SPC Benchmark 1™
Executive Summary

Dell, Inc.
Dell Storage SC4020 *(6 SSDs)*

SPC-1 V1.14

Submitted for Review: March 18, 2015
Submission Identifier: A00156

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Test Sponsor Alternate Contact	Dell, Inc. – http://www.dell.com John Shirley – John_Shirley@dell.com 7625 Smetana Lane Eden Prairie, MN 55344 Phone: (952) 563-9233 FAX: (952) 567-6600
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-1 Specification revision number	V1.14
SPC-1 Workload Generator revision number	V2.3.0
Date Results were first used publicly	March 18, 2015
Date the FDR was submitted to the SPC	March 18, 2015
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	March 17, 2015

Tested Storage Product (TSP) Description

Dell Storage SC4020 provides superior storage performance for the medium-to-large enterprise with easy management and maximized effectiveness. The full line of Dell Storage SC4020 solution provides a wide range of flexibility for both front-end and back-end connectivity, drive types and interfaces, and RAID levels.

Dell Storage SC4020 provides intuitive and automated tools and reports for easy management and comes with Dell Copilot support services that include 24x7 active system monitoring to help improve performance and stability. It also comes with perpetual software licensing even across hardware upgrades.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Dell Storage SC4020 *(6 SSDs)*	
Metric	**Reported Result**
SPC-1 IOPS™	112,479.81
SPC-1 Price-Performance™	$0.37/SPC-1 IOPS™
Total ASU Capacity	984.054 GB
Data Protection Level	Protected 2 *(mirroring)*
Total Price	$41,836.40
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.
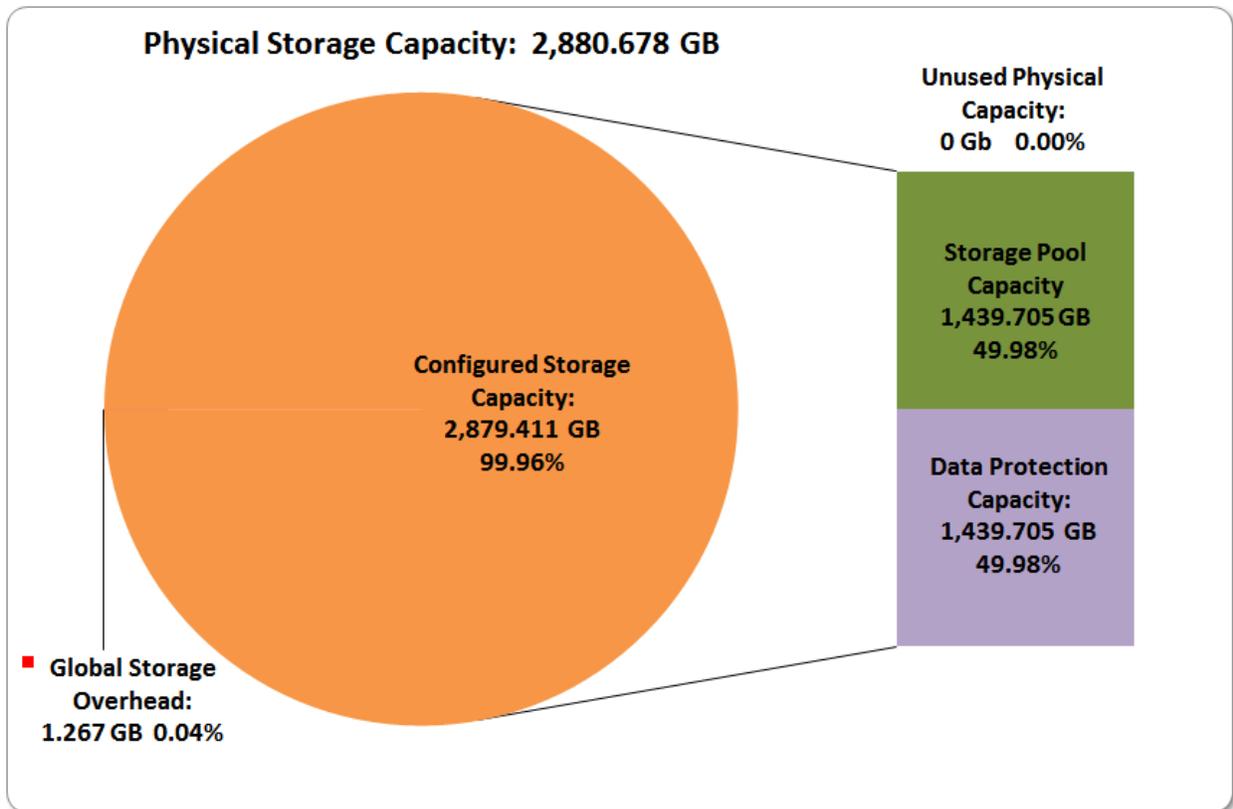
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency)*.
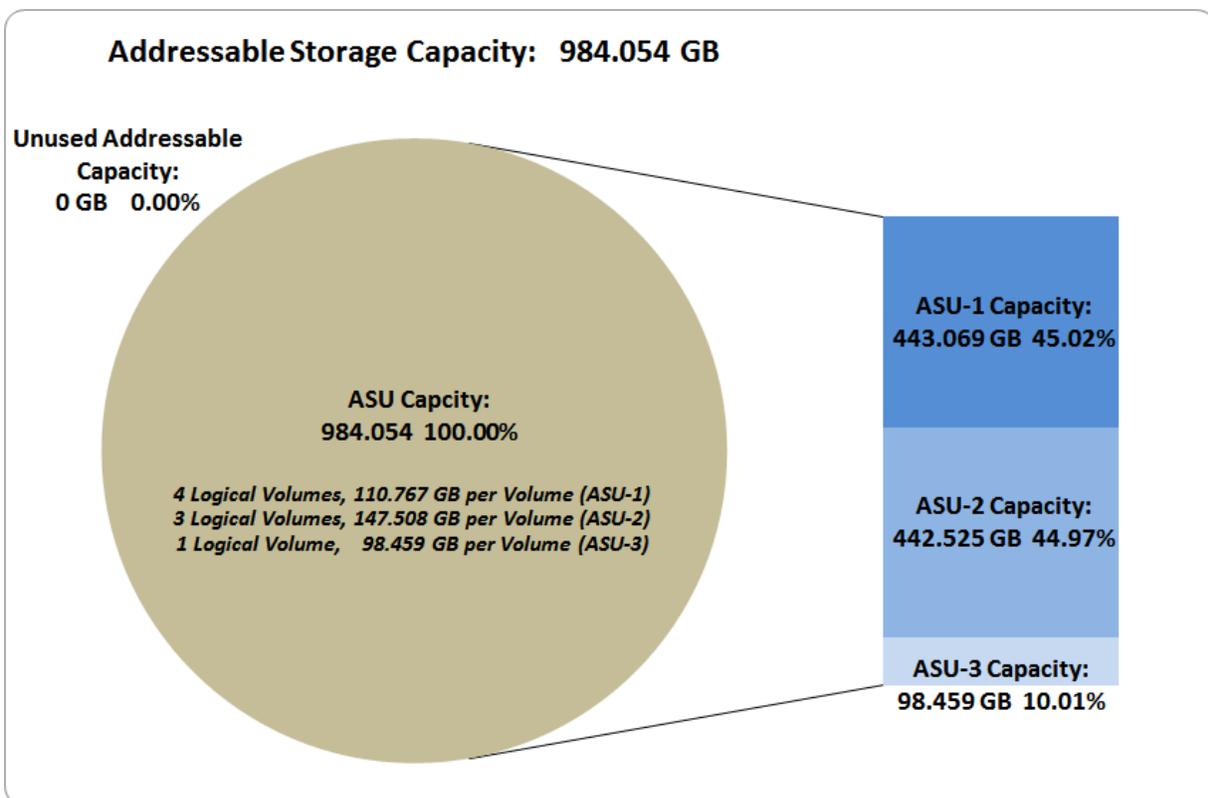
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

