Telecommunications Technology Association

Super Micro Computer, Inc.

TPC Express Benchmark™ IoT Full Disclosure Report

Machbase 8.0.1

running on

Supermicro A+ Server 1115SV-WTNR

(with 5x Supermicro A+ Server 1115SV-WTNR Nodes)

with

Red Hat Enterprise Linux Server Release 8.6

TPCx-IoT Version	2.1.0
Report Edition	First
Report Submitted	Sep 18, 2023

First Edition – September 2023

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Abstract

TTA conducted the TPC Express Benchmark™ IoT (TPCx-IoT) on the 5x Supermicro A+ Server 1115SV-WTNR. The software used included Machbase 8.0.1. 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 SuperMicro	Supermicro A+ Server 1115SV-WTNR	Machbase 8.0.1	Red Hat Enterprise Linux Release 8.6

TPC Express Benchmark™ IoT Metrics

Total System Cost (USD)	IoTps	USD/kIoTps	Availability Date
$248,443.45	4,529,397.35	$54.85	Sep 18, 2023

Executive Summary

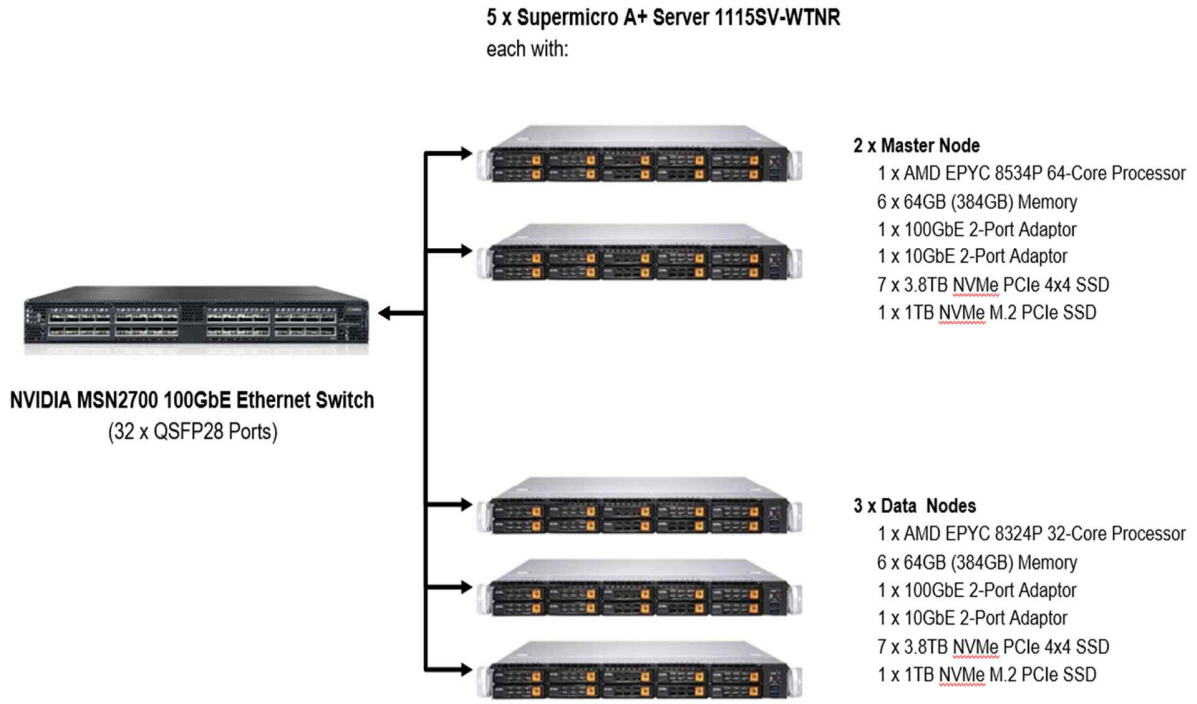
The Executive Summary follows on the next several pages.

