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 2.0.3
Report Edition First
Report Submitted 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.

<table>
<thead>
<tr>
<th>Measured Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name</td>
</tr>
<tr>
<td>HPE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TPC Express Benchmark™ HS Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total System Cost</td>
</tr>
<tr>
<td>$1,886,046</td>
</tr>
</tbody>
</table>

Executive Summary

The Executive Summary follows on the next several pages.
**EXECUTIVE SUMMARY**

**HPE ProLiant DL325 Gen11**

<table>
<thead>
<tr>
<th>Availability Date</th>
<th>TPCx-HS Performance</th>
<th>Price/Performance</th>
<th>Total System Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 5, 2022</td>
<td>42.91 HSp@1TB</td>
<td>$43,953.54 / HSp@1TB</td>
<td>$1,886,046 USD</td>
</tr>
</tbody>
</table>

**System Under Test Configuration Overview**

<table>
<thead>
<tr>
<th>Scale Factor</th>
<th>Hadoop Software</th>
<th>Operating System</th>
<th>Other Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CDP Private Cloud Base Edition 7.1.7</td>
<td>Red Hat Enterprise Linux 8.6</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Storage/Scale Factor: 416.00</th>
<th>Scale Factor/Physical Memory: 0.16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Servers:</td>
<td>17 (1 x ProLiant DL325 Gen11; 16 x ProLiant DL325 Gen11)</td>
</tr>
<tr>
<td>Total Processors/Cores/Threads:</td>
<td>17/544/1,088</td>
</tr>
</tbody>
</table>

**Server Configuration:**

- **Processors:** 1 x ProLiant DL325 Gen11
- **Memory:** 1 x AMD EPYC 9374F 32-Core Processor
- **Storage Device:** 384 GB (2 x 3.2 TB NVMe)
- **Network:** Mellanox Dual Port ConnectX-5 100 GbE NIC (Cluster Connectivity)

**Connectivity:**

- 1 x Mellanox Spectrum SN2700M Switch 32 x 100 Gigabit QSFP28
- 1 x HPE 1620-48G (admin)
- 17 (1U) + 1 (1U) + 1 (1U) = 19U
## Server Hardware

### Master Node

<table>
<thead>
<tr>
<th>Description</th>
<th>Price Key</th>
<th>Part Number</th>
<th>Unit Price</th>
<th>Qty</th>
<th>Extended Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPE DL325 Gen11 8SFF CTO Server</td>
<td>1</td>
<td>P54199-B21</td>
<td>$2,767</td>
<td>1</td>
<td>$2,767</td>
</tr>
<tr>
<td>AMD EPYC 9374F 3.85GHz 32-core 320W Processor for HPE</td>
<td>1</td>
<td>P53710-B21</td>
<td>$11,087</td>
<td>1</td>
<td>$11,087</td>
</tr>
<tr>
<td>HPE ProLiant DL3X5 Gen11 CPU Performance 1U Heat Sink Kit</td>
<td>1</td>
<td>P58457-B21</td>
<td>$430</td>
<td>1</td>
<td>$430</td>
</tr>
<tr>
<td>HPE ProLiant DL3XX Gen11 1U Performance Fan Kit</td>
<td>1</td>
<td>P58462-B21</td>
<td>$305</td>
<td>7</td>
<td>$2,135</td>
</tr>
<tr>
<td>HPE 32GB (1x32GB) Single Rank x4 DDR5-4800 EC8 Reg. Smart Memory</td>
<td>1</td>
<td>P50310-B21</td>
<td>$2,465</td>
<td>12</td>
<td>$29,580</td>
</tr>
<tr>
<td>HPE DL3X5 Gen11 NS204i-n NVMe Hot Plug Boot Device Cable Kit</td>
<td>1</td>
<td>P57013-B21</td>
<td>$83</td>
<td>1</td>
<td>$83</td>
</tr>
<tr>
<td>HPE 3.2TB NVMe MU SFF BC U.3 PM1735a SSD</td>
<td>1</td>
<td>P50230-B21</td>
<td>$6,476</td>
<td>2</td>
<td>$12,952</td>
</tr>
<tr>
<td>HPE 1600W FS Plat Ht Plg LH PS Kit</td>
<td>1</td>
<td>P38997-B21</td>
<td>$685</td>
<td>2</td>
<td>$1,370</td>
</tr>
<tr>
<td>Mellanox MCX623106A5-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE</td>
<td>1</td>
<td>P25960-B21</td>
<td>$4,373</td>
<td>1</td>
<td>$4,373</td>
</tr>
<tr>
<td>HPE DL3XX Gen11 Easy Install Rail 2 Kit</td>
<td>1</td>
<td>P52351-B21</td>
<td>$141</td>
<td>1</td>
<td>$141</td>
</tr>
<tr>
<td>HPE DL325Gen11 Standard Riser</td>
<td>1</td>
<td>stdDL325Gen11Riser</td>
<td>$1</td>
<td>16</td>
<td>$2,256</td>
</tr>
</tbody>
</table>

