SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

FUJITSU LIMITED
FUJITSU STORAGE SYSTEMS ETERNUS DX8400

SPC-1 V1.12

Submitted for Review: May 25, 2010
Submission Identifier: A00093

First Edition – May 2010

Trademarks

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AUDIT CERTIFICATION

C. A. Wilson
Fujitsu Limited
1250 East Arques Ave.
P.O. Box 3470
Sunnyvale, CA 94088 3470

May 25, 2010

The SPC Benchmark 1™ results listed below for the Fujitsu Storage Systems ETERNUS DX8400 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: Fujitsu Storage Systems ETERNUS DX8400	
Metric	**Reported Result**
SPC-1 IOPS™	171,736.84
SPC-1 Price-Performance	$8.39/SPC-1 IOPS™
Total ASU Capacity	99,080.868 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$1,440,545

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 Fujitsu Limited:
  - ✓ 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.

Storage Performance Council
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AUDIT CERTIFICATION *(CONT.)*

- SPC-1 Workload Generator commands and parameters used for the audited SPC Test Runs.
- The following Host System requirements, based on information supplied by Fujitsu Limited:
  - ✓ 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 Fujitsu Limited 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:

There were no audit notes or exceptions.

Respectfully,

Walter E. Baker

Walter E. Baker
SPC Auditor

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LETTER OF GOOD FAITH

FUJITSU

FUJITSU LIMITED
Kanagawa-ken, Kawasaki-shi, Nakahara-ku, Kamikodanaka,4-1-1,JAPAN 211-8588
TEL: 044-754-3240, FAX: 044-754-3719

Date: April 14, 2010

From: Fujitsu Limited, Test Sponsor

Submitted by:Yasuhito Arikawa ,
General Manager, Storage Systems Division
1-1, Kamikodanaka 4–chome, Nakahara-ku, Kawasaki-shi, Kanagawa-ken
211-8588, Japan

Contact Information: Carrel A. (Sandy) Wilson
Fujitsu America, Inc.
1250 East Arques Ave. PO Box 3470
Sunnyvale, CA 94088, U.S.A.

To: Walter E. Baker, SPC Auditor
Gradient Systems, Inc.
643 Bair Island Road, Suite 103
Redwood City, CA 94063-2755. U.S.A.

Subject: SPC-1 Letter of Good Faith for the ETERNUS DX8400

Fujitsu Limited is the SPC-1 Test Sponsor for the above listed product. To the best of our knowledge and belief, the required SPC-1 benchmark results and materials we have submitted for that product are complete, accurate, and in full compliance with V1.10.1 of the SPC-1 benchmark specification.

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

Signed: Yasuhito Arikawa Date: 14/Apr./2010

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Test Sponsor Alternate Contact	Fujitsu Limited – http://www.fujitsu.com/services/computing/storage/ Yasuhita Arikawa y.arikawa@jp.fumitsu.com 1-1 Kamikodanaka 4-chrome, Nakahara-ku, Kawasaki-shi, Kanagawa-ken 211-8588, Japan Phone: (044) 754-3632 FAX: (044) 754-3719
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	May 25, 2010
Date the FDR was submitted to the SPC	May 25, 2010
Date the priced storage configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	May 25, 2010

Tested Storage Product (TSP) Description

The Fujitsu ETERNUS DX8400 is a flexible, highly reliable storage array, equipped with redundant components to provide uncompromised availability to the high end and mid market requirements. A mixture of 300GB, 450GB, and 600GB 15krpm Fibre Channel disk drives, as well as 500GB, 750GB, and 1TB Nearline SATA disk drives may be used, up to a maximum of 1004 drives. The drives may be arranged in a variety of RAID groups, including RAID0, RAID1, RAID1+0(10), RAID5, and RAID6.

The product is offered with Fibre Channel (as tested), and iSCSI host connection options, with up to 64 channels available. In addition, a number of different snapshot and replication facilities, native disk data encryption, thin provisioning, and MAID capabilities are available.

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: Fujitsu Storage Systems ETERNUS DX8400	
Metric	**Reported Result**
SPC-1 IOPS™	171,736.84
SPC-1 Price-Performance	$8.39/SPC-1 IOPS™
Total ASU Capacity	99,080.868 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$1,440,545

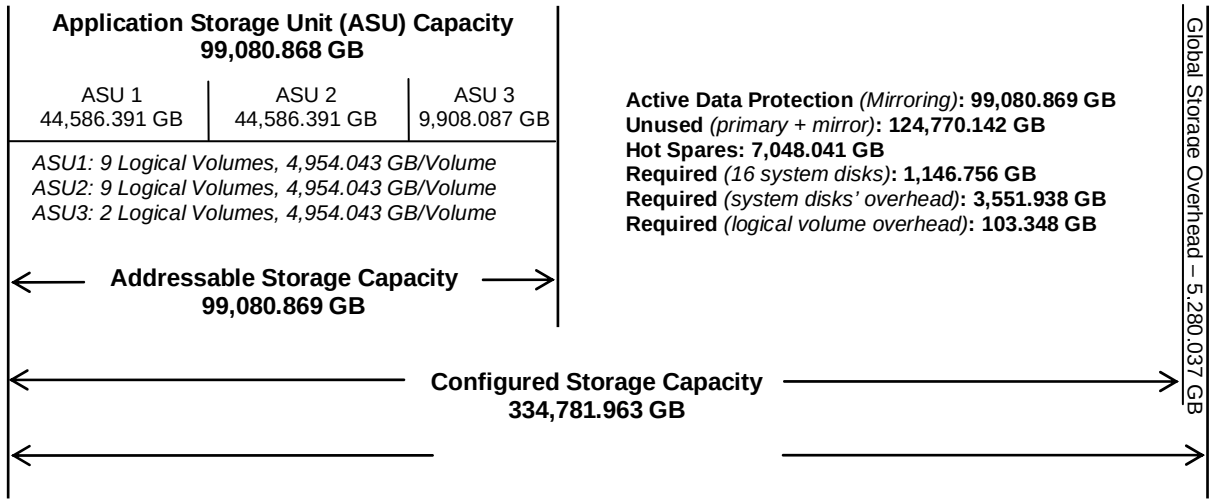
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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.

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	29.14%
Protected Application Utilization	58.29%
Unused Storage Ratio	36.69%

Application Utilization: Total ASU Capacity *(99,080.868 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*.

Protected Application Utilization: Total ASU Capacity *(99,080.868 GB)* plus total Data Protection Capacity *(161,517.614 GB)* minus unused Data Protection Capacity *(62,385.071 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*.

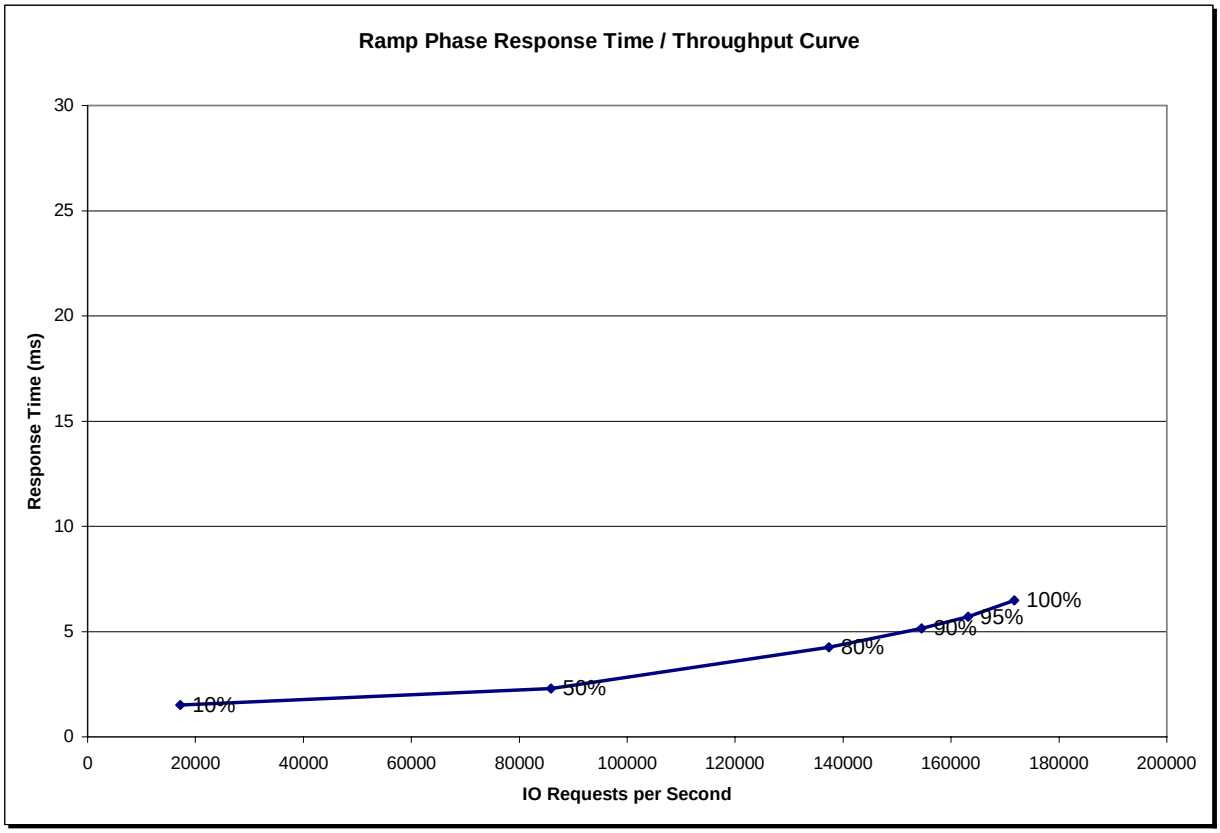
Unused Storage Ratio: Total unused capacity *(124,770.143 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*. The Unused Storage Ratio cannot exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 in the Full Disclosure Report.

Response Time – Throughput Curve

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

The Average Response Time measured at 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	17,147.78	85,840.06	137,411.58	154,560.30	163,176.06	171,736.84
Average Response Time (ms):						
All ASUs	1.52	2.29	4.26	5.15	5.71	6.47
ASU-1	2.09	3.03	5.07	6.06	6.69	7.54
ASU-2	1.33	2.12	4.12	5.01	5.55	6.27
ASU-3	0.38	0.81	2.59	3.28	3.70	4.29
Reads	3.29	4.59	6.80	7.96	8.69	9.63
Writes	0.36	0.80	2.60	3.32	3.77	4.42

Priced Storage Configuration Pricing

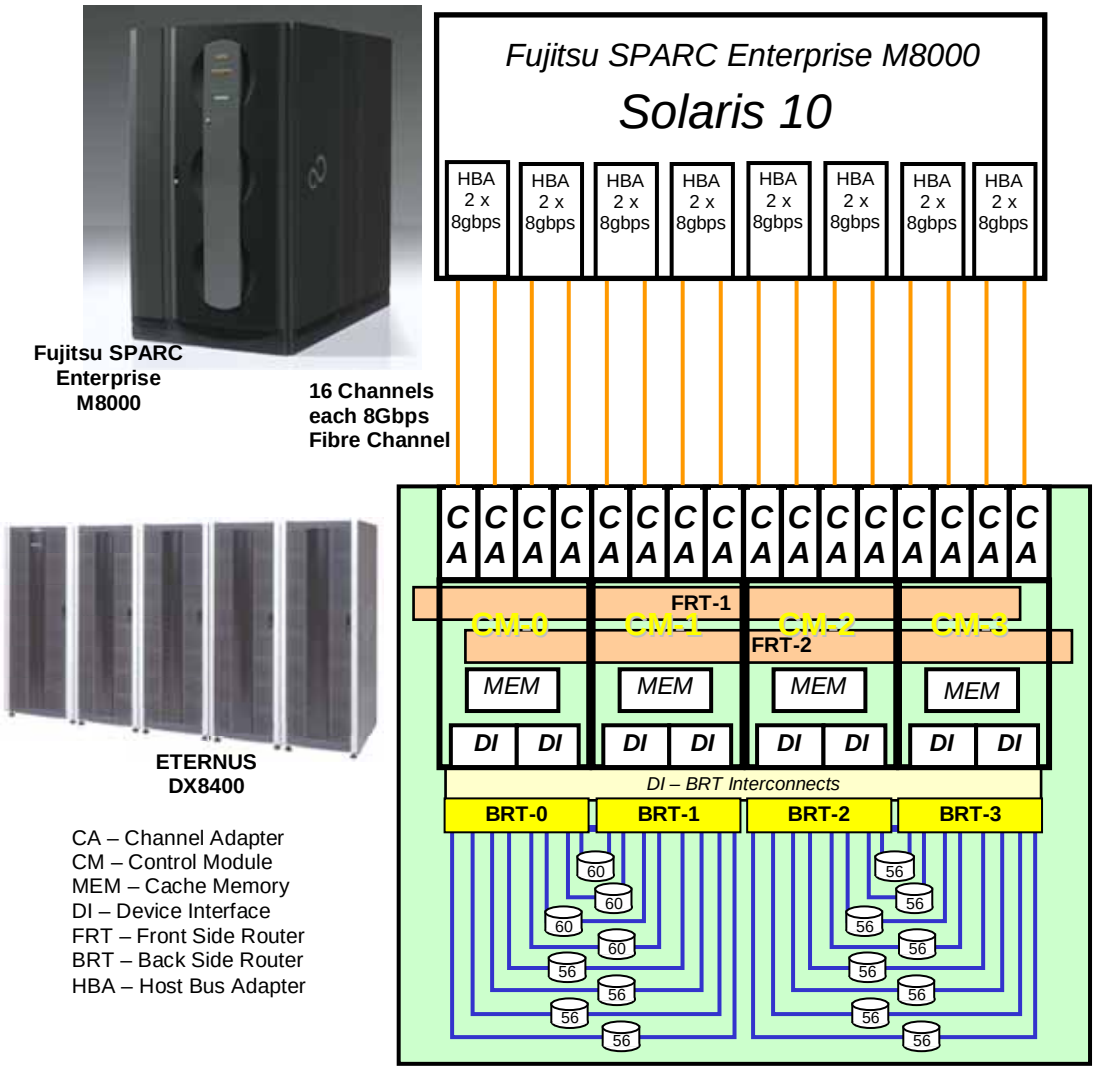
Item	Fujitsu ETERNUS DX8400 Product Id	Description	Qty	List Price Unit $	List Price Extd $
1	ET84S20AU	ETERNUS DX8400 Base Unit includes: 1x 1800mm rack, 2x controller module, 2x frontend router, 2x backend router, 4x drive enclosure, 4x system disk drive, 4x power distribution unit (AC200-240V)	1		
2	ETHERAU	Expansion Rack (DX8400/DX8700) includes: 1x 1800mm rack, 4x power distribution unit (AC200-240V)	5		
3	ETHDE1AU	Drive Enclosure (DX8400, basic rack w/BRT pair) includes: 4x drive enclosure, 2x backend router, 2x power distribution unit (AC200-240V)	1		
4	ETHDE2AU	Drive Enclosure (DX8400, Expansion rack) includes: 4x drive enclosure	14		
5	ETHC4U	Expansion Controller (DX8400) includes: 2x controller module, 2x power supply unit, 4x system disk drive	1		
6	ETHHF84U	Host Interface (8GBPS, 4-PORT) includes: 2x 2-port FC (8Gbps) CA	1		
7	ETMHF88U	HOST INTERFACE (8GBPS, FC, 8-PORT) includes: 2x 4-port FC (8Gbps) CA	7		
8	ETHFC3HU	300GB/15KRPM DISK DRIVE	440		
9	ETHFC4HU	450GB/15KRPM DISK DRIVE	456		
10	ETHM04U	Cache Memory (32GB) includes: 8x 4GB DIMM	4		
11	ETHMSSU	Cache Expansion Kit (DX8400) includes: 4x system disk drive	2		
	Total	ETERNUS DX8400 Storage Array System	1	$2,335,000	$2,335,000
12	61-343827-015	LC/LC Fibre Channel Cable, 15 M. (Multimode - 50/125um, Riser Rated)	16	$181	$2,896
13	QLE2562-CK	Qlogic 8Gbps HBA	8	$2,597	$20,776
14	ETDX84-W004240-ABW	EDTX 8400 Warranty, 24 months, Enhanced Plus 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	1	$0	$0
15	ETDX84-P004121-ABW	ETDX 8400 Post Wararnty, 12 Months Enhanced Plus 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	1	$219,204	$219,204
16	ETDX84-P004121-ABX	ETDX 8400 Post Warranty, 12 Months Ehnaced Plus Expansion Kit Post Warranty coverage (ETHMSSU) 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	2	$120	$240
17	ETDX84-N067005-ABW	ETDX 8400 Installation during normal business hours ETERNUS Installation, One Time billing	1	$3,500	$3,500
18	FTSPS-ET-QSDX840	Professional Services-ETERNUSDX Model 8400 Quickstart ETERNUS Quickstart, One Time billing	1	$13,875	$13,875
		Total Fujitsu Product List Price			$2,335,000
		Product Discount		45%	
		Net Product Price			$1,284,250
		Total Non Fujitsu Product List Price			$23,672
		Product Discount		40%	
		Net Non Fujitsu Product Price			$14,203
		Total Service List Price			$236,819
		Service Discount		40%	
		Net Service Price			$142,091
		Total Sell Price, including 3 years Service			**$1,440,545**

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

The Tested Storage Configuration had a mixture of 4 port and 2 port Fibre Channel 8Gbps channel adapters (CA), also called Host Interfaces, due to availability of equipment in the lab. A total of 16 CAs were installed – 13 x 4-port units and 3 x 2-port units. Only a single port on each of the 16 CAs was used in the Tested Storage Configuration.

The Priced Storage Configuration includes 14 x 4 port units and 2 x 2 port units. That configuration, if used in the TSC, would have not had any impact on the reported SPC-1 IOPS.

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



Priced Storage Configuration Components

Priced Storage Configuration:
8 –Qlogic QLE2562-CK dual-port 8 Gbps HBAs
SC-1: Fujitsu Storage Systems ETERNUS DX8400 4 – Controller Modules, each with 32 GB cache *(128 GB total)* 4 – Channel Adapter (CA) modules *(16 total)* 14 – 4 port 8 Gbps FC CAs 2 – 2 port 8 Gbps FC CAs 60 ports configured 1 port used per CA, 16 total used 2 – Front Side Routers 2 – Back Side Routers
16 – Front side Fibre Channels *(8 Gbps)* 16 – Back side Fibre Channels *(4 Gbps)*
64 – Drive Enclosure Modules, each with dual switched FC-AL interfaces, 15 hot swap drive slots
456 – 300 GB 15K RPM disk drives *(440 drives in 44 RAID Groups and 16 reserved for system use)* 456 – 450 GB 15K RPM disk drives *(440 drives in 44 RAID Groups plus 16 Hot Spares)*

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 Tested Storage Configuration did not utilize network storage.

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.

Host System:	Tested Storage Configuration (TSC)
HS-1: Fujitsu SPARC Enterprise M8000 16 – 2.4 GHz SPARC64 VI chips each with: 128 KB L1 instruction cache, 128 KB L1 data cache, 6 MB L2 cache	8 –Qlogic QLE2562-CK dual-port 8 Gbps HBAs
512 GB main memory	**SC-1: Fujitsu Storage Systems ETERNUS DX8400** 4 – Controller Modules, each with 32 GB cache *(128 GB total)* 4 – Channel Adapter (CA) modules *(16 total)* 13 – 4 port 8 Gbps FC CAs 3 – 2 port 8 Gbps FC CAs 58 ports configured 1 port used per CA, 16 total used 2 – Front Side Routers 2 – Back Side Routers
Solaris 10	16 – Front side Fibre Channels *(8 Gbps)* 16 – Back side Fibre Channels *(4 Gbps)*
Solaris Volume Manager *(included with Solaris 10)*	64 – Drive Enclosure Modules, each with dual switched FC-AL interfaces, 15 hot swap drive slots
PCI Express	456 – 300 GB 15K RPM disk drives *(440 drives in 44 RAID Groups and 16 reserved for system use)* 456 – 450 GB 15K RPM disk drives *(440 drives in 44 RAID Groups plus 16 Hot Spares)*
WG	

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 64 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 66 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 105.

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 60 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)	99,080.868
Addressable Storage Capacity	Gigabytes (GB)	99,080.869
Configured Storage Capacity	Gigabytes (GB)	334,781.963
Physical Storage Capacity	Gigabytes (GB)	340,062.001
Data Protection *(Mirroring)*	Gigabytes (GB)	161,517.614
Required Storage *(including spares)*	Gigabytes (GB)	8,298.145
Global Storage Overhead	Gigabytes (GB)	5,280.037
Total Unused Storage	Gigabytes (GB)	124,770.143

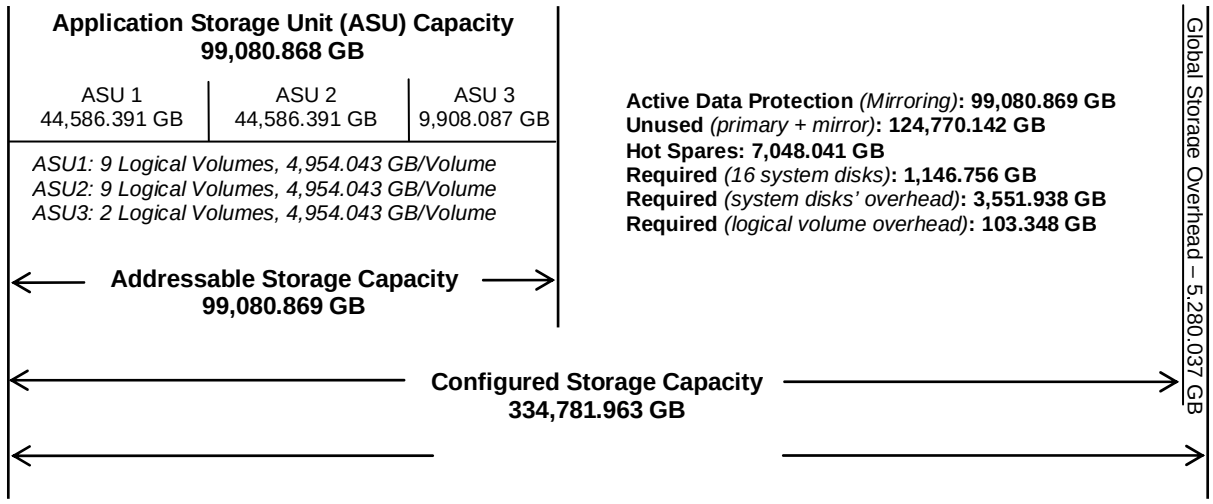
SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	**Configured Storage Capacity**	**Physical Storage Capacity**
Total ASU Capacity	100.00%	29.60%	29.14%
Required for Data Protection *(Mirrored)*		48.25%	47.50%
Addressable Storage Capacity		29.60%	29.14%
Required Storage *(including spares)*		2.48%	2.44%
Configured Storage Capacity			98.45%
Global Storage Overhead			1.55%
Unused Storage:			
Addressable	0.00%		
Configured		37.27%	
Physical			0.00%

The Physical Storage Capacity consisted of 340,062.001 GB distributed over 456 disk drives each with a formatted capacity of 298.300 GB and 456 disk drives each with a formatted capacity of 447.450 GB. There was 0.000 GB (0.00%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 5,280.037 GB (1.55%) of Physical Storage Capacity. There was 124,770.142 GB (37.27%) of Unused Storage within the Configured Storage Capacity, including unused Data Protection capacity. The Total ASU Capacity utilized 100.00% of the Addressable Storage Capacity resulting in 0.001 GB (0.00%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(mirroring)* capacity was 161,517.614 GB of which 99.132.543 GB was utilized. The total Unused Storage was 124,770.143 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 (44,586.391 GB)	**ASU-2 (44,586.391 GB)**	**ASU-3 (9,908.087 GB)**
9 Logical Volume 4,954.043 GB per Logical Volume (4,954.043 GB used per Logical Volume)	9 Logical Volume 4,954.043 GB per Logical Volume (4,954.043 GB used per Logical Volume)	2 Logical Volume 4,954.043 GB per Logical Volume (4,954.043 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

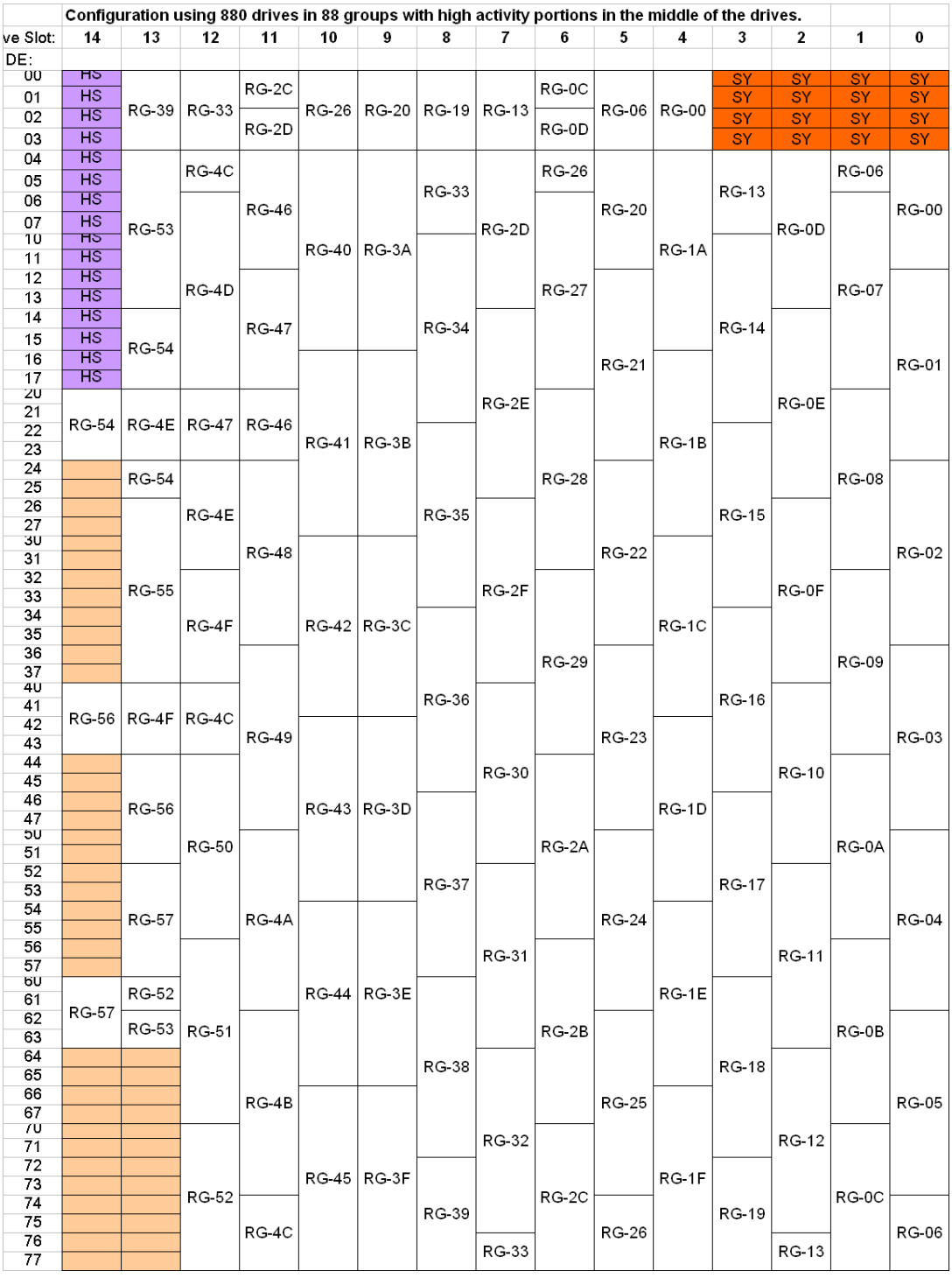
Unused Storage Ratio is defined as Total Unused Capacity divided by Physical Storage Capacity and may not exceed 45%.

