

**TPC Benchmark™ TPCx-HS
Full Disclosure Report
DELL PowerEdge R720xd
Using
VMware vSphere 6.0
and
Suse SLES 11 SP3**



First Edition

Submitted for review

March 9, 2015

Dell Inc. PowerEdge R720xd Server with VMware vSphere, Suse Linux Enterprise Server and Cloudera CDH

First Printing March 2015

All rights reserved. Permission is hereby granted to reproduce this document in whole or in part provided the copyright notice is included on the title page of each item reproduced.

Printed in U.S.A.

DELL believes that the technical, pricing and discounting information in this document is accurate as of its publication date. The performance information in this document is for guidance only. System performance is highly dependent on many factors including system hardware, system and user software, and user-application characteristics. Customer applications must be carefully evaluated before estimating performance. DELL does not warrant or represent that a user can or will achieve similar performance as expressed in this document.

THE TERMS AND CONDITIONS GOVERNING THE SALE OF DELL HARDWARE PRODUCTS AND THE LICENSING OF DELL SOFTWARE CONSIST SOLELY OF THOSE SET FORTH IN THE WRITTEN CONTRACTS BETWEEN DELL AND ITS CUSTOMERS. NO REPRESENTATION OR OTHER AFFIRMATION OF FACT CONTAINED IN THIS DOCUMENT INCLUDING BUT NOT LIMITED TO STATEMENTS REGARDING PRICE, CAPACITY, RESPONSE-TIME PERFORMANCE, SUITABILITY FOR USE, OR PERFORMANCE OF PRODUCTS DESCRIBED HEREIN SHALL BE DEEMED TO BE A WARRANTY BY DELL FOR ANY PURPOSE, OR GIVE RISES TO ANY LIABILITY OF DELL WHATSOEVER.

DELL assumes no responsibility for any errors that may appear in this document. DELL reserves the right to make changes in specifications and other information contained in this document without prior notice, and the reader should in all cases consult DELL to determine whether any such changes have been made.

PowerEdge is an U.S. registered trademark of Dell Inc.

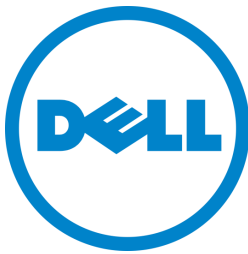
vSphere is a registered trademark of VMware Inc.

Suse Linux Enterprise Server and SLES are registered trademarks of SUSE.

CDH is a registered trademark of Cloudera.

Intel and Xeon are registered trademarks of Intel Corporation.

TPC Benchmark TPCx-HS is a trademark of the Transaction Processing Performance Council.



**DELL
PowerEdge R720xd
with
VMware vSphere 6.0**

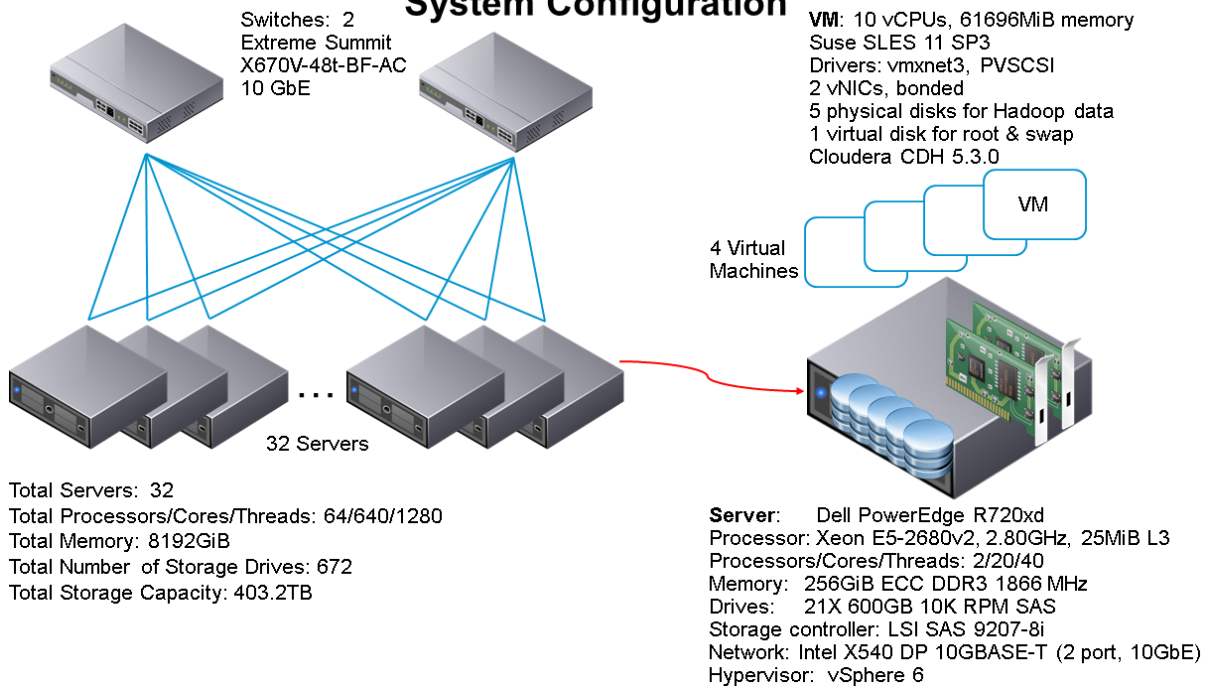
**TPCx-HS Rev. 1.2.0
TPC-Pricing Rev. 1.7.0**

