SPC BENCHMARK 1™
EXECUTIVE SUMMARY

HUAWEI TECHNOLOGIES CO., LTD.
HUAWEI OCEANSTOR™ 5800 V3

SPC-1 V1.14

Submitted for Review: May 10, 2016
Submission Identifier: A00177

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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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

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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	May 10, 2016
Date the FDR was submitted to the SPC	May 10, 2016
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	May 9, 2016

Tested Storage Product (TSP) Description

The Huawei OceanStor™ 5800 V3 offers a cloud architecture-oriented operating system, high-performance hardware platform, and a complete suite of smart management software.

The product is scalable to eight controllers, 1,024 GB cache, a maximum of 1,500 storage devices, with a variety of interfaces, including 16 Gbit/s FC, 56 Gbit/s InfiniBand, PCIe 3.0, 12 Gbit/s SAS, and smart I/O cards.

The Huawei OceanStor™ 5800 V3 is a perfect storage system for large OLTP/OLAP databases, file sharing, and cloud computing in the government, finance, telecom, energy, and media industries.

OceanStor OS, the Huawei OceanStor storage operating system, enables Huawei storage products evolve to the future cloud architecture and deliver the core business platform. It supports all OceanStor Storage arrays, specifically, for managing the underlying infrastructure, the physical space and logical space. OceanStor OS delivers intelligent and]convergent services and multiple SLAs to the application scenarios, including SAN and NAS convergence, all-level storage convergence, performance and capacity convergence, primary and backup storage convergence, and heterogeneous storage convergence. OceanStor OS helps customers evolve their traditional storage to cloud services in the future.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Huawei OceanStor™ 5800 V3	
Metric	**Reported Result**
SPC-1 IOPS™	601,022.56
SPC-1 Price-Performance™	$0.32/SPC-1 IOPS™
Total ASU Capacity	12,852.690 GB
Data Protection Level	Protected 2 *(Mirroring)*
Total Price	$194,482.21
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* ***storage device*** *in the configuration will not result in permanent loss of access to or integrity of the SPC-1 Data Repository.*

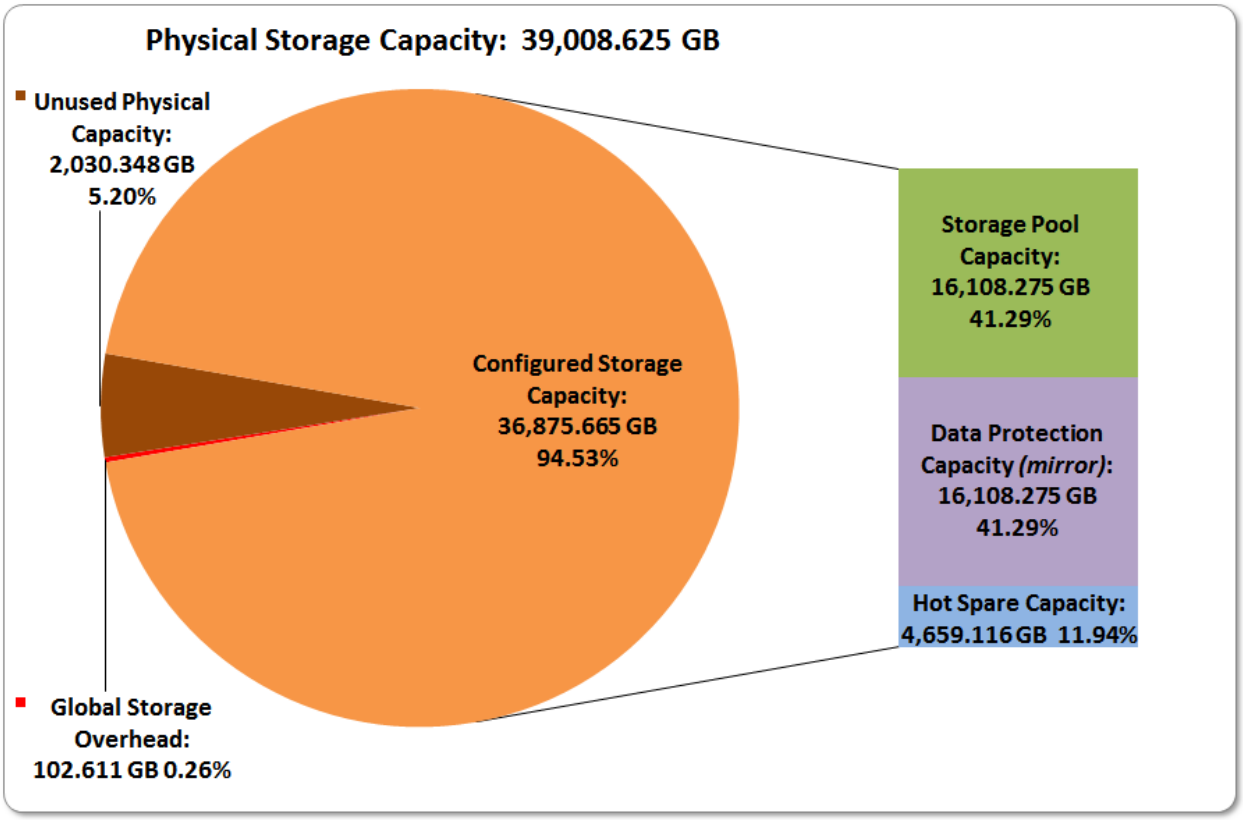
Total Price includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 9.