SPC-1 Storage Capacity Utilization	
Application Utilization	29.14%
Protected Application Utilization	58.29%
Unused Storage Ratio	36.69%

Assignment of RAID Groups and LUNs

The 88 RAID Group Assignments are RAID1+0(5+5) sets, each divided into 20 Logical Volumes, for a total of 1760 LVs.

The RAID Group assignments to drives in the array are illustrated by the following chart.



The RAID Groups and LUN assignments are set up through a series of actions on the GUI Management Interface (ETERNUS Administrator). The task of setting up the configuration for each customer is provided as part of the base system price by Fujitsu. Different techniques are applied, depending upon the needs of the customer. This configuration reflects the customary techniques that are applied when a high performance requirement dominates the customer environment. Other techniques are applied when the primary requirement is for maximum capacity. In the case of high performance, it is customary to define RAID Groups arranged in RAID1+0 configurations. In this configuration, all of the RAID Groups are 1+0(5+5) arrangements. Please see section "Tested Storage Configuration Creation" for further details on preparing the configuration.

There are (16) of the drives reserved exclusively for system use, and (16) Hot Spare drives have been included in the configuration. There are (48) empty drive slots in this configuration, as well.

The 1760 Logical Volumes are grouped into eight separate sets of LUNs each with 220 LUNs. These are connected to the host server through the 16 ports and directly connected HBA ports. The LUNs, seen through the 16 HBA ports by Solaris, are grouped into Solaris Volume Groups, and used with 8 MB stripe unit depths across the sets. Nine Logical Volumes, each with 88 LUNs are used for ASU1 and another nine for ASU2, while two Volumes, also each with 88 LUNs are used for ASU3. The sizes are reflected in the ASU Logical Volume Mapping chart.

Two optional facilities in the ETERNUS DX8400 (ESC and Trace), which are used to collect information during operation, were turned off during this benchmark run. They are normally not enabled during operations. Two secondary enhanced reliability features (Patrol and sampled Read after Write compare), which may be optionally enabled by a customer, were turned off during this benchmark run. The optional encryption feature was turned off during this benchmark, as well. Due to the transaction nature of the workload, as is customary for such workloads, the write sequential feature was turned off.

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 61 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 106.

Sustainability Test Results File

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

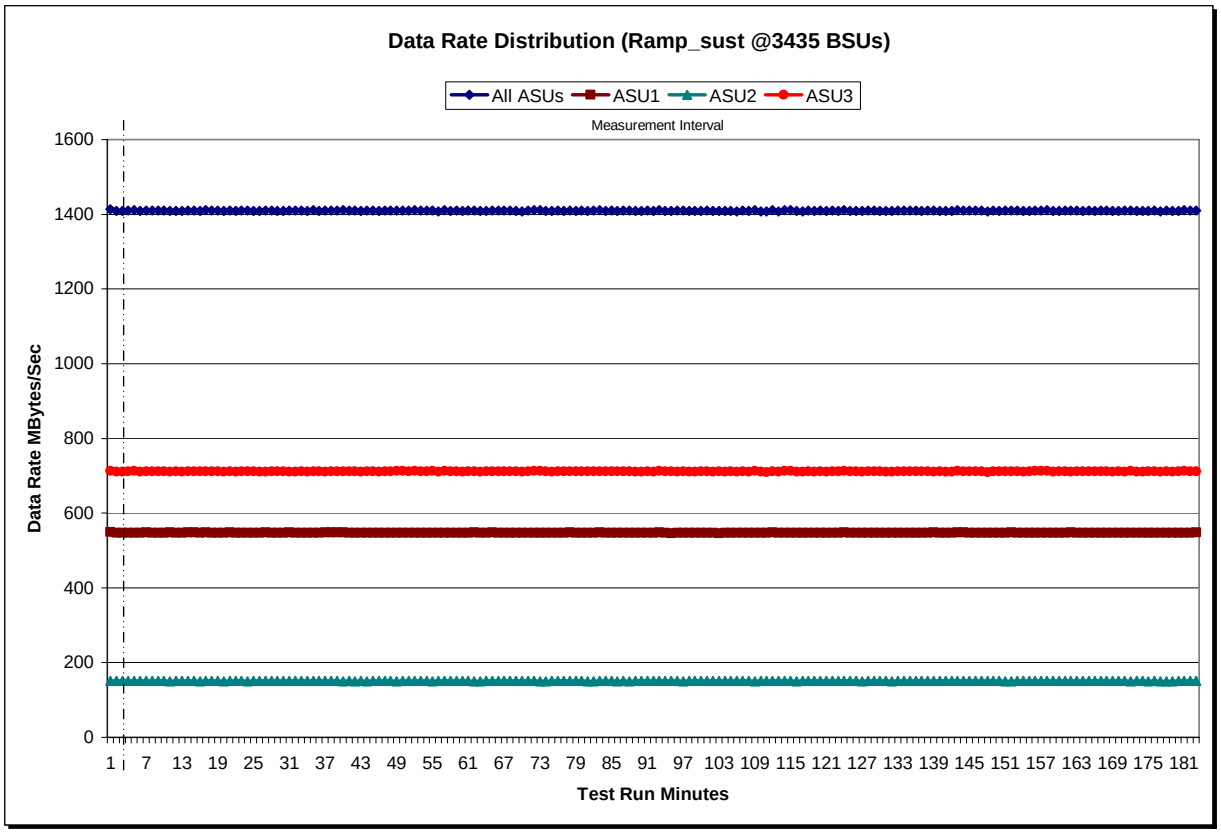
Sustainability Test Results File

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

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	4:28:38	4:31:38	0-2	0:03:00
Measurement Interval	4:31:38	7:31:38	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	1,413.78	548.99	151.26	713.53	63	1,408.85	547.13	150.41	711.31	126	1,408.33	547.26	150.29	710.78
1	1,409.16	547.48	150.53	711.14	64	1,410.47	548.12	150.65	711.70	127	1,410.31	547.17	151.02	712.11
2	1,408.71	547.33	150.63	710.74	65	1,410.07	547.42	150.67	711.97	128	1,410.47	547.38	150.96	712.13
3	1,409.50	547.44	150.39	711.67	66	1,410.09	547.38	150.61	712.10	129	1,408.48	546.67	150.42	711.39
4	1,410.65	547.34	150.86	712.46	67	1,409.69	547.60	150.47	711.63	130	1,409.01	547.34	150.61	711.06
5	1,408.95	547.02	150.67	711.26	68	1,408.91	546.61	150.38	711.92	131	1,408.43	547.37	150.12	710.94
6	1,409.89	547.82	150.44	711.63	69	1,408.09	546.74	150.74	710.61	132	1,409.49	547.30	150.63	711.56
7	1,409.70	547.26	150.45	711.99	70	1,410.09	547.62	150.69	711.79	133	1,410.05	546.74	151.00	712.31
8	1,410.43	547.43	150.79	712.21	71	1,410.97	547.63	150.54	712.80	134	1,410.24	547.60	150.40	712.24
9	1,409.83	547.25	150.46	712.12	72	1,410.66	547.53	150.18	712.95	135	1,409.92	547.60	150.42	711.89
10	1,408.61	547.83	150.13	710.65	73	1,409.13	547.00	150.29	711.84	136	1,409.07	546.85	150.35	711.86
11	1,409.23	547.21	150.57	711.45	74	1,408.60	547.71	150.74	710.15	137	1,409.98	547.53	150.72	711.73
12	1,409.12	547.19	150.77	711.16	75	1,409.81	547.13	150.34	712.34	138	1,409.78	548.29	150.45	711.04
13	1,410.51	547.78	150.50	712.23	76	1,409.34	547.26	150.37	711.72	139	1,409.25	547.12	150.35	711.77
14	1,409.88	547.75	150.70	711.43	77	1,410.47	547.80	150.54	712.13	140	1,408.64	547.06	150.34	711.25
15	1,408.66	547.25	150.02	711.39	78	1,409.18	547.00	150.76	711.43	141	1,408.69	547.01	150.39	711.29
16	1,410.84	547.74	150.67	712.43	79	1,410.41	547.43	150.58	712.40	142	1,411.38	547.80	150.72	712.85
17	1,409.70	547.17	150.54	711.99	80	1,409.03	546.89	150.31	711.84	143	1,410.11	547.79	150.43	711.88
18	1,409.90	547.26	150.51	712.13	81	1,409.41	547.41	150.27	711.73	144	1,409.51	547.60	150.55	711.35
19	1,408.69	547.19	150.25	711.24	82	1,410.57	548.02	150.73	711.82	145	1,409.40	546.90	150.74	711.76
20	1,409.94	547.77	150.56	711.62	83	1,409.21	546.96	150.87	711.38	146	1,409.38	547.49	150.58	711.31
21	1,408.35	547.15	150.63	710.57	84	1,410.50	547.67	150.63	712.20	147	1,408.11	547.24	150.95	709.92
22	1,409.91	547.33	150.75	711.84	85	1,408.40	546.62	150.27	711.52	148	1,409.93	547.36	150.52	712.06
23	1,409.78	547.51	150.26	712.01	86	1,410.19	547.03	150.82	712.34	149	1,408.97	546.72	150.42	711.83
24	1,409.35	547.18	150.55	711.62	87	1,409.49	547.22	150.30	711.97	150	1,409.80	547.11	150.26	712.44
25	1,408.42	546.94	150.38	711.10	88	1,408.90	547.04	150.79	711.07	151	1,410.45	547.75	150.30	712.39
26	1,409.84	548.12	150.50	711.22	89	1,408.78	547.26	150.48	711.04	152	1,409.54	547.19	150.39	711.95
27	1,409.92	547.68	150.56	711.67	90	1,410.26	547.42	150.48	712.36	153	1,409.34	547.58	150.92	710.84
28	1,409.00	547.02	150.48	711.51	91	1,408.74	546.78	150.68	711.29	154	1,408.90	546.72	150.55	711.63
29	1,409.31	547.15	150.57	711.59	92	1,411.20	547.78	150.72	712.70	155	1,410.33	546.92	150.63	712.78
30	1,409.45	547.80	150.37	711.29	93	1,409.24	547.04	150.62	711.58	156	1,410.41	547.15	150.79	712.47
31	1,409.56	547.64	150.73	711.19	94	1,408.50	546.52	150.54	711.45	157	1,410.84	547.52	150.62	712.70
32	1,409.92	547.38	150.67	711.87	95	1,409.40	547.62	150.58	711.20	158	1,409.03	547.37	150.50	711.16
33	1,408.73	547.31	150.50	710.92	96	1,409.58	547.05	150.25	712.29	159	1,409.00	546.94	150.48	711.58
34	1,410.72	547.68	150.88	712.16	97	1,408.90	547.62	150.77	710.51	160	1,409.86	546.92	150.95	711.99
35	1,409.22	546.99	150.35	711.88	98	1,408.89	547.72	150.51	710.66	161	1,410.01	548.18	150.53	711.29
36	1,409.95	548.00	150.67	711.28	99	1,409.01	547.06	150.57	711.38	162	1,409.39	547.34	150.57	711.48
37	1,409.88	547.77	150.78	711.32	100	1,410.01	547.21	150.75	712.05	163	1,409.25	547.35	150.40	711.49
38	1,410.21	547.82	150.37	712.02	101	1,409.16	547.33	150.62	711.21	164	1,409.75	547.40	150.85	711.49
39	1,410.53	548.09	150.32	712.13	102	1,408.76	546.53	150.68	711.55	165	1,408.94	546.98	150.52	711.44
40	1,409.97	547.10	150.72	712.14	103	1,409.03	547.18	150.55	711.30	166	1,409.90	547.24	150.52	712.14
41	1,409.43	547.41	150.30	711.72	104	1,409.13	547.40	150.33	711.40	167	1,410.38	547.42	150.56	712.39
42	1,409.03	547.54	150.43	711.07	105	1,407.73	546.61	150.47	710.65	168	1,409.25	547.32	150.63	711.30
43	1,409.86	547.60	150.10	712.16	106	1,409.88	547.48	150.82	711.59	169	1,409.16	546.76	150.68	711.72
44	1,409.68	547.09	150.52	712.07	107	1,408.97	547.07	150.60	711.30	170	1,409.37	547.64	150.55	711.18
45	1,409.05	547.40	150.57	711.09	108	1,410.86	547.42	150.18	713.26	171	1,410.29	547.40	150.19	712.71
46	1,409.89	546.72	151.13	712.04	109	1,408.19	546.79	150.58	710.81	172	1,408.86	547.60	150.41	710.85
47	1,409.83	547.08	150.84	711.90	110	1,407.66	547.05	150.48	710.13	173	1,408.56	547.25	150.41	710.90
48	1,410.32	547.29	150.23	712.80	111	1,410.53	547.79	150.81	711.92	174	1,409.34	547.23	150.29	711.82
49	1,410.12	546.94	150.66	712.52	112	1,407.99	547.05	150.37	710.57	175	1,409.82	547.24	150.44	712.14
50	1,410.13	547.44	150.57	712.11	113	1,411.08	547.25	150.41	713.42	176	1,408.03	547.25	150.32	710.45
51	1,411.09	547.56	150.81	712.72	114	1,410.52	547.35	150.56	712.61	177	1,409.51	547.41	150.30	711.80
52	1,409.44	547.41	150.67	711.36	115	1,408.48	547.03	150.32	711.14	178	1,409.01	547.44	150.30	711.26
53	1,410.25	547.69	150.41	712.16	116	1,407.82	546.75	150.55	710.52	179	1,409.24	546.82	150.73	711.69
54	1,410.20	547.36	150.21	712.64	117	1,409.69	547.42	150.50	711.76	180	1,411.13	547.64	150.79	712.70
55	1,408.18	547.13	150.59	710.46	118	1,408.98	547.34	150.65	711.00	181	1,410.51	547.65	150.69	712.17
56	1,410.69	547.26	150.76	712.67	119	1,409.36	547.33	150.41	711.62	182	1,410.16	547.95	150.41	711.80
57	1,409.17	547.12	150.57	711.48	120	1,409.26	547.40	150.59	711.26					
58	1,410.18	547.52	150.64	712.02	121	1,409.81	547.38	150.60	711.84					
59	1,408.34	547.27	150.89	710.18	122	1,408.65	546.72	150.50	711.42					
60	1,409.60	546.94	150.39	712.27	123	1,411.31	547.86	150.56	712.88					
61	1,409.88	547.92	150.27	711.68	124	1,409.31	547.13	150.69	711.49					
62	1,408.21	547.05	150.09	711.07	125	1,409.06	547.02	150.35	711.69					