**Report Date:
March 9, 2015**

Total System Cost	TPCx-HS Performance Metric	Price/Performance
\$1,019,535	20.76 HSph@30TB	49,110.55 \$/HSph@30TB

Apache Hadoop Compatible Software	Operating System	Other Software	System Availability Date
Cloudera CDH 5.3.0, HDFS API ver 2, Map Reduce API ver 1	Suse SLES 11 SP3	VMware vSphere 6.0, Java HotSpot 1.7.0_55	March 12, 2015

System Configuration



Physical Storage/Scale Factor	Scale Factor/Physical Memory
13.44	3.41

Cluster Configuration

Total Servers	32X PowerEdge R720xd
Total Processors/Cores/Threads	64/640/1280
Total Memory	8192GiB
Total Storage Capacity	403.2TB

Server Configuration

Processors	2X Intel Xeon E5-2680v2, 2.80GHz, 25MiB L3
Memory	256GiB
Storage Controller	Dell H220: LSI SAS9207-8i
Storage Devices	21X 600GB 10K SAS SFF HDD (internal)
Network Interface	Intel X540 DP 10GBASE-T (2 port, 10GbE)

Network Connectivity

Network Switches	2X Extreme Summit X670V-48t-BF-AC
------------------	-----------------------------------



**Dell PowerEdge
R720xd with
VMware vSphere 6**

**TPCx-HS Rev. 1.2.0
TPC-Pricing Rev. 1.7.0
Report Date
March 9, 2015**

Description	Part Number	Key	Unit Price	Quantity	Extended Price	3 yr. Maint. Price
PowerEdge R720xd, Intel Xeon E-26XX Processors	210-ABMY	1	1596.53	32	51088.96	
PowerEdge R720 Motherboard, TPM	591-BBBP	1		32	0.00	
Dell Hardware Limited Warranty Plus On Site Service Initial Year	936-0967	1	117.14	32		3748.48
Non-Mission Critical: 4-Hour 7x24 On-site Service After Problem Diagnosis, 2 Year						
Extended	936-7183	1	962.86	32		30811.52
ProSupport: 7x24 HW / SW Tech Support and Assistance, 3 Year	936-7263	1	1712.86	32		54811.52
Dell Hardware Limited Warranty Plus On Site Service Extended Year	939-3398	1	168.57	32		5394.24
Non-Mission Critical: 4-Hour 7x24 On-site Service After Problem Diagnosis, Initial Year	989-2611	1	180.00	32		5760.00
Dell ProSupport. For tech support, visit http://support.dell.com/ProSupport or call 1-800-945-3355	989-3439	1		32		0.00
On-Site Installation Declined	900-9997	1		32	0.00	
Proactive Maintenance Service Declined	926-2979	1		32	0.00	
PowerEdge R720 Shipping	331-4437	1		32	0.00	
Intel Ethernet X540 DP 10GBASE-T Server Adapter, Low Profile	430-4439	1	971.33	32	31082.56	
IDRAC7 Enterprise	421-5339	1	387.95	32	12414.40	
Broadcom 5720 QP 1Gb Network Daughter Card	430-4418	1	72.92	32	2333.44	
Chassis with up to 24, 2.5" Hard Drives	342-3566	1	670.80	32	21465.60	
No Bezel	313-0869	1		32	0.00	
Power Saving Dell Active Power Controller	330-5116	1		32	0.00	
No RAID for H310 (1-16 HDDs)	331-4533	1		32	0.00	
LSI 9207, Internal Passthrough Host Bus Adapter Card for R720 and R720 XD with 2.5in HDDs	342-5964	1	281.00	32	8992.00	
Heat Sink for PowerEdge R720 and R720xd	331-4508	1		32	0.00	
Intel Xeon E5-2680v2 2.8GHz, 25M Cache, 8.0GT/s QPI, Turbo, HT, 10C, 115W, Max Mem 1866MHz	338-BCUH	1	2274.22	32	72775.04	
DIMM Blanks for Systems with 2 Processors	317-8688	1		32	0.00	
Heat Sink for PowerEdge R720 and R720xd	331-4508	1		32	0.00	
Intel Xeon E5-2680v2 2.8GHz, 25M Cache, 8.0GT/s QPI, Turbo, HT, 10C, 115W, Max Mem 1866MHz, 2nd Proc	338-BCUI	1	2274.22	32	72775.04	
16GB RDIMM, 1866MT/s, Standard Volt, Dual Rank, x4 Data Width	370-AAWL	1	364.62	512	186685.44	
1866MT/s RDIMMs	370-AAWM	1		32	0.00	
Performance Optimized	331-4428	1		32	0.00	
600GB 10K RPM SAS 6Gbps 2.5in Hot-plug Hard Drive	342-0847	1	504.63	672	339111.36	
Electronic System Documentation and OpenManage DVD Kit for R720 and R720xd	331-5914	1		32	0.00	
ReadyRails Sliding Rails With Cable Management Arm	331-4433	1	183.77	32	5880.64	
Dual, Hot-plug, Redundant Power Supply (1+1), 1100W	331-4607	1	476.42	32	15245.44	
Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 10 feet / 3 meter	310-8509	1		64	0.00	
SUSE Linux Enterprise Server, Non Factory Install, Requires License and Subscription Selection	421-7145	1		32	0.00	
SuSe Enterprise Linux Server, 1-2 Socket, 3yr Subscription and Licensing, Unlimited Virtual Licenses	421-9363	1	5055.00	32	161760.00	included
No Media Required	421-5736	1		32	0.00	
vSphere Ess Plus Kit v5.x 6CPU License, 3yr Subscription w/Dwngrd Rights*	421-7743	1	8278.39	11	91062.29	included
Cloudera Enterprise Basic Edition, Capacity License, 24X7, Subscription (per TB, per year) for the Basic Edition of the Cloudera Enterprise platform.**	A8182567	1	178.00	1152	205056.00	included
DELL DISCOUNT 30%		1			-383318.46	-30157.73
Dell Quote number: 702936152		1				
Extreme Summit X670V-48t-BF-AC	17202	2	25995.00	2	51990.00	
EXTREME DISCOUNT hardware 35%		2			-18196.50	
Extreme support: EW 4hr AHR-17202	97007-17202	2	10920.00	2		21840.00
EXTREME DISCOUNT support 15%		2				-3276.00
Extreme quote number: VMwareCL102614 02		2				
Cat6a patch cable 10G RJ45 7ft (Inc 10% spares)	1117918	3	11.99	71	851.29	
CPI Adjustable ServerRack - 51U	1506291	3	614.99	2	1229.98	
Acer - LED monitor - 18.5" (Inc 2 spares)	2978003	3	87.99	3	263.97	
Logitech USB KB/Mouse (Inc 2 spares)	2124292	3	17.99	3	53.97	

