SPC Benchmark 1™
Executive Summary

Fujitsu Limited
Fujitsu Storage Systems ETERNUS DX600 S3

SPC-1 V1.14

Submitted for Review: July 25, 2014
Submission Identifier: A00146

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Revision Information and Key Dates

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SPC-1 Specification revision number	V1.14
SPC-1 Workload Generator revision number	V2.3.0
Date Results were first used publicly	July 25, 2014
Date the FDR was submitted to the SPC	July 25, 2014
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	July 22, 2014

Tested Storage Product (TSP) Description

The scalable, unified Fujitsu Storage ETERNUS DX600 S3 system delivers leading storage performance and automated quality of service management enabling a maximum of system utilization and contributing to a fast ROI. It is the perfect solution when consolidating data in large-scale databases, business critical applications and business analytics / big data - all into one system.

It provides ample headroom for demanding server/desktop virtualization environments and enterprise file services. Extensive high-availability and disaster recovery capabilities make ETERNUS DX600 S3 an ideal storage system for business-critical data.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Fujitsu Storage Systems ETERNUS DX600 S3	
Metric	**Reported Result**
SPC-1 IOPS™	320,206.35
SPC-1 Price-Performance™	$1.54/SPC-1 IOPS™
Total ASU Capacity	5,306.00GB
Data Protection Level	Protected 2 *(mirroring)*
Total Price	$493,346.14
Currency Used	U.S. Dollars
Target Country for availability, sales and support	USA

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

SPC-1 Price-Performance™ is the ratio of **Total Price** to **SPC-1 IOPS™**.

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

A **Data Protection Level** of **Protected 2** using *Mirroring* configures two or more identical copies of user data..

