



# **SPC BENCHMARK 2™**

## **EXECUTIVE SUMMARY**

**NETAPP, INC.**

**NETAPP EF600 ALL-FLASH ARRAY**

**SPC-2™ v1.7.0**

**SUBMITTED FOR REVIEW: JULY 24, 2020**

**SUBMISSION IDENTIFIER: B12006**

## **EXECUTIVE SUMMARY**

### **Test Sponsor and Contact Information**

<b>Test Sponsor and Contact Information</b>	
<b>Test Sponsor Primary Contact</b>	NetApp, Inc. – <a href="http://www.netapp.com">www.netapp.com</a> Mark Register – <a href="mailto:mark.register@netapp.com">mark.register@netapp.com</a>
<b>Auditor</b>	InfoSizing – <a href="http://www.sizing.com/">http://www.sizing.com/</a> Doug Johnson – <a href="mailto:doug@sizing.com">doug@sizing.com</a>

### **Revision Information and Key Dates**

<b>Revision Information and Key Dates</b>	
<b>SPC-2 Specification revision number</b>	v1.7.0
<b>SPC-2 Workload Generator revision number</b>	v1.4.0
<b>Date Results were first used publicly</b>	July 23, 2020
<b>Date FDR was submitted to the SPC</b>	July 24, 2020
<b>Date the TSC will be available for shipment to customers</b>	July 1, 2020
<b>Date the TSC completed audit certification</b>	July 23, 2020

### **Tested Storage Product Description**

The NetApp EF600 is a 5th generation all-flash end to end NVMe array designed specifically for performance - intensive workloads supporting artificial intelligence, big data analytics, research, and high-performance computing. With extremely high throughput, and low latencies, the EF600 is designed to increase application responsiveness and accelerate modern enterprise applications. The system supports 367TB of raw flash capacity in a modular 2U building block.

The EF600 supports multiple high-speed host interfaces including NVMe/IB, NVMe/RoCE, NVMe/FC, 32Gb FC, 100Gb IB, and 200Gb IB. SANtricity System Manager gives customers the flexibility to manage their NetApp EF600 systems wherever they are through an easy-to-use, on-box, web-based interface. SANtricity Cloud Connector enables NetApp Data Fabric, or Hybrid Cloud capabilities, by providing cost-effective backup and recovery to the cloud.

NetApp E-Series arrays have a rich, 20+ year legacy of providing industry leading price/performance, value, and reliability with over 1 million systems installed.

## SPC-2 Reported Data

SPC-2 Reported Data consists of three groups of information:

- The following SPC-2 Primary Metrics, which characterize the overall benchmark result:
  - SPC-2 MBPS™
  - SPC-2 Price Performance™
  - Application Storage Unit (ASU) Capacity
- Supplemental data to the SPC-2 Primary Metrics.
  - Total Price
  - Data Protection Level
  - Currency Used
  - Target Country
- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

**SPC-2 MBPS™** represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

**SPC-2 Price-Performance™** is the ratio of **Total Price** to **SPC-2 MBPS™**.

**ASU (Application Storage Unit) Capacity** represents the total storage capacity available to be read and written in the course of executing the SPC-2 benchmark.

**Total Price** includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support.

**Data Protection Level of Protected 2** using **RAID-6**, which provides double parity RAID protection against data loss.