Total 930602.46 88932.03

Three-year cost of ownership: 1019535

HSph@30TB: 20.76

\$/HSph@30TB: 49110.55

Notes:
 * Each license covers 3 servers, free upgrade to vSphere 6 when available
 ** 384TB Hadoop data storage X 3 years: quantity=1152
 Price Key:
 1 - Dell, Brian Bassett (Brian_Bassett@Dell.com)
 2 - Extreme, Randy Norman (morman@extremenetworks.com)
 3 - CDW

Audited by Doug Johnson, InfoSizing Inc. (www.sizing.com)

"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 specification. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you."



DELL
PowerEdge R720xd
with
VMware vSphere 6.0

TPCx-HS Rev. 1.2.0
TPC-Pricing Rev. 1.7.0

Report Date:
March 9, 2015

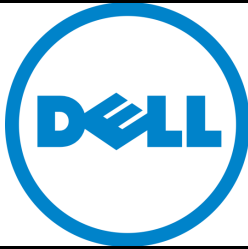
Numerical Quantities Summary

Measurement Results for Performance Run

Scale Factor	30TB
Run Start Time	2015/01/12 00:36:13
Run End Time	2015/01/12 02:02:51
Run Elapsed Time	5201.000
Start of HSGen	2015/01/12 00:36:13
End of HSGen	2015/01/12 00:54:17
HSGen Time	1085.464
Start of HSSort	2015/01/12 00:54:20
End of HSSort	2015/01/12 01:51:35
HSSort Time	3435.609
Start of HSValidate	2015/01/12 01:51:39
End of HSValidate	2015/01/12 02:02:51
HSValidate Time	674.168

Measurement Results for Repeatability Run

Scale Factor	30TB
Run Start Time	2015/01/11 23:06:41
Run End Time	2015/01/12 00:32:04
Run Elapsed Time	5128.000
Start of HSGen	2015/01/11 23:06:41
End of HSGen	2015/01/11 23:24:26
HSGen Time	1066.861
Start of HSSort	2015/01/11 23:24:29
End of HSSort	2015/01/12 00:20:18
HSSort Time	3349.784
Start of HSValidate	2015/01/12 00:20:22
End of HSValidate	2015/01/12 00:32:04
HSValidate Time	704.412



DELL
PowerEdge R720xd
with
VMware vSphere 6.0

TPCx-HS Rev. 1.2.0
TPC-Pricing Rev. 1.7.0

Report Date:
March 9, 2015

Run report for Performance Run

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

Test Run 2 details: Total Time = 5201
Total Size = 300000000000
Scale-Factor = 30.0000

TPCx-HS Performance Metric (HSph@SF): 20.7655
=====

Run report for Repeatability Run

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

Test Run 1 details: Total Time = 5128
Total Size = 300000000000
Scale-Factor = 30.0000

