



SPC BENCHMARK 2™
FULL DISCLOSURE REPORT
HEWLETT-PACKARD COMPANY
HP STORAGEWORKS 1000
MODULAR SMART ARRAY

SPC-2™ V1.2.1

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Table of Contents

Audit Certification	9
Audit Certification (cont.)	10
Letter of Good Faith	11
Executive Summary	12
Test Sponsor and Contact Information	12
Revision Information and Key Dates	12
Tested Storage Product (TSP) Description	12
SPC-2 Reported Data	13
Storage Capacities and Relationships	14
Tested Storage Configuration Pricing (Priced Storage Configuration)	15
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration	15
Benchmark Configuration/Tested Storage Configuration Diagram	16
Host System(s) and Tested Storage Configuration Components	16
Configuration Information	17
Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram	17
Storage Network Configuration	17
Host System and Tested Storage Configuration Table	17
Customer Tunable Parameters and Options	18
Tested Storage Configuration (TSC) Description	18
SPC-2 Workload Generator Storage Configuration	18
SPC-2 Data Repository	19
SPC-2 Storage Capacities and Relationships	19
SPC-2 Storage Capacities	19
SPC-2 Storage Hierarchy Ratios	20
SPC-2 Storage Capacities and Relationships Illustration	20
Logical Volume Capacity and ASU Mapping	21
SPC-2 Test Execution Results	22
SPC-2 Tests, Test Phases, Test Run Sequences, and Test Runs	22
Large File Processing Test	25
SPC-2 Workload Generator Commands and Parameters.....	25
SPC-2 Test Results File	26
SPC-2 Large File Processing Average Data Rates (MB/s).....	26
SPC-2 Large File Processing Average Data Rates Graph	27
SPC-2 Large File Processing Average Data Rate per Stream.....	28

SPC-2 Large File Processing Average Data Rate per Stream Graph	29
SPC-2 Large File Processing Average Response Time.....	29
SPC-2 Large File Processing Average Response Time.....	30
SPC-2 Large File Processing Average Response Time Graph.....	31
Large File Processing Test – WRITE ONLY Test Phase	32
SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Test Run Data – Ramp-Up Period.....	33
SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	34
SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	35
SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	35
SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Data Rate per Stream Graph.....	36
SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Response Time Graph.....	36
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Test Run Data – Ramp-Up Period.....	37
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	38
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	39
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	39
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate per Stream Graph	40
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Response Time Graph.....	40
Large File Processing Test – READ-WRITE Test Phase	41
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Test Run Data – Ramp-Up Period.....	42
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	43
SPC-2 “Large File Processing/ READ-WRITE/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	44
SPC-2 “Large File Processing/ READ-WRITE/1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	44
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Average Data Rate per Stream Graph	45
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Average Response Time Graph.....	45

SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Test Run Data – Ramp-Up Period.....	46
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	47
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	48
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	48
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate per Stream Graph	49
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Response Time Graph.....	49
Large File Processing Test – READ ONLY Test Phase	50
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Test Run Data – Ramp Up Period.....	51
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Test Run Data.....	52
Measurement Interval, Run-Out, and Ramp-Down Periods	52
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	53
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	53
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate per Stream Graph	54
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Response Time Graph.....	54
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Test Run Data – Ramp-Up Period.....	55
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	56
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run	57
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only	57
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate per Stream Graph	58
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Response Time Graph.....	58
Large Database Query Test.....	59
SPC-2 Workload Generator Commands and Parameters.....	59
SPC-2 Test Results File	59
SPC-2 Large Database Query Average Data Rates (MB/s)	60
SPC-2 Large Database Query Average Data Rates Graph.....	60

SPC-2 Large Database Query Average Data Rate per Stream	61
SPC-2 Large Database Query Average Data Rate per Stream Graph.....	61
SPC-2 Large Database Query Average Response Time.....	62
SPC-2 Large Database Query Average Response Time Graph	62
Large Database Query Test – 1024 KiB TRANSFER SIZE Test Phase	63
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Test Run Data – Ramp-Up Period.....	64
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	65
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Complete Test Run	66
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Measurement Interval (MI) Only	66
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate per Stream Graph	67
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Response Time Graph.....	67
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Test Run Data – Ramp-Up Period.....	68
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	69
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Complete Test Run	70
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Measurement Interval (MI) Only	70
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate per Stream Graph	71
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Response Time Graph.....	71
Large Database Query Test – 64 KiB TRANSFER SIZE Test Phase	72
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Test Run Data – Ramp-Up Period.....	73
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Periods	74
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Complete Test Run	75
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Measurement Interval (MI) Only	75
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate per Stream Graph.....	76
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Response Time Graph.....	76

SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Test Run Data – Ramp-Up Period.....	77
PC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Period.....	78
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Complete Test Run	79
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Measurement Interval (MI) Only	79
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate per Stream Graph.....	80
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Response Time Graph.....	80
Video on Demand Delivery Test	81
SPC-2 Workload Generator Commands and Parameters.....	81
SPC-2 Test Results File	82
SPC-2 Video on Demand Delivery Test Run Data	82
Video on Demand Delivery Test – TEST RUN DATA BY INTERVAL.....	83
SPC-2 Video on Demand Delivery Average Data Rate Graph	84
SPC-2 Video on Demand Delivery Average Data Rate per Stream Graph.....	84
SPC-2 Video on Demand Delivery Average Response Time Graph	85
SPC-2 Video on Demand Delivery Maximum Response Time Graph.....	85
Data Persistence Test.....	86
SPC-2 Workload Generator Commands and Parameters.....	86
Data Persistence Test Results File	86
Data Persistence Test Results.....	87
Priced Storage Configuration Availability Date.....	88
Anomalies or Irregularities	88
Appendix A: SPC-2 Glossary	89
“Decimal” (<i>powers of ten</i>) Measurement Units.....	89
“Binary” (<i>powers of two</i>) Measurement Units.....	89
SPC-2 Data Repository Definitions.....	89
SPC-2 Data Protection Levels	90
SPC-2 Test Execution Definitions	90
I/O Completion Types.....	93
SPC-2 Test Run Components.....	93
Appendix B: Customer Tunable Parameters and Options.....	94
Appendix C: Tested Storage Configuration (TSC) Creation	95
TSC Creation/Configuration Script	95

Appendix D: SPC-2 Workload Generator Storage Commands and Parameters	96
Large File Processing Test (LFP)	96
Large Database Query Test (LDQ)	97
Video on Demand Delivery Test (VOD)	98
Persistence Test Run 1 (write phase)	98
Persistence Test Run 2 (read phase)	99
Appendix E: SPC-2 Workload Generator Execution Commands and Parameters	100
Large File Processing Test, Large Database Query Tests, and Persistence Test Run 1.....	100
Persistence Test Run 2.....	100

AUDIT CERTIFICATION



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

March 8, 2007

The SPC Benchmark 2™ results listed below for the HP StorageWorks 1000 Modular Smart Array were produced in compliance with the SPC Benchmark 2™ V1.2.1 Remote Audit requirements.

SPC Benchmark 2™ V1.2.1 Results	
Tested Storage Product (TSP) Name: HP StorageWorks 1000 Modular Smart Array	
Metric	Reported Result
SPC-2 MBPS™	285.39
SPC-2 Price-Performance	\$73.12/SPC-2 MBPS™
Total ASU Capacity	362.925 GB
Data Protection Level	Mirroring
Total Price (including three-year maintenance)	\$20,868

The following SPC Benchmark 2™ Remote Audit requirements were reviewed and found compliant with V1.2.1 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 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.
- An appropriate diagram of the Benchmark Configuration (BC)/Tested Storage Configuration (TSC).
- Listings and commands to create and configure the Benchmark Configuration/Tested Storage Configuration, including each customer tunable parameter or option that was changed from its default value.

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Redwood City, CA 94062
AuditService@StoragePerformance.org
650.556.9384

AUDIT CERTIFICATION (CONT.)

HP StorageWorks 1000 Modular Smart Array
SPC-2 Audit Certification

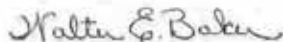
Page 2

- The following Host System items were verified by documentation supplied by Hewlett-Packard Company:
 - ✓ Required Host System configuration information.
 - ✓ The TSC boundary within each Host System.
- The following SPC-2 Workload Generator information was verified by 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 for each of the following were authentic, accurate, and compliant with all of the requirements and constraints of Clauses 5 and 6 of the SPC-2 Benchmark Specification:
 - ✓ Data Persistence Test
 - ✓ Large File Processing Test
 - ✓ Large Database Query Test
 - ✓ Video on Demand Delivery Test
- The difference documented between the Tested Storage Configuration (TSC) used for the benchmark and Priced Storage Configuration would have no performance impact if the TSC was configured identical to the Priced Storage Configuration.
- The final version of the pricing spreadsheet 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.

Audit Notes:

There were no additional audit notes or exceptions.

Respectfully,



Walter E. Baker
SPC Auditor

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LETTER OF GOOD FAITH



Hewlett-Packard Company
8000 Foothills Boulevard
Roseville, CA 95747

Date: March 2, 2007

From: Chuck Paridon, Solutions Performance Team; 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 MSA 1000 Modular SAN Array

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 V1.2.1 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:

A handwritten signature in black ink, appearing to read 'Mike Polston', written over a horizontal line.

*Mike Polston, Director
Modular SAN Array Products
StorageWorks Division*

Date:

A handwritten date '3/2/2007' in black ink, written over a horizontal line.

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 95747-5785 Phone: (916) 785-5155
Test Sponsor Alternate Contact	Hewlett-Packard Company – http://www.hp.com William Ton – william.ton@hp.com 8000 Foothills Blvd. M/S 5785 Roseville, CA 95747-5785 Phone: (916) 785-2240
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	V1.2.1
SPC-2 Workload Generator revision number	spc2rc9g
Date Results were first used publicly	March 9, 2007
Date FDR was submitted to the SPC	March 9, 2007
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	March 8, 2007

Tested Storage Product (TSP) Description

The HP StorageWorks 1000 Modular Smart Array (MSA1000) is a 2Gb Fibre Channel storage system for the entry-level to midrange storage area network (SAN). It provides the customer with a low-cost, scalable, high performance storage consolidation system with investment protection. It is designed to reduce the complexity and risk of SAN deployments. The powerful but easy to use management software makes it ideal for departmental and remote location SANs. The ability to easily move most data, disks, and enclosures currently directly attached to Ultra 320 Smart Array controllers (DAS) to a shared storage environment (SAN) will save the user both money and time. With the addition of two more drive enclosures, it can control up to 42 enterprise-class U320 SCSI drives allowing capacity of twelve terabytes. All configuration, management, and partitioning and licensing software come standard with no extra charges.

SPC-2 Reported Data

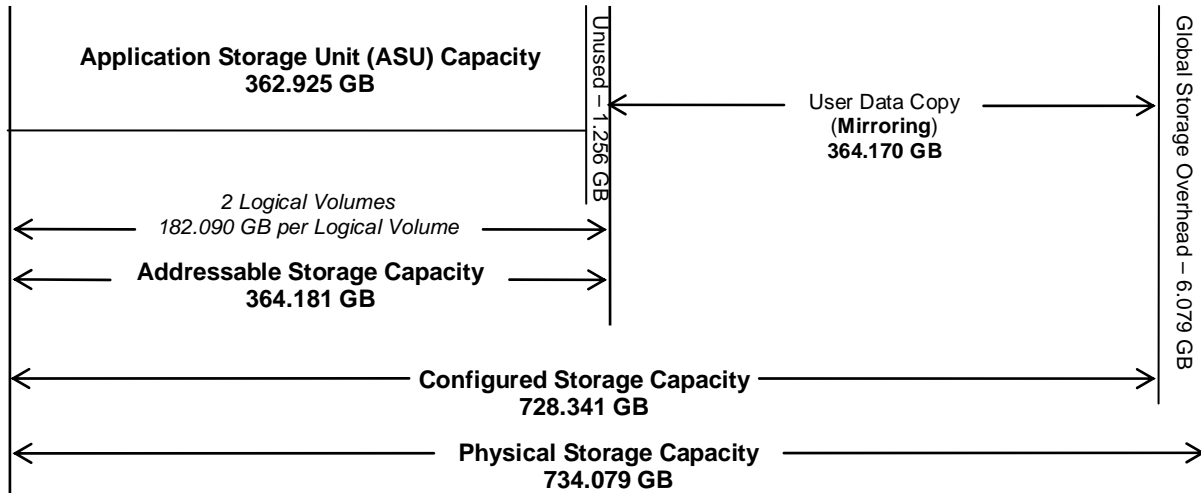
SPC-2 Reported Data consists of three groups of information:

- 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
- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

SPC-2 Reported Data				
HP StorageWorks 1000 Modular Smart Array				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
285.39	\$73.12	362.925	\$20,868	Mirroring
<i>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)</i>				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	269.61			\$77.40
Write Only:				
1024 KiB Transfer	222.94	28	7.96	
256 KiB Transfer	216.73	28	7.74	
Read-Write:				
1024 KiB Transfer	277.02	28	9.89	
256 KiB Transfer	243.25	28	8.69	
Read Only:				
1024 KiB Transfer	330.03	28	11.79	
256 KiB Transfer	327.70	28	11.70	
<i>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).</i>				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	287.71			\$72.53
1024 KiB Transfer Size				
4 I/Os Outstanding	330.20	28	11.79	
1 I/O Outstanding	329.91	28	11.78	
64 KiB Transfer Size				
4 I/Os Outstanding	271.97	28	9.71	
1 I/O Outstanding	218.77	28	7.81	
<i>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).</i>				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	298.84	380	0.79	\$69.83

Storage Capacities and Relationships

The following diagram (not to scale) documents the various storage capacities and their relationships, used in this SPC-2 benchmark measurement.



Tested Storage Configuration Pricing (*Priced Storage Configuration*)

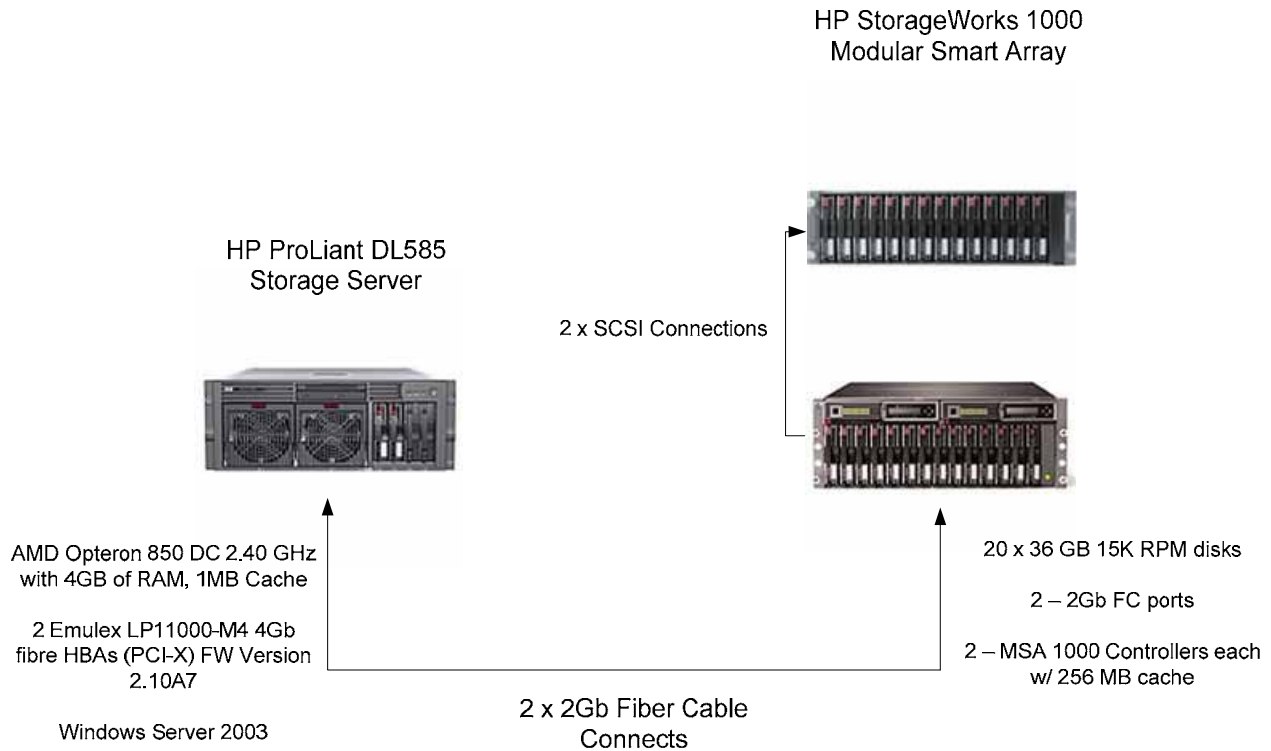
Part Number	Description	List Price	Quantity	Ext. Price	Discount	Final Price
AD510A	MSA1000 Controller/enclosure	6,995.00	1	6,995.00	21.00%	5,526.05
218231-B22	HP MSA1000/1500 2nd Controller	4,290.00	1	4,290.00	21.00%	3,389.10
371534-B21	36GB U320 15K Hot Plug Hard Drive	249.00	20	4,980.00	21.00%	3,934.20
218960-B21	2nd FC IO Module	375.00	1	375.00	21.00%	296.25
302969-B21	2nd SCSI Disk Enclosure	2,829.00	1	2,829.00	21.00%	2,234.91
HA104A3 8PM	MSA1000 enclosure support	3,403.00	1	3,403.00	30.00%	2,382.10
H104A3 7GT	2nd SCSI Disk Enclosure support	1,827.00	1	1,827.00	30.00%	1,278.90
281541-B21	2 Gb FC Single Port HBA	1,450.00	2	2,900.00	45.00%	1,595.00
313374-003	SCSI Cable	60.76	2	121.52	21.00%	96.00
263895-004	15 M FC Cable	86.00	2	172.00	21.00%	135.88
\$ 27,892.52						\$ 20,868.39

The above pricing provides maintenance/support for 24 hours per day, 7 days per week for three years with four hour acknowledgement and four hour subsequent response (support engineer onsite or customer replaceable part available).

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

The Tested Storage Configuration (TSC) was configured with 4 Gb single port HBAs and in the Priced Storage Configuration those HBAs were replaced with 2 Gb single port HBAs. The host (front-end) ports on the MSA1000 are 2 Gb ports so there would have been no performance difference if the 2 Gb HBAs had been used in the TSC.

Benchmark Configuration/Tested Storage Configuration Diagram



Host System(s) and Tested Storage Configuration Components

Host Systems:	Tested Storage Configuration (TSC):
UID=HS-1	2 - Emulex LP11000-MA 4 Gb FC HBAs
1 - HP ProLiant DL585 Storage Server 1 - AMD Opteron 80 DualCore 2.4 GHz processor with 1 MB cache	UID=SC-1/2: HP StorageWorks 1000 Modular Smart Array 2 controllers with 256 MB cache per controller
4 GB main memory	2 - 2 Gb FC front-end ports, 1 per controller
Windows Server 2003	2 - backend SCSi connections (U320)
PCI-X	1 - SCSi disk enclosure, in addition to 1 standard
WG	20 - 36 GB 15K RPM disk drives

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 10.6.5.7

The Executive Summary 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 16 (*Benchmark Configuration/Tested Storage Configuration Diagram*).

Storage Network Configuration

Clause 9.2.4.4.2

If a storage network was configured as a part of the Tested Storage Configuration and the Benchmark Configuration described in Clause 10.6.5.7 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 10.8.

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 10.6.5.9

The Executive Summary 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 16 (*Host System(s) and Tested Storage Configuration Components*).

Customer Tunable Parameters and Options

Clause 10.6.6.1

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 94 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Description

Clause 10.6.6.2

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 (Clause 10.6.6.1), 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 95 contains the detailed information that describes how to create and configure the logical TSC.

SPC-2 Workload Generator Storage Configuration

Clause 10.6.6.3

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 Parameters” on page 95.

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 89 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

Two tables and an illustration documenting the storage capacities and relationships of the SPC-2 Storage Hierarchy (Clause 2.1) shall be included in the FDR.

SPC-2 Storage Capacities

SPC-2 Storage Capacities		
Storage Hierarchy Component	Units	Capacity
Total ASU Capacity	Gigabytes (GB)	362.925
Addressable Storage Capacity	Gigabytes (GB)	364.181
Configured Storage Capacity	Gigabytes (GB)	728.341
Physical Storage Capacity	Gigabytes (GB)	734.079
Data Protection Overhead (<i>Mirroring</i>)	Gigabytes (GB)	364.170
Required Storage	Gigabytes (GB)	0.000
Global Storage Overhead	Gigabytes (GB)	6.079
Total Unused Storage	Gigabytes (GB)	2.512

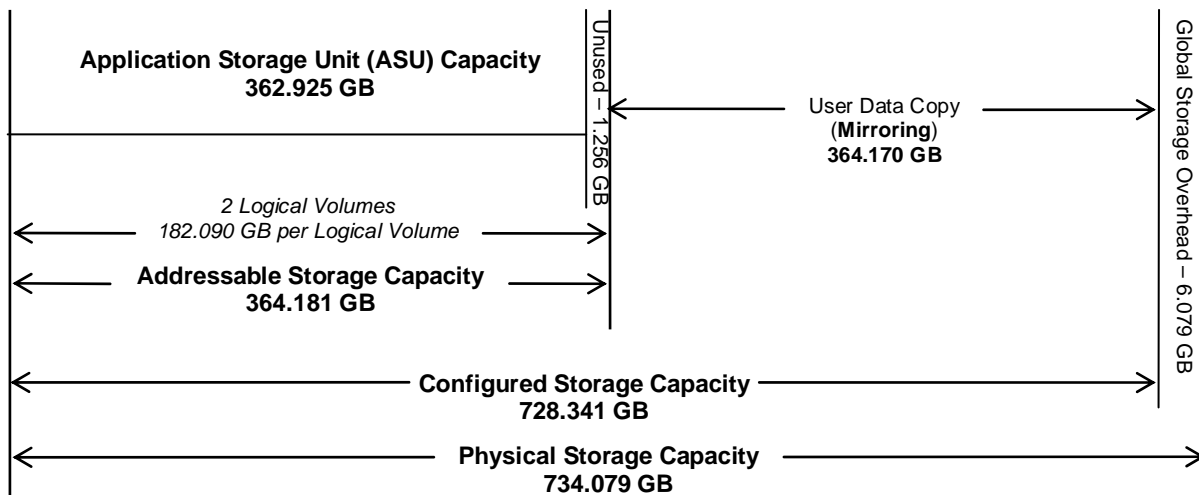
SPC-2 Storage Hierarchy Ratios

	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
Total ASU Capacity	99.66%	49.83%	49.44%
Required for Data Protection (Mirroring)		50.00%	49.61%
Addressable Storage Capacity		50.00%	49.61%
Required Storage (spares)		0.00%	0.00%
Configured Storage Capacity			99.22%
Global Storage Overhead			0.83%
Unused Storage:			
Addressable	0.34%		
Configured		0.00%	
Physical			0.00%

The Physical Storage Capacity consisted of 734.079 GB distributed over 20 disk drives each with a formatted capacity of 36.704 GB. There was 0.000 GB (0.00%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 6.079 GB (0.83%) of Physical Storage Capacity. There was 0.000 GB (0.00%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 99.66% of the Addressable Storage Capacity resulting in 1.256 GB (0.34%) of Unused Storage within the Addressable Storage Capacity.

SPC-2 Storage Capacities and Relationships Illustration

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



Logical Volume Capacity and ASU Mapping

Clause 10.6.7.2

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 (362.925 GB)			
	Total Capacity (GB)	Capacity Used (GB)	Capacity Unused (GB)
Logical Volumes 1,2	182.090 per LV	181.462 per LV	0.628 per LV

See the Storage Definition (sd) entries in “Appendix D: SPC-2 Workload Generator Storage Commands and Parameters” on page 96 for more detailed configuration information.

SPC-2 TEST EXECUTION RESULTS

This portion of the Full Disclosure Report documents the results of the various SPC-2 Test, Test Phases, Test Run Sequences, and Test Runs. “SPC-2 Test Execution Definitions” on page 90 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

- **Large File Processing Test (continued)**
 - 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 6.4.2.1

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 6.4.2.2

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 10.6.8.1

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. *A table that contains the following information for each Test Run in all three Test Phases of the Large File Processing 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. *Average Data Rate and Average Data Rate per Stream graphs as defined in Clauses 10.1.1 and 10.1.2.*

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 100.

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.

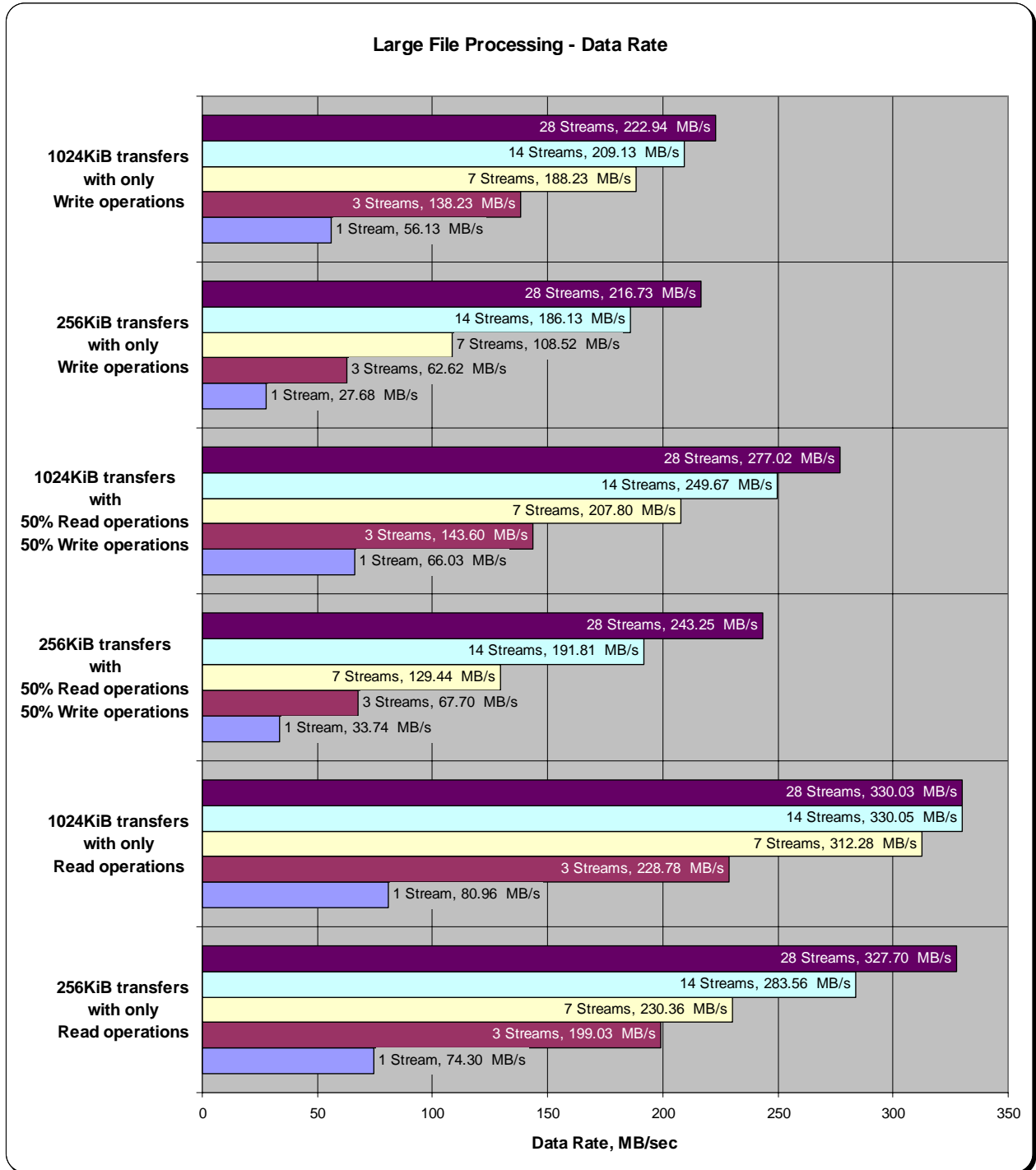
[SPC-2 Large File Processing Test Results File](#)

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	3 Streams	7 Streams	14 Streams	28 Streams
Write 1024KiB	56.13	138.23	188.23	209.13	222.94
Write 256KiB	27.68	62.62	108.52	186.13	216.73
Read/Write 1024KiB	66.03	143.60	207.80	249.67	277.02
Read/Write 256KiB	33.74	67.70	129.44	191.81	243.25
Read 1024KiB	80.96	228.78	312.28	330.05	330.03
Read 256KiB	74.30	199.03	230.36	283.56	327.70

SPC-2 Large File Processing Average Data Rates Graph

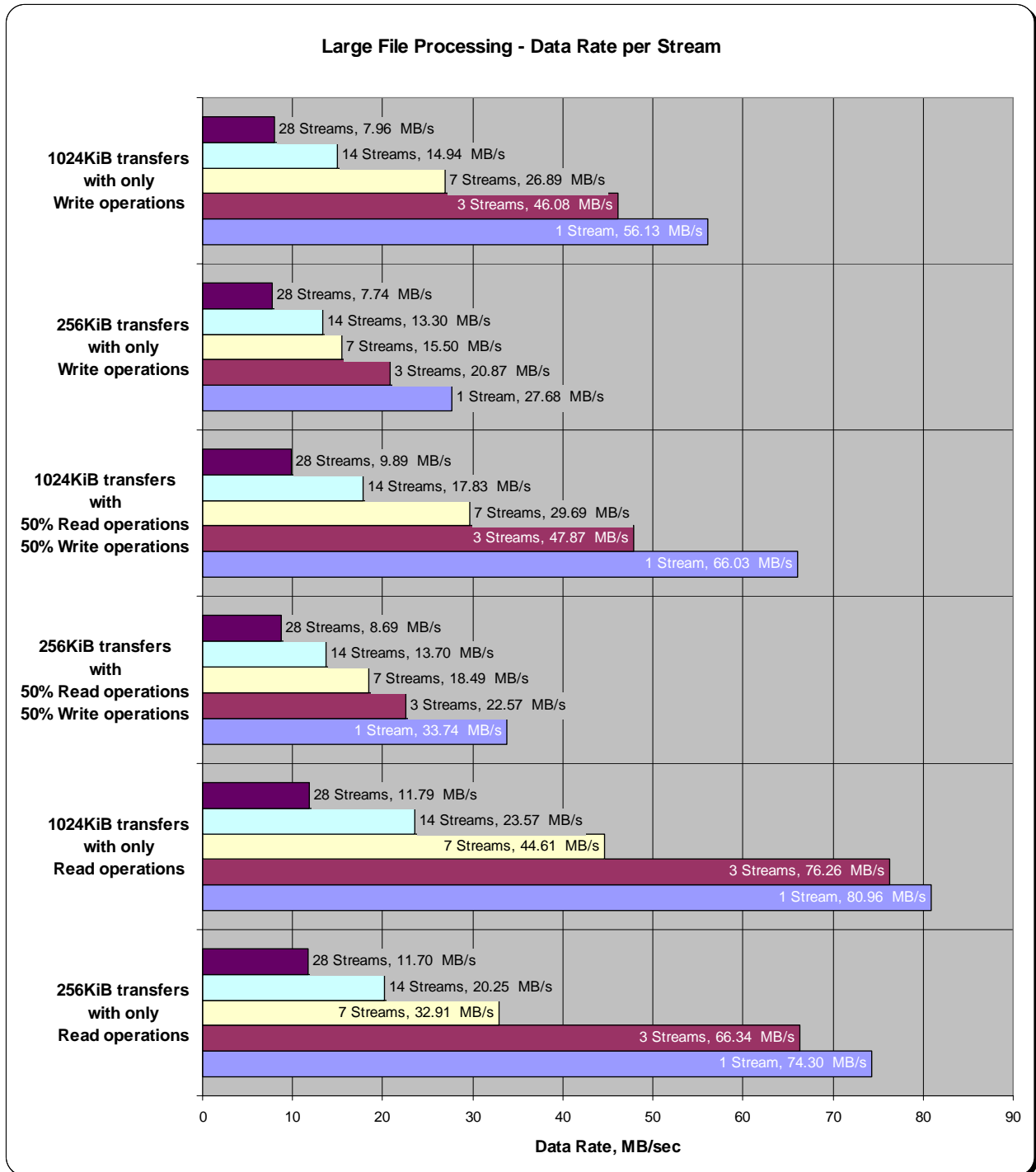


SPC-2 Large File Processing Average Data Rate per Stream

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	3 Streams	7 Streams	14 Streams	28 Streams
Write 1024KiB	56.13	46.08	26.89	14.94	7.96
Write 256KiB	27.68	20.87	15.50	13.30	7.74
Read/Write 1024KiB	66.03	47.87	29.69	17.83	9.89
Read/Write 256KiB	33.74	22.57	18.49	13.70	8.69
Read 1024KiB	80.96	76.26	44.61	23.57	11.79
Read 256KiB	74.30	66.34	32.91	20.25	11.70

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

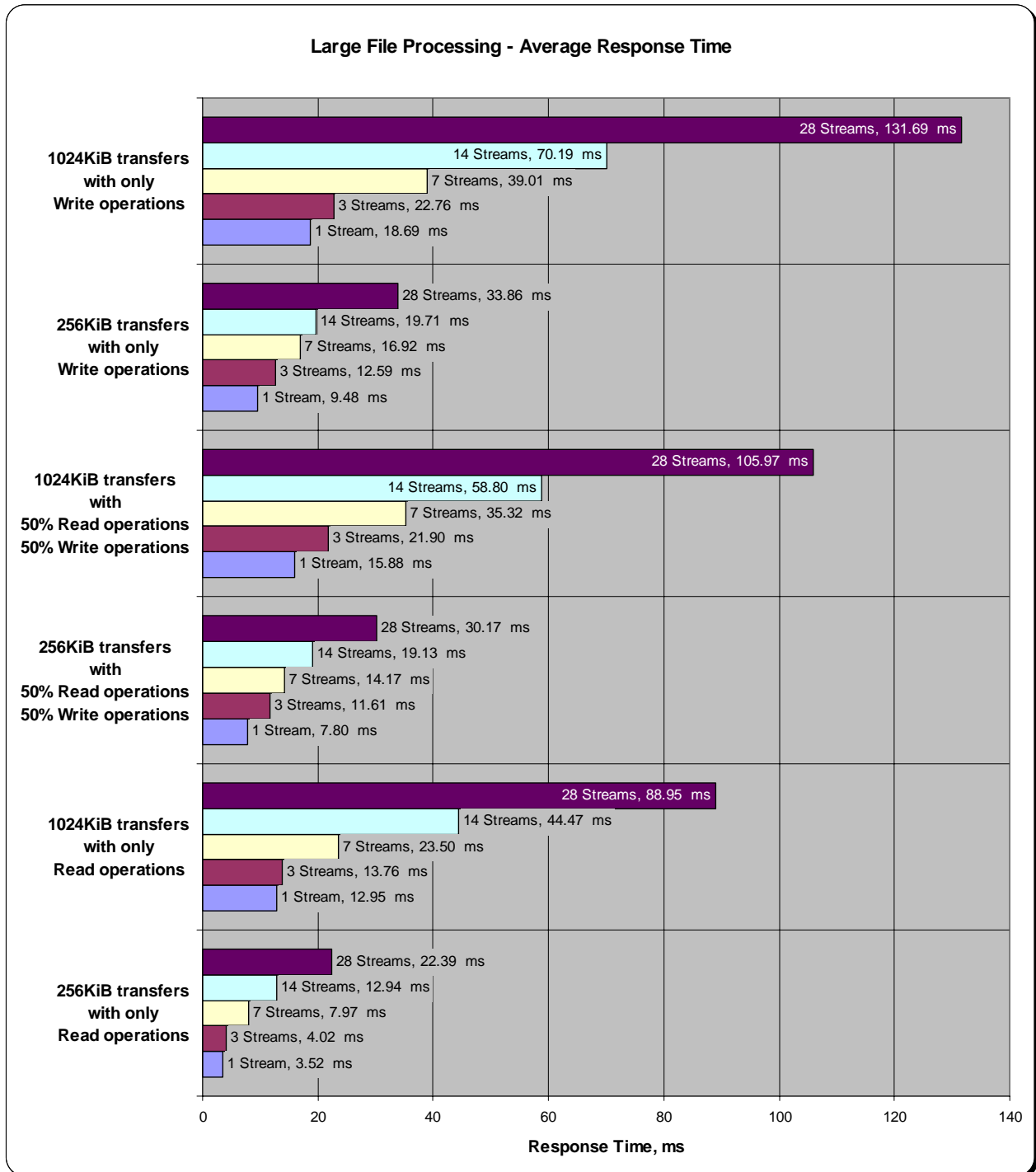


SPC-2 Large File Processing Average Response Time

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	3 Streams	7 Streams	14 Streams	28 Streams
Write 1024KiB	18.69	22.76	39.01	70.19	131.69
Write 256KiB	9.48	12.59	16.92	19.71	33.86
Read/Write 1024KiB	15.88	21.90	35.32	58.80	105.97
Read/Write 256KiB	7.80	11.61	14.17	19.13	30.17
Read 1024KiB	12.95	13.76	23.50	44.47	88.95
Read 256KiB	3.52	4.02	7.97	12.94	22.39

SPC-2 Large File Processing Average Response Time Graph



Large File Processing Test – WRITE ONLY Test Phase

Clause 10.6.8.1.1

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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "WRITE ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

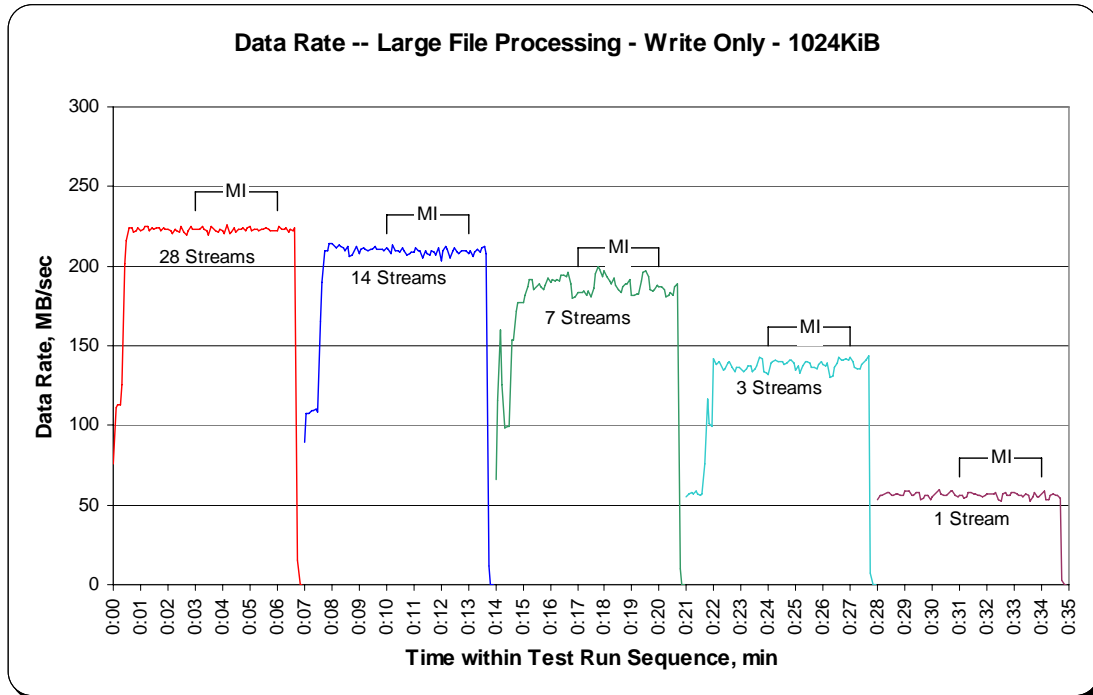
The SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Test Run data is contained in the table that appears on the next page. That table is followed by graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table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

Immediately following the SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" table and graphs will be the SPC-2 "Large File Processing/WRITE ONLY/64 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.

