SPC BENCHMARK 2™
FULL DISCLOSURE REPORT

HEWLETT-PACKARD COMPANY
HP XP7 STORAGE

SPC-2™ V1.5

Submitted for Review: December 1, 2014
Submission Identifier: B00070

First Edition – December 2014

Trademarks

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AUDIT CERTIFICATION

Chuck Paridon
Hewlett-Packard Company
8000 Foothills Blvd., M/S 5785
Roseville, CA 95747

November 30, 2014

The SPC Benchmark 2™ Reported Data listed below for the **HP XP7 Storage** was produced in compliance with the SPC Benchmark 2™ V1.5 Onsite Audit requirements.

SPC Benchmark 2™ V1.5 Reported Data	
Tested Storage Product (TSP) Name: HP XP7 Storage	
Metric	**Reported Result**
SPC-2 MBPS™	43,012.53
SPC-2 Price-Performance	$28.30/SPC-2 MBPS™
ASU Capacity	192,758.132 GB
Data Protection Level	Protected 2 *(RAID-5)*
Total Price *(including three-year maintenance)*	$1,217,462.00
Currency Used	U.S. Dollars
Target Country for availability, sales and support	USA

The following SPC Benchmark 2™ Onsite Audit requirements were reviewed and found compliant with V1.5 of the SPC Benchmark 2™ specification:

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items were verified by physical inspection and documentation supplied by Hewlett-Packard Company:
  - ✓ Physical Storage Capacity and related requirements.
  - ✓ Configured Storage Capacity and related requirements.
  - ✓ Addressable Storage Capacity and related requirements.
  - ✓ Capacity of each Logical Volume and related requirements.
  - ✓ Capacity of the Application Storage Unit (ASU) and related requirements.
- The total Application Storage Unit (ASU) Capacity was filled with random data prior to the execution of the SPC-2 Tests.
- An appropriate diagram of the Benchmark Configuration (BC)/Tested Storage Configuration (TSC).

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

AUDIT CERTIFICATION *(CONT.)*

- Physical verification of the components to match the above diagram.
- Listings and commands used to create and configure the Benchmark Configuration/Tested Storage Configuration.
- Documentation that no customer tunable parameter or option was changed from its default value.
- The following Host System items were verified by physical inspection and documentation supplied by Hewlett-Packard Company:
  - ✓ Required Host System configuration information.
  - ✓ The TSC boundary within the Host System.
- The following SPC-2 Workload Generator information was verified by physical inspection and documentation supplied by Hewlett-Packard Company:
  - ✓ The presence and version number of the Workload Generator on each Host System.
  - ✓ Commands and parameters used to configure the SPC-2 Workload Generator.
- The Test Results Files and resultant Summary Results Files received from Hewlett-Packard Company for each of the following were authentic, accurate, and compliant with all of the requirements and constraints of Clauses 6 and 7 of the SPC-2 Benchmark Specification:
  - ✓ Data Persistence Test
  - ✓ Large File Processing Test
  - ✓ Large Database Query Test
  - ✓ Video on Demand Delivery Test
- There were no differences between the Tested Storage Configuration and Priced Storage Configuration..
- The submitted pricing information met all of the requirements and constraints of Clause 9 of the SPC-2 Benchmark Specification.
- The Full Disclosure Report (FDR) met all of the requirements in Clause 10 of the SPC-2 Benchmark Specification.
- This successfully audited SPC measurement is not subject to an SPC Confidential Review.

Audit Notes:

There were no audit notes or exceptions.

Respectfully,

Walter E. Baker

Walter E. Baker
SPC Auditor

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

LETTER OF GOOD FAITH

Hewlett-Packard Company
3404 East Harmony Road
Fort Collins, Co 80528
USA

hp.com

Date: August 22, 2014

From: Michael Fuhrman, XP Lab; Hewlett-Packard Company

To: Walter E. Baker, SPC Auditor
Storage Performance Council (SPC)
643 Bair Island Road, Suite 103
Redwood City, CA 94063-2755

Subject: SPC-2 Letter of Good Faith for the HP XP7 Storage

Hewlett-Packard is the SPC-2 Test Sponsor for the above listed product. To the best of our knowledge and belief, the required SPC-2 benchmark results and materials we have submitted for that product are complete, accurate, and in full compliance with V1.5 of the SPC-2 benchmark specification.

In addition, we have reported any items in the Benchmark Configuration and execution of the benchmark necessary to reproduce the reported results even if the items are not explicitly required to be disclosed by the above SPC-2 benchmark specification.

Signed: _____
Chris Powers, Vice President, Data Center Development Unit, HP Storage

Date: 22Aug14
Date of Signature

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Hewlett-Packard Company – http://www.hp.com Chuck Paridon – chuck.paridon@hp.com 8000 Foothills Blvd., M/S 5785. Roseville, CA 95747 Phone: (916) 785-5155 FAX: (919) 785-1812
Test Sponsor Alternate Contact	Hewlett-Packard Company - http://www.hp.com Michael Fuhrman – machael.fuhrman@hp.com 8000 Foothills Blvd., M/S 5218 Roseville, CA 95747 Phone: (916) 785-3167 FAX: (919) 785-1812
Auditor	Storage Performance Council – http://www.storageperformance.org Walter E. Baker – AuditService@StoragePerformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

Revision Information and Key Dates	
SPC-2 Specification revision number	V1.5
SPC-2 Workload Generator revision number	V1.2
Date Results were first used publicly	December 1, 2014
Date FDR was submitted to the SPC	December 1, 2014
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	November 30, 2014

Tested Storage Product (TSP) Description

The HP XP7 Storage is bulletproof storage for mission-critical converged infrastructure where constant access to data is required-even in the event of a disaster. Designed for organizations that simply cannot afford any downtime, the XP7 combines an ultra-high-performance on-line scalable fully redundant hardware platform with unique data replication capabilities integrated with clustering solutions for complete business continuity and data protection. The XP7 can adapt to changing business conditions in real time, while increasing data center capacity and lifespan and providing solutions that decrease risk and costs.

Massive consolidation becomes a reality by managing open systems, mainframe, and HP Non-Stop applications all on a single XP7 with ultra-high performance, low latency and reduced data center costs.

SPC-2 Reported Data

SPC-2 Reported Data consists of three groups of information:

- The following SPC-2 Primary Metrics, which characterize the overall benchmark result:
  - SPC-2 MBPS™
  - SPC-2 Price Performance™
  - Application Storage Unit (ASU) Capacity
- Supplemental data to the SPC-2 Primary Metrics.
  - Total Price
  - Data Protection Level
  - Currency Used
  - Target Country
- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

SPC-2 Price-Performance™ is the ratio of **Total Price** to **SPC-2 MBPS™**.

ASU *(Application Storage Unit)* **Capacity** represents the total storage capacity available to be read and written in the course of executing the SPC-2 benchmark.

Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 17.

Data Protection Level of **Protected 2** using ***RAID-5*** by distributing check data corresponding to user data across multiple disks in the form of bit-by-bit parity.

> ***Protected 2:*** *The single point of failure of any* ***component*** *in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.*

Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-2 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency).*

The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

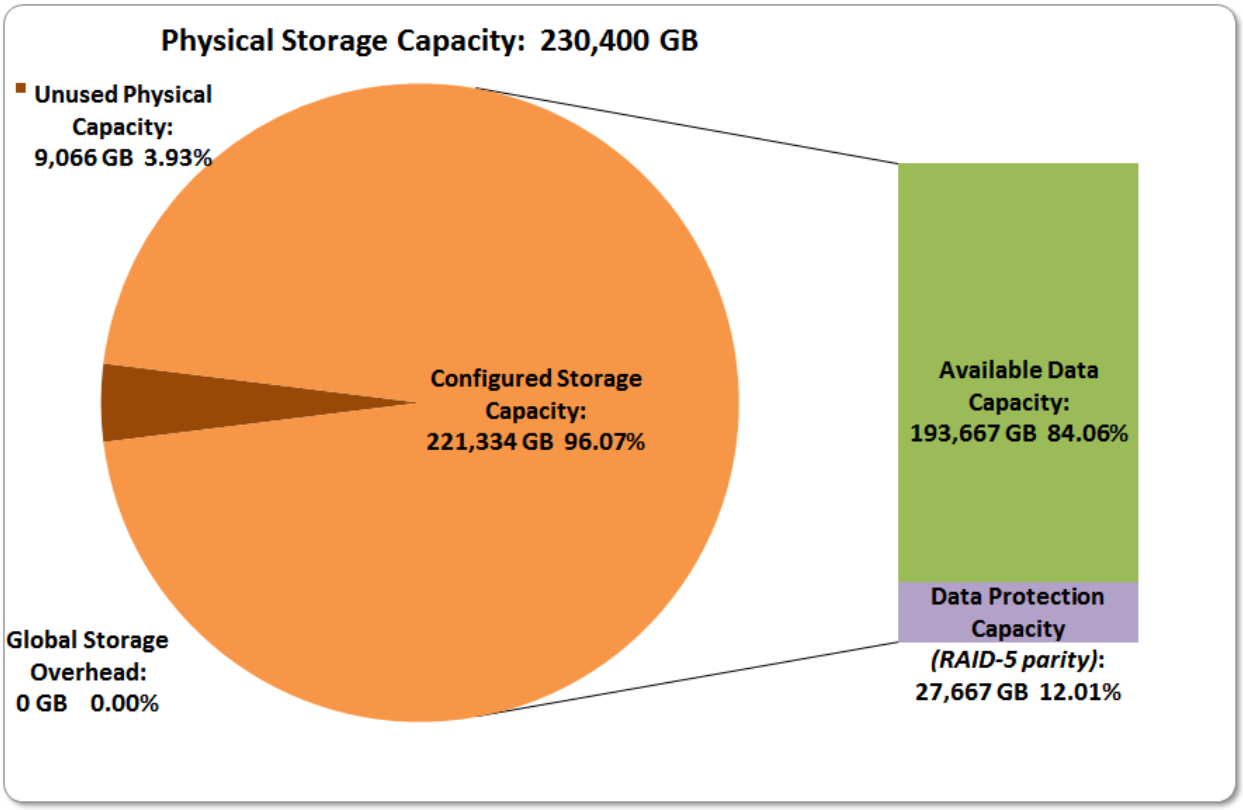
SPC-2 Reported Data *(continued)*

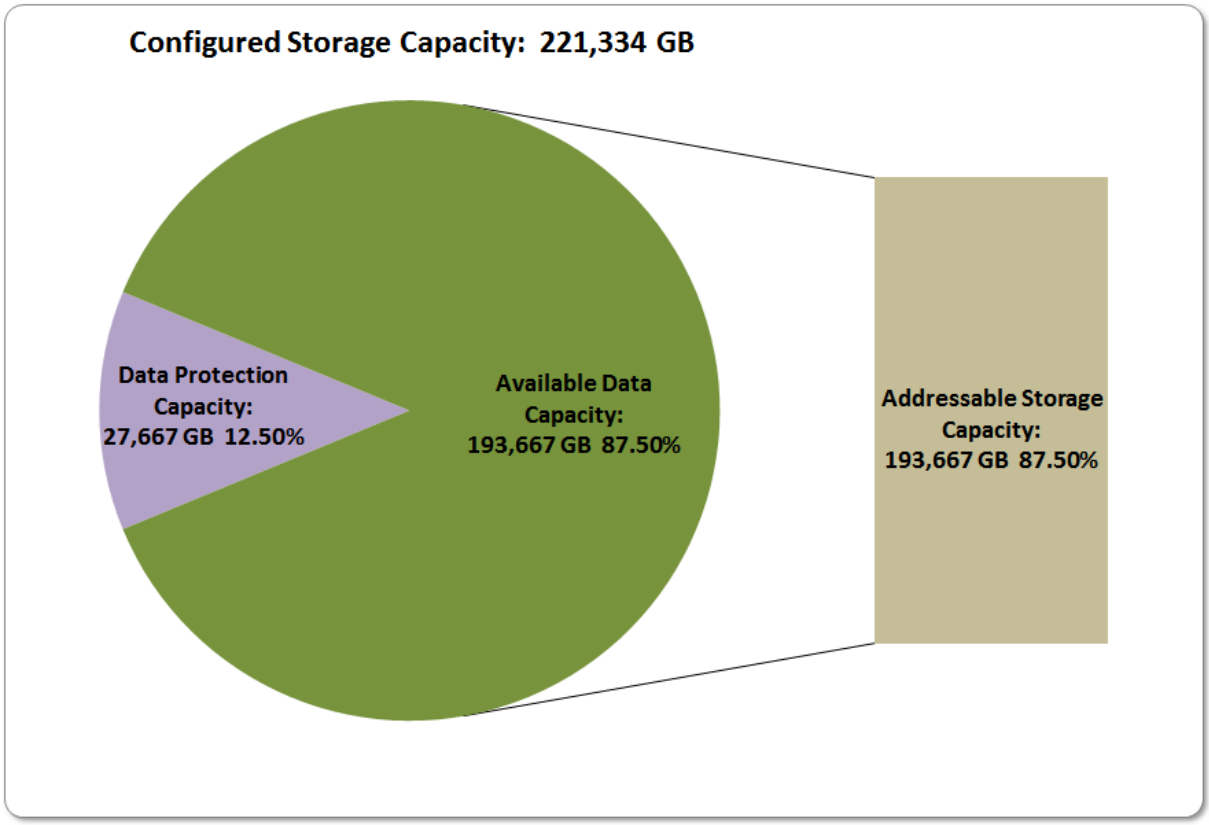
SPC-2 Reported Data				
HP XP7 Storage				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
43,012.53	$28.30	192,758.132	$1,217,462.00	Protected 2 *(RAID-5)*
The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video On Demand (VOD)				
Currency Used:		**"Target Country":**		
U.S. dollars		USA		
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	34,662.80			$35.12
Write Only:				
1024 KiB Transfer	20,697.93	1,400	14.78	
256 KiB Transfer	24,157.48	1,400	17.26	
Read-Write:				
1024 KiB Transfer	31,433.55	1,400	22.45	
256 KiB Transfer	33,082.57	1,400	23.63	
Read Only:				
1024 KiB Transfer	48,922.26	1,400	34.94	
256 KiB Transfer	49,682.98	1,400	35.49	
The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP Test Phases: (Write Only, Read-Write, and Read Only).				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LDQ Composite	48,762.56			$24.97
1024 KiB Transfer Size				
4 I/Os Outstanding	49,295.36	1,400	35.21	
1 I/O Outstanding	48,826.27	1,400	34.88	
64 KiB Transfer Size				
4 I/Os Outstanding	48,508.23	1,400	34.65	
1 I/O Outstanding	48,420.40	1,400	34.59	
The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ Test Phases: (1024 KiB and 64 KiB Transfer Sizes).				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
	45,612.23	58,000	0.79	$26.69

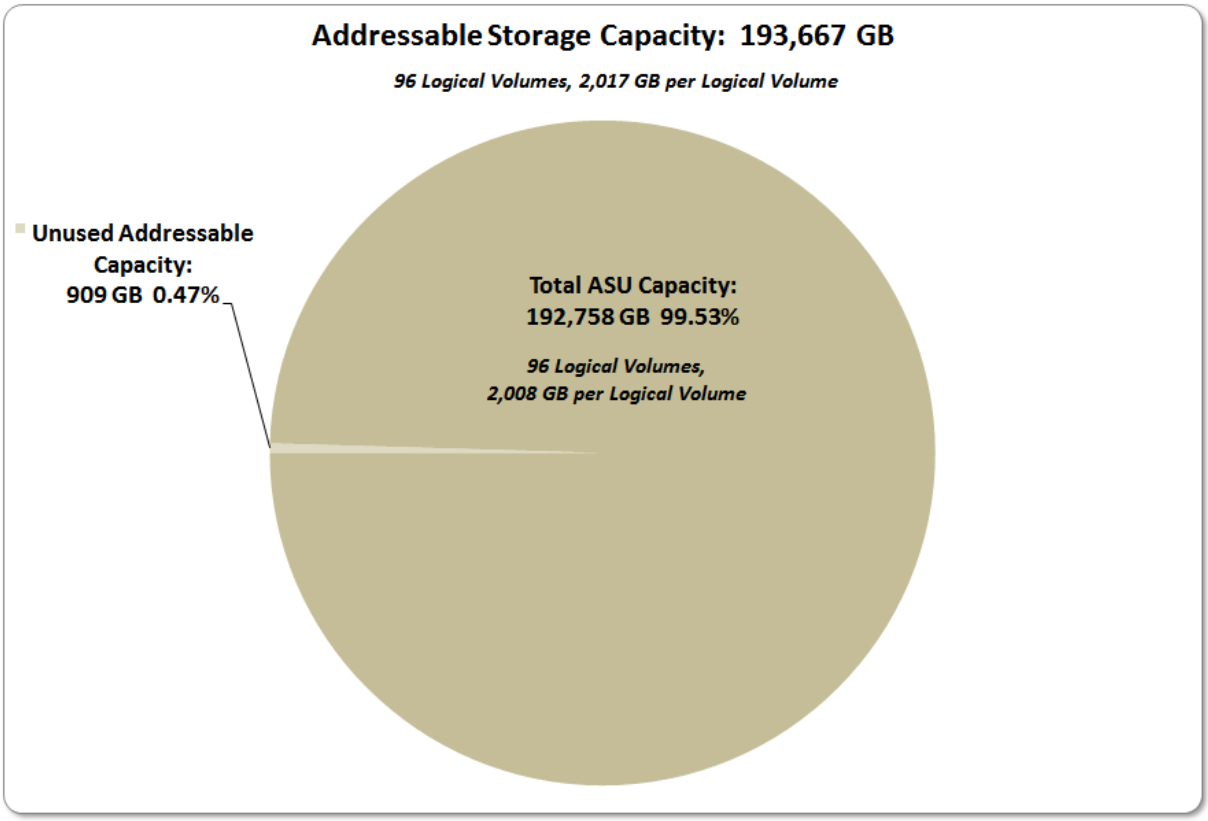
Storage Capacities, Relationships and Utilization

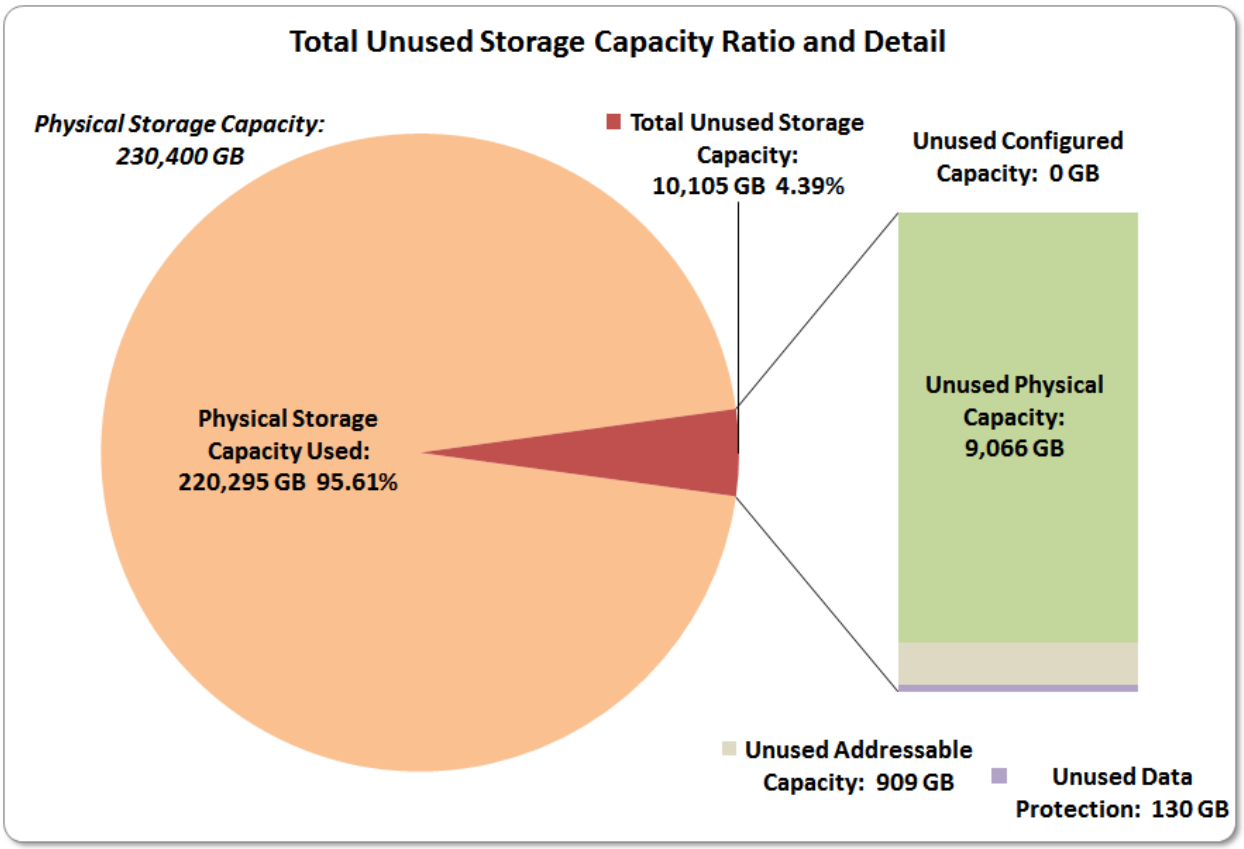
The following four charts and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.

The capacity values in each of the following four charts are listed as integer values, for readability, rather than the decimal values listed elsewhere in this document.




Configured Storage Capacity: 221,334 GB
Data Protection Capacity: 27,667 GB 12.50%
Available Data Capacity: 193,667 GB 87.50%
Addressable Storage Capacity: 193,667 GB 87.50%


Addressable Storage Capacity: 193,667 GB
96 Logical Volumes, 2,017 GB per Logical Volume
Unused Addressable Capacity: 909 GB 0.47%
Total ASU Capacity: 192,758 GB 99.53%
96 Logical Volumes, 2,008 GB per Logical Volume



SPC-2 Storage Capacity Utilization	
Application Utilization	83.66%
Protected Application Utilization	95.61%
Unused Storage Ratio	4.39%

Application Utilization: Total ASU Capacity *(192,758.132 GB)* divided by Physical Storage Capacity *(230,400.000 GB)*.

Protected Application Utilization: Total ASU Capacity *(192,758.132 GB)* plus total Data Protection Capacity *(27,666.756 GB)* minus unused Data Protection Capacity *(129.880 GB)* divided by Physical Storage Capacity *(230,400.000 GB)*.

Unused Storage Ratio: Total Unused Capacity *(10,104.992 GB)* divided by Physical Storage Capacity *(230,400.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 28-29 in the Full Disclosure Report.

Priced Storage Configuration Pricing

Qty	Part No.	Description	List Price	Ext. Price	Discount	Price
1	H6F99A	HP XP7 Storage System	$0.00	$0.00	63.00%	$0.00
1	H6F54A	HP XP7 Storage Rack	$17,100.00	$17,100.00	63.00%	$6,327.00
1	H6F56A	HP XP7 Primary DKC	$80,950.00	$80,950.00	63.00%	$29,951.50
2	H6F71A	HP XP7 Three Phase 60Hz PDU	$2,525.00	$5,050.00	63.00%	$1,868.50
2	H6F60A	HP XP7 2.5 inch Drive Chassis	$51,965.00	$103,930.00	63.00%	$38,454.10
1	H6F80A	HP XP7 60Hz DKC Power Cord	$692.00	$692.00	63.00%	$256.04
2	H6F81A	HP XP7 60Hz DKU Power Cord	$1,040.00	$2,080.00	63.00%	$769.60
2	H6G30A	HP XP7 16-port 8Gbps Fibre Host Adapter Pair	$17,967.00	$35,934.00	63.00%	$13,295.58
1	H6G08A	HP XP7 Processor Blade Pair	$211,180.00	$211,180.00	63.00%	$78,136.60
1	H6F95A	HP XP7 Service Processor	$21,399.00	$21,399.00	63.00%	$7,917.63
1	H6G20A	HP XP7 Cache Path Controller Adapter Pair	$64,654.00	$64,654.00	63.00%	$23,921.98
16	H6G21A	HP XP7 16GB Cache Memory Pair	$3,780.00	$60,480.00	63.00%	$22,377.60
2	H6G23A	HP XP7 Small Backup Memory Kit	$4,385.00	$8,770.00	63.00%	$3,244.90
2	H6G25A	HP XP7 128GB Backup Memory Pair	$37,210.00	$74,420.00	63.00%	$27,535.40
2	H6G06A	HP XP7 Disk Adapter Pair	$19,563.00	$39,126.00	63.00%	$14,476.62
1	H6G10A	HP XP7 1M Cu Intra-chassis Dev Int Cable	$5,647.00	$5,647.00	63.00%	$2,089.39
3	H6G11A	HP XP7 2M Cu Intra-rack Dev Int Cable	$5,647.00	$16,941.00	63.00%	$6,268.17
384	H6G40A	HP XP7 300GB 15K 2.5in SAS HDD	$1,550.00	$595,200.00	63.00%	$220,224.00
1	H6F54A	HP XP7 Storage Rack	$17,100.00	$17,100.00	63.00%	$6,327.00
1	H6F57A	HP XP7 Secondary DKC	$85,880.00	$85,880.00	63.00%	$31,775.60
2	H6F71A	HP XP7 Three Phase 60Hz PDU	$2,525.00	$5,050.00	63.00%	$1,868.50
2	H6F60A	HP XP7 2.5 inch Drive Chassis	$51,965.00	$103,930.00	63.00%	$38,454.10
1	H6F80A	HP XP7 60Hz DKC Power Cord	$692.00	$692.00	63.00%	$256.04
2	H6F81A	HP XP7 60Hz DKU Power Cord	$1,040.00	$2,080.00	63.00%	$769.60
2	H6G30A	HP XP7 16-port 8Gbps Fibre Host Adapter Pair	$17,967.00	$35,934.00	63.00%	$13,295.58
1	H6G08A	HP XP7 Processor Blade Pair	$211,180.00	$211,180.00	63.00%	$78,136.60
1	H6F97A	HP XP7 Internal Hub	$4,737.00	$4,737.00	63.00%	$1,752.69
1	H6G20A	HP XP7 Cache Path Controller Adapter Pair	$64,654.00	$64,654.00	63.00%	$23,921.98
16	H6G21A	HP XP7 16GB Cache Memory Pair	$3,780.00	$60,480.00	63.00%	$22,377.60
2	H6G23A	HP XP7 Small Backup Memory Kit	$4,385.00	8770.00	63.00%	$3,244.90
2	H6G25A	HP XP7 128GB Backup Memory Pair	$37,210.00	$74,420.00	63.00%	$27,535.40
2	H6G06A	HP XP7 Disk Adapter Pair	$19,563.00	$39,126.00	63.00%	$14,476.62
1	H6G00A	HP XP7 5M DKC Interconnect Kit	$17,379.00	$17,379.00	63.00%	$6,430.23
1	H6G03A	HP XP7 5M DKC Interconnect Cable	$13,292.00	$13,292.00	63.00%	$4,918.04
1	H6G10A	HP XP7 1M Cu Intra-chassis Dev Int Cable	$5,647.00	$5,647.00	63.00%	$2,089.39
3	H6G11A	HP XP7 2M Cu Intra-rack Dev Int Cable	$5,647.00	$16,941.00	63.00%	$6,268.17
384	H6G40A	HP XP7 300GB 15K 2.5in SAS HDD	$1,550.00	$595,200.00	63.00%	$220,224.00
1	TK914AA	HP XP7 Array Mgr Suite Base LTU	$271.00	$271.00	63.00%	$100.27
173	TK914AC	HP XP7 Array Mgr Suite 1TB 101-250TB LTU	$1,762.00	$304,826.00	63.00%	$112,785.62

