SPC BENCHMARK 1™

FULL DISCLOSURE REPORT

HUAWEI TECHNOLOGIES CO., LTD
HUAWEI OCEANSTOR 18500 V5

SPC-1 V3.6

SUBMISSION IDENTIFIER: A31013

SUBMITTED FOR REVIEW: MAY 28 2018
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**Benchmark Specification and Glossary**

The official SPC Benchmark 1™ (SPC-1™) specification is available on the website of the Storage Performance Council (SPC) at [www.storageperformance.org](http://www.storageperformance.org).

The SPC-1™ specification contains a glossary of the SPC-1™ terms used in this publication.
**Table of Contents**

Audit Certification............................................................................................................. 4  
Letter Of Good Faith........................................................................................................... 6  
Executive Summary .......................................................................................................... 7  
Configuration Information ............................................................................................... 13  
  Benchmark Configuration and Tested Storage Configuration.......................................... 13  
  Benchmark Configuration Creation Process ...................................................................... 15  
Benchmark Execution Results............................................................................................ 16  
  Benchmark Execution Overview ...................................................................................... 16  
  SUSTAIN Test Phase........................................................................................................ 17  
  RAMPD_100 Test Phase..................................................................................................... 20  
  Response Time Ramp Test............................................................................................... 23  
  Repeatability Test ........................................................................................................... 25  
  Data Persistence Test....................................................................................................... 28  
Appendix A: Supporting Files............................................................................................ 29  
Appendix B: Third Party Quotation .................................................................................... 30  
Appendix C: Tuning Parameters and Options .................................................................... 33  
Appendix D: Storage Configuration Creation ................................................................... 36  
Appendix E: Configuration Inventory ................................................................................ 43  
Appendix F: Workload Generator ..................................................................................... 44
AUDIT CERTIFICATION

Zhong Xu
Huawei Technologies Co., Ltd.
Huawei Industrial Base, Bantian,
Longgang, Shenzhen city,
Guangdong province, China

May 26, 2018

I verified the SPC Benchmark 1™ (SPC-1™ Revision 3.6) test execution and performance results of the following Tested Storage Product:

HUAWEI OCEANSTOR 18500 V5

The results were:

<table>
<thead>
<tr>
<th>SPC-1 IOPS™</th>
<th>4,800,419</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPC-1 Price-Performance™</td>
<td>$400.96/SPC-1 KIOPS™</td>
</tr>
<tr>
<td>SPC-1 IOPS™ Response Time</td>
<td>0.821 ms</td>
</tr>
<tr>
<td>SPC-1 Overall Response Time</td>
<td>0.513 ms</td>
</tr>
<tr>
<td>SPC-1 ASU Capacity</td>
<td>109,093 GB</td>
</tr>
<tr>
<td>SPC-1 ASU Price</td>
<td>$17.65/GB</td>
</tr>
<tr>
<td>SPC-1 Total System Price</td>
<td>$1,924,748.73</td>
</tr>
</tbody>
</table>

In my opinion, these performance results were produced in compliance with the SPC requirements for the benchmark.

The testing was executed using the SPC-1 Toolkit Version 3.0 Build d34fb3c. The audit process was conducted in accordance with the SPC Policies and met the requirements for the benchmark.

A Letter of Good Faith was issued by the Test Sponsor, stating the accuracy and completeness of the documentation and testing data provided in support of the audit of this result.

A Full Disclosure Report for this result was prepared by InfoSizing, reviewed and approved by the Test Sponsor, and can be found at www.spcresults.org under the Submission Identifier A31013.

The independent audit process conducted by InfoSizing included the verifications of the following items:
The physical capacity of the data repository;
The total capacity of the Application Storage Unit (ASU);
The accuracy of the Benchmark Configuration diagram;
The tuning parameters used to configure the Benchmark Configuration;
The Workload Generator commands used to execute the testing;
The validity and integrity of the test result files;
The compliance of the results from each performance test;
The compliance of the results from the persistence test;
The compliance of the submitted pricing model; and
The differences between the tested and the priced configuration, if any.

The Full Disclosure Report for this result was prepared in accordance with the disclosure requirements set forth in the specification for the benchmark.

The following benchmark requirements, if any, were waived according to the SPC Policies:

- None.

Respectfully Yours,

François Raab, Certified SPC Auditor
LETTER OF GOOD FAITH

Date: May 25, 2018

From: Huawei Technologies Co., Ltd.

To: Mr. Francois Raah, Certified SPC Auditor
   InfoSizing
   20 Kreg Lane
   Manitou Springs, CO 80829

Subject: SPC-1 Letter of Good Faith for the Huawei OceanStor 18500 V5

Huawei Technologies Co., Ltd. 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 V3.6 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: [Signature]

Date: [Signature]

Meng Guangbin
President of Storage Product Line
SPC BENCHMARK 1™

EXECUTIVE SUMMARY

HUAWEI TECHNOLOGIES CO., LTD
HUAWEI OCEANSTOR 18500 V5

<table>
<thead>
<tr>
<th>SPC-1 IOPS™</th>
<th>4,800,419</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPC-1 Price-Performance™</td>
<td>$400.96/SPC-1 KIOPS™</td>
</tr>
<tr>
<td>SPC-1 IOPS™ Response Time</td>
<td>0.821 ms</td>
</tr>
<tr>
<td>SPC-1 Overall Response Time</td>
<td>0.513 ms</td>
</tr>
<tr>
<td>SPC-1 ASU Capacity</td>
<td>109,093 GB</td>
</tr>
<tr>
<td>SPC-1 ASU Price</td>
<td>$17.65/GB</td>
</tr>
<tr>
<td>SPC-1 Total System Price</td>
<td>$1,924,748.73</td>
</tr>
</tbody>
</table>

Data Protection Level: Protected 2 (RAID-10)
Physical Storage Capacity: 343,680 GB
Pricing Currency / Target Country: U.S. Dollars / USA

SPC-1 V3.6
SUBMISSION IDENTIFIER: A31013
SUBMITTED FOR REVIEW: MAY 28, 2018
Benchmark Configuration Diagram

**Host Systems**

23 x Huawei FusionServer™ RH2288H V3

2 x QLogic dual-ported QLE2562 FC HBA per FusionServer™

- - -

92 x FC connections
(4 connections per server)

**Huawei OceanStor 18500 V5**

16 x OceanStor 18500 V5 Active-Active Controllers
512 GB cache per controller (8192 GB total)
32 x 4-port 8Gbps Smart I/O Modules
16 x 12-port 12Gbps SAS I/O Modules
16 x 2-port PCIe Modules
2 x PCIe 16-port switches
16 x 2U SSD disk enclosures
288 x 900 GB SSDs
Tested Storage Product Description

Huawei’s OceanStor 18500/18800 V5 mission-critical all-flash storage systems are dedicated to providing the highest level of data services for enterprises’ mission-critical businesses.

Innovative SmartMatrix 2.0 architecture, industry-leading scalability, flash-enabled performance, and hybrid-cloud-ready solution provide the optimal data services for enterprises.

The OceanStor 18500/18800 V5 systems satisfy the storage requirements of large-database OLTP/OLAP and cloud computing, making it a perfect choice for the government, finance, telecommunications, and manufacturing sectors.

