SPC Benchmark 1™
Executive Summary

Hewlett-Packard Company
HP XP7 Storage

SPC-1 V1.14

Submitted for Review: August 26, 2015
Submission Identifier: A00162

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	August 26, 2015
Date the FDR was submitted to the SPC	August 26, 2015
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	August 25, 2015

Tested Storage Product (TSP) Description

The HP XP7 Storage is bulletproof storage for mission-critical converged infrastructure where constant access to data is required-even in the event of a disaster. Designed for organizations that simply cannot afford any downtime, the XP7 combines an ultra-high-performance on-line scalable fully redundant hardware platform with unique data replication capabilities integrated with clustering solutions for complete business continuity and data protection. The XP7 can adapt to changing business conditions in real time, while increasing data center capacity and lifespan and providing solutions that decrease risk and costs.

Massive consolidation becomes a reality by managing open systems, mainframe, and HP Non-Stop applications all on a single XP7 with ultra-high performance, low latency and reduced data center costs.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: HP XP7 Storage	
Metric	**Reported Result**
SPC-1 IOPS™	2,004,941.89
SPC-1 Price-Performance™	$0.98/SPC-1 IOPS™
Total ASU Capacity	30,962.247 GB
Data Protection Level	Protected 2 *(mirroring)*
Total Price	$1,972,095.28
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.
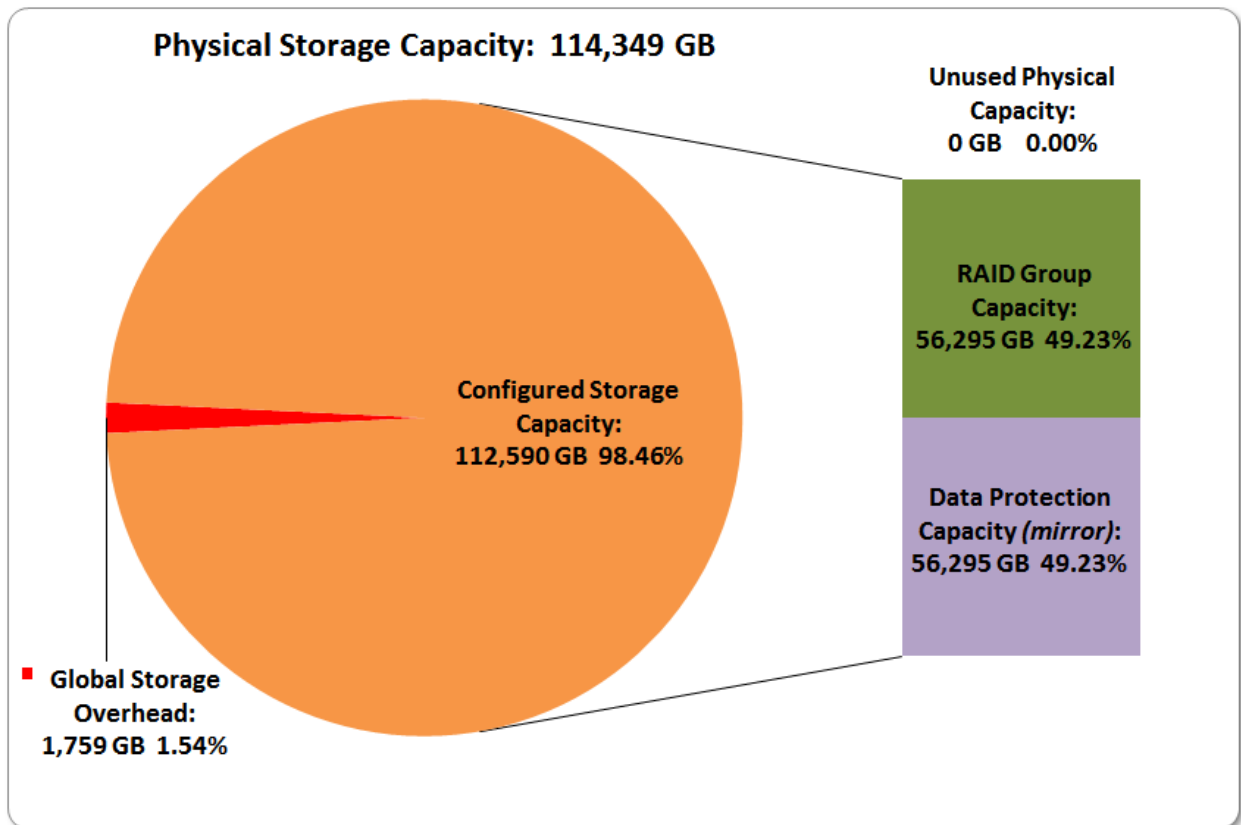
Currency Used is formal name for the currency used in calculating the **Total Price** and **SPC-1 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country *(non-local currency)*.
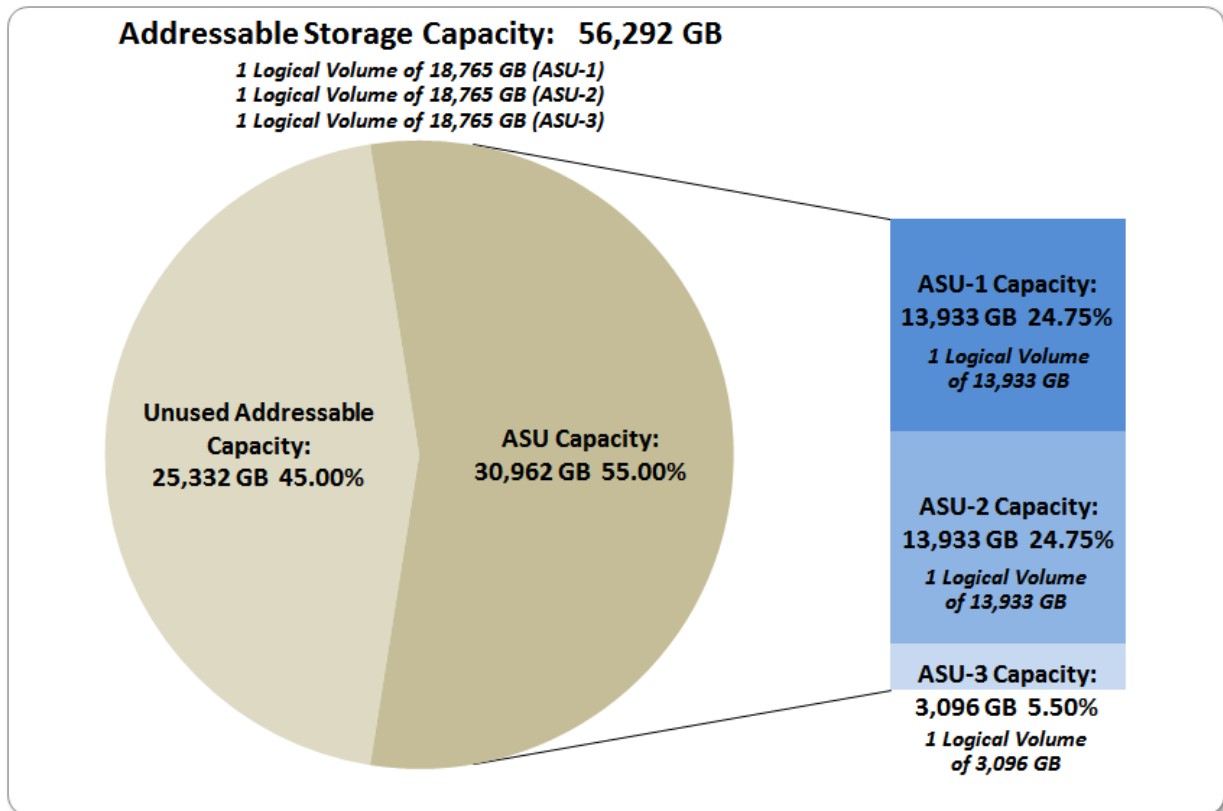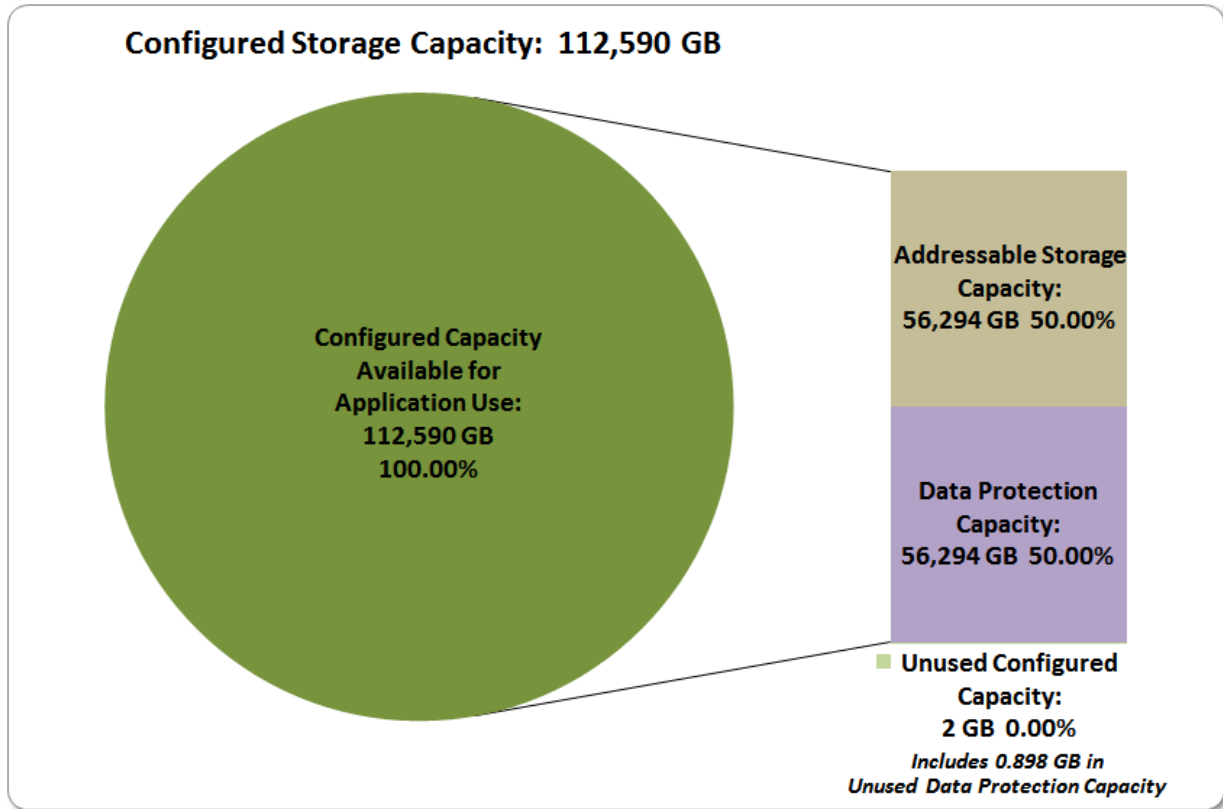
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

