



# Cisco Systems, Inc.

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TPC Express Benchmark™ HS (TPCx-HS)

Full Disclosure Report

for

Cisco UCS Integrated Infrastructure for Big Data (Cisco UCS  
CPA v3)

(with 17 Cisco UCS C240M4 Servers)

using

Cloudera Distribution for Apache Hadoop (CDH) 5.3.2

and

Red Hat Enterprise Linux Server 6.5

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**First Edition**

**September 24, 2015**

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## Cisco UCS Integrated Infrastructure for Big Data (Cisco UCS CPA v3)

TPCx-HS Rev. 1.3.0  
TPC-Pricing Rev. 2.1.0

Report Date:  
September 24, 2015

Total System Cost

TPCx-HS Performance Metric

Price/Performance

**518,063 USD**

**11.76**  
HSph@3TB

**44,052.98 USD**  
\$/HSph@3TB

Scale Factor

Apache Hadoop Compatible Software

Operating System

Other Software

Availability Date

3TB

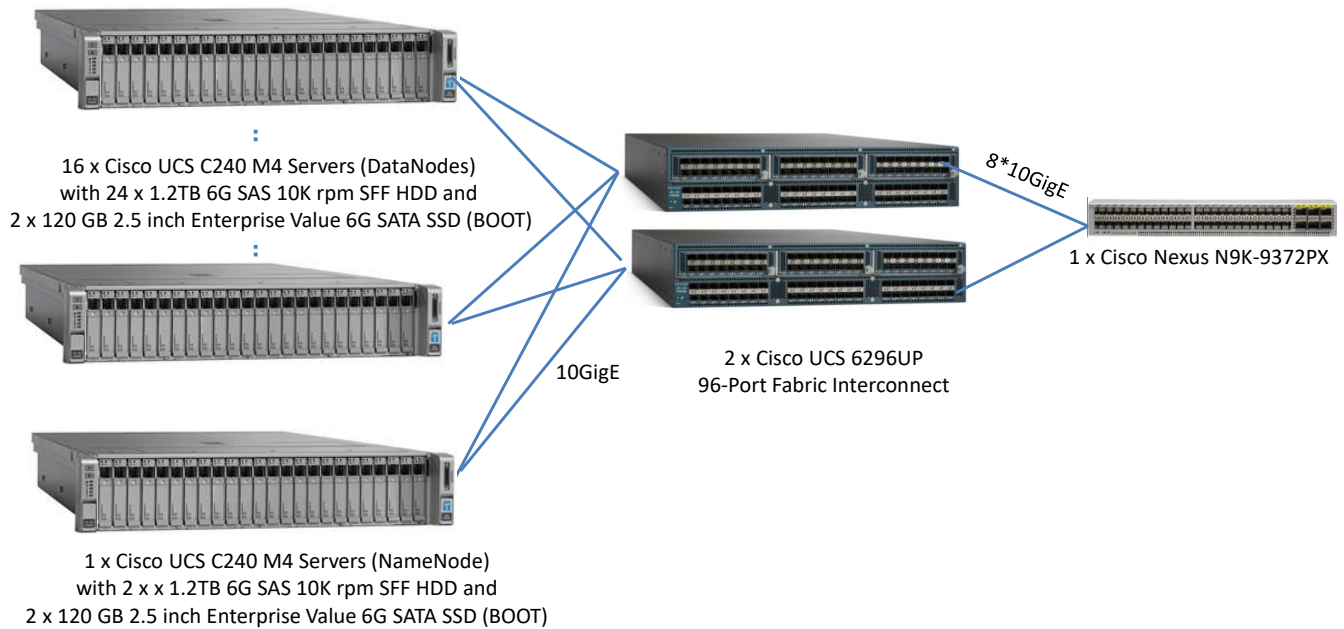
Cloudera Distribution for Apache Hadoop (CDH) 5.3.2

Red Hat Enterprise Linux Server 6.5

None

September 24, 2015

### System Configuration



Physical Storage/Scale Factor: 15.58

Scale Factor/Physical Memory: 7.06

Servers: 17 x Cisco UCS C240M4 Server  
Total Processors/Cores/Threads 34/408/816

Server Configuration:  
Processors 2 x Intel® Xeon® Processor E5-2680 v3, 2.50 GHz, 30MB L3  
Memory 256GB  
Storage Controller 1 x Cisco 12G SAS Modular Raid Controller, 2GB FBWC Cache  
Storage Device 24 x 1.2TB 6G SAS 10Krpm SFF HDD (for 16 DataNodes)  
2 x 1.2TB 6G SAS 10Krpm SFF HDD (for 1 NameNode)  
2 x 120GB 2.5in. Enterprise Value 6G SATA SSD (boot disks, all nodes)

