

TPC Express Benchmark™ HS

Full Disclosure Report

HPE ProLiant DL325 Gen11

(with 1x ProLiant DL325 Gen11 Server; 16x ProLiant DL325 Gen11 Servers)

Running

CDP Private Cloud Base Edition 7.1.7

on

Red Hat Enterprise Linux 8.6

TPCx-HS Version
Report Edition
Report Submitted

2.0.3
First
March 23, 2023

First Edition - March 2023

Hewlett Packard Enterprise Company (HPE), the Sponsor of this benchmark test, believes that the information in this document is accurate as of the publication date. The information in this document is subject to change without notice. The Sponsor assumes no responsibility for any errors that may appear in this document.

The pricing information in this document is believed to accurately reflect the current prices as of the publication date. However, the Sponsor provides no warranty of the pricing information in this document.

Benchmark results are highly dependent upon workload, specific application requirements, and system design and implementation. Relative system performance will vary because of these and other factors. Therefore, the TPC Express Benchmark™ V should not be used as a substitute for a specific customer application benchmark when critical capacity planning and/or product evaluation decisions are contemplated.

All performance data contained in this report was obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly. No warranty of system performance or price/performance is expressed or implied in this report.

HPE and the HPE Logo are trademarks of Hewlett Packard Enterprise Company and/or its affiliates in the U.S. and other countries. Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between HPE and any other company

TPC Express Benchmark™ HS, TPCx-HS, and HSph, are registered certification marks of the Transaction Processing Performance Council.

The HPE products, services or features identified in this document may not yet be available or may not be available in all areas and may be subject to change without notice. Consult your local HPE business contact for information on the products or services available in your area. You can find additional information via HPE's web site at www.hpe.com. Actual performance and environmental costs of HPE products will vary depending on individual customer configurations and conditions.

Copyright© 2023 Hewlett Packard Enterprise Company

All rights reserved. Permission is hereby granted to reproduce this document in whole or in part provided the copyright notice printed above is set forth in full text or on the title page of each item reproduced.

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.


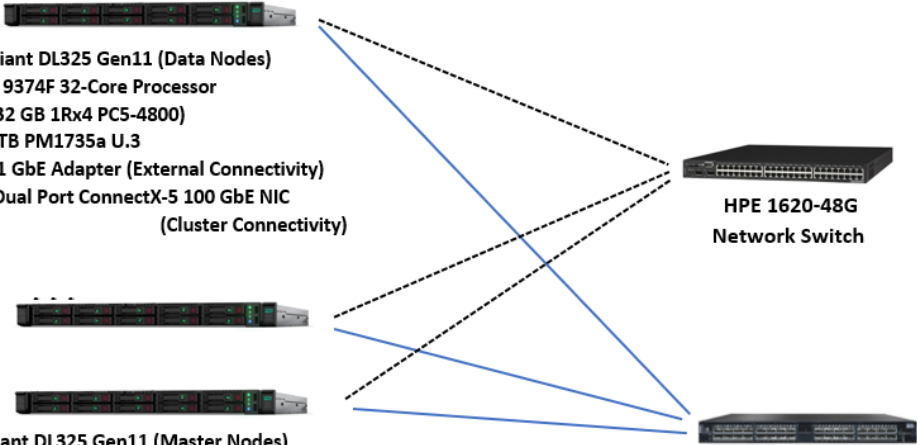
The benchmark results are summarized below.


