Alibaba Cloud

# Alibaba Cloud Computing Ltd.

---

TPC Express Benchmark™ Big Bench (TPCx-BB)

Full Disclosure Report

for

Alibaba Cloud MaxCompute

(with 11x Compute Nodes;

9x Storage Node

3x Master Nodes)

using

MaxCompute v3.42

and

Alibaba Group Enterprise Linux Server 7.2 (Paladin)

---

**First Edition**

**August 18, 2022**

***Alibaba Cloud Computing Ltd. (Alibaba)**, the Sponsor of this benchmark test, believes that the information in this document is accurate as of the publication date. The information in this document is subject to change without notice. The Sponsor assumes no responsibility for any errors that may appear in this document.*

*The pricing information in this document is believed to accurately reflect the current prices as of the publication date. However, the Sponsor provides no warranty of the pricing information in this document.*

*Benchmark results are highly dependent upon workload, specific application requirements, and system design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, the TPC Express Benchmark™ BB should not be used as a substitute for a specific customer application benchmark when critical capacity planning and/or product evaluation decisions are contemplated.*

*All performance data contained in this report was obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly. No warranty of system performance or price/performance is expressed or implied in this report.*

*Alibaba and the Alibaba Logo are trademarks of Alibaba Cloud Computing Ltd. and/or its affiliates in the U.S. and other countries. Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Alibaba and any other company.*

*TPC Benchmark™, TPCx-BB and BBQpm, are registered certification marks of the Transaction Processing Performance Council.*

*The Alibaba products, services or features identified in this document may not yet be available or may not be available in all areas and may be subject to change without notice. Consult your local Alibaba business contact for information on the products or services available in your area. You can find additional information via Alibaba's web site at www.alibabacloud.com. Actual performance and environmental costs of Alibaba products will vary depending on individual customer configurations and conditions.*

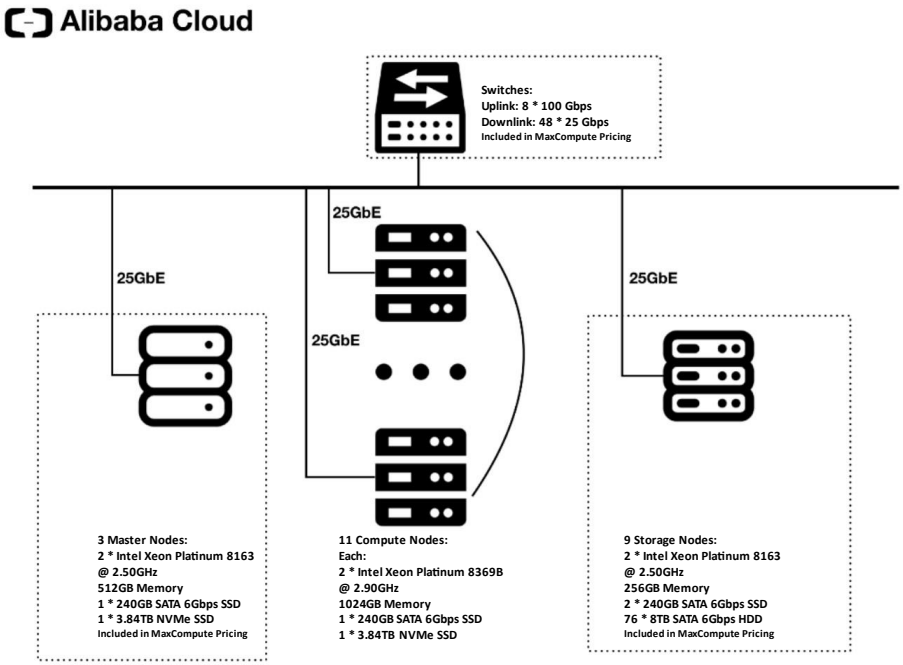
***Copyright © 2022 Alibaba Cloud Computing Ltd.***