### Data Nodes

<table>
<thead>
<tr>
<th>Description</th>
<th>Price Key</th>
<th>Part Number</th>
<th>Unit Price</th>
<th>Qty</th>
<th>Extended Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPE DL325 Gen11 8SFF CTO Server</td>
<td>1</td>
<td>P54199-B21</td>
<td>$2,767</td>
<td>16</td>
<td>$44,272</td>
</tr>
<tr>
<td>AMD EPYC 9374F 3.85GHz 32-core 320W Processor for HPE</td>
<td>1</td>
<td>P53710-B21</td>
<td>$11,087</td>
<td>16</td>
<td>$177,392</td>
</tr>
<tr>
<td>HPE ProLiant DL3X5 Gen11 CPU Performance 1U Heat Sink Kit</td>
<td>1</td>
<td>P58457-B21</td>
<td>$430</td>
<td>16</td>
<td>$6,880</td>
</tr>
<tr>
<td>HPE ProLiant DL3XX Gen11 1U Performance Fan Kit</td>
<td>1</td>
<td>P58462-B21</td>
<td>$305</td>
<td>112</td>
<td>$34,160</td>
</tr>
<tr>
<td>HPE 32GB (1x32GB) Single Rank x4 DDR5-4800 EC8 Reg. Smart Memory</td>
<td>1</td>
<td>P50310-B21</td>
<td>$2,465</td>
<td>192</td>
<td>$473,280</td>
</tr>
<tr>
<td>HPE DL3X5 Gen11 NS204i-n NVMe Hot Plug Boot Device Cable Kit</td>
<td>1</td>
<td>P57013-B21</td>
<td>$83</td>
<td>16</td>
<td>$1,328</td>
</tr>
<tr>
<td>HPE 3.2TB NVMe MU SFF BC U.3 PM1735a SSD</td>
<td>1</td>
<td>P50230-B21</td>
<td>$6,476</td>
<td>128</td>
<td>$828,928</td>
</tr>
<tr>
<td>HPE 1600W FS Plat Ht Plg LH PS Kit</td>
<td>1</td>
<td>P38997-B21</td>
<td>$685</td>
<td>32</td>
<td>$21,920</td>
</tr>
<tr>
<td>Mellanox MCX623106A5-CDAT Ethernet 100Gb 2-port QSFP56 Adapter for HPE</td>
<td>1</td>
<td>P25960-B21</td>
<td>$4,373</td>
<td>16</td>
<td>$69,968</td>
</tr>
<tr>
<td>HPE DL3XX Gen11 Easy Install Rail 2 Kit</td>
<td>1</td>
<td>P52351-B21</td>
<td>$141</td>
<td>16</td>
<td>$2,256</td>
</tr>
</tbody>
</table>

