



Super Micro Computer, Inc.

# TPC Express Benchmark™ HS Full Disclosure Report

## Supermicro Cluster

(with 16x AS-1114S-WN10RT Servers; 1x AS-1114S-WTRT Servers)

Running

CDP Private Cloud Base Edition 7.1.6

on

SUSE Linux Enterprise Server 12 SP5

TPCx-HS Version  
Report Edition  
Report Submitted

2.0.3  
First  
September 16, 2021

**First Edition - September 2021**

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# Abstract

This document contains the methodology and results of the TPC Express Benchmark™ HS (TPCx-HS) test conducted in conformance with the requirements of the TPCx-HS Standard Specification, Revision 2.0.3.


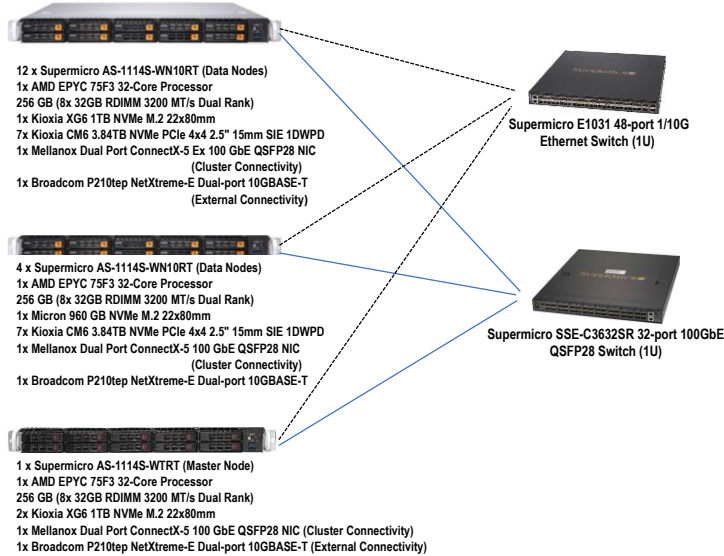
The benchmark results are summarized below.


Measured Configuration			
Company Name	Cluster Node	Hadoop Software	Operating System
Supermicro	AS-1114S-WN10RT	CDP Private Cloud Base Edition 7.1.6	SUSE Linux Enterprise Server 12 SP5


TPC Express Benchmark™ HS Metrics			
Total System Cost	HSph@100TB	Price/Performance	Availability Date
\$885,866	43.80	\$20,225.26	Currently Available


## Executive Summary

The [Executive Summary](#) follows on the next several pages.

