



Cisco Systems, Inc.

TPC Express Benchmark™ HS (TPCx-HS)
Full Disclosure Report
for
Cisco UCS Integrated Infrastructure for Big Data
(with 17 Cisco UCS C240M4 Servers)
using
Cloudera Enterprise Edition
and
Red Hat Enterprise Linux Server Release 6.7

Second Edition

December 14, 2016

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Cisco UCS Integrated Infrastructure for Big Data

TPCx-HS Rev. 1.4.1
TPC-Pricing Rev. 2.0.0

Report Date:
December 14, 2016

Total System Cost

TPCx-HS Performance Metric

Price/Performance

563,459 USD

13.47
HSph@3TB

41,830.67 USD
\$/HSph@3TB

Scale Factor

Apache Hadoop
Compatible Software

Operating System

Other Software

Availability Date

3TB

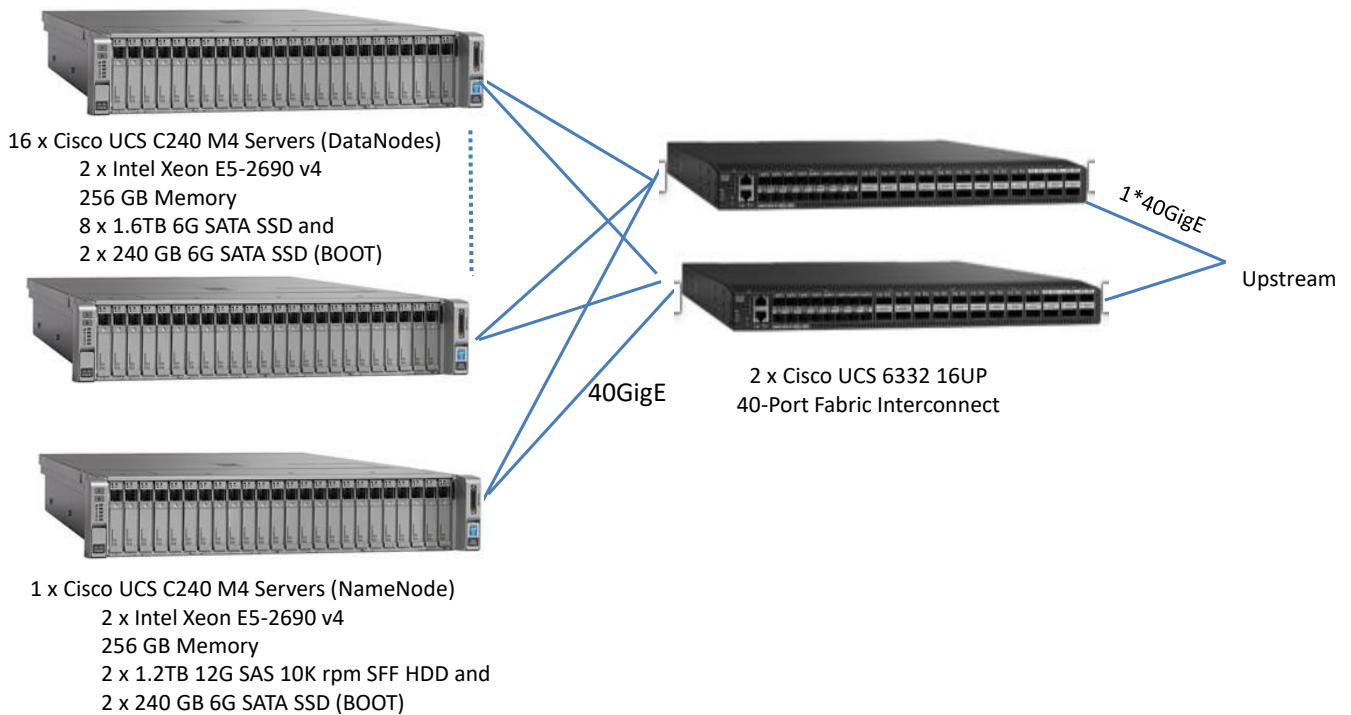
Cloudera Enterprise
Edition

Red Hat Enterprise Linux
Server Release 6.7

None

November 15,
2016

System Configuration



Physical Storage/Scale Factor: 71.79

Scale Factor/Physical Memory: 0.71

<p>Servers: 17 x Cisco UCS C240M4 Servers</p> <p>Total Processors/Cores/Threads 34/476 /952</p> <p>Server Configuration: Per Node:</p> <p style="padding-left: 20px;">Processors 2 x Intel® Xeon® CPU E5-2690 v4, 2.60 GHz, 35 MB L3</p> <p style="padding-left: 20px;">Memory 256GB</p> <p style="padding-left: 20px;">Storage Controller 1 x Cisco 12Gbps Modular SAS HBA</p> <p style="padding-left: 20px;">Storage Device 8 x 1.6TB 6G SATA SSD (DataNodes) 2 x 1.2TB 12G SAS 10K rpm SFF HDD (NameNode) 2 x 240GB 2.5 Enterprise Value SSD (all nodes, boot disk)</p> <p style="padding-left: 20px;">Network Cisco VIC 1387 Dual Port 40Gb QSFP CNA MLOM</p> <p style="padding-left: 20px;">Connectivity: 2 x Cisco UCS 6332-16UP 40-Port Fabric Interconnect</p> <p>Total Rack Units: (17*C240)+(2*FI) = (17*2RU)+(2*1RU) = 34+2 = 36</p>



Cisco UCS Integrated Infrastructure for Big Data

TPCx-HS Rev. 1.4.1
TPC-Pricing Rev. 2.0.0

Report Date:
December 14, 2016

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint. Price
High Performance Configuration w with SSDs	UCS-SPBD-C240M4-H2		\$479,000.00	2	\$ 958,000.00	
UCS C240 M4 SFF 24 HD w/o CPU mem HD PCIe PS railkt w/expndr	UCSC-C240-M4SX		\$ -	16	\$ -	
