06
8	3.08	3.57	3.08	2.05
9	3.10	3.58	3.07	2.07
10	3.09	3.59	3.06	2.07
11	3.09	3.57	3.09	2.08
12	3.09	3.56	3.06	2.09
13	3.08	3.54	3.08	2.09
14	3.10	3.58	3.12	2.07
15	3.09	3.60	3.03	2.05
16	3.10	3.60	3.08	2.05
17	3.09	3.60	3.05	2.05
18	3.10	3.59	3.09	2.06
19	3.44	4.03	3.30	2.24
Average	**3.13**	**3.63**	**3.10**	**2.09**

Repeatability 2 LRT –Average Response Time (ms) Distribution Graph
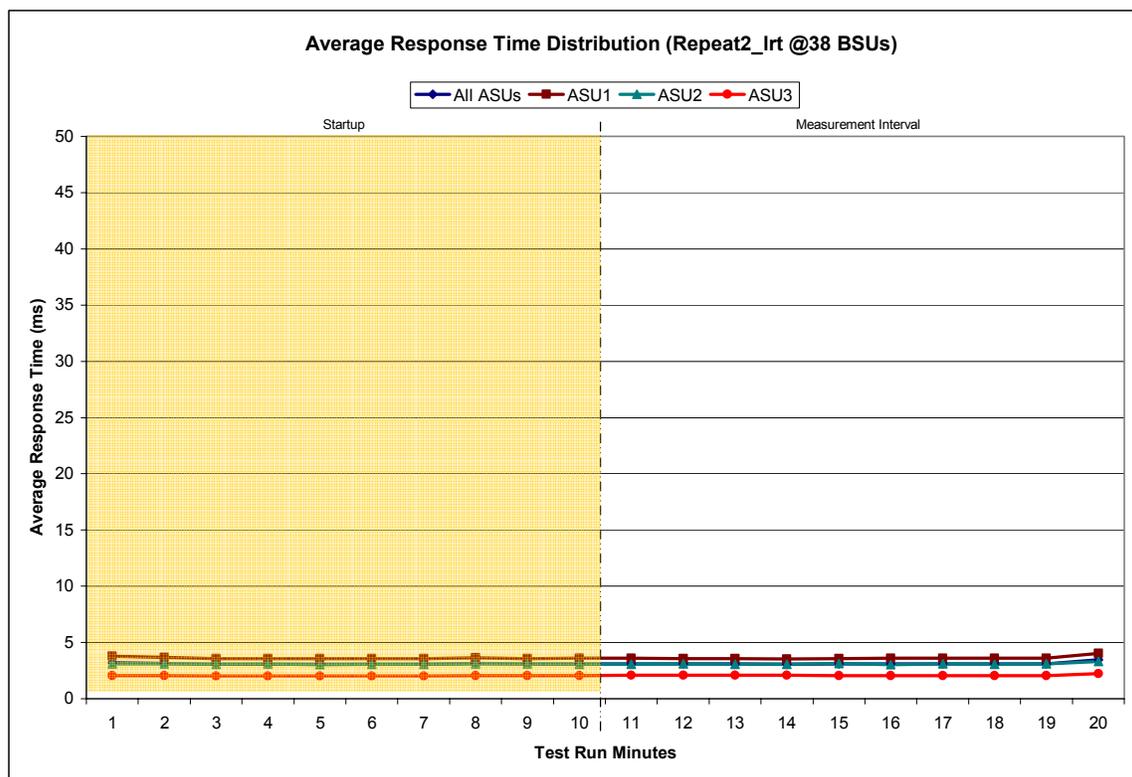
Repeatability 2 IOPS – I/O Request Throughput Distribution Data

| 381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:43:49	22:53:50	0-9	0:10:01
Measurement Interval	22:53:50	23:03:50	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	19,069.48	11,358.32	2,347.43	5,363.73
1	19,036.80	11,374.38	2,341.45	5,320.97
2	19,045.08	11,356.58	2,343.40	5,345.10
3	19,040.30	11,355.47	2,336.20	5,348.63
4	19,060.57	11,357.65	2,348.60	5,354.32
5	19,040.12	11,345.13	2,345.70	5,349.28
6	19,050.98	11,354.75	2,343.42	5,352.82
7	19,080.88	11,370.98	2,347.85	5,362.05
8	19,039.75	11,366.73	2,334.35	5,338.67
9	19,049.48	11,355.98	2,332.20	5,361.30
10	19,058.62	11,359.62	2,347.55	5,351.45
11	19,033.53	11,358.30	2,349.45	5,325.78
12	19,027.37	11,331.05	2,337.93	5,358.38
13	19,046.47	11,345.97	2,348.83	5,351.67
14	19,075.88	11,355.40	2,352.03	5,368.45
15	19,058.90	11,366.23	2,350.00	5,342.67
16	19,061.67	11,362.00	2,341.83	5,357.83
17	17,435.93	10,385.77	2,142.50	4,907.67
18	16,850.70	10,049.55	2,077.17	4,723.98
19	18,812.60	11,213.07	2,319.47	5,280.07
Average	**18,646.17**	**11,112.70**	**2,296.68**	**5,236.80**

Repeatability 2 IOPS – I/O Request Throughput Distribution Graph
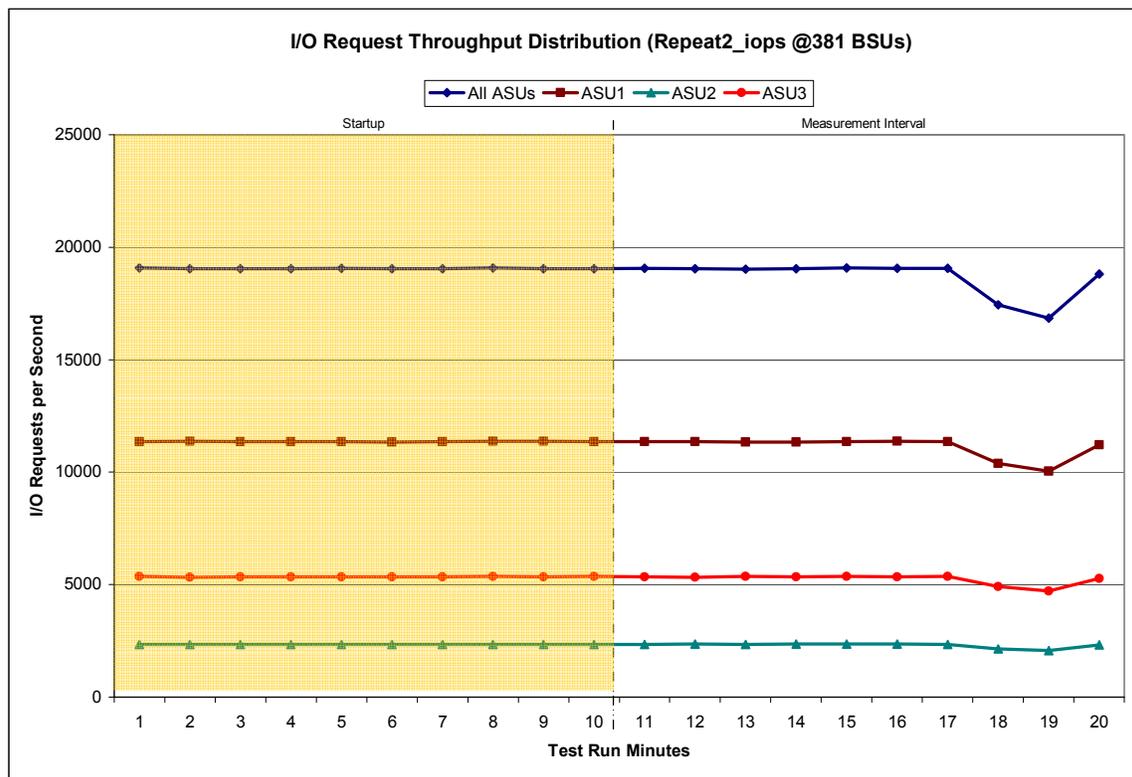
Repeatability 2 IOPS –Average Response Time (ms) Distribution Data