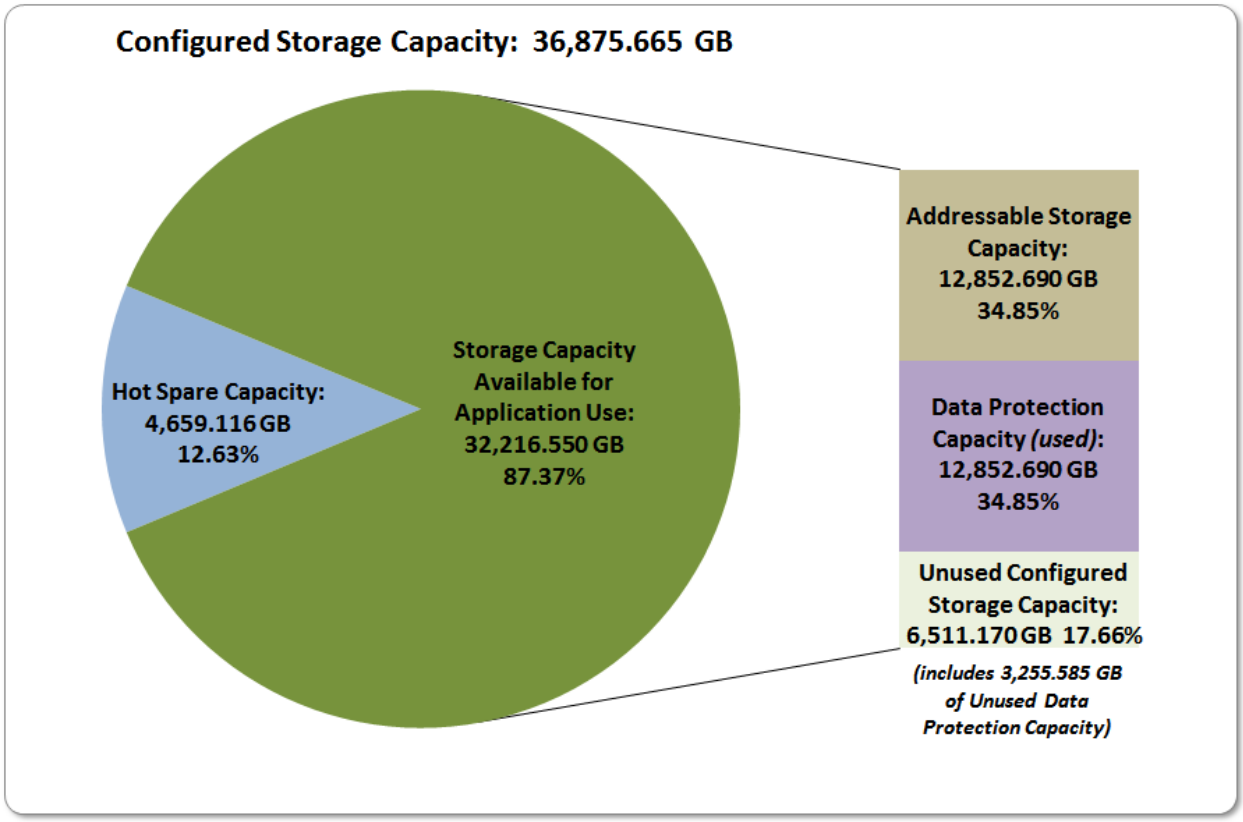
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency)*.

