SPC BENCHMARK 1/ENERGY™
EXECUTIVE SUMMARY

NETAPP, INC.
NETAPP FAS3270A

SPC-1/E™ V1.12

Submitted for Review: November 9, 2010
Submission Identifier: AE00004

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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	November 9, 2010
Date the FDR was submitted to the SPC	November 9, 2010
Date the priced storage configuration is available for shipment to customers	November 9, 2010
Date the TSC completed audit certification	November 8, 2010

Tested Storage Product (TSP) Description

The NetApp(R) FAS3270 is the highest performing mid-range platform, with enhanced scalability and flexibility options, in the new FAS3200 family of storage systems with NetApp's unified storage architecture. The FAS3200 series performance is driven by a 64-bit architecture that uses high throughput, low latency links and PCI Express for all internal and external data transfers. With the FAS3200 series and Data ONTAP 8.0.1 you can efficiently consolidate SAN, NAS, primary, and secondary storage on a single platform. Data ONTAP 8.0.1 is designed to provide customers with the next generation of features and functionality to ensure they are able to meet the demands of growing workloads. NetApp has designed systems to make them easy for you to install, configure, manage, and upgrade so you can quickly adapt your storage infrastructure to meet your changing business needs. Data center resources can be better utilized-by taking advantage of a comprehensive set of storage-saving software features in Data ONTAP like Deduplication and Thin Provisioning (FlexVols).

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: NetApp FAS3270A	
Metric	**Reported Result**
SPC-1 IOPS™	68,034.63
SPC-1 Price-Performance	$7.48/SPC-1 IOPS™
Total ASU Capacity	21,659.386 GB
Data Protection Level	Protected *(RAID DP™)*
Total TSC Price (including three-year maintenance)	$509,200.79

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

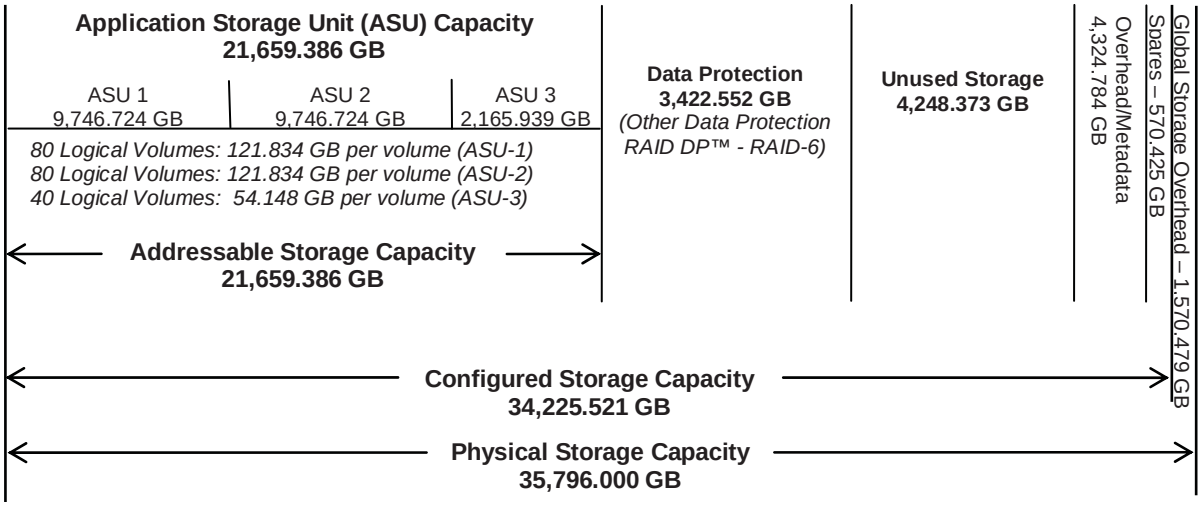
Total ASU *(Application Storage Unit)* **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level** of **Protected** using NetApp's RAID-DP™, a RAID-6 implementation, which provides double-parity RAID protection against data loss with negligible performance overhead and no cost penalty compared to single-parity RAID. Additional information is available at the following location:

http://www.netapp.com/products/software/raid-dp.html

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	60.51%
Protected Application Utilization	70.07%
Unused Storage Ratio	11.87%