Measured Configuration			
Company Name	Cluster Node	Hadoop Software	Operating System
HPE	ProLiant DL325 Gen11	CDP Private Cloud Base Edition 7.1.7	Red Hat Enterprise Linux 8.6


TPC Express Benchmark™ HS Metrics			
Total System Cost	HSph@1TB	Price/Performance	Availability Date
\$1,886,046	42.91	\$43,953.54	December 5, 2022

Executive Summary

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

 <p>Hewlett Packard Enterprise</p>	<h1 style="text-align: center;">HPE ProLiant DL325 Gen11</h1>		TPCx-HS 2.0.3 TPC Pricing 2.8.0 Report Date Mar. 23, 2023
Availability Date December 5, 2022	TPCx-HS Performance 42.91 HSp@1TB	Price/Performance \$43,953.54 / HSp@1TB	Total System Cost \$1,886,046 USD
System Under Test Configuration Overview			
Scale Factor 1	Hadoop Software CDP Private Cloud Base Edition 7.1.7	Operating System Red Hat Enterprise Linux 8.6	Other Software N/A
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>16 x HPE ProLiant DL325 Gen11 (Data Nodes) 1x AMD EPYC 9374F 32-Core Processor 384 GB (12 x 32 GB 1Rx4 PC5-4800) 8x NVMe 3.2 TB PM1735a U.3 1x USB3.0 to 1 GbE Adapter (External Connectivity) 1x Mellanox Dual Port ConnectX-5 100 GbE NIC (Cluster Connectivity)</p> <p>1 x HPE ProLiant DL325 Gen11 (Master Nodes) 1x AMD EPYC 9374F 32-Core Processor 384 GB (12 x 32 GB 1Rx4 PC5-4800) 2x NVMe 3.2 TB PM1735a U.3 1x USB3.0 to 1 GbE Adapter (External Connectivity) 1x Mellanox Dual Port ConnectX-5 100 GbE NIC (Cluster Connectivity)</p> </div> <div style="width: 45%; text-align: center;">  <p>HPE 1620-48G Network Switch</p> <p>Mellanox Spectrum SN2700M Switch 32 x 100 Gigabit QSFP28</p> </div> </div>			
Physical Storage/Scale Factor: 416.00		Scale Factor/Physical Memory: 0.16	
Total Number of Servers:		17 (1x ProLiant DL325 Gen11; 16x ProLiant DL325 Gen11)	
Total Processors/Cores/Threads:		17/544/1,088	
Server Configuration: Processors	1x ProLiant DL325 Gen11 1x AMD EPYC 9374F 32-Core Processor	16x ProLiant DL325 Gen11 1x AMD EPYC 9374F 32-Core Processor	
Memory	384 GiB	384 GiB	
Storage Device	2x 3.2 TB NVMe	8x 3.2 TB NVMe	
Network	Mellanox Dual Port 100 GbE	Mellanox Dual Port 100 GbE	
Connectivity:	1x Mellanox Spectrum SN2700M 32x100 GbE (cluster) 1x HPE 1620-48G (admin)		
Total Rack Units:	17 (1U) + 1 (1U) + 1 (1U) = 19U		