Priced Storage Configuration Pricing *(continued)*

Qty	Part No.	Description	List Price	Ext. Price	Discount	Price
Services and Support						
1	HA114A1	HP Installation and Startup Service	$0.00	$0.00	50.00%	$0.00
1	HA114A1	HP Startup XP7 P9500 Array DKC Mod 0 SVC	$22,125.00	$22,125.00	50.00%	$11,062.50
1	HA114A1	HP Startup XP7 P9500 Array DKC DKU SVC	$1,775.00	$1,775.00	50.00%	$887.50
4	HA114A1	HP Startup XP7 P9500 Array Expansion SVC	$900.00	$3,600.00	50.00%	$1,800.00
1	HA114A1	HP Startup XP7 P9500 Software Type 6 SVC	$5,250.00	$5,250.00	50.00%	$2,625.00
1	H7J34A3	HP 3yr Foundation Care 24x7 Service	$0.00	$0.00	63.00%	$0.00
173	H7J34A3	HP XP7 Array Mgr St 101-250TB LTU SWSup	$375.00	$64,875.00	63.00%	$24,003.75
		Total		*$3,108,767.00*		*$1,154,501.29*
Additional Hardware						
64	QK734AH	HP Premier Flex LC/LC OM4 2f 5m Cable	$114.00	$7,296.00	35.00%	$4,742.40
32	QW972A	HP SN1000Q 16Gb 2P FC HBA	$2,799.00	$89,568.00	35.00%	$58,219.00
		Total				*$62,961.40*
		Grand Total				**$1,217,462.69**

Note: Line item "HP XP7 Primary DKC" includes:

- **1 HP XP7 Service Processor (SVP)**
- **1 HP XP7 Processor Blade Pair**
- **1 HP XP7 Cache Path Controller Adapter Pair**

Line item "HP XP7 Secondary DKC" includes:

- **1 HP XP7 Processor Blade Pair**
- **1 HP XP7 Cache Path Controller Adapter Pair**

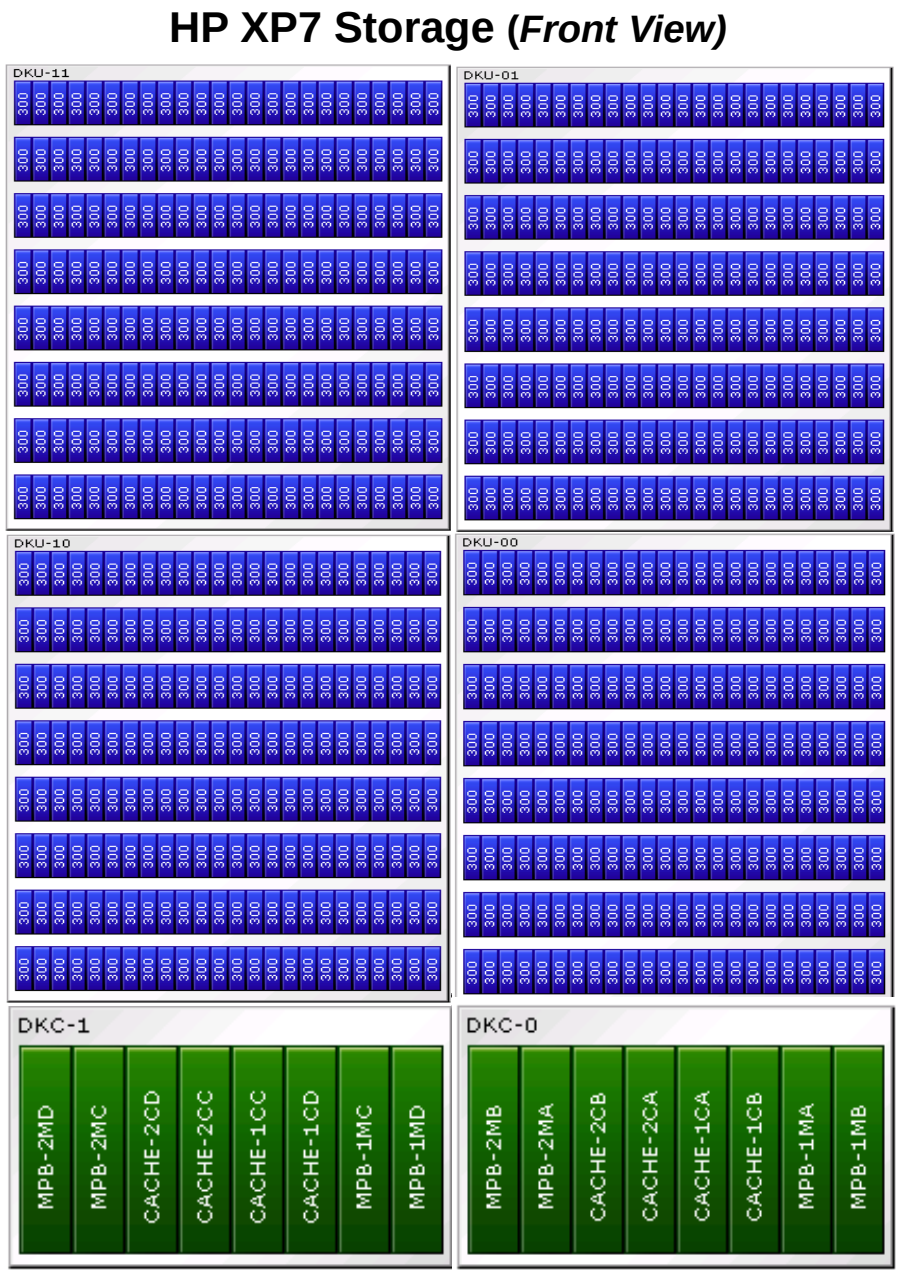
The above pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.

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

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

Priced Storage Configuration Diagram *(front view)*



4 – 2.5 inch Drive Chassis (DKU)

768 – 300 GB, 15K RPM, 2.5" SAS disk drives
192 per Drive Chassis

Primary and Secondary Controller Chassis (DKC-0, DKC-1)

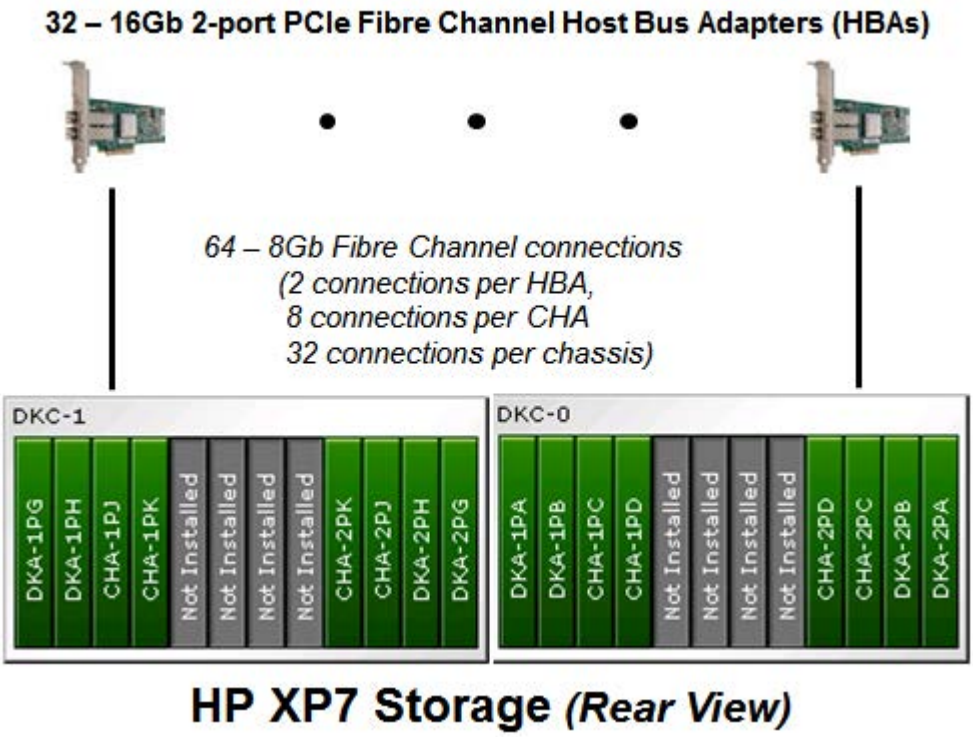
1 – Service Processor *(in chassis DKC-0)*

8 – MP Blades (MPB) *(2 pairs/4 MP blades per chassis)*

8 – Cache Path Controller Adapters (CACHE)
(2 pairs/4 adapters per chassis)

64 – Cache Memory Modules *(16 pairs/32 modules per chassis)*
(128 GB/module, 512 GB/chassis, 1024 GB total)

Priced Storage Configuration Diagram *(rear view)*



HP XP7 Storage *(Rear View)*

Primary and Secondary Controller Chassis (DKC-0, DKC-1)

4 – 16 port, 8Gb FC Host Adapters (CHA)

(2 – 8 port boards per adapter, 2 adapters per chassis)
(32 ports per chassis, 64 ports total)
(32 ports used per chassis, 64 ports used total)

4 – Disk Adapters (DKA) (SAS controllers)

(2 boards per adapter, 4 – 6Gb connections per board)
(2 adapters per chassis, 8 – 6Gb connections per adapter)
(16 connections per chassis, 32 connections total)
(16 connections used per chassis, 32 connections used total)

Priced Storage Configuration Components

Priced Storage Configuration
32 – 16Gb 2-port PCIe Fibre Channel Host Bus Adapters (HBAs) *(2 HBAs per server)*
HP XP7 Storage Primary and Secondary Controller Chassis (DKC-0, DKC-1) 1 – Service Processor *(in chassis DKC-0)* 8 – MP Blades (MPB) in 4 pairs *(2 pairs/4 MP Blades per chassis)* 8 – Cache Path Controller Adapters (CACHE) in 4 pairs *(2 pairs/4 adapters per chassis)* 64 – Cache Memory Modules in 32 pairs *(16 pairs/32 modules per chassis)* *(16 GB per module, 512 GB per chassis, 1024 GB total)* 8 – Backup Memory Modules in 4 pairs *(2 pairs/4 modules per chassis)* *(128 GB per module, 512 GB per chassis, 1024 GB total)* 4 – 16-port, 8Gb FC Host Adapters (CHA) *(2 – 8-port boards per adapter, 2 adapters per chassis)* *(16 ports per adapter,32 ports per chassis, 64 ports total)* *(32 ports used per chassis, 64 ports used total)* 4 – Disk Adapters (DKA) in 4 pairs *(SAS controllers)* *(2 boards per adapter, 4 – 6Gb connections per board)* *(2 adapters per chassis, 8 – 6Gb connections per adapter)* *(16 connections per chassis, 32 connections total)* *(16 connections used per chassis, 32 connections used total)*
4 – 2.5 inch Drive Chassis (DKU)
768 – 300 GB, 15K RPM, 2.5” SAS disk drives *(192 disk drives per Drive Chassis)*
2 – 19” 42U Storage Racks each with 2 Three-Phase 60Hz PDUs

CONFIGURATION INFORMATION

This portion of the Full Disclosure Report documents and illustrates the detailed information necessary to recreate the Benchmark Configuration (BC), including the Tested Storage Configuration (TSC), so that the SPC-2 benchmark result produced by the BC may be independently reproduced.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

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

Clause 10.6.6

The FDR will contain a one page BC/TSC diagram that illustrates all major components of the BC/TSC.

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) is illustrated on page 23 *(Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram)*.

Storage Network Configuration

Clause 10.6.6.1

If a storage network was configured as a part of the Tested Storage Configuration and the Benchmark Configuration described in Clause 10.6.6 contains a high-level illustration of the network configuration, the Executive Summary will contain a one page topology diagram of the storage network as illustrated in Figure 10.11.

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

Host System and Tested Storage Configuration Table

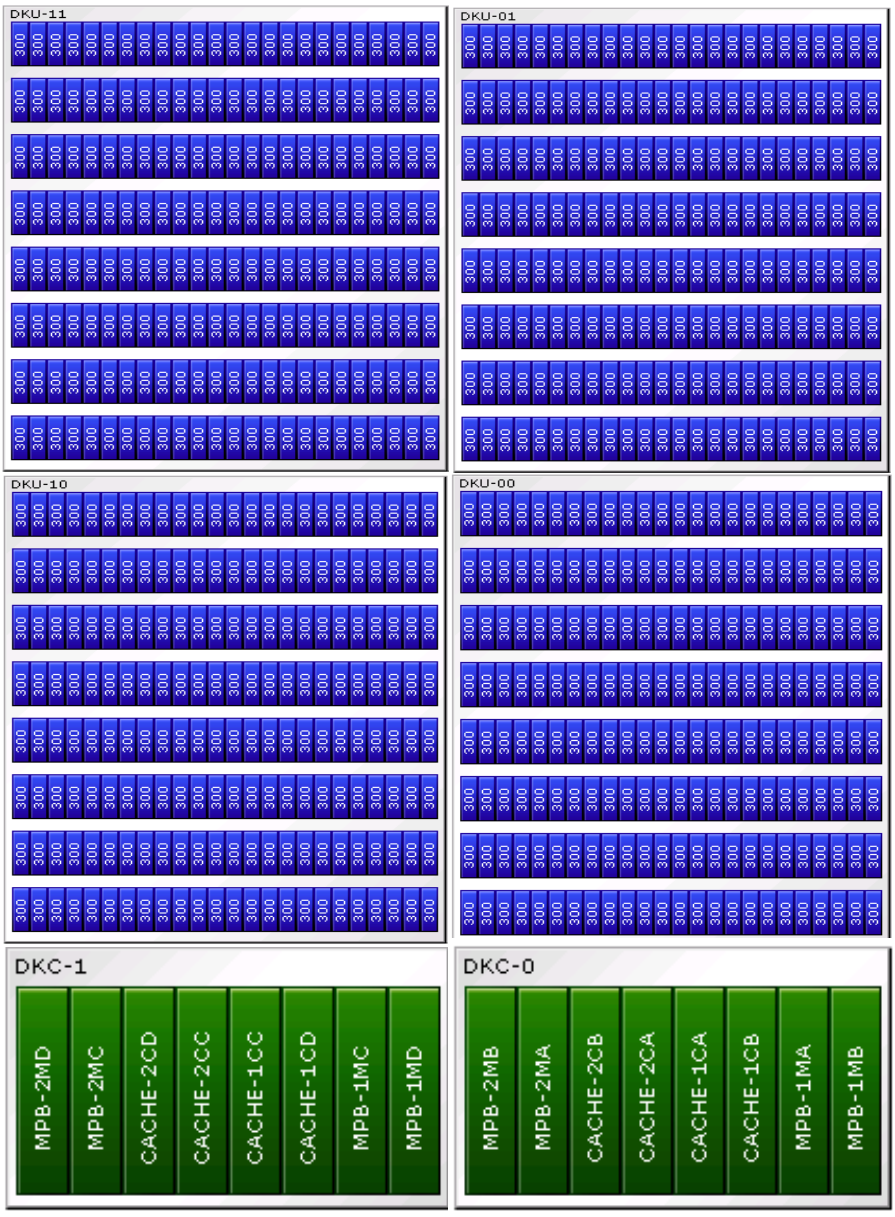
Clause 10.6.6.2

The FDR will contain a table that lists the major components of each Host System and the Tested Storage Configuration.

The components that comprise each Host System and the Tested Storage Configuration are listed in the table that appears on page 25 *(Host System and Tested Storage Configuration Components)*.

Benchmark Configuration/Tested Storage Configuration Diagram *(Front View)*

HP XP7 Storage (*Front View*)



4 – 2.5 inch Drive Chassis (DKU)

768 – 300 GB, 15K RPM, 2.5" SAS disk drives
192 per Drive Chassis

Primary and Secondary Controller Chassis (DKC-0, DKC-1)

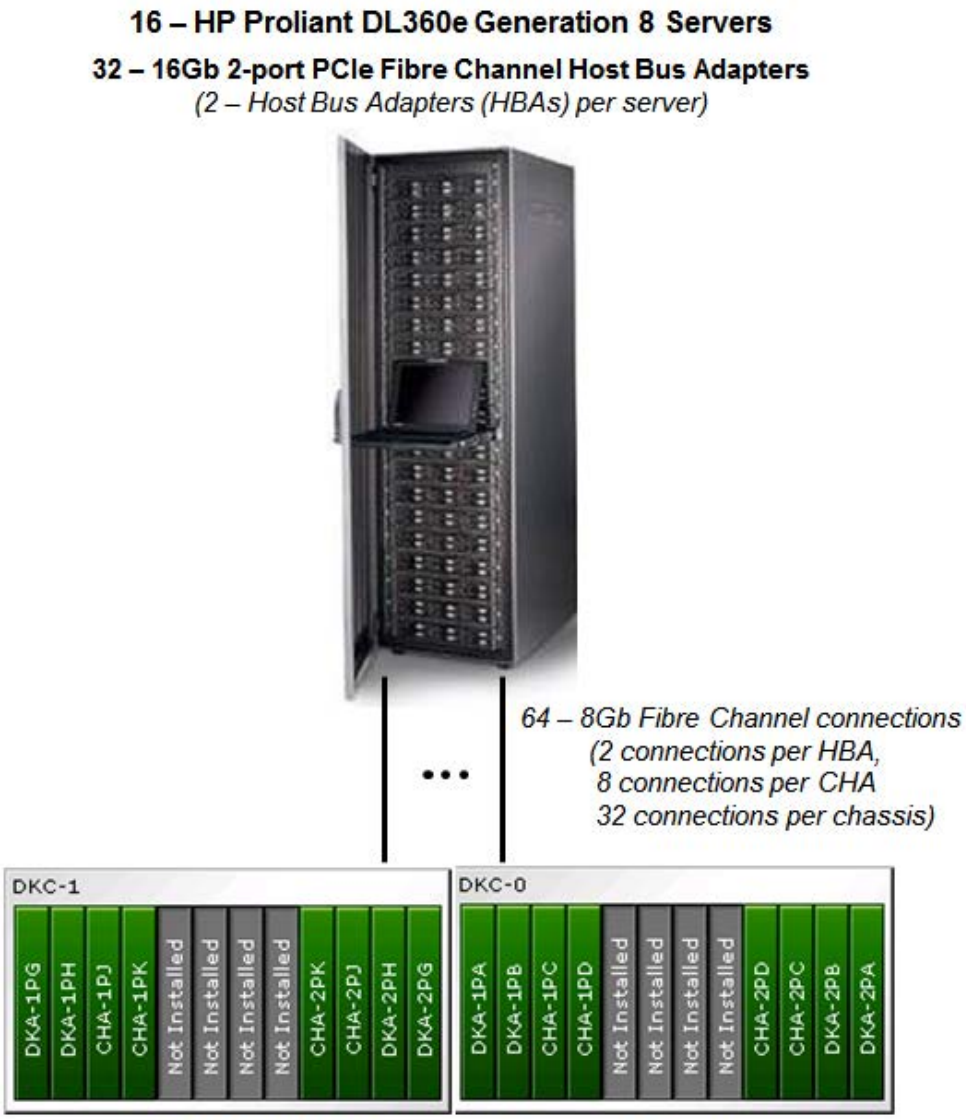
1 – Service Processor *(in chassis DKC-0)*

8 – MP Blades (MPB) *(2 pairs/4 MP blades per chassis)*

8 – Cache Path Controller Adapters (CACHE)
(2 pairs/4 adapters per chassis)

64 – Cache Memory Modules *(16 pairs/32 modules per chassis)*
(128 GB/module, 512 GB/chassis, 1024 GB total)

Benchmark Configuration/Tested Storage Configuration Diagram *(Rear View)*



HP XP7 Storage *(Rear View)*

Primary and Secondary Controller Chassis (DKC-0, DKC-1)

4 – 16 port, 8Gb FC Host Adapters (CHA)

(2 – 8 port boards per adapter, 2 adapters per chassis)
(32 ports per chassis, 64 ports total)
(32 ports used per chassis, 64 ports used total)

4 – Disk Adapters (DKA) (SAS controllers)

(2 boards per adapter, 4 – 6Gb connections per board)
(2 adapters per chassis, 8 – 6Gb connections per adapter)
(16 connections per chassis, 32 connections total)
(16 connections used per chassis, 32 connections used total)

Host System and Tested Storage Configuration Components

Host Systems
16 – HP Proliant DL360e Gen8 Servers, each with 2 – Intel® Xeon® E5-2440V2 1.90GHz processors 8 cores, 20 MB Intel® Smart Cache 32 GB main memory Microsoft Windows Server 2008 R2 Enterprise x64 SP1 PCIe
Tested Storage Configuration
32 – 16Gb 2-port PCIe Fibre Channel Host Bus Adapters (HBAs) *(2 HBAs per server)*
HP XP7 Storage Primary and Secondary Controller Chassis (DKC-0, DKC-1) 1 – Service Processor *(in chassis DKC-0)* 8 – MP Blades (MPB) in 4 pairs *(2 pairs/4 MP Blades per chassis)* 8 – Cache Path Controller Adapters (CACHE) in 4 pairs *(2 pairs/4 adapters per chassis)* 64 – Cache Memory Modules in 32 pairs *(16 pairs/32 modules per chassis)* *(16 GB per module, 512 GB per chassis, 1024 GB total)* 8 – Backup Memory Modules in 4 pairs *(2 pairs/4 modules per chassis)* *(128 GB per module, 512 GB per chassis, 1024 GB total)* 4 – 16-port, 8Gb FC Host Adapters (CHA) *(2 – 8-port boards per adapter, 2 adapters per chassis)* *(16 ports per adapter,32 ports per chassis, 64 ports total)* *(32 ports used per chassis, 64 ports used total)* 4 – Disk Adapters (DKA) in 4 pairs *(SAS controllers)* *(2 boards per adapter, 4 – 6Gb connections per board)* *(2 adapters per chassis, 8 – 6Gb connections per adapter)* *(16 connections per chassis, 32 connections total)* *(16 connections used per chassis, 32 connections used total)*
4 – 2.5 inch Drive Chassis (DKU)
768 – 300 GB, 15K RPM, 2.5” SAS disk drives *(192 disk drives per Drive Chassis)*
2 – 19” 42U Storage Racks each with 2 Three-Phase 60Hz PDUs

Customer Tunable Parameters and Options

Clause 10.6.7.1

All Benchmark Configuration (BC) components with customer tunable parameter and options that have been altered from their default values must be listed in the FDR. The FDR entry for each of those components must include both the name of the component and the altered value of the parameter or option. If the parameter name is not self-explanatory to a knowledgeable practitioner, a brief description of the parameter's use must also be included in the FDR entry.

Appendix B: Customer Tunable Parameters and Options on page 70 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Creation and Configuration

Clause 10.6.7.2

The Full Disclosure Report must include sufficient information to recreate the logical representation of the Tested Storage Configuration (TSC). In addition to customer tunable parameters and options (Clause10.6.6.1), that information must include, at a minimum:

- *A diagram and/or description of the following:*
  - *All physical components that comprise the TSC. Those components are also illustrated in the BC Configuration Diagram in Clause 10.6.5.7 and the Storage Network Configuration Diagram in Clause 10.6.5.8.*
  - *The logical representation of the TSC, configured from the above components that will be presented to the SPC-2 Workload Generator.*
- *Listings of scripts used to create the logical representation of the TSC.*
- *If scripts were not used, a description of the process used with sufficient detail to recreate the logical representation of the TSC.*

Appendix C: Tested Storage Configuration (TSC) Creation on page 71 contains the detailed information that describes how to create and configure the logical TSC.

SPC-2 Workload Generator Storage Configuration

Clause 10.6.7.3

The Full Disclosure Report will include all SPC-2 Workload Generator storage configuration commands and parameters used in the SPC-2 benchmark measurement.

The SPC-2 Workload Generator storage configuration commands and parameters for this measurement appear in Appendix D: SPC-2 Workload Generator Storage Commands and Parameter Files on page 80.

ASU Pre-Fill

Clause 6.3.3

The SPC-2 ASU is required to be completely filled with specified content prior to the execution of audited SPC-2 Tests. The content is required to consist of random data pattern such as that produced by an SPC recommended tool.

…

Clause 6.3.3.3

The required ASU pre-fill must be executed as the first step in the uninterrupted benchmark execution sequence described in Clause 6.4.2. That uninterrupted sequence will consist of: ASU Pre-Fill, Large File Processing, Large Database Query, Video on Demand Delivery and Persistence Test Run 1. The only exception to this requirement is described in Clause 6.3.3.4.

Clause 6.3.3.4

If approved by the Auditor, the Test Sponsor may complete the required ASU pre-fill prior to the execution of the audited SPC-2 Tests and not as part of the SPC-2 Test execution sequence.

The Auditor will verify the required random data pattern content in the ASU prior to the execution of the audited SPC-2 Tests. If that verification fails, the Test Sponsor is required to reload the specified content to the ASU.

The configuration file used to complete the required ASU pre-fill appears in Appendix D: SPC-2 Workload Generator Storage Commands and Parameter Files on page 80.

SPC-2 DATA REPOSITORY

This portion of the Full Disclosure Report presents the detailed information that fully documents the various SPC-2 storage capacities and mappings used in the Tested Storage Configuration. SPC-2 Data Repository Definitions on page 65 contains definitions of terms specific to the SPC-2 Data Repository.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

SPC-2 Storage Capacities and Relationships

Clause 10.6.8.1

Two tables and four charts documenting the storage capacities and relationships of the SPC-2 Storage Hierarchy (Clause 2.1) shall be included in the FDR. … The capacity value in each chart may be listed as an integer value, for readability, rather than the decimal value listed in the table below.

SPC-2 Storage Capacities

The Physical Storage Capacity consisted of 230,400.000 GB distributed over 768 disk drives each with a formatted capacity of 300.000 GB. There was 9,065.953 GB (3.93%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 0.000 GB (0.00%) of the Physical Storage Capacity. There was 0.000 GB (0.00%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 99.53% of the Addressable Storage Capacity resulting in 909.159 GB (0.47%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(RAID-5)* capacity was 27,666.756 GB of which 27,536.876 GB was utilized. The total Unused Storage was 10,104.992 GB.