	Machbase 8.0.1	TPCx-IoT 2.1.0 TPC Pricing 2.8.0 Report Date Sep. 18, 2023

Total System Cost	TPCx-IoT Performance Metric	Price/Performance
$248,443.45 USD	**4,529,397.35 IoTps**	**$54.85 USD/kIoTps**

Servers	Operating System	Other Software	Availability Date
Supermicro A+ Server 1115SV-WTNR	Red Hat Enterprise Linux Server Release 8.6	None	Sep 18, 2023

System Under Test Configuration Overview



Total Servers:	5x Supermicro A+ Server 1115SV-WTNR	
Total Processors/Cores/Threads:	5/224/448	
Server Configuration:	2x Master Node	3x Data Nodes
Processor	1x AMD EPYC 8534P (2.30GHz, 64-core, 128 MB L3)	1x AMD EPYC 8324P (2.65GHz, 32-core, 128 MB L3)
Memory	384 GB	384 GB
Storage Device	1x 1TB NVMe M.2 PCIe SSD Gen4 7x 3.8TB NVMe PCIe SSD Gen4	1x 1TB NVMe M.2 PCIe SSD Gen4 7x 3.8TB NVMe PCIe SSD Gen4
Network Controller	1x Mellanox CX-7 100GbE 1x Broadcom BCM57416 Dual-Port 10GbE	1x Mellanox CX-7 100GbE 1x Broadcom BCM57416 Dual-Port 10GbE
Connectivity	NVIDIA MSN2700 100GbE Switch	
Total Rack Units:	(5x 1115SV-WTNR) + (1x MSN2700) = (5x1) + (1x1) = 6 RU	

	Machbase 8.0.1	TPCx-IoT	2.1.0
		TPC Pricing	2.8.0
		Report Date	Sep. 18, 2023

Description	Part Number	Source	List Price (USD)	Qty	Extended Price (USD)	3 yr. Maint. Price (USD)
Server Hardware						
Supermicro A+ Server AS -1115SV-WTNRT (OPTIMIZED [NR]H13SVW-NT, CSE-116BTS-R000WNP,PWS-861A-1R)	AS -1115SV-WTNRT-OTO-10	1	10,456.00	2	20,912.00	
AS -1115SV-WTNRT(x1)[NR]H13SVW-NT, CSE-116BTS-R000WNP, PWS-861A-1R(CQ8600917423)	-	-	-	-		
8471.49.0000 / 5A992C	-	-	-	-		
PSE-SMP8534P-64C200W(x1)PSE-SMP8534P-64C200W	-	-	-	-		
MEM-DR564MC-ER48(x6)64GB DDR5-4800 2RX4 (16Gb) RDIMM	-	-	-	-		
8473.30.0002 / EAR99	-	-	-	-		
HDS-M2N4-960G0-E1-TXD-SED-110(x1)SSD M.2 NVMe PCIe4 960GB 1DWPD TLC D, SED/TCG 110mm	-	-	-	-		
8523.51.0000 / 5A992C	-	-	-	-		
HDS-25N4-003T8-E1-TXD-SED-007(x7)SSD 2.5" NVMe PCIe4 3.8TB 1DWPD TLC D, SED/TCG 7mm	-	-	-	-		
8523.51.0000 / 5A992C	-	-	-	-		
AOC-CX7660030-ST0(x1)Nvidia 900-9X766-003N-ST PCIe 1-port IB NDR200 OSFP Gen5	-	-	-	-		
8517.62.0050 / 5A992C	-	-	-	-		
AOC-STG-B2T-O(x1)Standard LP 2-port 10Gbase-T,Broadcom 57416,HF,RoHS	-	-	-	-		
8517.62.0050 / 5A992C	-	-	-	-		
MC0037(x1)ASSEMBLY FEE	-	-	-	-		
CBL-MCIO-1326M5(x2)MCIO (x8 to x8), STR,26cm,G5,32AWG, RoHS,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
CBL-MCIO-1340M5-1(x2)MCIO x8 (STR to STR),semi-flat, 40cm,32AWG,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
CBL-MCIO-1218M5(x1)MCIO x8 (STR to STR),18CM,85OHM,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
OS4HR3(x1)3 YR ONSITE 24X7X4 SERVICE	-	-	-	-		
Sales Tax	-	-	-	-	1,908.22	
Supermicro A+ Server AS -1115SV-WTNRT (OPTIMIZED [NR]H13SVW-NT, CSE-116BTS-R000WNP, PWS-861A-1R)	AS -1115SV-WTNRT-OTO-90	1	9,020.00	3	27,060.00	
AS -1115SV-WTNRT(x1)[NR]H13SVW-NT, CSE-116BTS-R000WNP, PWS-861A-1R(CQ8600918405)	-	-	-	-		
8471.49.0000 / 5A992C	-	-	-	-		
PSE-SMP8324P-32C180W(x1)PSE-SMP8324P-32C180W	-	-	-	-		
MEM-DR564MC-ER48(x6)64GB DDR5-4800 2RX4 (16Gb) RDIMM	-	-	-	-		
8473.30.0002 / EAR99	-	-	-	-		
HDS-M2N4-960G0-E1-TXD-SED-110(x1)SSD M.2 NVMe PCIe4 960GB 1DWPD TLC D, SED/TCG 110mm	-	-	-	-		
8523.51.0000 / 5A992C	-	-	-	-		
HDS-25N4-003T8-E1-TXD-SED-007(x7)SSD 2.5" NVMe PCIe4 3.8TB 1DWPD TLC D, SED/TCG 7mm	-	-	-	-		
8523.51.0000 / 5A992C	-	-	-	-		
AOC-CX7660030-ST0(x1)Nvidia 900-9X766-003N-ST PCIe 1-port IB NDR200 OSFP Gen5	-	-	-	-		
8517.62.0050 / 5A992C	-	-	-	-		
AOC-STG-B2T-O(x1)Standard LP 2-port 10Gbase-T, Broadcom 57416,HF,RoHS	-	-	-	-		