 <p>Hewlett Packard Enterprise</p>	<h1>HPE ProLiant DL325 Gen11</h1>	<p>TPCx-HS 2.0.3 TPC Pricing 2.8.0 Report Date Mar. 23, 2023</p>					
Server Hardware							
Master Node							
Description	Price Key	Part Number	Unit Price	Qty	Extended Price	3 Yr Maint Price	
HPE DL325 Gen11 8SFF CTO Server	1	P54199-B21	\$2,767	1	\$2,767		
AMD EPYC 9374F 3.85GHz 32-core 320W Processor for HPE	1	P53710-B21	\$11,087	1	\$11,087		
HPE ProLiant DL3X5 Gen11 CPU Performance 1U Heat Sink Kit	1	P58457-B21	\$430	1	\$430		
HPE ProLiant DL3XX Gen11 1U Performance Fan Kit	1	P58462-B21	\$305	7	\$2,135		
HPE 32GB (1x32GB) Single Rank x4 DDR5-4800 EC8 Reg. Smart Memory	1	P50310-B21	\$2,465	12	\$29,580		
HPE DL3X5 Gen11 NS204i-u NVMe Hot Plug Boot Device Cable Kit	1	P57013-B21	\$83	1	\$83		
HPE 3.2TB NVMe MU SFF BC U.3 PM1735a SSD	1	P50230-B21	\$6,476	2	\$12,952		
HPE 1600W FS Plat Ht Plug LH PS Kit	1	P38997-B21	\$685	2	\$1,370		
Mellanox MCX623106AS-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE	1	P25960-B21	\$4,373	1	\$4,373		
HPE DL3XX Gen11 Easy Install Rail 2 Kit	1	P52351-B21	\$141	1	\$141		
HPE DL325Gen11 Standard Riser	1	stdDL325Gen11Riser		1			
Data Nodes							
HPE DL325 Gen11 8SFF CTO Server	1	P54199-B21	\$2,767	16	\$44,272		
AMD EPYC 9374F 3.85GHz 32-core 320W Processor for HPE	1	P53710-B21	\$11,087	16	\$177,392		
HPE ProLiant DL3X5 Gen11 CPU Performance 1U Heat Sink Kit	1	P58457-B21	\$430	16	\$6,880		
HPE ProLiant DL3XX Gen11 1U Performance Fan Kit	1	P58462-B21	\$305	112	\$34,160		
HPE 32GB (1x32GB) Single Rank x4 DDR5-4800 EC8 Reg. Smart Memory	1	P50310-B21	\$2,465	192	\$473,280		
HPE DL3X5 Gen11 NS204i-u NVMe Hot Plug Boot Device Cable Kit	1	P57013-B21	\$83	16	\$1,328		
HPE 3.2TB NVMe MU SFF BC U.3 PM1735a SSD	1	P50230-B21	\$6,476	128	\$828,928		
HPE 1600W FS Plat Ht Plug LH PS Kit	1	P38997-B21	\$685	32	\$21,920		
Mellanox MCX623106AS-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE	1	P25960-B21	\$4,373	16	\$69,968		
HPE DL3XX Gen11 Easy Install Rail 2 Kit		P52351-B21	\$141	16	\$2,256		
HPE DL325Gen11 Standard Riser		stdDL325Gen11Riser		16			
Other Hardware Components							
HPE 1620 48G Switch (no support available above 90 days, hence increase qty to 3)	1	JG914A	\$630	3	\$1,890		
HPE SN2700M 100GbE 32QSFP28 Switch with 3Y Tech Care Essential Service	1	Q2F21A	\$34,510	1	\$34,510		
HPE USB US Keyboard/Mouse Kit	1	631341-B21	\$32	3	\$96		
HPE 100Gb QSFP28 to QSFP28 3m Direct Attach Copper Cable	1	845406-B21	\$685	20	\$13,700		
Rack 48U 600mmx 1075mm G2 Advanced Pallet	1	P9K19A	\$3,023	1	\$3,023		
HPE C13 - JIS C8303 JP 100V 12Amp 2.0m Power Cord	1	AF572A	\$54	37	\$1,994		
HPE 3 Year Tech Care Essential DL325 GEN11 Service	1	H78S6E	\$2,958	17		\$50,286	
			Subtotal		\$1,780,515		\$50,286
Other							
HP V22v G5 FHD Monitor	3	65P56AA	\$130	3	\$390		
USB3.0 to 1GbE Adapter	2		\$14.99	20	\$300		
			Subtotal		\$690		\$0
(Continued on next page.)							