Sustainability – Data Rate Distribution Graph

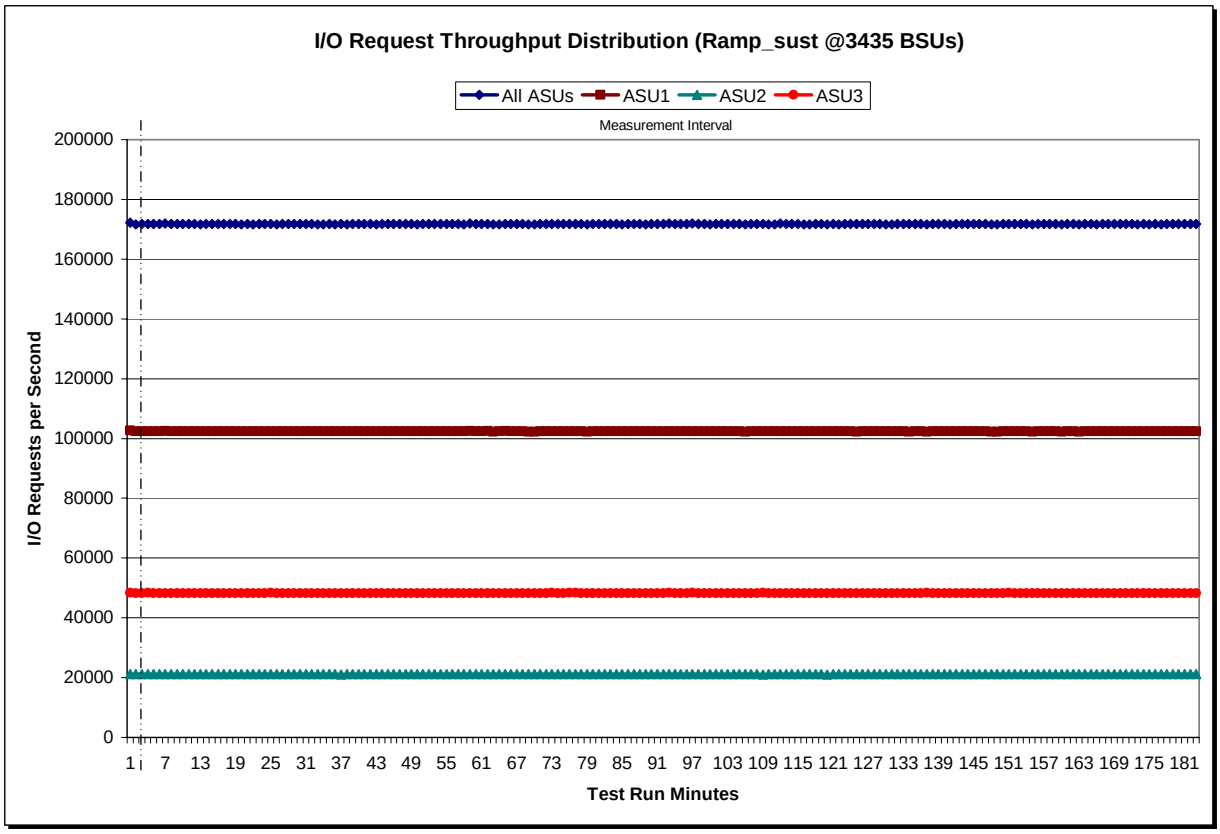


Sustainability – I/O Request Throughput Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	4:28:38	4:31:38	0-2	0:03:00
Measurement Interval	4:31:38	7:31:38	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	172,195.38	102,657.75	21,174.18	48,363.45	63	171,702.62	102,372.28	21,120.12	48,210.22	126	171,772.20	102,427.22	21,110.18	48,234.80
1	171,702.48	102,366.13	21,113.47	48,222.88	64	171,838.20	102,455.40	21,140.43	48,242.37	127	171,748.72	102,376.88	21,115.03	48,256.80
2	171,712.08	102,387.12	21,117.73	48,207.23	65	171,768.92	102,367.88	21,128.63	48,272.40	128	171,793.25	102,396.38	21,153.78	48,243.08
3	171,778.30	102,352.43	21,117.58	48,308.28	66	171,724.93	102,347.13	21,117.93	48,259.87	129	171,665.65	102,307.10	21,114.13	48,244.42
4	171,841.07	102,404.58	21,168.20	48,268.28	67	171,757.80	102,348.18	21,115.65	48,293.97	130	171,698.13	102,334.48	21,121.00	48,242.65
5	171,706.27	102,327.75	21,119.47	48,259.05	68	171,650.90	102,266.27	21,136.37	48,248.27	131	171,733.08	102,391.52	21,095.35	48,246.22
6	171,883.33	102,487.58	21,129.27	48,266.48	69	171,613.53	102,265.55	21,127.25	48,220.73	132	171,710.37	102,318.30	21,142.30	48,249.77
7	171,764.73	102,392.45	21,122.12	48,250.17	70	171,814.62	102,387.57	21,139.03	48,288.02	133	171,751.12	102,301.52	21,170.88	48,278.72
8	171,794.60	102,396.18	21,127.97	48,270.45	71	171,771.43	102,353.27	21,133.23	48,284.93	134	171,783.80	102,384.90	21,113.30	48,285.60
9	171,783.37	102,425.68	21,101.32	48,256.37	72	171,812.03	102,344.12	21,110.18	48,357.73	135	171,798.15	102,404.03	21,134.43	48,259.68
10	171,724.85	102,372.27	21,102.32	48,250.27	73	171,720.80	102,349.72	21,119.65	48,251.43	136	171,665.43	102,201.65	21,139.68	48,324.10
11	171,755.17	102,368.75	21,113.63	48,272.78	74	171,790.02	102,403.32	21,130.77	48,255.93	137	171,775.92	102,362.80	21,138.48	48,274.63
12	171,700.45	102,322.43	21,132.10	48,245.92	75	171,777.55	102,325.45	21,137.73	48,314.37	138	171,783.07	102,419.25	21,125.58	48,238.23
13	171,805.18	102,404.47	21,123.65	48,277.07	76	171,827.33	102,377.85	21,128.08	48,321.40	139	171,809.02	102,417.87	21,121.77	48,269.38
14	171,775.93	102,401.75	21,137.70	48,236.48	77	171,788.38	102,387.45	21,109.35	48,291.58	140	171,678.67	102,333.15	21,120.93	48,224.58
15	171,741.08	102,338.05	21,102.15	48,300.88	78	171,661.85	102,292.88	21,139.62	48,229.35	141	171,707.12	102,363.37	21,139.63	48,204.12
16	171,803.25	102,379.45	21,116.43	48,307.37	79	171,803.03	102,439.58	21,115.32	48,248.13	142	171,838.67	102,392.38	21,146.85	48,299.43
17	171,822.45	102,403.22	21,136.18	48,283.05	80	171,750.32	102,343.13	21,128.57	48,278.62	143	171,770.78	102,406.62	21,116.87	48,247.30
18	171,752.80	102,357.53	21,123.73	48,271.53	81	171,790.67	102,364.43	21,135.15	48,291.08	144	171,729.17	102,411.32	21,101.83	48,216.02
19	171,668.95	102,328.20	21,119.70	48,221.05	82	171,767.95	102,382.00	21,108.03	48,277.92	145	171,754.37	102,362.43	21,115.85	48,276.08
20	171,803.48	102,415.47	21,122.75	48,265.27	83	171,753.13	102,369.53	21,166.23	48,217.37	146	171,750.15	102,363.07	21,127.40	48,259.68
21	171,669.65	102,347.07	21,107.77	48,214.82	84	171,705.58	102,336.52	21,117.78	48,251.28	147	171,634.65	102,285.50	21,152.23	48,196.92
22	171,747.13	102,394.13	21,105.25	48,247.75	85	171,735.13	102,384.75	21,103.67	48,246.72	148	171,641.00	102,289.72	21,105.87	48,245.42
23	171,795.48	102,393.43	21,127.38	48,274.67	86	171,716.13	102,304.75	21,151.57	48,259.82	149	171,723.10	102,306.45	21,130.47	48,286.18
24	171,793.32	102,385.87	21,096.02	48,311.43	87	171,787.80	102,397.92	21,112.75	48,277.13	150	171,784.42	102,333.42	21,140.97	48,310.03
25	171,692.77	102,340.73	21,119.57	48,232.47	88	171,702.90	102,333.30	21,134.52	48,235.08	151	171,726.67	102,354.80	21,126.12	48,245.75
26	171,790.17	102,415.25	21,110.95	48,263.97	89	171,814.78	102,413.02	21,122.80	48,278.97	152	171,777.65	102,400.05	21,123.98	48,253.62
27	171,745.65	102,416.57	21,132.62	48,196.47	90	171,715.70	102,329.68	21,103.05	48,282.97	153	171,784.72	102,410.45	21,134.88	48,239.38
28	171,732.60	102,315.83	21,114.20	48,302.57	91	171,741.45	102,321.55	21,165.58	48,254.32	154	171,688.38	102,292.12	21,125.60	48,270.67
29	171,813.43	102,409.23	21,133.58	48,270.62	92	171,892.12	102,406.17	21,173.35	48,312.60	155	171,731.28	102,323.32	21,114.75	48,293.22
30	171,709.02	102,327.97	21,119.05	48,262.00	93	171,809.47	102,385.65	21,158.32	48,265.50	156	171,826.80	102,398.97	21,146.23	48,281.60
31	171,774.40	102,383.53	21,125.97	48,264.90	94	171,750.58	102,328.03	21,117.50	48,305.05	157	171,806.42	102,385.57	21,157.90	48,262.95
32	171,673.85	102,345.38	21,106.10	48,222.37	95	171,754.43	102,386.43	21,140.35	48,227.65	158	171,757.13	102,375.05	21,118.47	48,263.62
33	171,702.98	102,345.72	21,122.90	48,234.37	96	171,867.87	102,391.70	21,154.53	48,321.63	159	171,658.58	102,296.18	21,115.12	48,247.28
34	171,769.05	102,357.03	21,143.33	48,268.68	97	171,779.87	102,431.33	21,123.18	48,225.35	160	171,782.32	102,342.97	21,133.15	48,306.20
35	171,687.20	102,341.30	21,102.55	48,243.35	98	171,766.18	102,396.03	21,112.53	48,257.62	161	171,780.48	102,395.25	21,129.28	48,255.95
36	171,756.32	102,387.22	21,091.23	48,277.87	99	171,610.23	102,304.47	21,104.52	48,201.25	162	171,614.80	102,287.37	21,098.90	48,228.53
37	171,687.03	102,355.12	21,106.80	48,225.12	100	171,803.90	102,383.93	21,111.85	48,308.12	163	171,733.78	102,349.15	21,130.53	48,254.10
38	171,765.20	102,365.32	21,120.95	48,278.93	101	171,715.50	102,321.63	21,116.62	48,277.25	164	171,792.70	102,380.25	21,134.90	48,277.55
39	171,846.12	102,429.00	21,143.00	48,274.12	102	171,718.95	102,349.53	21,115.98	48,253.43	165	171,687.40	102,323.27	21,113.55	48,250.58
40	171,786.17	102,374.38	21,122.80	48,288.98	103	171,817.18	102,437.60	21,142.20	48,237.38	166	171,793.55	102,377.02	21,141.25	48,275.28
41	171,739.37	102,382.13	21,097.20	48,260.03	104	171,751.08	102,351.60	21,137.42	48,262.07	167	171,750.40	102,335.10	21,131.50	48,283.80
42	171,695.80	102,365.15	21,118.40	48,212.25	105	171,638.63	102,288.62	21,127.53	48,222.48	168	171,788.35	102,413.25	21,128.87	48,246.23
43	171,798.63	102,424.55	21,114.40	48,259.68	106	171,758.98	102,322.33	21,158.82	48,277.83	169	171,710.90	102,350.40	21,121.75	48,238.75
44	171,781.95	102,360.63	21,133.02	48,288.30	107	171,751.05	102,338.87	21,142.13	48,270.05	170	171,789.75	102,379.98	21,131.00	48,278.77
45	171,746.98	102,352.95	21,150.00	48,244.03	108	171,813.65	102,378.00	21,087.27	48,348.38	171	171,770.63	102,390.50	21,120.32	48,259.82
46	171,765.23	102,324.25	21,162.77	48,278.22	109	171,679.63	102,329.43	21,114.73	48,235.47	172	171,645.80	102,346.78	21,099.85	48,199.17
47	171,739.05	102,323.32	21,139.02	48,276.72	110	171,641.50	102,304.58	21,126.63	48,210.28	173	171,727.28	102,355.55	21,108.67	48,263.07
48	171,771.27	102,392.58	21,106.88	48,271.80	111	171,866.07	102,382.15	21,187.62	48,296.30	174	171,681.05	102,333.22	21,101.93	48,245.90
49	171,699.72	102,306.58	21,136.67	48,256.47	112	171,804.23	102,426.45	21,123.60	48,254.18	175	171,800.82	102,384.52	21,127.35	48,288.95
50	171,776.77	102,333.45	21,160.93	48,282.38	113	171,728.32	102,342.70	21,103.98	48,281.63	176	171,683.57	102,358.37	21,116.82	48,208.38
51	171,842.47	102,395.17	21,150.97	48,296.33	114	171,781.28	102,374.48	21,115.05	48,291.75	177	171,719.87	102,349.62	21,124.87	48,245.38
52	171,765.23	102,401.88	21,126.80	48,236.55	115	171,689.32	102,326.62	21,113.18	48,249.52	178	171,749.97	102,388.67	21,120.92	48,240.38
53	171,760.05	102,378.57	21,113.05	48,268.43	116	171,636.60	102,352.68	21,096.23	48,187.68	179	171,731.30	102,341.42	21,138.68	48,251.20
54	171,826.47	102,414.33	21,125.27	48,286.87	117	171,778.40	102,399.88	21,122.15	48,256.37	180	171,798.02	102,353.85	21,145.08	48,299.08
55	171,738.48	102,402.10	21,115.23	48,221.15	118	171,752.78	102,346.33	21,147.18	48,259.27	181	171,825.72	102,391.62	21,146.08	48,288.02
56	171,720.05	102,334.60	21,122.68	48,262.77	119	171,692.27	102,337.53	21,088.88	48,265.85	182	171,781.93	102,423.65	21,126.60	48,231.68
57	171,649.22	102,341.82	21,106.43	48,200.97	120	171,816.02	102,412.32	21,122.20	48,281.50	***Average***	***171,750.66***	***102,363.91***	***21,125.55***	***48,261.20***
58	171,865.72	102,452.72	21,133.65	48,279.35	121	171,663.58	102,306.90	21,102.22	48,254.47					
59	171,732.88	102,394.52	21,128.70	48,209.67	122	171,718.50	102,327.80	21,107.60	48,283.10					
60	171,709.13	102,333.85	21,107.57	48,267.72	123	171,784.07	102,379.42	21,120.65	48,284.00					
61	171,841.72	102,469.40	21,106.83	48,265.48	124	171,709.67	102,297.92	21,166.03	48,245.72					
62	171,649.35	102,298.42	21,113.18	48,237.75	125	171,715.60	102,319.80	21,150.38	48,245.42					

Sustainability – I/O Request Throughput Distribution Graph

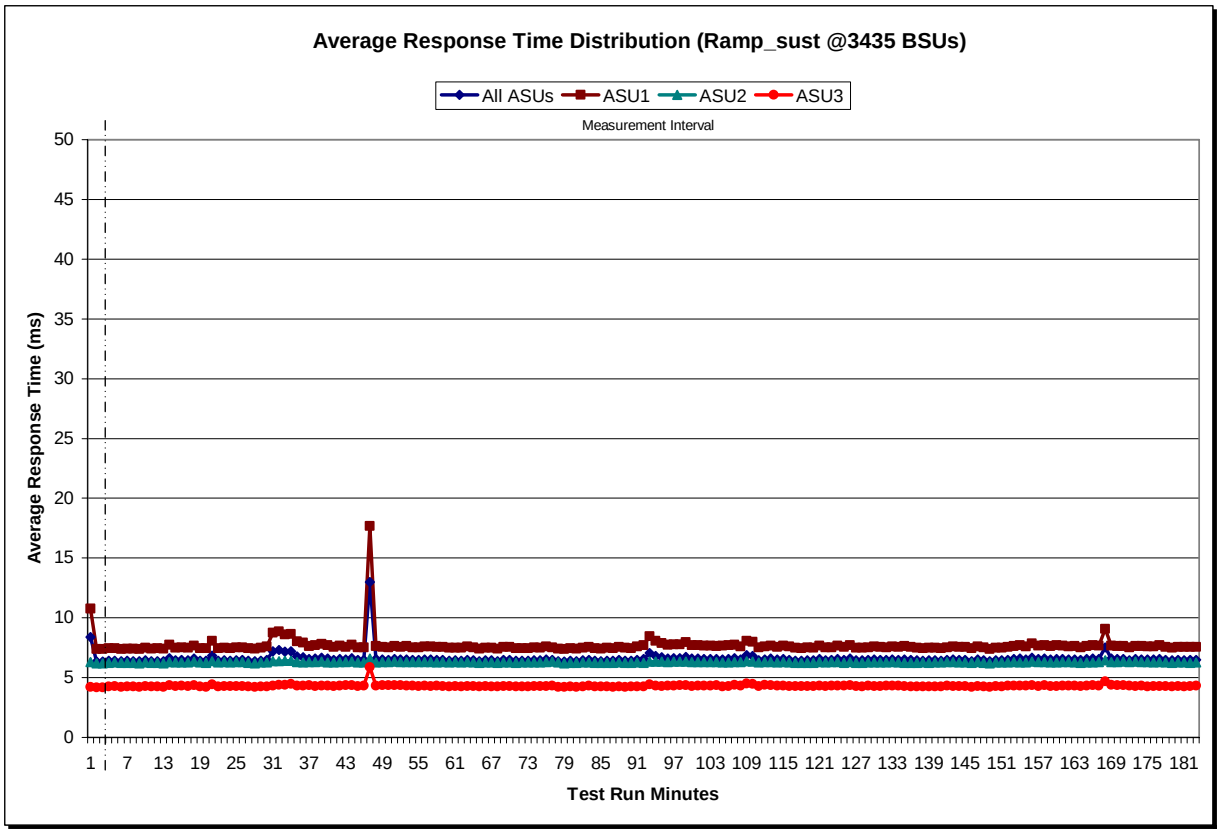


Sustainability – Average Response Time (ms) Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	4:28:38	4:31:38	0-2	0:03:00
Measurement Interval	4:31:38	7:31:38	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	8.38	10.76	6.29	4.22	63	6.46	7.53	6.27	4.28	126	6.43	7.49	6.24	4.27
1	6.34	7.39	6.19	4.18	64	6.37	7.40	6.23	4.24	127	6.43	7.50	6.24	4.26
2	6.35	7.39	6.20	4.19	65	6.44	7.49	6.27	4.28	128	6.47	7.53	6.26	4.30
3	6.41	7.45	6.24	4.27	66	6.43	7.50	6.26	4.24	129	6.50	7.60	6.27	4.27
4	6.42	7.47	6.26	4.28	67	6.38	7.42	6.23	4.23	130	6.48	7.56	6.27	4.29
5	6.36	7.40	6.22	4.23	68	6.47	7.54	6.28	4.29	131	6.48	7.54	6.28	4.30
6	6.39	7.42	6.24	4.26	69	6.47	7.54	6.26	4.28	132	6.51	7.58	6.31	4.31
7	6.37	7.41	6.24	4.23	70	6.40	7.44	6.24	4.25	133	6.49	7.57	6.28	4.31
8	6.35	7.39	6.21	4.22	71	6.40	7.43	6.26	4.25	134	6.51	7.62	6.23	4.28
9	6.45	7.50	6.27	4.30	72	6.40	7.46	6.26	4.24	135	6.46	7.55	6.24	4.26
10	6.39	7.42	6.24	4.25	73	6.45	7.51	6.27	4.28	136	6.43	7.50	6.21	4.25
11	6.39	7.43	6.24	4.24	74	6.44	7.49	6.26	4.27	137	6.41	7.46	6.25	4.26
12	6.36	7.40	6.21	4.23	75	6.50	7.59	6.32	4.30	138	6.44	7.50	6.24	4.26
13	6.62	7.75	6.30	4.36	76	6.48	7.53	6.32	4.33	139	6.43	7.49	6.25	4.26
14	6.43	7.48	6.26	4.28	77	6.38	7.42	6.25	4.23	140	6.40	7.45	6.25	4.25
15	6.47	7.54	6.27	4.31	78	6.34	7.38	6.21	4.21	141	6.48	7.54	6.29	4.31
16	6.43	7.48	6.27	4.27	79	6.39	7.45	6.21	4.23	142	6.51	7.60	6.30	4.30
17	6.58	7.68	6.33	4.35	80	6.37	7.41	6.22	4.22	143	6.47	7.55	6.26	4.28
18	6.40	7.44	6.27	4.26	81	6.43	7.49	6.28	4.26	144	6.48	7.56	6.27	4.28
19	6.40	7.46	6.24	4.22	82	6.48	7.54	6.28	4.31	145	6.38	7.44	6.22	4.21
20	6.83	8.06	6.37	4.43	83	6.41	7.46	6.23	4.24	146	6.50	7.59	6.29	4.29
21	6.40	7.45	6.26	4.24	84	6.38	7.42	6.23	4.23	147	6.43	7.51	6.21	4.24
22	6.44	7.49	6.29	4.27	85	6.42	7.48	6.24	4.24	148	6.36	7.40	6.19	4.22
23	6.42	7.46	6.27	4.28	86	6.40	7.47	6.23	4.21	149	6.43	7.48	6.25	4.27
24	6.45	7.51	6.28	4.28	87	6.48	7.57	6.27	4.26	150	6.43	7.48	6.26	4.27
25	6.47	7.54	6.29	4.29	88	6.42	7.49	6.24	4.22	151	6.49	7.56	6.28	4.30
26	6.41	7.46	6.24	4.25	89	6.40	7.46	6.24	4.23	152	6.54	7.64	6.29	4.31
27	6.35	7.40	6.20	4.20	90	6.49	7.60	6.26	4.26	153	6.58	7.71	6.27	4.32
28	6.42	7.47	6.27	4.25	91	6.55	7.69	6.23	4.25	154	6.50	7.59	6.27	4.30
29	6.48	7.58	6.26	4.26	92	7.06	8.45	6.35	4.42	155	6.68	7.84	6.34	4.36
30	7.21	8.76	6.37	4.30	93	6.79	8.05	6.33	4.31	156	6.55	7.67	6.28	4.29
31	7.30	8.87	6.39	4.39	94	6.68	7.89	6.32	4.29	157	6.58	7.69	6.28	4.36
32	7.15	8.61	6.39	4.37	95	6.60	7.73	6.31	4.31	158	6.52	7.63	6.25	4.28
33	7.20	8.65	6.40	4.47	96	6.64	7.79	6.34	4.33	159	6.56	7.70	6.26	4.29
34	6.77	8.02	6.31	4.30	97	6.64	7.78	6.34	4.35	160	6.56	7.68	6.30	4.33
35	6.70	7.91	6.27	4.33	98	6.74	7.95	6.35	4.36	161	6.52	7.60	6.29	4.33
36	6.56	7.64	6.31	4.37	99	6.58	7.71	6.29	4.29	162	6.53	7.63	6.28	4.31
37	6.58	7.72	6.30	4.29	100	6.58	7.69	6.30	4.34	163	6.46	7.53	6.25	4.29
38	6.65	7.81	6.32	4.32	101	6.55	7.66	6.29	4.33	164	6.54	7.64	6.27	4.32
39	6.58	7.71	6.28	4.32	102	6.56	7.67	6.28	4.33	165	6.60	7.72	6.28	4.35
40	6.47	7.54	6.25	4.28	103	6.55	7.63	6.31	4.35	166	6.55	7.65	6.29	4.31
41	6.57	7.68	6.29	4.33	104	6.53	7.66	6.28	4.26	167	7.53	9.08	6.45	4.69
42	6.50	7.56	6.30	4.34	105	6.56	7.69	6.26	4.30	168	6.58	7.67	6.31	4.38
43	6.61	7.73	6.34	4.37	106	6.63	7.75	6.31	4.39	169	6.54	7.62	6.30	4.35
44	6.46	7.54	6.26	4.28	107	6.51	7.59	6.28	4.33	170	6.54	7.62	6.32	4.35
45	6.47	7.53	6.26	4.30	108	6.86	8.07	6.38	4.49	171	6.46	7.51	6.28	4.32
46	12.99	17.67	6.60	5.87	109	6.79	7.99	6.34	4.45	172	6.53	7.63	6.32	4.29
47	6.54	7.64	6.28	4.32	110	6.46	7.52	6.26	4.29	173	6.53	7.62	6.29	4.31
48	6.51	7.57	6.31	4.34	111	6.53	7.59	6.31	4.37	174	6.50	7.61	6.29	4.26
49	6.48	7.53	6.30	4.34	112	6.57	7.67	6.31	4.36	175	6.51	7.61	6.28	4.28
50	6.54	7.62	6.32	4.35	113	6.50	7.57	6.28	4.33	176	6.57	7.69	6.30	4.29
51	6.51	7.57	6.29	4.36	114	6.56	7.68	6.31	4.31	177	6.48	7.55	6.28	4.29
52	6.53	7.62	6.30	4.33	115	6.49	7.59	6.25	4.27	178	6.44	7.50	6.24	4.26
53	6.46	7.51	6.29	4.31	116	6.42	7.48	6.22	4.27	179	6.49	7.57	6.27	4.30
54	6.47	7.53	6.29	4.30	117	6.41	7.46	6.22	4.28	180	6.46	7.54	6.25	4.25
55	6.52	7.60	6.29	4.31	118	6.45	7.53	6.22	4.28	181	6.48	7.57	6.23	4.30
56	6.51	7.61	6.31	4.28	119	6.43	7.49	6.23	4.27	182	6.48	7.55	6.27	4.31
57	6.49	7.56	6.28	4.31	120	6.55	7.66	6.29	4.32	***Average***	***6.56***	***7.67***	***6.28***	***4.31***
58	6.50	7.57	6.29	4.30	121	6.46	7.53	6.25	4.28					
59	6.42	7.47	6.28	4.25	122	6.48	7.53	6.29	4.32					
60	6.43	7.48	6.31	4.27	123	6.55	7.66	6.29	4.31					
61	6.42	7.47	6.28	4.26	124	6.47	7.54	6.24	4.31					
62	6.50	7.58	6.29	4.29	125	6.60	7.72	6.30	4.34					

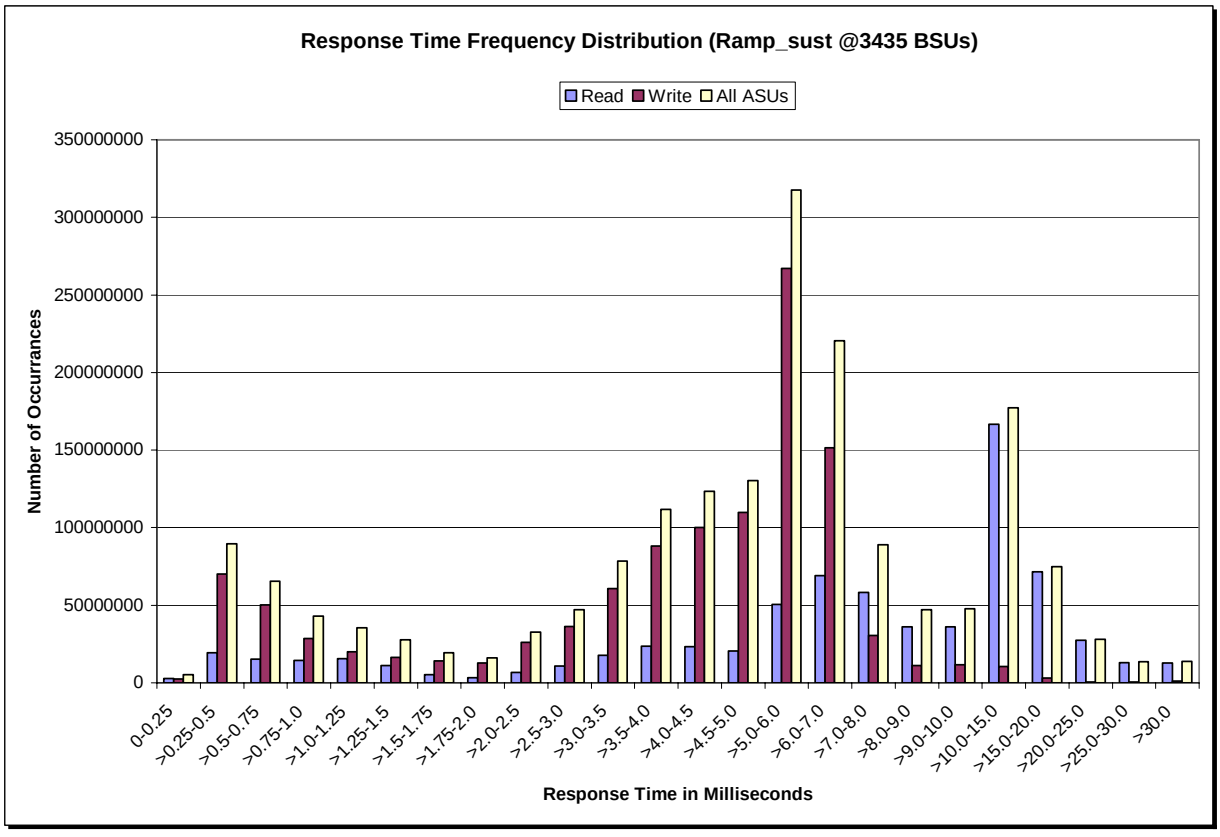
Sustainability – Average Response Time (ms) Distribution Graph



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	2,658,746	19,384,534	15,303,162	14,336,803	15,411,608	11,220,660	5,366,589	3,350,201
Write	2,472,907	70,225,709	50,108,423	28,515,157	20,105,482	16,385,636	14,025,542	12,732,126
All ASUs	5,131,653	89,610,243	65,411,585	42,851,960	35,517,090	27,606,296	19,392,131	16,082,327
ASU1	3,339,754	46,784,621	31,722,499	21,907,188	19,475,569	14,964,195	9,776,357	7,811,273
ASU2	1,000,184	13,123,919	9,314,341	6,792,486	6,297,794	4,807,414	2,943,200	2,232,889
ASU3	791,715	29,701,703	24,374,745	14,152,286	9,743,727	7,834,687	6,672,574	6,038,165
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	6,761,465	10,714,829	17,843,490	23,692,527	23,420,377	20,510,995	50,400,807	69,049,958
Write	25,976,052	36,294,994	60,693,335	88,107,478	100,087,163	109,732,725	267,144,450	151,420,056
All ASUs	32,737,517	47,009,823	78,536,825	111,800,005	123,507,540	130,243,720	317,545,257	220,470,014
ASU1	15,941,209	23,163,961	38,486,911	54,163,135	59,306,446	62,425,303	157,497,558	128,138,939
ASU2	4,512,312	6,714,617	11,278,223	15,559,355	16,194,570	15,532,083	34,103,664	22,202,235
ASU3	12,283,996	17,131,245	28,771,691	42,077,515	48,006,524	52,286,334	125,944,035	70,128,840
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	58,319,132	36,093,367	36,173,384	166,677,979	71,682,565	27,406,555	13,119,498	12,652,316
Write	30,606,705	11,090,490	11,550,590	10,601,535	3,139,070	589,321	554,692	1,194,749
All ASUs	88,925,837	47,183,857	47,723,974	177,279,514	74,821,635	27,995,876	13,674,190	13,847,065
ASU1	67,169,189	38,095,983	38,389,061	155,030,151	65,634,652	24,075,705	11,387,202	10,842,529
ASU2	8,979,714	4,920,447	4,926,116	19,095,791	8,946,037	3,846,377	2,180,804	2,651,258
ASU3	12,776,934	4,167,427	4,408,797	3,153,572	240,946	73,794	106,184	353,278

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	0.002	0.000	0.001	0.001	0.002	0.001	0.002	0.000

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 106.