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.

Physical Storage Capacity: 114,349 GB

Unused Physical Capacity:
0 GB   0.00%

RAID Group Capacity:
56,295 GB 49.23%

Configured Storage Capacity:
112,590 GB 98.46%

Data Protection Capacity *(mirror)*:
56,295 GB 49.23%

Global Storage Overhead:
1,759 GB 1.54%

Configured Storage Capacity: 112,590 GB

Configured Capacity Available for Application Use:
112,590 GB
100.00%

Addressable Storage Capacity:
56,294 GB 50.00%

Data Protection Capacity:
56,294 GB 50.00%

■ **Unused Configured Capacity:**
2 GB 0.00%
Includes 0.898 GB in Unused Data Protection Capacity

Addressable Storage Capacity: 56,292 GB

1 Logical Volume of 18,765 GB (ASU-1)
1 Logical Volume of 18,765 GB (ASU-2)
1 Logical Volume of 18,765 GB (ASU-3)

Unused Addressable Capacity:
25,332 GB 45.00%

ASU Capacity:
30,962 GB 55.00%

ASU-1 Capacity:
13,933 GB 24.75%
1 Logical Volume of 13,933 GB

ASU-2 Capacity:
13,933 GB 24.75%
1 Logical Volume of 13,933 GB

ASU-3 Capacity:
3,096 GB 5.50%
1 Logical Volume of 3,096 GB

Total Unused Storage Capacity Ratio and Details

Physical Storage Capacity:
114,349 GB

Unused Physical Capacity: 0 GB

Physical Storage Capacity Used: 63,686 GB 55.69%

Total Unused Storage Capacity: 50,665 GB 44.31%

Unused Addressable Capacity: 25,332 GB

Unused Data Protection Capacity: 25,332 GB

Unused Configured Capacity: 2 GB
Includes 0.898 GB in Unused Data Protection Capacity

SPC-1 Storage Capacity Utilization	
Application Utilization	27.08%
Protected Application Utilization	54.15%
Unused Storage Ratio	44.31%

Application Utilization: Total ASU Capacity *(30,962.247 GB)* divided by Physical Storage Capacity *(114,349.100 GB)*.

Protected Application Utilization: (Total ASU Capacity *(30,962.247 GB)* plus total Data Protection Capacity *(56,294.833 GB)* minus unused Data Protection Capacity *(25,332.585 GB)*) divided by Physical Storage Capacity *(114,349.100 GB)*.

Unused Storage Ratio: Total Unused Capacity *(50,665.170 GB)* divided by Physical Storage Capacity *(114,349.100 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 25-26 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.
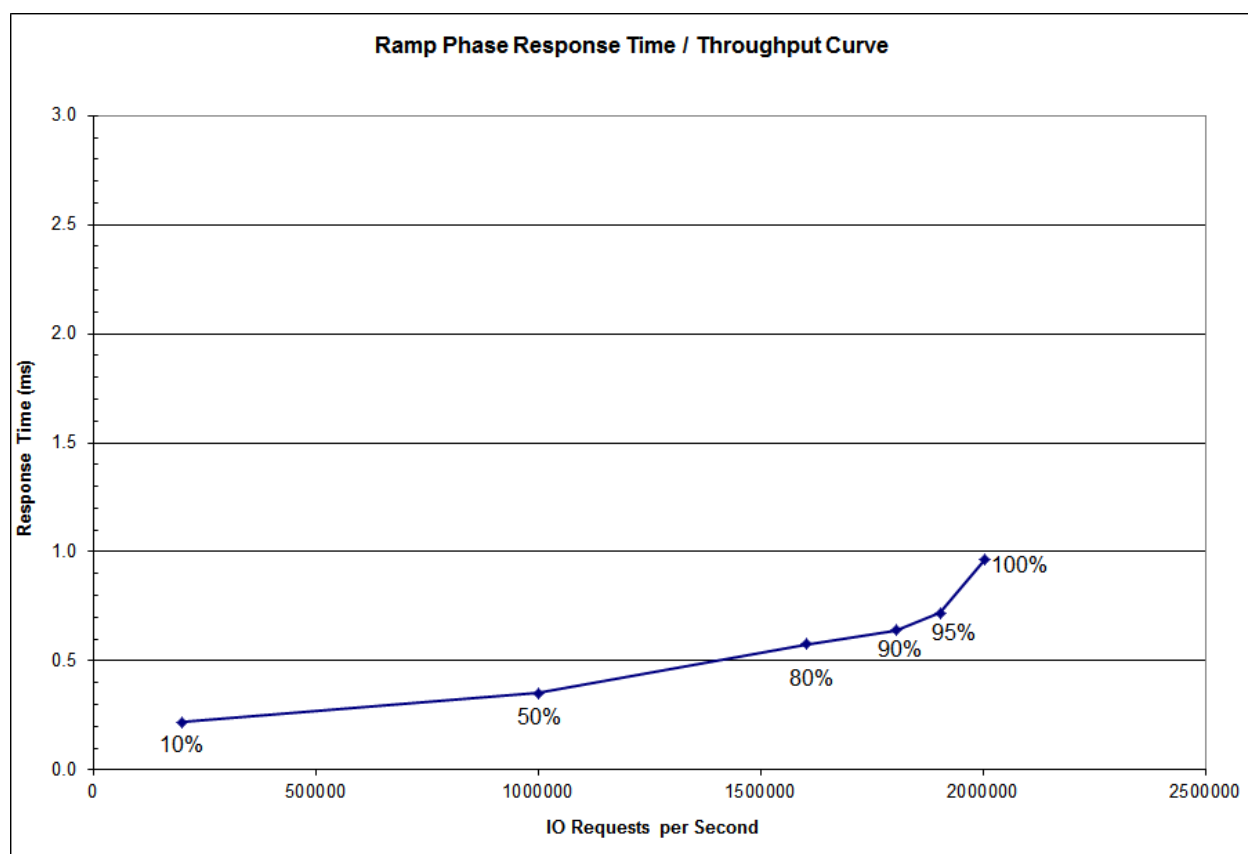
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	200,512.33	1,000,301.01	1,604,017.59	1,804,534.05	1,904,840.59	2,004,941.89
Average Response Time (ms):						
All ASUs	0.22	0.35	0.58	0.64	0.72	0.96
ASU-1	0.24	0.39	0.64	0.67	0.73	1.02
ASU-2	0.23	0.41	0.75	0.96	1.11	1.37
ASU-3	0.17	0.24	0.38	0.44	0.52	0.67
Reads	0.31	0.54	0.90	0.96	1.05	1.44
Writes	0.16	0.23	0.37	0.43	0.50	0.65