Network 1 x Cisco UCS VIC1227 VIC MLOM - Dual Port 10Gb SFP+

Connectivity: 2 x Cisco UCS 6296UP 96-Port Fabric Interconnect, 1 x Cisco Nexus N9K-9372PX



## Cisco UCS Integrated Infrastructure for Big Data (Cisco UCS CPA v3)

TPCx-HS Rev. 1.3.0  
TPC-Pricing Rev. 2.1.0

Report Date:  
September 24, 2015

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint.
<b>Hardware Components</b>						
<b>Cisco UCS CPA v3 Performance Optimized Bundle</b>	UCS-SL-CPA3-P	1	\$0.00	1	\$0.00	
UCS C240 M4SX w/E52680v3,256GB mem (no sold standalone)	UCS-SA-C240M4SX-P	1	\$48,005.00	16	\$768,080.00	
2.50 GHz E5-2680 v3/120W 12C/30MB Cache/DDR4 2133MHz	UCS-CPU-E52680D	1	\$0.00	32	\$0.00	
16GB DDR4-2133-MHz RDIMM/PC4-17000/dual rank/x4/1.2v	UCS-MR-1X162RU-A	1	\$0.00	256	\$0.00	
120 GB 2.5 inch Enterprise Value 6G SATA SSD (BOOT)	UCS-SD120G0KSB-EV	1	\$0.00	32	\$0.00	
1.2 TB 6G SAS 10K rpm SFF HDD	UCS-HD12T10KS2-E	1	\$0.00	384	\$0.00	
Cisco 12Gbps SAS 2GB FBWC Cache module (Raid 0/1/5/6)	UCSC-MRAID12G-2GB	1	\$0.00	16	\$0.00	
Cisco 12G SAS Modular Raid Controller	UCSC-MRAID12G	1	\$0.00	16	\$0.00	
Cisco UCS VIC1227 VIC MLOM - Dual Port 10Gb SFP+	UCSC-MLOM-CSC-02	1	\$0.00	16	\$0.00	
Right PCI Riser Bd (Riser 1) 2onbd SATA bootdrvs+ 2PCI slts	UCSC-PCI-1C-240M4	1	\$0.00	16	\$0.00	
1200W / 800W V2 AC Power Supply for 2U C-Series Servers	UCSC-PSU2V2-1200W	1	\$0.00	32	\$0.00	
Power Cord 125VAC 13A NEMA 5-15 Plug North America	CAB-9K12A-NA	1	\$0.00	32	\$0.00	
Right PCI Riser Bd (Riser 1) 2onbd SATA bootdrvs+ 2PCI slts	UCSC-PCI-1C-240M4	1	\$0.00	16	\$0.00	
Heat sink for UCS C240 M4 rack servers	UCSC-HS-C240M4	1	\$0.00	32	\$0.00	
Supercap cable 250mm	UCSC-SCCBL240	1	\$0.00	16	\$0.00	
Ball Bearing Rail Kit for C220 M4 and C240 M4 rack servers	UCSC-RAILB-M4	1	\$0.00	16	\$0.00	
(Not sold standalone) UCS 6296UP 2RU FI w/18p LIC,16xCables	UCS-SA-BD-FI96	1	\$22,517.00	2	\$45,034.00	
UCS 6296UP Power Supply/100-240VAC	UCS-PSU-6296UP-AC	1	\$0.00	4	\$0.00	
10GBASE-CU SFP+ Cable 3 Meter	SFP-H10GB-CU3M	1	\$0.00	32	\$0.00	
UCS Manager v2.2	N10-MGT012	1	\$0.00	2	\$0.00	
UCS 6296UP Chassis Accessory Kit	UCS-ACC-6296UP	1	\$0.00	2	\$0.00	
