



Huawei Technologies Co., LTD.

TPC Express Benchmark™ Big Bench (TPCx-BB)
Full Disclosure Report
for
Huawei FusionServer for Big Data
(with 16x RH2288H V3)
using
Cloudera for Apache Hadoop (CDH) 5.8
and
Red Hat Enterprise Linux Server 6.7

Second Edition

February 16, 2017

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		Huawei FusionServer for Big Data			TPCx-BB Rev. 1.2.0 TPC-Pricing Rev. 2.0.0	
					Report Date: February 16, 2017	
Total System Cost		TPCx-BB Performance Metric			Price/Performance	
395,092 USD		611.31 BBQpm@3000			646.31 USD \$/BBQpm@3000	
Framework	Operating System	Other Software	Availability Date	Scale Factor	Streams	
Cloudera for Apache Hadoop (CDH) 5.8	Red Hat Enterprise Linux Server 6.7	None	December 7, 2016	3000	8	
System Configuration						
<p>The diagram illustrates a network topology for a Big Data system. It features two groups of servers: 2 Management Nodes on the left and 14 Worker Nodes on the right. Both groups are connected to a central Huawei S5700-28X Switch (iMana connection). This switch is further connected to a Huawei CE6810-48S Switch (main connection), which is also connected to the Management Nodes. The Worker Nodes are connected to the CE6810-48S Switch. A software box indicates the use of Red Hat Enterprise Linux 6.7 and Cloudera Enterprise 5.8.</p>						
Each: Huawei FusionServer RH2288H V3 2x Intel Xeon E5-2697A v4 @ 2.60GHz 1x 480GB SATA SSD Memory 256GB				Each: Huawei FusionServer RH2288H V3 2x Intel Xeon E5-2697A v4 @ 2.60GHz 1x 480GB SATA SSD 16x 900GB SAS HDD 1x 800GB SAS SSD Memory 256GB		
2 Management Nodes				14 Worker Nodes		
Software: Red Hat Enterprise Linux 6.7 Cloudera Enterprise 5.8						
Physical Storage/Scale Factor: 73.49				Scale Factor/Physical Memory: 0.73		
Servers: Total Processors/Cores/Threads		16x RH2288H V3 32/512/1024				
Server Configuration: Processors Memory Storage Controller Storage Device		Per RH2288H V3: 2x Intel Xeon E5-2697A v4 @ 2.60GHz 256GB LSI 3108 RAID Card 1x 480GB SATA SSD (all nodes) 16x 900GB SAS HDD (worker nodes) 1x 800GB SAS HDD (worker nodes)				
Network		Intel Ethernet 2X10GE(82599)-SFP+ Adapter				
Connectivity:		Huawei CE6810-48S Switch (main connection), Huawei S5700-28X Switch (iMana connection)				



Huawei FusionServer for Big Data

TPCx-BB Rev. 1.2.0
 TPC-Pricing Rev. 2.0.0

Report Date:
 February 16, 2017

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint. Price
<u>Server Hardware - Management Nodes</u>						
RH2288H V3 (25HDD EXP Chassis)H22H-03	02310YJW	1	\$ 1,706.60	2	\$ 3,413.20	
Onboard Network card,2X10GE Port(82599)	02311EUU	1	\$ 1,139.50	2	\$ 2,279.00	
8056 Plus Fan module	02310YKP	1	\$ 45.58	8	\$ 364.64	
3*8X Riser Card Module	02310YKQ	1	\$ 126.14	2	\$ 252.28	
2*2.5" Rear Hard Disk Backplane Module	02311DUP	1	\$ 62.54	2	\$ 125.08	
750W platinum AC power supply unit	02310QWX	1	\$ 295.74	4	\$ 1,182.96	\$ 2,168.00
Intel Xeon E5-2697A v4(with Heatsink)	02311NFD	1	\$ 6,857.14	4	\$ 27,428.56	
32GB,288pin,0.83ns,2400000KHz,1.2V,ECC,2Rank(2G*4bit)	6200214	1	\$ 634.94	16	\$ 10,159.04	
480GB,SATA 6Gb/s, Mixed Use, 2.5inch,VE Series	02311LTP	1	\$ 1,260.34	2	\$ 2,520.68	
LSI 3108 RAID CARD-Support SuperCap	02310YMF	1	\$ 694.30	2	\$ 1,388.60	
LSI Flash Card,8GB,TFM,Supercap and 620mm Cable Moudle	02311BNX	1	\$ 386.90	2	\$ 773.80	
Network Card, Gigabit, RJ45 Copper, 2 ports, PCIE 2.0 x4-8086-1521-2	6310070	1	\$ 60.92	2	\$ 121.84	
<i>SubTotal</i>					\$ 50,009.68	\$ 2,168.00
<u>Server Hardware - Worker Nodes</u>						
RH2288H V3 (25HDD EXP Chassis)H22H-03	02310YJW	1	\$ 1,706.60	14	\$ 23,892.40	
Onboard Network card,2X10GE Port(82599)	02311EUU	1	\$ 1,139.50	14	\$ 15,953.00	
8056 Plus Fan module	02310YKP	1	\$ 45.58	56	\$ 2,552.48	
3*8X Riser Card Module	02310YKQ	1	\$ 126.14	14	\$ 1,765.96	
2*2.5" Rear Hard Disk Backplane Module	02311DUP	1	\$ 62.54	14	\$ 875.56	
750W platinum AC power supply unit	02310QWX	1	\$ 295.74	28	\$ 8,280.72	
Intel Xeon E5-2697A v4(with Heatsink)	02311NFD	1	\$ 6,857.14	28	\$ 191,999.92	\$ 15,176.00
32GB,288pin,0.83ns,2400000KHz,1.2V,ECC,2Rank(2G*4bit)	6200214	1	\$ 634.94	112	\$ 71,113.28	
480GB,SATA 6Gb/s,Mixed Use,2.5inch,VE Series	02311LTP	1	\$ 1,260.34	14	\$ 17,644.76	
900GB,SAS 12Gb/s,10000rpm,2.5inch	02311HAL	1	\$ 592.54	224	\$ 132,728.96	
SSD,800GB,SAS 12Gb/s,Write Intensive	02311HAG	1	\$ 3,433.34	14	\$ 48,066.76	
LSI 3108 RAID CARD-Support SuperCap	02310YMF	1	\$ 694.30	14	\$ 9,720.20	
LSI Flash Card,8GB,TFM,Supercap and 620mm Cable Moudle	02311BNX	1	\$ 386.90	14	\$ 5,416.60	
Network Card, Gigabit, RJ45 Copper, 2 ports, PCIE 2.0 x4-8086-1521-2	6310070	1	\$ 60.92	14	\$ 852.88	
<i>SubTotal</i>					\$ 530,863.48	\$ 15,176.00

