



Telecommunications Technology Association



Dell Inc.

TPC Express Benchmark™ IoT Full Disclosure Report

Machbase 7.0.6

running on

Dell PowerEdge R7615
(with 5x Dell PowerEdge R7615 Nodes)

with

Red Hat Enterprise Linux Server Release 8.6

TPCx-IoT Version
Report Edition
Report Submitted

2.1.0
First
Nov 13, 2022

First Edition – November 2022

Telecommunications Technology Association (TTA), the Sponsor, and **Dell Inc. (Dell)**, the Co-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 because of these and other factors. Therefore, the TPC Express Benchmark™ V 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.

TTA and the TTA Logo are trademarks of Telecommunications Technology Association 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 TTA and any other company

Dell and the Dell Logo are trademarks of Dell Inc. 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 Dell and any other company.

TPC Express Benchmark™ IoT, TPCx-IoT, and IoTps, are registered certification marks of the Transaction Processing Performance Council.

The Dell 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 Dell business contact for information on the products or services available in your area. You can find additional information via Dell's web site at www.dell.com. Actual performance and environmental costs of Dell products will vary depending on individual customer configurations and conditions.

Copyright© 2022 Telecommunications Technology Association

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

Copyright© 2022 Dell Inc.

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.

Abstract

TTA conducted the TPC Express Benchmark™ IoT (TPCx-IoT) on the PowerEdge R7615 with 5x PowerEdge R7615 Nodes. The software used included Machbase 7.0.6. This report provides full disclosure of the methodology and results. All testing was conducted in conformance with the requirements of the TPCx-IoT Standard Specification, Revision 2.1.0.

The benchmark results are summarized below.

Configuration Summary



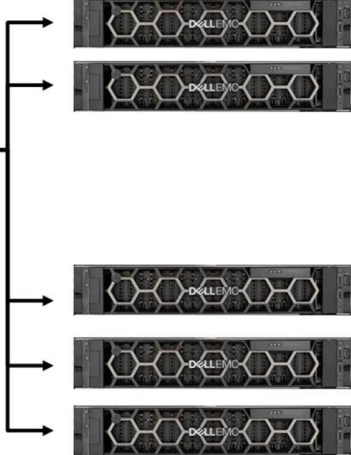
Sponsor	Cluster Nodes	Storage Software	Operating System
TTA Dell	Dell PowerEdge R7615	Machbase 7.0.6	Red Hat Enterprise Linux Release 8.6


TPC Express Benchmark™ IoT Metrics

Total System Cost (USD)	IoTps	USD/kIoTps	Availability Date
\$496,021.74	5,739,514.34	\$86.42	Feb 28, 2023

Executive Summary


The [Executive Summary](#) follows on the next several pages.


	<h1>Machbase 7.0.6</h1>		TPCx-IoT 2.1.0
			TPC Pricing 2.8.0
			Report Date Nov. 13, 2022
Total System Cost \$496,021.74 USD		TPCx-IoT Performance Metric 5,739,514.34 IoTps	Price/Performance \$86.42 USD/kIoTps
Servers	Operating System	Other Software	Availability Date
Dell PowerEdge R7615	Red Hat Enterprise Linux Server Release 8.6	None	Feb 28, 2023
System Under Test Configuration Overview			
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">  <p>NVIDIA MSN2700 100GbE Ethernet Switch (32 x QSFP28 Ports)</p> </div> <div style="width: 65%;"> <p>5 x Dell PowerEdge R7615 each with:</p>  <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>1 x Master Node(Dell PowerEdge R7615) 1 x AMD EPYC 9554 64-Core Processor 12 x 64GB (768GB) Memory 1 x 100GbE 2-Port Adaptor 1GbE 2-Port Adaptor 1 x 600GB SAS HDD</p> <p>1 x Master Node(Dell PowerEdge R7615) 1 x AMD EPYC 9554 64-Core Processor 12 x 64GB (768GB) Memory 1 x 100GbE 2-Port Adaptor 1GbE 2-Port Adaptor 1 x 960GB SAS SSD</p> </div> <div style="width: 45%;"> <p>3 x Data Nodes(Dell PowerEdge R7615) 1 x AMD EPYC 9374F 32-Core Processor 12 x 32GB (384GB) Memory 1 x 100GbE 2-Port Adaptor 1GbE 2-Port Adaptor 2 x 240GB NVMe M.2 SSD 8 x 3.84TB NVMe U.2 SSD</p> </div> </div> </div> </div>			
Total Servers: 5x Dell PowerEdge R7615 Total Processors/Cores/Threads: 5/224/448			
Server Configuration: Processor Memory Storage Device Network Controller	Master Node 2x AMD EPYC 9554 (2.7GHz, 64-core, 256 MB L3) 2x 768 GB 1x 600GB SAS U.2 HDD 1x 960GB SAS U.2 SSD 2x Mellanox MT28800 Family 100GbE 2x Broadcom BCM5720 Dual-Port 1GbE	Data Nodes 3x AMD EPYC 9374F (3.3GHz, 32-core, 256 MB L3) 3x 384 GB 6x 240GB NVMe M.2 SSD 24x 3.84TB NVMe U.2 SSD 3x Mellanox MT28800 Family 100GbE 3x Broadcom BCM5720 Dual-Port 1GbE	
Connectivity Total Rack Units:	NVIDIA MSN2700 100GbE Switch (5x PowerEdge R7615) + (1x MSN2700) = (5x2) + (1x1) = 11 RU		

