SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

FUJITSU LIMITED
FUJITSU STORAGE SYSTEMS
ETERNUS3000 MODEL 700

SPC-1 V1.8

Submitted for Review: June 30, 2004
Submission Identifier: A00032
Revised: July 9, 2004
Accepted: August 29, 2004

First Edition – June 2004

Trademarks

Notes

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

- Kilobyte (KB) is equal to 1,000 (10^3) bytes.
- Megabyte (MB) is equal to 1,000,000 (10^6) bytes.
- Gigabyte (GB) is equal to 1,000,000,000 (10^9) bytes.
- Terabyte (TB) is equal to 1,000,000,000,000 (10^{12}) bytes.

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AUDIT CERTIFICATION

C. A. (Sandy) Wilson
Fujitsu Limited
1250 East Arques Avenue
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Sunnyvale, CA 94088

June 29, 2004

The SPC Benchmark 1™ results listed below for the Fujitsu Storage Systems ETERNUS3000 Model 700 were produced in compliance with the SPC Benchmark 1™ V1.8 Remote Audit requirements.

SPC Benchmark 1™ V1.8 Results	
Tested Storage Configuration (TSC) Name: Fujitsu Storage Systems ETERNUS3000 Model 700	
Metric	**Reported Result**
SPC-1 IOPS™	41,202.56
SPC-1 Price-Performance	$11.84/SPC-1 IOPS™
Total ASU Capacity	8,428.400 GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	$488,058

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

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items were verified using 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).

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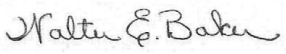
- Listings and commands to configure the Benchmark Configuration/Tested Storage Configuration, including customer tunable parameters.
- Commands and parameters used to configure the SPC-1 Workload Generator.
- The following Host System requirements were reviewed using documentation supplied by Fujitsu Limited:
  - ✓ The type of Host System including the number of processors and main memory.
  - ✓ The presence and version number of the Workload Generator on the Host System.
  - ✓ The TSC boundary within the Host System.
- The 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 Configuration.
- The final version of the pricing spreadsheet met all of the requirements and constraints of Clause 8 of the SPC-1 Benchmark Specification.
- The Full Disclosure Report (FDR) met all of the requirements in Clause 9 of the SPC-1 Benchmark Specification.

Audit Notes:

There were no additional audit notes or exceptions.

Respectfully,



Walter E. Baker
SPC Auditor

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LETTER OF GOOD FAITH

FUJITSU LIMITED
Kawasaki-shi, Nakahara-ku, Kamikodanaka 4-1-1, JAPAN 211-8588
TEL : 044-754-3605, FAX : 044-754-3609

FUJITSU

From: Fujitsu Limited, Test Sponsor

Submitted by: Hitoshi Matsushima
Vice President, Storage Systems division
Kanagawa-ken, Kanagawa-ken, Kawasaki-shi, Nakahara-ku, Kamikodanaka 4-1-1
Japan 211-8588

Contact Information: Carrel A. (Sandy) Wilson
Fujitsu Computer Systems Corp.
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 ETERNUS3000 Model 700

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 V1.80 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: H. Matsushima Date: 16/06/04

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Fujitsu Limited – http://www.fujitsu.com/services/computing/storage/ Fujitsu Computer Systems Corp. C.A. (Sandy) Wilson Sandy_Wilson@us.fujitsu.com 1250 East Arques Ave PO Box 3470 Sunnyvale, CA 94088-3470 Phone: (916) 434-8593
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Test Sponsor Alternate Contact	Fujitsu Limited – http://www.fujitsu.com/services/computing/storage/ Norihiko Kondo kondo.n@jp.fujitsu.com Kanagawa-ken, Kanagawa-ken, Kawasaki-shi, Nakahara-ku, Kamikodanaka 4-1-1 Japan 211-8588 Phone: 044- 754-3605
Auditor	Storage Performance Council – www.storageperformance.org Walter E. Baker – AuditService@storageperformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.8
SPC-1 Workload Generator revision number	V2.00.04a
Date Results were first used publicly	June 30, 2004
Date FDR was submitted to the SPC	June 30, 2004
Date revised FDR was submitted to the SPC Revised pricing-three year maintenance	July 9, 2004
Date the TSC is/was available for shipment to customers	August 20, 2004
Date the TSC completed audit certification	June 29, 2004

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: Fujitsu Storage Systems ETERNUS3000 Model 700	
Metric	**Reported Result**
SPC-1 IOPS™	41,202.56
SPC-1 Price-Performance	$12.67/SPC-1 IOPS™
Total ASU Capacity	8,428.400GB
Data Protection Level	Mirroring
Total TSC Price (including three-year maintenance)	$522,060

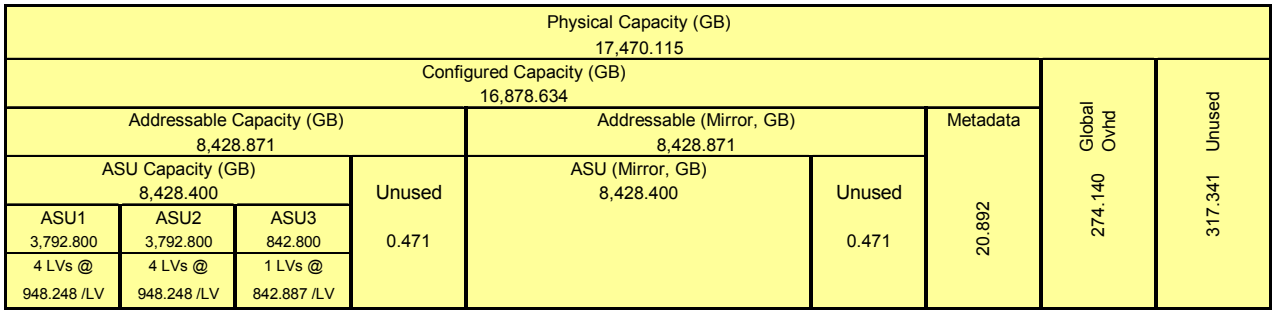
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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

A **Data Protection Level** of Mirroring configures two or more identical copies of user data.

Storage Capacities and Relationships

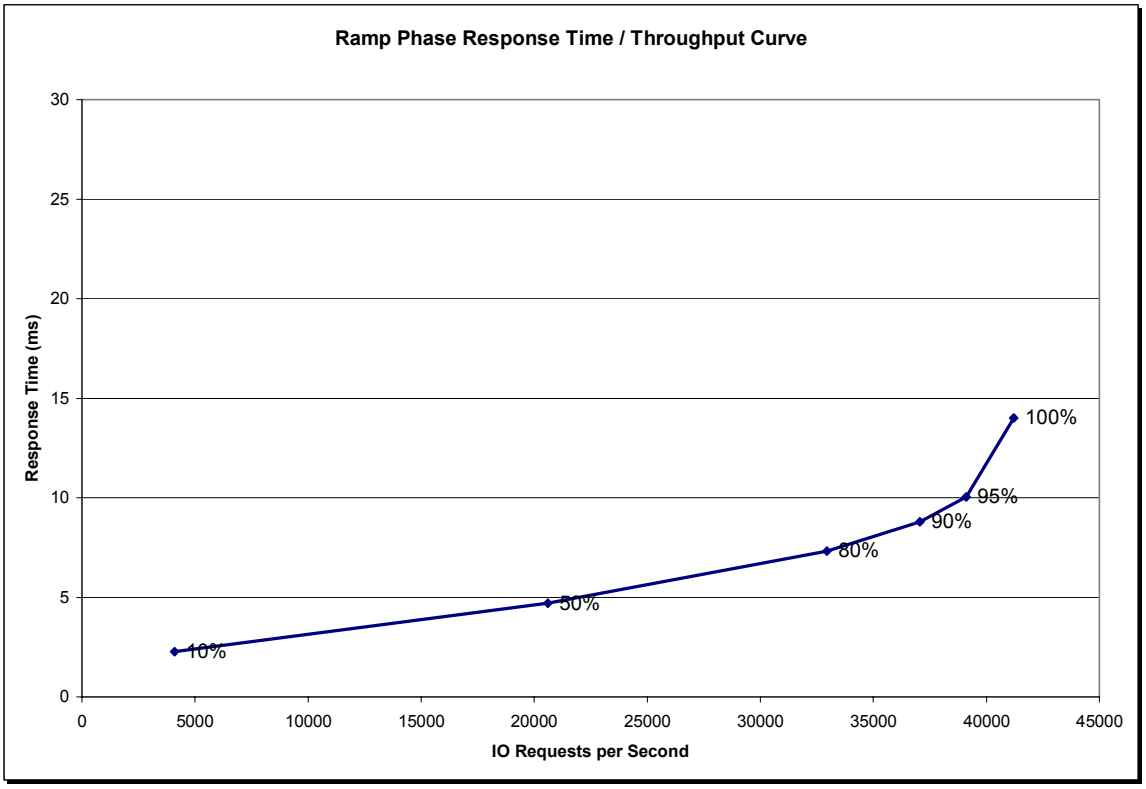
The following diagram documents the various storage capacities, used in this benchmark, and their relationships.



Response Time – Throughput Curve

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

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



Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	4,102.02	20,607.35	32,947.86	37,055.87	39,100.96	41,202.56
Average Response Time (ms):						
All ASUs	2.26	4.70	7.33	8.80	10.05	14.01
ASU-1	2.79	5.60	8.77	10.61	12.17	16.84
ASU-2	2.83	5.82	9.35	11.46	13.32	18.85
ASU-3	0.90	2.29	3.38	3.79	4.12	5.88
Reads	4.49	8.67	13.74	16.87	19.56	26.89
Writes	0.82	2.11	3.15	3.54	3.86	5.61

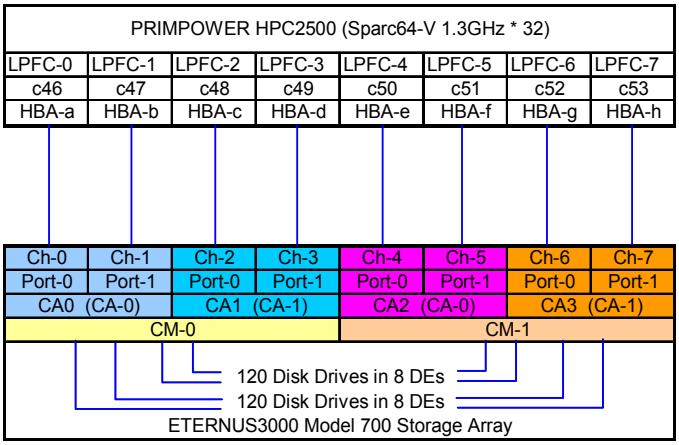
Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Item	Product Id	Description	Qty	Unit $	Extd $
1	E370S20AU	ETERNUS3000 Model 700 without Door including Controller Enclosure, 2x Controllers, each Controller with dual ports & 4GB Cache dual power supplies, dual battery units 2x drive enclosures 1800mm (36U) rack, 2x power distribution (200VAC) 4x FC cables (5m), 2x LAN cables (5m) rack mount kit, ETERNUSmgr & drivers slots for up to 30 disk drives	1	$58,000	$58,000
2	E340SR3U	ETERNUS3000 Expansion rack without Door including Expansion 1800mm (36U) rack 2x drive enclosures 2x power distribution (200 VAC) slots for up to 30 disk drives	1	$21,500	$21,500
3	E300CE2U	Drive Enclosure pair - (rack mount 2x 3U) with slots for up to 30 disk drives	6	$13,400	$80,400
4	E370CM8	Additional cache memory (2x 4GB)	1	$4,500	$4,500
5	E300CHF4	Additional host interface (2x dual ports)	1	$4,800	$4,800
6	E300CD7H	73GB/15krpm Disk Drives	240	$1,630	$391,200
7	CBL-MLLB15	Fibre Channel Cable	8	$250	$2,000
8	PW028FC3U	Emulex LP9802	8	$2,795	$22,360
9		Enhanced Plus Model 700 - Phone 24x7, On-site 24x7, with 4 hour response - 3 year Warranty Uplift Base w/ 2 DEs	1	$14,256	$14,256
10		Enhanced Plus Model 700 - Phone 24x7, On-site 24x7, with 4 hour response - 3 year Warranty Uplift per DE pair	7	$13,464	$94,248
		Total Product List Price			$584,760
		Product Discount		20%	
		Net Product Price			$467,808
		Total Service List Price			$108,504
		Service Discount		50%	
		Net Service Price			$54,252
		Total Sell Price, including 3 years Service			**$522,060**

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

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

Benchmark Configuration/Tested Storage Configuration Diagram



Host Systems:	Tested Storage Configuration (TSC):
UID=HS-1	8 – Emulex LP9802 FC HBAs (2 Gbit)
Fujitsu PRIMEPOWER HPC2500	***UID=SC-1:***
32 - SPARC64 V (1.3 GHz) CPUs, each with: 128 KB L1 instruction cache, 128 KB L1 data cache, and 2 MB L2 cache	Fujitsu ETERNUS3000 Model 700 2 – Controller Modules (CM), each with 3.2 GHz Xeon CPU 8 GB cache 2 dual channel FC Host interfaces 8 – Front side fibre channels – 2 Gbit each 4 – Drive side fibre channel switched loops 2 Gbit each
64 GB main memory	
Solaris 9	
PCI	
WG	240 – 73 GB 15K RPM disk drives
	16 – Drive enclosure modules, each with dual FC-AL interfaces 15 – hot swap drive slots

CONFIGURATION INFORMATION

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

Clause 9.2.4.4.1

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

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

Storage Network Configuration

Clause 9.2.4.4.2

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

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

Additionally the diagram shall:

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

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

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

Host System Configuration

Clause 9.2.4.4.3

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

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

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

Customer Tunable Parameters and Options

Clause 9.2.4.5.1

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

"Appendix A: Customer Tunable Parameters and Options" on page 51 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Description

Clause 9.2.4.5.2

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

- *All physical components that comprise the TSC. Those components are also illustrated in the Benchmark Configuration (BC) diagram in Clause 9.2.4.4.1 and, if applicable, the Storage Network Configuration Diagram in Clause 9.2.4.4.2.*
- *The logical representation of the TSC, configured from the above components that will be presented to the Workload Generator.*

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

"Appendix B: Tested Storage Configuration (TSC) Creation" on page 58 contains the detailed information that describes how to create and configure the logical TSC.

SPC-1 Workload Generator Storage Configuration

Clause 9.2.4.5.3

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

The SPC-1 Workload Generator storage configuration commands and parameters for this measurement appear in "Appendix C: SPC-1 Workload Generator Storage Commands and Parameters" on page 88.

DATA REPOSITORY

Definitions

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

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

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

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

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

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

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

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

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

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

Storage Capacities and Relationships

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

SPC-1 Storage Capacities

SPC-1 Storage Capacities		
Storage Hierarchy Component	**Units**	**Capacity**
Total ASU Capacity	Gigabytes (GB)	8,428.400
Addressable Storage Capacity	Gigabytes (GB)	8,428.873
Configured Storage Capacity	Gigabytes (GB)	16,878.634
Physical Storage Capacity	Gigabytes (GB)	17,470.115
Data Protection Overhead (mirror)	Gigabytes (GB)	8,428.873
Required Storage	Gigabytes (GB)	20.892
Global Storage Overhead	Gigabytes (GB)	274.140
Total Unused Storage	Gigabytes (GB)	318.761

SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
Total ASU Capacity	99.99%	49.94%	48.24%
Required for Data Protection (Mirroring)		49.94%	48.25%
Addressable Storage Capacity		49.94%	48.25%
Required Storage		0.12%	0.12%
Configured Storage Capacity			96.61%
Global Storage Overhead			1.57%
Unused Storage:			
Addressable	0.006%		
Configured		0.006%	
Physical			1.816%

The Physical Storage Capacity consisted of 17,470 GB distributed over 240 disk drives each with a formatted capacity of 72.792 GB. There was 317.341 GB (1.816%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 274.140 GB (1.57%) of Physical Storage Capacity. There was 0.947 GB (0.006%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 99.99% of the Addressable Storage Capacity resulting in 0.075 GB (0.006%) of Unused Storage within the Addressable Storage Capacity.

SPC-1 Storage Capacities and Relationships Illustration

The various storage capacities configured in the benchmark result are illustrated below (not to scale).

<table>
<tr><td colspan="7">Physical Capacity (GB)
17,470.115</td></tr>
<tr><td colspan="5">Configured Capacity (GB)
16,878.634</td><td rowspan="5">Global Ovhd
274.140</td><td rowspan="5">Unused
317.341</td></tr>
<tr><td colspan="3">Addressable Capacity (GB)
8,428.871</td><td colspan="2">Addressable (Mirror, GB)
8,428.871</td><td rowspan="4">Metadata
20.892</td></tr>
<tr><td colspan="2">ASU Capacity (GB)
8,428.400</td><td rowspan="3">Unused
0.471</td><td rowspan="3">ASU (Mirror, GB)
8,428.400</td><td rowspan="3">Unused
0.471</td></tr>
<tr><td>ASU1
3,792.800</td><td>ASU2
3,792.800</td><td>ASU3
842.800</td></tr>
<tr><td>4 LVs @
948.248 /LV</td><td>4 LVs @
948.248 /LV</td><td>1 LVs @
842.887 /LV</td></tr>
</table>

Logical Volume Capacity and ASU Mapping

Clause 9.2.4.6.2

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

Logical Volume Capacity and Mapping		
ASU-1 (3,792,800 GB)	**ASU-2 (3,792.800 GB)**	**ASU-3 (842,800 GB)**
4 Logical Volumes 948.248 GB per Logical Volume (948.200 GB used/Logical Volume)	4 Logical Volumes 948.248 GB per Logical Volume (948.200 GB used/Logical Volume)	1 Logical Volume 842.887 GB per Logical Volume (842.800 GB used/Logical Volume)

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

Assignment of RAID Groups and LUNs

RAID Group Assignments are RAID0+1(3+3) sets, each divided into 9 Logical Volumes, for a total of 360 LVs. These are grouped into eight separate sets of LUNs, using Host Affinity grouping, with 36 to 54 LUNs each. All 240 disk drives are used in the configuration, with no drives reserved for Hot Spares, providing the maximum usable space within the complement of drives.

Drive:	0	1	2	3	4
DE:					
00 10	RG 0 (0)	RG 1 (1)	RG 2 (2)	RG 3 (3)	RG 4 (4)
01 11	RG 5 (5)	RG 6 (6)	RG 7 (7)	RG 8 (8)	RG 9 (9)
02 12	RG A (10)	RG B (11)	RG C (12)	RG D (13)	RG E (14)
03 13	RG F (15)	RG 10 (16)	RG 11 (17)	RG 12 (18)	RG 13 (19)
04 14	RG 14 (20)	RG 15 (21)	RG 16 (22)	RG 17 (23)	RG 18 (24)
05 15	RG 19 (25)	RG 1A (26)	RG 1B (27)	RG 1C (28)	RG 1D (29)
06 16	RG 1E (30)	RG 1F (31)	RG 20 (32)	RG 21 (33)	RG 22 (34)
07 17	RG 23 (35)	RG 24 (36)	RG 25 (37)	RG 26 (38)	RG 27 (39)

Drive:	5	6	7	8	9	A	B	C	D	E
DE:										
00 10										
01 11										
02 12										
03 13										
04 14										
05 15										
06 16										
07 17										

The RAID Groups and LUN assignments are set up through a series of actions on the GUI Management Interface (ETERNUSmgr). 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 RAID0+1 configurations. In this configuration, all of the RAID Groups are 3+3 arrangements. One set of the drives, making up each RAID Group, is in one Drive Enclosure (DE), and the mating set is in another DE. A special case exists for the RAID Groups that include the drives (0-3) in DE0. These drives have reduced configurable capacity, due to reserved system space on each of these four drives. When these drives are mated with others in a RAID0+1 configuration, the other drives also have reduced space available. This results in RAID Groups 0 and 1 being somewhat smaller than the other groups. To make all of the RAID groups the same size, only the maximum user space available on these two RAID groups were used on all of the other groups as well. This unused space is not part of the Configured space, but is reflected in the unused physical space within the system.