381 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:43:49	22:53:50	0-9	0:10:01
Measurement Interval	22:53:50	23:03:50	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	28.82	28.13	28.36	30.48
1	29.07	28.26	28.48	31.06
2	29.44	28.71	28.85	31.24
3	27.46	26.85	26.95	28.98
4	27.29	26.70	26.82	28.77
5	28.54	27.83	27.88	30.34
6	29.41	28.69	28.75	31.23
7	30.11	29.34	29.47	32.02
8	27.83	27.19	27.19	29.46
9	28.10	27.38	27.60	29.86
10	27.60	26.99	27.28	29.06
11	27.52	26.90	27.15	29.00
12	26.83	26.22	26.38	28.32
13	27.26	26.61	26.72	28.89
14	27.32	26.71	26.75	28.84
15	27.47	26.86	26.99	28.95
16	27.30	26.65	26.86	28.89
17	23.58	23.25	23.15	24.48
18	24.24	23.84	23.89	25.23
19	33.02	32.09	32.25	35.34
Average	**27.21**	**26.61**	**26.74**	**28.70**

Repeatability 2 IOPS –Average Response Time (ms) Distribution Graph
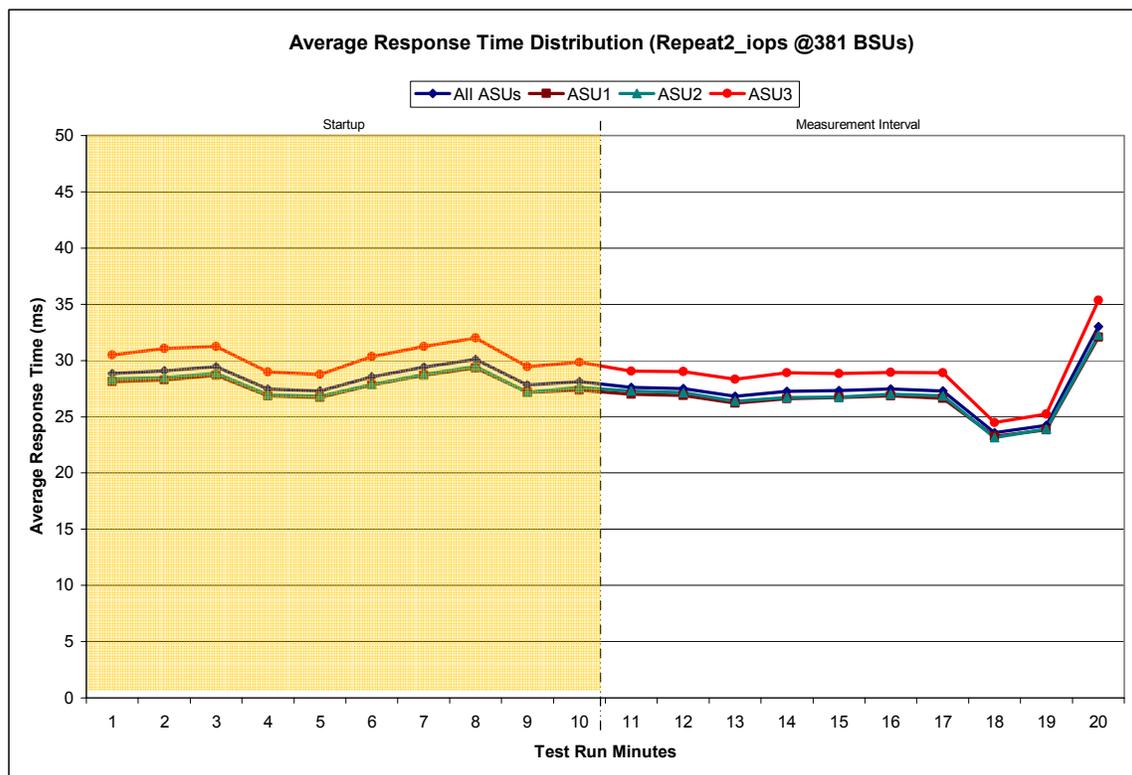
Repeatability 1 (LRT)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0353	0.2814	0.0702	0.2095	0.0178	0.0699	0.0350	0.2809
COV	0.019	0.004	0.011	0.005	0.014	0.012	0.012	0.004

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

Repeatability 1 (IOPS)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0350	0.2809	0.0700	0.2101	0.0180	0.0700	0.0350	0.2810
COV	0.006	0.001	0.004	0.001	0.009	0.004	0.004	0.002

Repeatability 2 (LRT)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0351	0.2805	0.0702	0.2104	0.0179	0.0698	0.0349	0.2812
COV	0.012	0.005	0.011	0.006	0.016	0.013	0.015	0.005

Repeatability 2 (IOPS)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0350	0.2810	0.0702	0.2099	0.0180	0.0702	0.0350	0.2809
COV	0.007	0.002	0.004	0.002	0.008	0.004	0.005	0.002

Data Persistence Test

Clause 6

The Data Persistence Test demonstrates the Tested Storage Configuration (TSC):

- *Is capable of maintain data integrity across a power cycle.*

- *Ensures the transfer of data between Logical Volumes and host systems occurs without corruption or loss.*

The SPC-1 Workload Generator will write 16 block I/O requests at random over the total Addressable Storage Capacity of the TSC for ten (10) minutes at a minimum of 25% of the load used to generate the SPC-1 IOP™ primary metric. The bit pattern selected to be written to each block as well as the address of the block will be retained in a log file.

The Benchmark Configuration will be shutdown and restarted using a power off/power on cycle at the end of the above sequence of write operations. In addition, any caches employing battery backup must be flushed/emptied.

The SPC-1 Workload Generator will then use the above log file to verify each block written contains the correct bit pattern.

Clause 9.2.4.8

The following content shall appear in this section of the FDR:

1. *A listing or screen image of all input parameters supplied to the Workload Generator.*

2. *For the successful Data Persistence Test Run, a table illustrating key results. The content, appearance, and format of this table are specified in Table 9-12. Information displayed in this table shall be obtained from the Test Run Results File referenced below in #3.*

3. *For the successful Data Persistence Test Run, the human readable Test Run Results File produced by the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Persistence Test Run 1 and Persistence Test Run 2 are listed below.

java persist1 –b 383

java persist2

Data Persistence Test Results File

A link to each test result file generated from each Data Persistence Test is listed below.

