SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

IBM CORPORATION
IBM SYSTEM STORAGE DS8700 RELEASE 5.1
(EASY TIER AND SSDS)

SPC-1 V1.12

Submitted for Review: April 13, 2010
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Table of Contents

Audit Certification vii

Audit Certification *(cont.)* viii

Letter of Good Faith ix

Executive Summary 10

- **Test Sponsor and Contact Information** 10
- **Revision Information and Key Dates** 10
- **Tested Storage Product (TSP) Description** 10
- **Summary of Results** 11
- **Storage Capacities, Relationships, and Utilization** 11
- **Response Time – Throughput Curve** 13
- **Response Time – Throughput Data** 13
- **Priced Storage Configuration Pricing** 14
- **Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration** 15
- **Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Diagram** 15
- **Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Components** 16

Configuration Information 17

- **Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram** 17
- **Storage Network Configuration** 17
- **Host System and Tested Storage Configuration (TSC) Table of Components** 17
- **Customer Tunable Parameters and Options** 18
- **Tested Storage Configuration (TSC) Description** 18
- **SPC-1 Workload Generator Storage Configuration** 18

SPC-1 Data Repository 19

- **Storage Capacities and Relationships** 19
  - SPC-1 Storage Capacities 19
  - SPC-1 Storage Hierarchy Ratios 19
  - SPC-1 Storage Capacities and Relationships Illustration 20
- **Logical Volume Capacity and ASU Mapping** 20
- **Storage Capacity Utilization** 21

SPC-1 Benchmark Execution Results 22

- **SPC-1 Tests, Test Phases, and Test Runs** 22
- **Primary Metrics Test – Sustainability Test Phase** 23
  - SPC-1 Workload Generator Input Parameters 23

Sustainability Test Results File 23
Sustainability – Data Rate Distribution Data *(MB/second)* 24
Sustainability – Data Rate Distribution Graph 24
Sustainability – I/O Request Throughput Distribution Data 25
Sustainability – I/O Request Throughput Distribution Graph 25
Sustainability – Average Response Time (ms) Distribution Data 26
Sustainability – Average Response Time (ms) Distribution Graph 26
Sustainability – Response Time Frequency Distribution Data 27
Sustainability – Response Time Frequency Distribution Graph 27
Sustainability – Measured Intensity Multiplier and Coefficient of Variation 28
Primary Metrics Test – IOPS Test Phase 29
SPC-1 Workload Generator Input Parameters 29
IOPS Test Results File 29
IOPS Test Run – I/O Request Throughput Distribution Data 30
IOPS Test Run – I/O Request Throughput Distribution Graph 30
IOPS Test Run – Average Response Time (ms) Distribution Data 31
IOPS Test Run – Average Response Time (ms) Distribution Graph 31
IOPS Test Run – Response Time Frequency Distribution Data 32
IOPS Test Run –Response Time Frequency Distribution Graph 32
IOPS Test Run – I/O Request Information 33
IOPS Test Run – Measured Intensity Multiplier and Coefficient of Variation 33
Primary Metrics Test – Response Time Ramp Test Phase 34
SPC-1 Workload Generator Input Parameters 34
Response Time Ramp Test Results File 34
Response Time Ramp Distribution (IOPS) Data 35
Response Time Ramp Distribution (IOPS) Graph 36
SPC-1 LRT™ Average Response Time (ms) Distribution Data 37
SPC-1 LRT™ Average Response Time (ms) Distribution Graph 37
SPC-1 LRT™ (10%) – Measured Intensity Multiplier and Coefficient of Variation 38
Repeatability Test 39
SPC-1 Workload Generator Input Parameters 39
Repeatability Test Results File 40
Repeatability 1 LRT – I/O Request Throughput Distribution Data 41
Repeatability 1 LRT – I/O Request Throughput Distribution Graph 41
Repeatability 1 LRT –Average Response Time (ms) Distribution Data 42
Repeatability 1 LRT –Average Response Time (ms) Distribution Graph 42
Repeatability 1 IOPS – I/O Request Throughput Distribution Data 43
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph 43
Repeatability 1 IOPS –Average Response Time (ms) Distribution Data 44

Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph 44
Repeatability 2 LRT – I/O Request Throughput Distribution Data 45
Repeatability 2 LRT – I/O Request Throughput Distribution Graph 45
Repeatability 2 LRT –Average Response Time (ms) Distribution Data 46
Repeatability 2 LRT –Average Response Time (ms) Distribution Graph 46
Repeatability 2 IOPS – I/O Request Throughput Distribution Data 47
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph 47
Repeatability 2 IOPS –Average Response Time (ms) Distribution Data 48
Repeatability 2 IOPS –Average Response Time (ms) Distribution Graph 48
Repeatability 1 (LRT) Measured Intensity Multiplier and Coefficient of Variation 49
Repeatability 1 (IOPS) Measured Intensity Multiplier and Coefficient of Variation 49
Repeatability 2 (LRT) Measured Intensity Multiplier and Coefficient of Variation 49
Repeatability 2 (IOPS) Measured Intensity Multiplier and Coefficient of Variation 50

Data Persistence Test 51

SPC-1 Workload Generator Input Parameters 51
Data Persistence Test Results File 51
Data Persistence Test Results 52

Priced Storage Configuration Availability Date 53

Pricing Information 53

Tested Storage Configuration (TSC) and Priced Storage Configuration Differences 53

Anomalies or Irregularities 53

Appendix A: SPC-1 Glossary 54

"Decimal" *(powers of ten)* Measurement Units 54
"Binary" *(powers of two)* Measurement Units 54
SPC-1 Data Repository Definitions 54
SPC-1 Data Protection Levels 55
SPC-1 Test Execution Definitions 55
I/O Completion Types 57
SPC-1 Test Run Components 57

Appendix B: Customer Tunable Parameters and Options 58

AIX Parameters 58
Easy Tier Options 58

Appendix C: Tested Storage Configuration (TSC) Creation 59

Easy Tier Configuration 59
DS8700 Configuration Steps 59

Create extent pools 59

Create the RAID-10 and RAID-5 ranks 59
Create the LUNs 60
Define The LUN access path 60
Deploy SSDs 61
AIX Configuration Steps 62
Appendix D: SPC-1 Workload Generator Storage Commands and Parameters 63
Primary Metrics Test 63
Sustainability 63
Ramp 100 Test Run 64
Ramp 95 Test Run 66
Ramp 90 Test Run 67
Ramp 80 Test Run 68
Ramp 50 Test Run 70
Ramp 10 Test Run 71
Repeatability Test 73
Repeat1 LRT Test Run Repeat1 IOPS Test Run 73
Repeat2 LRT Test Run Repeat2 IOPS Test Run 74
Persistence Test 76
Persistence Test Run 1 76
Persistence Test Run 2 77
Appendix E: SPC-1 Workload Generator Input Parameters 80
Slave JVM Invocation 80
runslaves.sh 80
slave1.txt 80
Primary Metrics Test, Repeatability Test, and Persistence Test Run 1 81
runthem.sh 82
Persistence Test Run 1 82
runit.sh 82
runpersist1.sh 82
Persistence Test Run 2 83
runpersist2.sh 83

AUDIT CERTIFICATION

Bruce McNutt
IBM Corporation
650 Harry Road C2 500
San Jose, CA 95120

April 12, 2010

The SPC Benchmark 1™ results listed below for the IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs)* were produced in compliance with the SPC Benchmark 1™ 1.12 Remote Audit requirements.

SPC Benchmark 1™ 1.12 Results	
Tested Storage Configuration (TSC) Name: IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs)*	
Metric	**Reported Result**
SPC-1 IOPS™	32,998.24
SPC-1 Price-Performance	$47.92/SPC-1 IOPS™
Total ASU Capacity	34,114.990 GB
Data Protection Level	Protected *(Mirroring, RAID-5)*
Total TSC Price (including three-year maintenance)	$1,581,207.60

The following SPC Benchmark 1™ Remote Audit requirements were reviewed and found compliant with 1.12 of the SPC Benchmark 1™ specification:

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items, based on information supplied by IBM Corporation:
  - ✓ 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).
- Listings and commands to configure the Benchmark Configuration/Tested Storage Configuration, including customer tunable parameters that were changed from default values.
- SPC-1 Workload Generator commands and parameters used for the audited SPC Test Runs.

Storage Performance Council
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Redwood City, CA 94062
AuditService@storageperformance.org
650.556.9384

AUDIT CERTIFICATION *(CONT.)*

- The following Host System requirements, based on information supplied by IBM Corporation:
  - ✓ The type of Host System including the number of processors and main memory.
  - ✓ The presence and version number of the SPC-1 Workload Generator on each Host System.
  - ✓ The TSC boundary within each Host System.
- The Test Results Files and resultant Summary Results Files received from IBM Corporation 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.
- The submitted pricing information 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.
- This successfully audited SPC measurement is not subject to an SPC Confidential Review.

Audit Notes:

The SPC-2 Persistence Test was approved for use to meet the SPC-1 persistence requirements.

Respectfully,

Walter E. Baker

Walter E. Baker
SPC Auditor

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LETTER OF GOOD FAITH

IBM

Vice President and Disk Storage Business Line Executive

IBM Technology & Systems Group
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Phone 1-919-543-6345
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March 30, 2010

Mr. Walter E. Baker, SPC Auditor
Gradient Systems, Inc.
643 Bair Island Road, Suite 103
Redwood City, CA 94063

Subject: SPC-1 Letter of Good Faith for the IBM System Storage DS8700 (Easy Tier and SSD's).

IBM Corporation 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 Version 1.10.1 of the SPC-1 benchmark specification.

Our disclosure of the Benchmark configuration and execution of the benchmark includes all items that, to the best of our knowledge and belief, materially affect the reported results, regardless of whether such items are explicitly required to be disclosed by the SPC-1 benchmark specification.

Sincerely,

Doug Balog

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	IBM Corporation – http://www.ibm.com Bruce McNutt – bmcnutt@us.ibm.com 650 Harry Road C2 500 San Jose, CA 95120 Phone: (408) 927-2717 FAX: 0086 28 62905793
Test Sponsor Alternate Contact	IBM Corporation – http://www.ibm.com Joe Hyde – joehyde@us.ibm.com 9000 S. Rita Road 9042-2 Tucson, AZ 85744 Phone: (520) 799-4026 FAX: (520) 799-5550
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	V1.12
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	April 13, 2010
Date the FDR was submitted to the SPC	April 13, 2010
Date the priced storage configuration is available for shipment to customers	May 21, 2010
Date the TSC completed audit certification	April 12, 2010

Tested Storage Product (TSP) Description

The IBM System Storage DS8000™ series encompasses the flagship disk enterprise storage products in the IBM System Storage portfolio. The DS8700 represents the latest in this series of enterprise disk storage systems designed for high-performance, high-capacity and resiliency. Major new capabilities include IBM POWER6 Processing technology and PCI-e I/O enclosures.

IBM System Storage Easy Tier feature of the DS8700 enables more effective storage consolidation by taking the guesswork out of deploying solid-state drives by automatically and dynamically moving the appropriate data to the appropriate drive tier in the system, based on ongoing performance monitoring. Such effective storage tiering will help ensure systems are optimized for solid-state technology from both a performance and cost perspective.

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs)*	
Metric	**Reported Result**
SPC-1 IOPS™	32,998.24
SPC-1 Price-Performance	$47.92/SPC-1 IOPS™
Total ASU Capacity	34,114.990 GB
Data Protection Level	Protected *(Mirroring, RAID-5)*
Total TSC Price (including three-year maintenance)	$1,581,207.60

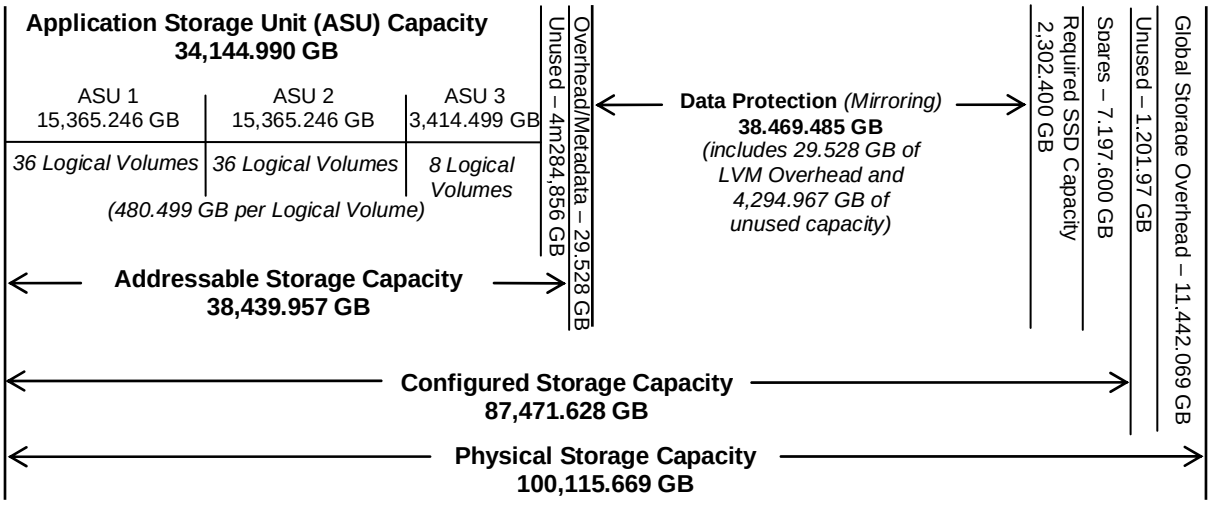
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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 **Protected** using ***Mirroring*** configures two or more identical copies of user data. The SSD portion of the configuration utilized a **Data Protection Level** of ***RAID-5*** which provides data protection by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

Storage Capacities, Relationships, and Utilization

The following diagram and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.



SPC-1 Storage Capacity Utilization	
Application Utilization	34.11%
Protected Application Utilization	68.24%
Unused Storage Ratio	9.78%

Application Utilization: Total ASU Capacity *(34,144.990 GB)* divided by Physical Storage Capacity *(100,115.669 GB)*

Protected Application Utilization: (Total ASU Capacity *(34,114.990 GB)* plus total Data Protection Capacity *(38,469.485 GB)* minus unused Data Protection Capacity *(4,294.967 GB)* divided by Physical Storage Capacity *(100,115.669 GB)*

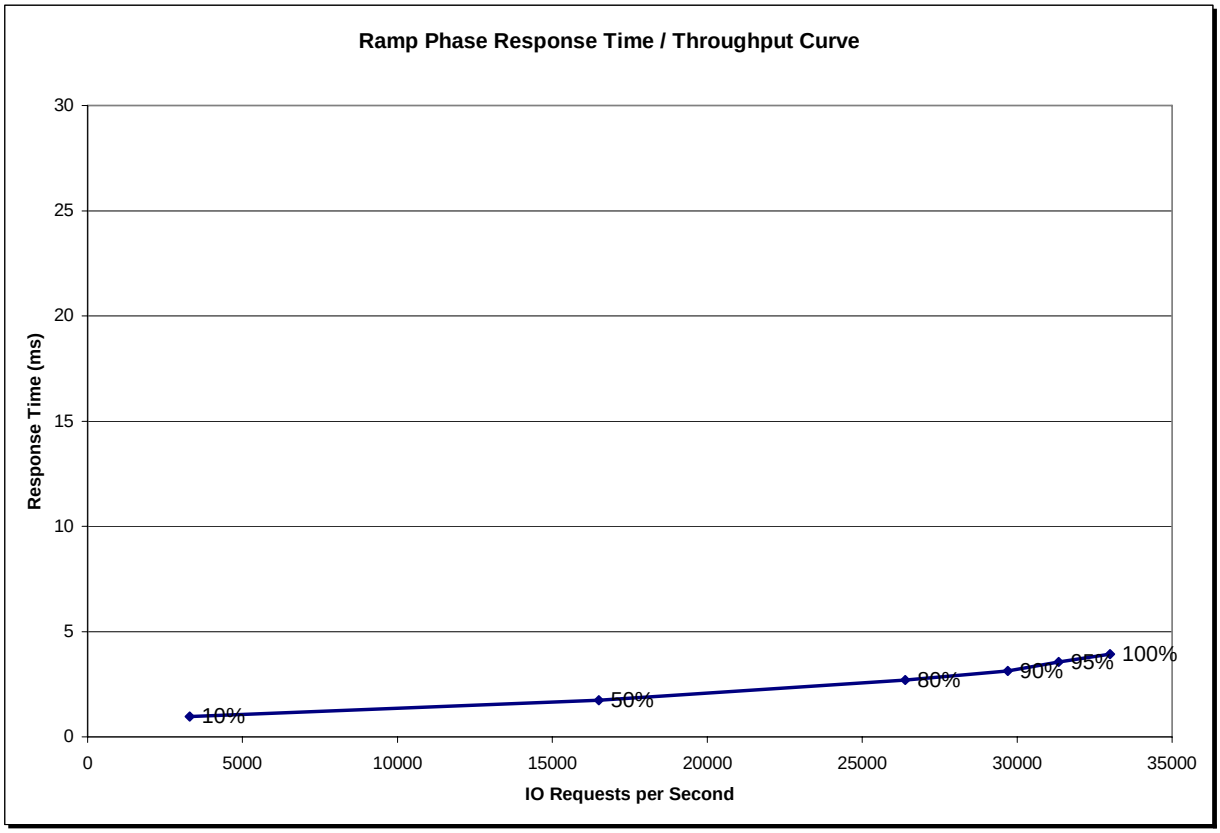
Unused Storage Ratio: Total Unused Capacity *(9,791.907 GB)* divided by Physical Storage Capacity *(100,115.669 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 19-20 in the Full Disclosure Report.

Response Time – Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.



Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	3,302.53	16,493.73	26,394.28	29,697.92	31,335.75	32,998.24
Average Response Time (ms):						
All ASUs	0.95	1.74	2.70	3.12	3.55	3.94
ASU-1	1.02	1.83	2.83	3.14	3.65	4.12
ASU-2	1.98	3.42	6.53	8.53	9.44	10.21
ASU-3	0.35	0.80	0.75	0.73	0.75	0.80
Reads	1.94	3.56	5.98	7.06	8.11	9.05
Writes	0.31	0.55	0.56	0.56	0.58	0.61

Priced Storage Configuration Pricing

Product	Description	Qty	Price	Extended Price	Discount (%)	Disc. Price
2423-941	System Storage DS8700	1	$ 72,419.00	$ 72,419.00	50.00%	$ 36,209.50
100	Eligible for EU Shipment	1	N/C			
700	OEL Indicator	1	N/C			
825	75.1 to 100.0 TB capacity	1	N/C			
900	Non-Standby CoD	1	N/C			
932	IBM System p Indicator	1	N/C			
1050	Battery Assembly	3	1,700.00	$ 5,100.00	50.00%	$ 2,550.00
1090	Line Cord (US/LA/AP/Canada)	1	1,900.00	$ 1,900.00	50.00%	$ 950.00
1120	Management Console - English Laptop Internal	1	9,160.00	$ 9,160.00	50.00%	$ 4,580.00
1210	Disk Enclosure Pair	4	10,000.00	$ 40,000.00	50.00%	$ 20,000.00
1211	Disk Drive Cable Group 1	1	1,000.00	$ 1,000.00	50.00%	$ 500.00
1301	I/O Enclosure Pair PCIE	2	11,780.00	$ 23,560.00	50.00%	$ 11,780.00
1321	PCI-E Cable Group 2	1	4,100.00	$ 4,100.00	50.00%	$ 2,050.00
1420	9 um Fibre Cable (LC)	12	100.00	$ 1,200.00	50.00%	$ 600.00
1711	Release 5 Bundle Family	1	40,000.00	$ 40,000.00	50.00%	$ 20,000.00
2816	1 TB 7.2K SATA Drive Set *(16 drives per set)*	6	89,780.00	$ 538,680.00	50.00%	$ 269,340.00
2999	Disk Enclosure Filler	1	100.00	$ 100.00	50.00%	$ 50.00
3043	Device Adapter Pair III	2	10,000.00	$ 20,000.00	50.00%	$ 10,000.00
3143	4Gb SW FCP/FICON Adapter PCIE	6	33,920.00	$ 203,520.00	50.00%	$ 101,760.00
4225	256 GB Processor Memory (4-Way)	1	784,640.00	$ 784,640.00	50.00%	$ 392,320.00
4302	4 Way Processor Card Pair	1	80,893.00	$ 80,893.00	50.00%	$ 40,446.50
6116	146 GB SSD Drive Set *(16 SSDs per set)*	1	923,552.00	$ 923,552.00	50.00%	$ 461,776.00
7040	OEL - 100 TB	1	N/C			
7051	OEL - 1 Value Unit	1	N/C			
7054	OEL - 25 Value Unit	1	N/C			
7055	OEL - 50 Value Unit	1	N/C			
8S1027	SSD System Order	1	N/C			
2398-LFA	DS8000 Function Authorization	1	N/C			
932	IBM System p Indicator	1	N/C			
7040	OEL - 100 TB	1	N/C			
7053	OEL - 10 Value Unit	1	$ 53,659.00	$ 53,659.00	40.00%	$ 32,195.40
7054	OEL - 25 Value Unit	1	$ 85,397.00	$ 85,397.00	40.00%	$ 51,238.20
7055	OEL - 50 Value Unit	1	$ 140,794.00	$ 140,794.00	40.00%	$ 84,476.40
2805-MC4	System Storage Productivity Center	1	$ 4,200.00	$ 4,200.00	50.00%	$ 2,100.00
18	IBM Tivoli Storage Productivity Center via AAS/eConfig	1	N/C			
1170	Power Cord, Standard Rack	2	N/C			
1810	Dual Power Supply Option	1	$ 199.00	$ 199.00	50.00%	$ 99.50
9100	Console Keyboard/Display/Drawer	1	$ 1,794.00	$ 1,794.00	50.00%	$ 897.00
9117-MMB						
5735	8 Gb PCI-e Dual Port FC HBA	11	$ 4,583.00	$ 50,413.00	30.00%	$ 35,289.10
	Total discounted price					**$1,581,207.60**

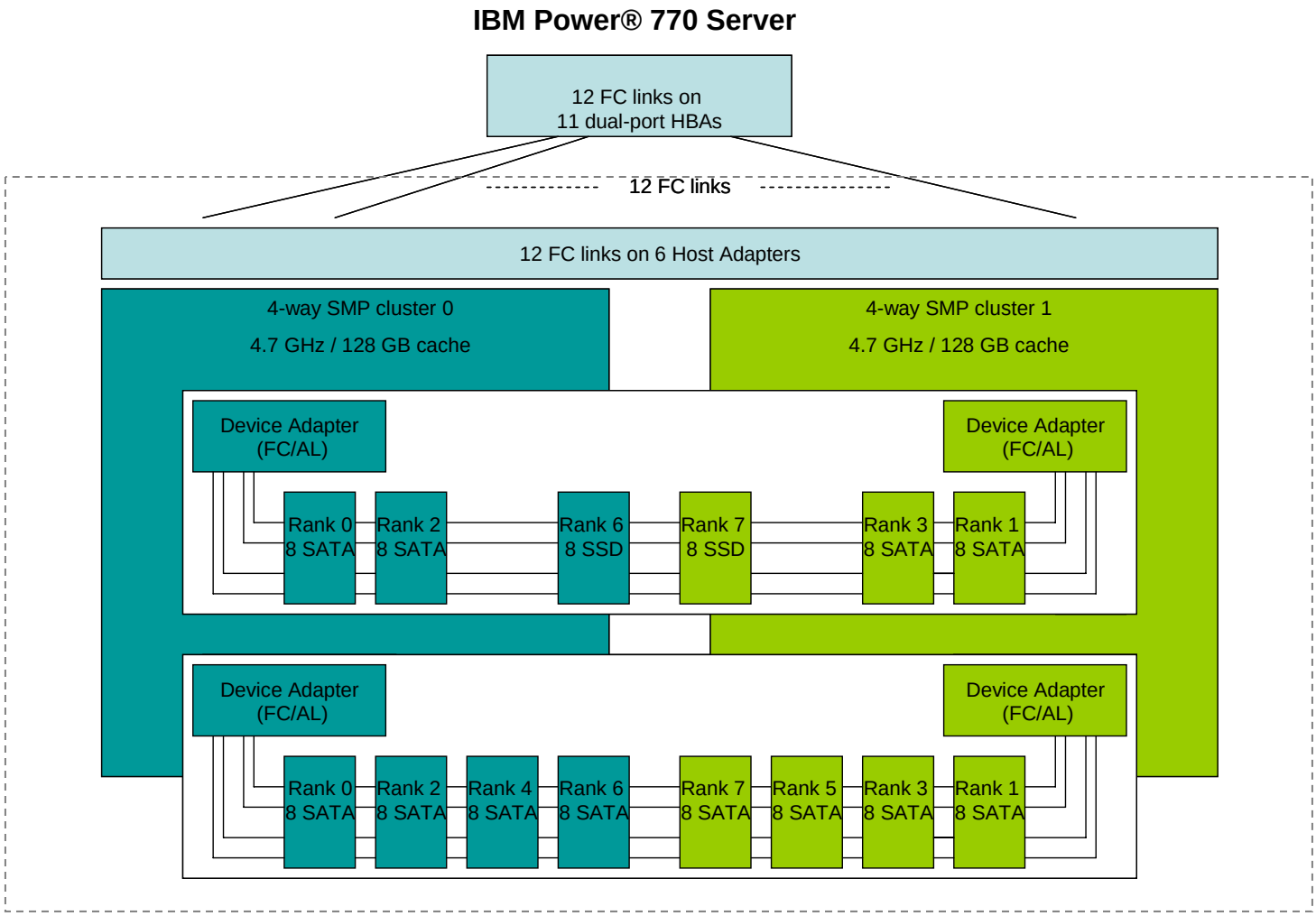
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite present of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Price Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.

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

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

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



IBM System Storage DS8700 Version 5.1 *(EasyTier and SSDs)*

Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Components

Host System:	Tested Storage Configuration (TSC)/ Priced Storage Configuration:
IBM Power® 770 *(P770-9119-MMB)*	11 – 8 Gb PCIe dual port FC HBAs
64 cores in: 8 – 3.1 GHz POWER7 processor modules 8 cores per processor module 256 KB L2 cache per core 4 MB L3 cache per core *(eDRAM)*	**IBM System Storage DS8700** 256 GB memory/cache 12 – 4 Gbps front-end physical connections *(2 per FCP/FICON Adapter)* 16 – 2 Gbps backend physical connections *(4 per Device Adapter)*
256 GB main memory	1 – 4 Way Processor Card Pair
AIX 6.1 TL 01	6 – 4 Gb SW FCP/FICON Adapter PCIe
PCIe	2 – Device Adapter Pair III
	1 – Management Console
	96 – 1 TB 7.2K RPM SATA disk drive
	16 – 146 GB SSDs

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-1 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

CONFIGURATION INFORMATION

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

Clause 9.4.3.4.1

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

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) is illustrated on page 15 *(Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Diagram).*

Storage Network Configuration

Clause 9.4.3.4.1

…

5. *If the TSC contains network storage, the diagram will include the network configuration. If a single diagram is not sufficient to illustrate both the Benchmark Configuration and network configuration in sufficient detail, the Benchmark Configuration diagram will include a high-level network illustration as shown in Figure 9-8. In that case, a separate, detailed network configuration diagram will also be included as described in Clause 9.4.3.4.2.*

Clause 9.4.3.4.2

If a storage network was configured as a part of the Tested Storage Configuration and the Benchmark Configuration diagram described in Clause 9.4.3.4.1 contains a high-level illustration of the network configuration, the Executive Summary will contain a one page topology diagram of the storage network as illustrated in Figure 9-9.

The Host System and TSC table of components may be found on page 15 *(Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Diagram).*

Host System and Tested Storage Configuration (TSC) Table of Components

Clause 9.4.3.4.3

The FDR will contain a table that lists the major components of each Host System and the Tested Storage Configuration (TSC). Table 9-10 specifies the content, format, and appearance of the table.

The Host System and TSC table of components may be found on page 16 *(Benchmark Configuration (BC)/Tested Storage Configuration (TSC)/ Priced Storage Configuration Components).*

Customer Tunable Parameters and Options

Clause 9.4.3.5.1

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. If the parameter name is not self-explanatory to a knowledgeable practitioner, a brief description of the parameter's use must also be included in the FDR entry.

"Appendix B: Customer Tunable Parameters and Options" on page 58 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Description

Clause 9.4.3.5.2

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 BC Configuration Diagram in Clause 9.2.4.4.1 and/or 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.*
- *Listings of scripts used to create the logical representation of the TSC.*
- *If scripts were not used, a description of the process used with sufficient detail to recreate the logical representation of the TSC.*

"Appendix C: Tested Storage Configuration (TSC) Creation" on page 59 contains the detailed information that describes how to create and configure the logical TSC.

SPC-1 Workload Generator Storage Configuration

Clause 9.4.3.5.3

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 D: SPC-1 Workload Generator Storage Commands and Parameters" on page 63.

SPC-1 DATA REPOSITORY

This portion of the Full Disclosure Report presents the detailed information that fully documents the various SPC-1 storage capacities and mappings used in the Tested Storage Configuration. "SPC-1 Data Repository Definitions" on page 54 contains definitions of terms specific to the SPC-1 Data Repository.

Storage Capacities and Relationships

Clause 9.4.3.6.1

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)	34,114.990
Addressable Storage Capacity	Gigabytes (GB)	38,439.957
Configured Storage Capacity	Gigabytes (GB)	87,471.628
Physical Storage Capacity	Gigabytes (GB)	100,115.669
Data Protection *(Mirroring)*	Gigabytes (GB)	38,469.485
Required Storage *(including spares)*	Gigabytes (GB)	10,591.713
Global Storage Overhead	Gigabytes (GB)	11,442.069
Total Unused Storage	Gigabytes (GB)	9,791.907

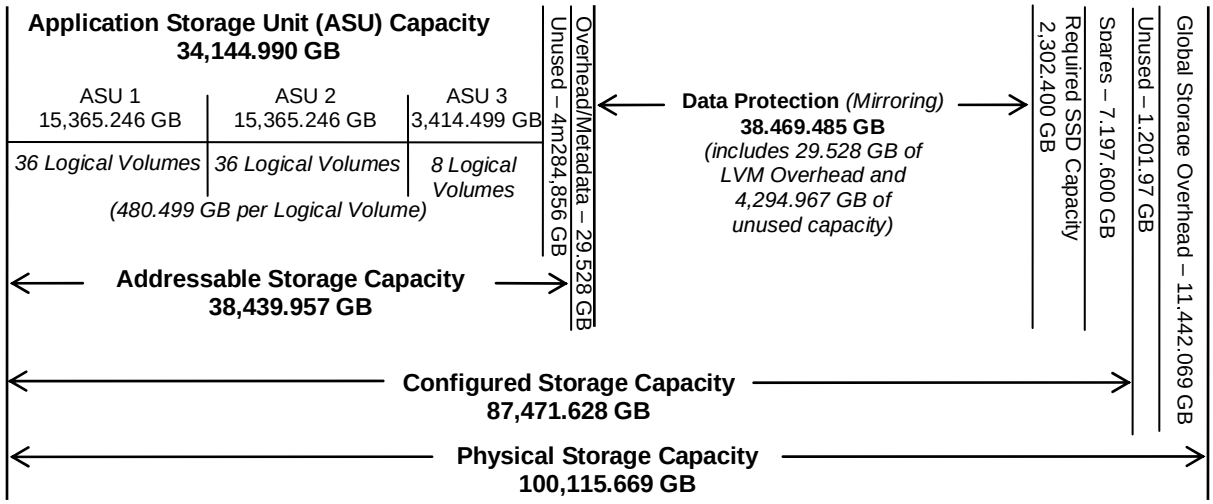
SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	**Configured Storage Capacity**	**Physical Storage Capacity**
Total ASU Capacity	88.83%	39.04%	34.11%
Required for Data Protection *(Mirrored)*		43.98%	38.43%
Addressable Storage Capacity		43.95%	38.40%
Required Storage *(including spares)*		12.11%	10.58%
Configured Storage Capacity			87.37%
Global Storage Overhead			11.43%
Unused Storage:			
Addressable	11.17%		
Configured		0.00%	
Physical			1.20%

The Physical Storage Capacity consisted of 101,115.669 GB distributed over 96 disk drives each with a physical capacity of 1,000.205 GB and 16 solid state storage devices (SSDs) each with a physical capacity of 256 GB. There was 0.000 GB (0.00%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 11,442.069 GB (11.43%) of Physical Storage Capacity. There was 0.000 GB (0.00%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 88.83% of the Addressable Storage Capacity resulting in 4,294.967GB (11.17%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(mirroring)* capacity was 38,469.485 GB of which 34,144.990 GB was utilized. The total Unused Storage was 9,791.907 GB.

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 9.4.3.6.3

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 (15,365.246 GB)	**ASU-2 (15,365.246 GB)**	**ASU-3 (3,414.499GB)**
36 Logical Volume 480.499 GB per Logical Volume (426.812 GB used per Logical Volume)	36 Logical Volume 480.499 GB per Logical Volume (426.812 GB used per Logical Volume)	8 Logical Volume 480.499 GB per Logical Volume (426.812 GB used per Logical Volume)

The Data Protection Level used for all Logical Volumes was "Mirrored" as described on page 11. See "ASU Configuration" in the **IOPS Test Results File** for more detailed configuration information.

Storage Capacity Utilization

Clause 9.4.3.6.2

The FDR will include a table illustrating the storage capacity utilization values defined for Application Utilization (Clause 2.8.1), Protected Application Utilization (Clause 2.8.2), and Unused Storage Ratio (Clause 2.8.3).

Clause 2,8.1

Application Utilization is defined as Total ASU Capacity divided by Physical Storage Capacity.

Clause 2,8.2

Protected Application Utilization is defined as (Total ASU Capacity plus total Data Protection Capacity minus unused Data Protection Capacity) divided by Physical Storage Capacity.

Clause 2,8.3

Unused Storage Ratio is defined as Total Unused Capacity divided by Physical Storage Capacity and may not exceed 45%.

SPC-1 Storage Capacity Utilization	
Application Utilization	34.11%
Protected Application Utilization	68.24%
Unused Storage Ratio	9.78%

SPC-1 BENCHMARK EXECUTION RESULTS

This portion of the Full Disclosure Report documents the results of the various SPC-1 Tests, Test Phases, and Test Runs. "SPC-1 Test Execution Definitions" on page 55 contains definitions of terms specific to the SPC-1 Tests, Test Phases, and Test Runs.

Clause 5.4.3

The Tests must be executed in the following sequence: Primary Metrics, Repeatability, and Data Persistence. That required sequence must be uninterrupted from the start of Primary Metrics to the completion of Persistence Test Run 1. Uninterrupted means the Benchmark Configuration shall not be power cycled, restarted, disturbed, altered, or adjusted during the above measurement sequence. If the required sequence is interrupted other than for the Host System/TSC power cycle between the two Persistence Test Runs, the measurement is invalid.

SPC-1 Tests, Test Phases, and Test Runs

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

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

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 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 5.4.4.1.1

The Sustainability Test Phase has exactly one Test Run and shall demonstrate the maximum sustainable I/O Request Throughput within at least a continuous three (3) hour Measurement Interval. This Test Phase also serves to insure that the TSC has reached Steady State prior to reporting the final maximum I/O Request Throughput result (SPC-1 IOPS™).

Clause 5.4.4.1.2

The computed I/O Request Throughput of the Sustainability Test must be within 5% of the reported SPC-1 IOPS™ result.

Clause 5.4.4.1.4

The Average Response Time, as defined in Clause 5.1.1, will be computed and reported for the Sustainability Test Run and cannot exceed 30 milliseconds. If the Average Response time exceeds that 30-milliseconds constraint, the measurement is invalid.

Clause 9.4.3.7.1

For the Sustainability Test Phase the FDR shall contain:

1. *A Data Rate Distribution graph and data table.*
2. *I/O Request Throughput Distribution graph and data table.*
3. *A Response Time Frequency Distribution graph and table.*
4. *An Average Response Time Distribution graph and table.*
5. *The human readable Test Run Results File produced by the Workload Generator (may be included in an appendix).*
6. *A listing or screen image of all input parameters supplied to the Workload Generator (may be included in an appendix).*
7. *The Measured Intensity Multiplier for each I/O stream.*
8. *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, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 80.