8517.62.0050 / 5A992C	-	-	-	-		
MC0037(x1)ASSEMBLY FEE	-	-	-	-		
CBL-MCIO-1326M5(x2)MCIO (x8 to x8), STR, 26cm,G5,32AWG, RoHS,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
CBL-MCIO-1340M5-1(x2)MCIO x8 (STR to STR), semi-flat, 40cm,32AWG,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
CBL-MCIO-1218M5(x2)MCIO x8 (STR to STR),18CM,85OHM,RoHS	-	-	-	-		
8544.42.0000 / EAR99	-	-	-	-		
OS4HR3(x1)3 YR ONSITE 24X7X4 SERVICE	-	-	-	-		
Sales Tax	-	-	-	-	2,469.23	
				Sub-Total	52,349.45	-
Network						
NVIDIA MSN2700-CS2F Spectrum 100GbE 1U Open Ethernet Switch	MSN2700-CS2F	2	21,568.00	1	21,568.00	
Mellanox MCP1600-E002E30 Passive NVIDIA MCP1600-C001E30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N	MCP1600-C001E30N	2	144.00	5	720.00	
Mellanox Technical Support and Warranty - Silver 3 Year with 4 Hours On-Site Support for SN2000 Series Switch	781-C27N4Z+P2CMI36	2	10,131.00	1		10,131.00
				Sub-Total	22,288.00	10,131.00
Software						
Red Hat Enterprise Linux Server8.6 with Premium Support 1 Year	RH00003	3	1,299.00	15		19,485.00
Machbase v8.0.1 Cluster Edition (includes 1y 7x24x4 Technical Support) (1Set = 5Node)	-	4	170,000.00	1	170,000.00	
Machbase v8.0.1 Cluster Edition 7x24x4 Technical Support	-	4	25,500.00	2		51,000.00
				Sub-Total	170,000.00	70,485.00
Infrastructure						
HP M27fw FHD Monitor (w/ spares)	2H1A4AA#ABA	5	159.00	3	477.00	
HP 225 Wired Mouse and Keyboard Combo (w/ spares)	286J4UT#ABA	5	21.00	3	63.00	
				Sub-Total	540.00	-
Discounts*						
Machbase v8.0.1 Cluster Edition (includes 1y 7x24x4 Technical Support)	-				(59,500.00)	
Machbase v8.0.1 Cluster Edition 7x24x4 Technical Support	-					(17,850.00)
				Sub-Total	(59,500.00)	(17,850.00)
				Total	**$185,677.45 USD**	**$62,766.00 USD**

Price Source
1) Super Micro Computer Inc. 2) NVIDIA Inc. 3) Red Hat Inc.
4) Machbase Inc. 5) 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:	**$248,443.45 USD**
IoTps:	**4,529,397.35**
USD/kIoTps:	**$54.85 USD**

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.