UCS 6200 Series Expansion Module Blank	UCS-BLKE-6200	1	\$0.00	6	\$0.00	
UCS 6296UP Fan Module	UCS-FAN-6296UP	1	\$0.00	8	\$0.00	
Power Cord 125VAC 13A NEMA 5-15 Plug North America	CAB-9K12A-NA	1	\$0.00	4	\$0.00	
UCS C240 M4 SFF 24 HD w/o CPU mem HD PCIe PS railkt w/expndr	UCSC-C240-M4SX	1	\$3,995.00	1	\$3,995.00	
2.50 GHz E5-2680 v3/120W 12C/30MB Cache/DDR4 2133MHz	UCS-CPU-E52680D	1	\$5,259.00	2	\$10,518.00	
16GB DDR3-1866-MHz RDIMM/PC3-14900/dual rank/x4/1.5v	UCS-MR-1X162RU-A	1	\$725.00	16	\$11,600.00	
120 GB 2.5 inch Enterprise Value 6G SATA SSD (BOOT)	UCS-SD120G0KSB-EV	1	\$748.00	2	\$1,496.00	
1.2 TB 6G SAS 10K rpm SFF HDD	UCS-HD12T10KS2-E	1	\$1,460.63	2	\$2,921.26	
Cisco 12Gbps SAS 2GB FBWC Cache module (Raid 0/1/5/6)	UCSC-MRAID12G-2GB	1	\$1,405.00	1	\$1,405.00	
Cisco 12G SAS Modular Raid Controller	UCSC-MRAID12G	1	\$656.00	1	\$656.00	
Cisco UCS VIC1227 VIC MLOM - Dual Port 10Gb SFP+	UCSC-MLOM-CSC-02	1	\$1,499.00	1	\$1,499.00	
1200W / 800W V2 AC Power Supply for 2U C-Series Servers	UCSC-PSU2V2-1200W	1	\$749.00	2	\$1,498.00	
Power Cord 125VAC 13A NEMA 5-15 Plug North America	CAB-9K12A-NA	1	\$0.00	2	\$0.00	
Right PCI Riser Bd (Riser 1) 2onbd SATA bootdrvs+ 2PCI slts	UCSC-PCI-1C-240M4	1	\$148.00	1	\$148.00	
Heat sink for UCS C240 M4 rack servers	UCSC-HS-C240M4	1	\$0.00	1	\$0.00	
Supercap cable 250mm	UCSC-SCCBL240	1	\$0.00	1	\$0.00	
Ball Bearing Rail Kit for C220 M4 and C240 M4 rack servers	UCSC-RAILB-M4	1	\$220.00	1	\$220.00	
Cisco Smart Net 24X7X4 3Y UCS C240 M4S BD SP Server	CON-OSP-C240V4SP	1	\$1,284.99	17		\$21,845
2nd Gen FI License to connect C-direct only	UCS-L-6200-10G-C	1	\$925.00	14	\$12,950.00	
10GBASE-CU SFP+ Cable 3 Meter	SFP-H10GB-CU3M	1	\$100.00	18	\$1,800.00	
Cisco R42610 standard rack w/side panels	RACK-UCS2	1	\$3,429.00	1	\$3,429.00	
Cisco Smart Net 24X7X4 3Y UCS 6296UP 2RU Fabric Int/2 PSU/4 Fans	CON-SNTP-FI6296UP	1	\$5,781.00	2		\$11,562
Cisco Nexus 9372PX Switch	N9K-C9372PX	1	\$22,500.00	1	\$22,500.00	
Cisco SNTP Cisco Nexus 9372PX Switch, 36 24x7	CON-SNTP-9372PX	1	\$5,256.00	1		\$5,256
<b>Hardware subtotal</b>					<b>\$889,749.26</b>	<b>\$38,663</b>