2.60 GHz E5-2690 v4/135W 14C/35MB Cache/DDR4 2400MHz	UCS-CPU-E52690E		\$ -	32	\$ -	
32GB DDR4-2400-MHz RDIMM/PC4-19200/dual rank/x4/1.2v	UCS-MR-1X322RV-A		\$ -	128	\$ -	
240 GB 2.5 inch Enterprise Value 6G SATA SSD (boot)	UCS-SD240GBKS4-EB		\$ -	32	\$ -	
1.6TB 2.5 inch Enterprise Value 6G SATA SSD	UCS-SD16TBKS4-EV		\$ -	128	\$ -	
Cisco 12Gbps Modular SAS HBA	UCSC-SAS12GHBA		\$ -	16	\$ -	
Cisco VIC 1387 Dual Port 40Gb QSFP CNA MLOM	UCSC-MLOM-C40Q-03		\$ -	16	\$ -	
1200W / 800W V2 AC Power Supply for 2U C-Series Servers	UCSC-PSU2V2-1200W		\$ -	32	\$ -	
Power Cord 125VAC 13A NEMA 5-15 Plug North America	CAB-9K12A-NA		\$ -	32	\$ -	
Right PCI Riser Bd (Riser 1) 2onbd SATA bootdrvs+ 2PCI slts	UCSC-PCI-1C-240M4		\$ -	16	\$ -	
Heat sink for UCS C240 M4 rack servers	UCSC-HS-C240M4		\$ -	32	\$ -	
Ball Bearing Rail Kit for C220 M4 and C240 M4 rack servers	UCSC-RAILB-M4		\$ -	16	\$ -	
UCS C240 M4 SFF 24 HD w/o CPU mem HD PCIe PS railkt w/expndr	UCSC-C240-M4SX		\$ 3,995.00	1	\$ 3,995.00	
2.60 GHz E5-2690 v4/135W 14C/35MB Cache/DDR4 2400MHz	UCS-CPU-E52690E		\$ 6,307.00	2	\$ 12,614.00	
32GB DDR4-2400-MHz RDIMM/PC4-19200/dual rank/x4/1.2v	UCS-MR-1X322RV-A		\$ 1,100.00	8	\$ 8,800.00	
240 GB 2.5 inch Enterprise Value 6G SATA SSD (boot)	UCS-SD240GBKS4-EB		\$ 917.00	2	\$ 1,834.00	
1.2 TB 12G SAS 10K RPM SFF HDD	UCS-HD12TB10K12G		\$ 1,460.00	2	\$ 2,920.00	
Cisco 12Gbps Modular SAS HBA	UCSC-SAS12GHBA		\$ 656.00	1	\$ 656.00	
Cisco VIC 1387 Dual Port 40Gb QSFP CNA MLOM	UCSC-MLOM-C40Q-03		\$ 2,192.00	1	\$ 2,192.00	
1200W / 800W V2 AC Power Supply for 2U C-Series Servers	UCSC-PSU2V2-1200W		\$ 749.00	2	\$ 1,498.00	
Power Cord 125VAC 13A NEMA 5-15 Plug North America	CAB-9K12A-NA		\$ -	2	\$ -	
Right PCI Riser Bd (Riser 1) 2onbd SATA bootdrvs+ 2PCI slts	UCSC-PCI-1C-240M4		\$ 148.00	1	\$ 148.00	
Heat sink for UCS C240 M4 rack servers	UCSC-HS-C240M4		\$ -	2	\$ -	
Ball Bearing Rail Kit for C220 M4 and C240 M4 rack servers	UCSC-RAILB-M4		\$ 220.00	1	\$ 220.00	
Cisco Smart Net 24X7X4 3Y UCS C240 M4S BD SP Server	CON-OSP-C240V4SP		\$ 1,284.99	17		\$ 21,844.83

