SPC BENCHMARK 1™

EXECUTIVE SUMMARY

FUJITSU LIMITED

FUJITSU STORAGE SYSTEMS ETERNUS DX8400

SPC-1 V1.12

Submitted for Review: May 25, 2010
Submission Identifier: A00093

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	V1.12
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	May 25, 2010
Date the FDR was submitted to the SPC	May 25, 2010
Date the priced storage configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	May 25, 2010

Tested Storage Product (TSP) Description

The Fujitsu ETERNUS DX8400 is a flexible, highly reliable storage array, equipped with redundant components to provide uncompromised availability to the high end and mid market requirements. A mixture of 300GB, 450GB, and 600GB 15krpm Fibre Channel disk drives, as well as 500GB, 750GB, and 1TB Nearline SATA disk drives may be used, up to a maximum of 1004 drives. The drives may be arranged in a variety of RAID groups, including RAID0, RAID1, RAID1+0(10), RAID5, and RAID6.

The product is offered with Fibre Channel (as tested), and iSCSI host connection options, with up to 64 channels available. In addition, a number of different snapshot and replication facilities, native disk data encryption, thin provisioning, and MAID capabilities are available.

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: Fujitsu Storage Systems ETERNUS DX8400	
Metric	**Reported Result**
SPC-1 IOPS™	171,736.84
SPC-1 Price-Performance	$8.39/SPC-1 IOPS™
Total ASU Capacity	99,080.868 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$1,440,545

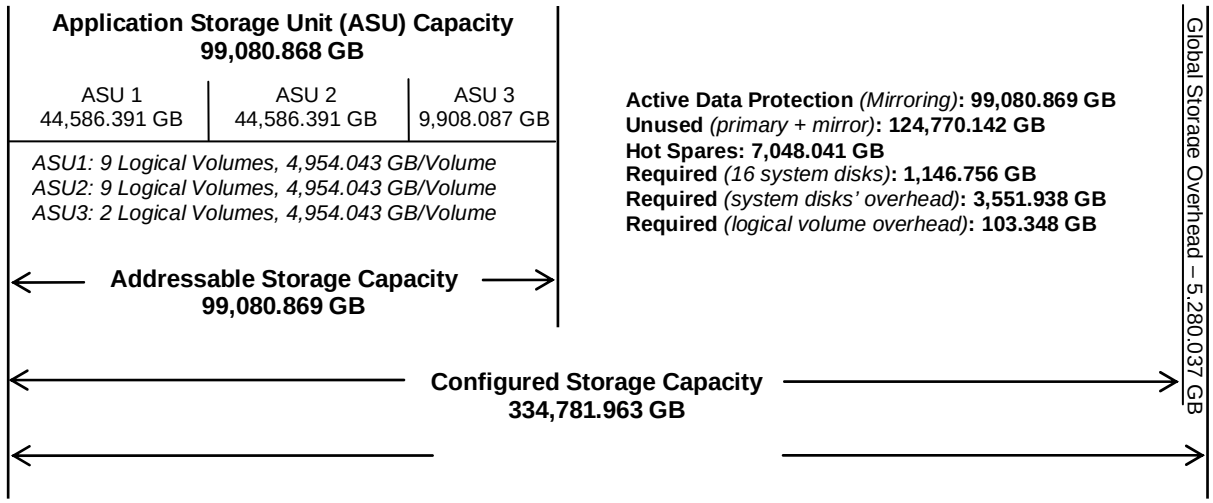
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU *(Application Storage Unit)* **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 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 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	29.14%
Protected Application Utilization	58.29%
Unused Storage Ratio	36.69%

Application Utilization: Total ASU Capacity *(99,080.868 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*.

Protected Application Utilization: Total ASU Capacity *(99,080.868 GB)* plus total Data Protection Capacity *(161,517.614 GB)* minus unused Data Protection Capacity *(62,385.071 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*.