*All rights reserved. Permission is hereby granted to reproduce this document in whole or in part provided the copyright notice printed above is set forth in full text or on the title page of each item reproduced.*

| Alibaba Cloud | **Alibaba Cloud MaxCompute** | TPCx-BB Rev. v1.5.2<br>TPC-Pricing Rev. v2.8.0<br>Report Date:<br>August 18, 2022 |
|---|---|---|
| Total System Cost | TPCx-BB Performance Metric | Price/Performance |
| **1,072,194 USD** | **23,307.23**<br>BBQpm@30000 | **46.01 USD**<br>$/BBQpm@30000 |

| Framework | Operating System | Other Software | Availability Date | Scale Factor | Streams |
|---|---|---|---|---|---|
| MaxCompute v3.42 | Alibaba Group Enterprise Linux Server 7.2 (Paladin) | None | August 18, 2022 | 30000 | 3 |

## System Configuration




| Physical Storage/Scale Factor: 184.45 | Scale Factor/Physical Memory: 1.99 |
|---|---|

| | | |
|---|---|---|
| Servers: | 23x Master Node / Compute Node / Storage Node | |
| Total Processors/Cores/Threads | 46/1,280/2,560 | |
| **3x Master Nodes:**<br>2x Intel® Xeon® Platinum 8163 CPU @ 2.50GHz<br>512 GiB<br>Onboard SATA Controller<br>1x 240 GB SATA 6 Gbps SSD<br>1x 3.84 TB NVMe SSD<br>Mellanox MT27710 2-port | **11x Compute Nodes:**<br>2x Intel(R) Xeon(R) Platinum 8369B CPU @ 2.90GHz<br>1,024 GiB<br>Onboard SATA Controller<br>1x 240 GB SATA 6 Gbps SSD<br>1x 3.84 TBD NVMe SSD<br>Mellanox MT28800 2-port | **9x Storage Nodes:**<br>2x Intel(R) Xeon(R) Platinum 8163 CPU @ 2.50GHz<br>256 GiB<br>Onboard SATA Controller<br>2x 240 GB SATA 6 Gbps SSD<br>76x 8 TB SATA 6 Gbps HDD<br>Mellanox MT27710 2-port |
| Connectivity: | Network Switch (8x 100 Gbps Up; 48x 25 Gbps Down) | |

| Description | Part Number | Source | Unit Price | Qty | Ext. Price | 3-Year Maint. |
|---|---|---|---|---|---|---|
| **License Compute and Software Services** | | | | | | |
| MaxCompute Annual Subscription (1,400 CU) | Asia Pacific SE 1 (Singapore) | 1 | $369,600.00 | 3 | $1,108,800.00 | |
| Master Node | | | | 3 | | |
| Intel® Xeon® Platinum 8163 @ 2.50 GHz | | | | 2 | | |
| 32 GB Memory | | | | 16 | | |
| 240 GB SATA 6 Gbps SSD | | | | 1 | | |
| 3.84 TB NVMe SSD | | | | 1 | | |
| Compute Node | | | | 11 | | |
| Intel® Xeon® Platinum 8369B @ 2.90 GHz | | | | 2 | | |
| 64 GB Memory | | | | 16 | | |
| 240 GB SATA 6 Gbps SSD | | | | 1 | | |
| 3.84 TB OCSSD | | | | 1 | | |
| Storage Node | | | | 9 | | |
| Intel® Xeon® Platinum 8163 @ 2.50 GHz | | | | 2 | | |
| 32 GB Memory | | | | 8 | | |
| 240 GB SATA 6 Gbps SSD | | | | 2 | | |
| 8 TB SATA 6 Gbps HDD | | | | 76 | | |
| Network Switches (8x100Gbps Up; 48x25Gbps Down) | | | | NA | | |
| 1-Year Annual Subscription Discount (30%) | | | -$110,880.00 | 3 | -$332,640.00 | |
| MaxCompute Storage for 1 year | | 1 | $1,378.96 | 3 | $4,136.88 | |
| 30000 Scale Factor (6.15 TB compressed) | | | | | | |
| MaxCompute Enterprise Service for 1 year | | 1 | $96,000.00 | 3 | | $288,000.00 |
| 24x7, 4 hour response | | | | | | |
| | **License Compute and Software Services Sub-Total** | | | | **$780,296.88** | **$288,000.00** |
| **Other Components** | | | | | | |
| 13-inch MacBook Pro M1 Chip (includes 2 spares) | | 2 | $1,299.00 | 3 | $3,897.00 | |
| | **Other Components Sub-Total** | | | | **$3,897.00** | **$0.00** |

Pricing:1 = Alibaba; 2 = Apple.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** | **$1,072,194** |
| **BBQpm@30000** | **23,307.23** |
| **$/BBQpm@30000** | **$ 46.01** |

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.