TPCx-HS Performance Metric (HSph@SF): 21.0614
=====

Table of Contents

Abstract	1
CLAUSE 1: GENERAL ITEMS	2
1.1 Test Sponsor	2
1.2 Parameter Settings	2
1.3 Disclosure Requirements	2
1.4 Measured and Priced Configurations	2
1.5 Distribution of Data	4
1.6 Software Components.....	6
1.7 Distributed Files System	6
1.8 Map/Reduce.....	6
CLAUSE 2: WORKLOAD RELATED ITEMS	7
2.1 Scripts.....	7
2.2 Version Number and Checksums.....	7
2.3 Run Report	7
2.4 Benchmark Kit changes	8
CLAUSE 3: SUT RELATED ITEMS	9
3.1 Data Storage and Memory Ratios	9
CLAUSE 4: PERFORMANCE METRICS	10
CLAUSE 8: AUDITOR-RELATED ITEMS	11
Auditor's Report	11
SUPPORTING FILES	14
PRICE QUOTATIONS	15

Abstract

This report document the methodology and results of the TPC Benchmark TPCx-HS test conducted on a cluster of 32 PowerEdge R720xd Servers using Cloudera CDH 5.3.0 in conformance with the requirements of the TPCx-HS Benchmark Specification. Each Server was virtualized with vSphere 6.0, and 4 Virtual Machines (VMs) per Server were used for the test. The operating system in each VM used for the benchmark was Suse SLES 11 SP3.

Measured Configuration

Hardware	Virtualization	Operating System
32X Dell PowerEdge R720xd with 10-core 2.80GHz Intel Xeon E5 2680v2 21x 600 GB 10K RPM HDDs	vSphere 6.0	Suse SLES 11 SP3

TPCx-HS metrics

Total System Cost	HSph@30TB	\$/HSph@30TB	Availability Date
\$1,019,535	20.76	\$49,110.55	March 12, 2015

The Transaction Processing Performance Council (TPC) developed the TPCx-HS Benchmark. The TPC was founded to define transactions processing benchmarks and to disseminate objective, verifiable performance data to the industry.

In order to verify compliance to the TPCx-HS benchmark specification, Doug Johnson audited the benchmark configuration, environment and methodology used to produce and validate the test results, and the pricing model used to calculate the price/performance.

CLAUSE 1: GENERAL ITEMS

1.1 Test Sponsor

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

DELL is the sponsor of this TPC Benchmark™ TPCx-HS result. Testing was performed with the involvement of VMware.

1.2 Parameter Settings

7.4.2 Settings must be provided for all customer-tunable parameters and options that 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 parameters and options used to configure the components involved in this benchmark are contained in the supporting files.

1.3 Disclosure Requirements

7.4.3 Explicit response to individual disclosure requirements specified in the body of earlier sections of this document must be provided.

All components of the system are available immediately except VMware vSphere 6, which determines the availability date of March 12, 2015. A pre-release version of vSphere was used for testing. There is no expected difference in performance for the release version. In the pricing spreadsheet, vSphere 5.x is priced with a free upgrade to vSphere 6 when it becomes available.

1.4 Measured and Priced Configurations

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.*

The following sample diagram illustrates a measured benchmark configuration using Ethernet, an external driver, and four processors each with two cores and four threads per node in the SUT. Note that this diagram does not depict or imply any optimal configuration for the TPCx-HS benchmark measurement.

Depending on the implementation of the SUT the Name Node, Job Tracker, Task Tracker, Data Nodes etc or the functional equivalents must be specified in the diagram.

Comment: *Detailed diagrams for system configurations and architectures can vary widely, and it is impossible to provide exact guidelines suitable for all implementations. The intent here is to describe the system components and connections in sufficient detail to allow independent reconstruction of the measurement environment. This example diagram shows homogeneous nodes. This does not preclude tests sponsors from using heterogeneous nodes as long as the system diagram reflects the correct system configuration.*

The System Under Test (SUT) comprises 32X DELL PowerEdge R720xd Servers and 2X Extreme Summit X670V-48t-BF-AC ethernet switches, depicted in the next diagram. The servers are named w3-hadoop-s001 through w3-hadoop-s032. Each Server consists of:

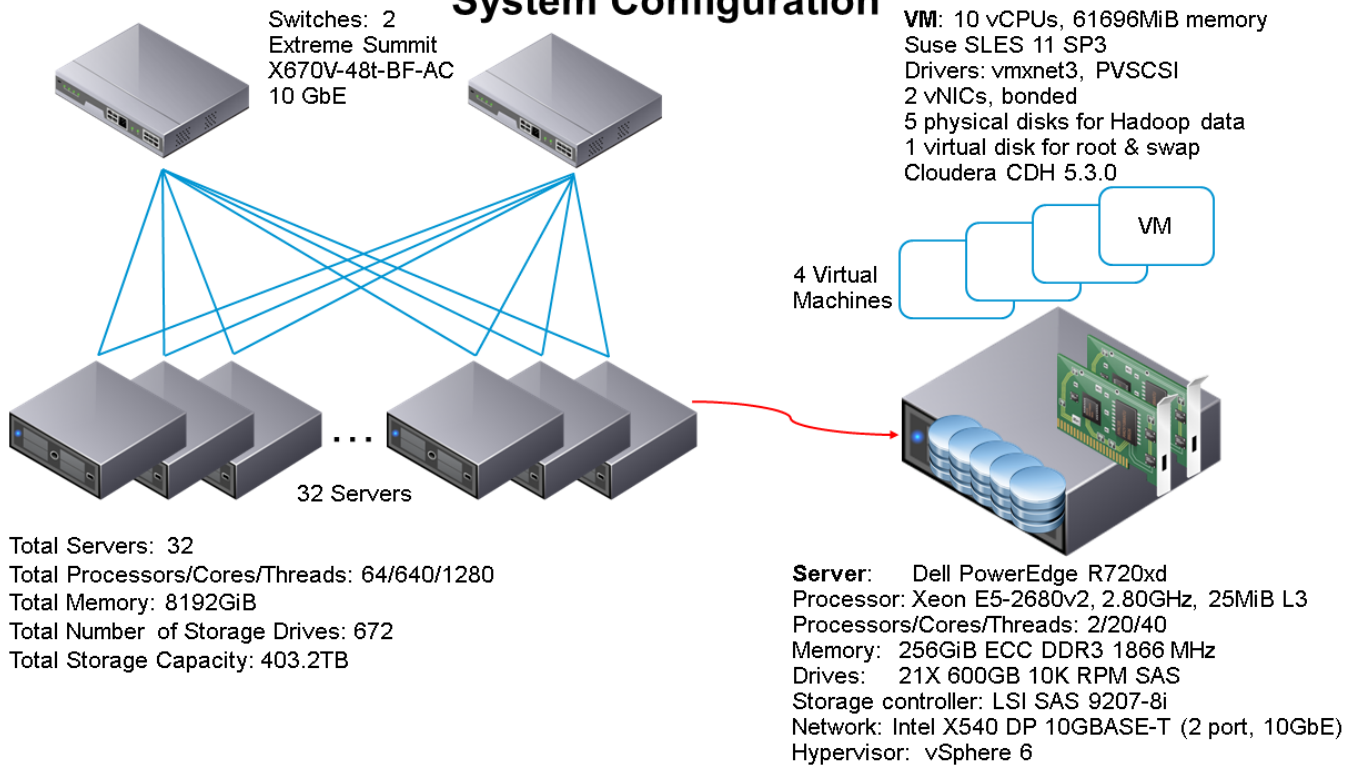
- 2X 2.80GHz Intel ® Xeon E5-2680v2 Processors, each with a 25MiB L3 cache and 10X 256KiB L2 caches (one per core), Hyper-Threading enabled, 40 total hardware threads
- 256GiB ECC DDR3 1866 MHz RAM
- Local storage controller: Dell H220, LSI SAS9207-8i, Internal Passthrough Host Bus Adapter, FW version 18, x8 PCI Express 3.0
- Intel Ethernet X540 DP 10GBASE-T: 2-port 10GbE, each port connected to one of the switches
- 21X 600GB 10K SAS 6Gbps HDD.

Each Server is virtualized with vSphere 6.0, and runs 4 Virtual Machines (VMs). The physical hardware is divided among the VMs. One of the physical disks is formatted with VMFS 5 and holds 4 15GiB virtual disks and other hypervisor data. One virtual disk is used for the root and swap partitions of each VM. The hypervisor (ESXi) itself is stateless and its filesystem is memory-based. The VMs are named cirrus1 through cirrus128. Each VM consists of:

- 10 vCPUs
- 61696MiB memory
- 5 disks, each mapped directly to a physical disk (with physical Raw Device Mapping, pRDM). Each disk is formatted with a single XFS partition.
- 1 virtual disk that holds the root and swap partitions of the guest Operation System (OS)
- 2 virtual NICs, bonded together in the guest OS

There are no differences between the priced and measured configurations.

System Configuration



1.5 Distribution of Data

7.4.5 The distribution of dataset across all media must be explicitly described using a format similar to that shown in the following example for both the tested and priced systems.

Table 1.5.1: Layout Description. Measured and priced configurations are the same. pRDM means “physical Raw Device Mapping”.

Virtual Machine	Physical Disk Drive	Disk Format	Description of Content
cirrus1–cirrus17, cirrus21–cirrus32	0	virtual	Operating system, root, swap
	1-5	pRDM	HDFS data, temp data
cirrus18	0	virtual	Operating system, root, swap
	1	pRDM	Secondary NameNode, HDFS data, temp data
	2-5	pRDM	HDFS data, temp data
cirrus19	0	virtual	Operating system, root, swap
	1	pRDM	NameNode
	2-5	-	Not used
cirrus20	0	virtual	Operating system, root, swap
	1	pRDM	JobTracker
	2-5	-	Not used
cirrus33–cirrus64	0	virtual	Operating system, root, swap
	6-10	pRDM	HDFS data, temp data
cirrus65–cirrus96	0	virtual	Operating system, root, swap
	11-15	pRDM	HDFS data, temp data
cirrus97–cirrus128	0	virtual	Operating system, root, swap
	16-20	pRDM	HDFS data, temp data

Table 1.5.2: Virtual Machine Layout Description. Measured and priced configurations are the same.

