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# New H3C Technologies Co., Limited

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TPC Benchmark™ DS  
Full Disclosure Report  
for  
H3C UniServer R4900 G3  
using  
GBase 8a v9  
and  
Red Hat Enterprise Linux Server Release 7.8

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**Second Edition**  
(First Edition released on December 23, 2020)

**April 2, 2021**

## **Second Edition – April 2, 2021**

*H3C is an industry leader in the provision of Digital Solutions, and is committed to becoming the most trusted partner of its customers in their quest for business innovation and digital transformation. We offer a full portfolio of Digital Infrastructure products, spanning across compute, storage, networking, 5G, security and related domains, and provide a comprehensive one-stop digital platform that includes cloud computing, big data, artificial intelligence (AI), industrial internet, information security, intelligent connectivity, new safety, and edge computing, as well as end-to-end technical services. We are also the exclusive provider of HPE® servers, storage and associated technical services in China.*

# Abstract


This document contains the methodology and results of the TPC Benchmark™ DS (TPC-DS) test conducted in conformance with the requirements of the TPC-DS Standard Specification, Revision 3.0.0. The test was conducted at a Scale Factor of 10000GB with 8 H3C UniServer R4900 G3 Servers running GBase 8a v9 on Red Hat Enterprise Linux Server Release 7.8.

## Measured Configuration

| Company Name | Cluster Node       | Database Software | Operating System                               |
|--------------|--------------------|-------------------|--|
| H3C          | UniServer R4900 G3 | GBase 8a v9       | Red Hat Enterprise Linux<br>Server Release 7.8 |

## TPC Benchmark™ DS Metrics

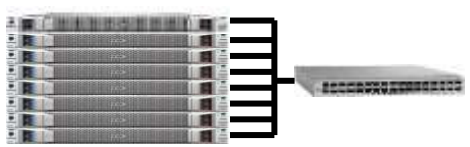
| Total System Cost | TPC-DS Throughput          | Price/Performance           | Availability Date |
|-------------------|----------------------------|-----------------------------|-------------------|
| ¥3,784,642<br>RMB | 8,944,478<br>QphDS@10000GB | ¥423.13<br>RMB/kQphDS@10000 | 23-Dec-2020       |

|  |                               |                   |  |
|--|-------------------------------|-------------------|--|
| <br>The Leader in Digital Solutions | <b>H3C UniServer R4900 G3</b> |                   | TPC-DS: 3.0.0<br>TPC-Pricing: 2.6.0<br>Report Date: 2-Apr-2021 |
|  | Total System Cost             | TPC-DS Throughput | Price / Performance  |

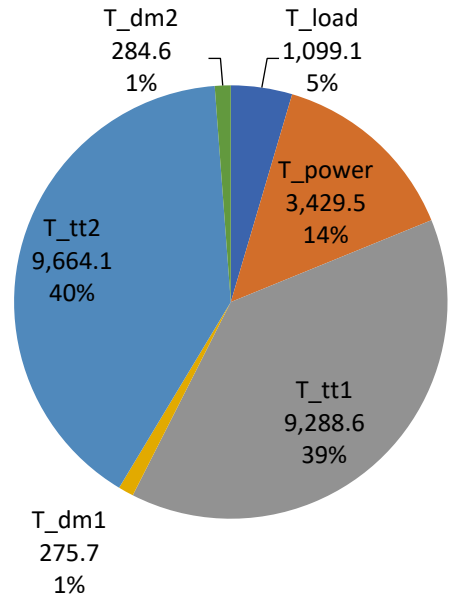
|                          |                                   |                                      |                    |
|--------------------------|-----------------------------------|--------------------------------------|--------------------|
| <b>¥3,784,642</b><br>RMB | <b>8,944,478</b><br>QphDS@10000GB | <b>¥423.13</b><br>RMB/kQphDS@10000GB | <b>23-Dec-2020</b> |
|--------------------------|-----------------------------------|--------------------------------------|--------------------|

|              |                  |   |                |         |
|--------------|------------------|---|----------------|---------|
| Dataset Size | Database Manager | Operating System                            | Other Software | Cluster |
| 10,000 GB    | GBase 8a V9      | Red Hat Enterprise Linux Server Release 7.8 | No             | Yes     |

**8 x H3C UniServer R4900 G3, each with:**  
2 x Intel Xeon Gold 6230R Processor  
512 GB DDR4 DRAM  
1 x 480GB Sata SSD Drive  
6 x 2TB NVMe Drive  
1x Intel E810-XXV 25Gb NIC



**Benchmarked Configuration**



**Elapsed Time**

|                                 |                                     |
|---------------------------------|-------------------------------------|
| Load includes backup = No       | RAID = RAID-10                      |
| <b>System Configuration</b>     | H3C UniServer R4900 G3              |
| Servers:                        | 8 x H3C UniServer R4900 G3          |
| Total Processors/Cores/Threads: | 16/416/832                          |
| Total Memory:                   | 4,096 GB                            |
| Total Storage:                  | 102,144GB                           |
| Storage Ratio:                  | 10.22                               |
| Connectivity:                   | 1 x Cisco Nexus 3232C Switch        |
| <b>Server Configuration:</b>    | Per node                            |
| Processors:                     | 2 x Intel Xeon Gold 6230R Processor |
| Memory:                         | 512 GB                              |
| Network:                        | 1x Intel E810-XXV 25Gb NIC          |
| Storage Device:                 | 6 x 2TB NVMe Drive (data disks)     |



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## H3C UniServer R4900 G3

TPC-DS: 3.0.0  
 TPC-Pricing: 2.6.0  
 Report Date: 2-Apr-2021

| Description   | Src | Part Number                 | Unit Price (RMB) | Qty | Extended Price (RMB)                   | 3 Year Maint. Price |
|---|-----|-----------------------------|------------------|-----|--|---------------------|
| <b>Hardware Components</b>  |     |                             |                  |     |  |                     |
| H3C UniServer R4900 G3 8SFF CTO Server  | 1   | 0235A2CR                    | 9,600            | 8   | 76,800                                 |                     |
| H3C UniServer R4900 G3 6230R(2.1GHz/26Cores/35.75MB/150W)CPU Module(CMCTO)  | 1   | 0231AEEC                    | 36,300           | 16  | 580,800                                |                     |
| 32GB 2Rx4 DDR4-2933P-R Memory Module(FIO)   | 1   | 0231ABDU                    | 3,100            | 128 | 396,800                                |                     |
| 8SFF HDD Cage Module BAY2(FIO)  | 1   | 0231A6QF                    | 600              | 8   | 4,800                                  |                     |
| 8SFF NVMe HDD Cage Module BAY3(FIO)   | 1   | 0231A6QE                    | 800              | 8   | 6,400                                  |                     |
| 2TB PCIe*Gen3 X4 NVMe U.2 2.5in RI P4510 SSD General Intelligent Disk Equipment Module(FIO)   | 1   | 0231A7P4                    | 10,355           | 48  | 497,040                                |                     |
| 480GB 6G SATA 2.5in MU S4610 SSD Generic Module-(FIO)   | 1   | 0231AARN                    | 3,380            | 8   | 27,040                                 |                     |
| FHHL Riser(Slot1/2)(1X16 FHHL and 1X8 FHHL)(FIO)  | 1   | 0231A6QR                    | 263              | 16  | 4,208                                  |                     |
| 8 Ports NVMe SSD Expander Module(Supporting 8 NVMe SSD Hard Disks)(FIO)   | 1   | 0231A6U5                    | 2,900            | 8   | 23,200                                 |                     |
| 800W AC & 240V HVDC Power Supply(FP-R1-Platinum)(CMCTO)   | 1   | 0231A8L0                    | 1,800            | 16  | 28,800                                 |                     |
| SAS HD Transit Cable,0.71m,SAS HD 72pinS,SAS Cable,2*(SAS HD 36pinA)  | 1   | 0404A0U3                    | 170              | 8   | 1,360                                  |                     |
| OCulink Transit Cable,0.67m,4*(OCulink 42pinS),SAS Cable,4*(OCulink 42pinS)   | 1   | 0404A0SX                    | 820              | 16  | 13,120                                 |                     |
| 2U Standard Fan Module(FIO)   | 1   | 0231A6QM                    | 100              | 8   | 800                                    |                     |
| H3C Server Installation and Startup Service   | 1   | 8814A0CP                    | 2,118            | 8   | 16,944                                 |                     |
| 3Y 7x24 Remote Technical Support -OS  | 1   | 8813A4NA                    | 4,140            | 8   |  | 33,120              |
| H3C RHEL Svr 2Sckt/2Gst 3yr 24x7 LTU  | 1   | 3132A05G                    | 43,050           | 8   | 344,400                                |                     |
| 25G SFP28 Optical Transceiver Module (850nm,100m,SR,MM,LC)  | 1   | 0231A7QP                    | 3,100            | 8   | 24,800                                 |                     |
| Fiber Connector,MTPY(8 core)/PC,4DLC/PC(2.0m),Multimode(OM3),3.0mm,10.0m  | 1   | 1413A00H                    | 370              | 2   | 740                                    |                     |
| QSFP28 100G Optical Transceiver Module(850nm,100m OM4,SR4,MPO)(ODM-T)   | 1   | 3407A001                    | 15,000           | 2   | 30,000                                 |                     |
| CISCO N3K-C3232C 32 ports switch (incl. spares)   | 4   | N3K-C3232C                  | 69,000           | 3   | 207,000                                |                     |
| Intel Ethernet Network Adapter E810XXVDA2BLK (incl. spares)   | 5   |                             | 2,370            | 10  | 23,700                                 |                     |
| PDU   | 3   |                             | 141              | 2   | 282                                    |                     |
| Cabinet   | 3   |                             | 1,700            | 1   | 1,700                                  |                     |
| LG 22MK400H 21.5" Monitor   | 3   |                             | 699              | 1   | 699                                    |                     |
| Keyboard & Mouse  | 3   |                             | 89               | 1   | 89                                     |                     |
|   |     | <b>SubTotal</b>             |                  |     | <b>2,311,522</b>                       | <b>33,120</b>       |
| <b>Software Componets</b>   |     |                             |                  |     |  |                     |
| GBase 8a MPP V9 With 1 years 24x7 support   | 2   | GBase 8a MPP                | 187,500          | 8   | 1,500,000                              |                     |
| 2 years 24x7 support  | 2   | GBase 8a MPP                | 240,000          | 1   |  | 240,000             |
|   |     | <b>SubTotal</b>             |                  |     | <b>1,500,000</b>                       | <b>240,000</b>      |
|   |     | <b>Total Extended Price</b> |                  |     | <b>3,811,522</b>                       | <b>273,120</b>      |
|   |     | <b>Total Discounts</b>      |                  |     | <b>300,000</b>                         | <b>0</b>            |
| Price Key: 1: H3C, 2: GBase, 3: jd.com, 4: Qizhen Electronic, 5: Digital China Group  |     |                             |                  |     |  |                     |
| <b>Audited by Francois Raab of InfoSizing (www.sizing.com)</b>  |     | <b>Grand Total</b>          |                  |     | <b>3,511,522</b>                       | <b>273,120</b>      |
| Discount is based on 20% of extended price for GBase licence. Discounts for similarly sized configurations will be similar to those quoted here, but may vary based on the components in the configuration. |     |                             |                  |     | <b>3 year cost of ownership (RMB):</b> | <b>3,784,642</b>    |
|   |     |                             |                  |     | <b>QphDS@10000GB</b>                   | <b>8,944,478</b>    |
|   |     |                             |                  |     | <b>RMB/kQphDS@10000GB</b>              | <b>423.13</b>       |