	<h1>Supermicro Cluster</h1>		TPCx-HS 2.0.3 TPC Pricing 2.7.0 Report Date Sep. 16, 2021
Availability Date  <b>Currently Available</b>	TPCx-HS Performance  <b>43.80 HSph@100TB</b>	Price/Performance  <b>\$20,225.26 \$ / HSph@100TB</b>	Total System Cost  <b>\$885,866 USD</b>
System Under Test Configuration Overview			
Scale Factor  100	Hadoop Software  CDP Private Cloud Base Edition 7.1.6	Operating System  SUSE Linux Enterprise Server 12 SP5	Other Software  None
 <p>The diagram illustrates the cluster configuration with three server types connected to two switches. The top server is a 12x Supermicro AS-1114S-WN10RT (Data Node) with 1x AMD EPYC 75F3 32-Core Processor, 256 GB (8x 32GB RDIMM 3200 MT/s Dual Rank), 1x Kioxia XG6 1TB NVMe M.2 22x80mm, 7x Kioxia CM6 3.84TB NVMe PCIe 4x4 2.5" 15mm SIE 1DWPD, 1x Mellanox Dual Port ConnectX-5 Ex 100 GbE QSFP28 NIC (Cluster Connectivity), and 1x Broadcom P210tep NetXtreme-E Dual-port 10GBASE-T (External Connectivity). The middle server is a 4x Supermicro AS-1114S-WN10RT (Data Node) with 1x AMD EPYC 75F3 32-Core Processor, 256 GB (8x 32GB RDIMM 3200 MT/s Dual Rank), 1x Micron 960 GB NVMe M.2 22x80mm, 7x Kioxia CM6 3.84TB NVMe PCIe 4x4 2.5" 15mm SIE 1DWPD, 1x Mellanox Dual Port ConnectX-5 Ex 100 GbE QSFP28 NIC (Cluster Connectivity), and 1x Broadcom P210tep NetXtreme-E Dual-port 10GBASE-T. The bottom server is a 1x Supermicro AS-1114S-WTRT (Master Node) with 1x AMD EPYC 75F3 32-Core Processor, 256 GB (8x 32GB RDIMM 3200 MT/s Dual Rank), 2x Kioxia XG6 1TB NVMe M.2 22x80mm, 1x Mellanox Dual Port ConnectX-5 Ex 100 GbE QSFP28 NIC (Cluster Connectivity), and 1x Broadcom P210tep NetXtreme-E Dual-port 10GBASE-T (External Connectivity). Both switches are Supermicro E1031 48-port 1/10G Ethernet Switch (1U) and Supermicro SSE-C3632SR 32-port 100GbE QSFP28 Switch (1U).</p>			
Physical Storage/Scale Factor: 4.48		Scale Factor/Physical Memory: 23.53	
Total Number of Servers: Total Processors/Cores/Threads:		17 (16x AS-1114S-WN10RT; 1x AS-1114S-WTRT) 17/544/1,088	
Server Configuration: Processors Memory Storage Device  Network	Per AS-1114S-WN10RT 1x AMD EPYC 75F3 256 GiB 1x 1 TB NVMe (12 nodes) 1x 960 GB NVMe (4 nodes) 7x 3.84 TB NVMe (all nodes) 1x Mellanox Dual-port ConnectX-5 Ex 100 GbE (12 nodes) 1x Mellanox Dual-port ConnectX-5 Ex 100 GbE (4 nodes) 1x Broadcom Dual-port 10 GbE (all nodes)		Per AS-1114S-WTRT 1x AMD EPYC 75F3 256 GiB 2x 1 TB NVMe  1x Mellanox Dual-port 100 GbE 1x Broadcom Dual-port 10 GbE
Connectivity: Total Rack Units:	1x SSE-C3632R 32-port 100 GbE; 1x E1031 48-port 1/10 GbE 16x(1U)+1x(1U)+1x(1U)+1x(1U) = 16U+1U+1U+1U = 19U		