Application Utilization: Total ASU Capacity *21,659.386 GB)* divided by Physical Storage Capacity *(35,796.000 GB)*

Protected Application Utilization: (Total ASU Capacity *(21,659.386 GB)* plus total Data Protection Capacity *(3,422.552 GB)* minus unused Data Protection Capacity *(0.000 GB)* divided by Physical Storage Capacity *(35,796.000 GB)*

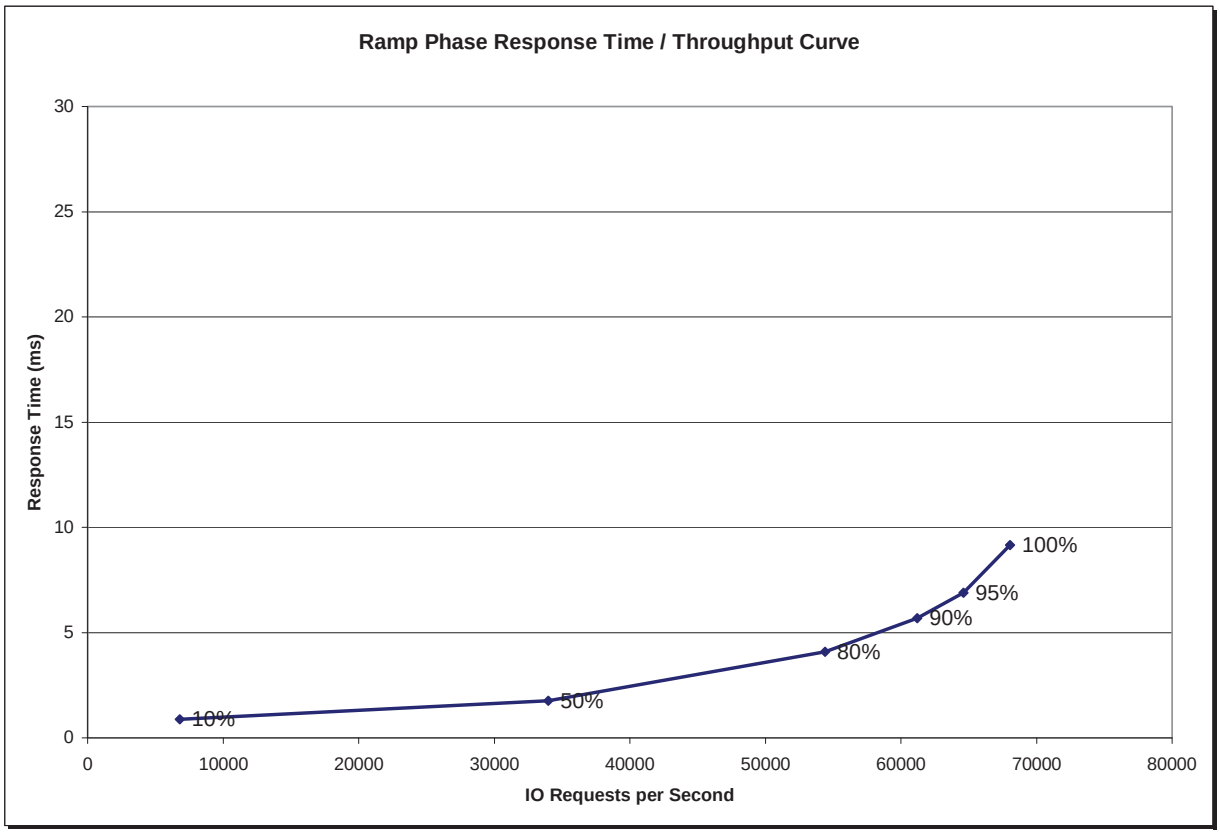
Unused Storage Ratio: Total Unused Capacity *(4,248.373 GB)* divided by Physical Storage Capacity *(35,796.000 GB)* and may not exceed 45%.