Persistence 1 Test Results File
Persistence 2 Test Results File

Data Persistence Test Results

Data Persistence Test Results	
Data Persistence Test Run Number: 1	
Total Number of Logical Blocks Written	45,512,432
Total Number of Logical Blocks Verified	38,977,744
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks	minutes
Size in Bytes of each Logical Block	512
Number of Failed I/O Requests in the process of the Test	0

In some cases the same address was the target of multiple writes, which resulted in more Logical Blocks Written than Logical Blocks Verified. In the case of multiple writes to the same address, the pattern written and verified must be associated with the last write to that address.

PRICED STORAGE CONFIGURATION AVAILABILITY DATE

Clause 9.2.4.9

The committed delivery data for general availability (Availability Date) of all products that comprise the Priced Storage Configuration must be reported. When the Priced Storage Configuration includes products or components with different availability dates, the reported Availability Date must be the date at which all components are committed to be available.

The FDR shall state: "The Priced Storage Configuration, as documented in this Full Disclosure Report will be available for shipment to customers on MMMM DD, YYYY." Where Priced Storage Configuration is the TSC Configuration Name as described in Clause 9.2.4.3.3 and MMMM is the alphanumeric month, DD is the numeric day, and YYYY is the numeric year of the date that the Priced Storage Configuration, as documented, is available for shipment to customers as described above.

The Sun StorEdge™ 6920, as documented in this Full Disclosure Report became available for customer purchase and shipment on July 23, 2004.

PRICING INFORMATION

Clause 9.2.4.11

A statement of the respective calculations for pricing must be included.

Pricing information may found in the Tested Storage Configuration Pricing section on page 12.

ANOMALIES OR IRREGULARITIES

Clause 9.2.4.10

The FDR shall include a clear and complete description of any anomalies or irregularities encountered in the course of executing the SPC-1 benchmark that may in any way call into question the accuracy, verifiability, or authenticity of information published in this FDR.

There were no anomalies or irregularities encountered during the SPC-1 Onsite Audit of the Sun StorEdge™ 6920.

APPENDIX A: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

The following settings were made in the Solaris "/etc/system" control file information for execution of the SPC-1 Workload Generator on the Sun Fire™ 4800, Sun Fire™ 480, and Sun Fire™ V20z:

```
*ident       "@(#)system   1.18   97/06/27 SMI" /* SVR4 1.5 */
*
* SYSTEM SPECIFICATION FILE
*

* moddir:
*
*    Set the search path for modules.  This has a format similar to the
*    csh path variable. If the module isn't found in the first directory
*    it tries the second and so on. The default is /kernel /usr/kernel
*
*    Example:
*           moddir: /kernel /usr/kernel /other/modules



* root device and root filesystem configuration:
*
*    The following may be used to override the defaults provided by
*    the boot program:
*
*    rootfs:             Set the filesystem type of the root.
*
*    rootdev:     Set the root device.  This should be a fully
*                 expanded physical pathname.  The default is the
*                 physical pathname of the device where the boot
*                 program resides.  The physical pathname is
*                 highly platform and configuration dependent.
*
*    Example:
*           rootfs:ufs
*           rootdev:/sbus@1,f8000000/esp@0,800000/sd@3,0:a
*
*    (Swap device configuration should be specified in /etc/vfstab.)



* exclude:
*
*    Modules appearing in the moddir path which are NOT to be loaded,
*    even if referenced. Note that `exclude' accepts either a module name,
*    or a filename which includes the directory.
*
*    Examples:
*           exclude: win
*           exclude: sys/shmsys



* forceload:
*
*    Cause these modules to be loaded at boot time, (just before mounting
*    the root filesystem) rather than at first reference. Note that
*    forceload expects a filename which includes the directory. Also
*    note that loading a module does not necessarily imply that it will
```

```
 *     be installed.
 *
 *     Example:
 *             forceload: drv/foo



 * set:
 *
 *     Set an integer variable in the kernel or a module to a new value.
 *     This facility should be used with caution.  See system(4).
 *
 *     Examples:
 *
 *     To set variables in 'unix':
 *
 *             set nautopush=32
 *             set maxusers=40
 *
 *     To set a variable named 'debug' in the module named 'test_module'
 *
 *             set test_module:debug = 0x13

 * ITOps add
set noexec_user_stack = 1
set noexec_user_stack_log = 1
* end ITOps add
*** IPC semaphores
set semsys:seminfo_semmap=4096
set semsys:seminfo_semmni=4096
set semsys:seminfo_semmns=4096
set semsys:seminfo_semmnu=4096
set semsys:seminfo_semume=64
set semsys:seminfo_semmsl=256

* IPC messages
set msgsys:msginfo_msgmap=4096
set msgsys:msginfo_msgmni=4096
set msgsys:msginfo_msgssz=64
set msgsys:msginfo_msgtql=40000

* pt_cnt : pseudo terminals are allocated dynamically
* set hard limit on file descriptors
* set rlim_fd_max = 8192
* set soft limit on file descriptors
set rlim_fd_cur = 1024

* buffer high water mark: limits the amount of RAM devoted to headers cache.
set bufhwm = 8000

* increase capability to do 1Mb IOs to *raw* devices, 32MB max.
*set maxphys = 1048576
set maxphys = 4194304

* Memory allocation parameters
set vxio:voliomem_chunk_size = 1048576
set vxio:voliomem_maxpool_sz = 134217728
* I/O related parameters
set vxio:vol_default_iodelay = 10
set vxio:vol_maxkiocount = 32768
set vxio:vol_maxioctl = 131072
set vxio:vol_maxio = 8192
set vxio:vol_maxspecialio = 10240
```

```
 * VM related
 * scanner I/Os per second page-outs.(default 65536 for E10000)
 * set maxpgio = 16384
 * # of pages the scanned when freelist falls below lotsfree.
 * set to 1/16 to 1/4 RAM up to 1Gb/sec (131072)
 *set fastscan = 65536
 **Fri Mar 31 16:07:32 PST 2000
 * R. McDougall: increase maxpgio to prevent the scanner from limiting writes
 set maxpgio = 65536
 * R. McDougall: increase fastscan to limit the effect the page scanner
 * has on file system throughput
 set fastscan = 65536


 * UFS related
 * filesystem write throttling high/low watermark
 * R. McDougall: set the write throttle higher for large systems > 1GB of RAM
 *
 set ufs:ufs_HW = 20971520
 set ufs:ufs_LW = 15728640

 * cool fsflushr on big memory memory machines
 set autoup = 1024
 set tune_t_fsflushr = 1

 * TCP related
 * decrease potential connection backlog by:
 * 1. increase connection hash table size, increase if connections are high.
 set tcp:tcp_conn_hash_size = 32768
 * 2. depth of destination queue (# of messages outbound streams can hold)
 * NOTE: sq_max_size = 0 is unlimited, but uses more kernel memory.
 set sq_max_size = 100
 *
 set sdd:sdd_max_throttle=256
 set maxphys = 8388608
 set sd:sd_max_throttle=256
 set qlc:qlc_enable_pm= 0x0
 set qlc:qlc_execution_throttle=256

 * ITOps add
 set noexec_user_stack = 1
 set noexec_user_stack_log = 1
 * end ITOps add
 * vxvm_START (do not remove)
 forceload: drv/vxdmp
 forceload: drv/vxio
 forceload: drv/vxspec
 * vxvm_END (do not remove)
```

APPENDIX B: TESTED STORAGE CONFIGURATION (TSC) CREATION

The Tested Storage Configuration contained 112 physical disks that were configured into 16 Vdisks with 7 physical disks per Vdisk. The 16 Vdisks were divided into 4 pools with 4 Vdisks per pool. Each pool was divided into 12 partitions. The 48 total partitions were striped to create 3 logical volumes, one for each SPC-1 ASU. The physical disk drive, volume, partition, Logical Volume, and ASU relationships are illustrated below followed by the scripts required to create and configure the above components.