Note: The configured Storage Devices may include additional storage capacity reserved for system overhead, which is not accessible for application use. That storage capacity may not be included in the value presented for Physical Storage Capacity.

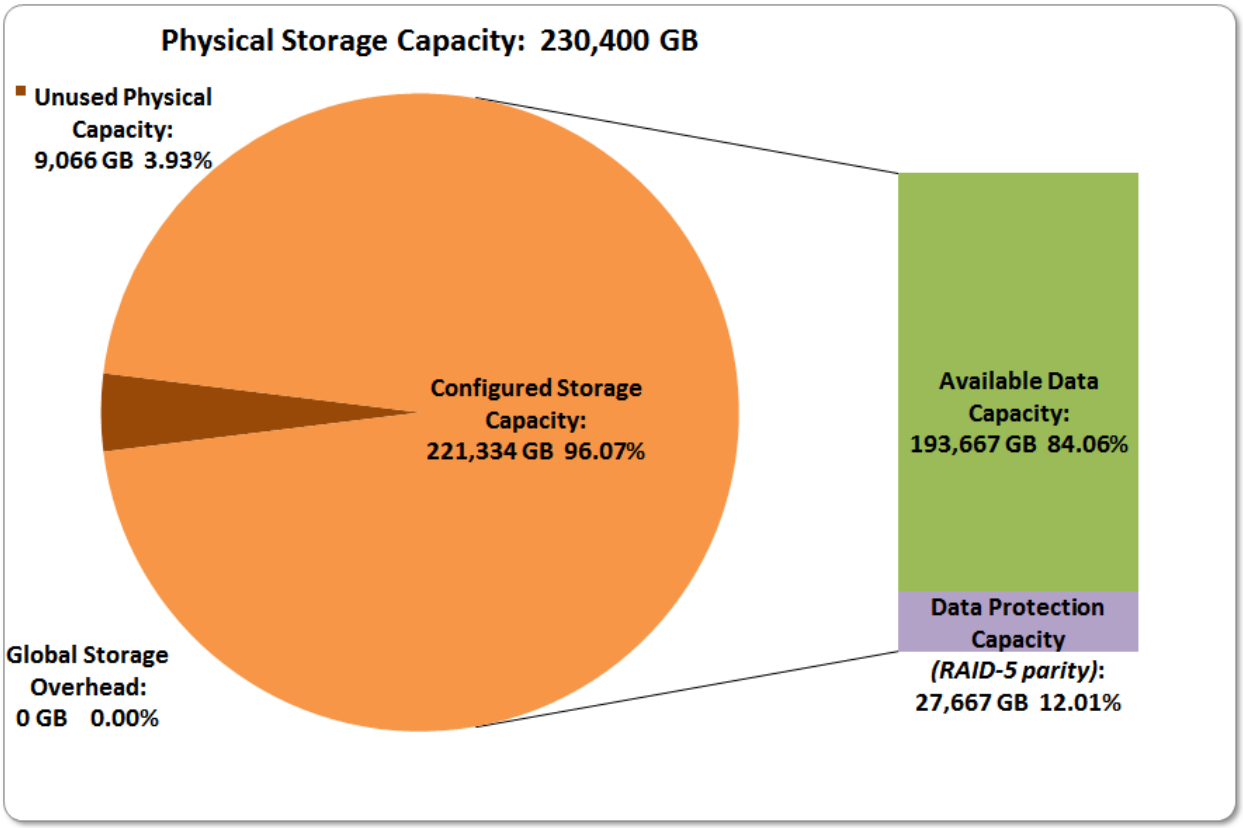
SPC-2 Storage Capacities

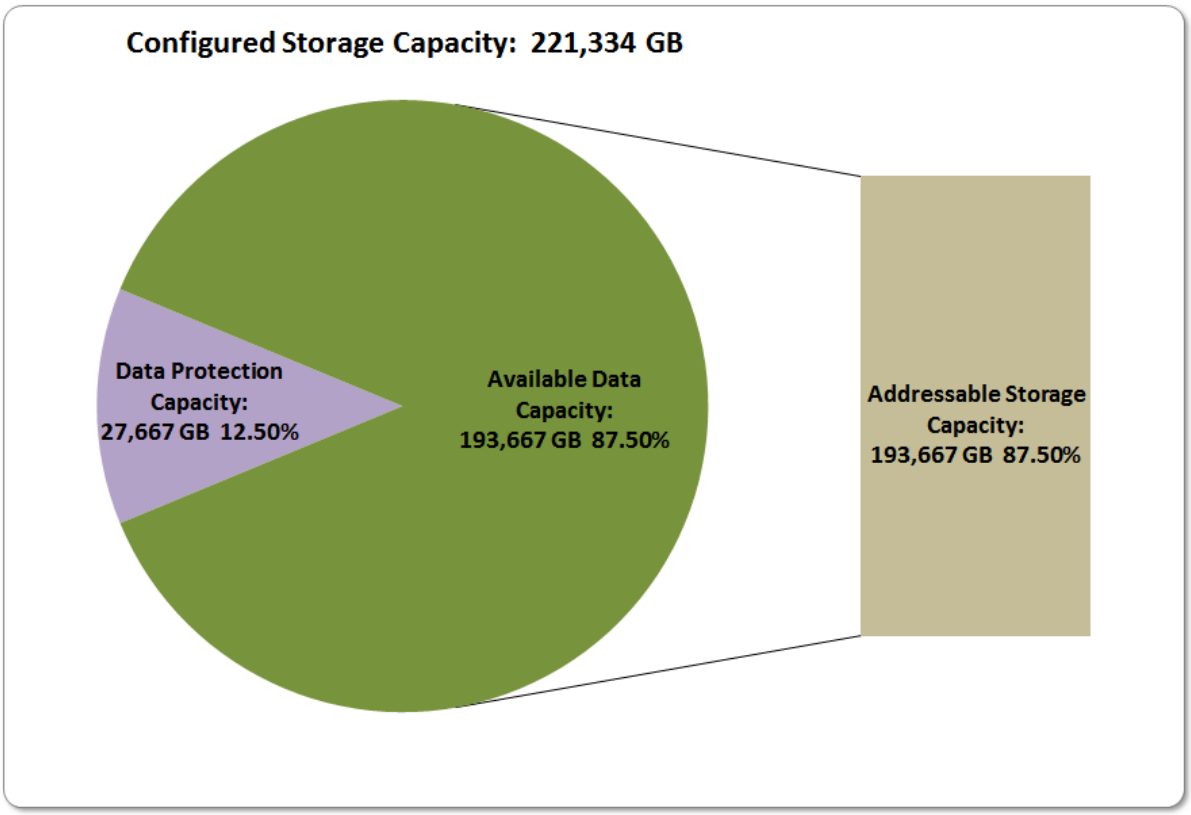
Storage Hierarchy Component	Units	Capacity
Total ASU Capacity	Gigabytes (GB)	192,758.132
Addressable Storage Capacity	Gigabytes (GB)	193,667.291
Configured Storage Capacity	Gigabytes (GB)	221,334.047
Physical Storage Capacity	Gigabytes (GB)	230,400.000
Data Protection *(RAID-5)*	Gigabytes (GB)	27,666.756
Required Storage	Gigabytes (GB)	0.000
Global Storage Overhead	Gigabytes (GB)	0.000
Total Unused Storage	Gigabytes (GB)	10,104.992

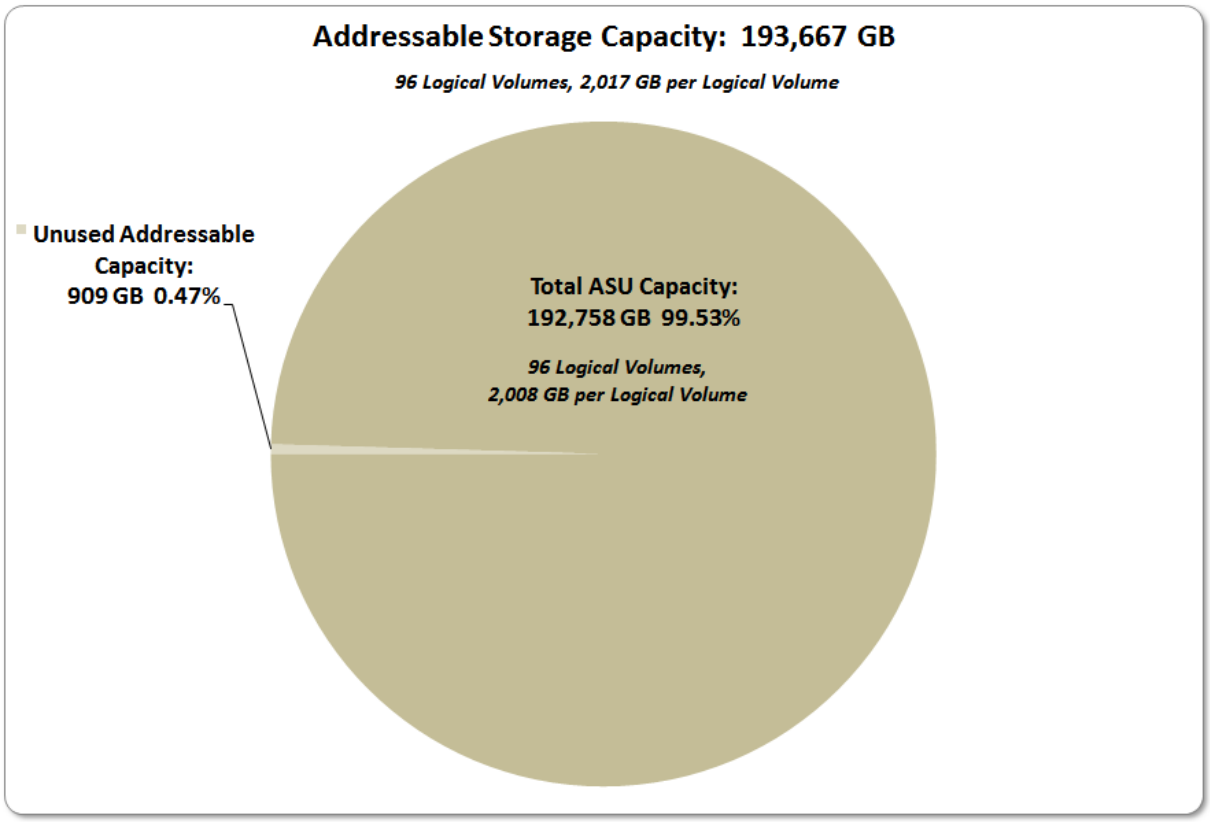
SPC-2 Storage Hierarchy Ratios

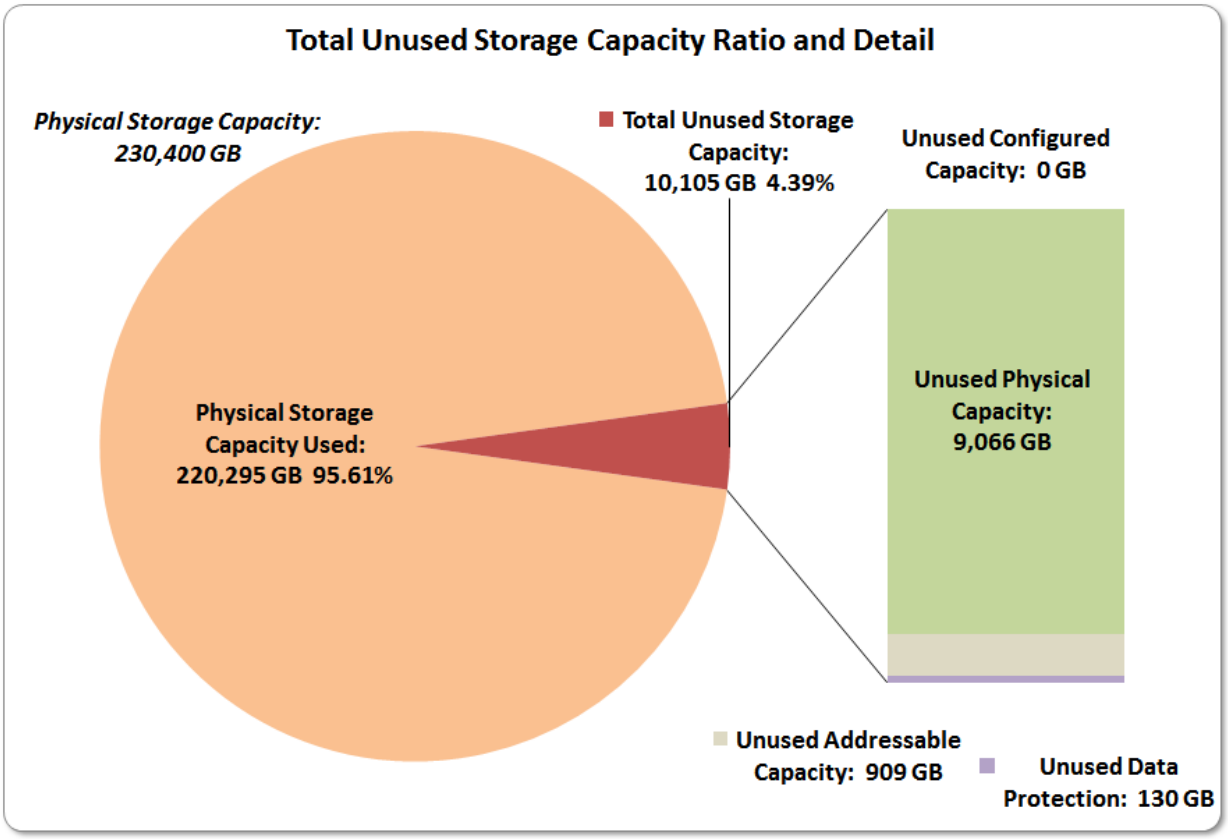
	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
Total ASU Capacity	99.53%	87.09%	83.66%
Data Protection *(RAID-5)*		12.50%	12.01%
Addressable Storage Capacity		87.50%	84.06%
Required Storage		0.00%	0.00%
Configured Storage Capacity			96.07%
Global Storage Overhead			0.00%
Unused Storage:			
Addressable	0.47%		
Configured		0.00%	
Physical			3.93%

SPC-1 Storage Capacity Charts




Configured Storage Capacity: 221,334 GB
Data Protection Capacity: 27,667 GB 12.50%
Available Data Capacity: 193,667 GB 87.50%
Addressable Storage Capacity: 193,667 GB 87.50%


Addressable Storage Capacity: 193,667 GB
96 Logical Volumes, 2,017 GB per Logical Volume
Unused Addressable Capacity: 909 GB 0.47%
Total ASU Capacity: 192,758 GB 99.53%
96 Logical Volumes, 2,008 GB per Logical Volume



Storage Capacity Utilization

Clause 10.6.8.2

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

Clause 2.8.1

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

Clause 2.8.2

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

Clause 2.8.3

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

SPC-2 Storage Capacity Utilization	
Application Utilization	83.66%
Protected Application Utilization	95.61%
Unused Storage Ratio	4.39%

Logical Volume Capacity and ASU Mapping

Clause 10.6.8.3

A table illustrating the capacity of the Application Storage Unit (ASU) and the mapping of Logical Volumes to ASU will be provided in the FDR. Capacity must be stated in gigabytes (GB) as a value with a minimum of two digits to the right of the decimal point. Each Logical Volume will be sequenced in the table from top to bottom per its position in the contiguous address space of the ASU. Each Logical Volume entry will list its total capacity, the portion of that capacity used for the ASU, and any unused capacity.

Logical Volume (LV) Capacity and Mapping			
ASU (192,758.132 GB)			
	Total Capacity *(GB)*	Capacity Used *(GB)*	Capacity Unused *(GB)*
96 Logical Volumes	2,017.368 per LV	2,007.897 per LV	9.47 per LV

See the Storage Definition (sd) entries in Appendix D: SPC-2 Workload Generator Storage Commands and Parameter Files on page 80 for more detailed configuration information.

SPC-2 BENCHMARK EXECUTION RESULTS

This portion of the Full Disclosure Report documents the results of the various SPC-2 Tests, Test Phases, Test Run Sequences, and Test Runs. An SPC-2 glossary on page 65 contains definitions of terms specific to the SPC-2 Data Repository.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

SPC-2 Tests, Test Phases, Test Run Sequences, and Test Runs

The SPC-2 benchmark consists of the following Tests, Test Phases, Test Run Sequences, and Test Runs:

- **Data Persistence Test**
  - Data Persistence Test Run 1
  - Data Persistence Test Run 2
- **Large File Processing Test**
  - WRITE ONLY Test Phase
    - Test Run Sequence 1
      - ✓ Test Run 1 – 1024 KiB Transfer – maximum number of Streams
      - ✓ Test Run 2 – 1024 KiB Transfer – 50% of Test Run 1's Streams value
      - ✓ Test Run 3 – 1024 KiB Transfer – 25% of Test Run 1's Streams value
      - ✓ Test Run 4 – 1024 KiB Transfer – 12.5% of Test Run 1's Streams value
      - ✓ Test Run 5 – 1024 KiB Transfer – single (1) Stream
    - Test Run Sequence 2
      - ✓ Test Run 6 – 256 KiB Transfer – maximum number of Streams
      - ✓ Test Run 7 – 256 KiB Transfer – 50% of Test Run 6's Streams value
      - ✓ Test Run 8 – 256 KiB Transfer – 25% of Test Run 6's Streams value
      - ✓ Test Run 9 – 256 KiB Transfer – 12.5% of Test Run 6's Streams value
      - ✓ Test Run 10 – 256 KiB Transfer – single (1) Stream
  - READ-WRITE Test Phase
    - Test Run Sequence 3
      - ✓ Test Run 11 – 1024 KiB Transfer – maximum number of Streams
      - ✓ Test Run 12 – 1024 KiB Transfer – 50% of Test Run 11's Streams value
      - ✓ Test Run 13 – 1024 KiB Transfer – 25% of Test Run 11's Streams value
      - ✓ Test Run 14 – 1024 KiB Transfer – 12.5% of Test Run 11's Streams value
      - ✓ Test Run 15 – 1024 KiB Transfer – single (1) Stream
    - Test Run Sequence 4
      - ✓ Test Run 16 – 256 KiB Transfer – maximum number of Streams
      - ✓ Test Run 17 – 256 KiB Transfer – 50% of Test Run 16's Streams value
      - ✓ Test Run 18 – 256 KiB Transfer – 25% of Test Run 16's Streams value
      - ✓ Test Run 19 – 256 KiB Transfer – 12.5% of Test Run 16's Streams value
      - ✓ Test Run 20 – 256 KiB Transfer – single (1) Stream
  - READ ONLY Test Phase
    - Test Run Sequence 5
      - ✓ Test Run 21 – 1024 KiB Transfer – maximum number of Streams

- ✓ Test Run 22 – 1024 KiB Transfer – 50% of Test Run 21's Streams value
- ✓ Test Run 23 – 1024 KiB Transfer – 25% of Test Run 21's Streams value
- ✓ Test Run 24 – 1024 KiB Transfer – 12.5% of Test Run 21's Streams value
- ✓ Test Run 25 – 1024 KiB Transfer – single (1) Stream

- Test Run Sequence 6
  - ✓ Test Run 26 – 256 KiB Transfer – maximum number of Streams
  - ✓ Test Run 27 – 256 KiB Transfer – 50% of Test Run 26's Streams value
  - ✓ Test Run 28 – 256 KiB Transfer – 25% of Test Run 26's Streams value
  - ✓ Test Run 29 – 256 KiB Transfer – 12.5% of Test Run 26's Streams value
  - ✓ Test Run 30 – 256 KiB Transfer – single (1) Stream

- **Large Database Query Test**
  - 1024 KIB TRANSFER SIZE Test Phase
    - Test Run Sequence 1
      - ✓ Test Run 1 – 4 I/O Requests Outstanding – maximum number of Streams
      - ✓ Test Run 2 – 4 I/O Requests Outstanding – 50% of Test Run 1's Streams value
      - ✓ Test Run 3 – 4 I/O Requests Outstanding – 25% of Test Run 1's Streams value
      - ✓ Test Run 4 – 4 I/O Requests Outstanding – 12.5% of Test Run 1's Streams value
      - ✓ Test Run 5 – 4 I/O Requests Outstanding – single (1) Stream
    - Test Run Sequence 2
      - ✓ Test Run 6 – 1 I/O Request Outstanding – maximum number of Streams
      - ✓ Test Run 7 – 1 I/O Request Outstanding – 50% of Test Run 6's Streams value
      - ✓ Test Run 8 – 1 I/O Request Outstanding – 25% of Test Run 6's Streams value
      - ✓ Test Run 9 – 1 I/O Request Outstanding – 12.5% of Test Run 6's Streams value
      - ✓ Test Run 10 – 1 I/O Request Outstanding – single (1) Stream
  - 64 KIB TRANSFER SIZE Test Phase
    - Test Run Sequence 3
      - ✓ Test Run 11 – 4 I/O Requests Outstanding – maximum number of Streams
      - ✓ Test Run 12 – 4 I/O Requests Outstanding – 50% of Test Run 11's Streams value
      - ✓ Test Run 13 – 4 I/O Requests Outstanding – 25% of Test Run 11's Streams value
      - ✓ Test Run 14 – 4 I/O Requests Outstanding – 12.5% of Test Run 11's Streams value
      - ✓ Test Run 15 – 4 I/O Requests Outstanding – single (1) Stream
    - Test Run Sequence 4
      - ✓ Test Run 16 – 1 I/O Request Outstanding – maximum number of Streams
      - ✓ Test Run 17 – 1 I/O Request Outstanding – 50% of Test Run 16's Streams value
      - ✓ Test Run 18 – 1 I/O Request Outstanding – 25% of Test Run 16's Streams value
      - ✓ Test Run 19 – 1 I/O Request Outstanding – 12.5% of Test Run 16's Streams value
      - ✓ Test Run 20 – 1 I/O Request Outstanding – single (1) Stream

- **Video on Demand Delivery Test**
  - Video on Demand Delivery 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.

Large File Processing Test

Clause 6.4.3.1

The Large File Processing Test consists of the I/O operations associated with the type of applications, in a wide range of fields, which require simple sequential processing of one or more large files. Specific examples of those types of applications include scientific computing and large-scale financial processing

Clause 6.4.3.2

The Large File Processing Test has three Test Phases, which shall be executed in the following uninterrupted sequence:

1. *WRITE ONLY*
2. *READ-WRITE*
3. *READ ONLY*

The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Large File Processing Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.

Clause 10.6.9.1

The Full Disclosure Report will contain the following content for the Large File Processing Test:

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Large File Processing Test.*
2. *The human readable SPC-2 Test Results File for each of the Test Runs in the Large File Processing Test.*
3. *The following three tables:*
    - *Average Data Rate: The average Data Rate, in MB per second for the Measurement Interval of each Test Run in the Large File Processing Test.*
    - *Average Data Rate per Stream: The average Data Rate per Stream, in MB per second, for the Measurement Interval of each Test Run in the Large File Processing Test.*
    - *Average Response Time: The average response time, in milliseconds (ms), for the Measurement Interval of each Test Run in the Large File Processing Test.*
4. *Average Data Rate, Average Data Rate per Stream and Average Response Time graphs as defined in Clauses 10.1.1, 10.1.2 and 10.1.3.*

SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Large File Processing Test Runs are documented in Appendix E: SPC-2 Workload Generator Execution Commands and Parameters on Page 118.

SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Large File Processing Test Runs is listed below.

