



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**LENOVO GROUP LTD.
LENOVO STORAGE S2200**

SPC-1 V1.14

**Submitted for Review: June 30, 2016
Submission Identifier: A00181**

EXECUTIVE SUMMARY**Test Sponsor and Contact Information**

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Lenovo Group Ltd. – http://www.lenovo.com Shawn Andrews – sandrews@lenovo.com 7001 Development Drive Morrisville, NC 27560 Phone: (919) 237-8042
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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	June 30, 2016
Date the FDR was submitted to the SPC	June 30, 2016
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	June 29, 2016

Tested Storage Product (TSP) Description

The Lenovo Storage S Series Portfolio of SAN Storage is designed for simplicity, speed, scalability and availability. Known for providing customer value, Lenovo delivers enterprise class SAN offerings loaded with proven storage innovations at an affordable price point without sacrificing performance. These feature-rich arrays can be easily integrated into your network environment and supports a variety of workloads ranging from general purpose web serving and data management/analytics that require high IOPs, to streaming workloads that need high throughput. Every Lenovo Storage S2200 comes with Lenovo SAN Manager. This intuitive GUI enables many advanced features:

- Thin Provisioning – helps customers purchase only the storage needed for operations
- SSD Read Caching – enables priority access to “hot” data accelerating read performance
- Rapid RAID Rebuild - minimizes recovery time and risk factors with rapid data restoration
- Snapshot - provides point-in-time copies of live data, eliminating the need for restore and performance hits
- Storage Pooling – virtualizes storage across multiple drive types improving IO by up to 2.5x without impacting applications

Each S Series S2200 supports 12 x 3.5" or 24 x 2.5" SSD and HDD, for a total of 96 drives. If additional capacity, Snapshots, Users, and Performance are required, then just swap out the controllers with no data migration. With this upgrade, the system can support up to 192 drives. With S Series, Lenovo delivers storage that is simple to deploy, easy to manage, and accessible to businesses and budgets of all sizes.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Lenovo Storage S2200	
Metric	Reported Result
SPC-1 IOPS™	41,046.45
SPC-1 Price-Performance™	\$0.23/SPC-1 IOPS™
Total ASU Capacity	755.971 GB
Data Protection Level	Protected 1 (<i>Mirroring</i>)
Total Price	\$9,508.40
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 1** using *Mirroring* configures two or more identical copies of user data.