IOPS Test Results File

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

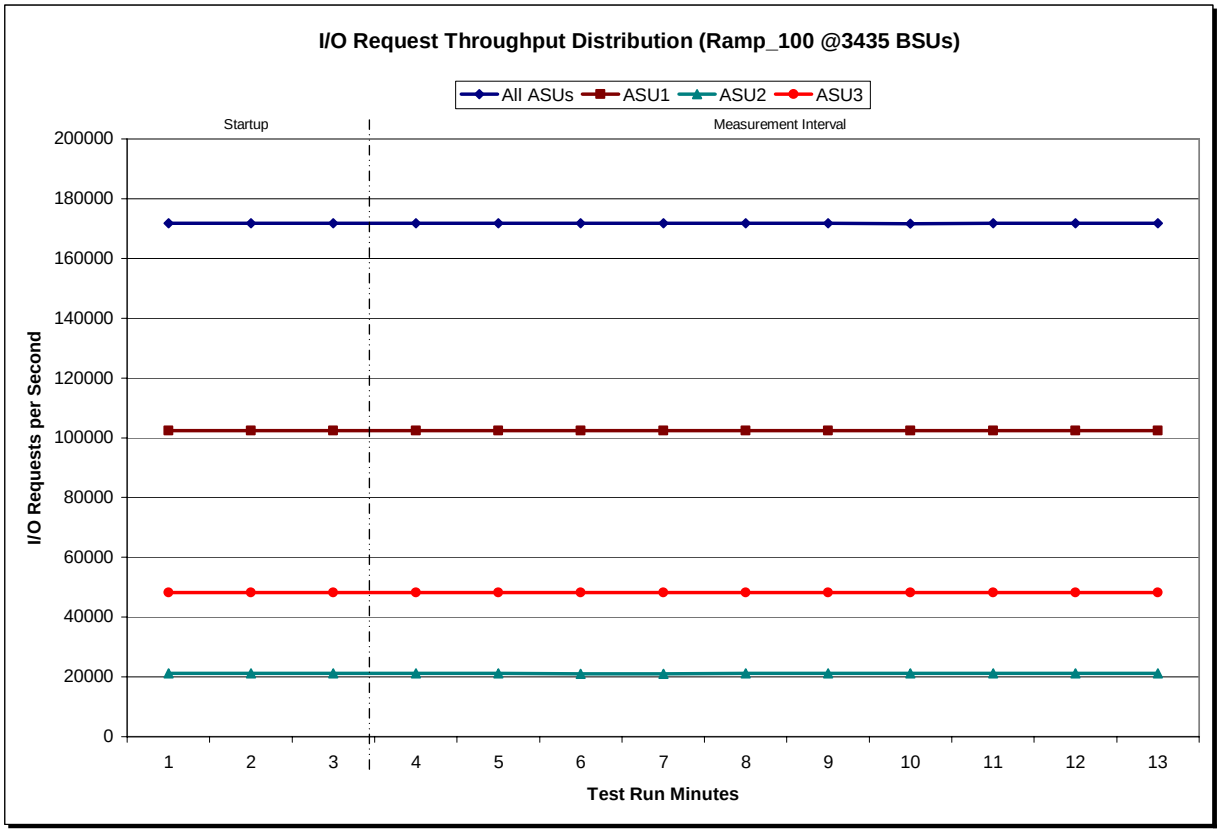
IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	7:37:45	7:40:46	0-2	0:03:01
Measurement Interval	7:40:46	7:50:46	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	171,796.20	102,340.85	21,171.57	48,283.78
1	171,840.30	102,445.30	21,113.53	48,281.47
2	171,809.77	102,391.97	21,137.52	48,280.28
3	171,731.07	102,309.28	21,114.33	48,307.45
4	171,715.70	102,371.42	21,105.85	48,238.43
5	171,750.40	102,384.03	21,093.77	48,272.60
6	171,749.27	102,391.05	21,093.72	48,264.50
7	171,766.07	102,419.98	21,117.27	48,228.82
8	171,715.33	102,342.80	21,116.43	48,256.10
9	171,673.13	102,309.27	21,127.65	48,236.22
10	171,706.83	102,331.70	21,123.63	48,251.50
11	171,798.27	102,396.27	21,132.57	48,269.43
12	171,762.30	102,382.38	21,123.30	48,256.62
Average	***171,736.84***	***102,363.82***	***21,114.85***	***48,258.17***

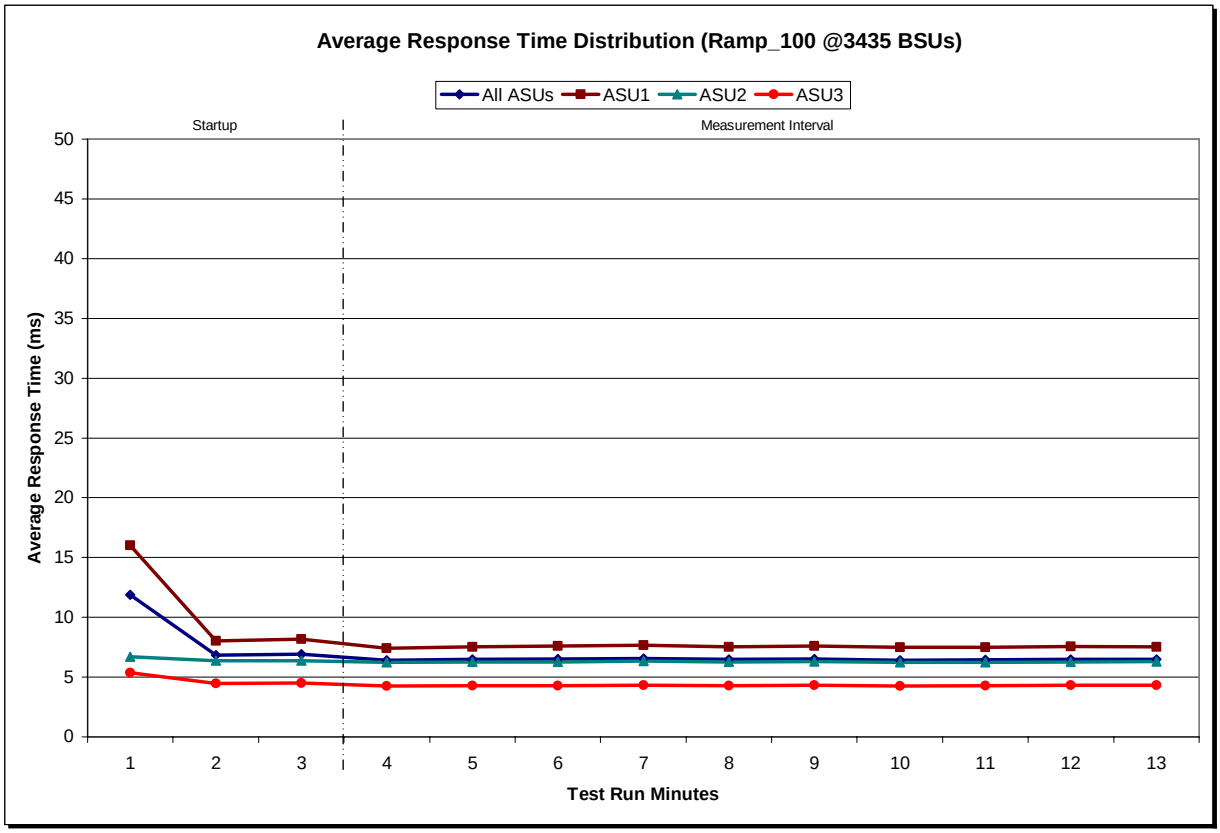
IOPS Test Run – I/O Request Throughput Distribution Graph



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

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	7:37:45	7:40:46	0-2	0:03:01
Measurement Interval	7:40:46	7:50:46	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	11.88	16.02	6.69	5.38
1	6.83	8.04	6.39	4.45
2	6.93	8.18	6.37	4.51
3	6.39	7.43	6.24	4.25
4	6.47	7.54	6.27	4.28
5	6.51	7.60	6.27	4.29
6	6.56	7.67	6.34	4.31
7	6.47	7.54	6.27	4.29
8	6.53	7.61	6.29	4.34
9	6.42	7.48	6.24	4.26
10	6.43	7.49	6.23	4.27
11	6.48	7.55	6.28	4.31
12	6.48	7.53	6.29	4.32
Average	***6.47***	***7.54***	***6.27***	***4.29***

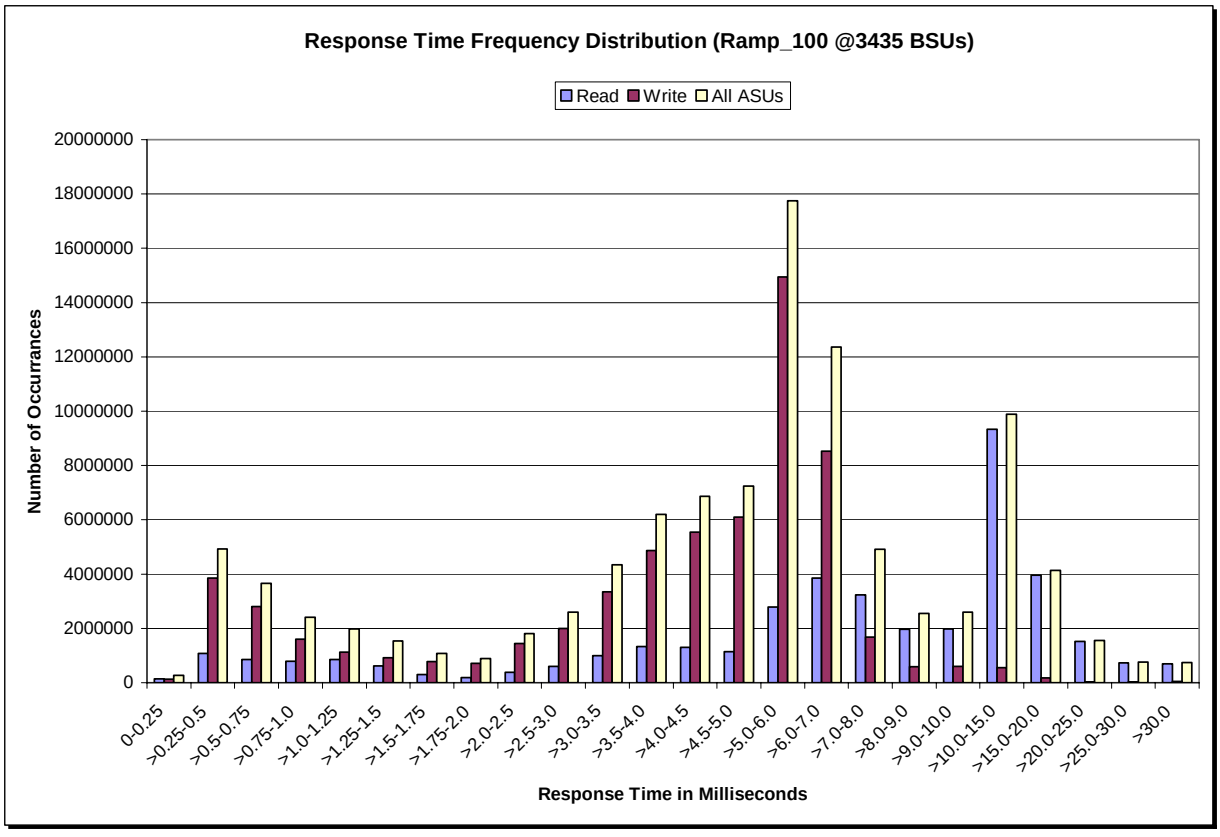
IOPS Test Run – Average Response Time (ms) Distribution Graph



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	143,907	1,075,506	858,884	799,818	854,466	622,666	298,797	186,205
Write	131,285	3,847,911	2,805,149	1,604,488	1,128,883	915,038	781,418	707,249
All ASUs	275,192	4,923,417	3,664,033	2,404,306	1,983,349	1,537,704	1,080,215	893,454
ASU1	179,451	2,574,406	1,781,934	1,230,172	1,087,306	833,604	545,797	435,574
ASU2	53,234	722,143	520,833	379,630	350,548	267,542	163,758	124,182
ASU3	42,507	1,626,868	1,361,266	794,504	545,495	436,558	370,660	333,698
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	374,718	596,756	995,061	1,325,488	1,306,284	1,139,490	2,796,937	3,846,822
Write	1,436,173	1,994,511	3,348,430	4,868,910	5,549,331	6,100,825	14,948,401	8,520,271
All ASUs	1,810,891	2,591,267	4,343,491	6,194,398	6,855,615	7,240,315	17,745,338	12,367,093
ASU1	883,593	1,285,632	2,141,012	3,019,951	3,301,704	3,465,582	8,767,043	7,164,864
ASU2	250,355	371,165	627,581	865,959	901,379	860,878	1,896,806	1,241,033
ASU3	676,943	934,470	1,574,898	2,308,488	2,652,532	2,913,855	7,081,489	3,961,196
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	3,227,311	1,963,586	1,982,075	9,329,544	3,969,262	1,528,465	724,162	693,622
Write	1,678,318	591,813	610,050	552,896	166,711	29,820	29,460	53,706
All ASUs	4,905,629	2,555,399	2,592,125	9,882,440	4,135,973	1,558,285	753,622	747,328
ASU1	3,709,312	2,068,943	2,098,086	8,661,418	3,631,213	1,340,165	627,623	583,054
ASU2	495,481	266,952	266,583	1,065,968	494,661	214,957	120,423	146,717
ASU3	700,836	219,504	227,456	155,054	10,099	3,163	5,576	17,557

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
103,040,879	102,293,551	747,328

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	0.0350	0.2809	0.0700	0.2101	0.0180	0.0700	0.0350	0.2810
COV	0.002	0.000	0.001	0.000	0.001	0.001	0.002	0.000

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 106.

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 - 3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	7:37:45	7:40:46	0-2	0:03:01
Measurement Interval	7:40:46	7:50:46	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	171,796.20	102,340.85	21,171.57	48,283.78
1	171,840.30	102,445.30	21,113.53	48,281.47
2	171,809.77	102,391.97	21,137.52	48,280.28
3	171,731.07	102,309.28	21,114.33	48,307.45
4	171,715.70	102,371.42	21,105.85	48,238.43
5	171,750.40	102,384.03	21,093.77	48,272.60
6	171,749.27	102,391.05	21,093.72	48,264.50
7	171,766.07	102,419.98	21,117.27	48,228.82
8	171,715.33	102,342.80	21,116.43	48,256.10
9	171,673.13	102,309.27	21,127.65	48,236.22
10	171,706.83	102,331.70	21,123.63	48,251.50
11	171,798.27	102,396.27	21,132.57	48,269.43
12	171,762.30	102,382.38	21,123.30	48,256.62
Average	171,736.84	102,363.82	21,114.85	48,258.17

95% Load Level - 3263 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	7:56:46	7:59:47	0-2	0:03:01
Measurement Interval	7:59:47	8:09:47	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	163,245.50	97,341.98	20,070.70	45,832.82
1	163,184.85	97,244.90	20,064.95	45,875.00
2	163,032.05	97,176.87	20,025.13	45,830.05
3	163,249.58	97,315.45	20,076.50	45,857.63
4	163,177.63	97,256.13	20,084.53	45,836.97
5	163,191.90	97,276.95	20,085.80	45,829.15
6	163,132.72	97,260.32	20,058.60	45,813.80
7	163,113.40	97,192.85	20,091.47	45,829.08
8	163,176.75	97,268.47	20,062.55	45,845.73
9	163,200.40	97,250.80	20,103.47	45,846.13
10	163,173.30	97,256.20	20,094.62	45,822.48
11	163,182.72	97,250.82	20,089.88	45,842.02
12	163,162.22	97,256.03	20,026.40	45,879.78
Average	163,176.06	97,258.40	20,077.38	45,840.28

90% Load Level - 3091 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	8:15:41	8:18:42	0-2	0:03:01
Measurement Interval	8:18:42	8:28:42	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	154,573.18	92,130.42	19,021.50	43,421.27
1	154,482.18	92,054.75	19,022.05	43,405.38
2	154,641.07	92,151.78	19,013.63	43,475.65
3	154,537.67	92,117.15	19,003.32	43,417.20
4	154,561.13	92,101.42	18,998.98	43,460.73
5	154,546.22	92,132.27	18,995.57	43,418.38
6	154,657.55	92,175.18	19,054.23	43,428.13
7	154,555.40	92,151.63	18,992.58	43,411.18
8	154,506.32	92,107.88	19,017.43	43,381.00
9	154,586.38	92,146.02	18,995.82	43,444.55
10	154,532.52	92,102.45	19,033.38	43,396.68
11	154,503.72	92,085.47	18,998.30	43,419.95
12	154,616.05	92,148.12	19,034.43	43,433.50
Average	154,560.30	92,126.76	19,012.41	43,421.13

80% Load Level - 2748 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	8:34:30	8:37:31	0-2	0:03:01
Measurement Interval	8:37:31	8:47:31	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	137,533.55	81,939.98	16,909.02	38,684.55
1	137,471.75	81,957.02	16,872.50	38,642.23
2	137,463.33	81,923.12	16,915.60	38,624.62
3	137,398.10	81,904.33	16,886.30	38,607.47
4	137,452.35	81,931.23	16,898.52	38,622.60
5	137,454.93	81,888.92	16,907.38	38,658.63
6	137,351.23	81,867.88	16,877.13	38,606.22
7	137,405.87	81,899.92	16,887.85	38,618.10
8	137,418.43	81,861.53	16,906.92	38,649.98
9	137,389.65	81,889.55	16,901.08	38,599.02
10	137,315.47	81,833.90	16,883.22	38,598.35
11	137,472.95	81,930.62	16,911.98	38,630.35
12	137,456.82	81,921.97	16,872.12	38,662.73
Average	137,411.58	81,892.99	16,893.25	38,625.35

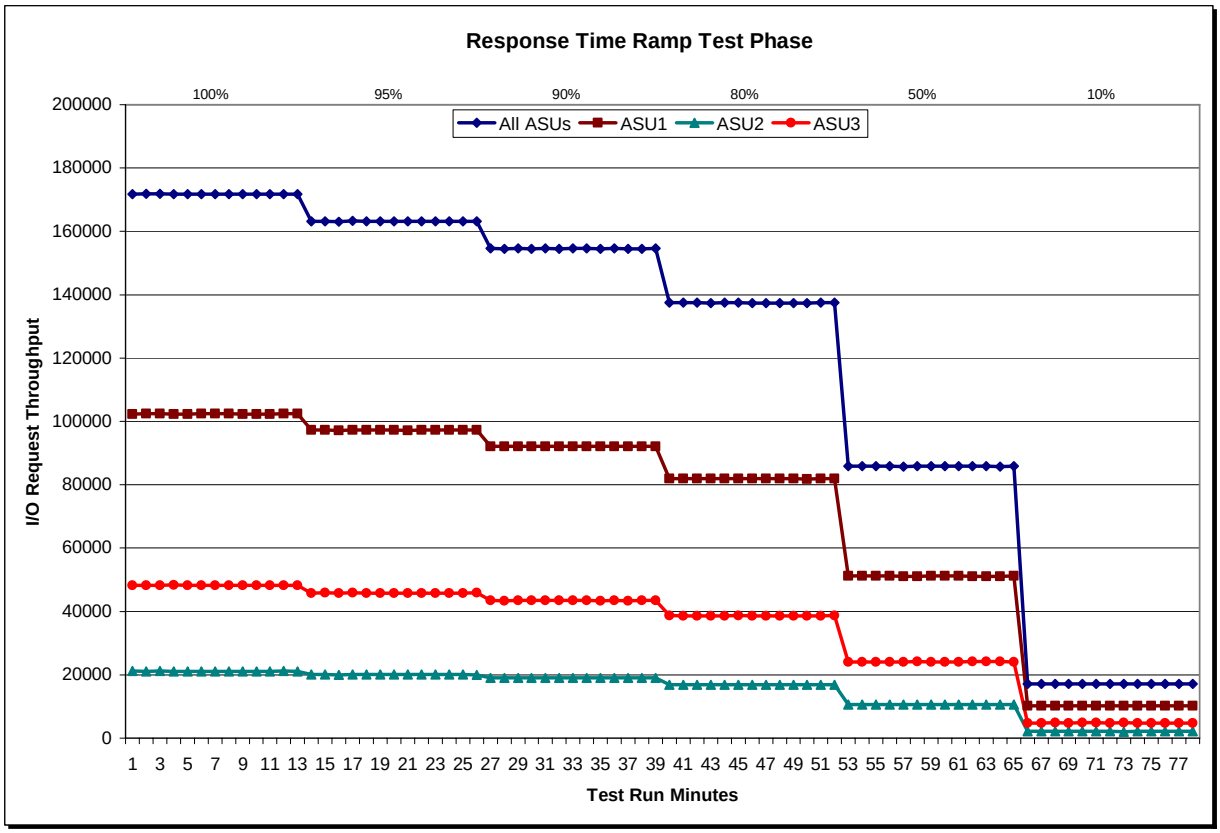
50% Load Level - 1717 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	8:53:08	8:56:09	0-2	0:03:01
Measurement Interval	8:56:09	9:06:09	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	85,834.32	51,166.77	10,558.98	24,108.57
1	85,926.60	51,257.20	10,556.23	24,113.17
2	85,892.48	51,204.82	10,578.65	24,109.02
3	85,875.03	51,188.68	10,571.93	24,114.42
4	85,789.73	51,120.43	10,553.52	24,115.78
5	85,869.75	51,150.85	10,577.68	24,141.22
6	85,821.87	51,181.40	10,539.72	24,100.75
7	85,858.10	51,191.70	10,562.93	24,103.47
8	85,852.97	51,186.90	10,566.43	24,099.63
9	85,857.85	51,134.20	10,585.10	24,138.55
10	85,832.08	51,151.22	10,558.52	24,122.35
11	85,797.65	51,135.63	10,530.77	24,131.25
12	85,845.57	51,182.72	10,569.50	24,093.35
Average	85,840.06	51,162.37	10,561.61	24,116.08

10% Load Level - 343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:11:55	9:14:56	0-2	0:03:01
Measurement Interval	9:14:56	9:24:56	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	17,168.12	10,241.87	2,119.27	4,806.98
1	17,177.00	10,255.12	2,109.68	4,812.20
2	17,173.38	10,226.20	2,114.37	4,832.82
3	17,155.13	10,226.43	2,107.40	4,821.30
4	17,145.48	10,211.92	2,106.05	4,827.52
5	17,169.83	10,224.97	2,112.60	4,832.27
6	17,149.37	10,227.27	2,110.03	4,812.07
7	17,149.02	10,220.43	2,099.28	4,829.30
8	17,139.48	10,215.78	2,107.38	4,816.32
9	17,125.42	10,211.70	2,108.38	4,805.33
10	17,157.62	10,226.38	2,117.05	4,814.18
11	17,129.47	10,210.52	2,110.45	4,808.50
12	17,156.93	10,225.65	2,113.03	4,818.25
Average	17,147.78	10,220.11	2,109.17	4,818.50

Response Time Ramp Distribution (IOPS) Graph

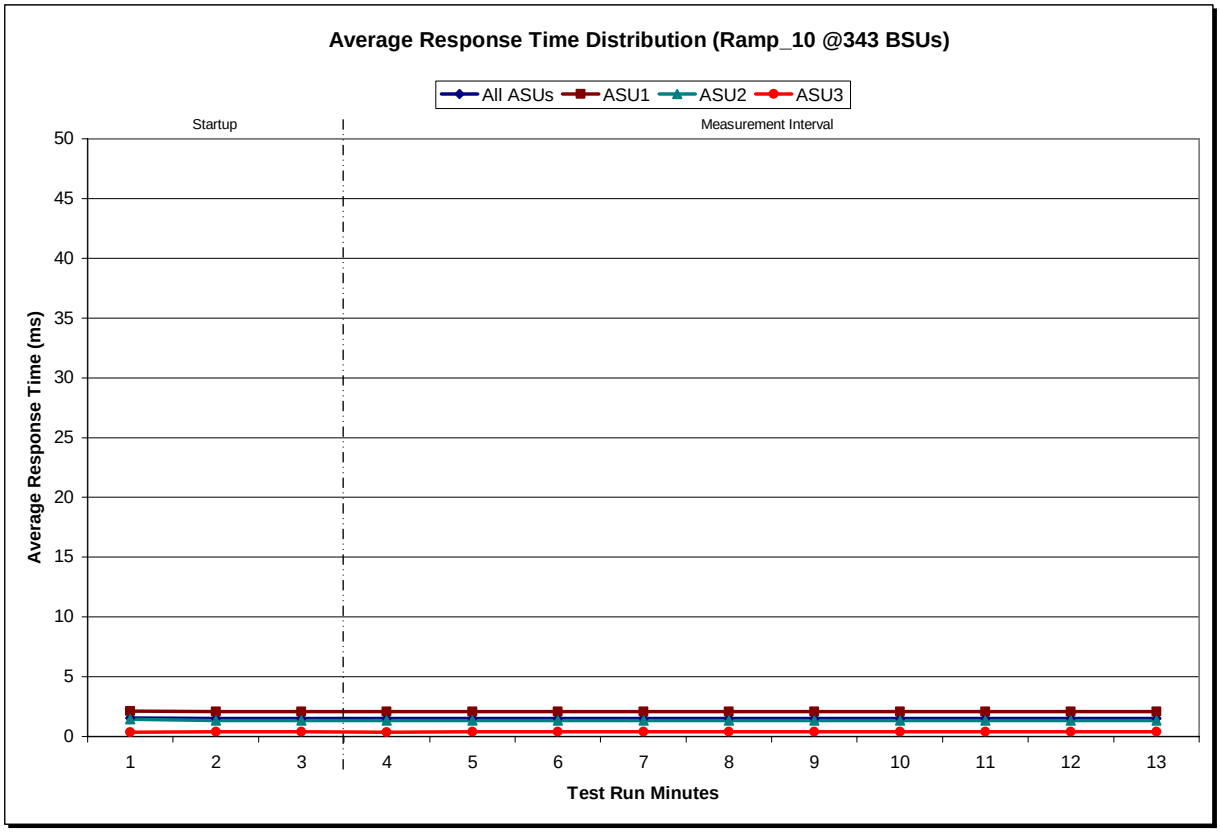


SPC-1 LRT™ Average Response Time (ms) Distribution Data

343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:11:55	9:14:56	0-2	0:03:01
Measurement Interval	9:14:56	9:24:56	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	1.54	2.11	1.44	0.37
1	1.53	2.10	1.33	0.38
2	1.52	2.10	1.33	0.38
3	1.52	2.09	1.32	0.38
4	1.51	2.08	1.33	0.38
5	1.52	2.10	1.32	0.38
6	1.52	2.10	1.33	0.38
7	1.51	2.09	1.32	0.38
8	1.52	2.09	1.33	0.38
9	1.52	2.09	1.34	0.38
10	1.51	2.09	1.33	0.38
11	1.52	2.09	1.34	0.38
12	1.51	2.08	1.33	0.38
Average	***1.52***	***2.09***	***1.33***	***0.38***

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	0.0350	0.2811	0.0699	0.2100	0.0180	0.0700	0.0350	0.2810
COV	0.005	0.001	0.004	0.001	0.005	0.003	0.007	0.001

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 106.