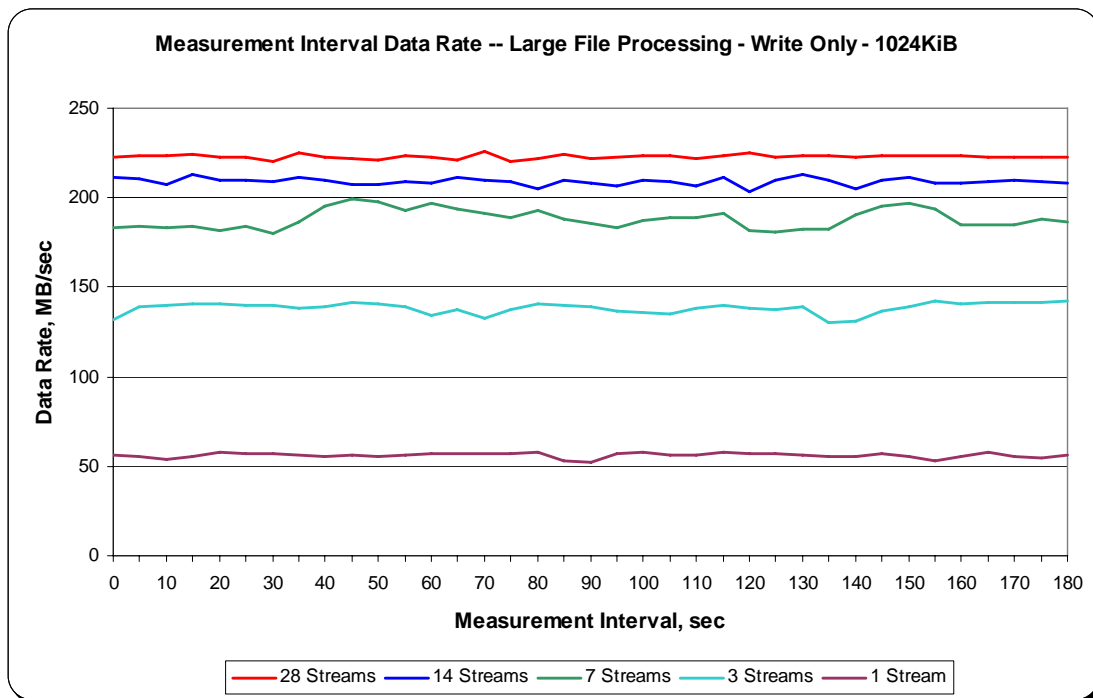
SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Test Run Data – Ramp-Up Period

TR1 Test Run Sequence Time	28 Streams			TR2 Test Run Sequence Time	14 Streams			TR3 Test Run Sequence Time	7 Streams			TR4 Test Run Sequence Time	3 Streams			TR5 Test Run Sequence Time	1 Stream		
	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	76.13	25.38	22.97	0:07:00	89.34	29.78	26.21	0:14:00	66.06	33.03	21.82	0:21:00	54.74	54.74	18.32	0:28:00	53.69	53.69	18.65
0:00:05	110.73	18.45	40.24	0:07:05	107.37	21.47	41.47	0:14:05	115.97	28.99	29.31	0:21:05	57.25	57.25	18.22	0:28:05	56.41	56.41	18.54
0:00:10	113.04	14.13	63.39	0:07:10	107.79	17.97	49.70	0:14:10	159.80	39.95	26.28	0:21:10	57.46	57.46	18.26	0:28:10	56.41	56.41	18.60
0:00:15	112.62	8.66	97.45	0:07:15	109.26	18.21	57.23	0:14:15	125.20	31.30	33.43	0:21:15	57.25	57.25	18.30	0:28:15	56.62	56.62	18.54
0:00:20	125.62	7.85	112.10	0:07:20	109.68	18.28	57.68	0:14:20	98.78	24.69	42.30	0:21:20	58.30	58.30	18.01	0:28:20	58.09	58.09	18.02
0:00:25	201.33	12.58	83.28	0:07:25	110.10	18.35	56.97	0:14:25	99.20	24.80	42.49	0:21:25	57.25	57.25	18.27	0:28:25	57.67	57.67	18.21
0:00:30	215.80	11.99	83.04	0:07:30	108.00	13.50	60.63	0:14:30	99.41	24.85	42.20	0:21:30	56.20	56.20	18.70	0:28:30	56.41	56.41	18.59
0:00:35	224.40	10.69	90.55	0:07:35	165.47	20.68	50.36	0:14:35	153.51	30.70	34.00	0:21:35	56.62	56.62	18.51	0:28:35	56.20	56.20	18.66
0:00:40	223.77	10.17	99.87	0:07:40	189.37	21.04	49.12	0:14:40	153.72	30.74	34.08	0:21:40	76.13	38.06	17.96	0:28:40	56.83	56.83	18.42
0:00:45	221.67	9.64	107.68	0:07:45	209.72	20.97	49.00	0:14:45	171.34	28.56	35.18	0:21:45	116.60	58.30	17.99	0:28:45	57.04	57.04	18.40
0:00:50	222.51	9.27	112.10	0:07:50	209.51	17.46	55.41	0:14:50	177.21	29.53	35.60	0:21:50	101.08	50.54	20.70	0:28:50	56.20	56.20	18.65
0:00:55	224.19	8.97	113.08	0:07:55	214.54	17.88	58.74	0:14:55	177.42	29.57	35.43	0:21:55	99.82	33.27	23.78	0:28:55	56.41	56.41	18.57
0:01:00	221.88	8.53	120.30	0:08:00	213.91	16.45	62.06	0:15:00	177.42	25.35	39.74	0:22:00	142.19	47.40	22.09	0:29:00	59.14	59.14	17.71
0:01:05	223.56	8.60	122.40	0:08:05	213.70	15.26	65.17	0:15:05	181.61	25.94	40.50	0:22:05	137.99	46.00	22.80	0:29:05	58.51	58.51	17.95
0:01:10	225.23	8.66	120.02	0:08:10	211.60	15.11	69.43	0:15:10	186.65	26.66	39.33	0:22:10	139.88	46.63	22.48	0:29:10	58.30	58.30	17.95
0:01:15	224.60	8.02	124.01	0:08:15	212.86	15.20	68.37	0:15:15	191.47	27.35	38.30	0:22:15	138.20	46.07	22.76	0:29:15	56.41	56.41	18.55
0:01:20	222.51	7.95	132.46	0:08:20	212.44	15.17	69.54	0:15:20	191.89	27.41	38.22	0:22:20	134.64	44.88	23.36	0:29:20	56.41	56.41	18.63
0:01:25	223.77	7.99	130.31	0:08:25	211.39	15.10	69.29	0:15:25	185.39	26.48	39.52	0:22:25	135.27	45.09	23.27	0:29:25	58.09	58.09	18.02
0:01:30	222.93	7.96	131.81	0:08:30	209.92	14.99	70.06	0:15:30	187.49	26.78	39.21	0:22:30	138.83	46.28	22.65	0:29:30	57.46	57.46	18.22
0:01:35	223.98	8.00	131.74	0:08:35	212.65	15.19	68.81	0:15:35	188.74	26.96	38.91	0:22:35	139.88	46.63	22.48	0:29:35	53.69	53.69	19.52
0:01:40	223.98	8.00	130.61	0:08:40	205.94	14.71	71.37	0:15:40	186.65	26.66	39.29	0:22:40	136.11	45.37	23.10	0:29:40	54.53	54.53	19.27
0:01:45	222.30	7.94	131.14	0:08:45	207.20	14.80	71.17	0:15:45	185.18	26.45	39.59	0:22:45	134.01	44.67	23.49	0:29:45	55.99	55.99	18.70
0:01:50	224.19	8.01	132.15	0:08:50	210.97	15.07	69.08	0:15:50	188.32	26.90	39.03	0:22:50	136.11	45.37	23.10	0:29:50	56.20	56.20	18.66
0:01:55	223.56	7.98	131.86	0:08:55	212.44	15.17	69.21	0:15:55	192.52	27.50	38.11	0:22:55	136.31	45.44	23.04	0:29:55	53.69	53.69	19.51
0:02:00	223.14	7.97	128.61	0:09:00	207.83	14.84	70.87	0:16:00	190.00	27.14	38.64	0:23:00	135.69	45.23	23.21	0:30:00	54.95	54.95	19.13
0:02:05	222.30	7.94	134.14	0:09:05	210.34	15.02	69.76	0:16:05	191.47	27.35	38.32	0:23:05	134.01	44.67	23.42	0:30:05	56.83	56.83	18.39
0:02:10	220.41	7.87	129.80	0:09:10	211.60	15.11	69.40	0:16:10	190.21	27.17	38.59	0:23:10	135.48	45.16	23.29	0:30:10	57.67	57.67	18.22
0:02:15	223.35	7.98	135.52	0:09:15	210.76	15.05	69.64	0:16:15	191.47	27.35	38.34	0:23:15	137.57	45.86	22.82	0:30:15	59.77	59.77	17.55
0:02:20	222.30	7.94	131.36	0:09:20	209.92	14.99	70.00	0:16:20	190.42	27.20	38.54	0:23:20	137.78	45.93	22.83	0:30:20	57.25	57.25	18.31
0:02:25	221.25	7.90	133.40	0:09:25	210.97	15.07	69.35	0:16:25	193.99	27.71	37.78	0:23:25	133.38	44.46	23.58	0:30:25	55.78	55.78	18.79
0:02:30	225.23	8.04	129.19	0:09:30	210.97	15.07	69.68	0:16:30	194.62	27.80	37.80	0:23:30	135.90	45.30	23.16	0:30:30	56.20	56.20	18.59
0:02:35	221.67	7.92	133.40	0:09:35	212.02	15.14	69.28	0:16:35	192.94	27.56	37.99	0:23:35	136.94	45.65	22.97	0:30:35	56.62	56.62	18.57
0:02:40	219.99	7.86	132.83	0:09:40	210.76	15.05	69.57	0:16:40	195.66	27.95	37.46	0:23:40	143.03	47.68	21.97	0:30:40	58.30	58.30	17.93
0:02:45	222.51	7.95	130.25	0:09:45	210.13	15.01	70.06	0:16:45	188.74	26.96	38.87	0:23:45	141.77	47.26	22.18	0:30:45	58.93	58.93	17.81
0:02:50	225.23	8.04	132.74	0:09:50	210.97	15.07	69.42	0:16:50	179.94	25.71	40.90	0:23:50	133.38	44.46	23.60	0:30:50	55.99	55.99	18.75
0:02:55	222.93	7.96	130.83	0:09:55	209.72	14.98	70.02	0:16:55	180.36	25.77	40.64	0:23:55	133.17	44.39	23.57	0:30:55	55.36	55.36	18.91

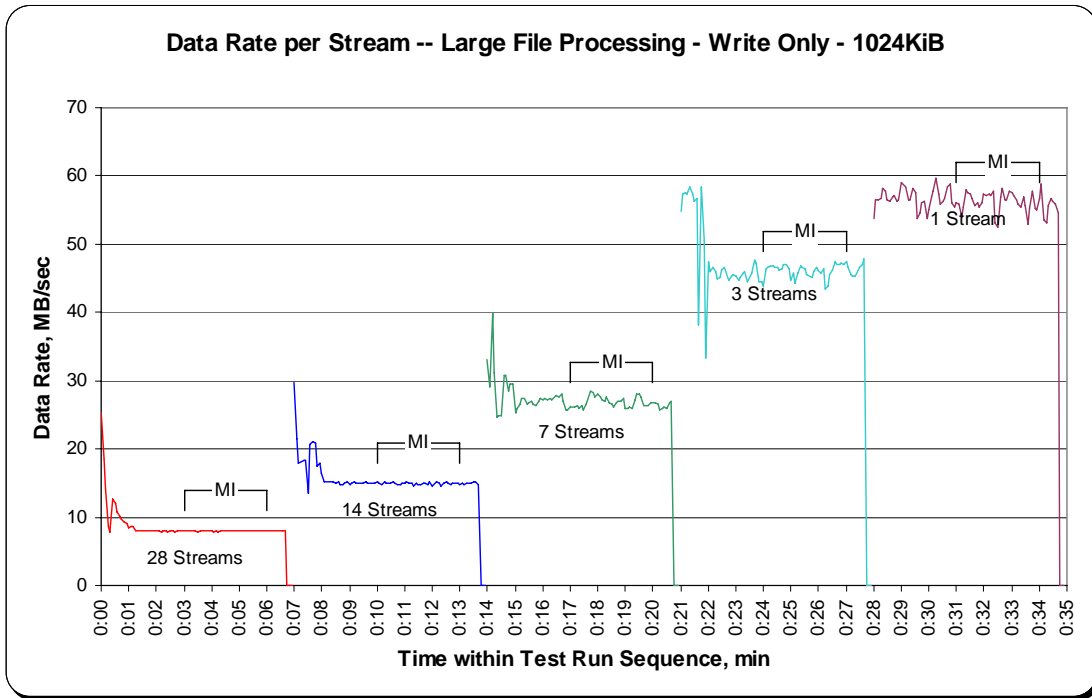
SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



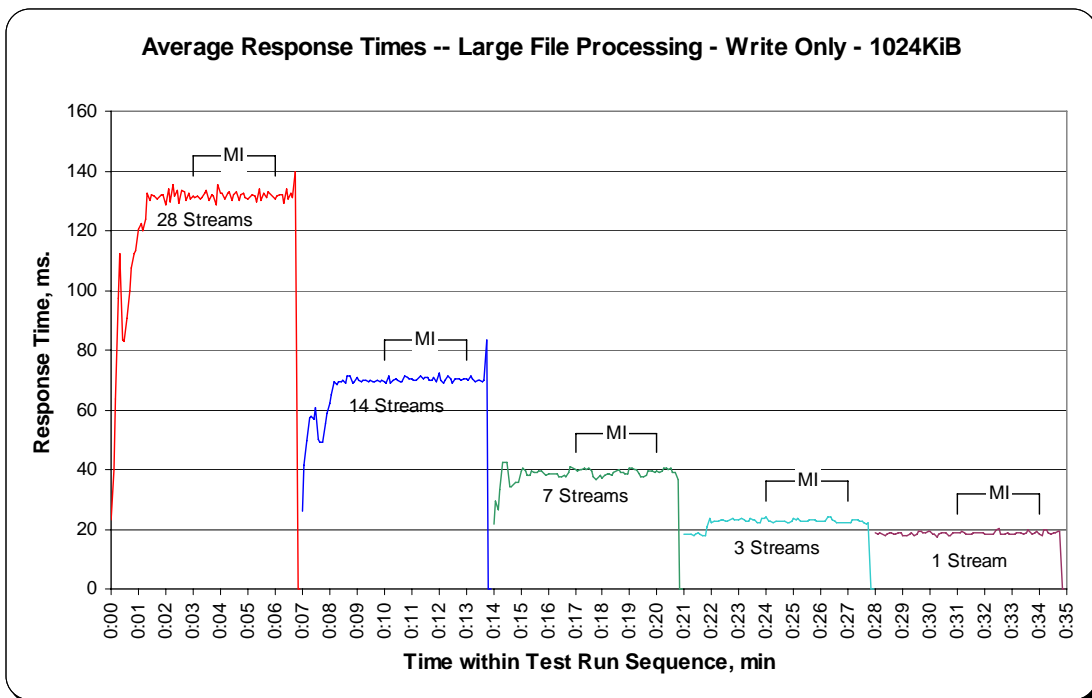
SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Data Rate per Stream Graph



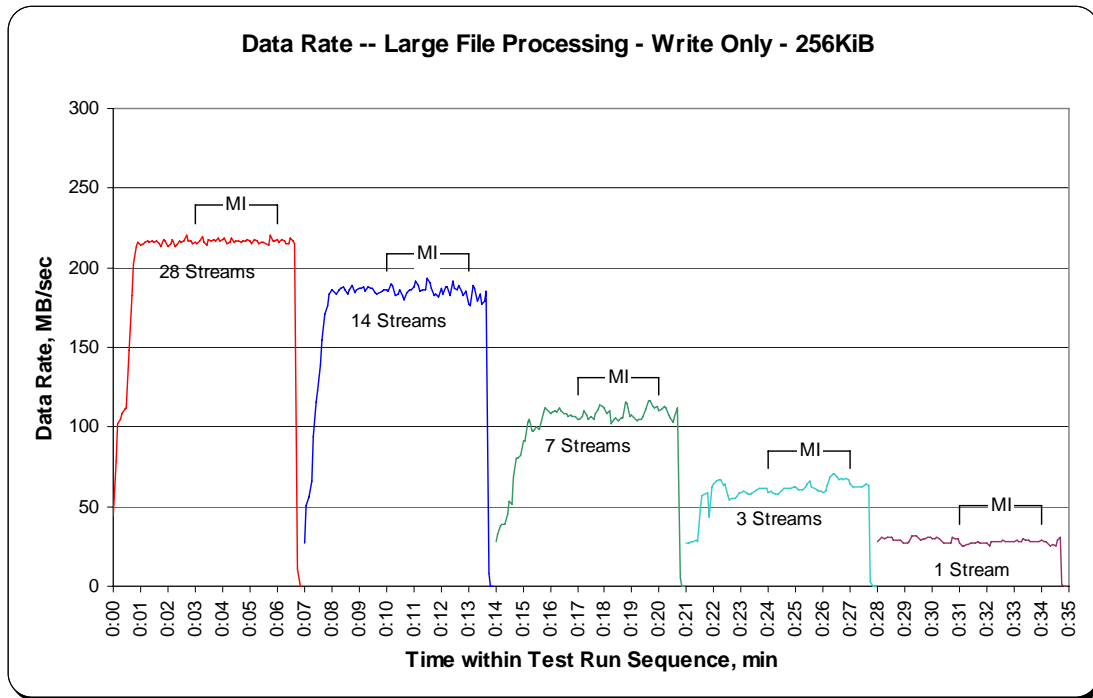
SPC-2 “Large File Processing/ WRITE ONLY /1024 KiB Transfer Size” Average Response Time Graph



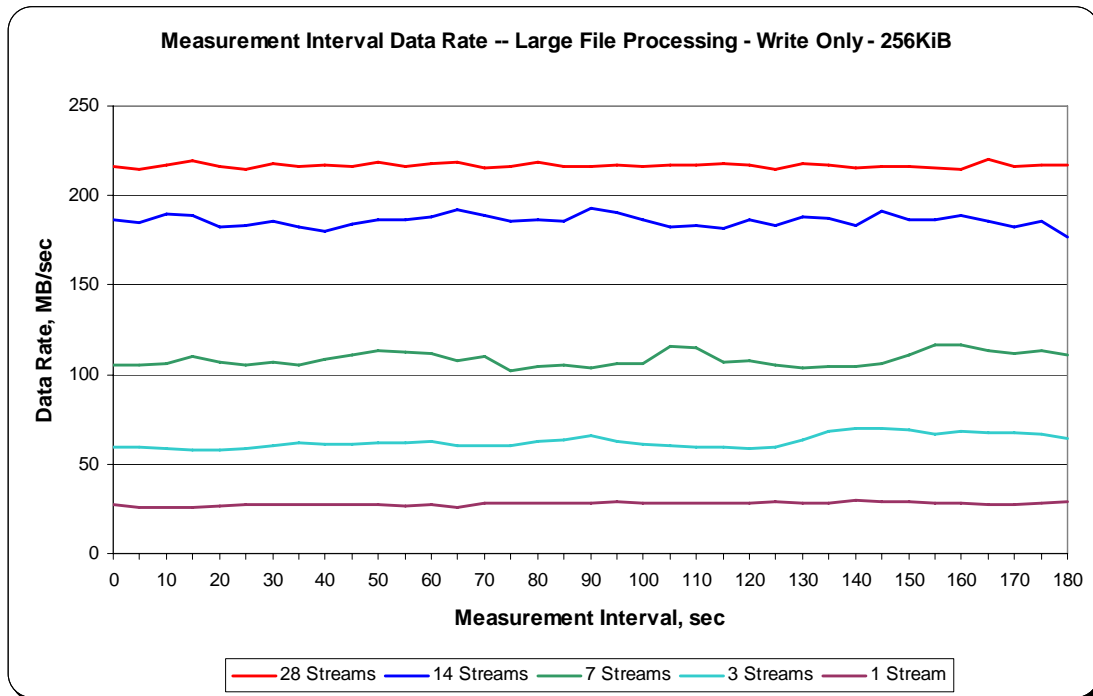
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Test Run Data – Ramp-Up Period

TR6 Test Run Sequence Time	28 Streams Data Rate			TR7 Test Run Sequence Time	14 Streams Data Rate			TR8 Test Run Sequence Time	7 Streams Data Rate			TR9 Test Run Sequence Time	3 Streams Data Rate			TR10 Test Run Sequence Time	1 Stream Data Rate		
	Data Rate, MB/sec	/ Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	/ Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	/ Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	/ Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	/ Stream, MB/sec	Response Time, ms
0:00:00	44.20	14.73	12.33	0:07:00	27.11	27.11	9.27	0:14:00	27.68	27.68	9.08	0:21:00	26.74	26.74	9.41	0:28:00	28.31	28.31	8.85
0:00:05	78.64	13.11	14.22	0:07:05	50.70	16.90	13.80	0:14:05	32.82	16.41	11.97	0:21:05	27.32	27.32	9.53	0:28:05	30.25	30.25	8.65
0:00:10	102.24	17.04	15.38	0:07:10	55.73	18.58	14.12	0:14:10	38.33	19.16	13.68	0:21:10	27.79	27.79	9.44	0:28:10	31.14	31.14	8.42
0:00:15	104.75	13.09	16.89	0:07:15	66.27	13.25	14.50	0:14:15	38.43	19.22	13.64	0:21:15	28.10	28.10	9.32	0:28:15	29.99	29.99	8.74
0:00:20	108.27	9.84	23.72	0:07:20	94.32	13.47	18.71	0:14:20	38.69	19.35	13.56	0:21:20	28.47	28.47	9.20	0:28:20	30.51	30.51	8.58
0:00:25	110.78	8.52	27.13	0:07:25	115.50	14.44	17.45	0:14:25	45.35	15.12	14.67	0:21:25	27.84	27.84	9.41	0:28:25	30.57	30.57	8.57
0:00:30	112.30	7.49	30.93	0:07:30	123.16	15.39	17.04	0:14:30	53.11	17.70	14.82	0:21:30	49.96	24.98	9.10	0:28:30	31.14	31.14	8.43
0:00:35	147.85	9.24	27.76	0:07:35	138.94	13.89	17.37	0:14:35	51.43	17.14	15.28	0:21:35	56.73	28.36	9.23	0:28:35	28.52	28.52	9.17
0:00:40	182.09	10.12	25.42	0:07:40	154.30	15.43	16.98	0:14:40	68.58	17.14	13.84	0:21:40	57.93	28.97	9.04	0:28:40	28.89	28.89	9.09
0:00:45	202.38	9.64	25.23	0:07:45	170.55	14.21	17.69	0:14:45	80.48	20.12	13.02	0:21:45	58.41	29.20	8.97	0:28:45	28.99	28.99	9.03
0:00:50	213.54	9.71	25.89	0:07:50	176.06	14.67	17.87	0:14:50	80.74	20.19	12.98	0:21:50	43.78	14.59	13.84	0:28:50	28.63	28.63	9.14
0:00:55	215.90	9.00	27.86	0:07:55	183.03	14.08	18.03	0:14:55	82.52	16.50	13.76	0:21:55	62.29	20.76	12.63	0:28:55	26.84	26.84	9.77
0:01:00	213.86	8.55	29.43	0:08:00	186.54	13.32	18.92	0:15:00	90.96	18.19	14.41	0:22:00	64.12	21.37	12.25	0:29:00	27.32	27.32	9.60
0:01:05	215.38	8.62	30.44	0:08:05	185.18	13.23	19.81	0:15:05	91.70	18.34	14.29	0:22:05	66.37	22.12	11.84	0:29:05	27.37	27.37	9.57
0:01:10	216.32	8.32	31.03	0:08:10	183.82	13.13	19.97	0:15:10	102.97	17.16	15.24	0:22:10	66.58	22.19	11.80	0:29:10	28.05	28.05	9.34
0:01:15	216.43	8.32	31.45	0:08:15	186.23	13.30	19.70	0:15:15	104.75	17.46	15.00	0:22:15	66.58	22.19	11.80	0:29:15	31.88	31.88	8.22
0:01:20	216.27	7.72	32.31	0:08:20	186.70	13.34	19.64	0:15:20	97.31	13.90	18.65	0:22:20	63.12	21.04	12.47	0:29:20	31.88	31.88	8.21
0:01:25	217.00	7.75	33.80	0:08:25	188.38	13.46	19.48	0:15:25	97.57	13.94	18.79	0:22:25	64.59	21.53	12.17	0:29:25	31.61	31.61	8.29
0:01:30	215.80	7.71	34.00	0:08:30	186.44	13.32	19.67	0:15:30	99.98	14.28	18.36	0:22:30	56.57	18.86	13.90	0:29:30	29.41	29.41	8.91
0:01:35	216.69	7.74	33.86	0:08:35	183.29	13.09	20.02	0:15:35	98.15	14.02	18.69	0:22:35	54.42	18.14	14.42	0:29:35	29.20	29.20	8.97
0:01:40	214.91	7.68	34.03	0:08:40	186.02	13.29	19.73	0:15:40	102.55	14.65	17.88	0:22:40	54.79	18.26	14.38	0:29:40	29.46	29.46	8.89
0:01:45	213.70	7.63	34.44	0:08:45	188.43	13.46	19.46	0:15:45	109.79	15.68	16.72	0:22:45	54.79	18.26	14.32	0:29:45	29.46	29.46	8.90
0:01:50	217.47	7.77	33.75	0:08:50	184.50	13.18	19.91	0:15:50	111.83	15.98	16.39	0:22:50	56.15	18.72	14.01	0:29:50	30.36	30.36	8.63
0:01:55	217.26	7.76	33.84	0:08:55	185.96	13.28	19.73	0:15:55	110.52	15.79	16.61	0:22:55	59.03	19.68	13.33	0:29:55	30.57	30.57	8.57
0:02:00	213.18	7.61	34.36	0:09:00	187.22	13.37	19.60	0:16:00	108.32	15.47	16.94	0:23:00	58.88	19.63	13.35	0:30:00	30.09	30.09	8.70
0:02:05	214.80	7.67	34.14	0:09:05	187.01	13.36	19.61	0:16:05	109.68	15.67	16.73	0:23:05	60.08	20.03	13.09	0:30:05	29.73	29.73	8.81
0:02:10	218.16	7.79	33.77	0:09:10	188.22	13.44	19.51	0:16:10	110.68	15.81	16.58	0:23:10	58.93	19.64	13.33	0:30:10	30.30	30.30	8.65
0:02:15	213.28	7.62	34.39	0:09:15	185.44	13.25	19.78	0:16:15	109.47	15.64	16.76	0:23:15	57.62	19.21	13.64	0:30:15	29.62	29.62	8.85
0:02:20	214.54	7.66	34.21	0:09:20	187.75	13.41	19.54	0:16:20	111.83	15.98	16.39	0:23:20	57.57	19.19	13.67	0:30:20	28.63	28.63	9.15
0:02:25	216.90	7.75	33.83	0:09:25	186.86	13.35	19.62	0:16:25	110.26	15.75	16.65	0:23:25	58.93	19.64	13.34	0:30:25	27.26	27.26	9.61
0:02:30	215.74	7.71	34.02	0:09:30	187.49	13.39	19.59	0:16:30	108.84	15.55	16.86	0:23:30	60.08	20.03	13.10	0:30:30	27.53	27.53	9.52
0:02:35	216.58	7.74	33.91	0:09:35	184.13	13.15	19.90	0:16:35	108.58	15.51	16.90	0:23:35	60.14	20.05	13.06	0:30:35	27.32	27.32	9.60
0:02:40	220.04	7.86	33.29	0:09:40	183.45	13.10	20.01	0:16:40	106.90	15.27	17.14	0:23:40	61.45	20.48	12.81	0:30:40	27.37	27.37	9.56
0:02:45	217.26	7.76	33.83	0:09:45	184.18	13.16	19.92	0:16:45	107.43	15.35	17.08	0:23:45	61.24	20.41	12.82	0:30:45	30.30	30.30	8.65
0:02:50	216.48	7.73	33.93	0:09:50	185.02	13.22	19.83	0:16:50	106.90	15.27	17.18	0:23:50	61.87	20.62	12.71	0:30:50	29.73	29.73	8.81
0:02:55	215.33	7.69	34.05	0:09:55	185.70	13.26	19.75	0:16:55	106.27	15.18	17.26	0:23:55	61.18	20.39	12.85	0:30:55	29.73	29.73	8.82

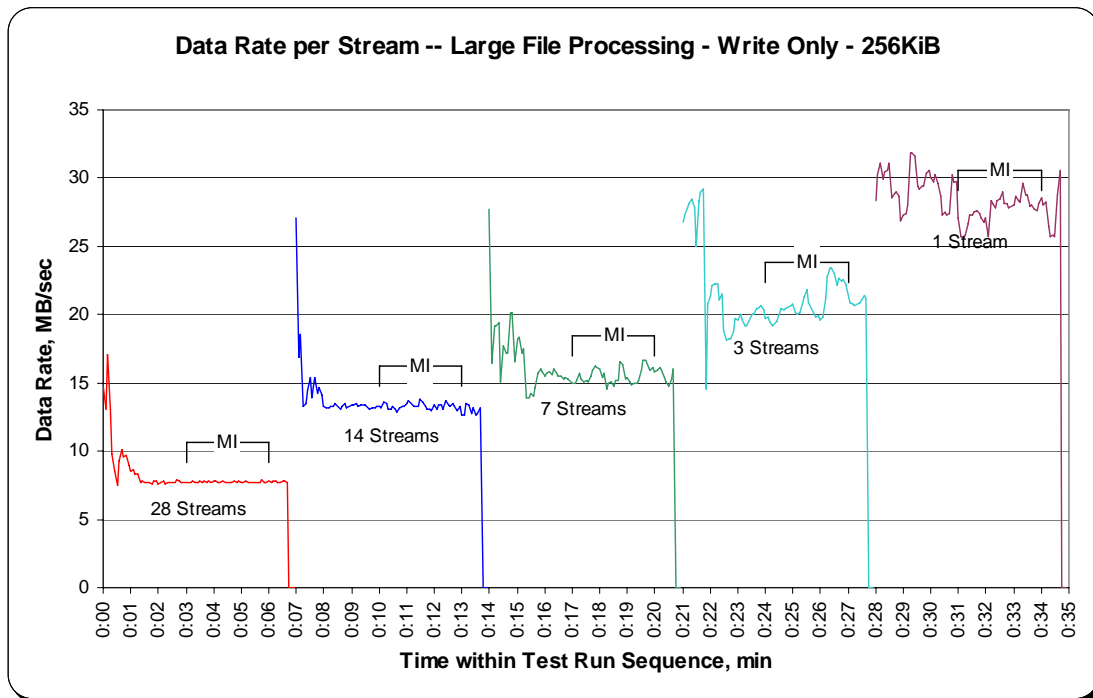
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



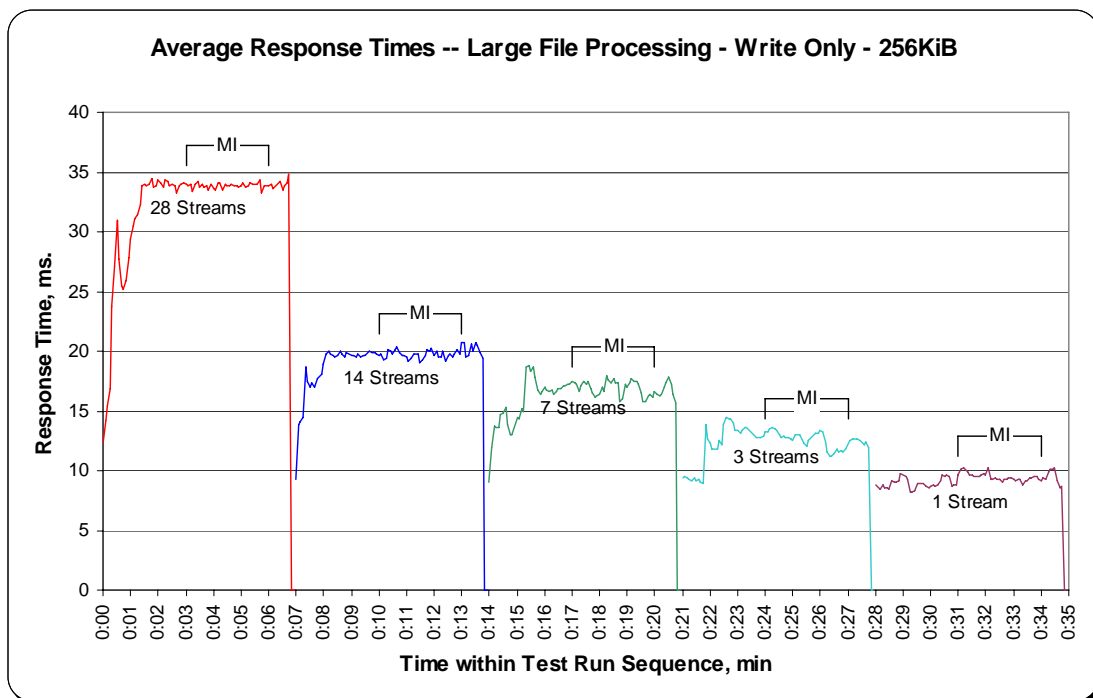
SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Data Rate per Stream Graph



SPC-2 “Large File Processing/ WRITE ONLY /256 KiB Transfer Size” Average Response Time Graph



Large File Processing Test – READ-WRITE Test Phase

Clause 10.6.8.1.2

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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "READ-WRITE, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

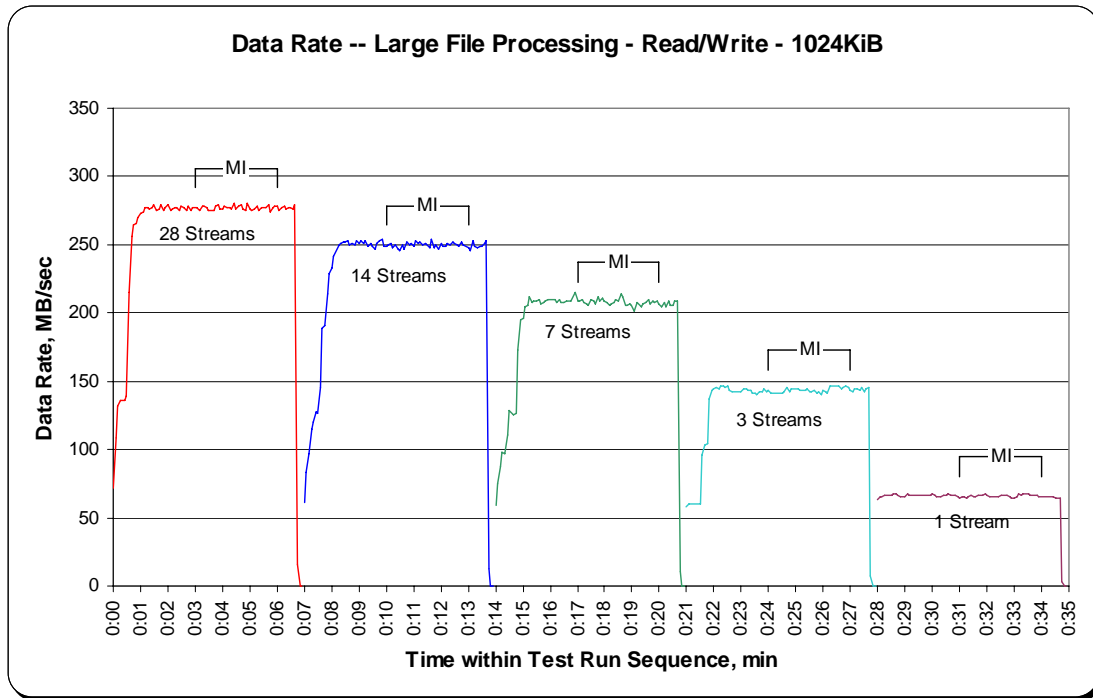
The SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Test Run data is contained in the table that appears on the next page. That table is followed by graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table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

Immediately following the SPC-2 "Large File Processing/ READ-WRITE /1024 KiB Transfer Size" table and graphs will be the SPC-2 "Large File Processing/ READ-WRITE /64 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.