**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-2 Data Repository.*

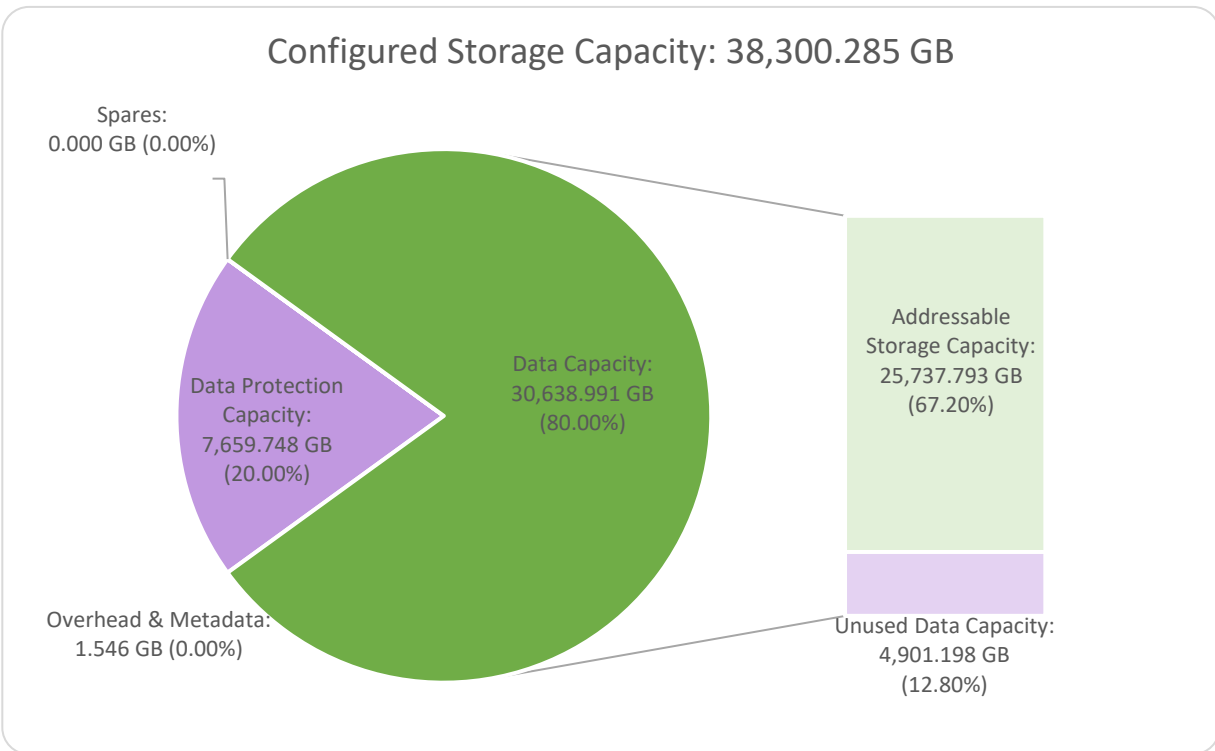
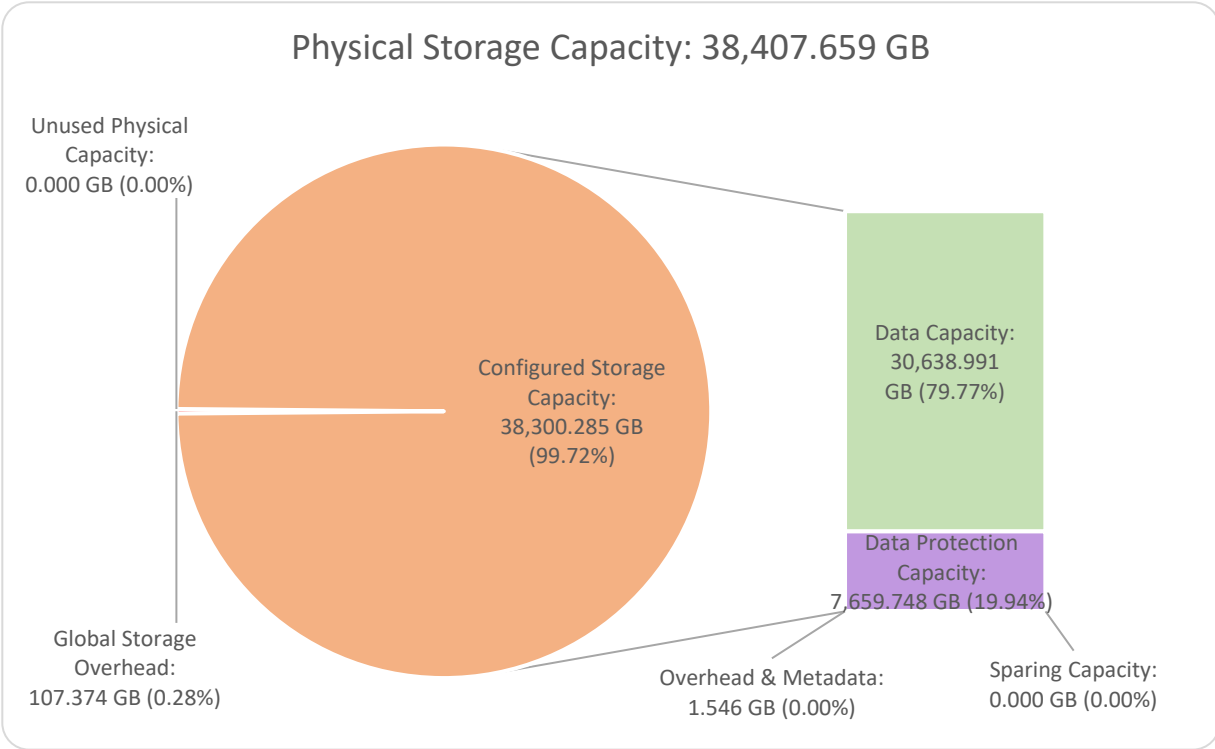
**Currency Used** is formal name for the currency used in calculating the **Total Price** and **SPC-2 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country (*non-local currency*).