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	6,806.31	33,998.92	54,395.92	61,212.00	64,599.52	68,034.63
Average Response Time (ms):						
All ASUs	0.88	1.75	4.09	5.68	6.88	9.16
ASU-1	0.88	1.80	4.36	6.13	7.54	10.24
ASU-2	1.43	3.00	6.29	8.30	9.58	11.89
ASU-3	0.65	1.09	2.56	3.56	4.32	5.66
Reads	1.25	2.73	6.24	8.50	10.19	13.38
Writes	0.65	1.11	2.69	3.84	4.73	6.41

SPC-1/E Reported Data

The initial SPC-1/E energy extension temperature, recorded during the first one minute of the Idle Test was 73.50F. The final SPC-1/E energy extension temperature, recorded during the last one minute of the Primary Metrics Test was 73.62F.

Power Environment

Average RMS Voltage:	**208.28**	**Average Power Factor:**	**0.935**

Usage Profile

	Hours of Use per Day			Nominal	Nominal	Nominal	Nominal
	Heavy	Moderate	Idle	Power, W	Traffic, IOPS	IOPS/W	Heat, BTU/hr
Low Daily Usage:	0	8	16	**2735.29**	**11332.97**	**4.14**	**9,333.07**
Medium Daily Usage:	4	14	6	**2755.83**	**28898.69**	**10.49**	**9,403.16**
High Daily Usage:	18	6	0	**2808.15**	**49296.67**	**17.55**	**9,581.67**
			Composite Metrics:	**2,766.42**	**29,842.78**	**10.79**	

Annual Energy Use, kWh:	**24,233.84**		
Energy Cost, $/kWh:	$ 0.12	**Annual Energy Cost, $:**	**$ 2,908.06**

The above usage profile describes conditions in environments that respectively impose light ("low"), moderate ("medium"), and extensive ("high") demands on the Tested Storage Configuration (TSC).

HEAVY SPC-1 Workload: 2,828.83W at 80% of maximum reported performance *(54,395.92 SPC-1 IOPS)*.

MODERATE SPC-1 Workload: 2,745.08W at 50% of maximum reported performance *(33,998.92 SPC-1 IOPS)*.

IDLE SPC-1 Workload: 2,729.89W at 0% of maximum reported performance *(0.00 SPC-1 IOPS)*.

AVERAGE RMS VOLTAGE: The average supply voltage applied to the Tested Storage Product (TSP) as measured during the Measurement Intervals of the SPC-1/E Tests.

AVERAGE POWER FACTOR: The ratio of average real power, in watts, to the average apparent power, in volt-amps flowing into the Tested Storage Product (TSP) during the Measurement Intervals of the SPC-1/E Tests.

NOMINAL POWER, W: The average power consumption over the course of a day *(24 hours)*, taking into account hourly load variations.

NOMINAL TRAFFIC, IOPS: The average level of I/O requests over the course of a day *(24 hours)*, taking into account hourly load variations.

NOMINAL IOPS/W: The overall efficiency with which I/O requests can be supported, reflected by the ratio of **NOMINAL TRAFFIC** versus the **NOMINAL POWER**.

NOMINAL HEAT, BTU/HR: The average amount of heat required to be dissipated over the course of a day *(24 hours)*, taking into account hourly load variations. *(1 watt = 3.412 BTU/hr)*

COMPOSITE METRICS: The aggregated **NOMINAL POWER**, **NOMINAL TRAFFIC**, and **NOMINAL IOPS/W** for all three environments: **LOW**, **MEDIUM**, and **HIGH DAILY USAGE**.