Machbase 8.0.1

TPCx-IoT	2.1.0
TPC Pricing	2.8.0
Report Date	Sep. 18, 2023

Numerical Quantities

Scale Factor	13000000000

Performance Run (Run2)

Warmup Run Start Time	2023-08-30 16:26:37.000
Warmup Run End Time	2023-08-30 17:09:45.000
Warmup Run Elapsed Time	2,587.186
Measured Run Start Time	2023-08-30 17:09:46.000
Measured Run End Time	2023-08-30 17:57:37.000
Measured Run Elapsed Time	2,870.139
Performance Metric (IoTps)	**4,529,397.35**

Repeatability Run (Run1)

Warmup Run Start Time	2023-08-30 17:58:57.000
Warmup Run End Time	2023-08-30 18:42:27.000
Warmup Run Elapsed Time	2,610.021
Measured Run Start Time	2023-08-30 18:42:29.000
Measured Run End Time	2023-08-30 19:27:46.000
Measured Run Elapsed Time	2,716.382
Performance Metric (IoTps)	4,785,777.55

Machbase 8.0.1

TPCx-IoT	2.1.0
TPC Pricing	2.8.0
Report Date	Sep. 18, 2023

Performance Run Report (Run2)

==========

TPCx-IoT Performance Metric (IoTps) Report
Test Run2 details : Total Time For Warmup Run In Seconds = 2,587.186
Test Run2 details : Total Time In Seconds = 2,870.139
Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 4,529,397.35

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Repeatability Run Report (Run1)

==========

TPCx-IoT Performance Metric (IoTps) Report
Test Run1 details : Total Time For Warmup Run In Seconds = 2,610.021
Test Run1 details : Total Time In Seconds = 2,716.382
Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 4,785,777.55

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Summary details of the run reports are show above. For the complete run reports, see the Supporting Files Archive.

Table of Contents

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. Re-distribution 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 co-sponsored by Telecommunications Technology Association and Super Micro Computer, 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.

