FUJITSU

THE POSSIBILITIES ARE INFINITE

SPC BENCHMARK 2™

EXECUTIVE SUMMARY

FUJITSU LIMITED

FUJITSU STORAGE SYSTEMS ETERNUS DX440 S2

SPC-2™ V1.3

Submitted for Review: April 10, 2012
Submission Identifier: B00057
Revised: April 12, 2012

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Fujitsu Limited – http://www.fujitsu.com/services/computing/storage/ Fujitsu America, Inc. C.A. (Sandy) Wilson Sandy_Wilson@us.fujitsu.com 1250 East Arques Ave PO Box 3470 Sunnyvale, CA 94088-3470 Phone: (916) 434-8593
Test Sponsor Alternate Contact	Fujitsu Limited – http://www.fujitsu.com/services/computing/storage/ Fujitsu America, Inc. Kun Katsumata Kun_Katsumata@us.fujitsu.com 1250 East Arques Ave PO Box 3470 Sunnyvale, CA 94088-3470 Phone: (408) 746-6415
Test Sponsor Alternate Contact	Fujitsu Limited http://www.fujitsu.com/services/computing/storage/ Yasuhito Arikawa y.arikawa@jp.fujitsu.com 1-1 Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa-ken 211-8588, Japan Phone: (044) 754-3632 FAX: (044) 754-3719
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	V1.3
SPC-2 Workload Generator revision number	V1.0
Date Results were first used publicly	April 10, 2012
Date FDR was submitted to the SPC	April 10, 2012
Date revised FDR was submitted to the SPC Revised SPC-2 Reported Data table to reflect the correct values	April 12, 2012
Date the TSC will be available for shipment to customers	currently available
Date the TSC completed audit certification	April 9, 2012

Tested Storage Product (TSP) Description

The Fujitsu ETERNUS DX440 S2 is a flexible, highly reliable storage array, equipped with redundant components to provide uncompromised availability to mid market requirements. A mixture of 300GB, 450GB, 600GB, & 900GB 10krpm 2.5" SAS drives, 300GB, 450GB, & 600GB 15krpm 3.5" SAS drives, as well as 1TB, 2TB, & 3TB Nearline SAS drives may be used. SSD drives are also available in 100 GB, 200 GB and 400 GB sizes. Up to 960 2.5" drives may be included, or up to 480 3.5" drives. Both sized drives can be included in the same storage array. The drives may be arranged in a variety of RAID groups, including RAID1, RAID1+0(10), RAID5, RAID6, and RAID5+0(50). The product is offered with Fibre Channel (4 port as tested or 2 port 2/4/8Gbps versions), iSCSI (1Gbps & 10 Gbps 2 port), and FCoE (10 Gbps 2 port) host connection Channel Adapters. Up to four Channel Adapters can be attached to each of the two Controllers, with multiple types available. In addition, a number of different snapshot and replication facilities, native disk data encryption, and MAID capabilities are available.

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				
Fujitsu Storage Systems ETERNUS DX440 S2				
SPC-2 MBPS™	**SPC-2 Price-Performance**	**ASU Capacity (GB)**	**Total Price**	**Data Protection Level**
5,768.04	$66.50	42,133.629	$383,576.20	Protected *(Mirroring)*
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)				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LFP Composite	4,558.06			$84.15
Write Only:				
1024 KiB Transfer	1,988.88	32	62.15	
256 KiB Transfer	1,952.51	32	61.02	
Read-Write:				
1024 KiB Transfer	3,100.13	32	96.88	
256 KiB Transfer	3,088.52	32	96.52	
Read Only:				
1024 KiB Transfer	8,657.02	72	120.24	
256 KiB Transfer	8,561.27	72	118.91	
The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP Test Phases: (Write Only, Read-Write, and Read Only).				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
LDQ Composite	8,027.49			$47.78
1024 KiB Transfer Size				
4 I/Os Outstanding	8,227.59	72	114.27	
1 I/O Outstanding	8,232.56	72	114.34	
64 KiB Transfer Size				
4 I/Os Outstanding	8,064.08	72	112.00	
1 I/O Outstanding	7,585.73	72	105.36	
The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ Test Phases: (1024 KiB and 64 KiB Transfer Sizes).				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate *(MB/second)*	**Number of Streams**	**Data Rate per Stream**	**Price-Performance**
	4,718.58	6,000	0.79	$81.29