 Hewlett Packard Enterprise	<h1>HPE ProLiant DL325 Gen11</h1>	TPCx-HS 2.0.3 TPC Pricing 2.8.0 Report Date Mar. 23, 2023																																																								
(Continued from previous page.)																																																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Description</th> <th style="text-align: left;">Price Key</th> <th style="text-align: left;">Part Number</th> <th style="text-align: right;">Unit Price</th> <th style="text-align: right;">Qty</th> <th style="text-align: right;">Extended Price</th> <th style="text-align: right;">3 Yr Maint Price</th> </tr> </thead> <tbody> <tr> <td colspan="7">Server Software</td> </tr> <tr> <td>RHEL Svr Sckt/2 Gst 3yr 24x7 E-LTU</td> <td>1</td> <td>G3J30AAE</td> <td style="text-align: right;">\$3,702</td> <td style="text-align: right;">17</td> <td style="text-align: right;">\$62,934</td> <td></td> </tr> <tr> <td>Cloudera Data Platform Private Cloud Base Edition - Annual Subscription per Node for up to 16 Cores/128 GB RAM for compute or up to 48 TB for storage. Business-Level Support. (3 years support)</td> <td>4</td> <td>CDP-PVC-BASE-BUS</td> <td style="text-align: right;">\$37,200</td> <td style="text-align: right;">17</td> <td style="text-align: right;">\$632,400</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: right;">Subtotal</td> <td style="text-align: right;">\$695,334</td> <td style="text-align: right;">\$0</td> </tr> <tr> <td colspan="5" style="text-align: right;">Total Extended Price</td> <td style="text-align: right;">\$2,476,539</td> <td style="text-align: right;">\$50,286</td> </tr> <tr> <td colspan="5" style="text-align: right;">Total Discounts</td> <td style="text-align: right;">\$623,180</td> <td style="text-align: right;">\$17,600</td> </tr> <tr> <td colspan="5" style="text-align: right;">Grand Total</td> <td style="text-align: right;">\$1,853,359</td> <td style="text-align: right;">\$32,686</td> </tr> </tbody> </table>			Description	Price Key	Part Number	Unit Price	Qty	Extended Price	3 Yr Maint Price	Server Software							RHEL Svr Sckt/2 Gst 3yr 24x7 E-LTU	1	G3J30AAE	\$3,702	17	\$62,934		Cloudera Data Platform Private Cloud Base Edition - Annual Subscription per Node for up to 16 Cores/128 GB RAM for compute or up to 48 TB for storage. Business-Level Support. (3 years support)	4	CDP-PVC-BASE-BUS	\$37,200	17	\$632,400		Subtotal					\$695,334	\$0	Total Extended Price					\$2,476,539	\$50,286	Total Discounts					\$623,180	\$17,600	Grand Total					\$1,853,359	\$32,686
Description	Price Key	Part Number	Unit Price	Qty	Extended Price	3 Yr Maint Price																																																				
Server Software																																																										
RHEL Svr Sckt/2 Gst 3yr 24x7 E-LTU	1	G3J30AAE	\$3,702	17	\$62,934																																																					
Cloudera Data Platform Private Cloud Base Edition - Annual Subscription per Node for up to 16 Cores/128 GB RAM for compute or up to 48 TB for storage. Business-Level Support. (3 years support)	4	CDP-PVC-BASE-BUS	\$37,200	17	\$632,400																																																					
Subtotal					\$695,334	\$0																																																				
Total Extended Price					\$2,476,539	\$50,286																																																				
Total Discounts					\$623,180	\$17,600																																																				
Grand Total					\$1,853,359	\$32,686																																																				
Pricing: 1 = HPE; 2 = BestBuy.com; 3 = hp.com; 4 = cloudera.com * All discounts are based on US list prices and for similar quantities and configurations. A 35% discount was based on the overall specific components pricing from vendor 1 in this single quotation. Discounts for similarly sized configurations will be similar to those quoted here, but may vary based on the components in the configuration.	Three-Year Cost of Ownership: \$1,886,046 HSph@1TB: 42.91 \$ / HSph@1TB: \$43,953.54																																																									
Audited by Doug Johnson, InfoSizing																																																										
Sales contact: HPE WW Headquarters, 3000 Hanover St., Palo Alto, CA 94304-1185 (650) 857-1501 or HPE: 855-472-5233																																																										
<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>																																																										

 Hewlett Packard Enterprise	<h1>HPE ProLiant DL325 Gen11</h1>	TPCx-HS 2.0.3 TPC Pricing 2.8.0 Report Date Mar. 23, 2023
--	-----------------------------------	---

