Telecommunications Technology Association

TPC Express Benchmark™ IoT Full Disclosure Report

Machbase 6.5.1

running on

Supermicro A+ Server 1114S-WN10RT

(with 4x H12SSW-NTR Nodes)

with

Red Hat Enterprise Linux Server Release 8.3

TPCx-IoT Version	2.0.0
Report Edition	Second
Report Submitted	April 2, 2021

Second Edition(First Edition released on <March 2021>)

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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.

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Abstract

TTA conducted the TPC Express Benchmark™ IoT (TPCx-IoT) on the Supermicro A+ Server 1114S-WN10RT with 4x H12SSW-NTR Nodes. The software used included Machbase 6.5.1. 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 2.0.0.

The benchmark results are summarized below.

Configuration Summary

Sponsor	Cluster Nodes	Storage Software	Operating System
TTA	Supermicro A+ Server 1114S-WN10RT	Machbase 6.5.1	Red Hat Enterprise Linux Release 8.3

TPC Express Benchmark™ IoT Metrics

Total System Cost (USD)	IoTps	USD/kIoTps	Availability Date
$302,788	3,410,800.16	$88.78	Mar 16, 2021

Executive Summary

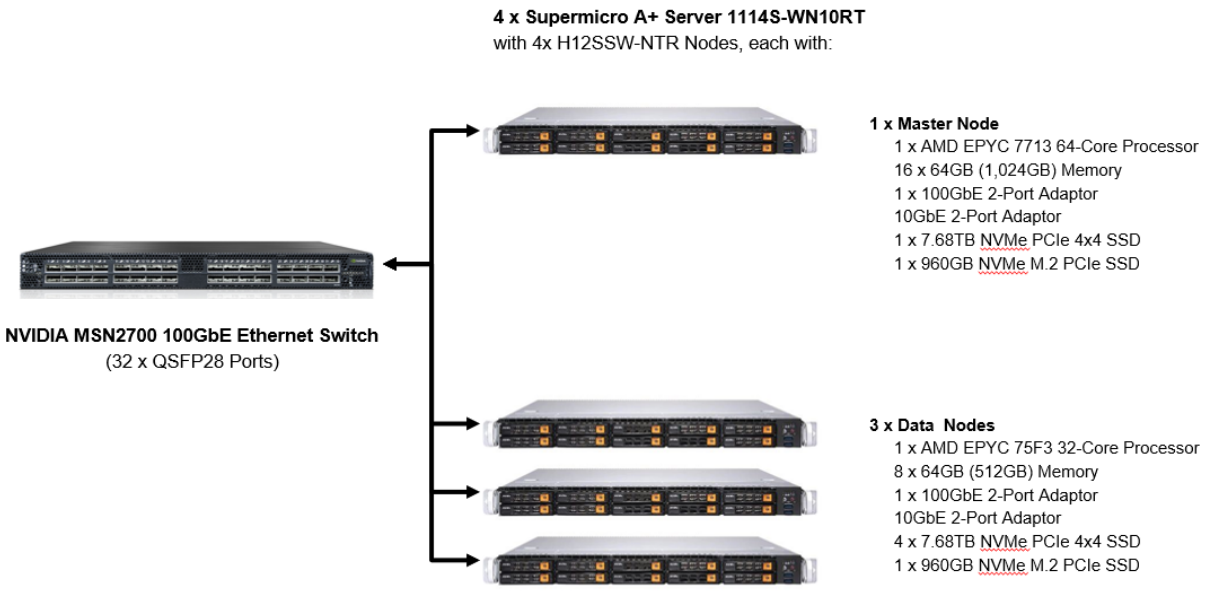
The Executive Summary follows on the next several pages.

TTA	**Machbase 6.5.1**	TPCx-IoT 2.0.0 TPC Pricing 2.6.0 Report Date April. 02, 2021

Total System Cost	TPCx-IoT Performance Metric	Price/Performance
$302,788 USD	**3,410,800.16 IoTps**	**$88.78 USD/kIoTps**

Servers	Operating System	Other Software	Availability Date
Supermicro A+ Server 1114S-WN10RT	Red Hat Enterprise Linux Server Release 8.3	None	Mar 16, 2021