# Numerical Quantities

| | |
|---|---|
| Scale Factor | 30000 |
| Streams | 3 |
| SUT Validation Test | PASS |

## Performance Run (Run 2)

| | |
|---|---|
| Overall Run Start Time | 2022-08-01 12:56:50.678 |
| Overall Run End Time | 2022-08-01 16:26:57.218 |
| Overall Run Elapsed Time | 12,606.540 |
| | |
| Load Test Start Time | 2022-08-01 12:56:50.679 |
| Load Test End Time | 2022-08-01 13:21:51.484 |
| Load Test Elapsed Time | 1,500.805 |
| | |
| Power Test Start Time | 2022-08-01 13:21:51.486 |
| Power Test End Time | 2022-08-01 14:25:32.224 |
| Power Test Elapsed Time | 3,820.738 |
| | |
| Throughput Test Start Time | 2022-08-01 14:25:32.225 |
| Throughput Test End Time | 2022-08-01 16:26:57.218 |
| Throughput Test Elapsed Time | 7,284.993 |
| | |
| Performance Metric (BBQpm@30000) | 23,307.23 |

## Repeatability Run (Run 1)

| | |
|---|---|
| Overall Run Start Time | 2022-08-01 08:20:12.210 |
| Overall Run End Time | 2022-08-01 11:37:27.153 |
| Overall Run Elapsed Time | 11,834.943 |
| | |
| Load Test Start Time | 2022-08-01 08:20:12.211 |
| Load Test End Time | 2022-08-01 08:46:03.844 |
| Load Test Elapsed Time | 1,551.633 |
| | |
| Power Test Start Time | 2022-08-01 08:46:03.846 |
| Power Test End Time | 2022-08-01 09:48:14.320 |
| Power Test Elapsed Time | 3,730.474 |
| | |
| Throughput Test Start Time | 2022-08-01 09:48:14.320 |
| Throughput Test End Time | 2022-08-01 11:37:27.152 |
| Throughput Test Elapsed Time | 6,552.832 |
| | |
| Performance Metric (BBQpm@30000) | 24,178.65 |

## Performance Run Report (Run 2)

**********
TPCx-BB
Result
v1.5.2
**********
INFO: T_LOAD = 1500.805
INFO: T_LD = 0.1 * T_LOAD: 150.0805
INFO: T_PT = 1933.42976945178
INFO: T_T_PUT = 7284.993
INFO: T_TT = 2428.331
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@30000 = 23307.235556107

## Repeatability Run Report (Run 1)

**********
TPCx-BB
Result
v1.5.2
**********
INFO: T_LOAD = 1551.633
INFO: T_LD = 0.1 * T_LOAD: 155.1633
INFO: T_PT = 1977.29542528246
INFO: T_T_PUT = 6552.832
INFO: T_TT = 2184.27733333333
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@30000 = 24178.6593513056

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

# Table of Contents


ABSTRACT ..... 8
PREFACE ..... 9
CLAUSE 1: GENERAL ITEMS ..... 10
1.1 TEST SPONSOR ..... 10
1.2 PARAMETER SETTINGS ..... 10
1.3 CONFIGURATION DIAGRAMS ..... 10
CLAUSE 2: SOFTWARE COMPONENTS AND DATASET DISTRIBUTION ..... 12
2.1 ROLES AND DATASET DISTRIBUTION ..... 12
2.2 DISTRIBUTED FILE SYSTEM IMPLEMENTATION ..... 12
2.3 ENGINE IMPLEMENTATION ..... 12
2.4 FRAMEWORKS ..... 13
2.5 APPLIED PATCHES ..... 13
CLAUSE 3: WORKLOAD RELATED ITEMS ..... 14
3.1 HARDWARE & SOFTWARE TUNABLE ..... 14
3.2 KIT VERSION ..... 14
3.3 RUN REPORT ..... 14
3.4 QUERY ELAPSED TIMES ..... 15
3.5 VALIDATION TEST OUTPUT ..... 16
3.6 GLOBAL FRAMEWORK PARAMETERS ..... 16
3.7 KIT MODIFICATIONS ..... 17
CLAUSE 4: SUT RELATED ITEMS ..... 18
4.1 SPECIALIZED HARDWARE/SOFTWARE ..... 18
4.2 FRAMEWORK CONFIGURATION FILES ..... 18
4.3 SUT ENVIRONMENT INFORMATION ..... 18
4.4 DATA STORAGE TO SCALE FACTOR RATIO ..... 18
4.5 SCALE FACTOR TO MEMORY RATIO ..... 18
CLAUSE 5: METRICS AND SCALE FACTORS ..... 19
5.1 PERFORMANCE RUN METRIC ..... 19
5.2 REPEATABILITY RUN METRIC ..... 19
5.3 PRICE-PERFORMANCE METRIC ..... 19
5.4 SCALE FACTOR ..... 19
5.5 STREAM COUNT ..... 19
5.6 ELAPSED RUN TIMES ..... 20
5.7 ELAPSED TEST TIMES ..... 20
AUDITORS' INFORMATION AND ATTESTATION LETTER ..... 21
THIRD PARTY PRICE QUOTES ..... 24
APPLE.COM ..... 24
SUPPORTING FILE INDEX ..... 25