Numerical Quantities

Performance Run – Run 1

Scale Factor	1TB
Run Start Time	2023-02-28 19:29:38.000
Run End Time	2023-02-28 19:31:00.000
Run Elapsed Time	84.000
HSGen Start Time	2023-02-28 19:29:39.000
HSGen End Time	2023-02-28 19:29:58.000
HSGen Elapsed Time	20.567
HSSort Start Time	2023-02-28 19:30:00.000
HSSort End Time	2023-02-28 19:30:49.000
HSSort Elapsed Time	49.830
HSValidate Start Time	2023-02-28 19:30:51.000
HSValidate End Time	2023-02-28 19:31:00.000
HSValidate Elapsed Time	10.316

Repeatability Run – Run 2

Scale Factor	1TB
Run Start Time	2023-02-28 19:31:14.000
Run End Time	2023-02-28 19:32:36.000
Run Elapsed Time	84.000
HSGen Start Time	2023-02-28 19:31:14.000
HSGen End Time	2023-02-28 19:31:34.000
HSGen Elapsed Time	20.965
HSSort Start Time	2023-02-28 19:31:36.000
HSSort End Time	2023-02-28 19:32:25.000
HSSort Elapsed Time	49.906
HSValidate Start Time	2023-02-28 19:32:27.000
HSValidate End Time	2023-02-28 19:32:36.000
HSValidate Elapsed Time	10.105

	<h1>HPE ProLiant DL325 Gen11</h1>	<table> <tr><td>TPCx-HS</td><td>2.0.3</td></tr> <tr><td>TPC Pricing</td><td>2.8.0</td></tr> <tr><td>Report Date</td><td>Mar. 23, 2023</td></tr> </table>	TPCx-HS	2.0.3	TPC Pricing	2.8.0	Report Date	Mar. 23, 2023
TPCx-HS	2.0.3							
TPC Pricing	2.8.0							
Report Date	Mar. 23, 2023							

Run Reports

Run Report for Performance Run – Run 1

=====

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details	Total Time =	84
	Total Size =	10000000000
	Scale-Factor =	1

TPCx-HS Performance Metric (HSph@SF): 42.9184

=====

Run Report for Repeatability Run – Run 2

=====

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details	Total Time =	84
	Total Size =	10000000000
	Scale-Factor =	1

TPCx-HS Performance Metric (HSph@SF): 42.9184

=====


 Hewlett Packard Enterprise	<h1>HPE ProLiant DL325 Gen11</h1>	TPCx-HS 2.0.3 TPC Pricing 2.8.0 Report Date Mar. 23, 2023
<h3>Revision History</h3>		
Date	Edition	Description
March 23, 2023	First	Initial Publication

Table of Contents

Abstract 3

Executive Summary 3

Table of Contents 10

Clause 0 – Preamble 11

 0.1 TPC Express Benchmark™ HS Overview 11

Clause 1 – General Items 12

 1.1 Test Sponsor 12

 1.2 Parameter Settings 12

 1.3 Configuration Diagrams 12

 1.3.1 Priced Configuration 13

 1.3.2 Measured Configuration 14

 1.4 Dataset Distribution 14

 1.5 Software Components Distribution 15

Clause 2 – Workload Related Items 16

 2.1 Hardware & Software Tunables 16

 2.2 Run Report 16

 2.3 Benchmark Kit Identification 16

 2.4 Benchmark Kit Changes 16

Clause 3 – SUT Related Items 17

 3.1 Data Storage Ratio 17

 3.2 Memory Ratio 17

Clause 4 – Metrics Related Items 18

 4.1 HSGen Time 18

 4.2 HSSort Time 18

 4.3 HSValidate Time 18

 4.4 HSDataCheck Times 18

 4.5 Performance & Price-Performance 18

Auditor’s Information & Letter of Attestation 19

Supporting Files Index 22

Third-Party Price Quotes 23

 BestBuy.com 23

 HP.com 24

 Cloudera.com 25

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 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.

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 Hewlett Packard Enterprise Company.