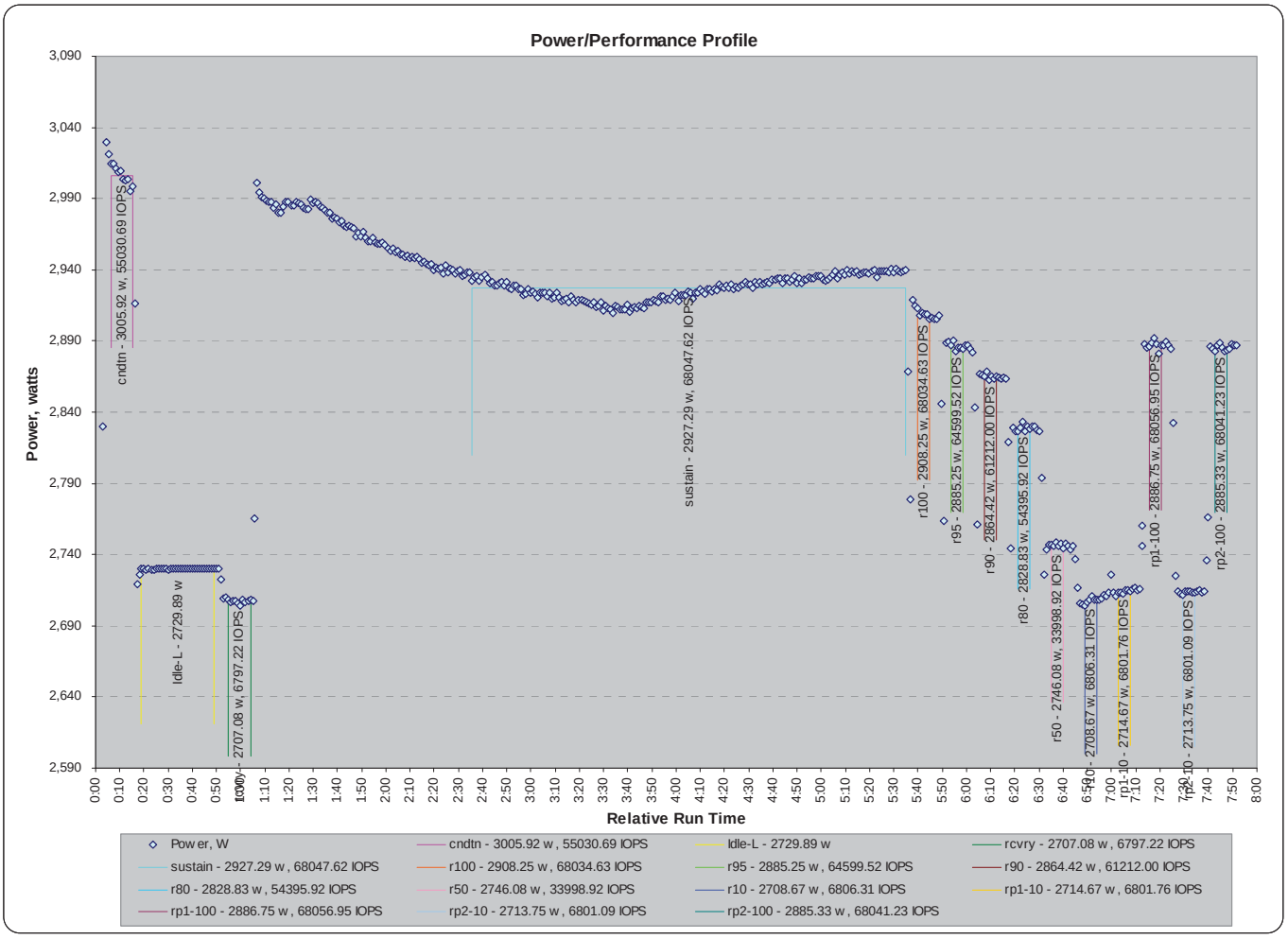
ANNUAL ENERGY USE, KWH: An estimate of the average energy use across the three environments over the course of a year and computed as (**NOMINAL POWER** * 24 *0.365).

ENERGY COST, $/KWH: A standardized energy cost per kilowatt hour.

ANNUAL ENERGY COST: An estimate of the annual energy use across the three environments over the course of a year and computed as (**ANNUAL ENERGY USE** * **ENERGY COST**).

SPC-1/E Power/Performance Profile

The SPC-1/E Power/Performance Profile chart provides a complete "at a glance" illustration and report for each SPC-1/E execution component. The power consumption at each step is reported and, where appropriate the measured SPC-1 performance *(SPC-1 IOPS™)* is also reported.