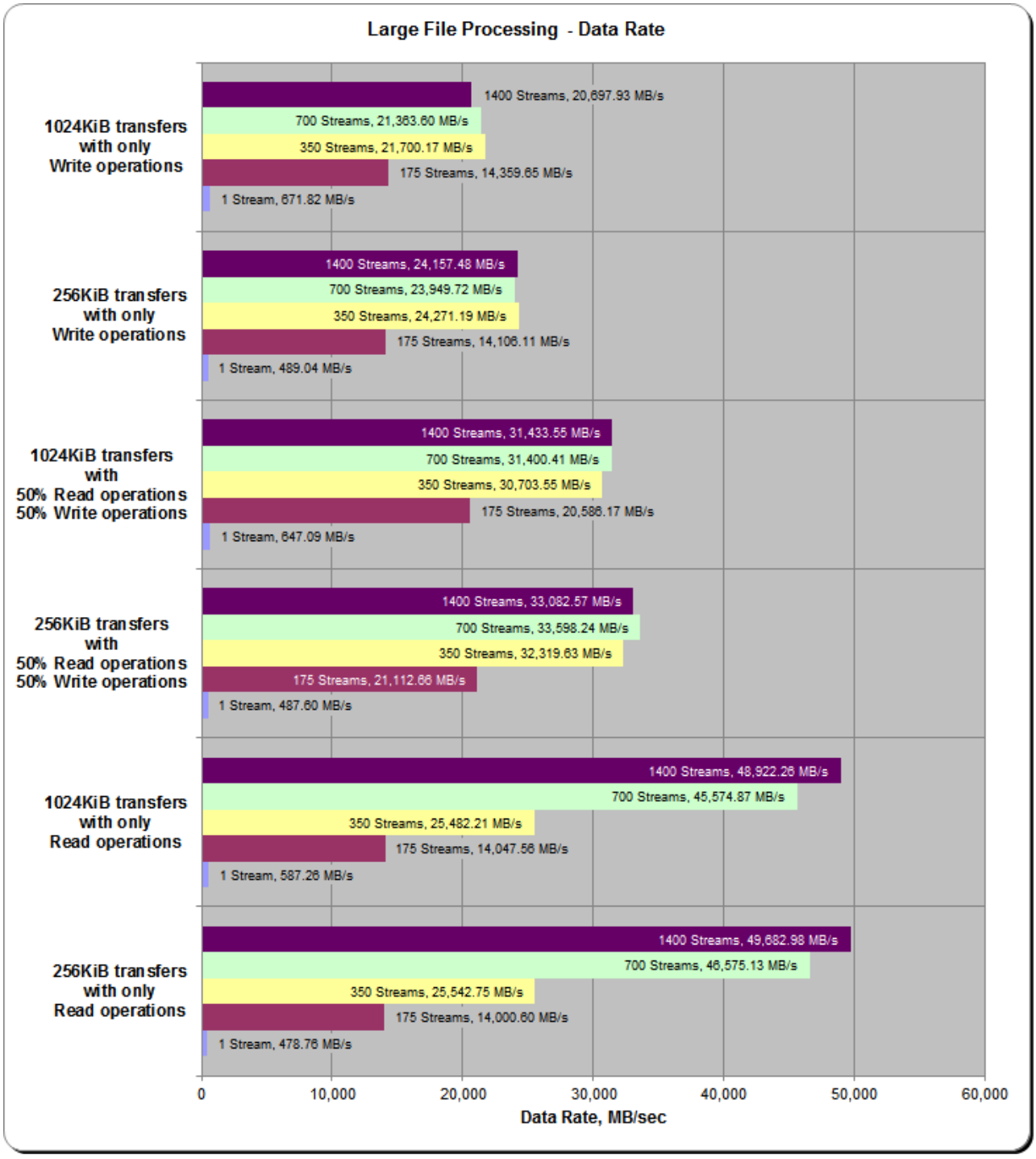
SPC-2 Large File Processing Test Results File

SPC-2 Large File Processing Average Data Rates (MB/s)

The average Data Rate (MB/s) for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
Write 1024KiB	671.82	14,359.65	21,700.17	21,363.60	20,697.93
Write 256KiB	489.04	14,106.11	24,271.19	23,949.72	24,157.48
Read/Write 1024KiB	647.09	20,586.17	30,703.55	31,400.41	31,433.55
Read/Write 256KiB	487.60	21,112.66	32,319.63	33,598.24	33,082.57
Read 1024KiB	587.26	14,047.56	25,482.21	45,574.87	48,922.26
Read 256KiB	478.76	14,000.60	25,542.75	46,575.13	49,682.98

SPC-2 Large File Processing Average Data Rates Graph

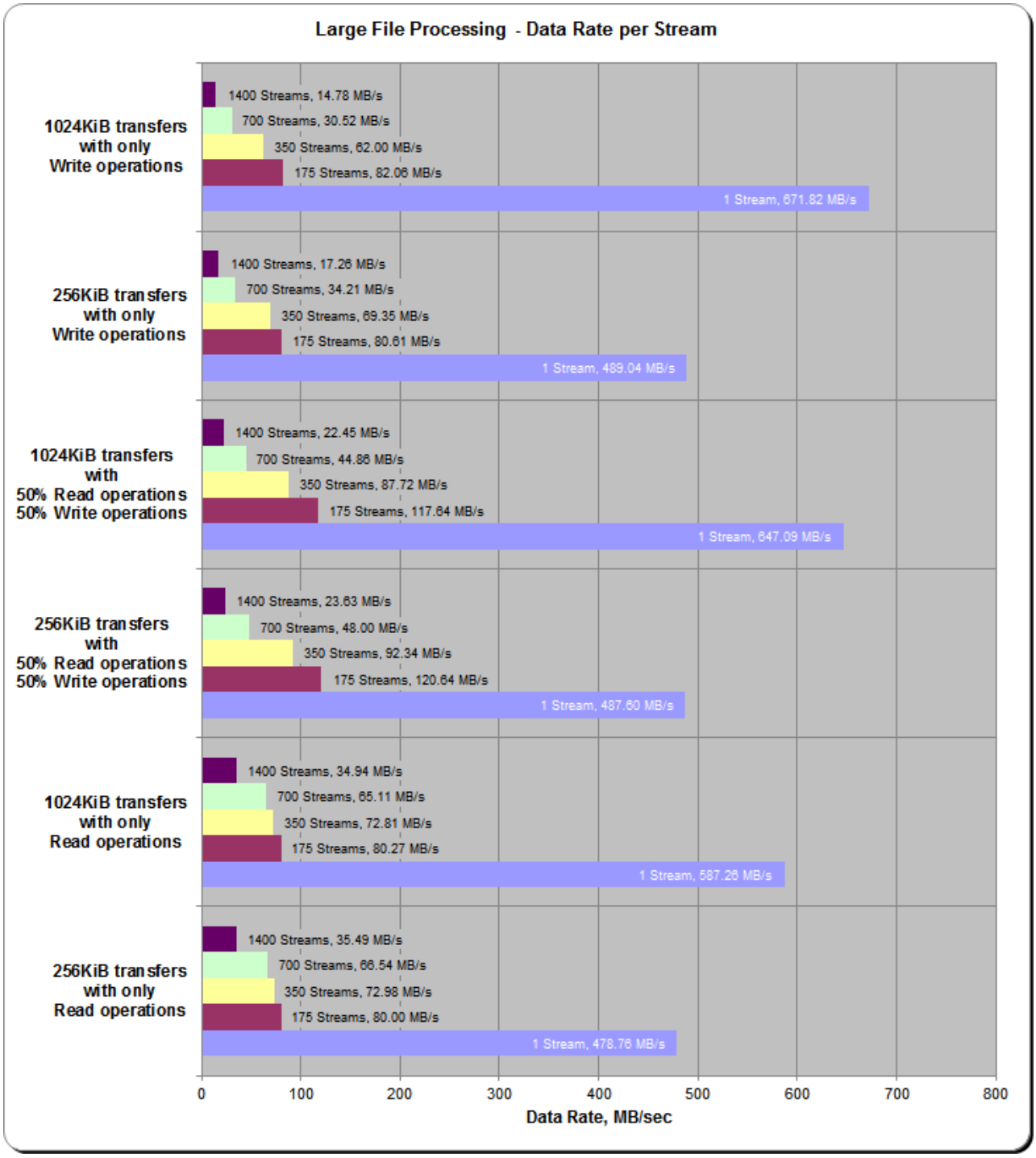


SPC-2 Large File Processing Average Data Rate per Stream

The average Data Rate per Stream for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
Write 1024KiB	671.82	82.06	62.00	30.52	14.78
Write 256KiB	489.04	80.61	69.35	34.21	17.26
Read/Write 1024KiB	647.09	117.64	87.72	44.86	22.45
Read/Write 256KiB	487.60	120.64	92.34	48.00	23.63
Read 1024KiB	587.26	80.27	72.81	65.11	34.94
Read 256KiB	478.76	80.00	72.98	66.54	35.49

SPC-2 Large File Processing Average Data Rate per Stream Graph

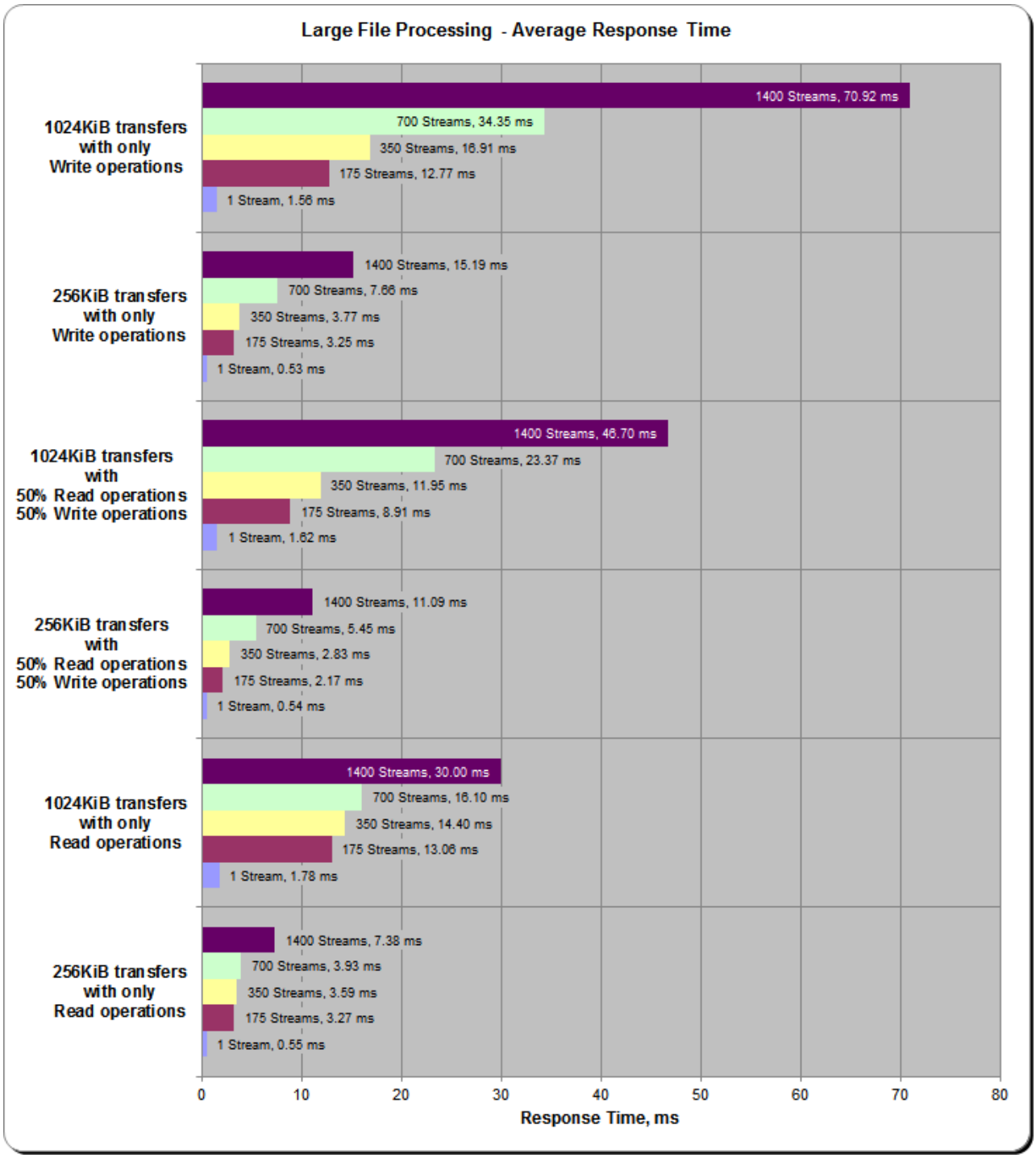


SPC-2 Large File Processing Average Response Time

The average Response Time, milliseconds (ms), for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
Write 1024KiB	1.56	12.77	16.91	34.35	70.92
Write 256KiB	0.53	3.25	3.77	7.66	15.19
Read/Write 1024KiB	1.62	8.91	11.95	23.37	46.70
Read/Write 256KiB	0.54	2.17	2.83	5.45	11.09
Read 1024KiB	1.78	13.06	14.40	16.10	30.00
Read 256KiB	0.55	3.27	3.59	3.93	7.38

SPC-2 Large File Processing Average Response Time Graph



Large File Processing Test – WRITE ONLY Test Phase

Clause 10.6.9.1.1

1. *A table that will contain the following information for each "WRITE ONLY, 1024 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "WRITE ONLY, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "WRITE ONLY, 256 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "WRITE ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" graphs
(four pages, 1 graph per page)

SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" graphs
(four pages, 1 graph per page)

Large File Processing Test – READ-WRITE Test Phase

Clause 10.6.9.1.2

1. *A table that will contain the following information for each "READ-WRITE, 1024 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ-WRITE, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each " READ-WRITE, 256 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ-WRITE, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" graphs
(four pages, 1 graph per page)

SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" graphs
(four pages, 1 graph per page)

Large File Processing Test – READ ONLY Test Phase

Clause 10.6.9.1.3

1. *A table that will contain the following information for each "READ ONLY, 1024 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ ONLY, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "READ ONLY, 256 KiB Transfer Size" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" graphs
(four pages, 1 graph per page)

SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" Test Run Data

SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" graphs
(four pages, 1 graph per page)

Large Database Query Test

Clause 6.4.4.1

The Large Database Query Test is comprised of a set of I/O operations representative of scans or joins of large relational tables such as those performed for data mining or business intelligence.

Clause 6.4.4.2

The Large Database Query Test has two Test Phases, which shall be executed in the following uninterrupted sequence:

1. *1024 KIB TRANSFER SIZE*
2. *64 KIB TRANSFER SIZE*

The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Large File Processing Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.

Clause 10.6.9.2

The Full Disclosure Report will contain the following content for the Large Database Query Test:

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Large Database Query Test.*
2. *The human readable SPC-2 Test Results File for each of the Test Runs in the Large Database Query Test.*
3. *A table that contains the following information for each Test Run in the two Test Phases of the Large Database Query Test:*
    - *Average Data Rate: The average Data Rate, in MB per second for the Measurement Interval of each Test Run in the Large Database Query Test.*
    - *Average Data Rate per Stream: The average Data Rate per Stream, in MB per second, for the Measurement Interval of each Test Run in the Large Database Query Test.*
    - *Average Response Time: The average response time, in milliseconds (ms), for the Measurement Interval of each Test Run in the Large Database Query Test.*
4. *Average Data Rate, Average Data Rate per Stream and Average Response time graphs as defined in Clauses 10.1.1, 10.1.2 and 10.1.3.*

SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Large Database Query Test Runs are documented in Appendix E: SPC-2 Workload Generator Execution Commands and Parameters on Page 118.

SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Large Database Query Test Runs is listed below.

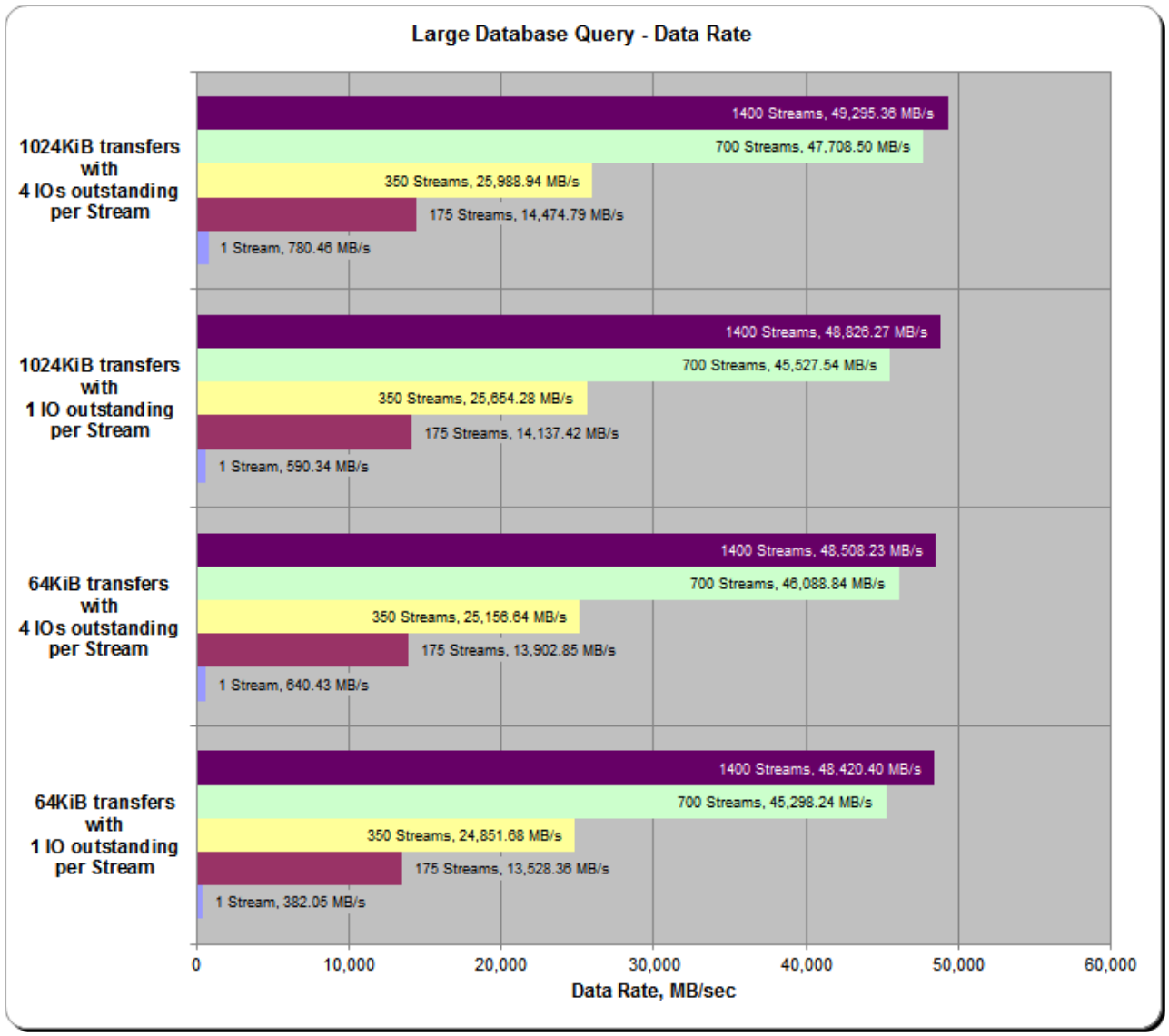
SPC-2 Large Database Query Test Results File

SPC-2 Large Database Query Average Data Rates (MB/s)

The average Data Rate (MB/s) for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
1024KiB w/ 4 IOs/Stream	780.46	14,474.79	25,988.94	47,708.50	49,295.36
1024KiB w/ 1 IO/Stream	590.34	14,137.42	25,654.28	45,527.54	48,826.27
64KiB w/ 4 IOs/Stream	640.43	13,902.85	25,156.64	46,088.84	48,508.23
64KiB w/ 1 IO/Stream	382.05	13,528.36	24,851.68	45,298.24	48,420.40

SPC-2 Large Database Query Average Data Rates Graph

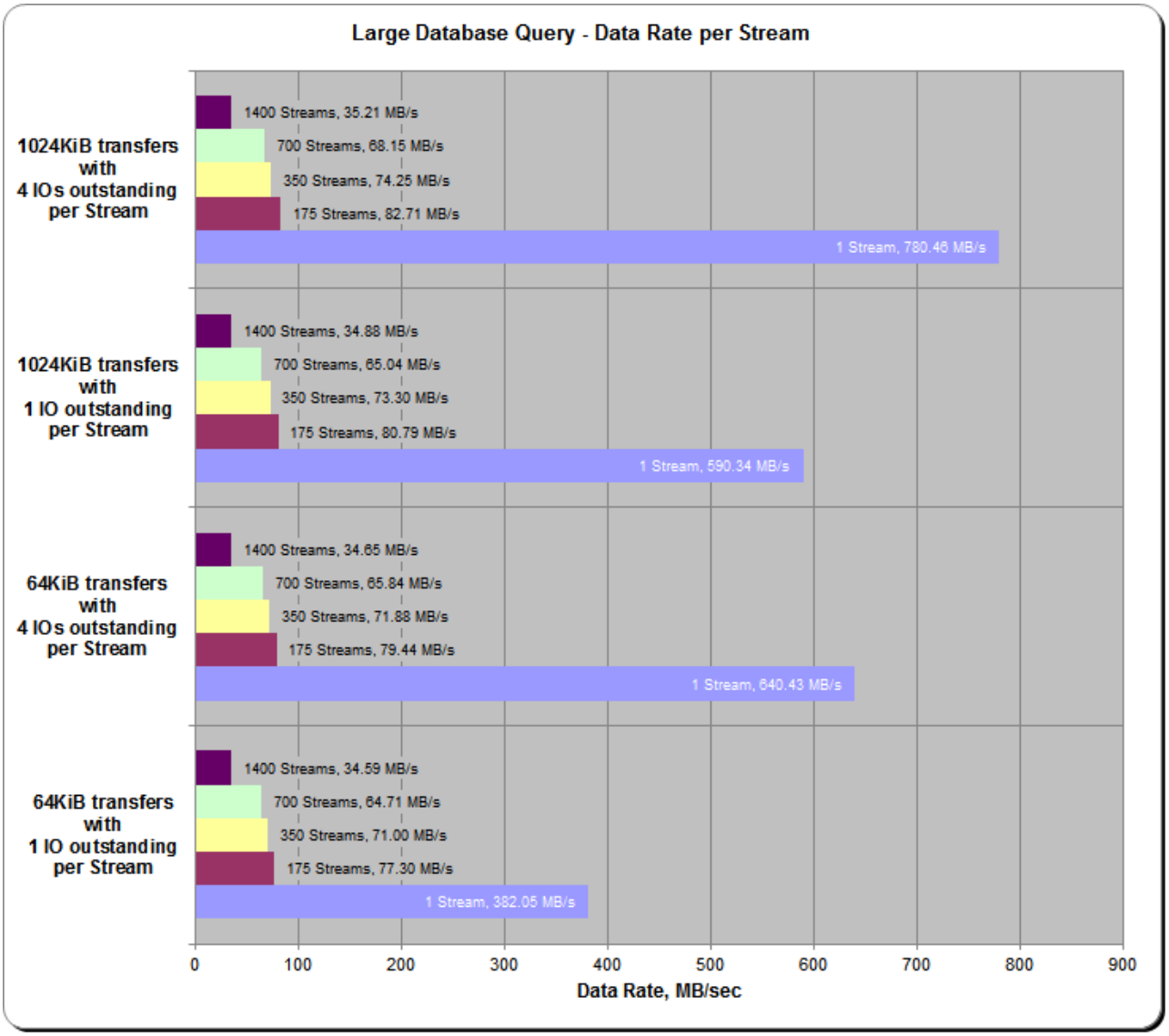


SPC-2 Large Database Query Average Data Rate per Stream

The average Data Rate per Stream for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
1024KiB w/ 4 IOs/Stream	780.46	82.71	74.25	68.15	35.21
1024KiB w/ 1 IO/Stream	590.34	80.79	73.30	65.04	34.88
64KiB w/ 4 IOs/Stream	640.43	79.44	71.88	65.84	34.65
64KiB w/ 1 IO/Stream	382.05	77.30	71.00	64.71	34.59

SPC-2 Large Database Query Average Data Rate per Stream Graph

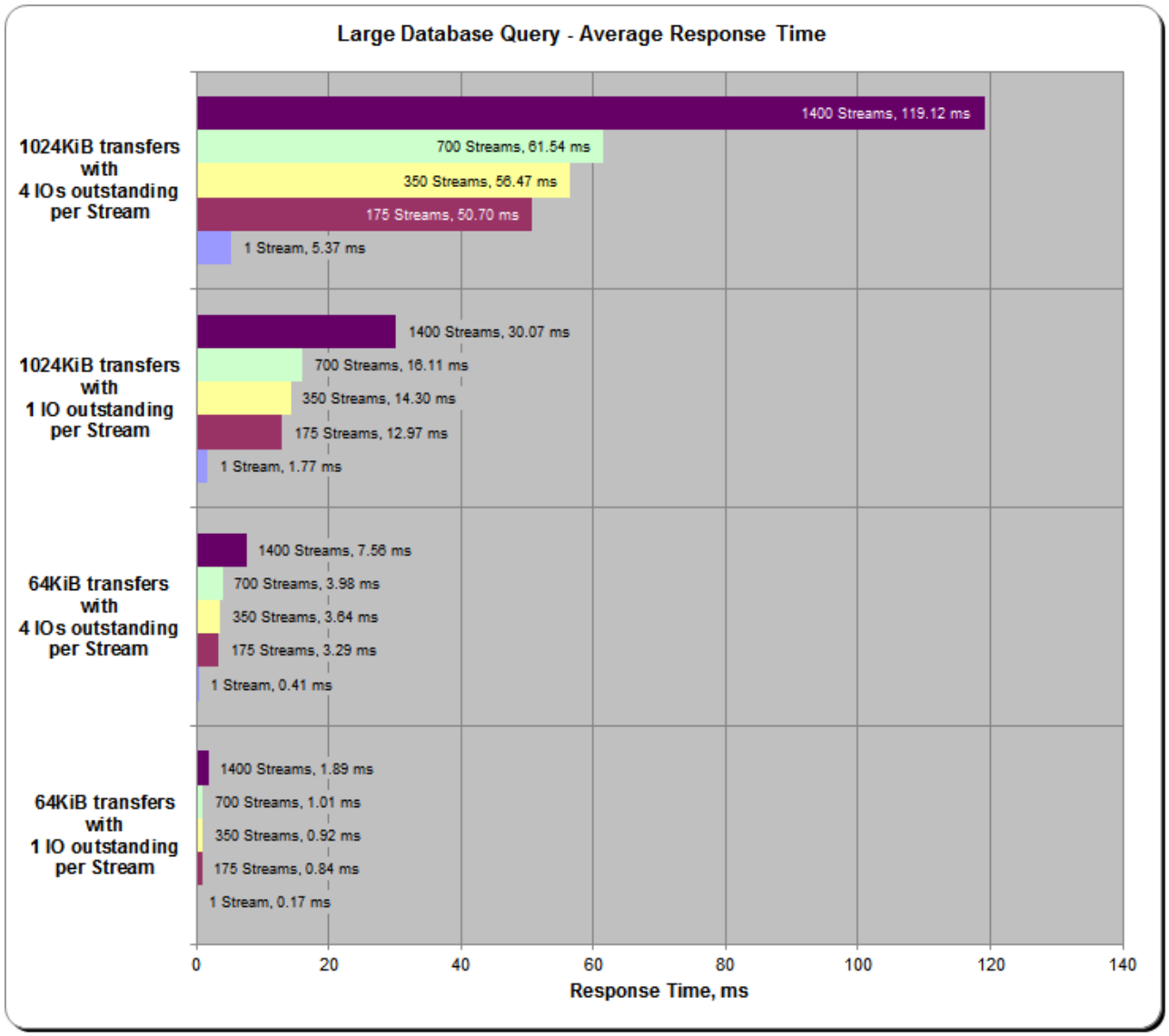


SPC-2 Large Database Query Average Response Time

The average Response Time, in milliseconds, for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	175 Streams	350 Streams	700 Streams	1400 Streams
1024KiB w/ 4 IOs/Stream	5.37	50.70	56.47	61.54	119.12
1024KiB w/ 1 IO/Stream	1.77	12.97	14.30	16.11	30.07
64KiB w/ 4 IOs/Stream	0.41	3.29	3.64	3.98	7.56
64KiB w/ 1 IO/Stream	0.17	0.84	0.92	1.01	1.89

SPC-2 Large Database Query Average Response Time Graph



Large Database Query Test – 1024 KIB TRANSFER SIZE Test Phase

Clause 10.6.9.2.1

1. *A table that will contain the following information for each "1024 KiB Transfer Size, 4 Outstanding I/Os" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "1024 KiB Transfer Size, 4 Outstanding I/Os" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "1024 KiB Transfer Size, 1 Outstanding I/O" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "1024 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" entries will be hyperlinks for SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run Data

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os" graphs
(four pages, 1 graph per page)

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O" Test Run Data

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O" graphs
(four pages, 1 graph per page)

Large Database Query Test – 64 KIB TRANSFER SIZE Test Phase

Clause 10.6.9.2.2

1. *A table that will contain the following information for each "64 KiB Transfer Size, 4 Outstanding I/Os" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "64 KiB Transfer Size, 4 Outstanding I/Os" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "64 KiB Transfer Size, 1 Outstanding I/O" Test Run:*
   - *The number of Streams specified.*
   - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "64 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" entries will be hyperlinks for SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/1 Outstanding I/O" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run Data

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/4 Outstanding I/Os" graphs
(four pages, 1 graph per page)

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/1 Outstanding I/O" Test Run Data

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/1 Outstanding I/O" Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods
(3 pages)

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/1 Outstanding I/O" Graphs

Average Data Rate – Complete Test Run

Average Data Rate – Measurement Interval (MI) Only

Average Data Rate per Stream

Average Response Time

SPC-2 "Large Database Query/64 KIB TRANSFER SIZE/1 Outstanding I/O" graphs
(four pages, 1 graph per page)

Video on Demand Delivery Test

Clause 6.4.5.1

The Video on Demand Delivery Test represents the I/O operations required to enable individualized video entertainment for a community of subscribers, which draw from a digital film library.