**Cisco UCS Integrated Infrastructure  
for Big Data (Cisco UCS CPA v3)**

TPCx-HS Rev. 1.3.0  
TPC-Pricing Rev. 2.1.0

Report Date:  
September 24, 2015

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint.
<b>Software Components</b>						
Red Hat Enterprise Linux Server, 3Y 24x7	CON-ISV1-RH2SUG3A	1	\$2,397.00	17	\$40,749.00	Inc.
Cloudera Enterprise Edition	UCS-BD-CB185-3YR	1	\$12,651.00	17	\$215,067.00	Inc.
<b>Software subtotal</b>					<b>\$255,816.00</b>	
<b>Total</b>					<b>\$1,145,565.26</b>	<b>\$38,663</b>
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	
Large Purchase Discount <sup>(1)</sup> (50% for products and 35% for service)		1			(\$652,972.20)	(\$13,532)

Pricing: 1 = Cisco, 2 = CDW.com

<sup>(1)</sup> 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, Inc.**

<b>Three-Year Cost of Ownership</b>	<b>\$518,063</b>
<b>HSph@3TB</b>	<b>11.76</b>
<b>\$/HSph@3TB</b>	<b>\$44,052.98</b>

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](mailto:pricing@tpc.org). Thank you.



**Measurement Results for Performance Run**

Scale Factor	3TB
Run Start Time	9/17/2015 20:33:29
Run End Time	9/17/2015 20:48:45
Run Elapsed Time	918.000
HSGen Start Time	9/17/2015 20:33:30
HSGen End Time	9/17/2015 20:37:22
HSGen Elapsed Time	233.249
HSSort Start Time	9/17/2015 20:37:25
HSSort End Time	9/17/2015 20:46:51
HSSort Elapsed Time	566.723
HSValidate Start Time	9/17/2015 20:46:54
HSValidate End Time	9/17/2015 20:48:45
HSValidate Elapsed Time	112.767

**Measurement Results for Repeatability Run**

Scale Factor	3TB
Run Start Time	9/17/2015 21:05:30
Run End Time	9/17/2015 21:20:45
Run Elapsed Time	917.000
HSGen Start Time	9/17/2015 21:05:32
HSGen End Time	9/17/2015 21:09:24
HSGen Elapsed Time	233.783
HSSort Start Time	9/17/2015 21:09:26
HSSort End Time	9/17/2015 21:18:53
HSSort Elapsed Time	567.124
HSValidate Start Time	9/17/2015 21:18:56
HSValidate End Time	9/17/2015 21:20:45
HSValidate Elapsed Time	110.832



### Run Report for Performance Run

```
=====  
TPCx-HS Performance Metric (HSph@SF) Report  
  
Test Run 1 details: Total Time = 918  
                    Total Size = 30000000000  
                    Scale-Factor = 3.0000  
  
TPCx-HS Performance Metric (HSph@SF): 11.7647  
=====
```

### Run Report for Repeatability Run

```
=====  
TPCx-HS Performance Metric (HSph@SF) Report  
  
Test Run 2 details: Total Time = 917  
                    Total Size = 30000000000  
                    Scale-Factor = 3.0000  
  
TPCx-HS Performance Metric (HSph@SF): 11.7785  
=====
```

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# Abstract

This document contains the methodology and results of the TPC Express Benchmark™ HS (TPCx-HS) test conducted in conformance with the requirements of the TPCx-HS Standard Specification, Revision 1.3.0.

The test was conducted at a Scale Factor of 3TB with 17 Cisco UCS C240M4 Servers running Cloudera Distribution for Apache Hadoop (CDH) 5.3.2 on Red Hat Enterprise Linux Server 6.5.

## Measured Configuration

Company Name	Cluster Node	Virtualization	Operating System
Cisco Systems, Inc.	Cisco UCS C240M4 Server	n/a	Red Hat Enterprise Linux Server 6.5

## TPC Express Benchmark©HS Metrics

Total System Cost	HSph@3TB	Price/Performance	Availability Date
518,063 USD	11.76	44,052.98 USD	September 24, 2015

# 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 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. 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](http://www.tpc.org/tpcx-hs) for more information). Users must sign-up and agree to the TPCx-HS User Licensing Agreement (ULA) to download the kit. Re-distribution of the kit is prohibited. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include TPCx-HS copyright. The TPCx-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](http://www.tpc.org)*

# Clause 1: General Items

## 1.1 Test Sponsor

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

This benchmark was sponsored by 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 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.*