Physical Server	Virtual Machines
w3-hadoop-s001	cirrus1, cirrus33, cirrus65, cirrus97
w3-hadoop-s002	cirrus2, cirrus34, cirrus66, cirrus98
w3-hadoop-s003	cirrus3, cirrus35, cirrus67, cirrus99
w3-hadoop-s004	cirrus4, cirrus36, cirrus68, cirrus100
w3-hadoop-s005	cirrus5, cirrus37, cirrus69, cirrus101
w3-hadoop-s006	cirrus6, cirrus38, cirrus70, cirrus102
w3-hadoop-s007	cirrus7, cirrus39, cirrus71, cirrus103
w3-hadoop-s008	cirrus8, cirrus40, cirrus72, cirrus104
w3-hadoop-s009	cirrus9, cirrus41, cirrus73, cirrus105
w3-hadoop-s010	cirrus10, cirrus42, cirrus74, cirrus106
w3-hadoop-s011	cirrus11, cirrus43, cirrus75, cirrus107
w3-hadoop-s012	cirrus12, cirrus44, cirrus76, cirrus108
w3-hadoop-s013	cirrus13, cirrus45, cirrus77, cirrus109
w3-hadoop-s014	cirrus14, cirrus46, cirrus78, cirrus110
w3-hadoop-s015	cirrus15, cirrus47, cirrus79, cirrus111
w3-hadoop-s016	cirrus16, cirrus48, cirrus80, cirrus112
w3-hadoop-s017	cirrus17, cirrus49, cirrus81, cirrus113
w3-hadoop-s018	cirrus18, cirrus50, cirrus82, cirrus114
w3-hadoop-s019	cirrus19, cirrus51, cirrus83, cirrus115
w3-hadoop-s020	cirrus20, cirrus52, cirrus84, cirrus116
w3-hadoop-s021	cirrus21, cirrus53, cirrus85, cirrus117
w3-hadoop-s022	cirrus22, cirrus54, cirrus86, cirrus118
w3-hadoop-s023	cirrus23, cirrus55, cirrus87, cirrus119
w3-hadoop-s024	cirrus24, cirrus56, cirrus88, cirrus120
w3-hadoop-s025	cirrus25, cirrus57, cirrus89, cirrus121
w3-hadoop-s026	cirrus26, cirrus58, cirrus90, cirrus122
w3-hadoop-s027	cirrus27, cirrus59, cirrus91, cirrus123
w3-hadoop-s028	cirrus28, cirrus60, cirrus92, cirrus124
w3-hadoop-s029	cirrus29, cirrus61, cirrus93, cirrus125
w3-hadoop-s030	cirrus30, cirrus62, cirrus94, cirrus126
w3-hadoop-s031	cirrus21, cirrus53, cirrus85, cirrus117
w3-hadoop-s032	cirrus32, cirrus64, cirrus96, cirrus128

1.6 Software Components

7.4.6 The distribution of various software components across the system must be explicitly described using a format similar to that shown in the following example for both the tested and priced systems.

Table 1.6: Distribution of Software Components. Measured and priced configurations are the same.

Virtual Machine	Software Component(s)
cirrus1–cirrus17, cirrus21–cirrus128	DataNode, TaskTracker
cirrus18	DataNode, TaskTracker, Secondary NameNode
cirrus19	NameNode, benchmark driver
cirrus20	JobTracker

1.7 Distributed Files System

7.4.7 Distributed file system implementation (e.g. Apache HDFS, Red Hat Storage, IBM GPFS, EMC Isilon OneFS) and corresponding Hadoop File System API version must be disclosed.

Apache HDFS version 2 was used. This is the only version of HDFS supported by CDH 5.3.0.

1.8 Map/Reduce

7.4.8 Map/Reduce implementation (e.g. Apache Map/Reduce, IBM Platform Symphony) and corresponding version must be disclosed.

Apache Map/Reduce version 1 was used, as indicated by the parameter `mapreduce.framework.name=classic` in `mapred-site.xml` (included in the supporting files).

CLAUSE 2: WORKLOAD RELATED ITEMS

2.1 Scripts

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

The tunable parameters involved in this benchmark are contained in the supporting files.