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.

Configured Storage Capacity: 2,897.411 GB

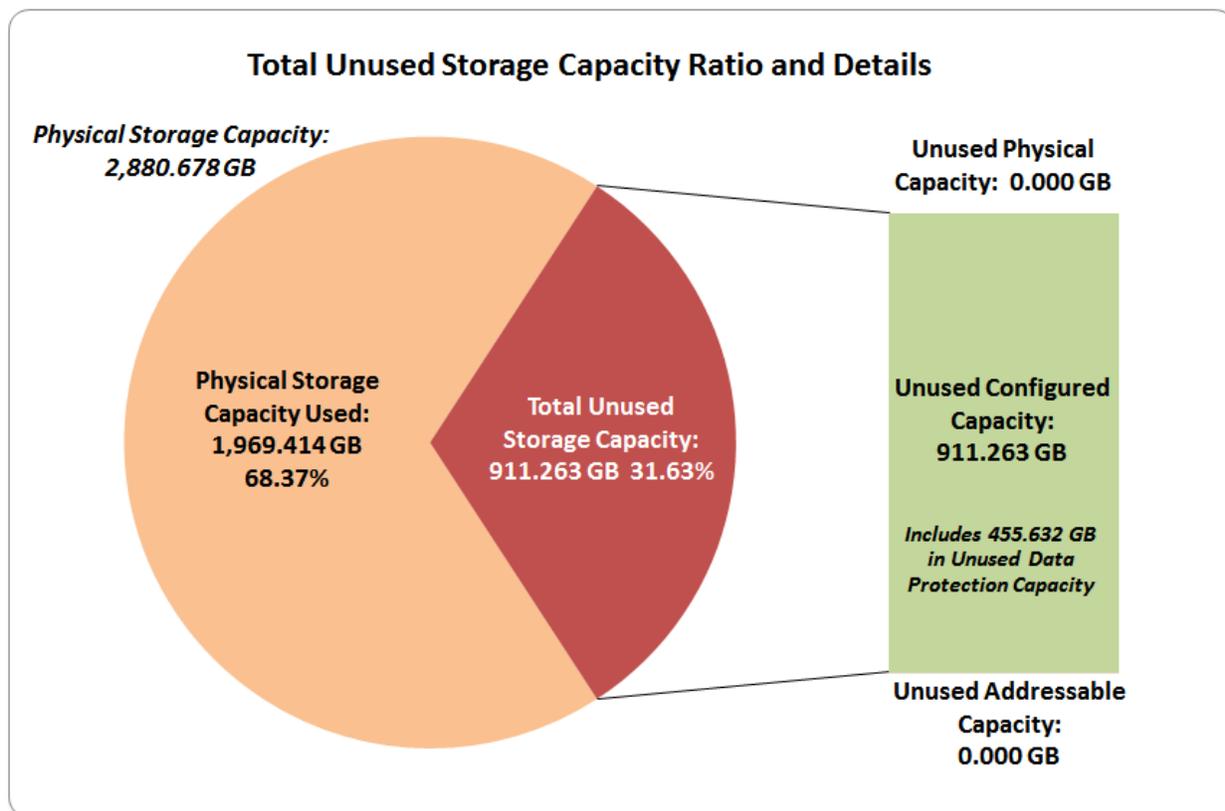**Configured Storage Capacity Available for Application Use:**
2,879.391 GB
100.00%

Addressable Storage Capacity:
984.054 GB 34.18%

Data Protection Capacity *(used)*:
984.074 GB 34.18%

Unused Configured Capacity:
911.263 GB 31.65%

Includes 455.632 GB in Unused Data Protection Capacity

Addressable Storage Capacity: 984.054 GB

Unused Addressable Capacity:
0 GB   0.00%

ASU Capcity:
984.054 100.00%

4 Logical Volumes, 110.767 GB per Volume (ASU-1)
3 Logical Volumes, 147.508 GB per Volume (ASU-2)
1 Logical Volume,   98.459 GB per Volume (ASU-3)

ASU-1 Capacity:
443.069 GB 45.02%

ASU-2 Capacity:
442.525 GB 44.97%

ASU-3 Capacity:
98.459 GB 10.01%

Total Unused Storage Capacity Ratio and Details

Physical Storage Capacity:
2,880.678 GB

Unused Physical Capacity: 0.000 GB

Physical Storage Capacity Used: 1,969.414 GB 68.37%

Total Unused Storage Capacity: 911.263 GB 31.63%

Unused Configured Capacity: 911.263 GB

Includes 455.632 GB in Unused Data Protection Capacity

Unused Addressable Capacity: 0.000 GB

SPC-1 Storage Capacity Utilization	
Application Utilization	34.16%
Protected Application Utilization	68.32%
Unused Storage Ratio	31.63%

Application Utilization: Total ASU Capacity *(984.054 GB)* divided by Physical Storage Capacity *(2,880.678 GB)*.

Protected Application Utilization: (Total ASU Capacity *(984.054 GB)* plus total Data Protection Capacity *(1,439.705 GB)* minus unused Data Protection Capacity *(455.632 GB)*) divided by Physical Storage Capacity *(2,880.678 GB)*.