For more details, visit:


Priced Storage Configuration Components

<table>
<thead>
<tr>
<th>46 x QLogic dual-ported QLE2562 FC HBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 x OceanStor 18500 V5 Active-Active Controllers, each with:</td>
</tr>
<tr>
<td>512 GB cache (8192 GB total)</td>
</tr>
<tr>
<td>2 x 4-port 8Gbps Smart I/O Modules</td>
</tr>
<tr>
<td>16 x 12-port 12Gbps SAS I/O Modules</td>
</tr>
<tr>
<td>16 x 2U disk enclosures, each with:</td>
</tr>
<tr>
<td>18 x 900 GB SSDs (288 total)</td>
</tr>
<tr>
<td>2 x PCIe 16-port switches</td>
</tr>
<tr>
<td>1 x Service Processor</td>
</tr>
<tr>
<td>1 x 8-port KVM</td>
</tr>
</tbody>
</table>
## Storage Configuration Pricing

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Ext. Price</th>
<th>Disc.</th>
<th>Disc. Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware &amp; Software</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85V5-4C2048G-AC-HW OceanStor 18500 V5 Engine (6U, Four Controller, AC240HVDC, 4<em>512GB Cache, 32</em>8Gb FC, 48<em>port 4</em>12Gb SAS,SPE73C0600)</td>
<td>4</td>
<td>501,015.00</td>
<td>2,004,060.00</td>
<td>72%</td>
<td>561,136.80</td>
</tr>
<tr>
<td>DV5-LPU5P2PCIE 2 port PCIe I/O module(with two NT Ports)</td>
<td>16</td>
<td>811.00</td>
<td>12,976.00</td>
<td>72%</td>
<td>3,633.28</td>
</tr>
<tr>
<td>HSSD-900G2S-A6 900GB SSD SAS Disk Unit(2.5&quot;)</td>
<td>288</td>
<td>10,624.00</td>
<td>3,059,712.00</td>
<td>75%</td>
<td>764,928.00</td>
</tr>
<tr>
<td>DAE52525U2-AC-A3 Disk Enclosure (2UAC240HVDC, 2.5&quot;, Expanding Module, 25 Disk Slots, w ithout Disk Unit, DAE52525U2)</td>
<td>16</td>
<td>8,364.50</td>
<td>133,832.00</td>
<td>72%</td>
<td>37,472.96</td>
</tr>
<tr>
<td>PRACK-SYS-H-AC OceanStor 18000 Series System Primary Cabinet (w ith Service Processor, KVM, External MiniSAS HD Cable, Power Cable)</td>
<td>1</td>
<td>54,609.00</td>
<td>54,609.00</td>
<td>0%</td>
<td>54,609.00</td>
</tr>
<tr>
<td>SRACK-SYS-H-AC OceanStor 18000 Series System Second Cabinet (w ith External MiniSAS HD Cable, Power Cable)</td>
<td>1</td>
<td>34,021.00</td>
<td>34,021.00</td>
<td>0%</td>
<td>34,021.00</td>
</tr>
<tr>
<td>N8GHBA000 QLOGIC QLE2562 HBA Card, PCIe, 8Gbps DualPort , Fiber Channel Multimode LC Optic Interface, English Manual, No Drive CD</td>
<td>46</td>
<td>1,698.00</td>
<td>78,108.00</td>
<td>0%</td>
<td>78,108.00</td>
</tr>
<tr>
<td>SWITCH-V5H2 PCIe 3.0 Switch (AC240HVDC, 8GB Cache, 16 Port, w ith 16*Quadwire 40 Gb/s Parallel AOC for PCIe 3.0, SWE1600P08)</td>
<td>2</td>
<td>11,472.00</td>
<td>22,944.00</td>
<td>0%</td>
<td>22,944.00</td>
</tr>
<tr>
<td>SN2F01FCPC Patch Cord, DLC/PC, DLC/PC, Multi-mode, 3m, A1a.2, 2mm, 42mm DLC, OM3 bending insensitive</td>
<td>92</td>
<td>14.00</td>
<td>1,288.00</td>
<td>0%</td>
<td>1,288.00</td>
</tr>
<tr>
<td>85V5-LBASIC-N License (Including OceanStor OS, Device Manager SmartThin, SmartMotion, SmartQoS, SmartPartition, SmartCache, SmartMigration, SmartErase, SmartMulti-tenant and SystemReporter, UltraPath)</td>
<td>1</td>
<td>149,505.00</td>
<td>149,505.00</td>
<td>72%</td>
<td>41,861.40</td>
</tr>
</tbody>
</table>

**Hardware & Software Subtotal** 1,600,002.44
**Third-Party Reseller**: Huawei Technologies Co., Ltd. only sells its products to third-party resellers who, in turn, sell those products to U.S. customers. The above reflects the pricing quoted by one of those third-party resellers. See Appendix B of the Full Disclosure Report for a copy of the third-party reseller’s quotation.

**Discount Details**: The discounts shown are based on the storage capacity purchased and are generally available.

**Warranty**: Hi-Care Premier On-Site Service include: 7x24 Technical Assistance Center Access. Access to all new software updates and Online Support. 24x7 with 4-hour On-site Hardware Replacement.

**Availability Date**: Currently available.

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<table>
<thead>
<tr>
<th>Support &amp; Maintenance</th>
<th>Unit Price</th>
<th>Tax</th>
<th>Total Price</th>
<th>Discount</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>02351QHB-88134ULF-36 OceanStor 18500 V5 Engine(6U, Four Controller, AC240HVDC, 4<em>512GB Cache, 32</em>8Gb FC, 48<em>port 4</em>12Gb SAS, SPE73C0600) Hi-Care Onsite Premier 24x7x4H Engineer Onsite Service-36Month(s)</td>
<td>12,855.60</td>
<td>51,422.40</td>
<td>0%</td>
<td>51,422.40</td>
<td></td>
</tr>
<tr>
<td>02351RYF-88134ULF-36 900GB SSD SAS Disk Unit(2.5’’)-Hi-Care Onsite Premier 24x7x4H Engineer Onsite Service-36Month(s)</td>
<td>244.80</td>
<td>70,502.40</td>
<td>0%</td>
<td>70,502.40</td>
<td></td>
</tr>
<tr>
<td>88034JGX-88134UHK-36 License (Including OceanStor OS, Device Manager, SmartThin, SmartMotion, SmartQoS, SmartPartition, SmartCache, SmartMigration, SmartErase, SmartMulti-tenant and SystemReporter, UltraPath) Hi-Care Application Software Upgrade Support Service-36Month(s)</td>
<td>59,626.80</td>
<td>59,626.80</td>
<td>0%</td>
<td>59,626.80</td>
<td></td>
</tr>
<tr>
<td>8812099165 OceanStor 18500 V5 Installation Service - Engineering</td>
<td>143,194.69</td>
<td>143,194.69</td>
<td>0%</td>
<td>143,194.69</td>
<td></td>
</tr>
</tbody>
</table>

**SPC-1 Total System Price** | 1,924,748.73

**SPC-1 IOPS™** | 4,800,419

**SPC-1 Price-Performance™ ($/SPC-1 KIOPS™)** | 400.96

**SPC-1 ASU Capacity (GB)** | 109,093

**SPC-1 ASU Price ($/GB)** | 17.65
Response Time and Throughput Graph

Contact Information

| Test Sponsor Primary Contact | Huawei Technologies Co., Ltd. – www.huawei.com  
Zhong Xu – xuzhong@huawei.com |
| SPC Auditor                   | InfoSizing – www.sizing.com  
Francois Raab – francois@sizing.com |

Revision Information

| SPC Benchmark 1™ Revision | V3.6.0 |
| SPC-1 Workload Generator Revision | V3.0 build d34fb3c |
| Publication Revision History | First Edition |
CONFIGURATION INFORMATION

Benchmark Configuration and Tested Storage Configuration

The following diagram illustrates the Benchmark Configuration (BC), including the Tested Storage Configuration (TSC) and the Host System(s).
Storage Network Configuration

The Tested Storage Configuration (TSC) involved an external storage subsystem made of 16 Huawei OceanStor 18500 V5, driven by 23 host systems (Huawei FusionServer RH2288H V3). The OceanStor controllers were grouped in sets of four, forming four OceanStor Engines. Each FusionServer host system connected one-to-one to each OceanStor Engine. That connection was established via a port from one of the two dual-port Fibre Chanel HBAs on the FusionServer; and a port from one of the eight 4-port Smart I/O Modules on the OceanStor Engine, leaving nine of these ports inactive in each Engine. These Fibre Chanel paths operated at 8Gbps.