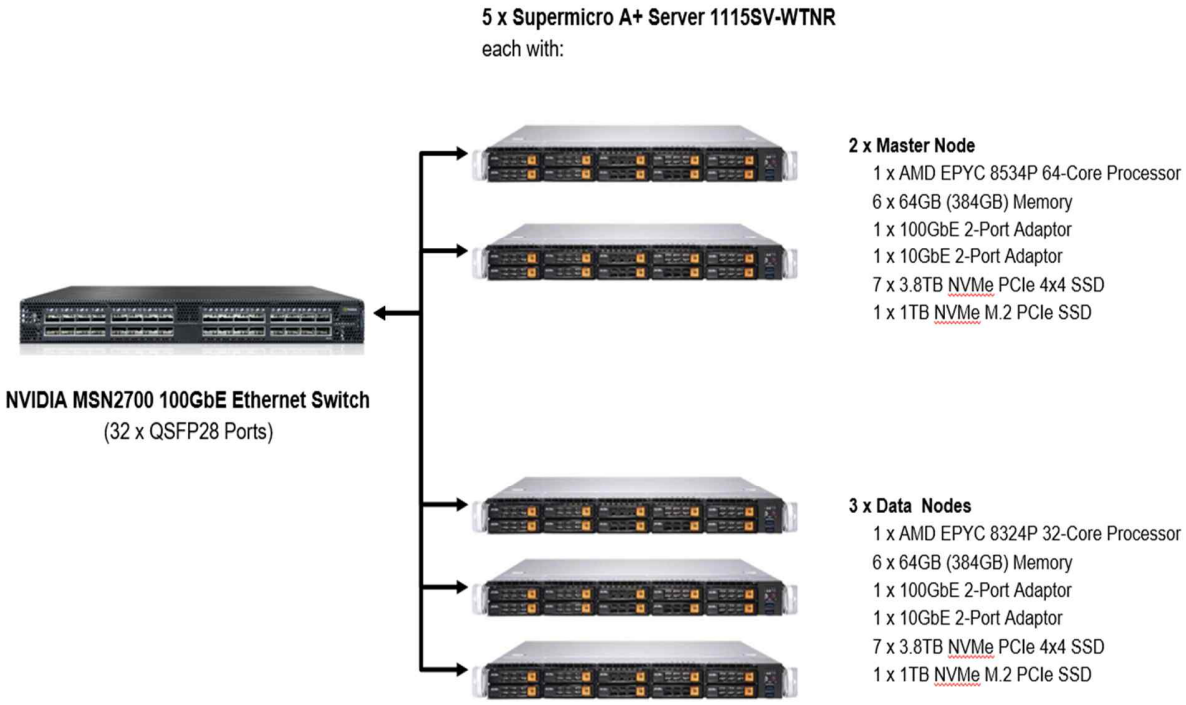

Figure 1-1 Measured Configuration

The measured configuration consisted of:

Total Nodes:	5	
Total Processors/Cores/Threads:	5/224/448	
Total Memory:	1.92TB	
Total Number of Storage Devices:	40	
Total Storage Capacity	29.5TB	
Connectivity:	NVIDIA MSN2700 100GbE Switch	
Servers	2x Master Node:	3x Data Nodes:
Processors/Cores/Threads:	1/64/128	1/32/64
Processor Model:	1x AMD EPYC 8534P (2.30GHz, 64-core, 128MB L3)	1x AMD EPYC 8324P (2.65GHz, 32-core, 128MB L3)
Memory:	384GB	384GB
Storage Devices:	1x 1TB NVMe M.2 PCIe SSD Gen4 7x 3.8TB NVMe PCIe SSD Gen4	1x 1TB NVMe M.2 PCIe SSD Gen4 7x 3.8TB NVMe PCIe SSD Gen4
Network Controller:	1x Mellanox CX-7 100GbE 1x Broadcom BCM57416 Dual-Port 10GbE	1x Mellanox CX-7 100GbE 1x Broadcom BCM57416 Dual-Port 10GbE

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
1-3	M.2 PCIe Gen4 PCIe Gen4	1 x 1TB NVMe SSD 7 x 3.8TB NVMe SSD	Operating System, Root, Swap, Machbase Coordinator, Machbase Data
4-5	M.2 PCIe Gen4 PCIe Gen4	1 x 1TB NVMe SSD 7 x 3.8TB NVMe SSD	Operating System, Root, Swap, Machbase Broker, Machbase Data

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		X
5	X		X

Table 1-2 Software Component Distribution Across Nodes

The storage system software used was Machbase 8.0.1.

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 = 2,587.186
Test Run 1 details : Total Time In Seconds = 2,870.139
Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 4,529,397.35

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Run Report for Run 2 (Performance Run)

==========

TPCx-IoT Performance Metric (IoTps) Report
Test Run 2 details : Total Time For Warmup Run In Seconds = 2,610.021
Test Run 2 details : Total Time In Seconds = 2,716.382
Total Number of Records = 13,000,000,000

TPCx-IoT Performance Metric (IoTps): 4,785,777.55

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2.1 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	a03b7d2a9fe20ade6e223a639ae2b8f5
IoT_cluster_validate_suite.sh	b2342754095f973ce27f43c28d3ca0ae

2.2 Benchmark Kit Changes

No modifications were made to TPC-provided kit.

Clause 3 System Under Test and Benchmark Driver

See files in directory clause3 of supporting files

Clause 4 Scale Factor and Metrics

4.1 Scale Factor, Performance, Price-Performance

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

	Run 1	Run 2
Scale Factor	13000000000	13000000000
Measured Run Time (seconds)	2,870.139	2,716.382
IoTps	4,529,397.35	4,785,777.55

Run2 Price-Performance: 54.85 $/kIoTps

Third-Party Price Quotes

NVIDIA Inc.