The LUNs, seen through the eight HBAs by Solaris, are then grouped into Solaris Logical Volumes, and used with 16 MB stripe units across the sets. Four Logical Volumes, each with 40 LUNs, are used for ASU1 and for ASU2, while one Logical Volume, also with 40 LUNs is used for ASU3. This assignment of LUNs to Logical Volumes ensures that no single storage unit presented to the SPC-1 Workload Generator is larger than 1 TB. The sizes are reflected in the ASU Logical Volume Mapping chart.

SPC-1 BENCHMARK EXECUTION RESULTS

Definitions

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

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

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

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

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

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

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

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

- **Data Persistence Test**
  - Data Persistence Test Run 1
  - Data Persistence Test Run 2
- **Primary Metrics Test**
  - Sustainability Test Phase and Test Run
  - IOPS Test Phase and Test Run
  - Response Time Ramp Test Phase
    - 95% of IOPS Test Run
    - 90% of IOPS Test Run
    - 80% of IOPS Test Run
    - 50% of IOPS Test Run
    - 10% of IOPS Test Run (LRT)
- **Repeatability Test**
  - Repeatability Test Phase 1
    - 10% of IOPS Test Run (LRT)
    - IOPS Test Run
  - Repeatability Test Phase 2
    - 10% of IOPS Test Run (LRT)
    - IOPS Test Run

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

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

Primary Metrics Test – Sustainability Test Phase

Clause 5.4.2.1

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

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

Clause 9.2.4.7.1

For the Sustainability Test Phase the FDR shall contain:

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

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are documented in "Appendix D: SPC-1 Workload Generator Input Parameters" on Page 89.

Sustainability Test Results File

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

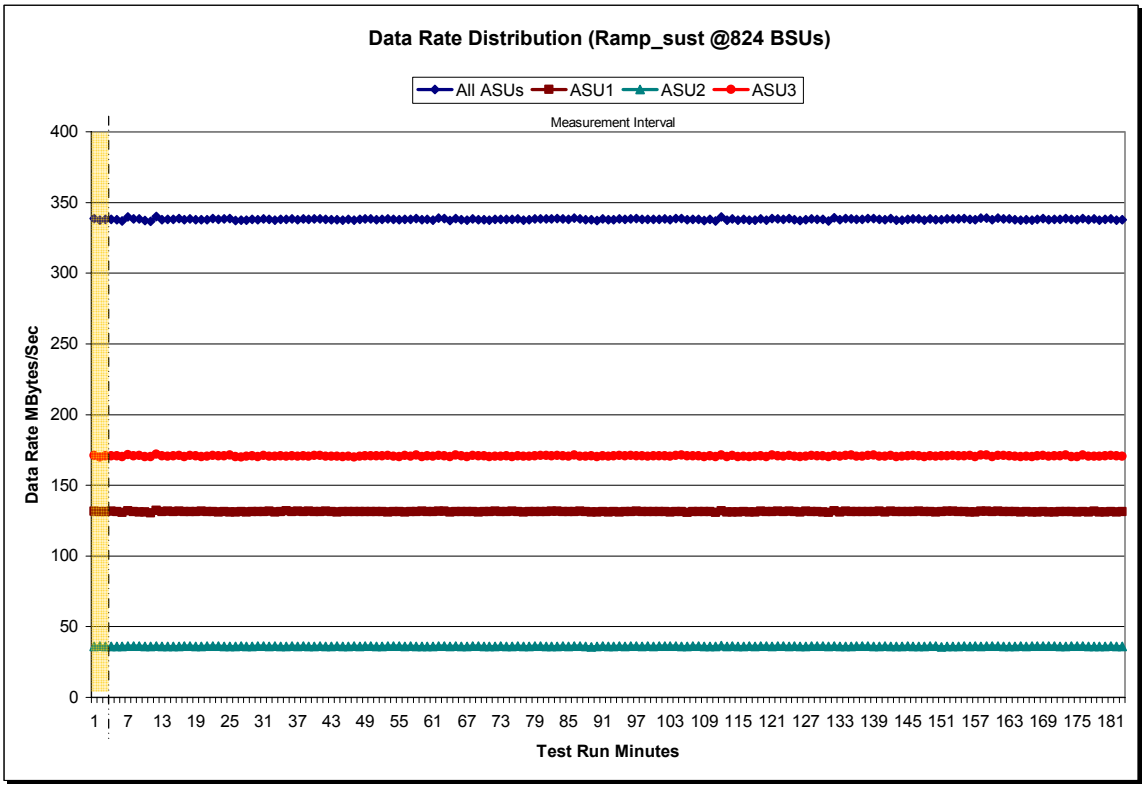
Sustainability Test Results File

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

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	21:24:58	21:27:58	0-2	0:03:00
Measurement Interval	21:27:58	0:27:58	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	338.74	131.52	36.08	171.14	63	337.20	131.10	35.94	170.15	126	337.75	131.46	35.90	170.38
1	337.57	131.38	36.14	170.05	64	338.62	131.24	36.16	171.22	127	338.44	131.21	36.16	171.07
2	337.95	131.20	35.93	170.82	65	337.80	131.19	35.97	170.63	128	338.17	131.18	36.31	170.68
3	338.20	131.56	35.91	170.73	66	337.58	131.26	35.99	170.33	129	337.97	131.16	36.14	170.67
4	337.89	131.18	36.01	170.71	67	338.50	131.28	36.19	171.03	130	336.99	130.75	35.93	170.30
5	336.91	130.78	35.91	170.21	68	337.93	131.12	36.17	170.63	131	339.24	131.84	36.41	170.98
6	339.85	131.91	36.24	171.71	69	337.88	131.20	36.05	170.63	132	337.82	131.16	36.08	170.58
7	338.39	131.21	36.31	170.88	70	337.42	131.24	35.98	170.21	133	338.62	131.47	36.02	171.13
8	338.50	131.16	36.33	171.02	71	338.10	131.62	36.06	170.43	134	338.51	131.22	36.01	171.29
9	337.32	131.14	35.90	170.28	72	337.99	131.29	36.23	170.48	135	338.01	131.23	36.26	170.52
10	336.58	130.49	36.01	170.08	73	338.01	131.22	35.97	170.82	136	338.12	131.33	36.39	170.41
11	340.10	132.08	36.22	171.80	74	338.01	131.66	36.13	170.22	137	338.53	131.30	36.28	170.95
12	337.92	131.26	35.96	170.71	75	338.28	131.41	36.21	170.66	138	338.66	131.34	36.09	171.22
13	338.08	131.49	36.04	170.54	76	337.41	130.98	35.89	170.54	139	338.18	131.66	36.12	170.41
14	338.04	131.25	36.02	170.77	77	337.80	131.20	36.09	170.51	140	337.87	131.16	36.26	170.46
15	338.71	131.65	36.13	170.92	78	338.36	131.29	36.30	170.77	141	338.67	131.59	35.95	171.14
16	337.74	131.34	36.21	170.19	79	338.50	131.29	36.23	170.99	142	337.63	131.30	36.07	170.26
17	338.50	131.39	36.15	170.95	80	338.38	131.18	36.10	171.10	143	337.64	131.30	35.92	170.42
18	337.89	131.21	36.05	170.63	81	338.28	131.48	35.98	170.82	144	338.22	131.35	36.19	170.67
19	337.71	131.57	36.03	170.11	82	338.68	131.51	36.10	171.06	145	338.42	131.18	36.09	171.15
20	337.80	131.24	36.19	170.37	83	338.42	131.36	36.31	170.76	146	338.32	131.50	36.13	170.69
21	338.74	131.38	36.26	171.11	84	337.98	131.35	36.06	170.57	147	337.59	131.26	36.07	170.27
22	338.17	131.15	36.14	170.89	85	338.84	131.19	36.23	171.43	148	338.32	131.30	36.14	170.87
23	338.36	131.37	36.10	170.88	86	338.36	131.58	36.15	170.63	149	337.71	130.93	36.16	170.62
24	338.62	131.11	36.03	171.49	87	337.93	131.25	36.14	170.54	150	337.84	131.32	35.78	170.74
25	337.33	131.12	36.06	170.15	88	337.83	131.15	35.84	170.84	151	338.49	131.50	36.08	170.91
26	337.57	131.21	36.34	170.02	89	337.27	131.12	35.93	170.22	152	338.50	131.52	35.95	171.03
27	337.48	130.90	35.97	170.60	90	338.28	131.22	36.29	170.77	153	338.41	131.40	36.11	170.91
28	338.09	131.30	35.87	170.91	91	337.73	131.15	35.95	170.62	154	338.54	131.33	36.33	170.89
29	337.82	131.37	36.25	170.20	92	337.91	131.18	36.09	170.64	155	338.15	131.05	36.01	171.10
30	338.38	131.27	36.16	170.95	93	338.27	131.05	36.29	170.93	156	337.76	131.15	36.32	170.29
31	338.23	131.71	36.09	170.43	94	338.09	131.35	36.04	170.70	157	339.06	131.70	36.07	171.29
32	337.59	131.04	36.18	170.36	95	338.47	131.27	36.17	171.03	158	339.08	131.51	36.34	171.23
33	338.15	131.36	36.11	170.67	96	338.59	131.52	36.24	170.83	159	337.69	131.30	36.23	170.16
34	338.17	131.76	35.92	170.49	97	338.06	131.19	36.12	170.76	160	338.98	131.72	36.17	171.09
35	338.34	131.33	36.16	170.85	98	337.99	131.29	36.24	170.46	161	338.44	131.24	36.09	171.11
36	337.77	131.50	35.87	170.39	99	338.19	131.20	36.13	170.86	162	338.30	131.43	36.13	170.75
37	338.37	131.18	36.30	170.89	100	338.17	131.18	36.16	170.84	163	337.66	131.18	35.87	170.61
38	338.12	131.59	36.03	170.49	101	338.32	131.38	36.31	170.63	164	337.46	131.10	36.20	170.16
39	338.36	131.36	35.96	171.04	102	337.93	131.16	36.18	170.59	165	337.82	131.31	36.08	170.43
40	338.44	131.27	36.15	171.02	103	338.66	131.35	36.21	171.10	166	337.48	130.99	36.23	170.26
41	338.09	131.52	36.11	170.46	104	338.64	131.33	36.06	171.25	167	338.03	131.06	36.34	170.63
42	337.85	131.33	36.12	170.40	105	337.88	130.87	36.12	170.89	168	338.60	131.41	36.22	170.97
43	337.90	131.12	36.20	170.58	106	338.21	131.21	36.25	170.75	169	337.93	131.16	36.18	170.59
44	337.55	131.42	36.02	170.12	107	338.16	131.22	36.19	170.75	170	338.16	131.12	36.14	170.90
45	338.13	131.42	36.10	170.60	108	337.20	131.22	35.92	170.06	171	338.10	131.35	36.03	170.73
46	337.47	131.33	36.27	169.87	109	338.11	131.29	35.95	170.87	172	338.75	131.21	36.08	171.46
47	338.04	131.37	36.05	170.62	110	336.99	130.85	35.99	170.15	173	337.96	131.37	36.31	170.27
48	338.30	131.42	36.22	170.66	111	339.69	131.78	36.44	171.47	174	337.76	131.15	36.29	170.32
49	338.24	131.18	36.23	170.83	112	337.55	131.09	36.14	170.33	175	338.80	131.34	36.19	171.28
50	337.93	131.18	36.06	170.68	113	338.27	131.15	36.19	170.94	176	337.69	131.13	35.98	170.58
51	338.22	131.44	36.14	170.64	114	337.52	131.11	36.09	170.31	177	338.23	131.53	36.10	170.61
52	338.36	131.12	36.26	170.98	115	338.09	131.38	36.09	170.62	178	337.64	131.16	35.95	170.53
53	337.97	131.45	36.17	170.35	116	337.43	131.00	36.17	170.26	179	337.95	131.07	36.08	170.81
54	337.85	131.38	36.23	170.24	117	337.48	130.96	36.10	170.41	180	338.42	131.24	36.23	170.95
55	338.06	131.11	35.86	171.09	118	338.52	131.48	36.20	170.83	181	337.62	131.02	35.97	170.63
56	337.98	131.26	36.20	170.52	119	337.60	131.31	36.15	170.14	182	337.76	131.31	36.02	170.43
57	338.59	131.30	35.95	171.34	120	338.66	131.43	35.91	171.32					
58	337.89	131.54	36.06	170.29	121	338.32	131.50	36.19	170.63					
59	338.15	131.36	35.95	170.85	122	338.00	131.26	36.18	170.57					
60	337.61	131.27	35.95	170.39	123	338.60	131.50	36.08	171.02					
61	338.95	131.63	36.32	171.00	124	337.92	131.24	36.17	170.51					
62	338.58	131.56	36.20	170.83	125	337.35	131.16	36.04	170.15					