# 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 v1.5.2.

The test was conducted at a Scale Factor of 30000 with 23 nodes (3x Master Nodes, 11x Compute Nodes, 9x Storage Nodes) running MaxCompute v3.42 on Alibaba Group Enterprise Linux Server 7.2 (Paladin).

**Measured Configuration**

| Company Name | Cluster Node | Virtualization | Operating System |
|---|---|---|---|
| Alibaba Cloud Computing Ltd. | 3x Master Nodes<br>11x Compute Node<br>9x Storage Node | n/a | Alibaba Group Enterprise Linux Server 7.2 (Paladin) |

**TPC Express Benchmark© Big Bench Metrics**

| Total System Cost | BBQpm@30000 | Price/Performance | Availability Date |
|---|---|---|---|
| 1,072,194 USD | 23,307.23 | 46.01 USD | August 18, 2022 |

# 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 Alibaba Cloud Computing 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.*

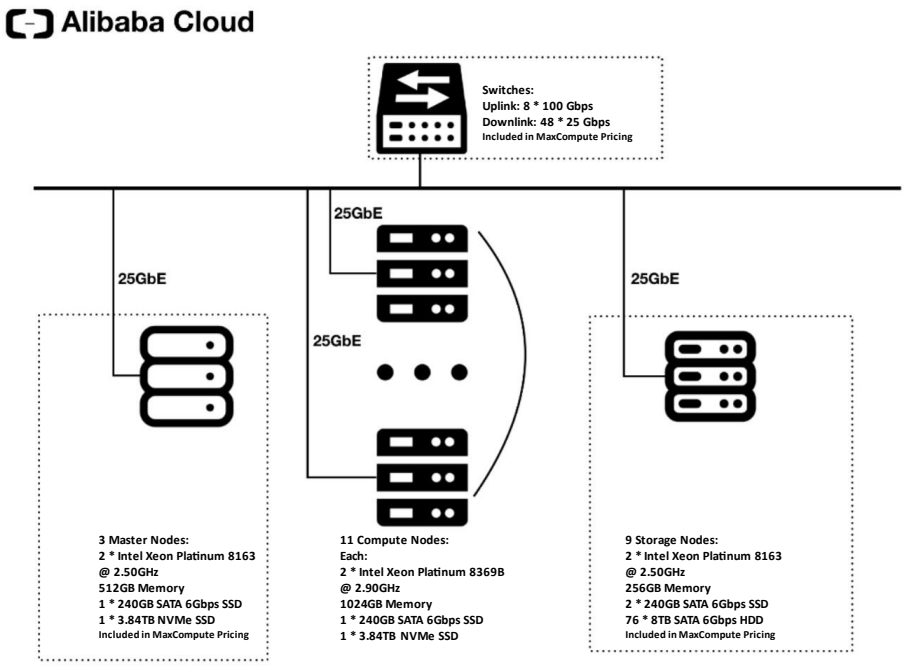
The Supporting Files Archive contains the parameters and options used to configure the components involved in this benchmark.