Clause 6.4.5.2

The Video on Demand Delivery Test consists of one (1) Test Run.

The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Video on Demand Delivery Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.

Clause 10.6.9.3

The Full Disclosure Report will contain the following content for the Video on Demand Delivery Test:

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute the Test Run in the Video on Demand Delivery Test.*
2. *The human readable SPC-2 Test Results File for the Test Run in the Video on Demand Delivery Test.*
3. *A table that contains the following information for the Test Run in the Video on Demand Delivery Test:*
    - *The number Streams specified.*
    - *The Ramp-Up duration in seconds.*
    - *The Measurement Interval duration in seconds.*
    - *The average data rate, in MB per second, for the Measurement Interval.*
    - *The average data rate, in MB per second, per Stream for the Measurement Interval.*
4. *A table that contains the following information for the single Video on Demand Delivery Test Run:*
    - *The number Streams specified.*
    - *The average data rate, average data rate per stream, average Response Time, and Maximum Response Time reported at 60 second intervals.*
5. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the single Video on Demand Delivery Test Run as specified in Clause 10.1.8.*
6. *A Maximum Response Time (intervals) graph as specified in Clause 10.1.8.*

SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Video on Demand Delivery Test Run are documented in Appendix E: SPC-2 Workload Generator Execution Commands and Parameters on Page 118..

SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Video on Demand Delivery Test Run is listed below.

SPC-2 Video on Demand Delivery Test Results File

SPC-2 Video on Demand Delivery Test Run Data

The number of Streams specified, Ramp-Up duration in seconds, Measurement Interval duration in seconds, average Data Rate for the Measurement Interval, and average Data Rate per Stream for the Measurement Interval are listed in the following table.

SPC-2-VOD	TR1
Number of Streams	58,000
Ramp-up Time, sec	4,500
Measurement Interval, sec	7,200
Average Data Rate, MB/sec	45,612.23
Per Stream Data Rate, MB/sec	0.79
Average Response Time, ms	2.32
Average Max Response Time, ms	223.34

Video on Demand Delivery Test – TEST RUN DATA BY INTERVAL

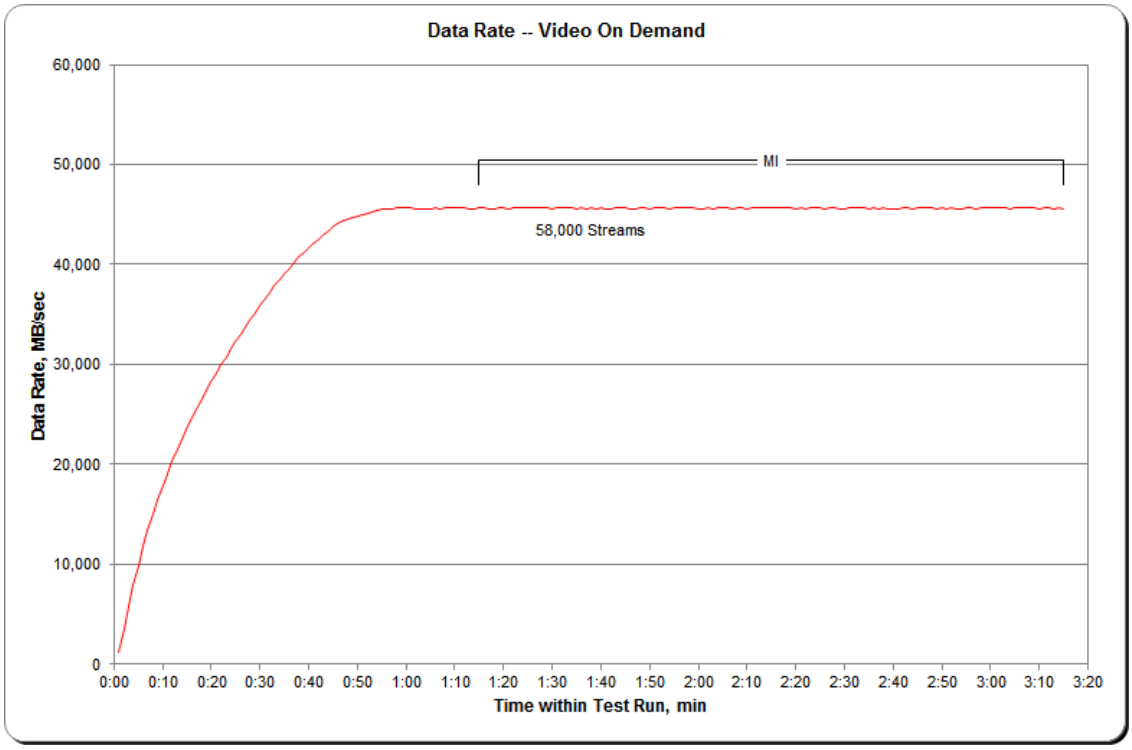
The SPC-2 Video on Demand Delivery Test Run data is contained in the table that appears below. That table is followed by graphs illustrating the average Data Rate and average Data Rate per Stream produced by the same Test Runs. The table and graphs present the data at sixty second intervals.

TR1	58,000 Streams				TR1	58,000 Streams				TR1	58,000 Streams			
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms
0:01:00	1,169.02	0.66	1.53	34.96	0:34:00	38,493.57	0.79	1.59	127.90	1:07:00	45,583.83	0.79	2.30	219.77
0:02:00	3,560.09	0.76	0.78	33.48	0:35:00	39,103.91	0.79	1.63	135.45	1:08:00	45,652.73	0.79	2.32	209.46
0:03:00	5,762.49	0.77	0.77	33.38	0:36:00	39,667.46	0.79	1.67	142.28	1:09:00	45,618.14	0.79	2.32	202.86
0:04:00	7,911.35	0.78	0.79	37.63	0:37:00	40,235.11	0.79	1.75	143.41	1:10:00	45,623.76	0.79	2.30	208.51
0:05:00	9,910.60	0.78	0.80	40.34	0:38:00	40,787.46	0.79	1.78	133.64	1:11:00	45,608.81	0.79	2.28	191.04
0:06:00	11,785.77	0.78	0.84	47.52	0:39:00	41,265.17	0.79	1.80	145.79	1:12:00	45,635.41	0.79	2.29	201.19
0:07:00	13,469.69	0.78	0.86	100.10	0:40:00	41,646.88	0.79	1.83	154.99	1:13:00	45,600.25	0.79	2.30	216.77
0:08:00	15,088.90	0.78	0.87	47.35	0:41:00	42,093.21	0.79	1.92	185.90	1:14:00	45,581.68	0.79	2.28	209.86
0:09:00	16,490.41	0.78	0.90	53.30	0:42:00	42,476.89	0.79	1.97	200.49	1:15:00	45,627.54	0.79	2.27	193.75
0:10:00	17,831.08	0.78	0.92	55.41	0:43:00	42,899.39	0.79	2.01	186.51	1:16:00	45,608.95	0.79	2.25	214.05
0:11:00	19,110.88	0.78	0.93	53.84	0:44:00	43,332.77	0.79	2.09	195.52	1:17:00	45,595.07	0.79	2.25	200.69
0:12:00	20,320.96	0.78	0.95	57.35	0:45:00	43,741.96	0.79	2.12	206.13	1:18:00	45,595.70	0.79	2.25	283.72
0:13:00	21,464.08	0.78	0.97	65.48	0:46:00	44,140.74	0.79	2.15	199.99	1:19:00	45,631.23	0.79	2.22	180.20
0:14:00	22,496.02	0.78	1.00	107.87	0:47:00	44,333.84	0.79	2.14	190.70	1:20:00	45,639.19	0.79	2.23	211.39
0:15:00	23,549.71	0.78	1.01	64.46	0:48:00	44,516.61	0.79	2.16	200.63	1:21:00	45,592.07	0.79	2.30	216.15
0:16:00	24,622.06	0.79	1.03	68.18	0:49:00	44,702.49	0.79	2.17	196.14	1:22:00	45,632.00	0.79	2.30	212.86
0:17:00	25,570.58	0.78	1.05	71.25	0:50:00	44,865.21	0.79	2.29	498.12	1:23:00	45,619.18	0.79	2.30	210.84
0:18:00	26,516.24	0.79	1.08	107.22	0:51:00	45,005.38	0.79	2.21	199.00	1:24:00	45,619.37	0.79	2.32	217.67
0:19:00	27,405.75	0.79	1.09	78.03	0:52:00	45,173.86	0.79	2.20	199.48	1:25:00	45,636.41	0.79	2.43	601.44
0:20:00	28,261.93	0.78	1.12	88.38	0:53:00	45,268.91	0.79	2.23	232.43	1:26:00	45,618.76	0.79	2.33	242.10
0:21:00	29,115.30	0.79	1.19	90.20	0:54:00	45,425.15	0.79	2.25	196.02	1:27:00	45,614.39	0.79	2.33	221.26
0:22:00	29,933.60	0.79	1.21	92.37	0:55:00	45,529.40	0.79	2.25	204.75	1:28:00	45,608.72	0.79	2.28	240.30
0:23:00	30,723.64	0.79	1.23	100.76	0:56:00	45,564.36	0.79	2.26	193.01	1:29:00	45,619.50	0.79	2.28	211.77
0:24:00	31,513.44	0.79	1.26	173.31	0:57:00	45,556.89	0.79	2.26	205.97	1:30:00	45,604.27	0.79	2.29	224.89
0:25:00	32,272.87	0.79	1.28	107.83	0:58:00	45,611.83	0.79	2.25	180.56	1:31:00	45,633.11	0.79	2.29	216.91
0:26:00	32,997.77	0.79	1.29	147.81	0:59:00	45,616.11	0.79	2.23	177.66	1:32:00	45,619.53	0.79	2.27	232.69
0:27:00	33,741.67	0.79	1.34	109.69	1:00:00	45,623.70	0.79	2.24	170.60	1:33:00	45,609.30	0.79	2.25	217.72
0:28:00	34,427.48	0.79	1.36	125.31	1:01:00	45,618.43	0.79	2.32	226.49	1:34:00	45,628.73	0.79	2.26	205.30
0:29:00	35,169.39	0.79	1.39	114.48	1:02:00	45,587.24	0.79	2.31	246.61	1:35:00	45,600.93	0.79	2.25	210.78
0:30:00	35,924.23	0.79	1.42	108.26	1:03:00	45,585.09	0.79	2.33	250.32	1:36:00	45,612.92	0.79	2.23	219.85
0:31:00	36,567.12	0.79	1.46	116.06	1:04:00	45,602.87	0.79	2.31	213.38	1:37:00	45,600.69	0.79	2.25	216.02
0:32:00	37,226.00	0.79	1.51	123.07	1:05:00	45,599.95	0.79	2.31	245.53	1:38:00	45,616.58	0.79	2.25	235.76
0:33:00	37,908.57	0.79	1.54	113.34	1:06:00	45,624.20	0.79	2.29	216.80	1:39:00	45,584.11	0.79	2.23	193.16

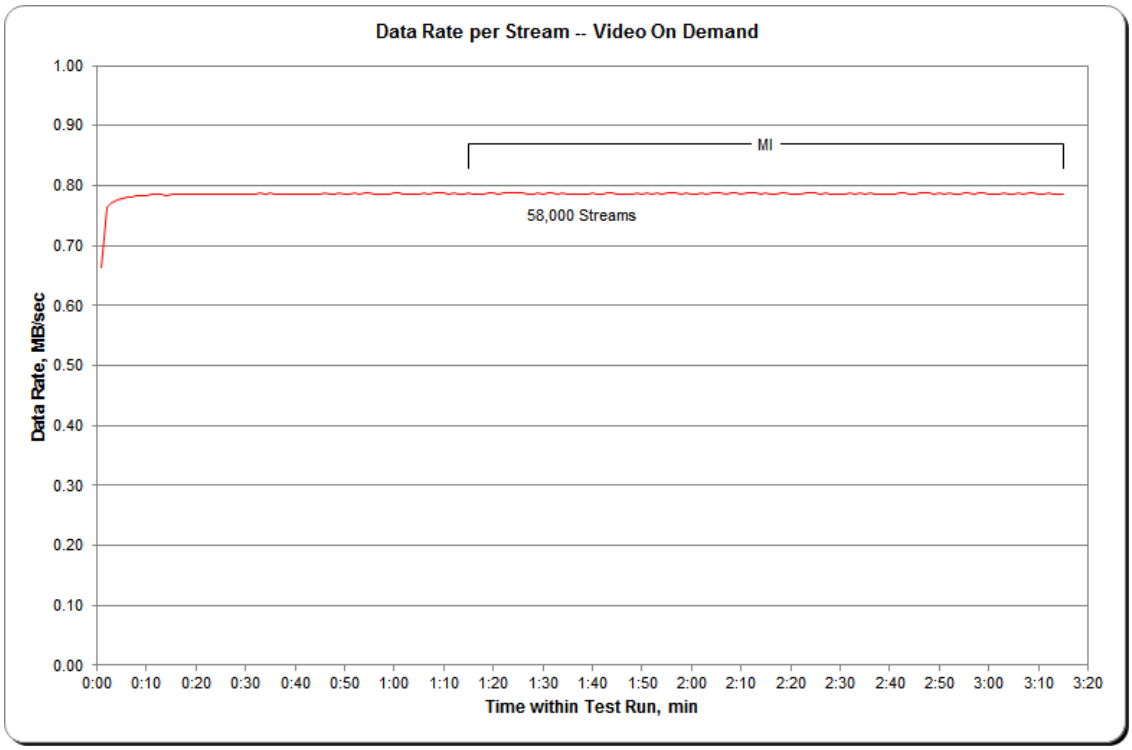
Video on Demand Delivery Test – TEST RUN DATA BY INTERVAL *(continued)*

TR1	58,000 Streams				TR1	58,000 Streams				TR1	58,000 Streams			
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms
1:40:00	45,653.27	0.79	2.25	248.05	2:12:00	45,638.21	0.79	2.31	210.26	2:44:00	45,602.10	0.79	2.45	211.11
1:41:00	45,589.22	0.79	2.31	250.38	2:13:00	45,624.86	0.79	2.32	215.35	2:45:00	45,608.55	0.79	2.41	228.02
1:42:00	45,591.43	0.79	2.30	283.39	2:14:00	45,613.21	0.79	2.36	198.65	2:46:00	45,621.45	0.79	2.42	197.61
1:43:00	45,627.63	0.79	2.26	236.35	2:15:00	45,618.20	0.79	2.37	199.60	2:47:00	45,662.34	0.79	2.37	239.38
1:44:00	45,624.70	0.79	2.27	252.31	2:16:00	45,612.07	0.79	2.45	523.89	2:48:00	45,626.75	0.79	2.30	230.84
1:45:00	45,611.50	0.79	2.26	248.24	2:17:00	45,616.62	0.79	2.33	214.73	2:49:00	45,602.67	0.79	2.28	209.11
1:46:00	45,573.60	0.79	2.23	206.30	2:18:00	45,625.56	0.79	2.34	195.04	2:50:00	45,634.71	0.79	2.27	215.93
1:47:00	45,598.63	0.79	2.22	250.98	2:19:00	45,625.51	0.79	2.36	179.14	2:51:00	45,581.86	0.79	2.26	218.58
1:48:00	45,612.75	0.79	2.19	196.56	2:20:00	45,599.84	0.79	2.34	214.41	2:52:00	45,620.33	0.79	2.26	203.41
1:49:00	45,626.44	0.79	2.21	243.78	2:21:00	45,614.38	0.79	2.40	230.94	2:53:00	45,590.71	0.79	2.27	234.27
1:50:00	45,582.23	0.79	2.20	210.94	2:22:00	45,601.36	0.79	2.41	212.22	2:54:00	45,594.85	0.79	2.27	189.09
1:51:00	45,630.81	0.79	2.19	233.49	2:23:00	45,667.64	0.79	2.44	233.30	2:55:00	45,643.59	0.79	2.25	192.54
1:52:00	45,610.49	0.79	2.22	212.65	2:24:00	45,629.40	0.79	2.44	222.88	2:56:00	45,631.48	0.79	2.25	200.45
1:53:00	45,617.86	0.79	2.21	226.85	2:25:00	45,625.63	0.79	2.42	205.25	2:57:00	45,605.35	0.79	2.25	189.57
1:54:00	45,552.15	0.79	2.23	205.86	2:26:00	45,598.47	0.79	2.42	223.62	2:58:00	45,621.40	0.79	2.26	190.30
1:55:00	45,659.33	0.79	2.25	219.56	2:27:00	45,624.61	0.79	2.44	214.26	2:59:00	45,643.56	0.79	2.26	199.69
1:56:00	45,639.26	0.79	2.26	198.51	2:28:00	45,613.75	0.79	2.40	216.76	3:00:00	45,607.52	0.79	2.25	189.19
1:57:00	45,626.55	0.79	2.26	227.80	2:29:00	45,589.89	0.79	2.40	218.39	3:01:00	45,608.89	0.79	2.34	216.32
1:58:00	45,613.03	0.79	2.27	205.09	2:30:00	45,589.82	0.79	2.40	195.99	3:02:00	45,610.29	0.79	2.33	223.27
1:59:00	45,652.79	0.79	2.28	221.57	2:31:00	45,611.30	0.79	2.41	214.93	3:03:00	45,632.16	0.79	2.32	249.17
2:00:00	45,606.98	0.79	2.26	204.57	2:32:00	45,640.27	0.79	2.40	221.38	3:04:00	45,582.23	0.79	2.34	203.32
2:01:00	45,591.90	0.79	2.35	238.23	2:33:00	45,612.63	0.79	2.36	206.43	3:05:00	45,616.26	0.79	2.35	227.06
2:02:00	45,617.92	0.79	2.36	242.49	2:34:00	45,620.09	0.79	2.38	224.20	3:06:00	45,621.11	0.79	2.35	192.87
2:03:00	45,596.49	0.79	2.36	255.69	2:35:00	45,541.54	0.79	2.38	200.90	3:07:00	45,610.93	0.79	2.33	196.51
2:04:00	45,635.98	0.79	2.35	224.78	2:36:00	45,628.11	0.79	2.42	211.04	3:08:00	45,623.50	0.79	2.30	197.52
2:05:00	45,621.09	0.79	2.35	233.30	2:37:00	45,588.57	0.79	2.43	241.32	3:09:00	45,642.48	0.79	2.31	192.78
2:06:00	45,651.31	0.79	2.35	221.07	2:38:00	45,611.26	0.79	2.45	254.63	3:10:00	45,593.16	0.79	2.29	197.15
2:07:00	45,594.49	0.79	2.35	210.40	2:39:00	45,602.49	0.79	2.43	232.17	3:11:00	45,611.59	0.79	2.31	208.20
2:08:00	45,628.03	0.79	2.32	206.20	2:40:00	45,581.76	0.79	2.44	260.59	3:12:00	45,632.70	0.79	2.29	205.43
2:09:00	45,626.79	0.79	2.35	227.92	2:41:00	45,602.11	0.79	2.56	230.47	3:13:00	45,605.54	0.79	2.28	216.94
2:10:00	45,599.07	0.79	2.32	215.24	2:42:00	45,635.59	0.79	2.53	269.19	3:14:00	45,608.34	0.79	2.26	208.08
2:11:00	45,624.59	0.79	2.30	188.64	2:43:00	45,643.34	0.79	2.47	243.64	3:15:00	45,586.70	0.79	2.24	190.44

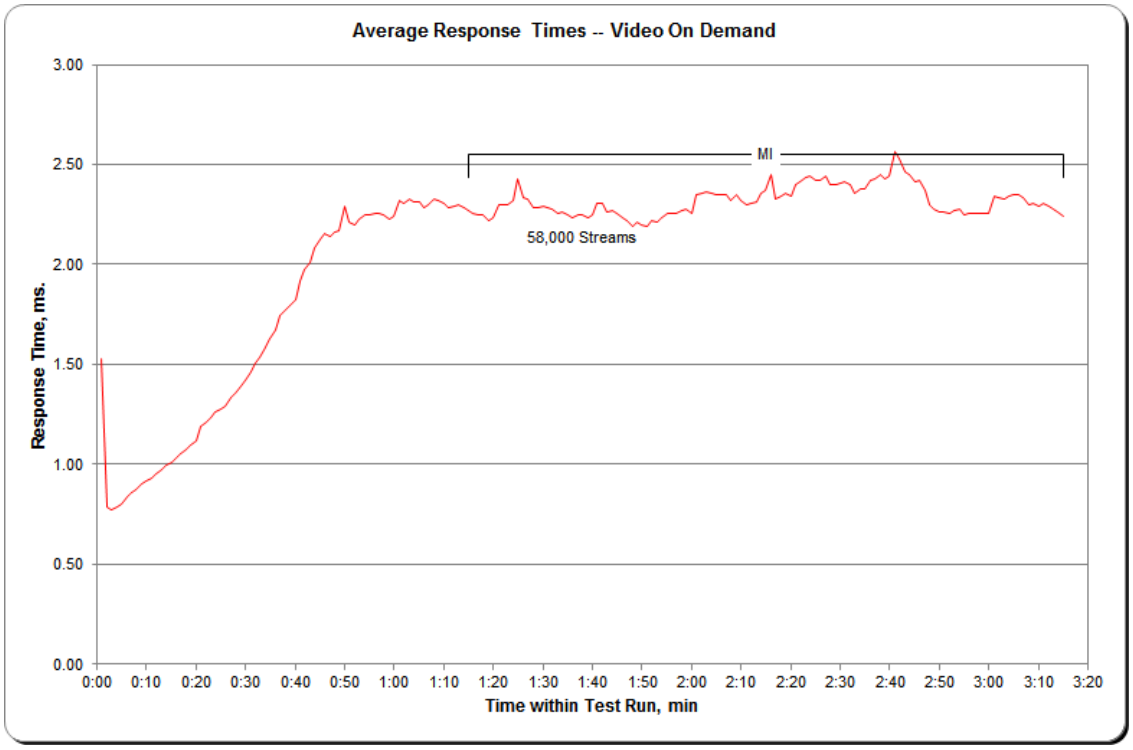
SPC-2 Video on Demand Delivery Average Data Rate Graph



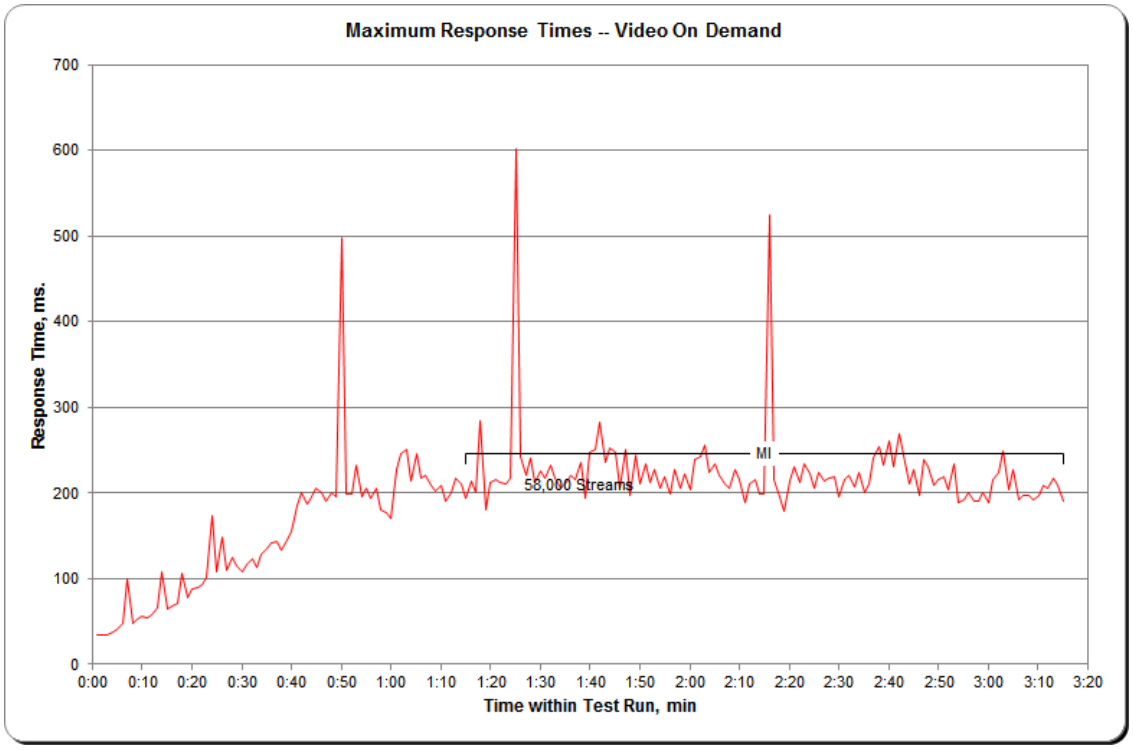
SPC-2 Video on Demand Delivery Average Data Rate per Stream Graph



SPC-2 Video on Demand Delivery Average Response Time Graph



SPC-2 Video on Demand Delivery Maximum Response Time Graph



Data Persistence Test

Clause 7

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-2 Workload Generator will write a specific pattern at randomly selected locations throughout the Total ASU Capacity (Persistence Test Run 1). The SPC-2 Workload Generator will retain the information necessary to later validate the pattern written at each location.

The Tested Storage 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.

Restart the TSC, and if the Host System(s) were shutdown and powered off, restart the Host System(s).

The SPC-2 Workload Generator will utilize the retained data from Persistence Test Run 1 to verify (Persistence Run 2) the bit patterns written in Persistence Test Run 1 and their corresponding location.

Clause 10.6.9.4

The Full Disclosure Report will contain the following content for the Data Persistence Test:

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Persistence Test.*
2. *The human readable SPC-2 Test Results File for each of the Test Runs in the Data Persistence Test.*
3. *A table from the successful Persistence Test, which contains the results from the test.*

SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Persistence Test Runs are documented in Appendix E: SPC-2 Workload Generator Execution Commands and Parameters on Page 118.

Data Persistence Test Results File

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

Persistence 1 Test Run *(write phase)* Results File

Persistence 2 Test Run *(read phase)* Results File

Data Persistence Test Results

Data Persistence Test Results	
Data Persistence Test Number: 1	
Total Number of Logical Blocks Written	1,247,787
Total Number of Logical Blocks Re-referenced	4,243
Total Number of Logical Blocks Verified	1,243,544
Total Number of Logical Blocks that Failed Verification	0
Number of Failed I/O Requests in the process of the Test	0

PRICED STORAGE CONFIGURATION AVAILABILITY DATE

Clause 10.6.9

The committed delivery date 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. All availability dates, whether for individual components or for the Priced Storage Configuration as a whole, must be disclosed to a precision of one day.