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

Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 8.
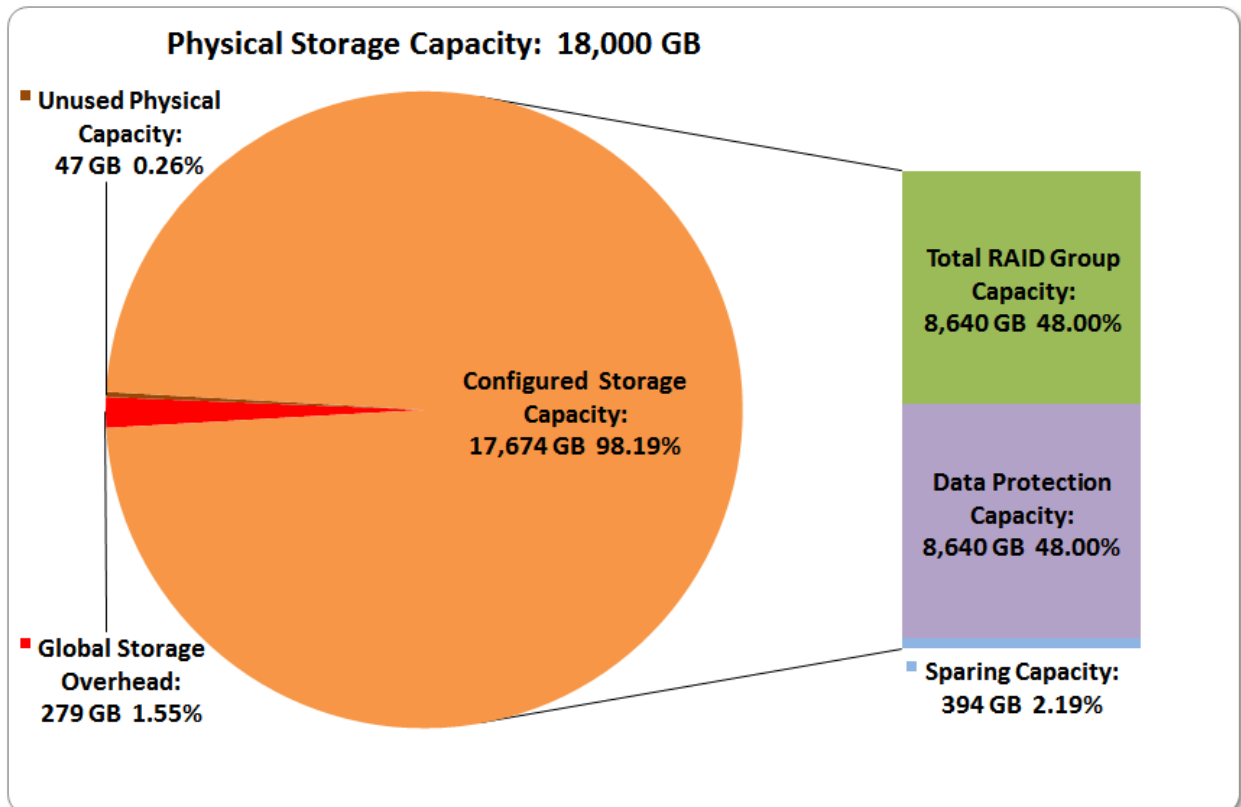
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency).*
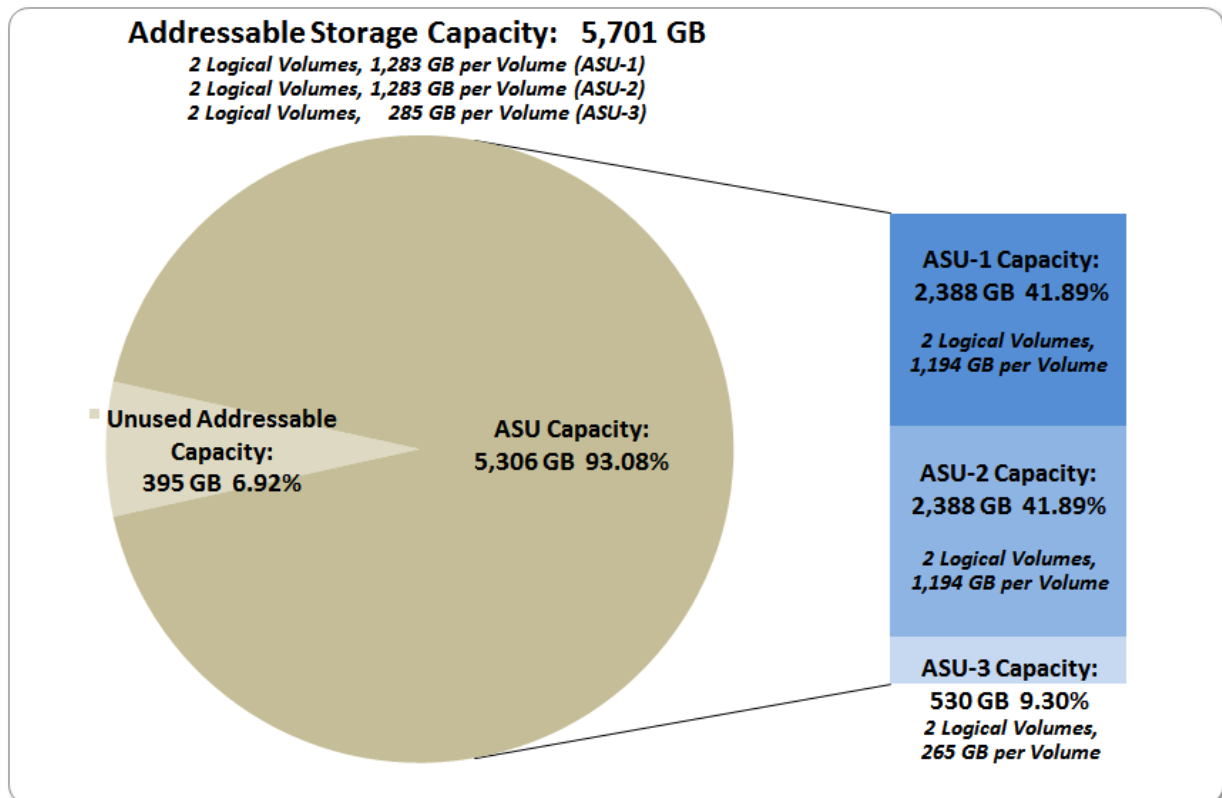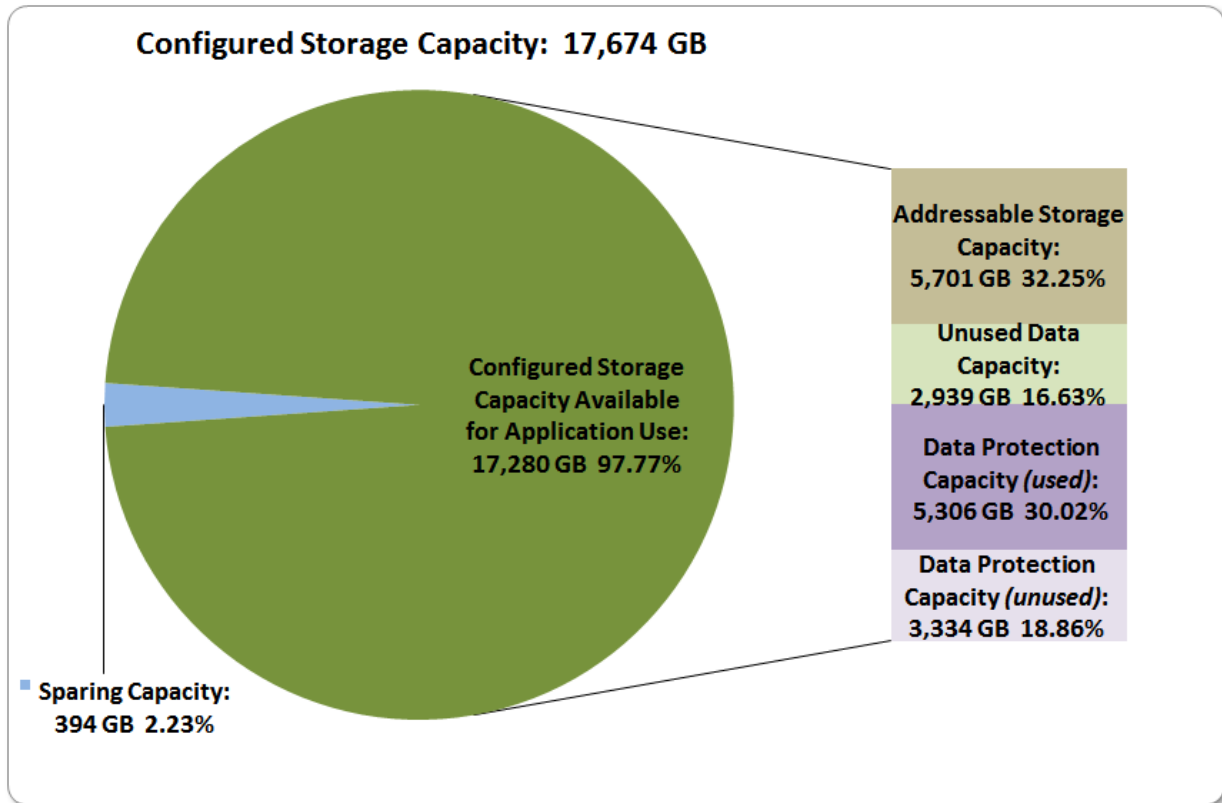
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