		<h1>Machbase 7.0.6</h1>			TPCx-IoT	2.1.0
					TPC Pricing	2.8.0
					Report Date	Nov. 13, 2022
Description	Part Number	Source	List Price (USD)	Qty	Extended Price (USD)	3 yr. Maint. Price (USD)
Server Hardware						
Dell PowerEdge R7615(Master Node)	210-BFVW	1	81,880.00	2	163,760.00	
2.5 Chassis	379-BDTF	1	0.00	2		
NVMe Backplane	379-BDSX	1	0.00	2		
Trusted Platform Module 2.0 V3	461-AAIM	1	0.00	2		
C3-3 8x U.2 G4 RAID	321-BIFE	1	0.00	2		
AMD EPYC 9554 3.10GHz, 64C/128T, 256M Cache (360W) DDR5-4800	338-CGXC	1	0.00	2		
Standard Heatsink	412-AASE	1	0.00	2		
Performance Optimized	370-AAIP	1	0.00	2		
4800MT/s RDIMMs	370-AHCL	1	0.00	24		
64GB RDIMM, 4800MT/s Dual Rank	370-AGZR	1	0.00	2		
Unconfigured RAID	780-BCDS	1	0.00	2		
PERC H755N Front	405-AAZE	1	0.00	2		
Performance BIOS Settings	384-BBBL	1	0.00	6		
High Performance Fan	750-AAWT	1	0.00	2		
Dual, Hot-Plug,Power Supply Redundant (1+1), 1400W, Mixed Mode	450-AJHG	1	0.00	2		
Jumper Cord - C13/C14, 4M, 250V, 12A (North America, Guam,North Marianas, Philippines, Samoa)	492-BBDV	1	0.00	2		
Riser Config 2, 2 x 16 FH + 2 x 16 LP PCIe slot	330-BBNL	1	0.00	4		
Broadcom 5720 Dual Port 1GbE Optional LOM	540-BDKD	1	0.00	2		
Mellanox ConnectX-5 EX Dual Port 40/100GbE QSFP28 Adapter,PCIe Full Height	540-BCIU	1	0.00	2		
PowerEdge R7615 Motherboard	329-BHOH	1	0.00	2		
iDRAC9,Enterprise 15G	385-BBOT	1	0.00	2		
PowerEdge 2U Standard Bezel	350-BBWP	1	0.00	2		
No Quick Sync	350-BBKU	1	0.00	2		
iDRAC,Legacy Password	379-BCSG	1	0.00	2		
iDRAC Group Manager, Enabled	379-BCQV	1	0.00	2		
Red Hat Enterprise Linux 8.6 (Ootpa), kernel 4.18.0-372.9.1.el8.x86_64	605-BBFL	1	0.00	2		
No Media Required	605-BBFN	1	0.00	2		
ReadyRails Sliding Rails	770-BBBQ	1	0.00	2		
No Internal Optical Drive	429-AAIQ	1	0.00	2		
No Systems Documentation, NoOpenManage DVD Kit	631-AACK	1	0.00	2		
PowerEdge R7615 Shipping	340-CMZG	1	0.00	2		
PowerEdge R7615 Ship Material	340-CODN	1	0.00	2		
PowerEdge R7615 No CE or CCCMarking	343-BBPP	1	0.00	2		
US Order	332-1286	1	0.00	2		
Dell Hardware Limited Warranty Plus On-Site Service	827-1402	1	200.00	2		400.00
ProSupport Mission Critical:7x24 HW / SW Technical Support and Assistance 3 Years	827-1344	1	1,383.00	2		2,766.00
ProSupport Mission Critical:4-Hour 7x24 On-Site Service with Emergency Dispatch 3 Years	827-1352	1	717.00	2		1,434.00
On-Site Installation Declined	900-9997	1	0.00	2		
Dell 24 Monitor	210-AIWG	1	169.99	1	169.99	
Dell PowerEdge R7615(Data Node)	210-BFVW	1	78,873.00	3	236,619.00	
2.5 Chassis	379-BDTF	1	0.00	3		

