

TPC Benchmark™ E
Full Disclosure Report for



PRIMERGY RX4770 M2

Using

**Microsoft SQL Server 2014
Enterprise Edition**

Using

**Microsoft Windows Server 2012 R2
Standard Edition**

TPC-E Version 1.13.0

Submitted for Review

May 8, 2015

First Edition May 2015

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Benchmark results are highly dependent upon workload, specific application requirements, system design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, TPC Benchmark™ E 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 were obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly. We do not warrant or represent that a user can or will achieve similar performance expressed in transactions per second (tpsE) or normalized price/performance (\$/tpsE). No warranty of system performance or price/performance is expressed or implied in this report.

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Abstract


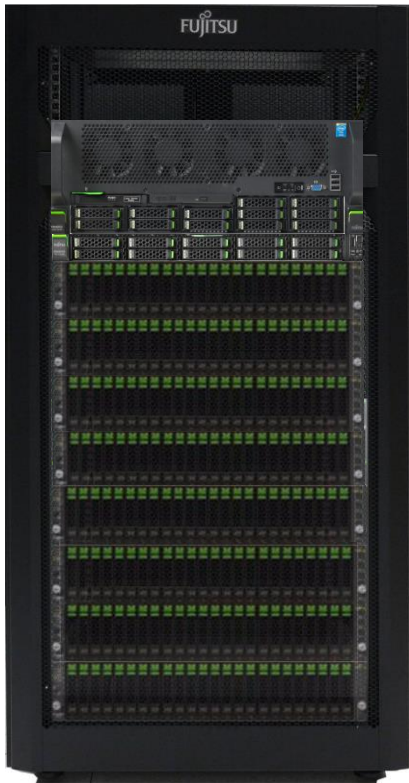
This report documents the TPC Benchmark™ E results achieved by Fujitsu using Microsoft SQL Server 2014 Enterprise Edition SP1.

The TPC Benchmark™ E tests were run on a PRIMERGY RX4770 M2 system using the Microsoft Windows Server 2012 R2 Standard Edition operating system.

The results, summarized below, show the number of TPC Benchmark™ E transactions per second (tpsE) and the price per tpsE (\$/tpsE).

Hardware	Software	Total System Cost	tpsE	\$ USD/tpsE	Availability Date
Fujitsu PRIMERGY RX4770 M2	Microsoft SQL Server 2014 Enterprise Edition Microsoft Windows Server 2012 R2 Standard Edition	\$ 873,303 USD	6,904.53	\$ 126.49 USD	June 1, 2015

The benchmark implementation and results were audited by Doug Johnson for InfoSizing Inc. (www.sizing.com). The auditor's attestation letter is contained in Section 8 of this report.

		PRIMERGY RX4770 M2		TPC-E 1.13.0 TPC Pricing 2.0.0
				Report Date May 8, 2015
TPC-E Throughput 6,904.53 tpsE	Price/Performance \$ 126.49 USD per tpsE	Availability Date June 1, 2015	Total System Cost \$ 873,303 USD	
Database Server Configuration				
Operating System Microsoft Windows Server 2012 R2 Standard Edition	Database Manager Microsoft SQL Server 2014 Enterprise Edition	Processors/Cores/Threads 4/72/144	Memory 2048 GB	
<div><div>SUT </div></div>		<div><div>Tier A PRIMERGY RX2530 M1 2x Intel Xeon E5-2697 v3 2.60 GHz 64 GB Memory 2x 300 GB 15k rpm SAS Drive 2x onboard LAN 10 Gb/s 1x Dual Port LAN 1 Gb/s 1x SAS RAID controller</div><div>Tier B PRIMERGY RX4770 M2 4x Intel Xeon E7-8890 v3 2.50 GHz 2048 GB Memory 2x 300 GB 15k rpm SAS Drives 6x 600 GB 15k rpm SAS Drives 2x onboard LAN 10 Gb/s 9x SAS RAID Controller</div><div>Storage 1x PRIMECENTER Rack 8x ETERNUS JX40 120x 400 GB SSD Drives</div></div>		
Initial Database Size 28,734 GB	Redundancy Level 1 RAID-5 data and RAID-10 log		Storage 120 x 400 GB SSD 6 x 600 GB 15k rpm HDD	



PRIMERGY RX4770 M2

TPC-E 1.13.0 TPC Pricing 2.0.0

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Description	Part Number	Price Source	Unit Price	Qty	Extended Price	3-yr. Maint. Price
Database Server (Tier B) Hardware			\$		\$	\$
PRIMERGY RX4770 M2						
PY RX4770 M2	S26361-K1503-V200	1	5,524.00	1	5,524.00	
Power Supply Module 1600W w/o power cord	S26113-F5295-E160	1	491.00	2	982.00	
Cable power cord (USA), 1.8m, grey	T26139-Y1742-E10	1	13.00	2	26.00	
Cool-safe Advanced Thermal Design	S26361-F3776-E101	1	4.00	1	4.00	
Intel Xeon E7-8890v3 18C/36T 2.50GHz	S26361-F3896-E390	1	9,697.00	4	38,788.00	
Memory Board RX4770 M2	S26361-F5295-E200	1	508.00	6	3,048.00	
64GB (2x32GB) 4Rx4 DDR4-2133 LR ECC	S26361-F3897-E644	1	2,065.00	32	66,080.00	
Memory Independent Mode Installation	S26361-F5295-E4	1	7.00	1	7.00	
HD SAS 12G 300GB 15K HOT PL 2.5' EP	S26361-F5531-E530	1	554.00	2	1,108.00	
HD SAS 12G 600GB 15K HOT PL 2.5' EP	S26361-F5531-E560	1	1,033.00	6	6,198.00	
PRAID EP400i	S26361-F5243-E1	1	514.00	1	514.00	
PRAID EP420e FH	S26361-F3847-E2	1	748.00	8	5,984.00	
Rack Mount Kit F2-C LV	S26361-F2735-E285	1	120.00	1	120.00	
Mounting of RMK in symmetrical racks	S26361-F4530-E10	1	7.00	1	7.00	
region-kit America	S26361-F1452-E130	1	13.00	1	13.00	
PYRX4770 Series during normal business hours, Primergy Installation, Midrange Server, w/o OS, One Time billing	PYR477-N038005-ONA	1	350.00	1		350.00
PYRX4770 Series Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7 4hr Onsite, Prepaid billing	PYR477_S26361-K1484-V200	1	1,309.00	1		1,309.00
				Subtotal (*)	128,403.00	1,659.00
Storage						
PRIMECENTER RACK						
PRIMECENTER M1 Rack 724S 24U-1050x700	S26361-K827-V220	1	2,435.00	1	2,435.00	
Dummy panel, plastics, 1U + assembly	S26361-F4530-L131	1	12.00	3	36.00	
Dummy panel, plastics, 2U + assembly	S26361-F4530-L132	1	12.00	1	12.00	
Socket strip 3phase 3x 8 sockets	S26361-F2262-L31	1	240.00	1	240.00	
PY PRIMECENTER during normal business hours, PRIMERGY Installation, Racks, One Time billing	PYPCTR-N076005-ONA	1	265.00	1		265.00
PY PRIMECENTER Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7 4hr Onsite, Prepaid billing (PYPCTR-U004361-ONA)	PYPCTR-U004361-ONA	1	750.00	1		750.00
ETERNUS JX40		1				
ETERNUS JX40	FTS:ETJXS11BG		2,679.00	8	21,432.00	
JX40 SSD SAS 12G 400GB MLC 2.5"	FTS:JX40-SSD400	1	2,635.00	120	316,200.00	
SAS CABLE 1X SFF 8088-1X SFF 8088 2M	D:KBSAS1S-1S-2M	1	73.00	8	584.00	
PY JX40 Warranty Uplift, 12 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PY JX40-U004121-ONA	1	639.00	8		5,112.00
PY JX40 Post Warranty, 24 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PY JX40-P004241-ONA	1	1,218.00	8		9,744.00
PY JX40 during normal business hours, Primergy storage installation, One Time billing	PY JX40-N043005-ONA	1	450.00	8		3,600.00
				Subtotal(*)	340,939.00	19,471.00