## 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: | 23 |
| Total Processors/Cores/Threads: | 46/1,280/2,560 |
| Total Memory: | 15,104 |
| Total Number of Storage Devices: | 730 |
| Total Storage Capacity: | 5,533,440 |
| Network: | Network Switch (8x 100 Gbps Up; 48x 25 Gbps Down) |

| **3x Master Nodes:** | **11x Compute Nodes:** | **9x Storage Nodes:** |
|---|---|---|
| 2/48/96 (processors/cores/threads) | 2/64/128 | 2/48/96 |
| 2x Intel(R) Xeon(R) Platinum 8163 CPU @ 2.50GHz | 2x Intel(R) Xeon(R) Platinum 8369B CPU @ 2.90GHz | 2x Intel(R) Xeon(R) Platinum 8163 CPU @ 2.50GHz |
| 512 GiB | 1,024 GiB | 256 GiB |
| Onboard SATA Controller | Onboard SATA Controller | Onboard SATA Controller |
| 1x 240 GB SATA 6 Gbps SSD | 1x 240 GB SATA 6 Gbps SSD | 2x 240 GB SATA 6 Gbps SSD |
| 1x 3.84 TB NVMe SSD | 1x 3.84 TBD NVMe SSD | 76x 8 TB SATA 6 Gbps HDD |
| Mellanox MT27710 2-port | Mellanox MT28800 2-port | Mellanox MT27710 2-port |

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 | Host Names | HW/SW Configuration | Storage Setup |
|---|---|---|---|---|---|
| MaxCompute Master Nodes | Pangu master<br>Fuxi Master<br>Nuwa | 3 | See Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/master-nodelist.txt | 2 * Intel Xeon Platinum 8163 @ 2.50GHz<br>512GB Memory<br>1 * 240GB SATA 6Gbps SSD<br>1 * 3.84TB NVMe SSD<br>2 * 25Gb<br>OS: Linux 3.10.0-327.ali2014.alios7.x86_64<br>Apsara: 1.11_u32 | OS:<br>1x 240GB SATA 6Gbps SSD<br><br>Data Drive:<br>1x 3.84TB NVMe SSD |
| MaxCompute Compute Nodes | Fuxi tubo | 11 | See Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/nodelist.txt | 2 * Intel Xeon Platinum 8369B @ 2.90GHz<br>1,024GB Memory<br>1 * 240GB SATA 6Gbps SSD<br>1 * 3.84TB NVMe SSD<br>2 * 25Gb<br>OS: Linux 3.10.0-327.ali2016.alios7.x86_64<br>Apsara: 1.11_u32 | OS:<br>1x 240GB SATA 6Gbps SSD<br><br>Data Drive:<br>1x 3.84TB NVMe SSD |
| MaxCompute Storage Nodes | Pangu ChunkServer | 9 | See Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/storage-nodelist.txt | 2 * Intel Xeon Platinum 8163 @ 2.50GHz<br>256GB Memory<br>2 * 240GB SATA 6Gbps SSD<br>76 * 8TB SATA 6Gbps HDD<br>OS: Linux 3.10.0-327.ali2010.rc7.alios7.x86_64<br>Apsara: 1.11_u32 | OS:<br>2x 240GB SATA 6Gbps SSD<br><br>Data Drive:<br>76x 8TB SATA 6Gbps HDD |

## 2.2 Distributed File System Implementation

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

MaxCompute v3.42.

## 2.3 Engine Implementation

*The Engine implementation and corresponding version must be disclosed.*

| Component | Version |
|---|---|
| MaxCompute SQL Task | 3.41 |

## 2.4 Frameworks

*Frameworks and Engine used in the benchmark should be disclosed.*

| Framework | Version |
|---|---|
| MaxCompute | 3.42 |

## 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 |
|---|
| v1.5.2 |

## 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 Report Summary (Repeatability Run)**

```
**********
TPCx-BB
Result
v1.5.2
**********
INFO: T_LOAD = 1551.633
INFO: T_LD = 0.1 * T_LOAD: 155.1633
INFO: T_PT = 1977.29542528246
INFO: T_T_PUT = 6552.832
INFO: T_TT = 2184.27733333333
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@30000 = 24178.6593513056
```

- **Run2 Report Summary (Performance Run)**

```
**********
TPCx-BB
Result
v1.5.2
**********
INFO: T_LOAD = 1500.805
INFO: T_LD = 0.1 * T_LOAD: 150.0805
INFO: T_PT = 1933.42976945178
INFO: T_T_PUT = 7284.993
INFO: T_TT = 2428.331
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@30000 = 23307.235556107
```