		<h1>Supermicro Cluster</h1>			TPCx-HS 2.0.3		
				TPC Pricing 2.7.0			
				Report Date Sep. 16, 2021			
Description		Part Number	Source	Qty	Unit Price	Extended Price	3 Yr. Maint. Price
<b>HARDWARE</b>							
<b>Data Nodes</b>							
H12SSW-NTR, CSE-116TS-R706WBP5-N10,RoHS	AS-1114S-WN10RT			1	16	\$1,477.00	\$23,632.00
32GB DDR4-3200 2Rx4 ECC REG DIMM	MEM-DR432L-HL01-ER32			1	128	\$184.60	\$23,628.80
Kioxia CM6 3.84TB NVMe PCIe 4x4 2.5" 15mm SIE 1DWPD	HDS-TUN-KCM6XRUL3T84			1	112	\$859.00	\$96,208.00
Mellanox ConnectX-5 EN network card 100GbE dual-port	AOC-MCX516A-CDAT			1	12	\$1,060.00	\$12,720.00
MCX516A-CCAT PCIe 2-port 100GbE QSFP28 Gen3.0 x16 CX-5	AOC-MCX516A-CCAT			1	4	\$849.00	\$3,396.00
Milan 75F3 DP/UP 32C/64T 2.95G 256M 280W SP3	PSE-MLN75F3-0313			1	16	\$4,834.00	\$77,344.00
Kioxia XG6 1TB NVMe M.2 22x80mm	HDS-TMN0-KXG60ZNV1T02			1	12	\$190.00	\$2,280.00
Micron 7300 PRO 960GB,PCIe NVMe,M.2 22x80mm,3D TLC,1DWPD	HDS-MMN-MTFDHB960TDF1AW			1	4	\$178.50	\$714.00
Out of Band Firmware Management License-BIOS Flash /Setting	SFT-OOB-LIC			1	16	\$15.00	\$240.00
ASSEMBLY FEE	MC0037			1	16	\$25.00	\$400.00
0% 3 YRS LABOR, 3 YRS PARTS, 1 YR CRS UNDER LIMITED WRNTY	EWCS			1	16 (included)		(included)
On Site 4hrs 24x7x365 Support 3 Years with Extended Wrnty	OS4HR3			1	16	\$516.28	\$8,260.42
<b>Master Node</b>							
H12SSW-NT, CSV-116TS-R504WBP	AS-1114S-WTRT			1	1	\$1,304.00	\$1,304.00
32GB DDR4-3200 2Rx4 ECC REG DIMM	MEM-DR432L-HL01-ER32			1	8	\$184.60	\$1,476.80
Kioxia XG6 1TB NVMe M.2 22x80mm	HDS-TMN0-KXG60ZNV1T02			1	2	\$190.00	\$380.00
Mellanox ConnectX-5 EN network card 100GbE dual-port	AOC-MCX516A-CDAT			1	1	\$1,060.00	\$1,060.00
Milan 75F3 DP/UP 32C/64T 2.95G 256M 280W SP3	PSE-MLN75F3-0313			1	1	\$4,834.00	\$4,834.00
Out of Band Firmware Management License-BIOS Flash /Setting	SFT-OOB-LIC			1	1	\$15.00	\$15.00
ASSEMBLY FEE	MC0037			1	1	\$25.00	\$25.00
0% 3 YRS LABOR, 3 YRS PARTS, 1 YR CRS UNDER LIMITED WRNTY	EWCS			1	1 (included)		(included)
On Site 4hrs 24x7x365 Support 3 Years with Extended Wrnty	OS4HR3			1	1	\$454.36	\$454.36
<b>Network and Cables</b>							
E1031 48-port 1/10G Ethernet ToR switch	SSE-G3648BR			1	1	\$1,675.00	\$1,675.00
Cumulus-Linux SW 1G perpetual license with 3 yr Cumulus	SFT-CLSPL1G-3Y			1	1	\$1,475.00	\$1,475.00
On Site 4hrs 24x7x365 Support 3 Years with Extended Wrnty	OS4HR3			1	1	\$315.00	\$315.00
32-port 100GbE QSFP28,B2F,2x800W R0872-F0004-01,HF	SSE-C3632SR			1	1	\$7,375.00	\$7,375.00
Cumulus-Linux Software 100G Perpetual License with 3 yr SnS	SFT-CLSNWPL-100G-3Y			1	1	\$6,399.00	\$6,399.00
On Site 4hrs 24x7x365 Support 3 Years with Extended Wrnty	OS4HR3			1	1	\$1,377.40	\$1,377.40
ETHERNET, QSFP28, 100GbE, PASSIVE, LSZH, 3m, Molex, RoHS	CBL-NTWK-0943-SQ28C30M			1	17	\$139.50	\$2,371.50
ETHERNET, CAT6, RJ45, SNAGLESS, YELLOW, 15FT (4.6M), 28AWG, Ro	CBL-C6-YL15FT-P			1	17	\$10.80	\$183.60
ETHERNET, CAT6, RJ45, SNAGLESS, GREEN, UTP, 15FT (4.5M), 28AWG, RoHS	CBL-C6-GN15FT-P			1	17	\$10.80	\$183.60
<b>Infrastructure</b>							
42U Enclosure system	SRK-42SE-11			1	1	\$1,516.30	\$1,516.30
Rack PDU, Switched, 2U, 30A, 208V, (16)C13	AP7911B			2	3	\$1,025.00	\$3,075.00
PWCD, US, IEC60320 C14 TO C13, 4FT, 16AWG, RoHS/REACH	CBL-PWCD-0373-IS			1	38	\$6.50	\$247.00
LONCEVON - 12 inch IPS 1920x1080p HDMI Monitor	N/A			3	3	\$99.99	\$299.97
Logitech MK200 Media Keyboard and Mouse Combo	920-002714			3	3	\$41.50	\$124.50
<b>Spares, Accessories</b>							
ETHERNET, QSFP28, 100GbE, PASSIVE, LSZH, 3m, Molex, RoHS	CBL-NTWK-0943-SQ28C30M			1	3	\$139.50	\$418.50
ETHERNET, CAT6, RJ45, SNAGLESS, YELLOW, 15FT (4.6M), 28AWG, Ro	CBL-C6-YL15FT-P			1	3	\$10.80	\$32.40
ETHERNET, CAT6, RJ45, SNAGLESS, GREEN, UTP, 15FT (4.5M), 28AWG, RoHS	CBL-C6-GN15FT-P			1	3	\$10.80	\$32.40
PWCD, US, IEC60320 C14 TO C13, 4FT, 16AWG, RoHS/REACH	CBL-PWCD-0373-IS			1	3	\$6.50	\$19.50
<b>HARDWARE Subtotals</b>					<b>\$275,085.87 \$10,407.17</b>		
(continued next page)							