PRIMERGY RX4770 M2

TPC-E 1.13.0 TPC Pricing 2.0.0

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June 1, 2015

Database Server (Tier B) Software						
SQL Server 2014 Enterprise Edition 2 Core License	7JQ-00750	2	13,472.50	36	485,010.00	
Microsoft Windows Server 2012 R2 Standard Edition 2 Processor License	P72-06284	2	735.00	2	1,470.00	
Microsoft Problem Resolution Services	n/a	2	259.00	1		259.00
				Subtotal	486,480.00	259.00
Application Server (Tier A) Hardware						
PRIMERGY RX2530 M1		1				
PY RX2530 M1 4x 2.5" expandable	S26361-K1492-V301	1	1,249.00	1	1,249.00	
Modular PSU 450W platinum hp	S26113-F575-E13	1	275.00	2	550.00	
Cable power cord rack, 4m, grey	T26139-Y1968-E100	1	13.00	2	26.00	
Cool-safe Advanced Thermal Design	S26361-F3776-E101	1	4.00	1	4.00	
Intel Xeon E5-2697v3 14C/28T 2.60 GHz	S26361-F3849-E197	1	4,145.00	2	8,290.00	
Cooler Kit 2nd CPU	S26361-F3849-E100	1	35.00	1	35.00	
8GB (1x8GB) 2Rx8 DDR4-2133 R ECC	S26361-F3843-E515	1	252.00	8	2,016.00	
Performance Mode Installation	S26361-F3694-E2	1	7.00	2	14.00	
DVD ROM Ultralim	S26361-F3718-E2	1	104.00	1	104.00	
HD SAS 12G 300GB 15K HOT PL 2.5" EP	S26361-F5531-E530	1	554.00	2	1,108.00	
PRAID EP400i	S26361-F5243-E1	1	514.00	1	514.00	
PLAN EM 2x10Gb T OC14000-LOM interface	S26361-F5302-E210	1	189.00	1	189.00	
PLAN CP 2x1Gbit Cu Intel I350-T2 LP	S26361-F4610-E202	1	268.00	1	268.00	
Rack Mount Kit F1-CMA Slim Line	S26361-F2735-E400	1	92.00	1	92.00	
Mounting of RMK in symmetrical racks	S26361-F4530-E10	1	7.00	1	7.00	
region-kit America	S26361-F1452-E130	1	13.00	1	13.00	
PYRX2530 M1 during normal business hours, Primergy Installation, Midrange Server, w/o OS, One Time billing	PYR253-N038005-ONA	1	350.00	1		350.00
PYRX2530 M1 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7 4hr Onsite, Prepaid billing	PYR253_S26361-K1492-V301	1	931.00	1		931.00
				Subtotal(*)	14,479.00	1,281.00
Application Server (Tier A) Software						
Microsoft Windows Server 2012 R2 Standard Edition 2 Processor License	P72-06284	2	735.00	1	735.00	
				Subtotal	735.00	
Miscellaneous						
DISPLAY B20T-6 LED (incl 2spares)	S26361-K1416-V140	1	200.00	3	600.00	
Infrastructure or Connectivity						
KB400 USB grey INT USA (incl 2 spares)	S26381-K550-E102	1	14.00	3	42.00	
Mouse M480 grey (incl 2 spares)	S26381-K431-E101	1	8.00	3	24.00	
StarTech.com Shielded Cat6a Molded STP Patch Cable - patch cable - 7 ft - b (incl 2 spares)	C6ASPA7BL	3	12.99	4	51.96	
				Subtotal(*)	717.96	0.00
				Total	971,753.96	22,670.00
Dollar Volume Discount (see Notes)	25%	1			121,121.75	
					850,632.21	

Notes: Price Source: 1=Fujitsu, 2=Microsoft Corporation, 3=www.cdw.com Discount applies to all subtotal marked with(*) . Pricing is for these or similar quantities. Discounts for similar sized configurations will be similar to what is quoted here, but may vary based on the specific components priced.	Three-Year Cost of Ownership USD		\$873,303.00
	TPC-E Throughput		6904.53
	\$ USD/tpsE		\$126.49

The benchmark results and test methodology were audited by Doug Johnson for InfoSizing Inc. (www.sizing.com)

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 section of the TPC benchmark pricing specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you.



PRIMERGY RX4770 M2

TPC-E 1.13.0 TPC Pricing 2.0.0

Report Date
May 8, 2015

Availability Date
June 1, 2015

Numerical Quantities Summary

Numerical Quantities Summary				
Reported Throughput:	6,904.53 tpsE	Configured Customers:		3,500,000
Response Times (in seconds)	Minimum	Average	90th%tile	Maximum
Broker Volume	0.01	0.01	0.02	0.13
Customer Position	0.01	0.01	0.01	0.27
Market Feed	0.01	0.01	0.02	0.22
Market Watch	0.01	0.01	0.01	0.45
Security Detail	0.01	0.01	0.01	0.12
Trade Lookup	0.01	0.05	0.08	0.59
Trade Order	0.01	0.04	0.13	0.76
Trade Result	0.01	0.01	0.02	0.61
Trade Status	0.01	0.01	0.01	0.15
Trade Update	0.01	0.06	0.08	0.59
Data Maintenance	0.01	0.01	N/A	0.15
Transaction Mix		Transaction Count		Mix %
Broker Volume		24,359,190		4.900%
Customer Position		64,626,082		13.000%
Market Feed		4,971,268		1.000%
Market Watch		89,483,221		18.000%
Security Detail		69,598,019		14.000%
Trade Lookup		39,770,007		8.000%
Trade Order		50,209,869		10.100%
Trade Result		49,712,645		10.000%
Trade Status		94,454,334		19.000%
Trade Update		9,942,519		2.000%
Data Maintenance		120		0.000%
Test Duration and Timings				
Ramp-up Time (hh:mm:ss)		0:20:00		
Measurement Interval (hh:mm:ss)		2:00:00		
Business Recovery Time (hh:mm:ss)		0:28:51		
Total Number of Transactions Completed		0		

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Clause 0: Preamble

Introduction

TPC Benchmark™ E (TPC-E) is an On-Line Transaction Processing (OLTP) workload. It is a mixture of read-only and update intensive transactions that simulate the activities found in complex OLTP application environments. The database schema, data population, transactions, and implementation rules have been designed to be broadly representative of modern OLTP systems. The benchmark exercises a breadth of system components associated with such environments, which are characterized by:

- The simultaneous execution of multiple transaction types that span a breadth of complexity; Moderate system and application execution time;
- A balanced mixture of disk input/output and processor usage; Transaction integrity (ACID properties);
- A mixture of uniform and non-uniform data access through primary and secondary keys;
- Databases consisting of many tables with a wide variety of sizes, attributes, and relationships with realistic content;
- Contention on data access and update.