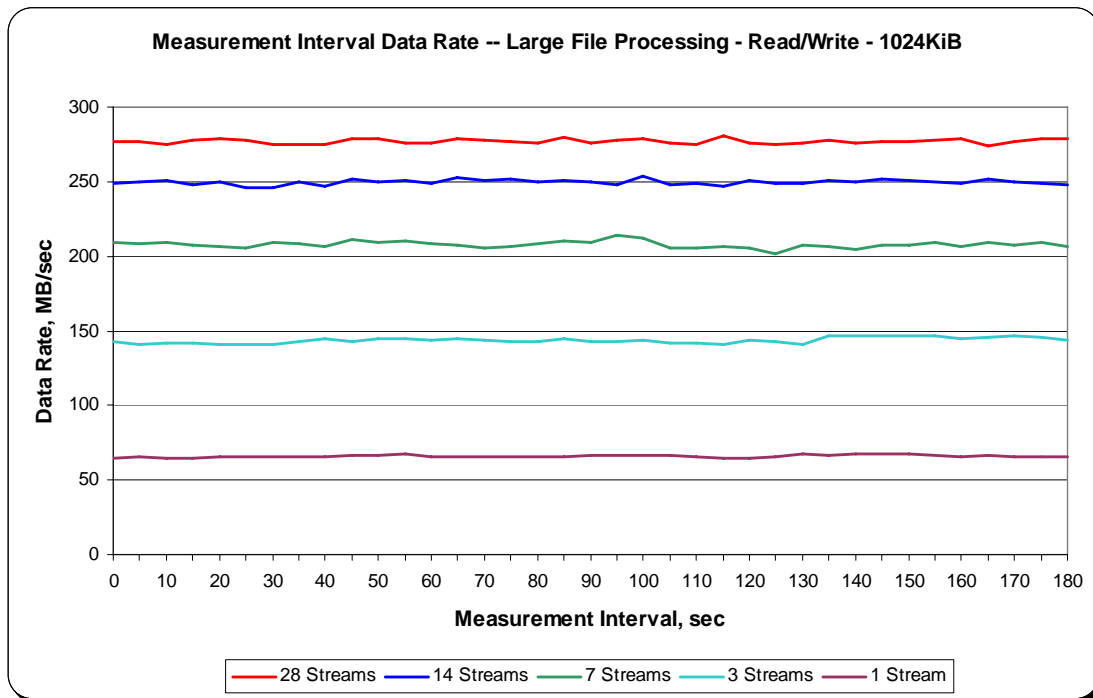
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Test Run Data – Ramp-Up Period

TR11	28 Streams			TR12	14 Streams			TR13	7 Streams			TR14	3 Streams			TR15	1 Stream		
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	71.72	35.86	20.11	0:07:00	60.82	60.82	16.43	0:14:00	58.51	58.51	17.20	0:21:00	57.67	57.67	17.40	0:28:00	63.54	63.54	15.82
0:00:05	108.63	15.52	35.49	0:07:05	82.84	41.42	23.76	0:14:05	75.08	37.54	22.02	0:21:05	60.19	60.19	17.42	0:28:05	65.43	65.43	15.93
0:00:10	131.49	13.15	66.21	0:07:10	96.47	24.12	31.00	0:14:10	87.24	29.08	24.21	0:21:10	60.19	60.19	17.44	0:28:10	65.64	65.64	15.96
0:00:15	136.11	13.61	76.25	0:07:15	115.13	23.03	40.31	0:14:15	98.36	32.79	31.93	0:21:15	60.19	60.19	17.41	0:28:15	66.69	66.69	15.75
0:00:20	135.48	13.55	77.69	0:07:20	120.17	20.03	46.31	0:14:20	97.31	32.44	32.30	0:21:20	60.61	60.61	17.30	0:28:20	66.06	66.06	15.87
0:00:25	135.69	11.31	82.15	0:07:25	127.93	18.28	55.94	0:14:25	110.94	27.73	32.99	0:21:25	59.77	59.77	17.49	0:28:25	66.06	66.06	15.86
0:00:30	138.83	10.68	97.71	0:07:30	126.67	18.10	58.01	0:14:30	128.35	32.09	32.67	0:21:30	60.61	60.61	17.33	0:28:30	66.90	66.90	15.64
0:00:35	215.59	12.68	76.69	0:07:35	145.33	18.17	52.81	0:14:35	126.25	31.56	33.13	0:21:35	95.42	47.71	19.68	0:28:35	67.11	67.11	15.61
0:00:40	256.27	13.49	73.69	0:07:40	188.74	23.59	44.50	0:14:40	125.20	31.30	33.55	0:21:40	103.60	51.80	20.14	0:28:40	67.95	67.95	15.45
0:00:45	264.87	13.94	75.36	0:07:45	190.42	23.80	44.02	0:14:45	126.46	31.61	33.21	0:21:45	104.65	52.32	20.02	0:28:45	66.90	66.90	15.68
0:00:50	265.50	12.64	77.12	0:07:50	213.49	21.35	43.99	0:14:50	172.60	34.52	29.68	0:21:50	136.73	45.58	21.74	0:28:50	65.64	65.64	15.95
0:00:55	269.48	12.25	82.12	0:07:55	228.80	22.88	45.78	0:14:55	195.45	32.58	31.36	0:21:55	143.65	47.88	21.88	0:28:55	65.01	65.01	16.12
0:01:00	272.84	11.37	89.19	0:08:00	233.20	21.20	48.07	0:15:00	196.29	32.72	32.01	0:22:00	144.28	48.09	21.76	0:29:00	65.22	65.22	16.09
0:01:05	274.10	10.54	93.64	0:08:05	241.17	20.10	50.77	0:15:05	204.68	29.24	35.43	0:22:05	145.75	48.58	21.58	0:29:05	67.11	67.11	15.61
0:01:10	277.45	10.28	99.78	0:08:10	245.37	20.45	51.22	0:15:10	205.94	29.42	35.59	0:22:10	144.70	48.23	21.74	0:29:10	66.27	66.27	15.81
0:01:15	276.82	10.25	102.11	0:08:15	249.56	19.20	53.56	0:15:15	211.39	30.20	34.68	0:22:15	147.01	49.00	21.40	0:29:15	66.90	66.90	15.68
0:01:20	275.78	9.85	103.73	0:08:20	250.40	17.89	57.35	0:15:20	207.41	29.63	35.47	0:22:20	146.38	48.79	21.52	0:29:20	66.90	66.90	15.67
0:01:25	276.82	9.89	105.71	0:08:25	252.29	18.02	58.38	0:15:25	208.88	29.84	35.10	0:22:25	145.75	48.58	21.54	0:29:25	66.90	66.90	15.66
0:01:30	278.92	9.96	106.27	0:08:30	252.29	18.02	58.11	0:15:30	209.09	29.87	35.15	0:22:30	146.59	48.86	21.47	0:29:30	66.27	66.27	15.81
0:01:35	275.36	9.83	106.08	0:08:35	252.71	18.05	58.20	0:15:35	209.30	29.90	35.05	0:22:35	143.24	47.75	21.92	0:29:35	66.48	66.48	15.79
0:01:40	276.40	9.87	106.18	0:08:40	249.98	17.86	58.61	0:15:40	206.99	29.57	35.36	0:22:40	142.82	47.61	22.04	0:29:40	66.69	66.69	15.71
0:01:45	278.92	9.96	105.56	0:08:45	250.82	17.92	58.41	0:15:45	207.83	29.69	35.37	0:22:45	142.82	47.61	22.02	0:29:45	66.27	66.27	15.82
0:01:50	275.15	9.83	106.51	0:08:50	249.77	17.84	58.88	0:15:50	208.88	29.84	35.17	0:22:50	142.61	47.54	22.07	0:29:50	66.48	66.48	15.74
0:01:55	277.03	9.89	106.13	0:08:55	252.50	18.04	58.16	0:15:55	209.30	29.90	35.00	0:22:55	142.61	47.54	22.04	0:29:55	66.48	66.48	15.82
0:02:00	279.13	9.97	105.43	0:09:00	250.40	17.89	58.54	0:16:00	209.30	29.90	35.14	0:23:00	142.82	47.61	22.03	0:30:00	67.11	67.11	15.62
0:02:05	275.15	9.83	106.50	0:09:05	252.71	18.05	58.22	0:16:05	209.51	29.93	34.97	0:23:05	144.91	48.30	21.61	0:30:05	66.69	66.69	15.71
0:02:10	276.40	9.87	106.17	0:09:10	250.40	17.89	58.48	0:16:10	209.92	29.99	34.99	0:23:10	144.07	48.02	21.91	0:30:10	65.01	65.01	16.12
0:02:15	277.24	9.90	105.66	0:09:15	253.13	18.08	58.20	0:16:15	207.83	29.69	35.30	0:23:15	143.86	47.95	21.88	0:30:15	65.85	65.85	15.94
0:02:20	277.03	9.89	105.99	0:09:20	248.93	17.78	58.95	0:16:20	209.51	29.93	35.04	0:23:20	143.65	47.88	21.88	0:30:20	65.43	65.43	16.02
0:02:25	275.57	9.84	106.59	0:09:25	250.40	17.89	58.56	0:16:25	208.04	29.72	35.26	0:23:25	141.35	47.12	22.21	0:30:25	66.69	66.69	15.68
0:02:30	278.50	9.95	105.59	0:09:30	248.72	17.77	59.06	0:16:30	207.83	29.69	35.30	0:23:30	141.14	47.05	22.32	0:30:30	66.48	66.48	15.75
0:02:35	277.66	9.92	105.85	0:09:35	246.83	17.63	59.35	0:16:35	208.46	29.78	35.24	0:23:35	140.30	46.77	22.41	0:30:35	67.11	67.11	15.64
0:02:40	275.57	9.84	106.55	0:09:40	250.40	17.89	58.54	0:16:40	208.67	29.81	35.13	0:23:40	142.19	47.40	22.09	0:30:40	66.69	66.69	15.71
0:02:45	278.50	9.95	105.70	0:09:45	252.50	18.04	58.19	0:16:45	208.25	29.75	35.29	0:23:45	141.98	47.33	22.21	0:30:45	66.27	66.27	15.85
0:02:50	275.15	9.83	106.17	0:09:50	253.97	18.14	57.92	0:16:50	210.55	30.08	34.81	0:23:50	144.07	48.02	21.80	0:30:50	66.90	66.90	15.66
0:02:55	276.82	9.89	105.89	0:09:55	248.93	17.78	58.69	0:16:55	214.54	30.65	34.28	0:23:55	142.40	47.47	22.07	0:30:55	65.64	65.64	15.95

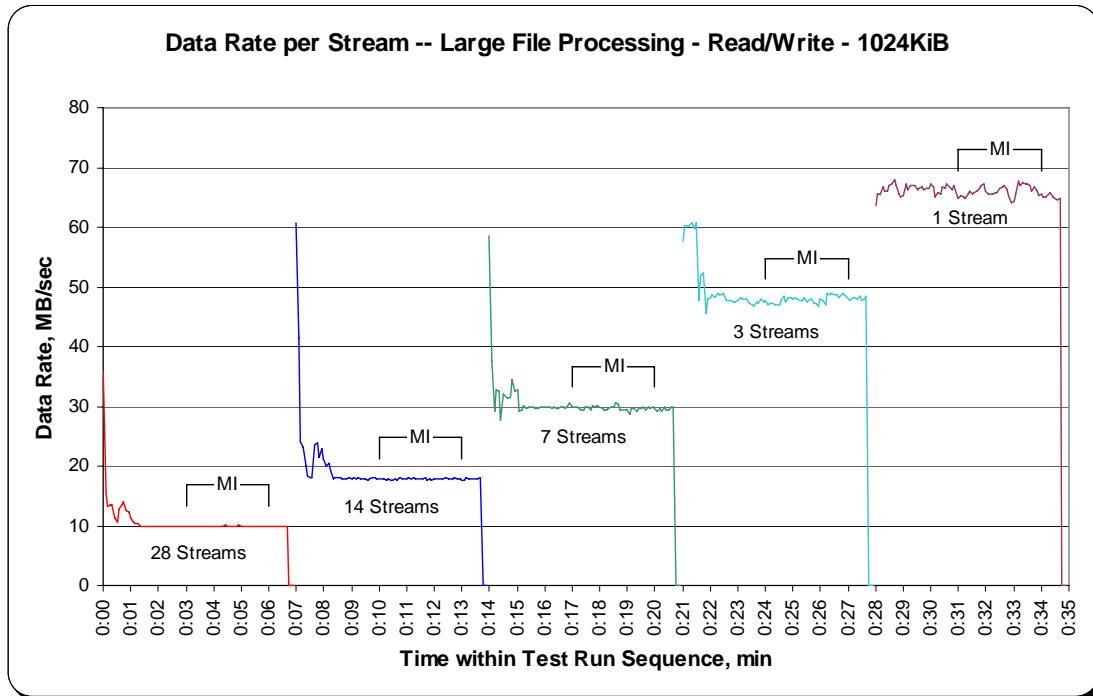
SPC-2 “Large File Processing/ READ-WRITE/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



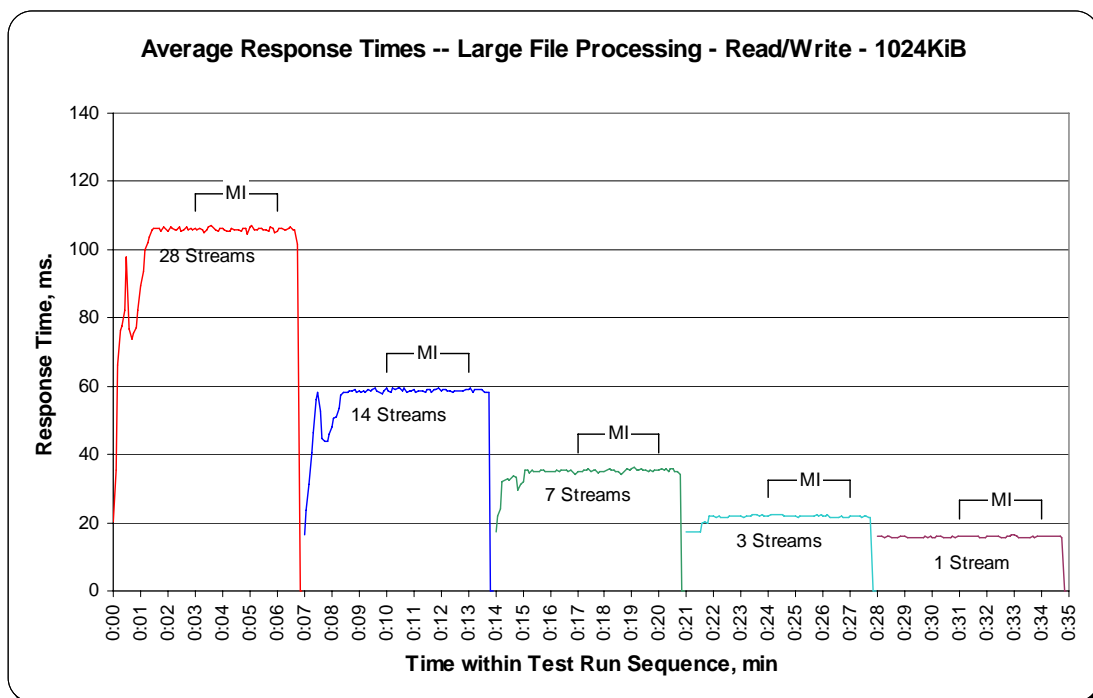
SPC-2 “Large File Processing/ READ-WRITE/1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Average Data Rate per Stream Graph



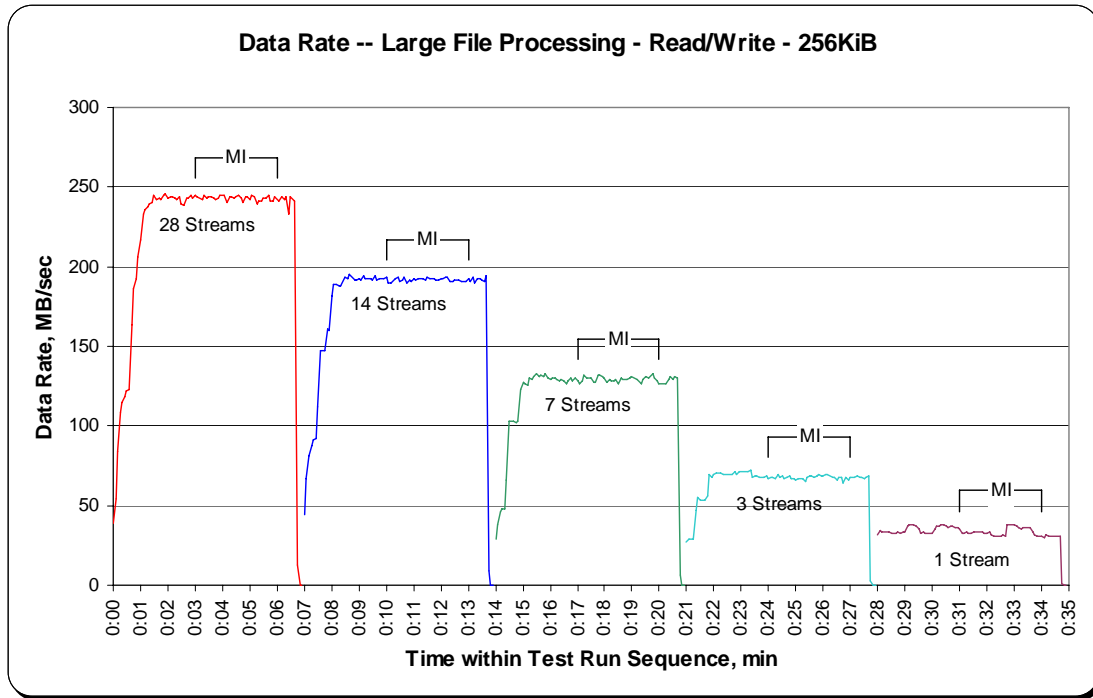
SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Average Response Time Graph



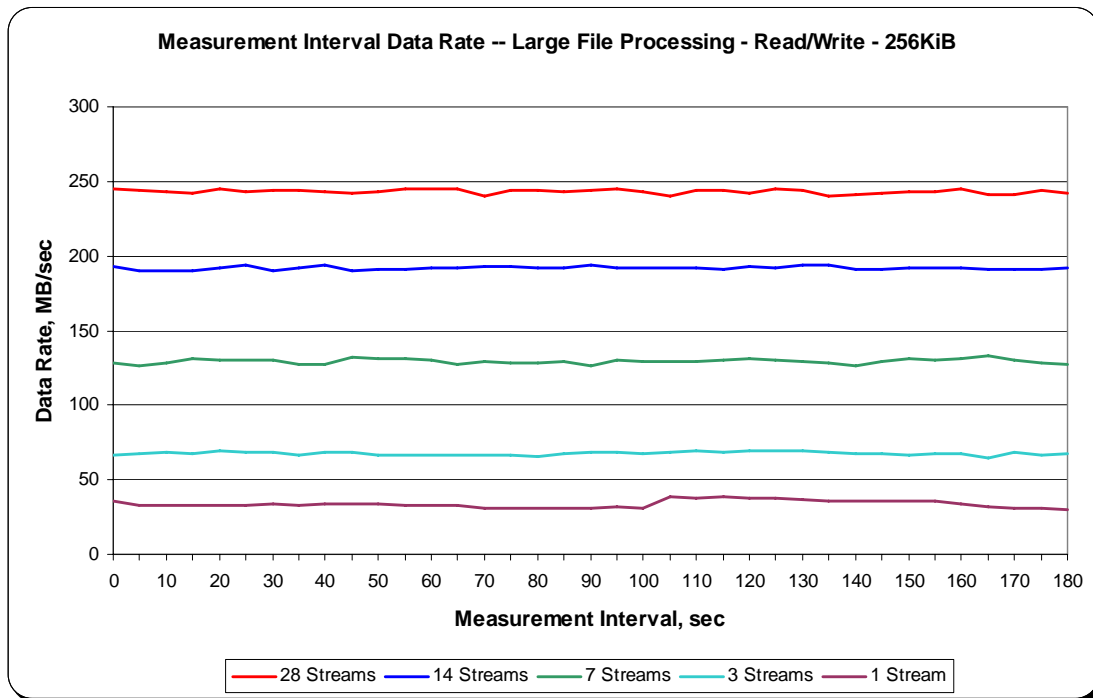
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Test Run Data - Ramp-Up Period

TR16	28 Streams			TR17	14 Streams			TR18	7 Streams			TR19	3 Streams			TR20	1 Stream		
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	38.69	19.35	9.33	0:07:00	44.51	14.84	10.71	0:14:00	28.78	28.78	8.72	0:21:00	26.79	26.79	9.36	0:28:00	31.88	31.88	7.88
0:00:05	54.63	18.21	11.28	0:07:05	67.21	16.80	12.64	0:14:05	37.59	18.80	9.87	0:21:05	28.57	28.57	9.12	0:28:05	33.92	33.92	7.73
0:00:10	84.04	10.51	15.85	0:07:10	81.05	16.21	14.90	0:14:10	46.19	23.09	11.37	0:21:10	28.89	28.89	9.09	0:28:10	33.29	33.29	7.87
0:00:15	108.16	10.82	21.03	0:07:15	87.82	14.64	16.15	0:14:15	47.82	23.91	10.95	0:21:15	29.10	29.10	9.01	0:28:15	33.45	33.45	7.83
0:00:20	114.45	10.40	24.97	0:07:20	91.70	15.28	17.15	0:14:20	47.97	23.99	10.93	0:21:20	47.34	23.67	9.87	0:28:20	33.29	33.29	7.87
0:00:25	118.17	9.09	26.95	0:07:25	92.12	13.16	17.37	0:14:25	66.17	13.23	13.11	0:21:25	54.68	27.34	9.58	0:28:25	33.87	33.87	7.74
0:00:30	122.00	8.71	28.95	0:07:30	112.09	12.45	18.10	0:14:30	102.87	20.57	12.72	0:21:30	53.11	26.56	9.86	0:28:30	32.82	32.82	7.98
0:00:35	123.16	8.80	29.61	0:07:35	147.43	16.38	16.00	0:14:35	102.71	20.54	12.76	0:21:35	53.53	26.76	9.81	0:28:35	32.72	32.72	8.01
0:00:40	163.26	10.20	25.14	0:07:40	147.17	16.35	16.01	0:14:40	102.97	20.59	12.72	0:21:40	53.42	26.71	9.80	0:28:40	32.72	32.72	8.01
0:00:45	186.49	10.97	23.63	0:07:45	146.85	14.69	16.10	0:14:45	102.03	20.41	12.85	0:21:45	56.05	18.68	10.32	0:28:45	33.03	33.03	7.94
0:00:50	192.57	10.70	23.50	0:07:50	161.11	16.11	16.26	0:14:50	103.18	20.64	12.69	0:21:50	69.21	23.07	11.36	0:28:50	32.98	32.98	7.93
0:00:55	205.84	10.83	23.74	0:07:55	160.17	16.02	16.36	0:14:55	123.16	17.59	13.76	0:21:55	67.58	22.53	11.63	0:28:55	33.19	33.19	7.90
0:01:00	217.06	9.87	24.65	0:08:00	181.56	13.97	17.61	0:15:00	126.98	18.14	14.46	0:22:00	69.21	23.07	11.36	0:29:00	33.14	33.14	7.90
0:01:05	232.94	9.71	25.84	0:08:05	189.16	14.55	18.00	0:15:05	126.62	18.09	14.48	0:22:05	70.88	23.63	11.09	0:29:05	37.07	37.07	7.07
0:01:10	235.98	9.83	26.64	0:08:10	188.69	14.51	18.06	0:15:10	125.72	17.96	14.60	0:22:10	70.10	23.37	11.21	0:29:10	37.54	37.54	6.98
0:01:15	237.92	9.52	26.70	0:08:15	187.64	14.43	18.17	0:15:15	130.50	18.64	14.05	0:22:15	70.04	23.35	11.23	0:29:15	37.70	37.70	6.96
0:01:20	239.02	8.54	28.09	0:08:20	188.38	13.46	18.41	0:15:20	129.13	18.45	14.20	0:22:20	69.47	23.16	11.32	0:29:20	37.75	37.75	6.94
0:01:25	240.75	8.60	30.32	0:08:25	191.78	13.70	19.13	0:15:25	131.28	18.75	13.97	0:22:25	69.52	23.17	11.31	0:29:25	37.12	37.12	7.06
0:01:30	244.69	8.74	30.03	0:08:30	193.36	13.81	18.99	0:15:30	133.22	19.03	13.78	0:22:30	69.89	23.30	11.24	0:29:30	35.44	35.44	7.38
0:01:35	242.17	8.65	30.29	0:08:35	192.47	13.75	19.03	0:15:35	131.44	18.78	13.96	0:22:35	69.94	23.31	11.24	0:29:35	32.77	32.77	8.01
0:01:40	242.85	8.67	30.23	0:08:40	195.24	13.95	18.80	0:15:40	131.70	18.81	13.92	0:22:40	69.99	23.33	11.25	0:29:40	33.03	33.03	7.93
0:01:45	242.27	8.65	30.30	0:08:45	193.72	13.84	18.95	0:15:45	131.39	18.77	13.95	0:22:45	71.09	23.70	11.05	0:29:45	32.40	32.40	8.09
0:01:50	244.53	8.73	29.99	0:08:50	191.68	13.69	19.13	0:15:50	133.06	19.01	13.79	0:22:50	69.57	23.19	11.29	0:29:50	32.82	32.82	7.98
0:01:55	245.37	8.76	29.92	0:08:55	191.21	13.66	19.20	0:15:55	130.23	18.60	14.10	0:22:55	71.04	23.68	11.08	0:29:55	32.51	32.51	8.06
0:02:00	242.85	8.67	30.18	0:09:00	192.68	13.76	19.05	0:16:00	129.45	18.49	14.16	0:23:00	71.25	23.75	11.02	0:30:00	32.61	32.61	8.03
0:02:05	243.64	8.70	30.12	0:09:05	191.63	13.69	19.12	0:16:05	130.39	18.63	14.07	0:23:05	71.62	23.87	10.98	0:30:05	35.23	35.23	7.44
0:02:10	244.32	8.73	30.08	0:09:10	194.30	13.88	18.90	0:16:10	130.29	18.61	14.07	0:23:10	71.78	23.93	10.96	0:30:10	36.70	36.70	7.14
0:02:15	243.06	8.68	30.18	0:09:15	192.41	13.74	19.06	0:16:15	129.03	18.43	14.22	0:23:15	71.15	23.72	11.04	0:30:15	37.38	37.38	7.01
0:02:20	241.80	8.64	30.34	0:09:20	192.89	13.78	19.03	0:16:20	128.14	18.31	14.31	0:23:20	72.25	24.08	10.89	0:30:20	37.85	37.85	6.92
0:02:25	243.74	8.71	30.13	0:09:25	192.20	13.73	19.09	0:16:25	129.29	18.47	14.19	0:23:25	68.11	22.70	11.54	0:30:25	37.59	37.59	6.97
0:02:30	239.08	8.54	30.69	0:09:30	191.52	13.68	19.16	0:16:30	127.93	18.28	14.34	0:23:30	68.52	22.84	11.47	0:30:30	37.07	37.07	7.07
0:02:35	238.66	8.52	30.75	0:09:35	194.09	13.86	18.89	0:16:35	126.20	18.03	14.54	0:23:35	68.47	22.82	11.48	0:30:35	36.44	36.44	7.19
0:02:40	242.90	8.68	30.22	0:09:40	191.37	13.67	19.19	0:16:40	128.50	18.36	14.27	0:23:40	68.21	22.74	11.52	0:30:40	37.07	37.07	7.06
0:02:45	242.85	8.67	30.19	0:09:45	192.10	13.72	19.10	0:16:45	130.23	18.60	14.08	0:23:45	68.05	22.68	11.55	0:30:45	36.65	36.65	7.16
0:02:50	244.79	8.74	30.01	0:09:50	192.57	13.76	19.05	0:16:50	128.24	18.32	14.32	0:23:50	68.00	22.67	11.56	0:30:50	36.18	36.18	7.24
0:02:55	243.27	8.69	30.15	0:09:55	192.20	13.73	19.09	0:16:55	130.39	18.63	14.06	0:23:55	68.89	22.96	11.42	0:30:55	36.23	36.23	7.23

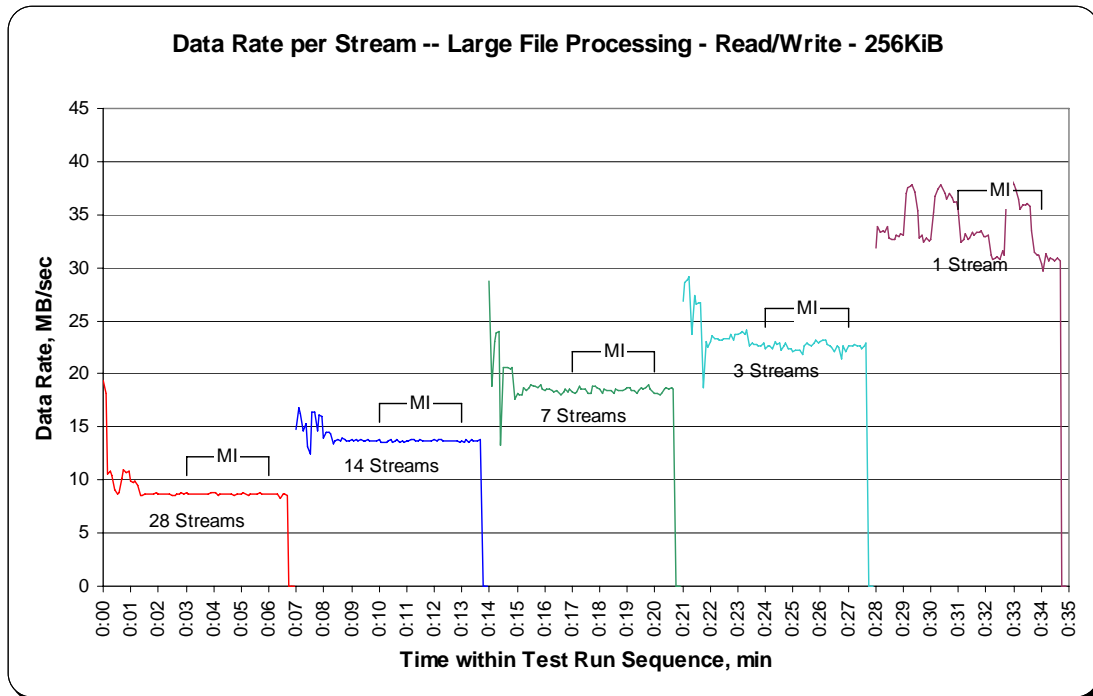
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



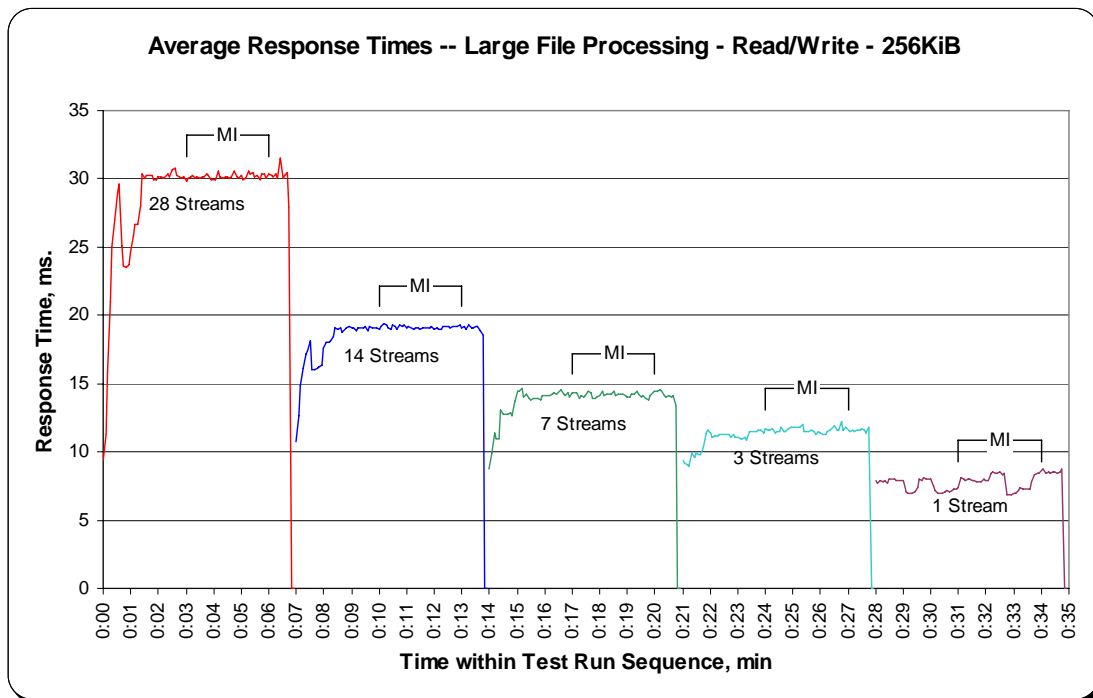
SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Data Rate per Stream Graph



SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Average Response Time Graph



Large File Processing Test – READ ONLY Test Phase

Clause 10.6.8.1.3

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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "READ ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

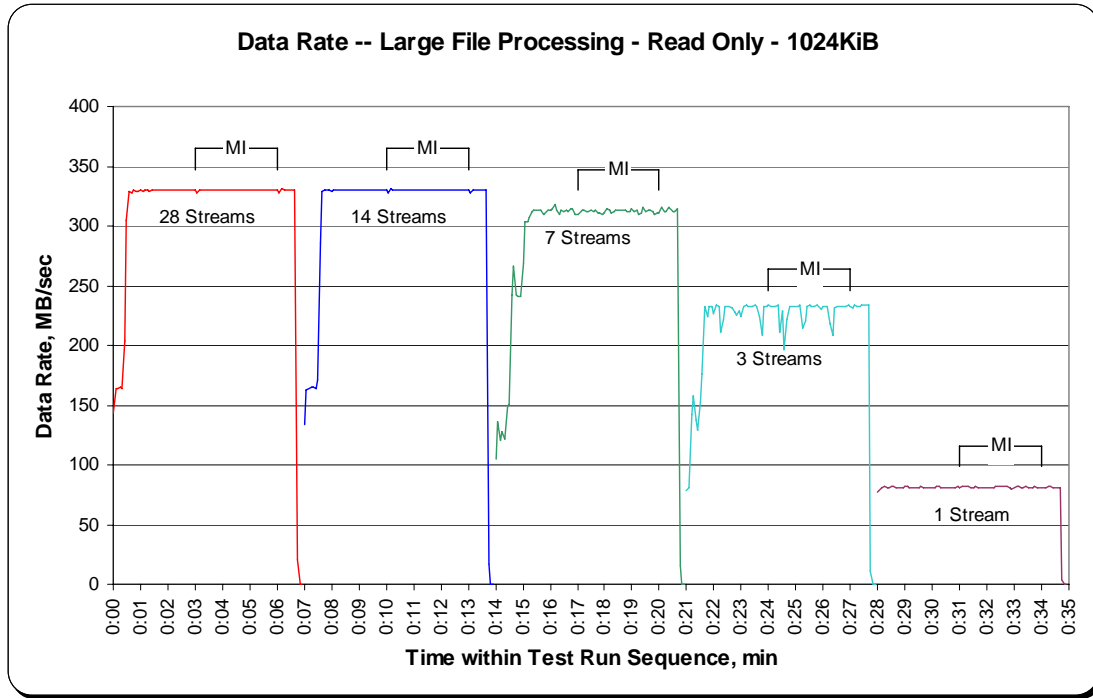
The SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Test Run data is contained in the table that appears on the next page. That table is followed by graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table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

Immediately following the SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" table and graphs will be the SPC-2 "Large File Processing/READ ONLY/64 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.