	<h1>Supermicro Cluster</h1>		TPCx-HS2.0.3				
			TPC Pricing2.7.0				
			Report DateSep. 16, 2021				
(continued from previous page)							
Description		Part Number	Source	Qty	Unit Price	Extended Price	3 Yr. Maint. Price
<b>SOFTWARE</b>							
SUSE Linux Enterprise Server, x86 & x86-64, 1-2 Sockets or 1-2 Virtual Machines, Priority Subscription, 3 Year 874-006883		SFT-NV-SU2P3YBAC		1 17	\$2,916.00	\$49,572.00	
Cloudera Data Platform Private Cloud Base Edition - Annual Subscription per Node for up to 16 Cores/128 GB RAM for compute and up to 48 TB for storage. BusinessLevel Support.		SMC-CDP-PVCBASE-BUS		1 51	\$9,600.00	\$489,600.00	
COMPUTE: price per CCU per year for compute in excess of 16 cores/128GB RAM per Node, where 1 CCU = 1 core + 8 GB RAM		SMC-CDP-COMPUTE		1 816	75	\$61,200.00	
<b>SOFTWARE Subtotals</b>						<b>\$600,372.00</b>	<b>\$0.00</b>
Pricing: 1 = Supermicro; 2 = APC; 3 = Amazon		<b>Three-Year Cost of Ownership:</b>		<b>\$885,866</b>			
* Discount applies to all line items where Key = 1. Discount based upon total system cost as purchased by a regular customer.		<b>HSph@100TB:</b>		<b>43.80</b>			
<b>Audited by Doug Johnson, InfoSizing</b>		<b>\$ / HSph@100TB:</b>		<b>\$20,225.26</b>			
<i>Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated Line Items. 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 Line Items. For complete details, see the pricing section of the TPC Benchmark Standard. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you.</i>							



Supermicro Cluster

TPCx-HS2.0.3

TPC Pricing2.7.0

Report Date Sep. 16, 2021


Numerical Quantities

Performance Run – Run 1

Scale Factor	100TB
Run Start Time	2021-09-02 08:33:35.000
Run End Time	2021-09-02 10:50:30.000
Run Elapsed Time	8,218.000
HSGen Start Time	2021-09-02 08:33:36.000
HSGen End Time	2021-09-02 09:00:39.000
HSGen Elapsed Time	1,624.553
HSSort Start Time	2021-09-02 09:00:50.000
HSSort End Time	2021-09-02 10:37:49.000
HSSort Elapsed Time	5,820.704
HSValidate Start Time	2021-09-02 10:38:00.000
HSValidate End Time	2021-09-02 10:50:30.000
HSValidate Elapsed Time	751.080

Repeatability Run – Run 2

Scale Factor	100TB
Run Start Time	2021-09-02 10:55:36.000
Run End Time	2021-09-02 13:12:19.000
Run Elapsed Time	8,206.000
HSGen Start Time	2021-09-02 10:55:37.000
HSGen End Time	2021-09-02 11:22:53.000
HSGen Elapsed Time	1,637.588
HSSort Start Time	2021-09-02 11:23:04.000
HSSort End Time	2021-09-02 12:59:42.000
HSSort Elapsed Time	5,799.461
HSValidate Start Time	2021-09-02 12:59:53.000
HSValidate End Time	2021-09-02 13:12:19.000
HSValidate Elapsed Time	747.356