(continued next page)



Huawei FusionServer for Big Data

TPCx-BB Rev. 1.2.0
 TPC-Prising Rev. 2.0.0

Report Date:
 February 16, 2017

Description	Part Number	Source	Unit Price	Qty	Extended Price	3 Year Maint. Price
(continued from previous page)						
<u>Network</u>						
Huawei S5700-28X-LI-AC Switch	2354215	1	\$ 2,730.56	1	\$ 2,730.56	
Huawei CE6810-48S-LI Switch	02350AQC	1	\$ 8,776.80	1	\$ 8,776.80	
Optical Transceiver,SFP+,10G,Multi-mode Module	2318169	1	\$ 270.40	16	\$ 4,326.40	\$ 6,192.72
HUAWEI VTL6900 42U AC CABINET (RACK-42U-VTL)	2114327	1	\$ 2,139.99	1	\$ 2,139.99	
Patch cord-LC/PC-LC/PC-Multimode-A1b-2mm-10m-PVC-Orange	14130222	1	\$ 14.40	20	\$ 288.00	
				<i>SubTotal</i>	\$ 18,261.75	\$ 6,192.72
<u>Monitor / Keyboard / Mouse (includes 2 spares each)</u>						
Lenovo ThinkVision T2424p 23.8-inch FHD LED Backlit LCD Monitor	9SIAA0T56C4340	2	\$ 198.19	3	\$ 594.57	
Lenovo 73P2620 Black 104 Normal Keys USB Wired Standard Keyboard	9SIA1N82KJ2787	2	\$ 40.79	3	\$ 122.37	
lenovo 41U3074 Black 1 x Wheel USB Wired Laser 2000 dpi Mouse	N82E16826509009	2	\$ 30.99	3	\$ 92.97	
				<i>SubTotal</i>	\$ 809.91	\$ -
<u>Server Software</u>						
Cloudera Ent Basic Ed 1yr 24x7	G7M 27A	1	\$ 2,304.00	48	\$ 110,592.00	Included
RHEL Svr 2 Sckt/2 Gst 3yr 24x7 E-LTU	G3J30AAE	1	\$ 3,889.00	16	\$ 62,224.00	Included
				<i>SubTotal</i>	\$ 172,816.00	\$ -
				Total Extended Price	\$772,760.82	\$ 23,536.72
				Total Discounts	\$ 389,437.69	\$ 11,768.36
				Totals	\$383,323.13	\$ 11,768.36

Pricing: 1 = Huawei; 2 = newegg.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	\$395,092
	BBQ pm@3000	611.31
	\$/BBQ pm@3000	\$646.31

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.



Huawei FusionServer for Big Data

TPCx-BB Rev. 1.2.0
TPC-Pricing Rev. 2.0.0

Report Date:
February 16, 2017

Numerical Quantities

Scale Factor	3000
Streams	8
SUT Validation Status	PASS

Performance Run

Overall Run Start Time	2016-12-15 01:26:32.856
Overall Run End Time	2016-12-15 20:59:00.827
Overall Run Elapsed Time	70,347.971

Load Test Start Time	2016-12-15 01:26:32.858
Load Test End Time	2016-12-15 01:48:15.091
Load Test Elapsed Time	1,302.233

Power Test Start Time	2016-12-15 01:48:15.096
Power Test End Time	2016-12-15 06:19:49.545
Power Test Elapsed Time	16,294.449

Throughput Test Start Time	2016-12-15 06:19:49.547
Throughput Test End Time	2016-12-15 20:59:00.826
Throughput Test Elapsed Time	52,751.279

Performance Metric (BBQpm@3000)	611.3126475
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Repeatability Run

Overall Run Start Time	2016-12-14 05:43:20.920
Overall Run End Time	2016-12-15 01:14:22.530
Overall Run Elapsed Time	70,261.610

Load Test Start Time	2016-12-14 05:43:20.922
Load Test End Time	2016-12-14 06:05:13.001
Load Test Elapsed Time	1,312.079

Power Test Start Time	2016-12-14 06:05:13.006
Power Test End Time	2016-12-14 10:34:07.454
Power Test Elapsed Time	16,134.448

Throughput Test Start Time	2016-12-14 10:34:07.456
Throughput Test End Time	2016-12-15 01:14:22.529
Throughput Test Elapsed Time	52,815.073

Performance Metric (BBQpm@SF)	611.7619714
-------------------------------	-------------