The TPC-E operations are modelled as follows: The database is continuously available 24 hours a day, 7 days a week, for data processing from multiple Sessions and data modifications against all tables, except possibly during infrequent (e.g., once a month) maintenance Sessions. Due to the worldwide nature of the application modelled by the TPC-E benchmark, any of the transactions may be executed against the database at any time, especially in relation to each other.

Goal of the TPC-E Benchmark

The TPC-E benchmark simulates the OLTP workload of a brokerage firm. The focus of the benchmark is the central database that executes transactions related to the firm's customer accounts. In keeping with the goal of measuring the performance characteristics of the database system, the benchmark does not attempt to measure the complex flow of data between multiple application systems that would exist in a real environment.

The mixture and variety of transactions being executed on the benchmark system is designed to capture the characteristic components of a complex system. Different transaction types are defined to simulate the interactions of the firm with its customers as well as its business partners. Different transaction types have varying run-time requirements.

The benchmark defines:

- Two types of transactions to simulate Consumer-to-Business as well as Business-to-Business activities
- Several transactions for each transaction type
- Different execution profiles for each transaction type
- A specific run-time mix for all defined transactions

For example, the database will simultaneously execute transactions generated by systems that interact with customers along with transactions that are generated by systems that interact with financial markets as well as administrative systems. The benchmark system will interact with a set of driver systems that simulate the various sources of transactions without requiring the benchmark to implement the complex environment.

The Performance Metric reported by TPC-E is a "business throughput" measure of the number of completed Trade-Result transactions processed per second (see Clause 6.7.1). Multiple Transactions are used to simulate the business activity of processing a trade, and each Transaction is subject to a Response Time constraint. The Performance Metric for the benchmark is expressed in transactions-per-second-E (tpsE). To be compliant with the TPC-E standard, all references to tpsE Results must include the tpsE rate, the associated price-per-tpsE, and the Availability Date of the Priced Configuration (See Clause 6.7.3 for more detail).

Although this specification defines the implementation in terms of a relational data model, the database may be implemented using any commercially available Database Management System (DBMS), Database Server, file

system, or other data repository that provides a functionally equivalent implementation. The terms "table", "row", and "column" are used in this document only as examples of logical data structures.

TPC-E uses terminology and metrics that are similar to other benchmarks, originated by the TPC and others. Such similarity in terminology does not imply that TPC-E Results are comparable to other benchmarks. The only benchmark Results comparable to TPC-E are other TPC-E Results that conform to a comparable version of the TPC-E specification.

Restrictions and Limitations

Despite the fact that this benchmark offers a rich environment that represents many OLTP applications, this benchmark does not reflect the entire range of OLTP requirements. In addition, the extent to which a customer can achieve the Results reported by a vendor is highly dependent on how closely TPC-E approximates the customer application. The relative performance of systems derived from this benchmark does not necessarily hold for other workloads or environments. Extrapolations to any other environment are not recommended.

Benchmark Results are highly dependent upon workload, specific application requirements, and systems design and implementation. Relative system performance will vary because of these and other factors. Therefore, TPC-E should not be used as a substitute for specific customer application benchmarking when critical capacity planning and/or product evaluation decisions are contemplated.

Benchmark Sponsors are permitted various possible implementation designs, insofar as they adhere to the model described and pictorially illustrated in this specification. A Full Disclosure Report (FDR) of the implementation details, as specified in Clause 9.1, must be made available along with the reported Results.

Clause 1: Overview

Order and Titles

The order and titles of sections in the Report and Supporting Files must correspond with the order and titles of sections from the TPC-E Standard Specification (i.e., this document). The intent is to make it as easy as possible for readers to compare and contrast material in different Reports (9.1.1.1).

The order and titles in this report correspond to those in the TPC-E specification.

Executive Summary Statement

The TPC Executive Summary Statement must be included near the beginning of the Report (9.2).

The Executive summary has been included near the beginning of this FDR.

Benchmark Sponsor

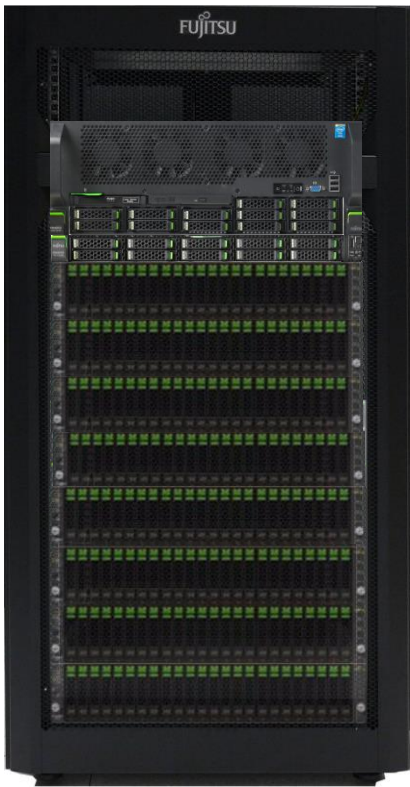
A statement identifying the benchmark sponsor(s) and other participating companies must be provided (9.3.1.1).

Fujitsu is the sponsor of this TPC Benchmark™ E result.

Configuration Diagram

Diagrams of both measured and Priced Configurations must be reported in the Report, accompanied by a description of the differences (9.3.1.2).

The measured and priced configurations are shown in the following figures. There are differences between both configurations at additional storage used for database setup and backup in the measured configuration. This storage is not used during measurement and not required for pricing.