Host System and Tested Storage Configuration Components

The following table lists the components of the Host System(s) and the Tested Storage Configuration (TSC).

<table>
<thead>
<tr>
<th>Host Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 x Huawei FusionServer™ RH2288H V3</td>
</tr>
<tr>
<td>2 x Intel® Xeon® E5-2667 v4 (3.2 GHz, 8 Cores, 25 MB L3)</td>
</tr>
<tr>
<td>128 GB Main Memory</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux 7.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Priced Storage Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>46 x QLogic dual-ported QLE2562 FC HBA</td>
</tr>
<tr>
<td>16 x OceanStor 18500 V5 Active-Active Controllers, each with:</td>
</tr>
<tr>
<td>512 GB cache (8192 GB total)</td>
</tr>
<tr>
<td>2 x 4-port 8Gbps Smart I/O Modules</td>
</tr>
<tr>
<td>16 x 12-port 12Gbps SAS I/O Modules</td>
</tr>
<tr>
<td>16 x 2U disk enclosures, each with:</td>
</tr>
<tr>
<td>18 x 900 GB SSDs (288 total)</td>
</tr>
<tr>
<td>2 x PCIe 16-port switches</td>
</tr>
<tr>
<td>1 x Service Processor</td>
</tr>
<tr>
<td>1 x 8-port KVM</td>
</tr>
</tbody>
</table>

Differences Between Tested and Priced Storage Configurations

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

Component Changes in Revised Full Disclosure Report

The following table outlines component changes that were made in revisions to this Full Disclosure Report.

<table>
<thead>
<tr>
<th>Original Component</th>
<th>Revised Component</th>
<th>Description of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Initial submission</td>
</tr>
</tbody>
</table>
Benchmark Configuration Creation Process

Customer Tuning Parameters and Options

All the customer tuning parameters and options that have been altered from their default values for this benchmark are included in Appendix C and in the Supporting Files (see Appendix A).

Tested Storage Configuration Creation

A detailed description of how the logical representation of the TSC was created is included in Appendix D and in the Supporting Files (see Appendix A).

Tested Storage Configuration Inventory

An inventory of the components in the TSC, as seen by the Benchmark Configuration, is included in Appendix E and in the Supporting Files (see Appendix A).

Workload Generator Storage Configuration

The SPC-1 Workload Generator storage configuration commands and parameters used to invoke the execution of the tests are included in Appendix F and in the Supporting Files (see Appendix A).

Logical Volume Capacity and ASU Mapping

The following table details the capacity of each ASU and how they are mapped to logical volumes (LV).

<table>
<thead>
<tr>
<th>LV per ASU</th>
<th>LV Capacity</th>
<th>Used per LV</th>
<th>Total per ASU</th>
<th>% ASU Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASU-1</td>
<td>18</td>
<td>2,727.4</td>
<td>2,727.3</td>
<td>49,091.5</td>
</tr>
<tr>
<td>ASU-2</td>
<td>18</td>
<td>2,727.4</td>
<td>2,727.3</td>
<td>49,091.5</td>
</tr>
<tr>
<td>ASU-3</td>
<td>2</td>
<td>5,454.7</td>
<td>5,454.6</td>
<td>10,909.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SPC-1 ASU Capacity</td>
</tr>
</tbody>
</table>

Physical Storage Capacity and Utilization

The following table details the Physical Capacity of the storage devices and the Physical Capacity Utilization (percentage of Total Physical Capacity used) in support of hosting the ASUs.

<table>
<thead>
<tr>
<th>Devices</th>
<th>Count</th>
<th>Physical Capacity</th>
<th>Total Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>900GB SSD</td>
<td>288</td>
<td>895.0</td>
<td>257,760.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Physical Capacity</td>
<td></td>
<td></td>
<td>257,760.0</td>
</tr>
<tr>
<td>Physical Capacity Utilization</td>
<td></td>
<td></td>
<td>42.32%</td>
</tr>
</tbody>
</table>

Data Protection

The data protection level used for all logical volumes was Protected 2, which was accomplished by configuring 16 pools of 18 drives into 16 RAID-10 arrays.
**BENCHMARK EXECUTION RESULTS**

This portion of the Full Disclosure Report documents the results of the various SPC-1 Tests, Test Phases, and Test Runs.

**Benchmark Execution Overview**

**Workload Generator Input Parameters**

The SPC-1 Workload Generator commands and input parameters for the Test Phases are presented in the Supporting Files (see Appendix A).

**Primary Metrics Test Phases**

The benchmark execution consists of the Primary Metrics Test Phases, including the Test Phases SUSTAIN, RAMPD_100 to RAMPD_10, RAMPU_50 to RAMPU_100, RAMP_0, REPEAT_1 and REPEAT_2.

Each Test Phase starts with a transition period followed by a Measurement Interval.

**Measurement Intervals by Test Phase Graph**

The following graph presents the average IOPS and the average Response Times measured over the Measurement Interval (MI) of each Test Phase.

![Measurement Intervals by Test Phase Graph](attachment:image.png)

**Exception and Waiver**

None.
SUSTAIN Test Phase

SUSTAIN – Results File

The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

SUSTAIN – Execution Times

<table>
<thead>
<tr>
<th>Interval</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Period</td>
<td>9-May-18 12:30:16</td>
<td>9-May-18 18:30:16</td>
<td>6:00:00</td>
</tr>
<tr>
<td>Measurement Interval</td>
<td>9-May-18 18:30:16</td>
<td>10-May-18 02:30:17</td>
<td>8:00:01</td>
</tr>
</tbody>
</table>

SUSTAIN – Throughput Graph

![Throughput Graph (SUSTAIN @ 4,800,200 IOPS)](image-url)
SUSTAIN – Response Time Graph

![Response Time Graph (SUSTAIN @ 4,800,200 IOPS)](image)

SUSTAIN – Data Rate Graph

![Data Rate Graph (SUSTAIN @ 4,800,200 IOPS)](image)
SUSTAIN – Response Time Frequency Graph

Response Time Frequency Graph
(SUSTAIN @ 4,800,200 IOPS)

SUSTAIN – Intensity Multiplier

The following table lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O STREAM, its coefficient of variation (Variation) and the percentage of difference (Difference) between Target and Measured.

<table>
<thead>
<tr>
<th></th>
<th>ASU1-1</th>
<th>ASU1-2</th>
<th>ASU1-3</th>
<th>ASU1-4</th>
<th>ASU2-1</th>
<th>ASU2-2</th>
<th>ASU2-3</th>
<th>ASU3-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defined</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Measured</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Variation</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0004</td>
<td>0.0002</td>
<td>0.0003</td>
<td>0.0001</td>
</tr>
<tr>
<td>Difference</td>
<td>0.006%</td>
<td>0.001%</td>
<td>0.004%</td>
<td>0.000%</td>
<td>0.005%</td>
<td>0.004%</td>
<td>0.006%</td>
<td>0.002%</td>
</tr>
</tbody>
</table>
RAMPD_100 Test Phase

RAMPD_100 – Results File

The results file generated during the execution of the RAMPD_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

RAMPD_100 – Execution Times

<table>
<thead>
<tr>
<th>Interval</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Period</td>
<td>10-May-18 02:31:16</td>
<td>10-May-18 02:36:16</td>
<td>0:05:00</td>
</tr>
<tr>
<td>Measurement Interval</td>
<td>10-May-18 02:36:16</td>
<td>10-May-18 02:46:17</td>
<td>0:10:01</td>
</tr>
</tbody>
</table>

RAMPD_100 – Throughput Graph

![Throughput Graph (RAMPD_100 @ 4,800,200 IOPS)](image_url)
**RAMPD_100 – Response Time Graph**

![Response Time Graph (RAMPD_100 @ 4,800,200 IOPS)](image)

**RAMPD_100 – Data Rate Graph**

![Data Rate Graph (RAMPD_100 @ 4,800,200 IOPS)](image)
RAMPD_100 – Response Time Frequency Graph

The following table lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O STREAM, its coefficient of variation (Variation) and the percentage of difference (Difference) between Target and Measured.