Run Report – Run 1

```
*****
TPCx-BB
Result
v1.2
*****
INFO: T_LOAD = 1312.079
INFO: T_LD = 0.1 * T_LOAD: 131.2079
INFO: T_PT = 11453.722479841466
INFO: T_T_PUT = 52815.073
INFO: T_TT = 6601.884125
INFO: === Checking validity of the final result ===
INFO: OK: All required BigBench phases were performed.
INFO: OK: All 30 queries were running in the power test.
INFO: OK: All 30 queries were running in the first throughput test.
INFO: OK: Pretend mode was inactive. All commands were executed.
INFO: === Final result ===
INFO: VALID BBQpm@3000 = 611.7619714266989
```

Run Report – Run 2

```
*****
TPCx-BB
Result
v1.2
*****
INFO: T_LOAD = 1302.233
INFO: T_LD = 0.1 * T_LOAD: 130.2233
INFO: T_PT = 11487.29127343826
INFO: T_T_PUT = 52751.279
INFO: T_TT = 6593.909875
INFO: === Checking validity of the final result ===
INFO: OK: All required BigBench phases were performed.
INFO: OK: All 30 queries were running in the power test.
INFO: OK: All 30 queries were running in the first throughput test.
INFO: OK: Pretend mode was inactive. All commands were executed.
INFO: === Final result ===
INFO: VALID BBQpm@3000 = 611.3126474853556
```

Summary details of the run reports are shown above. For the complete run reports, see the Support Files Archive.

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Abstract

This document contains the methodology and results of the TPC Express Benchmark™ Big Bench (TPCx-BB) test conducted in conformance with the requirements of the TPCx-BB Standard Specification, Revision 1.2.0.

The test was conducted at a Scale Factor of 3000 with 16 nodes (16x RH2288H V3) running Cloudera for Apache Hadoop (CDH) 5.8 on Red Hat Enterprise Linux Server 6.7.

Measured Configuration

Company Name	Cluster Node	Virtualization	Operating System
Huawei Technologies Co., LTD.	16x RH2288H V3	n/a	Red Hat Enterprise Linux Server 6.7

TPC Express Benchmark© Big Bench Metrics

Total System Cost	BBQ pm @3000	Price/Performance	Availability Date
395,092 USD	611.31	646.31 USD	December 7, 2016

Preface

TPC Express Benchmark™ Big Bench Overview

*Big data analytics is a growing field of research and business. The significant decrease in the overall cost of hardware, the emergence of Open Source based analytics frameworks, along with the greater depth of data mining capabilities allows new types of data sources to be correlated with traditional data sources. For example, online retailers used to record only successful transactions on their website, whereas modern systems are capable of recording every interaction. The former allowed for simple shopping basket analysis techniques, while the current level of detail in monitoring makes detailed user modeling possible. The growing demands on data management systems and the new forms of analysis have led to the development of a new type of **Big Data Analytics Systems (BDAS)**.*

*Similar to the advent of **Database Management Systems**, there is a vastly growing ecosystem of diverse approaches to enabling Big Data Analytics Systems. This leads to a dilemma for customers of **BDAS**, as there are no realistic and proven measures to compare different **BDAS** solutions. To address this, TPC has developed **TPCx-BB (BigBench)**, which is an express benchmark for comparing **BDAS** solutions. The **TPCx-BB Benchmark** was developed to cover essential functional and business aspects of big data use cases. The benchmark allows for an objective measurement of **BDAS** System under Test, and provides the industry with verifiable performance, price/performance, and availability metrics.*

*The **TPCx-BB** kit is available from the TPC website (see www.tpc.org for more information). Users must sign-up and agree to the **TPCx-BB End User Licensing Agreement (EULA)** to download the kit. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include the **TPCx-BB** copyright. The **TPCx-BB** kit includes: **TPCx-BB Specification** document (this document), **TPCx-BB Users Guide** documentation, shell scripts to set up the benchmark environment, Java code to execute the benchmark workload, **Data Generator**, **Query** files, and **Benchmark Driver**.*

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-BB** models and represents a Big Data Analytics System such as Hadoop ecosystem or 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 Huawei Technologies Co., LTD.

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 components used by the SUT.*
- *Configuration parameters and options for Operating System and file system components used by the SUT.*
- *Configuration parameters and options for any other software components (e.g compiler optimization options) used by the SUT.*

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.

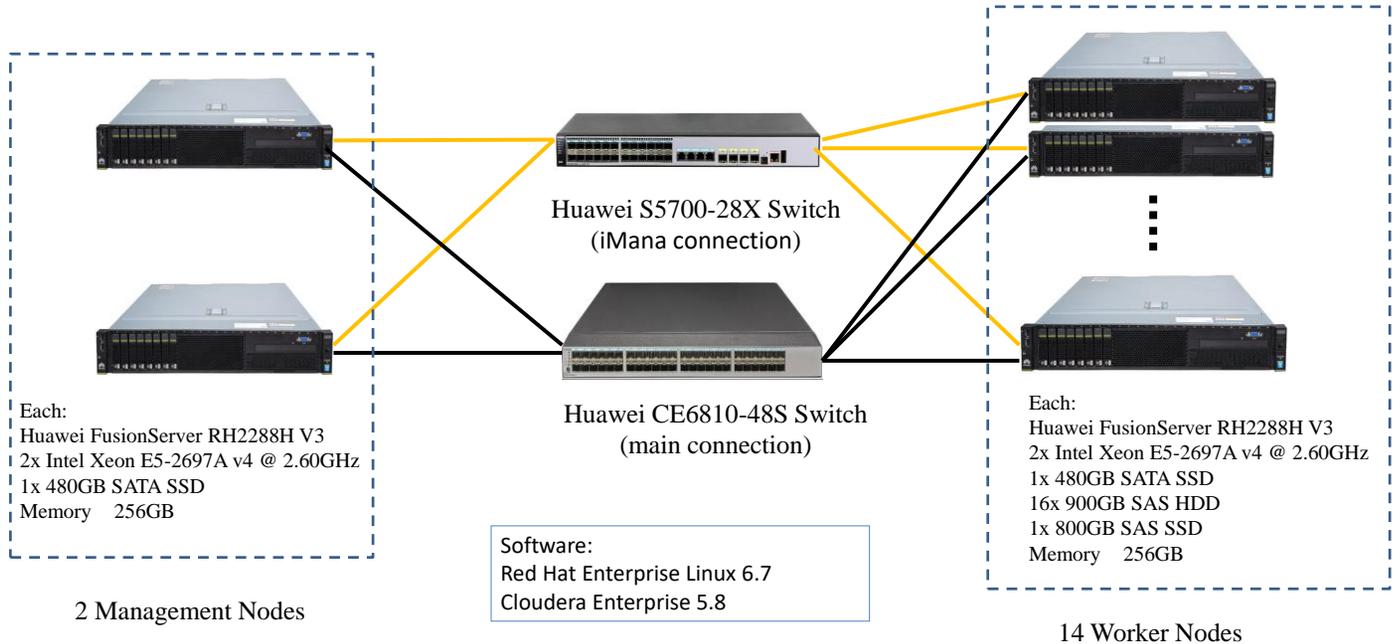
The Supporting Files Archive contains the parameters and options used to configure the components involved in this benchmark.