Tier A

PRIMERGY RX2530 M1
2x Intel Xeon E5-2697 v3 2.60 GHz
64 GB Memory
2x 300 GB 15k rpm SAS Drive
2x onboard LAN 10 Gb/s
1x Dual Port LAN 1 Gb/s
1x SAS RAID controller

Tier B

PRIMERGY RX4770 M2
4x Intel Xeon E7-8890 v3 2.50 GHz
2048 GB Memory
2x 300 GB 15k rpm SAS Drives
6x 600 GB 15k rpm SAS Drives
2x onboard LAN 10 Gb/s
9x SAS RAID Controller

Storage

1x PRIMECENTER Rack
8x ETERNUS JX40
120x 400 GB SSD Drives

Figure 1-1: Priced Configuration



Tier A

PRIMERGY RX2530 M1
 2x Intel Xeon E5-2697 v3 2.60 GHz
 64 GB Memory
 2x 300 GB 15k rpm SAS Drive
 2x onboard LAN 10 Gb/s
 1x Dual Port LAN 1 Gb/s
 1x SAS RAID controller

Tier B

PRIMERGY RX4770 M2
 4x Intel Xeon E7-8890 v3 2.50 GHz
 2048 GB Memory
 2x 300 GB 15k rpm SAS Drives
 6x 600 GB 15k rpm SAS Drives
 2x onboard LAN 10 Gb/s
 9x SAS RAID Controller

Storage

1x PRIMECENTER Rack
 8x ETERNUS JX40
 120x 400 GB SSD Drives

Figure 1-2: Measured Configuration

Hardware Configuration

A description of the steps taken to configure all the hardware must be reported in the Report (9.3.1.4).

Driver

The driver system is not part of the System Under Test (SUT) and priced configuration. This system was connected with Tier A system, using onboard LAN with 2 x 1 Gb/s Ethernet. There are two LAN segments for these connections.

Tier A

The Tier A server is a Fujitsu PRIMERGY RX2530 M1 with two Intel Xeon E5-2697 v3 Fourteen-Core Processor and 64 GB of memory. Two SAS 300 GB 15k rpm disk drives are connected to an onboard SAS controller. One 1 Gb/s dual port Ethernet LAN card is plugged in a PCI-E slot. These two 1 Gb/s LAN ports are used for driver connection. There are two onboard 10 Gb/s LAN ports. Each of the two ports is directly connected with one of the 10 Gb/s Ethernet onboard LAN ports of Tier B using a LAN crossover cable.

Tier B

The Tier B or database server is a Fujitsu PRIMERGY RX4770 M2 with four Intel Xeon E7-8890 v3 18-Core Processors and 2048 GB memory. The entire eight onboard 2.5" disk bays are used with 2x SAS 300 GB 15k rpm and 6x SAS 600 GB 15k rpm disk drives connected to PRAID EP400i. Two drives are configured with RAID1 for OS and database. The six drives with 600 GB are configured with RAID10 for database log. Eight RAID Controllers PRAID EP420e are used to connect the external disk drives to the server. The controller cache of all RAID controllers is configured with Write Through. The two onboard 10 Gb/s Ethernet LAN ports are connected to the Tier A system as described above.

Storage

8 Fujitsu ETERNUS JX40 are used, each with 15x 400GB SSD 2.5" RAID5. The enclosures are connected to the controllers PRAID EP420e. For details see table 2-2 Disk Configuration. The disk configuration can be done with the ServerView RAID Manager, which is shipped on ServerStart DVD together with the Server.

Software Configuration

A description of the steps taken to configure all the software must be reported in the Report (9.3.1.5).

The default installation of the operating system was executed on Tier A and B as well as the installation of the database SW on Tier B and the database client connectivity on Tier A. Information about changes to the software, settings and BenchCraft can be found in the SupportingFiles directory Introduction - Software.

Clause 2: Database Design, Scaling and Population

Database Creation

A description of the steps taken to create the database for the Reported Throughput must be reported in the Report (9.3.2).

The physical organization of tables and indices, within the database, must be reported in the Report. (9.3.2.1)

The database has been created for 3,500,000 customers. The SQL Server scripts and setup command files are included in the SupportingFiles\Clause2 folder. Two file groups are used for the tables and indices. The distribution is shown in table 2-1.

Partitioning

While few restrictions are placed upon horizontal or vertical partitioning of tables and rows in the TPC-E benchmark (see Clause 2.3.3), any such partitioning must be reported in the Report. (9.3.2.2)

There is no partitioning implemented in this configuration.

Replication and Duplicated Attributes

Replication of tables, if used, must be reported in the Report (9.3.2.3).

Additional and/or duplicated attributes in any table must be reported in the Report along with a statement on the impact on performance (9.3.2.4).

There is no replication implemented in this configuration.
No duplications or additional attributes were used.

Cardinality of Tables

The cardinality (e.g. the number of rows) of each table, as it existed after database load (see Clause 2.6), must be reported in the Report (9.3.2.5).

The database was configured for 3,500,000 customers. The cardinality of the tables after database load is as shown in the following table 2-1.

Table	Cardinality after database load	File Group
ACCOUNT_PERMISSION	24851082	1
ADDRESS	5250004	1
BROKER	35000	1
CASH_TRANSACTION	55641580672	2
CHARGE	15	1
COMMISSION_RATE	240	1
COMPANY	1750000	1
COMPANY_COMPETITOR	5250000	1
CUSTOMER	3500000	1
CUSTOMER_ACCOUNT	17500000	1
CUSTOMER_TAXRATE	7000000	1
DAILY_MARKET	3128737500	1
EXCHANGE	4	1
FINANCIAL	35000000	1
HOLDING	3096806241	2
HOLDING_HISTORY	81053233799	2
HOLDING_SUMMARY	174068725	2
INDUSTRY	102	1
LAST_TRADE	2397500	1
NEWS_ITEM	3500000	1
NEWS_XREF	3500000	1
SECTOR	12	1
SECURITY	2397500	1
SETTLEMENT	60480000000	2
STATUS_TYPE	5	1
TAXRATE	320	1
TRADE	60480000000	2
TRADE_HISTORY	145151921464	2
TRADE_REQUEST	0	2
TRADE_TYPE	5	1
WATCH_ITEM	350010375	1
WATCH_LIST	3500000	1
ZIP_CODE	14741	1

Table 2-1: Table Cardinality and File Groups

Distribution of Tables, Partitions and Logs

The distribution of tables, partitions and logs across all media must be explicitly depicted for the measured and Priced Configurations (9.3.2.6).