Storage Capacities, Relationships, and Utilization

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

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

Physical Storage Capacity: 18,000 GB

- Unused Physical Capacity: 47 GB 0.26%
- Configured Storage Capacity: 17,674 GB 98.19%
- Global Storage Overhead: 279 GB 1.55%
- Total RAID Group Capacity: 8,640 GB 48.00%
- Data Protection Capacity: 8,640 GB 48.00%
- Sparing Capacity: 394 GB 2.19%

Configured Storage Capacity: 17,674 GB

Configured Storage Capacity Available for Application Use: 17,280 GB 97.77%

Sparing Capacity: 394 GB 2.23%

Addressable Storage Capacity: 5,701 GB 32.25%

Unused Data Capacity: 2,939 GB 16.63%

Data Protection Capacity *(used)*: 5,306 GB 30.02%

Data Protection Capacity *(unused)*: 3,334 GB 18.86%

Addressable Storage Capacity: 5,701 GB

2 Logical Volumes, 1,283 GB per Volume (ASU-1)
2 Logical Volumes, 1,283 GB per Volume (ASU-2)
2 Logical Volumes,   285 GB per Volume (ASU-3)

Unused Addressable Capacity: 395 GB 6.92%

ASU Capacity: 5,306 GB 93.08%

ASU-1 Capacity: 2,388 GB 41.89%
2 Logical Volumes, 1,194 GB per Volume

ASU-2 Capacity: 2,388 GB 41.89%
2 Logical Volumes, 1,194 GB per Volume

ASU-3 Capacity: 530 GB 9.30%
2 Logical Volumes, 265 GB per Volume

Total Unused Storage Capacity Ratio and Details

Physical Storage Capacity: 18,000 GB

■ **Unused Physical Capacity: 47 GB**

Physical Storage Capacity Used: 11,285 GB 62.69%

Total Unused Storage Capacity: 6715 GB 37.31%

Unused Configured Capacity: 5,879 GB

(Includes 2,939 GB of unused RAID Group capacity and 2,939 GB of unused Data Protection Capacity)

■ **Unused Addressable Capacity: 395 GB**

■ **Unused Data Protection: 395 GB**

SPC-1 Storage Capacity Utilization	
Application Utilization	29.48%
Protected Application Utilization	58.96%
Unused Storage Ratio	37.31%

Application Utilization: Total ASU Capacity *(5,306.000 GB)* divided by Physical Storage Capacity *(18,000.000 GB)*.