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

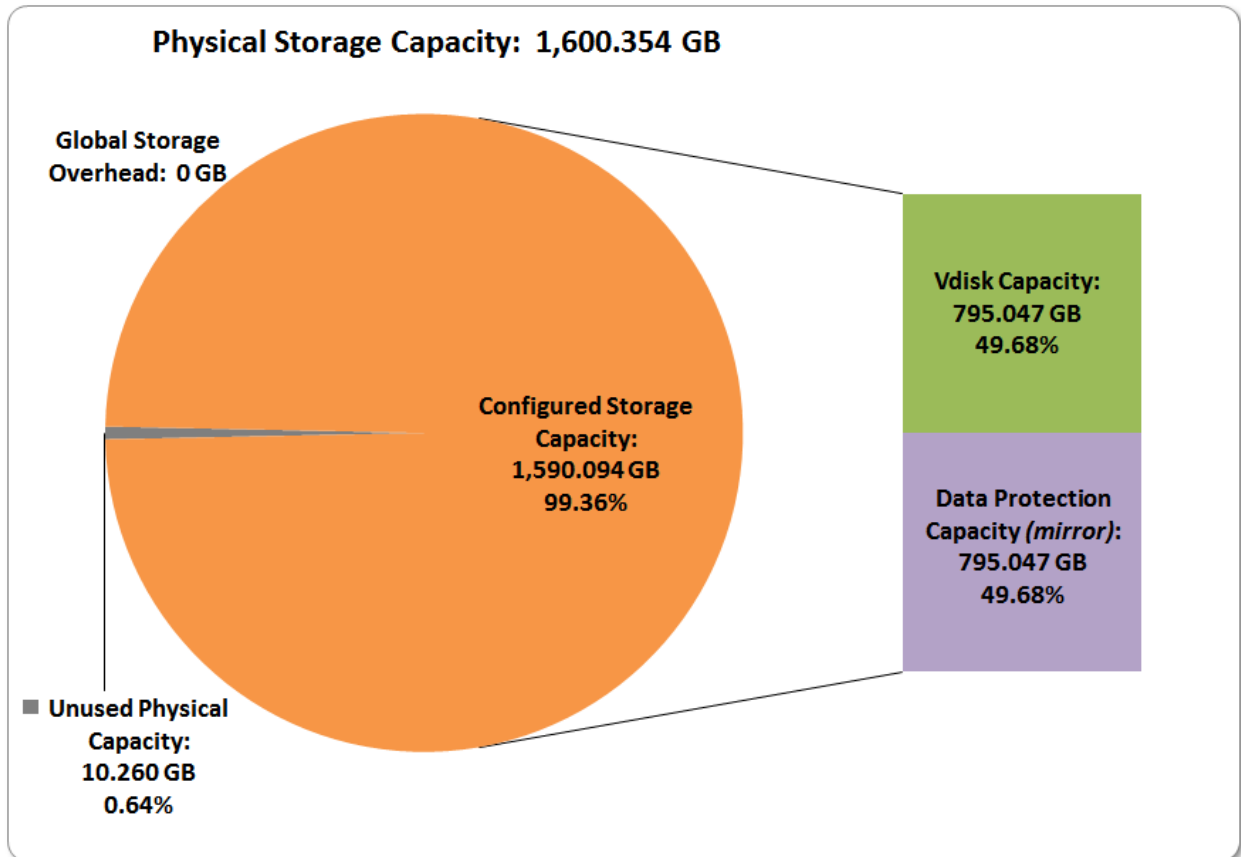
Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page [9](#).