NVMe Backplane	379-BDSX	1	0.00	3		
Trusted Platform Module 2.0 V3	461-AAIM	1	0.00	3		
C5-3 16x U.2 G4 RAID Low Z (Two PERCs)	321-BIFN	1	0.00	3		
AMD EPYC 9374F 3.85GHz, 32C/64T, 256M Cache (320W) DDR5-4800	338-CGXD	1	0.00	3		
Standard Heatsink	412-AASE	1	0.00	3		
Performance Optimized	370-AAIP	1	0.00	3		
4800MT/s RDIMMs	370-AHCL	1	0.00	3		
32GB RDIMM, 4800MT/s Dual Rank	370-AGZR	1	0.00	36		
Unconfigured RAID	780-BCDS	1	0.00	3		
BOSS-S2 controller card + with 2 M.2 240GB (RAID 1)	403-BCMG	1	0.00	3		
PERC H755N Front	405-AAZE	1	0.00	24		
3.84TB Data Center NVMe ReadIntensive AG Drive U2 Gen4 with Carrier	400-BMTN	1	0.00	3		
Performance BIOS Settings	384-BBBL	1	0.00	3		
High Performance Fan	750-AAWT	1	0.00	3		
Dual, Hot-Plug,Power Supply Redundant (1+1), 1400W, Mixed Mode	450-AJHG	1	0.00	6		
Jumper Cord - C13/C14, 4M, 250V, 12A (North America, Guam,North Marianas, Philippines, Samoa)	492-BBDV	1	0.00	3		
Riser Config 2, 2 x 16 FH + 2 x 16 LP PCIe slot	330-BBNL	1	0.00	3		
Broadcom 5720 Dual Port 1GbE Optional LOM	540-BDKD	1	0.00	3		
Mellanox ConnectX-5 EX Dual Port 40/100GbE QSFP28 Adapter,PCIe Full Height	540-BCIU	1	0.00	3		
PowerEdge R7615 Motherboard	329-BHOH	1	0.00	3		
iDRAC9,Enterprise 15G	385-BBOT	1	0.00	3		
PowerEdge 2U Standard Bezel	350-BBWP	1	0.00	3		
No Quick Sync	350-BBKU	1	0.00	3		
iDRAC,Legacy Password	379-BCSG	1	0.00	3		
iDRAC Group Manager, Enabled	379-BCQV	1	0.00	3		
Red Hat Enterprise Linux 8.6 (Ootpa), kernel 4.18.0-372.9.1.el8.x86_64	605-BBFL	1	0.00	3		
No Media Required	605-BBFN	1	0.00	3		
ReadyRails Sliding Rails	770-BBBQ	1	0.00	3		
No Internal Optical Drive	429-AAIQ	1	0.00	3		
No Systems Documentation, NoOpenManage DVD Kit	631-AACK	1	0.00	3		
PowerEdge R7615 Shipping	340-CMZG	1	0.00	3		
PowerEdge R7615 Ship Material	340-CODN	1	0.00	3		
PowerEdge R7615 No CE or CCCMarking	343-BBPP	1	0.00	3		
US Order	332-1286	1	0.00	3		
Dell Hardware Limited Warranty Plus On-Site Service	827-1402	1	200.00	3		600.00
ProSupport Mission Critical:7x24 HW / SW Technical Support and Assistance 3 Years	827-1344	1	1,383.00	3		4,149.00
ProSupport Mission Critical:4-Hour 7x24 On-Site Service with Emergency Dispatch 3 Years	827-1352	1	717.00	3		2,151.00
On-Site Installation Declined	900-9997	1	0.00	3		
Dell 24 Monitor	210-AIWG	1	169.99	1		169.99
600GB Hard Drive SAS ISE 12Gbps 10k 512n 2.5in Hot-Plug	400-BIFV	1	587.62	1		587.62
960GB SSD SAS ISE Read Intensive 12Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD, AP9567 - APC Basic Rack PDU - 0U - 120V NEMA 5-15 Input / 14 x NEMA 5-15 Output	400-AXQU	1	2468.62	1		2468.62
	A7541364	1	263.00	1		263.00
				Sub-Total		404,038.22
						11,500.00
Network Hardware						
Dell Networking S3048-ON, 48x 1GbE, 4x SFP+ 10GbE ports, Stacking, PSU to IO air, 1x AC PSU, NO OS	210-AEDQ	1	10,150.00	1		10,150.00