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: 16
- Total Processors/Cores/Threads: 32/512/1024
- Total Memory: 4,096GB
- Total Number of Storage Drives/Devices: 254
- Total Storage Capacity: 220,480GB

Network connectivity detail:

- Huawei CE6810-48S Switch (main connection), Huawei S5700-28X Switch (iMana connection)

16x RH2288H V3, each with:

- Processors/Cores/Threads: 2/32/64
- Processor Model: 2x Intel Xeon E5-2697A v4 @ 2.60GHz
- Memory: 256GB
- Controller: 1 x LSI 3108 RAID Card
- Drives:
 - 1 x 480GB SATA SSD (all nodes)
 - 16 x 900GB SAS HDD (worker nodes)
 - 1 x 800GB SAS HDD (worker nodes)
- Network: Intel Ethernet 2X10GE(82599)-SFP+ Adapter

The distribution of software components over server nodes is detailed in section 2.1.

Priced Configuration

There are no differences between the priced and measured configurations.

Clause 2: Software Components and Dataset Distribution

2.1 Roles and Dataset Distribution

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

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

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

Table 1.4: Software Components and Dataset Distribution

Server	Role(s)	Count	Virtual	Host Names	HW/SW Configuration	Storage Setup
Worker	HDFS Data Node/YARN Node Manager	13	N	test[3-15]	<ul style="list-style-type: none"> Huawei FusionServer RH2288H V3 HW/SW Config (Intel E5-2697Av4,2, 2.6GHz, 64) Memory: 256GB Storage: 16 x 900TB SAS HDD, 1 x 480GB SSD, 1 x 900GB SAS SSD Network: Intel 82599 SFP+10G OS: RHEL 6.7 Cloudera CDH 5.8 	OS: 480GB 6G SATA SSD, Intermediate/ Shuffle /Temp Data / Distributed FS: 1 x 900GB 12G SAS SSD, 16 x 900GB 12G SAS 10k HDD
Worker	HDFS Data Node/YARN Node Manager/ZooKeeper Server	1	N	test2	<ul style="list-style-type: none"> Huawei FusionServer RH2288H V3 HW/SW Config (Intel E5-2697Av4,2, 2.6GHz, 64) Memory: 256GB Storage: 16 x 900TB SAS HDD, 1 x 480GB SSD, 1 x 900GB SAS SSD Network: Intel 82599 SFP+10G OS: RHEL 6.7 Cloudera CDH 5.8 	OS: 480GB 6G SATA SSD, Intermediate/ Shuffle /Temp Data / Distributed FS: 1 x 900GB 12G SAS SSD, 16 x 900GB 12G SAS 10k HDD
Cloudera Manager Node #1	HDFSBalancer/HDFS Namenode/Hive Gateway/Hive Metastore Server/Hive Server2/Hue Server/Cloudera Management Services/YARN JobHistory Server/YARN ResourceManager/ZooKeeper Server/Spark Gateway/Spark History	1	N	test0	<ul style="list-style-type: none"> Huawei FusionServer RH2288H V3 HW/SW Config (Intel E5-2697Av4, 2, 2.6GHz, 64) Memory: 256GB Storage: 1 x 480GB SSD Network: Intel 82599 SFP+10G OS: RHEL 6.7 Cloudera CDH 5.8 	OS: 480GB 6G SATA SSD
Cloudera Manager Node #2	HDFS SecondaryNameNode /Hive Gateway /Spark Gateway /ZooKeeper Server	1	N	test1	<ul style="list-style-type: none"> Huawei FusionServer RH2288H V3 HW/SW Config (Intel E5-2697Av4, 2, 2.6GHz, 64) Memory: 256GB Storage: 1 x 480GB SSD Network: Intel 82599 SFP+10G OS: RHEL 6.7 Cloudera CDH 5.8 	OS: 480GB 6G SATA SSD

2.2 Distributed File System Implementation

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

Cloudera for Apache Hadoop (CDH) 5.8 (fully HDFS compatible at the API level).

2.3 Engine Implementation

The Engine implementation and corresponding version must be disclosed.

Component	Version
Hive	1.1.0
HDFS	2.6.0
YARN	2.6.0
Spark	1.6.0
MapReduce	2.6.0

2.4 Frameworks

Frameworks and Engine used in the benchmark should be disclosed.