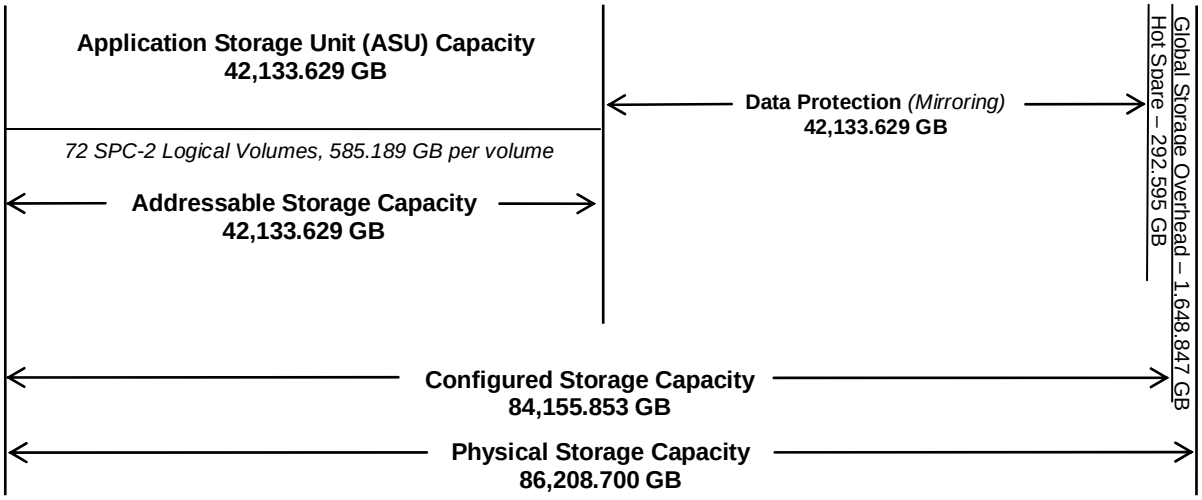
SPC-2 MBPS™ represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

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

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

Storage Capacities and Relationships

The following diagram *(not to scale)* 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.



SPC-1 Storage Capacity Utilization	
Application Utilization	48.87%
Protected Application Utilization	97.75%
Unused Storage Ratio	0.00%

Application Utilization: Total ASU Capacity *(42,133.629 GB)* divided by Physical Storage Capacity *(86,208.700 GB)*.

Protected Application Utilization: Total ASU Capacity *(42,133.629 GB)* plus total Data Protection Capacity *(42,133.629 GB)* minus unused Data Protection Capacity *(0.000 GB)* divided by Physical Storage Capacity *(86,208.700 GB)*.

Unused Storage Ratio: Total Unused Capacity *(0.000 GB)* divided by Physical Storage Capacity *(86,208.700 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 24-25 in the Full Disclosure Report.