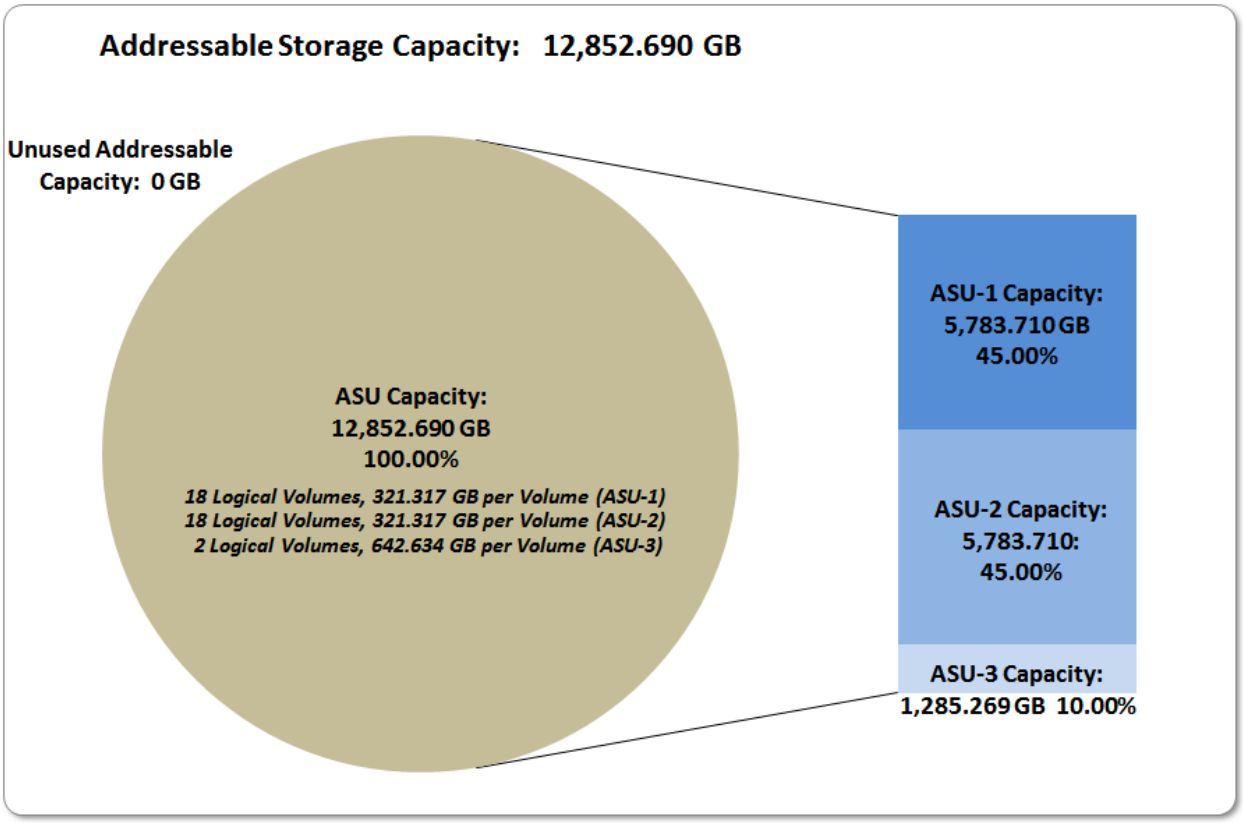
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