Disk Drives, Volumes, Partitions, Logical Volumes and ASUs
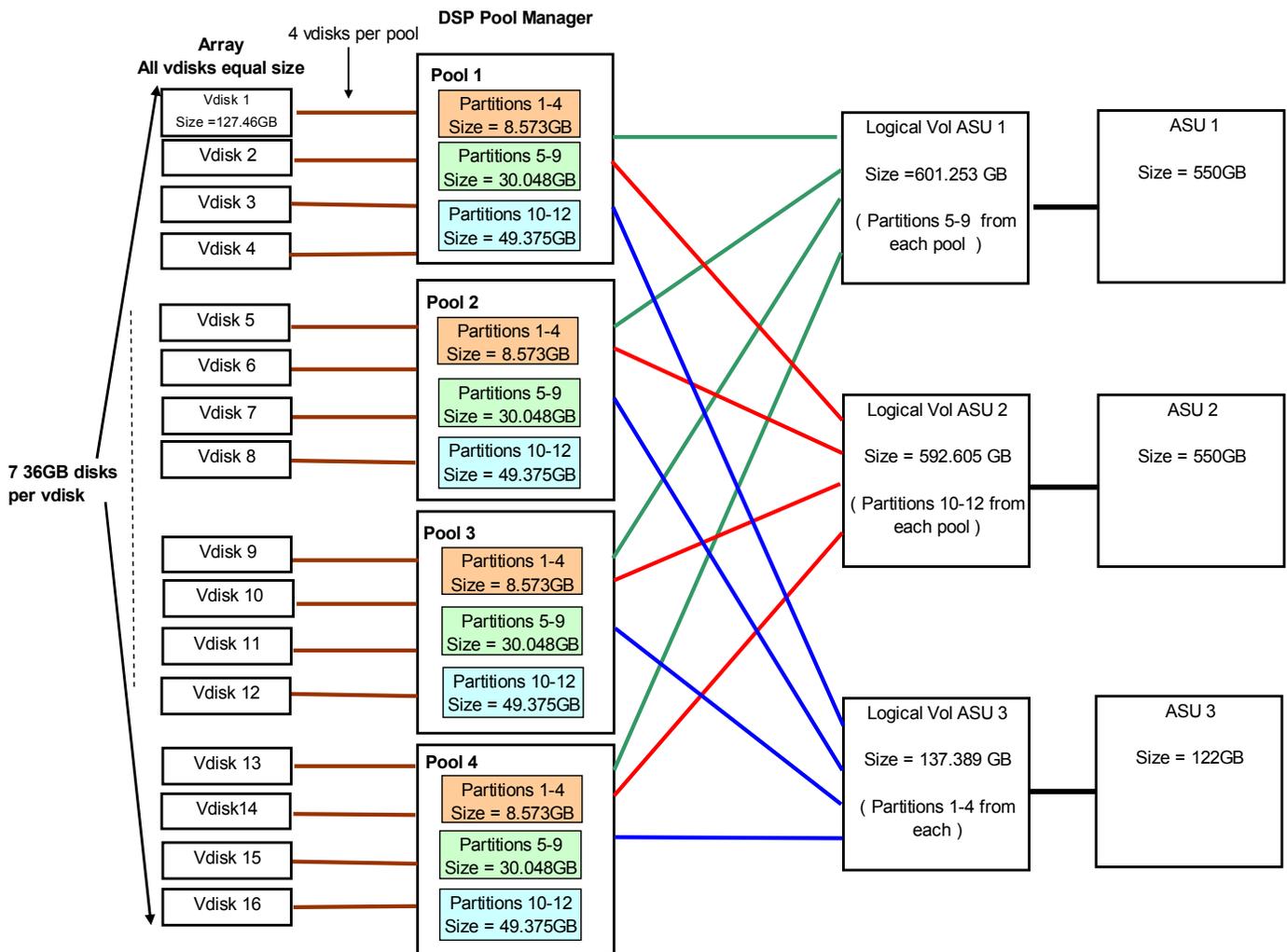
The following high level steps help define the operations necessary to configure and access the storage on the Sun StorEdge 9620 system from all four Hosts; Solaris 10 sparc, Solaris 9 sparc, Solaris 10 x86 and Windows 2003 Dell.

1. Access the storage interface
2. Create a Secure Virtual Storage Domain (SVSD)
3. Create the virtual pools and Vdisks using the MailSpooling profile
4. Create virtual volumes from the pools
5. Map the volumes to the initiators (Server HBA's)
6. Configure Solaris 9 sparc
7. Configure Solairs 10 sparc
8. Configure Solaris 10 x86
9. Configure Windows 2003 ; Dell system

1. The Web-UI is a browser based interface that manages the Storage Service Processor. To start the Web-UI, open a browser and use the following URL:

https://SP_WAN_IPADDRESS:6789.

Logging in requires a login and passwd.

2. From the Web-UI Console Window select the SE6920 Configuration Service link. Then, use the Storage Domains link to display the Storage Domain Summary window. To begin creating a new SVSD click on the "New" link. In the New Storage Domain window enter "spc" as the name, (Description is always optional), in the second step, select all the initiators displayed and finish creating the SVSD.

Steps 3, 4, and 5 can now be finished using the script below. The script will need to be created on the service processor at **/opt/se6x20/cli/bin**. Then run the command: **/opt/se6x20/cli/bin/sscs login -u storage -f -h localhost** to login to the CLI interface of the StorEdge 6920, a passwd will be required. Now the script can be executed and the virtual volumes will be created and mapped to the HBA's. This script will complete in about six hours.