Priced Storage Configuration Pricing

Part Number	Description	Ext Qty	List Price	Disc %	Net Price	Ext Net Price
CS-A-INST-4R	SupportEdge Standard Replace 4hr, Hardware Support	1	$56,072.79	0	$0.00	$56,072.79
	Documents, 32xx,-C	1	$0.00	0	$0.00	$0.00
DS4243-1507-24S-R5-C	DSK SHLF, 24x300GB, 15K, 3Gb SAS, IOM3, -C, R5	5	$50,764.00	0	$50,764.00	$253,820.00
FAS-V32XX-CHASSIS-R6-C	FAS/V32XX, Chassis, AC PS, -C, R6	1	$0.00	0	$0.00	$0.00
FAS3270A-BASE-R6	FAS3270 HA System Dual Cntlr, includes SFPs and QSFPs	2	$42,000.00	0	$42,000.00	$84,000.00
SW-3270A-ONTAP8-C	SW, Standard Data ONTAP Features, 3270A, -C	2	$0	0	$0.00	$0.00
SW-3270A-PAMII-C	SW, PAMII, 3270AA, -C	2	$0	0	$0.00	$0.00
SW-FCP-C	SW, FCP, -C	2	$0.00	0	$0.00	$0.00
X-320-0008-R5-C	8-Pt Brocade 300 Full Fab FC 8Gbps, -C, R5, includes SFPs	2	$2,939.00	0	$2,939.00	$5,878.00
X1938A-R5-C	PAM II 512GB Perf Accel Module FLASH PCIe, -C	2	$49,000.00		$49,000.00	$98,000.00
X1089A-R6	HBA,QLogic QLE2462,2-Port,4Gb,PCIe,R6	2	$1,700.00	0	$1,700.00	$3,400.00
X6553-R6-C	Cable, Cntlr-Shelf/Switch, 2m, LC/LC, Op, -C	8	$125.00	0	$125.00	$1,000.00
X6557-R6-C	Cable, SAS Cntlr-Shelf/Shelf-Shelf/HA, 0.5m, -C	6	$0.00	0	$0.00	$0.00
X6558-R6-C	Cable, SAS Cntlr-Shelf/Shelf-Shelf/HA, 2m, -C	4	$125.00	0	$125.00	$500.00
X6559-R6-C	Cable, SAS Cntlr-Shelf/Shelf-Shelf/HA, 5m, -C	4	$170.00	0	$170.00	$680.00
X6560-R6-C	Cable, Ethernet, 0.5m RJ45 CAT6, -C	6	$0.00	0	$0.00	$0.00
X6561-R6-C	Cable, Ethernet, 2m RJ45 CAT6, -C	1	$0.00	0	$0.00	$0.00
X6562-R6-C	Cable, Ethernet, 5m RJ45 CAT6, -C	4	$0.00	0	$0.00	$0.00
X800-42U-R6-C	Cabinet Component Power Cable, -C, R6	26	$0.00	0	$0.00	$0.00
X8712C-R6-C	PDU, 1-Phase, 12 Outlet, 30A, NEMA, -C, R6	4	$550.00	0	$550.00	$2,200.00
X870C-R6-C	Cab, Deep, Empty, No PDU, No Rails, -C	1	$3,550.00	0	$3,550.00	$3,550.00
X8778-R6-C	Mounting Bracket, Tie-Down, 32X0, -C, R6	2	$50.00	0	$50.00	$100.00
X877B-R6-C	Rail Kit II, Cab, -C, R6	9	$0.00	0	$0.00	$0.00
SW-FAK-LINUX	FCP LINUX Host Utilities	1	$0.00	0	$0.00	$0.00
	Total					**$509,200.79**