System Under Test Configuration Overview



Total Servers:	4x Supermicro A+ Server 1114S-WN10RT (with 4x H12SSW-NTR Nodes)	
Total Processors/Cores/Threads:	4/160/320	
Server Configuration:	1x Master Node	3x Data Nodes
Processor	1x AMD EPYC 7713 (2.00GHz, 64-core, 256 MB L3)	1x AMD EPYC 75F3 (2.95GHz, 32-core, 256 MB L3)
Memory	1,024 GB	512 GB
Storage Device	1x 960GB NVMe M.2 PCIe SSD Gen3 1x 7.68TB NVMe PCIe SSD Gen4	1x 960GB NVMe M.2 PCIe SSD Gen3 4x 7.68TB NVMe PCIe SSD Gen4
Network Controller	1x Mellanox MT27800 Family 100GbE 1x Broadcom BCM57416 NetXtreme-E Dual-Media 10GbE	1x Mellanox MT27800 Family 100GbE 1x Broadcom BCM57416 NetXtreme-E Dual-Media 10GbE
Connectivity	NVIDIA MSN2700 100GbE Switch	
Total Rack Units:	(4x 1114S-WN10RT) + (1x MSN2700) = (4x1) + (1x1) = 5 RU	

Machbase 6.5.1

TPCx-IoT	2.0.0
TPC Pricing	2.6.0
Report Date	April. 02, 2021

Description	Part Number	Source	List Price (USD)	Qty	Extended Price (USD)	3 yr. Maint. Price (USD)
Server Hardware						
Supermicro A+ Server 1114S-WN10RT	MBD-H12SSW-NTR	1	1,506.00	4	6,024.00	
AMD EPYC 7713 64-Core Processor	-	1	5,070.00	1	5,070.00	
AMD EPYC 75F3 32-Core Processor	-	1	4,920.00	3	14,760.00	
Supermicro 64GB DDR4-3200(PC4-25600)	MEM-DR464L-HL02-BR32	1	277.00	40	11,080.00	
Kioxia CD6 7.68TB NVMe PCIe 4x4	HDS-TUN0-KCD6XLUL7T68	1	990.00	13	12,870.00	
Mellanox Technologies MT27800 Family [ConnectX-5] Dual-port 100GbE card	-	1	1,060.00	4	4,240.00	
Micron 7300 PRO 960GB PCIe NVMe M.2	HDS-MMN-MTFDHBA960TDF1AW	1	130.00	4	520.00	
ASSEMBLY FEE	MC0037	1	-	1	-	
Maintenance - 7x24x4 Care Pack (3-yrs)	OS4HR3	1	2,000.00	4	-	8,000.00
				Sub-Total	54,564.00	8,000.00
Network						
NVIDIA MSN2700-CS2F Spectrum 100GbE 1U Open Ethernet Switch	MSN2700-CS2F	2	33,003.00	1	33,003.00	
Mellanox MCP1600-E002E30 Passive NVIDIA MCP1600-C001E30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N	MCP1600-C001E30N	2	85.00	6	510.00	
Mellanox Technical Support and Warranty - Silver 3 Year with 4 Hours On-Site Support for SN2000 Series Switch	SUP-SN2000-3S-4H	3	1,981.00	1		1,981.00
				Sub-Total	33,513.00	1,981.00
Software						
Red Hat Enterprise Linux Server8.3 with Premium Support 1 Year	RH00003	4	1,299.00	12		15,588.00
Machbase v6.5.1 Cluster Edition (includes 1y 7x24x4 Technical Support) (1Set = 4Node)	-	5	170,000.00	1	170,000.00	
Machbase v6.5.1 Cluster Edition 7x24x4 Technical Support	-	5	25,500.00	2		51,000.00
				Sub-Total	170,000.00	66,588.00
Infrastructure						
HP EliteDisplay E190i 18.9-inch LED Backlit IPS Monitor (w/ spares)	E4U30A8#ABA	6	179.00	3	537.00	
HP C2500 Desktop(Keyboard and Mouse) (w/ spares)	H3C53AA#ABA	6	35.00	3	105.00	
				Sub-Total	642.00	-
Discounts*						
Machbase v6.5.1 Cluster Edition (includes 1y 7x24x4 Technical Support)	-				(25,000.00)	
Machbase v6.5.1 Cluster Edition 7x24x4 Technical Support	-					(7,500.00)
				Sub-Total	(25,500.00)	(7,500.00)
				Total	**$233,719.00 USD**	**$69,069.00 USD**

Price Source

1) Super Micro Computer Inc. 2) NVIDIA Inc. 3) Mellanox Technologies Inc.
4) Red Hat Inc. 5) Machbase Inc. 6) 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:	**$302,788 USD**
IoTps:	**3,410,800.16**
USD/kIoTps:	**$88.78 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 6.5.1	TPCx-IoT	2.0.0
		TPC Pricing	2.6.0
		Report Date	April. 02, 2021

Numerical Quantities

Scale Factor	6440000000

Performance Run (Run2)