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	***171,736.84***
Repeatability Test Phase 1	171,772.52
Repeatability Test Phase 2	171,729.88

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	***1.52 ms***
Repeatability Test Phase 1	1.51 ms
Repeatability Test Phase 2	1.52 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)..

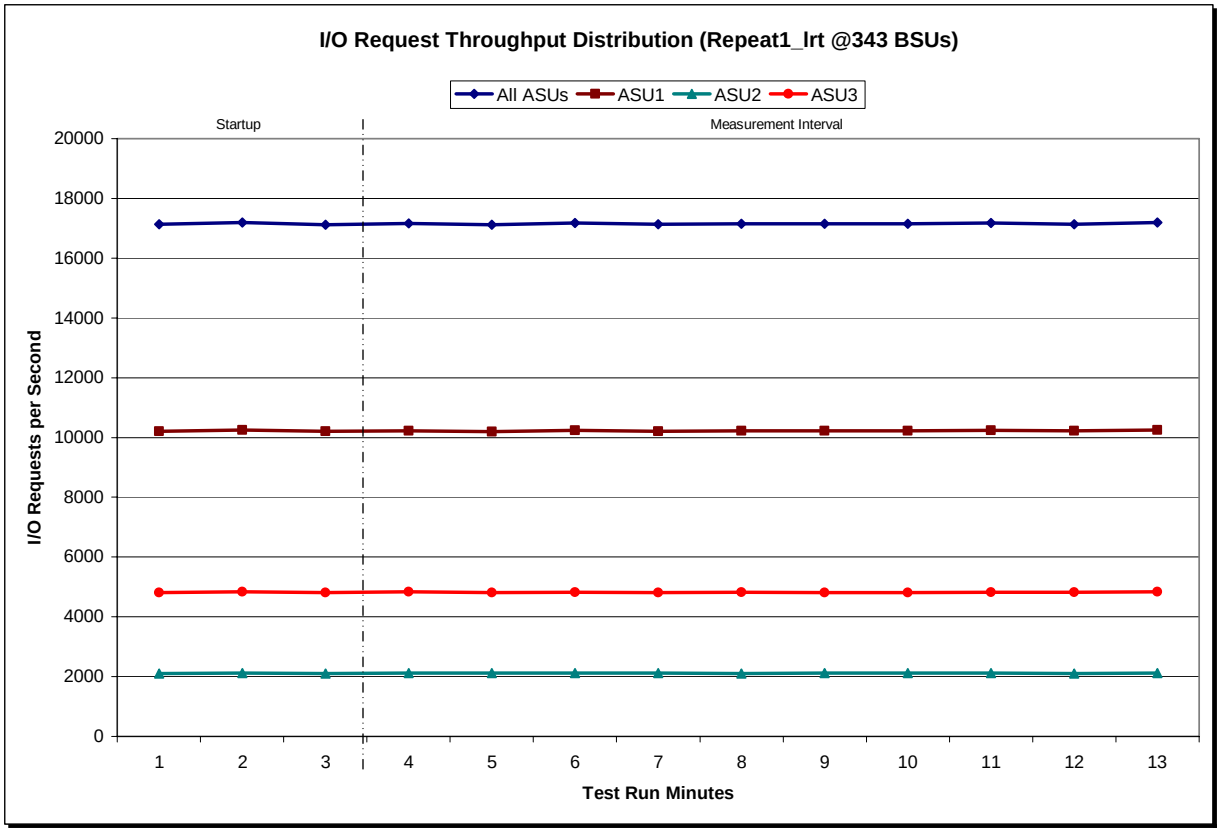
A link to the test result file generated from each Repeatability Test Run is listed below.

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

343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:30:48	9:33:48	0-2	0:03:00
Measurement Interval	9:33:48	9:43:48	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	17,134.22	10,211.45	2,106.90	4,815.87
1	17,196.70	10,245.73	2,119.23	4,831.73
2	17,125.63	10,204.98	2,105.77	4,814.88
3	17,167.35	10,216.03	2,119.45	4,831.87
4	17,114.42	10,190.82	2,111.23	4,812.37
5	17,174.80	10,239.18	2,115.58	4,820.03
6	17,137.50	10,207.78	2,120.03	4,809.68
7	17,155.38	10,221.80	2,107.38	4,826.20
8	17,145.07	10,223.95	2,110.25	4,810.87
9	17,151.70	10,225.93	2,111.82	4,813.95
10	17,179.55	10,240.37	2,113.02	4,826.17
11	17,140.68	10,217.93	2,104.58	4,818.17
12	17,196.45	10,248.80	2,115.37	4,832.28
Average	***17,156.29***	***10,223.26***	***2,112.87***	***4,820.16***

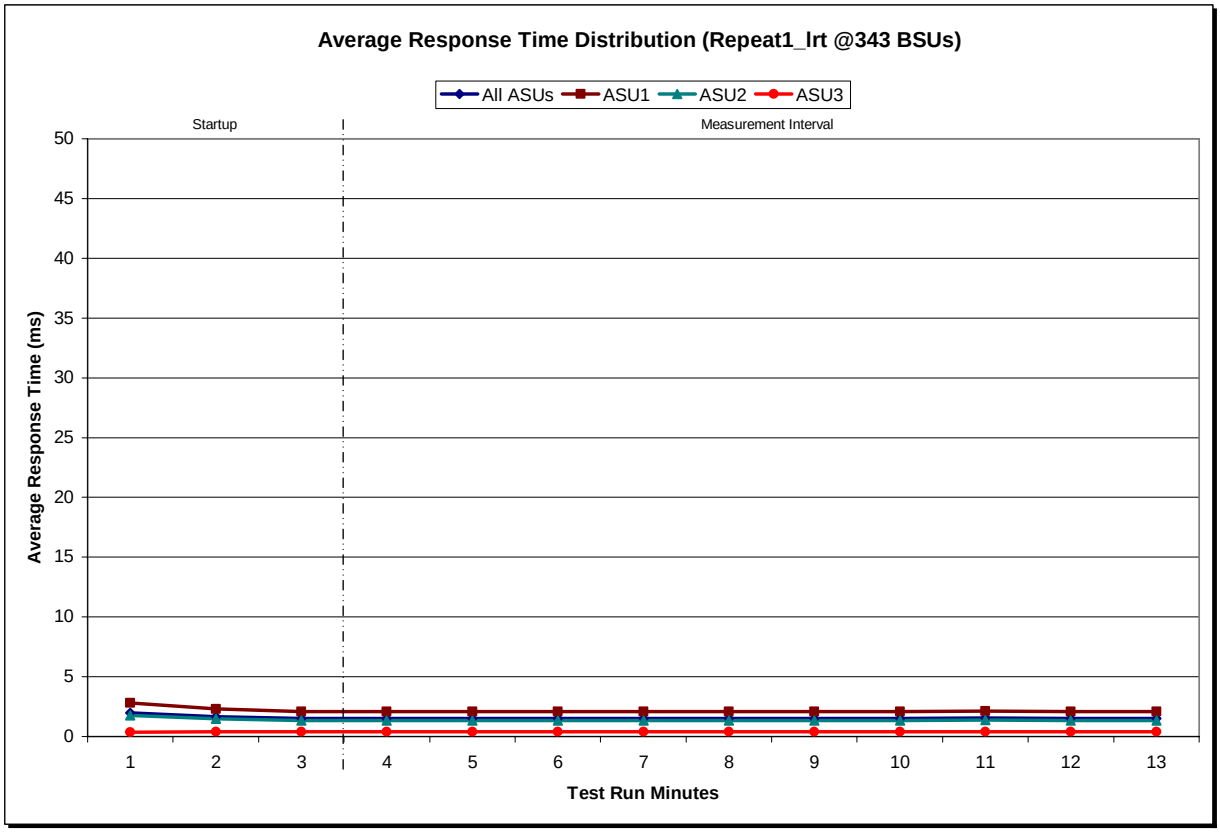
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



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

343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:30:48	9:33:48	0-2	0:03:00
Measurement Interval	9:33:48	9:43:48	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.99	2.80	1.78	0.37
1	1.67	2.32	1.47	0.38
2	1.52	2.10	1.34	0.38
3	1.51	2.09	1.33	0.38
4	1.51	2.08	1.32	0.38
5	1.51	2.07	1.32	0.38
6	1.51	2.07	1.33	0.38
7	1.51	2.08	1.34	0.38
8	1.51	2.08	1.33	0.38
9	1.52	2.09	1.33	0.38
10	1.53	2.12	1.35	0.38
11	1.52	2.10	1.33	0.38
12	1.51	2.08	1.33	0.38
Average	***1.51***	***2.09***	***1.33***	***0.38***

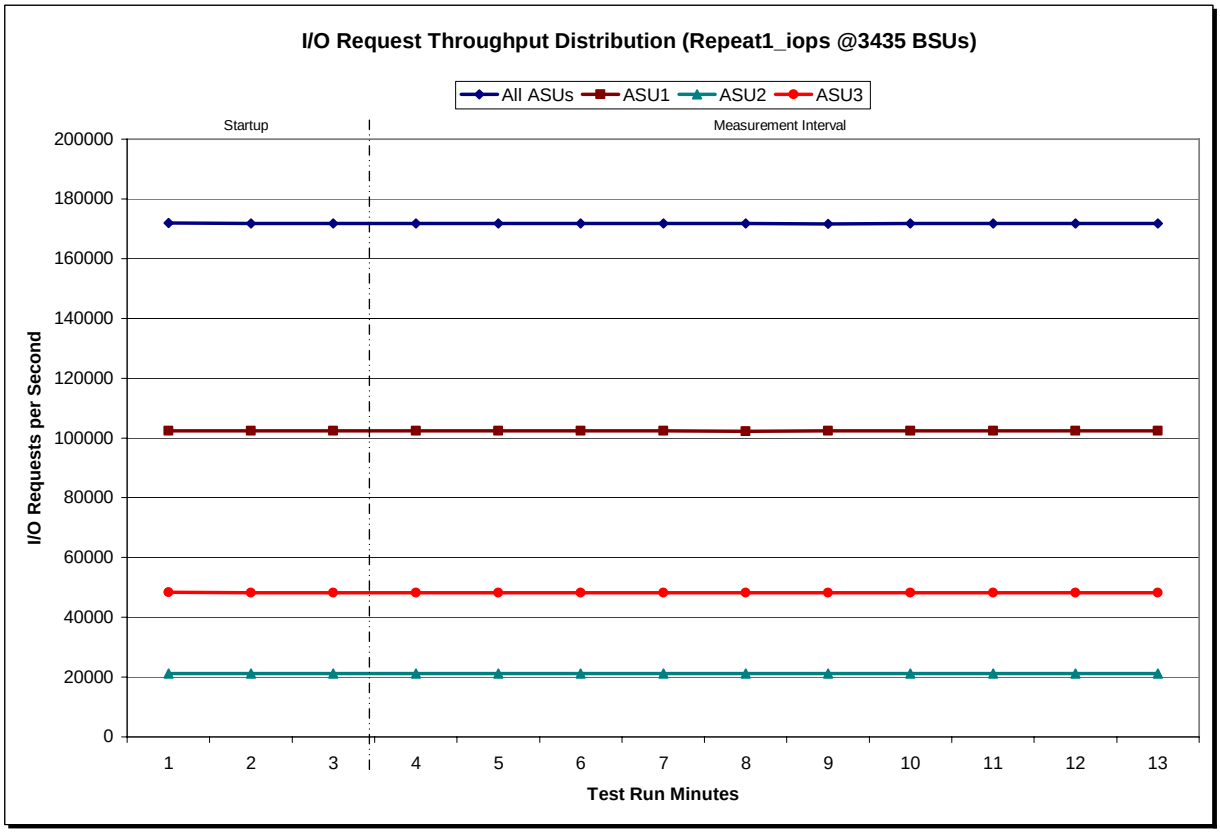
Repeatability 1 LRT –Average Response Time (ms) Distribution Graph



Repeatability 1 IOPS – I/O Request Throughput Distribution Data

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:49:41	9:52:42	0-2	0:03:01
Measurement Interval	9:52:42	10:02:42	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	171,885.57	102,439.15	21,137.50	48,308.92
1	171,810.70	102,382.35	21,139.65	48,288.70
2	171,800.52	102,426.58	21,132.70	48,241.23
3	171,807.00	102,372.22	21,146.57	48,288.22
4	171,779.68	102,376.20	21,130.18	48,273.30
5	171,761.97	102,339.70	21,171.12	48,251.15
6	171,765.58	102,373.33	21,142.30	48,249.95
7	171,729.13	102,294.57	21,163.25	48,271.32
8	171,677.73	102,319.62	21,118.17	48,239.95
9	171,800.32	102,345.07	21,151.40	48,303.85
10	171,761.03	102,333.78	21,131.53	48,295.72
11	171,801.45	102,408.47	21,123.18	48,269.80
12	171,841.30	102,410.87	21,147.58	48,282.85
Average	***171,772.52***	***102,357.38***	***21,142.53***	***48,272.61***

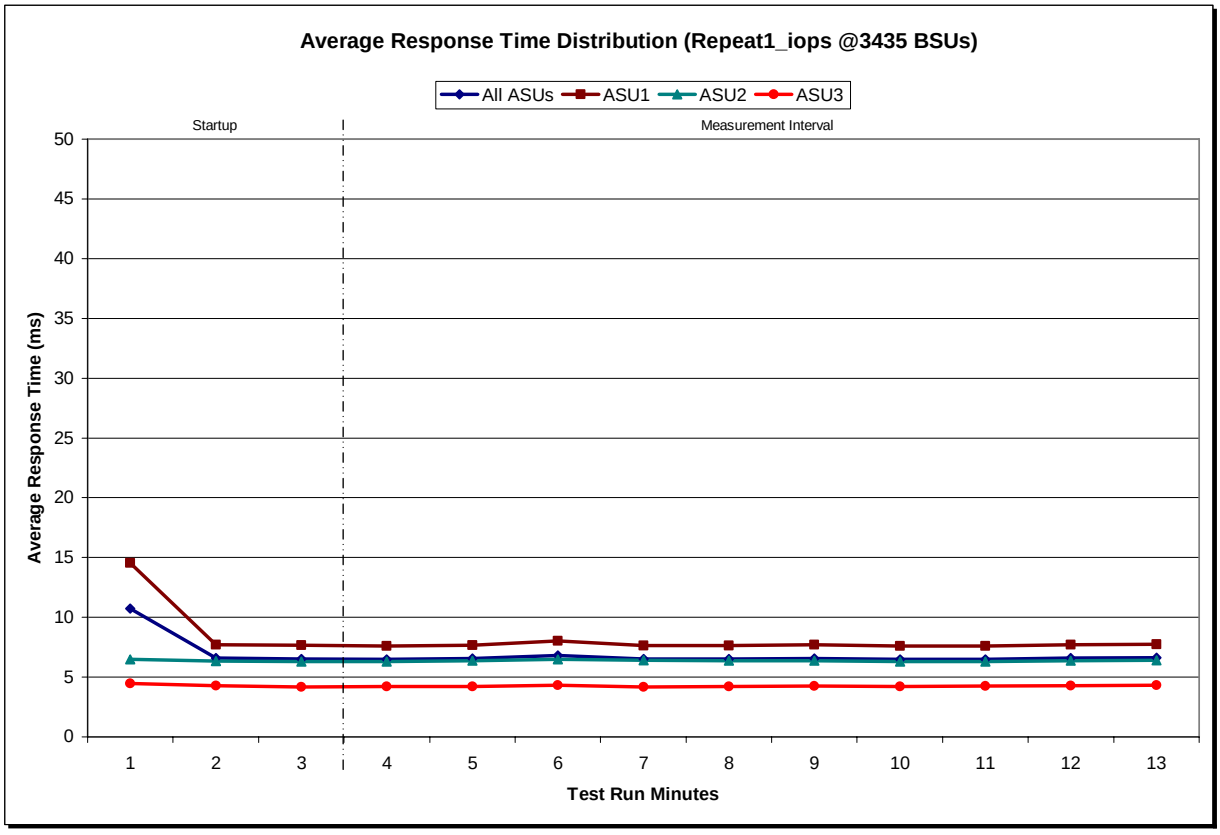
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph



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

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	9:49:41	9:52:42	0-2	0:03:01
Measurement Interval	9:52:42	10:02:42	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	10.71	14.53	6.49	4.48
1	6.57	7.69	6.34	4.30
2	6.51	7.65	6.29	4.19
3	6.49	7.60	6.30	4.22
4	6.55	7.68	6.38	4.23
5	6.81	8.04	6.48	4.32
6	6.52	7.64	6.41	4.19
7	6.52	7.64	6.38	4.19
8	6.57	7.71	6.37	4.24
9	6.49	7.61	6.31	4.22
10	6.49	7.59	6.29	4.24
11	6.58	7.71	6.35	4.29
12	6.63	7.76	6.41	4.32
Average	***6.56***	***7.70***	***6.37***	***4.25***

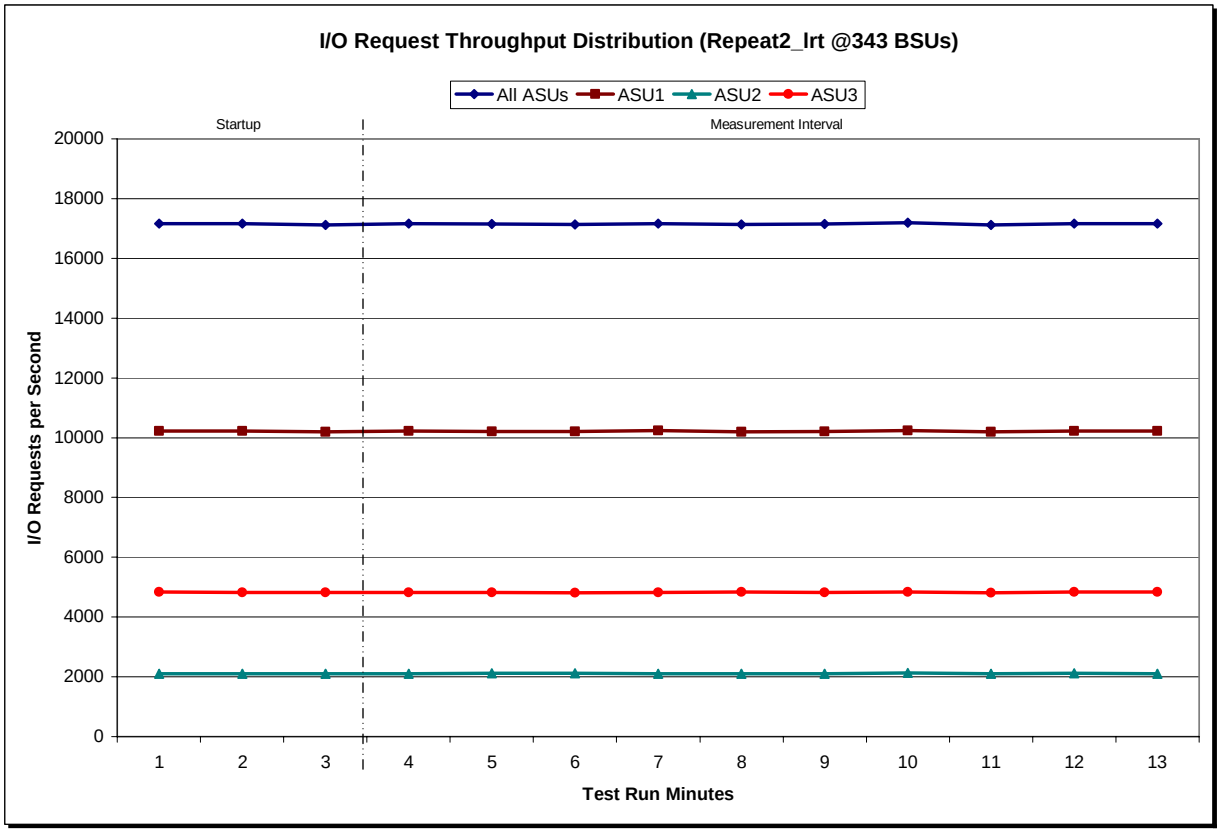
Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 2 LRT – I/O Request Throughput Distribution Data

343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	10:08:53	10:11:53	0-2	0:03:00
Measurement Interval	10:11:53	10:21:53	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	17,167.23	10,222.02	2,108.47	4,836.75
1	17,159.98	10,225.27	2,107.28	4,827.43
2	17,127.22	10,197.05	2,105.30	4,824.87
3	17,157.70	10,224.32	2,104.57	4,828.82
4	17,153.03	10,208.65	2,120.52	4,823.87
5	17,138.60	10,213.35	2,111.95	4,813.30
6	17,165.95	10,236.10	2,099.68	4,830.17
7	17,130.93	10,198.08	2,100.52	4,832.33
8	17,145.50	10,206.90	2,108.88	4,829.72
9	17,196.55	10,233.97	2,124.13	4,838.45
10	17,119.37	10,201.33	2,104.68	4,813.35
11	17,160.42	10,219.70	2,109.88	4,830.83
12	17,164.78	10,223.62	2,107.70	4,833.47
Average	***17,153.28***	***10,216.60***	***2,109.25***	***4,827.43***