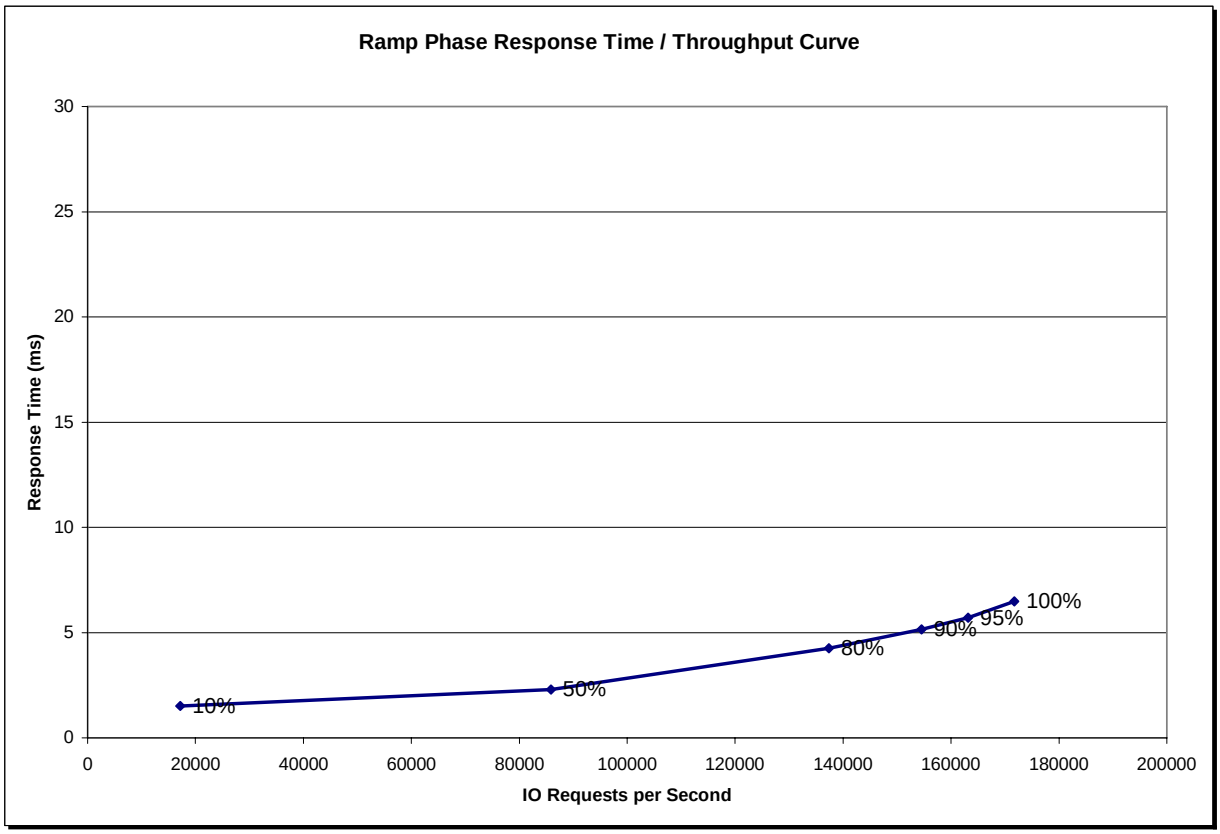
Unused Storage Ratio: Total unused capacity *(124,770.143 GB)* divided by Physical Storage Capacity *(340,062.001 GB)*. The Unused Storage Ratio cannot exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 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	17,147.78	85,840.06	137,411.58	154,560.30	163,176.06	171,736.84
Average Response Time (ms):						
All ASUs	1.52	2.29	4.26	5.15	5.71	6.47
ASU-1	2.09	3.03	5.07	6.06	6.69	7.54
ASU-2	1.33	2.12	4.12	5.01	5.55	6.27
ASU-3	0.38	0.81	2.59	3.28	3.70	4.29
Reads	3.29	4.59	6.80	7.96	8.69	9.63
Writes	0.36	0.80	2.60	3.32	3.77	4.42