Sustainability – Data Rate Distribution Graph

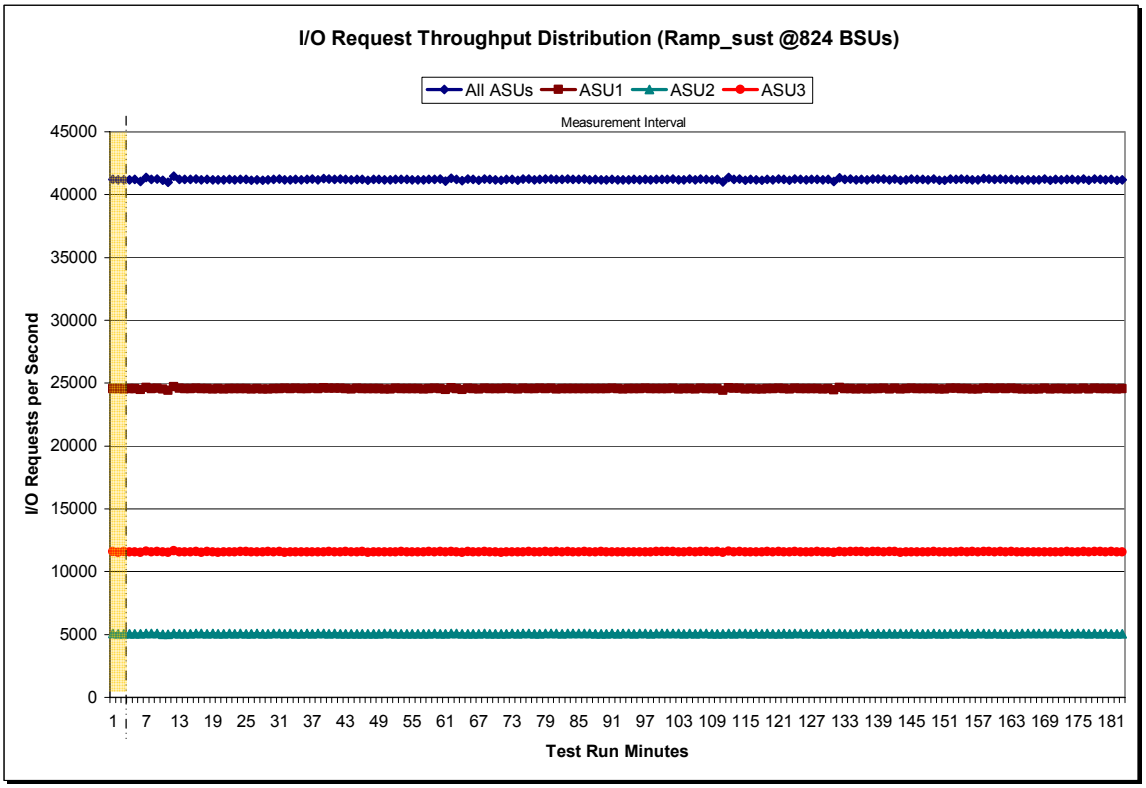


Sustainability – I/O Request Throughput Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	21:24:58	21:27:58	0-2	0:03:00
Measurement Interval	21:27:58	0:27:58	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	41,219.22	24,555.22	5,081.02	11,582.98	63	41,101.25	24,506.72	5,061.27	11,533.27	126	41,197.98	24,545.95	5,072.58	11,579.45
1	41,176.83	24,560.87	5,067.90	11,548.07	64	41,250.70	24,582.17	5,069.28	11,599.25	127	41,197.15	24,548.43	5,065.17	11,583.55
2	41,178.53	24,533.83	5,058.17	11,586.53	65	41,203.40	24,560.50	5,063.43	11,579.47	128	41,182.17	24,540.10	5,064.87	11,577.20
3	41,189.15	24,555.88	5,058.60	11,574.67	66	41,158.63	24,533.37	5,065.32	11,559.95	129	41,211.77	24,555.90	5,075.08	11,580.78
4	41,193.48	24,563.23	5,064.37	11,565.88	67	41,238.80	24,579.10	5,071.40	11,588.30	130	41,052.13	24,454.75	5,059.73	11,537.65
5	41,062.82	24,480.32	5,039.52	11,542.98	68	41,194.72	24,554.63	5,067.10	11,572.98	131	41,352.63	24,662.55	5,094.85	11,595.23
6	41,375.98	24,652.02	5,088.53	11,635.43	69	41,166.52	24,543.90	5,057.15	11,565.47	132	41,194.23	24,557.23	5,060.35	11,576.65
7	41,222.80	24,556.13	5,086.03	11,580.63	70	41,156.23	24,544.78	5,063.05	11,548.40	133	41,238.95	24,571.70	5,066.27	11,600.98
8	41,254.38	24,591.25	5,074.20	11,588.93	71	41,198.83	24,582.93	5,055.78	11,560.12	134	41,190.00	24,528.82	5,068.00	11,593.18
9	41,134.28	24,525.50	5,037.12	11,571.67	72	41,212.03	24,548.47	5,086.12	11,577.45	135	41,203.17	24,542.72	5,071.25	11,589.20
10	40,966.98	24,421.05	5,028.00	11,517.93	73	41,153.33	24,534.70	5,051.40	11,567.23	136	41,193.20	24,535.73	5,086.88	11,570.58
11	41,461.42	24,704.83	5,101.73	11,654.85	74	41,232.78	24,604.97	5,076.88	11,550.93	137	41,231.83	24,570.87	5,070.05	11,590.92
12	41,214.25	24,582.12	5,051.02	11,581.12	75	41,226.38	24,563.93	5,076.05	11,586.40	138	41,250.75	24,559.85	5,080.80	11,610.10
13	41,197.32	24,559.37	5,069.27	11,568.68	76	41,190.12	24,547.72	5,069.72	11,572.68	139	41,235.78	24,590.57	5,065.22	11,580.00
14	41,195.52	24,552.40	5,067.52	11,575.60	77	41,216.90	24,577.43	5,065.07	11,574.40	140	41,191.87	24,537.58	5,070.82	11,583.47
15	41,245.52	24,586.52	5,073.60	11,585.40	78	41,249.72	24,572.22	5,086.02	11,591.48	141	41,232.35	24,584.77	5,062.13	11,585.45
16	41,174.13	24,549.05	5,085.55	11,539.53	79	41,227.75	24,580.48	5,072.48	11,574.78	142	41,152.70	24,540.95	5,073.15	11,538.60
17	41,204.58	24,551.43	5,066.62	11,586.53	80	41,195.75	24,531.35	5,071.77	11,592.63	143	41,177.05	24,568.90	5,041.95	11,566.20
18	41,188.13	24,540.83	5,071.75	11,575.55	81	41,198.60	24,571.05	5,055.65	11,571.90	144	41,246.95	24,587.08	5,078.57	11,581.30
19	41,167.72	24,558.85	5,061.73	11,547.13	82	41,228.05	24,568.60	5,073.58	11,585.87	145	41,205.68	24,569.12	5,060.08	11,576.48
20	41,185.83	24,539.72	5,066.28	11,579.83	83	41,216.98	24,556.65	5,080.60	11,579.73	146	41,195.43	24,561.62	5,064.27	11,569.55
21	41,212.47	24,559.53	5,079.55	11,573.38	84	41,211.68	24,555.05	5,088.48	11,568.15	147	41,185.20	24,555.60	5,060.52	11,569.08
22	41,180.50	24,542.27	5,069.22	11,569.02	85	41,249.22	24,556.62	5,080.25	11,612.35	148	41,233.45	24,560.10	5,082.02	11,591.33
23	41,220.57	24,558.50	5,078.35	11,583.72	86	41,189.92	24,558.97	5,072.92	11,558.03	149	41,154.97	24,525.43	5,055.75	11,573.78
24	41,217.00	24,546.18	5,056.70	11,614.12	87	41,194.45	24,563.03	5,064.67	11,566.75	150	41,151.95	24,539.63	5,049.02	11,563.30
25	41,154.75	24,527.13	5,066.97	11,560.65	88	41,189.13	24,547.93	5,045.65	11,595.55	151	41,233.08	24,584.45	5,073.57	11,575.07
26	41,188.40	24,558.25	5,071.38	11,558.77	89	41,183.38	24,554.17	5,059.18	11,570.03	152	41,200.25	24,576.65	5,047.98	11,575.62
27	41,131.43	24,517.28	5,060.85	11,553.30	90	41,224.25	24,573.88	5,077.60	11,572.77	153	41,233.77	24,564.37	5,073.40	11,596.00
28	41,168.15	24,533.02	5,052.90	11,582.23	91	41,166.45	24,544.10	5,068.42	11,553.93	154	41,201.02	24,552.43	5,080.02	11,568.57
29	41,203.62	24,554.88	5,084.75	11,563.98	92	41,185.60	24,540.97	5,072.05	11,572.58	155	41,189.08	24,538.63	5,054.62	11,595.83
30	41,240.40	24,572.37	5,073.90	11,594.13	93	41,186.55	24,541.50	5,070.52	11,574.53	156	41,187.22	24,529.45	5,088.22	11,569.55
31	41,183.85	24,586.95	5,052.68	11,544.22	94	41,199.25	24,560.35	5,063.05	11,575.85	157	41,273.18	24,595.65	5,077.20	11,600.33
32	41,168.97	24,542.25	5,072.43	11,554.28	95	41,190.73	24,549.95	5,071.78	11,569.00	158	41,248.98	24,593.22	5,063.20	11,592.57
33	41,219.17	24,575.88	5,064.60	11,578.68	96	41,222.33	24,577.12	5,078.63	11,566.58	159	41,193.68	24,567.72	5,072.50	11,553.47
34	41,192.62	24,556.30	5,057.63	11,578.68	97	41,177.58	24,549.90	5,069.37	11,558.32	160	41,245.90	24,588.85	5,068.50	11,588.55
35	41,217.80	24,567.13	5,072.70	11,577.97	98	41,220.80	24,556.70	5,070.40	11,593.70	161	41,211.28	24,572.63	5,064.37	11,574.28
36	41,230.92	24,603.65	5,060.77	11,566.50	99	41,214.27	24,553.73	5,071.47	11,589.07	162	41,217.62	24,579.77	5,054.78	11,583.07
37	41,191.05	24,544.13	5,082.05	11,564.87	100	41,216.17	24,550.63	5,081.52	11,584.02	163	41,184.83	24,546.83	5,061.90	11,576.10
38	41,266.43	24,606.75	5,081.50	11,578.18	101	41,245.93	24,575.88	5,081.10	11,588.95	164	41,171.05	24,531.97	5,082.22	11,556.87
39	41,226.15	24,584.72	5,056.23	11,585.20	102	41,164.88	24,524.23	5,070.20	11,570.45	165	41,161.92	24,531.88	5,073.60	11,556.43
40	41,224.30	24,575.88	5,077.97	11,570.45	103	41,185.30	24,547.20	5,063.17	11,574.93	166	41,189.12	24,539.10	5,078.75	11,571.27
41	41,228.95	24,586.75	5,062.58	11,579.62	104	41,241.87	24,558.27	5,080.05	11,603.55	167	41,179.05	24,521.73	5,088.18	11,569.13
42	41,212.42	24,547.98	5,065.02	11,599.42	105	41,166.78	24,527.53	5,068.15	11,571.10	168	41,250.07	24,591.95	5,077.65	11,580.47
43	41,177.03	24,539.25	5,060.90	11,576.88	106	41,235.75	24,579.38	5,071.32	11,585.05	169	41,156.50	24,522.68	5,071.70	11,562.12
44	41,211.08	24,575.07	5,065.50	11,570.52	107	41,209.88	24,546.83	5,078.02	11,585.03	170	41,217.88	24,561.90	5,083.25	11,572.73
45	41,203.38	24,545.12	5,067.48	11,590.78	108	41,167.45	24,542.37	5,064.65	11,560.43	171	41,190.82	24,552.17	5,072.80	11,565.85
46	41,144.08	24,551.63	5,054.83	11,537.62	109	41,193.98	24,548.08	5,060.08	11,585.82	172	41,210.02	24,532.75	5,069.88	11,607.38
47	41,201.72	24,558.35	5,065.62	11,577.75	110	41,020.18	24,435.98	5,047.13	11,537.07	173	41,208.20	24,553.73	5,081.57	11,572.90
48	41,212.23	24,572.08	5,064.43	11,575.72	111	41,363.17	24,629.55	5,100.40	11,633.22	174	41,189.50	24,532.93	5,086.35	11,570.22
49	41,185.98	24,535.43	5,072.50	11,578.05	112	41,199.42	24,576.82	5,062.87	11,559.73	175	41,250.85	24,575.53	5,076.95	11,598.37
50	41,186.57	24,535.95	5,071.00	11,579.62	113	41,257.18	24,576.75	5,070.90	11,609.53	176	41,155.07	24,519.42	5,060.60	11,575.05
51	41,204.17	24,574.98	5,063.25	11,565.93	114	41,151.15	24,513.83	5,083.02	11,554.30	177	41,247.98	24,587.77	5,073.82	11,586.40
52	41,194.78	24,545.70	5,065.23	11,583.85	115	41,197.63	24,555.68	5,064.97	11,576.98	178	41,196.78	24,542.80	5,064.63	11,589.35
53	41,197.50	24,564.97	5,058.93	11,573.60	116	41,169.53	24,527.03	5,080.20	11,562.30	179	41,193.18	24,544.32	5,072.72	11,576.15
54	41,179.03	24,556.73	5,064.30	11,558.00	117	41,158.92	24,511.22	5,069.65	11,578.05	180	41,201.70	24,544.82	5,067.23	11,589.65
55	41,185.23	24,546.82	5,056.93	11,581.48	118	41,207.78	24,554.52	5,071.10	11,582.17	181	41,154.78	24,526.80	5,060.67	11,567.32
56	41,174.23	24,531.02	5,067.77	11,575.45	119	41,167.15	24,552.40	5,056.55	11,558.20	182	41,182.62	24,550.47	5,064.70	11,567.45
57	41,201.85	24,561.62	5,057.72	11,582.52	120	41,236.48	24,575.75	5,062.33	11,598.40	Average	41,201.02	24,556.16	5,068.76	11,576.10
58	41,224.68	24,584.52	5,072.27	11,567.90	121	41,222.33	24,567.48	5,078.90	11,575.95					
59	41,230.65	24,568.08	5,060.47	11,602.10	122	41,147.13	24,521.90	5,055.70	11,569.53					
60	41,090.73	24,488.72	5,045.47	11,556.55	123	41,241.98	24,579.75	5,070.50	11,591.73					
61	41,294.10	24,613.15	5,084.63	11,596.32	124	41,211.88	24,561.60	5,080.23	11,570.05					
62	41,207.45	24,568.17	5,079.57	11,559.72	125	41,173.28	24,551.08	5,062.73	11,559.47					

Sustainability – I/O Request Throughput Distribution Graph



Sustainability – Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
COV	0.003	0.001	0.002	0.001	0.004	0.003	0.003	0.001

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

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

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

Primary Metrics Test – IOPS Test Phase

Clause 5.4.2.2

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

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

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

Clause 9.2.4.7.2

For the IOPS Test Phase the FDR shall contain:

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

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are documented in "Appendix D: SPC-1 Workload Generator Input Parameters" on Page 89.

IOPS Test Results File

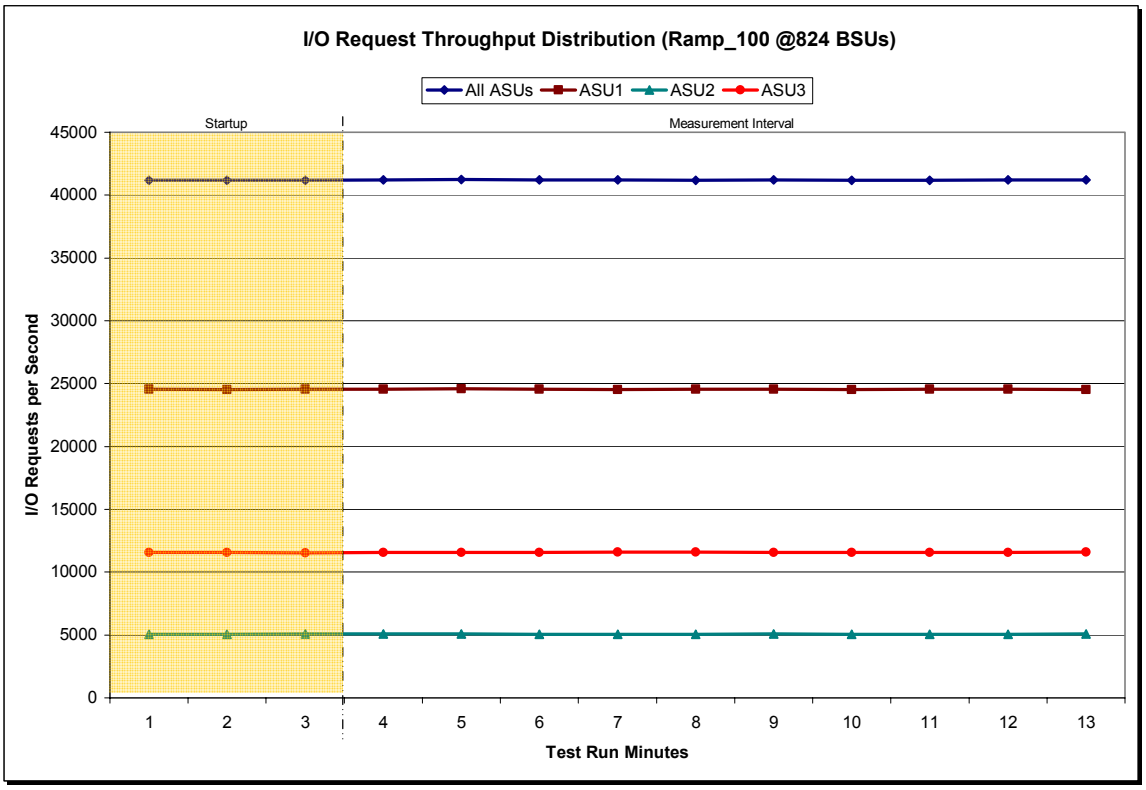
A link to the test results file generated from the IOPS Test Run is listed below.

IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	0:28:26	0:31:27	0-2	0:03:01
Measurement Interval	0:31:27	0:41:27	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	41,183.77	24,561.57	5,054.65	11,567.55
1	41,180.78	24,539.50	5,066.58	11,574.70
2	41,185.43	24,565.10	5,076.90	11,543.43
3	41,196.95	24,547.53	5,082.65	11,566.77
4	41,249.45	24,596.08	5,080.05	11,573.32
5	41,200.93	24,554.98	5,067.73	11,578.22
6	41,205.23	24,540.53	5,066.57	11,598.13
7	41,192.32	24,565.12	5,044.33	11,582.87
8	41,204.33	24,561.02	5,072.15	11,571.17
9	41,168.23	24,536.78	5,055.05	11,576.40
10	41,180.82	24,553.50	5,064.43	11,562.88
11	41,221.47	24,570.08	5,069.45	11,581.93
12	41,205.88	24,539.57	5,078.68	11,587.63
Average	41,202.56	24,556.52	5,068.11	11,577.93

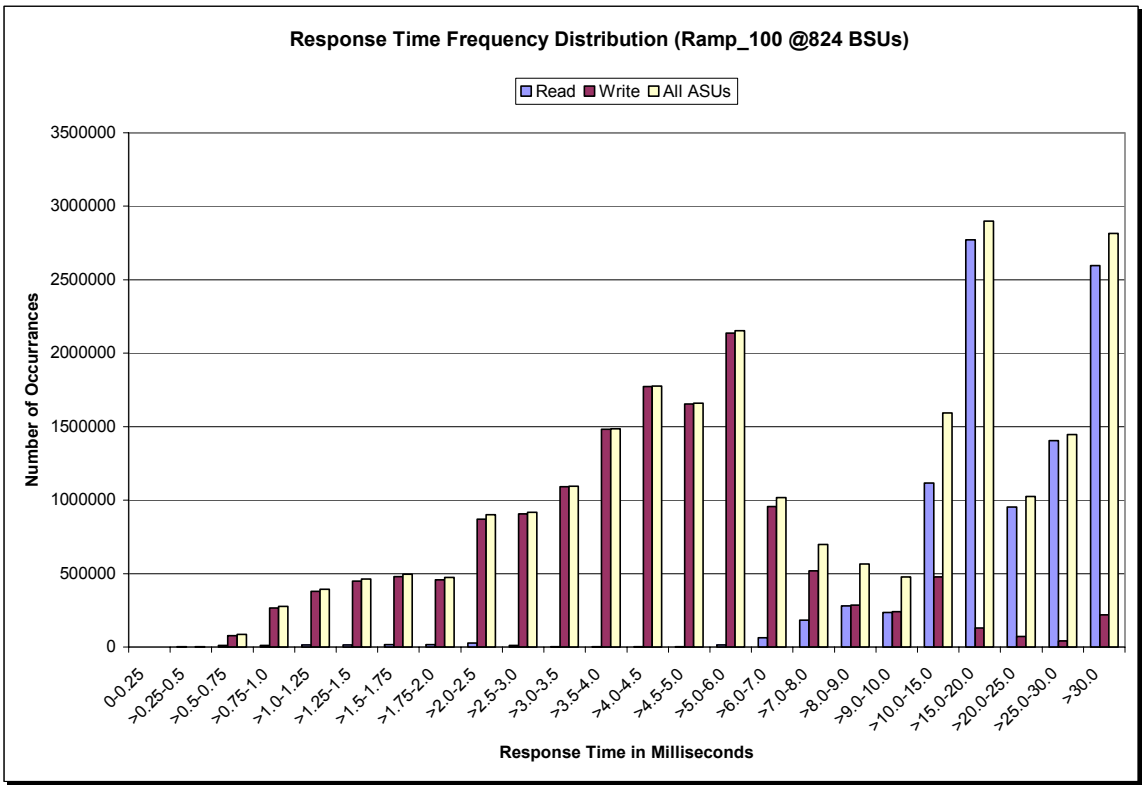
IOPS Test Run – I/O Request Throughput Distribution Graph



IOPS Test Run – Response Time Frequency Distribution Data

Response Time (ms)	0-0.25	>0.25-0.5	>0.5-0.75	>0.75-1.0	>1.0-1.25	>1.25-1.5	>1.5-1.75	>1.75-2.0
Read	0	2,685	9,862	11,735	13,716	14,038	15,785	16,675
Write	0	719	77,345	265,542	379,635	449,962	479,470	457,265
All ASUs	0	3,404	87,207	277,277	393,351	464,000	495,255	473,940
ASU1	0	2,934	51,697	148,762	199,275	228,645	240,444	228,330
ASU2	0	246	10,280	33,228	45,092	51,792	54,045	50,274
ASU3	0	224	25,230	95,287	148,984	183,563	200,766	195,336
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	28,103	11,427	3,204	2,372	2,706	3,359	14,863	62,843
Write	871,238	906,511	1,092,110	1,481,712	1,774,869	1,655,689	2,137,964	955,144
All ASUs	899,341	917,938	1,095,314	1,484,084	1,777,575	1,659,048	2,152,827	1,017,987
ASU1	431,183	431,637	511,396	694,799	823,415	750,971	908,140	351,650
ASU2	96,408	99,216	120,070	163,738	193,097	176,349	211,654	72,025
ASU3	371,750	387,085	463,848	625,547	761,063	731,728	1,033,033	594,312
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	181,589	280,816	234,185	1,117,228	2,770,078	953,075	1,403,755	2,596,999
Write	517,913	284,580	241,153	476,488	129,069	72,839	42,721	219,365
All ASUs	699,502	565,396	475,338	1,593,716	2,899,147	1,025,914	1,446,476	2,816,364
ASU1	292,261	348,556	303,767	1,167,268	2,431,582	840,433	1,191,784	2,154,209
ASU2	43,749	50,910	49,646	176,734	395,774	149,518	234,888	561,964
ASU3	363,492	165,930	121,925	249,714	71,791	35,963	19,804	100,191

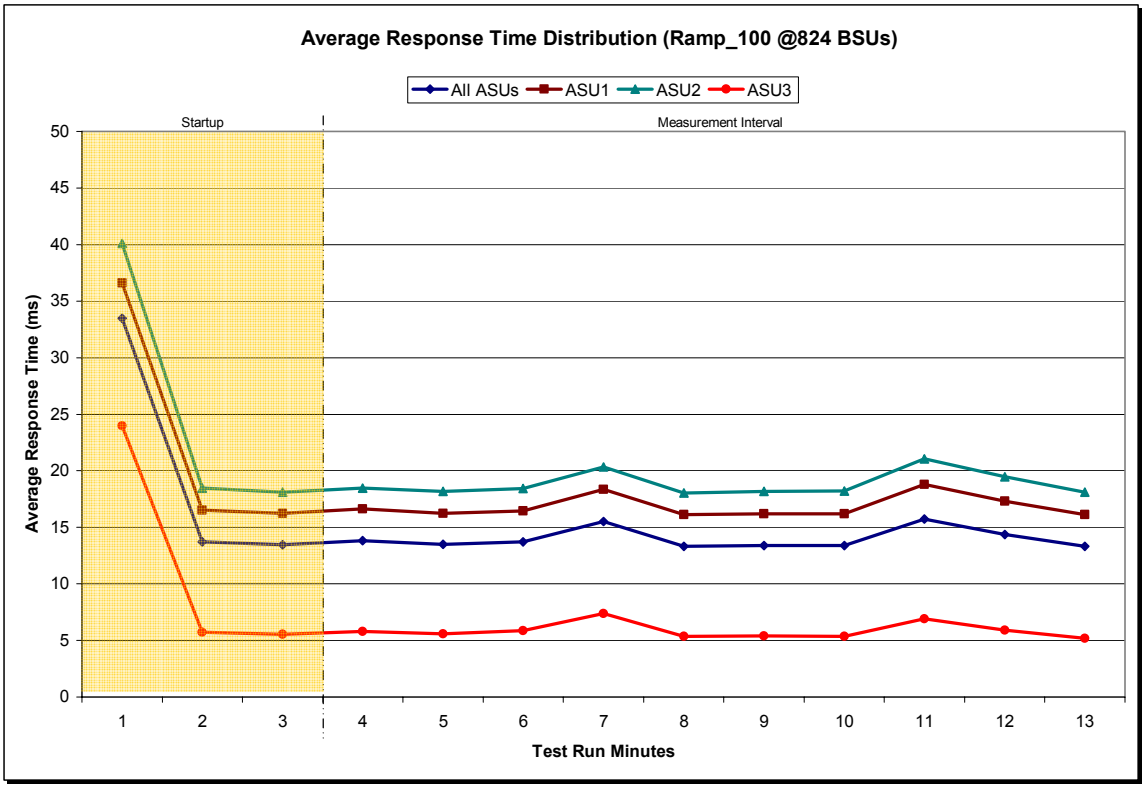
IOPS Test Run –Response Time Frequency Distribution Graph



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

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	0:28:26	0:31:27	0-2	0:03:01
Measurement Interval	0:31:27	0:41:27	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	33.49	36.62	40.09	23.97
1	13.73	16.52	18.45	5.72
2	13.47	16.22	18.11	5.56
3	13.82	16.63	18.48	5.81
4	13.48	16.22	18.18	5.59
5	13.73	16.47	18.42	5.85
6	15.53	18.37	20.35	7.40
7	13.33	16.12	18.04	5.36
8	13.40	16.19	18.17	5.39
9	13.39	16.19	18.21	5.36
10	15.74	18.79	21.05	6.92
11	14.36	17.30	19.46	5.91
12	13.30	16.14	18.12	5.18
Average	14.01	16.84	18.85	5.88

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



IOPS Test Run – I/O Request Information

I/O Requests Completed in the Measurement Interval	I/O Requests Completed with Response Time = or < 30 ms	I/O Requests Completed with Response Time > 30 ms
24,720,401	21,904,037	2,816,364

IOPS Test Run – Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0350	0.2808	0.0700	0.2101	0.0180	0.0701	0.0350	0.2810
COV	0.003	0.001	0.002	0.001	0.006	0.003	0.003	0.001

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

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

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

Primary Metrics Test – Response Time Ramp Test Phase

Clause 5.4.2.3

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

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

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

Clause 9.2.4.7.3

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

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

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, and Response Time Ramp Test Runs are documented in "Appendix D: SPC-1 Workload Generator Input Parameters" on Page 89.