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

### Sales Contacts

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**Metrics Details:**

| Name              | Value   | Unit    |
|-------------------|---------|---------|
| Scale Factor (SF) | 10,000  | GB      |
| Streams           | 4       | Stream  |
| Queries (Q)       | 396     | Queries |
| T_load            | 1,099.1 | Second  |
| T_ld              | 0.0123  | Hour    |
| T_power           | 3,429.5 | Second  |
| T_pt              | 3.8106  | Hour    |
| T_tt1             | 9,288.6 | Second  |
| T_tt2             | 9,664.1 | Second  |
| T_dm1             | 275.7   | Second  |
| T_dm2             | 284.6   | Second  |
| T_tt              | 5.2647  | Hour    |
| T_dm              | 0.1557  | Hour    |

| Load Step       | Start                       | End                         | (sec.)          | (hh:mm:ss)     |
|-----------------|-----------------------------|-----------------------------|-----------------|----------------|
| Build           | 12/14/20 22:41:40.88        | 12/14/20 22:59:59.93        | 1,099.05        | 0:18:19        |
| Audit           | 12/14/20 22:59:59.93        | 12/14/20 23:18:07.49        | 1,087.56        | 0:18:08        |
| Finish          | 12/14/20 23:18:07.49        | 12/14/20 23:18:07.49        | 0.00            | 0:00:00        |
| <b>Reported</b> | <b>12/14/20 22:41:40.88</b> | <b>12/14/20 23:18:07.49</b> | <b>1,099.05</b> | <b>0:18:19</b> |

| Test      | Start                | End                  | (sec.)   | (hh:mm:ss) |
|-----------|----------------------|----------------------|----------|------------|
| Power     | 12/14/20 23:27:39.49 | 12/15/20 00:24:48.91 | 3,429.42 | 0:57:09    |
| Thruput-1 | 12/15/20 00:24:48.93 | 12/15/20 02:59:37.53 | 9,288.60 | 2:34:49    |
| DM-1      | 12/15/20 02:59:37.55 | 12/15/20 03:04:13.25 | 275.70   | 0:04:36    |
| Thruput-2 | 12/15/20 03:04:13.27 | 12/15/20 05:45:17.36 | 9,664.09 | 2:41:04    |
| DM-2      | 12/15/20 05:45:17.38 | 12/15/20 05:50:01.94 | 284.56   | 0:04:45    |

| Stream   | Start                | End                  | (sec.)   | (hh:mm:ss) |
|----------|----------------------|----------------------|----------|------------|
| Pt - 0   | 12/14/20 23:27:39.49 | 12/15/20 00:24:48.91 | 3,429.42 | 0:57:09    |
| Tt1 - 1  | 12/15/20 00:24:48.93 | 12/15/20 02:57:06.73 | 9,137.80 | 2:32:18    |
| Tt1 - 2  | 12/15/20 00:24:48.93 | 12/15/20 02:59:37.53 | 9,288.60 | 2:34:49    |
| Tt1 - 3  | 12/15/20 00:24:48.93 | 12/15/20 02:58:30.93 | 9,222.00 | 2:33:42    |
| Tt1 - 4  | 12/15/20 00:24:48.93 | 12/15/20 02:59:25.60 | 9,276.67 | 2:34:37    |
| Tt2 - 5  | 12/15/20 03:04:13.27 | 12/15/20 05:43:44.01 | 9,570.74 | 2:39:31    |
| Tt2 - 6  | 12/15/20 03:04:13.27 | 12/15/20 05:44:25.93 | 9,612.66 | 2:40:13    |
| Tt2 - 7  | 12/15/20 03:04:13.27 | 12/15/20 05:45:00.69 | 9,647.42 | 2:40:47    |
| Tt2 - 8  | 12/15/20 03:04:13.27 | 12/15/20 05:45:17.36 | 9,664.09 | 2:41:04    |
| DMt1 - 1 | 12/15/20 02:59:37.55 | 12/15/20 03:01:55.16 | 137.61   | 0:02:18    |
| DMt1 - 2 | 12/15/20 03:01:55.16 | 12/15/20 03:04:13.25 | 138.09   | 0:02:18    |
| DMt2 - 3 | 12/15/20 05:45:17.38 | 12/15/20 05:47:41.54 | 144.16   | 0:02:24    |
| DMt2 - 4 | 12/15/20 05:47:41.53 | 12/15/20 05:50:01.94 | 140.41   | 0:02:20    |