The Availability Data shall be stated in either a combination of specific alphanumeric month, numeric day and numeric year or as "Currently Available".

The HP XP7 Storage, as documented in this SPC-2 Full Disclosure Report, is currently available for customer purchase and shipment.

ANOMALIES OR IRREGULARITIES

Clause 10.6.12

The FDR shall include a clear and complete description of any anomalies or irregularities encountered in the course of executing the SPC-2 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-2 Onsite Audit of the HP XP7 Storage.

APPENDIX A: SPC-2 GLOSSARY

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

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

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

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

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

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

SPC-2 Data Repository Definitions

Total ASU Capacity: The total storage capacity read and written in the course of executing the SPC-2 benchmark.

Application Storage Unit (ASU): The logical interface between the storage and SPC-2 Workload Generator. The ASU is 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-2 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-2 Workload Generator.

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

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

Data Protection Overhead: The storage capacity required to implement the selected level of data protection.

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

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 sum of unused storage capacity within the Physical Storage Capacity, Configured Storage Capacity, and Addressable Storage Capacity.

SPC-2 Data Protection Levels

Protected 1: The single point of failure of any ***storage device*** in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.

Protected 2: The single point of failure of any ***component*** in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.

SPC-2 Test Execution Definitions

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

Completion Time: The time recorded by the Workload Generator when an I/O Request is completed by the Tested Storage Configuration (TSC) as signaled by System Software.

Data Rate: The data volume, in MB, transferred by all Measured I/O Requests in an SPC-2 Test Run divided by the length of the Test Run in seconds.

Failed I/O Request: Any I/O Request issued by the SPC-2 Workload Generator that meets one of the following conditions *(see "I/O Completion Types" illustrated below)*:

- The I/O Request was signaled as failed by System Software.
- The I/O Request started within the Measurement Interval, but did not complete prior to the end of the appropriate Run-Out period..
- The I/O Request started within the Run-Out period, but did not complete prior to the end of the appropriate Ramp-Down period.

I/O Request Throughput: The total number of Measured I/O Requests in an SPC-2 Test Run divided by the duration of the Measurement Interval in seconds.

Measured I/O Request: A Completed I/O Request that begins (Start Time) within a Measurement Interval and completes (Completion Time) prior to the end of the appropriate Ramp Down *(see "I/O Completion Types" illustrated below).*

Measurement Interval: A specified, contiguous period of time, after the TSC has reached Steady State, when data is collected by the Workload Generator to produce the test results for a SPC-2 Test Run *(see "SPC-2 Test Run Components" illustrated below, Test Run 1: T_2-T_3 and Test Run 2: T_7-T_8).*

Outstanding I/O Requests: The Outstanding I/O Requests parameter specifies the maximum number of concurrent I/O Requests, associated with a give Stream, which have been issued but not yet completed. *(Clause 3.4.4 of the SPC-2 Benchmark Specification).*

Ramp-Down: A specified, contiguous period of time in which the TSC is required to complete I/O Requests started but not completed during the preceding Run-Out period. Ramp-Down begins at the end of the preceding Run-Out period *(see "SPC-2 Test Run Components" illustrated below, Test Run 1: T_4-T_5 and Test Run 2: T_9-T_{10}).* The Workload Generator will not submit any I/O Requests during the Ramp-Down.

Ramp-Up: A specified, contiguous period of time required for the Benchmark Configuration (BC) to produce Steady State throughput after the Workload Generator begins submitting I/O Requests to the TSC for execution. The Ramp-Up period ends at the beginning of the Measurement Interval *(see "SPC-2 Test Run Components" illustrated below, Test Run 1: T_0-T_2 and Test Run 2: T_5-T_7).*

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

Run-Out: A specified, contiguous period of time in which the TSC is required to complete I/O Requests started but not completed during the preceding Measurement Interval. The Run-Out period begins at the end of the preceding Measurement Interval and is a component of the Steady State period *(see "SPC-2 Test Run Components" illustrated below, Test Run 1: T_3-T_4 and Test Run 2: T_9-T_{10}).* The Workload Generator will continue to submit I/O Requests at the Test Run's specified rate during the Run-Out period.

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

Steady State: The period during which the workload presented to the TSC by the SPC-2 Workload Generator is constant and the resulting TSC I/O Request Throughput is both consistent and sustainable. The Steady State period includes both the Measurement Interval and Run-Out periods *(see "SPC-2 Test Run Components" illustrated below, Test Run 1: T_1-T_4 and Test Run 2: T_6-T_9).*

Steady State is achieved only after caches in the TSC have filled and as a result the I/O Request Throughput of the TSC has stabilized.

Stream: A collection of Stream Segments that started within a Test Run.

Stream Segment: A sequentially organized pattern of I/O requests, which transfers a contiguous range of data.

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

Test Phase: A collection of one or more SPC-2 Test Runs sharing a common objective and intended to be run in a specific sequence.

Test Run: The execution of SPC-2 that produces specific SPC-2 test results. SPC-2 Test Runs have specified, measured Ramp-Up, Measurement Interval, Run-Out and Ramp-Down periods. "SPC-2 Test Run Components" *(see below)* illustrates the Ramp-Up, Steady State, Measurement Interval, Run-Out, and Ramp-Down components contained in two uninterrupted SPC-2 Test Runs *(Test Run 1: T_0-T_5 and Test Run 2: T_5-T_{10})*.

Test Run Sequence: A related sequence of Large File Processing (LFP) or Large Database Query (LDQ) Test Runs. Each Test Run Sequence will consist of five Test Runs, which vary the number of Streams as follows:

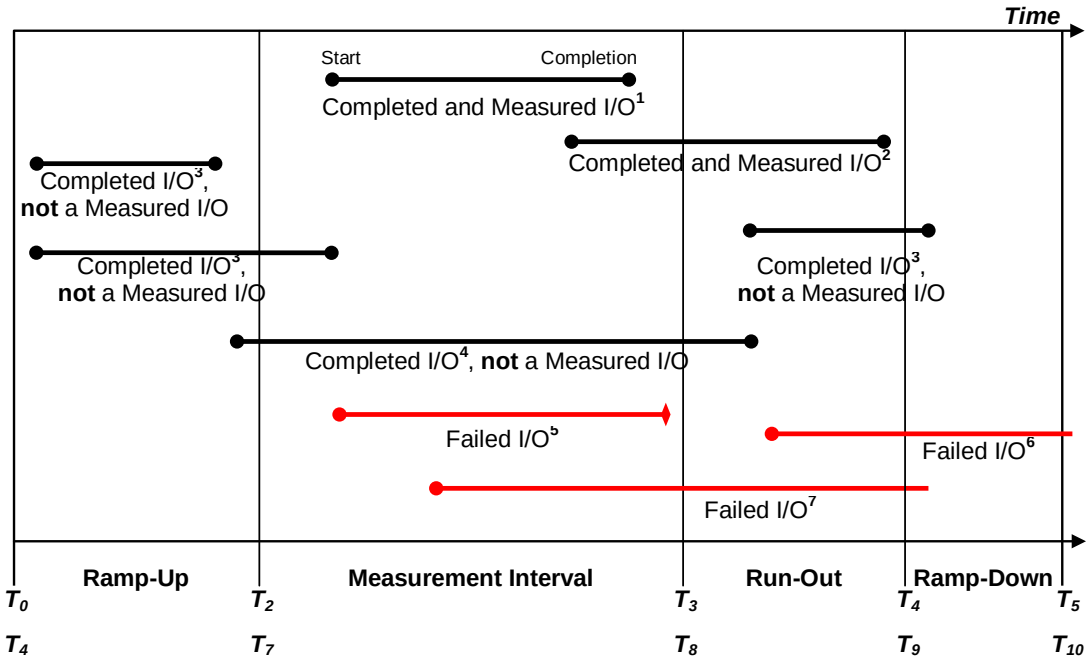
- Test Run 1: Maximum number of Streams, which is selected by the Test Sponsor
- Test Run 2: 50% of the maximum number of Streams used in Test Run 1.
- Test Run 3: 25% of the maximum number of Streams used in Test Run 1.
- Test Run 4: 12.5% of the maximum number of Streams used in Test Run 1.
- Test Run 5: 1 Stream.

Each of the five Test Runs in a Test Run Sequence will share the same attributes with the exception of the number of Streams. For example:

- Large File Processing, Read, 1024 KiB Transfer Size: Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 50% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 25% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 12.5% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 1 Stream

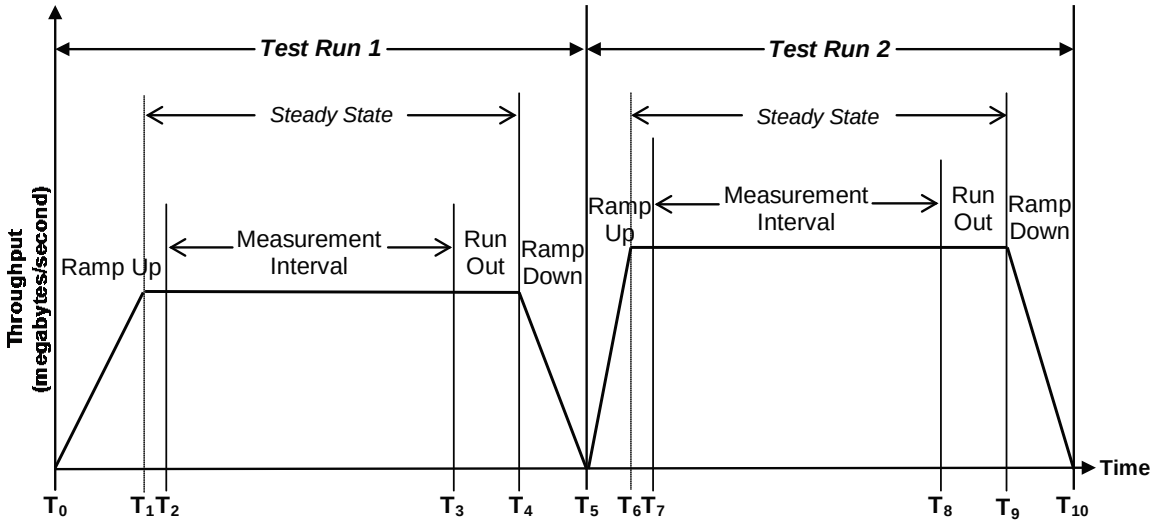
Transfer Size: The Transfer Size parameter specifies the number of bytes in KiB to transfer. *(Clause 3.4.7 of the SPC-2 Benchmark Specification)*

I/O Completion Types



Completed and Measured I/O[1]: *I/O started and completed within the Measurement Interval.*
Completed and Measured I/O[2]: *I/O started within the Measurement Interval and completed within Ramp Down.*
Completed I/O[3]: *I/O started before or after the Measurement Interval – not measured.*
Completed I/O[4]: *I/O started before and completed after the Measurement Interval – not measured.*
Failed I/O[5]: *Signaled as failed by System Software.*
Failed I/O[6]: *I/O did not complete prior to the end of Ramp-Down.*
Failed I/O[7]: *I/O did not complete prior to the end of Run-Out.*

SPC-2 Test Run Components



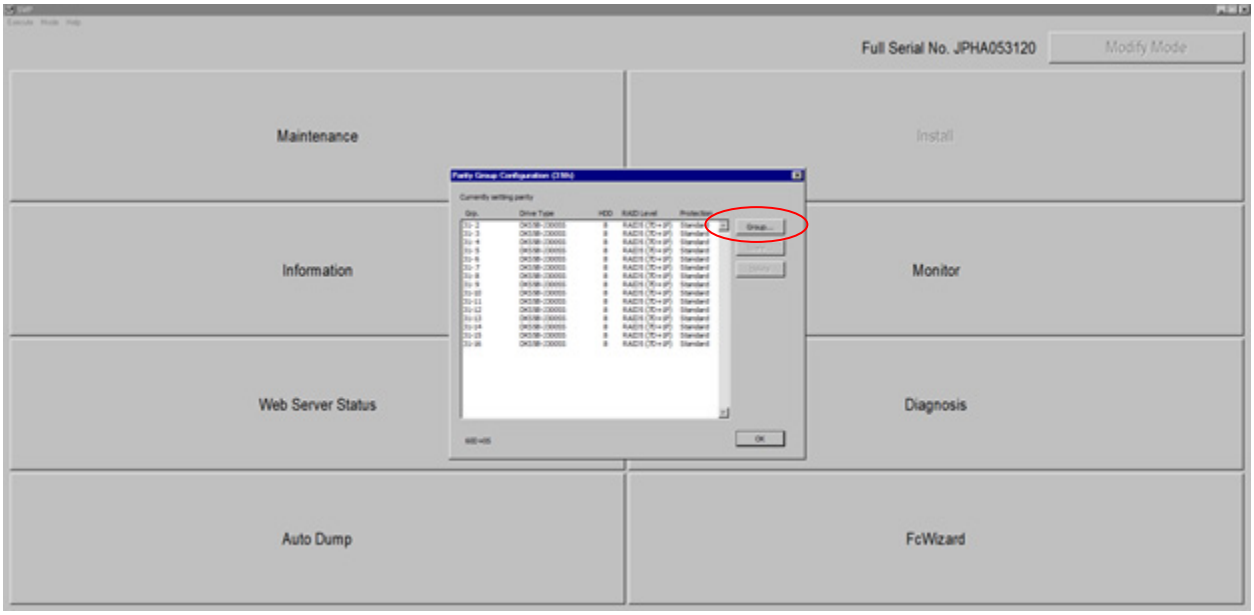
APPENDIX B: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

No customer tunable parameter or options were changed from default values for the SPC-1 benchmark measurements.

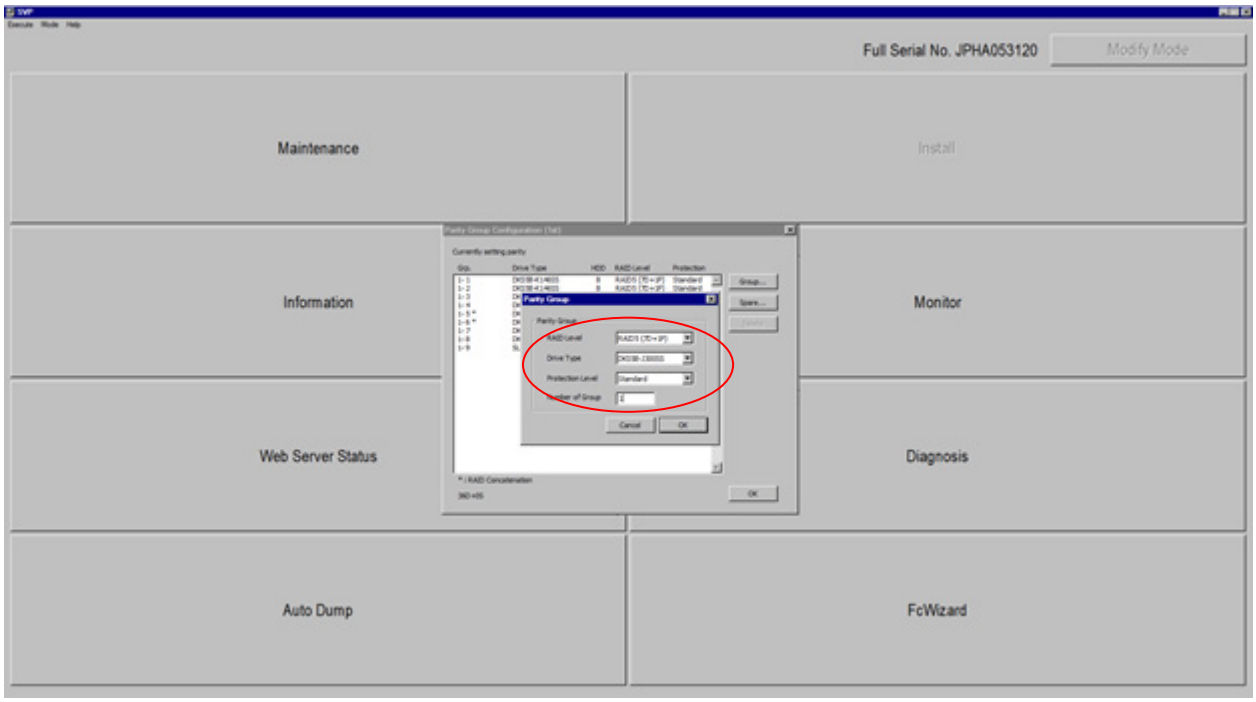
APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

The HP XP7 SVP (Service Processor) utility was used, as described in the following steps, to create the SPC-2 Logical Volumes (LUNs) used in the benchmark measurements:

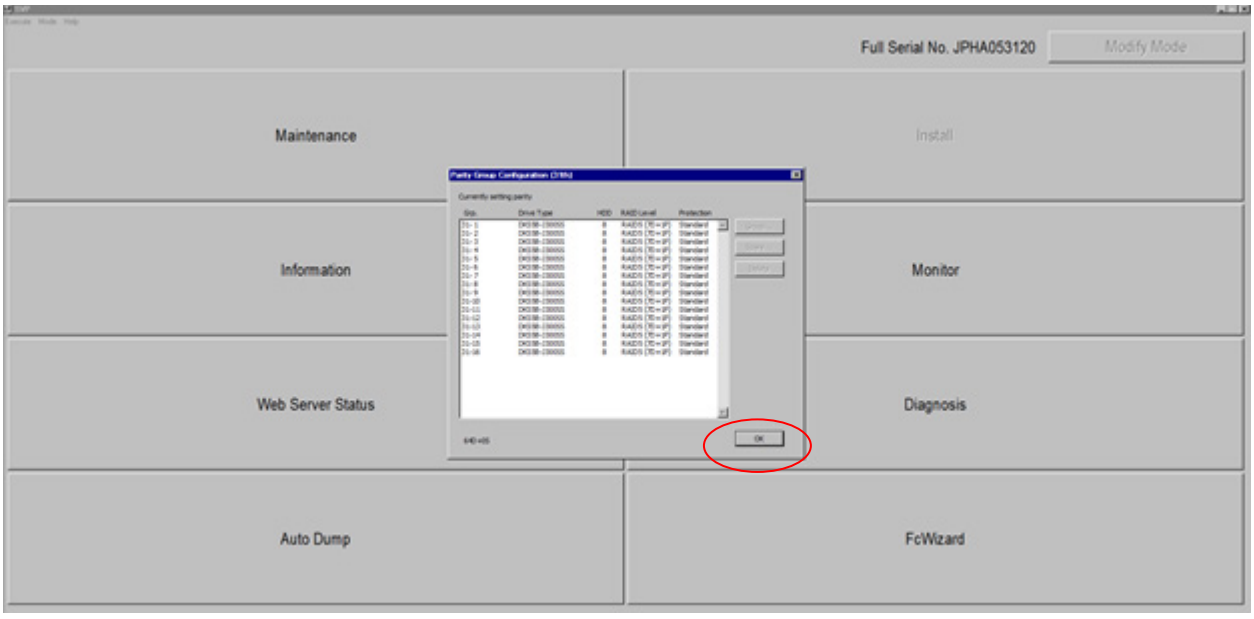
1. The HP XP7 SVP utility was launched from the storage service processor (embedded server) in order to begin the logical installation of disks and subsequent creation of the SPC-2 Logical Volumes (LUNs). There were 768 disk drives (300 GB, 15K RPM, 2.5" SAS) installed for the SPC-2 benchmark measurements.
2. Select **Group** on the following screen, which will launch the RAID definition screen.



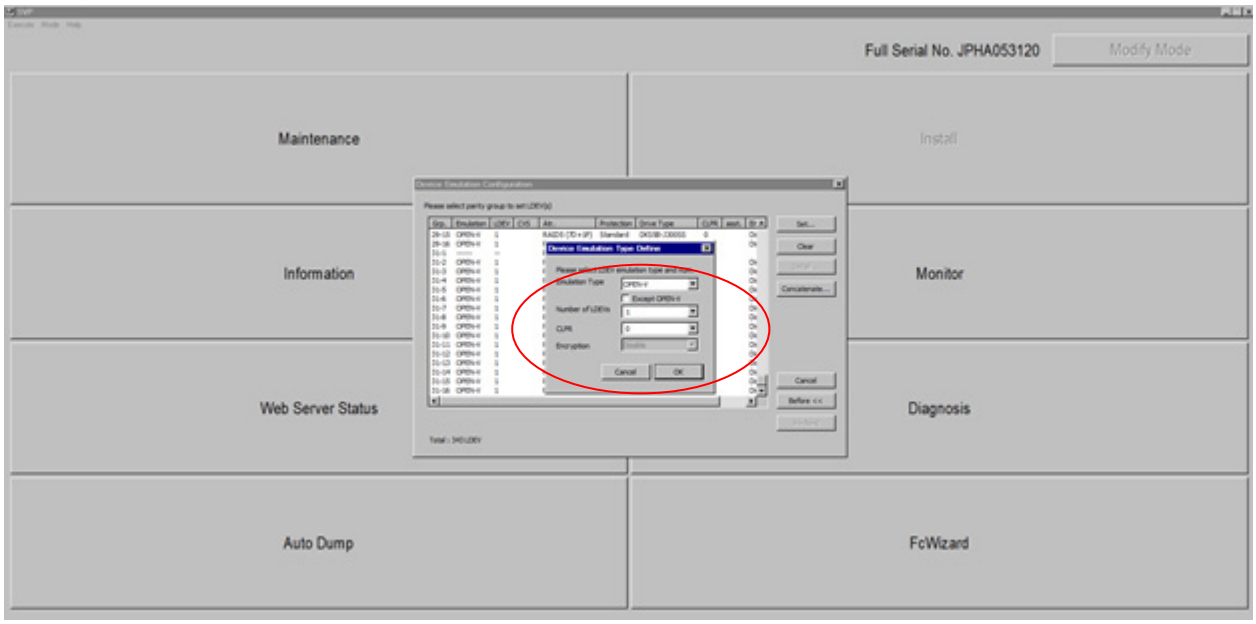
3. The Parity (RAID) Group is defined and created as a RAID-5 eight disk (7D+1P) group.



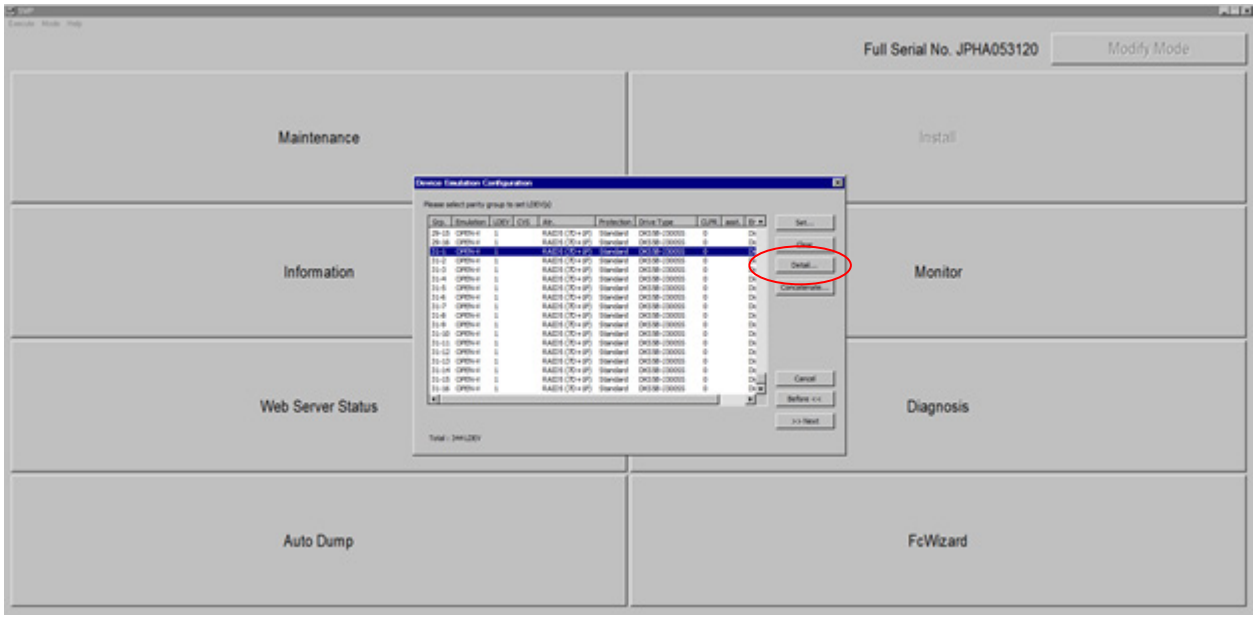
4. After selecting OK, the utility will return the previous screen where OK is selected again.



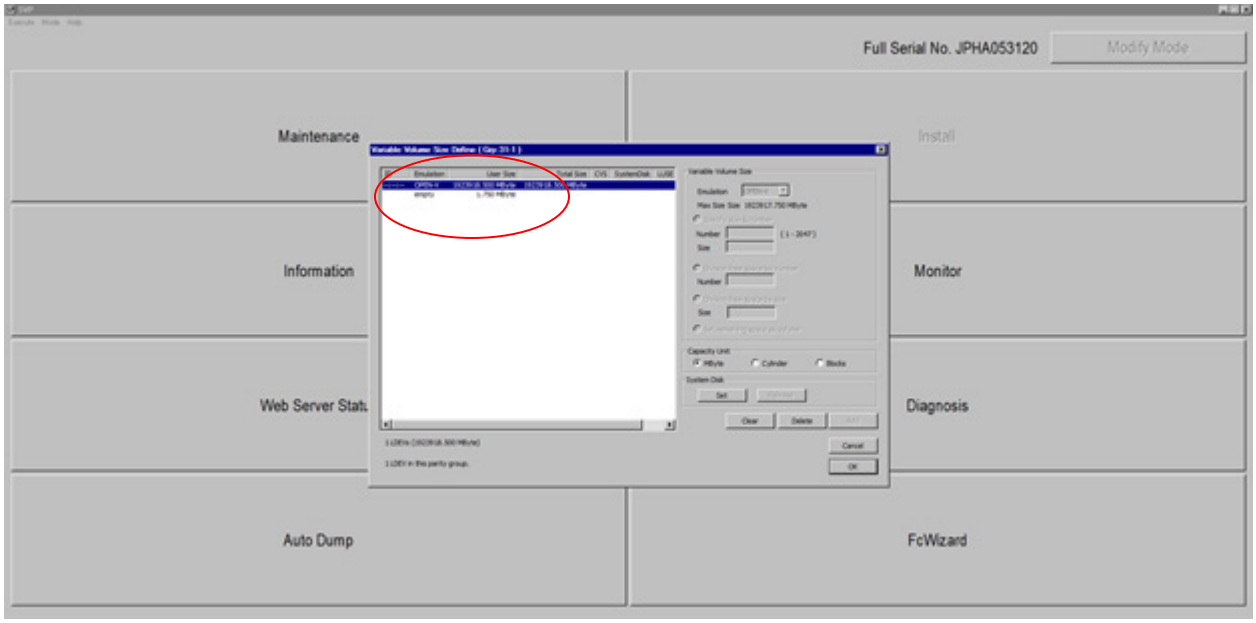
5. In the next step, the device emulation type is defined as an **Open-V** and **OK** is selected.