(continued next page)



Cisco UCS Integrated Infrastructure for Big Data

TPCx-HS Rev. 1.4.1
TPC-Pricing Rev. 2.0.0

Report Date:
December 14, 2016

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint. Price
(continued from previous page)						
UCS SP Select 6332-16UP F/No PSU/24 QSFP+ 16 Unified PT	UCS-SP-F633216-2X		\$ 49,000.00	1	\$ 49,000.00	
(Not sold standalone) UCS 6332-16UP F/No PSU/24 QSFP+ 16 PT	UCS-SP-F6332-16UP		\$ -	2	\$ -	
UCS 6332 Power Supply/100-240VAC	UCS-PSU-6332-AC		\$ -	4	\$ -	
16 Gbps Fibre Channel SW SFP+, LC	DS-SFP-FC16G-SW		\$ -	8	\$ -	
QSFP40G BiDi Short-reach Transceiver	QSFP-40G-SR-BD		\$ -	8	\$ -	
Power Cord, 125VAC 13A NEMA 5-15 Plug, North America	CAB-9K12A-NA		\$ -	4	\$ -	
UCS 6332 Fan Module	UCS-FAN-6332		\$ -	8	\$ -	
40GBASE-CR4 Passive Copper Cable, 3m	QSFP-H40G-CU3M		\$ -	8	\$ -	
UCS 6332 Chassis Accessory Kit	UCS-ACC-6332		\$ -	2	\$ -	
UCS Manager v3.1	N10-MGT014		\$ -	2	\$ -	
40GBASE-CR4 Passive Copper Cable, 3m	QSFP-H40G-CU3M=		\$ 250.00	28	\$ 7,000.00	
3rd Gen FI Per port License to connect C-direct only	UCS-LIC-6300-40GC		\$ 1,388.00	28	\$ 38,864.00	
Cisco R42610 standard rack w/side panels	RACK-UCS2		\$ 3,429.00	1	\$ 3,429.00	
3Y Support 24x7x4 UCS6332-16UP	CON-OSPT-F633216UP		\$ 3,330.25	2		\$ 6,660.50
Red Hat Enterprise Linux Server, 3Y 24x7	CON-ISV1-EL2S2V3A		\$ 3,897.00	17	\$ 66,249.00	Inc.
Cloudera Enterprise Edition, 3Y 24x7	UCS-BD-CEBN-GD=		\$ 14,057.00	17	\$ 238,969.00	Inc.
Total					\$1,396,388.00	\$ 28,505.33
Large Purchase Discount 1	61% for products and 35% for service	1			\$ (851,796.68)	\$ (9,976.87)
Acer V206HQLAbd - LED monitor - 20" (Inc 2 spares)	UM.1V6AA.A02	2	\$ 94.99	3	\$ 284.97	
Logitech USB Corded Keyboard/Mouse Combo MK120 (Inc 2 spares)	920-002565	2	\$ 17.99	3	\$ 53.97	

Pricing: 1 = Cisco, 2 = CDW.com

⁽¹⁾ All discounts are based on US list prices and for similar quantities and configurations. The discounts are based on the overall specific components pricing from respective vendors 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 of InfoSizing

Three-Year Cost of Ownership \$563,459

HSph@3TB 13.47

\$/HSph@3TB \$41,830.67

Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmark specifications. If you find that the stated prices are not available according to these terms, please inform at pricing@tpc.org. Thank you.