Repeatability 2 LRT – I/O Request Throughput Distribution Graph

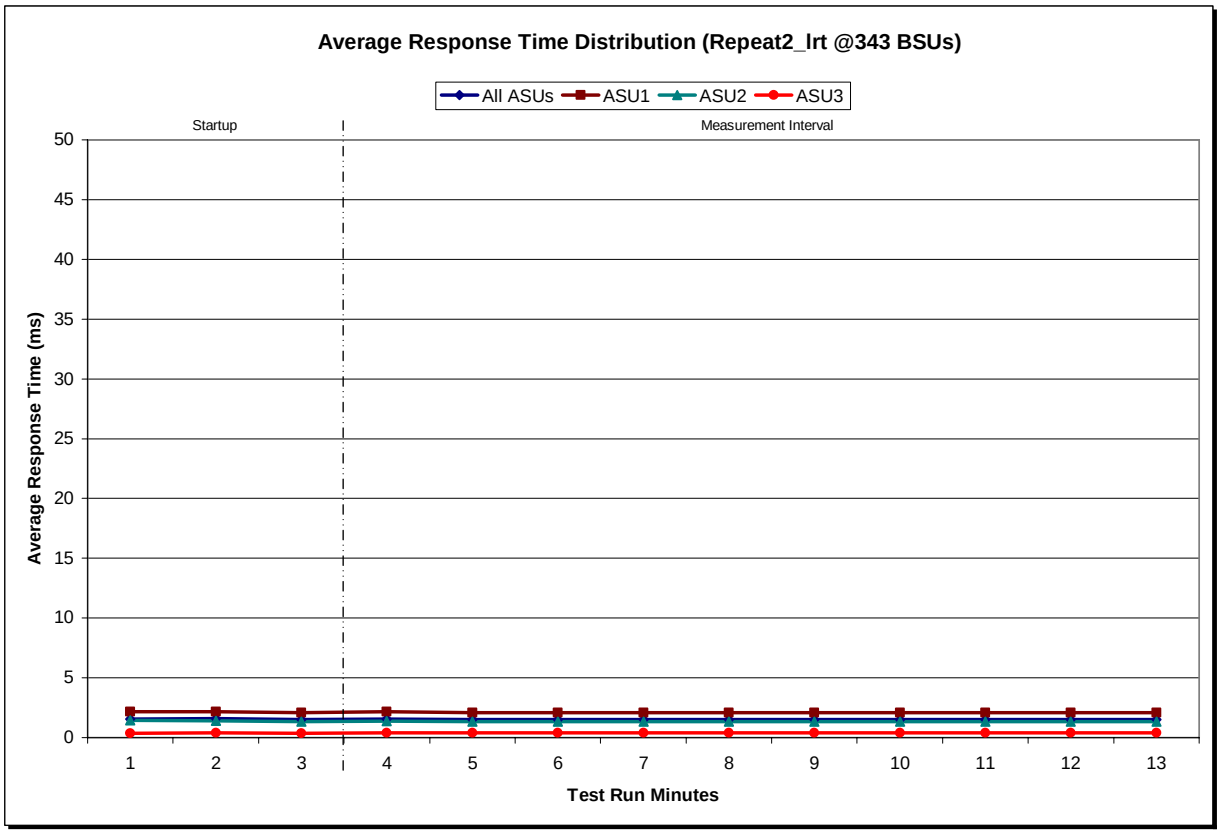


Repeatability 2 LRT –Average Response Time (ms) Distribution Data

343 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	10:08:53	10:11:53	0-2	0:03:00
Measurement Interval	10:11:53	10:21:53	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	1.56	2.15	1.44	0.37
1	1.58	2.18	1.41	0.38
2	1.51	2.08	1.33	0.38
3	1.56	2.16	1.36	0.38
4	1.52	2.10	1.35	0.38
5	1.52	2.09	1.34	0.38
6	1.52	2.10	1.34	0.38
7	1.51	2.08	1.33	0.38
8	1.51	2.09	1.33	0.38
9	1.51	2.08	1.33	0.38
10	1.51	2.08	1.32	0.38
11	1.51	2.09	1.34	0.38
12	1.52	2.09	1.34	0.38
Average	***1.52***	***2.10***	***1.34***	***0.38***

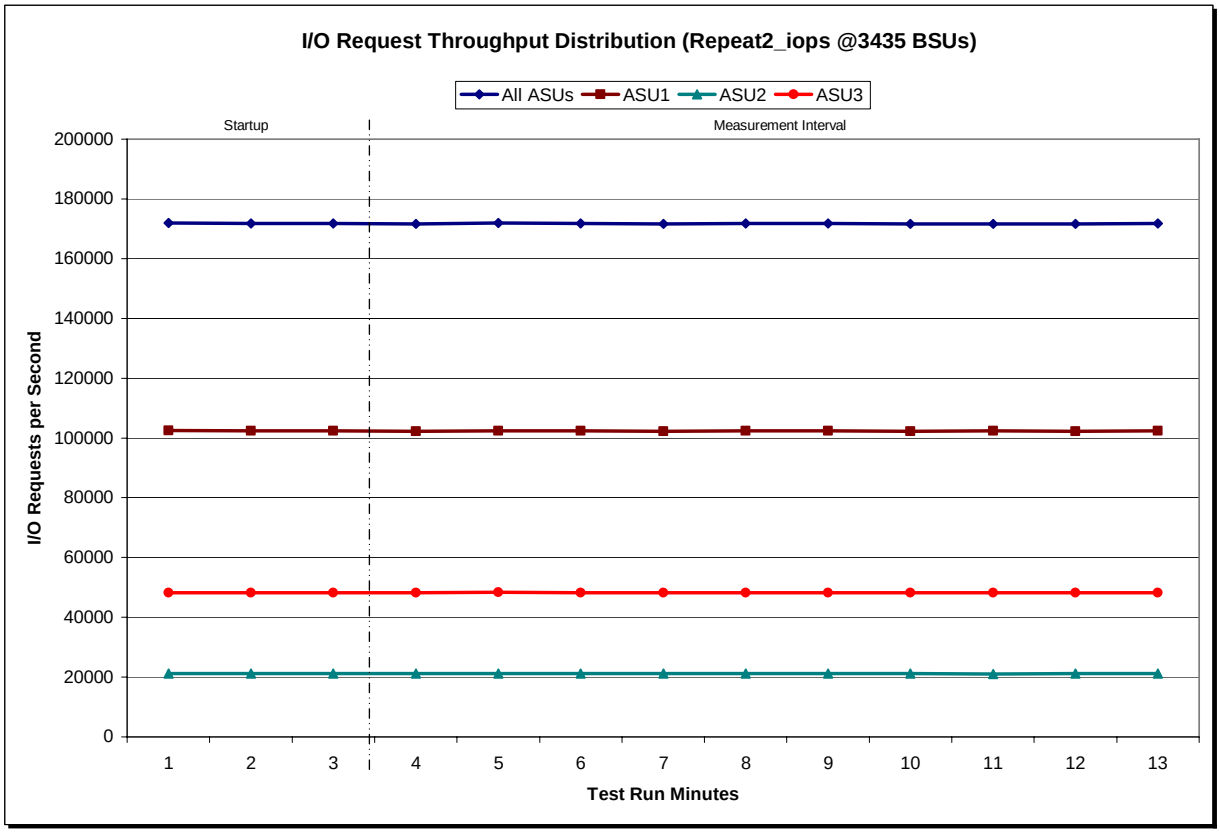
Repeatability 2 LRT –Average Response Time (ms) Distribution Graph



Repeatability 2 IOPS – I/O Request Throughput Distribution Data

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	10:27:50	10:30:51	0-2	0:03:01
Measurement Interval	10:30:51	10:40:51	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	171,858.77	102,461.62	21,129.27	48,267.88
1	171,797.30	102,405.17	21,152.92	48,239.22
2	171,818.03	102,371.87	21,145.48	48,300.68
3	171,641.08	102,292.35	21,129.28	48,219.45
4	171,856.08	102,411.65	21,117.50	48,326.93
5	171,755.52	102,383.30	21,126.05	48,246.17
6	171,642.93	102,258.95	21,123.98	48,260.00
7	171,749.00	102,439.53	21,096.78	48,212.68
8	171,787.13	102,405.93	21,115.45	48,265.75
9	171,692.03	102,277.23	21,138.47	48,276.33
10	171,699.47	102,338.55	21,082.87	48,278.05
11	171,681.33	102,290.00	21,123.42	48,267.92
12	171,794.22	102,398.57	21,114.07	48,281.58
Average	***171,729.88***	***102,349.61***	***21,116.79***	***48,263.49***

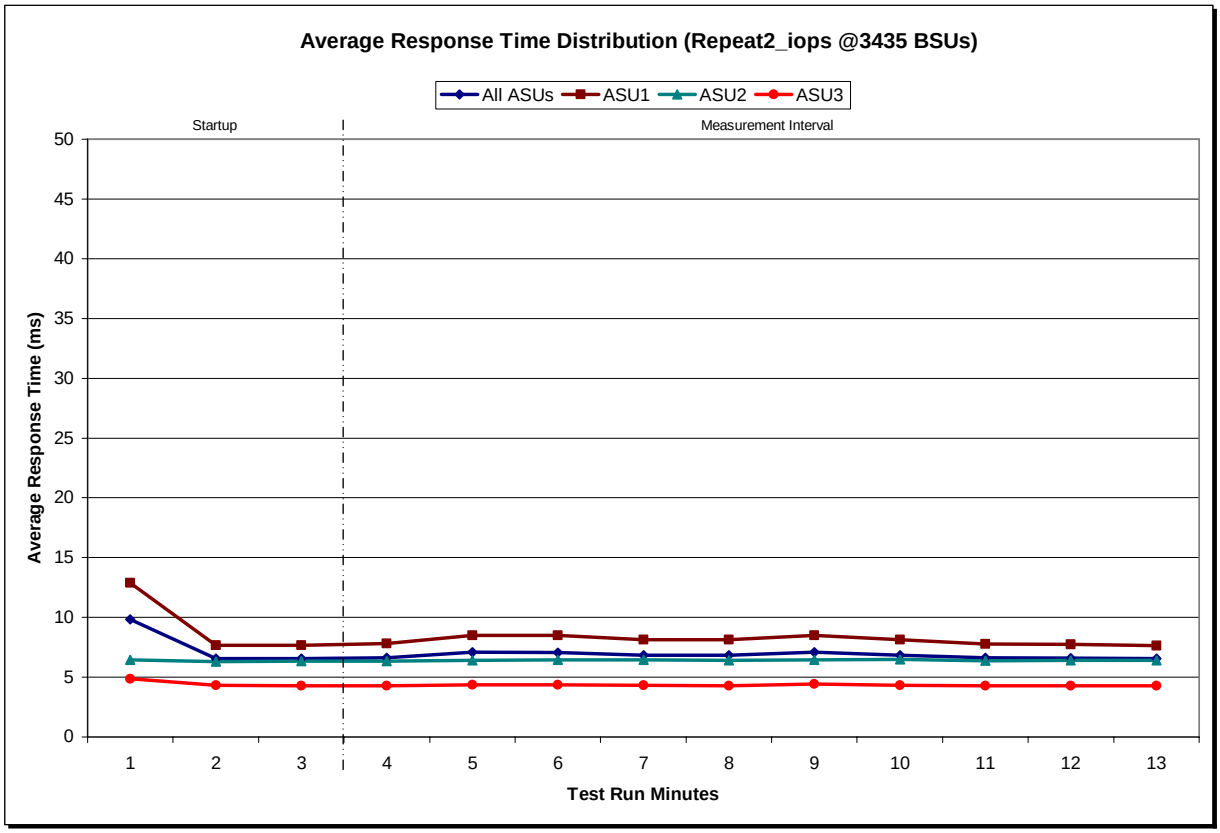
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



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

3435 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	10:27:50	10:30:51	0-2	0:03:01
Measurement Interval	10:30:51	10:40:51	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	9.84	12.89	6.45	4.84
1	6.56	7.68	6.31	4.31
2	6.54	7.65	6.32	4.27
3	6.63	7.80	6.32	4.28
4	7.08	8.50	6.39	4.37
5	7.07	8.48	6.46	4.35
6	6.85	8.13	6.44	4.31
7	6.85	8.15	6.40	4.30
8	7.11	8.50	6.46	4.43
9	6.85	8.13	6.46	4.32
10	6.63	7.79	6.38	4.28
11	6.59	7.72	6.39	4.28
12	6.54	7.64	6.39	4.28
Average	***6.82***	***8.08***	***6.41***	***4.32***

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	0.2809	0.0701	0.2099	0.0180	0.0702	0.0350	0.2810
COV	0.006	0.002	0.004	0.002	0.007	0.002	0l.006	0.001

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	0.0700	0.0350	0.2810
COV	0.001	0.000	0.001	0.001	0.003	0.001	0.002	0.000

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	0.0350	0.2807	0.0700	0.2100	0.0180	0.0700	0.0350	0.2814
COV	0.004	0.001	0.003	0.002	0.010	0.004	0.006	0.001

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

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0350	0.2810	0.0701	0.2100	0.0180	0.007	0.0350	0.2810
COV	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001

Data Persistence Test

Clause 6

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

- *Is capable of maintaining data integrity across a power cycle.*
- *Ensures the transfer of data between Logical Volumes and host systems occurs without corruption or loss.*

Execution of Persistence Test Run 1 will cause the SPC-1 Workload Generator to write a specific pattern at randomly selected locations throughout the Total ASU Capacity. The SPC-1 Workload Generator will retain the information necessary to later validate the pattern written at each location

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. If the TSC includes the Host System(s), the Host System(s) must also be shutdown and restarted using a power off/power on cycle.

Persistence Test Run 2, executed after the TSC has been restarted, will utilize the retained data from Persistence Test Run 1 to validate the patterns written at each location during Persistence Test Run 1.

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 (may optionally be referenced in an appendix).*
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 9-16. 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 106.

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	389,810,848
Total Number of Logical Blocks Verified	192,096,496
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks	10 minutes
Size in Bytes of each Logical Block	512
Number of Failed I/O Requests in the process of the Test	0

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

PRICED STORAGE CONFIGURATION AVAILABILITY DATE

Clause 9.2.4.9

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

The Fujitsu Storage Systems ETERNUS DX8400 as documented in this Full Disclosure Report is currently available 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 9.4.3.10

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 Fujitsu Storage Systems ETERNUS DX8400 .

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.

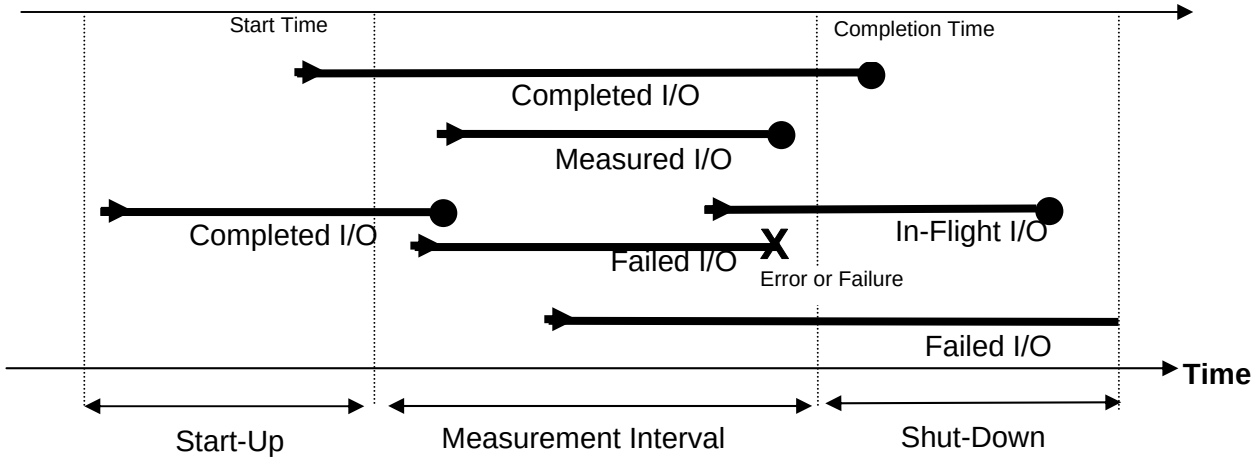
Test: A collection of Test Phases and or Test Runs sharing a common objective.

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

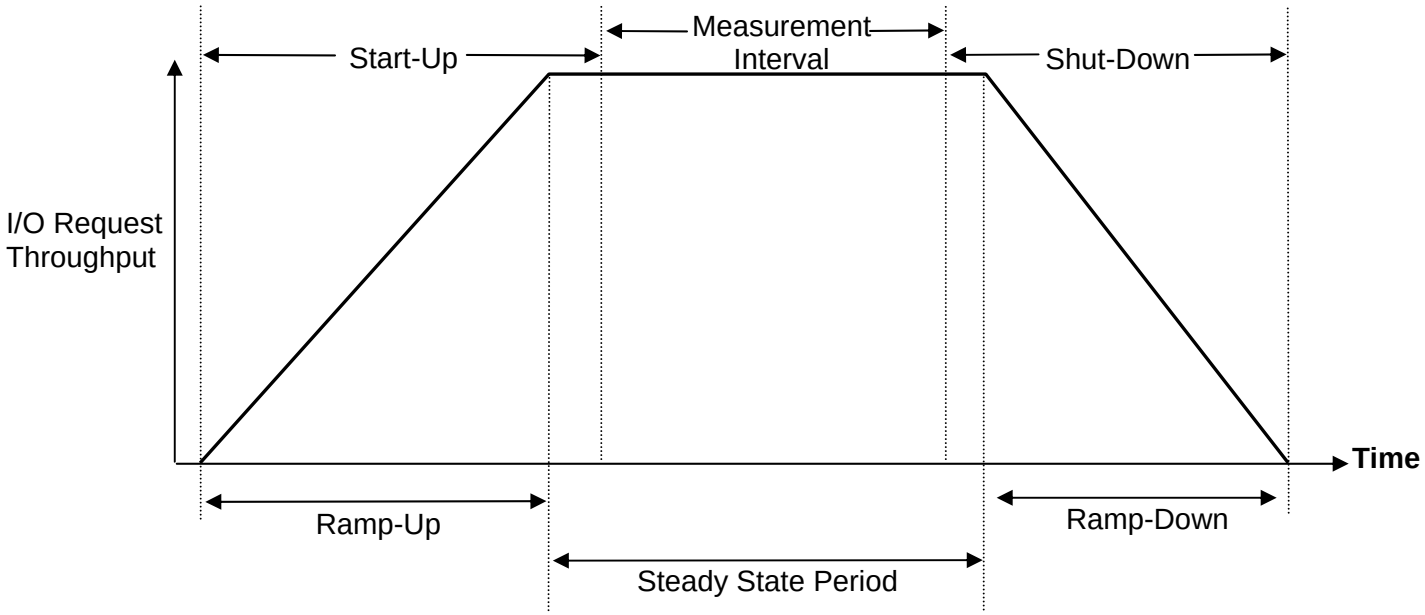
period, Shut-Down period, and Ramp-Down period as illustrated in the "SPC-1 Test Run Components" below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.

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

Solaris Parameter Adjustments

The following settings were made the Solaris **/etc/system** control file information for execution of the SPC-1 Workload Generator on the Fujitsu SPARC Enterprise M8000.

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

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



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



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



* forceload:
*
*    Cause these modules to be loaded at boot time, (just before mounting
*    the root filesystem) rather than at first reference. Note that
```

```
*    forceload expects a filename which includes the directory. Also
*    note that loading a module does not necessarily imply that it will
*    be installed.
*
*    Example:
*           forceload: drv/foo



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

set ssd:ssd_max_throttle = 4

set heaplp_use_stlb=0
set autoup=480
set drmach:fmem_timeout=30
set pcie:pcie_aer_ce_mask=0x2001
set mc-opl:mc_max_rewrite_loop=20000
set maxfastscan=0x2000
```

Entries in "ssd.conf"

The following entries in sdd.conf were defined to enable the Qlogic HBAs for accessing the LUNs defined in the Fujitsu SPARC Enterprise M8000 Host System.

```
#
# Copyright 2003 Sun Microsystems, Inc.  All rights reserved.
# Use is subject to license terms.
#
#ident      "@(#)ssd.conf 1.14   03/10/07 SMI"

name="ssd" parent="sf" target=0;
name="ssd" parent="fp" target=0;
name="ssd" parent="scsi_vhci" target=0;
```

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

The ETERNUS DX8440 Storage Array is configured using an interactive on-line tool called ETERNUS Administrator. When an ETERNUS DX8400 unit is delivered from the factory, there are a set of default RAID Groups and LUNs defined, and the tool is used to modify the configuration to that needed in the customer environment. The following paragraphs outline use of this tool to define the configuration outlined within this FDR. The primary definitions for use in making the configuration are provided through an Excel spreadsheet, called a Design Sheet. The Design sheets for the TSC are provided:

config_plan_R10(_5+5)_88RG_1760LUN_100408.xls

This design sheet is developed by the Fujitsu SE, in consultation with the customer, and is provided to the Fujitsu factory when the order for the system is placed. The factory will configure the system according to this design, using internal Fujitsu tools.

Should a customer need to change the delivered configuration, then a series of steps must be followed, using ETERNUS Administrator. The User Guide for the ETERNUS Administrator is available for download from:

http://www.fujitsu.com/downloads/STRSYS/system/dx400-dx8000_setting.pdf

To define a new RAID Group the following steps are used:

1. Assuming that there are available drives to assign to a new RAID Group, select "RAID Group Creation" tool in the main tool bar.
2. The Define RAID Groups screen will be presented. Select the RAID Group Creation tool. Use the Browse button to obtain a list of the drives. Select Free drives to be included in the RAID Group and the desired RAID Level, leaving the Assigned CM selection to Auto. You may optionally assign the RAID Group a name and click the "Next" button. A confirmation screen is provided before the action is committed. Click the "Finish" button to complete the definition of the RAID Group.
3. Additional RAID Groups can be defined by repeating the process.

It is necessary to define one or more Logical Volumes within each of the defined RAID Groups, using the following steps:

1. Select "Create Volume" Tool in the main tool bar.
2. The Create Logical Volume Screen (Volume Creation) screen will be presented, with a list of the RAID Groups defined, and the capacity of each (in MiB). Select the RAID Group in which a Logical Volume is to be defined, and click the "Next" button.
3. A blank name and default capacity of 1024 MB (1000 MiB) is presented. Up to the entire RAID Group may be used by putting in the capacity listed for the selected RAID Group. A number of like sized volumes can be defined by setting a value in the "Volumes" field. A name may be optionally assigned to the volume. Once you have set the factors for the volume creation, click the "Create Volume" icon above the section of the screen where volumes to be created will be listed. Additional volumes may be included in the create operation by clicking the "Create Volume" icon again. When you have a list with all of the volumes you want to create, then click the "Next" button. A confirmation screen is provided before the action is

committed. Click the "Finish" button on the configuration screen to create the volumes.

4. Additional Logical Volumes can be defined by repeating the process within the RAID group and for other RAID Groups.

The configuration plan for the SPC-1 Benchmark configuration has a SPARC Enterprise M8000 server directly connected from the four dual ported HBAs to Channel Adapter ports, 8 ports connections in all. Each port was set up using the following:

1. Select "Volume Settings" Tool in the main tool bar.
2. Select "Host I/FManagement" Tool in the tool bar.
3. When the "Set FC_Port parameters" is clicked, the screen will be presented.
4. Select the "Ports" tab to review the CA Port parameters. Select a port from the tree on the left to access the settings for that port. As this is a direct connection from the server HBA port to the storage CA port, the default selection of FC-AL Connection, Loop-Id (Manual), 0x00, Class 3, and Affinity Mode Off with default Host Response apply. The only item that was changed for the benchmark was the selection of 8Gbps for the Transfer Rate. Click the "Apply" button to save the settings for the selected port.
5. With the selections complete, click the "OK" button to reach the confirmation dialog box – click "Yes" to complete the operations.
6. Each of the eight ports in use for the benchmark are set up in the same manner.

The configuration plan for the SPC-1 Benchmark configuration assigns the 220 Logical Volumes as LUNs 0-219 on each of the Channel Adapter ports. There are 1760 Logical Volumes in the defined configuration, 20 on each of the 88 RAID Groups, according to the configuration plan. The following steps are used to set the LUN mapping for each of the CA ports:

1. Select the "Host Affinity Groups" tab on the ETERNUS Administrator Window. This will list the various host affinity groups defined. Groups 00-07 apply to the ports with Host Affinity OFF. Each port will show, under the Type column, "LUN Mapping", while the others will show "Host Affinity Group".
2. Select one of the port entries on the right side of the screen (not in the tree on the left side), which is going to have LUN mapping set up. This will enable the "Modify" button on the bottom of the screen.
3. Click the "Modify" button on the bottom of the screen and the Step 1 of 6.
4. Enter a name to enable the "Next" button, and click the "Next" button. This will present the Step 3 of 6: Assign Volumes screen, which contains a list of the available volumes which may be assigned.
5. Select one or more of the Available Volumes for mapping, and click the "Add" button in the middle of the screen to include the volumes in the list for mapping. When all of the volumes to be mapped have been included in the list on the right for adding into the LUN Mapping list, click the "Next" button.

6. This presents the screen Step 4 of 6: LUN Mapping, which shows the list of the volumes selected, and default LUN assignments for each. The default LUN assignments may be changed by entry in the respective "SCSI LUN" column entries or using the spinner buttons on the respective LUN number entries. Select the "Next" button when all of the LUN assignments have been set, as required.
7. This presents the screen Step 6 of 6: Summary, which shows all of the LUN Mapping assignments. If there are problems, use the "Back" button to return to previous screens to resolve the issues. In some cases, a Logical Volume may be included in more than one group mapping, and this is indicated in the "Duplicate Volume" section of the summary screen. Click the "Finish" button to complete the mapping configuration for the port.
8. The LUN mapping for each of the four ports are set up in the same manner.

The configuration plan also includes Hot Spare drives, which are defined in much the same way as RAID Groups, using the following steps:

1. Select the "RAID Groups" tab on the ETERNUS Administrator Window. This will list the various RAID Groups that are defined, along with a family of buttons across the bottom of the pane.
2. Select the "Hot Spare" button, and the screen to "Select disks to register or delete HotSpare disk" will be displayed. This screen will show the current role of all of the disk drives installed in the system, by Drive Enclosure. Any drive that is in the "Free"state may be selected for assignment as a Hot Spare drive. Selecting a drive that is currently marked as a Hotspare, will change it to a pending Free state. Click the OK button, and after a confirming acknowledgment, the changes indicated will be made.

Each step along the way to completing the configuration does a small part, and the configuration plan provides the details of the specific entries that are defined, using the ETERNUS Administrator interface. For most customer systems, where the design sheets provide the complete configuration plan, the ETERNUS DX8400 system is pre-configured at the factory. However, when the plan is not complete or not supplied with an order, a default configuration will be applied by the factory, based on the complement of components ordered.

Scripts and Commands used to Configure Storage Volumes

There are scripts, files, and commands used to create the logical representation of the TSC used in the benchmark measurement for the ETERNUS DX8400 Storage system.

The **makesol** script is used to create the Solaris Volume Manager (SVM) logical volumes based on a configuration description file. This script is called by:

```
./makesol  dx8400_p1_88rg_svmake.txt
```

The Configuration Description file is created by a macro within the Configuration Plan Excel workbook and contains the list of the raw disks that are used to create the SVM logical volumes assigned to ASU1, ASU2, and ASU3. It is used as an input by the **makesol** script.

The content of both the **makesol** script and the configuration description file appear below.

makesol

```
#!/bin/ksh
# Usage: usage
#           makesol configFile
#
LABELFILE="/tmp/makesollabel"
STATFILE="/tmp/makesolstat"
AWK=nawk
usage()
{
        echo "\nUsage: $0 configFile\n"
        exit 1
}

labelDisk()
{
     echo "l" > $LABELFILE
     echo "q" >> $LABELFILE
     format -s -f $LABELFILE $1
}

checkStat()
{
     typeset -i i=0
     del1=`grep $1 $STATFILE|$AWK '{ print $1 }'`
     if [ "$del1" != "" ] ; then
            for del in $del1
            do
                  i=0
                  while (( $i < $delete ))
                  do
                        if [ ${DELETE[(($i+1))]} == $del ] ; then
                              break
                        fi
                        i=$i+1
                  done
                  if (( $i == $delete )) ; then
                        delete=$delete+1
                        DELETE[$delete]=$del
                  fi
            done
     fi
}

getDiskSlice()
{
     vDisks=""
     for disk in ${DISKS[$1]}
     do
            ndisk=`echo $disk|$AWK 'BEGIN { FS="s"} ; { print $1 }'`
            vDisks=$vDisks$ndisk"s"$2" "
     done
}

makevol()
{
     typeset -i count=0
     typeset -i i=0
     typeset -i vcount
```

```
         tmp=`/usr/sbin/metastat -p|$AWK '{ print substr( $1, 2, length($1)-1 )}'`
      if [ "$tmp" == "" ] ; then
            i=0
      else
            for dgroup in $tmp
            do
                  if (( $dgroup > $i )) ; then
                        i=$dgroup
                  fi
            done
            i=$i+1
      fi
      while (( $count < $groups ))
      do
            count=$count+1
  #echo "/usr/sbin/metainit d$i 1 ${DISK_COUNT[$count]} ${DISKS[$count]}
  ${STRIPE[$count]}"
            tmp=`/usr/sbin/metainit d$i 1 ${DISK_COUNT[$count]} ${DISKS[$count]}
  ${STRIPE[$count]}`
            i=$i+1
            if [ "${VCOUNT[$count]}" != "" ] ; then
                  vcount=1
                  while (( $vcount < ${VCOUNT[$count]} ))
                  do
                        getSlice $vcount
                        getDiskSlice $count $num
                        tmp=`/usr/sbin/metainit d$i 1 ${DISK_COUNT[$count]} $vDisks
  ${STRIPE[$count]}`
                        i=$i+1
                        vcount=$vcount+1
                  done
            fi
      done
  }

  checkDisk()
  {
      typeset -i i=0
      tmp=$1"s"
      test=`grep $tmp /etc/vfstab`
      if [ "$test" != "" ] ; then
            echo "Found disk $1 in /etc/vfstab, we really shouldn't use it here"
            exit 4
      fi
      while (( $i < $groups ))
      do
            i=$i+1
            for disk in ${DISKS[$i]}
            do
                  tmp=$1"s0"
                  if [ "$disk" == $tmp ] ; then
                        echo "disk $1 repeated at line $lineno"
                        exit 4
                  fi
            done
         done
         disks=$disks+1
      part=$1"s0"
      DISKS[$groups]=${DISKS[$groups]}$part" "
      tmp=`prtvtoc -h /dev/dsk/$part 2>/dev/null`
      if [ $? != 0 ] ; then
            labelDisk $part
            tmp=`prtvtoc -h /dev/dsk/$part 2>/dev/null`
```

```
            if [ $? != 0 ] ; then
                  echo "prtvtoc failed for $part"
                  exit 4
            fi
      fi
      checkStat $1"s"
 }

 getSlice()
 {
      num=0
         case $1 in
         0)
             num=0
                 ;;
         1)
                 num=1
                 ;;
         2|3|4|5|6)
                 (( num=$1+1 ))
                 ;;
         esac
 }

 setVtoc()
 {
      typeset -i count=0
         typeset -i i=0
         while (( $i < $groups ))
         do
                 i=$i+1
                 for disk in ${DISKS[$i]}
                 do
                   if [ "${VCOUNT[$i]}" != "" ] ; then
                         sectors=`prtvtoc /dev/dsk/$disk 2>/dev/null|grep
 "accessible cylinders"|$AWK '{ print $2 }'`
                         seccyl=`prtvtoc /dev/dsk/$disk 2>/dev/null|grep
 "sectors/cylinder"|$AWK '{ print $2 }'`
                         (( sectors=$sectors-1 ))
                   fi
                   tmp=`prtvtoc -h /dev/dsk/$disk 2>/dev/null`
                   set $tmp
                   while (( $# > 5 ))
                   do
                         if (( $1 == 2 )) ; then
                               if [ "${VCOUNT[$i]}" == "" ] ; then
                                     echo "0 4 $3 $4 $5 $6" > $LABELFILE
                               else
                                     echo "* labelfile" > $LABELFILE
                                     (( secCount=$sectors/${VCOUNT[$i]} ))
                                     count=0
                                              (( sc=$secCount*$seccyl ))
                                              fs=$seccyl
                                     while (( $count < ${VCOUNT[$i]} ))
                                     do
                                           (( ls=$fs+$sc ))
                                           getSlice $count
                                           echo "$num 4 $3 $fs $sc $ls" >>
 $LABELFILE
                                                       count=$count+1
                                           (( fs=$fs+$sc ))
                                     done
                               fi
```

```
                                echo "$1 $2 $3 $4 $5 $6" >> $LABELFILE
                                tmp=`fmthard -s $LABELFILE /dev/rdsk/$disk`
                                break
                        fi
                        shift 6
                  done
            done
      done
}

delGroups()
{
     typeset -i i=0
     if [ $DELETE_ALL == "yes" ] ; then
           tmp=`/usr/sbin/metastat -p |$AWK '{ print $1 }'`
           for del in $tmp
           do
                 tmp=`/usr/sbin/metaclear $del`
                 if [ $? != 0 ] ; then
                       echo "Failed to delete volume $del"
                       exit 4
                 fi
           done
           return
     fi
     while (( $i < $delete ))
     do
           i=$i+1
           tmp=`/usr/sbin/metaclear ${DELETE[$i]}`
           if [ $? != 0 ] ; then
                 echo "Failed to delete volume ${DELETE[$i]}"
                 exit 4
           fi
     done
}

addDisks()
{
        typeset -i diskNum=0
        typeset -i count=$name
        typeset -i jump=1
        diskNum=${label#*d}
        if (( $diskNum < 10 ))
        then
                diskPrefix=`echo $label|awk '{ print substr( $1, 0, length($1)-1 )
}'`
        elif (( $diskNum < 100 ))
        then
                diskPrefix=`echo $label|awk '{ print substr( $1, 0, length($1)-2 )
}'`
        else
                diskPrefix=`echo $label|awk '{ print substr( $1, 0, length($1)-3 )
}'`
        fi
        if [ "$skip" != "" ]
        then
                jump=$skip
        fi
        count=$count-1
        while [ $count != 0 ]
        do
                count=$count-1
                diskNum=$diskNum+$jump
```

```
                diskName=$diskPrefix$diskNum
                checkDisk $diskName
        done

}

checkConfig()
{
        typeset -i lineno=1
        invg="no"
     DELETE_ALL="no"
        while read -r label name skip
        do
                case $label in
                "VOLUME_GROUP:")
                        VGNAME=$VGNAME$name" "
                        invg="yes"
                        groups=$groups+1
                        getSize="yes"
                        ;;
                "#")
                        ;;
                "")
                        ;;
            "VOLUME")
                        if [ "$invg" != "yes" ]
                        then
                                echo "invalid line in config file line=$lineno
data=\"$label $name\""
                         echo "VOLUME line must be in a volume_group definition"
                                exit 4
                        fi
                   tmp=`echo $name|grep ^[1-7]$`
                   if [ "$tmp" == "" ] ; then
                         echo "invalid line in config file line=$lineno
data=\"$label $name\""
                         echo "VOLUME count must be from 1-7"
                         exit 4
                   fi
                   VCOUNT[groups]=$name
                   ;;
                "STRIPE")
                        if [ "$invg" != "yes" ]
                        then
                                echo "invalid line in config file line=$lineno
data=\"$label $name\""
                                echo "STRIPE line must be in a volume_group
definition"
                                exit 4
                        fi
                        STRIPE[groups]="-i $name"
                        ;;
            "DELETE_ALL")
                      DELETE_ALL="yes"
                      ;;
                "END")
                   DISK_COUNT[$groups]=$disks
                   disks=0
                        invg="no"
                        ;;
                *)
                        if [ "$invg" != "yes" ]
                        then
```

```
                                echo "invalid line in config file line=$lineno
 data=\"$label $name\""
                                exit 4
                        fi
                        diskName=$label
                        checkDisk $diskName
                        if [ "$name" != "" ]
                        then
                                addDisks
                        fi
                esac
                lineno=$lineno+1
        done < $CONFIG
 }


 # main()

        typeset -i delete=0
        typeset -i groups=0
        typeset -i disks=0
        test=`uname -a|grep "Linux"`
        if [ "$test" != "" ]
        then
                AWK=awk
        fi
     case $# in
     1)
           CONFIG=$1
           echo "Doing solvm config from $1"
           ;;
     *)
           usage
           ;;
     esac
     tmp=`/usr/sbin/metadb`
     if [ "$tmp" == "" ] ; then
           echo "No replica database is defined"
           exit 4
     fi
     tmp=`/usr/sbin/metastat -p > $STATFILE`
     checkConfig
     delGroups
     setVtoc
     makevol
```

dx8400_p1_88rg_svmake.txt

```
DELETE_ALL
VOLUME_GROUP: asu1-1 (d0)
STRIPE 8m
VOLUME 1
c1t0d4
c2t0d4
c3t0d4
c4t0d4
c5t0d4
c6t0d4
c7t0d4
c8t0d4
c1t0d24
```

```
c2t0d24
c3t0d24
c4t0d24
c5t0d24
c6t0d24
c7t0d24
c8t0d24
c1t0d44
c2t0d44
c3t0d44
c4t0d44
c5t0d44
c6t0d44
c7t0d44
c8t0d44
c1t0d64
c2t0d64
c3t0d64
c4t0d64
c5t0d64
c6t0d64
c7t0d64
c8t0d64
c1t0d84
c2t0d84
c3t0d84
c4t0d84
c5t0d84
c6t0d84
c7t0d84
c8t0d84
c1t0d104
c2t0d104
c3t0d104
c4t0d104
c5t0d104
c6t0d104
c7t0d104
c8t0d104
c1t0d124
c2t0d124
c3t0d124
c4t0d124
c5t0d124
c6t0d124
c7t0d124
c8t0d124
c1t0d144
c2t0d144
c3t0d144
c4t0d144
c5t0d144
c6t0d144
c7t0d144
c8t0d144
c1t0d164
c2t0d164
c3t0d164
c4t0d164
c5t0d164
c6t0d164
c7t0d164
c8t0d164
```

```
c1t0d184
c2t0d184
c3t0d184
c4t0d184
c5t0d184
c6t0d184
c7t0d184
c8t0d184
c1t0d204
c2t0d204
c3t0d204
c4t0d204
c5t0d204
c6t0d204
c7t0d204
c8t0d204
END
VOLUME_GROUP: asu1-2 (d1)
STRIPE 8m
VOLUME 1
c1t0d5
c2t0d5
c3t0d5
c4t0d5
c5t0d5
c6t0d5
c7t0d5
c8t0d5
c1t0d25
c2t0d25
c3t0d25
c4t0d25
c5t0d25
c6t0d25
c7t0d25
c8t0d25
c1t0d45
c2t0d45
c3t0d45
c4t0d45
c5t0d45
c6t0d45
c7t0d45
c8t0d45
c1t0d65
c2t0d65
c3t0d65
c4t0d65
c5t0d65
c6t0d65
c7t0d65
c8t0d65
c1t0d85
c2t0d85
c3t0d85
c4t0d85
c5t0d85
c6t0d85
c7t0d85
c8t0d85
c1t0d105
c2t0d105
c3t0d105
```

```
  c4t0d105
  c5t0d105
  c6t0d105
  c7t0d105
  c8t0d105
  c1t0d125
  c2t0d125
  c3t0d125
  c4t0d125
  c5t0d125
  c6t0d125
  c7t0d125
  c8t0d125
  c1t0d145
  c2t0d145
  c3t0d145
  c4t0d145
  c5t0d145
  c6t0d145
  c7t0d145
  c8t0d145
  c1t0d165
  c2t0d165
  c3t0d165
  c4t0d165
  c5t0d165
  c6t0d165
  c7t0d165
  c8t0d165
  c1t0d185
  c2t0d185
  c3t0d185
  c4t0d185
  c5t0d185
  c6t0d185
  c7t0d185
  c8t0d185
  c1t0d205
  c2t0d205
  c3t0d205
  c4t0d205
  c5t0d205
  c6t0d205
  c7t0d205
  c8t0d205
  END
  VOLUME_GROUP: asu1-3 (d2)
  STRIPE 8m
  VOLUME 1
  c1t0d6
  c2t0d6
  c3t0d6
  c4t0d6
  c5t0d6
  c6t0d6
  c7t0d6
  c8t0d6
  c1t0d26
  c2t0d26
  c3t0d26
  c4t0d26
  c5t0d26
  c6t0d26
```

```
c7t0d26
c8t0d26
c1t0d46
c2t0d46
c3t0d46
c4t0d46
c5t0d46
c6t0d46
c7t0d46
c8t0d46
c1t0d66
c2t0d66
c3t0d66
c4t0d66
c5t0d66
c6t0d66
c7t0d66
c8t0d66
c1t0d86
c2t0d86
c3t0d86
c4t0d86
c5t0d86
c6t0d86
c7t0d86
c8t0d86
c1t0d106
c2t0d106
c3t0d106
c4t0d106
c5t0d106
c6t0d106
c7t0d106
c8t0d106
c1t0d126
c2t0d126
c3t0d126
c4t0d126
c5t0d126
c6t0d126
c7t0d126
c8t0d126
c1t0d146
c2t0d146
c3t0d146
c4t0d146
c5t0d146
c6t0d146
c7t0d146
c8t0d146
c1t0d166
c2t0d166
c3t0d166
c4t0d166
c5t0d166
c6t0d166
c7t0d166
c8t0d166
c1t0d186
c2t0d186
c3t0d186
c4t0d186
c5t0d186
```

```
c6t0d186
c7t0d186
c8t0d186
c1t0d206
c2t0d206
c3t0d206
c4t0d206
c5t0d206
c6t0d206
c7t0d206
c8t0d206
END
VOLUME_GROUP: asu1-4 (d3)
STRIPE 8m
VOLUME 1
c1t0d7
c2t0d7
c3t0d7
c4t0d7
c5t0d7
c6t0d7
c7t0d7
c8t0d7
c1t0d27
c2t0d27
c3t0d27
c4t0d27
c5t0d27
c6t0d27
c7t0d27
c8t0d27
c1t0d47
c2t0d47
c3t0d47
c4t0d47
c5t0d47
c6t0d47
c7t0d47
c8t0d47
c1t0d67
c2t0d67
c3t0d67
c4t0d67
c5t0d67
c6t0d67
c7t0d67
c8t0d67
c1t0d87
c2t0d87
c3t0d87
c4t0d87
c5t0d87
c6t0d87
c7t0d87
c8t0d87
c1t0d107
c2t0d107
c3t0d107
c4t0d107
c5t0d107
c6t0d107
c7t0d107
c8t0d107
```

```
c1t0d127
c2t0d127
c3t0d127
c4t0d127
c5t0d127
c6t0d127
c7t0d127
c8t0d127
c1t0d147
c2t0d147
c3t0d147
c4t0d147
c5t0d147
c6t0d147
c7t0d147
c8t0d147
c1t0d167
c2t0d167
c3t0d167
c4t0d167
c5t0d167
c6t0d167
c7t0d167
c8t0d167
c1t0d187
c2t0d187
c3t0d187
c4t0d187
c5t0d187
c6t0d187
c7t0d187
c8t0d187
c1t0d207
c2t0d207
c3t0d207
c4t0d207
c5t0d207
c6t0d207
c7t0d207
c8t0d207
END
VOLUME_GROUP: asu1-5 (d4)
STRIPE 8m
VOLUME 1
c1t0d8
c2t0d8
c3t0d8
c4t0d8
c5t0d8
c6t0d8
c7t0d8
c8t0d8
c1t0d28
c2t0d28
c3t0d28
c4t0d28
c5t0d28
c6t0d28
c7t0d28
c8t0d28
c1t0d48
c2t0d48
c3t0d48
```

```
c4t0d48
c5t0d48
c6t0d48
c7t0d48
c8t0d48
c1t0d68
c2t0d68
c3t0d68
c4t0d68
c5t0d68
c6t0d68
c7t0d68
c8t0d68
c1t0d88
c2t0d88
c3t0d88
c4t0d88
c5t0d88
c6t0d88
c7t0d88
c8t0d88
c1t0d108
c2t0d108
c3t0d108
c4t0d108
c5t0d108
c6t0d108
c7t0d108
c8t0d108
c1t0d128
c2t0d128
c3t0d128
c4t0d128
c5t0d128
c6t0d128
c7t0d128
c8t0d128
c1t0d148
c2t0d148
c3t0d148
c4t0d148
c5t0d148
c6t0d148
c7t0d148
c8t0d148
c1t0d168
c2t0d168
c3t0d168
c4t0d168
c5t0d168
c6t0d168
c7t0d168
c8t0d168
c1t0d188
c2t0d188
c3t0d188
c4t0d188
c5t0d188
c6t0d188
c7t0d188
c8t0d188
c1t0d208
c2t0d208
```

```
c3t0d208
c4t0d208
c5t0d208
c6t0d208
c7t0d208
c8t0d208
END
VOLUME_GROUP: asu1-6 (d5)
STRIPE 8m
VOLUME 1
c1t0d11
c2t0d11
c3t0d11
c4t0d11
c5t0d11
c6t0d11
c7t0d11
c8t0d11
c1t0d31
c2t0d31
c3t0d31
c4t0d31
c5t0d31
c6t0d31
c7t0d31
c8t0d31
c1t0d51
c2t0d51
c3t0d51
c4t0d51
c5t0d51
c6t0d51
c7t0d51
c8t0d51
c1t0d71
c2t0d71
c3t0d71
c4t0d71
c5t0d71
c6t0d71
c7t0d71
c8t0d71
c1t0d91
c2t0d91
c3t0d91
c4t0d91
c5t0d91
c6t0d91
c7t0d91
c8t0d91
c1t0d111
c2t0d111
c3t0d111
c4t0d111
c5t0d111
c6t0d111
c7t0d111
c8t0d111
c1t0d131
c2t0d131
c3t0d131
c4t0d131
c5t0d131
```

```
  c6t0d131
  c7t0d131
  c8t0d131
  c1t0d151
  c2t0d151
  c3t0d151
  c4t0d151
  c5t0d151
  c6t0d151
  c7t0d151
  c8t0d151
  c1t0d171
  c2t0d171
  c3t0d171
  c4t0d171
  c5t0d171
  c6t0d171
  c7t0d171
  c8t0d171
  c1t0d191
  c2t0d191
  c3t0d191
  c4t0d191
  c5t0d191
  c6t0d191
  c7t0d191
  c8t0d191
  c1t0d211
  c2t0d211
  c3t0d211
  c4t0d211
  c5t0d211
  c6t0d211
  c7t0d211
  c8t0d211
  END
  VOLUME_GROUP: asu1-7 (d6)
  STRIPE 8m
  VOLUME 1
  c1t0d12
  c2t0d12
  c3t0d12
  c4t0d12
  c5t0d12
  c6t0d12
  c7t0d12
  c8t0d12
  c1t0d32
  c2t0d32
  c3t0d32
  c4t0d32
  c5t0d32
  c6t0d32
  c7t0d32
  c8t0d32
  c1t0d52
  c2t0d52
  c3t0d52
  c4t0d52
  c5t0d52
  c6t0d52
  c7t0d52
  c8t0d52
```

```
c1t0d72
c2t0d72
c3t0d72
c4t0d72
c5t0d72
c6t0d72
c7t0d72
c8t0d72
c1t0d92
c2t0d92
c3t0d92
c4t0d92
c5t0d92
c6t0d92
c7t0d92
c8t0d92
c1t0d112
c2t0d112
c3t0d112
c4t0d112
c5t0d112
c6t0d112
c7t0d112
c8t0d112
c1t0d132
c2t0d132
c3t0d132
c4t0d132
c5t0d132
c6t0d132
c7t0d132
c8t0d132
c1t0d152
c2t0d152
c3t0d152
c4t0d152
c5t0d152
c6t0d152
c7t0d152
c8t0d152
c1t0d172
c2t0d172
c3t0d172
c4t0d172
c5t0d172
c6t0d172
c7t0d172
c8t0d172
c1t0d192
c2t0d192
c3t0d192
c4t0d192
c5t0d192
c6t0d192
c7t0d192
c8t0d192
c1t0d212
c2t0d212
c3t0d212
c4t0d212
c5t0d212
c6t0d212
c7t0d212
```

```
c8t0d212
END
VOLUME_GROUP: asu1-8 (d7)
STRIPE 8m
VOLUME 1
c1t0d13
c2t0d13
c3t0d13
c4t0d13
c5t0d13
c6t0d13
c7t0d13
c8t0d13
c1t0d33
c2t0d33
c3t0d33
c4t0d33
c5t0d33
c6t0d33
c7t0d33
c8t0d33
c1t0d53
c2t0d53
c3t0d53
c4t0d53
c5t0d53
c6t0d53
c7t0d53
c8t0d53
c1t0d73
c2t0d73
c3t0d73
c4t0d73
c5t0d73
c6t0d73
c7t0d73
c8t0d73
c1t0d93
c2t0d93
c3t0d93
c4t0d93
c5t0d93
c6t0d93
c7t0d93
c8t0d93
c1t0d113
c2t0d113
c3t0d113
c4t0d113
c5t0d113
c6t0d113
c7t0d113
c8t0d113
c1t0d133
c2t0d133
c3t0d133
c4t0d133
c5t0d133
c6t0d133
c7t0d133
c8t0d133
c1t0d153
c2t0d153
```