	<h1>Supermicro Cluster</h1>	TPCx-HS 2.0.3 TPC Pricing 2.7.0 Report Date Sep. 16, 2021																		
<div data-bbox="280 600 1341 648" data-label="Section-Header"> <h2>Run Reports</h2> </div> <div data-bbox="345 743 1281 1108" data-label="Text"> <p>Run Report for Performance Run – Run 1</p> <p>=====</p> <p>TPCx-HS Performance Metric (HSph@SF) Report</p> <table> <tr> <td>Test Run 1 Details</td><td>Total Time =</td><td>8218</td></tr> <tr> <td></td><td>Total Size =</td><td>1000000000000</td></tr> <tr> <td></td><td>Scale-Factor =</td><td>100</td></tr> </table> <p>TPCx-HS Performance Metric (HSph@SF): 43.8077</p> <p>=====</p> </div> <div data-bbox="345 1205 1281 1570" data-label="Text"> <p>Run Report for Repeatability Run – Run 2</p> <p>=====</p> <p>TPCx-HS Performance Metric (HSph@SF) Report</p> <table> <tr> <td>Test Run 2 Details</td><td>Total Time =</td><td>8206</td></tr> <tr> <td></td><td>Total Size =</td><td>1000000000000</td></tr> <tr> <td></td><td>Scale-Factor =</td><td>100</td></tr> </table> <p>TPCx-HS Performance Metric (HSph@SF): 43.8711</p> <p>=====</p> </div>			Test Run 1 Details	Total Time =	8218		Total Size =	1000000000000		Scale-Factor =	100	Test Run 2 Details	Total Time =	8206		Total Size =	1000000000000		Scale-Factor =	100
Test Run 1 Details	Total Time =	8218																		
	Total Size =	1000000000000																		
	Scale-Factor =	100																		
Test Run 2 Details	Total Time =	8206																		
	Total Size =	1000000000000																		
	Scale-Factor =	100																		





## Supermicro Cluster

TPCx-HS	2.0.3
TPC Pricing	2.7.0
Report Date	Sep. 16, 2021

### Revision History

Date	Edition	Description
September 16, 2021	First	Initial Publication

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# Clause 0 – Preamble

## 0.1 TPC Express Benchmark™ HS Overview

The TPC Express Benchmark™ HS (TPCx-HS) was developed to provide an objective measure of hardware, operating system and commercial Apache Hadoop File System API compatible software distributions, and to provide the industry with verifiable performance, price-performance and availability metrics. The benchmark models a continuous system availability of 24 hours a day, 7 days a week.

Even though the modeled application is simple, the results are highly relevant to hardware and software dealing with Big Data systems in general. TPCx-HS stresses both hardware and software including Hadoop run-time, Hadoop File-system API compatible systems and MapReduce layers. This workload can be used to assess a broad range of system topologies and implementation of Hadoop clusters. TPCx-HS can be used to assess a broad range of system topologies and implementation methodologies in a technically rigorous and directly comparable and vendor-neutral manner.

The TPCx-HS kit is available from the TPC (See [www.tpc.org/tpcx-hs](http://www.tpc.org/tpcx-hs) for more information). Users must sign-up and agree to the TPCx-HS User Licensing Agreement (ULA) to download the kit. Re-distribution of the kit is prohibited. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include TPCx-HS copyright. The TPCx-HS Kit includes: TPCx-HS Specification document, TPCx-HS Users Guide documentation, shell scripts to set up the benchmark environment and Java code to execute the benchmark load.

The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users. To achieve that purpose, TPC benchmark specifications require that benchmark tests be implemented with systems, products, technologies and pricing that:

- Are generally available to users;
- Are relevant to the market segment that the individual TPC benchmark models or represents (e.g., TPCx-HS models and represents Hadoop run-time and Hadoop File-system API compatible systems);
- Would plausibly be implemented by a significant number of users in the market segment the benchmark models or represents.

The use of new systems, products, technologies (hardware or software) and pricing is encouraged so long as they meet the requirements above. Specifically prohibited are benchmark systems, products, technologies or pricing (hereafter referred to as "implementations") whose primary purpose is performance optimization of TPC benchmark results without any corresponding applicability to real-world applications and environments. In other words, all "benchmark special" implementations that improve benchmark results but not real-world performance or pricing, are prohibited.

The rules for pricing are included in the TPC Pricing Specification and rules for energy measurement are included in the TPC Energy Specification. Further information is available at [www.tpc.org](http://www.tpc.org).