HBA - Port	Disk#	Drives	Partition	Size	Use
Ctrl 0 onboard	0	2x300GB 15K SAS, RAID1	C:\	278 GB	OS, DB
	1	6x600GB 15K SAS, RAID10	L:\	1675 GB	DB Log
Ctrl 1 Port 0 JX40	2	15x400GB SSD, RAID5	C:\jp\tpce011	102.5 GB	Filegroup1
			C:\jp\tpce012	5106 GB	Filegroup2
	3	8x1200GB HDD, RAID5	C:\jp\help01	7821 GB	DB Setup,Backup
Ctrl 2 Port 0 JX40	4	15x400GB SSD, RAID5	C:\jp\tpce021	102.5 GB	Filegroup1
			C:\jp\tpce022	5106 GB	Filegroup2
	5	8x1200GB HDD, RAID5	C:\jp\help02	7821 GB	DB Setup,Backup
Ctrl 3 Port 0 JX40	6	15x400GB SSD, RAID5	C:\jp\tpce031	102.5 GB	Filegroup1
			C:\jp\tpce032	5106 GB	Filegroup2
	7	8x1200GB HDD, RAID5	C:\jp\help03	7821 GB	DB Setup,Backup
Ctrl 4 Port 0 JX40	8	15x400GB SSD, RAID5	C:\jp\tpce041	102.5 GB	Filegroup1
			C:\jp\tpce042	5106 GB	Filegroup2
	9	8x1200GB HDD, RAID5	C:\jp\help04	7821 GB	DB Setup,Backup
Ctrl 5 Port 0 JX40	10	15x400GB SSD, RAID5	C:\jp\tpce051	102.5 GB	Filegroup1
			C:\jp\tpce052	5106 GB	Filegroup2
	11	8x1200GB HDD, RAID5	C:\jp\help05	7821 GB	DB Setup,Backup
Ctrl 6 Port 0 JX40	12	15x400GB SSD, RAID5	C:\jp\tpce061	102.5 GB	Filegroup1
			C:\jp\tpce062	5106 GB	Filegroup2
	13	8x1200GB HDD, RAID5	C:\jp\help06	7821 GB	DB Setup,Backup
Ctrl 7 Port 0 JX40	14	15x400GB SSD, RAID5	C:\jp\tpce071	102.5 GB	Filegroup1
			C:\jp\tpce072	5106 GB	Filegroup2
	15	8x1200GB HDD, RAID5	C:\jp\help07	7821 GB	DB Setup,Backup
Ctrl 8 Port 0 JX40	16	15x400GB SSD, RAID5	C:\jp\tpce081	102.5 GB	Filegroup1
			C:\jp\tpce082	5106 GB	Filegroup2

Table 2-2: Disk Configuration

Database Interface, Data Model and Load Methodology

A statement must be provided in the Report that describes:

The Database Interface (e.g., embedded, call level) and access language (e.g., SQL, COBOL read/write) used to implement the TPC-E Transactions. If more than one interface / access language is used to implement TPC-E, each interface / access language must be described and a list of which interface /access language is used with which Transaction type must be reported.

The data model implemented by the DBMS (e.g., relational, network, hierarchical) (9.3.2.7).

The methodology used to load the database must be reported in the Report (9.3.2.8).

Microsoft SQL Server 2014 Enterprise Edition is a relational database. The interface used was Microsoft SQL Server stored procedures accessed with Remote Procedure Calls embedded in C++ code using the Microsoft ODBC interface.

The methodology used to load the database is described in Clause2 of the SupportingFiles directory.

Clause 3: Transactions

Vendor-Supplied Code

A statement that vendor-supplied code is functionally equivalent to Pseudo-code in the specification (see Clause 3.2.1.6) must be reported in the Report (9.3.3.1).

The vendor supplied code is functionally equivalent to the pseudo-code.

Database Footprint Requirements

A statement that the database footprint requirements (as described in Clause 3.3) were met must be reported in the Report (9.3.3.2).

Database footprint requirements were met as described in the specification.

Clause 4: SUT, Driver and Network

Network Configuration

The Network configurations of both the measured and Priced Configurations must be described and reported in the Report. This includes the mandatory Network between the Driver and Tier A (see Clause 4.2.2) and any optional Database Server interface networks (9.3.4.2):

Figures 1-1 and 1-2 show the configuration of the measured and priced configurations. Both are identical in case of the network configuration. Tier B system PRIMERGY RX4770 M2 has an onboard Ethernet controller with two 10 Gb/s ports. Tier A system PRIMERGY RX2530 M1 has an onboard Ethernet controller with two 10 Gb/s ports. These two ports were directly connected with the two onboard ports of Tier B using different LAN segments. Tier A system was extended with one dual-port 1 Gb/s Ethernet controller card for driver system connection.

Clause 5: EGen

EGen Version

The version of EGen used in the benchmark must be reported (9.3.5.1).

The EGen version used was 1.13.0.

EGen Code

A statement that all required TPC-provided EGen code was used in the benchmark must be reported (9.3.5.2).

All the required TPC-provided code was used in the benchmark.

EGen Modifications

If the Test Sponsor modified EGen, a statement EGen has been modified must be reported in the Report. All formal waivers from the TPC documenting the allowed changes to EGen must also be reported in the Report (see Clause 5.3.7.1). If any of the changes to EGen do not have a formal waiver that must also be reported (9.3.5.3).

If the Test Sponsor extended EGenLoader (as described in Appendix A.6), the use of the extended EGenLoader and the audit of the extension code by an Auditor must be reported (9.3.5.4).

EGen v1.13.0 introduces non-trivial constructors for certain classes defined in TxnHarnessStructs.h. As a consequence it is a compile-time error to use any of these classes as a member of a union. The TPC-E subcommittee has been informed of this situation. This change in EGen compile-time behavior is unintentional so the TPC-E subcommittee has classified this as a logic error (per TPC Policies v6.2 Clause 5.4.4) and will address it in a future release of EGen. In the interim, the TPC-E subcommittee recommends that affected test sponsors wishing to publish a result proceed according to TPC-E v1.13.0 Clause 5.3.6. Accordingly, EGen was modified for this publication by removing the constructors in question. The TPC-E subcommittee has discussed this solution and found no compliance issues with it.

The file TxnHarnessStructs.h can be found in Supporting Files Clause5.

Clause 6: Performance Metrics and Response time

EGen Driver

The number of EGenDriverMEE and EGenDriverCE instances used in the benchmark must be reported in the Report (see Clause 6.2.5) (9.3.1.1).

One Tier A system was used and configured to drive 16 EGenDriverMEE and 16 EGenDriverCE instances.

Measured Throughput

The Measured Throughput must be reported in the Report (see Clause 6.7.1.2) (9.3.6.2).

The measured throughput was 6,904.53 tpsE.

Test Run Graph

A Test Run Graph of throughput versus elapsed wall clock time must be reported in the Report for the Trade-Result Transaction (see Clause 6.7.2) (9.3.6.3).