The four scripts to configure TSC for each Host System (steps #6-#9) follow this initial script.

```
#!/sbin/sh
#
# Copyright (c) 2001 by Sun Microsystems, Inc.
# All rights reserved.
#
##
PATH=/opt/se6x20/cli/bin:$PATH
```

```
set -x
#
# UnMap volumes
#
#STARTTIME=`date`
#for init in `sscs list initiator | awk '{print $2}'| sort`
#do
#        for vol in `sscs list volume | awk '{print $2}'`
#        do
#        echo "UnMapping Volume $vol from $init..."
#        sscs unmap -S spc -i $init volume $vol
#        done
##
##
## Delete volumes
##
##
#for vol in `sscs list volume | awk '{print $2}'`
#do
#        echo "Deleteing Volume $vol ..."
#        sscs delete -S spc volume $vol
#
#done
#echo "Start time = $STARTTIME"
#date
###############################################################
## Remove Vdisk
##
##sscs delete -S spc -p pool-1 vdisk disk/3/2/1/0/0
##sscs delete -S spc -p pool-1 vdisk disk/3/8/1/0/0
##sscs delete -S spc -p pool-1 vdisk disk/3/4/1/0/0
##sscs delete -S spc -p pool-1 vdisk disk/3/5/1/0/0
##
##sscs delete -S spc -p pool-2 vdisk disk/4/2/2/1/0
##sscs delete -S spc -p pool-2 vdisk disk/4/8/2/1/0
##sscs delete -S spc -p pool-2 vdisk disk/4/4/2/1/0
##sscs delete -S spc -p pool-2 vdisk disk/4/5/2/1/0
####
##sscs delete -S spc -p pool-3 vdisk disk/3/2/1/2/0
##sscs delete -S spc -p pool-3 vdisk disk/3/8/1/2/0
##sscs delete -S spc -p pool-3 vdisk disk/3/4/1/2/0
##sscs delete -S spc -p pool-3 vdisk disk/3/5/1/2/0
####
##sscs delete -S spc -p pool-4 vdisk disk/4/2/2/3/0
##sscs delete -S spc -p pool-4 vdisk disk/4/8/2/3/0
##sscs delete -S spc -p pool-4 vdisk disk/4/4/2/3/0
##sscs delete -S spc -p pool-4 vdisk disk/4/5/2/3/0
###############################################################
# Remove Storage pools
#
#sscs delete -S spc pool pool-1
#sscs delete -S spc pool pool-2
#sscs delete -S spc pool pool-3
#sscs delete -S spc pool pool-4
#
###############################################################
###############################################################
# Create Storage pools
#
sscs create -p MailSpooling -S spc -d pool-1 pool pool-1
sscs create -p MailSpooling -S spc -d pool-2 pool pool-2
sscs create -p MailSpooling -S spc -d pool-3 pool pool-3
sscs create -p MailSpooling -S spc -d pool-4 pool pool-4
```

```
#
#
#
#
#
#
#
#
#
###############################################################
# Create Vdisks in all pools
#
sscs create -p pool-1 -t 0 -a array00 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-1 -t 0 -a array01 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-1 -t 0 -a array02 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-1 -t 0 -a array03 -S spc -d 7 vdisk
sleep 120
#
sscs create -p pool-2 -t 1 -a array00 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-2 -t 1 -a array01 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-2 -t 1 -a array02 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-2 -t 1 -a array03 -S spc -d 7 vdisk
sleep 120


sscs create -p pool-3 -t 0 -a array00 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-3 -t 0 -a array01 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-3 -t 0 -a array02 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-3 -t 0 -a array03 -S spc -d 7 vdisk
sleep 120
###
sscs create -p pool-4 -t 1 -a array00 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-4 -t 1 -a array01 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-4 -t 1 -a array02 -S spc -d 7 vdisk
sleep 120
sscs create -p pool-4 -t 1 -a array03 -S spc -d 7 vdisk
sleep 120
##
##
echo Verifying all vdisks are created
VDisk=`sscs list -S spc vdisk | wc -l`
while (test "$VDisk" -lt "16")
do
        sscs list -S spc vdisk
        sleep 180
VDisk=`sscs list -S spc vdisk | wc -l`
done
echo Lets move on
#
#
#
#
#
```

```
#
#
#
#############################################################
# Create ASU3 volumes on all pools
echo Creating asu3 volumes on pool-1
pool=1
while (test "$pool" -lt "5")
do
counter=1
while (test "$counter" -lt "5")
do
        echo Creating asu3 volumes on pool-$pool
    sscs create -p pool-$pool -s 8g -S spc -t volume p$pool-asu3-s$counter
sleep 10
    counter=`expr $counter + 1`
done
    pool=`expr $pool + 1`
done
#############################################################

#
# Create ASU1 volumes on all pools
date
pool=1
while (test "$pool" -lt "5")
do
echo Creating asu1 volumes on pool-$pool
counter=1
while (test "$counter" -lt "6")
do
        echo Creating asu1 volumes on pool-$pool
    sscs create -p pool-$pool -s 28g -S spc -t volume p$pool-asu1-s$counter
    counter=`expr $counter + 1`
done
pool=`expr $pool + 1`
done

#############################################################

# Create ASU2 volumes
date
pool=1
while (test "$pool" -lt "5")
do
echo Creating asu2 volumes on pool-$pool
counter=1
while (test "$counter" -lt "4")
do
        echo Creating asu2 volumes on pool-$pool
    sscs create -p pool-$pool -s 46g -S spc -t volume p$pool-asu2-s$counter
    counter=`expr $counter + 1`
done
pool=`expr $pool + 1`
done
#############################################################
# Map volumes ASU3
#############################################################
# POOL-1
counter=1
while (test "$counter" -lt "5")
do
target=`expr $counter + 0`
```

```
                echo Mapping p1-asu3-s$counter to all Initiators
                        for init in `sscs list initiator | awk '{print $2}'| sort`
                        do
                        sscs map -S spc -v p1-asu3-s$counter -P readwrite -l $target
initiator $init
                        echo Mapping $init
                        done
        counter=`expr $counter + 1`
done
###########################################################
#Pool-2
counter=1
while (test "$counter" -lt "5")
do
target=`expr $counter + 4`
        echo Mapping p2-asu3-s$counter to all Initiators
                        for init in `sscs list initiator | awk '{print $2}'| sort`
                        do
                        sscs map -S spc -v p2-asu3-s$counter -P readwrite -l $target
initiator $init
                        echo Mapping $init
                        done
        counter=`expr $counter + 1`
done
###########################################################
#Pool-3
date
counter=1
while (test "$counter" -lt "5")
do
target=`expr $counter + 8`
        echo Mapping p3-asu3-s$counter to all Initiators
                        for init in `sscs list initiator | awk '{print $2}'| sort`
                        do
                        sscs map -S spc -v p3-asu3-s$counter -P readwrite -l $target
initiator $init
                        echo Mapping $init
                        done
        counter=`expr $counter + 1`
done
###########################################################
#
#
#
#
#
#
#
#Pool-4
#
counter=1
while (test "$counter" -lt "5")
do
target=`expr $counter + 12`
        echo Mapping p4-asu3-s$counter to all Initiators
                        for init in `sscs list initiator | awk '{print $2}'| sort`
                        do
                        sscs map -S spc -v p4-asu3-s$counter -P readwrite -l $target
initiator $init
                        echo Mapping $init
                        done
   counter=`expr $counter + 1`
done
```

```
#############################################################
# Map asu1
#############################################################
#Pool-1
counter=1
while (test "$counter" -lt "6")
do
target=`expr $counter + 16`
        echo Mapping p1-asu1-s$counter to all Initiators
        for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p1-asu1-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done

    counter=`expr $counter + 1`
done
#############################################################
#Pool-2
counter=1
while (test "$counter" -lt "6")
do
target=`expr $counter + 21`
        echo Mapping p2-asu1-s$counter to all Initiators
        for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p2-asu1-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done

    counter=`expr $counter + 1`
done
```