Sustainability Test Results File

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

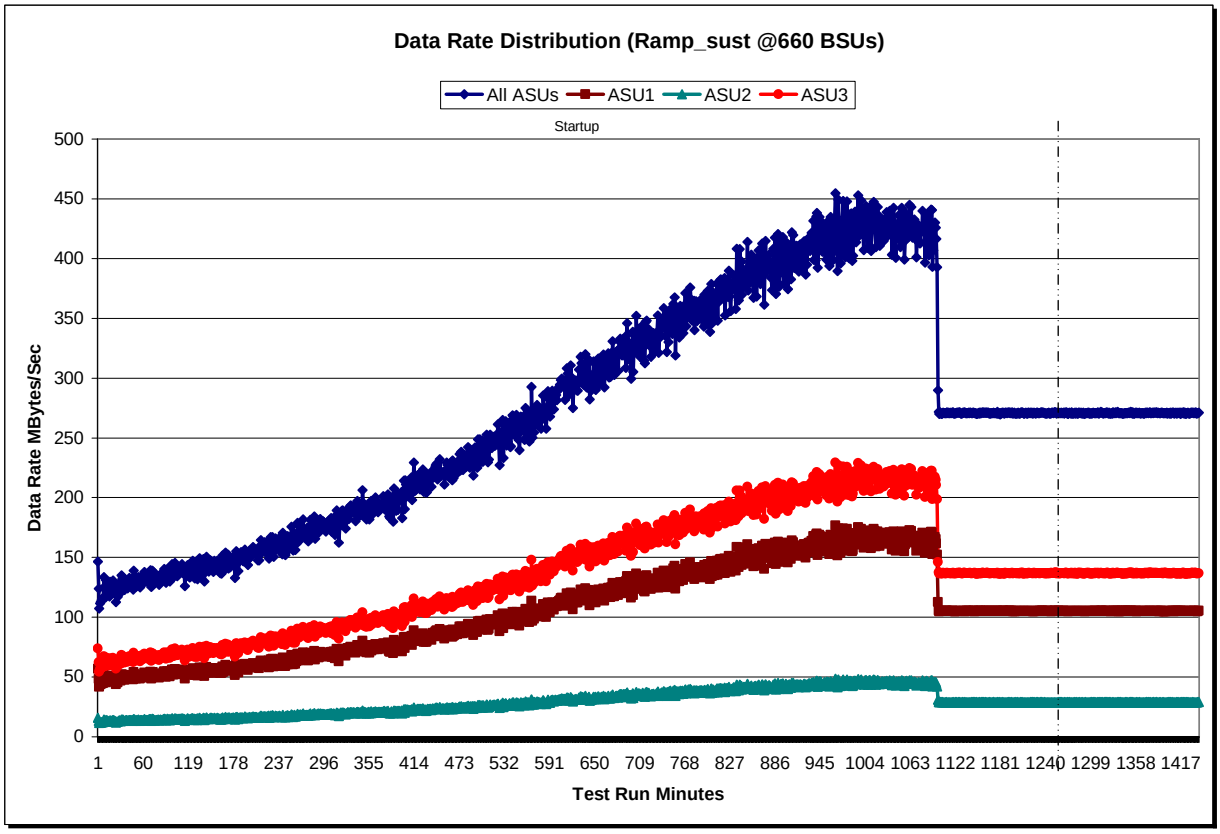
Sustainability Test Results File

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

The Sustainability Data Rate table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability Data Rate Table

Sustainability – Data Rate Distribution Graph

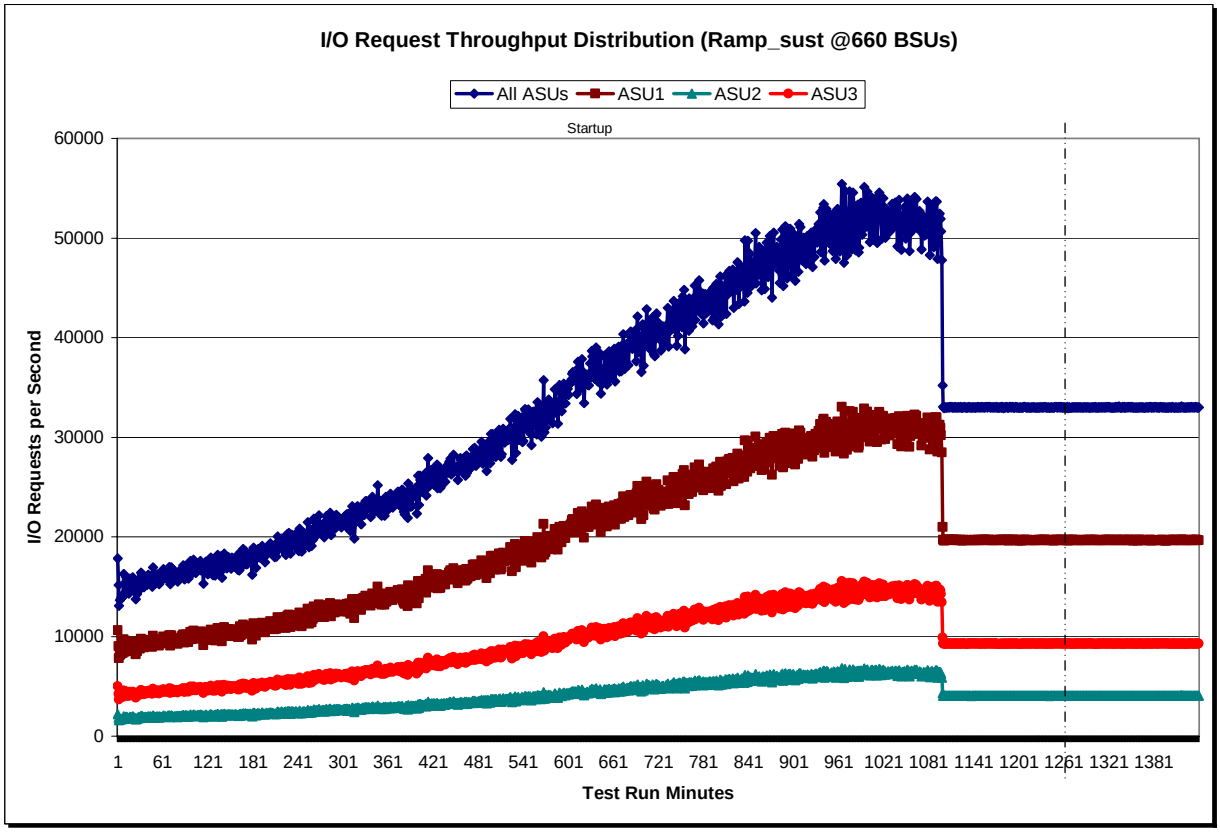


Sustainability – I/O Request Throughput Distribution Data

The Sustainability I/O Request Throughput table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability I/O Request Throughput Table

Sustainability – I/O Request Throughput Distribution Graph

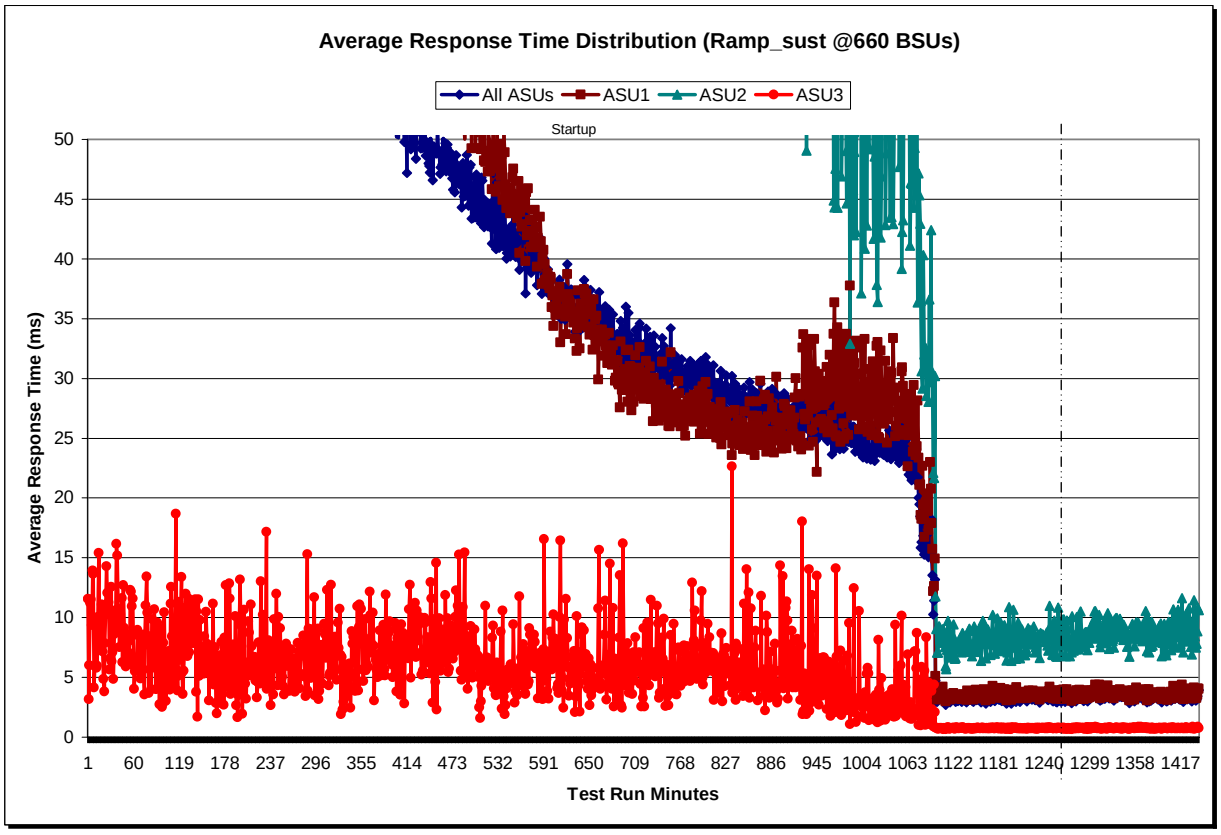


Sustainability – Average Response Time (ms) Distribution Data

The Sustainability Average Response Time table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability Average Response Time Table

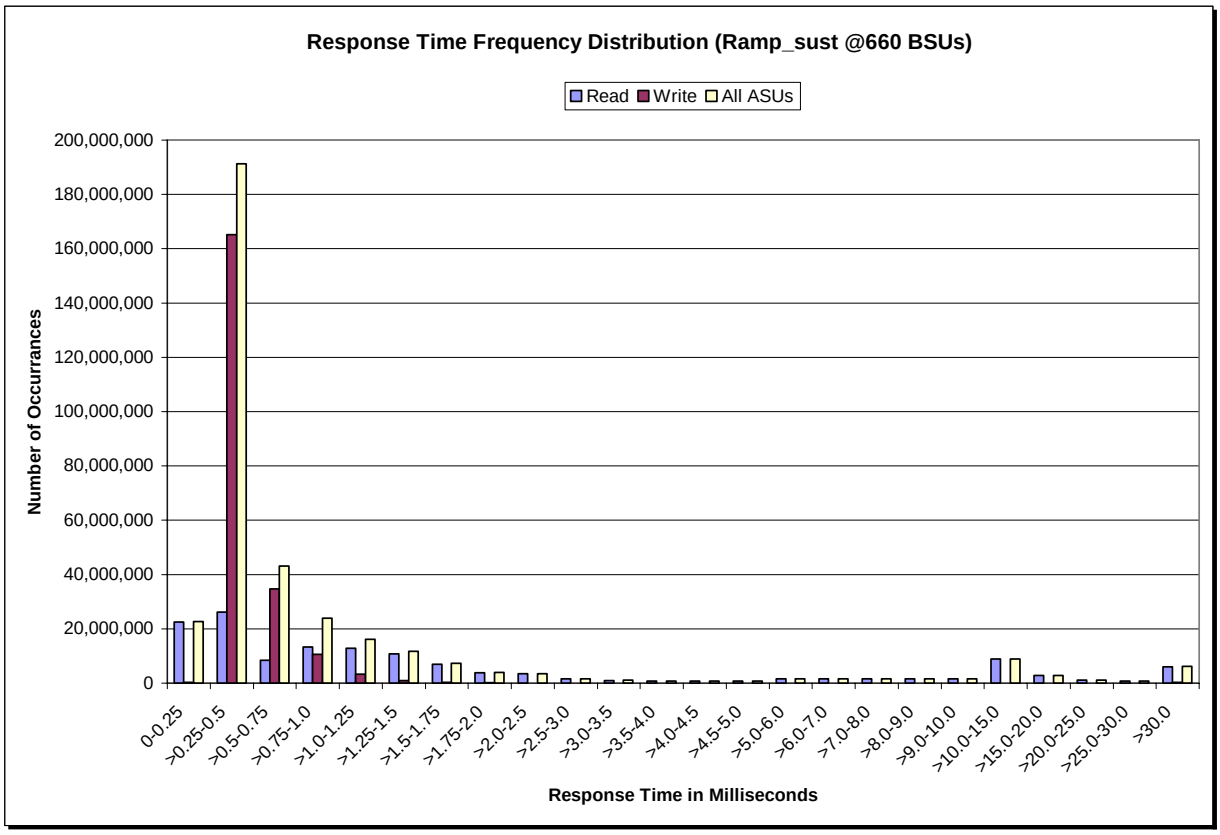
Sustainability – Average Response Time (ms) Distribution Graph



Sustainability – 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	22,436,197	26,131,727	8,377,398	13,267,702	12,791,448	10,823,537	6,953,400	3,856,668
Write	264,630	165,075,303	34,773,858	10,674,357	3,295,804	970,631	280,321	80,645
All ASUs	22,700,827	191,207,030	43,151,256	23,942,059	16,087,252	11,794,168	7,233,721	3,937,313
ASU1	18,643,897	97,035,042	18,214,524	15,666,244	12,845,810	10,411,281	6,614,999	3,652,375
ASU2	4,003,000	23,848,860	4,071,500	2,288,814	1,417,263	851,842	467,183	241,456
ASU3	53,930	70,323,128	20,865,232	5,987,001	1,824,179	531,045	151,539	43,482
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	3,442,660	1,536,706	1,028,769	860,011	796,699	773,654	1,521,037	1,547,669
Write	32,169	6,196	3,742	3,341	3,019	2,882	5,597	5,222
All ASUs	3,474,829	1,542,902	1,032,511	863,352	799,718	776,536	1,526,634	1,552,891
ASU1	3,247,526	1,448,775	972,266	815,907	757,357	735,480	1,438,352	1,447,047
ASU2	210,099	90,967	58,338	45,565	40,656	39,303	84,736	102,281
ASU3	17,204	3,160	1,907	1,880	1,705	1,753	3,546	3,563
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	1,582,129	1,514,505	1,575,848	8,867,789	2,885,675	1,160,279	835,829	5,976,214
Write	5,281	5,128	4,833	21,140	16,437	16,030	15,577	272,659
All ASUs	1,587,410	1,519,633	1,580,681	8,888,929	2,902,112	1,176,309	851,406	6,248,873
ASU1	1,459,481	1,367,106	1,394,578	7,573,771	1,939,746	691,346	499,201	3,514,937
ASU2	124,201	148,802	182,554	1,298,442	947,120	469,732	337,296	2,470,314
ASU3	3,728	3,725	3,549	16,716	15,246	15,231	14,909	263,622

Sustainability – Response Time Frequency Distribution Graph



Sustainability – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

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.*

Clauses 5.1.10 and 5.3.13.2

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%.*

Clause 5.3.13.3

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

	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	0.003	0.001	0.003	0.001	0.006	0.003	0.003	0.001

Primary Metrics Test – IOPS Test Phase

Clause 5.4.4.2

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 9.4.3.7.2

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, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in “Appendix E: SPC-1 Workload Generator Input Parameters” on Page 80.

IOPS Test Results File

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

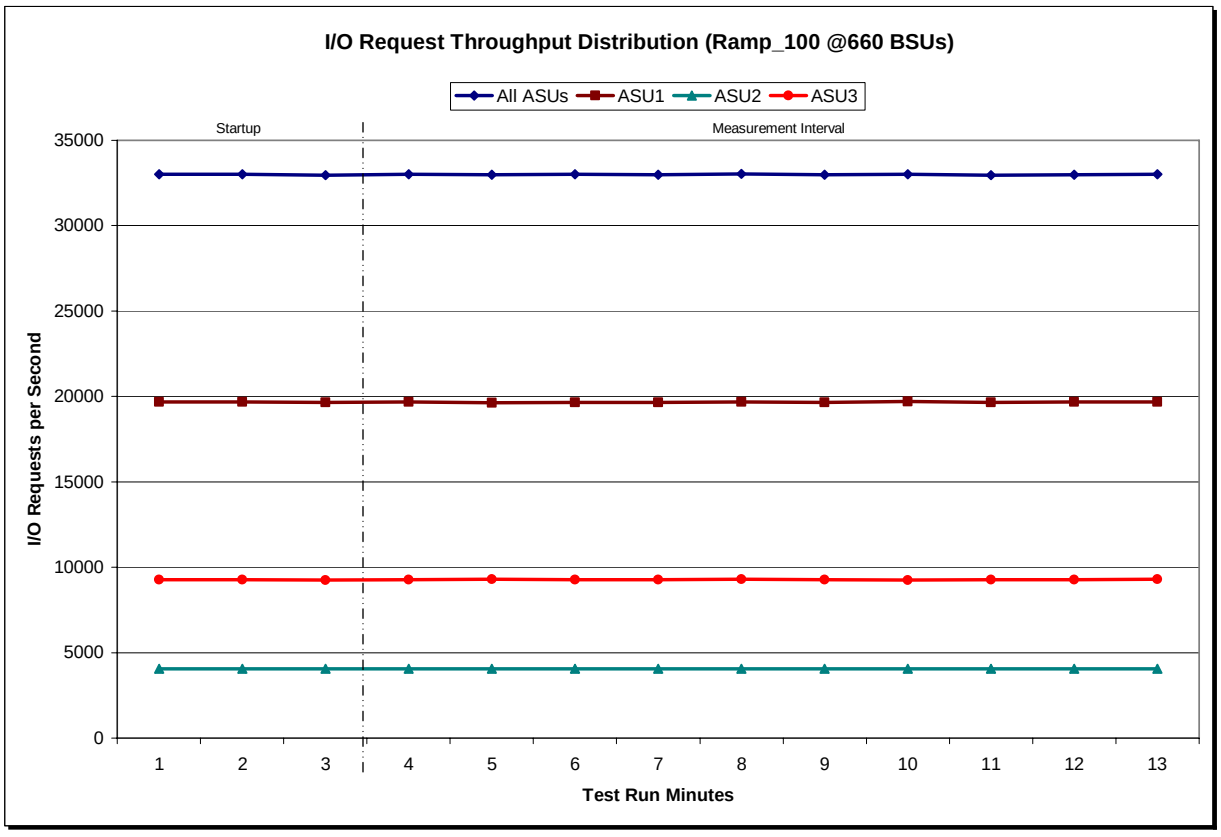
IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:05:24	20:08:24	0-2	0:03:00
Measurement Interval	20:08:24	20:18:24	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	32,999.60	19,670.45	4,048.05	9,281.10
1	33,009.55	19,676.68	4,047.95	9,284.92
2	32,968.53	19,653.82	4,056.68	9,258.03
3	33,007.72	19,676.18	4,061.57	9,269.97
4	32,993.12	19,635.68	4,064.10	9,293.33
5	33,010.42	19,663.88	4,068.17	9,278.37
6	32,979.95	19,648.23	4,057.42	9,274.30
7	33,027.95	19,668.05	4,056.27	9,303.63
8	32,985.32	19,649.38	4,067.13	9,268.80
9	33,007.68	19,698.28	4,056.15	9,253.25
10	32,971.42	19,661.37	4,049.12	9,260.93
11	32,983.57	19,670.48	4,047.58	9,265.50
12	33,015.23	19,672.08	4,053.35	9,289.80
Average	***32,998.24***	***19,664.36***	***4,058.09***	***9,275.79***

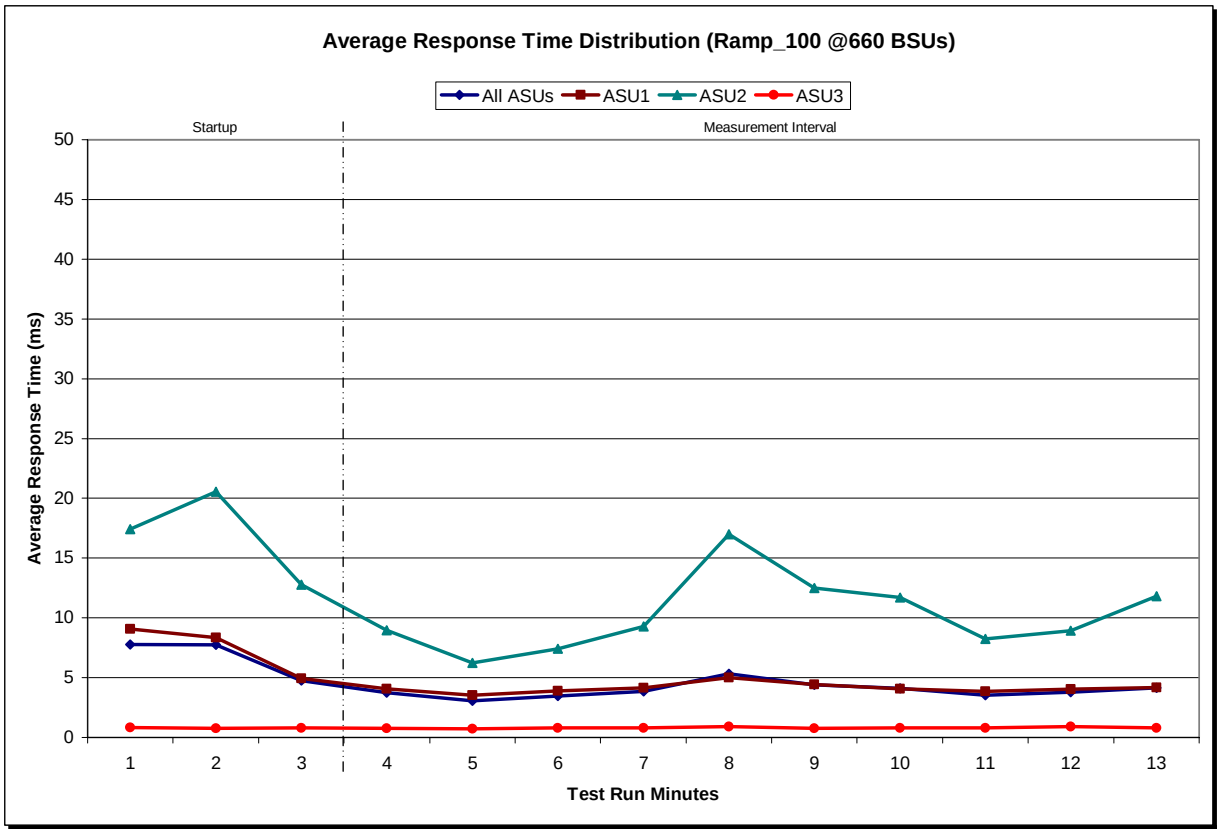
IOPS Test Run – I/O Request Throughput Distribution Graph