Unused Storage Ratio: Total Unused Capacity *(307.004 GB)* divided by Physical Storage Capacity *(2,880.678 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 22-23 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.
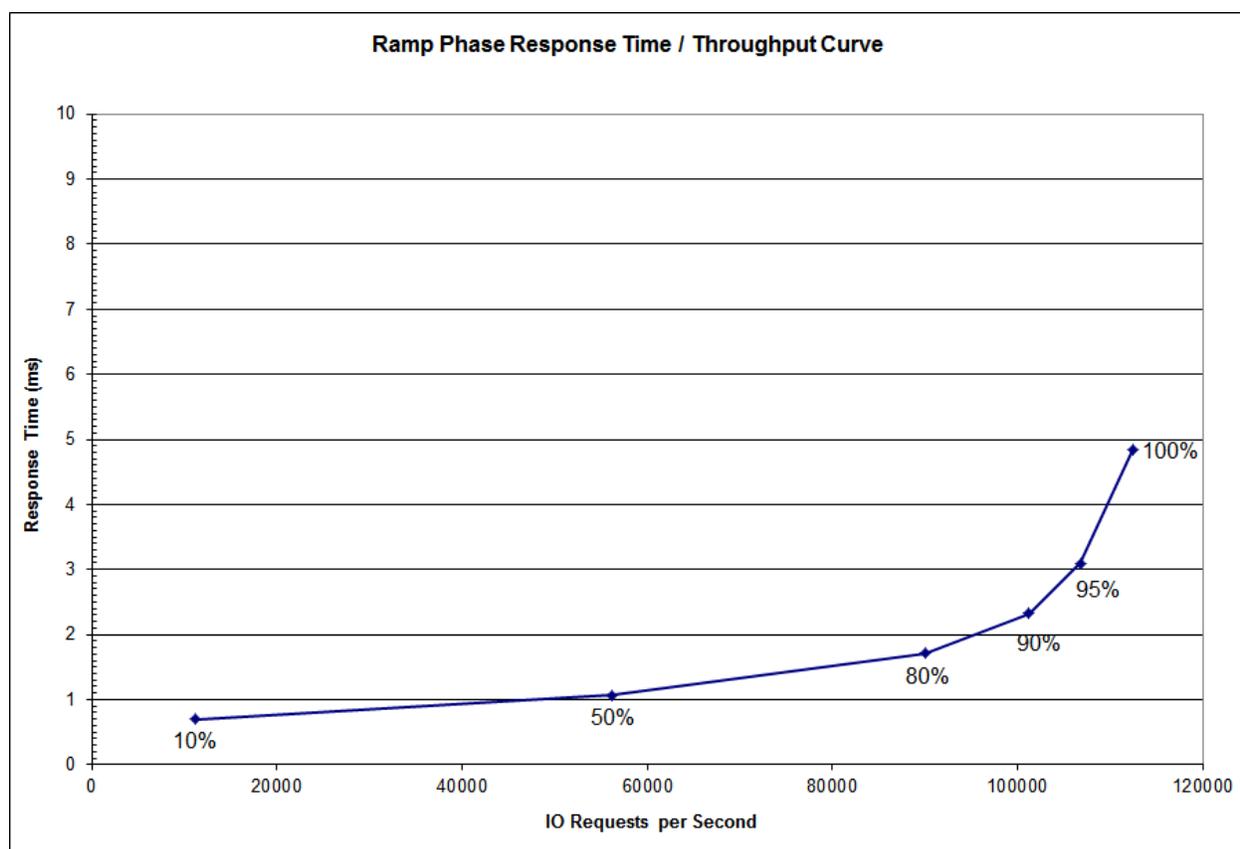
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	11,249.97	56,250.78	90,004.15	101,249.03	106,829.21	112,479.81
Average Response Time (ms):						
All ASUs	0.70	1.07	1.71	2.32	3.10	4.83
ASU-1	0.68	1.05	1.76	2.41	3.32	5.06
ASU-2	0.75	1.04	1.50	1.86	2.18	2.91
ASU-3	0.73	1.11	1.70	2.35	3.02	5.19
Reads	0.53	0.93	1.43	1.77	2.31	3.24
Writes	0.81	1.16	1.90	2.68	3.61	5.87

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Priced Storage Configuration Pricing