Framework	Version
CDH	5.8.0
Hive	1.1.0
HDFS	2.6.0
YARN	2.6.0
Spark	1.6.0
MapReduce	2.6.0

2.5 Applied Patches

Any additional vendor supported patches applied to the SUT should be disclosed.

No additional patches were applied.

Clause 3: Workload Related Items

3.1 Hardware & Software Tunable

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

The Supporting Files Archive contains all configuration scripts.

3.2 Kit Version

Version number of the TPCx-BB kit must be included in the Report.

TPCx-BB Kit Version
1.2

3.3 Run Report

The run report generated by TPCx-BB benchmark kit must be included in the Report.

The Supporting File Archive contains the full run report. Following are summary extracts from both runs.

- **Run1 Performance Summary**

```
*****
TPCx-BB
Result
v1.2
*****
INFO: T_LOAD = 1312.079
INFO: T_LD = 0.1 * T_LOAD: 131.2079
INFO: T_PT= 11453.722479841466
INFO: T_T_PUT = 52815.073
INFO: T_TT = 6601.884125
INFO: === Checking validity of the final result ===
INFO: OK: All required BigBench phases were performed.
INFO: OK: All 30 queries were running in the power test.
INFO: OK: All 30 queries were running in the first throughput test.
INFO: OK: Pretend mode was inactive. All commands were executed.
INFO: === Final result ===
INFO: VALID BBQpm@ 3000 = 611.7619714266989
```

- **Run2 Performance Summary**

```
*****
TPCx-BB
Result
v1.2
*****
INFO: T_LOAD = 1302.233
INFO: T_LD = 0.1 * T_LOAD: 130.2233
INFO: T_PT= 11487.29127343826
INFO: T_T_PUT = 52751.279
INFO: T_TT = 6593.909875
INFO: === Checking validity of the final result ===
INFO: OK: All required BigBench phases were performed.
INFO: OK: All 30 queries were running in the power test.
INFO: OK: All 30 queries were running in the first throughput test.
INFO: OK: Pretend mode was inactive. All commands were executed.
INFO: === Final result ===
INFO: VALID BBQpm@ 3000 = 611.3126474853556
```

3.4 Query Elapsed Times

Elapsed times of all power and throughput Queries needs to be reported from the Performance Run, grouped respectively as Structured, semi-structured and unstructured buckets.

Query Type	Query Number	Power	Throughput							
		Stream 1	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5	Stream 6	Stream 7	Stream 8
Structured	1	514.394	1,560.519	1,393.934	2,312.238	1,415.373	1,657.981	1,613.118	1,613.787	1,436.760
	6	255.184	698.419	660.001	739.270	860.528	288.124	677.316	691.329	704.046
	7	339.822	608.749	583.030	648.075	779.536	845.267	697.627	630.555	654.412
	9	155.015	434.055	324.379	437.770	329.032	351.565	295.600	274.999	424.599
	11	479.779	1,495.411	1,370.489	1,439.886	1,348.506	1,465.091	1,036.924	1,238.184	1,389.469
	13	228.891	769.564	650.708	573.972	369.217	862.924	652.485	588.640	869.211
	14	60.763	192.113	171.753	189.137	177.384	180.887	148.663	79.759	124.685
	15	106.166	271.122	242.488	206.451	218.605	103.150	217.435	224.294	280.771
	16	630.210	2,251.262	1,569.357	1,610.354	1,477.668	1,545.229	1,743.573	2,205.201	1,395.508
	17	270.492	712.976	623.935	501.319	765.699	666.707	696.668	319.497	695.142
	20	2,867.370	6,024.216	5,920.856	6,106.729	6,233.904	5,692.811	5,904.592	5,979.742	5,771.329
	21	439.858	912.348	929.039	814.125	810.503	850.516	869.000	856.367	1,002.226
	22	281.447	653.214	662.969	715.165	697.917	673.394	550.349	696.338	306.594
	23	474.289	1,245.379	1,503.711	1,247.221	1,543.693	661.435	1,221.647	602.428	1,402.272
	24	587.654	1,628.689	906.026	1,811.332	1,672.292	1,609.586	1,742.058	1,924.387	1,649.416
	25	202.299	491.021	483.474	388.903	416.404	455.488	522.071	539.604	244.633
26	197.599	773.316	648.050	672.175	622.055	461.822	732.628	420.018	463.062	
29	340.779	932.805	1,170.799	1,046.647	1,085.225	453.697	985.916	989.178	918.594	
Semi-structured	2	217.592	541.968	512.406	610.950	516.074	588.722	523.353	596.528	304.051
	3	1,103.867	5,944.681	6,311.269	6,201.438	6,300.642	6,506.216	5,958.629	5,818.488	6,159.483
	4	627.442	2,762.543	2,188.157	1,561.399	2,815.833	3,027.962	2,808.573	2,524.196	2,694.906
	5	957.549	5,756.489	4,253.025	5,329.644	3,226.014	3,066.371	5,489.786	5,678.288	2,408.310
	8	1,214.333	2,711.699	6,377.489	6,046.427	2,939.683	5,954.495	6,236.848	3,172.902	6,055.382
	12	378.941	1,383.919	1,154.901	1,263.106	1,069.945	1,061.377	890.492	1,172.208	934.166
	30	281.724	1,260.330	1,005.877	858.445	1,016.995	853.314	998.286	733.140	925.802
Unstructured	10	370.963	987.658	922.216	814.449	604.210	1,004.769	1,117.574	1,032.002	844.736
	18	108.262	259.756	196.879	233.482	249.617	227.232	172.916	200.382	205.295
	19	521.356	1,047.156	1,465.101	1,265.150	1,238.149	1,199.162	1,278.572	1,161.201	1,271.404
	27	426.766	1,136.285	1,381.840	1,007.800	1,500.188	1,481.120	1,431.239	1,245.896	1,070.318
	28	1,653.542	4,935.047	7,014.674	5,068.714	9,303.313	8,843.296	3,823.995	9,541.676	10,046.735

3.5 Validation Test Output

Output report from successful SUT Validation test must be included in the Report.