### Other Hardware Components

<table>
<thead>
<tr>
<th>Description</th>
<th>Price Key</th>
<th>Part Number</th>
<th>Unit Price</th>
<th>Qty</th>
<th>Extended Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPE 1620 48G Switch (no support available above 90 days, hence increase qty to 3 )</td>
<td>1</td>
<td>JG914A</td>
<td>$630</td>
<td>3</td>
<td>$1,890</td>
</tr>
<tr>
<td>HPE SN2700M 100GbE 32QSFP28 Switch with 3Y Tech Care Essential Service</td>
<td>1</td>
<td>Q2F21A</td>
<td>$34,510</td>
<td>1</td>
<td>$34,510</td>
</tr>
<tr>
<td>HPE USB US Keyboard/Mouse Kit</td>
<td>1</td>
<td>631341-B21</td>
<td>$32</td>
<td>3</td>
<td>$96</td>
</tr>
<tr>
<td>HPE 100Gb QSFP28 to QSFP28 3m Direct Attach Copper Cable</td>
<td>1</td>
<td>845406-B2</td>
<td>$685</td>
<td>20</td>
<td>$13,700</td>
</tr>
<tr>
<td>Rack 48U 600mm x 1075mm G2 Advanced Pallet</td>
<td>1</td>
<td>P9K19A</td>
<td>$3,023</td>
<td>1</td>
<td>$3,023</td>
</tr>
<tr>
<td>HPE C13 - JIS C8303 JP 100V 12Amp 2.0m Power Cord</td>
<td>1</td>
<td>AF572A</td>
<td>$54</td>
<td>37</td>
<td>$1,994</td>
</tr>
<tr>
<td>HPE 3 Year Tech Care Essential DL325 GEN11 Service</td>
<td>1</td>
<td>H7860E</td>
<td>$2,958</td>
<td>17</td>
<td>$50,286</td>
</tr>
</tbody>
</table>

**Subtotal** $1,780,515 $50,286

### Other

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
<th>Part Number</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP V22t G5 FHD Monitor</td>
<td>3</td>
<td>6SP566A</td>
<td>$130</td>
</tr>
<tr>
<td>USB3.0 to 1GbE Adapter</td>
<td>2</td>
<td>$14.99</td>
<td>$300</td>
</tr>
</tbody>
</table>

**Subtotal** $690 $0

(Continued on next page.)
**Executive Summary**

*HPE ProLiant DL325 Gen11*

**TPC Pricing** 2.0.3

**Report Date** Mar. 23, 2023

---

**Server Software**

<table>
<thead>
<tr>
<th>Description</th>
<th>Price Key</th>
<th>Part Number</th>
<th>Unit Price</th>
<th>Qty</th>
<th>Extended Price</th>
<th>3 Yr Maint Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHEL Svr Sckt/2 Gst 3yr 24x7 E-LTU</td>
<td>1</td>
<td>G3I30AAE</td>
<td>$3,702</td>
<td>17</td>
<td>$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>$37,200</td>
<td>17</td>
<td>$632,400</td>
<td></td>
</tr>
</tbody>
</table>

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.

**Audited by Doug Johnson, InfoSizing**

**Three-Year Cost of Ownership:**

- HSp@1TB: $43,953.54
- $ / HSp@1TB: 42.91
- $1,886,046

---

*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.*
### Numerical Quantities