# Timing Intervals for Queries (in Seconds)

| Query | S 0   | S 1   | S 2   | S 3     | S 4   | Min   | 25%tile | Median | 75%tile | Max     | S 5   | S 6   | S 7     | S 8     | Min   | 25%tile | Median | 75%tile | Max     |
|-------|-------|-------|-------|---------|-------|-------|---------|--------|---------|---------|-------|-------|---------|---------|-------|---------|--------|---------|---------|
| 1     | 10.5  | 75.4  | 22.8  | 35.1    | 33.8  | 22.8  | 31.1    | 34.5   | 45.2    | 75.4    | 45.7  | 33.3  | 32.9    | 48.1    | 32.9  | 33.2    | 39.5   | 46.3    | 48.1    |
| 2     | 65.1  | 138.0 | 182.7 | 126.9   | 189.1 | 126.9 | 135.2   | 160.4  | 184.3   | 189.1   | 166.3 | 203.4 | 134.5   | 102.3   | 102.3 | 126.5   | 150.4  | 175.6   | 203.4   |
| 3     | 9.4   | 20.4  | 31.2  | 52.3    | 39.8  | 20.4  | 28.5    | 35.5   | 42.9    | 52.3    | 22.6  | 23.4  | 24.7    | 13.9    | 13.9  | 20.4    | 23.0   | 23.7    | 24.7    |
| 4     | 76.0  | 264.8 | 242.5 | 162.4   | 258.8 | 162.4 | 222.5   | 250.7  | 260.3   | 264.8   | 341.1 | 277.6 | 320.3   | 240.9   | 240.9 | 268.4   | 299.0  | 325.5   | 341.1   |
| 5     | 2.0   | 13.6  | 14.5  | 11.3    | 7.9   | 7.9   | 10.5    | 12.5   | 13.8    | 14.5    | 21.5  | 13.1  | 16.0    | 10.8    | 10.8  | 12.5    | 14.6   | 17.4    | 21.5    |
| 6     | 12.0  | 45.9  | 52.5  | 35.7    | 30.6  | 30.6  | 34.4    | 40.8   | 47.6    | 52.5    | 22.0  | 42.4  | 27.8    | 27.2    | 22.0  | 25.9    | 27.5   | 31.5    | 42.4    |
| 7     | 28.9  | 55.2  | 54.4  | 83.1    | 53.9  | 53.9  | 54.3    | 54.8   | 62.2    | 83.1    | 59.8  | 51.3  | 67.6    | 58.3    | 51.3  | 56.6    | 59.1   | 61.8    | 67.6    |
| 8     | 31.5  | 100.8 | 99.8  | 87.3    | 63.0  | 63.0  | 81.2    | 93.6   | 100.1   | 100.8   | 72.0  | 103.5 | 80.8    | 98.2    | 72.0  | 78.6    | 89.5   | 99.5    | 103.5   |
| 9     | 47.1  | 100.7 | 87.7  | 92.5    | 79.3  | 79.3  | 85.6    | 90.1   | 94.6    | 100.7   | 116.8 | 94.7  | 110.5   | 103.6   | 94.7  | 101.4   | 107.1  | 112.1   | 116.8   |
| 10    | 53.0  | 135.2 | 87.8  | 117.2   | 157.7 | 87.8  | 109.9   | 126.2  | 140.8   | 157.7   | 176.2 | 301.4 | 132.1   | 293.7   | 132.1 | 165.2   | 235.0  | 295.6   | 301.4   |
| 11    | 28.9  | 107.2 | 70.7  | 99.3    | 108.3 | 70.7  | 92.2    | 103.3  | 107.5   | 108.3   | 142.1 | 138.3 | 123.1   | 163.2   | 123.1 | 134.5   | 140.2  | 147.4   | 163.2   |
| 12    | 3.8   | 24.3  | 21.4  | 17.2    | 11.9  | 11.9  | 15.9    | 19.3   | 22.1    | 24.3    | 8.1   | 18.2  | 16.7    | 18.9    | 8.1   | 14.6    | 17.5   | 18.4    | 18.9    |
| 13    | 10.3  | 39.5  | 50.5  | 44.0    | 24.5  | 24.5  | 35.8    | 41.8   | 45.6    | 50.5    | 117.9 | 104.1 | 61.2    | 69.5    | 61.2  | 67.4    | 86.8   | 107.6   | 117.9   |
| 14    | 120.6 | 270.5 | 248.0 | 267.7   | 295.0 | 248.0 | 262.8   | 269.1  | 276.6   | 295.0   | 218.7 | 289.3 | 310.9   | 271.1   | 218.7 | 258.0   | 280.2  | 294.7   | 310.9   |
| 15    | 17.7  | 77.4  | 36.6  | 97.0    | 66.9  | 36.6  | 59.3    | 72.2   | 82.3    | 97.0    | 40.4  | 93.9  | 53.0    | 42.0    | 40.4  | 41.6    | 47.5   | 63.2    | 93.9    |
| 16    | 61.4  | 140.4 | 150.8 | 153.1   | 169.4 | 140.4 | 148.2   | 152.0  | 157.2   | 169.4   | 168.6 | 138.4 | 122.6   | 88.0    | 88.0  | 114.0   | 130.5  | 146.0   | 168.6   |
| 17    | 20.4  | 47.9  | 39.3  | 73.8    | 44.3  | 39.3  | 43.1    | 46.1   | 54.4    | 73.8    | 40.9  | 54.3  | 45.8    | 47.4    | 40.9  | 44.6    | 46.6   | 49.1    | 54.3    |
| 18    | 16.2  | 70.6  | 111.5 | 100.0   | 160.1 | 70.6  | 92.7    | 105.8  | 123.7   | 160.1   | 80.7  | 64.0  | 81.3    | 120.4   | 64.0  | 76.5    | 81.0   | 91.1    | 120.4   |
| 19    | 12.2  | 52.7  | 36.2  | 36.7    | 32.5  | 32.5  | 35.3    | 36.5   | 40.7    | 52.7    | 34.7  | 31.2  | 25.0    | 31.5    | 25.0  | 29.7    | 31.4   | 32.3    | 34.7    |
| 20    | 1.3   | 4.2   | 10.3  | 6.6     | 7.7   | 4.2   | 6.0     | 7.2    | 8.4     | 10.3    | 12.5  | 3.6   | 8.4     | 6.8     | 3.6   | 6.0     | 7.6    | 9.4     | 12.5    |
| 21    | 0.9   | 6.4   | 5.4   | 5.6     | 8.0   | 5.4   | 5.6     | 6.0    | 6.8     | 8.0     | 3.9   | 6.4   | 3.7     | 6.6     | 3.7   | 3.9     | 5.2    | 6.5     | 6.6     |
| 22    | 4.8   | 9.0   | 10.0  | 16.3    | 9.9   | 9.0   | 9.7     | 10.0   | 11.6    | 16.3    | 11.9  | 21.9  | 9.0     | 15.2    | 9.0   | 11.2    | 13.6   | 16.9    | 21.9    |
| 23    | 408.0 | 744.0 | 900.5 | 1,029.0 | 785.7 | 744.0 | 775.3   | 843.1  | 932.6   | 1,029.0 | 883.1 | 801.4 | 1,083.8 | 1,017.8 | 801.4 | 862.7   | 950.5  | 1,034.3 | 1,083.8 |
| 24    | 105.2 | 264.0 | 315.3 | 376.8   | 408.8 | 264.0 | 302.5   | 346.1  | 384.8   | 408.8   | 420.2 | 305.6 | 363.3   | 327.9   | 305.6 | 322.3   | 345.6  | 377.5   | 420.2   |
| 25    | 12.6  | 40.4  | 37.4  | 33.9    | 34.6  | 33.9  | 34.4    | 36.0   | 38.2    | 40.4    | 32.3  | 43.2  | 34.8    | 27.9    | 27.9  | 31.2    | 33.6   | 36.9    | 43.2    |
| 26    | 8.3   | 23.7  | 27.1  | 21.6    | 19.2  | 19.2  | 21.0    | 22.7   | 24.6    | 27.1    | 24.2  | 31.1  | 23.4    | 23.1    | 23.1  | 23.3    | 23.8   | 25.9    | 31.1    |
| 27    | 18.2  | 72.5  | 44.9  | 49.2    | 34.3  | 34.3  | 42.3    | 47.1   | 55.0    | 72.5    | 61.6  | 49.0  | 30.7    | 45.3    | 30.7  | 47.2    | 47.2   | 52.2    | 61.6    |
| 28    | 21.6  | 110.8 | 67.6  | 68.2    | 62.9  | 62.9  | 66.4    | 67.9   | 78.9    | 110.8   | 87.1  | 81.6  | 108.9   | 84.0    | 81.6  | 83.4    | 85.6   | 92.6    | 108.9   |
| 29    | 12.4  | 30.7  | 34.2  | 30.7    | 38.4  | 30.7  | 30.7    | 32.5   | 35.3    | 38.4    | 41.6  | 48.9  | 33.5    | 45.2    | 33.5  | 39.6    | 43.4   | 46.1    | 48.9    |
| 30    | 7.5   | 21.7  | 24.0  | 22.4    | 37.9  | 21.7  | 22.2    | 23.2   | 27.5    | 37.9    | 34.5  | 18.4  | 23.0    | 55.0    | 18.4  | 21.9    | 28.8   | 39.6    | 55.0    |
| 31    | 49.8  | 119.3 | 108.8 | 123.6   | 119.9 | 108.8 | 116.7   | 119.6  | 120.8   | 123.6   | 105.5 | 158.5 | 92.8    | 82.6    | 92.8  | 90.3    | 99.2   | 118.8   | 158.5   |
| 32    | 1.5   | 4.2   | 7.1   | 7.1     | 5.4   | 4.2   | 5.1     | 6.3    | 7.1     | 7.1     | 6.9   | 5.5   | 4.2     | 6.8     | 4.2   | 5.2     | 6.2    | 6.8     | 6.9     |