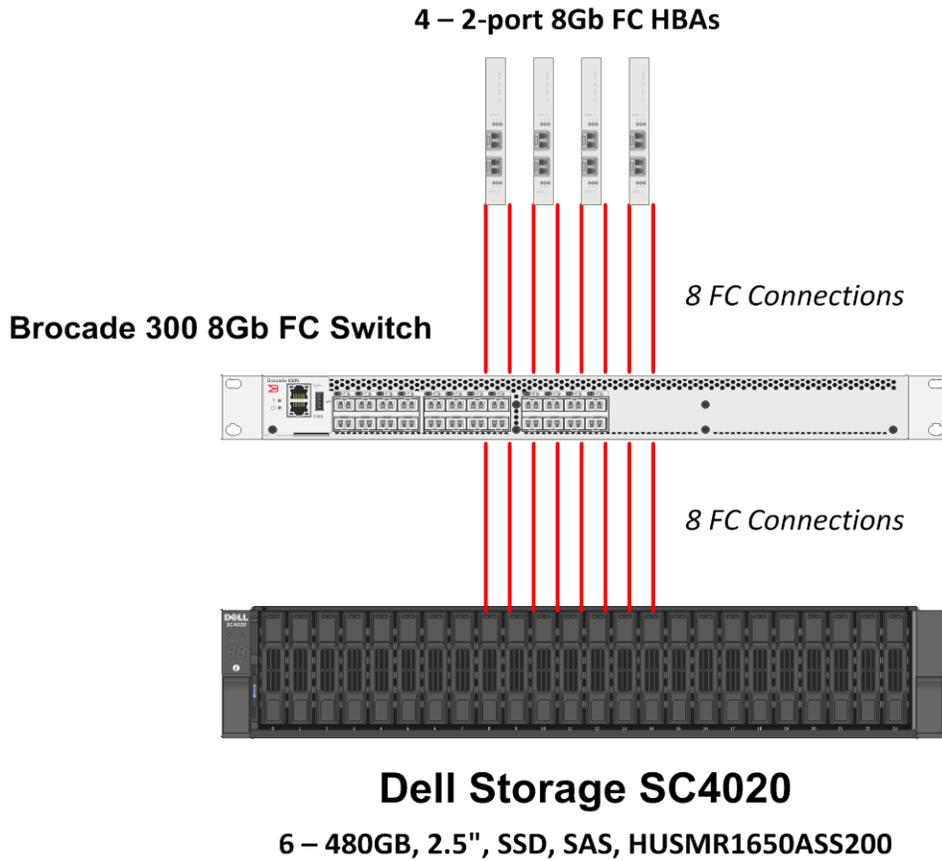| Product Description	Qty.	Unit List Price	Extended List Price	Discount	Purchase Price
Hardware Products					
SC4020 Dual Controller, 16 GB cache/controller 8x8Gb FC ports, 6x480GB 2.5" RI SSDs	1	$43,215.00	$43,215.00	45%	$23,768.25
Peripherals (Drive Blanks and Power Cords)	1	$200.00	$200.00	45%	$110.00
Qlogic Dual Port Fibre Channel HBA QLE2562 8G	4	$1,849.00	$7,396.00	45%	$4,067.80
LC-LC Optical Cable, 3M (Fibre Channel Cables)	16	$53.00	$848.00	45%	$466.40
Brocade 300 8-16-24 Port FC8 Switch includes 8x8Gb SFPs	2	$3,799.00	$7,598.00	45%	$4,178.90
Brocade 300 8 Port FC8 Upgrade, License and SFPs	2	$2,799.00	$5,598.00	45%	$3,078.90
Brocade Switch Rails	2	$80.00	$160.00	45%	$88.00
Hardware Product Total			**$65,015.00**		**$35,758.25**
Software Products					
SW, Storage Center OS Core License (Up To 48 Active Drives)	1	$0.00	$0.00		
Software Product Total		**$0.00**	**$0.00**		
Installation and Suport					
Brocade Switch Support 3yr 24x7x4Hr - Onsite	1	$628.02	$628.02	45%	$345.41
Support, 24x7, Dell/Compellent Series SC4020	1	$4,775.08	$4,775.08	45%	$2,626.29
Support, 24x7, SW, Storage Center OS Core	1	$1,800.09	$1,800.09	45%	$990.05
Dell Storage and Switch Installation Support (up to 2 hosts)	1	$3,848.00	$3,848.00	45%	$2,116.40
Installation and Support Total			**$11,051.19**	45%	**$6,078.15**
Total			**$76,066.19**		**$41,836.40**

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

A second Brocade 300 switch was included in the Priced Storage Configuration as a spare to fulfill one of the requirements for a data protection level of **Protected 2**.

Priced Storage Configuration Diagram

4 – 2-port 8Gb FC HBAs

8 FC Connections

Brocade 300 8Gb FC Switch

8 FC Connections

Dell Storage SC4020

6 – 480GB, 2.5", SSD, SAS, HUSMR1650ASS200

Priced Storage Configuration Components

Priced Storage Configuration
4 – QLogic QLE2562 Dual Port 8Gb FC HBAs
2 – Brocade 300 8Gb 12-24 port FC Switch *(16 ports/SFPs active)* *(second switch is a spare)*
Dell Storage SC4020 SC4020 Dual Controller   16 GB cache per controller *(32 GB total)* 8 – 8Gb FC ports *(4 ports per controller, 8 ports used)* 4 – backend 6Gb SAS connections *(2 connections per controller)* *(4 connections used)* 6 – 480GB 6Gb 2.5" SSDs