**Performance Run – Run 1**

<table>
<thead>
<tr>
<th>Scale Factor</th>
<th>1TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run Start Time</td>
<td>2023-02-28 19:29:38.000</td>
</tr>
<tr>
<td>Run End Time</td>
<td>2023-02-28 19:31:00.000</td>
</tr>
<tr>
<td>Run Elapsed Time</td>
<td>84.000</td>
</tr>
<tr>
<td>HSGen Start Time</td>
<td>2023-02-28 19:29:39.000</td>
</tr>
<tr>
<td>HSGen End Time</td>
<td>2023-02-28 19:29:58.000</td>
</tr>
<tr>
<td>HSGen Elapsed Time</td>
<td>20.567</td>
</tr>
<tr>
<td>HSSort Start Time</td>
<td>2023-02-28 19:30:00.000</td>
</tr>
<tr>
<td>HSSort End Time</td>
<td>2023-02-28 19:30:49.000</td>
</tr>
<tr>
<td>HSSort Elapsed Time</td>
<td>49.830</td>
</tr>
<tr>
<td>HSVValidate Start Time</td>
<td>2023-02-28 19:30:51.000</td>
</tr>
<tr>
<td>HSVValidate End Time</td>
<td>2023-02-28 19:31:00.000</td>
</tr>
<tr>
<td>HSVValidate Elapsed Time</td>
<td>10.316</td>
</tr>
</tbody>
</table>

**Repeatability Run – Run 2**

<table>
<thead>
<tr>
<th>Scale Factor</th>
<th>1TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run Start Time</td>
<td>2023-02-28 19:31:14.000</td>
</tr>
<tr>
<td>Run End Time</td>
<td>2023-02-28 19:32:36.000</td>
</tr>
<tr>
<td>Run Elapsed Time</td>
<td>84.000</td>
</tr>
<tr>
<td>HSGen Start Time</td>
<td>2023-02-28 19:31:14.000</td>
</tr>
<tr>
<td>HSGen End Time</td>
<td>2023-02-28 19:31:34.000</td>
</tr>
<tr>
<td>HSGen Elapsed Time</td>
<td>20.965</td>
</tr>
<tr>
<td>HSSort Start Time</td>
<td>2023-02-28 19:31:36.000</td>
</tr>
<tr>
<td>HSSort End Time</td>
<td>2023-02-28 19:32:25.000</td>
</tr>
<tr>
<td>HSSort Elapsed Time</td>
<td>49.906</td>
</tr>
<tr>
<td>HSVValidate Start Time</td>
<td>2023-02-28 19:32:27.000</td>
</tr>
<tr>
<td>HSVValidate End Time</td>
<td>2023-02-28 19:32:36.000</td>
</tr>
<tr>
<td>HSVValidate Elapsed Time</td>
<td>10.105</td>
</tr>
</tbody>
</table>
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
HPE ProLiant DL325 Gen11

Revision History

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 HSVValidate 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

TPCx-HS 2.0.3    HPE
Full Disclosure Report    HPE ProLiant DL325 Gen11
Report Date    March 23, 2023
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

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.

<table>
<thead>
<tr>
<th>Server Node</th>
<th>Controller</th>
<th>Disk Drive</th>
<th>Description of Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NVMe</td>
<td>nvme0n1, nvme1n1</td>
<td>Operating System, Root, swap, Hadoop Master</td>
</tr>
<tr>
<td>2-5</td>
<td>NVMe</td>
<td>nvme0n1</td>
<td>Operating System, Root, swap, Hadoop Master</td>
</tr>
<tr>
<td>2-5</td>
<td>NVMe</td>
<td>nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1, nvme7n1</td>
<td>Data, Temp</td>
</tr>
<tr>
<td>6-17</td>
<td>NVMe</td>
<td>nvme0n1</td>
<td>Operating System, Root, swap, Hadoop Master</td>
</tr>
<tr>
<td>6-17</td>
<td>NVMe</td>
<td>nvme0n1, nvme1n1, nvme2n1, nvme3n1, nvme4n1, nvme5n1, nvme6n1, nvme7n1</td>
<td>Data, Temp</td>
</tr>
</tbody>
</table>

*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.