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 - 824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	0:28:26	0:31:27	0-2	0:03:01
Measurement Interval	0:31:27	0:41:27	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	41,183.77	24,561.57	5,054.65	11,567.55
1	41,180.78	24,539.50	5,066.58	11,574.70
2	41,185.43	24,565.10	5,076.90	11,543.43
3	41,196.95	24,547.53	5,082.65	11,566.77
4	41,249.45	24,596.08	5,080.05	11,573.32
5	41,200.93	24,554.98	5,067.73	11,578.22
6	41,205.23	24,540.53	5,066.57	11,598.13
7	41,192.32	24,565.12	5,044.33	11,582.87
8	41,204.33	24,561.02	5,072.15	11,571.17
9	41,168.23	24,536.78	5,055.05	11,576.40
10	41,180.82	24,553.50	5,064.43	11,562.88
11	41,221.47	24,570.08	5,069.45	11,581.93
12	41,205.88	24,539.57	5,078.68	11,587.63
Average	41,202.56	24,556.52	5,068.11	11,577.93

95% Load Level - 782 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	0:41:42	0:44:43	0-2	0:03:01
Measurement Interval	0:44:43	0:54:43	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	39,099.48	23,302.32	4,805.80	10,991.37
1	39,139.57	23,332.58	4,815.95	10,991.03
2	39,149.88	23,331.60	4,813.78	11,004.50
3	39,120.00	23,342.32	4,798.50	10,979.18
4	39,082.47	23,273.63	4,811.93	10,996.90
5	39,097.62	23,294.58	4,812.32	10,990.72
6	39,117.42	23,319.45	4,809.63	10,988.33
7	39,064.58	23,291.85	4,812.47	10,960.27
8	39,090.18	23,300.80	4,808.18	10,981.20
9	39,124.72	23,312.05	4,817.05	10,995.62
10	39,086.22	23,291.28	4,799.75	10,995.18
11	39,095.00	23,303.83	4,817.08	10,974.08
12	39,131.37	23,304.35	4,818.17	11,008.85
Average	39,100.96	23,303.42	4,810.51	10,987.03

90% Load Level - 741 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	0:54:58	0:57:59	0-2	0:03:01
Measurement Interval	0:57:59	1:07:59	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	37,072.82	22,079.72	4,563.50	10,429.60
1	37,048.33	22,069.75	4,554.50	10,424.08
2	37,001.57	22,048.62	4,553.75	10,399.20
3	37,058.92	22,066.57	4,576.43	10,415.92
4	37,027.55	22,058.47	4,558.88	10,410.20
5	37,091.82	22,113.72	4,565.60	10,412.50
6	37,040.37	22,077.25	4,559.62	10,403.50
7	37,063.45	22,091.55	4,569.07	10,402.83
8	37,054.48	22,104.75	4,554.18	10,395.55
9	37,041.95	22,094.05	4,556.70	10,391.20
10	37,073.15	22,102.57	4,557.75	10,412.83
11	37,066.02	22,092.42	4,568.33	10,405.27
12	37,041.00	22,067.25	4,559.90	10,413.85
Average	37,055.87	22,086.86	4,562.65	10,406.37

80% Load Level - 659 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:08:15	1:11:16	0-2	0:03:01
Measurement Interval	1:11:16	1:21:16	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	32,957.45	19,638.50	4,053.95	9,265.00
1	32,945.95	19,644.85	4,054.10	9,247.00
2	32,935.03	19,637.35	4,044.73	9,252.95
3	32,942.92	19,617.53	4,058.68	9,266.70
4	32,948.78	19,625.27	4,038.13	9,285.38
5	32,965.73	19,637.98	4,056.63	9,271.12
6	32,933.18	19,610.45	4,064.25	9,258.48
7	32,974.57	19,638.97	4,062.58	9,273.02
8	32,982.22	19,631.33	4,070.10	9,280.78
9	32,910.12	19,602.98	4,057.65	9,249.48
10	32,927.63	19,618.05	4,050.97	9,258.62
11	32,955.25	19,650.23	4,068.10	9,236.92
12	32,938.17	19,620.47	4,053.07	9,264.63
Average	32,947.86	19,625.33	4,058.02	9,264.51

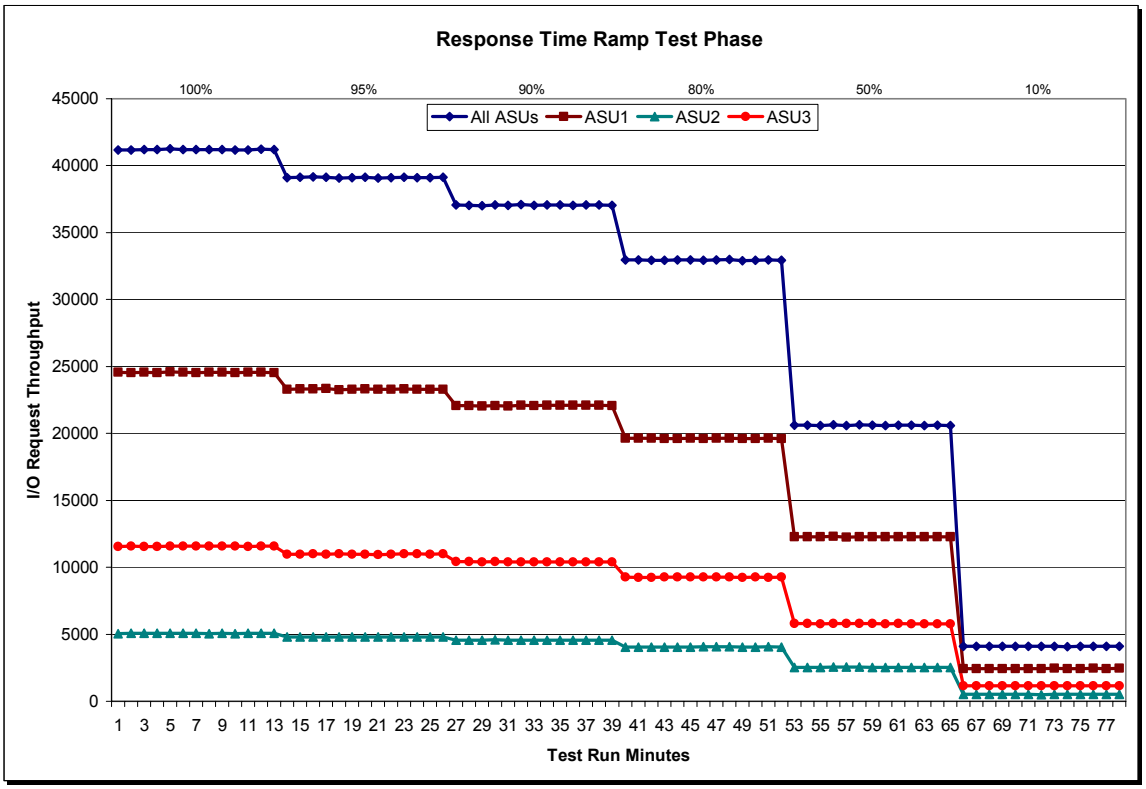
50% Load Level - 412 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:21:31	1:24:32	0-2	0:03:01
Measurement Interval	1:24:32	1:34:32	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	20,603.85	12,275.72	2,531.52	5,796.62
1	20,624.47	12,282.45	2,538.32	5,803.70
2	20,586.35	12,271.10	2,531.60	5,783.65
3	20,638.58	12,302.28	2,542.30	5,794.00
4	20,591.35	12,252.23	2,546.02	5,793.10
5	20,645.45	12,295.28	2,544.27	5,805.90
6	20,608.65	12,288.18	2,527.10	5,793.37
7	20,589.63	12,271.97	2,536.92	5,780.75
8	20,614.30	12,281.58	2,534.83	5,797.88
9	20,602.23	12,274.72	2,537.58	5,789.93
10	20,597.82	12,283.58	2,535.65	5,778.58
11	20,602.22	12,274.55	2,536.72	5,790.95
12	20,583.25	12,271.28	2,528.98	5,782.98
Average	20,607.35	12,279.57	2,537.04	5,790.75

10% Load Level - 82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:34:43	1:37:44	0-2	0:03:01
Measurement Interval	1:37:44	1:47:44	3-12	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	4,100.62	2,440.05	506.00	1,154.57
1	4,106.58	2,447.50	506.63	1,152.45
2	4,100.58	2,444.03	506.90	1,149.65
3	4,114.33	2,445.55	509.15	1,159.63
4	4,105.80	2,445.08	507.82	1,152.90
5	4,105.35	2,442.63	507.60	1,155.12
6	4,095.78	2,442.22	499.85	1,153.72
7	4,106.87	2,450.30	505.78	1,150.78
8	4,085.25	2,434.15	504.93	1,146.17
9	4,100.18	2,436.22	506.78	1,157.18
10	4,105.32	2,448.77	506.97	1,149.58
11	4,098.70	2,443.82	507.12	1,147.77
12	4,102.58	2,448.45	503.15	1,150.98
Average	4,102.02	2,443.72	505.92	1,152.38

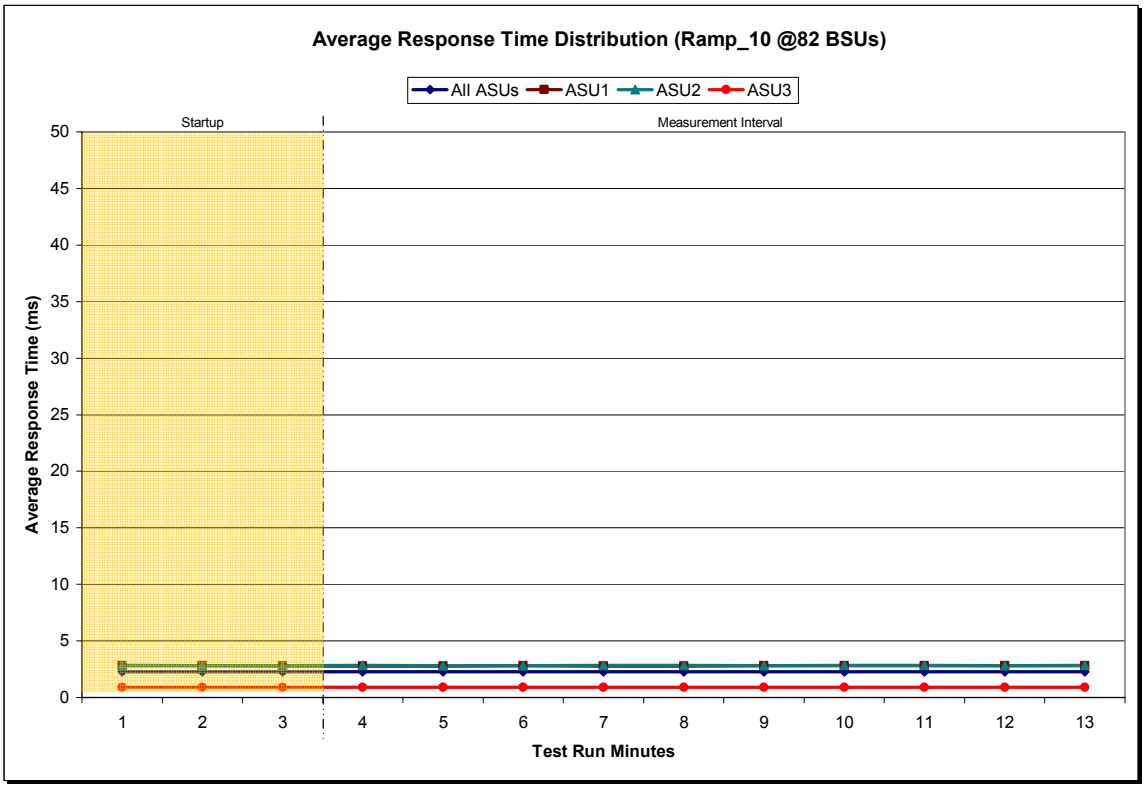
Response Time Ramp Distribution (IOPS) Graph



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

82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:34:43	1:37:44	0-2	0:03:01
Measurement Interval	1:37:44	1:47:44	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.28	2.82	2.85	0.90
1	2.26	2.79	2.80	0.90
2	2.26	2.78	2.82	0.90
3	2.26	2.78	2.83	0.91
4	2.26	2.79	2.80	0.90
5	2.26	2.79	2.82	0.90
6	2.26	2.78	2.83	0.90
7	2.26	2.79	2.84	0.90
8	2.27	2.80	2.82	0.90
9	2.27	2.81	2.83	0.90
10	2.28	2.81	2.84	0.89
11	2.26	2.79	2.82	0.90
12	2.26	2.79	2.84	0.89
Average	2.26	2.79	2.83	0.90

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



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

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0351	0.2807	0.0699	0.2100	0.0181	0.0704	0.0348	0.2809
COV	0.011	0.004	0.009	0.005	0.017	0.007	0.009	0.003

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

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

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

Repeatability Test

Clause 5.4.3

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

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

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

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

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

Clause 9.2.4.7.3

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

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

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Repeatability Test Runs are documented in "Appendix D: SPC-1 Workload Generator Input Parameters" on Page 89.

Repeatability Test Results File

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

	SPC-1 IOPS™	SPC-1 LRT™
Primary Metrics	*41,202.56*	*2.26*
Repeatability Test Phase 1	40,792.53	2.26
Repeatability Test Phase 2	41,204.93	2.26

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

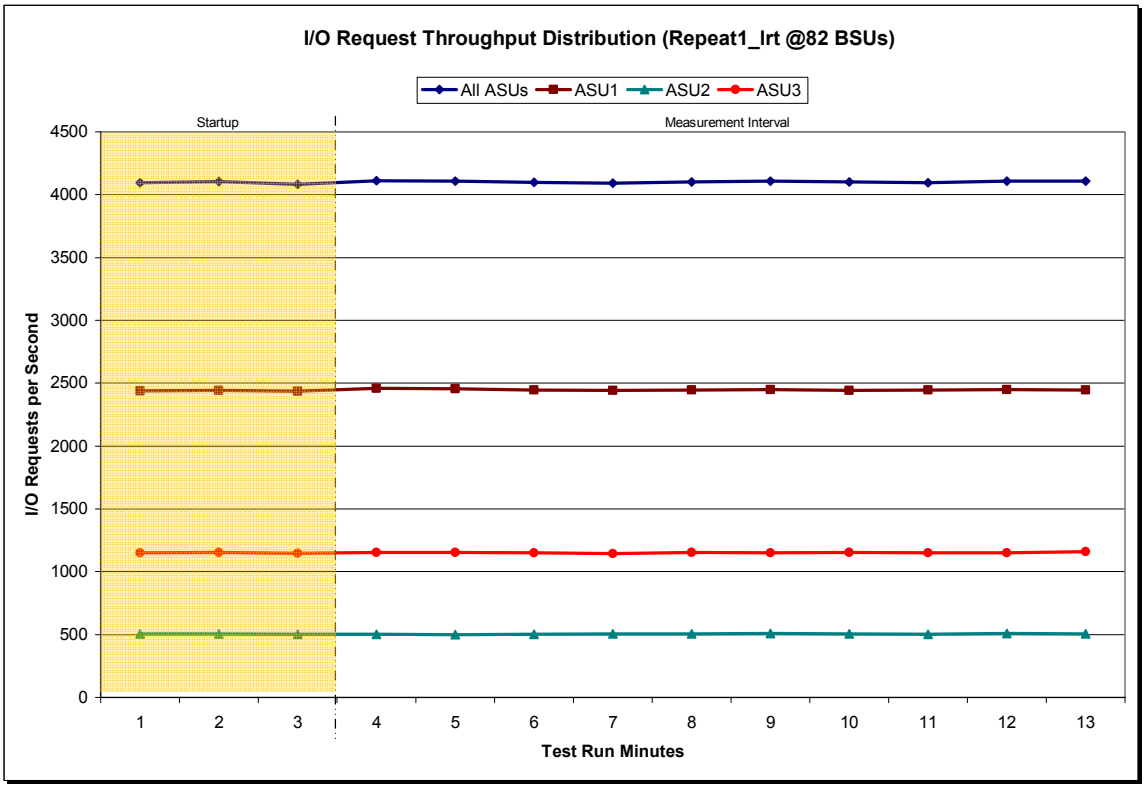
Repeatability Test Phase 1, Test Run 1 (LRT)
Repeatability Test Phase 1, Test Run 2 (IOPS)
Repeatability Test Phase 2, Test Run 1 (LRT)
Repeatability Test Phase 2, Test Run 2 (IOPS)

Repeatability 1 LRT – I/O Request Throughput Distribution Data

82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:48:08	1:51:08	0-2	0:03:00
Measurement Interval	1:51:08	2:01:08	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	4,096.23	2,440.60	506.48	1,149.15
1	4,103.40	2,444.32	505.53	1,153.55
2	4,083.40	2,435.22	502.88	1,145.30
3	4,112.50	2,458.37	501.88	1,152.25
4	4,107.15	2,454.12	499.02	1,154.02
5	4,098.10	2,446.50	502.93	1,148.67
6	4,092.63	2,443.63	504.57	1,144.43
7	4,101.73	2,444.65	504.65	1,152.43
8	4,108.17	2,447.75	509.03	1,151.38
9	4,101.07	2,443.25	504.60	1,153.22
10	4,095.55	2,444.40	502.00	1,149.15
11	4,107.68	2,449.55	507.77	1,150.37
12	4,108.42	2,445.43	504.62	1,158.37
Average	4,103.30	2,447.77	504.11	1,151.43

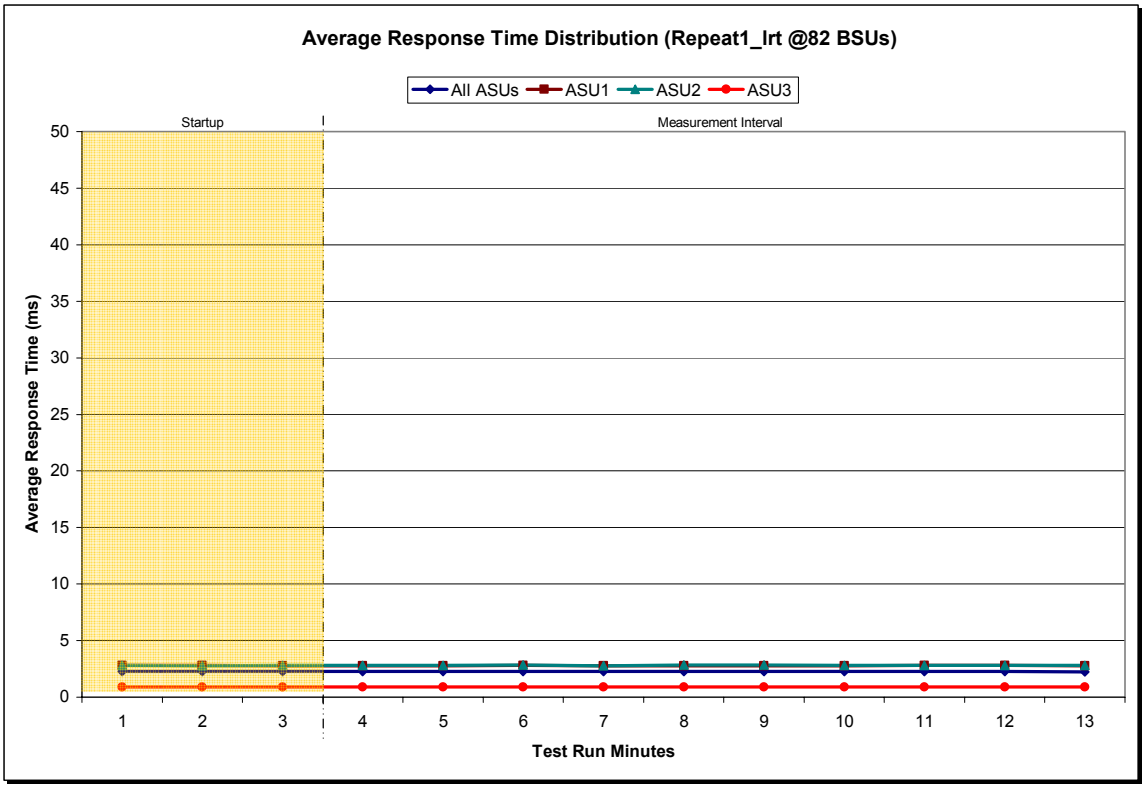
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