# 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.*

| Type | Query | Power | Stream 1 | Stream 2 | Stream 3 |
|---|---|---|---|---|---|
| Structured | 1 | 44.118 | 80.965 | 46.961 | 42.744 |
| | 6 | 59.043 | 79.569 | 84.576 | 223.465 |
| | 7 | 52.115 | 72.438 | 106.482 | 557.115 |
| | 9 | 32.721 | 53.783 | 38.062 | 37.523 |
| | 11 | 26.081 | 34.314 | 36.379 | 31.702 |
| | 13 | 44.521 | 66.488 | 57.834 | 68.852 |
| | 14 | 10.198 | 11.397 | 39.652 | 14.357 |
| | 15 | 10.985 | 16.007 | 11.828 | 16.524 |
| | 16 | 36.695 | 232.795 | 51.135 | 43.533 |
| | 17 | 13.451 | 107.926 | 26.577 | 21.111 |
| | 20 | 72.157 | 104.674 | 506.573 | 82.479 |
| | 21 | 77.382 | 114.932 | 91.959 | 97.007 |
| | 22 | 9.558 | 12.550 | 8.516 | 9.870 |
| | 23 | 17.798 | 49.615 | 62.235 | 78.124 |
| | 24 | 14.092 | 34.241 | 16.984 | 14.363 |
| | 25 | 80.303 | 82.183 | 345.487 | 80.990 |
| | 26 | 82.025 | 81.119 | 260.555 | 112.875 |
| | 29 | 37.272 | 45.239 | 92.598 | 59.778 |
| Semi-structured | 2 | 327.387 | 660.552 | 326.817 | 593.367 |
| | 3 | 239.719 | 271.857 | 486.227 | 241.774 |
| | 4 | 325.042 | 568.822 | 710.956 | 644.320 |
| | 5 | 463.357 | 543.491 | 703.028 | 536.600 |
| | 8 | 88.476 | 146.646 | 144.991 | 321.908 |
| | 12 | 19.414 | 28.671 | 88.025 | 19.540 |
| | 30 | 337.185 | 591.543 | 610.668 | 595.214 |
| Unstructured | 10 | 163.158 | 425.638 | 165.855 | 231.260 |
| | 18 | 707.944 | 643.226 | 1,242.247 | 1,101.986 |
| | 19 | 196.346 | 194.083 | 190.411 | 201.881 |
| | 27 | 93.877 | 518.747 | 591.045 | 90.162 |
| | 28 | 138.283 | 597.910 | 140.316 | 667.589 |

## 3.5 Validation Test Output

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

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

## 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/userSettings.conf
- bigBench-configs/sql/conf/engineSettings.conf
- bigBench-configs/sql/conf/engineSettings.sql
- bigBench-configs/sql/conf/queryParameters.sql
- bigBench-configs/sql/queries/q01/engineLocalSettings.sql
- bigBench-configs/sql/queries/q02/engineLocalSettings.sql
- bigBench-configs/sql/queries/q03/engineLocalSettings.sql
- bigBench-configs/sql/queries/q04/engineLocalSettings.sql
- bigBench-configs/sql/queries/q05/engineLocalSettings.sql
- bigBench-configs/sql/queries/q06/engineLocalSettings.sql
- bigBench-configs/sql/queries/q07/engineLocalSettings.sql
- bigBench-configs/sql/queries/q08/engineLocalSettings.sql
- bigBench-configs/sql/queries/q09/engineLocalSettings.sql
- bigBench-configs/sql/queries/q10/engineLocalSettings.sql
- bigBench-configs/sql/queries/q11/engineLocalSettings.sql
- bigBench-configs/sql/queries/q12/engineLocalSettings.sql
- bigBench-configs/sql/queries/q13/engineLocalSettings.sql
- bigBench-configs/sql/queries/q14/engineLocalSettings.sql
- bigBench-configs/sql/queries/q15/engineLocalSettings.sql
- bigBench-configs/sql/queries/q16/engineLocalSettings.sql
- bigBench-configs/sql/queries/q17/engineLocalSettings.sql
- bigBench-configs/sql/queries/q18/engineLocalSettings.sql
- bigBench-configs/sql/queries/q19/engineLocalSettings.sql
- bigBench-configs/sql/queries/q20/engineLocalSettings.sql
- bigBench-configs/sql/queries/q21/engineLocalSettings.sql
- bigBench-configs/sql/queries/q22/engineLocalSettings.sql
- bigBench-configs/sql/queries/q23/engineLocalSettings.sql
- bigBench-configs/sql/queries/q24/engineLocalSettings.sql
- bigBench-configs/sql/queries/q25/engineLocalSettings.sql
- bigBench-configs/sql/queries/q26/engineLocalSettings.sql
- bigBench-configs/sql/queries/q27/engineLocalSettings.sql
- bigBench-configs/sql/queries/q28/engineLocalSettings.sql
- bigBench-configs/sql/queries/q29/engineLocalSettings.sql
- bigBench-configs/sql/queries/q30/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 form every role in the server*.