Date: 8/24/2023
Quote # Q-1003297
Opportunity # O-313351
Expiration Date 11/22/2023

Advanced Micro Devices (AMD)

Pricing Request Type

NPN Solution Provider
Direct

End Customer
Advanced Micro Devices (AMD)
United States

NVIDIA Salesperson
Martin McNarney
mcnarney@nvidia.com

Qty	MoQ	Part Number	Reference Part Number	Description	Term (Year)	Unit Price	Discount (%)	Sale Price	Total
1	6	920-9N101-00F7-0C1	MSN2700-CS2FC	NVIDIA Spectrum based 100GbE 1U Open Ethernet Switch with Cumulus Linux, 32 QSFP28 ports, 2 Power Supplies (AC), x86 CPU, standard depth, P2C ai rflow, Rail Kit		$21,568.00	0.00	$21,568.00	$21,568.00
1	0	781-C27N4Z +P2CMI36		NVIDIA ENT Business Critical Support Services 4HR On-Site CE for SN2700_ CL - 36.0 Months	3	$10,131.00	0.00	$10,131.00	$10,131.00

Net Total $31,699.00

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.
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  - Reseller, Reseller Contact, End Customer information
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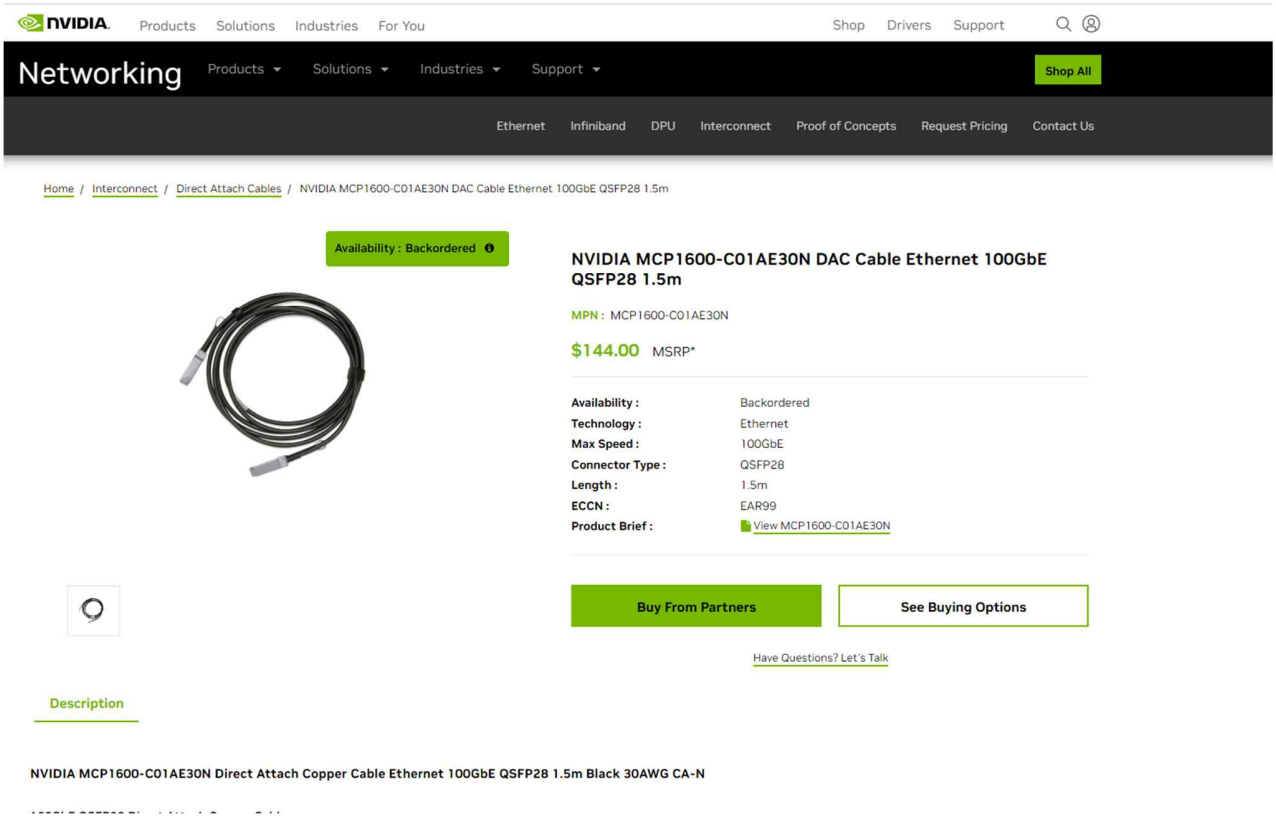