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

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:05:24	20:08:24	0-2	0:03:00
Measurement Interval	20:08:24	20:18:24	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	7.78	9.08	17.43	0.82
1	7.72	8.37	20.56	0.76
2	4.74	4.93	12.79	0.80
3	3.74	4.06	8.95	0.77
4	3.07	3.53	6.22	0.74
5	3.46	3.89	7.42	0.81
6	3.84	4.15	9.29	0.79
7	5.32	5.00	16.99	0.89
8	4.39	4.43	12.49	0.74
9	4.10	4.08	11.71	0.80
10	3.53	3.85	8.25	0.78
11	3.76	4.05	8.93	0.90
12	4.15	4.17	11.81	0.79
Average	***3.94***	***4.12***	***10.21***	***0.80***

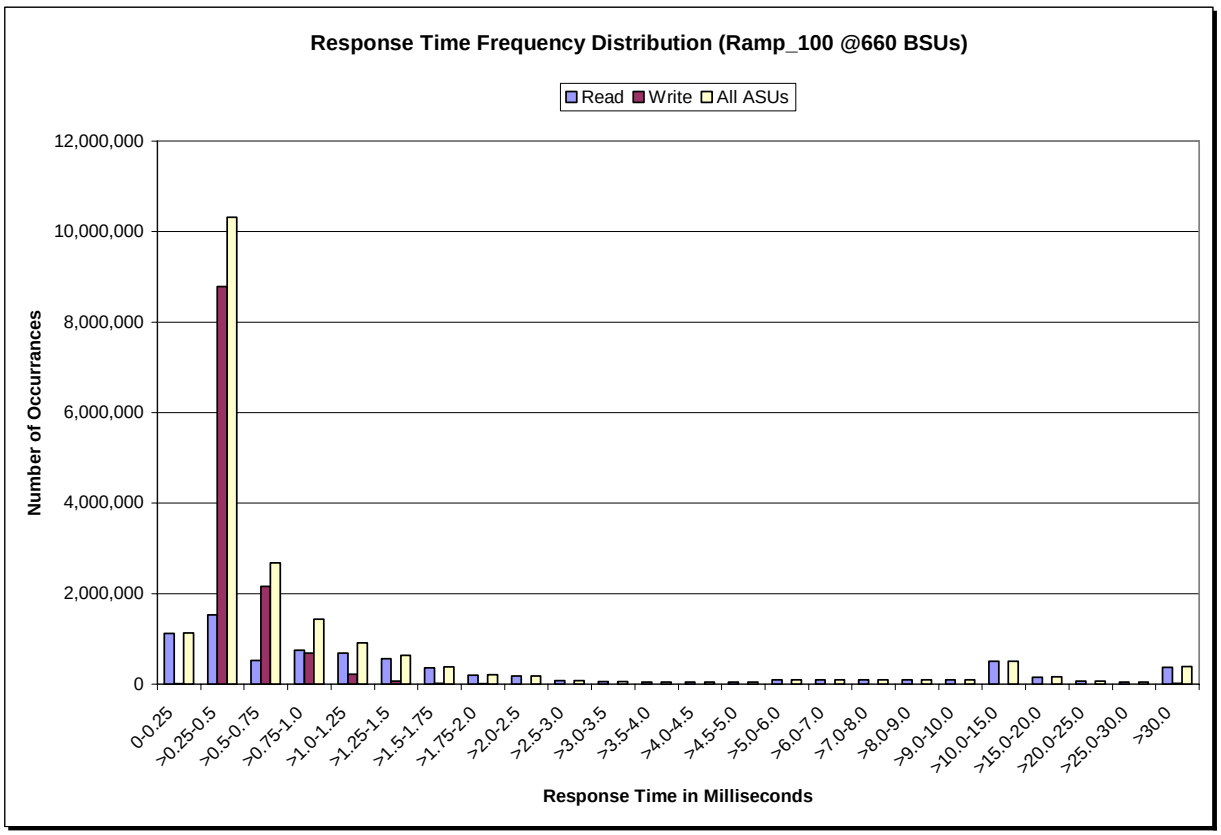
IOPS Test Run – Average Response Time (ms) Distribution Graph



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	1,117,920	1,528,624	520,415	750,884	687,118	564,345	363,572	200,722
Write	9,562	8,787,711	2,161,965	686,277	221,567	69,671	21,362	6,642
All ASUs	1,127,482	10,316,335	2,682,380	1,437,161	908,685	634,016	384,934	207,364
ASU1	931,967	5,306,669	1,147,587	913,400	703,027	546,853	347,302	190,789
ASU2	193,597	1,296,635	261,704	143,426	84,361	49,495	26,240	13,075
ASU3	1,918	3,713,031	1,273,089	380,335	121,297	37,668	11,392	3,500
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	177,566	80,054	57,049	50,987	48,556	47,343	94,151	94,592
Write	2,619	439	213	207	170	160	304	291
All ASUs	180,185	80,493	57,262	51,194	48,726	47,503	94,455	94,883
ASU1	167,782	75,786	54,408	48,781	46,613	45,397	89,953	89,398
ASU2	11,011	4,483	2,746	2,295	2,010	1,994	4,293	5,274
ASU3	1,392	224	108	118	103	112	209	211
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	95,031	90,547	92,446	503,973	156,273	64,455	47,892	372,868
Write	302	323	332	1,225	1,024	1,036	963	16,978
All ASUs	95,333	90,870	92,778	505,198	157,297	65,491	48,855	389,846
ASU1	88,548	82,818	83,026	437,031	107,813	39,545	29,487	224,519
ASU2	6,564	7,840	9,510	67,185	48,540	24,968	18,445	149,072
ASU3	221	212	242	982	944	978	923	16,255

IOPS Test Run –Response Time Frequency 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
19,798,726	19,408,880	389,846

IOPS Test Run – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

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.*

Clauses 5.1.10 and 5.3.13.2

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%.*

Clause 5.3.13.3

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

	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	0.2809	0.0701	0.2100	0.0180	0.0700	0.0350	0.2811
COV	0.003	0.001	0.003	0.002	0.005	0.003	0.003	0.001

Primary Metrics Test – Response Time Ramp Test Phase

Clause 5.4.4.3

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 13.

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

Clause 9.4.3.7.3

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, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 80.

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 - 660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:05:24	20:08:24	0-2	0:03:00
Measurement Interval	20:08:24	20:18:24	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	32,999.60	19,670.45	4,048.05	9,281.10
1	33,009.55	19,676.68	4,047.95	9,284.92
2	32,968.53	19,653.82	4,056.68	9,258.03
3	33,007.72	19,676.18	4,061.57	9,269.97
4	32,993.12	19,635.68	4,064.10	9,293.33
5	33,010.42	19,663.88	4,068.17	9,278.37
6	32,979.95	19,648.23	4,057.42	9,274.30
7	33,027.95	19,668.05	4,056.27	9,303.63
8	32,985.32	19,649.38	4,067.13	9,268.80
9	33,007.68	19,698.28	4,056.15	9,253.25
10	32,971.42	19,661.37	4,049.12	9,260.93
11	32,983.57	19,670.48	4,047.58	9,265.50
12	33,015.23	19,672.08	4,053.35	9,289.80
Average	32,998.24	19,664.36	4,058.09	9,275.79

95% Load Level - 627 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:18:42	20:21:42	0-2	0:03:00
Measurement Interval	20:21:42	20:31:42	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	31,370.98	18,682.82	3,858.28	8,829.88
1	31,362.53	18,705.20	3,838.97	8,818.37
2	31,364.88	18,691.38	3,856.75	8,816.75
3	31,326.98	18,666.10	3,850.63	8,810.25
4	31,311.52	18,650.32	3,838.63	8,822.57
5	31,346.65	18,689.18	3,847.95	8,809.52
6	31,339.22	18,673.83	3,863.18	8,802.20
7	31,341.57	18,690.00	3,856.85	8,794.72
8	31,334.90	18,666.88	3,862.52	8,805.50
9	31,333.05	18,685.15	3,847.50	8,800.40
10	31,352.32	18,682.55	3,849.82	8,819.95
11	31,347.62	18,669.07	3,858.55	8,820.00
12	31,323.70	18,683.32	3,855.45	8,784.93
Average	31,335.75	18,675.64	3,853.11	8,807.00

90% Load Level - 594 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:31:59	20:34:59	0-2	0:03:00
Measurement Interval	20:34:59	20:44:59	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	29,719.20	17,711.55	3,652.97	8,354.68
1	29,661.02	17,697.53	3,647.07	8,316.42
2	29,716.42	17,740.25	3,649.13	8,327.03
3	29,691.55	17,705.80	3,652.83	8,332.92
4	29,708.73	17,706.45	3,655.98	8,346.30
5	29,709.23	17,710.27	3,638.80	8,360.17
6	29,703.70	17,702.45	3,648.83	8,352.42
7	29,686.87	17,663.55	3,667.75	8,355.57
8	29,685.72	17,696.47	3,659.70	8,329.55
9	29,686.40	17,709.05	3,657.58	8,319.77
10	29,773.22	17,736.57	3,659.12	8,377.53
11	29,681.82	17,696.00	3,642.78	8,343.03
12	29,651.92	17,662.48	3,642.90	8,346.53
Average	29,697.92	17,698.91	3,652.63	8,346.38

80% Load Level - 528 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:45:17	20:48:17	0-2	0:03:00
Measurement Interval	20:48:17	20:58:17	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	26,409.80	15,744.15	3,234.60	7,431.05
1	26,403.68	15,740.53	3,242.02	7,421.13
2	26,397.15	15,736.75	3,247.72	7,412.68
3	26,373.55	15,726.53	3,250.03	7,396.98
4	26,371.62	15,703.15	3,259.77	7,408.70
5	26,430.00	15,752.93	3,258.27	7,418.80
6	26,397.90	15,736.28	3,240.17	7,421.45
7	26,401.33	15,731.25	3,258.57	7,411.52
8	26,371.32	15,721.63	3,247.73	7,401.95
9	26,394.10	15,720.70	3,244.83	7,428.57
10	26,391.02	15,741.63	3,239.57	7,409.82
11	26,414.20	15,745.60	3,245.90	7,422.70
12	26,397.77	15,736.45	3,240.85	7,420.47
Average	26,394.28	15,731.62	3,248.57	7,414.10

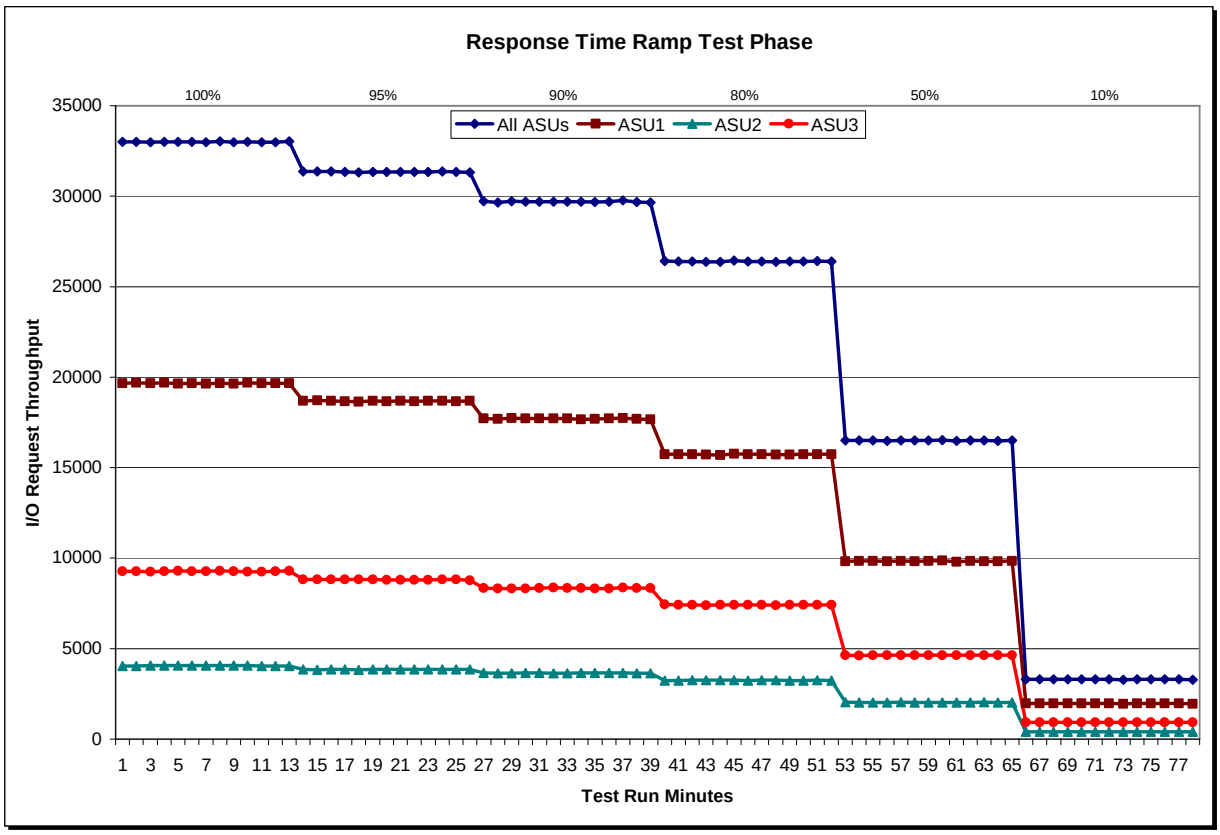
50% Load Level - 330 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:58:34	21:01:34	0-2	0:03:00
Measurement Interval	21:01:34	21:11:34	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	16,495.72	9,815.38	2,039.60	4,640.73
1	16,491.30	9,837.47	2,031.27	4,622.57
2	16,499.13	9,846.80	2,025.15	4,627.18
3	16,486.13	9,826.50	2,031.67	4,627.97
4	16,497.58	9,833.60	2,033.38	4,630.60
5	16,493.65	9,826.87	2,026.02	4,640.77
6	16,504.97	9,834.70	2,029.62	4,640.65
7	16,527.60	9,857.48	2,026.43	4,643.68
8	16,466.28	9,804.83	2,031.28	4,630.17
9	16,498.97	9,840.32	2,022.70	4,635.95
10	16,499.87	9,826.63	2,033.90	4,639.33
11	16,467.45	9,812.82	2,022.53	4,632.10
12	16,494.83	9,846.28	2,020.77	4,627.78
Average	16,493.73	9,831.00	2,027.83	4,634.90

10% Load Level - 66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	17:27:52	17:30:52	0-2	0:03:00
Measurement Interval	17:30:52	17:40:55	3-12	0:10:03

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	3,299.92	1,968.52	405.00	926.40
1	3,298.18	1,965.77	404.30	928.12
2	3,303.30	1,968.27	408.02	927.02
3	3,302.67	1,970.95	405.17	926.55
4	3,306.80	1,969.40	406.98	930.42
5	3,301.23	1,966.93	408.67	925.63
6	3,308.60	1,976.77	404.17	927.67
7	3,288.97	1,960.02	406.17	922.78
8	3,308.52	1,967.53	406.75	934.23
9	3,305.75	1,970.33	409.87	925.55
10	3,303.05	1,974.72	404.72	923.62
11	3,310.77	1,973.38	407.28	930.10
12	3,288.95	1,958.63	408.53	921.78
Average	3,302.53	1,968.87	406.83	926.83

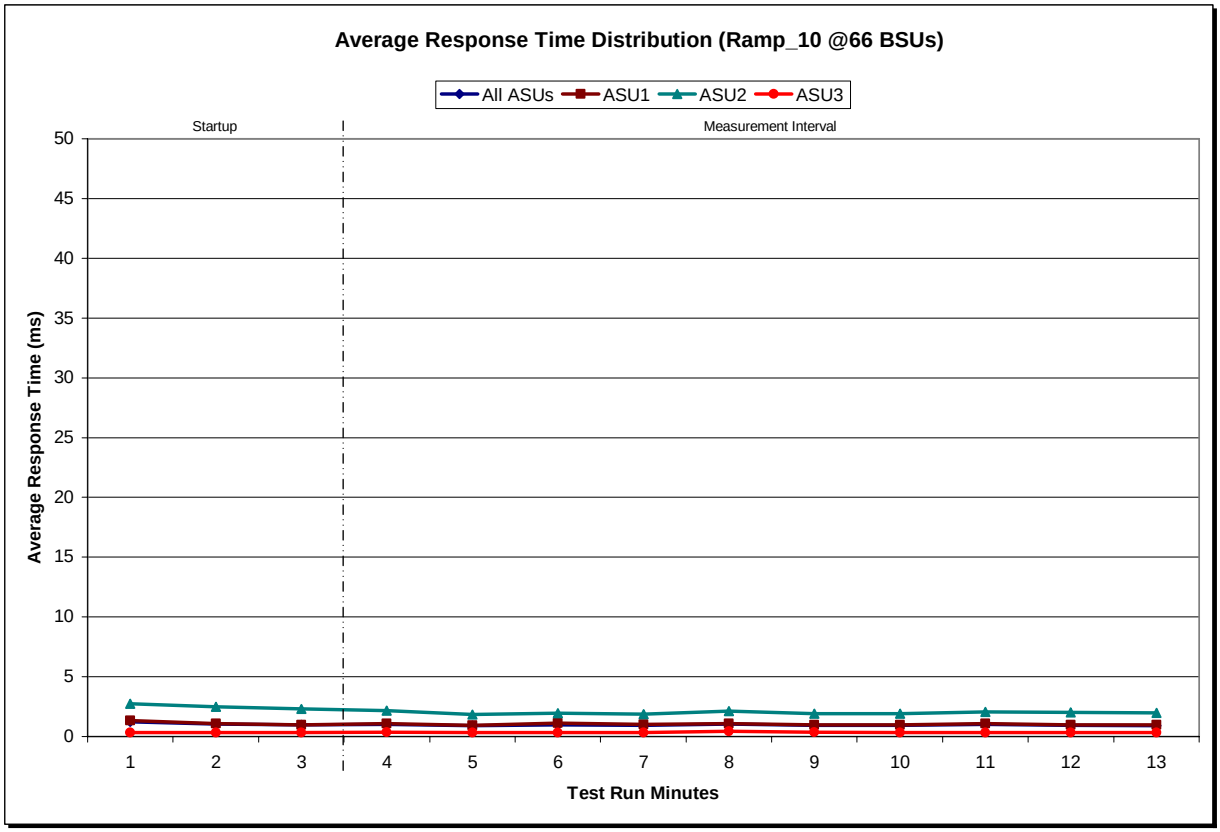
Response Time Ramp Distribution (IOPS) Graph



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

66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:11:51	21:14:51	0-2	0:03:00
Measurement Interval	21:14:51	21:24:51	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.22	1.33	2.73	0.34
1	1.04	1.08	2.47	0.34
2	0.96	0.97	2.32	0.34
3	1.01	1.08	2.16	0.36
4	0.89	0.95	1.83	0.34
5	0.99	1.10	1.95	0.34
6	0.92	1.01	1.86	0.34
7	1.03	1.08	2.11	0.45
8	0.92	0.99	1.90	0.34
9	0.92	0.99	1.90	0.34
10	1.00	1.10	2.04	0.34
11	0.94	0.99	2.03	0.34
12	0.91	0.96	1.99	0.34
Average	***0.95***	***1.02***	***1.98***	***0.35***

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



SPC-1 LRT™ (10%) – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

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.*

Clauses 5.1.10 and 5.3.13.2

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%.*

Clause 5.3.13.3

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

	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	0.0348	0.2812	0.0702	0.2100	0.0179	0.0704	0.0349	0.2806
COV	0.014	0.003	0.008	0.003	0.015	0.007	0.013	0.003

Repeatability Test

Clause 5.4.5

The Repeatability Test demonstrates the repeatability and reproducibility of the SPC-1 IOPS™ primary metric and SPC-1 LRT™ metric 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™ metric. Each Average Response Time value must be less than the SPC-1 LRT™ metric plus 5% or less than the SPC-1 LRT™ metric plus one (1) millisecond (ms).