| 33    | 14.1  | 51.9  | 39.3  | 50.9    | 42.7  | 39.3  | 41.9    | 46.8   | 51.2    | 51.9    | 64.0  | 50.4  | 64.5    | 54.4    | 50.4  | 53.4    | 59.2   | 64.1    | 64.5    |
| 34    | 25.2  | 68.2  | 112.1 | 62.5    | 49.0  | 49.0  | 59.1    | 65.4   | 79.2    | 112.1   | 53.1  | 88.8  | 69.0    | 80.4    | 53.1  | 65.0    | 74.7   | 82.5    | 88.8    |
| 35    | 104.2 | 284.1 | 432.7 | 275.1   | 233.0 | 233.0 | 264.6   | 279.6  | 321.3   | 432.7   | 251.3 | 263.3 | 298.4   | 293.7   | 251.3 | 260.3   | 278.5  | 294.9   | 298.4   |
| 36    | 16.0  | 24.9  | 38.8  | 22.0    | 37.2  | 22.0  | 24.2    | 31.1   | 37.6    | 38.8    | 43.2  | 31.3  | 47.5    | 38.1    | 31.3  | 36.4    | 40.7   | 44.3    | 47.5    |
| 37    | 3.9   | 11.6  | 9.2   | 8.3     | 16.1  | 8.3   | 9.0     | 10.4   | 12.7    | 16.1    | 6.8   | 25.8  | 9.2     | 9.0     | 6.8   | 8.5     | 9.1    | 13.4    | 25.8    |
| 38    | 147.8 | 337.4 | 371.0 | 325.1   | 485.9 | 325.1 | 334.3   | 354.2  | 399.7   | 485.9   | 465.9 | 400.9 | 464.9   | 440.9   | 400.9 | 430.9   | 452.9  | 465.2   | 465.9   |
| 39    | 4.6   | 13.9  | 7.9   | 21.6    | 22.8  | 7.9   | 12.4    | 17.8   | 21.9    | 22.8    | 13.1  | 19.1  | 14.8    | 23.4    | 13.1  | 14.4    | 17.0   | 20.2    | 23.4    |
| 40    | 2.3   | 3.0   | 2.4   | 38.4    | 13.1  | 2.4   | 2.9     | 8.1    | 19.4    | 38.4    | 12.7  | 8.5   | 5.7     | 7.2     | 5.7   | 6.8     | 7.9    | 9.6     | 12.7    |
| 41    | 1.8   | 16.6  | 12.1  | 5.9     | 12.2  | 5.9   | 10.6    | 12.2   | 13.3    | 16.6    | 13.7  | 12.7  | 8.3     | 14.8    | 8.3   | 11.6    | 13.2   | 14.0    | 14.8    |
| 42    | 9.2   | 21.6  | 24.0  | 27.3    | 24.2  | 21.6  | 23.4    | 24.1   | 25.0    | 27.3    | 22.1  | 25.0  | 20.0    | 30.5    | 20.0  | 21.6    | 23.6   | 26.4    | 30.5    |
| 43    | 35.3  | 95.0  | 42.8  | 84.2    | 101.0 | 42.8  | 73.9    | 89.6   | 96.5    | 101.0   | 118.7 | 89.7  | 90.0    | 64.9    | 64.9  | 83.5    | 89.9   | 97.2    | 118.7   |
| 44    | 5.1   | 25.2  | 13.5  | 51.6    | 51.7  | 13.5  | 22.3    | 38.4   | 51.6    | 51.7    | 30.9  | 21.7  | 11.4    | 25.2    | 11.4  | 19.1    | 23.5   | 26.6    | 30.9    |
| 45    | 8.8   | 32.7  | 23.1  | 31.5    | 33.1  | 23.1  | 29.4    | 32.1   | 32.8    | 33.1    | 27.4  | 53.9  | 39.0    | 37.0    | 27.4  | 34.6    | 38.0   | 42.7    | 53.9    |
| 46    | 28.4  | 88.7  | 85.6  | 85.4    | 95.1  | 85.4  | 85.6    | 87.2   | 90.3    | 95.1    | 100.8 | 92.3  | 89.1    | 103.8   | 89.1  | 91.5    | 96.6   | 101.6   | 103.8   |
| 47    | 79.1  | 146.7 | 136.9 | 191.6   | 171.6 | 136.9 | 144.3   | 159.2  | 176.6   | 191.6   | 239.1 | 175.2 | 191.6   | 161.0   | 161.0 | 171.7   | 183.4  | 203.5   | 239.1   |
| 48    | 12.0  | 40.8  | 10.0  | 44.6    | 20.3  | 10.0  | 17.7    | 30.6   | 41.8    | 44.6    | 40.9  | 26.7  | 33.5    | 19.1    | 19.1  | 24.8    | 30.1   | 35.4    | 40.9    |
| 49    | 3.5   | 12.0  | 10.2  | 13.7    | 15.1  | 10.2  | 11.6    | 12.9   | 14.1    | 15.1    | 13.4  | 9.1   | 11.9    | 11.2    | 9.1   | 10.7    | 11.6   | 12.3    | 13.4    |
| 50    | 16.4  | 44.6  | 47.5  | 41.2    | 42.4  | 41.2  | 42.1    | 43.5   | 45.3    | 47.5    | 63.2  | 33.0  | 37.2    | 33.9    | 33.0  | 33.7    | 35.6   | 43.7    | 63.2    |
| 51    | 69.2  | 222.6 | 178.6 | 176.1   | 188.6 | 176.1 | 178.0   | 183.6  | 197.1   | 222.6   | 122.8 | 209.1 | 202.8   | 264.9   | 122.8 | 182.8   | 206.0  | 223.1   | 264.9   |
| 52    | 8.1   | 22.9  | 16.2  | 23.1    | 13.5  | 13.5  | 15.5    | 19.6   | 23.0    | 23.1    | 28.0  | 36.5  | 22.1    | 21.3    | 21.3  | 21.9    | 25.1   | 30.1    | 36.5    |
| 53    | 19.5  | 47.4  | 34.3  | 49.3    | 39.9  | 34.3  | 38.5    | 43.7   | 47.9    | 49.3    | 52.1  | 38.3  | 49.6    | 47.8    | 38.3  | 45.4    | 48.7   | 50.2    | 52.1    |
| 54    | 19.2  | 59.3  | 31.8  | 83.1    | 60.4  | 31.8  | 52.4    | 59.9   | 66.1    | 83.1    | 86.6  | 54.9  | 44.2    | 63.8    | 44.2  | 52.2    | 59.4   | 69.5    | 86.6    |
| 55    | 8.4   | 23.5  | 11.2  | 20.1    | 18.3  | 11.2  | 16.5    | 19.2   | 21.0    | 23.5    | 20.4  | 20.6  | 24.9    | 25.9    | 20.4  | 20.6    | 22.8   | 25.2    | 25.9    |
| 56    | 12.4  | 58.3  | 44.8  | 37.9    | 49.6  | 37.9  | 43.1    | 47.2   | 51.8    | 58.3    | 54.7  | 98.3  | 32.8    | 68.7    | 32.8  | 49.2    | 61.7   | 76.1    | 98.3    |
| 57    | 40.7  | 77.2  | 101.2 | 83.4    | 85.5  | 93.8  | 77.2    | 83.4   | 89.7    | 95.7    | 101.2 | 85.0  | 110.2   | 88.6    | 92.3  | 85.0    | 87.7   | 90.5    | 98.6    |
| 58    | 13.1  | 44.6  | 57.0  | 31.0    | 46.9  | 31.0  | 41.2    | 45.8   | 49.4    | 57.0    | 34.5  | 28.5  | 30.8    | 43.6    | 28.5  | 30.2    | 32.7   | 36.8    | 43.6    |
| 59    | 103.1 | 230.0 | 219.7 | 263.3   | 258.8 | 219.7 | 227.4   | 244.4  | 259.9   | 263.3   | 223.6 | 206.1 | 210.1   | 205.2   | 205.2 | 205.9   | 208.1  | 213.5   | 223.6   |
| 60    | 12.8  | 87.3  | 76.2  | 52.1    | 61.2  | 52.1  | 58.9    | 68.7   | 79.0    | 87.3    | 35.5  | 43.2  | 68.2    | 44.2    | 35.5  | 41.3    | 43.7   | 50.2    | 68.2    |
| 61    | 20.7  | 66.0  | 60.2  | 61.4    | 68.4  | 60.2  | 61.1    | 63.7   | 66.6    | 68.4    | 71.0  | 40.7  | 70.2    | 68.8    | 40.7  | 61.8    | 69.5   | 70.4    | 71.0    |
| 62    | 18.3  | 45.6  | 52.1  | 47.8    | 45.6  | 45.6  | 45.6    | 46.7   | 48.9    | 52.1    | 39.7  | 58.1  | 53.6    | 57.7    | 39.7  | 50.1    | 55.7   | 57.8    | 58.1    |
| 63    | 20.7  | 41.2  | 37.2  | 47.2    | 51.4  | 37.2  | 40.2    | 44.2   | 48.3    | 51.4    | 56.5  | 37.7  | 36.1    | 19.9    | 19.9  | 32.1    | 36.9   | 42.4    | 56.5    |
| 64    | 43.7  | 242.0 | 206.8 | 278.3   | 190.6 | 190.6 | 202.8   | 224.4  | 251.1   | 278.3   | 224.0 | 142.6 | 127.6   | 188.9   | 127.6 | 138.9   | 165.8  | 197.7   | 224.0   |
| 65    | 19.8  | 55.6  | 47.8  | 41.6    | 49.2  | 41.6  | 46.3    | 48.5   | 50.8    | 55.6    | 37.7  | 49.0  | 46.5    | 56.5    | 37.7  | 44.3    | 47.8   | 50.9    | 56.5    |
| 66    | 18.4  | 58.2  |       |         |       |       |         |        |         |         |       |       |         |         |       |         |        |         |         |