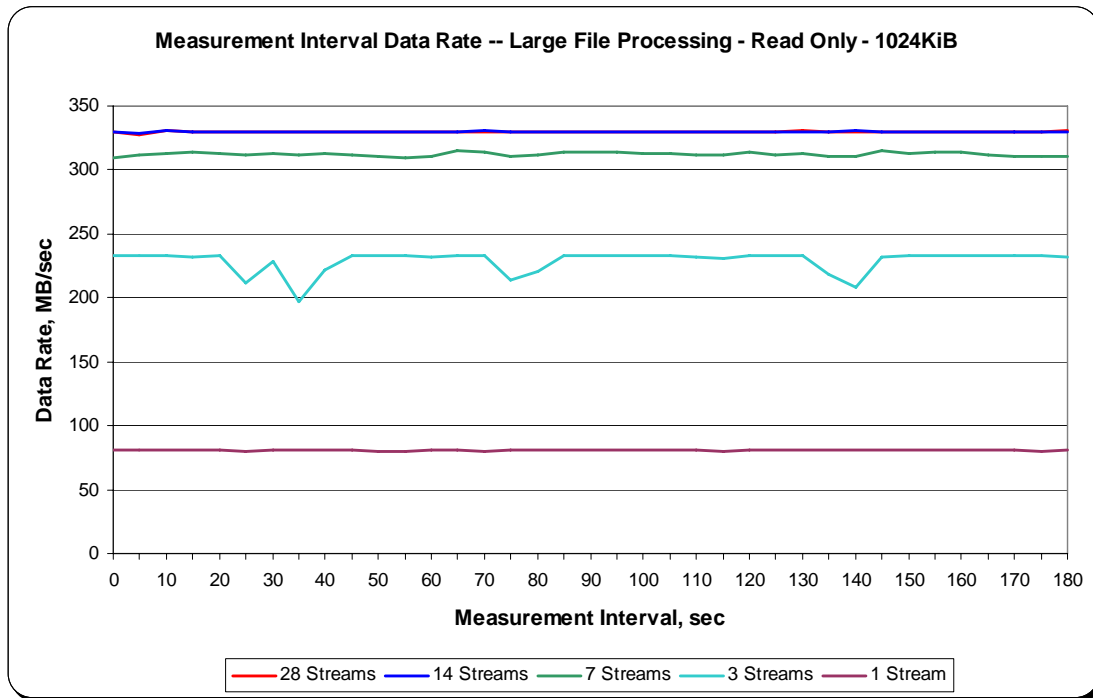
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Test Run Data – Ramp Up Period

TR21 Test Run Sequence Time	28 Streams			TR22 Test Run Sequence Time	14 Streams			TR23 Test Run Sequence Time	7 Streams			TR24 Test Run Sequence Time	3 Streams			TR25 Test Run Sequence Time	1 Stream		
	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	142.82	35.70	24.03	0:07:00	133.38	33.34	22.48	0:14:00	105.28	52.64	17.17	0:21:00	78.01	78.01	12.91	0:28:00	76.97	76.97	13.00
0:00:05	163.37	20.42	37.09	0:07:05	162.53	40.63	25.68	0:14:05	136.73	68.37	15.34	0:21:05	80.95	80.95	12.86	0:28:05	80.11	80.11	13.07
0:00:10	164.00	16.40	57.79	0:07:10	163.58	32.72	25.67	0:14:10	121.01	60.50	17.31	0:21:10	142.19	71.09	12.96	0:28:10	80.95	80.95	12.96
0:00:15	165.05	15.00	66.84	0:07:15	164.84	32.97	31.74	0:14:15	127.51	63.75	16.44	0:21:15	157.92	78.96	13.28	0:28:15	81.58	81.58	12.85
0:00:20	164.21	11.73	80.11	0:07:20	164.84	27.47	36.73	0:14:20	122.05	40.68	18.30	0:21:20	137.78	68.89	15.22	0:28:20	80.74	80.74	12.98
0:00:25	203.84	12.74	74.38	0:07:25	164.00	23.43	43.20	0:14:25	149.95	49.98	20.99	0:21:25	128.97	64.49	16.25	0:28:25	81.16	81.16	12.93
0:00:30	304.93	16.94	55.25	0:07:30	171.34	21.42	43.32	0:14:30	150.79	50.26	20.84	0:21:30	152.67	76.34	13.73	0:28:30	81.37	81.37	12.87
0:00:35	328.83	16.44	59.06	0:07:35	285.42	25.95	33.41	0:14:35	242.43	48.49	18.75	0:21:35	175.95	58.65	13.63	0:28:35	81.37	81.37	12.86
0:00:40	328.20	16.41	63.52	0:07:40	328.41	27.37	35.74	0:14:40	266.76	53.35	19.52	0:21:40	232.78	77.59	13.51	0:28:40	80.53	80.53	13.06
0:00:45	330.72	16.54	63.52	0:07:45	330.30	27.53	38.09	0:14:45	241.59	48.32	21.72	0:21:45	224.19	74.73	14.01	0:28:45	80.32	80.32	13.03
0:00:50	329.25	15.68	65.89	0:07:50	330.51	27.54	38.07	0:14:50	241.17	48.23	21.72	0:21:50	232.78	77.59	13.52	0:28:50	80.74	80.74	12.99
0:00:55	329.25	14.32	71.76	0:07:55	330.30	27.53	38.09	0:14:55	240.96	48.19	21.78	0:21:55	232.78	77.59	13.50	0:28:55	80.74	80.74	12.99
0:01:00	330.30	14.36	73.00	0:08:00	329.25	25.33	38.57	0:15:00	269.06	44.84	21.27	0:22:00	226.70	75.57	13.86	0:29:00	81.58	81.58	12.85
0:01:05	328.62	12.64	79.26	0:08:05	330.51	25.42	41.29	0:15:05	303.46	50.58	20.74	0:22:05	233.20	77.73	13.48	0:29:05	81.37	81.37	12.88
0:01:10	330.30	12.70	82.53	0:08:10	330.09	25.39	41.29	0:15:10	303.04	50.51	20.75	0:22:10	232.78	77.59	13.52	0:29:10	81.16	81.16	12.92
0:01:15	329.88	12.69	82.60	0:08:15	329.67	23.55	41.94	0:15:15	307.65	43.95	22.26	0:22:15	210.55	70.18	14.91	0:29:15	80.74	80.74	12.98
0:01:20	329.46	12.20	82.82	0:08:20	329.67	23.55	44.47	0:15:20	312.06	44.58	23.50	0:22:20	222.09	74.03	14.17	0:29:20	80.74	80.74	12.97
0:01:25	329.67	11.77	86.42	0:08:25	330.30	23.59	44.46	0:15:25	312.90	44.70	23.46	0:22:25	232.78	77.59	13.51	0:29:25	80.74	80.74	12.97
0:01:30	329.88	11.78	88.97	0:08:30	329.88	23.56	44.49	0:15:30	313.73	44.82	23.39	0:22:30	232.36	77.45	13.53	0:29:30	80.74	80.74	12.99
0:01:35	330.09	11.79	88.98	0:08:35	330.30	23.59	44.45	0:15:35	313.73	44.82	23.39	0:22:35	232.78	77.59	13.51	0:29:35	81.58	81.58	12.87
0:01:40	329.88	11.78	88.97	0:08:40	330.51	23.61	44.42	0:15:40	312.69	44.67	23.44	0:22:40	231.11	77.04	13.61	0:29:40	80.74	80.74	12.97
0:01:45	330.30	11.80	88.93	0:08:45	329.88	23.56	44.47	0:15:45	310.17	44.31	23.68	0:22:45	227.12	75.71	13.84	0:29:45	80.74	80.74	13.00
0:01:50	329.88	11.78	88.91	0:08:50	330.30	23.59	44.47	0:15:50	311.01	44.43	23.60	0:22:50	225.23	75.08	13.95	0:29:50	80.53	80.53	12.98
0:01:55	330.30	11.80	88.94	0:08:55	330.30	23.59	44.44	0:15:55	313.10	44.73	23.44	0:22:55	229.01	76.34	13.74	0:29:55	80.53	80.53	13.03
0:02:00	330.09	11.79	88.95	0:09:00	330.09	23.58	44.46	0:16:00	313.31	44.76	23.41	0:23:00	224.19	74.73	14.03	0:30:00	80.95	80.95	12.96
0:02:05	329.67	11.77	88.95	0:09:05	330.30	23.59	44.47	0:16:05	314.99	45.00	23.32	0:23:05	232.36	77.45	13.52	0:30:05	81.16	81.16	12.91
0:02:10	330.51	11.80	88.93	0:09:10	330.09	23.58	44.44	0:16:10	317.72	45.39	23.08	0:23:10	233.20	77.73	13.49	0:30:10	81.37	81.37	12.87
0:02:15	330.09	11.79	88.90	0:09:15	330.30	23.59	44.44	0:16:15	312.69	44.67	23.47	0:23:15	232.78	77.59	13.50	0:30:15	81.37	81.37	12.89
0:02:20	330.30	11.80	88.92	0:09:20	330.09	23.58	44.48	0:16:20	309.54	44.22	23.71	0:23:20	232.99	77.66	13.49	0:30:20	80.53	80.53	13.03
0:02:25	330.09	11.79	88.95	0:09:25	330.09	23.58	44.46	0:16:25	312.90	44.70	23.45	0:23:25	232.99	77.66	13.51	0:30:25	80.74	80.74	12.99
0:02:30	330.30	11.80	88.91	0:09:30	329.88	23.56	44.46	0:16:30	311.64	44.52	23.54	0:23:30	233.20	77.73	13.48	0:30:30	80.74	80.74	12.98
0:02:35	329.88	11.78	88.95	0:09:35	330.30	23.59	44.46	0:16:35	312.69	44.67	23.48	0:23:35	232.36	77.45	13.52	0:30:35	80.74	80.74	12.97
0:02:40	330.51	11.80	88.89	0:09:40	330.30	23.59	44.46	0:16:40	311.64	44.52	23.56	0:23:40	223.56	74.52	14.06	0:30:40	80.32	80.32	13.03
0:02:45	329.88	11.78	88.93	0:09:45	330.09	23.58	44.45	0:16:45	314.15	44.88	23.34	0:23:45	208.46	69.49	15.10	0:30:45	81.16	81.16	12.91
0:02:50	330.09	11.79	88.96	0:09:50	330.30	23.59	44.46	0:16:50	314.78	44.97	23.31	0:23:50	232.78	77.59	13.49	0:30:50	81.16	81.16	12.92
0:02:55	329.88	11.78	88.97	0:09:55	330.09	23.58	44.45	0:16:55	309.33	44.19	23.73	0:23:55	232.78	77.59	13.51	0:30:55	81.58	81.58	12.85

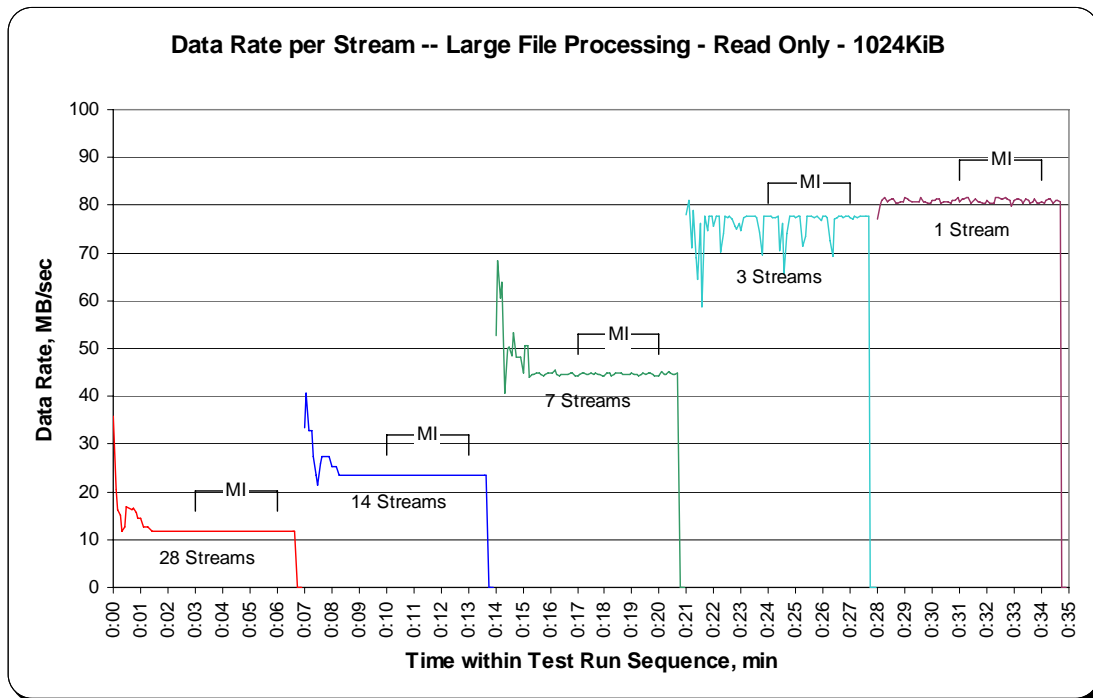
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



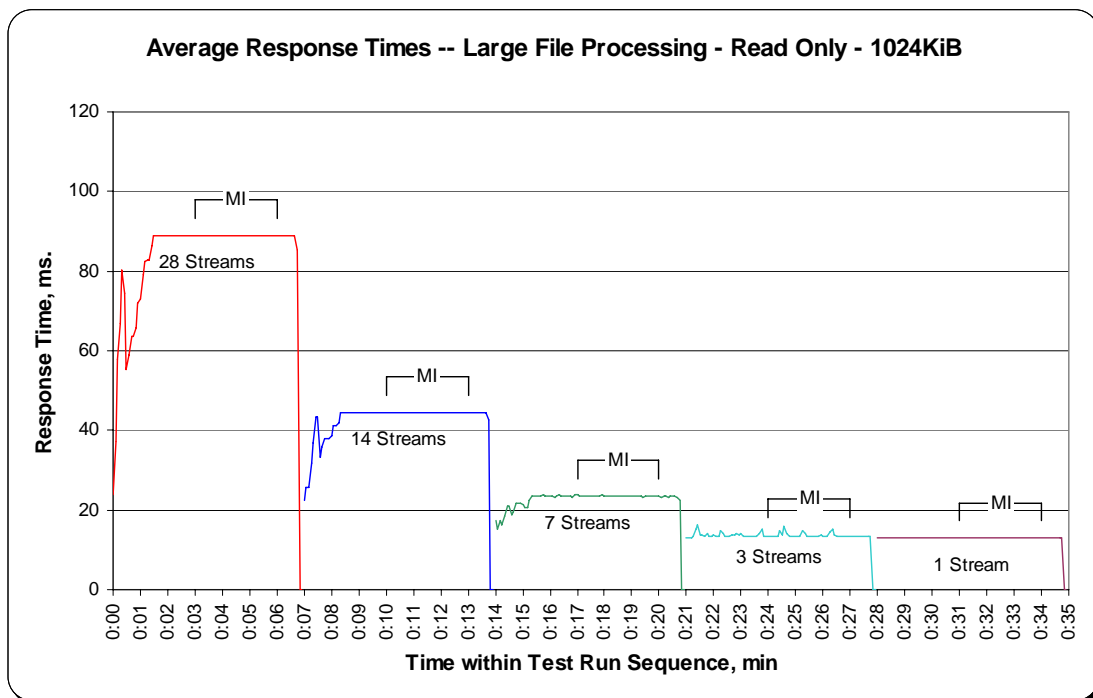
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Data Rate per Stream Graph



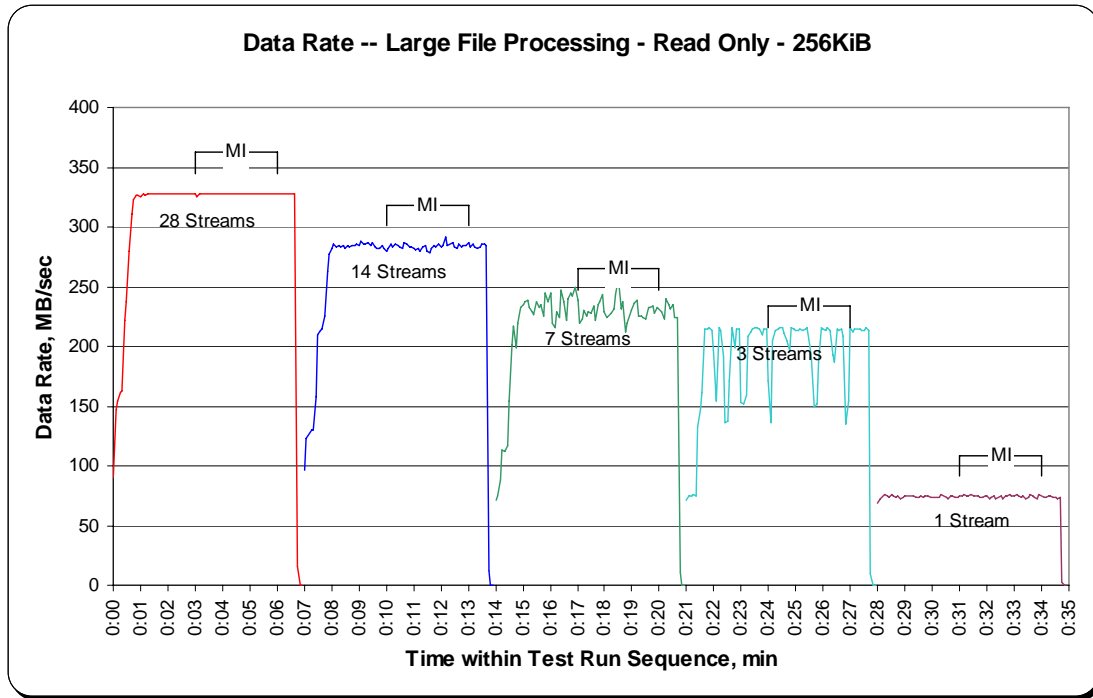
SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Average Response Time Graph



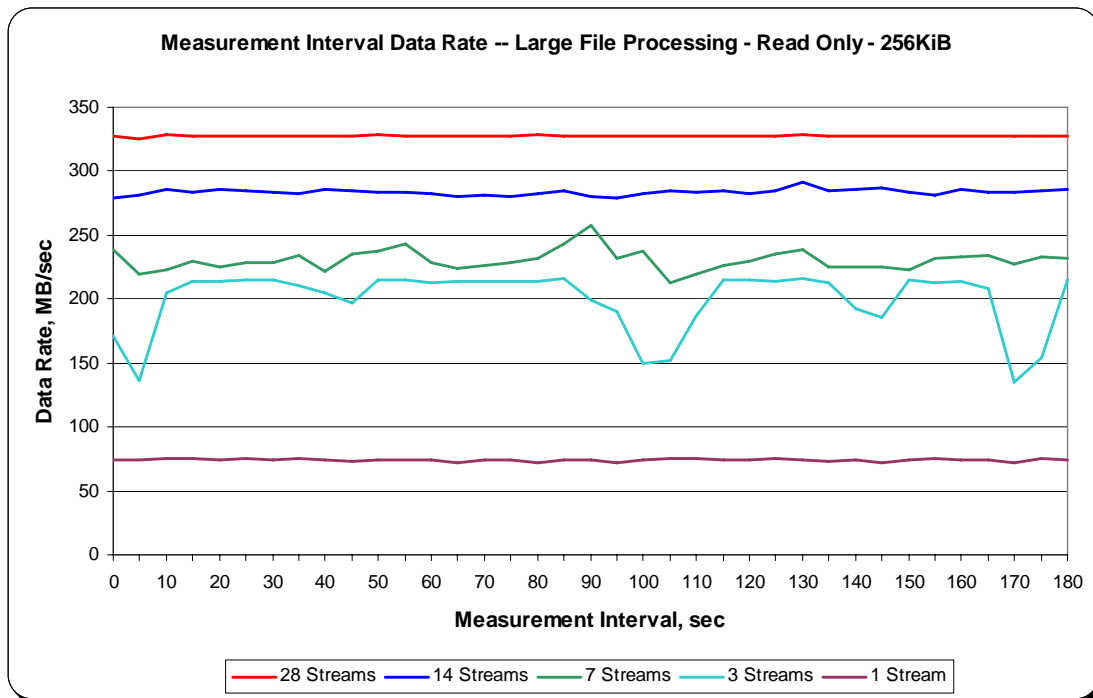
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Test Run Data – Ramp-Up Period

TR26	28 Streams			TR27	14 Streams			TR28	7 Streams			TR29	3 Streams			TR30	1 Stream		
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	90.49	15.08	9.36	0:07:00	96.10	19.22	8.93	0:14:00	71.67	71.67	3.51	0:21:00	71.15	71.15	3.52	0:28:00	69.21	69.21	3.62
0:00:05	147.01	18.38	13.94	0:07:05	122.53	24.51	10.63	0:14:05	74.55	74.55	3.49	0:21:05	74.92	74.92	3.49	0:28:05	72.67	72.67	3.61
0:00:10	153.88	15.39	15.36	0:07:10	126.72	25.34	10.35	0:14:10	88.45	29.48	6.22	0:21:10	74.82	74.82	3.50	0:28:10	73.51	73.51	3.56
0:00:15	161.48	13.46	18.89	0:07:15	130.23	21.71	11.59	0:14:15	113.25	37.75	6.94	0:21:15	75.45	75.45	3.47	0:28:15	75.50	75.50	3.47
0:00:20	162.63	12.51	20.57	0:07:20	130.23	21.71	12.00	0:14:20	112.62	37.54	6.99	0:21:20	74.71	74.71	3.50	0:28:20	74.40	74.40	3.52
0:00:25	221.56	14.77	17.23	0:07:25	158.28	19.79	11.18	0:14:25	116.97	38.99	6.71	0:21:25	132.59	66.30	3.57	0:28:25	73.92	73.92	3.54
0:00:30	237.55	13.97	16.71	0:07:30	209.19	26.15	10.02	0:14:30	154.72	30.94	6.63	0:21:30	146.59	73.30	3.57	0:28:30	75.45	75.45	3.47
0:00:35	279.13	13.29	17.23	0:07:35	213.75	26.72	9.81	0:14:35	201.75	33.62	7.05	0:21:35	161.27	53.76	3.68	0:28:35	74.76	74.76	3.50
0:00:40	310.59	13.50	17.90	0:07:40	214.80	23.87	10.04	0:14:40	216.27	36.04	7.27	0:21:40	214.85	71.62	3.66	0:28:40	73.09	73.09	3.58
0:00:45	322.80	13.45	19.31	0:07:45	225.60	20.51	11.04	0:14:45	198.44	33.07	7.93	0:21:45	214.17	71.39	3.67	0:28:45	74.66	74.66	3.51
0:00:50	326.21	13.05	19.92	0:07:50	262.98	21.92	11.22	0:14:50	219.36	31.34	8.26	0:21:50	215.69	71.90	3.64	0:28:50	72.56	72.56	3.61
0:00:55	326.11	13.04	20.09	0:07:55	276.61	21.28	11.54	0:14:55	232.84	33.26	7.87	0:21:55	213.59	71.20	3.68	0:28:55	73.87	73.87	3.54
0:01:00	325.90	12.53	20.19	0:08:00	282.28	21.71	12.06	0:15:00	235.51	33.64	7.79	0:22:00	196.66	65.55	3.99	0:29:00	74.66	74.66	3.51
0:01:05	327.37	12.59	20.82	0:08:05	285.06	20.36	12.63	0:15:05	237.35	33.91	7.73	0:22:05	154.30	51.43	5.10	0:29:05	74.71	74.71	3.50
0:01:10	326.95	12.11	21.53	0:08:10	283.01	20.22	12.96	0:15:10	238.92	34.13	7.68	0:22:10	215.43	71.81	3.65	0:29:10	74.55	74.55	3.51
0:01:15	327.31	11.69	21.77	0:08:15	284.48	20.32	12.90	0:15:15	232.89	33.27	7.87	0:22:15	213.59	71.20	3.68	0:29:15	74.76	74.76	3.50
0:01:20	327.78	11.71	22.39	0:08:20	282.91	20.21	12.97	0:15:20	229.32	32.76	8.00	0:22:20	191.89	63.96	4.09	0:29:20	74.66	74.66	3.51
0:01:25	328.15	11.72	22.36	0:08:25	284.48	20.32	12.90	0:15:25	226.44	32.35	8.10	0:22:25	135.74	45.25	5.79	0:29:25	73.87	73.87	3.55
0:01:30	327.78	11.71	22.39	0:08:30	282.07	20.15	13.01	0:15:30	237.35	33.91	7.73	0:22:30	137.36	45.79	5.72	0:29:30	73.87	73.87	3.54
0:01:35	327.84	11.71	22.39	0:08:35	284.32	20.31	12.90	0:15:35	232.68	33.24	7.88	0:22:35	171.65	57.22	4.58	0:29:35	74.50	74.50	3.52
0:01:40	327.73	11.70	22.39	0:08:40	282.96	20.21	12.96	0:15:40	234.88	33.55	7.80	0:22:40	216.11	72.04	3.64	0:29:40	74.08	74.08	3.53
0:01:45	327.73	11.70	22.39	0:08:45	284.69	20.33	12.89	0:15:45	225.55	32.22	8.13	0:22:45	199.23	66.41	3.94	0:29:45	74.71	74.71	3.51
0:01:50	327.78	11.71	22.39	0:08:50	284.06	20.29	12.92	0:15:50	244.00	34.86	7.51	0:22:50	214.59	71.53	3.66	0:29:50	74.34	74.34	3.52
0:01:55	327.99	11.71	22.38	0:08:55	285.42	20.39	12.85	0:15:55	237.71	33.96	7.72	0:22:55	215.01	71.67	3.65	0:29:55	74.08	74.08	3.54
0:02:00	327.58	11.70	22.40	0:09:00	284.11	20.29	12.92	0:16:00	244.27	34.90	7.51	0:23:00	153.09	51.03	5.13	0:30:00	73.92	73.92	3.54
0:02:05	327.94	11.71	22.38	0:09:05	287.68	20.55	12.76	0:16:05	219.57	31.37	8.36	0:23:05	151.83	50.61	5.18	0:30:05	73.09	73.09	3.58
0:02:10	327.78	11.71	22.39	0:09:10	285.27	20.38	12.85	0:16:10	215.38	30.77	8.51	0:23:10	158.91	52.97	4.95	0:30:10	74.08	74.08	3.53
0:02:15	327.58	11.70	22.40	0:09:15	285.06	20.36	12.88	0:16:15	228.80	32.69	8.02	0:23:15	207.99	69.33	3.78	0:30:15	73.82	73.82	3.55
0:02:20	327.73	11.70	22.39	0:09:20	286.52	20.47	12.81	0:16:20	223.82	31.97	8.18	0:23:20	211.81	70.60	3.71	0:30:20	75.45	75.45	3.47
0:02:25	327.89	11.71	22.38	0:09:25	284.79	20.34	12.88	0:16:25	246.63	35.23	7.44	0:23:25	214.07	71.36	3.67	0:30:25	74.66	74.66	3.51
0:02:30	327.84	11.71	22.38	0:09:30	286.26	20.45	12.82	0:16:30	236.93	33.85	7.74	0:23:30	215.06	71.69	3.65	0:30:30	74.03	74.03	3.54
0:02:35	327.89	11.71	22.38	0:09:35	282.80	20.20	12.97	0:16:35	221.62	31.66	8.27	0:23:35	215.12	71.71	3.65	0:30:35	72.67	72.67	3.61
0:02:40	327.89	11.71	22.40	0:09:40	282.38	20.17	12.99	0:16:40	239.60	34.23	7.65	0:23:40	214.33	71.44	3.67	0:30:40	74.55	74.55	3.51
0:02:45	327.78	11.71	22.38	0:09:45	282.33	20.17	13.00	0:16:45	244.89	34.98	7.50	0:23:45	210.13	70.04	3.74	0:30:45	74.13	74.13	3.53
0:02:50	327.63	11.70	22.39	0:09:50	284.43	20.32	12.90	0:16:50	242.01	34.57	7.57	0:23:50	214.17	71.39	3.67	0:30:50	73.87	73.87	3.55
0:02:55	327.89	11.71	22.39	0:09:55	281.80	20.13	13.02	0:16:55	248.88	35.55	7.37	0:23:55	214.07	71.36	3.67	0:30:55	73.71	73.71	3.55

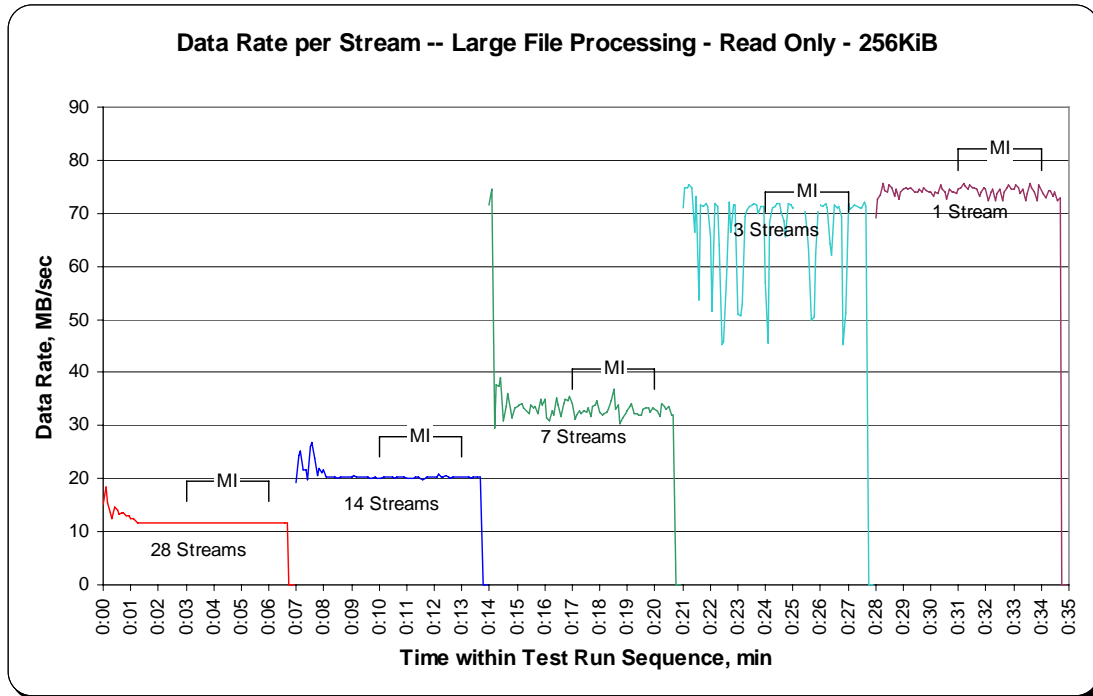
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate Graph – Complete Test Run



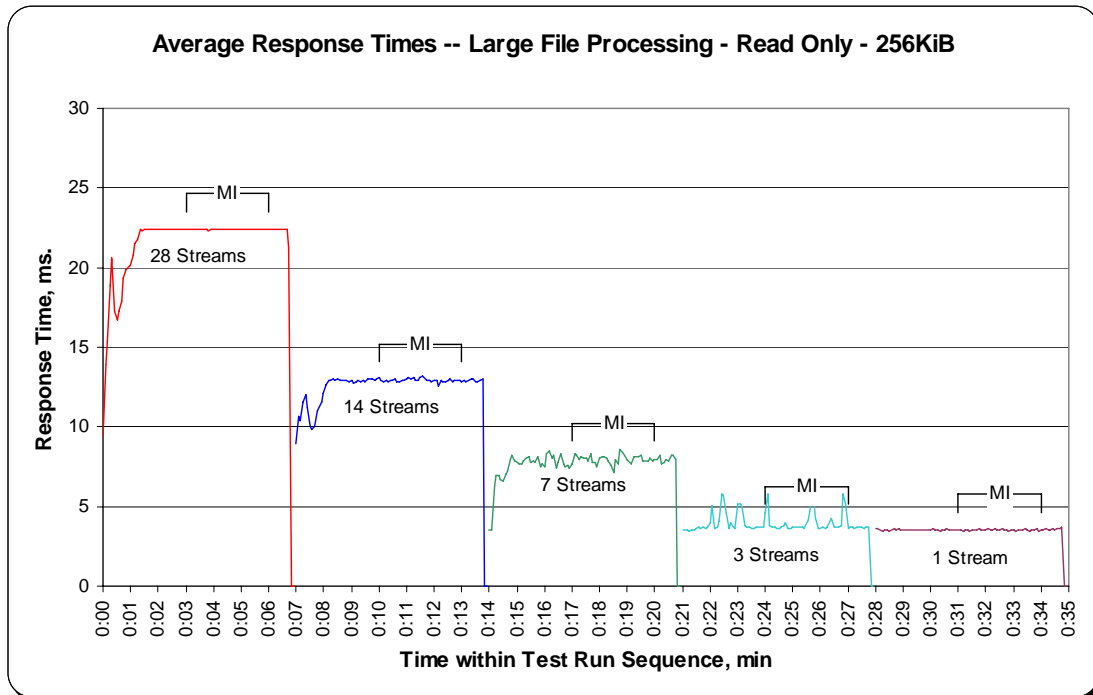
SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Data Rate per Stream Graph



SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Average Response Time Graph



Large Database Query Test

Clause 6.4.3.1

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 6.4.3.2

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 10.6.8.2

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:*
 - 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. Average Data Rate and Average Data Rate per Stream graphs as defined in Clauses 10.1.1 and 10.1.2.*

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 100.