Query Number	Execution Successful	Validation Successful
1	TRUE	TRUE
2	TRUE	TRUE
3	TRUE	TRUE
4	TRUE	TRUE
5	TRUE	TRUE
6	TRUE	TRUE
7	TRUE	TRUE
8	TRUE	TRUE
9	TRUE	TRUE
10	TRUE	TRUE
11	TRUE	TRUE
12	TRUE	TRUE
13	TRUE	TRUE
14	TRUE	TRUE
15	TRUE	TRUE
16	TRUE	TRUE
17	TRUE	TRUE
18	TRUE	TRUE
19	TRUE	TRUE
20	TRUE	TRUE
21	TRUE	TRUE
22	TRUE	TRUE
23	TRUE	TRUE
24	TRUE	TRUE
25	TRUE	TRUE
26	TRUE	TRUE
27	TRUE	TRUE
28	TRUE	TRUE
29	TRUE	TRUE
30	TRUE	TRUE

3.6 Global Framework Parameters

Global Framework parameter settings files must be included in the Report.

The Supporting File Archive contains the global framework parameter settings files.

3.7 Kit Modifications

Test Sponsor kit modifications files must be included in the Report..

The following files were modified by the Test Sponsor to facilitate system, platform and Framework differences.

- bigBench-configs/conf/bigBench.properties
- bigBench-configs/conf/userSettings.conf
- bigBench-configs/hive/queries/q10/engineLocalSettings.sql
- bigBench-configs/hive/queries/q28/engineLocalSettings.sql

Clause 4: SUT Related Items

4.1 Specialized Hardware/Software

Specialized Hardware/Software used in the SUT must be included.

No specialized hardware or software was used.

4.2 Framework Configuration Files

All Framework configuration files from SUT, for the performance run.

All Framework configuration files are included in the Supporting Files Archive.

4.3 SUT Environment Information

SUT environment info in form of envinfo.log from a representative worker node from every role in the server.

All envinfo.log files are include in the Supporting Files Archive.

4.4 Data Storage to Scale Factor Ratio

The data storage ratio must be disclosed.

Nodes	Disks	Size (GB)	Total (GB)
16	1	480	7,680
14	1	800	11,200
14	16	900	201,600

Total Storage (GB)	220,480
Scale Factor	3,000
Data Storage Ratio	73.49

4.5 Scale Factor to Memory Ratio

The Scale Factor to memory ratio must be disclosed.

Nodes	Memory (GB)	Total (GB)
16	256	4,096

Scale Factor	3,000
Total Memory (GB)	4,096
SF / Memory Ratio	0.73

Clause 5: Metrics and Scale Factors

5.1 Performance Run Metric

The Reported Performance Metric (BBQpm@SF for the Performance Run) must be disclosed in the Report.

Performance Run	
BBQpm@3000	611.3126475

5.2 Repeatability Run Metric

The Performance Metric (BBQpm@SF) for the Repeatability Run must be disclosed in the Report..

Repeatability Run	
BBQpm@3000	611.7619714

5.3 Price-Performance Metric

The Reported Performance Metric (BBQpm@SF for the Performance Run) must be disclosed in the Report.

Price-Performance	
\$/BBQpm@3000	\$646.31

5.4 Scale Factor

The Scale Factor used for the Result must be disclosed in the Report.

Scale Factor
3000

5.5 Stream Count

The number of streams in the throughput run used for the Result must be disclosed in the Report.

Streams
8

5.6 Elapsed Run Times

The total elapsed time for the execution of the Performance Run and Repeatability Run must be disclosed in the Report.

Run	Elapsed Time	Seconds
Run 1	19:31:01.610	70,261.610
Run 2	19:32:27.971	70,347.971

5.7 Elapsed Test Times

The total time for each of the three tests must be disclosed for the Performance Run and the Repeatability Run.

Test	Performance Run	Repeatability Run
Load Test	1,302.233	1,312.079
Power Test	16,294.449	16,134.448
Throughput Test	52,751.279	52,815.073

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, InfoSizing

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

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.



The Right Metric For Sizing IT

TPC Transaction Processing Performance Council

Certified Auditors

Mr. Long Qiu
President of the Server Product Line
Huawei Technologies Co. Ltd
Huawei Base D1-1A01
Bantian, Longgang District
Shenzhen, China 518129

December 26, 2016

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

Platform: Huawei FusionServer for Big Data (with 16x RH2288H V3 Servers)
Operating System: Red Hat Enterprise Linux Server 6.7
Apache Hadoop Cloudera for Apache Hadoop (CDH) 5.8
Compatible Software:

The results were:

Performance Metric 611.31 BBQpm@3000GB
Run Elapsed Time 19:32:27.971 (70,347.971 Seconds)

Cluster 16x Huawei FusionServer RH2288H V3 Servers
Table with 4 columns: Component, Qty, Size, Type. Rows include CPUs, Memory, and Storage details.

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
The tested Scale Factor (3000GB) was confirmed to be valid for publication
All validation queries executed successfully and produced compliant results

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- No errors were reported during the run
- 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:

From the TPCx-BB Kit's README:

Q28 Depending on the Hadoop distribution version can fail automated Engine Validation due to empty space characters when the output is written to HDFS. Manually open the result file and validate the reference values and written values.