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▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬

```
#
#
#
#
#
#
#Pool-3
#
date
counter=1
while (test "$counter" -lt "6")
do
target=`expr $counter + 26`
        echo Mapping p3-asu1-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p3-asu1-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done

    counter=`expr $counter + 1`
done
#############################################################
#Pool-4
#
counter=1
```

```
while (test "$counter" -lt "6")
do
target=`expr $counter + 31`
        echo Mapping p4-asu1-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p4-asu1-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done
   counter=`expr $counter + 1`
done
###########################################################
# Map asu2
###########################################################
#Pool-1
#
#
counter=1
while (test "$counter" -lt "4")
do
target=`expr $counter + 36`
        echo Mapping p1-asu2-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p1-asu2-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done
   counter=`expr $counter + 1`
done
```

```
#
#
#
#
#Pool-2
#
counter=1
while (test "$counter" -lt "4")
do
target=`expr $counter + 39`
        echo Mapping p2-asu2-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p2-asu2-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done
   counter=`expr $counter + 1`
done
###########################################################
#Pool-3
#
#
counter=1
while (test "$counter" -lt "4")
do
target=`expr $counter + 42`
        echo Mapping p3-asu2-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
```

```
                sscs map -S spc -v p3-asu2-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done
    counter=`expr $counter + 1`
done
############################################################
#Pool-4
#
counter=1
while (test "$counter" -lt "4")
do
target=`expr $counter + 45`
        echo Mapping p4-asu2-s$counter to all Initiators
for init in `sscs list initiator | awk '{print $2}'| sort`
                do
                sscs map -S spc -v p4-asu2-s$counter -P readwrite -l $target
initiator $init
                echo Mapping $init
                done
    counter=`expr $counter + 1`
done
############################################################
echo $StartTime
date
```

Configuring all four Hosts

6. On the Solaris 9 sparc server run the following command as root from /spc/spc1 directory. This script will configure all ASU volumes needed to run SPC1.

```ksh
# . ./config-sol9-sparc.sh

#!/bin/ksh
#
# Created by Javier Chavez for Sun Microsystem SPC1 Benchmark
# 1-19-2005
#
# This script is generally in /spc/spc1
#
# Modify the variable below so the script will work with your controller ID
#
CID=c12
#
#
clear
echo " "
echo " "
echo "Removing old Disk links and Meta devices"
echo " "
echo " "
sleep 5
metaclear d1 d2 d3

# Probe server and remove all old device links
devfsadm -C
echo " "
echo " "
echo " Configuring new disks"
echo " "
echo " Configuring `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks"
sleep 5
echo " "
ls /dev/rdsk/$CID*d0s2 > disks
echo " "
echo " Starting to Label all new disks"
sleep 5
cat disks | sed 's/s2\@/s2/g' > disk1
rm disks

C_disks=disk1
#
for f in `cat $C_disks`
do
format $f << EOFF
ty
0
y
label
y
quit
EOFF
done
clear
echo " "
echo " "
echo " All `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks have been configured"
```

```
echo " "
# Create a new disk list
format > formatD << EOFF
EOFF
# Stop here for some tweaks
sleep 5
echo " "
echo " "
echo " Configuring asu device files"
rm disk1
# asu config files
#
# Change all c12 controller ID to create prtvtoc report
#
grep 5886 formatD | awk '{print $2}' >> asu2-4prtvtoc
cat asu2-4prtvtoc | sed 's/d0/d0s2/g' >asu2-4prtvtoc1
rm asu2-4prtvtoc
cat asu2-4prtvtoc1 | sed 's/c12/\/dev\/rdsk\/c12/g' >asu2-4prtvtoc2
rm asu2-4prtvtoc1
####
echo " " > asu2-prtvtoc
echo "Prtvtoc of all asu2 Logical Volumes " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
cat asu2-4prtvtoc2 >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
for x in `cat asu2-4prtvtoc2`
do
echo " " >> asu2-prtvtoc
echo "+++++++++++++++++++++++++++++++++++++++++++++++++" >> asu2-prtvtoc
echo $x >>asu2-prtvtoc
echo " " >> asu2-prtvtoc
prtvtoc $x >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
done
rm asu2-4prtvtoc2
#echo " asu2 vtoc report has been created "
#
# d1
echo " " > asu1-4prtvtoc
grep 3582 formatD | awk '{print $2}' >> asu1-4prtvtoc
cat asu1-4prtvtoc | sed 's/d0/d0s2/g' >asu1-4prtvtoc1
rm asu1-4prtvtoc
cat asu1-4prtvtoc1 | sed 's/c12/\/dev\/rdsk\/c12/g' >asu1-4prtvtoc2
rm asu1-4prtvtoc1
#
####
echo " " > asu1-prtvtoc
echo "Prtvtoc of all asu1 Logical Volumes " >> asu1-prtvtoc
cat asu1-4prtvtoc2 >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
for x in `cat asu1-4prtvtoc2`
do
echo " " >> asu1-prtvtoc
echo "+++++++++++++++++++++++++++++++++++++++++++++++++" >> asu1-prtvtoc
echo $x >>asu1-prtvtoc
echo " " >> asu1-prtvtoc
prtvtoc $x >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
done
```

```
rm asu1-4prtvtoc2
#echo " asu1 vtoc report has been created "
echo " asu1 vtoc report has been created "
# d3
echo " " > asu3-4prtvtoc
grep 1022 formatD | awk '{print $2}' >> asu3-4prtvtoc
cat asu3-4prtvtoc | sed 's/d0/d0s2/g' >asu3-4prtvtoc1
rm asu3-4prtvtoc
cat asu3-4prtvtoc1 | sed 's/c12/\/dev\/rdsk\/c12/g' >asu3-4prtvtoc2
rm asu3-4prtvtoc1
#
####
echo " " > asu3-prtvtoc
echo "Prtvtoc of all asu3 Logical Volumes " >> asu3-prtvtoc
cat asu3-4prtvtoc2 >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
for x in `cat asu3-4prtvtoc2`
do
echo " " >> asu3-prtvtoc
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu3-prtvtoc
echo $x >>asu3-prtvtoc
echo " " >> asu3-prtvtoc
prtvtoc $x >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
done
rm asu3-4prtvtoc2
cat asu1-prtvtoc >prtvtoc-output
cat asu2-prtvtoc >>prtvtoc-output
cat asu3-prtvtoc >>prtvtoc-output
rm asu3-prtvtoc
rm asu2-prtvtoc
rm asu1-prtvtoc
echo " asu vtoc report has been created "
#
#
echo "d2 1 12 \\" > asu2
grep 5886 formatD | awk '{print $2}' >> asu2
echo "-i 100m" >>asu2
#
# d1
echo "d1 1 20 \\" > asu1
grep 3582 formatD | awk '{print $2}' >> asu1
echo "-i 100m" >>asu1
#
# d3
echo "d3 1 16 \\" > asu3
grep 1022 formatD | awk '{print $2}' >> asu3
echo "-i 100m" >>asu3
#
echo " "
echo " Creating new md.tab file"
sleep 5
echo " "
#
# Create md.tab file
cat asu* > md.ta
#
rm asu?
# Clean up md.tab file
cat md.ta | sed 's/d0/d0s2 \\/g' >md.tab
##
```

```
rm md.ta
# Copy new md.tab file to /etc/lvm
cp md.tab /etc/lvm/md.tab

echo " New md.tab file has been created"
sleep 5
echo " Starting to create new metadevices."
sleep 5
# create metadevice
metainit d1
echo " "
metainit d2
echo " "
metainit d3
sleep 5
## Display results
#clear
#metastat
```