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

82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:48:08	1:51:08	0-2	0:03:00
Measurement Interval	1:51:08	2:01:08	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.27	2.81	2.82	0.89
1	2.26	2.80	2.78	0.90
2	2.25	2.78	2.79	0.89
3	2.26	2.78	2.82	0.90
4	2.26	2.78	2.82	0.89
5	2.27	2.79	2.83	0.89
6	2.26	2.79	2.79	0.89
7	2.26	2.79	2.84	0.90
8	2.26	2.78	2.83	0.89
9	2.26	2.78	2.82	0.90
10	2.27	2.80	2.82	0.89
11	2.26	2.79	2.81	0.90
12	2.25	2.77	2.80	0.90
Average	2.26	2.79	2.82	0.90

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

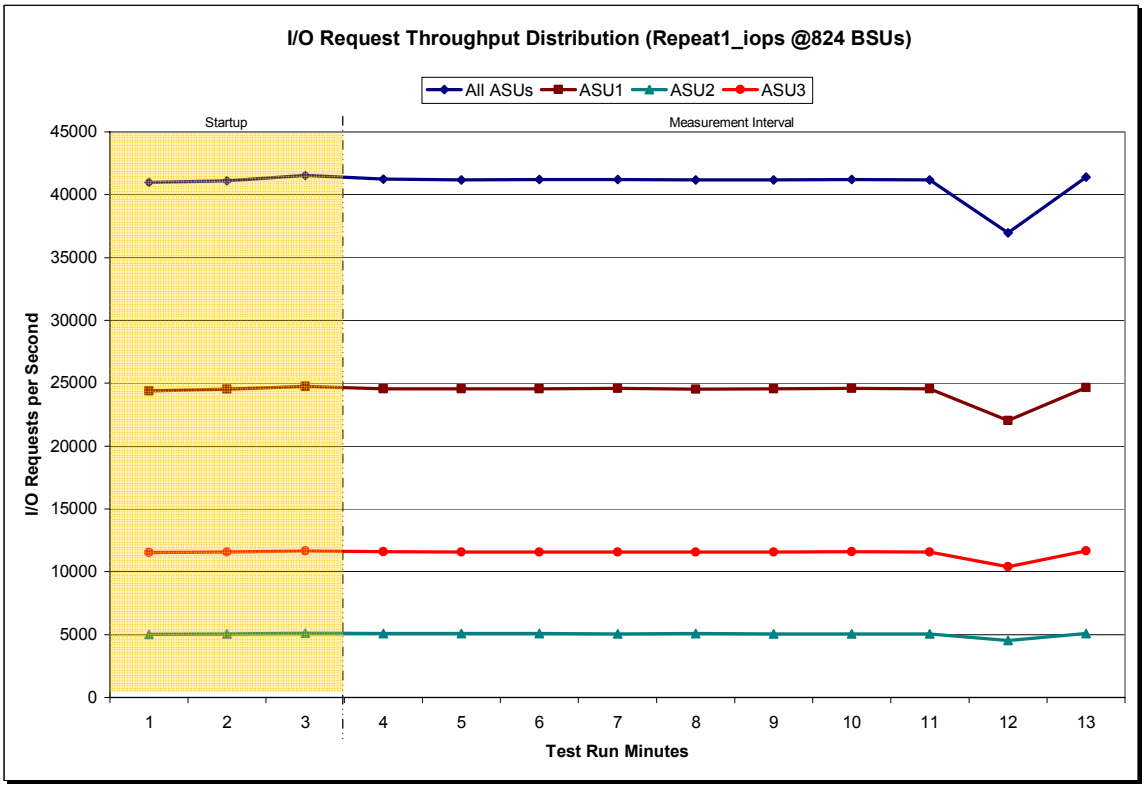


Repeatability 1 IOPS – I/O Request Throughput Distribution Data

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:01:23	2:04:24	0-2	0:03:01
Measurement Interval	2:04:24	2:14:24	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	40,970.52	24,408.90	5,033.75	11,527.87
1	41,127.32	24,529.02	5,045.00	11,553.30
2	41,535.28	24,751.65	5,117.50	11,666.13
3	41,226.93	24,560.45	5,072.23	11,594.25
4	41,183.45	24,541.35	5,074.02	11,568.08
5	41,201.00	24,560.03	5,071.38	11,569.58
6	41,218.32	24,582.70	5,058.08	11,577.53
7	41,168.15	24,515.08	5,087.27	11,565.80
8	41,185.00	24,546.30	5,063.57	11,575.13
9	41,220.48	24,574.48	5,063.78	11,582.22
10	41,161.50	24,541.45	5,068.88	11,551.17
11	36,954.53	22,019.72	4,547.65	10,387.17
12	41,405.97	24,663.50	5,087.03	11,655.43
Average	40,792.53	24,310.51	5,019.39	11,462.64

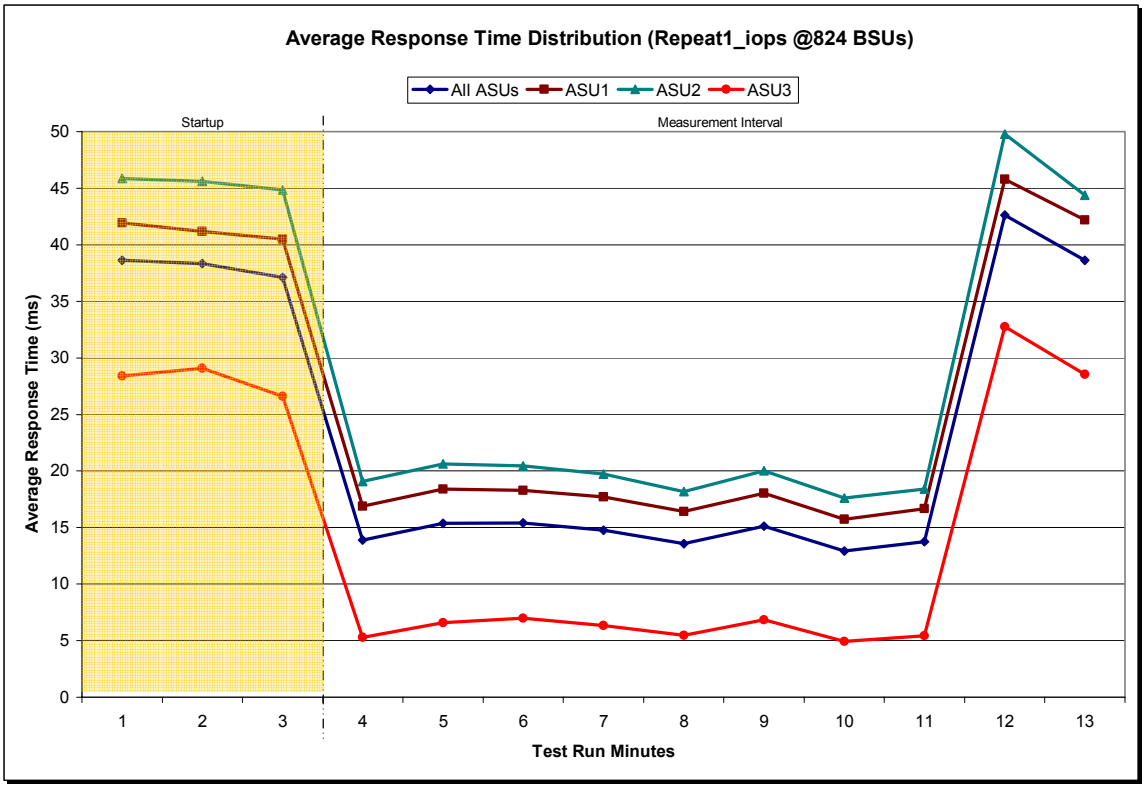
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph



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

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:01:23	2:04:24	0-2	0:03:01
Measurement Interval	2:04:24	2:14:24	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	38.61	41.95	45.87	28.39
1	38.33	41.19	45.60	29.07
2	37.13	40.49	44.84	26.61
3	13.89	16.89	19.07	5.28
4	15.36	18.40	20.64	6.60
5	15.39	18.30	20.46	7.00
6	14.77	17.72	19.73	6.35
7	13.57	16.43	18.19	5.48
8	15.12	18.02	20.00	6.84
9	12.92	15.72	17.61	4.95
10	13.73	16.68	18.39	5.43
11	42.61	45.78	49.79	32.75
12	38.62	42.19	44.38	28.56
Average	19.60	22.61	24.82	10.92

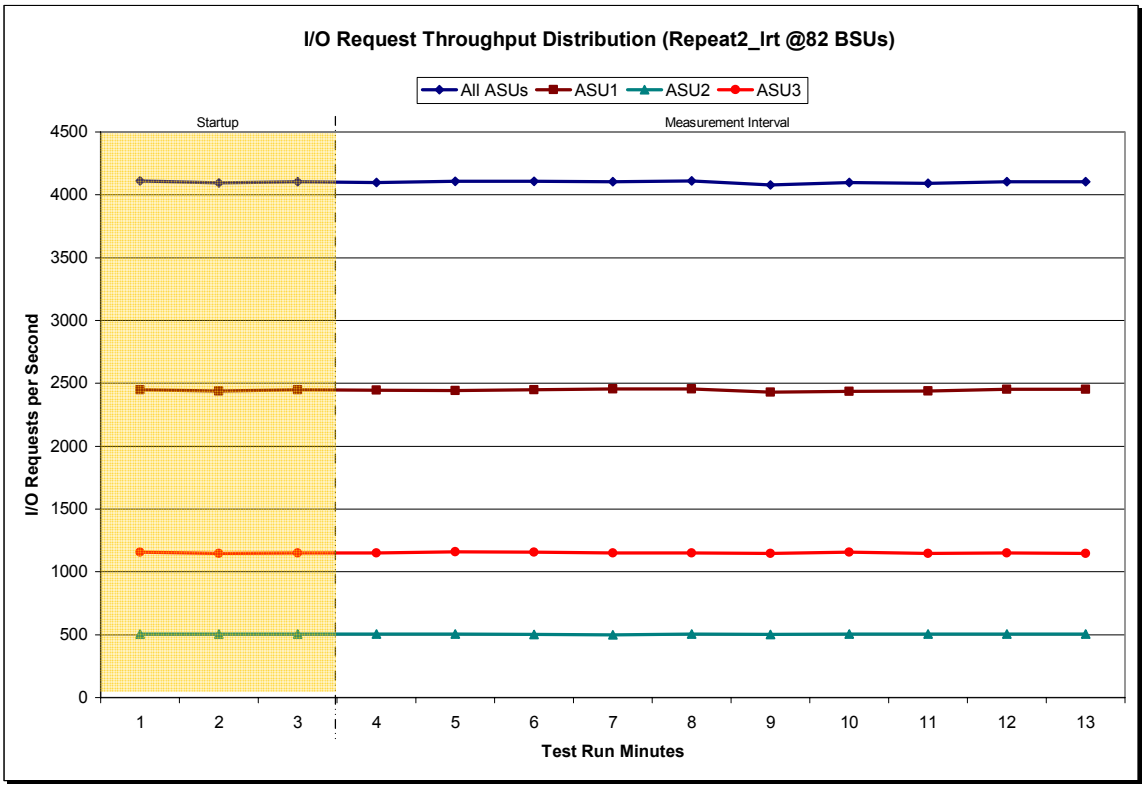
Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 2 LRT – I/O Request Throughput Distribution Data

82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:14:48	2:17:48	0-2	0:03:00
Measurement Interval	2:17:48	2:27:48	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	4,112.03	2,449.05	505.78	1,157.20
1	4,093.48	2,439.62	505.52	1,148.35
2	4,105.48	2,450.53	504.70	1,150.25
3	4,099.82	2,445.25	505.47	1,149.10
4	4,107.32	2,442.63	505.67	1,159.02
5	4,108.82	2,448.77	502.60	1,157.45
6	4,106.02	2,456.07	499.33	1,150.62
7	4,110.97	2,455.18	505.13	1,150.65
8	4,078.55	2,429.10	501.38	1,148.07
9	4,099.47	2,436.55	506.37	1,156.55
10	4,091.17	2,439.45	504.12	1,147.60
11	4,104.02	2,450.92	504.23	1,148.87
12	4,104.85	2,450.93	505.77	1,148.15
Average	4,101.10	2,445.49	504.01	1,151.61

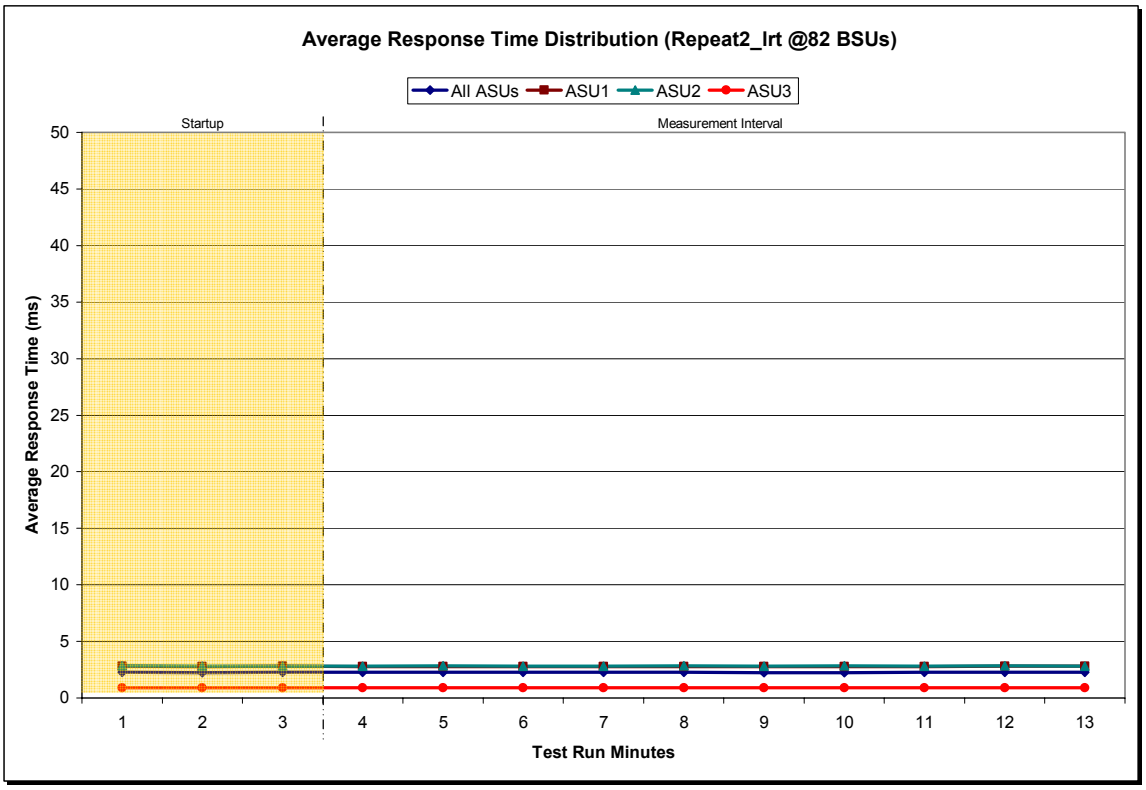
Repeatability 2 LRT – I/O Request Throughput Distribution Graph



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

82 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:14:48	2:17:48	0-2	0:03:00
Measurement Interval	2:17:48	2:27:48	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.27	2.80	2.84	0.89
1	2.25	2.77	2.81	0.90
2	2.27	2.81	2.80	0.89
3	2.26	2.78	2.80	0.90
4	2.26	2.78	2.83	0.91
5	2.26	2.79	2.82	0.90
6	2.26	2.78	2.82	0.90
7	2.26	2.79	2.85	0.89
8	2.24	2.76	2.82	0.90
9	2.25	2.77	2.83	0.89
10	2.26	2.79	2.81	0.89
11	2.27	2.79	2.83	0.89
12	2.26	2.79	2.82	0.89
Average	2.26	2.78	2.82	0.90

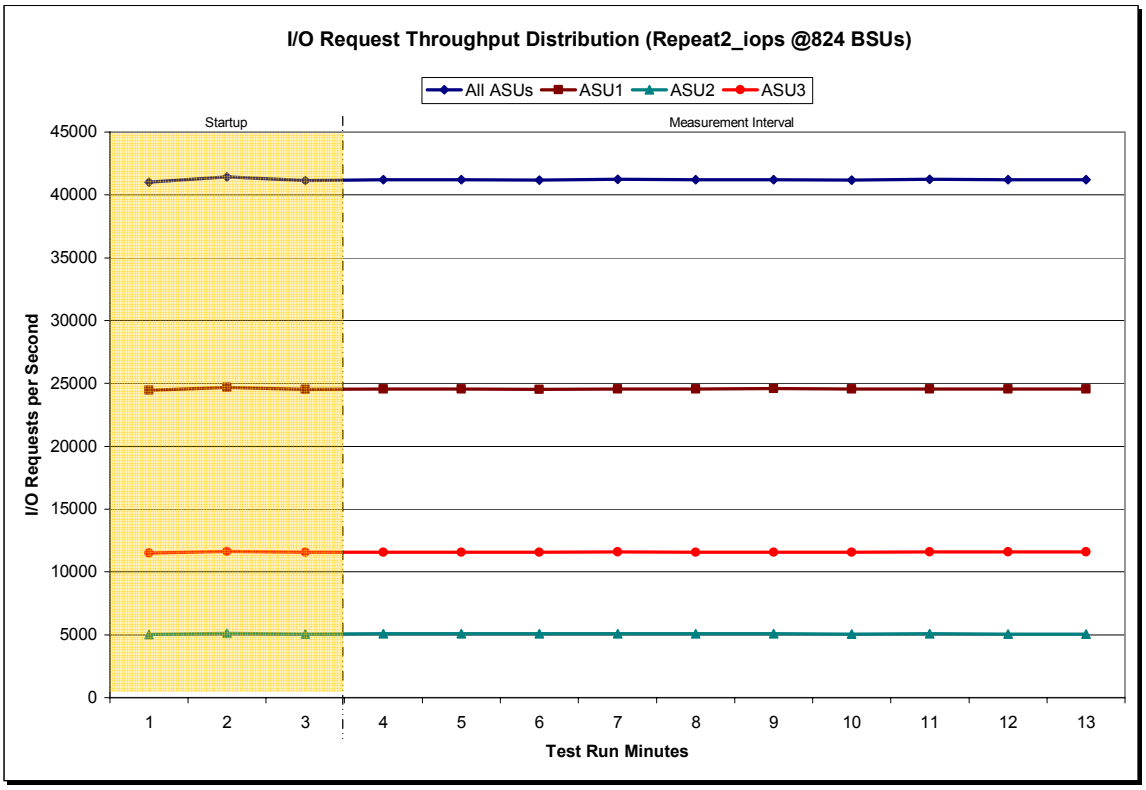
Repeatability 2 LRT –Average Response Time (ms) Distribution Graph