Priced Storage Configuration Pricing

Quantity	PN	Description	List Price	Ext. Price
		HARDWARE		
1	H6F99A	HP XP7 Storage System	$ -	$ -
1	H6F56A	HP XP7 Primary DKC	$ 80,950.00	$ 80,950.00
1	H6F95A	HP XP7 Service Processor	$ 21,399.00	$ 21,399.00
2	H6F54A	HP XP7 Storage Rack	$ 17,100.00	$ 34,200.00
64	H6G70A	HP XP7 1.6TB Flash Module Device	$ 34,900.00	$ 2,233,600.00
4	H6G24A	HP XP7 Large Backup Memory Kit	$ 9,360.00	$ 37,440.00
4	H6G26A	HP XP7 256GB Backup Memory Pair	$ 77,800.00	$ 311,200.00
1	H6F57A	HP XP7 Secondary DKC	$ 85,880.00	$ 85,880.00
2	H6G11A	HP XP7 2M Cu Intra-rack Dev Int Cable	$ 5,647.00	$ 11,294.00
32	H6G22A	HP XP7 32GB Cache Memory Pair	$ 17,780.00	$ 568,960.00
2	H6G20A	HP XP7 Cache Path Controller Adapter Pair	$ 64,654.00	$ 129,308.00
2	H6F62A	HP XP7 Flash Module Chassis	$ 71,815.00	$ 143,630.00
2	H6F97A	HP XP7 Internal Hub	$ 4,737.00	$ 9,474.00
1	H6G03A	HP XP7 5M DKC Interconnect Cable	$ 13,292.00	$ 13,292.00
1	H6G00A	HP XP7 5M DKC Interconnect Kit	$ 17,379.00	$ 17,379.00
6	H6G08A	HP XP7 Processor Blade Pair	$ 211,180.00	$ 1,267,080.00
2	H6F82A	HP XP7 60Hz Flash Module Power Cord	$ 3,276.00	$ 6,552.00
2	H6F80A	HP XP7 60Hz DKC Power Cord	$ 692.00	$ 1,384.00
4	H6G06A	HP XP7 Disk Adapter Pair	$ 19,563.00	$ 78,252.00
4	H6G30A	HP XP7 16-port 8Gbps Fibre Host Adapter Pair	$ 17,967.00	$ 71,868.00
8	H6F70A	HP XP7 Single Phase 60Hz PDU	$ 920.00	$ 7,360.00
2	H6G10A	HP XP7 1M Cu Intra-chassis Dev Int Cable	$ 5,647.00	$ 11,294.00
		TOTAL		**$ 5,141,796.00**
		SOFTWARE		
1	TK914AA	HP XP7 Array Mgr Suite Base LTU	$ 271.00	$ 271.00
52	TK914AB	HP XP7 Array Mgr Suite 1TB 0-100TB LTU	$ 1,833.00	$ 95,316.00
		TOTAL		**$ 95,587.00**
		INSTALLATION & HARDWARE SUPPORT		
1	HA114A1	HP Installation and Startup Service	$ -	$ -
1	HA114A1 5	HP Startup XP7 P9500 Array DKC Mod 0 SVC	$ 22,125.00	$ 22,125.00
1	HA114A1 5	HP Startup XP7 P9500 Array DKC DKU SVC	$ 1,775.00	$ 1,775.00
4	HA114A1 5	HP Startup XP7 P9500 Array Expansion SVC	$ 900.00	$ 3,600.00
1	HA114A1 5	HP Startup XP7 P9500 Software Type 6 SVC	$ 5,250.00	$ 5,250.00
1	H7J34A3	HP 3yr Foundation Care 24x7 Service	$ -	$ -
		TOTAL		**$ 32,750.00**