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.

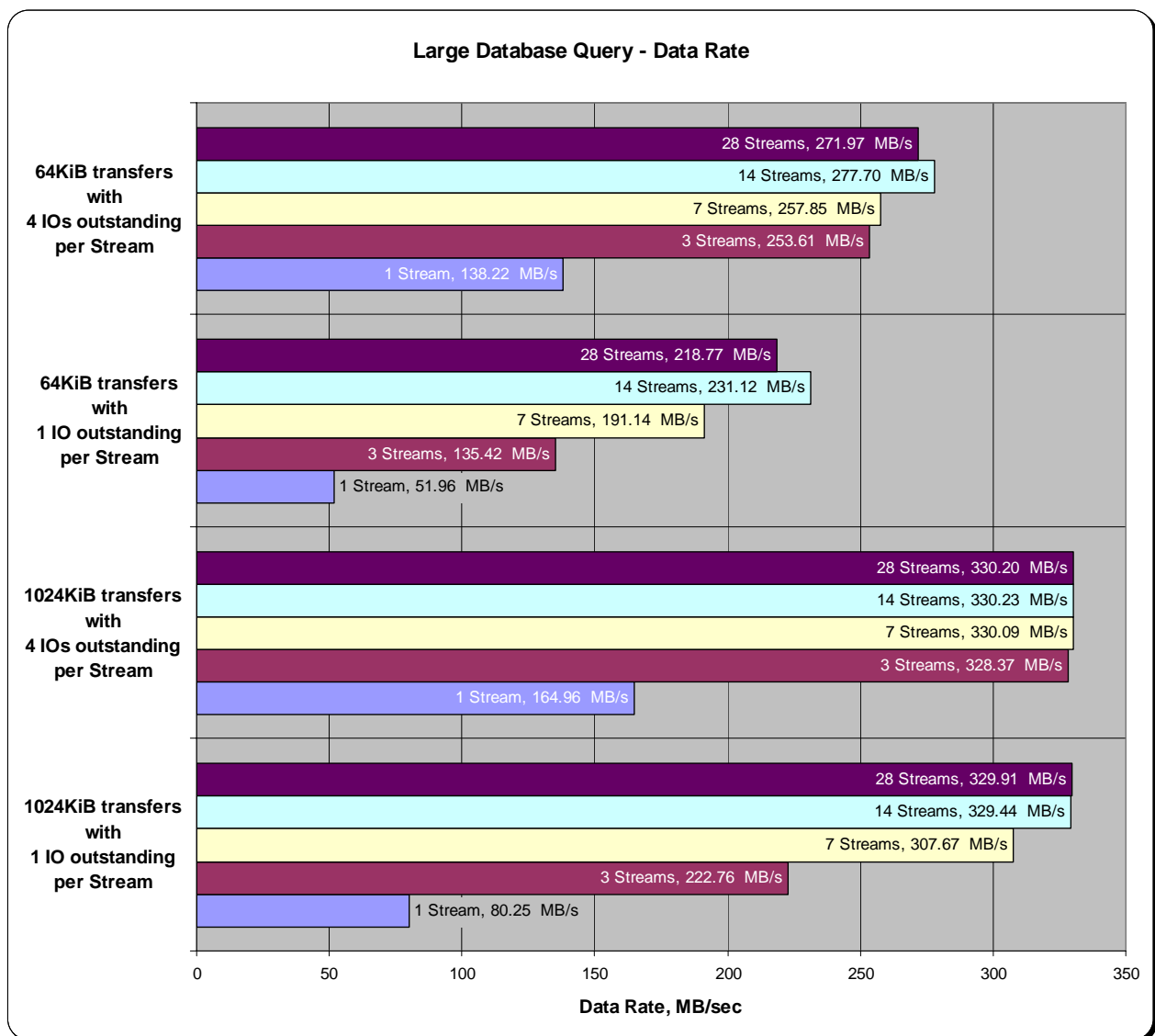
[SPC-2 Large Database Query Test Results File](#)

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	3 Streams	7 Streams	14 Streams	28 Streams
64KiB w/ 4 IOs/Stream	138.22	253.61	257.85	277.70	271.97
64KiB w/ 1 IO/Stream	51.96	135.42	191.14	231.12	218.77
1024KiB w/ 4 IOs/Stream	164.96	328.37	330.09	330.23	330.20
1024KiB w/ 1 IO/Stream	80.25	222.76	307.67	329.44	329.91

SPC-2 Large Database Query Average Data Rates Graph

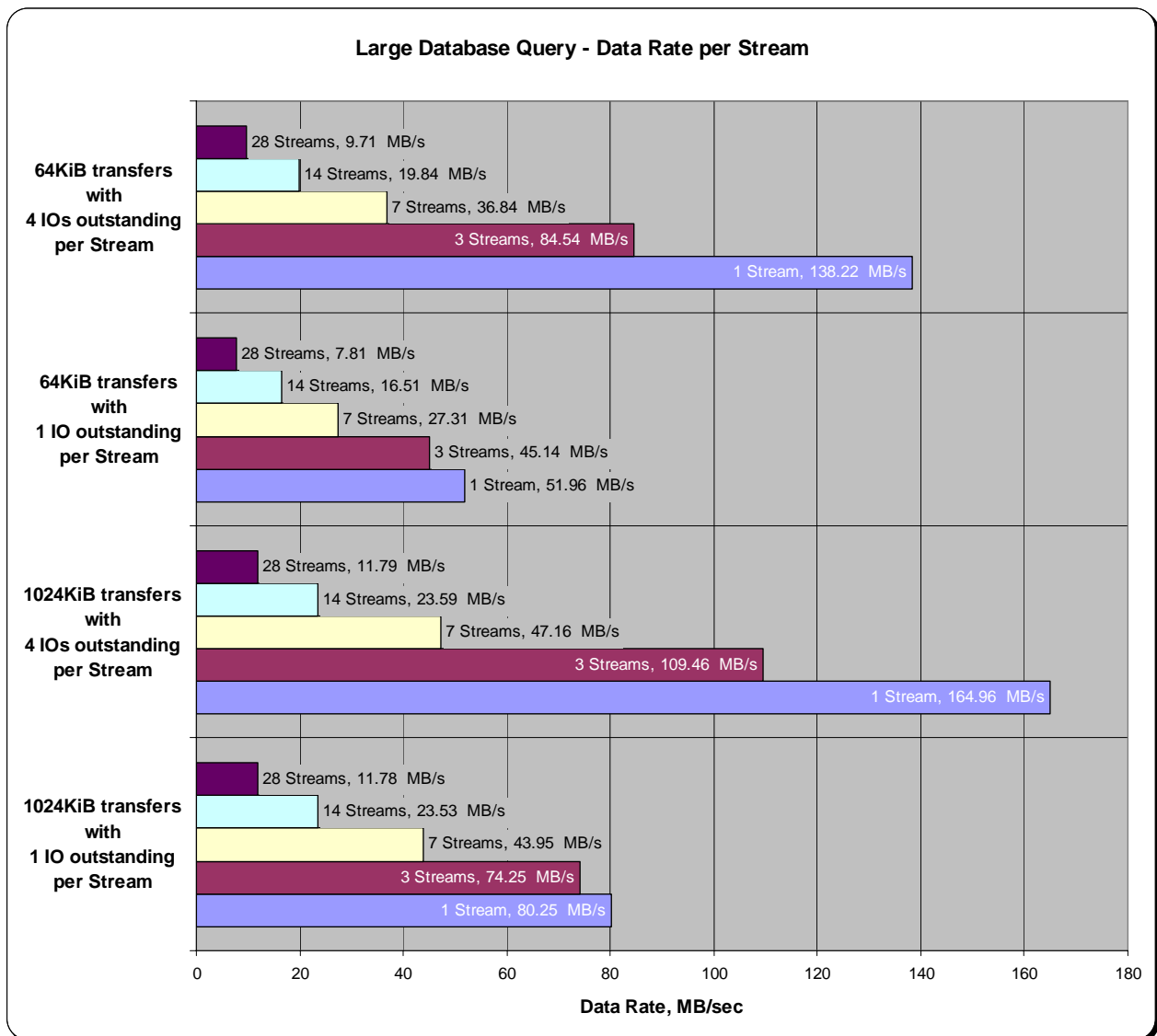


SPC-2 Large Database Query Average Data Rate per Stream

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	3 Streams	7 Streams	14 Streams	28 Streams
64KiB w/ 4 IOs/Stream	138.22	84.54	36.84	19.84	9.71
64KiB w/ 1 IO/Stream	51.96	45.14	27.31	16.51	7.81
1024KiB w/ 4 IOs/Stream	164.96	109.46	47.16	23.59	11.79
1024KiB w/ 1 IO/Stream	80.25	74.25	43.95	23.53	11.78

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

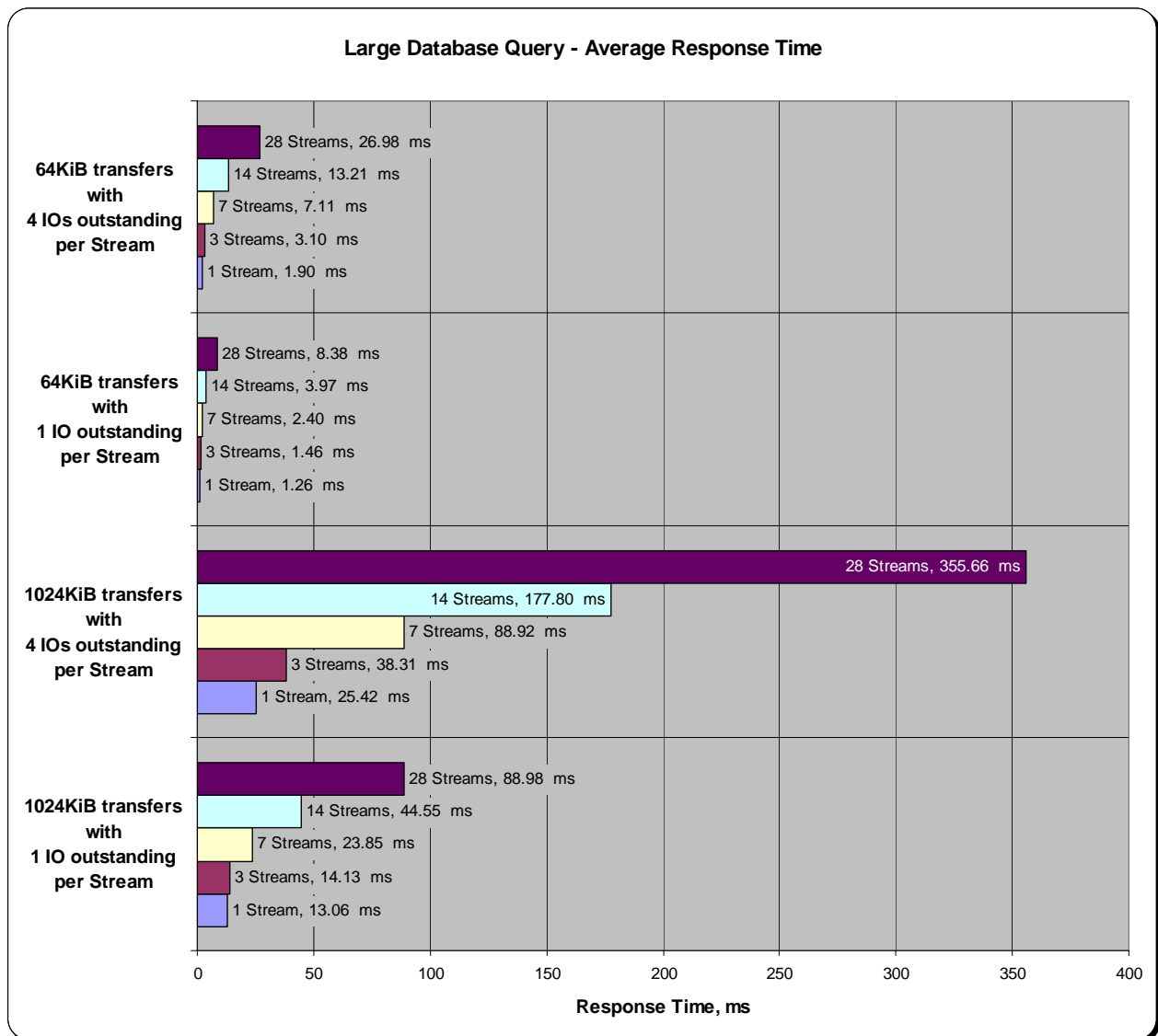


SPC-2 Large Database Query Average Response Time

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	3 Streams	7 Streams	14 Streams	28 Streams
64KiB w/ 4 IOs/Stream	1.90	3.10	7.11	13.21	26.98
64KiB w/ 1 IO/Stream	1.26	1.46	2.40	3.97	8.38
1024KiB w/ 4 IOs/Stream	25.42	38.31	88.92	177.80	355.66
1024KiB w/ 1 IO/Stream	13.06	14.13	23.85	44.55	88.98

SPC-2 Large Database Query Average Response Time Graph



Large Database Query Test – 1024 KiB TRANSFER SIZE Test Phase

Clause 10.6.8.2.1

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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "1024 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

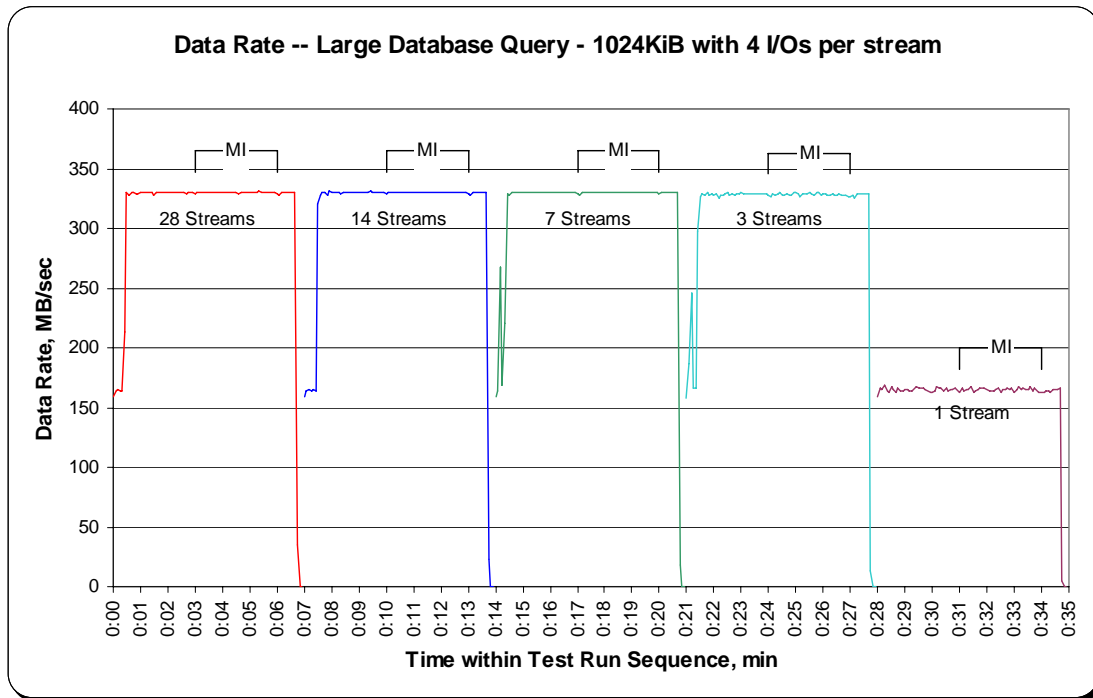
The SPC-2 "Large DatabaseQuery/1024 KiB TRANSFER SIZE/4 Outstanding I/Os" Test Run data is contained in the table that appears on the next page. That table is followed by graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the SPC-2 "Large DatabaseQuery/1024 KiB TRANSFER SIZE/4 Outstanding I/Os" table and graphs will be the SPC-2 "Large DatabaseQuery/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.

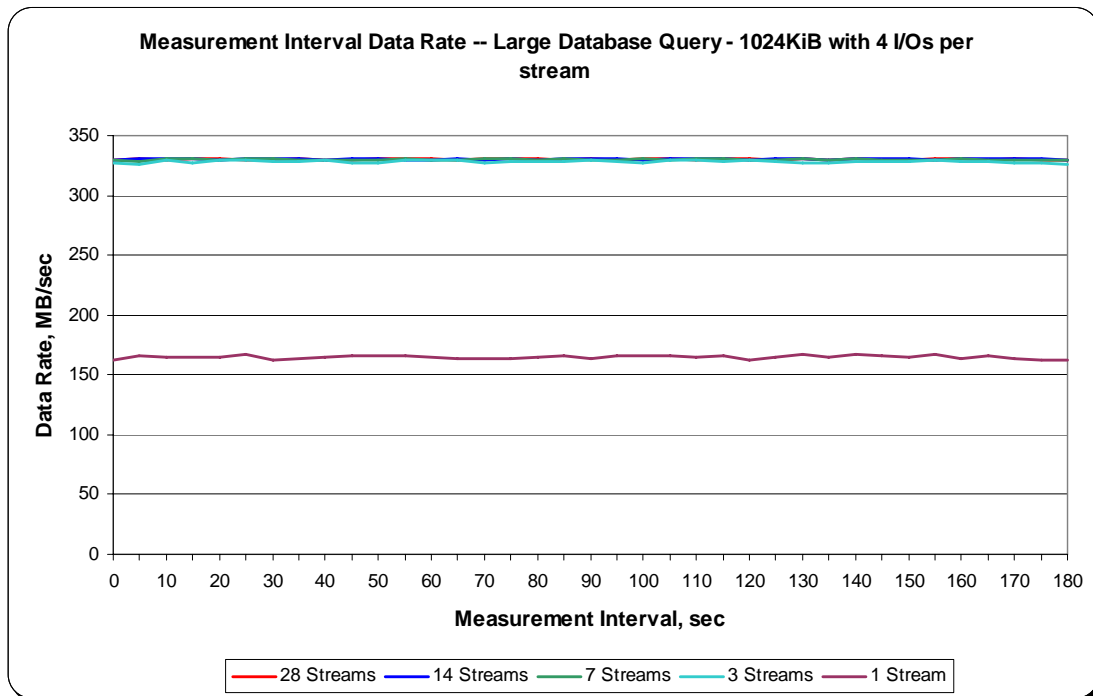
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Test Run Data - Ramp-Up Period

TR11 Test Run Sequence Time	28 Streams Data Rate / Stream, MB/sec			Response Time, ms	TR12 Test Run Sequence Time	14 Streams Data Rate / Stream, MB/sec			Response Time, ms	TR13 Test Run Sequence Time	7 Streams Data Rate / Stream, MB/sec			Response Time, ms	TR14 Test Run Sequence Time	3 Streams Data Rate / Stream, MB/sec			Response Time, ms	TR15 Test Run Sequence Time	1 Stream Data Rate / Stream, MB/sec			Response Time, ms
0:00:00	159.38	79.69	39.42	0:07:00	159.38	79.69	42.83	0:14:00	159.17	79.59	37.61	0:21:00	157.71	157.71	25.73	0:28:00	159.17	159.17	25.58					
0:00:05	163.37	32.67	91.17	0:07:05	164.42	82.21	50.78	0:14:05	164.42	82.21	50.86	0:21:05	187.07	93.53	25.91	0:28:05	166.09	166.09	25.23					
0:00:10	165.26	27.54	134.50	0:07:10	164.84	41.21	55.54	0:14:10	267.39	66.85	51.55	0:21:10	245.79	122.89	34.12	0:28:10	165.47	165.47	25.35					
0:00:15	164.00	18.22	173.76	0:07:15	163.58	27.26	122.94	0:14:15	169.24	42.31	98.13	0:21:15	166.09	83.05	50.46	0:28:15	168.19	168.19	24.95					
0:00:20	164.42	14.95	240.96	0:07:20	165.05	23.58	175.76	0:14:20	221.04	44.21	82.52	0:21:20	166.09	83.05	50.48	0:28:20	163.37	163.37	25.67					
0:00:25	212.65	12.51	257.49	0:07:25	164.42	23.49	178.13	0:14:25	329.25	54.88	67.89	0:21:25	297.59	99.20	39.51	0:28:25	162.95	162.95	25.71					
0:00:30	330.30	18.35	226.11	0:07:30	320.03	35.56	108.33	0:14:30	327.99	54.67	76.28	0:21:30	326.53	108.84	38.53	0:28:30	166.93	166.93	25.13					
0:00:35	328.20	16.41	240.61	0:07:35	328.20	36.47	114.29	0:14:35	330.51	55.09	76.11	0:21:35	328.41	109.47	38.30	0:28:35	165.26	165.26	25.36					
0:00:40	329.88	15.71	263.99	0:07:40	330.09	36.68	114.18	0:14:40	330.72	55.12	76.31	0:21:40	327.16	109.05	38.49	0:28:40	162.53	162.53	25.83					
0:00:45	330.51	15.74	267.02	0:07:45	329.88	32.99	118.36	0:14:45	330.09	55.02	76.17	0:21:45	329.88	109.96	38.10	0:28:45	166.72	166.72	25.15					
0:00:50	329.04	13.71	286.78	0:07:50	327.99	29.82	133.14	0:14:50	329.88	47.13	82.11	0:21:50	327.58	109.19	38.43	0:28:50	163.58	163.58	25.64					
0:00:55	328.41	13.14	309.03	0:07:55	330.93	30.08	139.84	0:14:55	330.09	47.16	88.99	0:21:55	328.41	109.47	38.27	0:28:55	164.42	164.42	25.50					
0:01:00	330.09	13.20	317.54	0:08:00	330.09	30.01	139.78	0:15:00	330.09	47.16	88.95	0:22:00	327.78	109.26	38.43	0:29:00	164.63	164.63	25.50					
0:01:05	330.51	13.22	317.71	0:08:05	330.30	30.03	139.70	0:15:05	330.09	47.16	88.95	0:22:05	328.62	109.54	38.31	0:29:05	165.47	165.47	25.34					
0:01:10	329.67	13.19	317.58	0:08:10	330.09	27.51	148.96	0:15:10	330.09	47.16	88.97	0:22:10	325.48	108.49	38.61	0:29:10	163.37	163.37	25.66					
0:01:15	330.09	12.70	324.89	0:08:15	330.09	23.58	157.43	0:15:15	329.88	47.13	88.89	0:22:15	327.99	109.33	38.38	0:29:15	164.21	164.21	25.55					
0:01:20	330.30	12.23	332.36	0:08:20	328.41	23.46	177.87	0:15:20	330.30	47.19	88.96	0:22:20	327.16	109.05	38.46	0:29:20	164.84	164.84	25.42					
0:01:25	330.30	11.80	354.80	0:08:25	330.72	23.62	177.71	0:15:25	329.88	47.13	88.95	0:22:25	328.41	109.47	38.31	0:29:25	167.14	167.14	25.10					
0:01:30	328.20	11.72	355.58	0:08:30	330.30	23.59	177.85	0:15:30	330.09	47.16	89.02	0:22:30	330.09	110.03	38.13	0:29:30	166.09	166.09	25.25					
0:01:35	330.72	11.81	355.93	0:08:35	330.09	23.58	177.80	0:15:35	330.09	47.16	88.82	0:22:35	327.37	109.12	38.40	0:29:35	165.88	165.88	25.30					
0:01:40	329.88	11.78	355.59	0:08:40	330.51	23.61	177.81	0:15:40	330.30	47.19	88.97	0:22:40	328.41	109.47	38.33	0:29:40	165.68	165.68	25.28					
0:01:45	330.30	11.80	355.81	0:08:45	330.30	23.59	177.81	0:15:45	330.30	47.19	88.84	0:22:45	328.20	109.40	38.35	0:29:45	165.05	165.05	25.44					
0:01:50	330.09	11.79	355.56	0:08:50	329.88	23.56	177.86	0:15:50	330.30	47.19	88.91	0:22:50	329.25	109.75	38.20	0:29:50	164.21	164.21	25.52					
0:01:55	330.30	11.80	355.58	0:08:55	330.09	23.58	177.90	0:15:55	330.30	47.19	88.95	0:22:55	329.46	109.82	38.18	0:29:55	163.16	163.16	25.71					
0:02:00	330.09	11.79	355.43	0:09:00	330.30	23.59	177.97	0:16:00	329.88	47.13	88.96	0:23:00	330.72	110.24	38.06	0:30:00	162.32	162.32	25.84					
0:02:05	330.51	11.80	355.68	0:09:05	329.88	23.56	177.83	0:16:05	330.30	47.19	88.91	0:23:05	329.04	109.68	38.24	0:30:05	164.21	164.21	25.55					
0:02:10	330.51	11.80	355.49	0:09:10	330.09	23.58	177.93	0:16:10	330.30	47.19	88.89	0:23:10	328.83	109.61	38.27	0:30:10	167.35	167.35	25.05					
0:02:15	330.30	11.80	355.58	0:09:15	330.09	23.58	177.78	0:16:15	329.88	47.13	88.99	0:23:15	328.62	109.54	38.29	0:30:15	165.88	165.88	25.28					
0:02:20	329.67	11.77	355.93	0:09:20	330.09	23.58	177.77	0:16:20	330.51	47.22	88.85	0:23:20	329.25	109.75	38.21	0:30:20	165.88	165.88	25.26					
0:02:25	330.51	11.80	355.51	0:09:25	330.93	23.64	177.67	0:16:25	329.88	47.13	88.94	0:23:25	328.62	109.54	38.27	0:30:25	164.42	164.42	25.54					
0:02:30	330.09	11.79	355.74	0:09:30	329.88	23.56	177.80	0:16:30	330.09	47.16	88.94	0:23:30	329.04	109.68	38.23	0:30:30	166.09	166.09	25.25					
0:02:35	330.09	11.79	355.76	0:09:35	330.51	23.61	177.84	0:16:35	330.09	47.16	88.97	0:23:35	328.62	109.54	38.33	0:30:35	164.21	164.21	25.49					
0:02:40	329.46	11.77	355.73	0:09:40	330.30	23.59	177.75	0:16:40	330.09	47.16	88.94	0:23:40	329.46	109.82	38.17	0:30:40	165.26	165.26	25.42					
0:02:45	330.72	11.81	355.73	0:09:45	330.30	23.59	177.87	0:16:45	329.88	47.13	89.01	0:23:45	328.62	109.54	38.27	0:30:45	164.63	164.63	25.47					
0:02:50	330.51	11.80	355.83	0:09:50	330.09	23.58	177.81	0:16:50	330.09	47.16	88.98	0:23:50	328.83	109.61	38.27	0:30:50	166.30	166.30	25.22					
0:02:55	329.88	11.78	355.57	0:09:55	330.30	23.59	177.75	0:16:55	329.88	47.13	88.92	0:23:55	328.83	109.61	38.23	0:30:55	164.00	164.00	25.58					

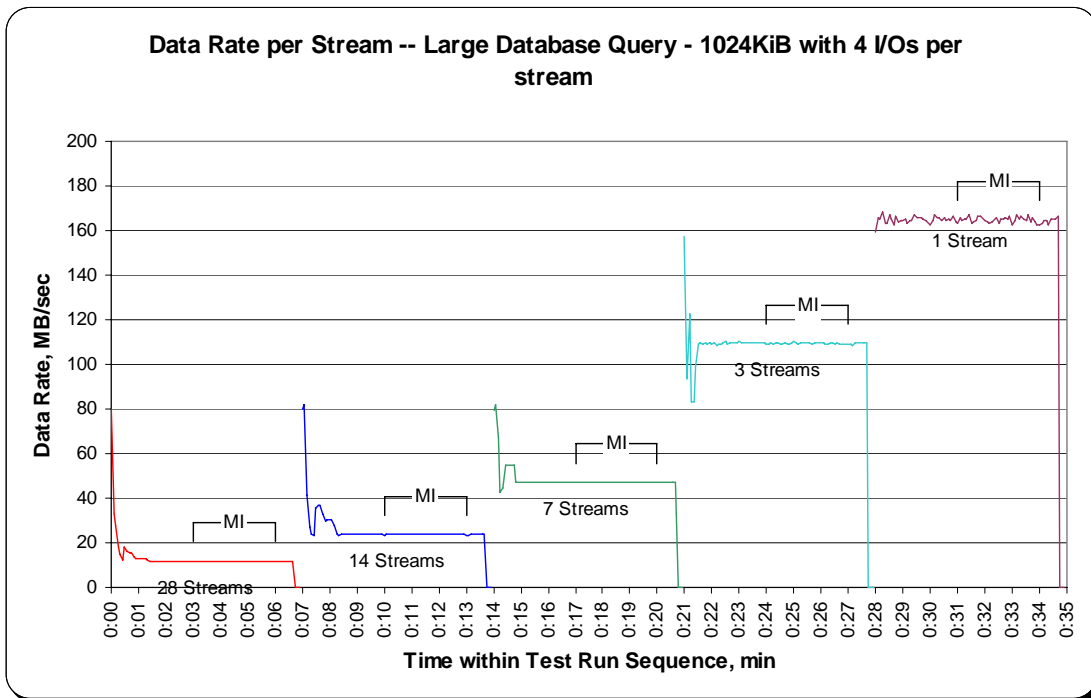
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Complete Test Run



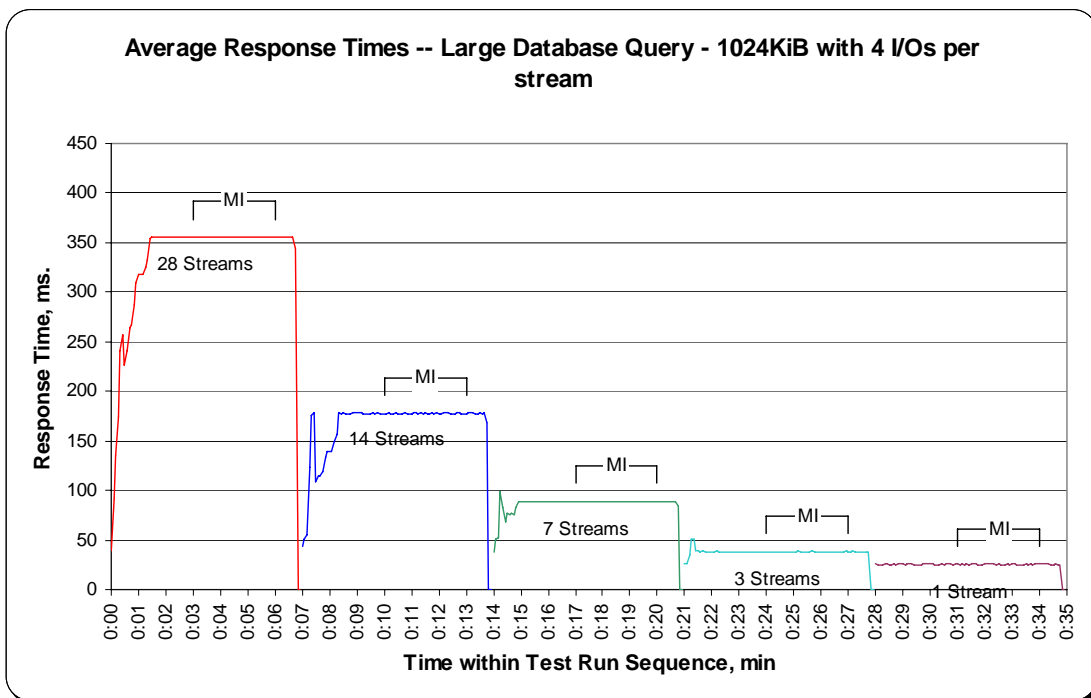
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate per Stream Graph



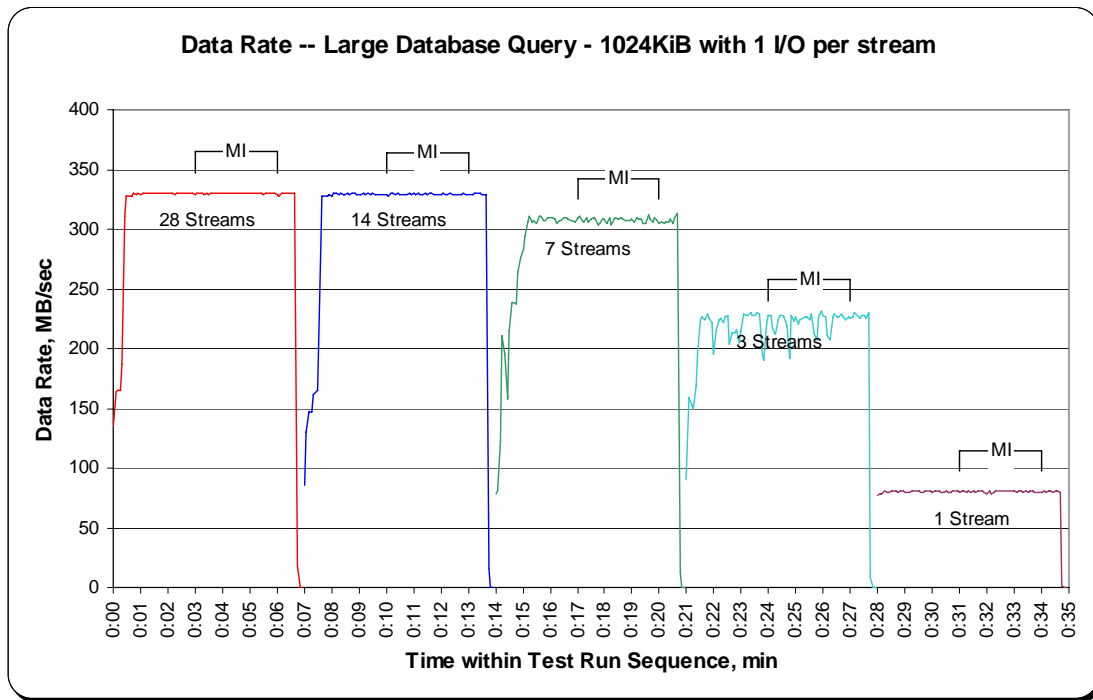
SPC-2 “Large Database Query/1024 KiB Transfer Size/4 Outstanding I/Os” Average Response Time Graph