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 9.4.3.7.4

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 Repeatability Test.*
2. *An I/O Request Throughput Distribution graph and table.*
3. *An Average Response Time Distribution graph and table.*
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 Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 80.

Repeatability Test Results File

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

	SPC-1 IOPS™
Primary Metrics	***32,998.24***
Repeatability Test Phase 1	32,998.67
Repeatability Test Phase 2	33,005.81

The SPC-1 IOPS™ values in the above table were generated using 100% of the specified Business Scaling Unit (BSU) load level. Each of the Repeatability Test Phase values for SPC-1 IOPS™ must greater than 95% of the reported SPC-1 IOPS™ Primary Metric.

	SPC-1 LRT™
Primary Metrics	***0.95 ms***
Repeatability Test Phase 1	0.88 ms
Repeatability Test Phase 2	0.97 ms

The average response time values in the SPC-1 LRT™ column were generated using 10% of the specified Business Scaling Unit (BSU) load level. Each of the Repeatability Test Phase values for SPC-1 LRT™ must be less than 105% of the reported SPC-1 LRT™ Primary Metric or less than the reported SPC-1 LRT™ Primary Metric minus one (1) millisecond (ms)..

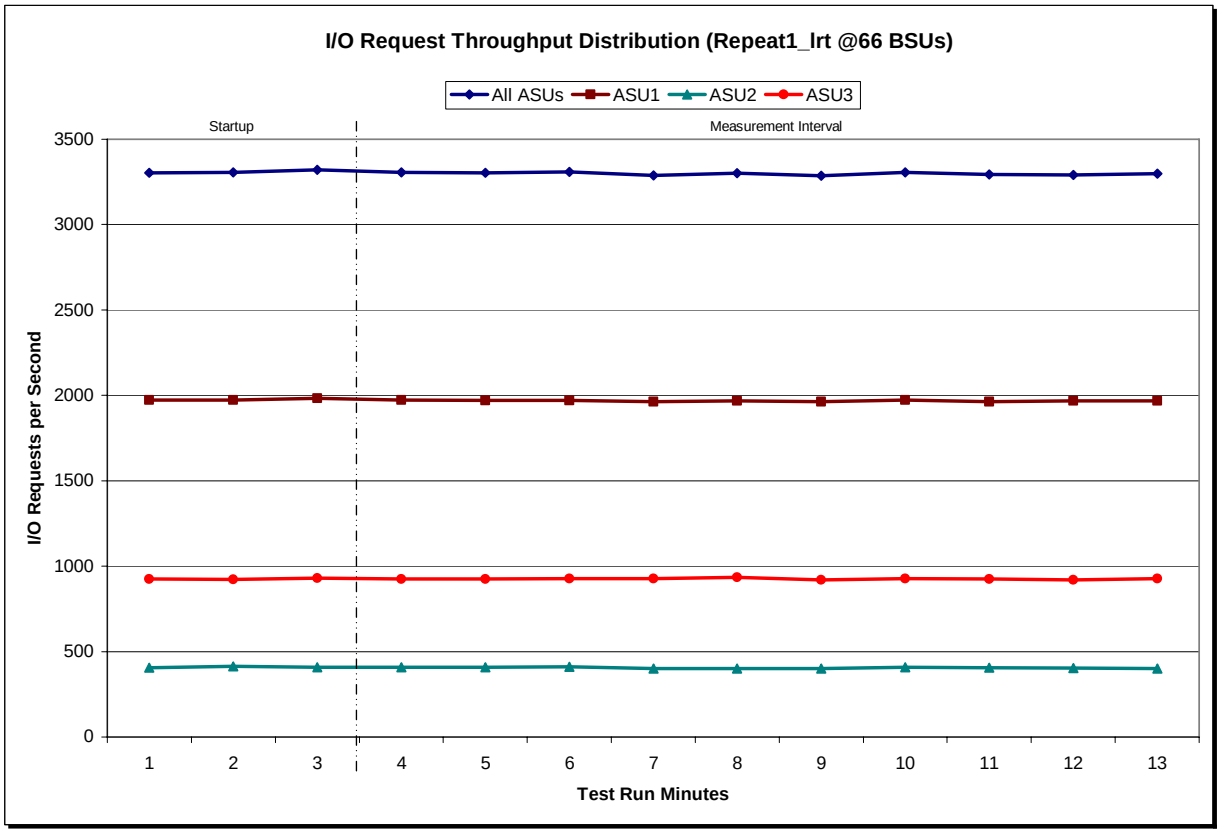
A link to the test result file generated from each Repeatability Test Run is listed below.

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

66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:25:07	21:28:07	0-2	0:03:00
Measurement Interval	21:28:07	21:38:07	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	3,302.35	1,973.57	404.95	923.83
1	3,306.83	1,972.33	412.15	922.35
2	3,319.97	1,982.15	407.63	930.18
3	3,306.73	1,973.23	407.55	925.95
4	3,304.07	1,970.93	407.25	925.88
5	3,309.48	1,971.42	410.52	927.55
6	3,288.18	1,962.17	399.95	926.07
7	3,301.33	1,967.07	400.62	933.65
8	3,285.03	1,963.28	401.25	920.50
9	3,307.08	1,973.18	407.17	926.73
10	3,292.58	1,962.03	405.73	924.82
11	3,292.10	1,967.58	403.63	920.88
12	3,299.33	1,969.17	401.72	928.45
Average	***3,298.59***	***1,968.01***	***404.54***	***926.05***

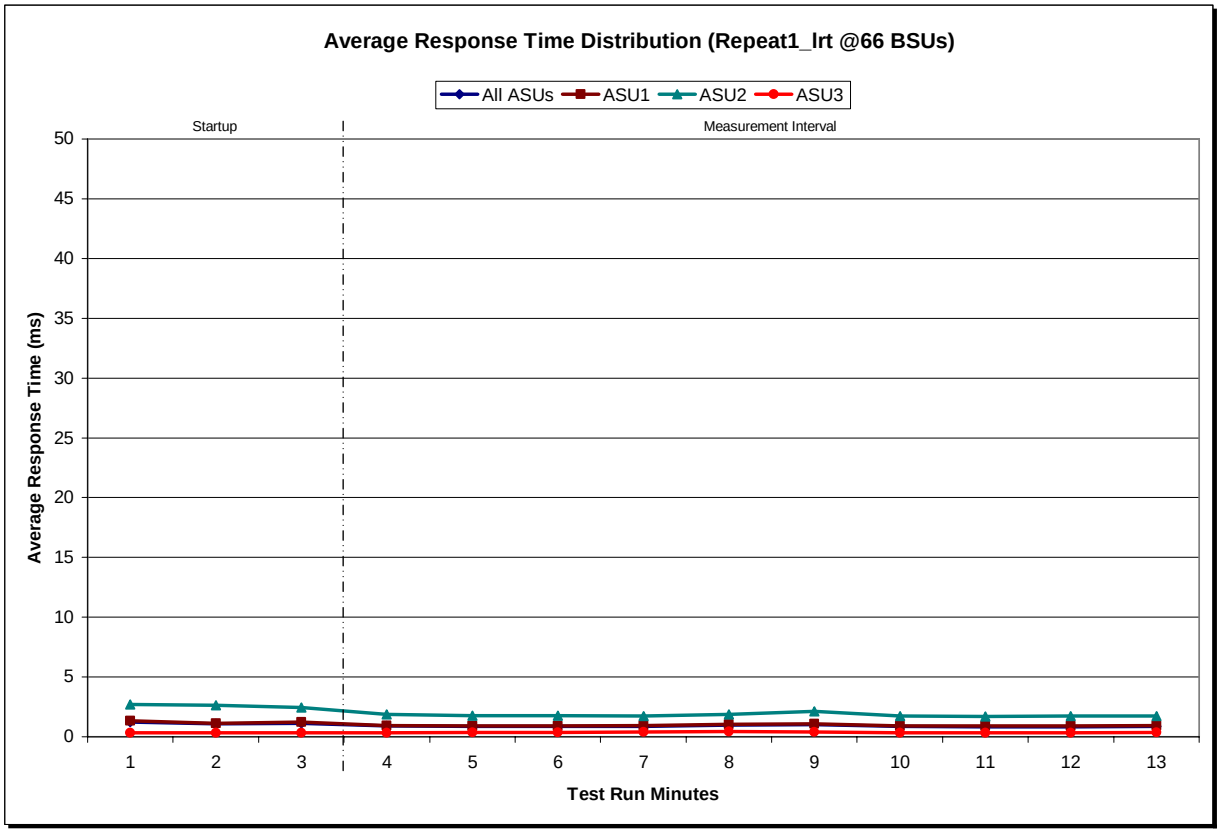
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



Repeatability 1 LRT –Average Response Time (ms) Distribution Data

66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:25:07	21:28:07	0-2	0:03:00
Measurement Interval	21:28:07	21:38:07	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.22	1.33	2.69	0.34
1	1.09	1.12	2.64	0.34
2	1.12	1.21	2.44	0.34
3	0.88	0.93	1.87	0.34
4	0.85	0.90	1.77	0.34
5	0.86	0.92	1.77	0.34
6	0.87	0.92	1.73	0.39
7	0.97	1.05	1.88	0.42
8	1.01	1.08	2.14	0.38
9	0.85	0.91	1.71	0.34
10	0.83	0.89	1.70	0.34
11	0.84	0.90	1.73	0.34
12	0.86	0.93	1.74	0.34
Average	***0.88***	***0.94***	***1.80***	***0.36***

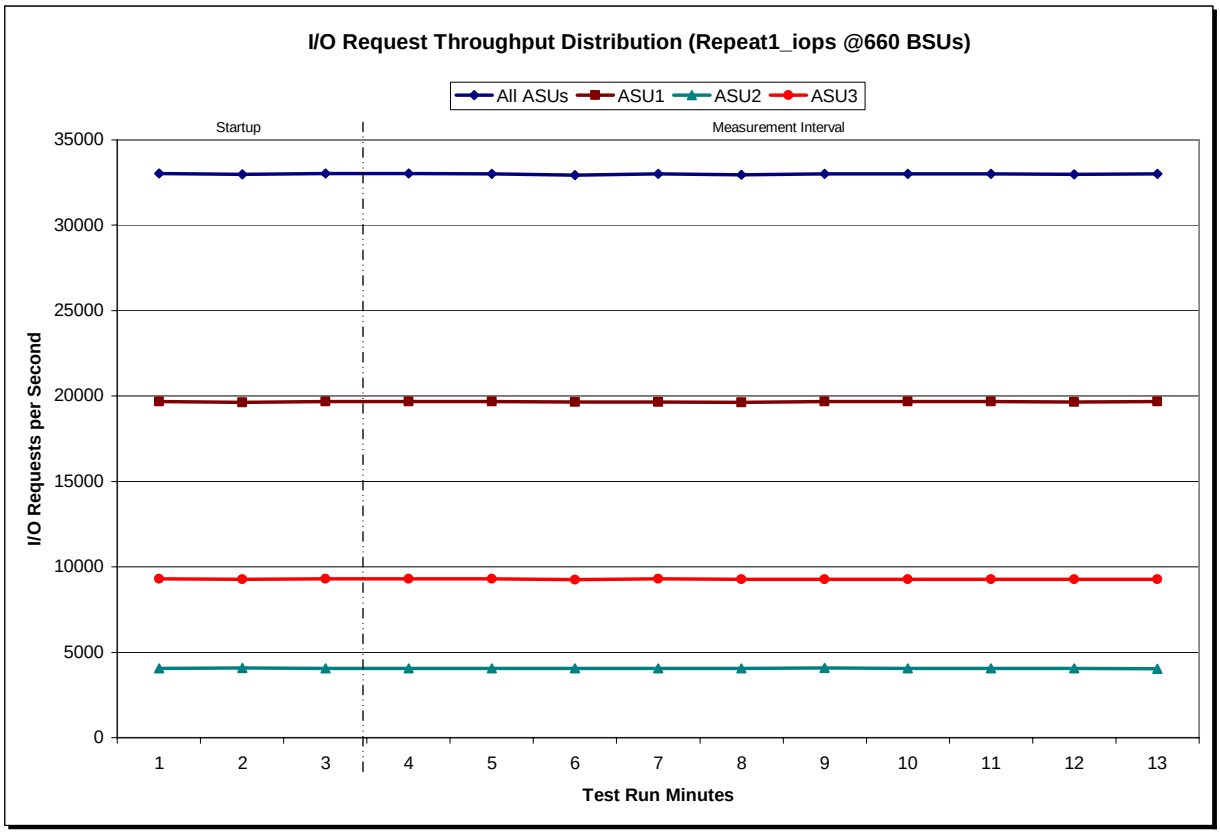
Repeatability 1 LRT –Average Response Time (ms) Distribution Graph



Repeatability 1 IOPS – I/O Request Throughput Distribution Data

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:38:16	21:41:17	0-2	0:03:01
Measurement Interval	21:41:17	21:51:17	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	33,033.25	19,683.60	4,057.53	9,292.12
1	32,978.75	19,630.18	4,072.42	9,276.15
2	33,033.95	19,671.78	4,060.03	9,302.13
3	33,023.98	19,667.67	4,064.72	9,291.60
4	33,021.18	19,677.07	4,056.47	9,287.65
5	32,944.50	19,644.52	4,045.03	9,254.95
6	33,015.72	19,659.25	4,058.80	9,297.67
7	32,955.40	19,632.20	4,060.28	9,262.92
8	33,017.55	19,675.10	4,070.33	9,272.12
9	33,012.57	19,672.10	4,059.12	9,281.35
10	33,017.30	19,691.63	4,055.25	9,270.42
11	32,981.58	19,649.20	4,056.83	9,275.55
12	32,996.95	19,686.68	4,043.42	9,266.85
Average	***32,998.67***	***19,665.54***	***4,057.03***	***9,276.11***

Repeatability 1 IOPS – I/O Request Throughput Distribution Graph

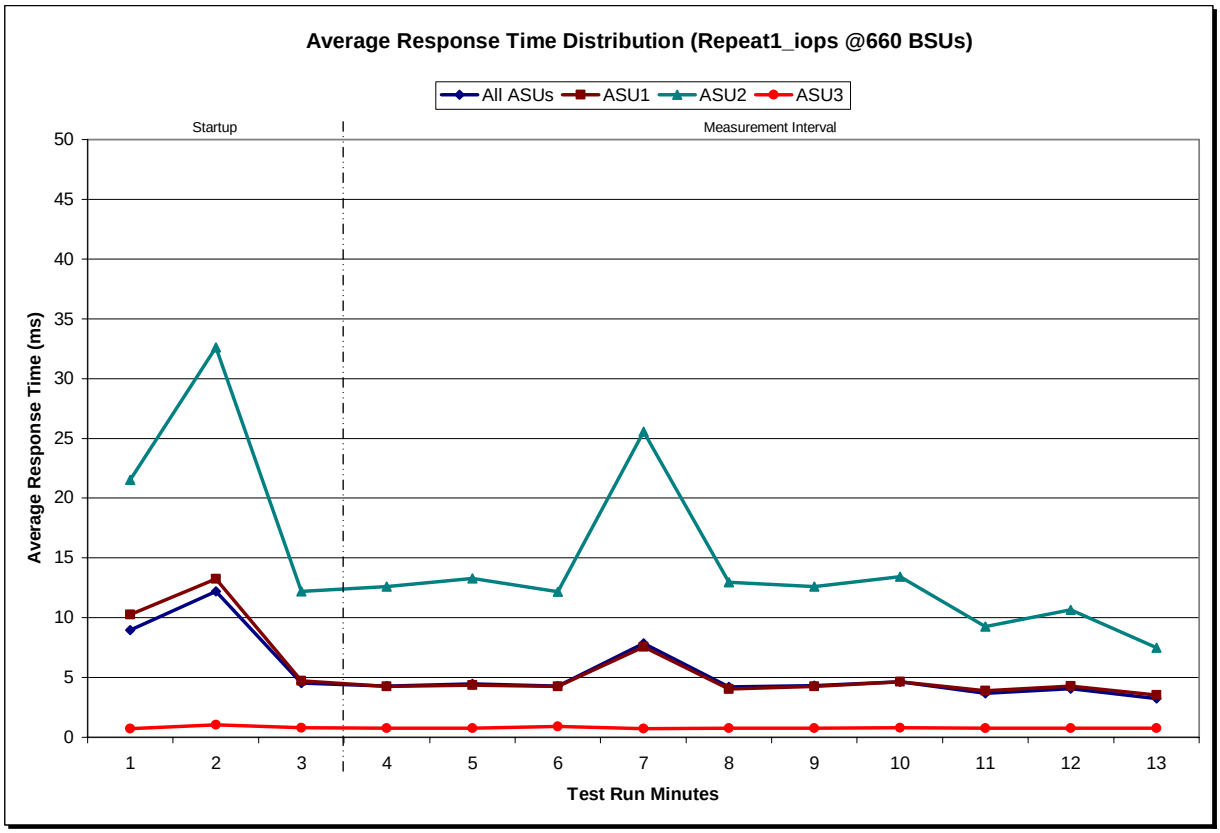


Repeatability 1 IOPS –Average Response Time (ms) Distribution Data

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:38:16	21:41:17	0-2	0:03:01
Measurement Interval	21:41:17	21:51:17	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	8.97	10.26	21.52	0.73
1	12.21	13.26	32.61	1.04
2	4.52	4.70	12.20	0.80
3	4.30	4.25	12.61	0.76
4	4.45	4.37	13.28	0.77
5	4.29	4.26	12.18	0.89
6	7.85	7.56	25.55	0.73
7	4.22	4.04	12.97	0.76
8	4.30	4.26	12.58	0.75
9	4.63	4.63	13.42	0.79
10	3.67	3.90	9.26	0.76
11	4.08	4.30	10.65	0.76
12	3.24	3.52	7.49	0.77
Average	***4.50***	***4.51***	***13.00***	***0.77***

Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph

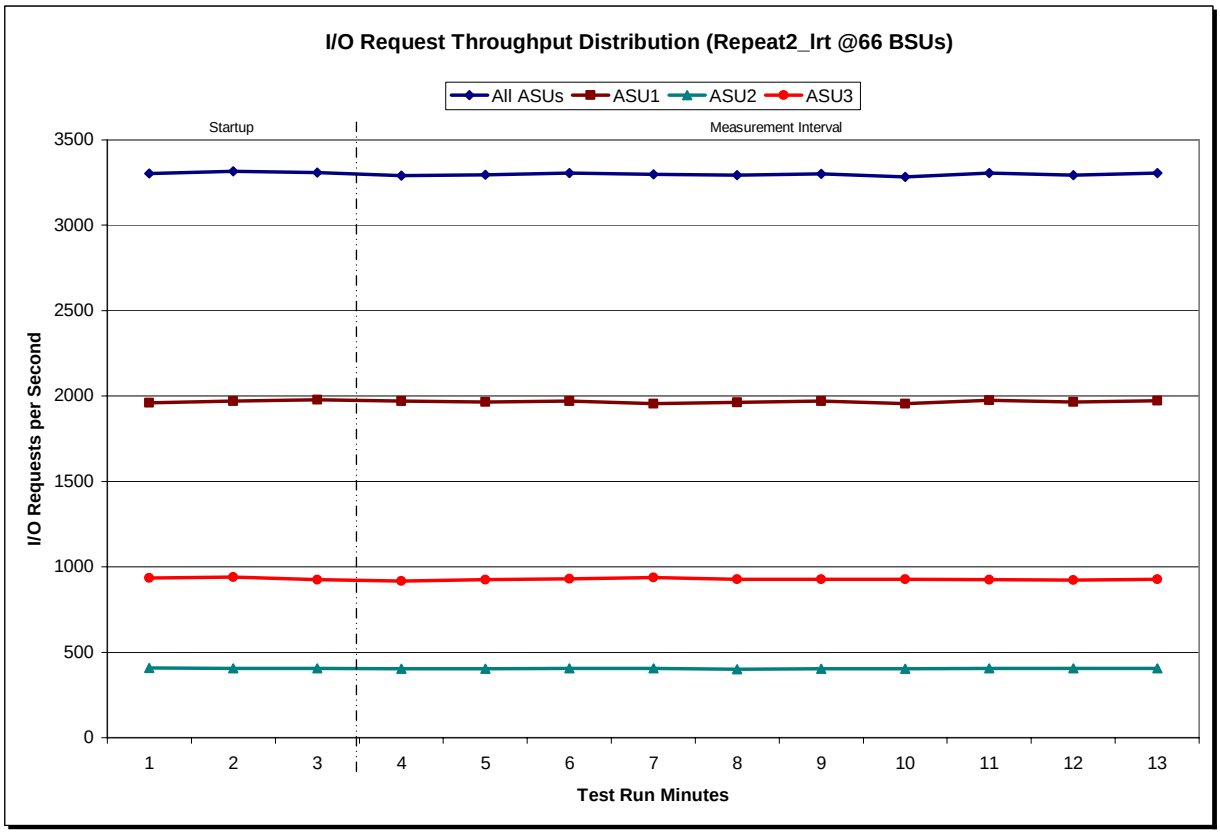


Repeatability 2 LRT – I/O Request Throughput Distribution Data

66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:51:33	21:54:33	0-2	0:03:00
Measurement Interval	21:54:33	22:04:33	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	3,304.25	1,961.15	409.27	933.83
1	3,315.33	1,970.38	404.50	940.45
2	3,307.28	1,977.43	405.65	924.20
3	3,290.80	1,969.27	403.22	918.32
4	3,294.93	1,966.40	403.58	924.95
5	3,304.87	1,969.98	406.10	928.78
6	3,299.08	1,955.23	406.82	937.03
7	3,292.15	1,962.63	401.07	928.45
8	3,300.20	1,969.43	403.10	927.67
9	3,283.18	1,954.13	402.43	926.62
10	3,305.03	1,975.13	404.63	925.27
11	3,292.48	1,964.55	406.75	921.18
12	3,306.52	1,973.40	405.82	927.30
Average	***3,296.93***	***1,966.02***	***404.35***	***926.56***

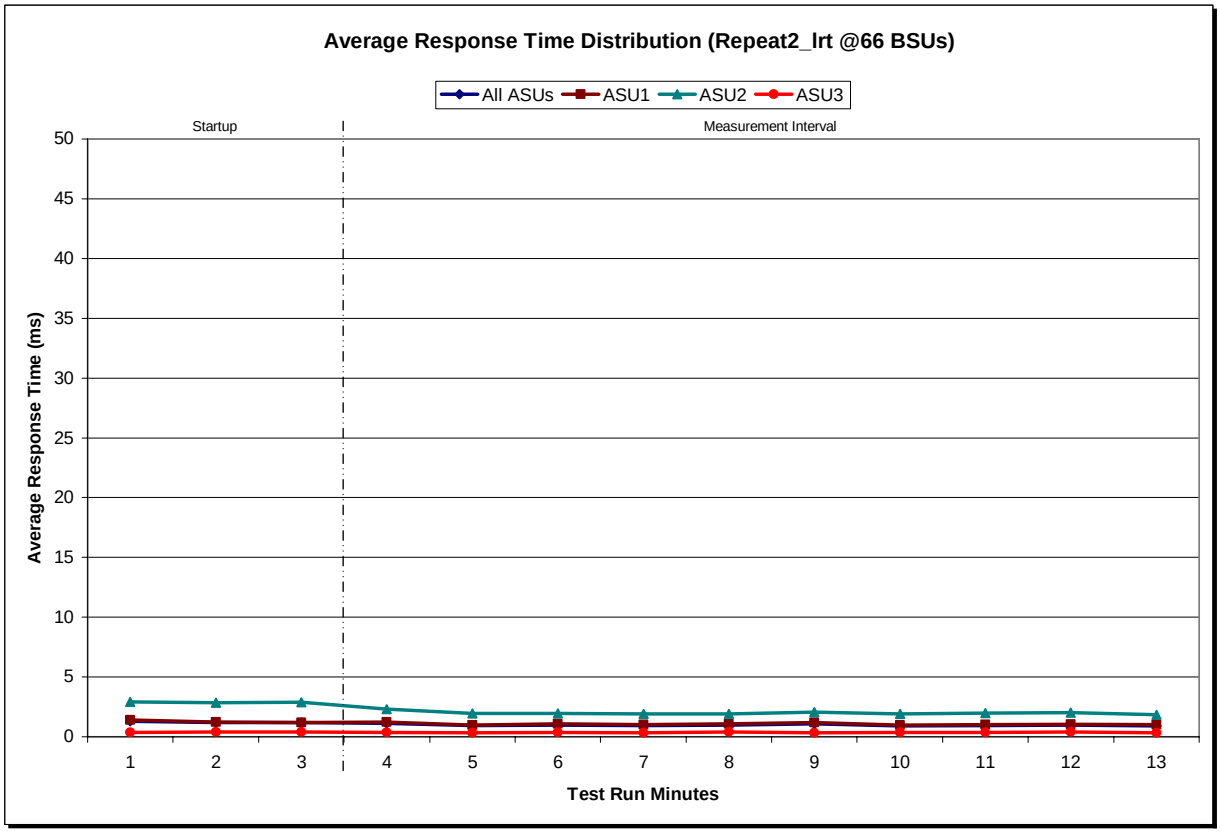
Repeatability 2 LRT – I/O Request Throughput Distribution Graph



Repeatability 2 LRT –Average Response Time (ms) Distribution Data

66 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:51:33	21:54:33	0-2	0:03:00
Measurement Interval	21:54:33	22:04:33	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.30	1.42	2.92	0.35
1	1.17	1.21	2.84	0.38
2	1.18	1.20	2.88	0.41
3	1.11	1.23	2.30	0.34
4	0.92	0.99	1.94	0.34
5	0.97	1.06	1.93	0.37
6	0.93	1.01	1.91	0.34
7	0.97	1.07	1.90	0.38
8	1.07	1.21	2.07	0.34
9	0.91	0.97	1.89	0.35
10	0.95	1.02	1.97	0.35
11	0.97	1.04	2.00	0.39
12	0.92	1.00	1.84	0.34
Average	***0.97***	***1.06***	***1.97***	***0.35***

Repeatability 2 LRT –Average Response Time (ms) Distribution Graph

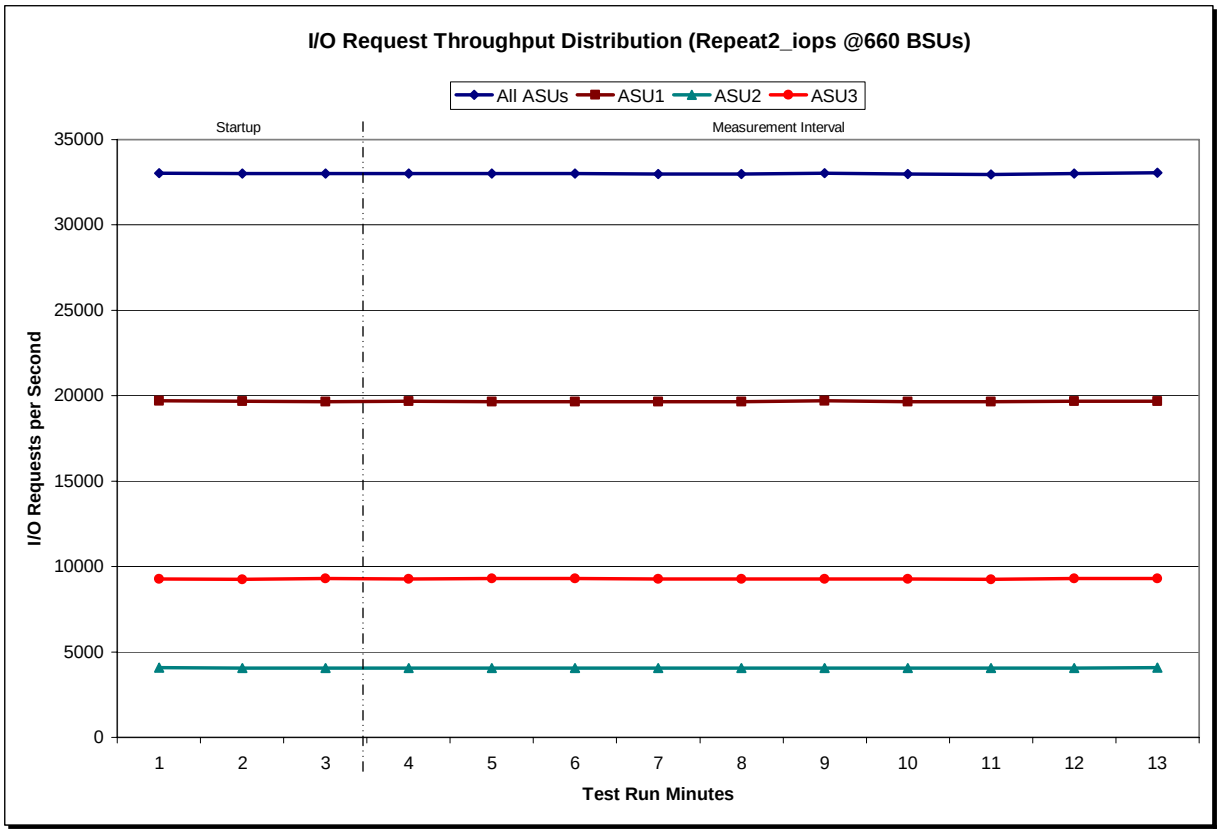


Repeatability 2 IOPS – I/O Request Throughput Distribution Data

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:04:42	22:07:43	0-2	0:03:01
Measurement Interval	22:07:43	22:17:43	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	33,038.43	19,692.70	4,069.58	9,276.15
1	33,001.05	19,690.98	4,053.13	9,256.93
2	33,019.10	19,665.58	4,063.52	9,290.00
3	33,001.05	19,670.62	4,050.75	9,279.68
4	32,998.68	19,642.80	4,061.90	9,293.98
5	33,020.00	19,660.15	4,062.75	9,297.10
6	32,993.80	19,652.83	4,068.12	9,272.85
7	32,983.43	19,660.73	4,056.43	9,266.27
8	33,043.25	19,700.03	4,065.98	9,277.23
9	32,986.13	19,662.43	4,058.82	9,264.88
10	32,966.62	19,665.25	4,053.55	9,247.82
11	33,015.27	19,674.68	4,053.75	9,286.83
12	33,049.88	19,683.17	4,078.88	9,287.83
Average	***33,005.81***	***19,667.27***	***4,061.09***	***9,277.45***

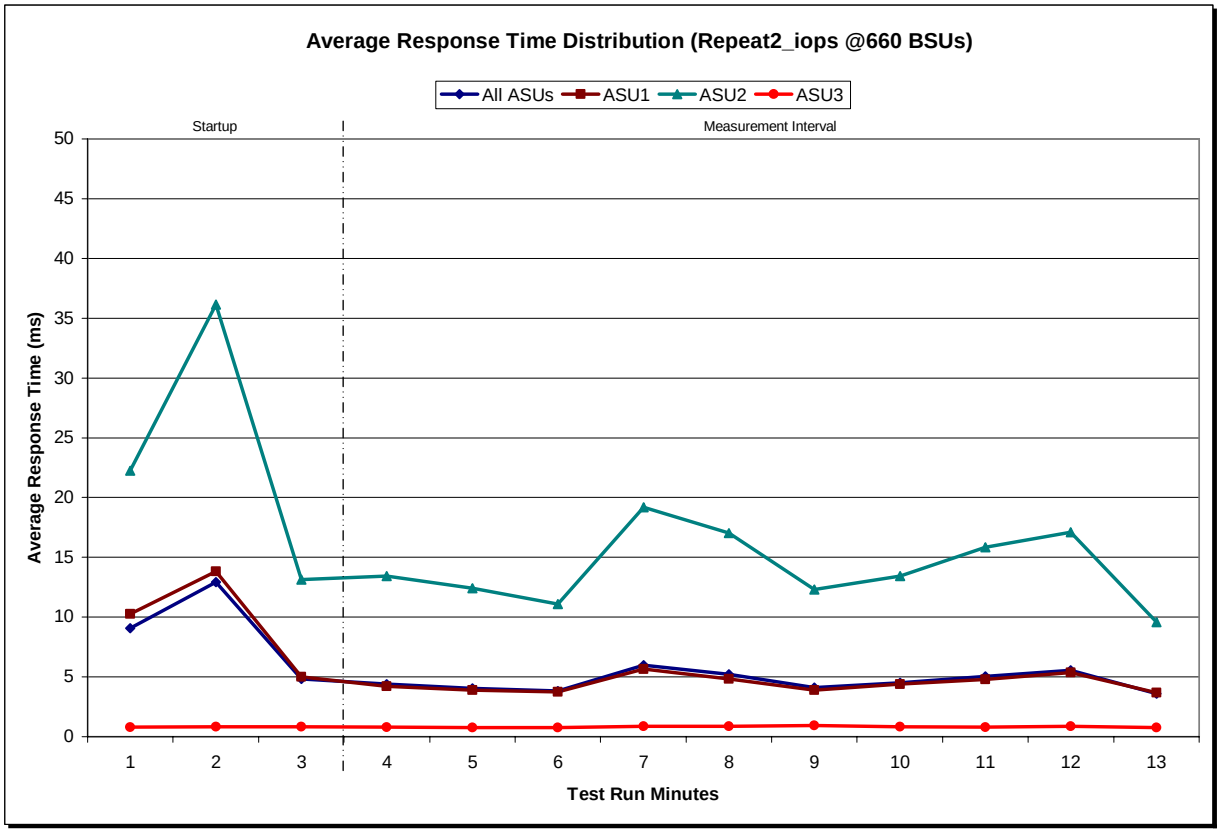
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



Repeatability 2 IOPS –Average Response Time (ms) Distribution Data

660 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:04:42	22:07:43	0-2	0:03:01
Measurement Interval	22:07:43	22:17:43	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	9.07	10.26	22.26	0.78
1	12.92	13.83	36.13	0.81
2	4.83	5.01	13.14	0.82
3	4.39	4.22	13.43	0.79
4	4.05	3.88	12.42	0.76
5	3.82	3.76	11.09	0.76
6	5.97	5.66	19.19	0.85
7	5.22	4.83	17.02	0.87
8	4.09	3.88	12.31	0.94
9	4.50	4.38	13.42	0.83
10	5.03	4.79	15.84	0.81
11	5.55	5.38	17.09	0.88
12	3.58	3.68	9.56	0.76
Average	***4.62***	***4.44***	***14.14***	***0.82***

Repeatability 2 IOPS –Average Response Time (ms) Distribution Graph



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

Clause 3.4.3

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.*

Clauses 5.1.10 and 5.3.13.2

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%.*

Clause 5.3.13.3

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

	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	0.2811	0.0700	0.2104	0.0179	0.0700	0.0348	0.2807
COV	0.007	0.002	0.010	0.004	0.023	0.010	0.012	0.003

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	0.2810	0.0700	0.2100	0.0180	0.0699	0.0350	0.2811
COV	0.004	0.001	0.002	0.001	0.004	0.002	0.004	0.001

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	0.0352	0.2813	0.0696	0.2102	0.0180	0.0698	0.0348	0.2810
COV	0.011	0.003	0.011	0.006	0.016	0.004	0.011	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	0.2811	0.0699	0.2098	0.0180	0.0701	0.0350	0.2811
COV	0.004	0.001	0.002	0.002	0.006	0.002	0.004	0.001

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 IOPS™ 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 Tested Storage Configuration (TSC) 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 9.4.3.8

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 Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 80.

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	336,315
Total Number of Logical Blocks Verified	334,558
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks	5 minutes
Size in Bytes of each Logical Block	1024
Number of Failed I/O Requests in the process of the Test	0

If approved by the SPC Auditor, the SPC-2 Persistence Test may be used to meet the SPC-1 persistence requirements. Both the SPC-1 and SPC-2 Persistence Tests provide the same level of functionality and verification of data integrity. The SPC-2 Persistence Test may be easily configured to address an SPC-1 storage configuration. The SPC-2 Persistence Test extends the size of storage configurations that may be tested and significantly reduces the test duration of such configurations.

The SPC-2 Persistence Test was approved for use in this set of audited measurements.

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 for the Priced Storage Configuration must be the date at which all components are committed to be available.

The IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs)* as documented in this Full Disclosure Report will becom availabile on May 21, 2010 for customer purchase and shipment.

PRICING INFORMATION

Clause 9.4.3.3.6

The Executive Summary shall contain a pricing spreadsheet as documented in Clause 8.3.1.

Pricing information may found in the Priced Storage Configuration Pricing section on page 14.

TESTED STORAGE CONFIGURATION (TSC) AND PRICED STORAGE CONFIGURATION DIFFERENCES

Clause 9.4.3.3.7

The Executive Summary shall contain a pricing a list of all differenced between the Tested Storage Configuration (TSC) and the Priced Storage Configuration.

A list of all differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration may be found in the Executive Summary portion of this document on page 14.

ANOMALIES OR IRREGULARITIES

Clause 9.4.3.3.10

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 Remote Audit of the IBM System Storage DS8700 Release 5.1 *(Easy Tier and SSDs).*

APPENDIX A: SPC-1 GLOSSARY

"Decimal" *(powers of ten)* Measurement Units

In the storage industry, the terms "kilo", "mega", "giga", "tera", "peta", and "exa" are commonly used prefixes for computing performance and capacity. For the purposes of the SPC workload definitions, all of the following terms are defined in "powers of ten" measurement units.