Priced Storage Configuration Pricing

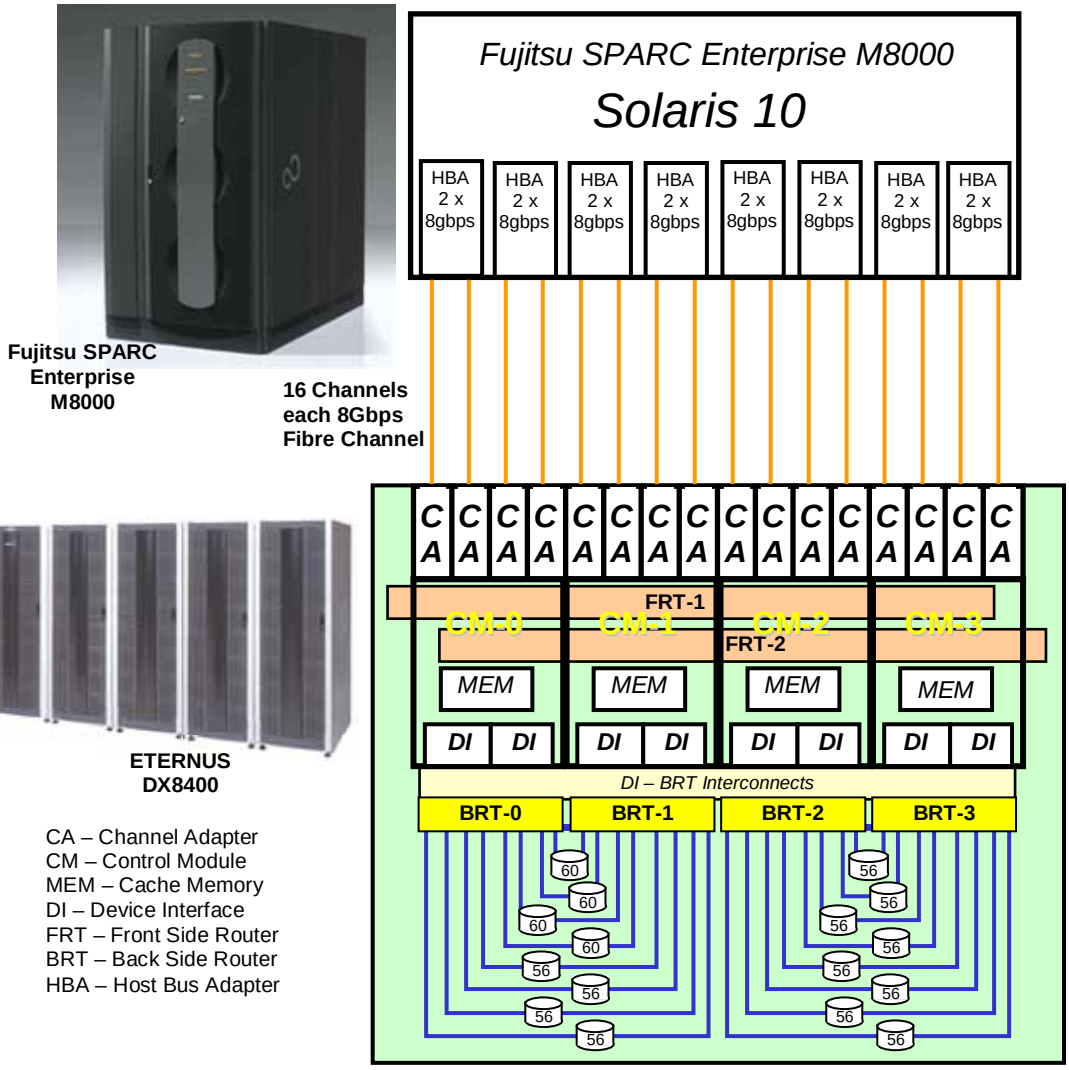
Item	Fujitsu ETERNUS DX8400 Product Id	Description	Qty	List Price Unit $	List Price Extd $
1	ET84S20AU	ETERNUS DX8400 Base Unit includes: 1x 1800mm rack, 2x controller module, 2x frontend router, 2x backend router, 4x drive enclosure, 4x system disk drive, 4x power distribution unit (AC200-240V)	1		
2	ETHERAU	Expansion Rack (DX8400/DX8700) includes: 1x 1800mm rack, 4x power distribution unit (AC200-240V)	5		
3	ETHDE1AU	Drive Enclosure (DX8400, basic rack w/BRT pair) includes: 4x drive enclosure, 2x backend router, 2x power distribution unit (AC200-240V)	1		
4	ETHDE2AU	Drive Enclosure (DX8400, Expansion rack) includes: 4x drive enclosure	14		
5	ETHC4U	Expansion Controller (DX8400) includes: 2x controller module, 2x power supply unit, 4x system disk drive	1		
6	ETHHF84U	Host Interface (8GBPS, 4-PORT) includes: 2x 2-port FC (8Gbps) CA	1		
7	ETMHF88U	HOST INTERFACE (8GBPS, FC, 8-PORT) includes: 2x 4-port FC (8Gbps) CA	7		
8	ETHFC3HU	300GB/15KRPM DISK DRIVE	440		
9	ETHFC4HU	450GB/15KRPM DISK DRIVE	456		
10	ETHM04U	Cache Memory (32GB) includes: 8x 4GB DIMM	4		
11	ETHMSSU	Cache Expansion Kit (DX8400) includes: 4x system disk drive	2		
	Total	ETERNUS DX8400 Storage Array System	1	$2,335,000	$2,335,000
12	61-343827-015	LC/LC Fibre Channel Cable, 15 M. (Multimode - 50/125um, Riser Rated)	16	$181	$2,896
13	QLE2562-CK	Qlogic 8Gbps HBA	8	$2,597	$20,776
14	ETDX84-W004240-ABW	EDTX 8400 Warranty, 24 months, Enhanced Plus 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	1	$0	$0
15	ETDX84-P004121-ABW	ETDX 8400 Post Wararnty, 12 Months Enhanced Plus 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	1	$219,204	$219,204
16	ETDX84-P004121-ABX	ETDX 8400 Post Warranty, 12 Months Ehnaced Plus Expansion Kit Post Warranty coverage (ETHMSSU) 24x7x365 Phone support 24x7x365 Onsite and Parts within 4 hours	2	$120	$240
17	ETDX84-N067005-ABW	ETDX 8400 Installation during normal business hours ETERNUS Installation, One Time billing	1	$3,500	$3,500
18	FTSPS-ET-QSDX840	Professional Services-ETERNUSDX Model 8400 Quickstart ETERNUS Quickstart, One Time billing	1	$13,875	$13,875
		Total Fujitsu Product List Price			$2,335,000
		Product Discount		45%	
		Net Product Price			$1,284,250
		Total Non Fujitsu Product List Price			$23,672
		Product Discount		40%	
		Net Non Fujitsu Product Price			$14,203
		Total Service List Price			$236,819
		Service Discount		40%	
		Net Service Price			$142,091
		Total Sell Price, including 3 years Service			**$1,440,545**