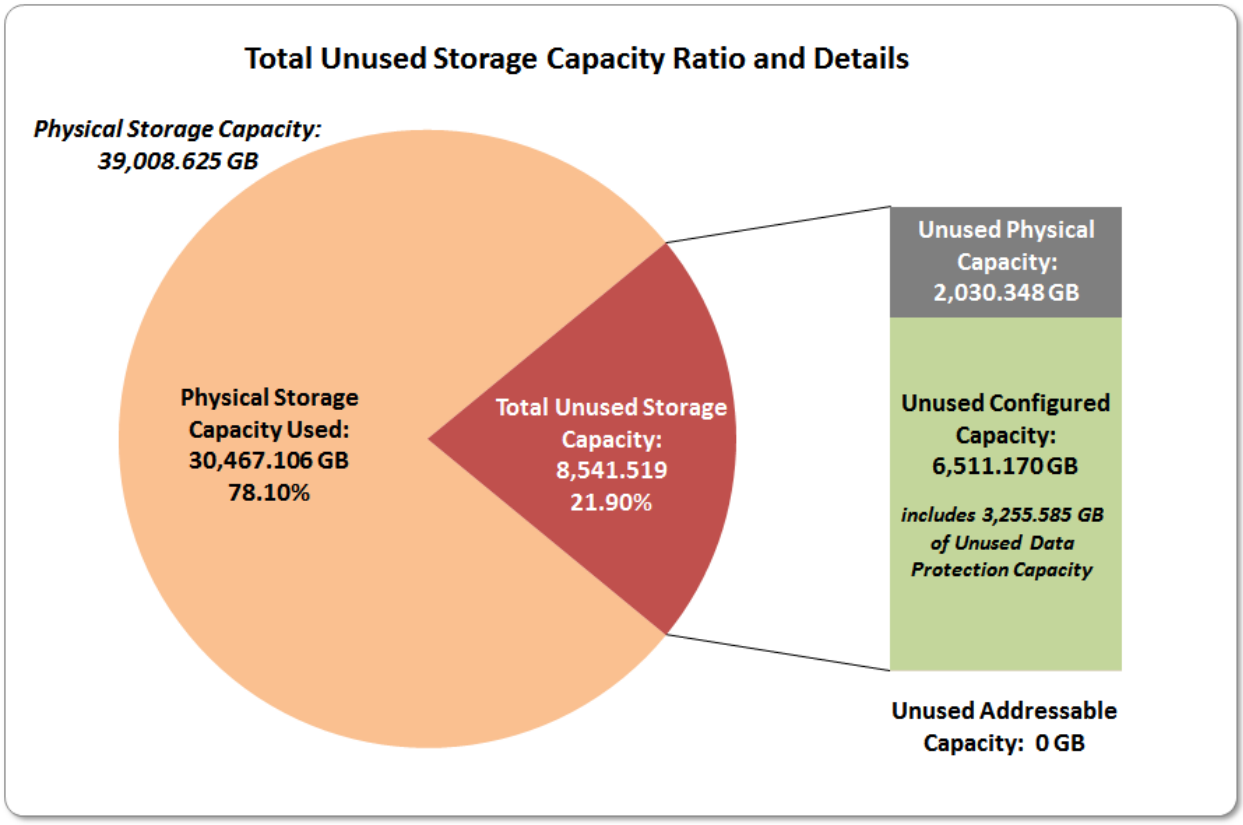
Storage Capacities, Relationships, and Utilization

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.