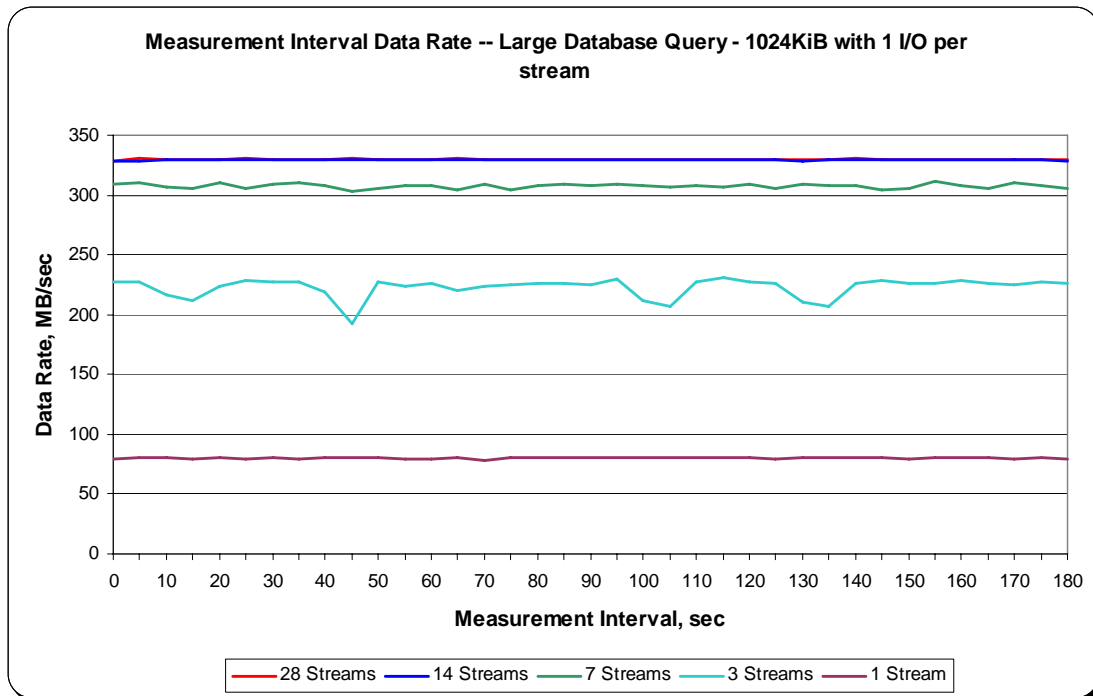
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Test Run Data – Ramp-Up Period

TR16				TR17				TR18				TR19				TR20			
28 Streams				14 Streams				7 Streams				3 Streams				1 Stream			
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	134.85	33.71	24.05	0:07:00	85.56	42.78	14.39	0:14:00	78.01	78.01	13.06	0:21:00	90.60	45.30	13.12	0:28:00	77.38	77.38	13.17
0:00:05	163.58	23.37	43.11	0:07:05	129.81	43.27	17.37	0:14:05	80.74	40.37	13.29	0:21:05	158.96	79.48	13.10	0:28:05	77.80	77.80	13.41
0:00:10	164.63	18.29	50.97	0:07:10	147.22	49.07	21.37	0:14:10	122.89	40.96	19.04	0:21:10	152.46	76.23	13.78	0:28:10	78.85	78.85	13.29
0:00:15	164.84	18.32	57.18	0:07:15	146.80	36.70	21.80	0:14:15	211.39	52.85	19.03	0:21:15	149.95	74.97	13.97	0:28:15	81.16	81.16	12.94
0:00:20	186.44	11.65	63.50	0:07:20	160.85	26.81	32.15	0:14:20	194.62	48.65	21.56	0:21:20	169.03	56.34	16.22	0:28:20	79.90	79.90	13.11
0:00:25	311.43	17.30	54.67	0:07:25	164.21	23.46	40.18	0:14:25	158.13	39.53	26.49	0:21:25	196.29	65.43	16.01	0:28:25	79.69	79.69	13.14
0:00:30	327.16	18.18	57.71	0:07:30	164.84	23.55	44.54	0:14:30	214.75	42.95	23.00	0:21:30	223.77	74.59	14.04	0:28:30	80.32	80.32	13.06
0:00:35	328.20	16.41	60.53	0:07:35	272.21	24.75	34.14	0:14:35	238.45	47.69	21.85	0:21:35	226.28	75.43	13.91	0:28:35	80.32	80.32	13.04
0:00:40	327.99	14.26	72.53	0:07:40	327.16	29.74	35.23	0:14:40	238.87	47.77	21.97	0:21:40	223.77	74.59	14.05	0:28:40	80.32	80.32	13.07
0:00:45	329.88	13.75	75.27	0:07:45	327.58	29.78	35.23	0:14:45	236.77	47.35	22.11	0:21:45	228.80	76.27	13.75	0:28:45	79.69	79.69	13.13
0:00:50	329.04	12.66	79.27	0:07:50	327.99	27.33	37.87	0:14:50	264.45	52.89	19.85	0:21:50	225.86	75.29	13.91	0:28:50	80.74	80.74	12.99
0:00:55	329.88	12.69	82.61	0:07:55	329.25	27.44	38.22	0:14:55	275.57	55.11	19.03	0:21:55	221.88	73.96	14.17	0:28:55	80.32	80.32	13.06
0:01:00	329.04	11.75	85.08	0:08:00	328.20	23.44	42.58	0:15:00	282.91	47.15	18.97	0:22:00	194.83	64.94	16.14	0:29:00	79.90	79.90	13.12
0:01:05	329.67	11.77	89.00	0:08:05	329.67	23.55	44.53	0:15:05	293.39	41.91	22.02	0:22:05	216.01	72.00	14.57	0:29:05	80.11	80.11	13.07
0:01:10	330.09	11.79	89.04	0:08:10	329.88	23.56	44.51	0:15:10	305.56	43.65	24.03	0:22:10	223.98	74.66	14.03	0:29:10	80.11	80.11	13.09
0:01:15	330.30	11.80	88.88	0:08:15	329.25	23.52	44.59	0:15:15	310.59	44.37	23.64	0:22:15	225.86	75.29	13.92	0:29:15	80.53	80.53	13.02
0:01:20	329.88	11.78	88.96	0:08:20	329.67	23.55	44.50	0:15:20	305.56	43.65	24.01	0:22:20	221.25	73.75	14.21	0:29:20	80.53	80.53	13.03
0:01:25	329.88	11.78	89.02	0:08:25	329.25	23.52	44.60	0:15:25	307.44	43.92	23.87	0:22:25	226.28	75.43	13.90	0:29:25	80.53	80.53	12.99
0:01:30	330.09	11.79	88.91	0:08:30	329.46	23.53	44.55	0:15:30	304.30	43.47	24.13	0:22:30	227.12	75.71	13.84	0:29:30	80.32	80.32	13.06
0:01:35	329.67	11.77	89.01	0:08:35	329.67	23.55	44.52	0:15:35	310.80	44.40	23.62	0:22:35	203.84	67.95	15.42	0:29:35	79.90	79.90	13.14
0:01:40	330.09	11.79	89.01	0:08:40	329.25	23.52	44.56	0:15:40	310.38	44.34	23.65	0:22:40	213.49	71.16	14.73	0:29:40	80.11	80.11	13.06
0:01:45	330.09	11.79	88.96	0:08:45	329.67	23.55	44.54	0:15:45	307.02	43.86	23.89	0:22:45	213.28	71.09	14.74	0:29:45	81.16	81.16	12.92
0:01:50	329.88	11.78	88.96	0:08:50	329.88	23.56	44.52	0:15:50	307.23	43.89	23.86	0:22:50	215.17	71.72	14.62	0:29:50	80.74	80.74	13.00
0:01:55	329.88	11.78	88.99	0:08:55	329.25	23.52	44.55	0:15:55	309.75	44.25	23.71	0:22:55	204.89	68.30	15.34	0:29:55	80.32	80.32	13.06
0:02:00	330.30	11.80	88.92	0:09:00	329.46	23.53	44.54	0:16:00	310.17	44.31	23.66	0:23:00	214.54	71.51	14.66	0:30:00	80.11	80.11	13.06
0:02:05	329.88	11.78	89.03	0:09:05	329.25	23.52	44.58	0:16:05	309.33	44.19	23.71	0:23:05	229.01	76.34	13.74	0:30:05	80.53	80.53	13.04
0:02:10	330.09	11.79	88.92	0:09:10	329.88	23.56	44.53	0:16:10	308.70	44.10	23.78	0:23:10	227.54	75.85	13.81	0:30:10	80.32	80.32	13.05
0:02:15	329.46	11.77	88.97	0:09:15	329.46	23.53	44.54	0:16:15	305.35	43.62	24.03	0:23:15	227.75	75.92	13.80	0:30:15	80.32	80.32	13.04
0:02:20	330.51	11.80	88.95	0:09:20	329.67	23.55	44.53	0:16:20	306.81	43.83	23.93	0:23:20	229.64	76.55	13.69	0:30:20	79.06	79.06	13.27
0:02:25	329.88	11.78	88.97	0:09:25	329.46	23.53	44.54	0:16:25	307.65	43.95	23.85	0:23:25	227.33	75.78	13.82	0:30:25	79.06	79.06	13.25
0:02:30	330.09	11.79	88.96	0:09:30	329.67	23.55	44.54	0:16:30	309.54	44.22	23.71	0:23:30	227.96	75.99	13.81	0:30:30	80.32	80.32	13.04
0:02:35	329.88	11.78	88.99	0:09:35	329.46	23.53	44.58	0:16:35	309.54	44.22	23.69	0:23:35	230.69	76.90	13.63	0:30:35	79.90	79.90	13.15
0:02:40	329.88	11.78	88.98	0:09:40	329.25	23.52	44.56	0:16:40	308.49	44.07	23.80	0:23:40	229.22	76.41	13.72	0:30:40	79.90	79.90	13.10
0:02:45	330.30	11.80	88.91	0:09:45	329.25	23.52	44.56	0:16:45	307.23	43.89	23.88	0:23:45	195.45	65.15	16.08	0:30:45	80.32	80.32	13.07
0:02:50	329.88	11.78	88.96	0:09:50	329.25	23.52	44.59	0:16:50	307.23	43.89	23.88	0:23:50	190.21	63.40	16.51	0:30:50	80.53	80.53	13.01
0:02:55	330.09	11.79	88.98	0:09:55	329.04	23.50	44.61	0:16:55	306.18	43.74	23.96	0:23:55	222.09	74.03	14.19	0:30:55	80.95	80.95	12.96

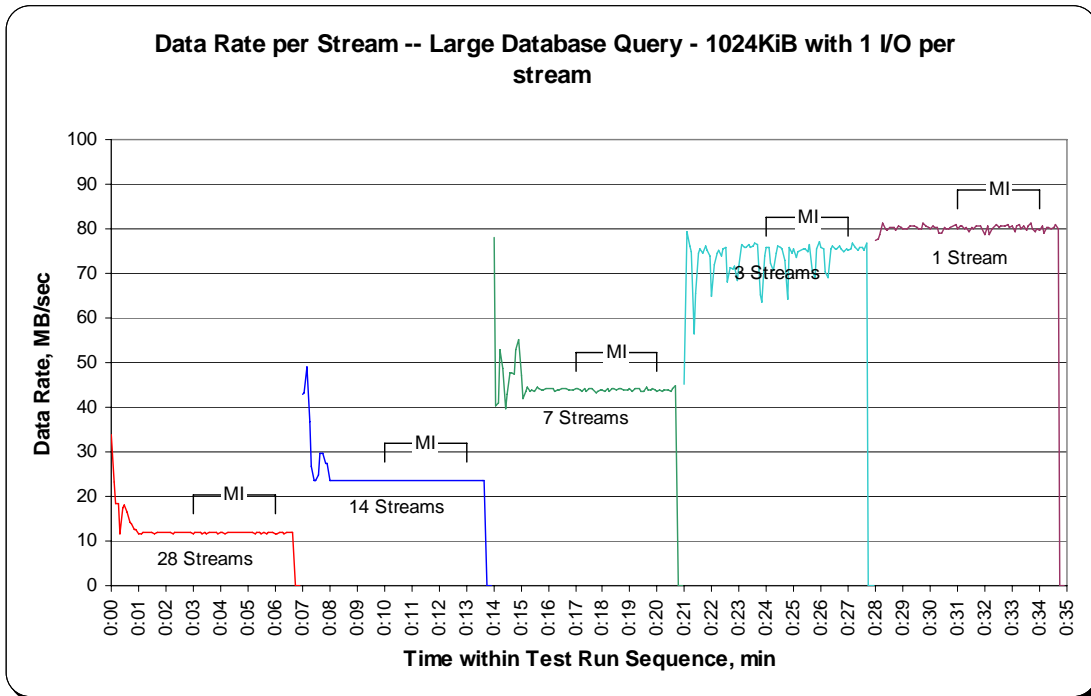
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Complete Test Run



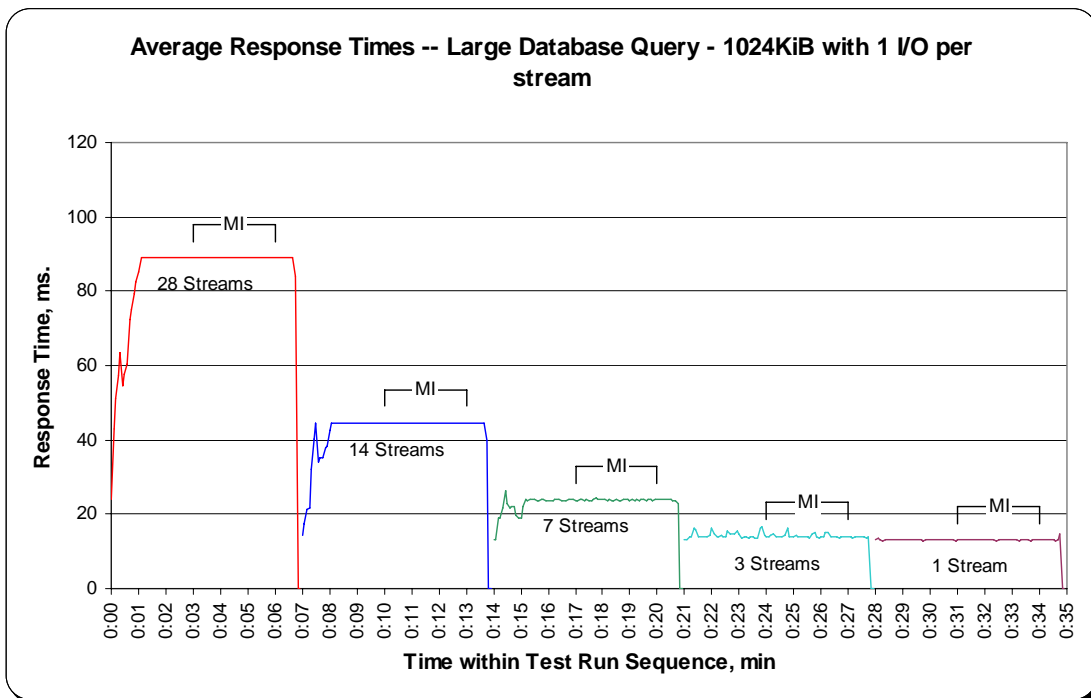
SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Data Rate per Stream Graph



SPC-2 “Large Database Query/1024 KiB Transfer Size/1 Outstanding I/O” Average Response Time Graph



Large Database Query Test – 64 KiB TRANSFER SIZE Test Phase

Clause 10.6.8.2.1

5. 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.
6. Average Data Rate (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "64 KiB Transfer Size, 4 Outstanding I/Os" Test Runs as specified in Clauses 10.1.4 – 10.1.6.
7. 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.
8. Average Data Rate (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the "64 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

The SPC-2 "Large DatabaseQuery/64 KiB TRANSFER SIZE/4 Outstanding I/Os" Test Run data is contained in the table that appears on the next page. That table is followed by 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 SPC-2 "Large DatabaseQuery/64 KiB TRANSFER SIZE/4 Outstanding I/Os" table and graphs will be the SPC-2 "Large DatabaseQuery/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.

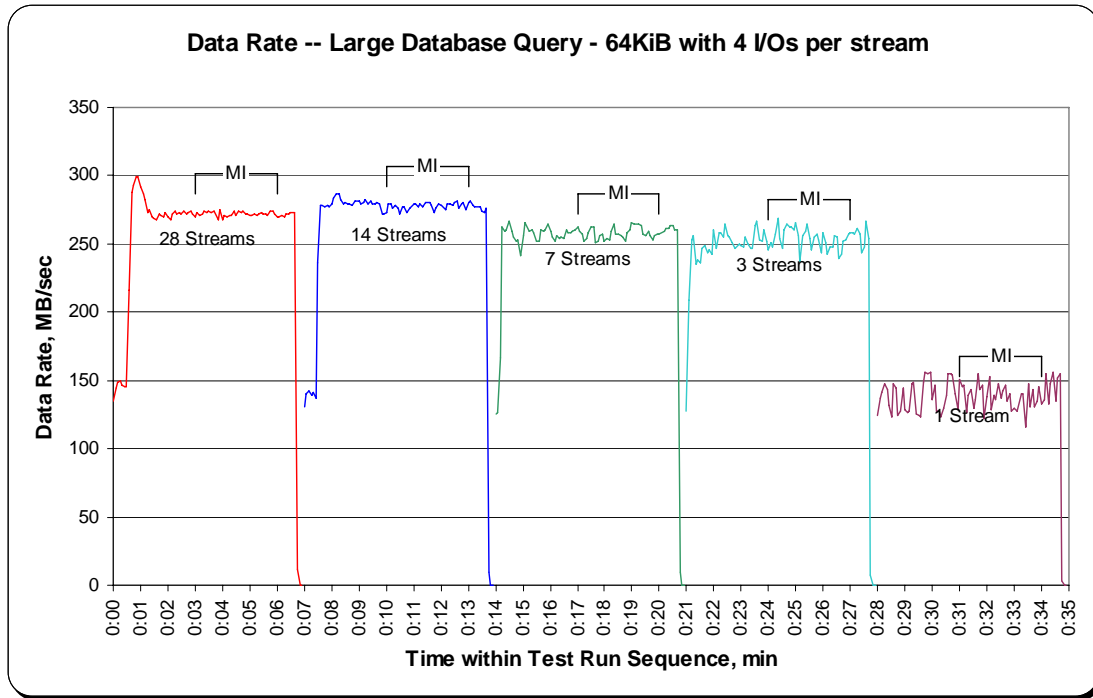
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Test Run Data – Ramp-Up Period

TR1 Test Run Sequence Time	28 Streams			TR2 Test Run Sequence Time	14 Streams			TR3 Test Run Sequence Time	7 Streams			TR4 Test Run Sequence Time	3 Streams			TR5 Test Run Sequence Time	1 Stream		
	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:00:00	135.04	45.01	4.05	0:07:00	130.75	43.58	4.46	0:14:00	125.42	62.71	2.61	0:21:00	127.20	127.20	2.00	0:28:00	124.62	124.62	2.05
0:00:05	144.69	24.12	7.08	0:07:05	140.13	23.36	8.29	0:14:05	126.15	63.08	4.13	0:21:05	209.25	104.63	1.98	0:28:05	136.88	136.88	1.91
0:00:10	148.38	18.55	13.46	0:07:10	142.07	23.68	11.08	0:14:10	166.47	41.62	5.06	0:21:10	253.52	84.51	3.08	0:28:10	141.49	141.49	1.85
0:00:15	149.46	16.61	15.06	0:07:15	139.48	23.25	11.28	0:14:15	262.68	52.54	4.47	0:21:15	256.65	85.55	3.06	0:28:15	147.98	147.98	1.77
0:00:20	146.61	13.33	19.06	0:07:20	141.79	20.26	11.09	0:14:20	259.04	51.81	5.06	0:21:20	234.63	78.21	3.35	0:28:20	143.04	143.04	1.83
0:00:25	145.13	12.09	21.20	0:07:25	136.63	19.52	13.42	0:14:25	260.72	43.45	5.59	0:21:25	238.34	79.45	3.30	0:28:25	131.79	131.79	1.99
0:00:30	145.63	10.40	22.92	0:07:30	235.87	26.21	8.76	0:14:30	266.67	44.45	5.89	0:21:30	235.85	78.62	3.33	0:28:30	122.85	122.85	2.13
0:00:35	216.26	13.52	17.74	0:07:35	278.70	27.87	8.78	0:14:35	259.83	43.30	6.05	0:21:35	246.54	82.18	3.18	0:28:35	147.91	147.91	1.77
0:00:40	287.84	16.93	14.97	0:07:40	278.18	27.82	9.43	0:14:40	255.54	42.59	6.15	0:21:40	249.13	83.04	3.15	0:28:40	144.51	144.51	1.81
0:00:45	293.23	14.66	15.96	0:07:45	277.05	27.71	9.46	0:14:45	251.91	41.98	6.24	0:21:45	243.54	81.18	3.23	0:28:45	124.37	124.37	2.10
0:00:50	299.91	14.28	17.92	0:07:50	278.59	27.86	9.40	0:14:50	252.58	36.08	6.68	0:21:50	245.22	81.74	3.20	0:28:50	127.51	127.51	2.05
0:00:55	298.90	14.23	18.41	0:07:55	277.72	25.25	9.63	0:14:55	241.51	34.50	7.55	0:21:55	242.59	80.86	3.24	0:28:55	144.71	144.71	1.81
0:01:00	292.43	11.70	20.65	0:08:00	279.42	25.40	10.26	0:15:00	256.53	36.65	7.15	0:22:00	260.09	86.70	3.02	0:29:00	128.15	128.15	2.04
0:01:05	287.25	11.49	22.67	0:08:05	283.98	23.66	10.33	0:15:05	265.56	37.94	6.91	0:22:05	247.15	82.38	3.18	0:29:05	126.14	126.14	2.08
0:01:10	282.84	10.48	23.89	0:08:10	286.73	23.89	10.97	0:15:10	261.11	37.30	7.02	0:22:10	257.89	85.96	3.04	0:29:10	127.32	127.32	2.06
0:01:15	273.35	10.12	25.76	0:08:15	287.27	22.10	11.37	0:15:15	259.62	37.09	7.06	0:22:15	257.87	85.96	3.05	0:29:15	148.00	148.00	1.77
0:01:20	274.64	9.81	25.93	0:08:20	282.22	20.16	12.30	0:15:20	260.49	37.21	7.04	0:22:20	254.59	84.86	3.09	0:29:20	149.01	149.01	1.76
0:01:25	269.70	9.63	27.20	0:08:25	279.82	19.99	13.13	0:15:25	258.49	36.93	7.10	0:22:25	264.16	88.05	2.97	0:29:25	125.57	125.57	2.08
0:01:30	268.58	9.59	27.35	0:08:30	280.31	20.02	13.09	0:15:30	252.33	36.05	7.26	0:22:30	256.37	85.46	3.06	0:29:30	124.32	124.32	2.10
0:01:35	268.24	9.58	27.35	0:08:35	279.61	19.97	13.12	0:15:35	251.70	35.96	7.29	0:22:35	255.12	85.04	3.08	0:29:35	123.56	123.56	2.12
0:01:40	271.95	9.71	26.99	0:08:40	279.45	19.96	13.14	0:15:40	260.83	37.26	7.03	0:22:40	250.42	83.47	3.14	0:29:40	148.92	148.92	1.76
0:01:45	271.20	9.69	27.05	0:08:45	278.55	19.90	13.16	0:15:45	258.87	36.98	7.08	0:22:45	246.29	82.10	3.19	0:29:45	156.01	156.01	1.68
0:01:50	269.80	9.64	27.21	0:08:50	281.50	20.11	13.04	0:15:50	260.40	37.20	7.04	0:22:50	247.99	82.66	3.17	0:29:50	154.90	154.90	1.69
0:01:55	273.46	9.77	26.84	0:08:55	281.34	20.10	13.04	0:15:55	264.88	37.84	6.92	0:22:55	250.04	83.35	3.14	0:29:55	156.01	156.01	1.68
0:02:00	269.53	9.63	27.22	0:09:00	281.95	20.14	13.01	0:16:00	259.83	37.12	7.05	0:23:00	248.63	82.88	3.16	0:30:00	136.17	136.17	1.92
0:02:05	268.29	9.58	27.35	0:09:05	279.12	19.94	13.16	0:16:05	255.16	36.45	7.19	0:23:05	248.15	82.72	3.17	0:30:05	146.85	146.85	1.78
0:02:10	272.51	9.73	26.95	0:09:10	280.87	20.06	13.07	0:16:10	252.37	36.05	7.26	0:23:10	255.62	85.21	3.07	0:30:10	127.51	127.51	2.05
0:02:15	274.52	9.80	26.70	0:09:15	282.95	20.21	12.97	0:16:15	256.36	36.62	7.16	0:23:15	249.92	83.31	3.14	0:30:15	127.74	127.74	2.05
0:02:20	272.37	9.73	26.97	0:09:20	279.23	19.94	13.13	0:16:20	253.80	36.26	7.22	0:23:20	246.64	82.21	3.19	0:30:20	123.16	123.16	2.13
0:02:25	273.37	9.76	26.83	0:09:25	281.53	20.11	13.03	0:16:25	255.07	36.44	7.19	0:23:25	246.77	82.26	3.18	0:30:25	129.87	129.87	2.02
0:02:30	271.52	9.70	27.04	0:09:30	279.49	19.96	13.13	0:16:30	253.86	36.27	7.23	0:23:30	263.31	87.77	2.98	0:30:30	139.68	139.68	1.87
0:02:35	273.70	9.77	26.81	0:09:35	279.61	19.97	13.12	0:16:35	260.20	37.17	7.05	0:23:35	266.84	88.95	2.94	0:30:35	155.28	155.28	1.69
0:02:40	271.48	9.70	27.02	0:09:40	280.76	20.05	13.07	0:16:40	257.78	36.83	7.12	0:23:40	253.52	84.51	3.10	0:30:40	155.02	155.02	1.69
0:02:45	273.36	9.76	26.86	0:09:45	279.84	19.99	13.12	0:16:45	258.00	36.86	7.11	0:23:45	251.77	83.92	3.12	0:30:45	154.15	154.15	1.70
0:02:50	273.58	9.77	26.82	0:09:50	272.22	19.44	13.46	0:16:50	259.40	37.06	7.07	0:23:50	260.21	86.74	3.02	0:30:50	140.62	140.62	1.86
0:02:55	272.50	9.73	26.93	0:09:55	272.37	19.45	13.48	0:16:55	260.69	37.24	7.04	0:23:55	252.39	84.13	3.11	0:30:55	128.12	128.12	2.04

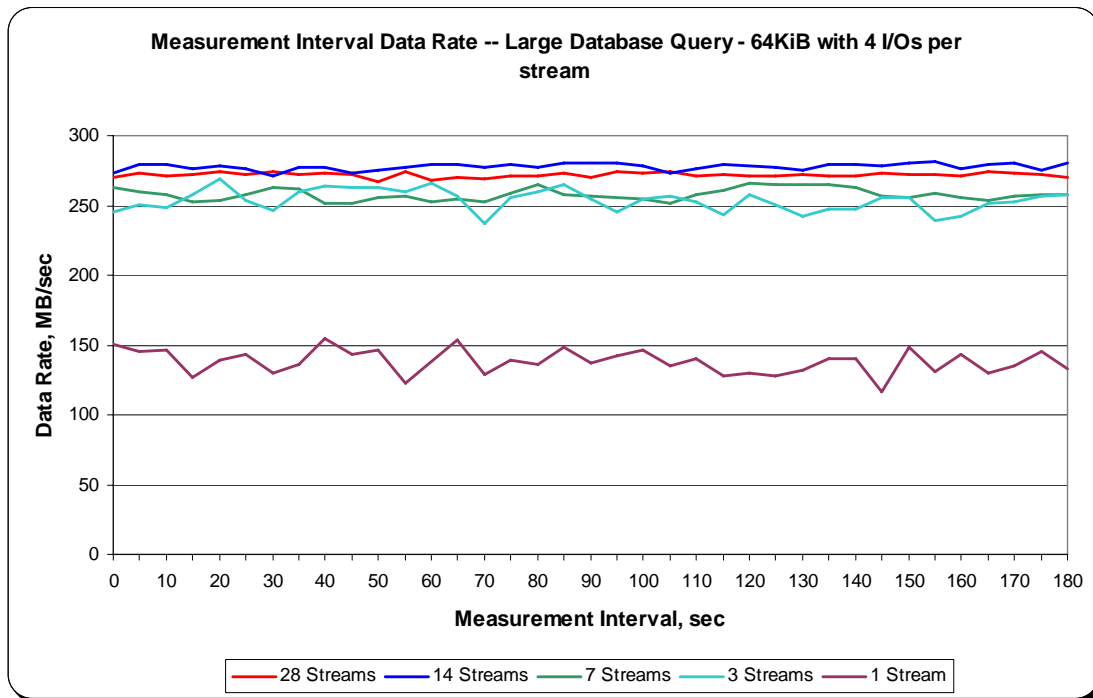
**SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Test Run Data
 Measurement Interval, Run-Out, and Ramp-Down Periods**

TR1 Test Run Sequence Time	28 Streams			TR2 Test Run Sequence Time	14 Streams			TR3 Test Run Sequence Time	7 Streams			TR4 Test Run Sequence Time	3 Streams			TR5 Test Run Sequence Time	1 Stream		
	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms		Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:03:00	269.64	9.63	27.14	0:10:00	273.43	19.53	13.37	0:17:00	262.98	37.57	6.95	0:24:00	245.25	81.75	3.19	0:31:00	150.58	150.58	1.73
0:03:05	273.49	9.77	26.65	0:10:05	279.40	19.96	13.14	0:17:05	259.85	37.12	7.06	0:24:05	251.01	83.67	3.11	0:31:05	145.43	145.43	1.79
0:03:10	270.86	9.67	27.14	0:10:10	279.71	19.98	13.11	0:17:10	257.49	36.78	7.12	0:24:10	248.09	82.70	3.17	0:31:10	146.29	146.29	1.79
0:03:15	272.27	9.72	26.98	0:10:15	276.53	19.75	13.27	0:17:15	252.33	36.05	7.27	0:24:15	257.43	85.81	3.05	0:31:15	126.40	126.40	2.07
0:03:20	274.62	9.81	26.70	0:10:20	278.17	19.87	13.19	0:17:20	253.70	36.24	7.23	0:24:20	269.26	89.75	2.92	0:31:20	139.54	139.54	1.88
0:03:25	272.61	9.74	26.92	0:10:25	276.28	19.73	13.29	0:17:25	258.24	36.89	7.10	0:24:25	253.77	84.59	3.09	0:31:25	143.38	143.38	1.82
0:03:30	273.98	9.79	26.79	0:10:30	271.60	19.40	13.50	0:17:30	262.62	37.52	6.99	0:24:30	246.77	82.26	3.18	0:31:30	129.62	129.62	2.02
0:03:35	272.52	9.73	26.92	0:10:35	277.09	19.79	13.24	0:17:35	262.19	37.46	6.99	0:24:35	260.03	86.68	3.02	0:31:35	136.23	136.23	1.92
0:03:40	273.67	9.77	26.81	0:10:40	277.55	19.82	13.22	0:17:40	251.40	35.91	7.30	0:24:40	264.34	88.11	2.97	0:31:40	154.77	154.77	1.69
0:03:45	271.71	9.70	27.01	0:10:45	273.30	19.52	13.43	0:17:45	251.99	36.00	7.28	0:24:45	262.75	87.58	2.99	0:31:45	143.75	143.75	1.82
0:03:50	267.41	9.55	27.46	0:10:50	275.72	19.69	13.30	0:17:50	255.68	36.53	7.18	0:24:50	262.47	87.49	2.99	0:31:50	146.51	146.51	1.79
0:03:55	274.71	9.81	26.70	0:10:55	277.10	19.79	13.25	0:17:55	257.16	36.74	7.13	0:24:55	259.99	86.66	3.02	0:31:55	122.77	122.77	2.13
0:04:00	268.13	9.58	27.37	0:11:00	279.17	19.94	13.14	0:18:00	252.34	36.05	7.27	0:25:00	265.49	88.50	2.96	0:32:00	137.95	137.95	1.90
0:04:05	270.57	9.66	27.14	0:11:05	279.05	19.93	13.16	0:18:05	254.36	36.34	7.21	0:25:05	256.26	85.42	3.06	0:32:05	153.13	153.13	1.71
0:04:10	269.54	9.63	27.22	0:11:10	276.81	19.77	13.25	0:18:10	253.06	36.15	7.25	0:25:10	237.55	79.18	3.31	0:32:10	128.41	128.41	2.04
0:04:15	270.96	9.68	27.10	0:11:15	279.32	19.95	13.14	0:18:15	258.90	36.99	7.09	0:25:15	255.87	85.29	3.07	0:32:15	138.95	138.95	1.88
0:04:20	270.75	9.67	27.09	0:11:20	276.88	19.78	13.25	0:18:20	265.10	37.87	6.92	0:25:20	259.68	86.56	3.03	0:32:20	136.20	136.20	1.92
0:04:25	273.64	9.77	26.84	0:11:25	280.82	20.06	13.07	0:18:25	257.49	36.78	7.12	0:25:25	264.92	88.31	2.96	0:32:25	148.07	148.07	1.77
0:04:30	270.60	9.66	27.12	0:11:30	280.14	20.01	13.10	0:18:30	256.85	36.69	7.14	0:25:30	254.58	84.86	3.09	0:32:30	136.86	136.86	1.91
0:04:35	273.73	9.78	26.79	0:11:35	279.95	20.00	13.10	0:18:35	255.71	36.53	7.17	0:25:35	245.30	81.77	3.20	0:32:35	142.00	142.00	1.84
0:04:40	273.14	9.76	26.86	0:11:40	278.49	19.89	13.17	0:18:40	255.00	36.43	7.19	0:25:40	254.75	84.92	3.08	0:32:40	146.23	146.23	1.79
0:04:45	273.87	9.78	26.82	0:11:45	273.45	19.53	13.42	0:18:45	251.61	35.94	7.29	0:25:45	257.00	85.67	3.06	0:32:45	134.95	134.95	1.94
0:04:50	271.60	9.70	27.02	0:11:50	276.26	19.73	13.28	0:18:50	257.83	36.83	7.11	0:25:50	252.83	84.28	3.11	0:32:50	140.68	140.68	1.86
0:04:55	272.12	9.72	26.94	0:11:55	278.97	19.93	13.15	0:18:55	260.38	37.20	7.05	0:25:55	243.40	81.13	3.23	0:32:55	127.67	127.67	2.05
0:05:00	271.25	9.69	27.08	0:12:00	278.73	19.91	13.16	0:19:00	265.58	37.94	6.90	0:26:00	258.03	86.01	3.04	0:33:00	129.77	129.77	2.02
0:05:05	271.46	9.69	27.03	0:12:05	277.24	19.80	13.23	0:19:05	265.08	37.87	6.92	0:26:05	251.02	83.67	3.13	0:33:05	127.42	127.42	2.05
0:05:10	272.30	9.73	26.95	0:12:10	275.51	19.68	13.32	0:19:10	264.79	37.83	6.93	0:26:10	242.17	80.72	3.24	0:33:10	132.07	132.07	1.98
0:05:15	271.20	9.69	27.08	0:12:15	278.96	19.93	13.15	0:19:15	264.67	37.81	6.93	0:26:15	247.57	82.52	3.17	0:33:15	140.51	140.51	1.86
0:05:20	271.53	9.70	27.02	0:12:20	279.60	19.97	13.12	0:19:20	263.15	37.59	6.97	0:26:20	247.63	82.54	3.17	0:33:20	140.67	140.67	1.86
0:05:25	273.49	9.77	26.83	0:12:25	278.19	19.87	13.19	0:19:25	256.99	36.71	7.14	0:26:25	255.74	85.25	3.07	0:33:25	116.38	116.38	2.25
0:05:30	271.67	9.70	27.01	0:12:30	280.31	20.02	13.08	0:19:30	256.08	36.58	7.16	0:26:30	255.34	85.11	3.07	0:33:30	147.94	147.94	1.77
0:05:35	271.73	9.70	27.03	0:12:35	281.92	20.14	13.03	0:19:35	258.96	36.99	7.08	0:26:35	239.20	79.73	3.28	0:33:35	130.55	130.55	2.00
0:05:40	270.64	9.67	27.11	0:12:40	276.26	19.73	13.28	0:19:40	255.79	36.54	7.17	0:26:40	242.75	80.92	3.24	0:33:40	143.74	143.74	1.82
0:05:45	274.20	9.79	26.76	0:12:45	279.47	19.96	13.12	0:19:45	253.45	36.21	7.24	0:26:45	251.76	83.92	3.12	0:33:45	130.38	130.38	2.01
0:05:50	273.64	9.77	26.82	0:12:50	280.35	20.02	13.10	0:19:50	256.61	36.66	7.15	0:26:50	252.91	84.30	3.10	0:33:50	134.75	134.75	1.94
0:05:55	271.68	9.70	27.01	0:12:55	275.52	19.68	13.31	0:19:55	257.30	36.76	7.13	0:26:55	257.06	85.69	3.06	0:33:55	145.32	145.32	1.80
0:06:00	270.23	9.65	27.08	0:13:00	280.03	20.00	13.07	0:20:00	257.36	36.77	7.11	0:27:00	258.24	86.08	3.03	0:34:00	132.90	132.90	1.97
0:06:05	269.79	9.64	27.19	0:13:05	281.00	20.07	13.05	0:20:05	257.94	36.85	7.07	0:27:05	258.64	86.21	3.04	0:34:05	135.66	135.66	1.93
0:06:10	270.85	9.67	27.13	0:13:10	278.67	19.90	13.17	0:20:10	259.17	37.02	7.09	0:27:10	257.72	85.91	3.05	0:34:10	155.46	155.46	1.68
0:06:15	270.10	9.65	27.15	0:13:15	276.91	19.78	13.23	0:20:15	261.81	37.40	7.00	0:27:15	261.61	87.20	3.00	0:34:15	132.56	132.56	1.97
0:06:20	271.98	9.71	26.95	0:13:20	277.29	19.81	13.25	0:20:20	261.67	37.38	7.01	0:27:20	257.27	85.76	3.05	0:34:20	147.60	147.60	1.77
0:06:25	272.43	9.73	26.95	0:13:25	277.44	19.82	13.22	0:20:25	263.88	37.70	6.95	0:27:25	243.37	81.12	3.23	0:34:25	156.33	156.33	1.67
0:06:30	272.71	9.74	26.94	0:13:30	274.60	19.61	13.37	0:20:30	263.18	37.60	6.96	0:27:30	247.28	82.43	3.18	0:34:30	135.29	135.29	1.93
0:06:35	273.05	9.75	26.89	0:13:35	273.09	19.51	13.44	0:20:35	260.41	37.20	7.05	0:27:35	266.59	88.86	2.95	0:34:35	151.42	151.42	1.73
0:06:40	273.52	9.77	26.81	0:13:40	275.69	19.69	13.30	0:20:40	259.92	37.13	7.05	0:27:40	254.02	84.67	3.09	0:34:40	155.40	155.40	1.68
0:06:45	11.35	0.00	28.56	0:13:45	9.81	0.00	13.97	0:20:45	9.84	0.00	7.16	0:27:45	7.22	0.00	4.04	0:34:45	3.48	0.00	1.72
0:06:50	0.00	0.00	0.00	0:13:50	0.00	0.00	0.00	0:20:50	0.00	0.00	0.00	0:27:50	0.00	0.00	0.00	0:34:50	0.00	0.00	0.00
0:06:55	0.00	0.00	0.00	0:13:55	0.00	0.00	0.00	0:20:55	0.00	0.00	0.00	0:27:55	0.00	0.00	0.00	0:34:55	0.00	0.00	0.00