7. On the Solaris 10 sparc server run the following command as root from /spc/spc1
directory. This script will configure all ASU volumes needed to run SPC1.
#. ./config-sol10-sparc.sh

```
#!/bin/ksh
#
# Created by Javier Chavez for Sun Microsystem SPC1 Benchmark
# 1-19-2005
#
# This script is generally in /spc/spc1
#
# Modify the variable below so the script will work with your controller ID
#
CID=c10
#
#
clear
echo " "
echo " "
echo "Removing old Disk links and Meta devices"
echo " "
echo " "
sleep 5
metaclear d1 d2 d3

# Probe server and remove all old device links
devfsadm -C
echo " "
echo " "
echo " Configuring new disks"
echo " "
echo " Configuring `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks"
sleep 5
echo " "
ls /dev/rdsk/$CID*d0s2 > disks
echo " "
echo " Starting to Label all new disks"
sleep 5
cat disks | sed 's/s2\@/s2/g' > disk1
rm disks
```

```
C_disks=disk1
#
for f in `cat $C_disks`
do
format $f << EOFF
ty
0
y
label
y
quit
EOFF
done
clear
echo " "
echo " "
echo " All `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks have been configured"
echo " "
# Create a new disk list
format > formatD << EOFF
EOFF
# Stop here for some tweaks
sleep 5
echo " "
echo " "
echo " Configuring asu device files"
rm disk1
# asu config files
#
# Change all c10 controller ID to create prtvtoc report
#
grep 5886 formatD | awk '{print $2}' >> asu2-4prtvtoc
cat asu2-4prtvtoc | sed 's/d0/d0s2/g' >asu2-4prtvtoc1
rm asu2-4prtvtoc
cat asu2-4prtvtoc1 | sed 's/c10/\/dev\/rdsk\/c10/g' >asu2-4prtvtoc2
rm asu2-4prtvtoc1
####
echo " " > asu2-prtvtoc
echo "Prtvtoc of all asu2 Logical Volumes " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
cat asu2-4prtvtoc2 >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
for x in `cat asu2-4prtvtoc2`
do
echo " " >> asu2-prtvtoc
echo "+++++++++++++++++++++++++++++++++++++++++++++++" >> asu2-prtvtoc
echo $x >>asu2-prtvtoc
echo " " >> asu2-prtvtoc
prtvtoc $x >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
done
rm asu2-4prtvtoc2
#echo " asu2 vtoc report has been created "
#
# d1
echo " " > asu1-4prtvtoc
grep 3582 formatD | awk '{print $2}' >> asu1-4prtvtoc
cat asu1-4prtvtoc | sed 's/d0/d0s2/g' >asu1-4prtvtoc1
rm asu1-4prtvtoc
cat asu1-4prtvtoc1 | sed 's/c10/\/dev\/rdsk\/c10/g' >asu1-4prtvtoc2
rm asu1-4prtvtoc1
```

```
#
####
echo " " > asu1-prtvtoc
echo "Prtvtoc of all asu1 Logical Volumes " >> asu1-prtvtoc
cat asu1-4prtvtoc2 >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
for x in `cat asu1-4prtvtoc2`
do
echo " " >> asu1-prtvtoc
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu1-prtvtoc
echo $x >>asu1-prtvtoc
echo " " >> asu1-prtvtoc
prtvtoc $x >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
done
rm asu1-4prtvtoc2
#echo " asu1 vtoc report has been created "
echo " asu1 vtoc report has been created "
# d3
echo " " > asu3-4prtvtoc
grep 1022 formatD | awk '{print $2}' >> asu3-4prtvtoc
cat asu3-4prtvtoc | sed 's/d0/d0s2/g' >asu3-4prtvtoc1
rm asu3-4prtvtoc
cat asu3-4prtvtoc1 | sed 's/c10/\/dev\/rdsk\/c10/g' >asu3-4prtvtoc2
rm asu3-4prtvtoc1
#
####
echo " " > asu3-prtvtoc
echo "Prtvtoc of all asu3 Logical Volumes " >> asu3-prtvtoc
cat asu3-4prtvtoc2 >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
for x in `cat asu3-4prtvtoc2`
do
echo " " >> asu3-prtvtoc
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu3-prtvtoc
echo $x >>asu3-prtvtoc
echo " " >> asu3-prtvtoc
prtvtoc $x >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
done
rm asu3-4prtvtoc2
cat asu1-prtvtoc >prtvtoc-output
cat asu2-prtvtoc >>prtvtoc-output
cat asu3-prtvtoc >>prtvtoc-output
rm asu3-prtvtoc
rm asu2-prtvtoc
rm asu1-prtvtoc
echo " asu vtoc report has been created "
#
#
echo "d2 1 12 \\" > asu2
grep 5886 formatD | awk '{print $2}' >> asu2
echo "-i 100m" >>asu2
#
# d1
echo "d1 1 20 \\" > asu1
grep 3582 formatD | awk '{print $2}' >> asu1
echo "-i 100m" >>asu1
#
```

```
# d3
echo "d3 1 16 \\" > asu3
grep 1022 formatD | awk '{print $2}' >> asu3
echo "-i 100m" >>asu3
#
echo " "
echo " Creating new md.tab file"
sleep 5
echo " "
#
# Create md.tab file
cat asu* > md.ta
#
rm asu?
# Clean up md.tab file
cat md.ta | sed 's/d0/d0s2 \\/g' >md.tab
##
rm md.ta
# Copy new md.tab file to /etc/lvm
cp md.tab /etc/lvm/md.tab

echo " New md.tab file has been created"
sleep 5
echo " Starting to create new metadevices."
sleep 5
# create metadevice
metainit d1
echo " "
metainit d2
echo " "
metainit d3
sleep 5
## Display results
#clear
#metastat
```