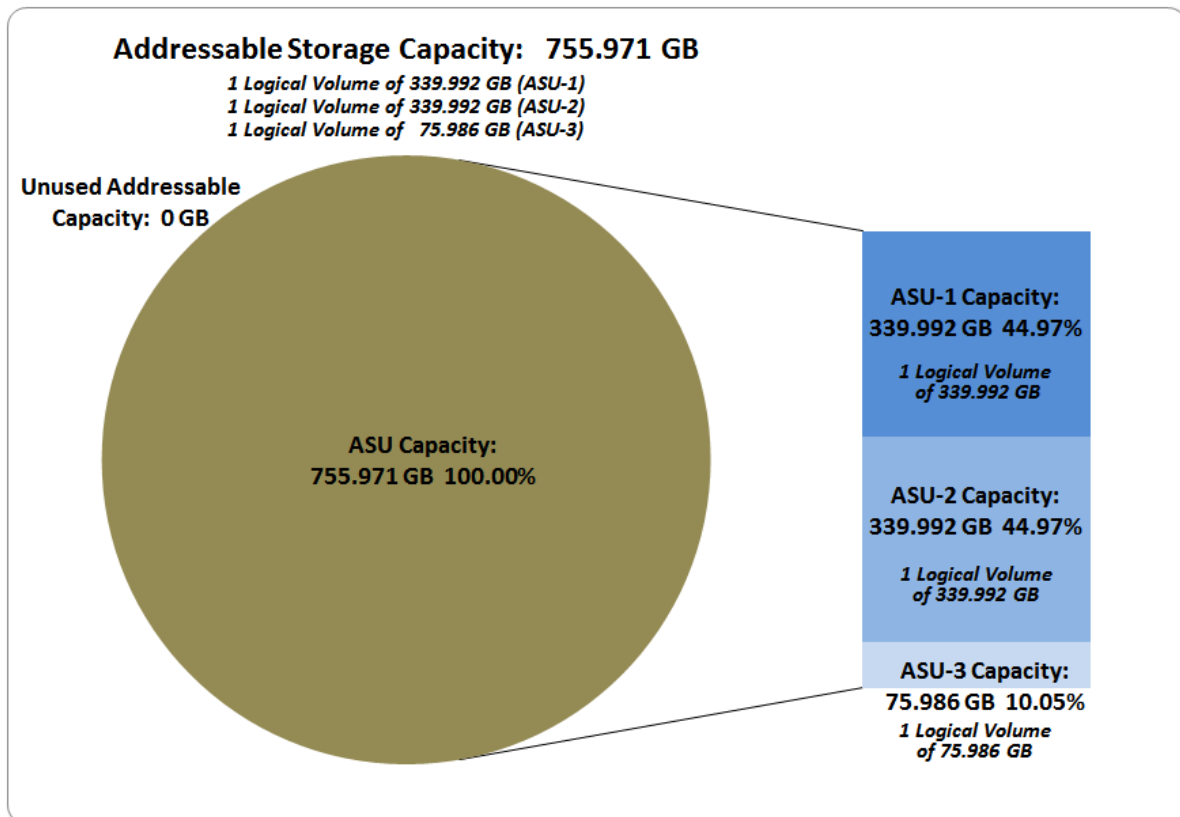
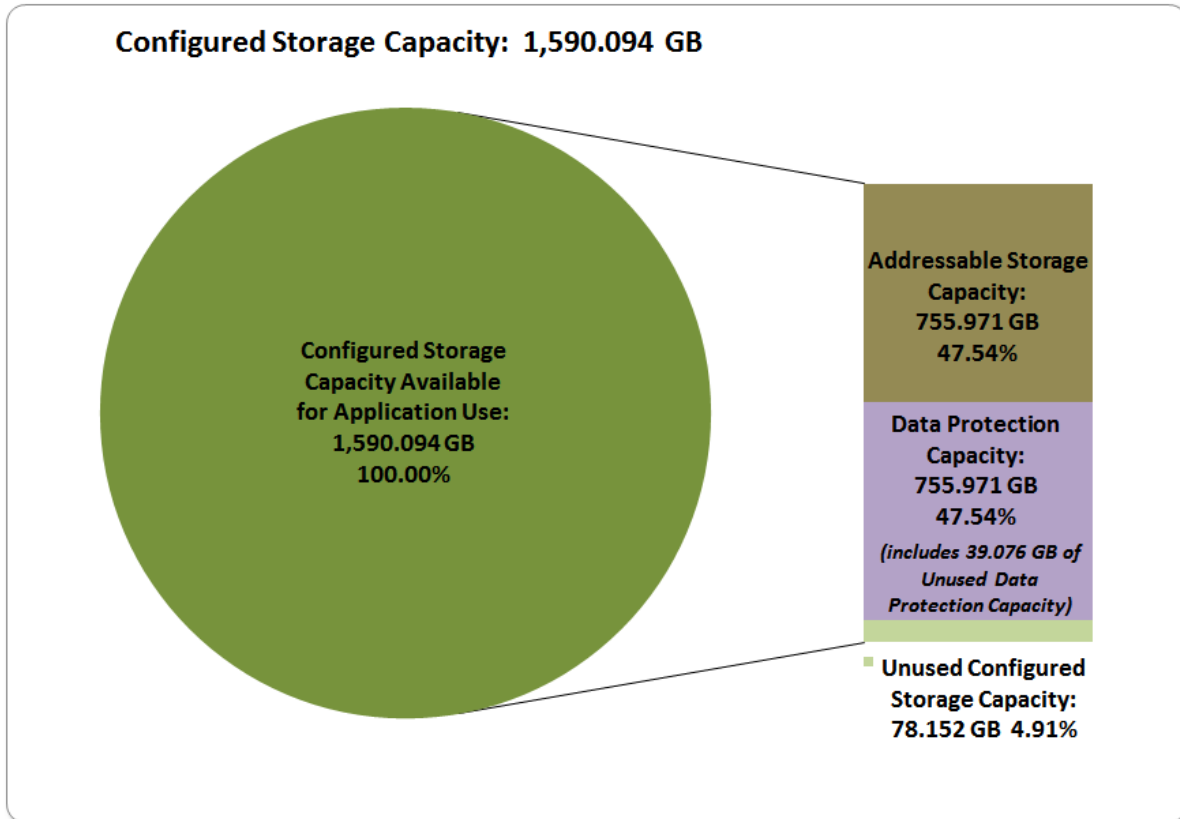
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country (*non-local currency*).