2.2 Version Number and Checksums

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

Version number of the kit used is 1.2.0
md5sum checksums of the kit files:

58c13ddb98a2d1228f2df10f4a087a71	BigData_cluster_validate_suite.sh
16242f64ecbf2eb6cfccf6a3490a113f	TPCx-HS-master.sh
4ceaefc51c698c0733b57244b7760808	TPCx-HS-master.jar

2.3 Run Report

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

The full output file is given in the supporting files. The summary lines of the 2 runs from that file are:

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

Test Run 1 details: Total Time = 5128
                    Total Size = 300000000000
                    Scale-Factor = 30.0000

TPCx-HS Performance Metric (HSph@SF): 21.0614
=====
```

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

Test Run 2 details: Total Time = 5201
                    Total Size = 300000000000
                    Scale-Factor = 30.0000

TPCx-HS Performance Metric (HSph@SF): 20.7655
=====
```

2.4 Benchmark Kit changes

The file TPCx-HS-master.sh was changed to correct the version number and renamed TPCx-HS-master-fixver.sh. The checksum of the modified file is as follows:

```
50bfa0b6afabba3b1438b60ee315499b TPCx-HS-master-fixver.sh
```

The difference between the new and original files is as follows:

```
--- TPCx-HS-master.sh 2015-01-10 20:36:13.000000000 -0800
+++ TPCx-HS-master-fixver.sh 2015-01-10 20:39:13.000000000 -0800
@@ -54,54 @@
-TPCx-HS version 1.1.2
+TPCx-HS version 1.2.0
@@ -189,189 @@
-echo -e "${green} TPCx-HS Version 1.1.2 ${NC}" | tee -a ./TPCx-HS-result-"$prefix".log
+echo -e "${green} TPCx-HS Version 1.2.0 ${NC}" | tee -a ./TPCx-HS-result-"$prefix".log
```


CLAUSE 3: SUT RELATED ITEMS

3.1 Data Storage and Memory Ratios

7.6.1 The data storage ratio must be disclosed. It is computed by dividing the total physical data storage present in the priced configuration (expressed in TB) by the chosen Scale Factor as defined in Clause 4.1. Let r be the ratio. The reported value for r must be rounded to the nearest 0.01. That is, reported value= $\text{round}(r,2)$. For example, a system configured with 96 disks of 1TB capacity for a 1TB Scale Factor has a data storage ratio of 96.

Each disk is 600GB = 0.6TB. Total physical data storage is 32 servers X 21 disks X 0.6TB = 403.2TB.
Scale factor is 30TB.

Data storage ratio is $403.2/30 = \mathbf{13.44}$.

7.6.2 The Scale Factor to memory ratio must be disclosed. It is computed by dividing the Scale Factor by the total physical memory present in the priced configuration (see clause 3). Let r be this ratio. The reported ratio must be rounded to the nearest 0.01. That is, reported value= $\text{round}(r,2)$. For example, a system configured with 1TB of physical memory for a 10TB Scale Factor has a memory ratio of 10.00.

Memory per host is 256GiB = 274.878GB = 0.274878TB.

Total physical memory is 32 servers X 0.274878TB = 8.796TB.

Scale factor is 30TB.

Scale Factor to memory ratio is $30/8.796 = \mathbf{3.41}$.

CLAUSE 4: PERFORMANCE METRICS

7.7.1 The HSGen time must be disclosed for Run1 and Run2.

7.7.2 The HSSort time must be disclosed for Run1 and Run2.

7.7.3 The HSValidate time must be disclosed for Run1 and Run2.

7.7.4 Both HSDataCheck times must be disclosed for Run1 and Run2.

7.7.5 The performance metric (HSph@SF) must be disclosed for Run1 and Run2. Price-performance metric (\$/HSph@SF) must be disclosed for the performance run. See Clause 2.3 and Clause 4.

Table 5.1: Elapsed times, performance and price-performance metrics.

	Run1 (repeatability)	Run2 (performance)
HSGen	1066.861	1085.464
HSDataCheck	3.000	3.000
HSSort	3349.784	3435.609
HSDataCheck	4.000	4.000
HSValidate	704.412	674.168
HSph@30TB	21.0614	20.7655
\$/HSph@30TB		\$49,110.55

CLAUSE 8: AUDITOR-RELATED ITEMS

Auditor's Report

The auditor's agency name, address, phone number, and Attestation letter with a brief audit summary report indicating compliance 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.

Brian Bassett
Primary TPC Representative, Dell Inc.
1 Dell Way
Round Rock, Texas 78682

March 6, 2015

I verified the TPC Express Benchmark™ HS v1.2.0 performance of the following configuration:

Platform: Dell 32-Node PowerEdge R720xd with VMware vSphere 6.0
Operating System: Suse SLES 11 SP3
Apache Hadoop: Cloudera CDH 5.3.0
Compatible Software:

The results were:

Performance Metric 20.76 HSph@30TB
Run Elapsed Time 5201.00 Seconds

<u>Cluster</u>	<u>32 x Dell PowerEdge R720xd Servers (each with)</u>		
Processor	2 x Intel Xeon Processor E5-2680 v2 (2.80 GHz, 10-core, 25 MB L3)		
Memory	256 GiB		
Storage	Qty	Size	Type
	21	600 GB	10K rpm SAS HDD
Virtualization	4 x Virtual Machines (each with)		
Processor	10 x vCPUs		
Memory	61,696 MiB		
Storage	Qty	Size	Type
	1	15 GiB	Virtual (root, swap)
	5	600 GB	Virtual direct to Physical (Hadoop data)

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 v1.2.0
- 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 30TB
- The generated dataset and the sorted dataset were replicated a minimum of 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 FILES

The following table describes the files contained in the supporting files archive.