Repeatability 2 IOPS – I/O Request Throughput Distribution Data

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:28:03	2:31:04	0-2	0:03:01
Measurement Interval	2:31:04	2:41:04	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	41,013.15	24,464.47	5,037.38	11,511.30
1	41,437.78	24,686.80	5,117.08	11,633.90
2	41,142.83	24,524.37	5,058.87	11,559.60
3	41,218.37	24,569.93	5,074.82	11,573.62
4	41,197.80	24,570.45	5,072.58	11,554.77
5	41,187.35	24,517.62	5,089.68	11,580.05
6	41,238.30	24,561.80	5,081.22	11,595.28
7	41,199.65	24,553.12	5,072.30	11,574.23
8	41,200.63	24,575.75	5,070.32	11,554.57
9	41,183.70	24,552.20	5,066.92	11,564.58
10	41,226.50	24,549.12	5,075.25	11,602.13
11	41,202.68	24,550.27	5,066.77	11,585.65
12	41,194.33	24,541.85	5,055.37	11,597.12
Average	41,204.93	24,554.21	5,072.52	11,578.20

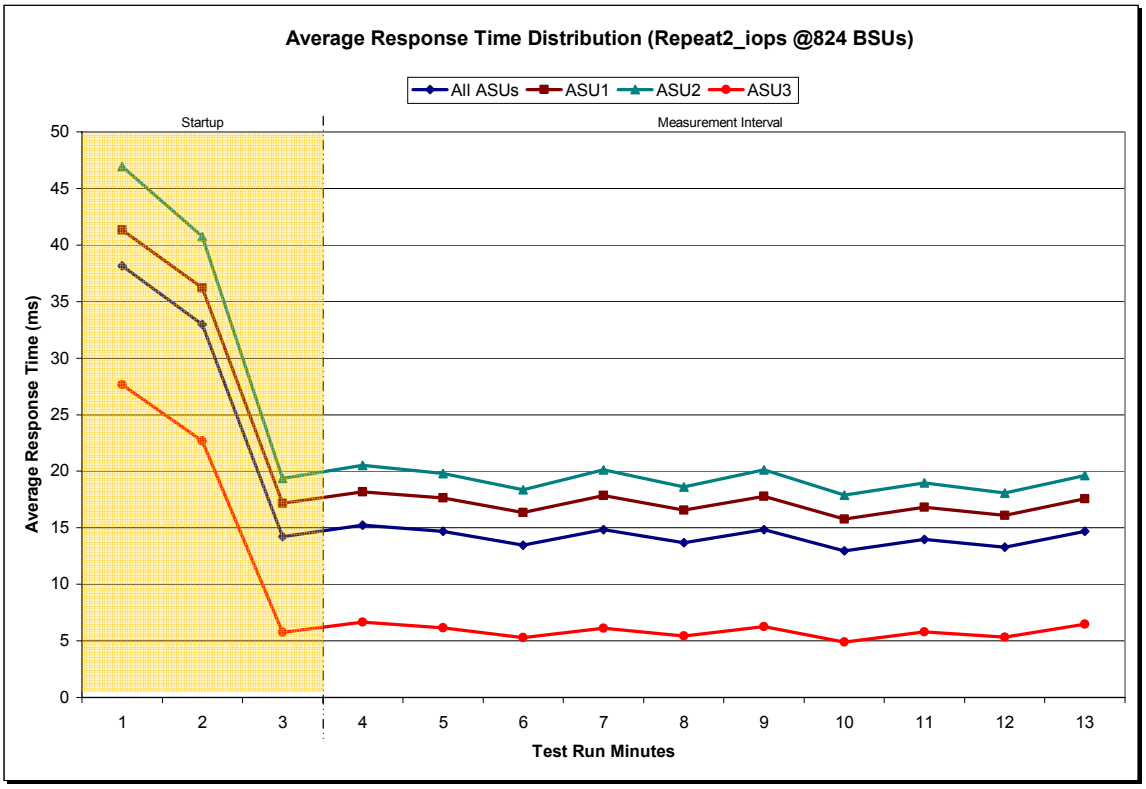
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



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

824 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:28:03	2:31:04	0-2	0:03:01
Measurement Interval	2:31:04	2:41:04	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	38.16	41.32	46.92	27.63
1	32.98	36.21	40.74	22.69
2	14.23	17.17	19.37	5.75
3	15.23	18.17	20.52	6.66
4	14.69	17.65	19.80	6.14
5	13.47	16.33	18.37	5.28
6	14.83	17.84	20.11	6.13
7	13.68	16.55	18.61	5.44
8	14.84	17.78	20.12	6.26
9	12.97	15.77	17.88	4.88
10	13.97	16.81	18.97	5.78
11	13.30	16.08	18.06	5.33
12	14.69	17.56	19.63	6.49
Average	14.17	17.05	19.21	5.84

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



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

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0349	0.2812	0.0700	0.2104	0.0180	0.0698	0.0350	0.2806
COV	0.014	0.003	0.005	0.004	0.012	0.008	0.011	0.002

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

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

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

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	0.2811	0.0699	0.2099	0.0180	0.0700	0.0351	0.2810
COV	0.003	0.001	0.003	0.001	0.005	0.002	0.004	0.001

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

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	*0.0350*	*0.2810*	*0.0700*	*0.2100*	*0.0180*	*0.0700*	*0.0350*	*0.2810*
MIM	0.0348	0.2812	0.0702	0.2101	0.0180	0.0700	0.0349	0.2808
COV	0.015	0.005	0.006	0.004	0.019	0.005	0.012	0.003

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	0.2809	0.0699	0.2100	0.0180	0.0700	0.0350	0.2810
COV	0.003	0.001	0.002	0.001	0.006	0.002	0.002	0.001

Data Persistence Test

Clause 6

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

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

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

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

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

Clause 9.2.4.8

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

1. *A listing or screen image of all input parameters supplied to the Workload Generator.*
2. *For the successful Data Persistence Test Run, a table illustrating key results. The content, appearance, and format of this table are specified in Table 9-12. Information displayed in this table shall be obtained from the Test Run Results File referenced below in #3.*
3. *For the successful Data Persistence Test Run, the human readable Test Run Results File produced by the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Persistence Test Runs are documented in "Appendix D: SPC-1 Workload Generator Input Parameters" on Page 89.

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	87,909,920
Total Number of Logical Blocks Verified	74,579,264
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 must be the date at which all components are committed to be available.

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

The Fujitsu Storage Systems ETERNUS3000 Model 700, as documented in this Full Disclosure Report will become available for customer purchase and shipment on August 20, 2004.

PRICING INFORMATION

Clause 9.2.4.11

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

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

ANOMALIES OR IRREGULARITIES

Clause 9.2.4.10

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

There were no anomalies or irregularities encountered during the SPC-1 Remote Audit of the Fujitsu Storage Systems ETERNUS3000 Model 700.

APPENDIX A: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

Solaris Parameter Adjustments

The following settings were made in the Solaris /etc/system control file information for execution of the Workload Generator on the PRIMEPOWER HPC2500:

```
*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

* Begin FJSVssf (do not edit)
set ftrace_atboot = 1
set kmem_flags = 0x100
set kmem_lite_maxalign = 8192
* End FJSVssf (do not edit)
* Begin FJSVpnl (do not edit)
forceload:      drv/FJSVpanel
* End FJSVpnl (do not edit)
forceload:      drv/se
forceload:      drv/fjmse

* The forceload of drv/clone is required for successful
* IP operation of EMULEX fibre channel drivers lpfc / lpfs
* and for the diagnostics (dfc) interface.
forceload: drv/clone
```

Emulex HBA Configuration Parameters

These parameters are set in "lpfc.conf" for controlling the operation of the Emulex Fibre Channel HBAs. The following values have been changed from their default values for accessing the ETERNUS3000 Model 700 Storage System:

```
# COPYRIGHT 2003, EMULEX CORPORATION
# 3535 Harbor Boulevard, Costa Mesa, CA 92626
#
# All rights reserved.  This computer program and related documentation
# is protected by copyright and distributed under licenses restricting
# its use, copying, distribution and decompilation.  This computer
# program and its documentation are CONFIDENTIAL and a TRADE SECRET
# of EMULEX CORPORATION.  The receipt or possession of this program
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```

```
# of the copyright laws and may subject you to criminal prosecution.
#
# $Id: lpfc.conf 1.19 2002/06/03 16:08:49 mks Exp $
#
# Solaris LightPulse lpfc (SCSI) / lpfn (IP) driver: global initialized data.
#

# Verbosity:  only turn this flag on if you are willing to risk being
# deluged with LOTS of information.
# You can set a bit mask to record specific types of verbose messages:
#
# 0x1    ELS events
# 0x2    Device Discovery events
# 0x4    Mailbox Command events
# 0x8    Miscellaneous events
# 0x10   Link Attention events
# 0x20   IP events
# 0x40   FCP events
# 0x80   Node table events
# 0x1000 FCP Check Condition events
log-verbose=0;

# Setting log-only to 0 causes log messages to be printed on the
# console and to be logged to syslog (which may send them to the
# console again if it's configured to do so).
# Setting log-only to 1 causes log messages to go to syslog only.
log-only=1;

#
# +++ Variables relating to FCP (SCSI) support. +++
#

# Setup FCP persistent bindings,
# fcp-bind-WWPN binds a specific WorldWide PortName to a target id,
# fcp-bind-WWNN binds a specific WorldWide NodeName to a target id,
# fcp-bind-DID binds a specific DID to a target id.
# Only one binding method can be used.
# WWNN, WWPN and DID are hexadecimal values.
# WWNN must be 16 digits with leading 0s.
# WWPN must be 16 digits with leading 0s.
# DID must be 6 digits with leading 0s.
# The SCSI ID to bind to consists of two parts, the lpfc interface
# to bind to, and the target number for that interface.
# Thus lpfc0t2 specifies target 2 on interface lpfc0.
# NOTE: Target ids, with all luns supported, must also be in sd.conf.
# scan-down must be set to 0 or 1, not 2 which is the default!!
#
# Here are some examples:
#                WWNN             SCSI ID
# fcp-bind-WWNN="2000123456789abc:lpfc1t0",
#               "20000020370c27f7:lpfc0t2";
#
#                WWPN             SCSI ID
# fcp-bind-WWPN="2100123456789abc:lpfc0t0",
#               "21000020370c2855:lpfc0t1",
#               "2100122222222222:lpfc2t2";
#
#                DID   SCSI ID
# fcp-bind-DID="0000ef:lpfc0t3";
# BEGIN: LPUTIL-managed Persistent Bindings
fcp-bind-WWPN="21ff00e000a8ffc5:lpfc0t0",
              "22ff00e000a8ffc5:lpfc1t0",
              "23ff00e000a8ffc5:lpfc2t0",
```

```
                "24ff00e000a8ffc5:lpfc3t0",
                "25ff00e000a8ffc5:lpfc4t0",
                "26ff00e000a8ffc5:lpfc5t0",
                "27ff00e000a8ffc5:lpfc6t0",
                "28ff00e000a8ffc5:lpfc7t0";

  # If automap is set, SCSI IDs for all FCP nodes without
  # persistent bindings will be automatically generated.
  # If new FCP devices are added to the network when the system is down,
  # there is no guarantee that these SCSI IDs will remain the same
  # when the system is booted again.
  # If one of the above fcp binding methods is specified, then automap
  # devices will use the same mapping method to preserve
  # SCSI IDs between link down and link up.
  # If no bindings are specified above, a value of 1 will force WWNN
  # binding, 2 for WWPN binding, and 3 for DID binding.
  # If automap is 0, only devices with persistent bindings will be
  # recognized by the system.
  automap=2;

  # fcp-on:  true (1) if FCP access is enabled, false (0) if not.
  fcp-on=1;

  # lun-queue-depth:  the default value lpfc will use to limit
  # the number of outstanding commands per FCP LUN.  This value is
  # global, affecting each LUN recognized by the driver, but may be
  # overridden on a per-LUN basis (see below). RAID arrays may want
  # to be configured using the per-LUN tunable throttles.
  lun-queue-depth=128;

  # tgt-queue-depth:  the default value lpfc will use to limit
  # the number of outstanding commands per FCP target.  This value is
  # global, affecting each target recognized by the driver, but may be
  # overridden on a per-target basis (see below). RAID arrays may want
  # to be configured using the per-target tunable throttles. A value
  # of 0 means don't throttle the target.
  tgt-queue-depth=128;

  # lpfcNtM-lun-throttle:  the maximum number of outstanding commands to
  # permit for each LUN of an FCP target that supports multiple LUNs.
  # The default throttle for the number of commands outstanding to a single
  # LUN of a multiple-LUN target is lun-queue-depth. For a target that
  # can support multiple LUNs, it may be useful to specify a LUN throttle
  # that differs from the default.
  # Example: lpfc0t17-lun-throttle=48;
  # says that each LUN on target 17, interface lpfc0 should be allowed
  # up to 48 simultaneously outstanding commands.
  #lpfc1t39-lun-throttle=10;
  #lpfc0t40-lun-throttle=30;

  # lpfcNtM-tgt-throttle:  the maximum number of outstanding commands to
  # permit for a FCP target.
  # By default, target throttle is diabled.
  # Example: lpfc0t17-tgt-throttle=48;
  # says that target 17, interface lpfc0 should be allowed
  # up to 48 simultaneously outstanding commands.
  #lpfc1t39-tgt-throttle=10;
  #lpfc0t40-tgt-throttle=30;

  # no-device-delay [0 to 30] - determines the length of
  # the interval between deciding to fail back an I/O because there is no way
  # to communicate with its particular device (e.g., due to device failure) and
  # the actual fail back.  A value of zero implies no delay whatsoever.
```

```
# Cautions:  (1)  This value is in seconds.
# (2)  Setting a long delay value may permit I/O to build up,
# each with a pending timeout, which could result in the exhaustion of
# critical Solaris kernel resources.  In this case, you may see a fatal
# message such as
#           PANIC:  Timeout table overflow
#
# Note that this value can have an impact on the speed with which a
# system can shut down with I/Os pending and with the HBA not able to
# communicate with the loop or fabric, e.g., with a cable pulled.
no-device-delay=1;

#
# +++ Variables relating to IP networking support. +++
#

# network-on:  true (1) if networking is enabled, false (0) if not
# This variable will be set during the installation of the driver
# via pkgadd.
network-on=0;

# xmt-que-size:  size of the transmit queue for mbufs (128 - 10240)
xmt-que-size=256;

#
# +++ Variables common to both SCSI (FCP) and IP networking support. +++
#

# Some disk devices have a "select ID" or "select Target" capability.
# From a protocol standpoint "select ID" usually means select the
# Fibre channel "ALPA".  In the FC-AL Profile there is an "informative
# annex" which contains a table that maps a "select ID" (a number
# between 0 and 7F) to an ALPA.  If scan-down is set to a value of 0,
# the lpfc driver assigns target ids by scanning its ALPA map
# from low ALPA to high ALPA.
#
# Turning on the scan-down variable (on = 1,2, off = 0) will
# cause the lpfc driver to use an inverted ALPA map, effectively
# scanning ALPAs from high to low as specified in the FC-AL annex.
# A value of 2, will also cause target assignment in a private loop
# environment to be based on the ALPA (hard addressed).
#
# Note: This "select ID" functionality is a PRIVATE LOOP ONLY
# characteristic and will not work across a fabric.
scan-down=2;

# Determine how long the driver will wait to begin linkdown processing
# when a cable has been pulled or the link has otherwise become
# inaccessible, 1 - 255 secs.  Linkdown processing includes failing back
# cmds to the target driver that have been waiting around for the link
# to come back up.  There's a tradeoff here:  small values of the timer
# cause the link to appear to "bounce", while large values of the
# timer can delay failover in a fault tolerant environment. Units are in
# seconds. A value of 0 means never failback cmds until the link comes up.
linkdown-tmo=30;

# If set, nodev-holdio will hold all I/O errors on devices that disappear
# until they come back. Default is 0, return errors with no-device-delay.
nodev-holdio=0;

# If set, nodev-tmo will hold all I/O errors on devices that disappear
# until the timer expires. Default is 0, return errors with no-device-delay.
nodev-tmo=0;
```

```
# Use no-device-delay to delay FCP RSP errors and certain check conditions.
delay-rsp-err=0;

# Treat certain check conditions as an FCP error.
check-cond-err=0;

# num-iocbs:  number of iocb buffers to allocate (128 to 10240)
num-iocbs=1024;

# num-bufs:  number of ELS buffers to allocate (128 to 4096)
# ELS buffers are needed to support Fibre channel Extended Link Services.
# Also used for SLI-2 FCP buffers, one per FCP command, and Mailbox commands.
num-bufs=1024;

# topology:  link topology for initializing the Fibre Channel connection.
#          0 = attempt loop mode, if it fails attempt point-to-point mode
#          2 = attempt point-to-point mode only
#          4 = attempt loop mode only
#          6 = attempt point-to-point mode, if it fails attempt loop mode
# Set point-to-point mode if you want to run as an N_Port.
# Set loop mode if you want to run as an NL_Port.
topology=4;

# Set a preferred ALPA for the adapter, only valid if topology is loop.
# lpfc0-assign-alpa=2;  Request ALPA 2 for lpfc0

# ip-class:  FC class (2 or 3) to use for the IP protocol.
ip-class=3;

# fcp-class:  FC class (2 or 3) to use for the FCP protocol.
fcp-class=3;

# Use ADISC for FCP rediscovery instead of PLOGI.
use-adisc=0;

# Extra FCP timeout for fabrics (in seconds).
fcpfabric-tmo=0;

# Number of 4k STREAMS buffers to post to IP ring.
post-ip-buf=128;

# Set to 1 to decrement lun throttle on a queue full condition.
dqfull-throttle=1;

#Use dqfull-throttle-up-time to specify when to increment the current Q depth.
# This variable is in seconds.
dqfull-throttle-up-time=1;

# Increment the current Q depth by dqfull-throttle-up-inc
dqfull-throttle-up-inc=1;

# Use ACK0, instead of ACK1 for class 2 acknowledgement.
ack0=0;

# cr-delay: Coalesce Response Delay
# This value specifies a count of milliseconds after which an interrupt response
# is generated if cr-count has not been satisfied. This value is set to 0
# to disable the Coalesce Response feature as default.
cr-delay=0;

# cr-count: Coalesce Response Count
# This value specifies a count of I/O completions after which an interrupt response
```

```
# is generated. This feature is disabled if cr-delay is set to 0.
cr-count=0;

# link-speed:  link speed selection for initializing the Fibre Channel connection.
#       0 = auto select (default)
#       1 = 1 Gigabaud
#       2 = 2 Gigabaud
link-speed=0;

# fdmi-on:  true (1) if FCP access is enabled, false (0) if not.
fdmi-on=0;
```

APPENDIX B: TESTED STORAGE CONFIGURATION (TSC) CREATION

HBA to LUN Access – *Entries in "sd.conf"*

The following entries in sd.conf were defined to enable the Emulex HBAs for accessing the LUNs defined in the ETERNUS3000 Model 700.