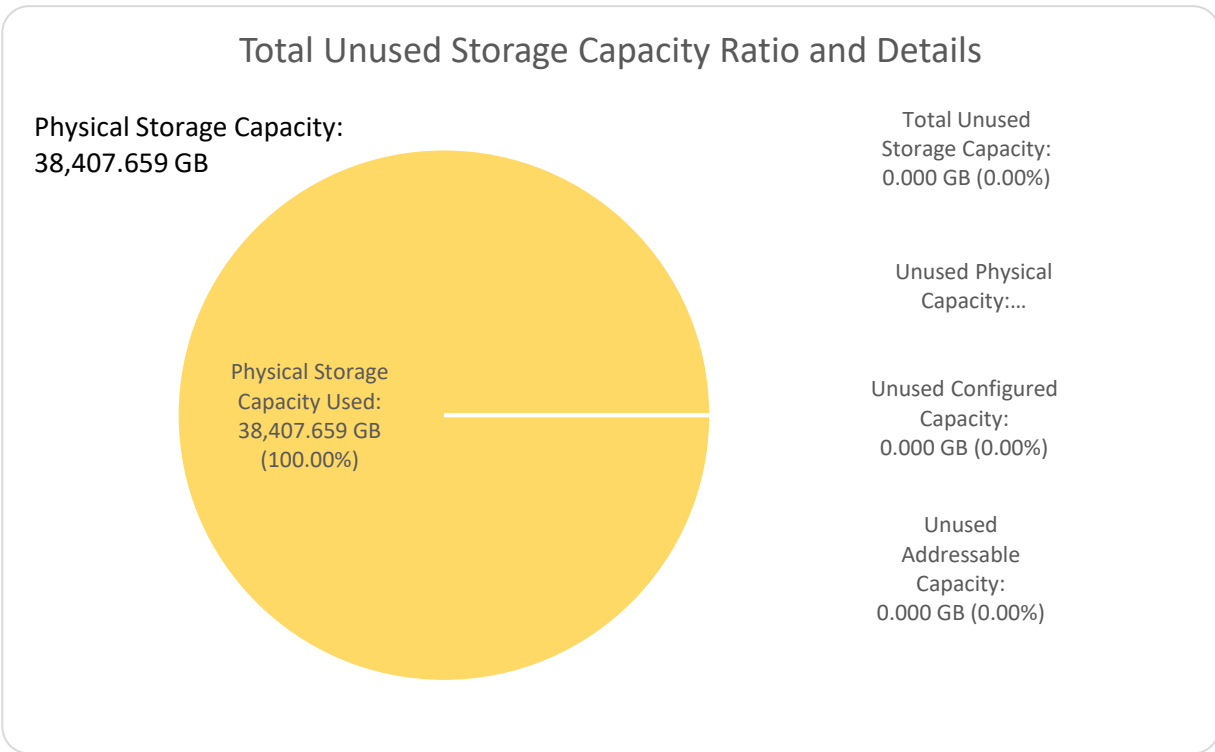
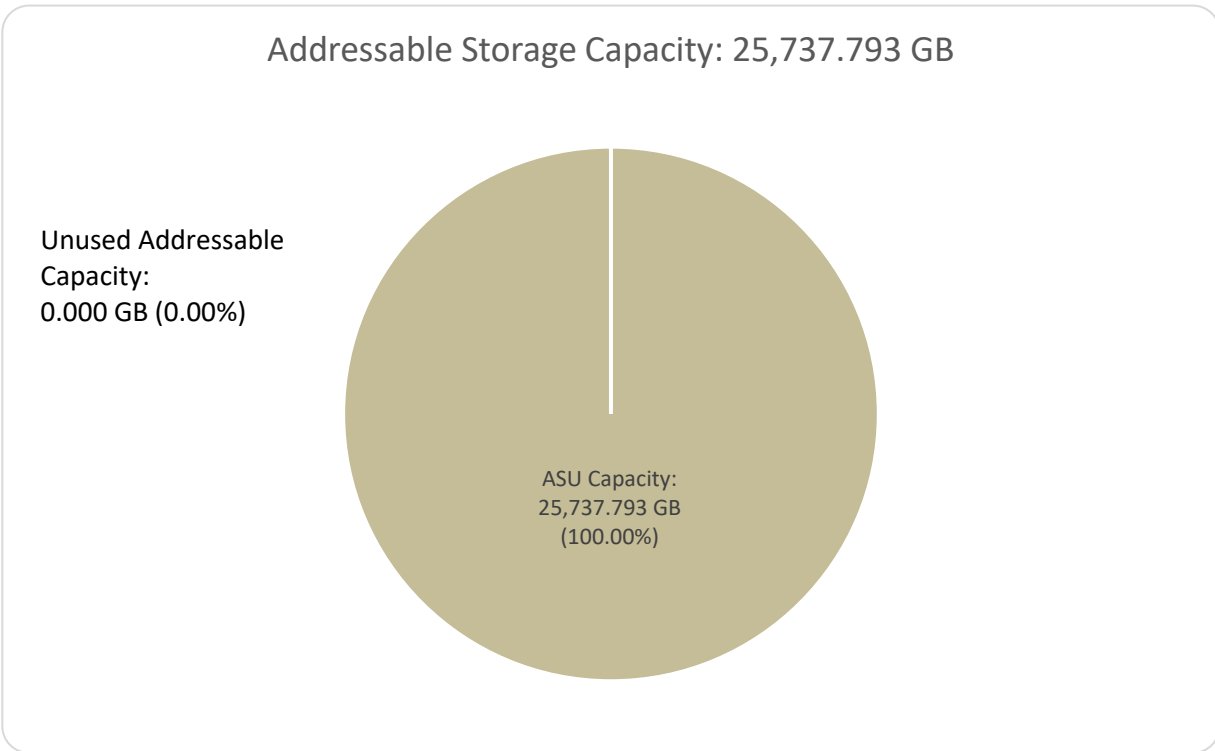
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