Clause	Description	Location
Clause 1	Parameters and options used to configure Hadoop	supporting_files_virtual_30TB/Clause_1/Hadoop
	Parameters and options used to configure the Linux OS	supporting_files_virtual_30TB/Clause_1/OS
Clause 2	Configuration scripts, run report	supporting_files_virtual_30TB/Clause_2
Clause 3	System configuration details	supporting_files_virtual_30TB/Clause_3

PRICE QUOTATIONS



Products
Solutions & Services
Account Center
More search options ▾









All Product Catalog ▾

Hardware
Software
NEW Cloud
Product Finders
Brands
Best Deals

Shopping Cart

[Log On](#) to Save this Cart, View Saved Carts or E-mail this Cart


Add Item to Cart:

Item	Quantity	Availability	Unit Price	Item Total	
 Acer V196HQLAb - LED monitor - 18.5" MFG Part#: UM.XV6AA.A01 CDW Part#: 2978003 UNSPSC: 43211902 Pricing Option Applied: Advertised Price  Ships today if ordered within 1 hrs 34 mins + Show Accessories + Show Warranties + Show Services	<input type="text" value="3"/> Update	In Stock	\$87.99	\$263.97	Remove
 Logitech USB Corded Keyboard/Mouse Combo K120 MFG Part#: 920-002565 CDW Part#: 2124292 UNSPSC: 43211706 Pricing Option Applied: Advertised Price  Ships today if ordered within 1 hrs 34 mins + Show Accessories	<input type="text" value="3"/> Update	In Stock	\$17.99	\$53.97	Remove
 Tripp Lite 7ft Augmented Cat6 Cat6a Snagless Patch Cable 10G RJ45 Aqua 7' MFG Part#: N261-007-AQ CDW Part#: 1117918 UNSPSC: 26121604 Pricing Option Applied: Advertised Price  Ships today if ordered within 1 hrs 34 mins	<input type="text" value="71"/> Update	In Stock	\$11.99	\$851.29	Remove
 CPI Adjustable ServerRack - rack - 51U MFG Part#: 15213-715 CDW Part#: 1246776 UNSPSC: 24102001 Pricing Option Applied: Advertised Price  Orders placed today will ship within 3 days.	<input type="text" value="2"/> Update	1-3 days	\$614.99	\$1,229.98	Remove

[Update All](#) | [Remove All](#)

Subtotal: \$2,399.21

Tax and shipping will be calculated in checkout.

[Lease Option](#) (\$74.86 /month)



Randy Norman: (408)-391-7487
 Payment Terms: Net 30
 Shipping FOB Origin
 Email: rnorman@extremenetworks.com

Name: Chuck Lintell
 Company: VMware

Quote Number: **VMwareCL102614 02**
 Date: 05-Mar-15
 Quote Expiration: 03-Jun-15

This quote is governed solely by the master purchase agreement in effect between purchaser and Extreme if any, or in the absence of a master purchase agreement, by Extreme Networks standard Terms and Conditions of Sale and Service a copy of which is attached hereto. Extreme Networks hereby rejects any customer terms and conditions. Extreme Networks Standard Terms and Conditions shall govern and apply notwithstanding any terms to the contrary on customer's purchase order

Products (Hardware and Software)								
Line #	Part #	Part Name	Description	Qty	List Price	Extended List	Unit Net	Extended Net
1	17202	Summit X670V-48t-BF-AC	48 10GBASE-T, 4 10GBASE-X (unpopulated and shared with 4 ports of the 48 10GBase-T ports), one VIM4 slot (unpopulated), ExtremeXOS Advanced Edge License, 2 Back-to-Front 550W AC power supplies, Back-to-Front airflow fans, Trade Agreement Act compli	2	\$25,995.00	\$51,990.00	\$16,896.75	\$33,793.50
TOTAL PRODUCT COST						\$51,990.00		\$33,793.50

Services (Maintenance and Support, Training, and PSP)									
Line #	Part #	Part Name	Description	Qty	Years	List Price	Extended List	Unit Net	Extended Net
1	97007-17202	EW 4hr AHR-17202	EW 4hr AHR-17202	2	3.00	\$10,920.00	\$21,840.00	\$9,282.00	\$18,564.00
Total Service and Training Cost							\$21,840.00		\$18,564.00

TOTAL		
Products		\$33,793.50
Services		\$18,564.00
GRAND TOTAL		\$52,357.50

NOTE: Applicable Taxes and Shipping Costs not reflected in above quote. Shipping will be extra based on desired method of freight

ExtremeWorks Professional Services:

- Professional Services support available from Extreme Networks on a custom quote basis.
- Suggested Professional Services activities include: Comprehensive Installation, Managed Deployment, etc.
- Firm Professional Services quotes available upon definition of total project requirements.