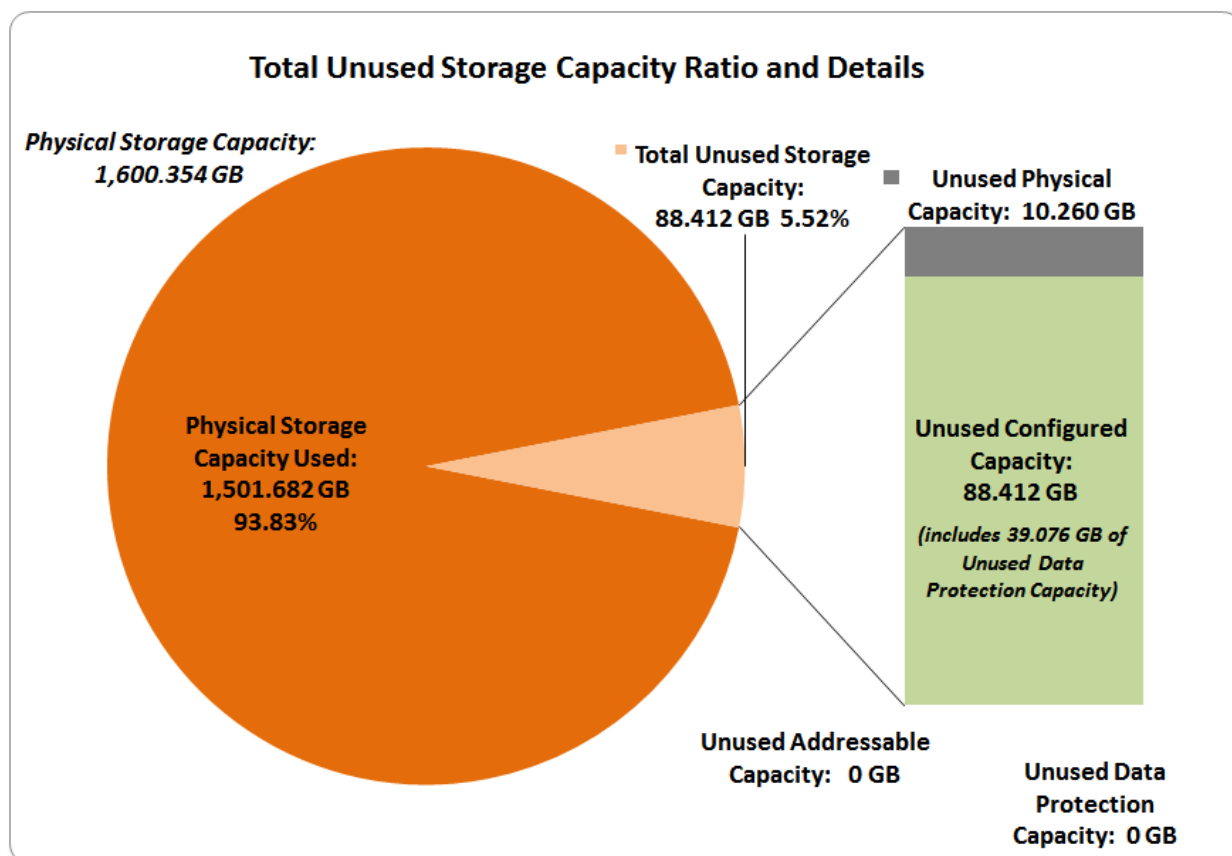
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

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.