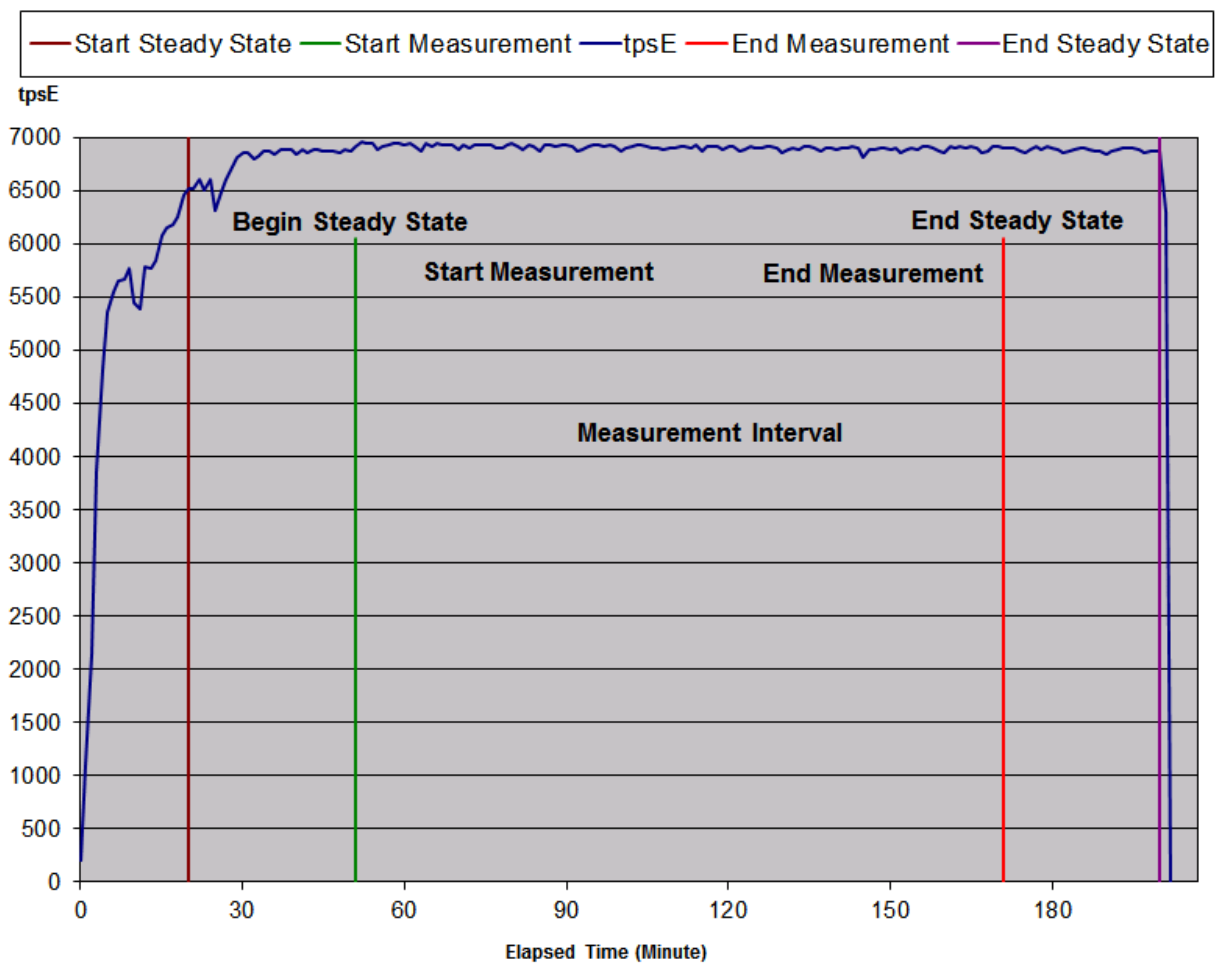


Figure 6-1: Test Run Graph

Steady State

The method used to determine that the SUT had reached a Steady State prior to commencing the Measurement Interval must be reported in the Report (9.3.6.4).

During the run the tpsE throughput was observed to determine steady state. After the run steady state was confirmed by:

1. Looked at the Test Run Graph and verified that tpsE was steady prior to commencing the Measurement Interval.
2. Calculated 60 minute average tpsE during the Steady State moving the time window 10 minutes each time. Then confirmed that the minimum 60 minute average tpsE was not less than 98% of the Reported Throughput, and that the maximum 60 minute average tpsE was not greater than 102% of the Reported Throughput.
3. Calculated 10 minute average tpsE during the Steady State moving the window 1 minute each time. Then confirmed that the minimum 10 minute average tpsE was not less than 80% of the Reported Throughput, and that the maximum 10 minute average tpsE was not greater than 120% of the Reported Throughput.

Work Performed During Steady State

A description of how the work normally performed during a Test Run, actually occurred during the Measurement Interval must be reported in the Report (for example checkpointing, writing Undo/Redo Log records, etc.) (9.3.6.5).

The Microsoft SQL Server recovery interval parameter was set to the maximum allowable value to perform checkpoint at specific intervals. Checkpoints were automatically issued at specified intervals (449 seconds) and specified duration (440 seconds). SQL Server was started with trace flag 3502, which caused it to log the occurrence of the checkpoints. This information was used to verify that the checkpoints occurred at the appropriate times and duration during steady state.

Transaction Input Parameter Averages

The recorded averages over the Measurement Interval for each of the Transaction input parameters specified by clause 6.4.1 must be reported (9.3.6.6).

Transaction	Parameter	Range Min	Range Max	Value	Check
Customer Position	By Tax ID	48.00%	52.00%	50.00%	Ok
	Get History	48.00%	52.00%	49.99%	Ok
	Overall				Ok
Market Watch	By Watch List	57.00%	63.00%	60.00%	Ok
	By Customer Account	33.00%	37.00%	35.00%	Ok
	By Industry	4.50%	5.50%	5.00%	Ok
	Overall				Ok
Security Detail	Access LOB	0.90%	1.10%	1.00%	Ok
	Overall				Ok
Trade Lookup	Frame 1	28.50%	31.50%	30.00%	Ok
	Frame 2	28.50%	31.50%	30.00%	Ok
	Frame 3	28.50%	31.50%	30.00%	Ok
	Frame 4	9.50%	10.50%	10.00%	Ok
	Overall				Ok
Trade Update	Frame 1	31.00%	35.00%	33.03%	Ok
	Frame 2	31.00%	35.00%	32.97%	Ok
	Frame 3	32.00%	36.00%	34.00%	Ok
	Overall				Ok
Trade Order	By Non-Owner	9.50%	10.50%	10.00%	Ok
	By Company Name	38.00%	42.00%	40.00%	Ok
	Buy On Margin	7.50%	8.50%	8.00%	Ok
	Rollback	0.94%	1.04%	0.99%	Ok
	LIFO	33.00%	37.00%	34.99%	Ok
	Trade Qty 100	24.00%	26.00%	24.99%	Ok
	Trade Qty 200	24.00%	26.00%	25.00%	Ok
	Trade Qty 400	24.00%	26.00%	25.00%	Ok
	Trade Qty 800	24.00%	26.00%	25.00%	Ok
	Market Buy	29.70%	30.30%	29.99%	Ok
	Market Sell	29.70%	30.30%	30.01%	Ok
	Limit Buy	19.80%	20.20%	20.00%	Ok
	Limit Sell	9.90%	10.10%	10.01%	Ok
	Stop Loss	9.90%	10.10%	10.00%	Ok
	Overall				Ok

Table 6-2: Transaction Input Parameter Averages.

Clause 7: Transaction and System Properties

ACID Tests

The results of the ACID tests must be reported in the Report along with a description of how the ACID requirements were met, and how the ACID tests were run (9.3.7.1).

The TPC Benchmark™ E Standard Specification defines a set of transaction processing system properties that a system under test (SUT) must support during the execution of the benchmark. Those properties are Atomicity, Consistency, Isolation and Durability (ACID). This section quotes the specification definition of each of those properties and describes the tests done as specified and monitored by the auditor, to demonstrate compliance. See also file MSTPCE ACID Procedures.pdf in the SupportingFiles directory.

Redundancy Level and Data Accessibility

The Test Sponsor must report in the Report the Redundancy Level (see Clause 7.5.7.1) and describe the Data Accessibility test(s) used to demonstrate compliance (9.3.7.2).