Cisco UCS Integrated Infrastructure for Big Data

TPCx-HS Rev. 1.4.1
TPC-Pricing Rev. 2.0.0

Report Date:
December 14, 2016

Performance Run

Scale Factor 3TB

Run Start Time 2016-10-17 21:01:31

Run End Time 2016-10-17 21:14:51

Run Elapsed Time 802.000

HSGen Start Time 2016-10-17 21:01:32

HSGen End Time 2016-10-17 21:04:40

HSGen Elapsed Time 189.556

HSSort Start Time 2016-10-17 21:04:42

HSSort End Time 2016-10-17 21:13:33

HSSort Elapsed Time 531.503

HSValidate Start Time 2016-10-17 21:13:36

HSValidate End Time 2016-10-17 21:14:51

HSValidate Elapsed Time 76.640

Repeatability Run

Scale Factor 3TB

Run Start Time 2016-10-17 20:44:08

Run End Time 2016-10-17 20:57:26

Run Elapsed Time 799.000

HSGen Start Time 2016-10-17 20:44:10

HSGen End Time 2016-10-17 20:47:19

HSGen Elapsed Time 190.610

HSSort Start Time 2016-10-17 20:47:21

HSSort End Time 2016-10-17 20:56:02

HSSort Elapsed Time 521.966

HSValidate Start Time 2016-10-17 20:56:06

HSValidate End Time 2016-10-17 20:57:26

HSValidate Elapsed Time 81.546



Cisco UCS Integrated Infrastructure for Big Data

TPCx-HS Rev. 1.4.1
TPC-Pricing Rev. 2.0.0

Report Date:
December 14, 2016

Run Report for Performance Run - Run 2

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details	Total Time =	802
	Total Size =	30000000000
	Scale-Factor =	3

TPCx-HS Performance Metric (HSph@SF): 13.471

Run Report for Repeatability Run - Run 1

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details	Total Time =	799
	Total Size =	30000000000
	Scale-Factor =	3

TPCx-HS Performance Metric (HSph@SF): 13.5196

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Abstract

This document contains the methodology and results of the TPCExpress Benchmark™ HS (TPCx-HS) test conducted in conformance with the requirements of the TPCx-HS Standard Specification, Revision 1.4.1.

The test was conducted at a Scale Factor of 3TB with 17 Cisco UCS C240M4 Servers running Cloudera Enterprise Edition on Red Hat Enterprise Linux Server Release 6.7.

Measured Configuration

Company Name	Cluster Node	Virtualization	Operating System
Cisco Systems, Inc.	Cisco UCS C240M4 Server	n/a	Red Hat Enterprise Linux Server Release 6.7

TPC Express Benchmark© HS Metrics

Total System Cost	HSph@3TB	Price/Performance	Availability Date
563,459 USD	13.47	41,830.67 USD	November 15, 2016

Preface

TPC Express Benchmark™ HS Overview

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. The TPCx-HS stresses both hardware and software including Hadoop runtime, 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. The 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-H 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 Cisco Systems, 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 but 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.