<table>
<thead>
<tr>
<th>ASU1-1</th>
<th>ASU1-2</th>
<th>ASU1-3</th>
<th>ASU1-4</th>
<th>ASU2-1</th>
<th>ASU2-2</th>
<th>ASU2-3</th>
<th>ASU3-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defined</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
</tr>
<tr>
<td>Measured</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
</tr>
<tr>
<td>Variation</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0006</td>
<td>0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td>Difference</td>
<td>0.001%</td>
<td>0.003%</td>
<td>0.000%</td>
<td>0.002%</td>
<td>0.024%</td>
<td>0.004%</td>
<td>0.007%</td>
</tr>
</tbody>
</table>

RAMPD_100 – I/O Request Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Requests Completed in the Measurement Interval</td>
<td>2,880,276,193</td>
</tr>
<tr>
<td>I/O Requests Completed with Response Time &lt;= 30 ms</td>
<td>2,880,265,339</td>
</tr>
<tr>
<td>I/O Requests Completed with Response Time &gt; 30 ms</td>
<td>10,854</td>
</tr>
</tbody>
</table>
Response Time Ramp Test

Response Time Ramp Test – Results File

The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

Response Time Ramp Test – Phases

The Response Time Ramp Test is comprised of 11 Test Phases, including six Ramp-Down Phases (executed at 100%, 95%, 90%, 80%, 50%, and 10% of the Business Scaling Unit) and five Ramp-Up Phases (executed at 50%, 80%, 90%, 95%, and 100% of the Business Scaling Unit).

Response Time Ramp Test – Average Throughput Graph

![Average Throughput Graph](image-url)
Response Time Ramp Test – Average Response Time Graph

Response Time Ramp Test – RAMPD_10 Response Time Graph
Repeatability Test

Repeatability Test Results File

The results file generated during the execution of the Repeatability Test is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

Repeatability Test Results

The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT_1 and REPEAT_2) are listed in the tables below.

<table>
<thead>
<tr>
<th>Test Phase</th>
<th>100% IOPS</th>
<th>10% IOPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAMPD</td>
<td>4,800,419.6</td>
<td>480,010.6</td>
</tr>
<tr>
<td>REPEAT_1</td>
<td>4,800,504.7</td>
<td>480,019.5</td>
</tr>
<tr>
<td>REPEAT_2</td>
<td>4,800,418.2</td>
<td>480,019.9</td>
</tr>
</tbody>
</table>

REPEAT_1_100 – Throughput Graph

![Throughput Graph (REPEAT_1_100 @ 4,800,200 IOPS)](image-url)
**REPEAT_1_100 – Response Time Graph**

![Response Time Graph](image_url)

**REPEAT_2_100 – Throughput Graph**

![Throughput Graph](image_url)
**REPEAT_2_100 – Response Time Graph**

![Response Time Graph (REPEAT_2_100 @ 4,800,200 IOPS)](image)

**Repeatability Test – Intensity Multiplier**

The following tables lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O STREAM, its coefficient of variation (Variation) and the percent of difference (Difference) between Target and Measured.

**REPEAT_1_100 Test Phase**

<table>
<thead>
<tr>
<th></th>
<th>ASU1-1</th>
<th>ASU1-2</th>
<th>ASU1-3</th>
<th>ASU1-4</th>
<th>ASU2-1</th>
<th>ASU2-2</th>
<th>ASU2-3</th>
<th>ASU3-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defined</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Measured</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Variation</td>
<td>0.0003</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0004</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
</tr>
<tr>
<td>Difference</td>
<td>0.009%</td>
<td>0.004%</td>
<td>0.012%</td>
<td>0.003%</td>
<td>0.007%</td>
<td>0.013%</td>
<td>0.003%</td>
<td>0.006%</td>
</tr>
</tbody>
</table>

**REPEAT_2_100 Test Phase**

<table>
<thead>
<tr>
<th></th>
<th>ASU1-1</th>
<th>ASU1-2</th>
<th>ASU1-3</th>
<th>ASU1-4</th>
<th>ASU2-1</th>
<th>ASU2-2</th>
<th>ASU2-3</th>
<th>ASU3-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defined</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Measured</td>
<td>0.0350</td>
<td>0.2810</td>
<td>0.0700</td>
<td>0.2100</td>
<td>0.0180</td>
<td>0.0700</td>
<td>0.0350</td>
<td>0.2810</td>
</tr>
<tr>
<td>Variation</td>
<td>0.0004</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0005</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0001</td>
</tr>
<tr>
<td>Difference</td>
<td>0.007%</td>
<td>0.001%</td>
<td>0.011%</td>
<td>0.001%</td>
<td>0.003%</td>
<td>0.003%</td>
<td>0.007%</td>
<td>0.002%</td>
</tr>
</tbody>
</table>
Data Persistence Test

Data Persistence Test Results file

The results files generated during the execution of the Data Persistence Test is included in the Supporting Files (see Appendix A) as follows:

- SPC1_PERSIST_1_0_Raw_Results.xlsx
- SPC1_PERSIST_2_0_Raw_Results.xlsx

Data Persistence Test Execution

The Data Persistence Test was executed using the following sequence of steps:

- The PERSIST_1_0 Test Phase was executed to completion.
- The Benchmark Configuration was taken through an orderly shutdown process and powered off.
- The Benchmark Configuration was powered on and taken through an orderly startup process.
- The PERSIST_2_0 Test Phase was executed to completion.

Data Persistence Test Results

<table>
<thead>
<tr>
<th>Data Persistence Test Phase: Persist1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Logical Blocks Written</td>
<td>296,864,268</td>
</tr>
<tr>
<td>Total Number of Logical Blocks Verified</td>
<td>149,656,998</td>
</tr>
<tr>
<td>Total Number of Logical Blocks that Failed Verification</td>
<td>147,207,270</td>
</tr>
<tr>
<td>Time Duration for Writing Test Logical Blocks (sec.)</td>
<td>0</td>
</tr>
<tr>
<td>Size in bytes of each Logical Block</td>
<td>300</td>
</tr>
<tr>
<td>Number of Failed I/O Requests in the process of the Test</td>
<td>8,192</td>
</tr>
</tbody>
</table>

Committed Data Persistence Implementation

The persistency of committed data is implemented at two levels. At the disk level, data loss is prevented through the use of RAID 10 arrays. At the controller level, all caches are mirrored across controllers, where write requests are only completed once the local cache has been successfully mirrored in another controller’s cache. In addition, cache content is protected from a loss of power by flushing the cache content to permanent flash memory, as soon as a power loss is detected. The flushing action is powered by a battery backup located in each controller.
## APPENDIX A: SUPPORTING FILES

The following table details the content of the Supporting Files provided as part of this Full Disclosure Report.