Warmup Run Start Time	2021-03-03 02:02:07.000
Warmup Run End Time	2021-03-03 02:32:50.000
Warmup Run Elapsed Time	1,841.657
Measured Run Start Time	2021-03-03 02:32:50.000
Measured Run End Time	2021-03-03 03:04:19.000
Measured Run Elapsed Time	1,888.120
Performance Metric (IoTps)	**3,410,800.16**

Repeatability Run (Run1)

Warmup Run Start Time	2021-03-03 00:54:58.000
Warmup Run End Time	2021-03-03 01:25:02.000
Warmup Run Elapsed Time	1,802.580
Measured Run Start Time	2021-03-03 01:25:02.000
Measured Run End Time	2021-03-03 01:56:09.000
Measured Run Elapsed Time	1,866.829
Performance Metric (IoTps)	3,449,699.99

Performance Run Report (Run2)

```
================================================
TPCx-IoT Performance Metric (IoTps) Report
Test Run2 details :     Total Time For Warmup Run In Seconds = 1,841.657
Test Run2 details :     Total Time In Seconds = 1,888.120
                        Total Number of Records = 6440000000

TPCx-IoT Performance Metric (IoTps): 3410800.1610

================================================
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Repeatability Run Report (Run1)

```
================================================
TPCx-IoT Performance Metric (IoTps) Report
Test Run1 details :     Total Time For Warmup Run In Seconds = 1,802.580
Test Run1 details :     Total Time In Seconds = 1,866.829
                        Total Number of Records = 6440000000

TPCx-IoT Performance Metric (IoTps): 3449699.9993

================================================
```

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

Revision History

Date	Edition	Description
March 15, 2021	First	Initial Publication
April 2, 2021	Second	Update Price Performance Metric

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 sponsored by Telecommunications Technology Association.

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.

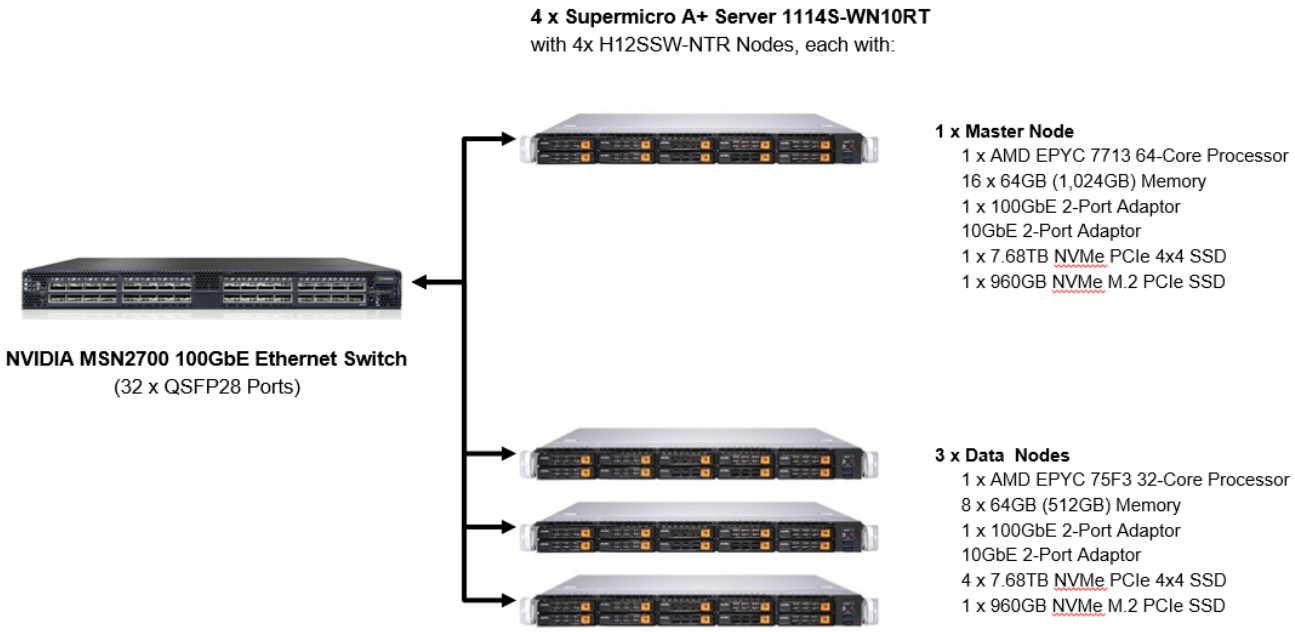


Figure 1-1 Measured Configuration

The measured configuration consisted of:

Total Nodes:	4	
Total Processors/Cores/Threads:	4/160/320	
Total Memory:	1.53TB	
Total Number of Storage Devices:	17	
Total Storage Capacity	103.68TB	
Connectivity:	NVIDIA MSN2700 100GbE Switch	
Servers	1x Master Node:	3x Data Nodes:
Processors/Cores/Threads:	1/64/128	1/32/64
Processor Model:	1x AMD EPYC 7713 (2.00GHz, 64-core, 256MB L3)	1x AMD EPYC 75F3 (2.95GHz, 32-core, 256MB L3)
Memory:	1,024GB	512GB
Storage Devices:	1x 960GB NVMe M.2 PCIe SSD Gen3 1x 7.68TB NVMe PCIe SSD Gen4	1x 960GB NVMe M.2 PCIe SSD Gen3 4x 7.68TB NVMe PCIe SSD Gen4
Network Controller:	1x Mellanox MT27800 Family 100GbE 1x Broadcom BCM57416 NetXtreme-E Dual-Media 10GbE	1x Mellanox MT27800 Family 100GbE 1x Broadcom BCM57416 NetXtreme-E Dual-Media 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	M.2 PCIe Gen3 PCIe Gen4	1 x 960GB NVMe SSD 1 x 7.68TB NVMe SSD	Machbase Broker, Operating System, Root, Swap
2-4	M.2 PCIe Gen3 PCIe Gen4	1 x 960GB NVMe SSD 4 x 7.68TB NVMe SSD	Operating System, Root, Swap Machbase Data, coordinator

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		
2		X	X
3			X
4			X

Table 1-2 Software Component Distribution Across Nodes

The storage system software used was Machbase 6.5.1.

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 = 1,802.580
Test Run 1 details :    Total Time In Seconds = 1,866.829
                        Total Number of Records = 6440000000

TPCx-IoT Performance Metric (IoTps): 3449699.9993

================================================
```