<table>
<thead>
<tr>
<th>Node</th>
<th>Map/Reduce</th>
<th>HDFS</th>
<th>ZooKeeper</th>
<th>Spark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resource Manager</td>
<td>Node Manager</td>
<td>NameNode</td>
<td>DataNode</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2-5</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6-17</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>File</th>
<th>MD5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BigData_cluster_validate_suite.sh</td>
<td>57f7cd68251a9aba0feb6648630ff5da</td>
</tr>
<tr>
<td>HSDataCheck.sh</td>
<td>faeff3091759aac98080be4e39f7896a</td>
</tr>
<tr>
<td>TPCx-HS-master_Spark.jar</td>
<td>19f3ce092066e056b884a85ee92fb7f3c</td>
</tr>
<tr>
<td>TPCx-HS-master.sh</td>
<td>c619a0819571ecd00cd75d2b76ba8c64</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Capacity</th>
<th>Total (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3.2 TB</td>
<td>6.4</td>
</tr>
<tr>
<td>128</td>
<td>3.2 TB</td>
<td>409.6</td>
</tr>
<tr>
<td><strong>Total Storage (TB)</strong></td>
<td></td>
<td><strong>416.00</strong></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSGen</td>
<td>20.567</td>
<td>20.965</td>
</tr>
</tbody>
</table>

*Table 4-1 HSGen Times*

4.2 HSSort Time
The HSSort time must be disclosed for Run1 and Run2.

<table>
<thead>
<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSSort</td>
<td>49.830</td>
<td>49.906</td>
</tr>
</tbody>
</table>

*Table 4-2 HSSort Times*

4.3 HSVValidate Time
The HSVValidate time must be disclosed for Run1 and Run2.

<table>
<thead>
<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSVValidate</td>
<td>10.316</td>
<td>10.105</td>
</tr>
</tbody>
</table>

*Table 4-3 HSVValidate Times*

4.4 HSDataCheck Times
Both HSDataCheck times must be disclosed for Run1 and Run2.

<table>
<thead>
<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSDataCheck (pre-sort)</td>
<td>2.000</td>
<td>2.000</td>
</tr>
<tr>
<td>HSDataCheck (post-sort)</td>
<td>2.000</td>
<td>2.000</td>
</tr>
</tbody>
</table>

*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.

<table>
<thead>
<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSph@1TB</td>
<td>42.91</td>
<td>42.91</td>
</tr>
</tbody>
</table>

*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 Choulsey
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**

- **Metric**
  - Run Elapsed Time: 84.00 Seconds
  - **Performance** 42.91 HSp@1TB

**Cluster**

- **CPUs**: 1x AMD® EPYC 9374F 32-Core Processor (all nodes)
- **Memory**: 384 GB (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.
- The generated dataset and the sorted dataset were replicated 3-times.
- 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-EQAT 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
## Supporting Files Index

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
<th>Archive File Pathname</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clause 1</td>
<td>Parameters and options used to configure the system</td>
<td>SupportingFiles/Clause1</td>
</tr>
<tr>
<td>Clause 2</td>
<td>Configuration scripts and Run Report</td>
<td>SupportingFiles/Clause2</td>
</tr>
<tr>
<td>Clause 3</td>
<td>System configuration details</td>
<td>SupportingFiles/Clause3</td>
</tr>
</tbody>
</table>
Third-Party Price Quotes

BestBuy.com

Best Buy essentials™ - USB to Ethernet Adapter - White

Model: BE-PA3U9E
SKU: 6451327

4.6 (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:

New Sale
3-Day Sale
USB Cables & Adapters deals
Outlet Deals

Get it today nearby

Pickup: Order now for pickup on Thu, Jan 12 at Compton
See all pickup locations

FREE Shipping: Get it by Thu, Jan 12
See all shipping options for 80001

Add to Cart

Compare
Save

Cardmember Offers
Get rewards
HP V22v G5 FHD Monitor

- FHD (1920x1080)
- 2000:1 Dynamic Contrast
- 60Hz refresh rate

Can't find what you're looking for? See Similar Products

$129.99

ADD TO CART

PROTECT YOUR DEVICE WITH AN HP CARE PACK

1 Year Standard Warranty

Included

HP 2 Year Next Business Day Exchange Service for Consumer Monitors

HP RECOMMENDS

Price: $20.00

IN STOCK: Ships in 1 business day

LEARN MORE
Cloudera.com