# Clause 1 – General Items

## 1.1 Test Sponsor

*A statement identifying the benchmark sponsor(s) and other participating companies must be provided*

This benchmark was sponsored by Super Micro Computer, Inc..

## 1.2 Parameter Settings

*Settings must be provided for all customer-tunable parameters and options which have been changed from the defaults found in actual products, including by not limited to:*

- *Configuration parameters and options for server, storage, network and other hardware component incorporated into the pricing structure;*
- *Configuration parameters and options for operating system and file system component incorporated into the pricing structure;*
- *Configuration parameters and options for any other software component incorporated into the pricing structure;*
- *Compiler optimization options.*

*Comment 1: In the event that some parameters and options are set multiple times, it must be easily discernible by an interested reader when the parameter or option was modified and what new value it received each time.*

*Comment 2: This requirement can be satisfied by providing a full list of all parameters and options, as long as all those that have been modified from their default values have been clearly identified and these parameters and options are only set once.*

The supporting files contain the parameters and options used to configure the components involved in this benchmark.

## 1.3 Configuration Diagrams

*Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:*

- *Total number of nodes used;*
- *Total number and type of processors used/total number of cores used/total number of threads used (including sizes of L2 and L3 caches);*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test;*
- *Number and type of disk units (and controllers, if applicable);*
- *Number of channels or bus connections to disk units, including their protocol type;*
- *Number of LAN (e.g., Ethernet) connections and speed for switches and other hardware components physically used in the test or are incorporated into the pricing structure;*
- *Type and the run-time execution location of software components.*

1.3.1 Measured Configuration

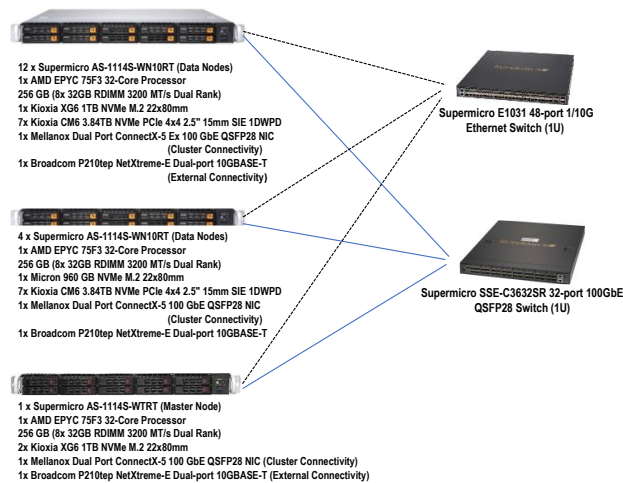


Figure 1-1 Measured Configuration

The measured configuration consisted of:

- Total Nodes: 17 (16x AS-1114S-WN10RT; 1x AS-1114S-WTRT)
- Total Processors/Cores/Threads: 17/544/1,088
- Total Memory: 4.25TiB
- Total Number of Storage Drives/Devices: 130
- Total Storage Capacity: 447.92TB

Server node details:

16x AS-1114S-WN10RT Servers, each with: <ul style="list-style-type: none"><li>• Processors/Cores/Threads: 1/32/64</li><li>• Processor Model: AMD EPYC 75F3</li><li>• Memory: 256 GiB</li><li>• Drives:<ul style="list-style-type: none"><li>○ 1x 1 TB NVMe (12 nodes)</li><li>○ 1x 960 GB NVMe (4 nodes)</li><li>○ 7x 3.84 TB NVMe (all nodes)</li></ul></li><li>• Network:<ul style="list-style-type: none"><li>○ 1x Mellanox Dual-port ConnectX-5 Ex 100 GbE (12 nodes)</li><li>○ 1x Mellanox Dual-port ConnectX-5 100 GbE (4 nodes)</li><li>○ 1x Broadcom Dual-port 10 GbE (all nodes)</li></ul></li></ul>	1x AS-1114S-WTRT Servers, each with: <ul style="list-style-type: none"><li>• Processors/Cores/Threads: 1/32/64</li><li>• Processor Model: AMD EPYC 75F3</li><li>• Memory: 256 GiB</li><li>• Drives:<ul style="list-style-type: none"><li>○ 2x 1 TB NVMe</li></ul></li><li>• Network:<ul style="list-style-type: none"><li>○ 1x Mellanox Dual-port ConnectX-5 Ex 100 GbE</li><li>○ 1x Broadcom Dual-port 10 GbE</li></ul></li></ul>
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Network connectivity detail:

- 1x SSE-C3632R 32-port 100 GbE
- 1x E1031 48-port 1/10 GbE

The distribution of software components over server nodes is detailed in section 1.5.