Run Report for Run 2 (Performance Run)

```
================================================
TPCx-IoT Performance Metric (IoTps) Report
Test Run 2 details :    Total Time For Warmup Run In Seconds = 1,841.657
Test Run 2 details :    Total Time In Seconds = 1,888.120
                        Total Number of Records = 6440000000

TPCx-IoT Performance Metric (IoTps): 3410800.1610

================================================
```

2.3 Benchmark Kit Identification

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

TPCx-IoT Kit Version	1.0.5

File	MD5
TPC-IoT-master.sh	aabeca02709f778295fcd1891ce3f74e
tpcx-iot/machbase-binding/lib/core-0.13.0-SNAPSHOT.jar	18b59e748a7026036e85e2e70ba45af5
IoT_cluster_validate_suite.sh	1d85705dc67fb3c767d7a1fe8775275f

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	6440000000	6440000000
Measured Run Time (seconds)	1,866.829	1,888.120
IoTps	3,449,699.99	3,410,800.16

Run2 Price-Performance: 88.78 $/kIoTps

Third-Party Price Quotes

Super Micro Computer Inc.

SUPERMICRO

Quotation

980 Rock Ave.
San Jose, CA 95131 US
Phone: (408) 503-8000 Fax: (408) 503-8008
Please email PO to Supermicro Order Desk: epo@supermicro.com
and cc Supermicro Sales Representative.