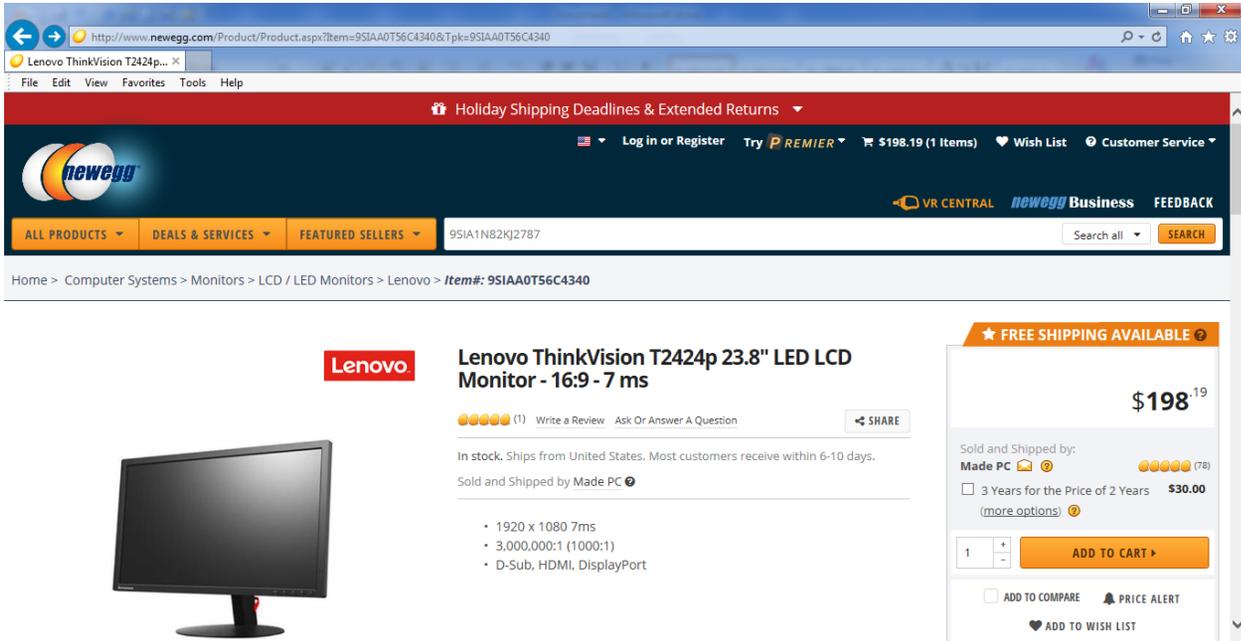
Query 28 failed automated Engine Validation. A manual validation was performed as part of this audit to confirm the only differences were due to white space.

Respectfully Yours,



Doug Johnson, TPC Auditor

Third Party Price Quotes



The screenshot shows the Newegg website interface for a Lenovo ThinkVision T2424p 23.8" LED LCD Monitor. The browser address bar shows the URL: http://www.newegg.com/Product/Product.aspx?Item=9SIAA0T56C4340&Tpk=9SIAA0T56C4340. The page header includes the Newegg logo, navigation links for 'ALL PRODUCTS', 'DEALS & SERVICES', and 'FEATURED SELLERS', and a search bar. The breadcrumb trail is: Home > Computer Systems > Monitors > LCD / LED Monitors > Lenovo > Item#: 9SIAA0T56C4340. The product title is 'Lenovo ThinkVision T2424p 23.8" LED LCD Monitor - 16:9 - 7 ms'. The price is \$198.¹⁹. The product is sold and shipped by 'Made PC'. A 'FREE SHIPPING AVAILABLE' badge is present. The 'ADD TO CART' button is highlighted. The product specifications listed are: 1920 x 1080 7ms, 3,000,000:1 (1000:1), and D-Sub, HDMI, DisplayPort.

Lenovo **Lenovo ThinkVision T2424p 23.8" LED LCD Monitor - 16:9 - 7 ms**

★★★★★ (1) Write a Review Ask Or Answer A Question [SHARE](#)

In stock. Ships from United States. Most customers receive within 6-10 days.
Sold and Shipped by **Made PC**

- 1920 x 1080 7ms
- 3,000,000:1 (1000:1)
- D-Sub, HDMI, DisplayPort

FREE SHIPPING AVAILABLE

\$198¹⁹

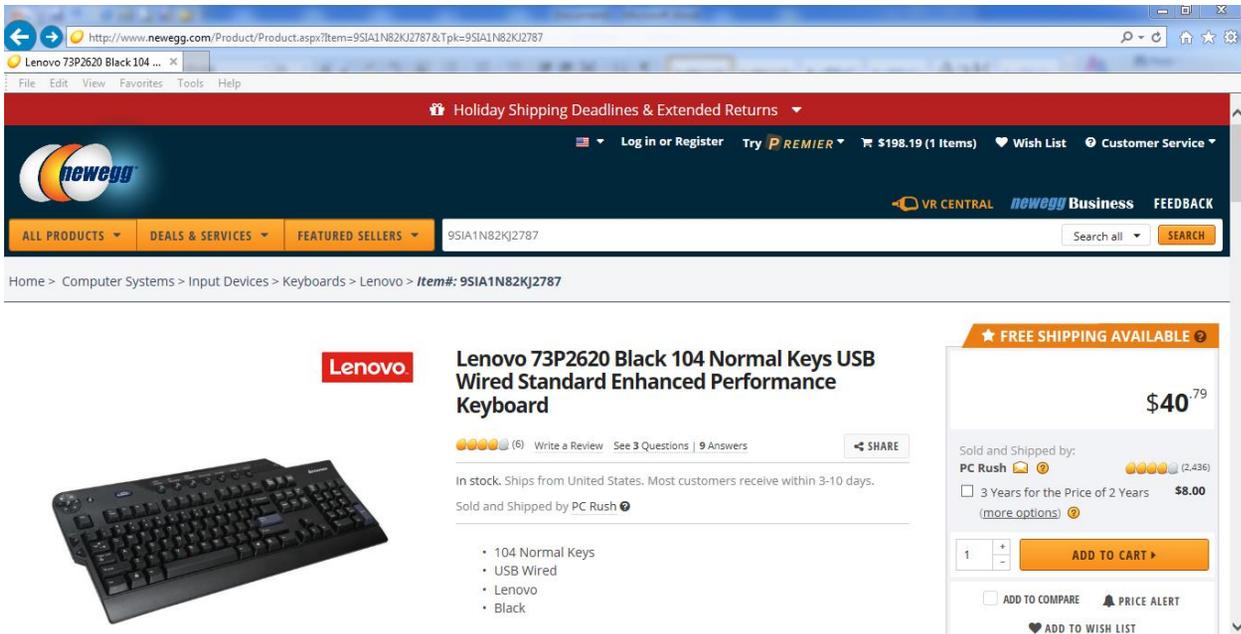
Sold and Shipped by: **Made PC** (78)