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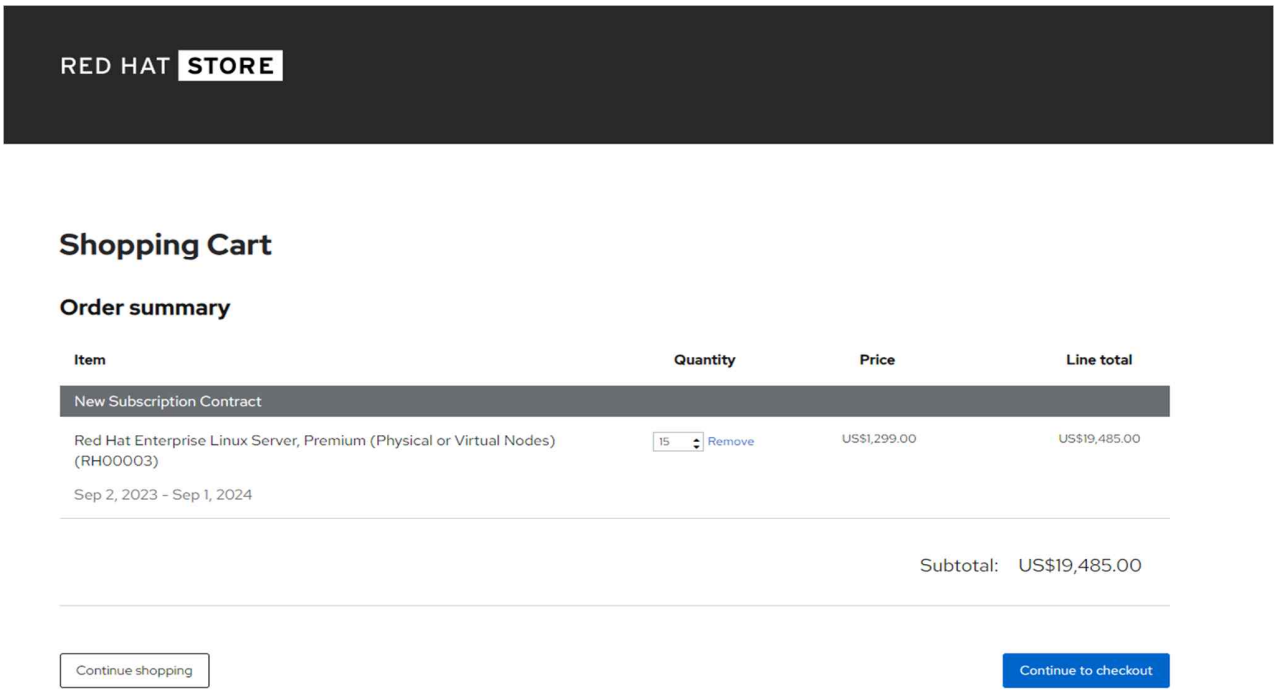
Home / Interconnect / Direct Attach Cables / NVIDIA MCP1600-C01AE30N DAC Cable Ethernet 100GbE QSFP28 1.5m
Availability : Backordered
NVIDIA MCP1600-C01AE30N DAC Cable Ethernet 100GbE QSFP28 1.5m
MPN : MCP1600-C01AE30N
$144.00 MSRP*
Availability : Backordered
Technology : Ethernet
Max Speed : 100GbE
Connector Type : QSFP28
Length : 1.5m
ECCN : EAR99
Product Brief : View MCP1600-C01AE30N
Buy From Partners
See Buying Options
Have Questions? Let's Talk
Description
NVIDIA MCP1600-C01AE30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 1.5m Black 30AWG CA-N

Red Hat Inc.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Item
Quantity
Price
Line total
New Subscription Contract
Red Hat Enterprise Linux Server, Premium (Physical or Virtual Nodes) (RH00003)
15
Remove
US$1,299.00
US$19,485.00
Sep 2, 2023 - Sep 1, 2024
Subtotal: US$19,485.00
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Machbase Inc.