Date	Page
02/18/2021	1
Quotation Number 860050274	
Expiration Date 07/15/2021	

Sold To:
ADVANCED MICRO DEVICES, INC (CA) DEBBIE CHRISTOPHER
2485 AUGUSTINE DRIVE
SANTA CLARA CA 95054-3002 USA

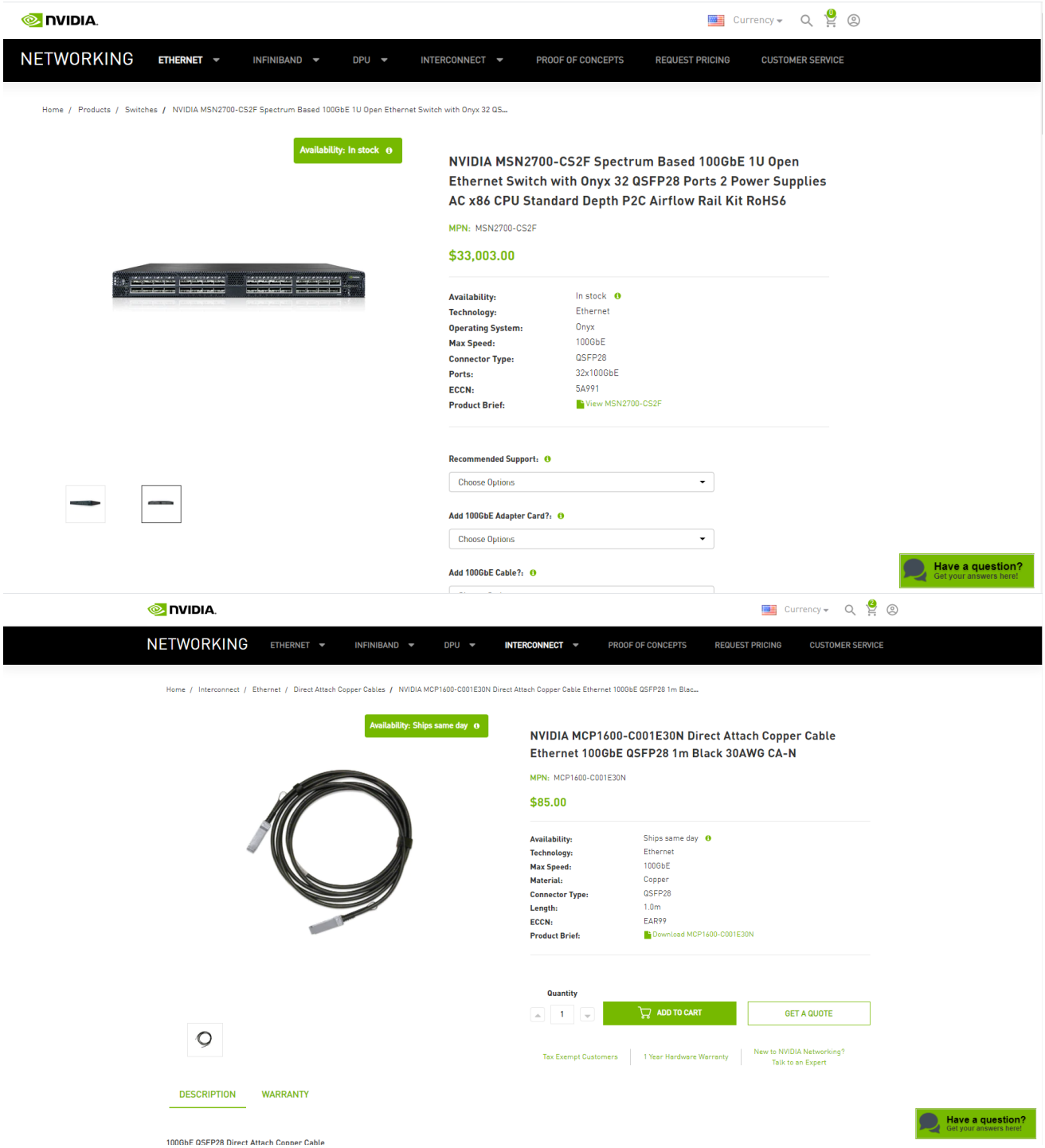
Ship To:
ADVANCED MICRO DEVICES, INC (CA) DEBBIE CHRISTOPHER
2485 AUGUSTINE DRIVE
SANTA CLARA CA 95054-3002 USA

Reference	Customer No.	Salesperson	Incoterms	Ship Via	Payment Terms
	AM00360U00	VIVIAN HUYEN	Ex Works	FED GROUND CUST	NET 45 DAYS

Qty. Ord.	Item Number	Description	Unit Price	UoM	Extended Price
4	AS -1114S-WN10RT	H12SSW-NTR, CSE-116TS-R706WBP5-N10, RoHS 8471.49.0000 / 5A992C	1,506.00	EA	6,024.00
1		Milan 7713 64C/128T	5,070.00	EA	5,070.00
3		Milan 75F3 32C/64T	4,920.00	EA	14,760.00
40	MEM-DR464L-HL02-BR32	64GB DDR4-3200 2Rx4 (16Gb) ECC RDIMM	277.00	EA	11,080.00
13	HDS--TUN0-KCD6XLUL7T68	Kioxia CD6 7.68TB NVMe PCIe 4x4 2.5" 15mm SIE 1DWPD 8523.B1.000 / BA992C	990.00	EA	12,870.00
4		Mellanox Technologies MT27800 Family [ConnectX-5] Dual-port 100GbE card	1060.00	EA	4,240.00
4	HDS-MMN-MTFDHBA960TDF1AW	Micron 7300 PRO 960GB PCIe NVMe M.2 22x80mm, 3D TLC, 1DWPD	130.00	EA	520.00
1	MC0037	ASSEMBLY FEE	0.00	EA	0.00
4	OS4HR3	3 YR ONSITE 24X7X4 SERVICE	2,000.00	EA	8,000.00

Comments:		
	Less Order Discount	
	Subtotal	62,564.00
	Total sales tax	0.00
	Total order	62,564.00