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

The Tested Storage Configuration had a mixture of 4 port and 2 port Fibre Channel 8Gbps channel adapters (CA), also called Host Interfaces, due to availability of equipment in the lab. A total of 16 CAs were installed – 13 x 4-port units and 3 x 2-port units. Only a single port on each of the 16 CAs was used in the Tested Storage Configuration.

The Priced Storage Configuration includes 14 x 4 port units and 2 x 2 port units. That configuration, if used in the TSC, would have not had any impact on the reported SPC-1 IOPS.

Priced Storage Configuration Diagram



Priced Storage Configuration Components

Priced Storage Configuration:
8 –Qlogic QLE2562-CK dual-port 8 Gbps HBAs
SC-1: Fujitsu Storage Systems ETERNUS DX8400 4 – Controller Modules, each with 32 GB cache *(128 GB total)* 4 – Channel Adapter (CA) modules *(16 total)* 14 – 4 port 8 Gbps FC CAs 2 – 2 port 8 Gbps FC CAs 60 ports configured 1 port used per CA, 16 total used 2 – Front Side Routers 2 – Back Side Routers
16 – Front side Fibre Channels *(8 Gbps)* 16 – Back side Fibre Channels *(4 Gbps)*
64 – Drive Enclosure Modules, each with dual switched FC-AL interfaces, 15 hot swap drive slots
456 – 300 GB 15K RPM disk drives *(440 drives in 44 RAID Groups and 16 reserved for system use)* 456 – 450 GB 15K RPM disk drives *(440 drives in 44 RAID Groups plus 16 Hot Spares)*