### Timing Intervals for Refresh Functions (in Seconds)

| DM Fx | R-Run 1 | R-Run 2 | R-Run 3 | R-Run 4 | Min  | 25%tile | Median | 75%tile | Max  |
|-------|---------|---------|---------|---------|------|---------|--------|---------|------|
| DF_CS | 22.7    | 22.4    | 24.4    | 25.0    | 22.4 | 22.7    | 23.6   | 24.6    | 25.0 |
| DF_I  | 8.4     | 7.8     | 8.7     | 8.0     | 7.8  | 8.0     | 8.2    | 8.5     | 8.7  |
| DF_SS | 54.0    | 53.9    | 57.9    | 54.2    | 53.9 | 54.0    | 54.1   | 55.1    | 57.9 |
| DF_WS | 23.3    | 22.5    | 24.5    | 25.4    | 22.5 | 23.1    | 23.9   | 24.7    | 25.4 |
| LF_CR | 52.4    | 49.2    | 52.4    | 53.0    | 49.2 | 51.6    | 52.4   | 52.5    | 53.0 |
| LF_CS | 57.4    | 57.8    | 58.7    | 60.0    | 57.4 | 57.7    | 58.3   | 59.0    | 60.0 |
| LF_I  | 13.2    | 13.4    | 15.2    | 12.5    | 12.5 | 13.1    | 13.3   | 13.8    | 15.2 |
| LF_SR | 44.0    | 35.8    | 37.7    | 39.8    | 35.8 | 37.2    | 38.8   | 40.9    | 44.0 |
| LF_SS | 50.5    | 47.6    | 54.9    | 53.1    | 47.6 | 49.8    | 51.8   | 53.5    | 54.9 |
| LF_WR | 50.1    | 50.2    | 50.3    | 49.3    | 49.3 | 49.9    | 50.2   | 50.2    | 50.3 |
| LF_WS | 54.4    | 57.6    | 56.5    | 53.7    | 53.7 | 54.2    | 55.5   | 56.8    | 57.6 |



# Preface

## TPC Benchmark™ DS Overview

The TPC Benchmark™ DS (TPC-DS) is a decision support benchmark that models several generally applicable aspects of a decision support system, including queries and data maintenance. The benchmark provides a representative evaluation of the System Under Test's (SUT) performance as a general-purpose decision support system.

This benchmark illustrates decision support systems that:

- Examine large volumes of data;
- Give answers to real-world business questions;
- Execute queries of various operational requirements and complexities (e.g., ad-hoc, reporting, iterative OLAP, data mining);
- Are characterized by high CPU and IO load;
- Are periodically synchronized with source OLTP databases through database maintenance functions.
- Run on "Big Data" solutions, such as RDBMS as well as Hadoop/Spark based systems.

A benchmark result measures query response time in single user mode, query throughput in multi user mode and data maintenance performance for a given hardware, operating system, and data processing system configuration under a controlled, complex, multi-user decision support workload

The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users. To achieve that purpose, TPC benchmark specifications require benchmark tests be implemented with systems, products, technologies and pricing that:

- a) Are generally available to users;
- b) Are relevant to the market segment that the individual TPC benchmark models or represents (e.g., TPC-DS models and represents complex, high data volume, decision support environments);
- c) Would plausibly be implemented by a significant number of users in the market segment modeled or represented by the benchmark.

In keeping with these requirements, the TPC-DS database must be implemented using commercially available data processing software, and its queries must be executed via SQL interface

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, which improve benchmark results but not real-world performance or pricing, are prohibited.

TPC benchmark results are expected to be accurate representations of system performance. Therefore, there are specific guidelines that are expected to be followed when measuring those results. The approach or methodology to be used in the measurements are either explicitly described in the specification or left to the discretion of the test sponsor. When not described in the specification, the methodologies and approaches used must meet the following requirements:

- a) The approach is an accepted engineering practice or standard;
- b) The approach does not enhance the result;
- c) Equipment used in measuring the results is calibrated according to established quality standards;
- d) Fidelity and candor is maintained in reporting any anomalies in the results, even if not specified in the benchmark requirements.

Further information is available at [www.tpc.org](http://www.tpc.org)

# General Items

## 0.1 Test Sponsor

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

This benchmark was sponsored by New H3C Technologies.

## 0.2 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:*

- *Database Tuning Options*
- *Optimizer/Query execution options*
- *Query processing tool/language configuration parameters*
- *Recovery/commit options*
- *Consistency/locking options*
- *Operating system and configuration parameters*
- *Configuration parameters and options for any other software component incorporated into the pricing structure*
- *Compiler optimization options*

*This requirement can be satisfied by providing a full list of all parameters and options, as long as all those which have been modified from their default values have been clearly identified and these parameters and options are only set once.*

The Supporting File Archive contains the Operating System and DBMS parameters used in this benchmark.

## 0.3 Configuration Diagrams

*Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:*

- *Number and type of processors*
- *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, including routers, workstations, terminals, etc., that were physically used in the test or are incorporated into the pricing structure.*
- *Type and the run-time execution location of software components (e.g., DBMS, query processing tools/languages, middle-ware components, software drivers, etc.)*

## Measured Configuration



The measured configuration consisted of:

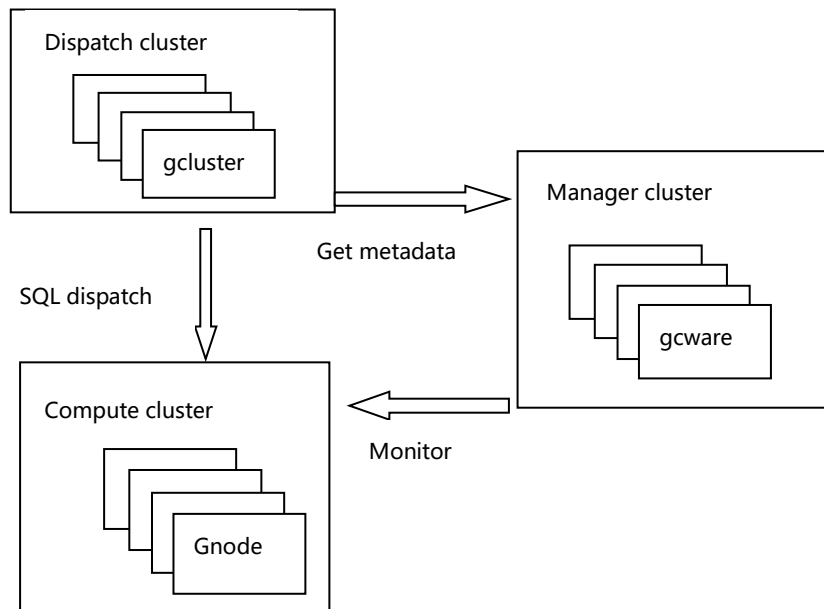
- Total Nodes: 8
- Total Processors/Cores/Threads: 16/416/832
- Total Memory: 4,096 GB
- Total Storage Capacity: 102,144 GB

Server nodes detail:

8 x H3C UniServer R4900 G3, each with:

- Processors/Cores/Threads: 2/52/104
- Processor Model: 2 x Intel Xeon Gold 6230R Processor
- Memory: 512 GB
- Storage Devices:
  - ✓ 6 x 2TB NVMe Drive (data disks)
  - ✓ 1 x 480 GB Sata SSD (boot disk)
- Network: 1x Intel E810-XXV 25Gb NIC

## GBase 8a Logical architecture



## Priced Configuration

There are no differences between the priced and measured configurations.

## GBase 8a Component Configurations

| Node | Gcluster | Gcware | Gnode |
|------|----------|--------|-------|
| 1-8  | 1        | 1      | 4     |

NOTE: In this table, gcluster, gcware, gnode are software services, not hardware nodes. We configure one gcluster, one gcware and four gnode services on one hardware node. The dispatch cluster include 8 gcluster services, manager cluster include 8 gcware services, compute cluster include 32 gnode services on 8 nodes.

## Clause 2: Logical Database Design

### 2.1 Database Definition Statements

*Listings must be provided for the DDL scripts and must include all table definition statements and all other statements used to set-up the test and qualification databases.*

The Supporting File Archive contains the table definitions and all other statements used to set up the test and qualification databases.