3 Years for the Price of 2 Years **\$30.00**
(more options)

1 **ADD TO CART**

ADD TO COMPARE PRICE ALERT

ADD TO WISH LIST



The screenshot shows the Newegg website interface for a Lenovo 73P2620 Black 104 Normal Keys USB Wired Standard Enhanced Performance Keyboard. The browser address bar shows the URL: http://www.newegg.com/Product/Product.aspx?Item=9SIA1N82KJ2787&Tpk=9SIA1N82KJ2787. The page header is identical to the first screenshot. The breadcrumb trail is: Home > Computer Systems > Input Devices > Keyboards > Lenovo > Item#: 9SIA1N82KJ2787. The product title is 'Lenovo 73P2620 Black 104 Normal Keys USB Wired Standard Enhanced Performance Keyboard'. The price is \$40.⁷⁹. The product is sold and shipped by 'PC Rush'. A 'FREE SHIPPING AVAILABLE' badge is present. The 'ADD TO CART' button is highlighted. The product specifications listed are: 104 Normal Keys, USB Wired, Lenovo, and Black.

Lenovo **Lenovo 73P2620 Black 104 Normal Keys USB Wired Standard Enhanced Performance Keyboard**

★★★★★ (6) Write a Review See 3 Questions | 9 Answers [SHARE](#)

In stock. Ships from United States. Most customers receive within 3-10 days.
Sold and Shipped by **PC Rush**

- 104 Normal Keys
- USB Wired
- Lenovo
- Black

FREE SHIPPING AVAILABLE

\$40⁷⁹

Sold and Shipped by: **PC Rush** (2,436)

3 Years for the Price of 2 Years **\$8.00**
(more options)

1 **ADD TO CART**

ADD TO COMPARE PRICE ALERT

ADD TO WISH LIST

http://www.newegg.com/Product/Product.aspx?Item=N82E16826509009&Tpk=N82E16826509009

lenovo 41U3074 Black Mou... x

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Home > Computer Systems > Input Devices > Mice > Lenovo > Item#: N82E16826509009



Lenovo **lenovo 41U3074 Black 1 x Wheel USB Wired Laser 2000 dpi Mouse**

★★★★★ (3) Write a Review See 1 Question | 1 Answer SHARE

In stock. Limit 5 per customer. Ships from United States.
Sold and Shipped by Newegg

- 1 x Wheel
- USB Wired
- Laser

~~\$37.99~~
\$30.99

Save: \$7.00 (18%)
\$1.49 Shipping (restrictions apply)

PREMIER - FREE 3 DAY or faster shipping

Sold and Shipped by: **Newegg**

3 Years for the Price of 2 Years **\$8.00**
(more options)

1 ADD TO CART >

! This product is available at a lower price from

Supporting File Index

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

Description	Archive File Pathname
Clause 1 - General Items	
The Supporting Files Archive contains the parameters and options used to configure the components involved in this benchmark	Supporting-Files-3TB-BDW-12-2016\
Validation Run Files	Supporting-Files-3TB-BDW-12-2016\Validati on-run-logs-20161214-052401-hi ve-sf3000
Performance Run Files	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000
Repeatability Run Files	upporting-Files-3TB-BDW-12-2016\Repeatability -run-logs-20161215-210141-hive-sf3000
Clause 3 - Workload Related Items	
Benchmark Generic Parameters	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\conf\userSettings.conf
Query Parameters used in the benchmark execution Settings	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\conf\queryParameters.sql
Benchmark Global Framework Parameters Settings	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\conf\engineSettings.sql
Benchmark Global Framework Parameters Settings	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\conf\engineSettings.conf
Load Test script	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\population\hiveCreateLoad.sql
Queries specific optimization parameters settings	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\queries\q[01-30]\engineLocalSettings.conf
Queries specific optimization parameters settings	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive\queries\q[01-30]\engineLocalSettings.sql
Clause 4 - SUT Related Items	
Data Redundancy report	Supporting-Files-3TB-BDW-12-2016\hdfs-data-redundancy-report.txt
Benchmark execution script	Supporting-Files-3TB-BDW-12-2016\run-all.sh
Hardware and Software Report from a representative node	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\run-logs\envInfo-test4\envInfo.log
All Framework configuration files are included in the Supporting Files Archive	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hadoop
	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\hive
	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\bigBench-configs\spark
Clause 5 - Metric and Scale Factor Related Items	
Benchmark Performance Report	Supporting-Files-3TB-BDW-12-2016\logs-20161215-011702-hive-sf3000\run-logs\BigBenchResult.log
Validation Test Report	Supporting-Files-3TB-BDW-12-2016\Validati on-run-logs-20161214-052401-hi ve-sf3000\run-logs\BigBenchResult.log