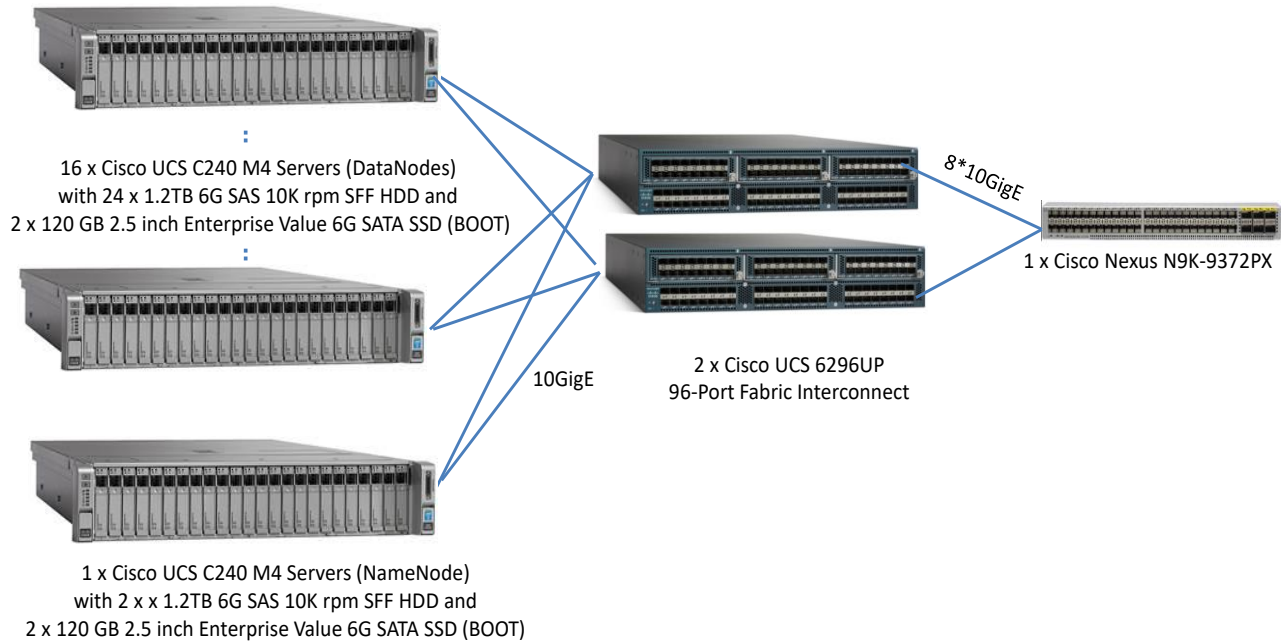
The supporting files contain the parameters and options used to configure the components involved in this benchmark.

## 1.3 Configuration Diagrams

*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: 34/408/816
- Total Memory: 4.25TB
- Total Number of Storage Drives/Devices: 420
- Total Storage Capacity: 467.28TB

Server nodes details:

- 17 x Cisco UCS C240M4 Servers, each with:
  - Processors/Cores/Threads: 2/24/48
  - Processor Model: 2 x Intel® Xeon® Processor E5-2680 v3, 2.50 GHz, 30MB L3
  - Memory: 256GB
  - Controller: 1 x Cisco 12G SAS Modular Raid Controller, 2GB FBWC Cache
  - Drives:
    - 24 x 1.2TB 6G SAS 10Krpm SFF HDD (for 16 DataNodes)
    - 2 x 1.2TB 6G SAS 10Krpm SFF HDD (for 1 NameNode)
    - 2 x 120GB 2.5in. Enterprise Value 6G SATA SSD (boot disks, all nodes)
  - Network: 1 x Cisco UCS VIC1227 VIC MLOM - Dual Port 10Gb SFP+

Network connectivity detail:

- 2 x Cisco UCS 6296UP 96-Port Fabric Interconnect, 1 x Cisco Nexus N9K-9372PX

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	MegaRAID 3108	1-2 (HDD)	Data, Temp
2-17	MegaRAID 3108	1-24 (HDD)	Data, Temp
1-17	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: Dataset Distribution**

Node	Map/Reduce		HDFS		ZooKeeper
	JobTracker	TaskTracker	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 Distribution for Apache Hadoop (CDH) 5.3.2 (fully HDFS compatible at the API level).

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

Cloudera Distribution for Apache Hadoop (CDH) 5.3.2 (compatible equivalent to Hadoop 2.7.0).

# 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.

- **Run1 Performance Summary**

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

Test Run 1 details: Total Time = 918
                    Total Size = 3000000000
                    Scale-Factor = 3.0000

TPCx-HS Performance Metric (HSph@SF): 11.7647
=====
```

- **Run2 Performance Summary**

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

Test Run 2 details: Total Time = 917
                    Total Size = 3000000000
                    Scale-Factor = 3.0000

TPCx-HS Performance Metric (HSph@SF): 11.7785
=====
```

## 2.3 Benchmark Kit Identification

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

The version number of the TPCx-HS kit used is 1.3.0. The md5sum for the TPCx-HS kit files used during the benchmark are:

```
TPCx-HS-master.jar 4ceaef51c698c0733b57244b7760808
BigData_cluster_validate_suite.sh 58c13ddb98a2d12282df10f4a087a71
TPCx-HS-master.sh 70ba6b440de47b4e4a902bf4983ee4c1
```

## 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)
386	1,200	463,200
34	120	4,080
<b>Total Storage (TB)</b>		<b>467.28</b>

Scale Factor = 3TB

**Data Storage Ratio** = (Storage / SF) = **15.58**

## 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) = **7.06**

# Clause 4: Scale Factors and Metrics

## 4.1 HSGen Time

The HSGen time must be disclosed for Run1 and Run2.