### 2.2 Physical Organization

*The physical organization of tables and indices within the test and qualification databases must be disclosed. If the column ordering of any table is different from that specified in Clause 2.3 or 2.4, it must be noted.*

There is no partition used and default column order used.

### 2.3 Horizontal Partitioning

*If any directives to DDLs are used to horizontally partition tables and rows in the test and qualification databases, these directives, DDLs, and other details necessary to replicate the partitioning behavior must be disclosed.*

We use some column as hash key to distribute data on all nodes. They are i\_item\_sk on item, c\_customer\_sk on customer, sr\_item\_sk on store\_returns, inv\_item\_sk on inventory, cr\_item\_sk on catalog\_returns, wr\_order\_number on web\_returns, ws\_order\_number on web\_sales, cs\_item\_sk on catalog\_sales and ss\_item\_sk on store\_sales.

### 2.4 Replication

*Any replication of physical objects must be disclosed and must conform to the requirements of Clause 2.5.3.*

No physical object was replicated.

## Clause 3: Scaling and Database Population

### 3.1 Initial Cardinality of Tables

The cardinality (e.g., the number of rows) of each table of the test database, as it existed at the completion of the database load (see Clause 7.1.2) must be disclosed.

Table 3.1 lists the cardinality of each table as they existed upon completion of the build.

Table 3.1 Initial Number of Rows

| Table Name             | Row Count      |
|------------------------|----------------|
| call_center            | 54             |
| catalog_page           | 40,000         |
| catalog_returns        | 1,440,033,112  |
| catalog_sales          | 14,399,964,710 |
| customer               | 65,000,000     |
| customer_address       | 32,500,000     |
| customer_demographics  | 1,920,800      |
| date_dim               | 73,049         |
| household_demographics | 7,200          |
| income_band            | 20             |
| inventory              | 1,311,525,000  |
| item                   | 402,000        |
| promotion              | 2,000          |
| reason                 | 70             |
| ship_mode              | 20             |
| store                  | 1,500          |
| store_returns          | 2,879,857,849  |
| store_sales            | 28,800,162,954 |
| time_dim               | 86,400         |
| warehouse              | 25             |
| web_page               | 4,002          |
| web_returns            | 720,020,485    |
| web_sales              | 7,199,963,324  |
| web_site               | 78             |

## 3.2 Distribution of Tables and Logs Across Media

*The distribution of tables and logs 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.*

| Server Node | Device Type    | Volume  | Content                      |
|-------------|----------------|---|------------------------------|
| 1-8         | Local SATA SSD | /dev/sda                                      | Operating system, root, swap |
|             | Local NVMe     | /dev/md0(/dev/nvme[0-5]n1p1<br>(Soft RAID 10) | GBase 8a ,Logs, Tables, Temp |

All the base Tables were stored on local storage.

## 3.3 Mapping of Database Partitions/Replications

*The mapping of database partitions/replications must be explicitly described.*

Neither database partitions nor replications were mapped to specific devices.

## 3.4 Implementation of RAID

*Implementations may use some form of RAID. The RAID level used must be disclosed for each device. If RAID is used in an implementation, the logical intent of its use must be disclosed.*

For each node, a soft RAID10 volume is created on six PCIe NVMe drives using the mdadm command and all GBase data is stored in this volume.

## 3.5 DBGEN Modifications

*The version number (i.e., the major revision number, the minor revision number, and third tier number) of dsdgen must be disclosed. Any modifications to the dsdgen source code (see Appendix B:) must be disclosed. In the event that a program other than dsdgen was used to populate the database, it must be disclosed in its entirety.*

Dsdgen version v2.13.0 was used. No changes were made to the dsdgen tool.

## 3.6 Database Load time

*The database load time for the test database (see Clause 7.4.3.7) must be disclosed.*

The database load time was 1,099.1 seconds.

### 3.7 Data Storage Ratio

The data storage ratio must be disclosed. It is computed by dividing the total data storage of the priced configuration (expressed in GB) by SF corresponding to the scale factor chosen for the test database as defined in Clause 3.1. The ratio must be reported to the nearest 1/100th, rounded up.

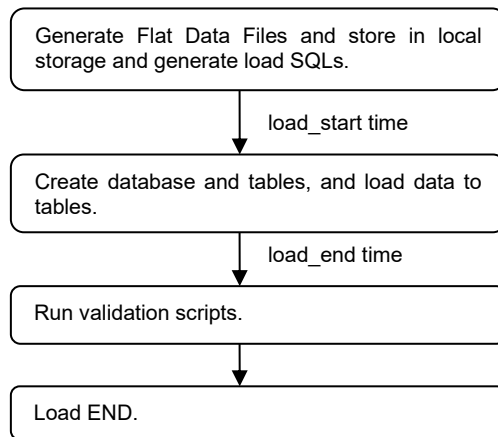
Total Storage Capacity (8 Local nodes) =  $8 \times (2048\text{GB} \times 6 + 480\text{GB}) = 102,144 \text{ GB}$

The data storage ratio is  $102,144 / 10,000 = 10.22$

### 3.8 Database Load Mechanism Details

The details of the database load must be disclosed, including a block diagram illustrating the overall process. Disclosure of the load procedure includes all steps, scripts, input and configuration files required to completely reproduce the test and qualification databases.

The database was built as shown in Figure 3.8. All of the related source code and scripts are included in the Supporting Files.



The final database load time is calculated as (load end time – load start time)

### 3.9 Qualification Database Configuration

Any differences between the configuration of the qualification database and the test database must be disclosed.

The qualification database was built using the same DDL as the test database with the following exceptions:

- The Scale factor is adjusted to 1 GB
- The generate script is not parallel run on all nodes, generate 1GB qualification data on one node.

All of the related source code and scripts are included in the Supporting Files



# Clauses 4 and 5: Query and Data

## Maintenance

### 4.1 Query Language

*The query language used to implement the queries must be identified.*

SQL was the query language used to implement the queries.

### 4.2 Verifying Random Number Generation

*The method of verification for the random number generation must be described unless the supplied dsdgen and dsqgen were used.*

TPC-supplied dsdgen version 2.13.0 and dsqgen version 2.13.0 were used.

### 4.3 Generating Values for Substitution Parameters

*The method used to generate values for substitution parameters must be disclosed. The version number (i.e., the major revision number, the minor revision number, and third tier number) of dsqgen must be disclosed.*

TPC supplied dsqgen version 2.13.0 was used to generate the substitution parameters, as follows:

```
./dsqgen -streams $stream -input ../query_templates/templates.lst -  
directory ../query_templates -dialect gbase -scale $TPCDS_SCALE -rngseed $SEED -  
verbose y - output_dir $STREAM_TMP
```

### 4.4 Query Text Minor Modifications

*The executable query text used for query validation must be disclosed along with the corresponding output data generated during the execution of the query text against the qualification database. If minor modifications have been applied to any functional query definitions or approved variants in order to obtain executable query text, these modifications must be disclosed and justified. The justification for a particular minor query modification can apply collectively to all queries for which it has been used. The output data for the power and Throughput Tests must be made available electronically upon request.*

Supporting Files Archive contains the actual query text and query output. Following are the modifications to the query.

The following MQM are used:

- Use sub-query alias (MQM e.1)  
Q2, Q14, Q23, Q49
- Use vendor-specific syntax of date expressions. (MQM f.1)  
Q5, Q12, Q16, Q20, Q21, Q32, Q37, Q40, Q77, Q80, Q82, Q92, Q94, Q95, Q98

- Use column references expression in ORDER BY clause (MQM e.2)  
Q36, Q70, Q86
- Use internal result table to hold the result set for Q64

The Supporting Files Archive contains the full set of executable query text template used in the test.

## **4.5 Query Substitution Parameters and Seeds Used**

*All the query substitution parameters used during the performance test must be disclosed in tabular format, along with the seeds used to generate these parameters.*

The Supporting Files Archive contains the query substitution parameters and seed used in the test.

## **4.6 Refresh Setting**

*All query and refresh session initialization parameters, settings and commands must be disclosed.*

The Supporting Files Archive contains the query and scripts.

## **4.7 Source Code of Refresh Functions**

*The details of how the data maintenance functions were implemented must be disclosed (including source code of any non-commercial program used).*

The Supporting Files Archive contains the source code implementing the refresh functions.

## **4.8 Staging Area**

*Any object created in the staging area (see Clause 5.1.8 for definition and usage restrictions) used to implement the data maintenance functions must be disclosed. Also, any disk storage used for the staging area must be priced, and any mapping or virtualization of disk storage must be disclosed.*

The staging area is not used.

## **Clause 6: Data Persistence Properties**

*The results of the data accessibility tests must be disclosed along with a description of how the data accessibility requirements were met.*

The data accessibility test was performed by failing the local storage of one node. This failure was induced during the execution of the first data maintenance test. The storage on each nodes made of 6 PCIe NVMe. The storage failure was simulated by removing access to 1 of the PCIe NVMe. The Supporting Files Archive contains the logs of status before and after the storage failures.