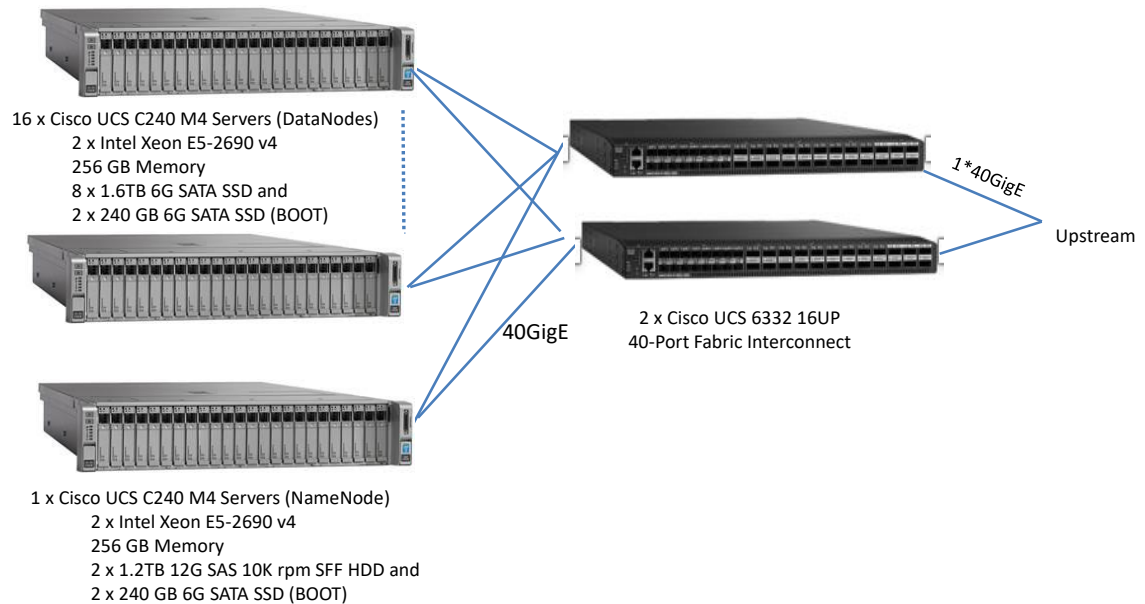
The supporting files contain the parameters and options used to configure the components involved in this benchmark.

1.3 Configuration Diagrams

7.4.4 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.*

Measured Configuration



The measured configuration consisted of:

- Total Nodes: 17
- Total Processors/Cores/Threads: 34/476/952
- Total Memory: 4.25TB
- Total Number of Storage Drives/Devices: 164
- Total Storage Capacity: 215.4TB

Server nodes details:

- 17 x Cisco UCS C240M4 Servers with:
 - Processors/Cores/Threads: 2/28 /56
 - Processor Model:
 - 2 x Intel® Xeon® CPU E5-2690 v4, 2.60 GHz, 35 MB L3
 - Memory: 256GB
 - Controller:
 - 1 x Cisco 12Gbps Modular SAS HBA
 - Drives:
 - 8 x 1.6TB 6G SATA SSD (DataNodes)
 - 2 x 1.2TB 12G SAS 10K rpm SFF HDD (NameNode)
 - 2 x 240GB 2.5 Enterprise Value SSD (all nodes, boot disk)
 - Network: Cisco VIC 1387 Dual Port 40Gb QSFP CNA MLOM

Network connectivity detail:

- 2 x Cisco UCS 6332-16UP 40-Port Fabric Interconnect

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

Priced Configuration

There are no differences between the priced and measured configurations.

1.4 Dataset Distribution

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

Table 1.4 describes the distribution of the dataset across all media in the system.

Table 1.4: Dataset Distribution

Server Node	Controller	Disk Drive	Description of Content
1 (Name Node)	Cisco 12Gbps Modular SAS HBA	1-2 (HDD)	Data, Temp
2-17 (Data Nodes)	Cisco 12Gbps Modular SAS HBA	1-8(SSD)	Data, Temp
1-17 (All Nodes)	Intel Chipset Embedded SATA RAID	0 (2 SSD, RAID 1)	Operating System, Root, Swap, Hadoop Master

1.5 Software Components Distribution

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

Table 1.5 describes the distribution of the software components across the system.

Table 1.5: Software Component Distribution

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

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

Cloudera Enterprise Edition (fully HDFS compatible at the API level).

Map/Reduce implementation and corresponding version must be disclosed.

Cloudera Enterprise Edition (compatible equivalent to Hadoop 2.7.1).