- A kilobyte (KB) is equal to 1,000 (10^3) bytes.
- A megabyte (MB) is equal to 1,000,000 (10^6) bytes.
- A gigabyte (GB) is equal to 1,000,000,000 (10^9) bytes.
- A terabyte (TB) is equal to 1,000,000,000,000 (10^{12}) bytes.
- A petabyte (PB) is equal to 1,000,000,000,000,000 (10^{15}) bytes
- An exabyte (EB) is equal to 1,000,000,000,000,000,000 (10^{18}) bytes

"Binary" *(powers of two)* Measurement Units

The sizes reported by many operating system components use "powers of two" measurement units rather than "power of ten" units. The following standardized definitions and terms are also valid and may be used in this document.

- A kibibyte (KiB) is equal to 1,024 (2^{10}) bytes.
- A mebibyte (MiB) is equal to 1,048,576 (2^{20}) bytes.
- A gigibyte (GiB) is equal to 1,073,741,824 (2^{30}) bytes.
- A tebibyte (TiB) is equal to 1,099,511,627,776 (2^{40}) bytes.
- A pebibyte (PiB) is equal to 1,125,899,906,842,624 (2^{50}) bytes.
- An exbibyte (EiB) is equal to 1,152,921,504,606,846,967 (2^{60}) bytes.

SPC-1 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 selected level of 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.

SPC-1 Data Protection Levels

Protected: This level will ensure data protection in the event of a single point of failure of any configured storage device. A brief description of the data protection utilized is included in the Executive Summary.

Unprotected: No claim of data protection is asserted in the event of a single point of failure.

SPC-1 Test Execution 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.

Completed I/O Request: An I/O Request with a Start Time and a Completion Time (see "I/O Completion Types" below).

Completion Time: The time recorded by the Workload Generator when an I/O Request is satisfied by the TSC as signaled by System Software.

Data Rate: The data transferred in all Measured I/O Requests in an SPC-1 Test Run divided by the length of the Test Run in seconds.

Expected I/O Count: For any given I/O Stream and Test Phase, the product of 50 times the BSU level, the duration of the Test Phase in seconds, and the Intensity Multiplier for that I/O Stream.

Failed I/O Request: Any I/O Request issued by the Workload Generator that could not be completed or was signaled as failed by System Software. A Failed I/O Request has no Completion Time (see "I/O Completion Types" below).

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.

In-Flight I/O Request: An I/O Request issued by the I/O Command Generator to the TSC that has a recorded Start Time, but does not complete within the Measurement Interval (see "I/O Completion Types" below).

Measured I/O Request: A Completed I/O Request with a Completion Time occurring within the Measurement Interval (see "I/O Completion Types" below).

Measured Intensity Multiplier: The percentage of all Measured I/O Requests that were issued by a given I/O Stream.

Measurement Interval: The finite and contiguous time period, after the 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.

Ramp-Up: The time required for the Benchmark Configuration (BC) to produce Steady State throughput after the Workload Generator begins submitting I/O Requests to the TSC for execution.

Ramp-Down: The time required for the BC to complete all I/O Requests issued by the Workload Generator. The Ramp-Down period begins when the Workload Generator ceases to issue new I/O Requests to the TSC.

Response Time: The Response Time of a Measured I/O Request is its Completion Time minus its Start Time.

Start Time: The time recorded by the Workload Generator when an I/O Request is submitted, by the Workload Generator, to the System Software for execution on the Tested Storage Configuration (TSC).

Start-Up: The period that begins after the Workload Generator starts to submit I/O requests to the TSC and ends at the beginning of the Measurement Interval.

Shut-Down: The period between the end of the Measurement Interval and the time when all I/O Requests issued by the Workload Generator have completed or failed.

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.

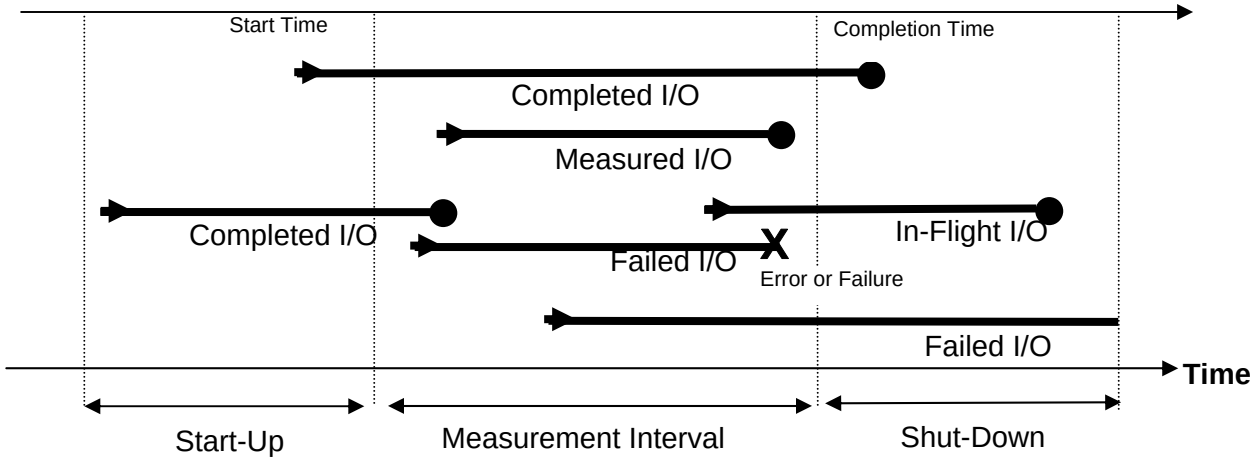
Test: A collection of Test Phases and or Test Runs sharing a common objective.

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

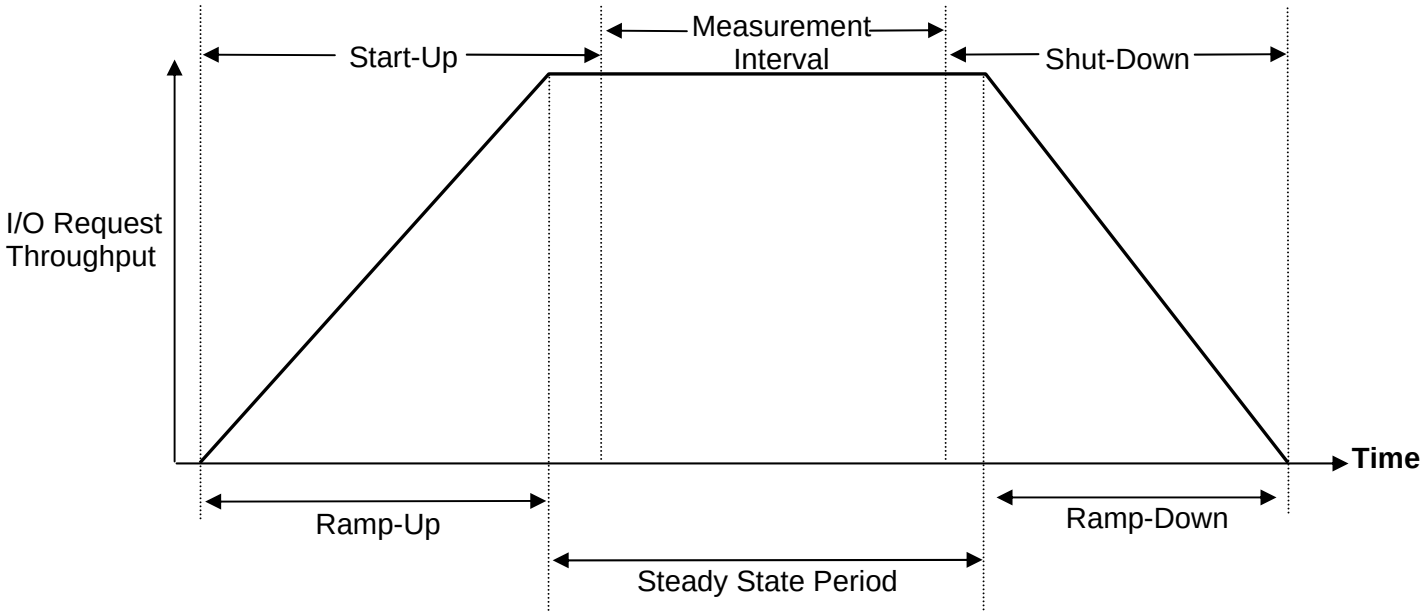
period, Shut-Down period, and Ramp-Down period as illustrated in the "SPC-1 Test Run Components" below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.

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.

I/O Completion Types



SPC-1 Test Run Components



APPENDIX B: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

AIX Parameters

The AIX queue depth was set to 80 from a default value of 20.

Easy Tier Options

- Minimum learning period (default: 24 hours). A setting of 1 hour was used.
- Minimum I/O threshold for extent migration (default: 1638). If set to a positive number, the minimum I/O threshold can have the effect that only a subset of the SSD storage is deployed. The setting of 0 was used, to ensure deployment of all SSD storage.

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

Easy Tier Configuration

The DS8700 is in Easy Tier Automatic Mode by default. Easy Tier setting options may be configured through IBM PFE services. These include the following:

- Maximum rate of migrations (default: 4 per 5 minute period per rank). The default setting was used.
- Minimum learning period (default: 24 hours). A setting of 1 hour was used.
- Minimum I/O threshold for extent migration (default: 1638). If set to a positive number, the minimum I/O threshold can have the effect that only a subset of the SSD storage is deployed. The setting of 0 was used, to ensure deployment of all SSD storage.

DS8700 Configuration Steps

The DS8700 portion of the configuration is implemented using DSCLI, a DS8700-specific script execution tool. DSCLI was used to carry out the following configuration steps.

Create extent pools

The **step1_extpool.txt** script defines a set of 2 extent pools. The extent pool names *(P0 and P1)* are used in subsequent scripts.

step1_extpool.txt

```
mkextpool -dev IBM.2107-75PT541 -rankgrp 0 -stgtype fb P0
mkextpool -dev IBM.2107-75PT541 -rankgrp 1 -stgtype fb P1
```

Create the RAID-10 and RAID-5 ranks

The **step2_makearray.txt** script groups the physical volumes into 2 RAID-5 arrays (SSDs) and 12 RAID-10 arrays (SATAs) . The system automatically generates a set of array names, A0 and A1 (SSDs) and A2-A13 (SATAs). The array names are used in subsequent scripts.

step2_makearray.txt

```
mkarray -dev IBM.2107-75PT541 -raidtype 5 -arsite S9
mkarray -dev IBM.2107-75PT541 -raidtype 5 -arsite S10
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S11
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S12
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S13
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S14
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S1
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S2
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S3
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S4
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S5
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S6
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S7
```

```
mkarray -dev IBM.2107-75PT541 -raidtype 10 -arsite S8
```

The **step3_mkranks.txt** script, defines the arrays, A0-A13, as 14 open system ranks, R0-R13. As in the previous script, the rank names are assigned by the system. The SATA ranks (R2-R13) were assigned to extent pools after rank creation was finished. The assignment of the SSD ranks (R0 and R1) to extent pools was deferred until just before running the SPC-1measurements, as described later in this appendix.

step3_makeranks.txt

```
mkrank -dev IBM.2107-75PT541 -array A0 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A2 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A1 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A3 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A4 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A6 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A5 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A7 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A8 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A9 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A10 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A11 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A12 -stgtype fb
mkrank -dev IBM.2107-75PT541 -array A13 -stgtype fb

chrank -dev IBM.2107-75PT541 –extpool P0 r2 r4 r6 r8 r10 r12
chrank -dev IBM.2107-75PT541 –extpool P1 r3 r5 r7 r9 r11 r13
```

Create the LUNs

The **step4_makevols.txt** script defines 10 LUNs on the set of 12 RAID-10 ranks.

step4_makevols.txt

```
mkfbvol -dev IBM.2107-75PT541 -extpool P0 -type ds -eam rotateexts -cap 3583 -name
sata_#h 2000-2004

mkfbvol -dev IBM.2107-75PT541 -extpool P1 -type ds -eam rotateexts -cap 3583 -name
sata_#h 2100-2104
```

The **step5_volgroups.txt** script assigns each volume to one of two volume groups, V0 or V1, so that paths can be assigned by groups of volumes. The LUNs assigned to V0 belong to extent pool P0; the LUNs assigned to V1 belong to extent pool P1.

step5_volgroups.txt

```
mkvolgrp -dev IBM.2107-75PT541 –hosttype pSeries volgrp0
mkvolgrp -dev IBM.2107-75PT541 –hosttype pSeries volgrp1

chvolgrp -dev IBM.2107-75PT541 -action replace -volume 2000,2001,2002,2003,2004 V0
chvolgrp -dev IBM.2107-75PT541 -action replace -volume  2100,2101,2102,2103,2104 V1
```

Define The LUN access path

The **step6_ports.txt** script sets the IO port topology to FC-AL for all ports that are being used.

step6_ports.txt

```
setioport -dev IBM.2107-75PB501 -topology FC-AL I0040 I0042 I0100 I0142 I0240 I0240
I0300 I0302 I0640 I0642 I0700 I0702
```

The **step7_define_paths.txt** script defines the required mappings so that volumes can be seen by the AIX host. Each host WWPN (total of 12) is assigned to one of the two volume groups, V0 or V1, depending upon whether the connection is to the even or odd part respectively of the system diagram.

step7_define_paths.txt

```
mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C997830D -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs1

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C99782C7 -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs3

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978DC6 -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs8

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978DC7 -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs9

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978EC5 -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs11

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978CAD -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs13

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C997911D -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs19

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9977C0D -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs21

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9977A19 -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs23

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978EE5 -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs29

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9977EDF -profile "IBM pSeries -
AIX" -volgrp V0 sh4a_fcs31

mkhostconnect -dev IBM.2107-75PT541 -wwname 10000000C9978929 -profile "IBM pSeries -
AIX" -volgrp V1 sh4a_fcs33
```

At this stage, the DS8700 volumes are ready to be discovered by AIX.

Deploy SSDs

The last DS8700 configuration action is shown here, but was deferred until just before the start of SPC-1 measurements. This was to run the **step8_enableSSD.txt** script, which adds the SSD resources to the existing SATA extent pools. The effect of running the **step8_enableSSD.txt** script is to enable the use of the SSD's by Easy Tier:

step8_enableSSD.txt

```
chrank -dev IBM.2107-75PT541 –extpool P0 r0
chrank -dev IBM.2107-75PT541 –extpool P1 r1
```

The SPC-1 measurements were started approximately 40 minutes after completing the step 8 script. No I/O load and no migration of data to or from SSDs occured between step 8 and the start of the SPC-1 measurements.

AIX Configuration Steps

To discover the set of 10 hdisks that represent the AIX view of the volumes, the command **cfgmgr** was executed. On the host system of the test, this resulted in discovering hdisk4, hdisk5, ..., hdisk13.

To change **queue_depth** and **max_transfer** of 10 hdisks, the following commands were executed:

```
h=4
      while [[ $h –le 13 ]]
            do
      chdev -l hdisk$i -a queue_depth=256 -a max_transfer='0x100000'
done
```

To define a striped logical volume group containing 10 hdisks, and to make available the logical volumes used for ASU storage, the **stripethem.sh** script was invoked as follows:

```
stripethem.sh 1790 256
```

stripethem.sh

```
# makes striped volume group from available hdisks; makes vols with a specified
number of specified meg partitions.
# important: assumes MPIO, assumes no. of hdisks divides no. of partitions.
if [[ ($# -lt 2) ]]
then
    echo "usage: stripethem partitions psize.  Partitions should be divisible by
hdisks"
    exit
fi
partspervol=$1
psize=$2

hfield=$(lsdev -Cc disk | grep 'MPIO FC 2107' | awk '{print $1}')
mkvg -fy thinstripevg -S -s $psize $hfield

hnum=`echo $hfield | wc -w`
parts=`lsvg thinstripevg | grep "FREE PPs:" | awk '{print $6}'`
let numlv="parts / partspervol"
let usedparts="partspervol * numlv"
print "creating $numlv logical volumes"
print "these will use $usedparts out of $parts available partitions"
l=1
while [[ $l -le $numlv ]]
do
mklv -b n -y thin$l -x 32512 -u $hnum -S 256K thinstripevg $partspervol
l=$((l+1))
done
```

The resulting 80 volumes were then provided as ASU storage.

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

The content of SPC-1 Workload Generator command and parameter files, used in this benchmark to execute the Primary Metrics and Repeatability Tests, is listed below.

Primary Metrics Test

Sustainability

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
```

```
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=sustain,bsus=660,startup=75600,elapsed=10800,interval=60
#rd=sustain,bsus=600,startup=180,elapsed=600,interval=60
```

Ramp 100 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
```

```
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_100,bsus=660,startup=180,elapsed=600,interval=60
```

Ramp 95 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
```

```
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_95,bsus=627,startup=180,elapsed=600,interval=60
```

Ramp 90 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
```

```
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_90,bsus=594,startup=180,elapsed=600,interval=60
```

Ramp 80 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
```

```
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
```

```
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_80,bsus=528,startup=180,elapsed=600,interval=60
```

Ramp 50 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
```

```
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_50,bsus=330,startup=180,elapsed=600,interval=60
```

Ramp 10 Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
```

```
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
```

```
sd=asu3_8,lun=/dev/rsatathin80
rd=ramp_10,bsus=66,startup=180,elapsed=600,interval=60
```

Repeatability Test

Repeat1 LRT Test Run
Repeat1 IOPS Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
```

```
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
rd=repeat1_lrt,bsus=66,startup=180,elapsed=600,interval=60
rd=repeat1_iops,bsus=660,startup=180,elapsed=600,interval=60
```

Repeat2 LRT Test Run
Repeat2 IOPS Test Run

```
host=master
slaves=(slave1,slave2,slave3,slave4,slave5,slave6,slave7)
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
```

```
  sd=asu1_22,lun=/dev/rsatathin22
  sd=asu1_23,lun=/dev/rsatathin23
  sd=asu1_24,lun=/dev/rsatathin24
  sd=asu1_25,lun=/dev/rsatathin25
  sd=asu1_26,lun=/dev/rsatathin26
  sd=asu1_27,lun=/dev/rsatathin27
  sd=asu1_28,lun=/dev/rsatathin28
  sd=asu1_29,lun=/dev/rsatathin29
  sd=asu1_30,lun=/dev/rsatathin30
  sd=asu1_31,lun=/dev/rsatathin31
  sd=asu1_32,lun=/dev/rsatathin32
  sd=asu1_33,lun=/dev/rsatathin33
  sd=asu1_34,lun=/dev/rsatathin34
  sd=asu1_35,lun=/dev/rsatathin35
  sd=asu1_36,lun=/dev/rsatathin36
  sd=asu2_1,lun=/dev/rsatathin37
  sd=asu2_2,lun=/dev/rsatathin38
  sd=asu2_3,lun=/dev/rsatathin39
  sd=asu2_4,lun=/dev/rsatathin40
  sd=asu2_5,lun=/dev/rsatathin41
  sd=asu2_6,lun=/dev/rsatathin42
  sd=asu2_7,lun=/dev/rsatathin43
  sd=asu2_8,lun=/dev/rsatathin44
  sd=asu2_9,lun=/dev/rsatathin45
  sd=asu2_10,lun=/dev/rsatathin46
  sd=asu2_11,lun=/dev/rsatathin47
  sd=asu2_12,lun=/dev/rsatathin48
  sd=asu2_13,lun=/dev/rsatathin49
  sd=asu2_14,lun=/dev/rsatathin50
  sd=asu2_15,lun=/dev/rsatathin51
  sd=asu2_16,lun=/dev/rsatathin52
  sd=asu2_17,lun=/dev/rsatathin53
  sd=asu2_18,lun=/dev/rsatathin54
  sd=asu2_19,lun=/dev/rsatathin55
  sd=asu2_20,lun=/dev/rsatathin56
  sd=asu2_21,lun=/dev/rsatathin57
  sd=asu2_22,lun=/dev/rsatathin58
  sd=asu2_23,lun=/dev/rsatathin59
  sd=asu2_24,lun=/dev/rsatathin60
  sd=asu2_25,lun=/dev/rsatathin61
  sd=asu2_26,lun=/dev/rsatathin62
  sd=asu2_27,lun=/dev/rsatathin63
  sd=asu2_28,lun=/dev/rsatathin64
  sd=asu2_29,lun=/dev/rsatathin65
  sd=asu2_30,lun=/dev/rsatathin66
  sd=asu2_31,lun=/dev/rsatathin67
  sd=asu2_32,lun=/dev/rsatathin68
  sd=asu2_33,lun=/dev/rsatathin69
  sd=asu2_34,lun=/dev/rsatathin70
  sd=asu2_35,lun=/dev/rsatathin71
  sd=asu2_36,lun=/dev/rsatathin72
  sd=asu3_1,lun=/dev/rsatathin73
  sd=asu3_2,lun=/dev/rsatathin74
  sd=asu3_3,lun=/dev/rsatathin75
  sd=asu3_4,lun=/dev/rsatathin76
  sd=asu3_5,lun=/dev/rsatathin77
  sd=asu3_6,lun=/dev/rsatathin78
  sd=asu3_7,lun=/dev/rsatathin79
  sd=asu3_8,lun=/dev/rsatathin80
  rd=repeat2_lrt,bsus=66,startup=180,elapsed=600,interval=60
  rd=repeat2_iops,bsus=660,startup=180,elapsed=600,interval=60
```