No OS Installed	619-AGYQ	1	0.00	1	0.00	
Dell Networking S3048-ON User Guide	634-BCXR	1	10.00	1	10.00	
Force10, Power Cord, 250V, 12A, 2 Meters, C13/C14	450-AASX	1	20.00	1	20.00	
ProDeploy Additional Deployment Time:8 Hour Onsite Project Management1	823-9284	1	2,613.75	1		2,613.75
Basic Deployment Dell Networking 1S Series Switch	825-5241	1	392.82	1		392.82
3 Years ProSupport Plus Mission Critical 4HR On-Site Service-Disti SNS	802-7389, 802-7400, 802-7415, 802-7429, 802-7430, 951-2015, 997-6306	1	6,207.13	1		6,207.13
MSN3420-CB2F Spectrum-2 based 25/100GbE 1U Open Ethernet Switch	MSN3420-CB2F	2	16,661.00	1	16,661.00	
MCP1600-C002E30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 2m Black 30AWG CA-N	MCP1600-C002E30N	2	1,832.00	1	1,832.00	
ENT Business Critical Support Services for SN3420 – 36 Months	780-C34N0Z+P2CMI36	2	3,666.00	1		3,666.00
				Sub-Total	28,673.00	12,879.7
Software						
Machbase v6.5.1 Cluster Edition (includes 1y 7x24x4 Technical Support) (1Set = 4Node)	-	3	170,000.00	1	170,000.00	
Machbase v6.5.1 Cluster Edition 7x24x4 Technical Support	-	3	25,500.00	2		51,000.00
				Sub-Total	170,000.00	51,000.00
Infrastructure						
HP 225 Wired Mouse and Keyboard Combo (w/ spares)	286J4UT#ABA	4	19.00	3	57.00	
				Sub-Total	57.00	-
Discounts*						
Hardware Server, Network Large Puchase Discount(35%)	-				(144,976.38)	(7,249.80)
Machbase v6.5.1 Cluster Edition (includes 1y 7x24x4 Technical Support)	-				(23,000.00)	
Machbase v6.5.1 Cluster Edition 7x24x4 Technical Support	-					(6,900.00)
				Sub-Total	(23,000.00)	(6,900.00)
				Total	\$434,791.84 USD	\$61,229.90 USD
Price Source 1) Dell Inc. 2) NVIDIA Inc. 3) Machbase Inc. 4) Hewlett Packard Inc. Audited by Pre-Publication Board *All discounts are based on US list prices and for similar quantities and configurations. Discounts for similarly sized configurations will be similar to those quoted here, but may vary based on the components in the configuration.				Three-Year Cost of Ownership: \$496,021.74 USD IoTps: 5,739,514.34 USD/kIoTps: \$86.42 USD		
<i>Prices used in TPC benchmarks must reflect the actual prices a customer would pay for purchase of the components in all regions specified in the result. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing conventions for the listed components. For complete details, see the pricing section of the TPC benchmark specification. If you find that stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you.</i>						

	<h2>Machbase 7.0.6</h2>	TPCx-IoT 2.1.0 TPC Pricing 2.8.0 Report Date Nov. 13, 2022
<h3>Numerical Quantities</h3>		
Scale Factor	13,000,000,000	
<h4>Performance Run (Run1)</h4>		
Warmup Run Start Time	2022-11-13 17:10:23.000	
Warmup Run End Time	2022-11-13 17:44:32.000	
Warmup Run Elapsed Time	2,049.000	
Measured Run Start Time	2022-11-13 17:44:33.000	
Measured Run End Time	2022-11-13 18:22:06.000	
Measured Run Elapsed Time	2,253.000	
Performance Metric (IoTps)	5,770,084.33	
<h4>Repeatability Run (Run2)</h4>		
Warmup Run Start Time	2022-11-13 18:23:14.000	
Warmup Run End Time	2022-11-13 18:58:07.000	
Warmup Run Elapsed Time	2,093.000	
Measured Run Start Time	2022-11-13 18:58:08.000	
Measured Run End Time	2022-11-13 19:35:53.000	
Measured Run Elapsed Time	2,265.000	
Performance Metric (IoTps)	5,739,514.34	

	<h2>Machbase 7.0.6</h2>	<table> <tr> <td>TPCx-IoT</td> <td>2.1.0</td> </tr> <tr> <td>TPC Pricing</td> <td>2.8.0</td> </tr> <tr> <td>Report Date</td> <td>Nov. 13, 2022</td> </tr> </table>	TPCx-IoT	2.1.0	TPC Pricing	2.8.0	Report Date	Nov. 13, 2022
TPCx-IoT	2.1.0							
TPC Pricing	2.8.0							
Report Date	Nov. 13, 2022							
<h3>Performance Run Report (Run1)</h3> <hr/> <p>TPCx-IoT Performance Metric (IoTps) Report</p> <p>Test Run2 details : Total Time For Warmup Run In Seconds = 2,049.000</p> <p>Test Run2 details : Total Time In Seconds = 2,253.000 Total Number of Records = 13,000,000,000</p> <p>TPCx-IoT Performance Metric (IoTps): 5,770,084.33</p> <hr/> <h3>Repeatability Run Report (Run2)</h3> <hr/> <p>TPCx-IoT Performance Metric (IoTps) Report</p> <p>Test Run1 details : Total Time For Warmup Run In Seconds = 2,093.000</p> <p>Test Run1 details : Total Time In Seconds = 2,265.000 Total Number of Records = 13,000,000,000</p> <p>TPCx-IoT Performance Metric (IoTps): 5,739,514.34</p> <hr/> <p>Summary details of the run reports are show above. For the complete run reports, see the Supporting Files Archive.</p>								