Configured Storage Capacity: 36,875.665 GB
Hot Spare Capacity:
4,659.116 GB
12.63%
Storage Capacity
Available for
Application Use:
32,216.550 GB
87.37%
Addressable Storage
Capacity:
12,852.690 GB
34.85%
Data Protection
Capacity (used):
12,852.690 GB
34.85%
Unused Configured
Storage Capacity:
6,511.170 GB 17.66%
(includes 3,255.585 GB
of Unused Data
Protection Capacity)


Addressable Storage Capacity: 12,852.690 GB
Unused Addressable
Capacity: 0 GB
ASU Capacity:
12,852.690 GB
100.00%
18 Logical Volumes, 321.317 GB per Volume (ASU-1)
18 Logical Volumes, 321.317 GB per Volume (ASU-2)
2 Logical Volumes, 642.634 GB per Volume (ASU-3)
ASU-1 Capacity:
5,783.710 GB
45.00%
ASU-2 Capacity:
5,783.710:
45.00%
ASU-3 Capacity:
1,285.269 GB 10.00%



SPC-1 Storage Capacity Utilization	
Application Utilization	32.95%
Protected Application Utilization	65.90%
Unused Storage Ratio	21.90%

Application Utilization:

Total ASU Capacity *(12,852.690 GB)* divided by Physical Storage Capacity *(39,008.625 GB)*.

Protected Application Utilization: (Total ASU Capacity *(12,852.690 GB)* plus total Data Protection Capacity *(16,108.275 GB)* minus unused Data Protection Capacity *(3,255.585 GB)*) divided by Physical Storage Capacity *(39,008.625 GB)*.