1.3.2 Priced Configuration

There are no differences between the priced configuration and the measured configuration.

## 1.4 Dataset Distribution

*The distribution of dataset across all media must be explicitly described.*

Table 1-1 describes the distribution of the dataset across all media in the system.

Server Node	Controller	Disk Drive	Description of Content
1	NVMe	nvme7n1	Operating System, Root, Swap, Hadoop Master
2-3	NVMe	nvme7n1	Operating System, Root, Swap, Hadoop Master
2-3	NVMe	nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1	Data, Temp
4-17	NVMe	nvme7n1	Operating System, Root, Swap, Hadoop Master
4-17	NVMe	nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1	Data, Temp

*Table 1-1 Dataset Distribution*

## 1.5 Software Components Distribution

*The distribution of various software components across the system must be explicitly described.*

Table 1-2 Describes the distribution of the software components across the system.

Node	Map/Reduce		HDFS		ZooKeeper
	Resource Manager	Node Manager	NameNode	DataNode	QuorumPeer
1	X		X		X
2-3		X		X	
4-17		X		X	

*Table 1-2 Software Component Distribution*

*Distributed file system implementation and corresponding Hadoop File System API version must be disclosed.*

CDP Private Cloud Base Edition 7.1.6 (fully HDFS compatible at the API level).

*Map/Reduce implementation and corresponding version must be disclosed.*

CDP Private Cloud Base Edition 7.1.6 (compatible equivalent to Hadoop 3.1.1.7.1.6.0-297).

## Clause 2 – Workload Related Items

### 2.1 Hardware & Software Tunables

*Script or text used to set for all hardware and software tunable parameters must be reported.*

The Supporting File Archive contains all configuration scripts.

### 2.2 Run Report

*The run report generated by TPCx-HS benchmark kit must be reported.*

The Supporting File Archive contains the full run report. Following are extracts from the run report that lists the performance summary for both runs.

#### Run Report for Run 1 – Performance Run

```
=====
TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details      Total Time =                8218
                        Total Size =            1000000000000
                        Scale-Factor =              100

TPCx-HS Performance Metric (HSph@SF):                43.8077

=====
```

#### Run Report for Run 2 – Repeatability Run

```
=====
TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details      Total Time =                8206
                        Total Size =            1000000000000
                        Scale-Factor =              100

TPCx-HS Performance Metric (HSph@SF):                43.8711

=====
```

### 2.3 Benchmark Kit Identification

*Version number of TPCx-HS kit and checksum for HSGen, HSSort and HSValidate Programs must be reported.*

Kit Version	2.0.3
File	MD5
BigData_cluster_validate_suite.sh	57f7cd68251a9aba0feb6648630ff5da
HSDDataCheck.sh	bcf0b946a49d1249c9da174b5d9805f1
TPCx-HS-master_MR2.jar	492cbc51a1a60c28b43d96c79d08683d
TPCx-HS-master.sh	c619a0819571ecd00cd75d2b76ba8c64

## 2.4 Benchmark Kit Changes

The required data protection was provided by HDFS Erasure Coding rather than the default three-way data replication. A policy of RS-6-3-1024k was used. Therefore, each block group consisted of 6 data blocks and 3 parity blocks. Each block within a given block group was placed on a different node thus ensuring the required data protection.

To collect the necessary data for auditing, the HSDDataCheck.sh script was modified. In accordance with the TPCx-HS Standard Specification, this change received prior approval from the TPCx-HS subcommittee.



## Clause 3 – SUT Related Items

### 3.1 Data Storage Ratio

*The data storage ratio must be disclosed.*

Table 3-1 describes the details of the storage devices configured on the system and their capacity.