SPC-1 Storage Capacity Utilization	
Application Utilization	47.24%
Protected Application Utilization	94.48%
Unused Storage Ratio	5.52%

Application Utilization: Total ASU Capacity (755.971 GB) divided by Physical Storage Capacity (1,600.354 GB).

Protected Application Utilization: (Total ASU Capacity (755.971 GB) plus total Data Protection Capacity (795.047 GB) minus unused Data Protection Capacity (39.076 GB)) divided by Physical Storage Capacity (1,600.354 GB).

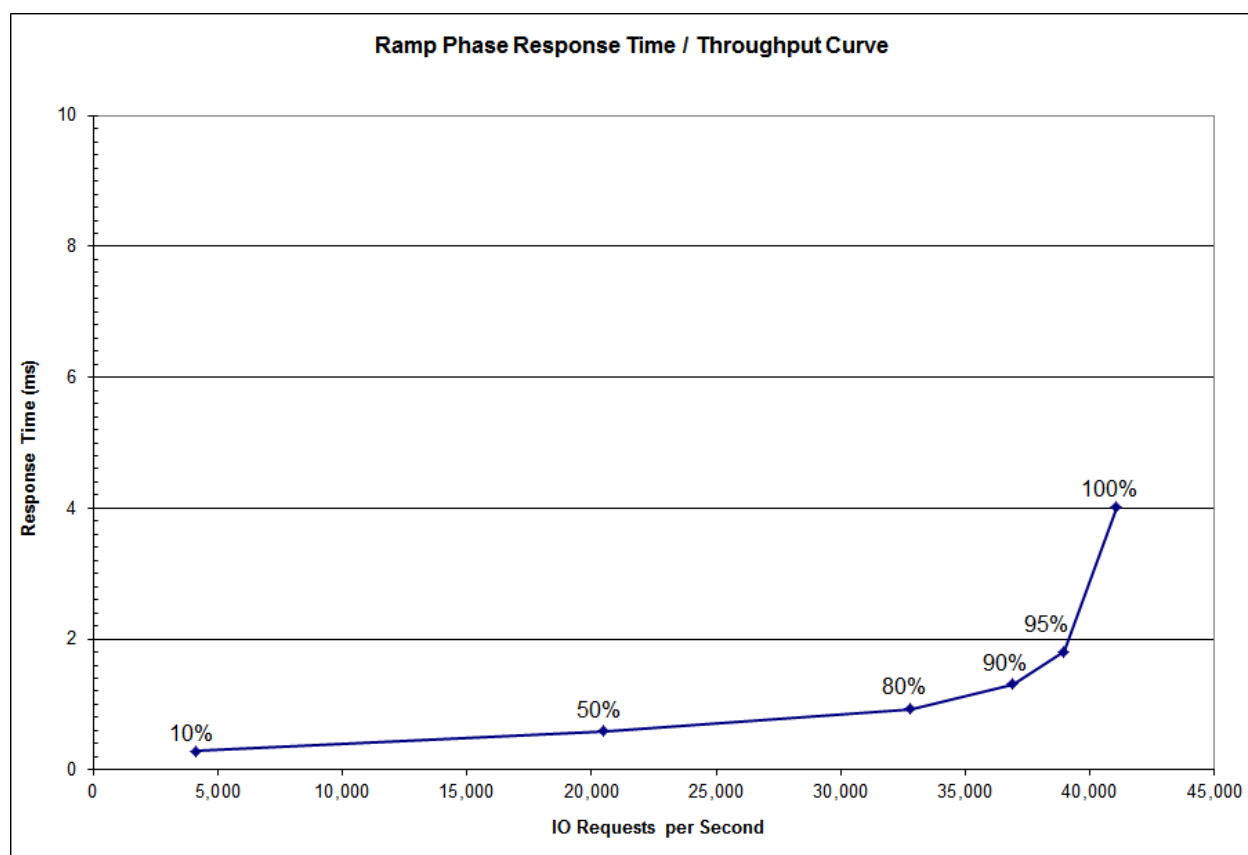
Unused Storage Ratio: Total Unused Capacity (88.412 GB) divided by Physical Storage Capacity (1,600.354 GB) and may not exceed 45%..