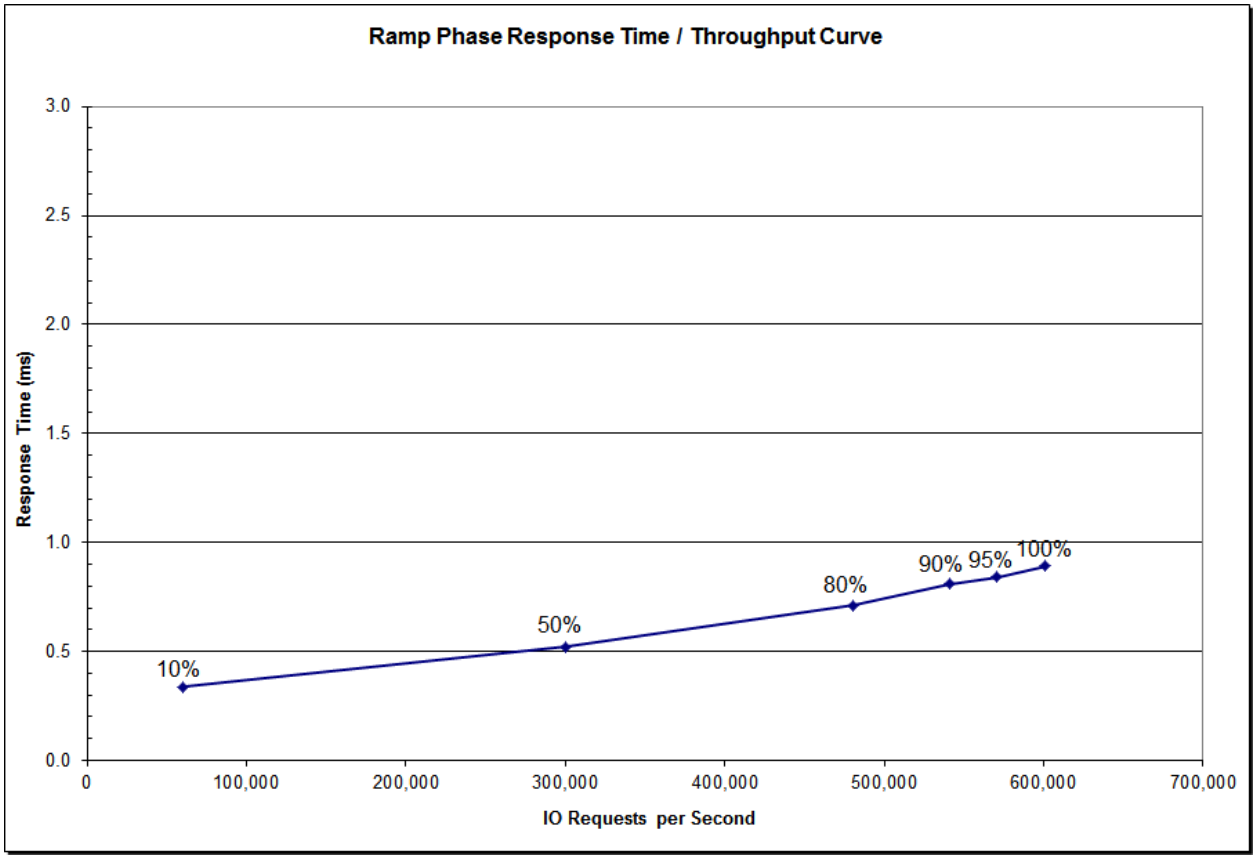
Unused Storage Ratio: Total Unused Capacity *(8,541.519 GB)* divided by Physical Storage Capacity *(39,008.625 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 35-36 of the associated 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	60,114.89	300,494.17	480,791.99	540,880.86	570,955.30	601,022.56
Average Response Time (ms):						
All ASUs	0.34	0.52	0.71	0.81	0.84	0.89
ASU-1	0.34	0.58	0.80	0.91	0.95	1.01
ASU-2	0.36	0.61	0.84	0.94	0.99	1.05
ASU-3	0.31	0.35	0.47	0.55	0.55	0.59
Reads	0.39	0.80	1.11	1.24	1.31	1.39
Writes	0.30	0.34	0.45	0.53	0.53	0.57