	<h1>Machbase 7.0.6</h1>	TPCx-IoT 2.1.0 TPC Pricing 2.8.0 Report Date Nov. 13, 2022						
<h2>Revision History</h2> <table><thead><tr><th data-bbox="359 616 422 645">Date</th><th data-bbox="619 616 707 645">Edition</th><th data-bbox="783 616 927 645">Description</th></tr></thead><tbody><tr><td data-bbox="359 674 518 703">Nov 13, 2022</td><td data-bbox="619 674 675 703">First</td><td data-bbox="783 674 991 703">Initial Publication</td></tr></tbody></table>			Date	Edition	Description	Nov 13, 2022	First	Initial Publication
Date	Edition	Description						
Nov 13, 2022	First	Initial Publication						

Table of Contents

Abstract.....	3
Executive Summary.....	3
Table of Contents.....	9
Clause 0 Preamble.....	10
0.1 TPC Express Benchmark™ IoT Overview.....	10
Clause 1 General Items.....	11
1.1 Test Sponsor.....	11
1.2 Parameter Settings.....	11
1.3 Configuration Diagrams.....	11
1.3.1 Measured Configuration.....	12
1.3.2 Priced Configuration.....	13
1.4 Dataset Distribution.....	13
1.5 Software Component Distribution.....	13
Clause 2 Workload Related Items.....	14
2.1 Hardware and Software Tunable Parameters.....	14
2.2 Run Report.....	14
2.3 Benchmark Kit Identification.....	15
2.4 Benchmark Kit Changes.....	15
Clause 3 Scale Factor and Metrics.....	16
3.1 Scale Factor, Performance, Price-Performance.....	16
Third-Party Price Quotes.....	17
NVIDIA Inc.....	17
Machbase Inc.....	19
Hewlett Packard Inc.....	20
Supporting File Index.....	21

Clause 0 Preamble

0.1 TPC Express Benchmark™ IoT Overview

TPC Express Benchmark™ IoT (TPCx-IoT) was developed to provide an objective measure of hardware, operating system and commercial NoSQL database software distributions, and to provide the industry with verifiable performance, price-performance and availability metrics. The benchmark models a continuous system availability of 24 hours a day, 7 days a week.

Even though the modeled application is simple, the results are highly relevant to hardware and software dealing with IoT gateway systems in general. TPCx-IoT stresses both hardware and software including database APIs and network connections to the database. This workload can be used to assess a broad range of NoSQL databases. TPCx-IoT can be used to assess a range of NoSQL implementations in a technically rigorous and directly comparable and vendor-neutral manner. The metric effectively represents the total number of records that can be inserted into a NoSQL database per second while running queries against the database.

The TPCx-IoT kit is available from the TPC (See www.tpc.org/tpcx-iot for more information). Users must sign up and agree to the TPCx-IoT User Licensing Agreement (ULA) to download the kit. Redistribution of the kit is prohibited. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include TPCx-IoT copyright. The TPCx-IoT Kit includes: the TPCx-IoT Specification document, the TPCx-IoT Users Guide document, shell scripts to set up the benchmark environment and Java code to execute the benchmark load.

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

- Are generally available to users;
- Are relevant to the market segment that the individual TPC benchmark models or represents (e.g., TPCx- IoT models and represents a NoSQL database mimicking an IoT gateway system)
- 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. 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 Telecommunications Technology Association and Dell Inc..

1.2 Parameter Settings

Settings must be provided for all customer-tunable parameters and options which have been changed from the defaults found in actual products, including by not limited to:

- *Configuration parameters and options for server, storage, network and other hardware component incorporated into the pricing structure;*
- *Configuration parameters and options for operating system and file system component incorporated into the pricing structure;*
- *Configuration parameters and options for any other software component incorporated into the pricing structure;*
- *Compiler optimization options.*

Comment 1: In the event that some parameters and options are set multiple times, it must be easily discernible by an interested reader when the parameter or option was modified and what new value it received each time.

Comment 2: This requirement can be satisfied by providing a full list of all parameters and options, as long as all those that have been modified from their default values have been clearly identified and these parameters and options are only set once.