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>/SPC1_RESULTS</td>
<td>Data reduction worksheets</td>
<td>root</td>
</tr>
<tr>
<td>SPC1_INIT_0_Raw_Results.xlsx</td>
<td>Raw results for INIT Test Phase</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_METRICS_0_Quick_Look.xlsx</td>
<td>Quick Look Test Run Overview</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_METRICS_0_Raw_Results.xlsx</td>
<td>Raw results for Primary Metrics Test</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_METRICS_0_Summary_Results.xlsx</td>
<td>Primary Metrics Summary</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_PERSIST_1_0_Raw_Results.xlsx</td>
<td>Raw results for PERSIST1 Test Phase</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_PERSIST_2_0_Raw_Results.xlsx</td>
<td>Raw results for PERSIST2 Test Phase</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_Run_SetOverview.xlsx</td>
<td>Run Set Overview Worksheet</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_VERIFY_0_Raw_Results.xlsx</td>
<td>Raw results for first VERIFY Test Phase</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>SPC1_VERIFY_1_Raw_Results.xlsx</td>
<td>Raw results for second VERIFY Test Phase</td>
<td>/SPC1_RESULTS</td>
</tr>
<tr>
<td>/C_Tuning</td>
<td>Tuning parameters and options</td>
<td>root</td>
</tr>
<tr>
<td>aio-max-nr.sh</td>
<td>Set maximum asynchronous I/O</td>
<td>/C_Tuning</td>
</tr>
<tr>
<td>nr_requests.sh</td>
<td>Increase disk queue depth</td>
<td>/C_Tuning</td>
</tr>
<tr>
<td>scheduler.sh</td>
<td>Change the I/O scheduler</td>
<td>/C_Tuning</td>
</tr>
<tr>
<td>/D_Creation</td>
<td>Storage configuration creation</td>
<td>root</td>
</tr>
<tr>
<td>mklun.txt</td>
<td>Create the storage environment</td>
<td>/D_Creation</td>
</tr>
<tr>
<td>mkvolume.sh</td>
<td>Create the Logical Volumes</td>
<td>/D_Creation</td>
</tr>
<tr>
<td>/E_Inventory</td>
<td>Configuration inventory</td>
<td>root</td>
</tr>
<tr>
<td>shstorage.tcl</td>
<td>Captures profile of storage environment</td>
<td>/E_Inventory</td>
</tr>
<tr>
<td>profile1_volume.log</td>
<td>List of logical volumes before INIT</td>
<td>/E_Inventory</td>
</tr>
<tr>
<td>profile1_storage.log</td>
<td>List of storage devices before INIT</td>
<td>/E_Inventory</td>
</tr>
<tr>
<td>profile2_volume.log</td>
<td>List of logical volumes after restart</td>
<td>/E_Inventory</td>
</tr>
<tr>
<td>profile2_storage.log</td>
<td>List of storage devices after restart</td>
<td>/E_Inventory</td>
</tr>
<tr>
<td>/F_Generator</td>
<td>Workload generator</td>
<td>root</td>
</tr>
<tr>
<td>slave_asu.asu</td>
<td>Defining LUNs hosting the ASUs</td>
<td>/F_generator</td>
</tr>
<tr>
<td>23host.HST</td>
<td>Host configuration file</td>
<td>/F_generator</td>
</tr>
<tr>
<td>full_run.sh</td>
<td>Executing all test phases</td>
<td>/F_generator</td>
</tr>
</tbody>
</table>
# Appendix B: Third Party Quotation

![Quotation Image]

<table>
<thead>
<tr>
<th>No.</th>
<th>Model</th>
<th>Description</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Est. Price</th>
<th>Disc. (%)</th>
<th>Total Disc. Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Phase Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Location</td>
<td>OceanStor 18500 V5 Main Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.1</td>
<td>Controller Enclosure</td>
<td>OceanStor 18500 V5 Engineered Four Controller, AC249H-V4, C4.512GB Cache, 32GB FC, 48 port 4*12GB SAS, SPEE3000E600</td>
<td>4</td>
<td>501,015.00</td>
<td>2,004,000.00</td>
<td>72.00%</td>
<td>561,196.00</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Expanding Interface Module</td>
<td>2 port PCIe I/O module with two NT Ports</td>
<td>16</td>
<td>811.00</td>
<td>12,976.00</td>
<td>72.00%</td>
<td>3,633.28</td>
</tr>
<tr>
<td>1.1.3</td>
<td>Disk Components</td>
<td>HSSD-900G2S-A6 900GB SSD SAS Disk Unit (2.5&quot;)</td>
<td>288</td>
<td>10,624.00</td>
<td>3,059,712.00</td>
<td>75.00%</td>
<td>764,328.00</td>
</tr>
<tr>
<td>1.1.4</td>
<td>Disk Enclosure</td>
<td>DAE5252SU-AC-A3 Disk Enclosure (Dual AC249H-V4, 2.5&quot;)</td>
<td>16</td>
<td>8,364.50</td>
<td>133,832.00</td>
<td>72.00%</td>
<td>37,472.96</td>
</tr>
<tr>
<td>1.1.5</td>
<td>Cabinet</td>
<td>PRACK-SYS-H-AC OceanStor 18000 Series System Primary Cabinet with Service Processor KV/M, External MiniSAS HD Cable, Power Cable</td>
<td>1</td>
<td>54,609.00</td>
<td>54,609.00</td>
<td>0.00%</td>
<td>54,609.00</td>
</tr>
<tr>
<td>1.1.6</td>
<td></td>
<td>SRAK-SYS-H-AC OceanStor 18000 Series System Second Cabinet with External MiniSAS HD Cable, Power Cable</td>
<td>1</td>
<td>34,021.00</td>
<td>34,021.00</td>
<td>0.00%</td>
<td>34,021.00</td>
</tr>
<tr>
<td>1.1.7</td>
<td>HBA</td>
<td>QLOGIC QLE2562 HBA Card, PCIe, 10Gbps Dual Port, Fiber Channel Multimode LC Optic Interface, English Manual, No Other CD</td>
<td>46</td>
<td>1,598.00</td>
<td>78,108.00</td>
<td>0.00%</td>
<td>78,108.00</td>
</tr>
<tr>
<td>1.1.8</td>
<td>Accessory</td>
<td>SWITCH-V5Q PCIe 3.0 Switch AC249H-V4, 8GB Cache, 16 Port, with 16*Quadwire 40Gbps Parallel AOC for PCIe I/O Data Transfer</td>
<td>2</td>
<td>11,472.00</td>
<td>22,944.00</td>
<td>0.00%</td>
<td>22,944.00</td>
</tr>
</tbody>
</table>
# Tuning Parameters and Options

## SPC Benchmark™ V3.6

**Huawei Technologies Co., Ltd**

**Huawei OceanStor 18500 V5**

**FULL DISCLOSURE REPORT**

**Submission Identifier: A31013**

**Submitted for Review: May 28, 2018**

---

### Tuning Parameters and Options

#### Storage Software

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Rate</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNQF01FCPC</td>
<td>Basic Software Suite Unlimited Capacity License (Including OceanStor OS,Device Manager,SmartThin,SmartMotion,SmartQoS,SmartPartition,SmartCache,SmartMigration,SmartErase,SmartMulti-tenant and SystemReporter, UltraPath)</td>
<td>1,286.00</td>
<td>145,505.00</td>
<td>72.00%</td>
<td>41,861.40</td>
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<tr>
<td>68V5-LBASIC-N</td>
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#### Total of Product

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<table>
<thead>
<tr>
<th></th>
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</tbody>
</table>

#### Total of Service (3 years)

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

---

**Total Price:** 1,924,748.73

**Notes:** Hi-Care Premier On-Site Service include: 7*24 Technical Assistance Center Access. Access to all new software updates and Online Support. 24*7*4 Hours Onsite Hardware Replacement.