A Data Accessibility Graph for each run demonstrating a Redundancy Level must be reported in the Report (see Clause 7.5.7.2) (9.3.7.3).

Redundancy Level 1 was used for the storage system. To prove Redundancy Level 1, the following steps were successfully performed on a database data and log disk. The test for Redundancy Level 1 is the test for Permanent Irrecoverable Failure of any single Durable Medium. The different steps and the various states of the two disks are reported by ServerView RAID and written to the system event (see SupportingFiles).

1. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
2. Start submitting Transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 5 minutes with a throughput above 95% of reported throughput.
3. Induce the failure described for the redundancy level being demonstrated. In this case fail a disk in a database log array database data array. Since RAID10 is used, the transactions continue. Run for at least 5 minutes with throughput above 95% of reported throughput.
4. Induce the failure described for the redundancy level being demonstrated. In this case fail a disk in the database data array. Since RAID5 is used, the transactions continue. Run for at least 5 minutes.
5. Begin the necessary recovery process, by replacing the failed drives in the database data array and start the rebuild process.
6. Begin the necessary recovery process, by replacing the failed drives in the database log array and start the rebuild.
7. Continue running the Driver for at least 20.
8. Terminate the run gracefully from the Driver.
9. Wait until rebuild process has finished.
10. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
11. Run the evaluation of Trade-Result Transactions executed and compare it with the difference of the SETTLEMENT rows counted.

The Graph in Figure 7-1 show the measured throughput versus time and the different test stated.

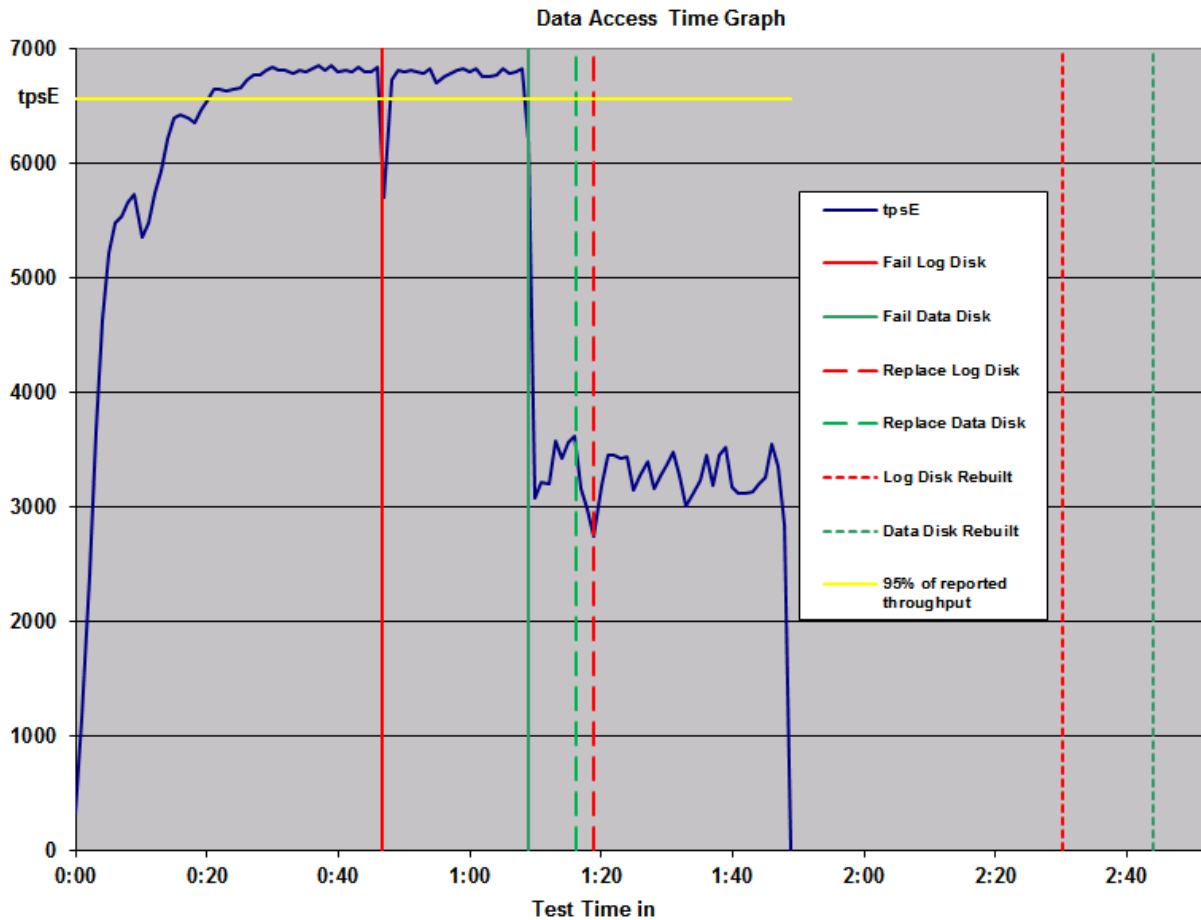


Figure 7-1: Redundancy Level and Data Accessibility Graph

Business Recovery

The Test Sponsor must describe in the Report the test(s) used to demonstrate Business Recovery (9.3.4.7). The Business Recovery Time must be reported on the Executive Summary Statement and in the Report. If the failures described in Clauses 7.5.2.2, 7.5.2.3 and 7.5.2.4 were not combined into one Durability test (usually powering off the Database Server during the run), then the Business Recovery Time for the failure described for instantaneous interruption is the Business Recovery Time that must be reported in the Executive Summary Statement. All the Business Recovery Times for each test requiring Business Recovery must be reported in the Report (9.3.7.6). 9.3.7.6 The Business Recovery Time Graph (see Clause 7.5.7.4) must be reported in the Report for all Business Recovery tests (9.3.7.7).

The tests for "Instantaneous interrupt," "Failure of all or part of memory," and "Loss of external power to the SUT" were combined by power off Tier A and B.

1. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
2. Start submitting transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes.
3. Induce the failures by power off Tier B.
4. On the driver side the number of MEE connections is captured and after transaction failures is noted by the drivers, terminate the run and collect the data for Pre-Failure Run.
5. Re-power and restart Tier B.

6. When restarting the database on Tier B, it automatically starts the recovery and records timestamps. The Database Recovery Time was 00:12:07 (hh:mm:ss).
7. After recovery has completed Trade-Cleanup has been executed. A new run started again submitting transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes. The Application Recovery Time was 00:16:44 (hh:mm:ss).
8. Terminate the run gracefully from the Driver and collect the data for Post-Failure Run.
9. Verify that there are no errors in the Post-Failure run and check the consistency of the database as specified in Clause 7.3.1.1.
10. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
11. Run the evaluation of Trade-Result Transactions executed in both runs and compare it with the difference of the SETTLEMENT rows counted. The difference must be less than or equal to the maximum number of Transactions which can be simultaneously in-flight from the Driver to the SUT.

The Business Recovery Time (per Clause 7.5.7 Step15) was 00:28:51 (hh:mm:ss).

The Graph in Figure 7-2 shows the measured throughput versus time and the Business Recovery.