The [Supporting Files Archive](#) contains the parameters and options used to configure the components involved in this benchmark.

1.3 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:

- *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 (for example, 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*

1.3.1 Measured Configuration

Figure 1-1 shows the measured configuration.

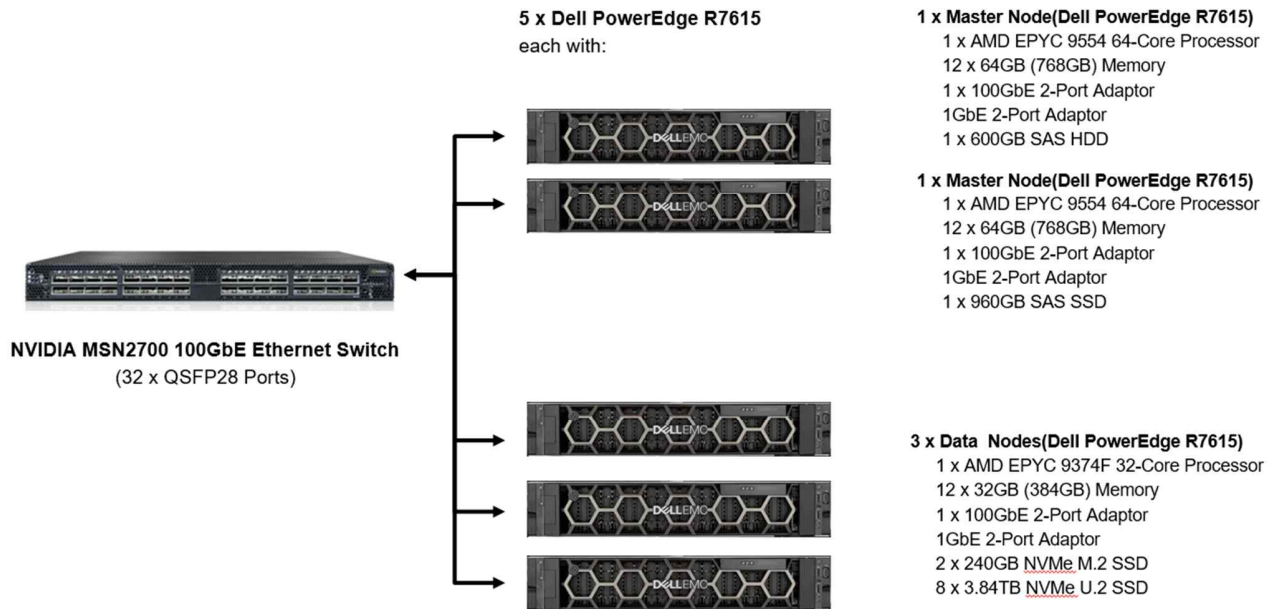


Figure 1-1 Measured Configuration

The measured configuration consisted of:

Total Nodes:	5
Total Processors/Cores/Threads:	5/224/449
Total Memory:	2,688GB
Total Number of Storage Devices:	32
Total Storage Capacity	92.93TB

Connectivity: NVIDIA MSN2700 100GbE Switch

Servers	Master Node:	3x Data Nodes:
Processors/Cores/Threads:	2/128/256	3/96/192
Processor Model:	2x AMD EPYC 9554 (2.7GHz, 64-core, 256MB L3)	3x AMD EPYC 9374F (3.3GHz, 32-core, 256MB L3)
Memory:	2x 768GB	3x 384GB
Storage Devices:	1x 600GB SAS U.2 HDD 1x 960GB SAS U.2 SSD	6x 240GB NVMe M.2 SSD 24x 3.84TB NVMe U.2 SSD
Network Controller:	2x Mellanox MT28800 Family 100GbE 2x Broadcom BCM5720 Dual-Port 1GbE	3x Mellanox MT28800 Family 100GbE 3x Broadcom BCM5720 Dual-Port 1GbE

The distribution of software components over server nodes is detailed in section 1.5.

1.3.2 Priced Configuration

There are no differences between the priced configuration and the measured configuration.

1.4 Dataset Distribution

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

Table 1-1 describes the distribution of the dataset across all storage media in the system.

Server	Storage	Disk Drive	Description of Content
1-2	U.2 PCIe Gen3	1 x 600GB SAS HDD	Machbase Broker, Operating System, Root, Swap, coordinator
	U.2 PCIe Gen3	1 x 960GB SAS SSD	
3-5	M.2 PCIe Gen4	3 x 240GB NVMe SSD	Operating System, Root, Swap Machbase Data,
	U.2 PCIe Gen4	8 x 3.84TB NVMe SSD	

Table 1-1 Dataset Distribution Across Storage Media

1.5 Software Component Distribution

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

Table describes the distribution of the software components across the system.