All envinfo.log files are included 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) |
|---|---|---|---|
| 14 | 1 | 240 | 3,360 |
| 14 | 1 | 3,840 | 53,760 |
| 9 | 2 | 240 | 4,320 |
| 9 | 76 | 8,000 | 5,472,000 |

| | |
|---|---|
| Total Storage (GB) | 5,533,440 |
| Scale Factor | 30000 |
| Data Storage Ratio | 184.45 |

## 4.5 Scale Factor to Memory Ratio

*The Scale Factor to memory ratio must be disclosed.*

| Nodes | Memory (GiB) | Total (GiB) |
|---|---|---|
| 3 | 512 | 1,536 |
| 11 | 1,024 | 11,264 |
| 9 | 256 | 2,304 |

| | |
|---|---|
| Scale Factor | 30000 |
| Total Memory (GiB) | 15,104 |
| SF / Memory Ratio | 1.99 |

# 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@30000 23,307.23 |

## 5.2 Repeatability Run Metric

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

| Repeatability Run |
|---|
| BBQpm@30000 24,178.65 |

## 5.3 Price-Performance Metric

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

| Price / Performance |
|---|
| $BBQpm@30000 46.01 |

## 5.4 Scale Factor

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

| Scale Factor |
|---|
| 30000 |

## 5.5 Stream Count

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

| Streams |
|---|
| 3 |

## 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 | 00 03:17:14.943 | 11,834.943 |
| Run 2 | 00 03:30:06.540 | 12,606.540 |

## 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 | 1,500.805 | 1,551.633 |
| Power Test | 3,820.738 | 3,730.474 |
| Throughput Test | 7,284.993 | 6,552.832 |

# 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.

InfoSizing
The Right Metric For Sizing IT

TPC
Certified Auditor

Jing Sun
Alibaba Cloud Computing Co., Ltd.
No.12, Zhuantang
Science and Technology Economic Zone
Xihu District, Hangzhou City
Zhejiang Province China

August 17, 2022

I verified the TPC Express Benchmark™ BB v1.5.2 performance of the following configuration:

| | |
|---|---|
| Platform: | Alibaba Cloud MaxCompute<br>(w/ 3x Master Nodes, 11x Compute Nodes, 9 Storage Nodes) |
| Operating System: | Alibaba Group Enterprise Linux Server 7.2 (Paladin) |
| Framework: | MaxCompute v3.42 |

The results were:

| | |
|---|---|
| **Performance Metric** | **23,307.23 BBQpm@30000** |
| Run Elapsed Time | 00 03:30:06.540 (12,606.540 Seconds) |

| **Cluster** | **3x Master Nodes, 11x Compute Nodes, 9x Storage Nodes** |
|---|---|
| CPUs | 2x Intel® Xeon® Platinum 8163 (2.50 GHz, 24-core, 33 MB L3)<br>(Master, Storage nodes)<br>2x Intel® Xeon® Platinum 8369B (2.90 GHz, 32-core, 48 MB L3)<br>(Compute nodes) |
| Memory | 512GiB (Master nodes), 1,024GiB (Compute nodes), 256GiB (Storage nodes) |
| Storage | ***Qty*** ***Size*** ***Type***<br>1 240 GB SATA 6 Gbps SSD (Master, Compute nodes)<br>2 240 GB SATA 6 Gbps SSD (Storage nodes)<br>1 3.84 TB NVMe SSD (Master, Compute nodes)<br>76 8 TB SATA 6 Gbps HDD (Storage 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 v1.5.2
- No modifications were made to any of the Java code

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

- Any and all modifications to shell scripts were reviewed for compliance
- The tested Scale Factor (30000GB) was confirmed to be valid for publication
- All validation queries executed successfully and produced compliant results
- 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:

None.