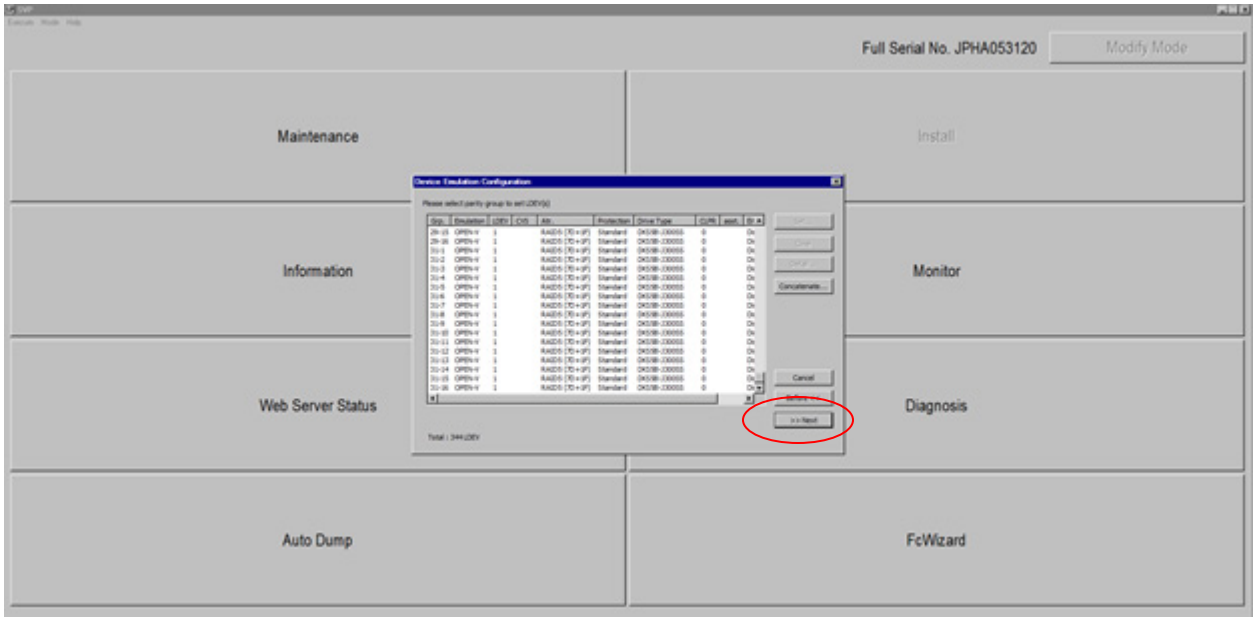
6. After defining the logical devices as **Open-V**, the **Device Emulation Configuration** screen is automatically displayed where each RAID group is highlighted and **Detail** is selected.



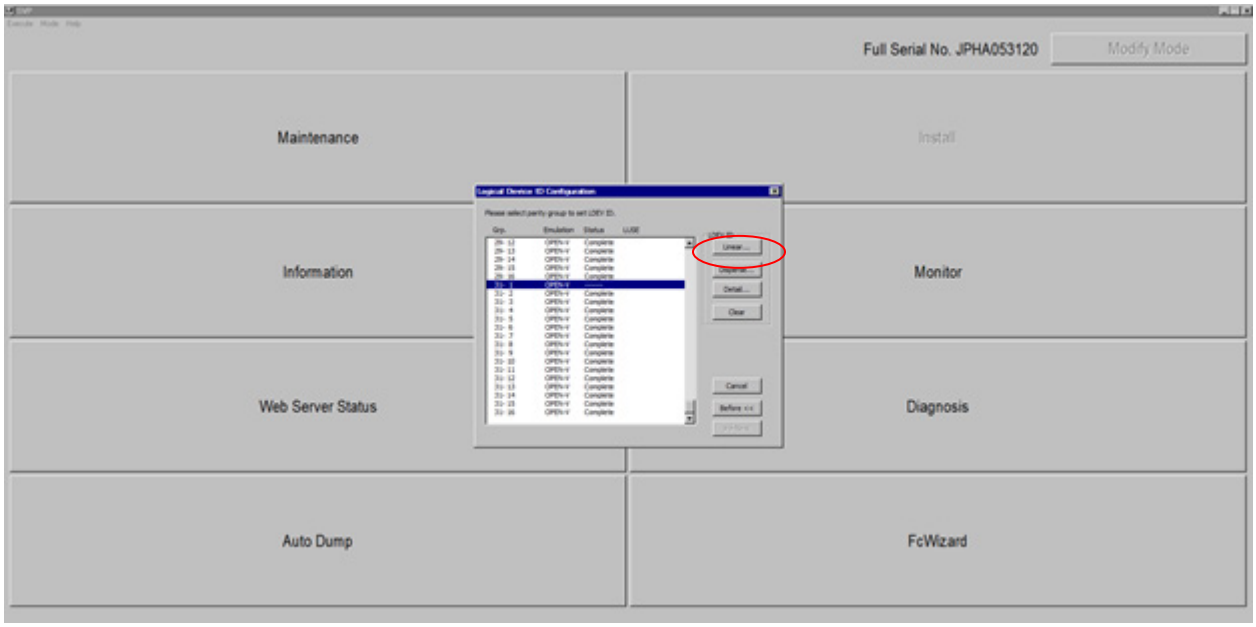
7. The next screen displays the total usable disk space (1,923,915.000 MiB) of the each eight-disk RAID group, excluding the RAID-5 parity overhead.
8. At this point the size of each logical device (ldev) is defined. The default of one logical device per eight-disk RAID group, utilizing all available space, is used for the SPC-2 benchmark measurements, so no further action is required. This results in a logical device with 1,923,915.000 MiB available for application use.



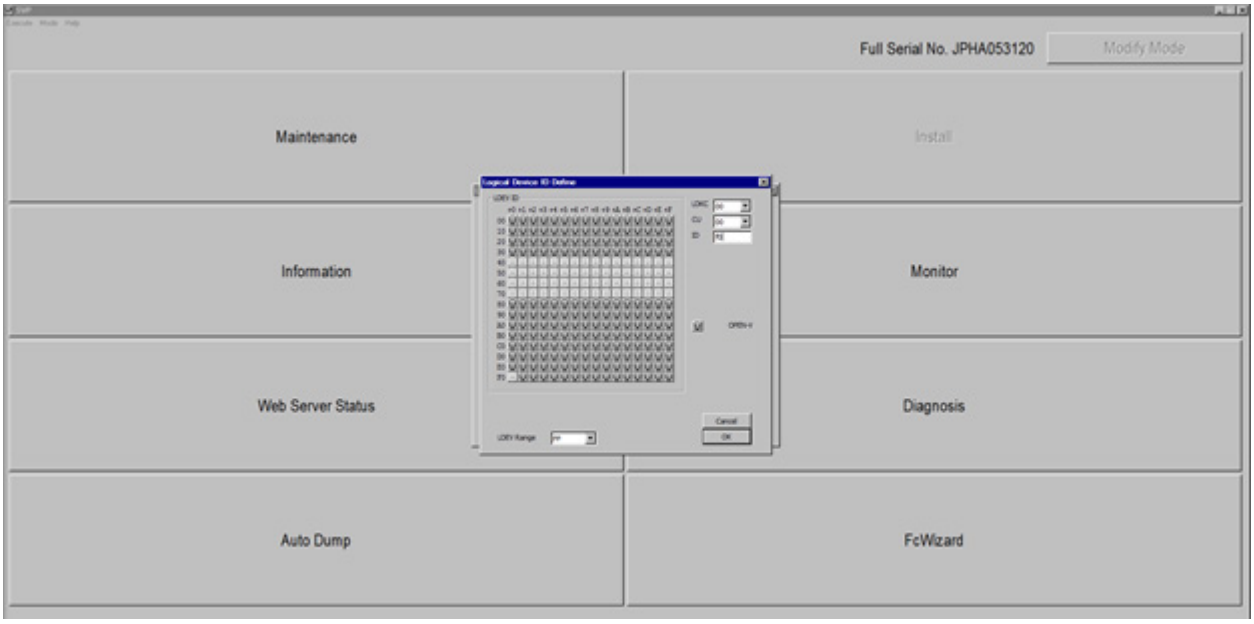
9. After completing steps 3-8 for the 96 RAID groups, return to the **Device Emulation Configuration** screen and select **Next**.



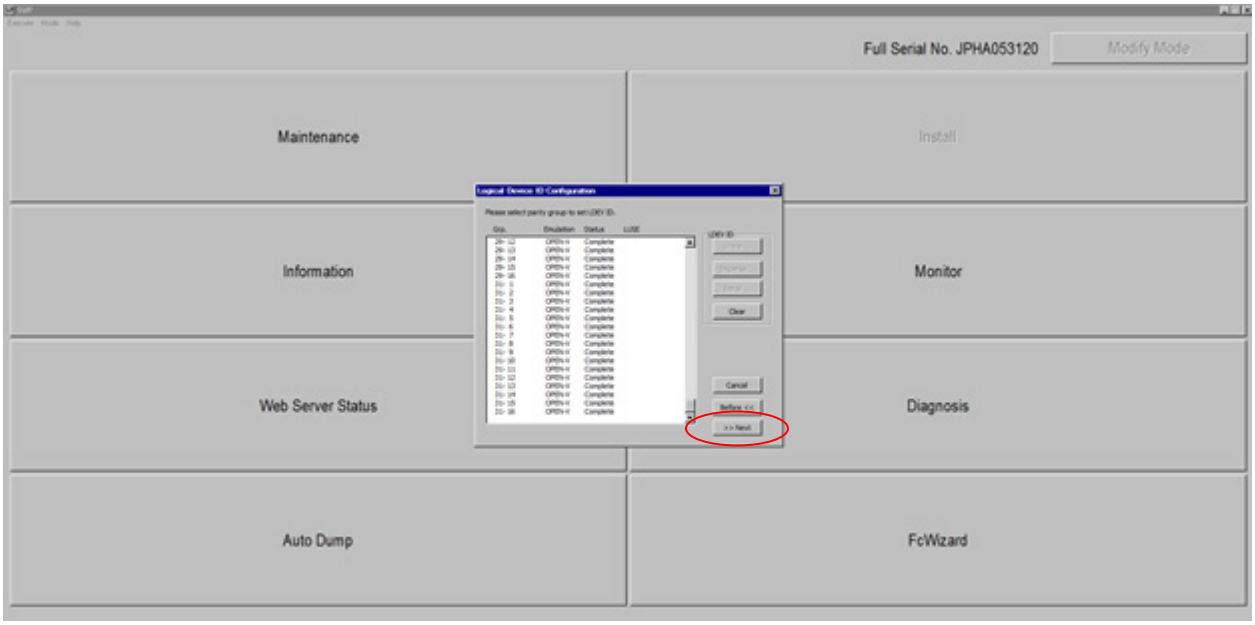
10. All RAID groups used in the SPC-2 benchmark are selected and directed to the linear mode of logical device number assignment in the **Logical Device ID Configuration** screen.



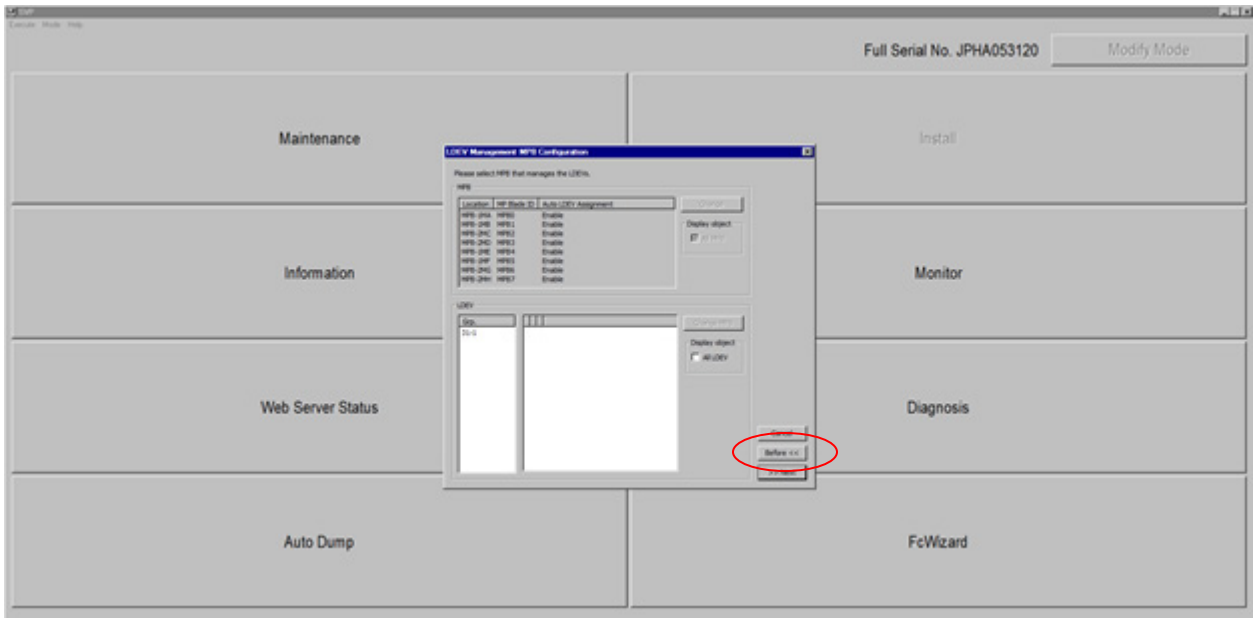
11. The specific Control Unit and ldev number are assigned as illustrated below. In this case Control Unit number 00 was selected starting at logical device number 00 resulting in the 96 SPC-2 logical devices being numbered 00:00 through 00:5F.



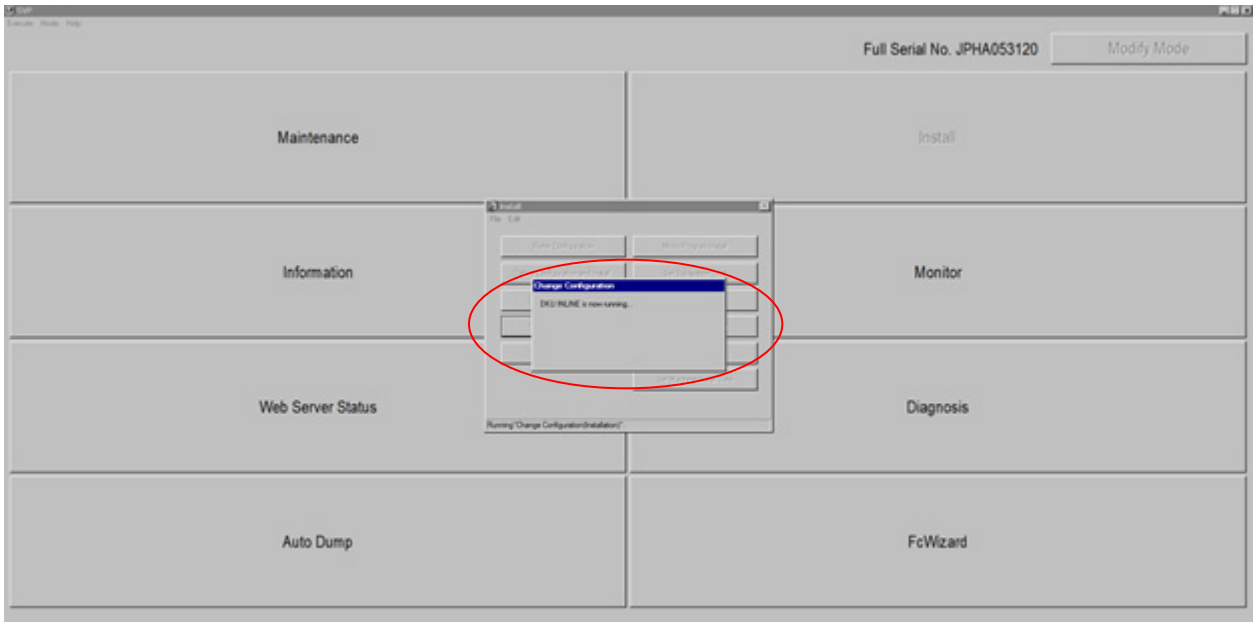
12. Once the "cu:ldev" assignments are completed, select **Next**.



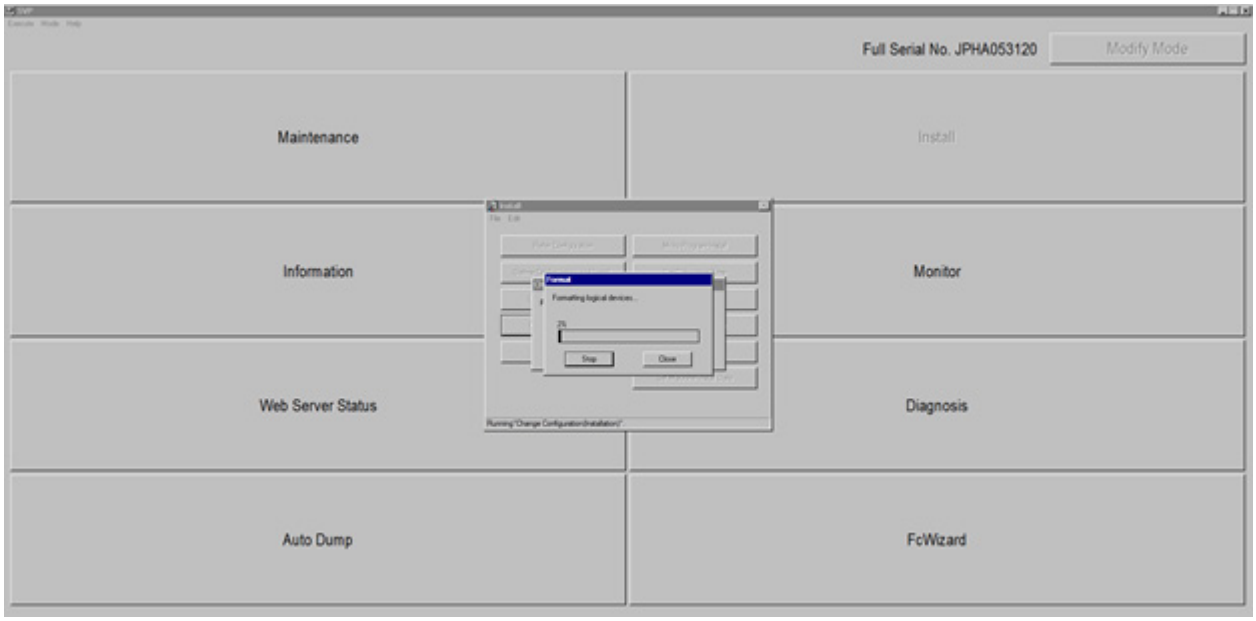
13. Logical devices are then assigned by default to microprocessor blades (MPBs) in a round-robin fashion to all 4 MPB pairs. Selecting **Next** starts the initialization process.



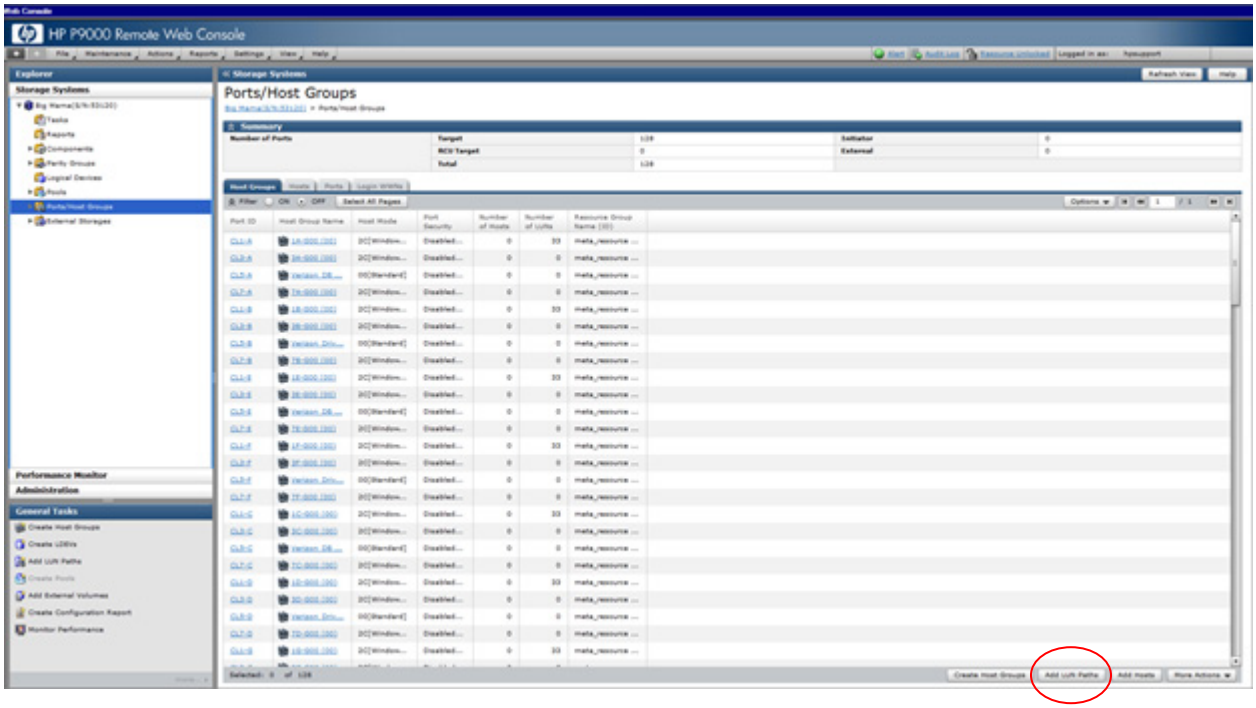
14. The logical devices are initialized, brought online and diagnostics are run as illustrated below ("***DKU INLINE is now running***").



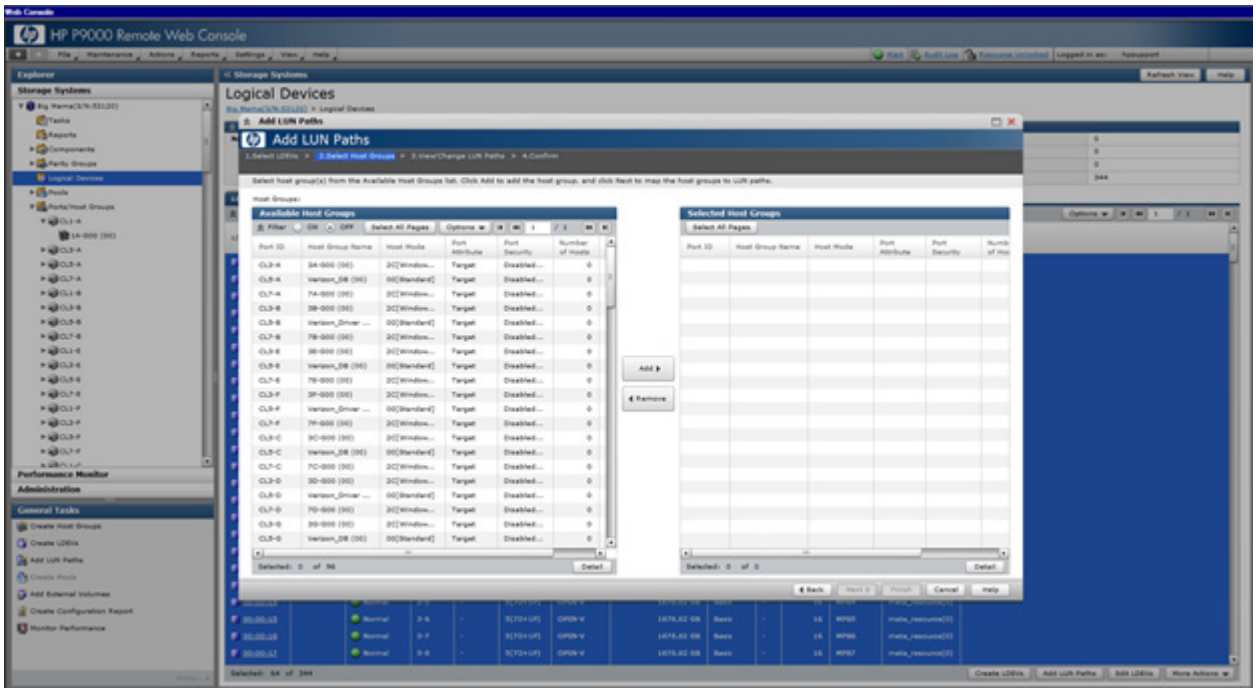
15. Once diagnostics are completed, the logical devices are formatted automatically and then available to be presented as LUNs to the Host Systems.



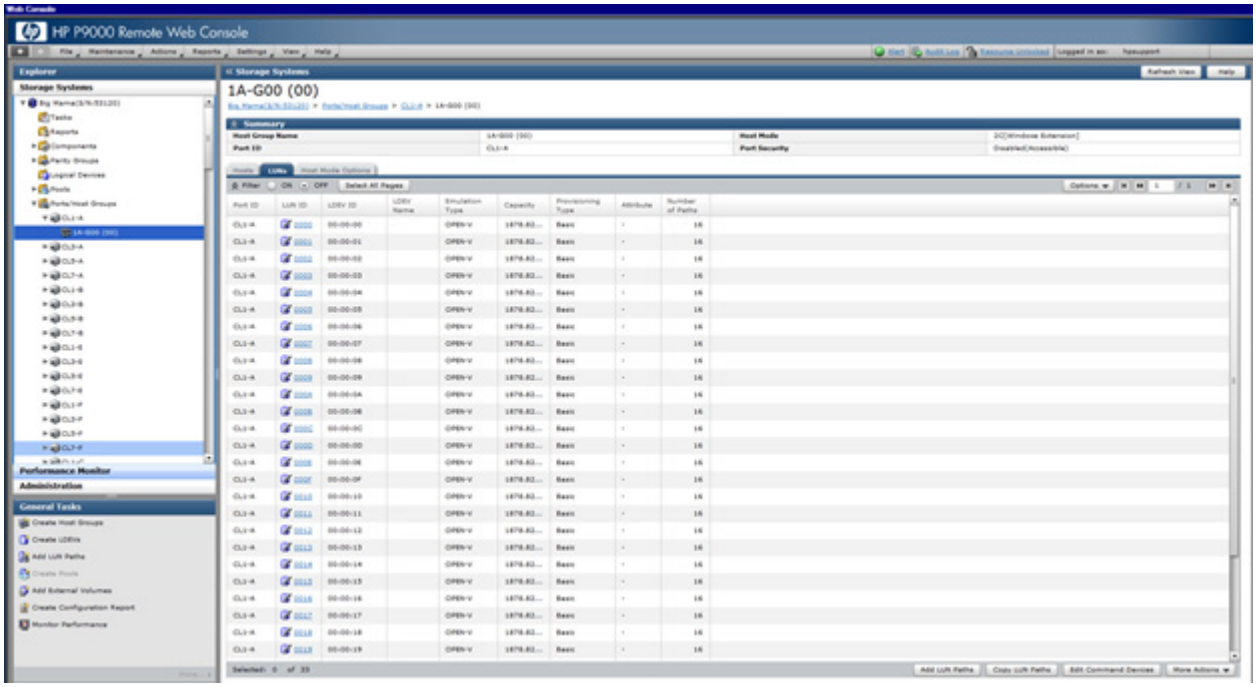
16. Next the Remote Web Console utility is launched from the SVP. **Ports/Host Groups** is selected in the left frame, ports used are selected and finally **Add LUN Paths** is selected as seen below.