Server	Broker	Coordinator	Warehouse
1	X	X	
2	X	X	
3			X
4			X
5			X

Table 1-2 Software Component Distribution Across Nodes

The storage system software used was Machbase 7.0.6.

Clause 2 Workload Related Items

2.1 Hardware and Software Tunable Parameters

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

The [Supporting Files Archive](#) contains all configuration scripts.

2.2 Run Report

The run report generated by the TPCx-IoT Kit for Performance Run and Repeatability Run must be reported.

The [Supporting Files Archive](#) contains the full run report. The following excerpts from the run report summarize the Performance Run and the Repeatability Run.

Run Report for Run 1 (Repeatability Run)

=====
TPCx-IoT Performance Metric (IoTps) Report

Test Run 1 details : Total Time For Warmup Run In Seconds = 2,049.000

Test Run 1 details : Total Time In Seconds = 2,253.000

Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 5,770,084.33
=====

Run Report for Run 2 (Performance Run)

=====
TPCx-IoT Performance Metric (IoTps) Report

Test Run 2 details : Total Time For Warmup Run In Seconds = 2,093.000

Test Run 2 details : Total Time In Seconds = 2,265.000

Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 5,739,514.34
=====

2.3 Benchmark Kit Identification

The version of the TPCx-IoT kit and checksums for key files are listed below.

TPCx-IoT Kit Version	2.1.0
----------------------	-------

File	MD5
TPC-IoT-master.sh	cc24620cfdee08290d771c5471a8d1ee
tpcx-iot/machbase-binding/lib/core-0.13.0-SNAPSHOT.jar	7566fae175b35cd2e396814ecba3da39
IoT_cluster_validate_suite.sh	b2342754095f973ce27f43c28d3ca0ae

The md5sum in our publication is different from that of the official KIT, because we used a pre-published compile of the KIT, which was also used for testing the KIT as part of the release procedure.

2.4 Benchmark Kit Changes

No modifications were made to TPC-provided kit.

Clause 3 Scale Factor and Metrics

3.1 Scale Factor, Performance, Price-Performance

The metrics for Run 1 and Run 2 are summarized below.

	Run 1	Run 2
Scale Factor	13,000,000,000	13,000,000,000
Measured Run Time (seconds)	2,253.000	2,265.000
IoTps	5,770,084.33	5,739,514.34

Run2 Price-Performance: 86.42 \$/kIoTps

Third-Party Price Quotes

NVIDIA Inc



Date: 11/8/2022
 Quote #: Q-865140
 Opportunity #: O-313351
 Expiration Date: 2/6/2023

Advanced Micro Devices (AMD)

End Customer
 Advanced Micro Devices (AMD)
 United States

Pricing Request Type

NPN Solution Provider
 Direct

NVIDIA Salesperson
 Martin McNarney
 mcnarney@nvidia.com

Qty	Part Number	Reference Part Number	Description	Term (Year)	Unit Price	Discount (%)	Sale Price	Total
1	920-9N213-00F7-0X0	MSN3420-CB2F	Mellanox Spectrum-2 based 25GbE/100GbE 1U Open Ethernet switch with Onyx , 48 SFP28 ports and 12 QSFP28 ports, 2 Power Supplies (AC), x86 CPU, sh ort depth, P2C airflow, Rail Kit		\$16,661.00	0.00	\$16,661.00	\$16,661.00
1	780-C34N0Z +P2CMI36		NVIDIA ENT Business Critical Support Services for SN3420 - 36 Months	3	\$3,666.00	0.00	\$3,666.00	\$3,666.00

Net Total \$20,327.00


NOTES

- All pricing is in USD and subject to change. Pricing does not include currency conversion fees, taxes or VAT, and other considerations that may affect the final price that you pay.
- Purchase Order Receipt Date AND Customer Request Date (CRD) must be earlier than Quote expiration date.
- Distributor Purchase Order to NVIDIA:
 - Quote number listed in this document must be included and can only be used for one unique order and may not be used in any other orders.
 - All products, quantities, pricing, reseller and end customer information must align with those on the referenced, valid quote.
 - Reseller, Reseller Contact, End Customer information
 - Must include full company name with no acronyms or abbreviations, address, first and last name of the product end customer contact, and a valid email address with a domain that matches the company name.
- Please reference your NVIDIA Price List for all ordering rules.
- This document serves as a pricing information to the Distributor.
- This quotation is subject to the terms and conditions specified in the applicable signed agreement between NVIDIA and Partner. In the absence of such signed agreement, NVIDIA's Standard Terms & Conditions will apply.
- Accordingly, the products are offered under the applicable terms and conditions, and this quotation is expressly conditional on acceptance of such terms and conditions. No additional or conflicting terms and conditions will apply without NVIDIA's prior, express written consent, and any such additional or conflicting terms and conditions on partner's purchase order, acknowledgement or other business form are hereby rejected by NVIDIA.