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

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

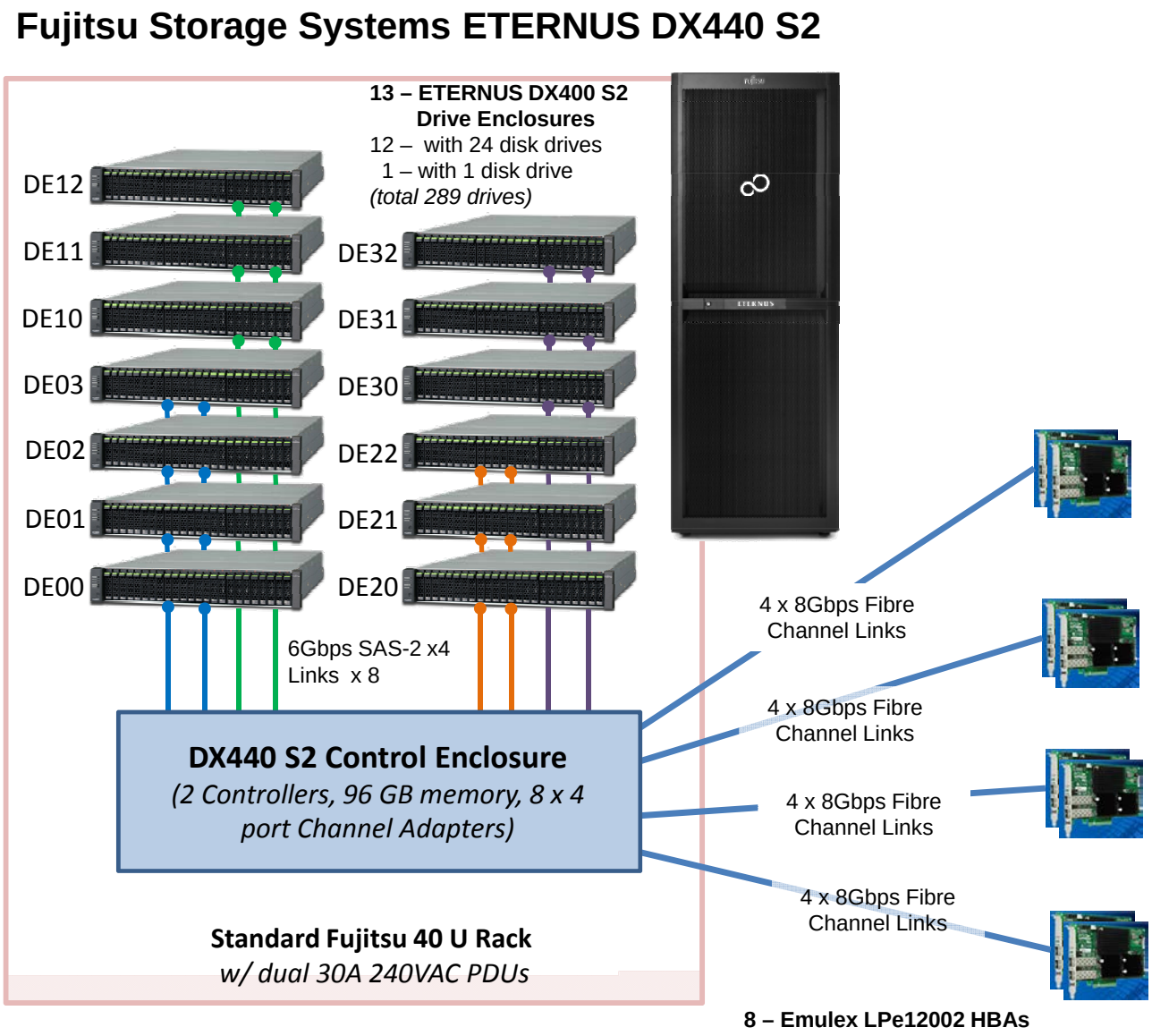
Priced Storage Configuration Pricing

Product ID	Product Name	Qty	Unit List Price	Extended LP	Discount %	Discounted Price
ET442SAU	DX440 S2 Base System Rackmount (AC200V, 3RU)	1	$39,515.00	$39,515.00	30%	$27,660.50
ETNHF24	FC Host Interface, pair - 8 ports (2/4/8 Gbps, Host/Remote Connect)	4	$10,300.00	$41,200.00	30%	$28,840.00
ETNM86	48GB Cache Memory for DX440 S2 (8GB two sets of 3)	2	$3,600.00	$7,200.00	30%	$5,040.00
ETNAD2CU	Drive Enclosure (2.5" HDD) Rackmount (AC200V, 2RU)	13	$6,700.00	$87,100.00	30%	$60,970.00
ETND3HC	300GB/10krpm 2.5" Disk Drives	289	$865.00	$249,985.00	30%	$174,989.50
19R-174A1	Base Rack - Standard (40RU) with Front & Rear doors, side panels	1	$3,150.00	$3,150.00	30%	$2,205.00
19R-16BP31	Blank panel (3RU)	3	$60.00	$180.00	30%	$126.00
19R-16BP21	Blank panel (2RU)	1	$40.00	$40.00	30%	$28.00
ETNP16U-L	Power Distribution Unit for DX (AC240V, 30A - 8 enclosures, 2RU)	2	$1,520.00	$3,040.00	30%	$2,128.00
Third-Party LP312002-M8	Emulex 8Gbps Dual Port Fibre Channel Host Bus Adapter	8	$1,785.00	$14,280.00	10%	$12,852.00
61-343827-003	Fibre Channel Cable LC-LC 3 m	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)					
	36 months, Enhanced Plus	1	$96,084.00	$96,084.00	30%	$67,258.80
	SFPs are included.			**Total:**		**$383,576.20**

The following pricing includes the following:

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

Priced Storage Configuration Diagram



Priced Configuration Components

Priced Storage Configuration
8 – Emulex LPe12002-M8 FC dual port FC HBAs *(8 Gbps)*
Fujitsu Storage Systems ETERNUS DX440 S2 2 – Controller Modules, each with: 48 GB cache *(96 GB total)* Flash Memory power fail protection 4 – Channel Adapter modules, each with 4 –8 Gbps Fibre Channel ports *(front-end Host connections, 16 total and 8 used)* *(32 connections available and 16 used with both controllers)* 4 – SAS 2 x4 Expander Drive interfaces *(backend connections to first drive enclosure*)
13 –ETERNUS DX400 S2 Drive Enclosures, each with 2 – I/O Modules, each with SAS 2 x 4 Expander Drive interface *(2 total, 2 used)*
289 – 300 GB 10K RPM 2.5” SAS Disk Drives: *24 disk drives in each of 12 ETERNUS DX400 S2 Drive Enclosures* *1 disk drive in 1 ETERNUS DX80 S2 Drive Enclosure*
1 – standard Fujitsu 40U rack w/dual 30A 240VAC PDUs