	Run1	Run2
HSGen	233.249	233.783

## 4.2 HSSort Time

The HSSort time must be disclosed for Run1 and Run2.

	Run1	Run2
HSSort	566.723	567.124

## 4.3 HSValidate Time

The HSValidate time must be disclosed for Run1 and Run2.

	Run1	Run2
HSValidate	112.767	110.832

## 4.4 HSDataCheck Times

Both HSDataCheck times must be disclosed for Run1 and Run2.

	Run1	Run2
HSDataCheck (pre-Sort)	3.000	2.000
HSDataCheck (post-Sort)	3.000	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	11.76	11.77

\$/HSph@3TB	44,052.98 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, Inc.

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](http://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

September 19, 2015

I verified the TPC Express Benchmark™ HS v1.3.0 performance of the following configuration:

Platform: Cisco UCS Integrated Infrastructure for Big Data (Cisco UCS CPA v3)  
(with 17 Cisco UCS C240M4 Servers)  
Operating System: Red Hat Enterprise Linux Server 6.5  
Apache Hadoop Cloudera Distribution for Apache Hadoop (CDH) 5.3.2  
Compatible Software:

The results were:

**Performance Metric 11.76 HSph@3TB**  
Run Elapsed Time 918.00 Seconds

**Cluster 17 Cisco UCS C240M4 Servers (each with)**

CPU	2 x Intel Xeon Processor E5-2680 v3 (2.50 GHz, 12-core, 30 MB L3)		
Memory	256 GB		
Storage	<b>Qty</b>	<b>Size</b>	<b>Type</b>
	24	1.2 TB	10K rpm SFF HDD (16 <u>DataNodes</u> )
	2	1.2 TB	10K rpm SFF HDD (1 <u>NameNode</u> )
	2	120GB	SATA SSD (boot disks, all nodes)

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

The following verification items were given special attention:

- All TPC-provided components were verified to be v1.3.0
- 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

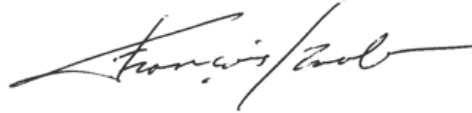
Additional Audit Notes:

None.

Respectfully Yours,



Doug Johnson, Auditor



François Raab, President

# Supporting File Index

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

Clause	Description	Archive File Pathname
Clause 1	Parameters and options used to configure the system	SupportingFilesArchive\Clause1
Clause 2	Configuration scripts & Run report	SupportingFilesArchive\Clause2
Clause 3	System configuration details	SupportingFilesArchive\Clause3

# Third Party Price Quotes

CDW LLC (US) | https://www.cdw.com/shop/products/Logitech-USB-Corded-Keyboard-Mouse-Combo-MK120/2124292.aspx?pfm=srh

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**CDW** Products Solutions & Services Account Center | All Product Catalog | Search for...


Hardware Software Cloud Product Finders Brands Best Deals

Home > Computer Accessories > Keyboards & Keyboards > Keyboard and Mouse Bundle

## Logitech USB Corded Keyboard/Mouse Combo MK120

logitech Mfg. Part: 920-002565 | CDW Part: 2124292 | UNSPSC: 43211708

★★★★★ | [Read 1 review](#) | [Write a review](#)



Availability: **In Stock**

Ships same day if ordered before 4 PM CT

- Keyboard
- mouse
- Wired
- PC compatible
- USB interface
- standard version

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CDW LLC (US) | https://www.cdw.com/shop/products/Acer-V206HQL-Abd-LED-monitor-20in-Wide-LCD/3051875.aspx?pfm=srh

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

★★★★★ | [Read all 46 reviews](#) | [Write a review](#)



Availability: **In Stock**

Ships same day if ordered before 4 PM CT

- LED Backlight LCD
- 20" wide (19.5" viewable)
- Maximum Resolution: 1600 x 900
- Dynamic Contrast Ratio: 100,000,000:1
- Signal Connectors: VGA / DVI (HDCP)
- Detachable Foot Stand
- Kensington Lock Supported

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**Recommended Warranty and Services**

[Acer Two-way freight for depot - extended service agreement - 3 years - pic](#)

**\$10.99**