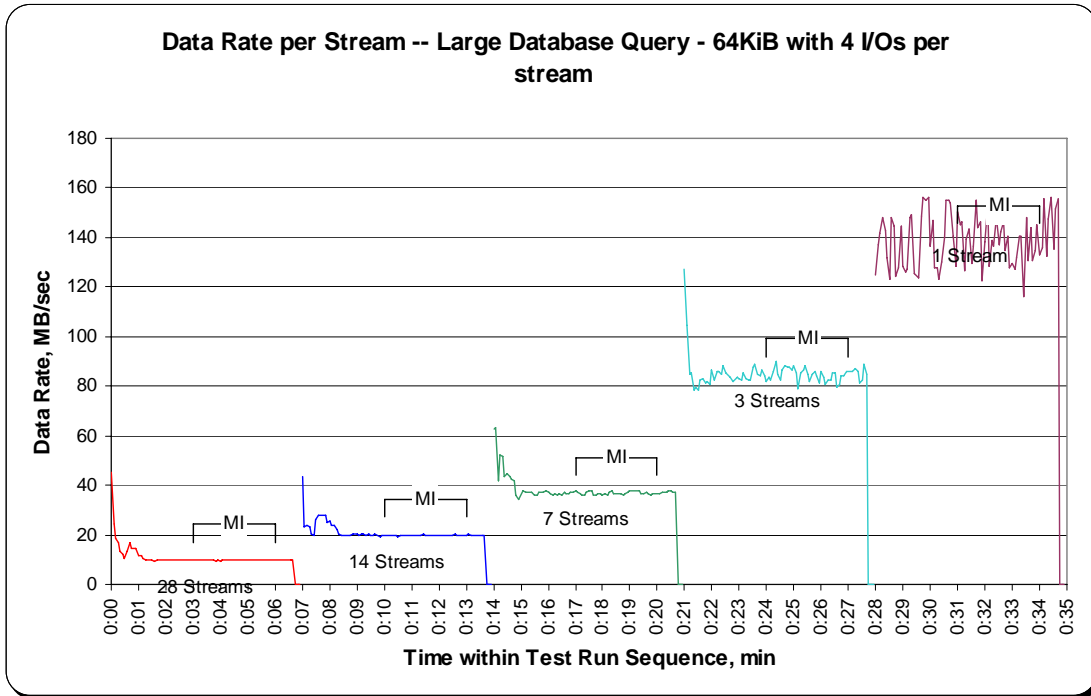
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Complete Test Run



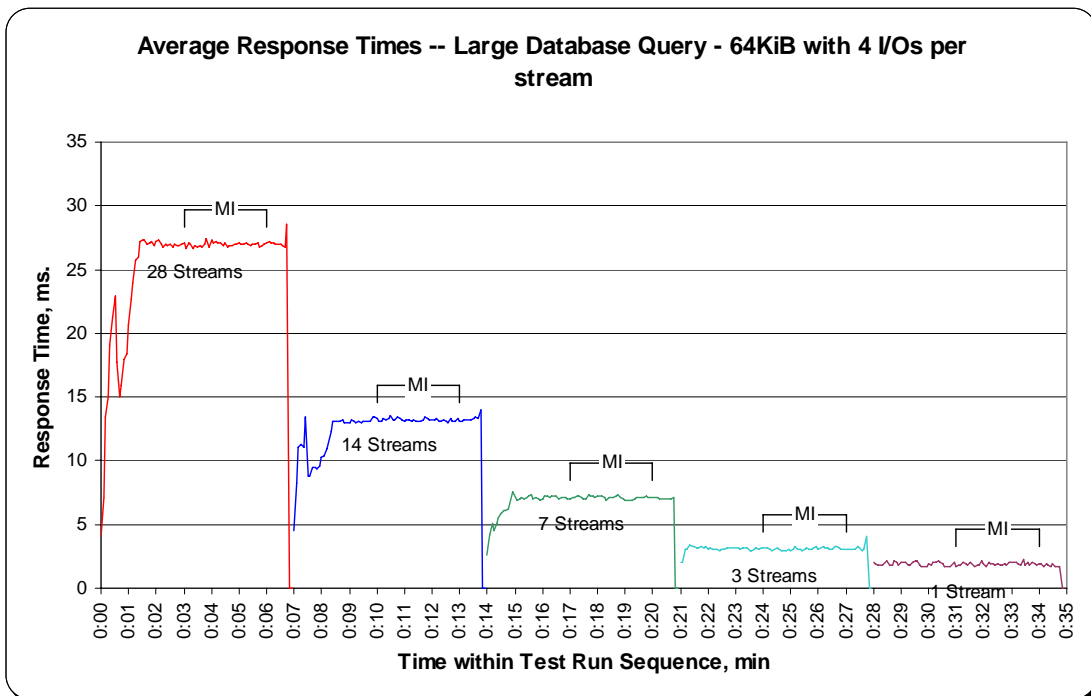
SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Data Rate per Stream Graph



SPC-2 “Large Database Query/64 KiB Transfer Size/4 Outstanding I/Os” Average Response Time Graph



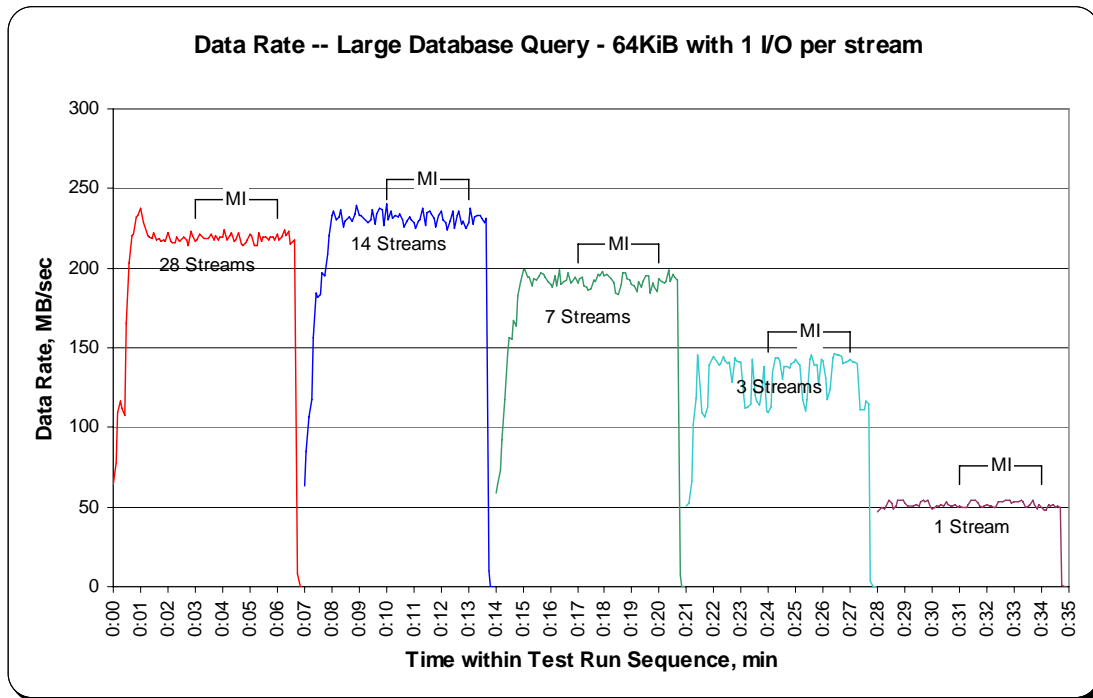
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Test Run Data – Ramp-Up Period

TR6				TR7				TR8				TR9				TR10			
Test Run Sequence Time	28 Streams		Response Time, ms	Test Run Sequence Time	14 Streams		Response Time, ms	Test Run Sequence Time	7 Streams		Response Time, ms	Test Run Sequence Time	3 Streams		Response Time, ms	Test Run Sequence Time	1 Stream		Response Time, ms
	Data Rate, MB/sec	Data Rate / Stream, MB/sec			Data Rate, MB/sec	Data Rate / Stream, MB/sec			Data Rate, MB/sec	Data Rate / Stream, MB/sec			Data Rate, MB/sec	Data Rate / Stream, MB/sec			Data Rate, MB/sec	Data Rate / Stream, MB/sec	
0:00:00	64.49	32.24	1.88	0:07:00	63.53	21.18	1.97	0:14:00	58.51	29.26	1.80	0:21:00	50.28	50.28	1.27	0:28:00	46.61	46.61	1.37
0:00:05	77.79	19.45	2.20	0:07:05	84.92	21.23	2.52	0:14:05	64.49	32.24	2.03	0:21:05	52.70	52.70	1.23	0:28:05	48.99	48.99	1.33
0:00:10	108.93	15.56	3.52	0:07:10	106.18	15.17	2.87	0:14:10	73.02	24.34	2.04	0:21:10	66.06	33.03	1.27	0:28:10	49.95	49.95	1.31
0:00:15	116.81	14.60	4.35	0:07:15	117.33	16.76	3.90	0:14:15	92.42	30.81	2.12	0:21:15	101.92	50.96	1.28	0:28:15	48.40	48.40	1.35
0:00:20	112.10	9.34	5.93	0:07:20	156.24	17.36	3.44	0:14:20	117.49	29.37	1.90	0:21:20	117.98	39.33	1.34	0:28:20	52.14	52.14	1.25
0:00:25	107.12	7.14	8.21	0:07:25	184.63	20.51	3.19	0:14:25	145.96	36.49	1.78	0:21:25	145.54	48.51	1.35	0:28:25	54.21	54.21	1.21
0:00:30	165.21	9.72	6.08	0:07:30	181.98	20.22	3.24	0:14:30	156.41	31.28	2.04	0:21:30	122.66	40.89	1.60	0:28:30	52.21	52.21	1.25
0:00:35	203.75	10.19	5.75	0:07:35	183.62	20.40	3.21	0:14:35	155.70	31.14	2.10	0:21:35	109.47	36.49	1.79	0:28:35	48.91	48.91	1.34
0:00:40	220.56	11.03	5.94	0:07:40	196.81	19.68	3.26	0:14:40	167.56	27.93	2.29	0:21:40	107.06	35.69	1.83	0:28:40	50.55	50.55	1.29
0:00:45	221.72	10.08	6.05	0:07:45	195.29	19.53	3.35	0:14:45	163.75	27.29	2.40	0:21:45	113.33	37.78	1.73	0:28:45	54.32	54.32	1.20
0:00:50	232.07	10.55	6.21	0:07:50	208.37	18.94	3.34	0:14:50	182.72	26.10	2.47	0:21:50	139.30	46.43	1.41	0:28:50	53.79	53.79	1.21
0:00:55	233.20	10.14	6.37	0:07:55	220.89	16.99	3.38	0:14:55	191.43	27.35	2.39	0:21:55	143.07	47.69	1.37	0:28:55	54.19	54.19	1.21
0:01:00	237.81	9.91	6.33	0:08:00	233.50	17.96	3.64	0:15:00	198.71	28.39	2.30	0:22:00	144.65	48.22	1.36	0:29:00	52.28	52.28	1.25
0:01:05	228.68	8.80	7.36	0:08:05	235.94	18.15	3.61	0:15:05	199.01	28.43	2.30	0:22:05	141.45	47.15	1.39	0:29:05	50.44	50.44	1.30
0:01:10	225.81	8.06	7.82	0:08:10	230.41	17.72	3.69	0:15:10	194.00	27.71	2.36	0:22:10	139.30	46.43	1.41	0:29:10	50.64	50.64	1.29
0:01:15	220.77	7.88	8.31	0:08:15	231.78	17.83	3.67	0:15:15	194.41	27.77	2.36	0:22:15	139.98	46.66	1.40	0:29:15	50.59	50.59	1.29
0:01:20	219.95	7.86	8.33	0:08:20	236.34	18.18	3.60	0:15:20	189.07	27.01	2.42	0:22:20	144.17	48.06	1.36	0:29:20	50.31	50.31	1.30
0:01:25	218.46	7.80	8.39	0:08:25	226.34	16.17	4.04	0:15:25	193.41	27.63	2.37	0:22:25	141.77	47.26	1.38	0:29:25	51.57	51.57	1.27
0:01:30	221.90	7.92	8.28	0:08:30	229.54	16.40	3.99	0:15:30	192.79	27.54	2.38	0:22:30	139.69	46.56	1.40	0:29:30	50.33	50.33	1.30
0:01:35	217.85	7.78	8.42	0:08:35	231.74	16.55	3.96	0:15:35	194.83	27.83	2.35	0:22:35	141.05	47.02	1.39	0:29:35	52.94	52.94	1.23
0:01:40	218.94	7.82	8.37	0:08:40	232.10	16.58	3.95	0:15:40	197.30	28.19	2.32	0:22:40	128.34	42.78	1.53	0:29:40	53.78	53.78	1.22
0:01:45	217.26	7.76	8.45	0:08:45	229.85	16.42	3.99	0:15:45	196.27	28.04	2.33	0:22:45	143.36	47.79	1.37	0:29:45	53.16	53.16	1.23
0:01:50	217.73	7.78	8.43	0:08:50	233.64	16.69	3.92	0:15:50	194.40	27.77	2.36	0:22:50	142.24	47.41	1.38	0:29:50	53.77	53.77	1.22
0:01:55	217.31	7.76	8.43	0:08:55	239.75	17.12	3.82	0:15:55	191.59	27.37	2.39	0:22:55	141.16	47.05	1.39	0:29:55	50.00	50.00	1.31
0:02:00	221.88	7.92	8.25	0:09:00	233.12	16.65	3.93	0:16:00	189.71	27.10	2.41	0:23:00	140.82	46.94	1.39	0:30:00	48.96	48.96	1.34
0:02:05	216.66	7.74	8.49	0:09:05	233.56	16.68	3.92	0:16:05	188.21	26.89	2.43	0:23:05	120.57	40.19	1.63	0:30:05	49.91	49.91	1.31
0:02:10	215.74	7.71	8.49	0:09:10	231.33	16.52	3.96	0:16:10	194.87	27.84	2.35	0:23:10	111.95	37.32	1.75	0:30:10	51.02	51.02	1.28
0:02:15	216.12	7.72	8.49	0:09:15	230.84	16.49	3.97	0:16:15	189.26	27.04	2.42	0:23:15	113.06	37.69	1.73	0:30:15	50.95	50.95	1.28
0:02:20	219.67	7.85	8.36	0:09:20	228.80	16.34	4.00	0:16:20	198.96	28.42	2.30	0:23:20	115.11	38.37	1.70	0:30:20	51.11	51.11	1.28
0:02:25	216.68	7.74	8.46	0:09:25	230.64	16.47	3.98	0:16:25	189.39	27.06	2.42	0:23:25	142.70	47.57	1.37	0:30:25	50.75	50.75	1.29
0:02:30	217.90	7.78	8.40	0:09:30	236.96	16.93	3.87	0:16:30	191.49	27.36	2.39	0:23:30	119.79	39.93	1.64	0:30:30	53.12	53.12	1.23
0:02:35	219.70	7.85	8.36	0:09:35	227.85	16.27	4.02	0:16:35	192.43	27.49	2.38	0:23:35	116.83	38.94	1.68	0:30:35	51.91	51.91	1.26
0:02:40	217.88	7.78	8.41	0:09:40	233.93	16.71	3.92	0:16:40	196.60	28.09	2.33	0:23:40	113.99	38.00	1.72	0:30:40	50.50	50.50	1.29
0:02:45	214.56	7.66	8.55	0:09:45	237.61	16.97	3.86	0:16:45	190.21	27.17	2.41	0:23:45	125.94	41.98	1.56	0:30:45	50.53	50.53	1.29
0:02:50	223.49	7.98	8.22	0:09:50	236.50	16.89	3.87	0:16:50	191.90	27.41	2.39	0:23:50	138.51	46.17	1.41	0:30:50	51.85	51.85	1.26
0:02:55	220.45	7.87	8.32	0:09:55	226.93	16.21	4.04	0:16:55	194.03	27.72	2.36	0:23:55	109.94	36.65	1.79	0:30:55	49.64	49.64	1.32

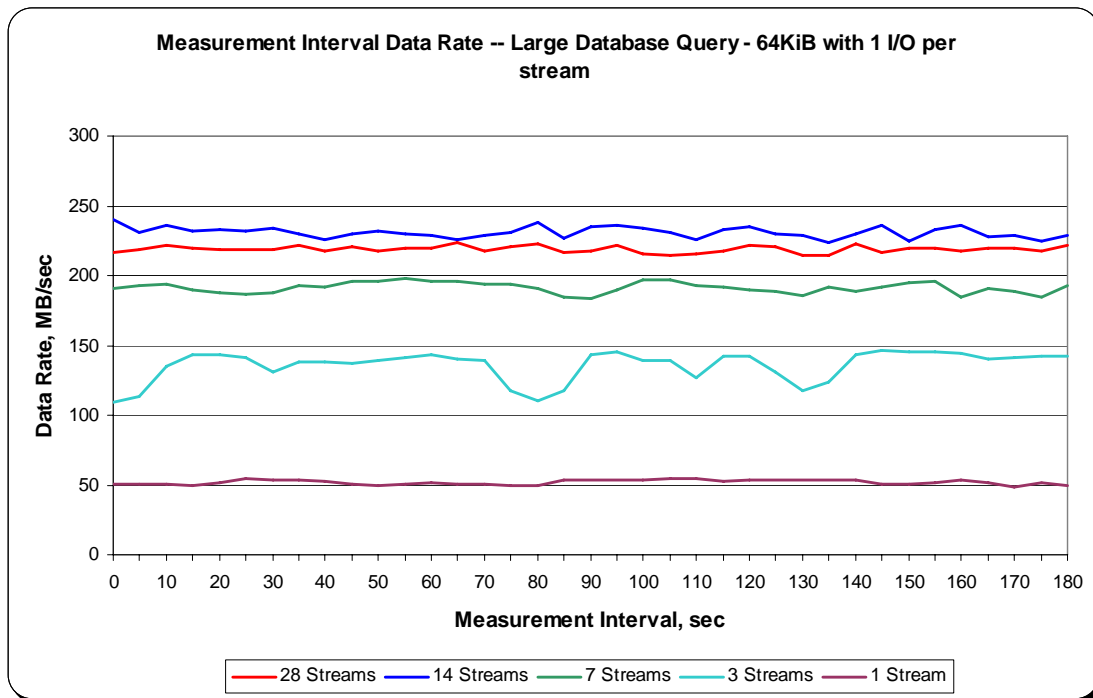
PC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Test Run Data Measurement Interval, Run-Out, and Ramp-Down Period

TR6	28 Streams			TR7	14 Streams			TR8	7 Streams			TR9	3 Streams			TR10	1 Stream		
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms
0:03:00	216.87	7.75	8.41	0:10:00	240.17	17.15	3.81	0:17:00	190.82	27.26	2.39	0:24:00	109.16	36.39	1.79	0:31:00	50.94	50.94	1.28
0:03:05	218.19	7.79	8.37	0:10:05	230.64	16.47	3.95	0:17:05	193.05	27.58	2.37	0:24:05	112.97	37.66	1.74	0:31:05	50.11	50.11	1.30
0:03:10	221.83	7.92	8.28	0:10:10	236.08	16.86	3.89	0:17:10	194.13	27.73	2.36	0:24:10	134.63	44.88	1.46	0:31:10	50.04	50.04	1.31
0:03:15	219.78	7.85	8.35	0:10:15	231.61	16.54	3.96	0:17:15	189.26	27.04	2.42	0:24:15	143.24	47.75	1.37	0:31:15	49.83	49.83	1.31
0:03:20	218.36	7.80	8.39	0:10:20	233.33	16.67	3.93	0:17:20	187.64	26.81	2.44	0:24:20	143.46	47.82	1.37	0:31:20	51.18	51.18	1.28
0:03:25	218.59	7.81	8.40	0:10:25	232.11	16.58	3.95	0:17:25	186.33	26.62	2.46	0:24:25	141.45	47.15	1.39	0:31:25	54.25	54.25	1.20
0:03:30	218.65	7.81	8.39	0:10:30	233.72	16.69	3.92	0:17:30	187.28	26.75	2.45	0:24:30	130.57	43.52	1.50	0:31:30	53.88	53.88	1.21
0:03:35	221.45	7.91	8.28	0:10:35	230.38	16.46	3.98	0:17:35	192.52	27.50	2.38	0:24:35	137.94	45.98	1.42	0:31:35	54.01	54.01	1.21
0:03:40	217.71	7.78	8.42	0:10:40	225.72	16.12	4.06	0:17:40	192.00	27.43	2.38	0:24:40	138.42	46.14	1.42	0:31:40	52.07	52.07	1.25
0:03:45	220.57	7.88	8.32	0:10:45	229.58	16.40	3.99	0:17:45	196.06	28.01	2.34	0:24:45	137.41	45.80	1.42	0:31:45	50.31	50.31	1.30
0:03:50	217.94	7.78	8.40	0:10:50	232.47	16.60	3.95	0:17:50	195.48	27.93	2.34	0:24:50	139.66	46.55	1.41	0:31:50	49.68	49.68	1.32
0:03:55	219.32	7.83	8.37	0:10:55	230.06	16.43	3.98	0:17:55	198.20	28.31	2.31	0:24:55	141.14	47.05	1.39	0:31:55	51.00	51.00	1.28
0:04:00	219.31	7.83	8.38	0:11:00	229.02	16.36	4.00	0:18:00	195.43	27.92	2.34	0:25:00	143.14	47.71	1.37	0:32:00	51.28	51.28	1.27
0:04:05	223.81	7.99	8.19	0:11:05	225.34	16.10	4.07	0:18:05	195.88	27.98	2.34	0:25:05	139.79	46.60	1.40	0:32:05	50.69	50.69	1.29
0:04:10	217.67	7.77	8.41	0:11:10	229.18	16.37	4.00	0:18:10	193.99	27.71	2.36	0:25:10	138.73	46.24	1.41	0:32:10	50.79	50.79	1.29
0:04:15	220.56	7.88	8.33	0:11:15	230.69	16.48	3.97	0:18:15	193.48	27.64	2.37	0:25:15	117.10	39.03	1.68	0:32:15	49.56	49.56	1.32
0:04:20	222.20	7.94	8.26	0:11:20	237.84	16.99	3.85	0:18:20	190.46	27.21	2.41	0:25:20	110.19	36.73	1.78	0:32:20	49.55	49.55	1.32
0:04:25	216.80	7.74	8.46	0:11:25	226.81	16.20	4.04	0:18:25	184.12	26.30	2.49	0:25:25	117.70	39.23	1.67	0:32:25	53.44	53.44	1.22
0:04:30	217.60	7.77	8.43	0:11:30	234.96	16.78	3.90	0:18:30	183.08	26.15	2.50	0:25:30	142.92	47.64	1.37	0:32:30	53.71	53.71	1.21
0:04:35	222.03	7.93	8.25	0:11:35	235.72	16.84	3.89	0:18:35	189.78	27.11	2.41	0:25:35	145.67	48.56	1.35	0:32:35	53.25	53.25	1.23
0:04:40	215.47	7.70	8.52	0:11:40	234.38	16.74	3.91	0:18:40	196.61	28.09	2.33	0:25:40	139.37	46.46	1.41	0:32:40	53.83	53.83	1.21
0:04:45	214.32	7.65	8.56	0:11:45	230.91	16.49	3.97	0:18:45	196.59	28.08	2.33	0:25:45	139.21	46.40	1.41	0:32:45	54.48	54.48	1.20
0:04:50	215.73	7.70	8.51	0:11:50	226.24	16.16	4.05	0:18:50	192.94	27.56	2.37	0:25:50	126.93	42.31	1.55	0:32:50	54.19	54.19	1.21
0:04:55	217.35	7.76	8.43	0:11:55	233.15	16.65	3.93	0:18:55	192.18	27.45	2.38	0:25:55	142.41	47.47	1.38	0:32:55	52.83	52.83	1.24
0:05:00	221.25	7.90	8.29	0:12:00	235.49	16.82	3.89	0:19:00	189.89	27.13	2.41	0:26:00	141.82	47.27	1.38	0:33:00	53.36	53.36	1.22
0:05:05	220.53	7.88	8.32	0:12:05	230.35	16.45	3.98	0:19:05	188.47	26.92	2.43	0:26:05	131.02	43.67	1.50	0:33:05	53.57	53.57	1.22
0:05:10	214.58	7.66	8.53	0:12:10	228.81	16.34	4.01	0:19:10	185.59	26.51	2.47	0:26:10	117.33	39.11	1.67	0:33:10	53.29	53.29	1.23
0:05:15	214.58	7.66	8.57	0:12:15	223.92	15.99	4.09	0:19:15	191.41	27.34	2.39	0:26:15	123.90	41.30	1.58	0:33:15	54.01	54.01	1.21
0:05:20	222.21	7.94	8.26	0:12:20	229.96	16.43	3.99	0:19:20	188.26	26.89	2.43	0:26:20	143.45	47.82	1.37	0:33:20	53.48	53.48	1.22
0:05:25	216.51	7.73	8.46	0:12:25	236.25	16.88	3.88	0:19:25	191.88	27.41	2.39	0:26:25	146.13	48.71	1.34	0:33:25	50.14	50.14	1.30
0:05:30	219.27	7.83	8.34	0:12:30	225.01	16.07	4.07	0:19:30	195.05	27.86	2.35	0:26:30	145.54	48.51	1.35	0:33:30	50.48	50.48	1.29
0:05:35	219.73	7.85	8.36	0:12:35	233.50	16.68	3.93	0:19:35	195.39	27.91	2.34	0:26:35	145.11	48.37	1.35	0:33:35	51.47	51.47	1.27
0:05:40	217.42	7.77	8.45	0:12:40	235.74	16.84	3.89	0:19:40	184.25	26.32	2.49	0:26:40	144.24	48.08	1.36	0:33:40	54.10	54.10	1.21
0:05:45	219.61	7.84	8.33	0:12:45	227.35	16.24	4.03	0:19:45	190.26	27.18	2.41	0:26:45	140.24	46.75	1.40	0:33:45	51.96	51.96	1.26
0:05:50	219.89	7.85	8.37	0:12:50	229.30	16.38	3.99	0:19:50	188.24	26.89	2.43	0:26:50	141.12	47.04	1.39	0:33:50	48.75	48.75	1.34
0:05:55	217.98	7.78	8.40	0:12:55	224.67	16.05	4.09	0:19:55	185.01	26.43	2.48	0:26:55	142.02	47.34	1.38	0:33:55	51.06	51.06	1.28
0:06:00	221.63	7.92	8.26	0:13:00	229.06	16.36	3.99	0:20:00	193.26	27.61	2.36	0:27:00	142.77	47.59	1.37	0:34:00	49.69	49.69	1.31
0:06:05	217.84	7.78	8.41	0:13:05	238.05	17.00	3.85	0:20:05	191.62	27.37	2.38	0:27:05	141.19	47.06	1.38	0:34:05	48.05	48.05	1.36
0:06:10	219.89	7.85	8.35	0:13:10	227.77	16.27	4.03	0:20:10	190.82	27.26	2.40	0:27:10	141.08	47.03	1.39	0:34:10	48.07	48.07	1.36
0:06:15	224.12	8.00	8.18	0:13:15	232.25	16.59	3.95	0:20:15	191.46	27.35	2.39	0:27:15	140.11	46.70	1.40	0:34:15	51.32	51.32	1.27
0:06:20	220.58	7.88	8.32	0:13:20	233.45	16.68	3.92	0:20:20	198.87	28.41	2.30	0:27:20	111.10	37.03	1.77	0:34:20	51.02	51.02	1.28
0:06:25	223.33	7.98	8.21	0:13:25	233.08	16.65	3.93	0:20:25	191.89	27.41	2.39	0:27:25	111.34	37.11	1.76	0:34:25	51.33	51.33	1.27
0:06:30	215.28	7.69	8.51	0:13:30	231.23	16.52	3.96	0:20:30	196.04	28.01	2.34	0:27:30	110.78	36.93	1.77	0:34:30	49.92	49.92	1.31
0:06:35	216.47	7.73	8.46	0:13:35	228.57	16.33	4.01	0:20:35	194.31	27.76	2.36	0:27:35	116.91	38.97	1.68	0:34:35	51.02	51.02	1.28
0:06:40	218.02	7.79	8.43	0:13:40	231.41	16.53	3.96	0:20:40	192.78	27.54	2.38	0:27:40	114.80	38.27	1.71	0:34:40	50.08	50.08	1.30
0:06:45	8.49	0.00	8.11	0:13:45	9.73	0.00	3.56	0:20:45	7.25	0.00	2.29	0:27:45	3.84	0.00	1.84	0:34:45	1.17	0.00	1.26
0:06:50	0.00	0.00	0.00	0:13:50	0.00	0.00	0.00	0:20:50	0.00	0.00	0.00	0:27:50	0.00	0.00	0.00	0:34:50	0.00	0.00	0.00
0:06:55	0.00	0.00	0.00	0:13:55	0.00	0.00	0.00	0:20:55	0.00	0.00	0.00	0:27:55	0.00	0.00	0.00	0:34:55	0.00	0.00	0.00

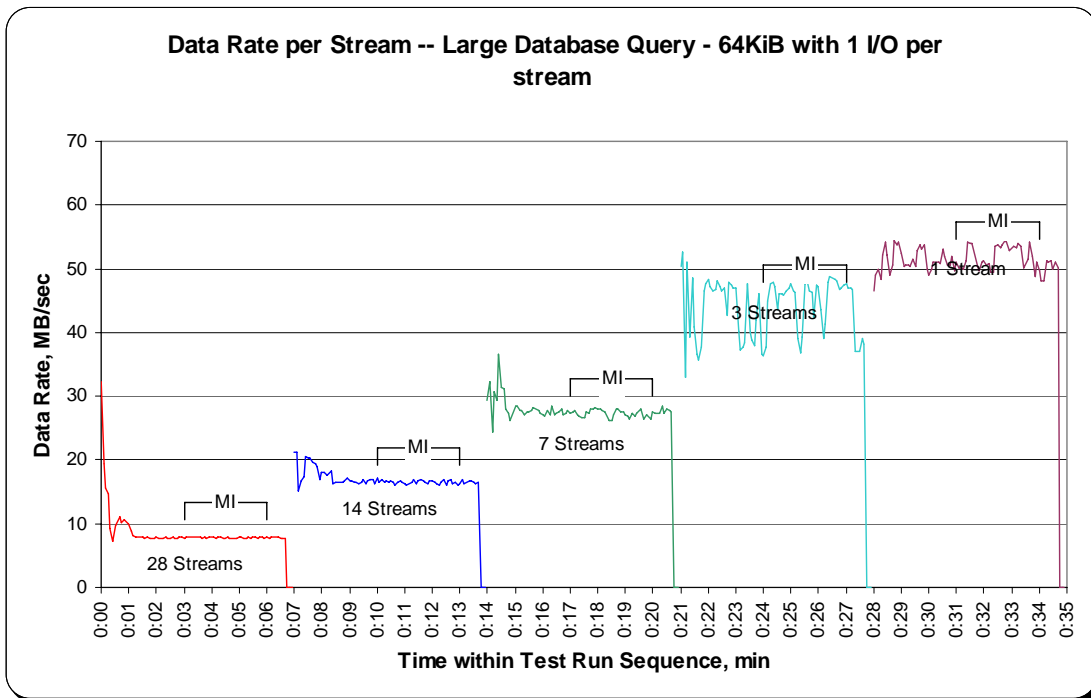
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Complete Test Run



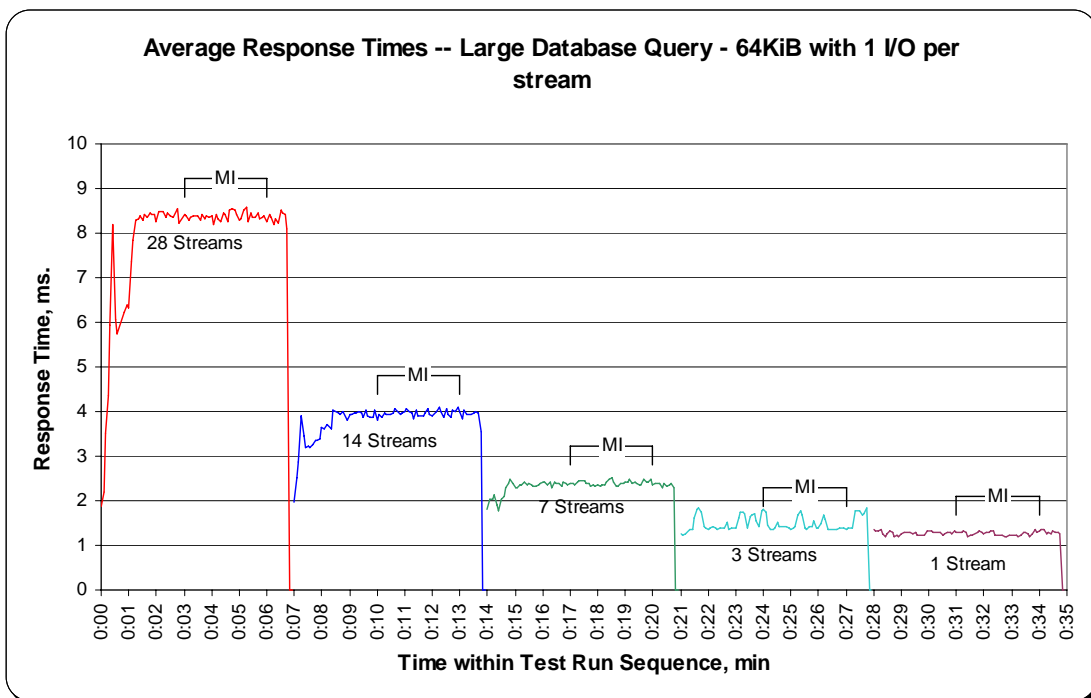
SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate Graph – Measurement Interval (MI) Only



SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Data Rate per Stream Graph



SPC-2 “Large Database Query/64 KiB Transfer Size/1 Outstanding I/O” Average Response Time Graph



Video on Demand Delivery Test

Clause 6.4.4.1

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 6.4.2.2

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 10.6.8.3

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 (intervals), Average Data Rate per Stream (intervals), and Average Response Time (intervals) graphs for the single Video on Demand Delivery Test Run as specified in Clauses 10.1.4-2-10.1.6.*
- 6. A Maximum Response Time (intervals) graph, which will utilize the format defined in Clause 10.1.6, substituting maximum Response Time data for average Response Time data.*

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 100.