SPC-2 Reported Data				
NetApp EF600 All-Flash Array				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
31,070.79	\$3.53	25,737.793	\$109,710.97	Protected 2 (RAID-6)
<i>The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video On Demand (VOD).</i>				
<b>Currency Used:</b>		<b>"Target Country":</b>		
U.S. Dollars		USA		
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	23,277.19			\$4.71
Write Only:				
1024 KiB Transfer	10,931.24	48	227.73	
256 KiB Transfer	10,862.34	48	226.30	
Read-Write:				
1024 KiB Transfer	18,942.97	48	394.65	
256 KiB Transfer	18,917.03	96	197.05	
Read Only:				
1024 KiB Transfer	40,184.85	96	418.59	
256 KiB Transfer	39,824.75	96	414.84	
<i>The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP Test Phases: (Write Only, Read-Write, and Read Only).</i>				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	39,264.31			\$2.79
1024 KiB Transfer Size				
4 I/Os Outstanding	40,118.16	96	417.90	
1 I/O Outstanding	39,670.85	96	413.24	
64 KiB Transfer Size				
4 I/Os Outstanding	37,919.78	48	790.00	
1 I/O Outstanding	39,348.44	96	409.88	
<i>The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ Test Phases: (1024 KiB and 64 KiB Transfer Sizes).</i>				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	30,670.87	39,000	0.79	\$3.58