NVIDIA Inc


NVIDIA
Currency
NETWORKING
ETHERNET
INFINIBAND
DPU
INTERCONNECT
PROOF OF CONCEPTS
REQUEST PRICING
CUSTOMER SERVICE
Home / Products / Switches / NVIDIA MSN2700-CS2F Spectrum Based 100GbE 1U Open Ethernet Switch with Onyx 32 QS...
Availability: In stock
NVIDIA MSN2700-CS2F Spectrum Based 100GbE 1U Open Ethernet Switch with Onyx 32 QSFP28 Ports 2 Power Supplies AC x86 CPU Standard Depth P2C Airflow Rail Kit RoHS6
MPN: MSN2700-CS2F
$33,003.00
Availability: In stock
Technology: Ethernet
Operating System: Onyx
Max Speed: 100GbE
Connector Type: QSFP28
Ports: 32x100GbE
ECCN: 5A991
Product Brief: View MSN2700-CS2F
Recommended Support:
Choose Options
Add 100GbE Adapter Card?:
Choose Options
Add 100GbE Cable?:
Have a question?
Get your answers here!
NVIDIA
Currency
NETWORKING
ETHERNET
INFINIBAND
DPU
INTERCONNECT
PROOF OF CONCEPTS
REQUEST PRICING
CUSTOMER SERVICE
Home / Interconnect / Ethernet / Direct Attach Copper Cables / NVIDIA MCP1600-C001E30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 1m Blac...
Availability: Ships same day
NVIDIA MCP1600-C001E30N Direct Attach Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N
MPN: MCP1600-C001E30N
$85.00
Availability: Ships same day
Technology: Ethernet
Max Speed: 100GbE
Material: Copper
Connector Type: QSFP28
Length: 1.0m
ECCN: EAR99
Product Brief: Download MCP1600-C001E30N
Quantity
1
ADD TO CART
GET A QUOTE
Tax Exempt Customers
1 Year Hardware Warranty
New to NVIDIA Networking? Talk to an Expert
DESCRIPTION
WARRANTY
100GbE QSFP28 Direct Attach Copper Cable
Have a question?
Get your answers here!

Mellanox Technologies Inc.

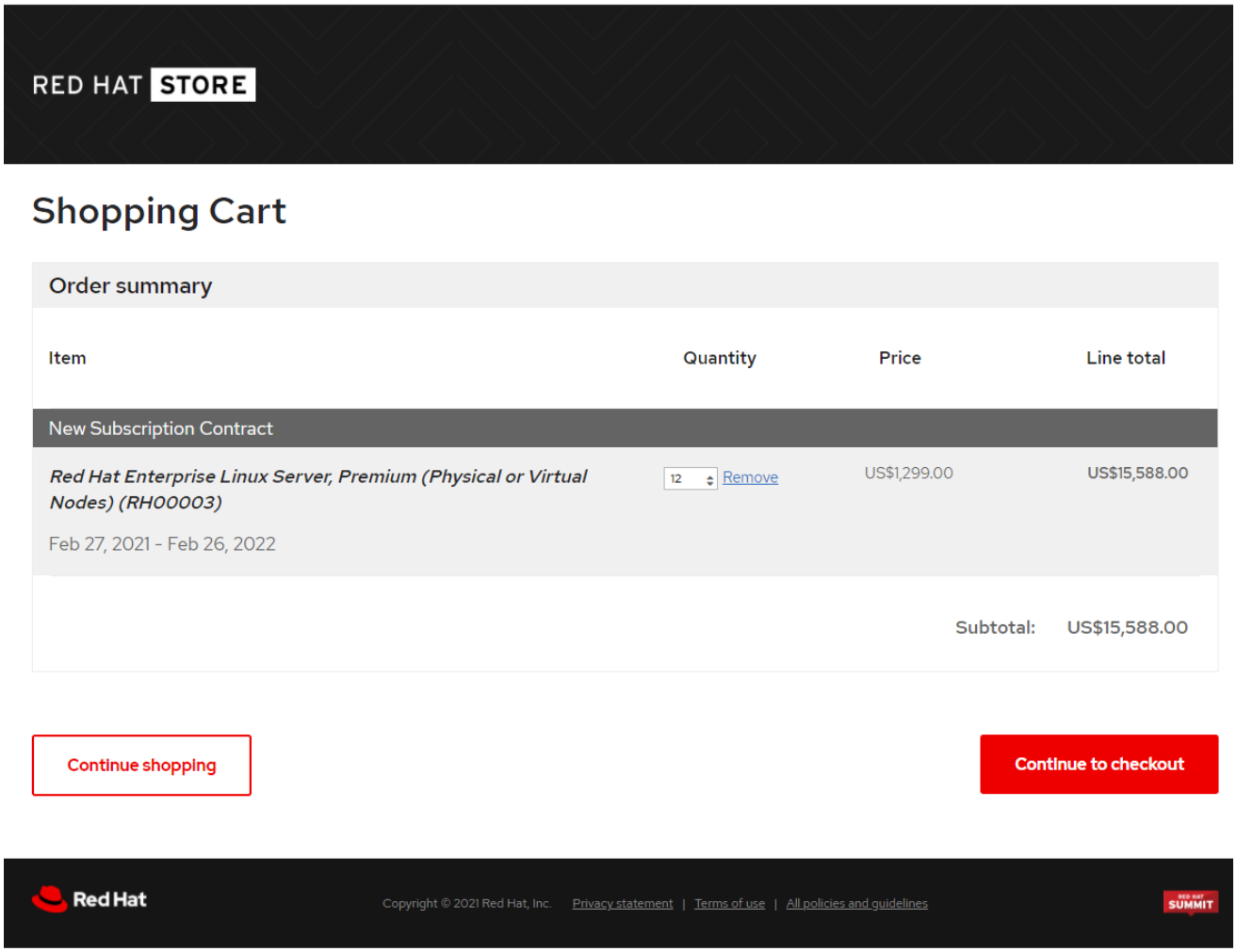
Quote Number: Q00169900v1
Quote Date: 3-10-2021
Quote Expiration Date: 6 -8-2021