Protected Application Utilization: (Total ASU Capacity *(5,306.000 GB)* plus total Data Protection Capacity *(8,639.864 GB)* minus unused Data Protection Capacity *(3,333.864 GB)*) divided by Physical Storage Capacity *(18,000.000 GB)*.

Unused Storage Ratio: Total Unused Capacity *(6,714.972 GB)* divided by Physical Storage Capacity *(18,000.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 25-26 in the Full Disclosure Report.

Response Time – Throughput Curve

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

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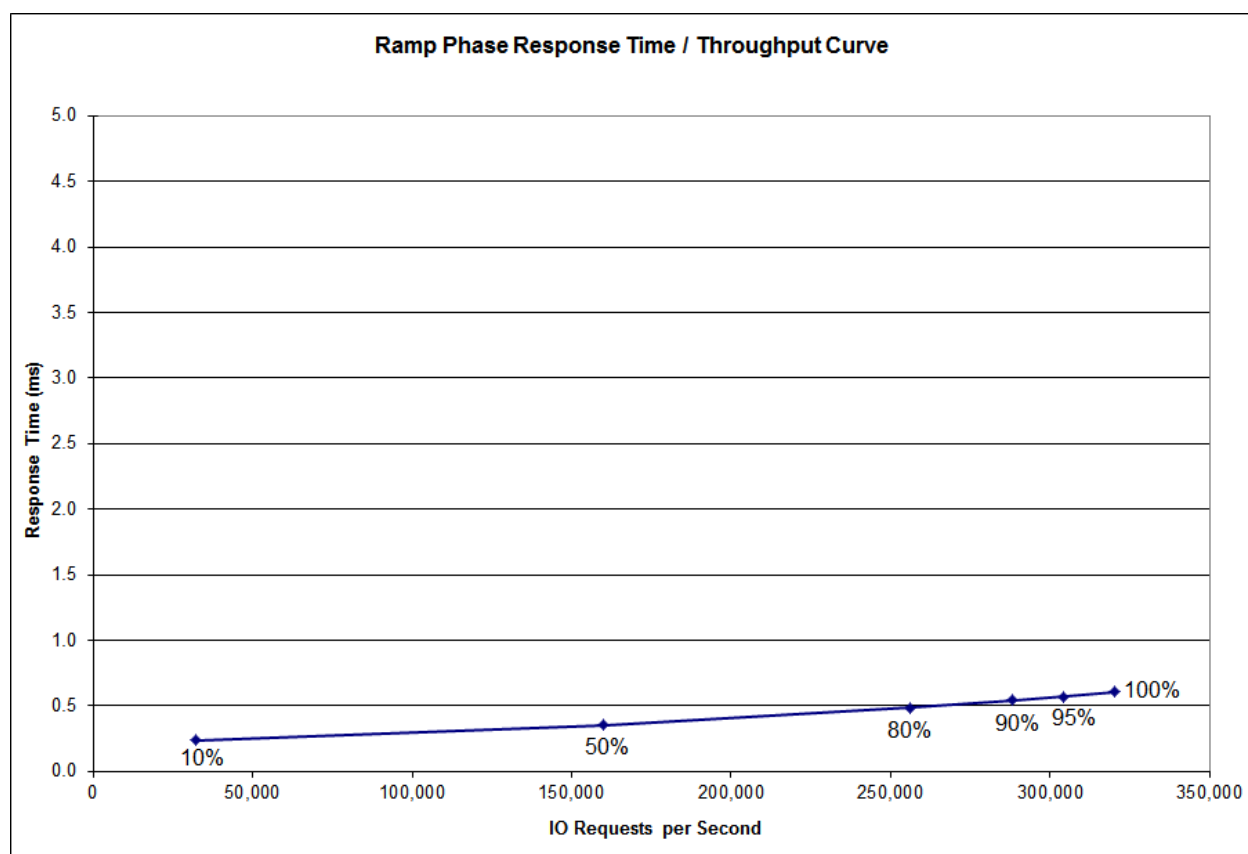
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	31,993.50	160,100.49	256,184.93	288,234.65	304,212.79	320,206.35
Average Response Time (ms):						
All ASUs	0.24	0.35	0.48	0.54	0.57	0.61
ASU-1	0.25	0.41	0.57	0.64	0.68	0.72
ASU-2	0.26	0.47	0.67	0.76	0.80	0.85
ASU-3	0.19	0.19	0.22	0.23	0.25	0.26
Reads	0.33	0.63	0.92	1.04	1.10	1.16
Writes	0.17	0.17	0.20	0.21	0.23	0.24