## 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-2 Storage Capacity Utilization	
Application Utilization	67.01%
Protected Application Utilization	86.96%
Unused Storage Ratio	0.00%

**Application Utilization:** Total ASU Capacity (25,737.793 GB) divided by Physical Storage Capacity (38,407.659 GB).

**Protected Application Utilization:** Total ASU Capacity (25,737.793 GB) plus total Data Protection Capacity (7,659.748 GB) minus unused Data Protection Capacity (0.000 GB) divided by Physical Storage Capacity (38,407.659 GB).

**Unused Storage Ratio:** Total Unused Capacity (0.000 GB) divided by Physical Storage Capacity (38,407.659 GB) and may not exceed 45%.

## Priced Storage Configuration Pricing

Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
<b>Hardware &amp; Software</b>							
E-X5725A-C	Enclosure,2U-24,NE224,Empty,-C, Rail Kit	1	1	2,400.00	2,400.00	55%	1,080.00
EF600A-32GB-C	EF600A, 32GB Ctlr,No HIC,-C	1	2	20,780.00	41,560.00	55%	18,702.00
X-56036-00-C	HIC, EF600, NVMe-FC,32Gb, 4-ports, -C	1	4	2,150.00	8,600.00	55%	3,870.00
X6603A-C	SFP+ Optical, 32Gb FC Shortwave, -C	1	16	1,250.00	20,000.00	55%	9,000.00
E-X4136B-C	SSD,1.9TB, NVMe, SED, NE224C,-C	1	20	3,690.00	73,800.00	55%	33,210.00
OS-SANTRICITY-NVME-01	OS Enable, Per-0.1TB, SANTRCTY, Low Latency, 01	1	380	99.00	37,620.00	55%	16,929.00
X-52197-00-0E-C	Power Cords, In-Cab, 2, C14-C13, E-Series,0E, -C	1	1	53.00	53.00	55%	23.85
X-50541-00-C	Blank, Drive Filler, NE224,-C	1	4	40.00	160.00	55%	72.00
DOC-NE224-SYS-C	Install Documents, System, NE224, -C	1	1	0.00	0.00	55%	0.00
AllHDD LPe32002	Broadcom/Emulex LPe32002 HBA, 32gb FC, 2-ports	2	8	1,740.00	13,920.00	0%	13,920.00
CDW PN 2445875	Tripp Lite, 2M, OM4, Fibre, Optical cable	3	16	26.80	428.80	0%	428.80
<b>Hardware &amp; Software Subtotal</b>							<b>97,235.65</b>
<b>Support &amp; Maintenance</b>							
CS-BASE-SUPPORT	Base Software Support	1	1	5,643.05	5,643.05	55%	2,539.38
CS-02-NOINSTALL-4HR	SupportEdge Premium 4hr Onsite	1	1	22,079.86	22,079.86	55%	9,935.94
<b>Support &amp; Maintenance Subtotal</b>							<b>12,475.32</b>
<b>SPC-2 Total System Price</b>							<b>109,710.97</b>
<p>Prices used in SPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the SPC benchmark specifications. If you find that the stated prices or maintenance levels are not available according to these terms, please inform the SPC at <a href="mailto:spcadmin@spcresults.org">spcadmin@spcresults.org</a>.</p>							