Priced Storage Configuration Pricing *(continued)*

	SOFTWARE SUPPORT					
52	H7J34A3	T{HP XP7 Array Mgr St 0-100TB LTU SWSup		$ 390.00	$	20,280.00
		TOTAL			**$**	**20,280.00**
	Additional Hardware					
32	QR559A	HP SN1000E 16Gb Dual Port Fibre Channel Host Adapte		$ 2,799.00	$	89,568.00
64	QK734AH	HP Premier Flex LC/LC OM4 2f 5m Cable		$ 114.00	$	7,296.00
		TOTAL			**$**	**96,864.00**

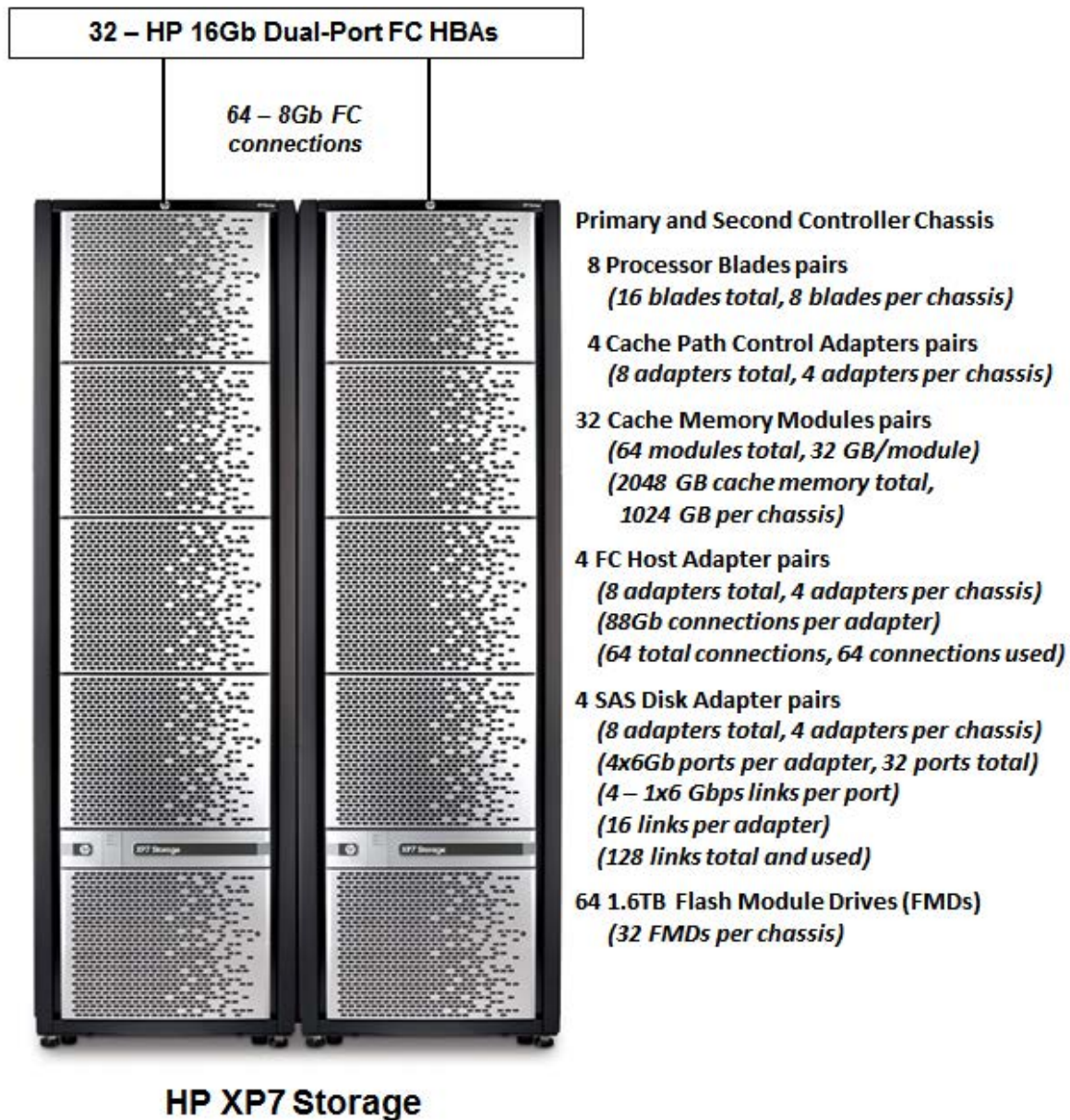| Category Totals	List Price	Discount	Net price
HARDWARE	$ 5,141,796.00	64%	$ 1,851,046.56
SOFTWARE	$ 95,587.00	64%	$ 34,411.32
INSTALLATION & HARDWARE SUPPORT	$ 32,750.00	50%	$ 16,375.00
SOFTWARE SUPPORT	$ 20,280.00	64%	$ 7,300.80
ADDITIONAL HARDWARE	$ 96,864.00	35%	$ 62,961.60
Grand Total	**$ 5,387,277.00**		**$ 1,972,095.28**