## **Clause 7: Performance Metrics and Execution Rules**

### **7.1 System Activity**

*Any system activity on the SUT that takes place between the conclusion of the load test and the beginning of the performance test must be fully disclosed including listings of scripts or command logs.*

The only activity between the end of the load test and the beginning of the performance test was the generation of the executable query text.

### **7.2 Test Steps**

*The details of the steps followed to implement the performance test must be disclosed.*

The Supporting Files Archive contains the scripts and logs.

### **7.3 Timing Intervals for Each Query and Refresh**

#### **Function**

*The timing intervals defined in Clause 7 must be disclosed.*

See the Executive Summary at the beginning of this report.

### **7.4 Throughput Test Result**

*For each Throughput Test, the minimum, the 25th percentile, the median, the 75th percentile, and the maximum times for each query shall be reported.*

See the Executive Summary at the beginning of this report.

## 7.5 Time for Each Stream

*The start time and finish time for each query stream must be reported.*

See the Executive Summary at the beginning of this report.

## 7.6 Time for Each Refresh Function

*The start time and finish time for each data maintenance function in the refresh run must be reported for the Throughput Tests.*

See the Executive Summary at the beginning of this report.

## 7.7 Performance Metrics

*The computed performance metric, related numerical quantities and the price/performance metric must be reported.*

QphDS@10000GB = 8,944,478

See the Executive Summary at the beginning of this report for more detail.

# Clause 8: SUT and Driver Implementation

## 8.1 Driver

*A detailed textual description of how the driver performs its functions, how its various components interact and any product functionalities or environmental settings on which it relies must be provided. All related source code, scripts and configuration files must be disclosed. The information provided should be sufficient for an independent reconstruction of the driver.*

The GBASE client was used to submit the queries. It connects to the GCLUSTER instance.

The command run a SQL file:

```
gccli -h${host} -P${port} -uroot -Dtpcds -c -f < SQL.sql
```

The command run a SQL command:

```
gccli -h${host} -P${port} -uroot -Dtpcds -c -e "SQL command"
```

The GCLUSTER instance accepts SQL queries from the GBASE clients and processes the queries. All queries are compiled on the GCLUSTER Coordinator node and then dispatched to the GNODE worker nodes as distributed tasks. When the tasks finish, their result is collected by the Coordinator which sends the query output to the GBASE client.

The Supporting Files Archive contains all the command, scripts and logs.

## **8.2 Implementation Specific Layer(ISL)**

*If an implementation specific layer is used, then a detailed description of how it performs its functions, how its various components interact and any product functionalities or environmental setting on which it relies must be provided. All related source code, scripts and configuration files must be disclosed. The information provided should be sufficient for an independent reconstruction of the implementation specific layer.*

No Implementation Specific Layer was used.

## **8.3 Profile-Directed Optimization**

*If profile-directed optimization as described in Clause 7.2.10 is used, such use must be disclosed. In particular, the procedure and any scripts used to perform the optimization must be disclosed.*

Profile-directed optimization was not used.

# **Clause 9: Pricing**

## **9.1 Hardware and Software Used**

*A detailed list of hardware and software used in the priced system must be reported. The rules for pricing are included in the current revision of the TPC Pricing Specification located on the TPC website (<http://www.tpc.org>)*

A detailed list of all licensed services, hardware and software, is provided in the Executive Summary of this report.

## **9.2 Availability Date**

*The System Availability Date (see Clause 7.6.5) must be the single availability date reported on the first page of the executive summary. The full disclosure report must report Availability Dates individually for at least each of the categories for which a pricing subtotal must be. All Availability Dates required to be reported must be disclosed to a precision of 1 day, but the precise format is left to the test sponsor.*

The total system is available as of the date of this report.

## **9.3 Country-Specific Pricing**

*Additional Clause 7 related items may be included in the full disclosure report for each country specific priced configuration.*

The configuration is priced in RMB for the China market.

## 9.4 Third Party Quotes

### GBase Quote

New H3C Technologies Co., Ltd.  
Located in 466 Changhe Road, Zhijiang Science Park, Hangzhou, China



Here is the information you requested regarding pricing for GBase 8a MPP products to be used in conjunction with your TPC-DS benchmark testing.  
All pricing shown is in RMB(¥)

| Part Code    | Description                               | Unit Price        | Quantity | Discount | Support                     | Extended Price |
|--------------|---|-------------------|----------|----------|-----------------------------|----------------|
| GBase 8a MPP | GBase 8a MPP V9 With 1 years 24x7 support | ¥ 187500 per node | 8        | 20%      | 20%<br>2 years 24x7 support | ¥ 1,440,000    |

Zhangshaoyong(GBase Manager of Data Intelligence Product Operation Department)  
zhangshaoyong@gbase.cn

### Digital China Group Quote

Here is the information you requested regarding pricing to Intel® Ethernet Network Adapter E810XXVDA2 MM: 978331.  
All pricing shown is RMB: 2370.00

| Part Code                    | Description                     | Unit Price    | Quantity | Total    |
|------------------------------|---------------------------------|---------------|----------|----------|
| E810-XXVDA2<br>MM:<br>978331 | Intel® Ethernet Network Adapter | ¥:<br>2370.00 | 8        | ¥: 18960 |

Dec 21, 2020  
Zhang Xiangyu  
[Zhangxyas@digitalchina.com](mailto:Zhangxyas@digitalchina.com)  
Digital China Group Co., Ltd  
Digital China Science and Technology Park, 111 Fuquan Road, Changning District, Shanghai  
Tel:021-22019765 Fax:021-22019930  
[www.digitalchina.com](http://www.digitalchina.com)

# Qizhen Electronic Quote

上海启震电子有限公司  
Shanghai Qizhen Electronic Co., Ltd.  
No.318 Line 388 Du Shi Road, Shanghai, PRC 201100  
TEL: +86 (21) 54570227



日期(Date): 2020年(Y) 12 月(M) 18 日(D)  
发信人(From): Qzhec.Service@qzhec.com

## 报价 QUOTATION

Vendor Code:1000011156

| No. | Part Number | Products&Services                | Price    | QTY | Total             | Warranty | Lead Time<br>(working days) |
|-----|-------------|----------------------------------|----------|-----|-------------------|----------|-----------------------------|
| 1   | N3K-C3232C  | CISCO N3K-C3232C 32 ports switch | 69000.00 | 1   | 69000.00          | 1year    | 15                          |
|     |             |                                  |          |     | <b>Total</b>      |          |                             |
|     |             |                                  |          |     | <b>¥69,000.00</b> |          |                             |

### Terms and Conditions

- 1 以上价格以人民币(RMB)按相关数量呈报, 包含专用增值税发票  
Prices quoted are in RMB and based on the stated quantity,include VAT
- 2 交货地址:北京  
Delivery Address:Beijing
- 3 交货周期: 25 工作日(标准),有现货可以提前交  
Lead time: 25 working days,advance with stock
- 4 报价有效期:5日  
Validity of Quotation: 5 days

### QZhec Beijing Branch

Rm. 412, Building E, Beijing XiangYu No.2 Wukiao Street Chaoyang District Beijing, PRC  
Office: +86 (10) 57572887 FAX:+86 (10) 57572887-1016

### QZhec Chengdu Branch

Room 1102 No.27 shuncheng Street JinjiangDistrict,Chengdu,610000,PRC  
Office: +86 (28) 8626 2721 FAX:+86 (28) 8626 2722

### QZhec Shenzhen Branch

Rm. 1217, GeIn Wangyuan Bldg., 96 Yantian Rd., Futian Dist., Shenzhen, Guangdong, PRC 518031  
Office: +86 (755) 8326 5701 FAX:+86 (755) 8829 1915

### QZhec Dalian Branch

Rm.1807, Block A, Kai Xuan International BLDG, No 129 Jinma Road, Kaifu District, Dalian, PRC 116600  
Office: +86 (411) 3926 7085

# Jd.com Quotes

This screenshot shows the product page for an LG 21.5-inch FreeSync monitor. The main image displays the monitor with a vibrant sunset scene. The price is listed as 699.00. The page includes a navigation bar with the LG logo, a product title, a price tag, and a '加入购物车' (Add to Cart) button. Below the main image, there are several smaller images showing different views of the monitor. The right side of the page features a list of related products and a '加入购物车' button.

This screenshot shows the product page for a Logitech MK120 keyboard and mouse set. The main image displays the white keyboard and mouse. The price is listed as 89.00. The page includes a navigation bar with the Logitech logo, a product title, a price tag, and a '加入购物车' (Add to Cart) button. Below the main image, there are several smaller images showing different views of the keyboard and mouse. The right side of the page features a list of related products and a '加入购物车' button.