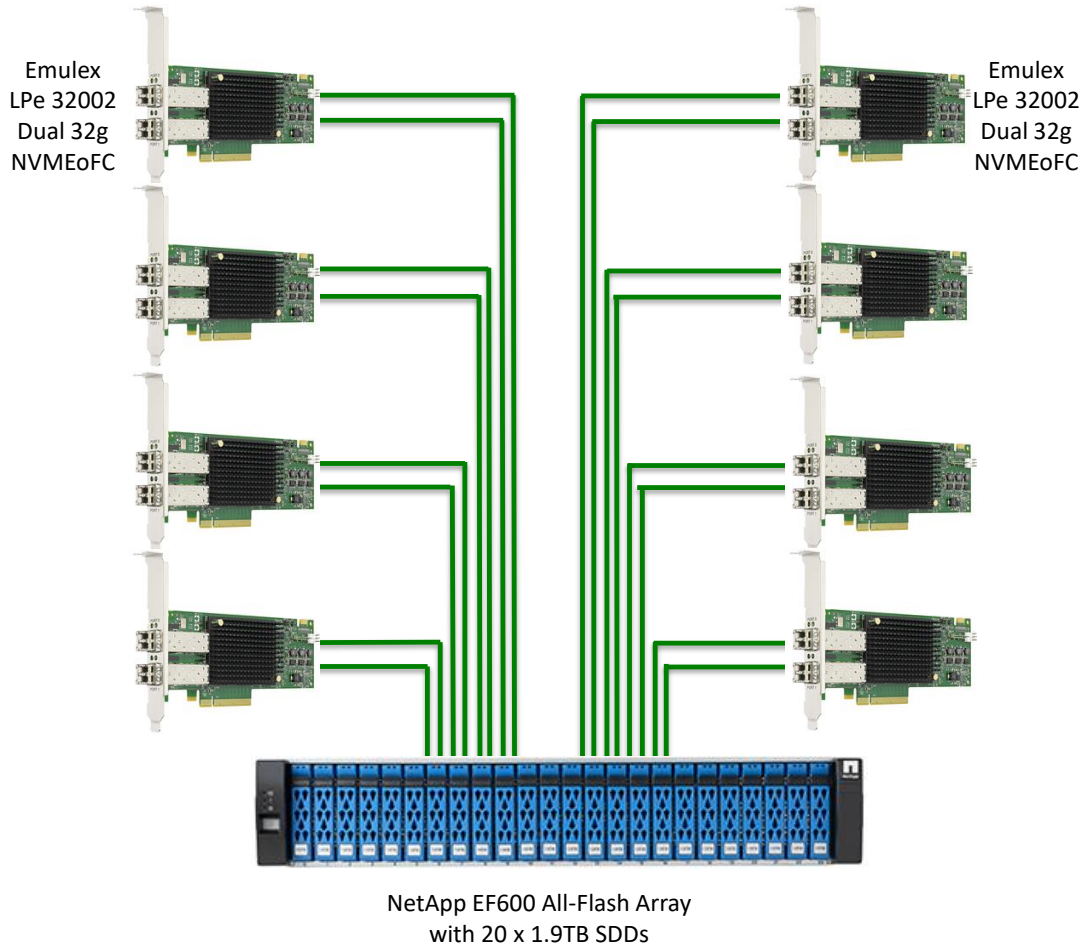
The above pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.

## Differences between Tested Storage Configuration 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
8x Emulex LPe32002 32Gb Dual Port FC HBAs
<b>NetApp EF600 All-Flash Array</b> 2x controllers, each with: 32 GB cache (64 GB total) 8x 32Gb FC connections (16 total) 20x 1.9 TB NVMe SSDs