**Payment Terms:**

**Comments:**
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APPENDIX C: TUNING PARAMETERS AND OPTIONS

The following scripts, listed below, were used to set tuning parameters and options:

- **aio-max-nr.sh** to change the maximum number of AIO operations to 1048576
- **nr_requests.sh** to change nr_requests from 128 to 1024 on each Host System for each device
- **scheduler.sh** to change the I/O scheduler from cfq to noop on each Host System, which will result in all incoming I/O requests inserted into a simple, unordered FIFO queue

The scripts described above are included in the Supporting Files (see Appendix A) and listed below.

**aio-max-nr.sh**
```
echo 1048576 > /proc/sys/fs/aio-max-nr
```

**nr_requests.sh**
```
echo 4096 >/sys/block/sdb/queue/nr_requests
echo 4096 >/sys/block/sdc/queue/nr_requests
echo 4096 >/sys/block/sdd/queue/nr_requests
echo 4096 >/sys/block/sde/queue/nr_requests
echo 4096 >/sys/block/sdf/queue/nr_requests
echo 4096 >/sys/block/sdg/queue/nr_requests
echo 4096 >/sys/block/sdh/queue/nr_requests
echo 4096 >/sys/block/sdi/queue/nr_requests
echo 4096 >/sys/block/sdj/queue/nr_requests
echo 4096 >/sys/block/sdk/queue/nr_requests
echo 4096 >/sys/block/sdl/queue/nr_requests
echo 4096 >/sys/block/sdm/queue/nr_requests
echo 4096 >/sys/block/sdn/queue/nr_requests
echo 4096 >/sys/block/sdo/queue/nr_requests
echo 4096 >/sys/block/sdp/queue/nr_requests
echo 4096 >/sys/block/sdq/queue/nr_requests
echo 4096 >/sys/block/sdr/queue/nr_requests
echo 4096 >/sys/block/sds/queue/nr_requests
echo 4096 >/sys/block/sdt/queue/nr_requests
echo 4096 >/sys/block/sdu/queue/nr_requests
echo 4096 >/sys/block/sdv/queue/nr_requests
echo 4096 >/sys/block/sdw/queue/nr_requests
echo 4096 >/sys/block/sdx/queue/nr_requests
echo 4096 >/sys/block/sdy/queue/nr_requests
echo 4096 >/sys/block/sdz/queue/nr_requests
echo 4096 >/sys/block/sdaa/queue/nr_requests
```

Huawei Technologies Co., Ltd
Submitted for Review: May 28, 2018
### Tuing Parameters and Options

```bash
echo 4096 >/sys/block/sdaj/queue.nr_requests
echo 4096 >/sys/block/sdak/queue.nr_requests
echo 4096 >/sys/block/sdal/queue.nr_requests
echo 4096 >/sys/block/sdam/queue.nr_requests
echo 4096 >/sys/block/sdan/queue.nr_requests
echo 4096 >/sys/block/sdao/queue.nr_requests
echo 4096 >/sys/block/sdap/queue.nr_requests
echo 4096 >/sys/block/sdaq/queue.nr_requests
echo 4096 >/sys/block/sdar/queue.nr_requests
echo 4096 >/sys/block/sdas/queue.nr_requests
echo 4096 >/sys/block/sdat/queue.nr_requests

• `scheduler.sh`

```bash
echo noop >/sys/block/sdb/queue/scheduler
echo noop >/sys/block/sdc/queue/scheduler
echo noop >/sys/block/sdd/queue/scheduler
echo noop >/sys/block/sde/queue/scheduler
echo noop >/sys/block/sdf/queue/scheduler
echo noop >/sys/block/sdg/queue/scheduler
echo noop >/sys/block/sdh/queue/scheduler
echo noop >/sys/block/sdi/queue/scheduler
echo noop >/sys/block/sdk/queue/scheduler
echo noop >/sys/block/sdl/queue/scheduler
echo noop >/sys/block/sdm/queue/scheduler
```

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echo noop >/sys/block/sdad/queue/scheduler
echo noop >/sys/block/sdae/queue/scheduler
echo noop >/sys/block/sdaf/queue/scheduler
echo noop >/sys/block/sdag/queue/scheduler
echo noop >/sys/block/sdah/queue/scheduler
echo noop >/sys/block/sdai/queue/scheduler
echo noop >/sys/block/sdaj/queue/scheduler
echo noop >/sys/block/sdak/queue/scheduler
echo noop >/sys/block/sdal/queue/scheduler
echo noop >/sys/block/sdam/queue/scheduler
echo noop >/sys/block/sdao/queue/scheduler
echo noop >/sys/block/sdap/queue/scheduler
echo noop >/sys/block/sdaq/queue/scheduler
echo noop >/sys/block/sdar/queue/scheduler
echo noop >/sys/block/sdas/queue/scheduler
echo noop >/sys/block/sdat/queue/scheduler
echo noop >/sys/block/sdau/queue/scheduler
echo noop >/sys/block/sdav/queue/scheduler
echo noop >/sys/block/sdaw/queue/scheduler
echo noop >/sys/block/sdax/queue/scheduler
echo noop >/sys/block/sday/queue/scheduler
echo noop >/sys/block/sdaz/queue/scheduler
echo noop >/sys/block/sdba/queue/scheduler
echo noop >/sys/block/sdbb/queue/scheduler
echo noop >/sys/block/sdbc/queue/scheduler
echo noop >/sys/block/sdbd/queue/scheduler
echo noop >/sys/block/sdbe/queue/scheduler
echo noop >/sys/block/sdbf/queue/scheduler
echo noop >/sys/block/sdbg/queue/scheduler
echo noop >/sys/block/sdbg/queue/scheduler
echo noop >/sys/block/sdbh/queue/scheduler
echo noop >/sys/block/sdbi/queue/scheduler
echo noop >/sys/block/sdbj/queue/scheduler
echo noop >/sys/block/sdbk/queue/scheduler
echo noop >/sys/block/sdbl/queue/scheduler
echo noop >/sys/block/sdbm/queue/scheduler
APPENDIX D: STORAGE CONFIGURATION CREATION

Environment
First, the CLI commands from the following command file are copied and pasted into the OceanStor 18500 V5 CLI window. These commands are executed on one of the Host Systems.

- mklun.txt

Next, the following shell script is executed on one of the Host Systems.

- mkvolume.sh

Step 1 - Create Disk Domains, Storage Pools, LUNs
The mklun.txt command file, listed below, includes all the CLI commands to perform the following actions:

- Create 16 disk domains
- Create 16 storage pools
- Create 64 LUNs
- Create one LUN group
- Add the 64 LUNs to the LUN group

The command file described above is included in the Supporting Files (see Appendix A) and listed below.