Persistence Test

Persistence Test Run 1

```
* Persistence Test Run 1
host=localhost,jvms=1,maxstreams=200

sd=default,host=localhost,size=426812375040
sd=sd1,lun=/dev/rsatathin1
sd=sd2,lun=/dev/rsatathin2
sd=sd3,lun=/dev/rsatathin3
sd=sd4,lun=/dev/rsatathin4
sd=sd5,lun=/dev/rsatathin5
sd=sd6,lun=/dev/rsatathin6
sd=sd7,lun=/dev/rsatathin7
sd=sd8,lun=/dev/rsatathin8
sd=sd9,lun=/dev/rsatathin9
sd=sd10,lun=/dev/rsatathin10
sd=sd11,lun=/dev/rsatathin11
sd=sd12,lun=/dev/rsatathin12
sd=sd13,lun=/dev/rsatathin13
sd=sd14,lun=/dev/rsatathin14
sd=sd15,lun=/dev/rsatathin15
sd=sd16,lun=/dev/rsatathin16
sd=sd17,lun=/dev/rsatathin17
sd=sd18,lun=/dev/rsatathin18
sd=sd19,lun=/dev/rsatathin19
sd=sd20,lun=/dev/rsatathin20
sd=sd21,lun=/dev/rsatathin21
sd=sd22,lun=/dev/rsatathin22
sd=sd23,lun=/dev/rsatathin23
sd=sd24,lun=/dev/rsatathin24
sd=sd25,lun=/dev/rsatathin25
sd=sd26,lun=/dev/rsatathin26
sd=sd27,lun=/dev/rsatathin27
sd=sd28,lun=/dev/rsatathin28
sd=sd29,lun=/dev/rsatathin29
sd=sd30,lun=/dev/rsatathin30
sd=sd31,lun=/dev/rsatathin31
sd=sd32,lun=/dev/rsatathin32
sd=sd33,lun=/dev/rsatathin33
sd=sd34,lun=/dev/rsatathin34
sd=sd35,lun=/dev/rsatathin35
sd=sd36,lun=/dev/rsatathin36
sd=sd37,lun=/dev/rsatathin37
sd=sd38,lun=/dev/rsatathin38
sd=sd39,lun=/dev/rsatathin39
sd=sd40,lun=/dev/rsatathin40
sd=sd41,lun=/dev/rsatathin41
sd=sd42,lun=/dev/rsatathin42
sd=sd43,lun=/dev/rsatathin43
sd=sd44,lun=/dev/rsatathin44
sd=sd45,lun=/dev/rsatathin45
sd=sd46,lun=/dev/rsatathin46
sd=sd47,lun=/dev/rsatathin47
sd=sd48,lun=/dev/rsatathin48
sd=sd49,lun=/dev/rsatathin49
sd=sd50,lun=/dev/rsatathin50
sd=sd51,lun=/dev/rsatathin51
sd=sd52,lun=/dev/rsatathin52
sd=sd53,lun=/dev/rsatathin53
sd=sd54,lun=/dev/rsatathin54
```

```
sd=sd55,lun=/dev/rsatathin55
sd=sd56,lun=/dev/rsatathin56
sd=sd57,lun=/dev/rsatathin57
sd=sd58,lun=/dev/rsatathin58
sd=sd59,lun=/dev/rsatathin59
sd=sd60,lun=/dev/rsatathin60
sd=sd61,lun=/dev/rsatathin61
sd=sd62,lun=/dev/rsatathin62
sd=sd63,lun=/dev/rsatathin63
sd=sd64,lun=/dev/rsatathin64
sd=sd65,lun=/dev/rsatathin65
sd=sd66,lun=/dev/rsatathin66
sd=sd67,lun=/dev/rsatathin67
sd=sd68,lun=/dev/rsatathin68
sd=sd69,lun=/dev/rsatathin69
sd=sd70,lun=/dev/rsatathin70
sd=sd71,lun=/dev/rsatathin71
sd=sd72,lun=/dev/rsatathin72
sd=sd73,lun=/dev/rsatathin73
sd=sd74,lun=/dev/rsatathin74
sd=sd75,lun=/dev/rsatathin75
sd=sd76,lun=/dev/rsatathin76
sd=sd77,lun=/dev/rsatathin77
sd=sd78,lun=/dev/rsatathin78
sd=sd79,lun=/dev/rsatathin79
sd=sd80,lun=/dev/rsatathin80
maxlatestart=1
reportinginterval=5
segmentlength=512m

rd=default,rampup=180,periods=90,measurement=300,runout=0,rampdown=0,buffers=1

rd=default,rdpct=0,xfersize=1024k
rd=TR1-5s_SPC-2-persist-w,streams=24
```

Persistence Test Run 2

```
* Persistence Test Run 2

host=localhost,jvms=1,maxstreams=200

sd=default,host=localhost,size=426812375040
sd=sd1,lun=/dev/rsatathin1
sd=sd2,lun=/dev/rsatathin2
sd=sd3,lun=/dev/rsatathin3
sd=sd4,lun=/dev/rsatathin4
sd=sd5,lun=/dev/rsatathin5
sd=sd6,lun=/dev/rsatathin6
sd=sd7,lun=/dev/rsatathin7
sd=sd8,lun=/dev/rsatathin8
sd=sd9,lun=/dev/rsatathin9
sd=sd10,lun=/dev/rsatathin10
sd=sd11,lun=/dev/rsatathin11
sd=sd12,lun=/dev/rsatathin12
sd=sd13,lun=/dev/rsatathin13
sd=sd14,lun=/dev/rsatathin14
sd=sd15,lun=/dev/rsatathin15
sd=sd16,lun=/dev/rsatathin16
sd=sd17,lun=/dev/rsatathin17
sd=sd18,lun=/dev/rsatathin18
sd=sd19,lun=/dev/rsatathin19
```

```
  sd=sd20,lun=/dev/rsatathin20
  sd=sd21,lun=/dev/rsatathin21
  sd=sd22,lun=/dev/rsatathin22
  sd=sd23,lun=/dev/rsatathin23
  sd=sd24,lun=/dev/rsatathin24
  sd=sd25,lun=/dev/rsatathin25
  sd=sd26,lun=/dev/rsatathin26
  sd=sd27,lun=/dev/rsatathin27
  sd=sd28,lun=/dev/rsatathin28
  sd=sd29,lun=/dev/rsatathin29
  sd=sd30,lun=/dev/rsatathin30
  sd=sd31,lun=/dev/rsatathin31
  sd=sd32,lun=/dev/rsatathin32
  sd=sd33,lun=/dev/rsatathin33
  sd=sd34,lun=/dev/rsatathin34
  sd=sd35,lun=/dev/rsatathin35
  sd=sd36,lun=/dev/rsatathin36
  sd=sd37,lun=/dev/rsatathin37
  sd=sd38,lun=/dev/rsatathin38
  sd=sd39,lun=/dev/rsatathin39
  sd=sd40,lun=/dev/rsatathin40
  sd=sd41,lun=/dev/rsatathin41
  sd=sd42,lun=/dev/rsatathin42
  sd=sd43,lun=/dev/rsatathin43
  sd=sd44,lun=/dev/rsatathin44
  sd=sd45,lun=/dev/rsatathin45
  sd=sd46,lun=/dev/rsatathin46
  sd=sd47,lun=/dev/rsatathin47
  sd=sd48,lun=/dev/rsatathin48
  sd=sd49,lun=/dev/rsatathin49
  sd=sd50,lun=/dev/rsatathin50
  sd=sd51,lun=/dev/rsatathin51
  sd=sd52,lun=/dev/rsatathin52
  sd=sd53,lun=/dev/rsatathin53
  sd=sd54,lun=/dev/rsatathin54
  sd=sd55,lun=/dev/rsatathin55
  sd=sd56,lun=/dev/rsatathin56
  sd=sd57,lun=/dev/rsatathin57
  sd=sd58,lun=/dev/rsatathin58
  sd=sd59,lun=/dev/rsatathin59
  sd=sd60,lun=/dev/rsatathin60
  sd=sd61,lun=/dev/rsatathin61
  sd=sd62,lun=/dev/rsatathin62
  sd=sd63,lun=/dev/rsatathin63
  sd=sd64,lun=/dev/rsatathin64
  sd=sd65,lun=/dev/rsatathin65
  sd=sd66,lun=/dev/rsatathin66
  sd=sd67,lun=/dev/rsatathin67
  sd=sd68,lun=/dev/rsatathin68
  sd=sd69,lun=/dev/rsatathin69
  sd=sd70,lun=/dev/rsatathin70
  sd=sd71,lun=/dev/rsatathin71
  sd=sd72,lun=/dev/rsatathin72
  sd=sd73,lun=/dev/rsatathin73
  sd=sd74,lun=/dev/rsatathin74
  sd=sd75,lun=/dev/rsatathin75
  sd=sd76,lun=/dev/rsatathin76
  sd=sd77,lun=/dev/rsatathin77
  sd=sd78,lun=/dev/rsatathin78
  sd=sd79,lun=/dev/rsatathin79
  sd=sd80,lun=/dev/rsatathin80
  maxlatestart=1
  reportinginterval=5
```

```
segmentlength=512m

maxpersistenceerrors=10
*corruptstreams=3

rd=default,buffers=1,rdpct=100,xfersize=1024k
rd=TR1-5s_SPC-2-persist-r
```

APPENDIX E: SPC-1 WORKLOAD GENERATOR INPUT PARAMETERS

Slave JVM Invocation

The Slave JVMs were started manually for the benchmark measurements rather than automatically by the SPC-1 Worload Generator. The script to start those Slave JVMs appears below.

runslaves.sh

```
export PATH=/usr/java5/bin:$PATH
export SPC1HOME=/perform/spc1install
export CLASSPATH=$SPC1HOME
export LIBPATH=$SPC1HOME/aix
export IBM_JAVADUMP_OUTOFMEMORY=false
export IBM_HEAPDUMP_OUTOFMEMORY=false
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave1.txt > slave1.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave2.txt > slave2.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave3.txt > slave3.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave4.txt > slave4.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave5.txt > slave5.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave6.txt > slave6.out&
nohup java -Xoptionsfile=javaopts.cfg spc1 -f slave7.txt > slave7.out&
```

An example of the configuration file used when starting each Slave JVM appears below.

slave1.txt

```
master=localhost
host=slave1
javaparms="-Xms1280m -Xmx1280m -Xss96k -Xgcpolicy:optavgpause"
sd=default,size=426812375040
sd=asu1_1,lun=/dev/rsatathin1
sd=asu1_2,lun=/dev/rsatathin2
sd=asu1_3,lun=/dev/rsatathin3
sd=asu1_4,lun=/dev/rsatathin4
sd=asu1_5,lun=/dev/rsatathin5
sd=asu1_6,lun=/dev/rsatathin6
sd=asu1_7,lun=/dev/rsatathin7
sd=asu1_8,lun=/dev/rsatathin8
sd=asu1_9,lun=/dev/rsatathin9
sd=asu1_10,lun=/dev/rsatathin10
sd=asu1_11,lun=/dev/rsatathin11
sd=asu1_12,lun=/dev/rsatathin12
sd=asu1_13,lun=/dev/rsatathin13
sd=asu1_14,lun=/dev/rsatathin14
sd=asu1_15,lun=/dev/rsatathin15
sd=asu1_16,lun=/dev/rsatathin16
sd=asu1_17,lun=/dev/rsatathin17
sd=asu1_18,lun=/dev/rsatathin18
sd=asu1_19,lun=/dev/rsatathin19
sd=asu1_20,lun=/dev/rsatathin20
sd=asu1_21,lun=/dev/rsatathin21
sd=asu1_22,lun=/dev/rsatathin22
sd=asu1_23,lun=/dev/rsatathin23
sd=asu1_24,lun=/dev/rsatathin24
```

```
sd=asu1_25,lun=/dev/rsatathin25
sd=asu1_26,lun=/dev/rsatathin26
sd=asu1_27,lun=/dev/rsatathin27
sd=asu1_28,lun=/dev/rsatathin28
sd=asu1_29,lun=/dev/rsatathin29
sd=asu1_30,lun=/dev/rsatathin30
sd=asu1_31,lun=/dev/rsatathin31
sd=asu1_32,lun=/dev/rsatathin32
sd=asu1_33,lun=/dev/rsatathin33
sd=asu1_34,lun=/dev/rsatathin34
sd=asu1_35,lun=/dev/rsatathin35
sd=asu1_36,lun=/dev/rsatathin36
sd=asu2_1,lun=/dev/rsatathin37
sd=asu2_2,lun=/dev/rsatathin38
sd=asu2_3,lun=/dev/rsatathin39
sd=asu2_4,lun=/dev/rsatathin40
sd=asu2_5,lun=/dev/rsatathin41
sd=asu2_6,lun=/dev/rsatathin42
sd=asu2_7,lun=/dev/rsatathin43
sd=asu2_8,lun=/dev/rsatathin44
sd=asu2_9,lun=/dev/rsatathin45
sd=asu2_10,lun=/dev/rsatathin46
sd=asu2_11,lun=/dev/rsatathin47
sd=asu2_12,lun=/dev/rsatathin48
sd=asu2_13,lun=/dev/rsatathin49
sd=asu2_14,lun=/dev/rsatathin50
sd=asu2_15,lun=/dev/rsatathin51
sd=asu2_16,lun=/dev/rsatathin52
sd=asu2_17,lun=/dev/rsatathin53
sd=asu2_18,lun=/dev/rsatathin54
sd=asu2_19,lun=/dev/rsatathin55
sd=asu2_20,lun=/dev/rsatathin56
sd=asu2_21,lun=/dev/rsatathin57
sd=asu2_22,lun=/dev/rsatathin58
sd=asu2_23,lun=/dev/rsatathin59
sd=asu2_24,lun=/dev/rsatathin60
sd=asu2_25,lun=/dev/rsatathin61
sd=asu2_26,lun=/dev/rsatathin62
sd=asu2_27,lun=/dev/rsatathin63
sd=asu2_28,lun=/dev/rsatathin64
sd=asu2_29,lun=/dev/rsatathin65
sd=asu2_30,lun=/dev/rsatathin66
sd=asu2_31,lun=/dev/rsatathin67
sd=asu2_32,lun=/dev/rsatathin68
sd=asu2_33,lun=/dev/rsatathin69
sd=asu2_34,lun=/dev/rsatathin70
sd=asu2_35,lun=/dev/rsatathin71
sd=asu2_36,lun=/dev/rsatathin72
sd=asu3_1,lun=/dev/rsatathin73
sd=asu3_2,lun=/dev/rsatathin74
sd=asu3_3,lun=/dev/rsatathin75
sd=asu3_4,lun=/dev/rsatathin76
sd=asu3_5,lun=/dev/rsatathin77
sd=asu3_6,lun=/dev/rsatathin78
sd=asu3_7,lun=/dev/rsatathin79
sd=asu3_8,lun=/dev/rsatathin80
```

Primary Metrics Test, Repeatability Test, and Persistence Test Run 1

The following script was used to execute the Primary Metrics Test *(Sustainability Test Phase, IOPS Test Phase, and Response Time Ramp Test Phase)*, Repeatability Test

(Repeatability Test Phase 1 and Repeatability Test Phase 2), and Persistence Test Run 1 in an uninterrupted sequence.

runthem.sh

```
export PATH=$PATH:/usr/java5/bin
export SPC1HOME=/perform/spc1install
export CLASSPATH=$SPC1HOME
export LIBPATH=$SPC1HOME/aix
export IBM_JAVADUMP_OUTOFMEMORY=false
export IBM_HEAPDUMP_OUTOFMEMORY=false
rm -fr SPCOut
runslaves.sh
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics1.txt -ometrics1 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics2.txt -ometrics2 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics3.txt -ometrics3 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics4.txt -ometrics4 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics5.txt -ometrics5 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics6.txt -ometrics6 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -fmetrics7.txt -ometrics7 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -frepeat1.txt -orepeat1 SPCOut
java -Xoptionsfile=javaopts.cfg spc1 -frepeat2.txt -orepeat2 SPCOut
rmslaves.sh 1 7
rundir=`pwd`
cd /perform/mm.perfss07/adr/spc2/sata_persist
rm -fr ./persistr
rm -fr ./persistw
./runinit.sh
./runpersist1.sh
cd $rundir
```

Persistence Test Run 1

The following two scripst were invoked from the above script to execute Persistence Test Run 1.

runit.sh

```
export PATH=$PATH:/usr/java5/bin
export SPC2HOME=/perform/spc2install
export CLASSPATH=$SPC2HOME
export LIBPATH=$SPC2HOME/aix
export IBM_JAVADUMP_OUTOFMEMORY=false
export IBM_HEAPDUMP_OUTOFMEMORY=false
java -Xoptionsfile=javaoptsp.cfg vdbench -f persistw.cfg -o persistw –init
```

runpersist1.sh

```
export PATH=$PATH:/usr/java5/bin
export SPC2HOME=/perform/spc2install
export CLASSPATH=$SPC2HOME
export LIBPATH=$SPC2HOME/aix
export IBM_JAVADUMP_OUTOFMEMORY=false
export IBM_HEAPDUMP_OUTOFMEMORY=false
java -Xoptionsfile=javaoptsp.cfg vdbench -f persistw.cfg -o persistw
date > pdisk.list
ssh -p 12201 perfss08h issmap -jctpfsa >> pdisk.list
date > lvmhdisk.list
lsvg satastripevg >> lvmhdisk.list
```

```
lsvg -p satastripevg >> lvmhdisk.list
date > lvmvols.list
lsvg satastripevg >> lvmvols.list
lsvg -l satastripevg >> lvmvols.list
```

Persistence Test Run 2

The following script was used to execute Persistence Test Run 2.

runpersist2.sh

```
export PATH=$PATH:/usr/java5/bin
export SPC2HOME=/perform/spc2install
export CLASSPATH=$SPC2HOME
export LIBPATH=$SPC2HOME/aix
export IBM_JAVADUMP_OUTOFMEMORY=false
export IBM_HEAPDUMP_OUTOFMEMORY=false
java -Xoptionsfile=javaoptsp.cfg vdbench -f persistr.cfg -o persistr
```