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 Priced Configuration

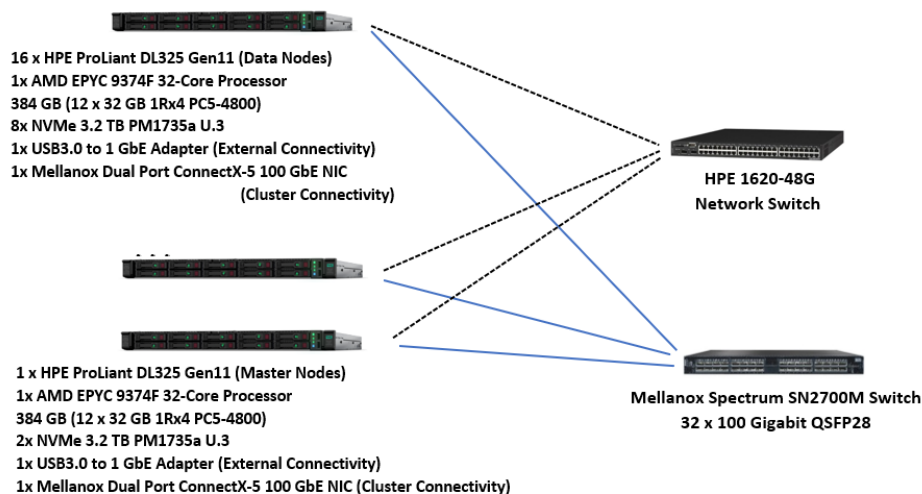


Figure 1-1 Priced Configuration

The priced configuration consists of:

- Total Nodes: 17 (1x ProLiant DL325 Gen11; 16x ProLiant DL325 Gen11)
- Total Processors/Cores/Threads: 17/544/1,088
- Total Memory: 6.38TiB
- Total Number of Storage Drives/Devices: 130
- Total Storage Capacity: 416.00TB

Server node details:

- 1x ProLiant DL325 Gen11 Servers, each with:
 - Processors/Cores/Threads: 1/32/64
 - Processor Model: AMD EPYC 9374F 32-Core Processor
 - Memory: 384 GiB
 - Drives: 2x 3.2 TB NVMe
 - Network: Mellanox Dual Port 100 GbE
- 16x ProLiant DL325 Gen11 Servers, each with:
 - Processors/Cores/Threads: 1/32/64
 - Processor Model: AMD EPYC 9374F 32-Core Processor
 - Memory: 384 GiB
 - Drives: 2x 3.2 TB NVMe
 - Network: Mellanox Dual Port 100 GbE

Network connectivity detail:

- 1x Mellanox Spectrum SN2700M 32x100 GbE (cluster connectivity)
- 1x HPE 1620-48G (admin)

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

1.3.2 Measured Configuration

The measured configuration used 8x Mellanox Technologies MT27800 Family [ConnectX-5] MCX556A-ECAT QSFP28 adapters and 9x Mellanox Technologies MT28800 Family [ConnectX-5 Ex] MCX556A-EDAT QSFP28 adapters that were substituted with 17x Mellanox MCX623106AS-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE adapters in the priced 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	nvme0n1, nvme1n1	Operating System, Root, swap, Hadoop Master
2-5	NVMe	nvme0n1	Operating System, Root, swap, Hadoop Master
2-5	NVMe	nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1, nvme7n1	Data, Temp
6-17	NVMe	nvme0n1	Operating System, Root, swap, Hadoop Master
6-17	NVMe	nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1, nvme7n1	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	Spark
	Resource Manager	Node Manager	NameNode	DataNode	QuorumPeer	HistoryServer
1	X		X		X	X
2-5		X		X	X	
6-17		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 7.1.7 (fully HDFS compatible at the API level).

Map/Reduce implementation and corresponding version must be disclosed.

CDP Private Cloud Base Edition 7.1.7 (compatible equivalent to Hadoop 3.1.1.7.1.7.0-551).