## **Clause 11: Audit**

### **9.1 Auditors' 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.*

This implementation of the TPC Benchmark™ H was audited by Francois Raab of InfoSizing, a certified TPC-DS auditor. Further information regarding the audit process may be obtained from:

Francois Raab  
InfoSizing ([www.sizing.com](http://www.sizing.com))  
20 Kreg Ln.  
Manitou Springs, CO 80829  
(719) 473-7555

TPC Benchmark™ DS Full Disclosure Report and other information can be downloaded from the Transaction Processing Performance Council web site at [www.tpc.org](http://www.tpc.org).

The Auditor's Letter of Attestation is included below:

Benchmark sponsor: Guoliang Zheng, Director  
New H3C Technologies Co., Ltd.  
No. 466 Changhe Road, Binjiang District,  
Hangzhou, Zhejiang 310052  
P.R. China

December 22, 2020

I verified the TPC Benchmark™ DS (TPC-DS™ v2.13.0) performance of the following configuration:

Platform: H3C UniServer R4900 G3  
Operating System: Red Hat Enterprise Linux Server Release 7.8  
Database Manager: GBase 8a v9

The results were:

**Performance Metric** 8,944,478 QphDS@10000GB  
Database Load Time 18m 19s

**Servers** H3C UniServer R4900 G3  
8 x R4900 G3, each with:

|         |  |             |             |
|---------|--|-------------|-------------|
| CPU     | 2 x Intel Xeon Gold 6230R (2.1Ghz, 26 Cores) |             |             |
| Memory  | 512 GB                                       |             |             |
| Storage | <b>Qty</b>                                   | <b>Size</b> | <b>Type</b> |
|         | 6  | 2,048 GB    | PCIe NVMe   |
|         | 1  | 480 GB      | SATA SSD    |

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:

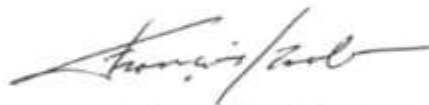
- The database records were defined with the proper layout and size
- The database population was generated using Dsdgen
- The database was properly scaled to 10,000GB and populated accordingly
- The database load time was correctly measured and reported

- The query templates were produced using approved minor query modifications and query variants.
- The query input variables were generated by Dsqgen
- The execution of the queries against the qualification database produced compliant output
- The tests were driven and sequenced according to the requirements
- The throughput tests involved 4 query streams
- The execution times for queries and data maintenance functions were correctly measured and reported
- The data accessibility test was performed and verified
- 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,



François Raab, TPC Certified Auditor

# Supporting Files Index

| Clause   | Description   | Archive File Pathname  |
|----------|---|--|
| Clause 3 | Tools for data generation, pre-generated SQL to load base tables      | SupportingFiles/Clause_3/generate_data.sh<br>SupportingFiles/Clause_3/doDatagen.sh<br>SupportingFiles/Clause_3/logs/generate_data.log<br>SupportingFiles/Clause_3/sqls/loadsql/  |
|          | Scripts and logs for load base tables                                 | SupportingFiles/Clause_3/doLoad.sh<br>SupportingFiles/Clause_3/sqls/ddl.sql<br>SupportingFiles/Clause_3/logs/load_tpcds_time.log<br>SupportingFiles/Clause_3/logs/load_tpcds.out<br>SupportingFiles/Clause_3/logs/create_tpcds_tables.out  |
|          | Scripts and SQL for validation and log files                          | SupportingFiles/Clause_3/doValidate.sh<br>SupportingFiles/Clause_3/sqls/count_tables.sql<br>SupportingFiles/Clause_3/sqls/desc_tables.sql<br>SupportingFiles/Clause_3/sqls/Validate_Data.sql<br>SupportingFiles/Clause_3/sqls/Check_Insert.sql<br>SupportingFiles/Clause_3/sqls/Check_RI.sql<br>SupportingFiles/Clause_3/sqls/create_tpcds_vld.sql<br>SupportingFiles/Clause_3/sqls/load_vld.sql<br>SupportingFiles/Clause_3/logs/row_count.out<br>SupportingFiles/Clause_3/logs/table_schema.out<br>SupportingFiles/Clause_3/logs/validate_data.log<br>SupportingFiles/Clause_3/logs/Check_Insert.log<br>SupportingFiles/Clause_3/logs/Check_RI.log |
|          | pre-generated SQL to data maintenance and output                      | SupportingFiles/Clause_3/sqls/mtsqs<br>SupportingFiles/Clause_3/logs/fetch*.out  |
| Clause 4 | The script to execute qualification test and log file                 | SupportingFiles/Clause_4/doQualification_test.sh<br>SupportingFiles/Clause_4/logs/qualification.log<br>SupportingFiles/Clause_4/logs/qual_*.out  |
|          | SQL for qualification queries   | SupportingFiles/Clause_4/queries/  |
|          | Output from executing qualification queries                           | SupportingFiles/Clause_4/output/   |
|          | Query templates modify  | SupportingFiles/Clause_4/query_templates_modify/<br>SupportingFiles/Clause_4/gbase.tpl   |
| Clause 5 | Data maintenance execution scripts and logs files for each stream [s] | SupportingFiles/Clause_5/doRefresh.sh<br>SupportingFiles/Clause_5/refresh.sh<br>SupportingFiles/Clause_5/logs/mt_[r]_time.log<br>SupportingFiles/Clause_5/logs/refresh_[s]_timing.log  |
|          | SQL scripts for DM functions for stream [s]                           | SupportingFiles/Clause_5/mtloadsql/*<br>SupportingFiles/Clause_5/mtsqs_[s]/LF*.sql<br>SupportingFiles/Clause_5/mtsqs_[s]/DF*.sql<br>SupportingFiles/Clause_5/mtsqs_[s]/ddl.sql   |

|          |  |   |
|----------|--|---|
|          | Output from executing DM functions                     | SupportingFiles/Clause_5/output/*.out   |
|          | Raw data files for maintenance                         | SupportingFiles/Clause_5/data/delete_[s].dat<br>SupportingFiles/Clause_5/data/inventory_delete_[s].dat  |
|          | MT function and data verification sqls and outputs     | SupportingFiles/Clause_5/doVerify_mt.sh<br>SupportingFiles/Clause_5/logs/run_verify_mt_[s].log<br>SupportingFiles/Clause_5/mtsqsl_[s]/fetch*.sql<br>SupportingFiles/Clause_5/mtsqsl_[s]/verify*.sql<br>SupportingFiles/Clause_5/mtsqsl_[s]/count_mt_tables.sql<br>SupportingFiles/Clause_5/output/mt_verify/*.out   |
| Clause 6 | Data accessibility test scripts, logs and output files | SupportingFiles/Clause_6/data_access.sh<br>SupportingFiles/Clause_6/data_access_test.log<br>SupportingFiles/Clause_6/data_disk_remove.out<br>SupportingFiles/Clause_6 /data_disk_status_fail.out<br>SupportingFiles/Clause_6 /data_disk_status_good.ou  |
| Clause 7 | Performance test scripts and logs                      | SupportingFiles/Clause_7/doQueryGen.sh<br>SupportingFiles/Clause_7/generate_queries.log<br>SupportingFiles/Clause_7/doPower.sh<br>SupportingFiles/Clause_7/doTT.sh<br>SupportingFiles/Clause_7/doStream.sh<br>SupportingFiles/Clause_7/logs/pt_time.log<br>SupportingFiles/Clause_7/logs/tt_[r]_time.log<br>SupportingFiles/Clause_7/logs/stream_[s]_time.log |
|          | Query text for query [q] in stream [s] by order[o]     | SupportingFiles/Clause_7/stream[s]/[s][o].query_[q].sql   |
|          | Output of query [q] in stream [s] by order[o]          | SupportingFiles/Clause_7/stream_[s]_out/[s][o].query_[q].out  |
| Clause 8 | System config  | SupportingFiles/Clause_8/system_profiles/<br>SupportingFiles/Clause_8/collect_system_profiles.sh<br>SupportingFiles/Clause_8/collect_system_profiles.log  |
|          | Database config  | SupportingFiles/Clause_8/gbase_config<br>SupportingFiles/Clause_8/collect_gbase_config.sh<br>SupportingFiles/Clause_8/collect_gbase_config.log  |
| General  | Compile tpcds  | SupportingFiles/General/compile_tpcds.sh<br>SupportingFiles/General/v2.13.0rc1  |
|          | Run all test   | SupportingFiles/General/common.sh<br>SupportingFiles/General/config.sh<br>SupportingFiles/General/hosts   |

|  |   |   |
|--|---|---|
|  |   | SupportingFiles/General/masterhost<br>SupportingFiles/General/runall.sh<br>SupportingFiles/General/run.log                          |
|  | Scripts for get q64 result,<br>sort stream outputs and<br>get QphH result | SupportingFiles/General/get_q64_result.sh<br>SupportingFiles/General/result_report.sh<br>SupportingFiles/General/sort_stream_log.sh |