Detailed information for the various storage capacities and utilizations is available on pages 23-24 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	4,098.13	20,496.21	32,803.21	36,906.24	38,940.86	41,046.45
Average Response Time (ms):						
All ASUs	0.29	0.59	0.94	1.31	1.81	4.02
ASU-1	0.31	0.61	0.95	1.32	1.84	4.71
ASU-2	0.30	0.62	0.96	1.30	1.69	2.72
ASU-3	0.24	0.54	0.89	1.29	1.80	3.12
Reads	0.38	0.68	1.03	1.35	1.78	4.18
Writes	0.23	0.53	0.88	1.28	1.83	3.91

Priced Storage Configuration Pricing

Description	Part Number	Quantity	List Price	Total Price
Lenovo Storage S2200 SFF SAS Dual Controller	6411-2B4	1	5,499.00	5,499.00
3 Year 24 x 7 4-Hour Response	00WX793	1	1,196.00	1,196.00
Lenovo Storage 2.5" 400GB SSD (SAS)	00MM720	4	2,499.00	9,996.00
External MiniSAS HD 8644/Mini SAS HD 8644 1m cable	00WE748	2	149.00	298.00
N2225 SAS/SATA HBA	00AE912	1	299.00	299.00

Total List Price	17,288.00
Discount	45%
Total Discounted Price	9,508.40

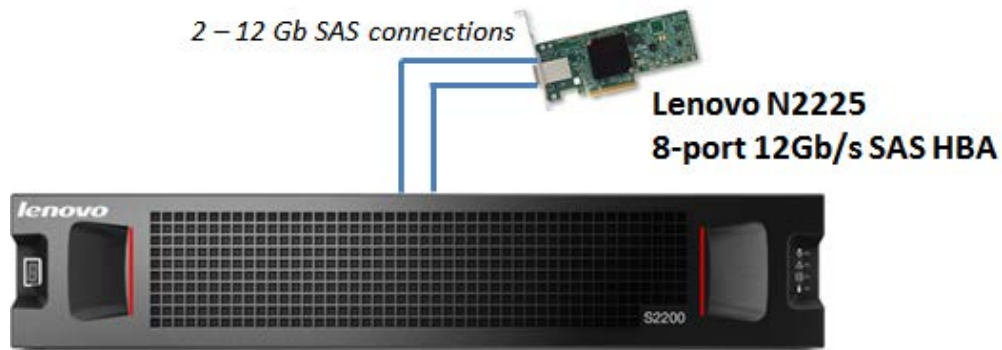
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- 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

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

Priced Storage Configuration Diagram



Lenovo Storage S2200

Dual-Active Controllers with:
 8GB cache, 4GB per controller
 4 – 400GB 2.5" SSD SAS disk drives

Priced Storage Configuration Components

Priced Storage Configuration
1 – Lenovo N2225 8-port, 12 Gb SAS HBA
Lenovo Storage S2200 2U24 Controller Enclosure Dual-Active Controllers each controller includes: 4 GB cache (8 GB total) 2 – 12 Gb SAS host ports (4 ports total and 2 ports used/1 port per controller) 1 – 6 Gb SAS connection (4 lanes) (2 total, none used) 4 – 400 GB SSDs