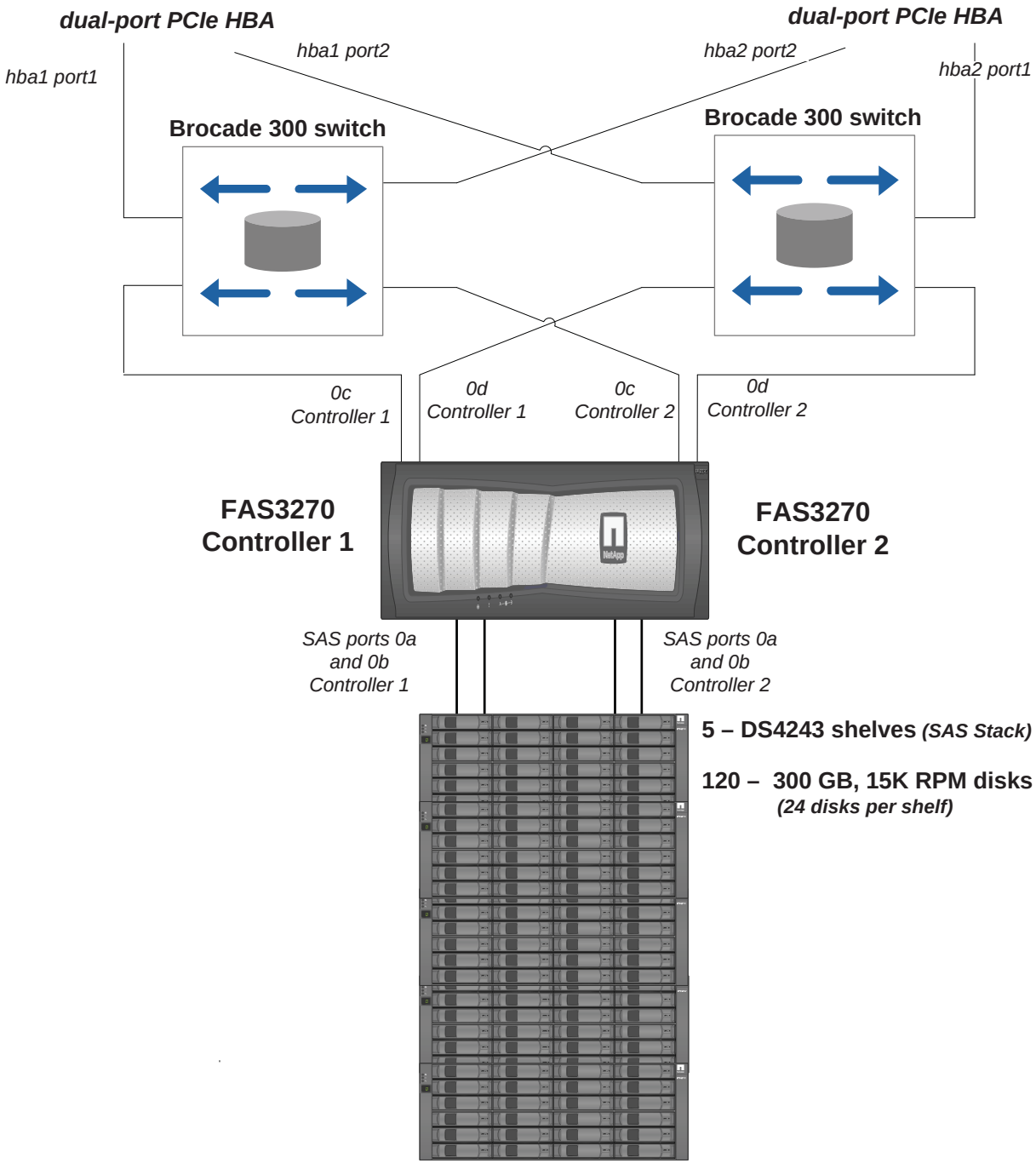
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite present 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 Price 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 Priced Storage Configuration.

Priced Storage Configuration Diagram



Priced Storage Configuration Components

Priced Storage Configuration
2 – Dual Port 4 Gb FC HBAs *(one per Host System)*
NetApp FAS3270A Single controller chassis with dual power supplies Dual Controllers each with: 16 GB memory *(32 GB total)* 6 MB L2 cache *(12 GB total*) 512 GB FlashCache card *(1024 GB total)* 2 FCP front-end connection *(4 total, 4 used)* 2 SAS backend connections *(4 total, 4 used))*
Data ONTAP 8.0.1
2 – 16-port Brocade 300 FC 8 Gbps switches, each switch licensed for 4 ports *(8 total)*
5 – DS4243 Disk Shelves
120 – 300 GB, 15K RPM SAS disk drives 24 disk drives per DS4243 Disk Shelf