```
name="sd" parent="lpfc" target=0 lun=0;
name="sd" parent="lpfc" target=0 lun=1;
name="sd" parent="lpfc" target=0 lun=2;
name="sd" parent="lpfc" target=0 lun=3;
name="sd" parent="lpfc" target=0 lun=4;
name="sd" parent="lpfc" target=0 lun=5;
name="sd" parent="lpfc" target=0 lun=6;
name="sd" parent="lpfc" target=0 lun=7;
name="sd" parent="lpfc" target=0 lun=8;
name="sd" parent="lpfc" target=0 lun=9;
name="sd" parent="lpfc" target=0 lun=10;
name="sd" parent="lpfc" target=0 lun=11;
name="sd" parent="lpfc" target=0 lun=12;
name="sd" parent="lpfc" target=0 lun=13;
name="sd" parent="lpfc" target=0 lun=14;
name="sd" parent="lpfc" target=0 lun=15;
name="sd" parent="lpfc" target=0 lun=16;
name="sd" parent="lpfc" target=0 lun=17;
name="sd" parent="lpfc" target=0 lun=18;
name="sd" parent="lpfc" target=0 lun=19;
name="sd" parent="lpfc" target=0 lun=20;
name="sd" parent="lpfc" target=0 lun=21;
name="sd" parent="lpfc" target=0 lun=22;
name="sd" parent="lpfc" target=0 lun=23;
name="sd" parent="lpfc" target=0 lun=24;
name="sd" parent="lpfc" target=0 lun=25;
name="sd" parent="lpfc" target=0 lun=26;
name="sd" parent="lpfc" target=0 lun=27;
name="sd" parent="lpfc" target=0 lun=28;
name="sd" parent="lpfc" target=0 lun=29;
name="sd" parent="lpfc" target=0 lun=30;
name="sd" parent="lpfc" target=0 lun=31;
name="sd" parent="lpfc" target=0 lun=32;
name="sd" parent="lpfc" target=0 lun=33;
name="sd" parent="lpfc" target=0 lun=34;
name="sd" parent="lpfc" target=0 lun=35;
name="sd" parent="lpfc" target=0 lun=36;
name="sd" parent="lpfc" target=0 lun=37;
name="sd" parent="lpfc" target=0 lun=38;
name="sd" parent="lpfc" target=0 lun=39;
name="sd" parent="lpfc" target=0 lun=40;
name="sd" parent="lpfc" target=0 lun=41;
name="sd" parent="lpfc" target=0 lun=42;
name="sd" parent="lpfc" target=0 lun=43;
name="sd" parent="lpfc" target=0 lun=44;
name="sd" parent="lpfc" target=0 lun=45;
name="sd" parent="lpfc" target=0 lun=46;
name="sd" parent="lpfc" target=0 lun=47;
name="sd" parent="lpfc" target=0 lun=48;
name="sd" parent="lpfc" target=0 lun=49;
name="sd" parent="lpfc" target=0 lun=50;
name="sd" parent="lpfc" target=0 lun=51;
name="sd" parent="lpfc" target=0 lun=52;
```

```
name="sd" parent="lpfc" target=0 lun=53;
name="sd" parent="lpfc" target=0 lun=54;
name="sd" parent="lpfc" target=0 lun=55;
name="sd" parent="lpfc" target=0 lun=56;
name="sd" parent="lpfc" target=0 lun=57;
name="sd" parent="lpfc" target=0 lun=58;
name="sd" parent="lpfc" target=0 lun=59;
name="sd" parent="lpfc" target=0 lun=60;
name="sd" parent="lpfc" target=0 lun=61;
name="sd" parent="lpfc" target=0 lun=62;
name="sd" parent="lpfc" target=0 lun=63;
name="sd" parent="lpfc" target=0 lun=64;
name="sd" parent="lpfc" target=0 lun=65;
name="sd" parent="lpfc" target=0 lun=66;
name="sd" parent="lpfc" target=0 lun=67;
name="sd" parent="lpfc" target=0 lun=68;
name="sd" parent="lpfc" target=0 lun=69;
name="sd" parent="lpfc" target=0 lun=70;
name="sd" parent="lpfc" target=0 lun=71;
```

Scripts and Commands to Configure Storage

The following script (**makesol**) and commands were used to create the logical representation of the TSC used in the benchmark measurement for the ETERNUS3000 Model 700 Storage system.

1. makesol

The **makesol** script is used to create the Solaris Volume Manage (SVM) logical volumes based on a configuration description file, **e3km700_D1-1-3_svmake.txt**. This script is called by:

```
./makesol e3km700_D1-1-3_svmake.txt
```

2. e3km700_D1-1-3_svmake.txt

This file contains the list of the raw disks that are used to create the SVM logical volumes assigned to ASU1, ASU2, and ASU3. This script is called by the **makesol** script.

3. metastat.txt

This file contains the list of the SVM logical volumes resulting from the execution of the **makesol** script using the **e3km700_D1-1-3_svmake.txt** control file.

4. solvm_vtoc.txt

This file contains the SVM logical volume information resulting from the execution of the **makesol** script using the **e3km700_D1-1-3_svmake.txt** control file.

The details follow:

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
}

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
```

e3kM700_D1-1-3_svmake.txt

```
DELETE_ALL
VOLUME_GROUP: asu1-1 (d0)
STRIPE 16m
VOLUME 1
c46t0d2
c46t0d11
c50t0d2
c50t0d11
c48t0d2
c48t0d11
c52t0d2
c52t0d11
c47t0d2
c47t0d11
c51t0d2
c51t0d11
c49t0d2
c49t0d11
c53t0d2
c53t0d11
c46t0d20
c46t0d29
c50t0d20
c50t0d29
c48t0d20
c52t0d20
c47t0d20
c51t0d20
c51t0d29
c49t0d20
```

```
c49t0d29
c53t0d20
c53t0d29
c46t0d38
c46t0d47
c50t0d38
c50t0d47
c48t0d29
c48t0d38
c52t0d29
c52t0d38
c47t0d29
c47t0d38
c51t0d38
END
VOLUME_GROUP: asu1-2 (d1)
STRIPE 16m
VOLUME 1
c46t0d3
c46t0d12
c50t0d3
c50t0d12
c48t0d3
c48t0d12
c52t0d3
c52t0d12
c47t0d3
c47t0d12
c51t0d3
c51t0d12
c49t0d3
c49t0d12
c53t0d3
c53t0d12
c46t0d21
c46t0d30
c50t0d21
c50t0d30
c48t0d21
c52t0d21
c47t0d21
c51t0d21
c51t0d30
c49t0d21
c49t0d30
c53t0d21
c53t0d30
c46t0d39
c46t0d48
c50t0d39
c50t0d48
c48t0d30
c48t0d39
c52t0d30
c52t0d39
c47t0d30
c47t0d39
c51t0d39
END
VOLUME_GROUP: asu1-3 (d2)
STRIPE 16m
VOLUME 1
```

```
c46t0d5
c46t0d14
c50t0d5
c50t0d14
c48t0d5
c48t0d14
c52t0d5
c52t0d14
c47t0d5
c47t0d14
c51t0d5
c51t0d14
c49t0d5
c49t0d14
c53t0d5
c53t0d14
c46t0d23
c46t0d32
c50t0d23
c50t0d32
c48t0d23
c52t0d23
c47t0d23
c51t0d23
c51t0d32
c49t0d23
c49t0d32
c53t0d23
c53t0d32
c46t0d41
c46t0d50
c50t0d41
c50t0d50
c48t0d32
c48t0d41
c52t0d32
c52t0d41
c47t0d32
c47t0d41
c51t0d41
END
VOLUME_GROUP: asu1-4 (d3)
STRIPE 16m
VOLUME 1
c46t0d6
c46t0d15
c50t0d6
c50t0d15
c48t0d6
c48t0d15
c52t0d6
c52t0d15
c47t0d6
c47t0d15
c51t0d6
c51t0d15
c49t0d6
c49t0d15
c53t0d6
c53t0d15
c46t0d24
c46t0d33
```

c50t0d24
c50t0d33
c48t0d24
c52t0d24
c47t0d24
c51t0d24
c51t0d33
c49t0d24
c49t0d33
c53t0d24
c53t0d33
c46t0d42
c46t0d51
c50t0d42
c50t0d51
c48t0d33
c48t0d42
c52t0d33
c52t0d42
c47t0d33
c47t0d42
c51t0d42
END
VOLUME_GROUP: asu2-1 (d4)
STRIPE 16m
VOLUME 1
c46t0d0
c46t0d9
c50t0d0
c50t0d9
c48t0d0
c48t0d9
c52t0d0
c52t0d9
c47t0d0
c47t0d9
c51t0d0
c51t0d9
c49t0d0
c49t0d9
c53t0d0
c53t0d9
c46t0d18
c46t0d27
c50t0d18
c50t0d27
c48t0d18
c52t0d18
c47t0d18
c51t0d18
c51t0d27
c49t0d18
c49t0d27
c53t0d18
c53t0d27
c46t0d36
c46t0d45
c50t0d36
c50t0d45
c48t0d27
c48t0d36
c52t0d27

```
c52t0d36
c47t0d27
c47t0d36
c51t0d36
END
VOLUME_GROUP: asu2-2 (d5)
STRIPE 16m
VOLUME 1
c46t0d1
c46t0d10
c50t0d1
c50t0d10
c48t0d1
c48t0d10
c52t0d1
c52t0d10
c47t0d1
c47t0d10
c51t0d1
c51t0d10
c49t0d1
c49t0d10
c53t0d1
c53t0d10
c46t0d19
c46t0d28
c50t0d19
c50t0d28
c48t0d19
c52t0d19
c47t0d19
c51t0d19
c51t0d28
c49t0d19
c49t0d28
c53t0d19
c53t0d28
c46t0d37
c46t0d46
c50t0d37
c50t0d46
c48t0d28
c48t0d37
c52t0d28
c52t0d37
c47t0d28
c47t0d37
c51t0d37
END
VOLUME_GROUP: asu2-3 (d6)
STRIPE 16m
VOLUME 1
c46t0d7
c46t0d16
c50t0d7
c50t0d16
c48t0d7
c48t0d16
c52t0d7
c52t0d16
c47t0d7
c47t0d16
```

```
c51t0d7
c51t0d16
c49t0d7
c49t0d16
c53t0d7
c53t0d16
c46t0d25
c46t0d34
c50t0d25
c50t0d34
c48t0d25
c52t0d25
c47t0d25
c51t0d25
c51t0d34
c49t0d25
c49t0d34
c53t0d25
c53t0d34
c46t0d43
c46t0d52
c50t0d43
c50t0d52
c48t0d34
c48t0d43
c52t0d34
c52t0d43
c47t0d34
c47t0d43
c51t0d43
END
VOLUME_GROUP: asu2-4 (d7)
STRIPE 16m
VOLUME 1
c46t0d8
c46t0d17
c50t0d8
c50t0d17
c48t0d8
c48t0d17
c52t0d8
c52t0d17
c47t0d8
c47t0d17
c51t0d8
c51t0d17
c49t0d8
c49t0d17
c53t0d8
c53t0d17
c46t0d26
c46t0d35
c50t0d26
c50t0d35
c48t0d26
c52t0d26
c47t0d26
c51t0d26
c51t0d35
c49t0d26
c49t0d35
c53t0d26
```

```
c53t0d35
c46t0d44
c46t0d53
c50t0d44
c50t0d53
c48t0d35
c48t0d44
c52t0d35
c52t0d44
c47t0d35
c47t0d44
c51t0d44
END
VOLUME_GROUP: asu3-1 (d8)
STRIPE 16m
VOLUME 1
c46t0d4
c46t0d13
c50t0d4
c50t0d13
c48t0d4
c48t0d13
c52t0d4
c52t0d13
c47t0d4
c47t0d13
c51t0d4
c51t0d13
c49t0d4
c49t0d13
c53t0d4
c53t0d13
c46t0d22
c46t0d31
c50t0d22
c50t0d31
c48t0d22
c52t0d22
c47t0d22
c51t0d22
c51t0d31
c49t0d22
c49t0d31
c53t0d22
c53t0d31
c46t0d40
c46t0d49
c50t0d40
c50t0d49
c48t0d31
c48t0d40
c52t0d31
c52t0d40
c47t0d31
c47t0d40
c51t0d40
END
```

metastat.txt

```
d8: Concat/Stripe
   Size: 1646264320 blocks (785 GB)
   Stripe 0: (interlace: 32768 blocks)
        Device      Start Block  Dbase        Reloc
        c46t0d4s0          0     No    Yes
        c46t0d13s0         0     No          Yes
        c50t0d4s0          0     No    Yes
        c50t0d13s0         0     No          Yes
        c48t0d4s0          0     No    Yes
        c48t0d13s0         0     No          Yes
        c52t0d4s0          0     No    Yes
        c52t0d13s0         0     No          Yes
        c47t0d4s0          0     No    Yes
        c47t0d13s0         0     No          Yes
        c51t0d4s0          0     No    Yes
        c51t0d13s0         0     No          Yes
        c49t0d4s0          0     No    Yes
        c49t0d13s0         0     No          Yes
        c53t0d4s0          0     No    Yes
        c53t0d13s0         0     No          Yes
        c46t0d22s0         0     No          Yes
        c46t0d31s0         0     No          Yes
        c50t0d22s0         0     No          Yes
        c50t0d31s0         0     No          Yes
        c48t0d22s0         0     No          Yes
        c52t0d22s0         0     No          Yes
        c47t0d22s0         0     No          Yes
        c51t0d22s0         0     No          Yes
        c51t0d31s0         0     No          Yes
        c49t0d22s0         0     No          Yes
        c49t0d31s0         0     No          Yes
        c53t0d22s0         0     No          Yes
        c53t0d31s0         0     No          Yes
        c46t0d40s0         0     No          Yes
        c46t0d49s0         0     No          Yes
        c50t0d40s0         0     No          Yes
        c50t0d49s0         0     No          Yes
        c48t0d31s0         0     No          Yes
        c48t0d40s0         0     No          Yes
        c52t0d31s0         0     No          Yes
        c52t0d40s0         0     No          Yes
        c47t0d31s0         0     No          Yes
        c47t0d40s0         0     No          Yes
        c51t0d40s0         0     No          Yes

d7: Concat/Stripe
   Size: 1852047360 blocks (883 GB)
   Stripe 0: (interlace: 32768 blocks)
        Device      Start Block  Dbase        Reloc
        c46t0d8s0          0     No    Yes
        c46t0d17s0         0     No          Yes
        c50t0d8s0          0     No    Yes
        c50t0d17s0         0     No          Yes
        c48t0d8s0          0     No    Yes
        c48t0d17s0         0     No          Yes
        c52t0d8s0          0     No    Yes
        c52t0d17s0         0     No          Yes
        c47t0d8s0          0     No    Yes
        c47t0d17s0         0     No          Yes
```

c51t0d8s0	0	No	Yes	
c51t0d17s0	0	No		Yes
c49t0d8s0	0	No	Yes	
c49t0d17s0	0	No		Yes
c53t0d8s0	0	No	Yes	
c53t0d17s0	0	No		Yes
c46t0d26s0	0	No		Yes
c46t0d35s0	0	No		Yes
c50t0d26s0	0	No		Yes
c50t0d35s0	0	No		Yes
c48t0d26s0	0	No		Yes
c52t0d26s0	0	No		Yes
c47t0d26s0	0	No		Yes
c51t0d26s0	0	No		Yes
c51t0d35s0	0	No		Yes
c49t0d26s0	0	No		Yes
c49t0d35s0	0	No		Yes
c53t0d26s0	0	No		Yes
c53t0d35s0	0	No		Yes
c46t0d44s0	0	No		Yes
c46t0d53s0	0	No		Yes
c50t0d44s0	0	No		Yes
c50t0d53s0	0	No		Yes
c48t0d35s0	0	No		Yes
c48t0d44s0	0	No		Yes
c52t0d35s0	0	No		Yes
c52t0d44s0	0	No		Yes
c47t0d35s0	0	No		Yes
c47t0d44s0	0	No		Yes
c51t0d44s0	0	No		Yes

d6: Concat/Stripe
Size: 1852047360 blocks (883 GB)
Stripe 0: (interlace: 32768 blocks)

Device	Start Block	Dbase		Reloc
c46t0d7s0	0	No	Yes	
c46t0d16s0	0	No		Yes
c50t0d7s0	0	No	Yes	
c50t0d16s0	0	No		Yes
c48t0d7s0	0	No	Yes	
c48t0d16s0	0	No		Yes
c52t0d7s0	0	No	Yes	
c52t0d16s0	0	No		Yes
c47t0d7s0	0	No	Yes	
c47t0d16s0	0	No		Yes
c51t0d7s0	0	No	Yes	
c51t0d16s0	0	No		Yes
c49t0d7s0	0	No	Yes	
c49t0d16s0	0	No		Yes
c53t0d7s0	0	No	Yes	
c53t0d16s0	0	No		Yes
c46t0d25s0	0	No		Yes
c46t0d34s0	0	No		Yes
c50t0d25s0	0	No		Yes
c50t0d34s0	0	No		Yes
c48t0d25s0	0	No		Yes
c52t0d25s0	0	No		Yes
c47t0d25s0	0	No		Yes
c51t0d25s0	0	No		Yes
c51t0d34s0	0	No		Yes
c49t0d25s0	0	No		Yes
c49t0d34s0	0	No		Yes

c53t0d25s0	0	No	Yes
c53t0d34s0	0	No	Yes
c46t0d43s0	0	No	Yes
c46t0d52s0	0	No	Yes
c50t0d43s0	0	No	Yes
c50t0d52s0	0	No	Yes
c48t0d34s0	0	No	Yes
c48t0d43s0	0	No	Yes
c52t0d34s0	0	No	Yes
c52t0d43s0	0	No	Yes
c47t0d34s0	0	No	Yes
c47t0d43s0	0	No	Yes
c51t0d43s0	0	No	Yes

d5: Concat/Stripe
Size: 1852047360 blocks (883 GB)
Stripe 0: (interlace: 32768 blocks)

Device	Start Block	Dbase	Reloc
c46t0d1s0	0	No	Yes
c46t0d10s0	0	No	Yes
c50t0d1s0	0	No	Yes
c50t0d10s0	0	No	Yes
c48t0d1s0	0	No	Yes
c48t0d10s0	0	No	Yes
c52t0d1s0	0	No	Yes
c52t0d10s0	0	No	Yes
c47t0d1s0	0	No	Yes
c47t0d10s0	0	No	Yes
c51t0d1s0	0	No	Yes
c51t0d10s0	0	No	Yes
c49t0d1s0	0	No	Yes
c49t0d10s0	0	No	Yes
c53t0d1s0	0	No	Yes
c53t0d10s0	0	No	Yes
c46t0d19s0	0	No	Yes
c46t0d28s0	0	No	Yes
c50t0d19s0	0	No	Yes
c50t0d28s0	0	No	Yes
c48t0d19s0	0	No	Yes
c52t0d19s0	0	No	Yes
c47t0d19s0	0	No	Yes
c51t0d19s0	0	No	Yes
c51t0d28s0	0	No	Yes
c49t0d19s0	0	No	Yes
c49t0d28s0	0	No	Yes
c53t0d19s0	0	No	Yes
c53t0d28s0	0	No	Yes
c46t0d37s0	0	No	Yes
c46t0d46s0	0	No	Yes
c50t0d37s0	0	No	Yes
c50t0d46s0	0	No	Yes
c48t0d28s0	0	No	Yes
c48t0d37s0	0	No	Yes
c52t0d28s0	0	No	Yes
c52t0d37s0	0	No	Yes
c47t0d28s0	0	No	Yes
c47t0d37s0	0	No	Yes
c51t0d37s0	0	No	Yes

d4: Concat/Stripe
Size: 1852047360 blocks (883 GB)
Stripe 0: (interlace: 32768 blocks)

Device	Start Block	Dbase		Reloc
c46t0d0s0	0	No	Yes	
c46t0d9s0	0	No	Yes	
c50t0d0s0	0	No	Yes	
c50t0d9s0	0	No	Yes	
c48t0d0s0	0	No	Yes	
c48t0d9s0	0	No	Yes	
c52t0d0s0	0	No	Yes	
c52t0d9s0	0	No	Yes	
c47t0d0s0	0	No	Yes	
c47t0d9s0	0	No	Yes	
c51t0d0s0	0	No	Yes	
c51t0d9s0	0	No	Yes	
c49t0d0s0	0	No	Yes	
c49t0d9s0	0	No	Yes	
c53t0d0s0	0	No	Yes	
c53t0d9s0	0	No	Yes	
c46t0d18s0	0	No		Yes
c46t0d27s0	0	No		Yes
c50t0d18s0	0	No		Yes
c50t0d27s0	0	No		Yes
c48t0d18s0	0	No		Yes
c52t0d18s0	0	No		Yes
c47t0d18s0	0	No		Yes
c51t0d18s0	0	No		Yes
c51t0d27s0	0	No		Yes
c49t0d18s0	0	No		Yes
c49t0d27s0	0	No		Yes
c53t0d18s0	0	No		Yes
c53t0d27s0	0	No		Yes
c46t0d36s0	0	No		Yes
c46t0d45s0	0	No		Yes
c50t0d36s0	0	No		Yes
c50t0d45s0	0	No		Yes
c48t0d27s0	0	No		Yes
c48t0d36s0	0	No		Yes
c52t0d27s0	0	No		Yes
c52t0d36s0	0	No		Yes
c47t0d27s0	0	No		Yes
c47t0d36s0	0	No		Yes
c51t0d36s0	0	No		Yes

d3: Concat/Stripe
Size: 1852047360 blocks (883 GB)
Stripe 0: (interlace: 32768 blocks)