8. On the Solaris 10 x86 server run the following command as root from /spc/spc1 directory.
This script will configure all ASU volumes needed to run SPC1.

```
#. ./config-sol10-x86.sh
#!/bin/ksh
#
# Created by Javier Chavez for Sun Microsystem SPC1 Benchmark
# 1-19-2005
#
# This script is generally in /spc/spc1
#
# Modify the variable below so the script will work with your controller ID
#
CID=c2
#
#
clear
echo " "
echo " "
echo "Removing old Disk links and Meta devices"
echo " "
echo " "
sleep 5
metaclear d1 d2 d3
```

```
# Probe server and remove all old device links
devfsadm -C
echo " "
echo " "
echo " Configuring new disks"
echo " "
echo " Configuring `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks"
sleep 5
echo " "
ls /dev/rdsk/$CID*d0s2 > disks
echo " "
echo " Starting to Label all new disks"
sleep 5
cat disks | sed 's/s2\@/s2/g' > disk1
rm disks

C_disks=disk1
#
for f in `cat $C_disks`
do
format $f << EOFF
ty
0
y
label
y
quit
EOFF
done
clear
echo " "
echo " "
echo " All `ls /dev/rdsk/$CID*d0s2 | wc -l ` disks have been configured"
echo " "
# Create a new disk list
format > formatD << EOFF
EOFF
# Stop here for some tweaks
sleep 5
echo " "
echo " "
echo " Configuring asu device files"
rm disk1
# asu config files
#
# Change all c2 controller ID to create prtvtoc report
#
grep 5885 formatD | awk '{print $2}' >> asu2-4prtvtoc
cat asu2-4prtvtoc | sed 's/d0/d0s2/g' >asu2-4prtvtoc1
rm asu2-4prtvtoc
cat asu2-4prtvtoc1 | sed 's/c2/\/dev\/rdsk\/c2/g' >asu2-4prtvtoc2
rm asu2-4prtvtoc1
####
echo " " > asu2-prtvtoc
echo "Prtvtoc of all asu2 Logical Volumes " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
cat asu2-4prtvtoc2 >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
for x in `cat asu2-4prtvtoc2`
do
echo " " >> asu2-prtvtoc
```

```
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu2-prtvtoc
echo $x >>asu2-prtvtoc
echo " " >> asu2-prtvtoc
prtvtoc $x >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
echo " " >> asu2-prtvtoc
done
rm asu2-4prtvtoc2
#echo " asu2 vtoc report has been created "
#
# d1
echo " " > asu1-4prtvtoc
grep 3581 formatD | awk '{print $2}' >> asu1-4prtvtoc
cat asu1-4prtvtoc | sed 's/d0/d0s2/g' >asu1-4prtvtoc1
rm asu1-4prtvtoc
cat asu1-4prtvtoc1 | sed 's/c2/\/dev\/rdsk\/c2/g' >asu1-4prtvtoc2
rm asu1-4prtvtoc1
#
####
echo " " > asu1-prtvtoc
echo "Prtvtoc of all asu1 Logical Volumes " >> asu1-prtvtoc
cat asu1-4prtvtoc2 >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
for x in `cat asu1-4prtvtoc2`
do
echo " " >> asu1-prtvtoc
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu1-prtvtoc
echo $x >>asu1-prtvtoc
echo " " >> asu1-prtvtoc
prtvtoc $x >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
echo " " >> asu1-prtvtoc
done
rm asu1-4prtvtoc2
#echo " asu1 vtoc report has been created "
echo " asu1 vtoc report has been created "
# d3
echo " " > asu3-4prtvtoc
grep 1021 formatD | awk '{print $2}' >> asu3-4prtvtoc
cat asu3-4prtvtoc | sed 's/d0/d0s2/g' >asu3-4prtvtoc1
rm asu3-4prtvtoc
cat asu3-4prtvtoc1 | sed 's/c2/\/dev\/rdsk\/c2/g' >asu3-4prtvtoc2
rm asu3-4prtvtoc1
#
####
echo " " > asu3-prtvtoc
echo "Prtvtoc of all asu3 Logical Volumes " >> asu3-prtvtoc
cat asu3-4prtvtoc2 >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
for x in `cat asu3-4prtvtoc2`
do
echo " " >> asu3-prtvtoc
echo "++++++++++++++++++++++++++++++++++++++++++++++++" >> asu3-prtvtoc
echo $x >>asu3-prtvtoc
echo " " >> asu3-prtvtoc
prtvtoc $x >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
echo " " >> asu3-prtvtoc
done
rm asu3-4prtvtoc2
cat asu1-prtvtoc >prtvtoc-output
```

```
cat asu2-prtvtoc >>prtvtoc-output
cat asu3-prtvtoc >>prtvtoc-output
rm asu3-prtvtoc
rm asu2-prtvtoc
rm asu1-prtvtoc
echo " asu vtoc report has been created "
#
#
echo "d2 1 12 \\" > asu2
grep 5885 formatD | awk '{print $2}' >> asu2
echo "-i 100m" >>asu2
#
# d1
echo "d1 1 20 \\" > asu1
grep 3581 formatD | awk '{print $2}' >> asu1
echo "-i 100m" >>asu1
#
# d3
echo "d3 1 16 \\" > asu3
grep 1021 formatD | awk '{print $2}' >> asu3
echo "-i 100m" >>asu3
#
echo " "
echo " Creating new md.tab file"
sleep 5
echo " "
#
# Create md.tab file
cat asu* > md.ta
#
rm asu?
# Clean up md.tab file
cat md.ta | sed 's/d0/d0s2 \\/g' >md.tab
##
rm md.ta
# Copy new md.tab file to /etc/lvm
cp md.tab /etc/lvm/md.tab

echo " New md.tab file has been created"
sleep 5
echo " Starting to create new metadevices."
sleep 5
# create metadevice
metainit d1
echo " "
metainit d2
echo " "
metainit d3
sleep 5
## Display results
#clear
#metastat
```

9. On the Windows 2003 Dell server run the following command.
diskpart -s delldisk.txt

```
Contents of delldisk.txt below.
select disk 0
convert dynamic
```

```
select disk 1
convert dynamic
select disk 2
convert dynamic
select disk 3
convert dynamic
select disk 4
convert dynamic
select disk 5
convert dynamic
select disk 6
convert dynamic
select disk 7
convert dynamic
select disk 8
convert dynamic
select disk 9
convert dynamic
select disk 10
convert dynamic
select disk 11
convert dynamic
select disk 12
convert dynamic
select disk 13
convert dynamic
select disk 14
convert dynamic
select disk 15
convert dynamic
select disk 16
convert dynamic
select disk 17
convert dynamic
select disk 18
convert dynamic
select disk 19
convert dynamic
select disk 20
convert dynamic
select disk 21
convert dynamic
select disk 22
convert dynamic
select disk 23
convert dynamic
select disk 24
convert dynamic
select disk 25
convert dynamic
select disk 26
convert dynamic
select disk 27
convert dynamic
select disk 28
convert dynamic
select disk 29
convert dynamic
select disk 30
convert dynamic
select disk 31
convert dynamic
select disk 32
```

```
convert dynamic
select disk 33
convert dynamic
select disk 34
convert dynamic
select disk 35
convert dynamic
select disk 36
convert dynamic
select disk 37
convert dynamic
select disk 38
convert dynamic
select disk 39
convert dynamic
select disk 40
convert dynamic
select disk 41
convert dynamic
select disk 42
convert dynamic
select disk 43
convert dynamic
select disk 44
convert dynamic
select disk 45
convert dynamic
select disk 46
convert dynamic
select disk 47
convert dynamic
create                               volume                               stripe
disk=16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35
assign letter=x

create volume stripe disk=36,37,38,39,40,41,42,43,44,45,46,47
assign letter=y

create volume stripe disk=0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15
assign letter=z

list disk

list volume
```

APPENDIX C: SPC-1 WORKLOAD GENERATOR STORAGE COMMANDS AND PARAMETERS

The contents of the SPC-1 Workload Generator command and parameter file is listed below.

Master Host System (Dell 2650):

```
host=master
slaves=(dell,sol9,sol10,x86)

sd=asu1_1,lun=\\.\x:,size=550g
sd=asu2_1,lun=\\.\y:,size=550g
sd=asu3_1,lun=\\.\z:,size=122g
```

Slave Host System (Sun Fire™ 4800):

```
master=sbm-dell9
host=sol9
sd=asu1_1,lun=/dev/md/rdsk/d1,size=550g
sd=asu2_1,lun=/dev/md/rdsk/d2,size=550g
sd=asu3_1,lun=/dev/md/rdsk/d3,size=122g
```

Slave Host System (Sun Fire™ 480):

```
master=sbm-dell9
host=sol10
sd=asu1_1,lun=/dev/md/rdsk/d1,size=550g
sd=asu2_1,lun=/dev/md/rdsk/d2,size=550g
sd=asu3_1,lun=/dev/md/rdsk/d3,size=122g
```

Slave Host System (Sun Fire™ V20z):

```
master=sbm-dell9
host=x86
sd=asu1_1,lun=/dev/md/rdsk/d1,size=550g
sd=asu2_1,lun=/dev/md/rdsk/d2,size=550g
sd=asu3_1,lun=/dev/md/rdsk/d3,size=122g
```