```
mklun.txt
create disk_domain name=dd00 disk_list=DAE000.0-17 tier0_hotspare_strategy=low disk_domain_id=0
create disk_domain name=dd01 disk_list=DAE004.0-17 tier0_hotspare_strategy=low disk_domain_id=1
create disk_domain name=dd02 disk_list=DAE020.0-17 tier0_hotspare_strategy=low disk_domain_id=2
create disk_domain name=dd03 disk_list=DAE024.0-17 tier0_hotspare_strategy=low disk_domain_id=3
create disk_domain name=dd04 disk_list=DAE100.0-17 tier0_hotspare_strategy=low disk_domain_id=4
create disk_domain name=dd05 disk_list=DAE104.0-17 tier0_hotspare_strategy=low disk_domain_id=5
create disk_domain name=dd06 disk_list=DAE120.0-17 tier0_hotspare_strategy=low disk_domain_id=6
create disk_domain name=dd07 disk_list=DAE124.0-17 tier0_hotspare_strategy=low disk_domain_id=7
create disk_domain name=dd08 disk_list=DAE200.0-17 tier0_hotspare_strategy=low disk_domain_id=8
create disk_domain name=dd09 disk_list=DAE204.0-17 tier0_hotspare_strategy=low disk_domain_id=9
create disk_domain name=dd10 disk_list=DAE220.0-17 tier0_hotspare_strategy=low disk_domain_id=10
create disk_domain name=dd11 disk_list=DAE224.0-17 tier0_hotspare_strategy=low disk_domain_id=11
create disk_domain name=dd12 disk_list=DAE300.0-17 tier0_hotspare_strategy=low disk_domain_id=12
```
create disk_domain name=dd13 disk_list=DAE304.0-17 tier0_hotspare_strategy=low
disk_domain_id=13
create disk_domain name=dd14 disk_list=DAE320.0-17 tier0_hotspare_strategy=low
disk_domain_id=14
create disk_domain name=dd15 disk_list=DAE324.0-17 tier0_hotspare_strategy=low
disk_domain_id=15
create storage_pool name=sp00 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=0 disk_domain_id=0
create storage_pool name=sp01 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=1 disk_domain_id=1
create storage_pool name=sp02 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=2 disk_domain_id=2
create storage_pool name=sp03 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=3 disk_domain_id=3
create storage_pool name=sp04 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=4 disk_domain_id=4
create storage_pool name=sp05 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=5 disk_domain_id=5
create storage_pool name=sp06 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=6 disk_domain_id=6
create storage_pool name=sp07 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=7 disk_domain_id=7
create storage_pool name=sp08 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=8 disk_domain_id=8
create storage_pool name=sp09 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=9 disk_domain_id=9
create storage_pool name=sp10 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=10 disk_domain_id=10
create storage_pool name=sp11 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=11 disk_domain_id=11
create storage_pool name=sp12 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=12 disk_domain_id=12
create storage_pool name=sp13 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=13 disk_domain_id=13
create storage_pool name=sp14 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=14 disk_domain_id=14
create storage_pool name=sp15 disk_type=SSD capacity=6705GB raid_level=RAID10
pool_id=15 disk_domain_id=15
create lun name=lun_sp00 lun_id_list=0-3 pool_id=0 capacity=1674GB
create lun name=lun_sp01 lun_id_list=4-7 pool_id=1 capacity=1674GB
create lun name=lun_sp02 lun_id_list=8-11 pool_id=2 capacity=1674GB
create lun name=lun_sp03 lun_id_list=12-15 pool_id=3 capacity=1674GB
create lun name=lun_sp04 lun_id_list=16-19 pool_id=4 capacity=1674GB
create lun name=lun_sp05 lun_id_list=20-23 pool_id=5 capacity=1674GB
create lun name=lun_sp06 lun_id_list=24-27 pool_id=6 capacity=1674GB
create lun name=lun_sp07 lun_id_list=28-31 pool_id=7 capacity=1674GB
create lun name=lun_sp08 lun_id_list=32-35 pool_id=8 capacity=1674GB
create lun name=lun_sp09 lun_id_list=36-39 pool_id=9 capacity=1674GB
create lun name=lun_sp10 lun_id_list=40-43 pool_id=10 capacity=1674GB
create lun name=lun_sp11 lun_id_list=44-47 pool_id=11 capacity=1674GB
create lun name=lun_sp12 lun_id_list=48-51 pool_id=12 capacity=1674GB
create lun name=lun_sp13 lun_id_list=52-55 pool_id=13 capacity=1674GB
create lun name=lun_sp14 lun_id_list=56-59 pool_id=14 capacity=1674GB
create lun name=lun_sp15 lun_id_list=60-63 pool_id=15 capacity=1674GB
create lun_group name=lg0 lun_group_id=0
add lun_group lun lun_group_id=0 lun_id_list=0-63
**Step 2 - Create Mapping View, Host Group and Host**

The mklun.txt command file, listed below, includes all the CLI commands to perform the following actions:

- Create 4 hosts
- Create a host group
- Create a mapping view
- Add the 4 hosts to the host group
- Add the host group and the LUN group to the mapping view
- Add the FC port’s WWN to the 4 hosts

The command file described above is included in the Supporting Files (see Appendix A) and listed below.

```
mklun.txt
create host name=host0 operating_system=Linux host_id=0
create host name=host1 operating_system=Linux host_id=1
create host name=host2 operating_system=Linux host_id=2
create host name=host3 operating_system=Linux host_id=3
create host_group name=hg0 host_group_id=0 host_id_list=0-3
create mapping_view name=mv1 mapping_view_id=1 lun_group_id=0 host_group_id=0
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1807b0
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1807b1
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1aa1e0
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1aa1e1
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2450
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2451
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2600
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2601
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2800
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c2801
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c7430
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c7431
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c23acd0
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c23acd1
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c28a9b0
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e1c28a9b1
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e2a1c10
add host initiator host_id=0 initiator_type=FC wwn=2100000e1e2a1c11
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff17df38
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff17df39
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff17dff4
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff553e1e
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff553e1f
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff2b0e74
add host initiator host_id=0 initiator_type=FC wwn=2100000e24ff2b0e75
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff17df5
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff17e0ba
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff17e0bb
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff17e0bc
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff17e0bd
add host initiator host_id=1 initiator_type=FC wwn=2100000e24ff369d90
```
add host initiator host_id=1 initiator_type=FC wwn=21000024ff369d91
add host initiator host_id=1 initiator_type=FC wwn=21000024ff37203c
add host initiator host_id=1 initiator_type=FC wwn=21000024ff37203d
add host initiator host_id=1 initiator_type=FC wwn=21000024ff3a3d5c
add host initiator host_id=1 initiator_type=FC wwn=21000024ff3a3d5d
add host initiator host_id=1 initiator_type=FC wwn=21000024ff3cc4ca
add host initiator host_id=1 initiator_type=FC wwn=21000024ff3cc4cb
add host initiator host_id=1 initiator_type=FC wwn=21000024ff4b81fc
add host initiator host_id=1 initiator_type=FC wwn=21000024ff4b82ea
add host initiator host_id=1 initiator_type=FC wwn=21000024ff4b82eb
add host initiator host_id=1 initiator_type=FC wwn=21000024ff5439d6
add host initiator host_id=1 initiator_type=FC wwn=21000024ff5439d7
add host initiator host_id=1 initiator_type=FC wwn=21000024ff543be2
add host initiator host_id=1 initiator_type=FC wwn=21000024ff543be3
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364e
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364f
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364g
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364h
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364i
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364j
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364k
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364l
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364m
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364n
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364o
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364p
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364q
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364r
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364s
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364t
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364u
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364v
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364w
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364x
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364y
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364z
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364aa
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ab
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ac
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ad
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ae
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364af
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ag
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ah
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ai
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364aj
add host initiator host_id=2 initiator_type=FC wwn=21000024ff5c364ak
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f42b9
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f42ba
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f431a
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f431b
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88a9
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88ab
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88ac
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88ad
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88ae
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88af
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88b12
add host initiator host_id=3 initiator_type=FC wwn=21000024ff7f88b13
add host initiator host_id=3 initiator_type=FC wwn=21000024ff536a85
add host initiator host_id=3 initiator_type=FC wwn=21000024ff536a84

Step 3 - Create Volumes on the Host Systems

The `mkvolume.sh` shell script, listed below, is invoked on the master Host Systems to perform the following actions:

- Create 64 physical volumes
- Create a volume group for the 64 physical volumes
- Create 18 Logical Volumes for ASU-1
- Create 18 Logical Volumes for ASU-2
- Create 2 Logical Volumes for ASU-3

The shell script described above is included in the Supporting Files (see Appendix A) and listed below.