Device	Start Block	Dbase		Reloc
c46t0d6s0	0	No	Yes	
c46t0d15s0	0	No		Yes
c50t0d6s0	0	No	Yes	
c50t0d15s0	0	No		Yes
c48t0d6s0	0	No	Yes	
c48t0d15s0	0	No		Yes
c52t0d6s0	0	No	Yes	
c52t0d15s0	0	No		Yes
c47t0d6s0	0	No	Yes	
c47t0d15s0	0	No		Yes
c51t0d6s0	0	No	Yes	
c51t0d15s0	0	No		Yes
c49t0d6s0	0	No	Yes	
c49t0d15s0	0	No		Yes
c53t0d6s0	0	No	Yes	
c53t0d15s0	0	No		Yes

c46t0d24s0	0	No	Yes
c46t0d33s0	0	No	Yes
c50t0d24s0	0	No	Yes
c50t0d33s0	0	No	Yes
c48t0d24s0	0	No	Yes
c52t0d24s0	0	No	Yes
c47t0d24s0	0	No	Yes
c51t0d24s0	0	No	Yes
c51t0d33s0	0	No	Yes
c49t0d24s0	0	No	Yes
c49t0d33s0	0	No	Yes
c53t0d24s0	0	No	Yes
c53t0d33s0	0	No	Yes
c46t0d42s0	0	No	Yes
c46t0d51s0	0	No	Yes
c50t0d42s0	0	No	Yes
c50t0d51s0	0	No	Yes
c48t0d33s0	0	No	Yes
c48t0d42s0	0	No	Yes
c52t0d33s0	0	No	Yes
c52t0d42s0	0	No	Yes
c47t0d33s0	0	No	Yes
c47t0d42s0	0	No	Yes
c51t0d42s0	0	No	Yes

d2: Concat/Stripe
Size: 1852047360 blocks (883 GB)
Stripe 0: (interlace: 32768 blocks)

Device	Start Block	Dbase	Reloc
c46t0d5s0	0	No	Yes
c46t0d14s0	0	No	Yes
c50t0d5s0	0	No	Yes
c50t0d14s0	0	No	Yes
c48t0d5s0	0	No	Yes
c48t0d14s0	0	No	Yes
c52t0d5s0	0	No	Yes
c52t0d14s0	0	No	Yes
c47t0d5s0	0	No	Yes
c47t0d14s0	0	No	Yes
c51t0d5s0	0	No	Yes
c51t0d14s0	0	No	Yes
c49t0d5s0	0	No	Yes
c49t0d14s0	0	No	Yes
c53t0d5s0	0	No	Yes
c53t0d14s0	0	No	Yes
c46t0d23s0	0	No	Yes
c46t0d32s0	0	No	Yes
c50t0d23s0	0	No	Yes
c50t0d32s0	0	No	Yes
c48t0d23s0	0	No	Yes
c52t0d23s0	0	No	Yes
c47t0d23s0	0	No	Yes
c51t0d23s0	0	No	Yes
c51t0d32s0	0	No	Yes
c49t0d23s0	0	No	Yes
c49t0d32s0	0	No	Yes
c53t0d23s0	0	No	Yes
c53t0d32s0	0	No	Yes
c46t0d41s0	0	No	Yes
c46t0d50s0	0	No	Yes
c50t0d41s0	0	No	Yes
c50t0d50s0	0	No	Yes

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        c48t0d32s0      0    No          Yes
        c48t0d41s0      0    No          Yes
        c52t0d32s0      0    No          Yes
        c52t0d41s0      0    No          Yes
        c47t0d32s0      0    No          Yes
        c47t0d41s0      0    No          Yes
        c51t0d41s0      0    No          Yes

d1: Concat/Stripe
   Size: 1852047360 blocks (883 GB)
   Stripe 0: (interlace: 32768 blocks)
        Device      Start Block  Dbase       Reloc
        c46t0d3s0       0    No   Yes
        c46t0d12s0      0    No               Yes
        c50t0d3s0       0    No   Yes
        c50t0d12s0      0    No               Yes
        c48t0d3s0       0    No   Yes
        c48t0d12s0      0    No               Yes
        c52t0d3s0       0    No   Yes
        c52t0d12s0      0    No               Yes
        c47t0d3s0       0    No   Yes
        c47t0d12s0      0    No               Yes
        c51t0d3s0       0    No   Yes
        c51t0d12s0      0    No               Yes
        c49t0d3s0       0    No   Yes
        c49t0d12s0      0    No               Yes
        c53t0d3s0       0    No   Yes
        c53t0d12s0      0    No               Yes
        c46t0d21s0      0    No               Yes
        c46t0d30s0      0    No               Yes
        c50t0d21s0      0    No               Yes
        c50t0d30s0      0    No               Yes
        c48t0d21s0      0    No               Yes
        c52t0d21s0      0    No               Yes
        c47t0d21s0      0    No               Yes
        c51t0d21s0      0    No               Yes
        c51t0d30s0      0    No               Yes
        c49t0d21s0      0    No               Yes
        c49t0d30s0      0    No               Yes
        c53t0d21s0      0    No               Yes
        c53t0d30s0      0    No               Yes
        c46t0d39s0      0    No               Yes
        c46t0d48s0      0    No               Yes
        c50t0d39s0      0    No               Yes
        c50t0d48s0      0    No               Yes
        c48t0d30s0      0    No               Yes
        c48t0d39s0      0    No               Yes
        c52t0d30s0      0    No               Yes
        c52t0d39s0      0    No               Yes
        c47t0d30s0      0    No               Yes
        c47t0d39s0      0    No               Yes
        c51t0d39s0      0    No               Yes

d0: Concat/Stripe
   Size: 1852047360 blocks (883 GB)
   Stripe 0: (interlace: 32768 blocks)
        Device      Start Block  Dbase       Reloc
        c46t0d2s0       0    No   Yes
        c46t0d11s0      0    No               Yes
        c50t0d2s0       0    No   Yes
        c50t0d11s0      0    No               Yes
        c48t0d2s0       0    No   Yes
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c48t0d11s0	0	No		Yes
c52t0d2s0	0	No	Yes	
c52t0d11s0	0	No		Yes
c47t0d2s0	0	No	Yes	
c47t0d11s0	0	No		Yes
c51t0d2s0	0	No	Yes	
c51t0d11s0	0	No		Yes
c49t0d2s0	0	No	Yes	
c49t0d11s0	0	No		Yes
c53t0d2s0	0	No	Yes	
c53t0d11s0	0	No		Yes
c46t0d20s0	0	No		Yes
c46t0d29s0	0	No		Yes
c50t0d20s0	0	No		Yes
c50t0d29s0	0	No		Yes
c48t0d20s0	0	No		Yes
c52t0d20s0	0	No		Yes
c47t0d20s0	0	No		Yes
c51t0d20s0	0	No		Yes
c51t0d29s0	0	No		Yes
c49t0d20s0	0	No		Yes
c49t0d29s0	0	No		Yes
c53t0d20s0	0	No		Yes
c53t0d29s0	0	No		Yes
c46t0d38s0	0	No		Yes
c46t0d47s0	0	No		Yes
c50t0d38s0	0	No		Yes
c50t0d47s0	0	No		Yes
c48t0d29s0	0	No		Yes
c48t0d38s0	0	No		Yes
c52t0d29s0	0	No		Yes
c52t0d38s0	0	No		Yes
c47t0d29s0	0	No		Yes
c47t0d38s0	0	No		Yes
c51t0d38s0	0	No		Yes

Device Relocation Information:

Device	Reloc	Device ID
c46t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303034
c46t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303044
c50t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303136
c50t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303146
c48t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303238
c48t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303331
c52t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303341
c52t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303433
c47t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303443
c47t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303535
c51t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303545
c51t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303637
c49t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303730
c49t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303739
c53t0d4	Yes	id1,sd@w46554a4954535520333030303030303230303832
c53t0d13	Yes	id1,sd@w46554a4954535520333030303030303230303842
c46t0d22	Yes	id1,sd@w46554a4954535520333030303030303230303934
c46t0d31	Yes	id1,sd@w46554a4954535520333030303030303230303944
c50t0d22	Yes	id1,sd@w46554a4954535520333030303030303230304136
c50t0d31	Yes	id1,sd@w46554a4954535520333030303030303230304146
c48t0d22	Yes	id1,sd@w46554a4954535520333030303030303230304238
c52t0d22	Yes	id1,sd@w46554a4954535520333030303030303230304331
c47t0d22	Yes	id1,sd@w46554a4954535520333030303030303230304341
c51t0d22	Yes	id1,sd@w46554a4954535520333030303030303230304433

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c51t0d31  Yes   id1,sd@w46554a4954535520333030303030303230304443
c49t0d22  Yes   id1,sd@w46554a4954535520333030303030303230304535
c49t0d31  Yes   id1,sd@w46554a4954535520333030303030303230304545
c53t0d22  Yes   id1,sd@w46554a4954535520333030303030303230304637
c53t0d31  Yes   id1,sd@w46554a4954535520333030303030303230313030
c46t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313039
c46t0d49  Yes   id1,sd@w46554a4954535520333030303030303230313132
c50t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313142
c50t0d49  Yes   id1,sd@w46554a4954535520333030303030303230313234
c48t0d31  Yes   id1,sd@w46554a4954535520333030303030303230313244
c48t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313336
c52t0d31  Yes   id1,sd@w46554a4954535520333030303030303230313346
c52t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313438
c47t0d31  Yes   id1,sd@w46554a4954535520333030303030303230313531
c47t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313541
c51t0d40  Yes   id1,sd@w46554a4954535520333030303030303230313633
c46t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303038
c46t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303131
c50t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303141
c50t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303233
c48t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303243
c48t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303335
c52t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303345
c52t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303437
c47t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303530
c47t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303539
c51t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303632
c51t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303642
c49t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303734
c49t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303744
c53t0d8   Yes   id1,sd@w46554a4954535520333030303030303230303836
c53t0d17  Yes   id1,sd@w46554a4954535520333030303030303230303846
c46t0d26  Yes   id1,sd@w46554a4954535520333030303030303230303938
c46t0d35  Yes   id1,sd@w46554a4954535520333030303030303230304131
c50t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304141
c50t0d35  Yes   id1,sd@w46554a4954535520333030303030303230304233
c48t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304243
c52t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304335
c47t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304345
c51t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304437
c51t0d35  Yes   id1,sd@w46554a4954535520333030303030303230304530
c49t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304539
c49t0d35  Yes   id1,sd@w46554a4954535520333030303030303230304632
c53t0d26  Yes   id1,sd@w46554a4954535520333030303030303230304642
c53t0d35  Yes   id1,sd@w46554a4954535520333030303030303230313034
c46t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313044
c46t0d53  Yes   id1,sd@w46554a4954535520333030303030303230313136
c50t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313146
c50t0d53  Yes   id1,sd@w46554a4954535520333030303030303230313238
c48t0d35  Yes   id1,sd@w46554a4954535520333030303030303230313331
c48t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313341
c52t0d35  Yes   id1,sd@w46554a4954535520333030303030303230313433
c52t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313443
c47t0d35  Yes   id1,sd@w46554a4954535520333030303030303230313535
c47t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313545
c51t0d44  Yes   id1,sd@w46554a4954535520333030303030303230313637
c46t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303037
c46t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303130
c50t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303139
c50t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303232
c48t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303242
c48t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303334
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c52t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303344
c52t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303436
c47t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303446
c47t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303538
c51t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303631
c51t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303641
c49t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303733
c49t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303743
c53t0d7   Yes   id1,sd@w46554a4954535520333030303030303230303835
c53t0d16  Yes   id1,sd@w46554a4954535520333030303030303230303845
c46t0d25  Yes   id1,sd@w46554a4954535520333030303030303230303937
c46t0d34  Yes   id1,sd@w46554a4954535520333030303030303230304130
c50t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304139
c50t0d34  Yes   id1,sd@w46554a4954535520333030303030303230304232
c48t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304242
c52t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304334
c47t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304344
c51t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304436
c51t0d34  Yes   id1,sd@w46554a4954535520333030303030303230304446
c49t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304538
c49t0d34  Yes   id1,sd@w46554a4954535520333030303030303230304631
c53t0d25  Yes   id1,sd@w46554a4954535520333030303030303230304641
c53t0d34  Yes   id1,sd@w46554a4954535520333030303030303230313033
c46t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313043
c46t0d52  Yes   id1,sd@w46554a4954535520333030303030303230313135
c50t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313145
c50t0d52  Yes   id1,sd@w46554a4954535520333030303030303230313237
c48t0d34  Yes   id1,sd@w46554a4954535520333030303030303230313330
c48t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313339
c52t0d34  Yes   id1,sd@w46554a4954535520333030303030303230313432
c52t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313442
c47t0d34  Yes   id1,sd@w46554a4954535520333030303030303230313534
c47t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313544
c51t0d43  Yes   id1,sd@w46554a4954535520333030303030303230313636
c46t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303031
c46t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303041
c50t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303133
c50t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303143
c48t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303235
c48t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303245
c52t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303337
c52t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303430
c47t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303439
c47t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303532
c51t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303542
c51t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303634
c49t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303644
c49t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303736
c53t0d1   Yes   id1,sd@w46554a4954535520333030303030303230303746
c53t0d10  Yes   id1,sd@w46554a4954535520333030303030303230303838
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solvm_vtoc.txt

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* /dev/md/rdsk/d0 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   47505 cylinders
*   47505 accessible cylinders
*
* Flags:
*   1: unmountable
*  10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*          0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
       0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d1 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   47505 cylinders
*   47505 accessible cylinders
```

```
*
* Flags:
*   1: unmountable
*  10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*         0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
      0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d2 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   47505 cylinders
*   47505 accessible cylinders
*
* Flags:
*   1: unmountable
*  10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*         0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
      0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d3 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   47505 cylinders
*   47505 accessible cylinders
*
* Flags:
*   1: unmountable
*  10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*         0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
      0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d4 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
```

```
*      64 tracks/cylinder
*    16384 sectors/cylinder
*    47505 cylinders
*    47505 accessible cylinders
*
* Flags:
*    1: unmountable
*   10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*          0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
       0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d5 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*    16384 sectors/cylinder
*    47505 cylinders
*    47505 accessible cylinders
*
* Flags:
*    1: unmountable
*   10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*          0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
       0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d6 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*    16384 sectors/cylinder
*    47505 cylinders
*    47505 accessible cylinders
*
* Flags:
*    1: unmountable
*   10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*          0     16384     16383
*
*                       First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
       0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d7 partition map
```

```
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   47505 cylinders
*   47505 accessible cylinders
*
* Flags:
*    1: unmountable
*   10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*         0     16384     16383
*
*                      First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
      0      0    00      16384 1852047360 1852063743
* /dev/md/rdsk/d8 partition map
*
* Dimensions:
*     512 bytes/sector
*     256 sectors/track
*      64 tracks/cylinder
*   16384 sectors/cylinder
*   34945 cylinders
*   34945 accessible cylinders
*
* Flags:
*    1: unmountable
*   10: read-only
*
* Unallocated space:
*           First     Sector    Last
*           Sector     Count    Sector
*         0     16384     16383
*
*                      First     Sector    Last
* Partition  Tag  Flags    Sector     Count    Sector  Mount Directory
      0      0    00      16384 1646264320 1646280703
```

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

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

```
sd=asu1_1,lun=/dev/md/rdsk/d0,size=948.2g
sd=asu1_2,lun=/dev/md/rdsk/d1,size=948.2g
sd=asu1_3,lun=/dev/md/rdsk/d2,size=948.2g
sd=asu1_4,lun=/dev/md/rdsk/d3,size=948.2g
sd=asu2_1,lun=/dev/md/rdsk/d4,size=948.2g
sd=asu2_2,lun=/dev/md/rdsk/d5,size=948.2g
sd=asu2_3,lun=/dev/md/rdsk/d6,size=948.2g
sd=asu2_4,lun=/dev/md/rdsk/d7,size=948.2g
sd=asu3_1,lun=/dev/md/rdsk/d8,size=842.8g
```

APPENDIX D: SPC-1 WORKLOAD GENERATOR INPUT PARAMETERS

Commands executed from the Command Line Interface:

```
java -Xmx512m persist1 -b 824

java -Xmx512m persist2

./run_fdr.sh D1-1-3_FINAL_FDR 824
```

The content of the "run_fdr.sh" script is:

```
#!/usr/bin/sh
#
# run_fdr

case $# in
0) echo "Usage: $0 CONFIG BSU " 1>&2; exit 2 ;;
1) echo "Usage: $0 CONFIG BSU " 1>&2; exit 2 ;;
esac

CONFIG=$1
BSU=$2

echo "`date +%Y.%m.%d:%H:%M:%S` > SPC FDR TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED" >>
run_fdr.txt

echo "`date +%Y.%m.%d:%H:%M:%S` > METRICS TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED" >>
run_fdr.txt
echo "`date +%Y.%m.%d:%H:%M:%S` > METRICS TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED"

java -Xms512m -Xmx1024m -Xoptimize metrics -b $BSU
#java -Xmx512m -Xss1024k -Xoptimize metrics -b $BSU
#java -Xmx512m -Xms512m -Xss1024k -Xoptimize metrics -b $BSU

echo "`date +%Y.%m.%d:%H:%M:%S` > REPEAT1 TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED" >>
run_fdr.txt
echo "`date +%Y.%m.%d:%H:%M:%S` > REPEAT1 TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED"

java -Xms512m -Xmx1024m -Xoptimize repeat1 -b $BSU
#java -Xmx512m -Xss1024k -Xoptimize repeat1 -b $BSU
#java -Xmx512m -Xms512m -Xss512k -Xoptimize repeat1 -b $BSU

echo "`date +%Y.%m.%d:%H:%M:%S` > REPEAT2 TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED" >>
run_fdr.txt
echo "`date +%Y.%m.%d:%H:%M:%S` > REPEAT2 TEST FOR CONFIG=$CONFIG BSU=$BSU STARTED"

java -Xms512m -Xmx1024m -Xoptimize repeat2 -b $BSU
#java -Xmx512m -Xss1024k -Xoptimize repeat2 -b $BSU
#java -Xmx512m -Xms512m -Xss512k -Xoptimize repeat2 -b $BSU

echo "`date +%Y.%m.%d:%H:%M:%S` > SPC FDR TEST FOR CONFIG=$CONFIG BSU=$BSU ENDED   " >>
run_fdr.txt
echo "`date +%Y.%m.%d:%H:%M:%S` > SPC FDR TEST FOR CONFIG=$CONFIG BSU=$BSU ENDED  "
```

The content of the "run_fdr.txt" text file is:

```
2004.06.24:13:24:33 > SPC FDR TEST FOR CONFIG=D1-1-3_FINAL_FDR BSU=824 STARTED
2004.06.24:13:24:33 > METRICS TEST FOR CONFIG=D1-1-3_FINAL_FDR BSU=824 STARTED
2004.06.24:17:47:47 > REPEAT1 TEST FOR CONFIG=D1-1-3_FINAL_FDR BSU=824 STARTED
```

```
2004.06.24:18:14:27 > REPEAT2 TEST FOR CONFIG=D1-1-3_FINAL_FDR BSU=824 STARTED
2004.06.24:18:41:07 > SPC FDR TEST FOR CONFIG=D1-1-3_FINAL_FDR BSU=824 ENDED
```