```
c3t0d153
c4t0d153
c5t0d153
c6t0d153
c7t0d153
c8t0d153
c1t0d173
c2t0d173
c3t0d173
c4t0d173
c5t0d173
c6t0d173
c7t0d173
c8t0d173
c1t0d193
c2t0d193
c3t0d193
c4t0d193
c5t0d193
c6t0d193
c7t0d193
c8t0d193
c1t0d213
c2t0d213
c3t0d213
c4t0d213
c5t0d213
c6t0d213
c7t0d213
c8t0d213
END
VOLUME_GROUP: asu1-9 (d8)
STRIPE 8m
VOLUME 1
c1t0d14
c2t0d14
c3t0d14
c4t0d14
c5t0d14
c6t0d14
c7t0d14
c8t0d14
c1t0d34
c2t0d34
c3t0d34
c4t0d34
c5t0d34
c6t0d34
c7t0d34
c8t0d34
c1t0d54
c2t0d54
c3t0d54
c4t0d54
c5t0d54
c6t0d54
c7t0d54
c8t0d54
c1t0d74
c2t0d74
c3t0d74
c4t0d74
c5t0d74
```

```
c6t0d74
c7t0d74
c8t0d74
c1t0d94
c2t0d94
c3t0d94
c4t0d94
c5t0d94
c6t0d94
c7t0d94
c8t0d94
c1t0d114
c2t0d114
c3t0d114
c4t0d114
c5t0d114
c6t0d114
c7t0d114
c8t0d114
c1t0d134
c2t0d134
c3t0d134
c4t0d134
c5t0d134
c6t0d134
c7t0d134
c8t0d134
c1t0d154
c2t0d154
c3t0d154
c4t0d154
c5t0d154
c6t0d154
c7t0d154
c8t0d154
c1t0d174
c2t0d174
c3t0d174
c4t0d174
c5t0d174
c6t0d174
c7t0d174
c8t0d174
c1t0d194
c2t0d194
c3t0d194
c4t0d194
c5t0d194
c6t0d194
c7t0d194
c8t0d194
c1t0d214
c2t0d214
c3t0d214
c4t0d214
c5t0d214
c6t0d214
c7t0d214
c8t0d214
END
VOLUME_GROUP: asu2-1 (d9)
STRIPE 8m
VOLUME 1
```

```
c1t0d0
c2t0d0
c3t0d0
c4t0d0
c5t0d0
c6t0d0
c7t0d0
c8t0d0
c1t0d20
c2t0d20
c3t0d20
c4t0d20
c5t0d20
c6t0d20
c7t0d20
c8t0d20
c1t0d40
c2t0d40
c3t0d40
c4t0d40
c5t0d40
c6t0d40
c7t0d40
c8t0d40
c1t0d60
c2t0d60
c3t0d60
c4t0d60
c5t0d60
c6t0d60
c7t0d60
c8t0d60
c1t0d80
c2t0d80
c3t0d80
c4t0d80
c5t0d80
c6t0d80
c7t0d80
c8t0d80
c1t0d100
c2t0d100
c3t0d100
c4t0d100
c5t0d100
c6t0d100
c7t0d100
c8t0d100
c1t0d120
c2t0d120
c3t0d120
c4t0d120
c5t0d120
c6t0d120
c7t0d120
c8t0d120
c1t0d140
c2t0d140
c3t0d140
c4t0d140
c5t0d140
c6t0d140
c7t0d140
```

```
c8t0d140
c1t0d160
c2t0d160
c3t0d160
c4t0d160
c5t0d160
c6t0d160
c7t0d160
c8t0d160
c1t0d180
c2t0d180
c3t0d180
c4t0d180
c5t0d180
c6t0d180
c7t0d180
c8t0d180
c1t0d200
c2t0d200
c3t0d200
c4t0d200
c5t0d200
c6t0d200
c7t0d200
c8t0d200
END
VOLUME_GROUP: asu2-2 (d10)
STRIPE 8m
VOLUME 1
c1t0d1
c2t0d1
c3t0d1
c4t0d1
c5t0d1
c6t0d1
c7t0d1
c8t0d1
c1t0d21
c2t0d21
c3t0d21
c4t0d21
c5t0d21
c6t0d21
c7t0d21
c8t0d21
c1t0d41
c2t0d41
c3t0d41
c4t0d41
c5t0d41
c6t0d41
c7t0d41
c8t0d41
c1t0d61
c2t0d61
c3t0d61
c4t0d61
c5t0d61
c6t0d61
c7t0d61
c8t0d61
c1t0d81
c2t0d81
```

```
  c3t0d81
  c4t0d81
  c5t0d81
  c6t0d81
  c7t0d81
  c8t0d81
  c1t0d101
  c2t0d101
  c3t0d101
  c4t0d101
  c5t0d101
  c6t0d101
  c7t0d101
  c8t0d101
  c1t0d121
  c2t0d121
  c3t0d121
  c4t0d121
  c5t0d121
  c6t0d121
  c7t0d121
  c8t0d121
  c1t0d141
  c2t0d141
  c3t0d141
  c4t0d141
  c5t0d141
  c6t0d141
  c7t0d141
  c8t0d141
  c1t0d161
  c2t0d161
  c3t0d161
  c4t0d161
  c5t0d161
  c6t0d161
  c7t0d161
  c8t0d161
  c1t0d181
  c2t0d181
  c3t0d181
  c4t0d181
  c5t0d181
  c6t0d181
  c7t0d181
  c8t0d181
  c1t0d201
  c2t0d201
  c3t0d201
  c4t0d201
  c5t0d201
  c6t0d201
  c7t0d201
  c8t0d201
  END
  VOLUME_GROUP: asu2-3 (d11)
  STRIPE 8m
  VOLUME 1
  c1t0d2
  c2t0d2
  c3t0d2
  c4t0d2
  c5t0d2
```

```
c6t0d2
c7t0d2
c8t0d2
c1t0d22
c2t0d22
c3t0d22
c4t0d22
c5t0d22
c6t0d22
c7t0d22
c8t0d22
c1t0d42
c2t0d42
c3t0d42
c4t0d42
c5t0d42
c6t0d42
c7t0d42
c8t0d42
c1t0d62
c2t0d62
c3t0d62
c4t0d62
c5t0d62
c6t0d62
c7t0d62
c8t0d62
c1t0d82
c2t0d82
c3t0d82
c4t0d82
c5t0d82
c6t0d82
c7t0d82
c8t0d82
c1t0d102
c2t0d102
c3t0d102
c4t0d102
c5t0d102
c6t0d102
c7t0d102
c8t0d102
c1t0d122
c2t0d122
c3t0d122
c4t0d122
c5t0d122
c6t0d122
c7t0d122
c8t0d122
c1t0d142
c2t0d142
c3t0d142
c4t0d142
c5t0d142
c6t0d142
c7t0d142
c8t0d142
c1t0d162
c2t0d162
c3t0d162
c4t0d162
```

```
c5t0d162
c6t0d162
c7t0d162
c8t0d162
c1t0d182
c2t0d182
c3t0d182
c4t0d182
c5t0d182
c6t0d182
c7t0d182
c8t0d182
c1t0d202
c2t0d202
c3t0d202
c4t0d202
c5t0d202
c6t0d202
c7t0d202
c8t0d202
END
VOLUME_GROUP: asu2-4 (d12)
STRIPE 8m
VOLUME 1
c1t0d3
c2t0d3
c3t0d3
c4t0d3
c5t0d3
c6t0d3
c7t0d3
c8t0d3
c1t0d23
c2t0d23
c3t0d23
c4t0d23
c5t0d23
c6t0d23
c7t0d23
c8t0d23
c1t0d43
c2t0d43
c3t0d43
c4t0d43
c5t0d43
c6t0d43
c7t0d43
c8t0d43
c1t0d63
c2t0d63
c3t0d63
c4t0d63
c5t0d63
c6t0d63
c7t0d63
c8t0d63
c1t0d83
c2t0d83
c3t0d83
c4t0d83
c5t0d83
c6t0d83
c7t0d83
```

```
c8t0d83
c1t0d103
c2t0d103
c3t0d103
c4t0d103
c5t0d103
c6t0d103
c7t0d103
c8t0d103
c1t0d123
c2t0d123
c3t0d123
c4t0d123
c5t0d123
c6t0d123
c7t0d123
c8t0d123
c1t0d143
c2t0d143
c3t0d143
c4t0d143
c5t0d143
c6t0d143
c7t0d143
c8t0d143
c1t0d163
c2t0d163
c3t0d163
c4t0d163
c5t0d163
c6t0d163
c7t0d163
c8t0d163
c1t0d183
c2t0d183
c3t0d183
c4t0d183
c5t0d183
c6t0d183
c7t0d183
c8t0d183
c1t0d203
c2t0d203
c3t0d203
c4t0d203
c5t0d203
c6t0d203
c7t0d203
c8t0d203
END
VOLUME_GROUP: asu2-5 (d13)
STRIPE 8m
VOLUME 1
c1t0d15
c2t0d15
c3t0d15
c4t0d15
c5t0d15
c6t0d15
c7t0d15
c8t0d15
c1t0d35
c2t0d35
```

```
c3t0d35
c4t0d35
c5t0d35
c6t0d35
c7t0d35
c8t0d35
c1t0d55
c2t0d55
c3t0d55
c4t0d55
c5t0d55
c6t0d55
c7t0d55
c8t0d55
c1t0d75
c2t0d75
c3t0d75
c4t0d75
c5t0d75
c6t0d75
c7t0d75
c8t0d75
c1t0d95
c2t0d95
c3t0d95
c4t0d95
c5t0d95
c6t0d95
c7t0d95
c8t0d95
c1t0d115
c2t0d115
c3t0d115
c4t0d115
c5t0d115
c6t0d115
c7t0d115
c8t0d115
c1t0d135
c2t0d135
c3t0d135
c4t0d135
c5t0d135
c6t0d135
c7t0d135
c8t0d135
c1t0d155
c2t0d155
c3t0d155
c4t0d155
c5t0d155
c6t0d155
c7t0d155
c8t0d155
c1t0d175
c2t0d175
c3t0d175
c4t0d175
c5t0d175
c6t0d175
c7t0d175
c8t0d175
c1t0d195
```

```
c2t0d195
c3t0d195
c4t0d195
c5t0d195
c6t0d195
c7t0d195
c8t0d195
c1t0d215
c2t0d215
c3t0d215
c4t0d215
c5t0d215
c6t0d215
c7t0d215
c8t0d215
END
VOLUME_GROUP: asu2-6 (d14)
STRIPE 8m
VOLUME 1
c1t0d16
c2t0d16
c3t0d16
c4t0d16
c5t0d16
c6t0d16
c7t0d16
c8t0d16
c1t0d36
c2t0d36
c3t0d36
c4t0d36
c5t0d36
c6t0d36
c7t0d36
c8t0d36
c1t0d56
c2t0d56
c3t0d56
c4t0d56
c5t0d56
c6t0d56
c7t0d56
c8t0d56
c1t0d76
c2t0d76
c3t0d76
c4t0d76
c5t0d76
c6t0d76
c7t0d76
c8t0d76
c1t0d96
c2t0d96
c3t0d96
c4t0d96
c5t0d96
c6t0d96
c7t0d96
c8t0d96
c1t0d116
c2t0d116
c3t0d116
c4t0d116
```

```
c5t0d116
c6t0d116
c7t0d116
c8t0d116
c1t0d136
c2t0d136
c3t0d136
c4t0d136
c5t0d136
c6t0d136
c7t0d136
c8t0d136
c1t0d156
c2t0d156
c3t0d156
c4t0d156
c5t0d156
c6t0d156
c7t0d156
c8t0d156
c1t0d176
c2t0d176
c3t0d176
c4t0d176
c5t0d176
c6t0d176
c7t0d176
c8t0d176
c1t0d196
c2t0d196
c3t0d196
c4t0d196
c5t0d196
c6t0d196
c7t0d196
c8t0d196
c1t0d216
c2t0d216
c3t0d216
c4t0d216
c5t0d216
c6t0d216
c7t0d216
c8t0d216
END
VOLUME_GROUP: asu2-7 (d15)
STRIPE 8m
VOLUME 1
c1t0d17
c2t0d17
c3t0d17
c4t0d17
c5t0d17
c6t0d17
c7t0d17
c8t0d17
c1t0d37
c2t0d37
c3t0d37
c4t0d37
c5t0d37
c6t0d37
c7t0d37
```

```
c8t0d37
c1t0d57
c2t0d57
c3t0d57
c4t0d57
c5t0d57
c6t0d57
c7t0d57
c8t0d57
c1t0d77
c2t0d77
c3t0d77
c4t0d77
c5t0d77
c6t0d77
c7t0d77
c8t0d77
c1t0d97
c2t0d97
c3t0d97
c4t0d97
c5t0d97
c6t0d97
c7t0d97
c8t0d97
c1t0d117
c2t0d117
c3t0d117
c4t0d117
c5t0d117
c6t0d117
c7t0d117
c8t0d117
c1t0d137
c2t0d137
c3t0d137
c4t0d137
c5t0d137
c6t0d137
c7t0d137
c8t0d137
c1t0d157
c2t0d157
c3t0d157
c4t0d157
c5t0d157
c6t0d157
c7t0d157
c8t0d157
c1t0d177
c2t0d177
c3t0d177
c4t0d177
c5t0d177
c6t0d177
c7t0d177
c8t0d177
c1t0d197
c2t0d197
c3t0d197
c4t0d197
c5t0d197
c6t0d197
```

```
c7t0d197
c8t0d197
c1t0d217
c2t0d217
c3t0d217
c4t0d217
c5t0d217
c6t0d217
c7t0d217
c8t0d217
END
VOLUME_GROUP: asu2-8 (d16)
STRIPE 8m
VOLUME 1
c1t0d18
c2t0d18
c3t0d18
c4t0d18
c5t0d18
c6t0d18
c7t0d18
c8t0d18
c1t0d38
c2t0d38
c3t0d38
c4t0d38
c5t0d38
c6t0d38
c7t0d38
c8t0d38
c1t0d58
c2t0d58
c3t0d58
c4t0d58
c5t0d58
c6t0d58
c7t0d58
c8t0d58
c1t0d78
c2t0d78
c3t0d78
c4t0d78
c5t0d78
c6t0d78
c7t0d78
c8t0d78
c1t0d98
c2t0d98
c3t0d98
c4t0d98
c5t0d98
c6t0d98
c7t0d98
c8t0d98
c1t0d118
c2t0d118
c3t0d118
c4t0d118
c5t0d118
c6t0d118
c7t0d118
c8t0d118
c1t0d138
```

```
c2t0d138
c3t0d138
c4t0d138
c5t0d138
c6t0d138
c7t0d138
c8t0d138
c1t0d158
c2t0d158
c3t0d158
c4t0d158
c5t0d158
c6t0d158
c7t0d158
c8t0d158
c1t0d178
c2t0d178
c3t0d178
c4t0d178
c5t0d178
c6t0d178
c7t0d178
c8t0d178
c1t0d198
c2t0d198
c3t0d198
c4t0d198
c5t0d198
c6t0d198
c7t0d198
c8t0d198
c1t0d218
c2t0d218
c3t0d218
c4t0d218
c5t0d218
c6t0d218
c7t0d218
c8t0d218
END
VOLUME_GROUP: asu2-9 (d17)
STRIPE 8m
VOLUME 1
c1t0d19
c2t0d19
c3t0d19
c4t0d19
c5t0d19
c6t0d19
c7t0d19
c8t0d19
c1t0d39
c2t0d39
c3t0d39
c4t0d39
c5t0d39
c6t0d39
c7t0d39
c8t0d39
c1t0d59
c2t0d59
c3t0d59
c4t0d59
```

```
c5t0d59
c6t0d59
c7t0d59
c8t0d59
c1t0d79
c2t0d79
c3t0d79
c4t0d79
c5t0d79
c6t0d79
c7t0d79
c8t0d79
c1t0d99
c2t0d99
c3t0d99
c4t0d99
c5t0d99
c6t0d99
c7t0d99
c8t0d99
c1t0d119
c2t0d119
c3t0d119
c4t0d119
c5t0d119
c6t0d119
c7t0d119
c8t0d119
c1t0d139
c2t0d139
c3t0d139
c4t0d139
c5t0d139
c6t0d139
c7t0d139
c8t0d139
c1t0d159
c2t0d159
c3t0d159
c4t0d159
c5t0d159
c6t0d159
c7t0d159
c8t0d159
c1t0d179
c2t0d179
c3t0d179
c4t0d179
c5t0d179
c6t0d179
c7t0d179
c8t0d179
c1t0d199
c2t0d199
c3t0d199
c4t0d199
c5t0d199
c6t0d199
c7t0d199
c8t0d199
c1t0d219
c2t0d219
c3t0d219
```

```
c4t0d219
c5t0d219
c6t0d219
c7t0d219
c8t0d219
END
VOLUME_GROUP: asu3-1 (d18)
STRIPE 8m
VOLUME 1
c1t0d9
c2t0d9
c3t0d9
c4t0d9
c5t0d9
c6t0d9
c7t0d9
c8t0d9
c1t0d29
c2t0d29
c3t0d29
c4t0d29
c5t0d29
c6t0d29
c7t0d29
c8t0d29
c1t0d49
c2t0d49
c3t0d49
c4t0d49
c5t0d49
c6t0d49
c7t0d49
c8t0d49
c1t0d69
c2t0d69
c3t0d69
c4t0d69
c5t0d69
c6t0d69
c7t0d69
c8t0d69
c1t0d89
c2t0d89
c3t0d89
c4t0d89
c5t0d89
c6t0d89
c7t0d89
c8t0d89
c1t0d109
c2t0d109
c3t0d109
c4t0d109
c5t0d109
c6t0d109
c7t0d109
c8t0d109
c1t0d129
c2t0d129
c3t0d129
c4t0d129
c5t0d129
c6t0d129
```

```
c7t0d129
c8t0d129
c1t0d149
c2t0d149
c3t0d149
c4t0d149
c5t0d149
c6t0d149
c7t0d149
c8t0d149
c1t0d169
c2t0d169
c3t0d169
c4t0d169
c5t0d169
c6t0d169
c7t0d169
c8t0d169
c1t0d189
c2t0d189
c3t0d189
c4t0d189
c5t0d189
c6t0d189
c7t0d189
c8t0d189
c1t0d209
c2t0d209
c3t0d209
c4t0d209
c5t0d209
c6t0d209
c7t0d209
c8t0d209
END
VOLUME_GROUP: asu3-2 (d19)
STRIPE 8m
VOLUME 1
c1t0d10
c2t0d10
c3t0d10
c4t0d10
c5t0d10
c6t0d10
c7t0d10
c8t0d10
c1t0d30
c2t0d30
c3t0d30
c4t0d30
c5t0d30
c6t0d30
c7t0d30
c8t0d30
c1t0d50
c2t0d50
c3t0d50
c4t0d50
c5t0d50
c6t0d50
c7t0d50
c8t0d50
c1t0d70
```

```
  c2t0d70
  c3t0d70
  c4t0d70
  c5t0d70
  c6t0d70
  c7t0d70
  c8t0d70
  c1t0d90
  c2t0d90
  c3t0d90
  c4t0d90
  c5t0d90
  c6t0d90
  c7t0d90
  c8t0d90
  c1t0d110
  c2t0d110
  c3t0d110
  c4t0d110
  c5t0d110
  c6t0d110
  c7t0d110
  c8t0d110
  c1t0d130
  c2t0d130
  c3t0d130
  c4t0d130
  c5t0d130
  c6t0d130
  c7t0d130
  c8t0d130
  c1t0d150
  c2t0d150
  c3t0d150
  c4t0d150
  c5t0d150
  c6t0d150
  c7t0d150
  c8t0d150
  c1t0d170
  c2t0d170
  c3t0d170
  c4t0d170
  c5t0d170
  c6t0d170
  c7t0d170
  c8t0d170
  c1t0d190
  c2t0d190
  c3t0d190
  c4t0d190
  c5t0d190
  c6t0d190
  c7t0d190
  c8t0d190
  c1t0d210
  c2t0d210
  c3t0d210
  c4t0d210
  c5t0d210
  c6t0d210
  c7t0d210
  c8t0d210
```

```
END
```

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

The SPC-1 Workload Generator command and parameter file, used in this benchmark to execute the Primary Metrics, Repeatability, and Persistence Tests, was created by a macro within the Configuration Plan Excel workbook *(see Appendix C)*. The file contains the list of Solaris Logical Volumes that form the definitions for the three ASUs used by the benchmark, ASU1, ASU2, and ASU3.

The content of the file is listed below.

```
javaparms="-Xmx1280m -Xms1280m -Xss96k"
sd=asu1_1,lun=/dev/md/rdsk/d0,size=4954.0434g
sd=asu1_2,lun=/dev/md/rdsk/d1,size=4954.0434g
sd=asu1_3,lun=/dev/md/rdsk/d2,size=4954.0434g
sd=asu1_4,lun=/dev/md/rdsk/d3,size=4954.0434g
sd=asu1_5,lun=/dev/md/rdsk/d4,size=4954.0434g
sd=asu1_6,lun=/dev/md/rdsk/d5,size=4954.0434g
sd=asu1_7,lun=/dev/md/rdsk/d6,size=4954.0434g
sd=asu1_8,lun=/dev/md/rdsk/d7,size=4954.0434g
sd=asu1_9,lun=/dev/md/rdsk/d8,size=4954.0434g
sd=asu2_1,lun=/dev/md/rdsk/d9,size=4954.0434g
sd=asu2_2,lun=/dev/md/rdsk/d10,size=4954.0434g
sd=asu2_3,lun=/dev/md/rdsk/d11,size=4954.0434g
sd=asu2_4,lun=/dev/md/rdsk/d12,size=4954.0434g
sd=asu2_5,lun=/dev/md/rdsk/d13,size=4954.0434g
sd=asu2_6,lun=/dev/md/rdsk/d14,size=4954.0434g
sd=asu2_7,lun=/dev/md/rdsk/d15,size=4954.0434g
sd=asu2_8,lun=/dev/md/rdsk/d16,size=4954.0434g
sd=asu2_9,lun=/dev/md/rdsk/d17,size=4954.0434g
sd=asu3_1,lun=/dev/md/rdsk/d18,size=4954.0434g
sd=asu3_2,lun=/dev/md/rdsk/d19,size=4954.0434g
```

APPENDIX E: SPC-1 WORKLOAD GENERATOR INPUT PARAMETERS

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.

```
#metrics
java -Xmx2048m -Xms2048m -Xss1024k metrics -b 3435

#repeat-1
java -Xmx2048m -Xms2048m -Xss1024k repeat1 -b 3435

#repeat-2
java -Xmx2048m -Xms2048m -Xss1024k repeat2 -b 3435

#persist-1
./killslaves.sh
./killslaves_1.sh

cp -f fdr_persist_1_2_SPC1.cfg SPC1.cfg
java -Xmx1280m -Xms1280m -Xss96k persist1 -b 3435
echo "persist1_complete"
```

The following scripts were called to terminate the slave JVMs at the end of the Repeatability Test and prior to the execution of Persistence Test Run 1, since that Test Run will only utilize a single JVM.

killslaves.sh

```
ps -ef|grep java|grep spc1|awk '{print $2}'|xargs -n1 kill
#ps -ef|grep java|grep txt1|awk '{print $2}'|xargs -n1 kill
```

killslaves_1.sh

```
#ps -ef|grep java|grep spc1|awk '{print $2}'|xargs -n1 kill
ps -ef|grep java|grep txt1|awk '{print $2}'|xargs -n1 kill
```

Persistence Test Run 2

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

```
java -Xmx1280m -Xms1280m -Xss96k persist2

mv metrics metrics_DX8400_100401_FDR_bsu3435
mv repeatability1 repeat1_DX8400_100401_FDR_bsu3435
mv repeatability2 repeat2_DX8400_100401_FDR_bsu3435
mv persistence1 persist1_DX8400_100401_FDR_bsu3435
mv persistence2 persist2_DX8400_100401_FDR_bsu3435
mv SPCOut SPCOut_DX8400_100401_FDR_bsu3435

zip -r metrics_DX8400_100401_FDR_bsu3435.zip metrics_DX8400_100401_FDR_bsu3435
zip -r repeat1_DX8400_100401_FDR_bsu3435.zip repeat1_DX8400_100401_FDR_bsu3435
zip -r repeat2_DX8400_100401_FDR_bsu3435.zip repeat2_DX8400_100401_FDR_bsu3435
```

```
zip -r persist1_DX8400_100401_FDR_bsu3435.zip persist1_DX8400_100401_FDR_bsu3435
zip -r persist2_DX8400_100401_FDR_bsu3435.zip persist2_DX8400_100401_FDR_bsu3435
zip -r SPCOut_DX8400_100401_FDR_bsu3435.zip SPCOut_DX8400_100401_FDR_bsu3435
```