Priced Storage Configuration Pricing

No.	Model	Description	Qty.	Unit Price (USD)	Total Price (USD)
1	Phase				
1	Location				
1.1	OceanStor 5800 V3 Storage System				
1.1.1	Engine				
	5800V3-256G-AC	5800 V3(3U,Dual Ctrl,AC,256GB,SPE62C0300)	2	28,410.48	56,820.96
1.1.2	Expand Interface Module				
	SMARTIO8FC	4 port SmartIO I/O module(SFP+,8Gb FC)	8	665.04	5,320.32
	SMARTIO10ETH	4 port SmartIO I/O module(SFP+,10Gb Eth/FCoE(VN2VF)/Scale-out)	4	1310.16	5,240.64
	LPU4S12V3	4 port 4*12Gb SAS I/O module(MiniSAS HD)	8	992.64	7,941.12
1.1.3	Disk Components				
	SSDM-400G2S-A1	400GB SSD SAS Disk Unit(2.5")	96	710.40	68,198.40
1.1.4	Disk Enclosure				
	DAE22525U2-1-AC	Disk Enclosure(2U,AC,2.5",Expanding Module,25 Disk Slots,without Disk Unit, DAE22525U2)	4	2,116.80	8,467.20
1.1.5	Installation Material				
	SN2F01FCPC	Patch Cord,DLC/PC,DLC/PC,Multi-mode,3m,A1a.2,2mm,OM3 bending insensitive	40	11.00	440.00
1.1.6	HBA				
	N8GHBA000	QLOGIC QLE2562 HBA Card,PCIE,8Gbps DualPort ,Fiber Channel Multimode LC Optic Interface,English Manual, No Drive CD	16	1,000.00	16,000.00
1.1.7	Storage Software				
	LIC-5800V3-BS	Basic Software License for Block(Include Device Management,SmartThin,SmartMulti-tenant,SmartMigration,SmartErase,SmartMotion,Cloud Service)	1	3,841.92	3,841.92
	LIC-5800V3-PATH	OceanStor HW UltraPath Software License	1	945.60	945.60
Total of Product					173,216.16
1.1.8	Maintenance Support Service				
	02359825-88134ULF-3	5800 V3(3U,Dual Ctrl,AC,256GB,SPE62C0300)-Hi-Care Onsite Premier 24x7x4H Engineer Onsite Service-3Year(s)	2	5,180.00	10,360.01
	02359806-88134ULJ-3	Disk Enclosure(2U,AC,2.5",Expanding Module,25 Disk Slots,without Disk Unit,DAE22525U2)-Warranty Upgrade To Hi-Care Onsite Premier 24x7x4H Engineer Onsite Service-3Year(s)	4	2,440.01	9,760.04
	88032KNK-88134UHK-3	OceanStor HW UltraPath Software License-Hi-Care Application Software Upgrade Support Service-3Year(s)	1	354.00	354.00
	88032NMQ-88134UHK-3	Basic Software License for Block(Include Device Management,SmartThin,SmartMulti-tenant,SmartMigration,SmartErase,SmartMotion,Cloud Service)-Hi-Care Application Software Upgrade Support Service-3Year(s)	1	792.00	792.00
Total of Service (3 years)					21,266.05
Total Price					194,482.21
Notes:Hi-Care Premier On-Site Service include: 7*24 Technical Assistance Center Access. Access to all new software updates and Online Support. 24*7*4 Hours Onsite Hardware Replacement.					

Huawei Technologies Co., Ltd. only sells its products to third-party resellers, who in turn, sell those products to U.S. customers. The above pricing, which also includes the required three-year maintenance and support, was obtained from one of those third-party resellers. See page 83 *(Appendix F: Third-Party Quotation)* of the Full Disclosure Report for a copy of the third-party reseller quotation.