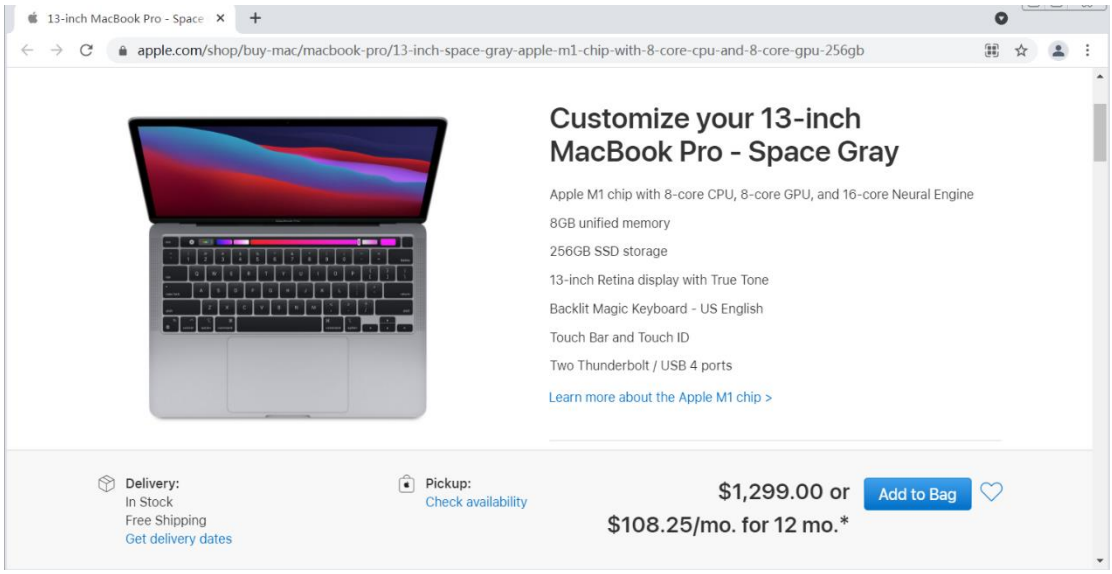
Respectfully Yours,

Doug Johnson, TPC Auditor

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

# Third Party Price Quotes

## Apple.com



# 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 | **Support-Files-for-Alibaba-Maxcompute-11nodes-30TB** |
| Validation Run Files | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Validation-Run-logs-20220801-071510-sql-sf30000 |
| Performance Run Files | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000 |
| Repeatability Run Files | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Repeatability-Run-logs-20220801-164106-sql-sf30000 |
| **Clause 3 - Workload Related Items** | |
| Benchmark Generic Parameters | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/bigBench-configs/conf/userSettings.conf |
| Query Parameters used in the benchmark execution Settings | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/bigBench-configs/sql/conf/queryParameters.sql |
| Benchmark Global Framework Parameters Settings | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/bigBench-configs/sql/conf/engineSettings.sql |
| Load Test script | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/bigBench-configs/sql/population/odpsCreateLoad.sql |
| Queries specific optimization parameters settings | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/bigBench-configs/sql/queries/q[01-30]/engineLocalSettings.conf |
| **Clause 4 - SUT Related Items** | |
| Data Redundancy report | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/pangu_redundant_info_20220801-164139.txt |
| Benchmark execution script | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/TPCxBB_FullBenchmark_sequence_run.sh |
| Hardware and Software Report from a representative master node | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/envInfo-s54c06379.cloud.eo166/envInfo.log |
| Hardware and Software Report from a representative compute node | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/envInfo-s78c12077.cloud.eo166/envInfo.log |
| Hardware and Software Report from a representative storage node | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/envInfo-s54c10320.cloud.eo166/envInfo.log |
| All Framework configuration files are included in the Supporting Files Archive | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/odps_config.ini Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/session_config.ini |
| **Clause 5 - Metric and Scale Factor Related Items** | |
| Benchmark Performance Report | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Performance-Run-logs-20220801-115140-sql-sf30000/run-logs/BigBenchResult.log |
| Validation Test Report | Support-Files-for-Alibaba-Maxcompute-11nodes-30TB/Validation-Run-logs-20220801-071510-sql-sf30000/run-logs/BigBenchResult.log |