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 =                84
                        Total Size =                10000000000
                        Scale-Factor =                1

TPCx-HS Performance Metric (HSph@SF):                42.9184

=====
```

```
Run Report for Run 2 – Repeatability Run
=====
TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details      Total Time =                84
                        Total Size =                10000000000
                        Scale-Factor =                1

TPCx-HS Performance Metric (HSph@SF):                42.9184

=====
```

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                faeff3091759aac98080be4e39f7896a
TPCx-HS-master_Spark.jar        19f3ce092066e056b884a85ee92fb7fc
TPCx-HS-master.sh                c619a0819571ecd00cd75d2b76ba8c64
```

2.4 Benchmark Kit Changes

No modifications were made to the TPC-provided kit.

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)
2	3.2 TB	6.4
128	3.2 TB	409.6
Total Storage (TB)		416.00

Table 3-1 Storage Device Capacities

Scale Factor = 1

Data Storage Ratio = (Total Storage (TB) / SF) = **416.00**

3.2 Memory Ratio

The Scale Factor to memory ratio must be disclosed.

Total Configured Memory (TiB) = 6.38

Scale Factor to Memory Ratio = (SF / Total Memory(TiB)) = **0.16**

Clause 4 – Metrics Related Items

4.1 HSGen Time

The HSGen time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSGen	20.567	20.965

Table 4-1 HSGen Times

4.2 HSSort Time

The HSSort time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSSort	49.830	49.906

Table 4-2 HSSort Times

4.3 HSValidate Time

The HSValidate time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSValidate	10.316	10.105

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)	2.000	2.000
HSDataCheck (post-sort)	2.000	2.000

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@1TB	42.91	42.91

Table 4-5 Performance Metrics

Run 1 Price-Performance: 43,953.54 \$/ HSph@1TB

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.

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



Ankit Chouksey
Hewlett-Packard Enterprise
192 Mahadevapura,
Whitefield Road
Bangalore, India 560048

March 21, 2023

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

Platform: 16x HPE ProLiant DL325 Gen11 Servers (Data Nodes)
1x HPE ProLiant DL325 Gen11 Server (Master Node)
Operating System: Red Hat Enterprise Linux 8.6
Apache Hadoop CDP Private Cloud Base Edition 7.1.7 (using Spark)
Compatible Software:

The results were:

Performance 42.91 HSph@1TB

Metric

Run Elapsed Time 84.00 Seconds

Cluster

16x ProLiant DL325 Gen11, 1x ProLiant DL325 Gen11 with:

CPUs 1x AMD® EPYC 9374F 32-Core Processor (all nodes)

Memory 384 GiB (all nodes)

Storage	Qty	Size	Type
	8	3.2 TB	NVMe (data nodes)
	2	3.2 TB	NVMe (master node)

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.
- The generated dataset was properly scaled to 1 TB.

63 Lourdes Dr. | Leominster, MA 01453 | 978-343-6562 | www.sizing.com

- The generated dataset and the sorted dataset were replicated 3-ways.
- 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:

The measured configuration used 8x Mellanox Technologies MT27800 Family [ConnectX-5] MCX556A-ECAT QSFP28 adapters and 9x Mellanox Technologies MT28800 Family [ConnectX-5 Ex] MCX556A-EDAT QSFP28 adapters that were substituted with 17x Mellanox MCX623106AS-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE adapters in the priced configuration. The TPCx-HS Subcommittee approved this substitution and based on product specifications it is my opinion that this substitution has no significant effect on performance.

Respectfully Yours,



Doug Johnson, Certified TPC Auditor

63 Lourdes Dr. | Leominster, MA 01453 | 978-343-6562 | www.sizing.com

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

Third-Party Price Quotes

BestBuy.com

BEST BUY Menu Compton Cart

[Top Deals](#) [Deal of the Day](#) [Totaltech Membership](#) [Credit Cards](#) [More](#) [Account](#) [Recently Viewed](#) [Order Status](#) [Saved Items](#)

Content creation made easy. **logitech** [Shop now](#)

[Best Buy](#) > [Computers & Tablets](#) > [Computer Accessories & Peripherals](#) > [Cables & Connectors](#) > [USB Cables & Adapters](#)