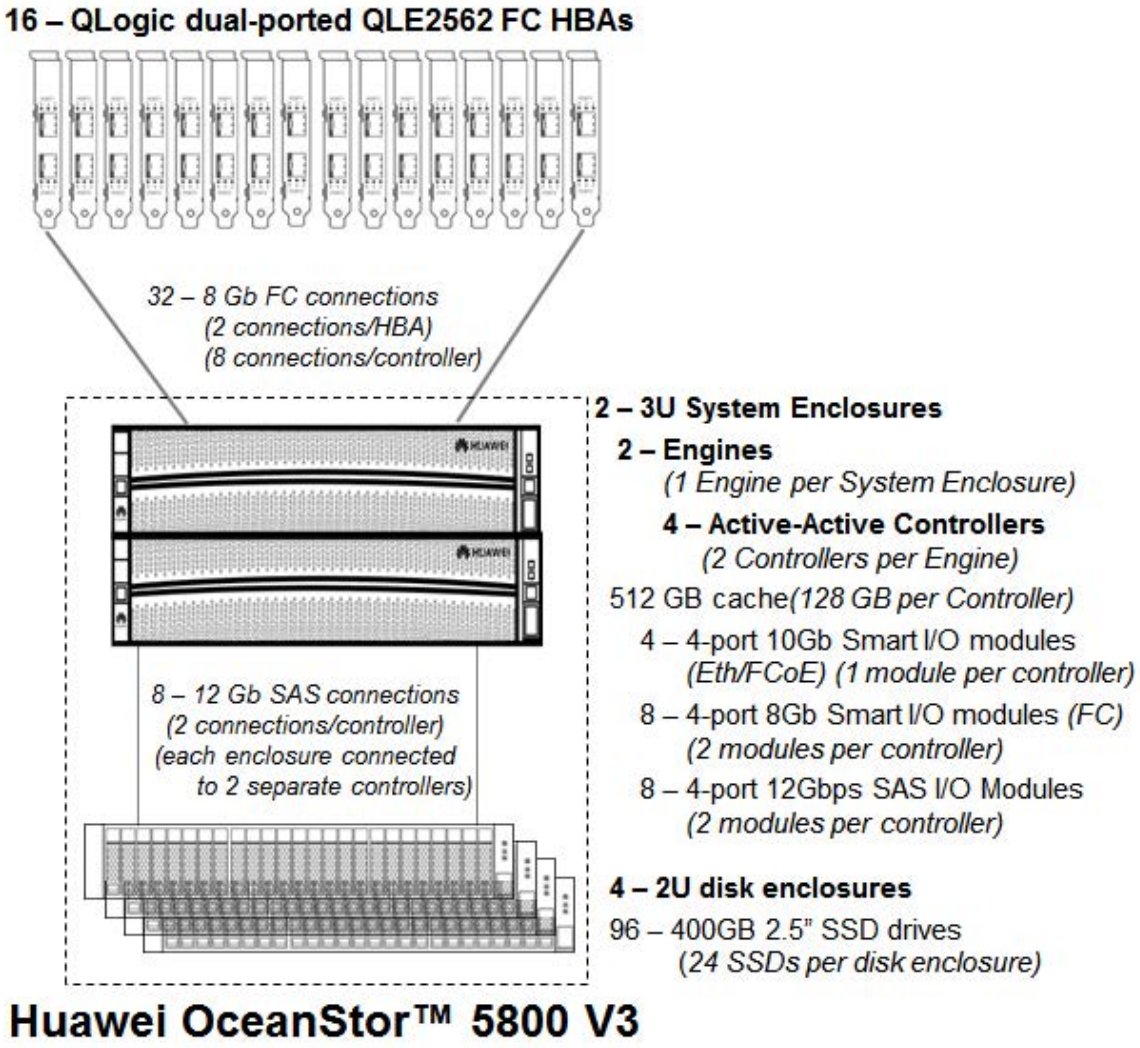
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- 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



Priced Storage Configuration Components

Priced Storage Configuration
OceanStor UltraPath
16 – QLogic QLE2562 dual-port, 8 Gbps, FC HBAs
Huawei OceanStor™ 5800 V3 2 – 3U System Enclosures 4 – Active-Active Controllers *(2 controllers per System Enclosure)* each controller includes: 128 GB cache *(512 GB total)* 1 – 4-port 10Gb Smart I/O modules *(Eth/FCoE)* *(used for inter-controller connectivity)* *(4 modules total, 4 ports per controller)* *(16 ports total and used)* 2 – 4-port 8Gb Smart I/O module *(FC)* *(8 modules total, 8 ports per controller* *(32 ports total and used)* 2 – 4-port 12Gbps SAS I/O Modules (8 modules total, 8 ports per controller) (32 ports total, 8 ports used)
4 – 2U Disk Enclosures
96 – 400 GB, 2.5" SSD drives *(24 SSDs per disk enclosure)*

The major components used in the Benchmark Configuration/Tested Storage Configuration are documented in further detail on page 24 of the Full Disclosure Report.

The Engine, Controller and FC Module relationships are documented on page 26 of the Full Disclosure Report.

The FC HBA/Controller Host Port FC connections are documented on page 27 of the Full Disclosure Report.

The Engine, Controller, Eth/FCoE Module/Active Port relationships are documented on page 28 of the Full Disclosure Report.

The Controller-to-Controller Eth/FCoE connections are documented on pages 29-30 of the Full Disclosure Report.

The Engine, Controller, SAS Module/Active SAS Port, Disk Enclosure and SSD Relationships are documented on page 32 of the Full Disclosure Report.

The Controller/Disk Enclosure SAS connections are documented on page 33 of the Full Disclosure Report.