Quantity	Capacity	Total (TB)
12	1 TB	12.00
4	960 GB	3.84
112	3.84 TB	430.08
2	1 TB	2.00
<b>Total Storage (TB)</b>		<b>447.92</b>

*Table 3-1 Storage Device Capacities*

Scale Factor = 100

**Data Storage Ratio** = (Total Storage (TB) / SF) = **4.48**

### 3.2 Memory Ratio

*The Scale Factor to memory ratio must be disclosed.*

Total Configured Memory (TiB) = 4.25

**Scale Factor to Memory Ratio** = (SF / Total Memory(TiB)) = **23.53**

## Clause 4 – Metrics Related Items

### 4.1 HSGen Time

The HSGen time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSGen	1,624.553	1,637.588

Table 4-1 HSGen Times

### 4.2 HSSort Time

The HSSort time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSSort	5,820.704	5,799.461

Table 4-2 HSSort Times

### 4.3 HSValidate Time

The HSValidate time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSValidate	751.080	747.356

Table 4-3 HSValidate Times

### 4.4 HSDataCheck Times

Both HSDataCheck times must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSDataCheck (pre-sort)	11.000	11.000
HSDataCheck (post-sort)	11.000	11.000

Table 4-4 HSDataCheck Times

### 4.5 Performance & Price-Performance

The performance metric (HSph@SF) must be disclosed for Run 1 and Run 2. Price-performance metric (\$/HSph@SF) must be disclosed for the performance run.

	Run 1	Run 2
HSph@100TB	43.80	43.87

Table 4-5 Performance Metrics

Run 1 Price-Performance: 20,225.26 \$/ HSph@100TB

## Auditor's Information & Letter of Attestation

*The auditor's agency name, address, phone number, and Attestation letter must be included in the full disclosure report. A statement should be included specifying who to contact in order to obtain further information regarding the audit process.*

This benchmark was audited by Doug Johnson, InfoSizing.

www.sizing.com  
63 Lourdes Drive  
Leominster, MA 10453  
978-343-6562

This benchmark's Full Disclosure Report (FDR) can be downloaded from [www.tpc.org](http://www.tpc.org).

A copy of the auditor's Letter of Attestation follows.



Srini Bala  
Super Micro Computer, Inc.  
980 Rock Avenue,  
San Jose, CA 95131  
USA

September 15, 2021

I verified the TPC Express Benchmark™ HS v2.0.3 performance of the following configuration:

Platform: Supermicro Cluster with:  
16x AS-1114S-WN10RT Servers (Data Nodes)  
1x AS-1114S-WTRT Server (Master Node)  
Operating System: SUSE Linux Enterprise Server 12 SP5  
Apache Hadoop CDP Private Cloud Base Edition 7.1.6  
Compatible Software:

The results were:

**Performance Metric 43.80 HSph@100TB**  
Run Elapsed Time 8,218.00 Seconds

**Cluster 16x AS-1114S-WN10RT, 1x AS-1114S-WTRT with:**

CPUs 1x AMD® EPYC 75F3 32-Core Processor (all nodes)  
Memory 256 GiB (all nodes)

Storage	Qty	Size	Type
	2	1 TB	NVMe (master node)
	1	1 TB	NVMe (12 data nodes)
	1	960 GB	NVMe (4 data nodes)
	7	3.84 TB	NVMe (all data nodes)

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark.

The following verification items were given special attention:

- All TPC-provided components were verified to be v2.0.3
- No modifications were made to any of the Java code
- Any and all modifications to shell scripts were reviewed for compliance
- All checksums were validated for compliance

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- The generated dataset was properly scaled to 100 TB
- The generated dataset and the sorted dataset were erasure coded with a policy of RS-6-3-1024k
- The elapsed times for all phases and runs were correctly measured and reported
- The Storage and Memory Ratios were correctly calculated and reported
- The system pricing was verified for major components and maintenance
- The major pages from the FDR were verified for accuracy

Additional Audit Notes:

None.

Respectfully Yours,

A handwritten signature in black ink, appearing to read "Doug Johnson", with a long horizontal flourish extending to the right.

Doug Johnson, Certified TPC Auditor

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## Supporting Files Index

Clause	Description	Archive File Pathname
Clause 1	Parameters and options used to configure the system	SupportingFiles/Clause1
Clause 2	Configuration scripts and Run Report	SupportingFiles/Clause2
Clause 3	System configuration details	SupportingFiles/Clause3

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