Clause 2: Workload Related Items

2.1 Hardware & Software Tunable

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 - Repeatability Run

=====

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details	Total Time =	799
	Total Size =	30000000000
	Scale-Factor =	3

TPCx-HS Performance Metric (HSph@SF):	13.5196
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Run Report for Run 2 - Performance Run

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TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details	Total Time =	802
	Total Size =	30000000000
	Scale-Factor =	3

TPCx-HS Performance Metric (HSph@SF):	13.471
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2.3 Benchmark Kit Identification

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

Kit Version	1.4.1
File	MD5
BigData_cluster_validate_suite.sh	58c13ddb98a2d1228f2df10f4a087a71
TPCx-HS-master.jar	a7310f65339708afe92af0029960a2cc
TPCx-HS-master.sh	f0d6c7361870983740ff65956a9cbe2e

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 3.1: Storage Device Capacity

Qty	Capacity (GB)	Total (GB)
34	240	8,160
128	1,600	204,800
2	1,200	2,400
Total Storage (TB)		215.4

Scale Factor = 3TB

Data Storage Ratio = (Storage / SF) = 71.79

3.2 Memory Ratio

The Scale Factor to memory ratio must be disclosed.

Total Configured Memory = 4.25TB

Scale Factor to Memory Ratio = (SF / Memory) = 0.71

Clause 4: Scale Factors and Metrics

4.1 HSGen Time

The HSGen time must be disclosed for Run1 and Run2.

	Run1	Run2
HSGen	190.610	189.556

4.2 HSSort Time

The HSSort time must be disclosed for Run1 and Run2.

	Run1	Run2
HSSort	521.966	531.503

4.3 HSValidate Time

The HSValidate time must be disclosed for Run1 and Run2.

	Run1	Run2
HSValidate	81.546	76.640

4.4 HSDataCheck Times

Both HSDataCheck times must be disclosed for Run1 and Run2.

	Run1	Run2
HSDataCheck (pre-Sort)	2.000	2.000
HSDataCheck (post-Sort)	4.000	3.000

4.5 Performance & Price-Performance

The performance metric ($HSph@SF$) must be disclosed for Run1 and Run2. Price-performance metric ($\$/HSph@SF$) must be disclosed for the performance run.

	Run1	Run2
HSph@3TB	13.51	13.47

$\$/HSph@3TB$	41,830.67 USD
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Auditors' Information and Attestation Letter

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 for InfoSizing

www.sizing.com
20 Kreg Lane
Manitou Springs, CO 80829
719-473-7555.

This benchmark's Full Disclosure Report (FDR) can be downloaded from www.tpc.org.

A copy of the auditor's attestation letter is included in the next two pages.

Raghunath Nambiar
Cisco Systems Inc.
3800 Zanker Road
San Jose, CA 95134

December 14, 2016

I verified the TPC Express Benchmark™ HS v1.4.1 performance of the following configuration:

Platform: Cisco UCS Integrated Infrastructure for Big Data
(with 17 Cisco UCS C240M4 Servers)
Operating System: Red Hat Enterprise Linux Server 6.7
Apache Hadoop Cloudera Enterprise Edition
Compatible Software:

The results were:

Performance Metric 13.47 HSph@3TB

Run Elapsed Time 802.00 Seconds

Cluster

17 Cisco UCS C240M4 Servers, each node with:

CPU's	2 x Intel Xeon Processor E5-2690 v4 (2.60 GHz, 14-core, 35 MB L3)		
Memory	256 GB		
Storage	Qty	Size	Type
	8	1.6 TB	6G SATA SSD (Data Nodes)
	2	1.2TB	12G SAS 10K rpm SFF HDD (Name Node)
	2	240GB	6G SATA SSD (All Nodes, boot disk)

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 v1.4.1
- 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 3TB
- 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:

This result was originally certified on November 15, 2016. It has been reviewed for a pricing update.

Respectfully Yours,



Doug Johnson, Auditor



François Raab, President

Supporting File Index

The following index outlines the information included in the supporting files archive.

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Clause 1	Parameters and options used to configure the system	SupportingFilesArchive\Clause1
Clause 2	Configuration scripts & Run report	SupportingFilesArchive\Clause2
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Third Party Price Quotes



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Logitech MK120 USB Wired Keyboard/Mouse Set – \$4.50 svgs while supplies last

logitech Mfg. Part: 920-002565 | CDW Part: 2124292 | UNSPSC: 43211706

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- Wired
- PC compatible
- USB interface
- standard version

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Acer V206HQL – LED monitor – 20"

acer Mfg. Part: UM.IV6AA.A02 | CDW Part: 3051875 | UNSPSC: 43211902

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- TN
- 200 cd/m2
- 5 ms
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