```
mkvolume.sh
    pvcreate /dev/sdb
    pvcreate /dev/sdc
    pvcreate /dev/sdd
    pvcreate /dev/sde
    pvcreate /dev/sdf
    pvcreate /dev/sgd
    pvcreate /dev/sdh
    pvcreate /dev/sdi
    pvcreate /dev/sdj
    pvcreate /dev/sdk
    pvcreate /dev/sdl
    pvcreate /dev/sdm
    pvcreate /dev/sdn
    pvcreate /dev/sdo
    pvcreate /dev/sdp
    pvcreate /dev/sdq
    pvcreate /dev/sdr
    pvcreate /dev/sds
    pvcreate /dev/sdt
    pvcreate /dev/sdu
    pvcreate /dev/sdw
    pvcreate /dev/sdx
    pvcreate /dev/sdy
    pvcreate /dev/sdz
    pvcreate /dev/sdab
    pvcreate /dev/sdab
    pvcreate /dev/sdac
    pvcreate /dev/sdab
    pvcreate /dev/sdae
    pvcreate /dev/sdaf
    pvcreate /dev/sdag
    pvcreate /dev/sdah
    pvcreate /dev/sdai
    pvcreate /dev/sdaj
    pvcreate /dev/sdak
    pvcreate /dev/sdal
    pvcreate /dev/sdam
    pvcreate /dev/sdan
    pvcreate /dev/sdao
```
pvcreate /dev/sdap
pvcreate /dev/sdaq
pvcreate /dev/sdar
pvcreate /dev/sdat
pvcreate /dev/sdas
pvcreate /dev/sdav
pvcreate /dev/sdaw
pvcreate /dev/sdax
pvcreate /dev/sday
pvcreate /dev/sdba
pvcreate /dev/sdbb
pvcreate /dev/sdbc
pvcreate /dev/sdbd
pvcreate /dev/sdbf
pvcreate /dev/sdbg
pvcreate /dev/sdbh
pvcreate /dev/sdbi
pvcreate /dev/sdbj
pvcreate /dev/sdbk
pvcreate /dev/sdbl
pvcreate /dev/sdbm

vgcreate vg1 /dev/sdb /dev/sdc /dev/sdd /dev/sde /dev/sdf /dev/sdg /dev/sdh
/dev/sdi /dev/sdj /dev/sdk /dev/sdl /dev/sdm /dev/sdn /dev/sdo /dev/sdp
/dev/sdq /dev/sdr /dev/sds /dev/sdt /dev/sdv /dev/sdr /dev/sdw /dev/sdx
/dev/sdy /dev/sdz /dev/sdaa /dev/sdab /dev/sdac /dev/sdab /dev/sdab /dev/sdab
/dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab
/dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab
/dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab
/dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab /dev/sdab
lvcreate -n asu101 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu102 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu103 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu104 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu105 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu106 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu107 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu108 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu109 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu110 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu111 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu112 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu113 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu114 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu115 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu116 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu117 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu118 -i 64 -i 512 -c y -l 2540g vg1

lvcreate -n asu201 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu202 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu203 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu204 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu205 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu206 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu207 -i 64 -i 512 -c y -l 2540g vg1
lvcreate -n asu208 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu209 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu210 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu211 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu212 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu213 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu214 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu215 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu216 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu217 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu218 -i 64 -I 512 -C y -L 2540g vg1
lvcreate -n asu301 -i 64 -I 512 -C y -L 5080g vg1
lvcreate -n asu302 -i 64 -I 512 -C y -L 5080g vg1
APPENDIX E: CONFIGURATION INVENTORY

An inventory of the Tested Storage Configuration was collected during the execution the script `full_run.sh`. It generated the following log file:

- `profile1_volume.log` List of configured volumes before the INIT Phase.
- `profile1_storage.log` List of configured storage before the INIT Phase.
- `Profile2_volume.log` List of configured volumes after TSC restart.
- `Profile2_storage.log` List of configured storage after TSC restart.

The above log files are included in the Supporting Files (see Appendix A).
APPENDIX F: WORKLOAD GENERATOR

The ASUs accessed by the SPC-1 workload generator, are defined using the script `slave_asu.asu`.

The phases of the benchmark are executed using the script `full_run.sh`. The script pauses at the end of the PERSIST_1 test phase. Once the TSC has been restarted, the PERSIST_2 test phase is executed by pressing ENTER from the console where the script has been invoked.

The above scripts are included in the Supporting Files (see Appendix A) and listed below.

```
slave_asu.asu

ASU=1
OFFSET=0
SIZE=0
DEVICE=/dev/vg1/asu101
DEVICE=/dev/vg1/asu102
DEVICE=/dev/vg1/asu103
DEVICE=/dev/vg1/asu104
DEVICE=/dev/vg1/asu105
DEVICE=/dev/vg1/asu106
DEVICE=/dev/vg1/asu107
DEVICE=/dev/vg1/asu108
DEVICE=/dev/vg1/asu109
DEVICE=/dev/vg1/asu110
DEVICE=/dev/vg1/asu111
DEVICE=/dev/vg1/asu112
DEVICE=/dev/vg1/asu113
DEVICE=/dev/vg1/asu114
DEVICE=/dev/vg1/asu115
DEVICE=/dev/vg1/asu116
DEVICE=/dev/vg1/asu117
DEVICE=/dev/vg1/asu118

--
ASU=2
OFFSET=0
SIZE=0
DEVICE=/dev/vg1/asu201
DEVICE=/dev/vg1/asu202
DEVICE=/dev/vg1/asu203
DEVICE=/dev/vg1/asu204
DEVICE=/dev/vg1/asu205
DEVICE=/dev/vg1/asu206
DEVICE=/dev/vg1/asu207
DEVICE=/dev/vg1/asu208
DEVICE=/dev/vg1/asu209
DEVICE=/dev/vg1/asu210
DEVICE=/dev/vg1/asu211
DEVICE=/dev/vg1/asu212
DEVICE=/dev/vg1/asu213
DEVICE=/dev/vg1/asu214
DEVICE=/dev/vg1/asu215
DEVICE=/dev/vg1/asu216
```
```
DEVICE=/dev/vg1/asu217
DEVICE=/dev/vg1/asu218

ASU=3
OFFSET=0
SIZE=0
DEVICE=/dev/vg1/asu301
DEVICE=/dev/vg1/asu302

full_run.sh
#!/bin/sh

expect shstorage.tcl > profile1_storage.log
date > profile1_volume.log
lvdisplay >> profile1_volume.log
date >> profile1_volume.log

spc1 -run SPC1_INIT -iops 26000 -storage slave_asu.asu -output
    ./newtool/spc1_INIT_36k_iops -master 23host.HST

spc1 -run SPC1VERIFY -iops 1000 -storage slave_asu.asu -output
    ./newtool/spc1_VERIFY1_1000_iops

spc1 -run SPC1_METRICS -iops 4800000 -storage slave_asu.asu -output
    ./newtool/spc1_METRICS_4800k_iops -master 23host.HST

spc1 -run SPC1_VERIFY -iops 1000 -storage slave_asu.asu -output
    ./newtool/spc1_VERIFY2_1000_iops

spc1 -run SPC1_PERSIST_1 -iops 600000 -storage slave_asu.asu -output
    ./newtool/spc1_PERSIST_600k_iops -master 23host.HST

echo "Power cycle TSC, then Enter to continue"
read

expect shstorage.tcl > profile2_storage.log
date > profile2_volume.log
lvdisplay >> profile2_volume.log
date >> profile2_volume.log

spc1 -run SPC1_PERSIST_2 -iops 600000 -storage slave_asu.asu -output
    ~/newtool/spc1_PERSIST_600k_iops -master 23host.HST
```