17. The 96 logical devices are selected and assigned to the 64 ports for Host System presentation.



18. The 96 LUNs are then available to the Host Systems for use in the SPC-2 benchmark measurements. Selecting port **CL1-A** displays the specific LUNs mapped to that port.



APPENDIX D: SPC-2 WORKLOAD GENERATOR STORAGE COMMANDS AND PARAMETER FILES

ASU Pre-Fill

```
compratio=1.00
sd=default,th=4
***

sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
sd=sd18,lun=\\.\PhysicalDrive18
sd=sd19,lun=\\.\PhysicalDrive19
sd=sd20,lun=\\.\PhysicalDrive20
sd=sd21,lun=\\.\PhysicalDrive21
sd=sd22,lun=\\.\PhysicalDrive22
sd=sd23,lun=\\.\PhysicalDrive23
sd=sd24,lun=\\.\PhysicalDrive24
sd=sd25,lun=\\.\PhysicalDrive25
sd=sd26,lun=\\.\PhysicalDrive26
sd=sd27,lun=\\.\PhysicalDrive27
sd=sd28,lun=\\.\PhysicalDrive28
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sd=sd30,lun=\\.\PhysicalDrive30
sd=sd31,lun=\\.\PhysicalDrive31
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sd=sd35,lun=\\.\PhysicalDrive35
sd=sd36,lun=\\.\PhysicalDrive36
sd=sd37,lun=\\.\PhysicalDrive37
sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
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sd=sd46,lun=\\.\PhysicalDrive46
sd=sd47,lun=\\.\PhysicalDrive47
sd=sd48,lun=\\.\PhysicalDrive48
sd=sd49,lun=\\.\PhysicalDrive49
sd=sd50,lun=\\.\PhysicalDrive50
sd=sd51,lun=\\.\PhysicalDrive51
```

```
sd=sd52,lun=\\.\PhysicalDrive52
sd=sd53,lun=\\.\PhysicalDrive53
sd=sd54,lun=\\.\PhysicalDrive54
sd=sd55,lun=\\.\PhysicalDrive55
sd=sd56,lun=\\.\PhysicalDrive56
sd=sd57,lun=\\.\PhysicalDrive57
sd=sd58,lun=\\.\PhysicalDrive58
sd=sd59,lun=\\.\PhysicalDrive59
sd=sd60,lun=\\.\PhysicalDrive60
sd=sd61,lun=\\.\PhysicalDrive61
sd=sd62,lun=\\.\PhysicalDrive62
sd=sd63,lun=\\.\PhysicalDrive63
sd=sd64,lun=\\.\PhysicalDrive64
sd=sd65,lun=\\.\PhysicalDrive65
sd=sd66,lun=\\.\PhysicalDrive66
sd=sd67,lun=\\.\PhysicalDrive67
sd=sd68,lun=\\.\PhysicalDrive68
sd=sd69,lun=\\.\PhysicalDrive69
sd=sd70,lun=\\.\PhysicalDrive70
sd=sd71,lun=\\.\PhysicalDrive71
sd=sd72,lun=\\.\PhysicalDrive72
sd=sd73,lun=\\.\PhysicalDrive73
sd=sd74,lun=\\.\PhysicalDrive74
sd=sd75,lun=\\.\PhysicalDrive75
sd=sd76,lun=\\.\PhysicalDrive76
sd=sd77,lun=\\.\PhysicalDrive77
sd=sd78,lun=\\.\PhysicalDrive78
sd=sd79,lun=\\.\PhysicalDrive79
sd=sd80,lun=\\.\PhysicalDrive80
sd=sd81,lun=\\.\PhysicalDrive81
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sd=sd83,lun=\\.\PhysicalDrive83
sd=sd84,lun=\\.\PhysicalDrive84
sd=sd85,lun=\\.\PhysicalDrive85
sd=sd86,lun=\\.\PhysicalDrive86
sd=sd87,lun=\\.\PhysicalDrive87
sd=sd88,lun=\\.\PhysicalDrive88
sd=sd89,lun=\\.\PhysicalDrive89
sd=sd90,lun=\\.\PhysicalDrive90
sd=sd91,lun=\\.\PhysicalDrive91
sd=sd92,lun=\\.\PhysicalDrive92
sd=sd93,lun=\\.\PhysicalDrive93
sd=sd94,lun=\\.\PhysicalDrive94
sd=sd95,lun=\\.\PhysicalDrive95
sd=sd96,lun=\\.\PhysicalDrive96


***

wd=wd1,sd=sd*,seekpct=eof,rdpct=0,xfersize=1m
rd=rd1,wd=wd*,elapsed=72h,interval=60,iorate=max
```

Common Commands/Parameters – LFP and LDQ Tests

The following command/parameter lines appear in each of the command and parameter files for the Large File Processing (LFP) and Large Database Query (LDQ) Tests. The command lines are only listed below to eliminate redundancy.

```
host=localhost,
java=(c:\java\jre7\bin\java -Xmx 15120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=1,
maxstreams=1,

host=default,java=(c:\java\jre7\bin\java -Xmx5120m -Xss64k -
Xincgc),spc2="c:\spc\spc2",shell=spc2,jvms=6
host=(15.32.72.165,slave1),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.166,slave2),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.167,slave3),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.168,slave4),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200


host=(15.32.72.169,slave5),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200


host=(15.32.72.170,slave6),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200
```

```
host=(15.32.72.171,slave7),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200


host=(15.32.72.172,slave8),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200


host=(15.32.72.173,slave9),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.174,slave10),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.175,slave11),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.176,slave12),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.177,slave13),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.178,slave14),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200

host=(15.32.72.179,slave15),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
```

```
maxstreams=200

host=(15.32.72.180,slave16),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=200
```

Common Commands/Parameters – LFP, LDQ and VOD Tests

The following command/parameter lines appear in each of the command and parameter files for the Large File Processing (LFP), Large Database Query (LDQ) and Video on Demand (VOD) Tests. The command lines are only listed below to eliminate redundancy.

```
sd=default,host=localhost,size=1870g

***

sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
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sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
```

```
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
sd=sd45,lun=\\.\PhysicalDrive45
sd=sd46,lun=\\.\PhysicalDrive46
sd=sd47,lun=\\.\PhysicalDrive47
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sd=sd73,lun=\\.\PhysicalDrive73
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sd=sd81,lun=\\.\PhysicalDrive81
sd=sd82,lun=\\.\PhysicalDrive82
sd=sd83,lun=\\.\PhysicalDrive83
sd=sd84,lun=\\.\PhysicalDrive84
sd=sd85,lun=\\.\PhysicalDrive85
sd=sd86,lun=\\.\PhysicalDrive86
sd=sd87,lun=\\.\PhysicalDrive87
sd=sd88,lun=\\.\PhysicalDrive88
sd=sd89,lun=\\.\PhysicalDrive89
sd=sd90,lun=\\.\PhysicalDrive90
sd=sd91,lun=\\.\PhysicalDrive91
sd=sd92,lun=\\.\PhysicalDrive92
sd=sd93,lun=\\.\PhysicalDrive93
sd=sd94,lun=\\.\PhysicalDrive94
sd=sd95,lun=\\.\PhysicalDrive95
sd=sd96,lun=\\.\PhysicalDrive96

sd=default,host=slave1,size=1870g

sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
```

```
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
sd=sd18,lun=\\.\PhysicalDrive18
sd=sd19,lun=\\.\PhysicalDrive19
sd=sd20,lun=\\.\PhysicalDrive20
sd=sd21,lun=\\.\PhysicalDrive21
sd=sd22,lun=\\.\PhysicalDrive22
sd=sd23,lun=\\.\PhysicalDrive23
sd=sd24,lun=\\.\PhysicalDrive24
sd=sd25,lun=\\.\PhysicalDrive25
sd=sd26,lun=\\.\PhysicalDrive26
sd=sd27,lun=\\.\PhysicalDrive27
sd=sd28,lun=\\.\PhysicalDrive28
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sd=sd30,lun=\\.\PhysicalDrive30
sd=sd31,lun=\\.\PhysicalDrive31
sd=sd32,lun=\\.\PhysicalDrive32
sd=sd33,lun=\\.\PhysicalDrive33
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sd=sd35,lun=\\.\PhysicalDrive35
sd=sd36,lun=\\.\PhysicalDrive36
sd=sd37,lun=\\.\PhysicalDrive37
sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
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sd=sd60,lun=\\.\PhysicalDrive60
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sd=sd62,lun=\\.\PhysicalDrive62
sd=sd63,lun=\\.\PhysicalDrive63
sd=sd64,lun=\\.\PhysicalDrive64
sd=sd65,lun=\\.\PhysicalDrive65
sd=sd66,lun=\\.\PhysicalDrive66
sd=sd67,lun=\\.\PhysicalDrive67
sd=sd68,lun=\\.\PhysicalDrive68
sd=sd69,lun=\\.\PhysicalDrive69
```

```
sd=sd70,lun=\\.\PhysicalDrive70
sd=sd71,lun=\\.\PhysicalDrive71
sd=sd72,lun=\\.\PhysicalDrive72
sd=sd73,lun=\\.\PhysicalDrive73
sd=sd74,lun=\\.\PhysicalDrive74
sd=sd75,lun=\\.\PhysicalDrive75
sd=sd76,lun=\\.\PhysicalDrive76
sd=sd77,lun=\\.\PhysicalDrive77
sd=sd78,lun=\\.\PhysicalDrive78
sd=sd79,lun=\\.\PhysicalDrive79
sd=sd80,lun=\\.\PhysicalDrive80
sd=sd81,lun=\\.\PhysicalDrive81
sd=sd82,lun=\\.\PhysicalDrive82
sd=sd83,lun=\\.\PhysicalDrive83
sd=sd84,lun=\\.\PhysicalDrive84
sd=sd85,lun=\\.\PhysicalDrive85
sd=sd86,lun=\\.\PhysicalDrive86
sd=sd87,lun=\\.\PhysicalDrive87
sd=sd88,lun=\\.\PhysicalDrive88
sd=sd89,lun=\\.\PhysicalDrive89
sd=sd90,lun=\\.\PhysicalDrive90
sd=sd91,lun=\\.\PhysicalDrive91
sd=sd92,lun=\\.\PhysicalDrive92
sd=sd93,lun=\\.\PhysicalDrive93
sd=sd94,lun=\\.\PhysicalDrive94
sd=sd95,lun=\\.\PhysicalDrive95
sd=sd96,lun=\\.\PhysicalDrive96

sd=default,host=slave2,size=1870g

sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
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sd=sd96,lun=\\.\PhysicalDrive96

sd=default,host=slave4,size=1870g

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sd=default,host=slave5,size=1870g

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  sd=default,host=slave6,size=1870g

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sd=default,host=slave7,size=1870g

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sd=sd96,lun=\\.\PhysicalDrive96

sd=default,host=slave8,size=1870g

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sd=default,host=slave9,size=1870g

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sd=default,host=slave11,size=1870g

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sd=default,host=slave12,size=1870g

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  sd=sd96,lun=\\.\PhysicalDrive96

  sd=default,host=slave13,size=1870g

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sd=sd76,lun=\\.\PhysicalDrive76
sd=sd77,lun=\\.\PhysicalDrive77
sd=sd78,lun=\\.\PhysicalDrive78
```

```
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  sd=sd96,lun=\\.\PhysicalDrive96

  sd=default,host=slave14,size=1870g

  sd=sd1,lun=\\.\PhysicalDrive1
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```

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  sd=sd92,lun=\\.\PhysicalDrive92
  sd=sd93,lun=\\.\PhysicalDrive93
  sd=sd94,lun=\\.\PhysicalDrive94
  sd=sd95,lun=\\.\PhysicalDrive95
  sd=sd96,lun=\\.\PhysicalDrive96

  sd=default,host=slave15,size=1870g

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  sd=sd2,lun=\\.\PhysicalDrive2
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  sd=sd4,lun=\\.\PhysicalDrive4
  sd=sd5,lun=\\.\PhysicalDrive5
  sd=sd6,lun=\\.\PhysicalDrive6
```

```
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```

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sd=sd96,lun=\\.\PhysicalDrive96

sd=default,host=slave16,size=1870g

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```

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sd=sd93,lun=\\.\PhysicalDrive93
sd=sd94,lun=\\.\PhysicalDrive94
sd=sd95,lun=\\.\PhysicalDrive95
sd=sd96,lun=\\.\PhysicalDrive96
```

Large File Processing Test (LFP)

Common Commands/Parameters – LFP and LDQ

Common Commands/Parmeters – LFP, LDQ and VOD

```
*** Large File Processing Tests

maxlatestart=0
reportinginterval=5
segmentlength=512m
rd=default,measurement=180,runout=45,rampdown=15,buffers=1

** LFP, "write" Test Phase

rd=default,rdpct=0,xfersize=1024k
rd=TR1_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR2_SPC-2-FP2.0,streams=700
rd=TR3_SPC-2-FP2.0,streams=350
rd=TR4_SPC-2-FP2.0,streams=175
rd=TR5_SPC-2-FP2.0,streams=1

rd=default,xfersize=256k
rd=TR6_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR7_SPC-2-FP2.0,streams=700
rd=TR8_SPC-2-FP2.0,streams=350
rd=TR9_SPC-2-FP2.0,streams=175
rd=TR10_SPC-2-FP2.0,streams=1

** LFP, "read-write" Test Phase

rd=default,rdpct=50,xfersize=1024k
rd=TR11_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR12_SPC-2-FP2.0,streams=700
rd=TR13_SPC-2-FP2.0,streams=350
rd=TR14_SPC-2-FP2.0,streams=175
rd=TR15_SPC-2-FP2.0,streams=1

rd=default,xfersize=256k
rd=TR16_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR17_SPC-2-FP2.0,streams=700
rd=TR18_SPC-2-FP2.0,streams=350
rd=TR19_SPC-2-FP2.0,streams=175
rd=TR20_SPC-2-FP2.0,streams=1

** LFP, "read" Test Phase

rd=default,rdpct=100,xfersize=1024k
rd=TR21_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR22_SPC-2-FP2.0,streams=700
rd=TR23_SPC-2-FP2.0,streams=350
rd=TR24_SPC-2-FP2.0,streams=175
rd=TR25_SPC-2-FP2.0,streams=1
```

```
rd=default,xfersize=256k
rd=TR26_SPC-2-FP2.0,rampup=180,periods=90,streams=1400
rd=default,rampup=180,periods=90
rd=TR27_SPC-2-FP2.0,streams=700
rd=TR28_SPC-2-FP2.0,streams=350
rd=TR29_SPC-2-FP2.0,streams=175
rd=TR30_SPC-2-FP2.0,streams=1
```

Large Database Query Test (LDQ)

Common Commands/Parameters – LFP and LDQ

Common Commands/Parmeters – LFP, LDQ and VOD

```
* Large database Processing:
*
maxlatestart=0
reportinginterval=5
segmentlength=512m

* Fixed parameters
rd=default,rdpct=99,rampup=180,measurement=180,runout=45,rampdown=15,periods=90


rd=default,xfersize=1024k,buffers=4,streams=1400
rd=TR1_SPC-2-DQ2.0,streams=1400
rd=TR2_SPC-2-DQ2.0,streams=700
rd=TR3_SPC-2-DQ2.0,streams=350
rd=TR4_SPC-2-DQ2.0,streams=175
rd=TR5_SPC-2-DQ2.0,streams=1

rd=default,xfersize=1024k,buffers=1,streams=1400
rd=TR6_SPC-2-DQ2.0,streams=1400
rd=TR7_SPC-2-DQ2.0,streams=700
rd=TR8_SPC-2-DQ2.0,streams=350
rd=TR9_SPC-2-DQ2.0,streams=175
rd=TR10_SPC-2-DQ2.0,streams=1

rd=default,xfersize=64k,buffers=4,streams=1400
rd=TR11_SPC-2-DQ2.0,streams=1400
rd=TR12_SPC-2-DQ2.0,streams=700
rd=TR13_SPC-2-DQ2.0,streams=350
rd=TR14_SPC-2-DQ2.0,streams=175
rd=TR15_SPC-2-DQ2.0,streams=1

rd=default,xfersize=64k,buffers=1,streams=1400
rd=TR16_SPC-2-DQ2.0,streams=1400
rd=TR17_SPC-2-DQ2.0,streams=700
rd=TR18_SPC-2-DQ2.0,streams=350
rd=TR19_SPC-2-DQ2.0,streams=175
rd=TR20_SPC-2-DQ2.0,streams=1
```

Logical Volume Initialization and Video on Demand Delivery (VOD)

```
host=localhost,
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=1,
maxstreams=1,

host=default,java=(c:\java\bin\java -Xmx1500m -Xss64k -
Xincgc),spc2="c:\spc\spc2",shell=spc2,jvms=6
host=(15.32.72.165,slave1),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000

host=(15.32.72.166,slave2),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000

host=(15.32.72.167,slave3),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000

host=(15.32.72.168,slave4),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000


host=(15.32.72.169,slave5),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000


host=(15.32.72.170,slave6),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000


host=(15.32.72.171,slave7),
java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
```

```
  maxstreams=4000


  host=(15.32.72.172,slave8),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000


  host=(15.32.72.173,slave9),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.174,slave10),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.175,slave11),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.176,slave12),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.177,slave13),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.178,slave14),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.179,slave15),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
  shell=spc2,
  jvms=12,
  maxstreams=4000

  host=(15.32.72.180,slave16),
  java=(c:\java\jre7\bin\java -Xmx 5120m -Xss64k -Xincgc),
  spc2="c:\spc\spc2",
```

```
shell=spc2,
jvms=12,
maxstreams=4000
```

Common Commands/Parmeters – LFP, LDQ and VOD

```
maxlatestart=0
videosegmentduration=1200
maxlatevod=0
reportinginterval=5
rd=default,rampup=4500,periods=2250,measurement=7200,runout=45,rampdown=15,buffers=8
rd=TR1_SPC-2-VOD11.0,streams=58000
```

Common Commands/Parameters – Persistence Test Runs

The following command/parameter lines appear in each of the command and parameter files for the Persistence Test Runs. The command lines are only listed below to eliminate redundancy.

```
host=localhost,
java=(c:\java\jre7\bin\java -Xss64k),
spc2="c:\spc\spc2",
shell=spc2,
jvms=12,
maxstreams=4000,


sd=default,host=localhost,size=1870g

***
sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
sd=sd18,lun=\\.\PhysicalDrive18
sd=sd19,lun=\\.\PhysicalDrive19
sd=sd20,lun=\\.\PhysicalDrive20
sd=sd21,lun=\\.\PhysicalDrive21
sd=sd22,lun=\\.\PhysicalDrive22
sd=sd23,lun=\\.\PhysicalDrive23
sd=sd24,lun=\\.\PhysicalDrive24
sd=sd25,lun=\\.\PhysicalDrive25
sd=sd26,lun=\\.\PhysicalDrive26
sd=sd27,lun=\\.\PhysicalDrive27
sd=sd28,lun=\\.\PhysicalDrive28
sd=sd29,lun=\\.\PhysicalDrive29
sd=sd30,lun=\\.\PhysicalDrive30
sd=sd31,lun=\\.\PhysicalDrive31
```

```
sd=sd32,lun=\\.\PhysicalDrive32
sd=sd33,lun=\\.\PhysicalDrive33
sd=sd34,lun=\\.\PhysicalDrive34
sd=sd35,lun=\\.\PhysicalDrive35
sd=sd36,lun=\\.\PhysicalDrive36
sd=sd37,lun=\\.\PhysicalDrive37
sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
sd=sd45,lun=\\.\PhysicalDrive45
sd=sd46,lun=\\.\PhysicalDrive46
sd=sd47,lun=\\.\PhysicalDrive47
sd=sd48,lun=\\.\PhysicalDrive48
sd=sd49,lun=\\.\PhysicalDrive49
sd=sd50,lun=\\.\PhysicalDrive50
sd=sd51,lun=\\.\PhysicalDrive51
sd=sd52,lun=\\.\PhysicalDrive52
sd=sd53,lun=\\.\PhysicalDrive53
sd=sd54,lun=\\.\PhysicalDrive54
sd=sd55,lun=\\.\PhysicalDrive55
sd=sd56,lun=\\.\PhysicalDrive56
sd=sd57,lun=\\.\PhysicalDrive57
sd=sd58,lun=\\.\PhysicalDrive58
sd=sd59,lun=\\.\PhysicalDrive59
sd=sd60,lun=\\.\PhysicalDrive60
sd=sd61,lun=\\.\PhysicalDrive61
sd=sd62,lun=\\.\PhysicalDrive62
sd=sd63,lun=\\.\PhysicalDrive63
sd=sd64,lun=\\.\PhysicalDrive64
sd=sd65,lun=\\.\PhysicalDrive65
sd=sd66,lun=\\.\PhysicalDrive66
sd=sd67,lun=\\.\PhysicalDrive67
sd=sd68,lun=\\.\PhysicalDrive68
sd=sd69,lun=\\.\PhysicalDrive69
sd=sd70,lun=\\.\PhysicalDrive70
sd=sd71,lun=\\.\PhysicalDrive71
sd=sd72,lun=\\.\PhysicalDrive72
sd=sd73,lun=\\.\PhysicalDrive73
sd=sd74,lun=\\.\PhysicalDrive74
sd=sd75,lun=\\.\PhysicalDrive75
sd=sd76,lun=\\.\PhysicalDrive76
sd=sd77,lun=\\.\PhysicalDrive77
sd=sd78,lun=\\.\PhysicalDrive78
sd=sd79,lun=\\.\PhysicalDrive79
sd=sd80,lun=\\.\PhysicalDrive80
sd=sd81,lun=\\.\PhysicalDrive81
sd=sd82,lun=\\.\PhysicalDrive82
sd=sd83,lun=\\.\PhysicalDrive83
sd=sd84,lun=\\.\PhysicalDrive84
sd=sd85,lun=\\.\PhysicalDrive85
sd=sd86,lun=\\.\PhysicalDrive86
sd=sd87,lun=\\.\PhysicalDrive87
sd=sd88,lun=\\.\PhysicalDrive88
sd=sd89,lun=\\.\PhysicalDrive89
sd=sd90,lun=\\.\PhysicalDrive90
sd=sd91,lun=\\.\PhysicalDrive91
sd=sd92,lun=\\.\PhysicalDrive92
sd=sd93,lun=\\.\PhysicalDrive93
sd=sd94,lun=\\.\PhysicalDrive94
```

```
sd=sd95,lun=\\.\PhysicalDrive95
sd=sd96,lun=\\.\PhysicalDrive96
```

SPC-2 Persistence Test Run 1 *(write phase)*

Common Commands/Parameters – Persistence

```
* Persistence Write Test:
*
maxlatestart=0
reportinginterval=5
segmentlength=512m

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

* prstw, "write" Test Phase

rd=default,rdpct=0,xfersize=1024k
rd=TR1_SPC-2-persist-w,streams=1400
```

SPC-2 Persistence Test Run 2 *(read phase)*

Common Commands/Parameters – Persistence

```
* Persistence Read Test:
*
maxlatestart=0
reportinginterval=5
segmentlength=512m

maxpersistenceerrors=10

* Fixed parameters
rd=default,rampup=0,periods=0,measurement=300,runout=0,rampdown=0,buffers=1

* prstr, "read" Test Phase

rd=default,rdpct=100,xfersize=1024k
rd=TR1_SPC-2-persist-r,streams=0
```

APPENDIX E: SPC-2 WORKLOAD GENERATOR EXECUTION COMMANDS AND PARAMETERS

ASU Pre-Fill, Large File Processing (LFP) Test, Large Database Query (LDQ) Test, Video on Demand Delivery (VOD) Test, and SPC-2 Persistence Test Run 1 *(write phase)*

The following script, **runspc2_16xp7host.bat**, executes the following in an uninterrupted sequence:

- Required ASU Pre-Fill
- SPC-2 Tests:
  - Large File Processing (LFP)
  - Large Database Query (LDQ)
  - Video On Demand (VOD)
  - SPC-2 Persistence – Test Run 1 *(write phase)*

runspc2_16xp7host.bat

```
rem chdir to rc5 vdbench directory
chdir c:\spc\spc2\rc5

rem run prefill script
call vdbench.bat -f c:\spc\spc2\prefill1brkparmfile.txt -o
c:\spc\spc2\spc2_output\prefill

rem chdir to spc2 directory
chdir c:\spc\spc2

rem vod test
call spc2.bat -f 16xp7host.vod -o c:\spc\spc2\spc2_output\vod

rem lfp test
call spc2.bat -f 16xp7host.lfp -o c:\spc\spc2\spc2_output\lfp

rem ldq test
call spc2.bat -f 16xp7host.ldq -o c:\spc\spc2\spc2_output\ldq

rem init volumes
call spc2.bat -f 1brkparmfile.ldq -o c:\spc\spc2\spc2_output\init -init

rem prstw test
call spc2.bat -f 1brkparmfilet1.prstw -o c:\spc\spc2\spc2_output\prstw

rem prstr test
rem call spc2.bat -f 1brkparmfilet1.prstr -o c:\spc\spc2\spc2_output\prstr
```

SPC-2 Persistence Test Run 2 *(read phase)*

The following script, **runspc2_16xp7host_prstr.bat**, was invoked to execute SPC-2 Persistence Test Run 2 *(read phase)* after the required TSC power off/power on cycle.

runspc2_16xp7host_prstr.bat

```
rem prstr test
call spc2.bat -f 1brkparmfilet1.prstr -o c:\spc\spc2\spc2_output\prstr
```