Best Buy essentials™ - USB to Ethernet Adapter - White

Model: BE-PA3U6E SKU: 6451327

★★★★★ 4.8 (88 Reviews) | 3 Answered Questions

Highly rated by customers for: [Connections](#), [Price](#), [Ethernet](#)

A BEST BUY Brand



\$14.99

15-DAY FREE & EASY RETURNS
If received today, the last day to return this item would be Jan 21.
[Learn more](#)

Open-Box: from \$11.99

Deals on related items:

3-Day Sale
3-Day Sale

USB Cables & Adapters deals

Outlet Deals
Outlet Deals

Get it today nearby

Pickup: Order now for pickup on Thu, Jan 12 at Compton
Available today at a location 6 miles away
[See all pickup locations](#)

FREE Shipping: Get it by Thu, Jan 12
[See all shipping options for 90001](#)

Add to Cart

Compare

Save

Cardmember Offers

[Get rewards](#)

HP.com

The screenshot displays the HP.com website interface for the HP V22v G5 FHD Monitor. At the top, there is a navigation bar with links for 'Explore', 'Shop', and 'Support', along with a search bar. A promotional banner for 'Holiday Sneak Peek' offers up to 62% off on early holiday doorbusters. The main product image shows the monitor with a green and red abstract pattern. To the right of the image, the product name 'HP V22v G5 FHD Monitor' is displayed, followed by specifications: FHD (1920 x 1080), 3000:1 contrast, and 5ms GTG (with overdrive). The price is listed as \$129.99. Below the price, there are buttons for 'ADD TO CART' and 'SEE SIMILAR PRODUCTS'. A section for 'SPECIAL OFFERS' highlights the 'Holiday Sneak Peek' and a 'LEARN MORE' link. A 'PROTECT YOUR DEVICE WITH AN HP CARE PACK' section offers a '1-Year Standard Warranty' (included) and an 'HP 2 Year Next Day Exchange Service for Consumer Monitors' (recommended for \$20.00). The product is marked as 'IN STOCK' and 'Ships in 1 business day'. An 'ADD TO COMPARE' button is also visible.

Cloudera.com

cloudera.com/products/pricing.html

Overview CDP Public Cloud **CDP Private Cloud** CDP support Additional offerings [Contact sales](#)

CDP Private Cloud Data Services

Easy to use, auto-scaling Data Engineering, Data Warehouse, and Machine Learning Data Services that rely on CDP Private Cloud Base for HDFS, Ozone object storage, or select third party storage, with SDX technologies.

CDP Private Cloud Base

Traditional data clusters - built with modern open-source data management and analytics software - that run against HDFS files stores, high-density Ozone object storage, or select third party storage, with SDX technologies.

CDP Private Cloud pricing		Annual subscription ⁵
Data Services¹	Data Engineering Data Service	
	Data Warehouse Data Service	\$650/CCU ⁶
	Machine Learning Data Service	
Base	Ozone Object Store with SDX ²	
	Select Third-Party Storage with SDX ²	\$10,000/Node + Variable Compute & Storage ⁷
	HDFS with SDX ^{2,3}	
	Traditional Data Clusters Spark, Kafka, HBase, Hive, Impala ⁴	

¹Runs on embedded ECS or dedicated OpenShift and relies on Base for storage
²Storage subscription required for total capacity under management
³HDFS storage limited to 100TB per server
⁴Base edition data cluster open source [projects & components](#)
⁵CDP Private Cloud Pricing reflects Business Level Support
⁶Cloudera Compute Unit (CCU) - 1 Core and 8 GB RAM
⁷Variable compute price: \$75 per CCU over 16 Cores / 128GB RAM Node cap; Variable storage price: HDFS: \$25 per TB over 48TB Node cap or Ozone/Third Party Storage \$100 per TB over 48TB Node cap.

[Learn more about Private Cloud](#) [Compare Base Edition to CDH & HDP](#)