Quotation

Doc. No.	: MACH-SALES-20230831-01	Business License	120-87-96403		
Date	: 2023-08-31	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 belows	Tel.	T : 02-2038-4606		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 V8.0.1**	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)

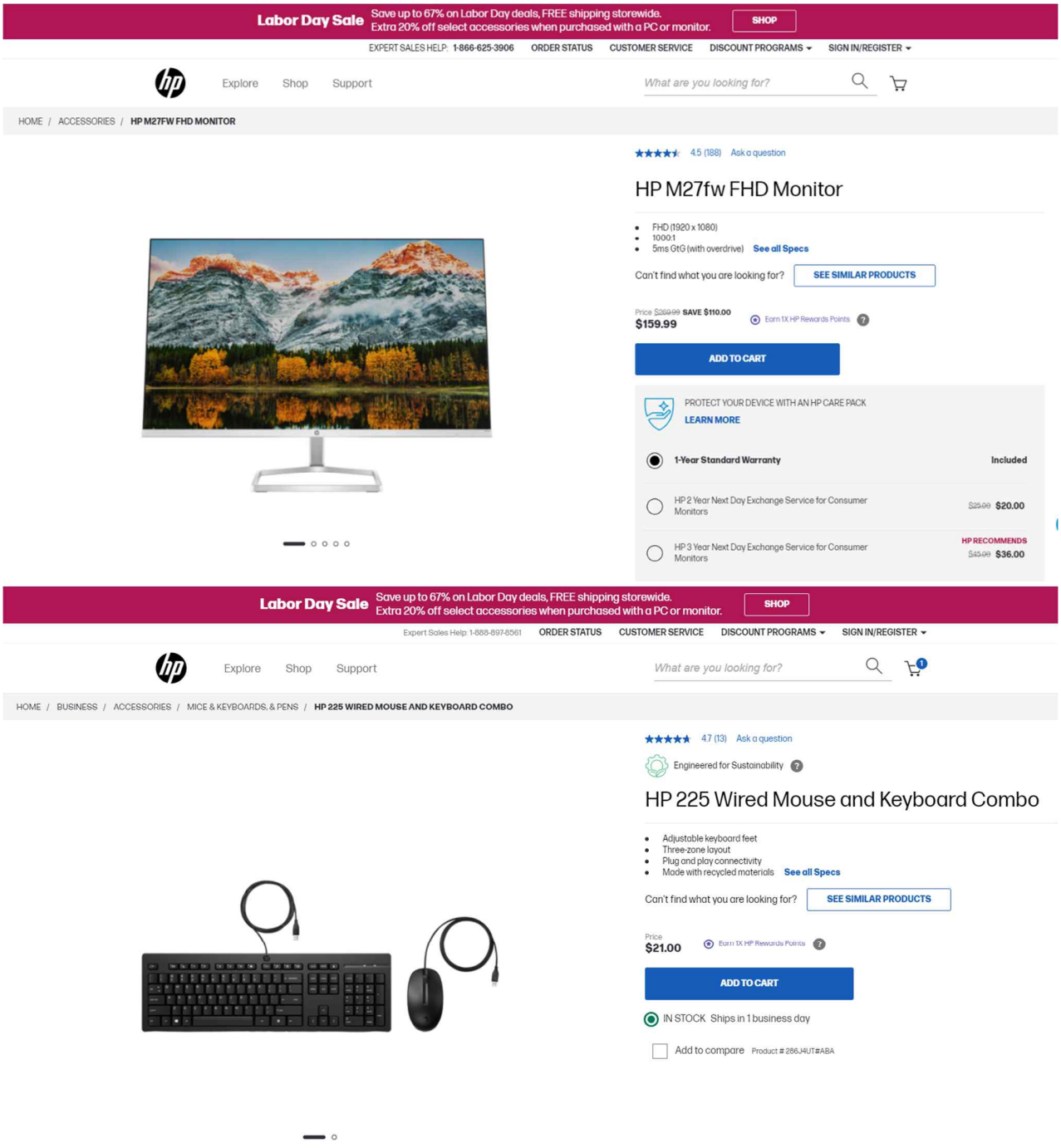
.- Server installation condition: It is recommended to separate DB server and Storage server.

.- 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

MACHBASE

Hewlett Packard Inc.



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