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 TSC and the Priced Storage Configuration.

Priced Storage Configuration Diagram

32 – HP 16Gb Dual-Port FC HBAs

64 – 8Gb FC connections

Primary and Second Controller Chassis

8 Processor Blades pairs
(16 blades total, 8 blades per chassis)

4 Cache Path Control Adapters pairs
(8 adapters total, 4 adapters per chassis)

32 Cache Memory Modules pairs
(64 modules total, 32 GB/module)
(2048 GB cache memory total,
1024 GB per chassis)

4 FC Host Adapter pairs
(8 adapters total, 4 adapters per chassis)
(88Gb connections per adapter)
(64 total connections, 64 connections used)

4 SAS Disk Adapter pairs
(8 adapters total, 4 adapters per chassis)
(4x6Gb ports per adapter, 32 ports total)
(4 – 1x6 Gbps links per port)
(16 links per adapter)
(128 links total and used)

64 1.6TB Flash Module Drives (FMDs)
(32 FMDs per chassis)

HP XP7 Storage

Priced Storage Configuration Components

Priced Storage Configuration:
32 – HP 16Gb Dual-Port HBAs

HP XP7 Storage
 	
Primary and Second Controller Chassis
 	
  1 – Interconnect kit
 	
  2 – Hubs *(1 Hub per chassis)*
 	
  8 Processor Blade pairs *(16 blades total)*
    (8 blades per chassis)
 	
  4 – Cache Path Control Adapter pairs
     (8 adapters total, 4 adapters per chassis)
 	
  32 – Cache Memory Modules pairs *(32 GB per module)*
       (64 modules total, 32 modules per chassis)
       (2048 GB cache memory, 1024 GB per chassis)
 	
  4 Cache Flash Memory Modules pairs
     (256 GB per module, 8 modules total)
     (2048 GB backup flash)
 	
  4 FC Host Adapter pairs
     (8 adapters total, 4 adapters per chassis)
     (8x8Gb connections per adapter)
     (64 total connections, 64 connections used)
 	
  4 SAS Disk Adapter pairs
     (8 adapters total, 4 BEDs per chassis)
     (4x6Gb ports per BED, 32 total ports)
     (4 – 1x6 Gbps links per port, 16 links per BED)
     (128 total links, 128 links used)

2 – Flash Module Drive Chassis
64 – 1.6 TB Flash Module Drives (FMDs)   *(24 FMDs per chassis)*
8 – Single Phase 60Hz PDUs
2 – Storage Racks