Priced Storage Configuration Pricing

Product ID	Product Name	Qty	Unit List Price	Extended LP	Discount %	Discounted Price
ET603SAU	DX600 S3 Base System Dual Controllers (CMs) Rackmount (AC200V, 3RU)	1	$39,515.00	$39,515.00	30%	$27,660.50
ETPEADU	Drive Enclosure - DX500/600 Rackmount (AC200V, 2RU) (2.5" HDD)	4	$4,275.00	$17,100.00	30%	$11,970.00
ETPM8H	Cache Memory - DX600 S3 128GB (64GB per CM)	1	$48,000.00	$48,000.00	30%	$33,600.00
ETPHH4	FC Host Channel Adapter (CA) pair, 4 ports DX500/600 S3 (2 ports per CA) (4/8/16Gbps, Host/Remote Connect)	4	$10,500.00	$42,000.00	30%	$29,400.00
ETPSA4	MLC-SSD 400GB 2.5" Drive x1 SAS for DX100/200 S3	45	$8,000.00	$360,000.00	30%	$252,000.00
QLE2562	QLogic 8Gbps Dual Port Fibre Channel Host Bus Adapter	16	$2,597.85	$41,565.60	10%	$37,409.04
ETPKC10U	AC Power Cords (125V - IEC320-C14, 0.5m)	5	$130.00	$650.00	30%	$455.00
ETPP12U-L	Power Distribution Unit for DX (AC240V, 6 enclosures, 2RU)	1	$2,170.00	$2,170.00	30%	$1,519.00
ETPRANU	Base Rack (42RU, 1000x2000mm) with Front & Rear Doors, side panels without Earthquake Stabilizers	1	$4,210.00	$4,210.00	30%	$2,947.00
61-343827-003	Fibre Channel Host IF Cable LC/LC - 3m	16	$132.00	$2,112.00	30%	$1,478.40
(Provide 24 hour per day / 7days per week 4 hour response maintenance for 36 months within North America)						
ETD600-W059360-ABD	Warranty Service, 36 months Standard, 9x5 phone, NBD response	1	$0.00	$0.00		$0.00
ETD600-U004361-ABD	Warranty Uplift, 36 months Enhanced plus, 24x7 4hr onsite	1	$116,204.00	$116,204.00	20%	$92,963.20
ETD600-N067005-ABD	ETERNUS Installation, normal business hours	1	$2,430.00	$2,430.00	20%	$1,944.00
SFPs are included.				Total:		$493,346.14

The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems within four (4) hours.

- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.
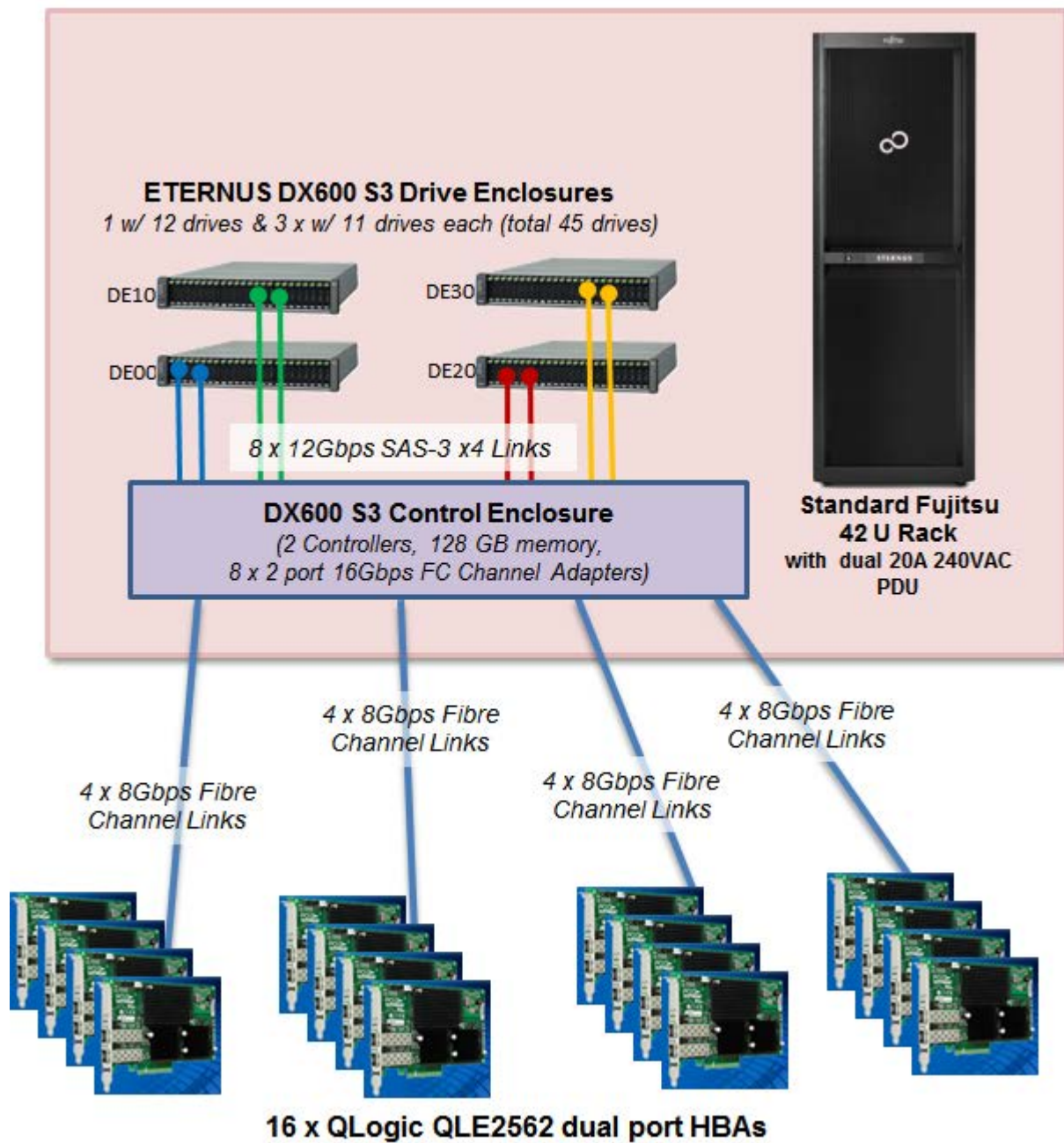
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

The TSC was configured with four Channel Adapters (CAs), each with 4 ports of which 2 ports were used in each CA for the SPC-1 measurements. The Priced Storage Configuration included four Channel Adapters (CAs) each with 2 ports. If the TSC had been configured with the 2 port CAs there would not have been a difference in the reported SPC-1 performance.

The TSC was configured with rack that had three PDUs, but the TSC only utilized the capacity of one PDU. The Priced Storage Configuration included only a single PDU. If the TSC had been configured with only a single PDU there would not have been a difference in the reported SPC-1 performance.

Priced Storage Configuration Diagram

Priced Storage Configuration Components

Priced Storage Configuration
8 – QLogic QLE2562 dual-port HBAs

Fujitsu Storage Systems ETERNUS DX600 S3
 	
  1 – DX600 S3 Control Enclosure with
     2 – Controllers (CMs) each with
          64 GB cache (128 GB total)
            4 – FC Channel Adapters (CAs) each with
               2 – 16 Gbps FC host ports
                  (8 ports per CM, 16 ports total)
            4 – SAS Expander Drive Interfaces with QSFP 12 Gbps SAS-3
               (2 – SAS-3 x4 links per interface,
               8 – SAS-3 x4 links total and used)

45 – 400 GB SAS MLC 2.5" SSD storage devices

4 – ETERNUS DX600 S3 Drive Enclosures each with
     24 – Hot Swap drive slots
       2 – SAS Interface/Expander Modules with QSFP 12 Gbps SAS-3
     (12 – 400 GB SAS MLC 2.5" SSD storage devices in one enclosure)
     (11 – 400 GB SAS MLC 2.5" SSD storage devices in each of three enclosures)

1 – Standard Fujitsu 42U Rack with a dual 20A 240VAC PDU