Prepared For:
Distributor:
System Integrator:

Customer: ADVANCED MICRO DEVICES INC

Ordering Part Number - Description	Quantity	Sales Price	Total Price
Mellanox Products			
		Total Products Amount	**$.00**
Services and Support			
*Support or maintenance renewals for the same part number, service level and service period are available at the prices shown in this quotation			
SUP-SN2000-3S-4H *Mellanox Technical Support and Warranty - Silver 3 Year with 4 Hours On-Site Support for SN2000 Series Switch*	1	$1,981.00	$1,981.00
		Total Services and Support	**$1,981.00**
		Grand Total	**$1,981.00**
Optional Products			
Optional Products are Not Included in this Quotation			

Red Hat Inc.


RED HAT STORE
Shopping Cart
Order summary
Item
Quantity
Price
Line total
New Subscription Contract
Red Hat Enterprise Linux Server, Premium (Physical or Virtual Nodes) (RH00003)
12
Remove
US$1,299.00
US$15,588.00
Feb 27, 2021 - Feb 26, 2022
Subtotal:
US$15,588.00
Continue shopping
Continue to checkout
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Machbase Inc.

Quotation

Doc. No.	: MACH-SALES-20210302-05	Business License	120-87-96403			
Date	: 2021-03-02	Company	Machbase Inc.		CEO	Andrew Kim
To	: TTA	BusinessTerritory	Service, Business Service		ProductType	Software
CC	: Mr. Seo Byoung Joon	Address	10, Teheran-ro 20-gil, Gangnam-gu			
Charge	: Stefan Song (+82-10-5440-1734)		Seoul, Korea			
Here we quote as belows		Tel.	T : 02-2109-5607		F : 02-2038-4607	
Quote	207,350	USD (VAT Incl.)				

No.	Content	List Price (USD/Set)	Proposed Price (USD/Set)	Quantity (1Set= 4Node)	Supply Price (USD)	Tax. Incl. (USD)
1	**Machbase Cluster Edition V6.5.1**	170,000	145,000	1	145,000	159,500
	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**	145,000	15%	2.00	43,500	47,850
	Support & On-site Guide					
	Fault Handling					
	API Connection					
	Guide for Server & Node Configuration					
Total					**188,500**	**207,350**

<< REMARK >>

.- Here is a quote for applying a Machbase time series database for TTA.

.- Quotation : Machbase Cluster Edition Run-Time License 4 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)