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.

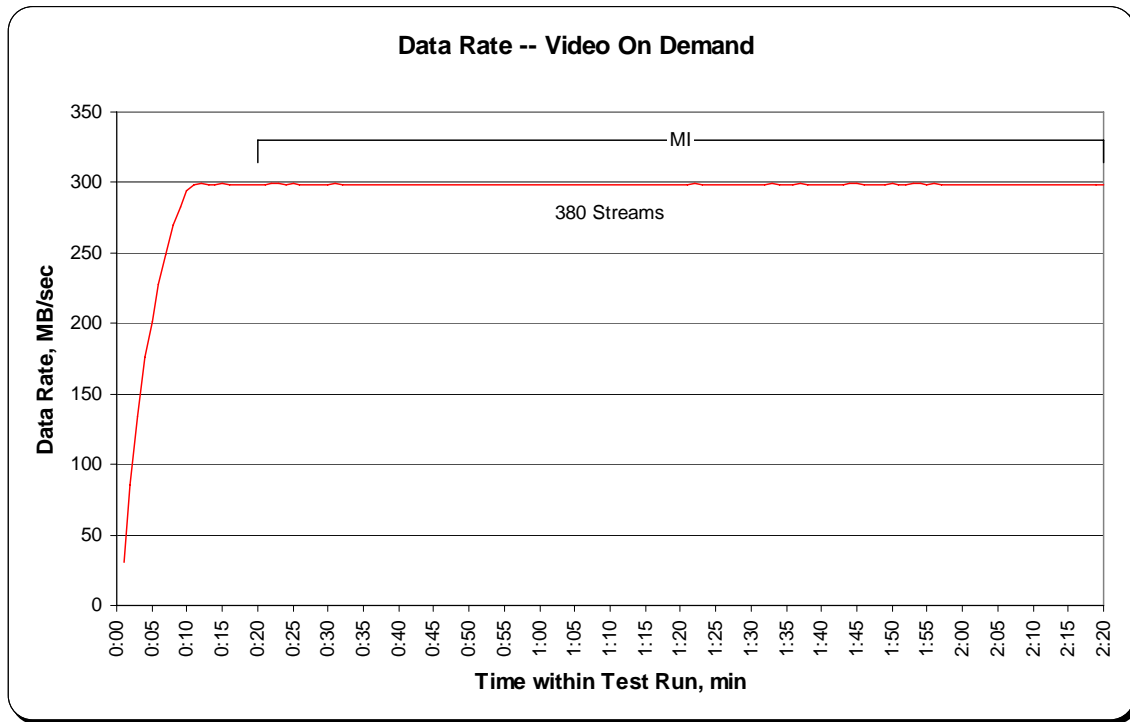
SPC-2-VOD	TR1
Number of Streams	380
Ramp-up Time, sec	1200
Measurement Interval, sec	7200
Average Data Rate, MB/sec	298.84
Per Stream Data Rate, MB/sec	0.79
Average Response Time, ms	25.97
Average Max Response Time, ms	95.68

Video on Demand Delivery Test – TEST RUN DATA BY INTERVAL

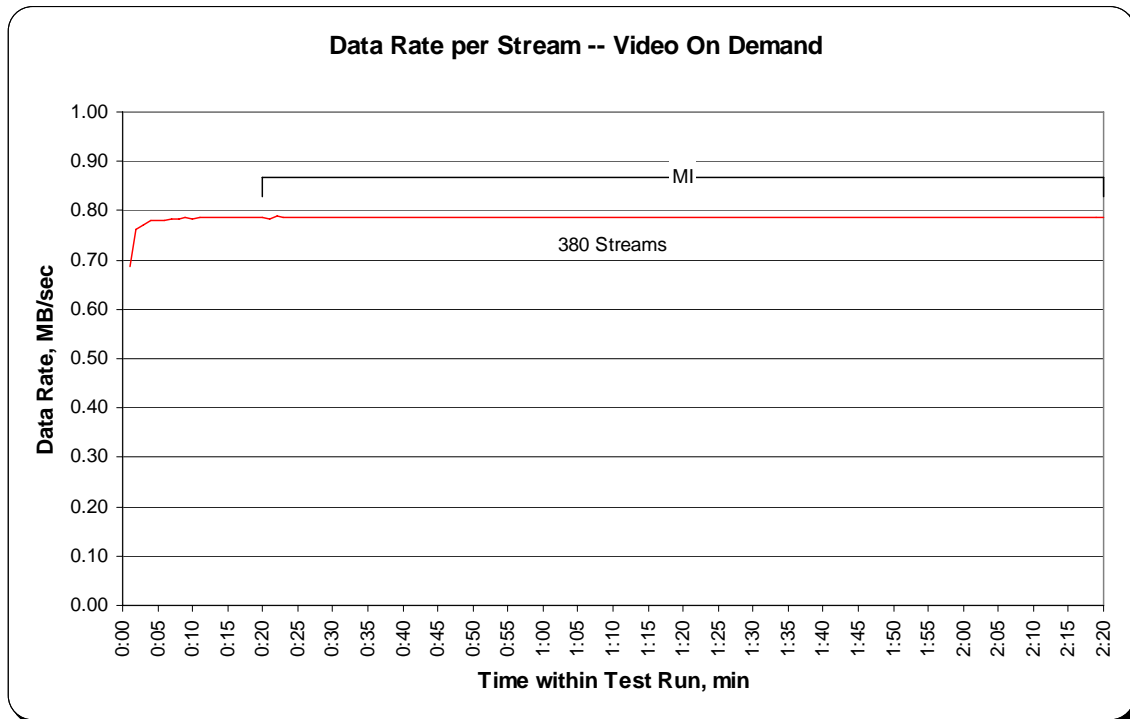
The SPC-2 Video on Demand Delivery Test Run data is contained in the table that appears on the next page. That table is followed by graphs illustrating the average Data Rate and average Data Rate per Stream produced by the same Test Runs. The table and graphs present the data at sixty second intervals.

TR1					TR1					TR1				
Test Run Sequence Time	380 Streams				Test Run Sequence Time	380 Streams				Test Run Sequence Time	380 Streams			
	Data Rate, / Stream, MB/sec	Data Rate, / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms		Data Rate, / Stream, MB/sec	Data Rate, / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms		Data Rate, / Stream, MB/sec	Data Rate, / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms
0:01:00	30.17	0.69	8.19	27.78	0:51:00	298.85	0.79	25.74	112.90	1:41:00	298.83	0.79	26.20	112.97
0:02:00	85.81	0.76	12.40	31.36	0:52:00	298.86	0.79	25.09	90.54	1:42:00	298.86	0.79	26.23	116.63
0:03:00	133.97	0.77	14.07	35.15	0:53:00	298.86	0.79	25.56	120.26	1:43:00	298.84	0.79	26.21	117.77
0:04:00	176.50	0.78	15.35	40.95	0:54:00	298.85	0.79	25.13	129.88	1:44:00	298.89	0.79	27.49	94.14
0:05:00	201.82	0.78	16.28	47.22	0:55:00	298.86	0.79	25.01	92.94	1:45:00	298.87	0.79	26.15	85.71
0:06:00	227.36	0.78	17.60	52.37	0:56:00	298.86	0.79	24.71	89.95	1:46:00	298.85	0.79	24.12	70.83
0:07:00	249.06	0.78	18.87	54.08	0:57:00	298.86	0.79	24.58	87.67	1:47:00	298.82	0.79	23.88	68.59
0:08:00	270.29	0.78	20.82	74.60	0:58:00	298.82	0.79	24.77	92.36	1:48:00	298.84	0.79	23.68	65.55
0:09:00	282.08	0.78	22.30	96.13	0:59:00	298.83	0.79	25.78	87.33	1:49:00	298.86	0.79	24.54	76.08
0:10:00	294.53	0.78	24.10	107.35	1:00:00	298.84	0.79	26.30	134.85	1:50:00	298.87	0.79	24.73	91.70
0:11:00	298.85	0.79	25.02	118.57	1:01:00	298.85	0.79	25.26	78.99	1:51:00	298.83	0.79	25.03	83.96
0:12:00	298.87	0.79	24.75	97.83	1:02:00	298.83	0.79	27.30	140.99	1:52:00	298.85	0.79	25.20	79.88
0:13:00	298.87	0.79	24.90	99.07	1:03:00	298.84	0.79	25.77	169.68	1:53:00	298.87	0.79	25.15	78.95
0:14:00	298.77	0.79	25.16	105.21	1:04:00	298.84	0.79	25.78	88.77	1:54:00	298.87	0.79	25.18	80.58
0:15:00	298.87	0.79	24.78	91.73	1:05:00	298.86	0.79	25.26	94.47	1:55:00	298.77	0.79	25.02	94.13
0:16:00	298.83	0.79	25.03	83.57	1:06:00	298.85	0.79	24.90	87.31	1:56:00	298.87	0.79	25.87	97.37
0:17:00	298.86	0.79	25.49	80.27	1:07:00	298.84	0.79	25.13	85.34	1:57:00	298.83	0.79	24.83	103.74
0:18:00	298.82	0.79	25.25	94.77	1:08:00	298.85	0.79	24.42	82.94	1:58:00	298.85	0.79	24.43	99.84
0:19:00	298.84	0.79	26.82	105.93	1:09:00	298.85	0.79	23.75	85.91	1:59:00	298.83	0.79	24.74	130.49
0:20:00	298.85	0.79	26.82	113.24	1:10:00	298.81	0.79	23.66	88.45	2:00:00	298.83	0.79	24.62	123.35
0:21:00	297.95	0.78	101.69	233.71	1:11:00	298.86	0.79	23.41	97.89	2:01:00	298.84	0.79	24.29	87.36
0:22:00	299.53	0.79	48.98	157.12	1:12:00	298.83	0.79	23.34	75.52	2:02:00	298.83	0.79	23.69	83.34
0:23:00	298.87	0.79	27.40	119.57	1:13:00	298.84	0.79	23.73	92.50	2:03:00	298.83	0.79	24.12	89.12
0:24:00	298.82	0.79	35.99	101.90	1:14:00	298.83	0.79	24.07	93.13	2:04:00	298.83	0.79	24.04	85.61
0:25:00	298.91	0.79	25.87	96.60	1:15:00	298.85	0.79	23.62	76.56	2:05:00	298.83	0.79	23.90	83.03
0:26:00	298.84	0.79	27.21	90.25	1:16:00	298.84	0.79	24.81	88.84	2:06:00	298.82	0.79	24.51	89.40
0:27:00	298.85	0.79	28.56	90.78	1:17:00	298.85	0.79	24.00	91.13	2:07:00	298.85	0.79	25.00	101.76
0:28:00	298.85	0.79	29.38	108.45	1:18:00	298.84	0.79	23.33	75.03	2:08:00	298.83	0.79	26.85	111.13
0:29:00	298.85	0.79	27.55	109.37	1:19:00	298.83	0.79	23.48	78.16	2:09:00	298.87	0.79	25.58	82.16
0:30:00	298.87	0.79	25.66	110.36	1:20:00	298.83	0.79	23.57	77.91	2:10:00	298.85	0.79	24.98	72.60
0:31:00	298.91	0.79	25.41	131.91	1:21:00	298.83	0.79	23.90	143.41	2:11:00	298.84	0.79	24.43	70.12
0:32:00	298.87	0.79	25.39	127.19	1:22:00	298.88	0.79	24.04	81.78	2:12:00	298.84	0.79	24.38	77.76
0:33:00	298.87	0.79	25.05	136.22	1:23:00	298.84	0.79	23.46	69.26	2:13:00	298.85	0.79	24.75	74.97
0:34:00	298.86	0.79	25.07	129.57	1:24:00	298.82	0.79	23.35	101.69	2:14:00	298.85	0.79	24.43	78.38
0:35:00	298.85	0.79	25.42	103.44	1:25:00	298.84	0.79	23.66	64.61	2:15:00	298.84	0.79	24.21	76.16
0:36:00	298.85	0.79	26.13	77.14	1:26:00	298.83	0.79	23.38	65.28	2:16:00	298.85	0.79	24.18	67.96
0:37:00	298.83	0.79	25.54	74.07	1:27:00	298.84	0.79	23.21	64.59	2:17:00	298.84	0.79	24.27	71.82
0:38:00	298.86	0.79	24.71	78.03	1:28:00	298.83	0.79	24.02	95.80	2:18:00	298.84	0.79	24.09	70.88
0:39:00	298.84	0.79	24.71	78.13	1:29:00	298.83	0.79	24.67	68.45	2:19:00	298.84	0.79	23.99	81.25
0:40:00	298.85	0.79	24.10	80.95	1:30:00	298.84	0.79	24.28	63.79	2:20:00	298.84	0.79	23.90	87.59
0:41:00	298.82	0.79	24.54	78.49	1:31:00	298.84	0.79	24.35	67.87					
0:42:00	298.86	0.79	24.09	74.42	1:32:00	298.79	0.79	27.06	84.55					
0:43:00	298.84	0.79	24.62	87.27	1:33:00	298.91	0.79	35.80	117.82					
0:44:00	298.84	0.79	24.56	78.80	1:34:00	298.81	0.79	26.12	126.94					
0:45:00	298.85	0.79	24.54	72.50	1:35:00	298.85	0.79	26.07	123.44					
0:46:00	298.87	0.79	24.50	73.37	1:36:00	298.87	0.79	25.09	111.99					
0:47:00	298.83	0.79	23.91	69.45	1:37:00	298.88	0.79	25.22	142.02					
0:48:00	298.86	0.79	23.70	68.92	1:38:00	298.84	0.79	26.14	148.11					
0:49:00	298.84	0.79	24.47	101.58	1:39:00	298.85	0.79	25.71	116.18					
0:50:00	298.86	0.79	24.63	112.90	1:40:00	298.83	0.79	25.88	117.91					

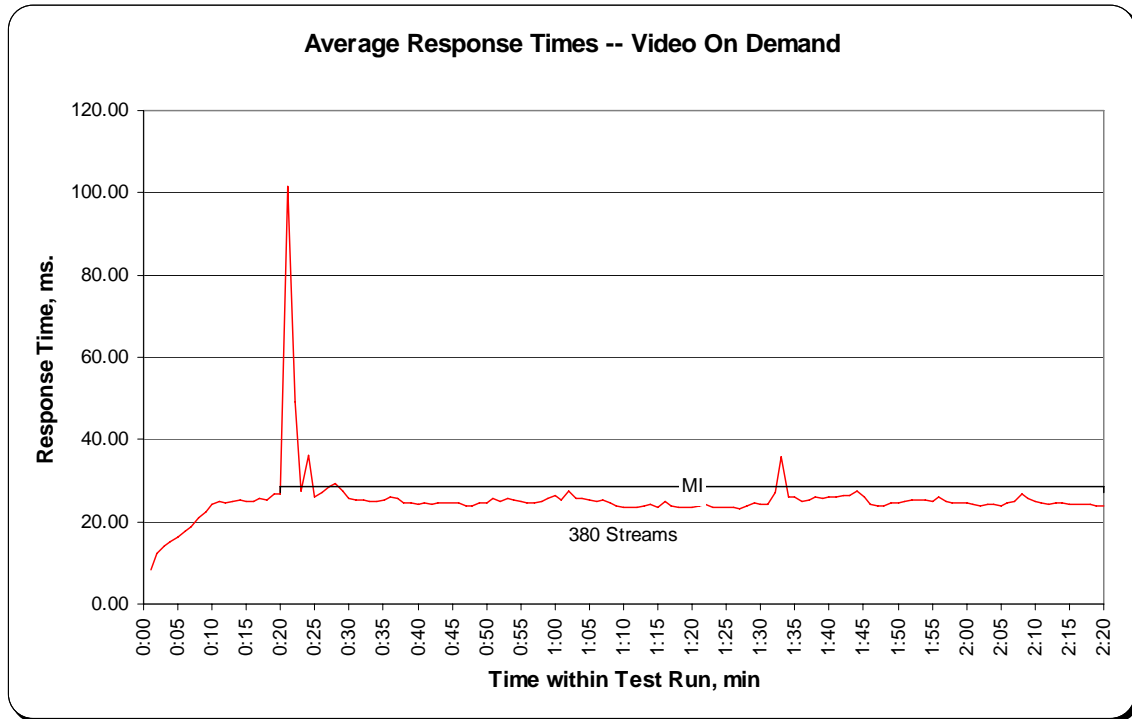
SPC-2 Video on Demand Delivery Average Data Rate Graph



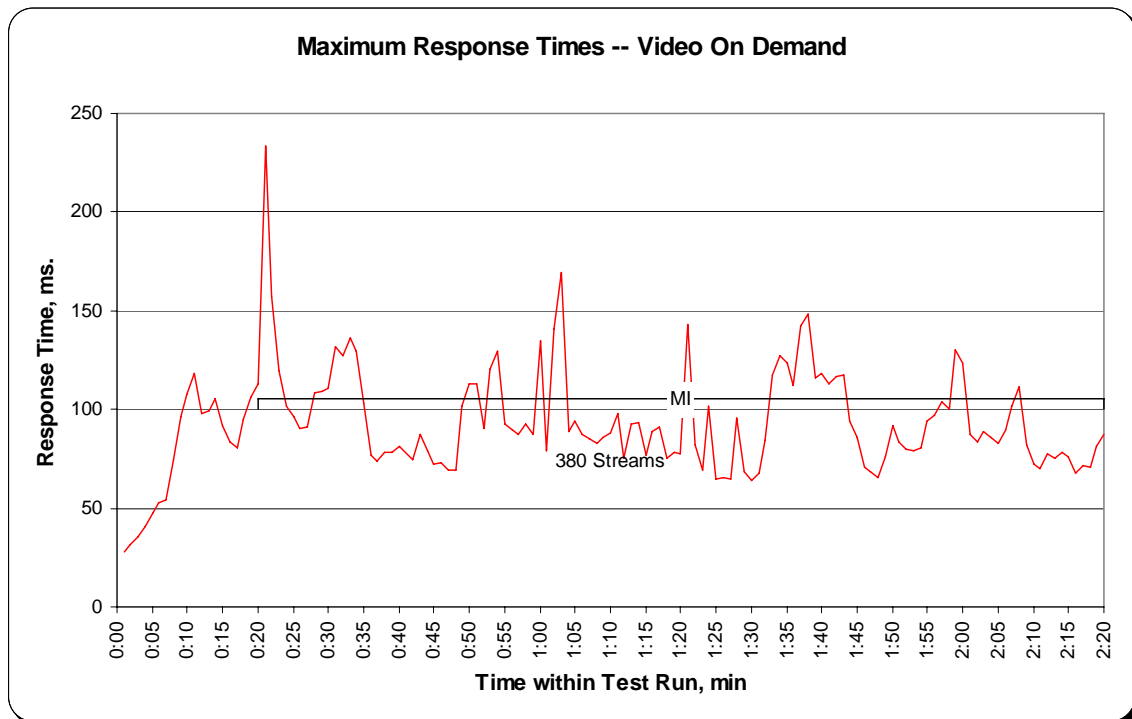
SPC-2 Video on Demand Delivery Average Data Rate per Stream Graph



SPC-2 Video on Demand Delivery Average Response Time Graph



SPC-2 Video on Demand Delivery Maximum Response Time Graph



Data Persistence Test

Clause 6

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

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

The SPC-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 10.6.8.4

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 100.

Data Persistence Test Results File

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

[Persistence 1 Test Results File](#)

[Persistence 2 Test Results File](#)

Data Persistence Test Results

Data Persistence Test Results	
Data Persistence Test Number: 1	
Total Number of Logical Blocks Written	97,053
Total Number of Logical Blocks Re-referenced	12,866
Total Number of Logical Blocks Verified	84,187
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 FDR shall state: "The **Priced Storage Configuration**, as documented in this Full Disclosure Report will be available for shipment to customers on MMMM DD, YYYY." Where **Priced Storage Configuration** is the Priced Storage Configuration Name as described in Clause 10.6.5.3, #1 and MM is month, DD is the day, and YY is the year of the date that the Priced Storage Configuration, as documented, is available for shipment to customers as described above.*

The HP StorageWorks 1000 Modular Smart Array, as documented in this SPC-2 Full Disclosure Report, is currently available for customer purchase and shipment.

ANOMALIES OR IRREGULARITIES

Clause 10.6.11

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 Remote Audit of the HP StorageWorks 1000 Modular Smart Array.

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 gibibyte (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

RAID5: User data is distributed across the disks in the array. Check data corresponding to user data is distributed across multiple disks in the form of bit-by-bit parity.

Mirroring: Two or more identical copies of user data are maintained on separate disks.

Other Protection Level: Any data protection other than **RAID5** or **Mirroring**.

Unprotected: There is no data protection provided.

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:

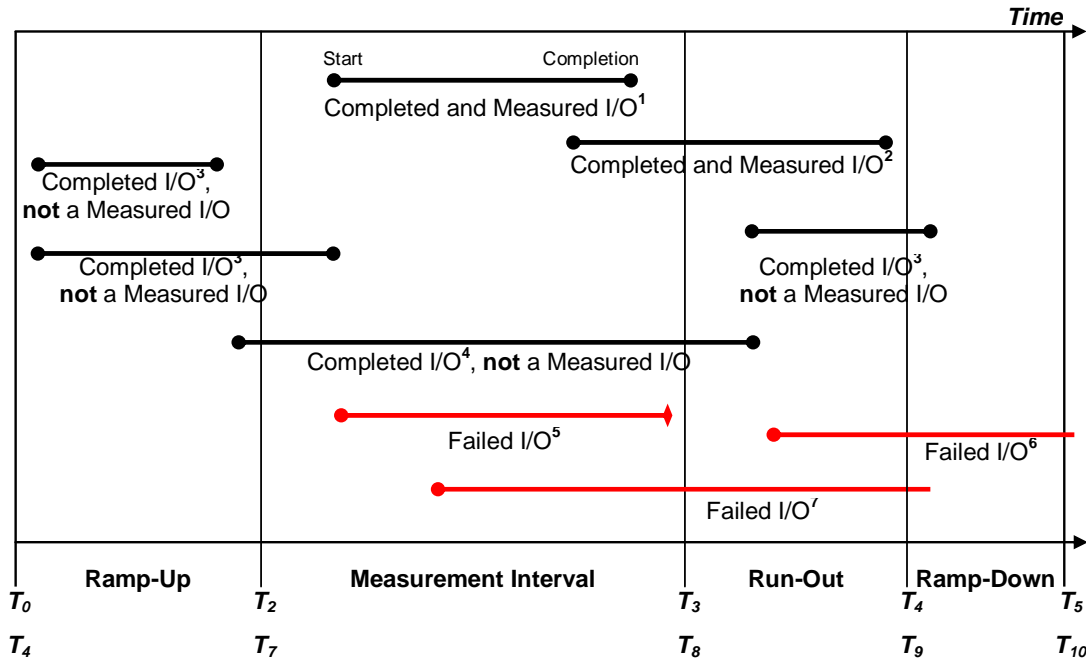
- Test Run 1: Maximum number of Streams, which is selected by the Test Sponsor
- Test Run 2: 50% of the maximum number of Streams used in Test Run 1.
- Test Run 3: 25% of the maximum number of Streams used in Test Run 1.
- Test Run 4: 12.5% of the maximum number of Streams used in Test Run 1.
- Test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

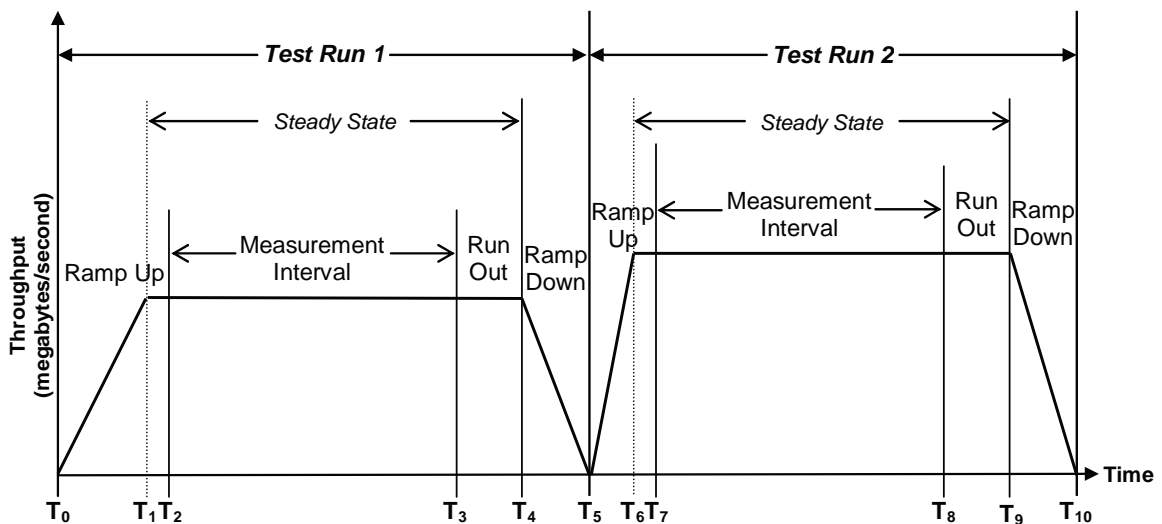
Transfer Size: The Transfer Size parameter specifies the number of bytes in KiB to transfer. (*Clause 3.4.7 of the SPC-2 Benchmark Specification*)

I/O Completion Types



- Completed and Measured I/O¹:** I/O started and completed within the Measurement Interval.
- Completed and Measured I/O²:** I/O started within the Measurement Interval and completed within Ramp Down.
- Completed I/O³:** I/O started before or after the Measurement Interval – not measured.
- Completed I/O⁴:** I/O started before and completed after the Measurement Interval – not measured.
- Failed I/O⁵:** Signaled as failed by System Software.
- Failed I/O⁶:** I/O did not complete prior to the end of Ramp-Down.
- Failed I/O⁷:** I/O did not complete prior to the end of Run-Out.

SPC-2 Test Run Components



APPENDIX B: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

The “stripe size” for all LUNs was changed to 256 KB from the default of 128 KB.

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

The following steps were used to create and configure the TSC by executing the script listed below using the HP CLI utility:

- Create two RAID 1/0 LUNs
- Enable selective storage presentation
- Add connections H1 and H2 and set host mode to Windows
- Present logical drive 1 to H1 and logical drive 2 to H2
- Enables cache ratio to 100% writes

TSC Creation/Configuration Script

```
hpacucli.exe controller wwn=500805f300038311 create type=logicaldrive
drives=1:1-1:5,1:8-1:12 raid=1+0 stripesize=256

hpacucli.exe controller wwn=500805f300038311 create type=logicaldrive
drives=2:1-2:5,3:8-3:12 raid=1+0 stripesize=256

hpacucli.exe controller wwn=500805f300038311 modify ssp=on forced

hpacucli.exe controller wwn=500805f300038311 modify
adapterid=10000000C9509B60 connectionname="H1"

hpacucli.exe controller wwn=500805f300038311 modify
adapterid=10000000C9509C44 connectionname="H2"

hpacucli.exe controller wwn=500805f300038311 modify ai=10000000C9509B60
hostmode=Windows

hpacucli.exe controller wwn=500805f300038311 modify ai=10000000C9509C44
hostmode=Windows

hpacucli.exe controller wwn=500805f300038311 ld 1 modify
unmask=10000000C9509C44

hpacucli.exe controller wwn=500805f300038311 ld 2 modify
unmask=10000000C9509B60

hpacucli.exe controller wwn=500805f300038311 modify cacheratio=100/0
```

APPENDIX D: SPC-2 WORKLOAD GENERATOR STORAGE COMMANDS AND PARAMETERS

Large File Processing Test (LFP)

```
* Master Host Definition Parameter
host=localhost,jvms=4,maxstreams=100
* Remote Host Definition Parameter
*host=(15.3.105.8,fsc2w),
*java=(C:/j2sdk1.4.2_10/bin/java.exe,-Xmx1024m -Xms128m *-Xss96k),
*spc2=C:/spc2version1/,
*shell=spc2,
*jvms=2,
*maxstreams=75

reportinginterval=5
segmentlength=512m
sd=default,host=localhost,size=169g

sd=sd1,lun=\\.\PhysicalDrive0
sd=sd2,lun=\\.\PhysicalDrive1

*sd=default,host=fsc2w,size=60g
*sd=sd1,lun=\\.\PhysicalDrive0
*sd=sd2,lun=\\.\PhysicalDrive2
*sd=sd3,lun=\\.\PhysicalDrive4
*sd=sd4,lun=\\.\PhysicalDrive7
*sd=sd5,lun=\\.\PhysicalDrive9
*sd=sd6,lun=\\.\PhysicalDrive11

* Fixed parameters
rd=default,rampup=180,measurement=180,runout=45,rampdown=15,buffers=1,periods=90

* Write Only Test
rd=default,rdpct=0,xfersize=1024k
rd=TR1_SPC-2-FP2.0,streams=28
rd=TR2_SPC-2-FP2.0,streams=14
rd=TR3_SPC-2-FP2.0,streams=7
rd=TR4_SPC-2-FP2.0,streams=3
rd=TR5_SPC-2-FP2.0,streams=1

rd=default,rdpct=0,xfersize=256k
rd=TR6_SPC-2-FP2.0,streams=28
rd=TR7_SPC-2-FP2.0,streams=14
rd=TR8_SPC-2-FP2.0,streams=7
rd=TR9_SPC-2-FP2.0,streams=3
rd=TR10_SPC-2-FP2.0,streams=1
```



```
* Read/write Test
rd=default,rdpct=50,xfersize=1024k
rd=TR11_SPC-2-FP2.0,streams=28
rd=TR12_SPC-2-FP2.0,streams=14
rd=TR13_SPC-2-FP2.0,streams=7
rd=TR14_SPC-2-FP2.0,streams=3
rd=TR15_SPC-2-FP2.0,streams=1
```

```
rd=default,rdpct=50,xfersize=256k
rd=TR16_SPC-2-FP2.0,streams=28
rd=TR17_SPC-2-FP2.0,streams=14
rd=TR18_SPC-2-FP2.0,streams=7
rd=TR19_SPC-2-FP2.0,streams=3
rd=TR20_SPC-2-FP2.0,streams=1
```

```
* Read Only Test
rd=default,rdpct=100,xfersize=1024k
rd=TR21_SPC-2-FP2.0,streams=28
rd=TR22_SPC-2-FP2.0,streams=14
rd=TR23_SPC-2-FP2.0,streams=7
rd=TR24_SPC-2-FP2.0,streams=3
rd=TR25_SPC-2-FP2.0,streams=1
```

```
rd=default,rdpct=100,xfersize=256k
rd=TR26_SPC-2-FP2.0,streams=28
rd=TR27_SPC-2-FP2.0,streams=14
rd=TR28_SPC-2-FP2.0,streams=7
rd=TR29_SPC-2-FP2.0,streams=3
rd=TR30_SPC-2-FP2.0,streams=1
```

Large Database Query Test (*LDQ*)

```
* Master Host Definition Parameter
host=localhost,jvms=4,maxstreams=100
* Remote Host Definition Parameter
*host=(15.3.105.8,fsc2w),
*java=(C:/j2sdk1.4.2_10/bin/java.exe,-Xmx1024m -Xms128m *-Xss96k),
*spc2=C:/spc2version1/,
*shell=spc2,
*jvms=2,
*maxstreams=75
```

```
reportinginterval=5
segmentlength=512m
sd=default,host=localhost,size=169g
```

```
sd=sd1,lun=\\.\PhysicalDrive0
sd=sd2,lun=\\.\PhysicalDrive1
```

```
rd=default,rdpct=99,rampup=180,measurement=180,runout=45,rampdown=15,buffer=1,periods=90
```

```
rd=default,xfersize=64k,buffer=4  
rd=TR1_SPC-2-DQ2.0,streams=28  
rd=TR2_SPC-2-DQ2.0,streams=14  
rd=TR3_SPC-2-DQ2.0,streams=7  
rd=TR4_SPC-2-DQ2.0,streams=3  
rd=TR5_SPC-2-DQ2.0,streams=1
```

```
rd=default,xfersize=64k,buffer=1  
rd=TR6_SPC-2-DQ2.0,streams=28  
rd=TR7_SPC-2-DQ2.0,streams=14  
rd=TR8_SPC-2-DQ2.0,streams=7  
rd=TR9_SPC-2-DQ2.0,streams=3  
rd=TR10_SPC-2-DQ2.0,streams=1
```

```
rd=default,xfersize=1024k,buffer=4  
rd=TR11_SPC-2-DQ2.0,streams=28  
rd=TR12_SPC-2-DQ2.0,streams=14  
rd=TR13_SPC-2-DQ2.0,streams=7  
rd=TR14_SPC-2-DQ2.0,streams=3  
rd=TR15_SPC-2-DQ2.0,streams=1
```

```
rd=default,xfersize=1024k,buffer=1  
rd=TR16_SPC-2-DQ2.0,streams=28  
rd=TR17_SPC-2-DQ2.0,streams=14  
rd=TR18_SPC-2-DQ2.0,streams=7  
rd=TR19_SPC-2-DQ2.0,streams=3  
rd=TR20_SPC-2-DQ2.0,streams=1
```

Video on Demand Delivery Test (VOD)

Persistence Test Run 1 (*write phase*)

```
* Master Host Definition Parameter  
host=localhost,jvms=4,maxstreams=100
```

```
reportinginterval=5  
segmentlength=512m  
sd=default,host=localhost,size=169g
```

```
sd=sd1,lun=\\.\PhysicalDrive0  
sd=sd2,lun=\\.\PhysicalDrive1
```

```
rd=default,rampup=180,periods=90,measurement=300,runout=0,rampdown=0,buffer=1  
rd=default,rdpct=0,xfersize=1024k  
rd=TR1-40s_SPC-2-persist-w,streams=28
```

Persistence Test Run 2 (*read phase*)

* Master Host Definition Parameter
host=localhost, jvms=4, maxstreams=100

reportinginterval=5
segmentlength=512m
sd=default, host=localhost, size=169g

sd=sd1, lun=\\.\PhysicalDrive2
sd=sd2, lun=\\.\PhysicalDrive0

rd=default, buffers=1, rdpct=100, xfersize=1024k
rd=TR1-40s_SPC-2-persist-r

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

Large File Processing Test, Large Database Query Tests, and Persistence Test Run 1

The following script was used to execute the Large File Processing and Large Database Query Tests, as well as, Persistence Test Run 1.

```
start /wait spc2 -f parmfile.vod -o msalk_fw715_aa_spc2_vod
start /wait spc2 -f parmfile.lfp -o msalk_fw715_aa_spc2_lfp
start /wait spc2 -f parmfile.ldq -o msalk_fw715_aa_spc2_ldq
start /wait spc2 -f persist-1.txt -o msalk_fw715_aa_spc2_p1
```

Persistence Test Run 2

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

```
*** executed after power cycle of storage ***
start /wait spc2 -f persist-2.txt -o msalk_fw715_aa_spc2_p1
```