2788 San Tomas Expressway | Santa Clara, CA 95051 | T 408.486.2000 | F 408.486.2200 | www.nvidia.com

The screenshot shows the NVIDIA Networking product page. At the top, there is a navigation bar with the NVIDIA logo and links for Products, Solutions, Industries, and For You. On the right side of the navigation bar, there are links for Shop, Drivers, and Support, along with a search icon and a user profile icon. Below the navigation bar, the word "Networking" is prominently displayed. Underneath "Networking", there are dropdown menus for Products, Solutions, Industries, and Support. A secondary navigation bar contains links for Ethernet, Infiniband, DPU, Interconnect, Proof of Concepts, Request Pricing, and Contact Us. The main content area features a product listing for the "NVIDIA MCP1600-C002E30N DAC Cable Ethernet 100GbE QSFP28 2m". To the left of the product name is an image of the cable. To the right, the price is listed as "\$229.00 MSRP*" and there is a green "Buy Now" button. Below the product name, there are four expandable details: Technology: Ethernet, Max Speed: 100GbE, Connector Type: QSFP28, and Length: 2.0m.

Machbase Inc.

Quotation						
Doc. No. : MACH-SALES-20210222-05	Business License	120-87-96403				
Date : 2022-11-09	Company	Machbase Inc.	CEO	Andrew Kim		
To : TTA	BusinessTerritory	Service, Business Service	ProductType	Software		
CC : Mr. Seo Byong Joon	Address	10, Teheran-ro 20-gil, Gangnam-gu				
Charge : Grey Shim (+82-10-9910-8086)		Seoul, Korea				
Here we quote as follows		Tel.	T : 02-2109-5607	F : 02-2038-4607		
Quote	210,210	USD (VAT Incl.)				
No.	Content	List Price (USD/Set)	Proposed Price (USD/Set)	Quantity (1Set=5Node)	Supply Price (USD)	Tax. Incl. (USD)
1	Machbase Cluster Edition V7.0.6	170,000	147,000	1	147,000	161,700
	Machbase Run-Time License					
	Machbase Time Series DBMS					
	Machbase Client Developmet Kit					
	Machbase Coordinator					
	Machbase Broker					
	Machbase Warehouse					
	Machbase Web Admin					
	Machbase Tag Analyzer					
No.	Content	Ref. Price (USD)	Maintenance Rate (%)	Total Period (Year)	Supply Price (USD)	Tax. Incl. (USD)
2	Maintenance	147,000	15%	2.00	44,100	48,510
	Support & On-site Guide					
	Fault Handling					
	API Connection					
	Guide for Server & Node Configuration					
Total					191,100	210,210
<< REMARK >>						
.- Here is a quote for applying a Machbase time series database for TTA.						
.- Quotation : Machbase Cluster Edition Run-Time License 5 nodes(1set) and 3 years Maintenance (1 Year for free)						
.- Maintenance: Free maintenance for one year after the contract, 15% of maintenance rate applied afterwards.						
.- Payment terms: Cash payment terms. (Within 30 days of issue of tax invoice)						
.- Server installation condition: It is recommended to separate DB server and Storage server.						
.- Installation : Cluster Edition - 7 Days, DB Table Guide is seperately guided with DB Professional Service.						
.- Quotation validity period: 120 days from the date of quotation						
						

Hewlett Packard Inc.

Black Friday Deals Now Save up to 70% on limited time doorbusters, FREE shipping storewide. Need help? Sale experts available. Call: 877-203-4758 [SHOP](#)

EXPERT SALES HELP: 1-866-625-3906 ORDER STATUS CUSTOMER SERVICE DISCOUNT PROGRAMS MY HP REWARDS SIGN IN/REGISTER

Explore Shop Support

/ HP PAVILION KEYBOARD AND MOUSE 200

HP Pavilion Keyboard and Mouse 200

- Simple shortcuts for better work
- Type in total comfort
- Compact, clean design [See all Specs](#)


Can't find what you are looking for? [SEE SIMILAR PRODUCTS](#)

~~\$24.99~~ **SAVE \$3.00** **\$21.99** [Earn 1X HP Rewards Points](#)

[ADD TO CART](#)

IN STOCK Ships in 1 business day

[ADD TO COMPARE](#) Product # 90F28AA#ABL



1/6

Supporting File Index

Clause	Description	Archive Pathname
Clause 1	Parameters and options used to configure and tune the SUT	/Clause1
Clause 2	Configuration scripts and Run Report	/Clause2
Clause 3	System configuration details	/Clause3