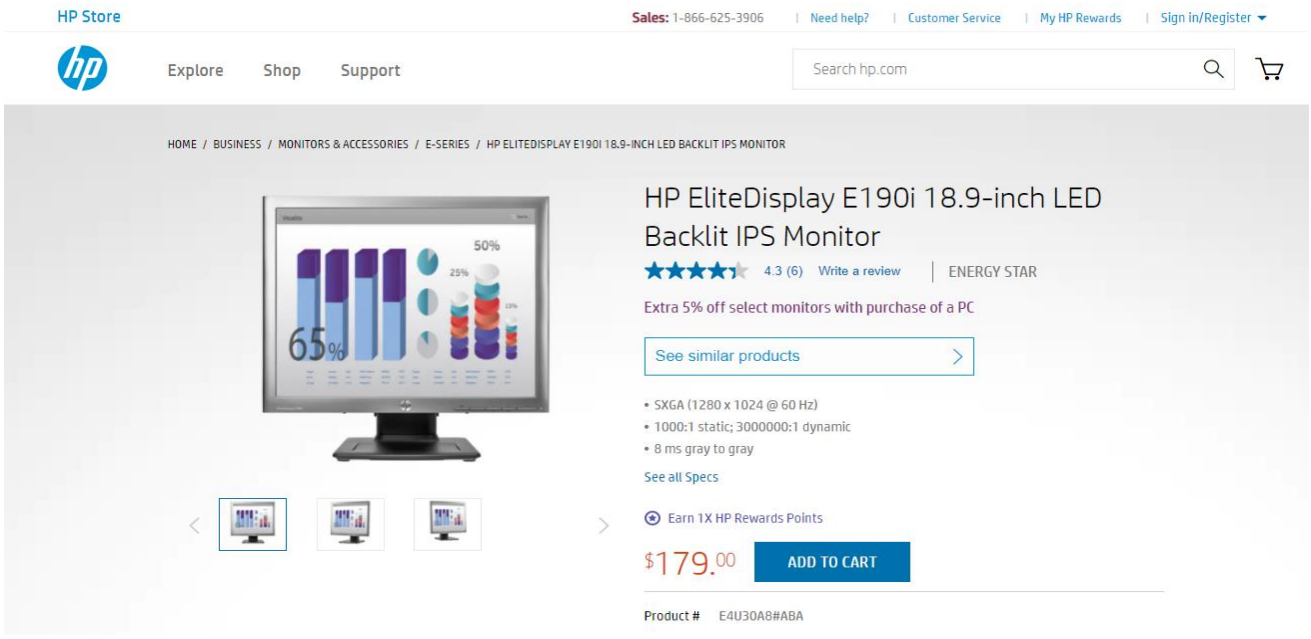
.- Server installation condition: It is recommended to separate DB server and Storage server.

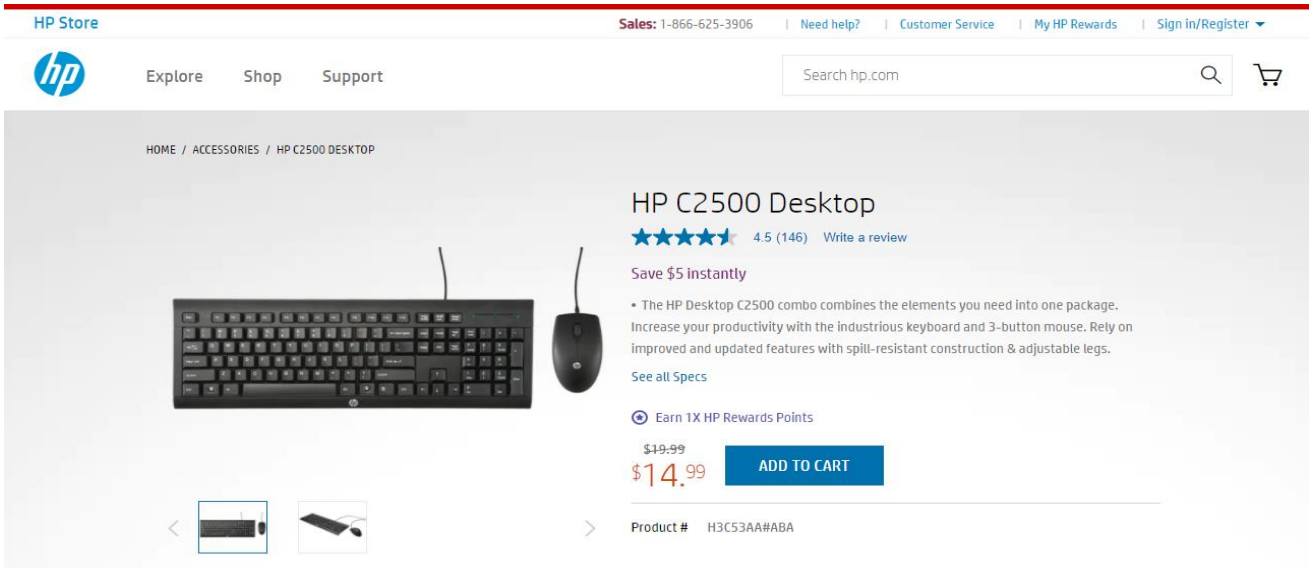
.- Installation : Cluster Edition - 7 Days, DB Table Guide is seperately guided with DB Professional Service.

.- 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