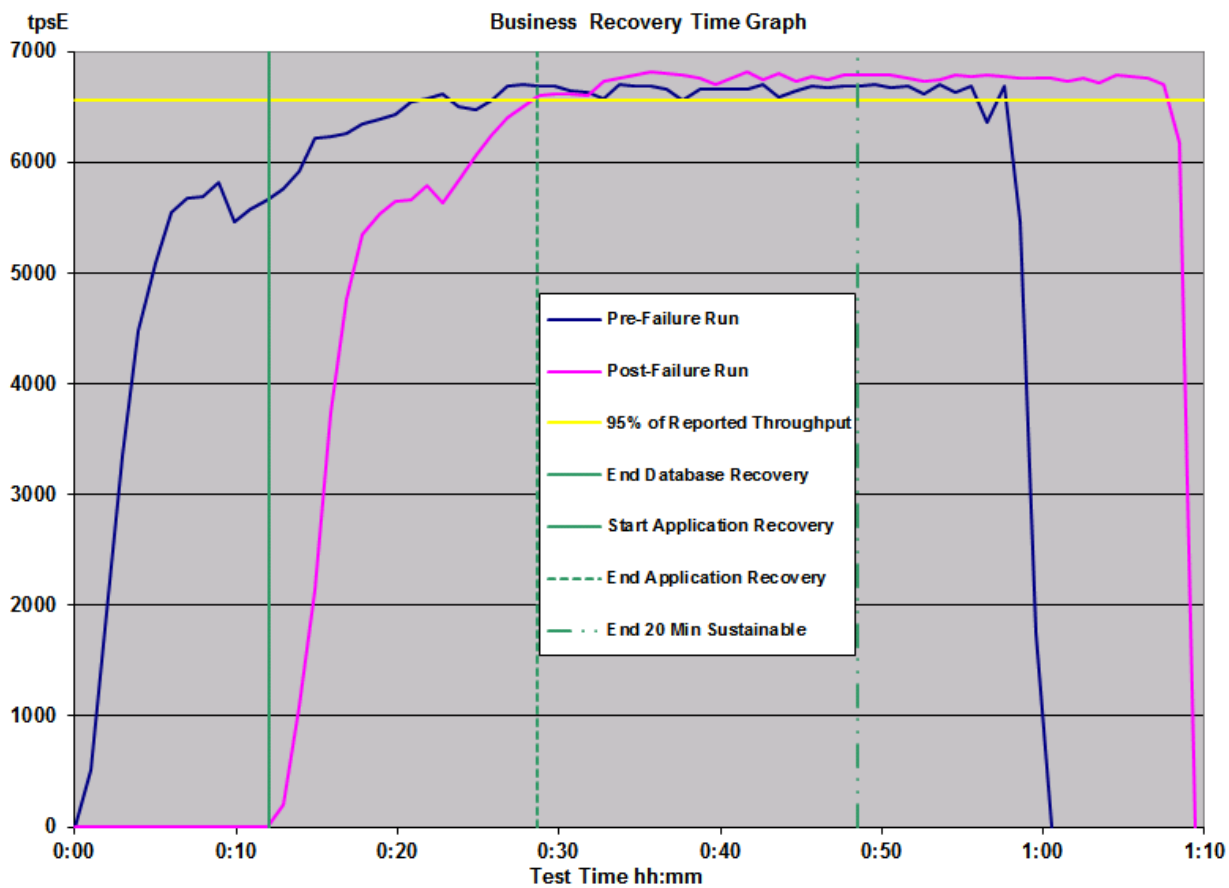


Figure 7-2: Business Recovery Graph

Clause 8: Pricing Related Items

60-Day Space

Details of the 60-Day Space computations along with proof that the database is configured to sustain a Business Day of growth must be reported (9.3.8.1).

Customers Used		TPC-E Disk Space Requirements							
Performance	3,500,000	TpsE	settlements after 8 hours (Busines Day)	198,850,464					
Table	Initial Rows	Data (KB)	Index size (KB)	Extra 5% (KB)	inital size Total + 5% (KB)	grow size After run (KB)	Growth (KB)	1 Day Growth (KB)	Req. Add. (KB)
ACCOUNT_PERMISSION	24,851,082	1,368,488	8,864	68,868	1,446,220	1,377,456	104	256	68,868
ADDRESS	5,250,004	302,920	2,440	15,268	320,628	305,416	56	138	15,268
BROKER	35,000	2,552	2,616	258	5,426	5,168	0	0	258
CASH_TRANSACTION	55,649,453,636	5,789,873,720	12,214,344	290,104,403	6,092,192,467	5,816,072,256	13,984,192	34,343,796	34,343,796
CHARGE	15	8	8	1	17	16	0	0	1
COMMISSION_RATE	240	16	16	2	34	32	0	0	2
COMPANY	1,750,000	373,608	114,256	24,393	512,257	487,864	0	0	24,393
COMPANY_COMPETITOR	5,250,000	141,048	130,360	13,570	284,978	271,408	0	0	13,570
CUSTOMER	3,500,000	573,616	171,632	37,262	782,510	745,280	32	79	37,262
CUSTOMER_ACCOUNT	17,500,000	1,585,856	390,688	98,827	2,075,371	1,976,544	0	0	98,827
CUSTOMER_TAXRATE	7,000,000	146,032	2,384	7,421	155,837	148,568	152	374	7,421
DAILY_MARKET	3,128,737,500	146,800,784	430,216	7,361,550	154,592,550	147,232,368	1,368	3,360	7,361,550
EXCHANGE	4	8	8	1	17	16	0	0	1
FINANCIAL	35,000,000	3,944,224	12,736	197,848	4,154,808	3,957,280	320	786	197,848
HOLDING	3,097,025,764	207,708,816	141,652,744	17,468,078	366,829,638	354,134,744	4,773,184	11,722,470	11,722,470
HOLDING_HISTORY	81,064,772,611	2,947,766,776	1,969,705,392	245,873,608	5,163,345,776	4,934,627,752	17,155,584	42,132,422	42,132,422
HOLDING_SUMMARY	174,069,036	7,637,736	29,808	383,377	8,050,921	7,667,544	0	0	0
INDUSTRY	102	8	24	2	34	32	0	0	2
LAST_TRADE	2,397,500	149,576	2,416	7,600	159,592	151,992	0	0	7,600
NEWS_ITEM	3,500,000	379,463,920	5,992	18,973,496	398,443,408	379,469,984	72	177	18,973,496
NEWS_XREF	3,500,000	87,248	2,384	4,482	94,114	89,632	0	0	4,482
SECTOR	12	8	24	2	34	32	0	0	2
SECURITY	2,397,500	332,704	94,568	21,364	448,636	427,304	32	79	21,364
SETTLEMENT	60,488,557,898	2,884,763,464	6,084,480	144,542,397	3,035,390,341	2,898,641,416	7,793,472	19,139,999	19,139,999
STATUS_TYPE	5	8	8	1	17	16	0	0	1
TAXRATE	320	40	16	3	59	56	0	0	3
TRADE	60,488,951,877	7,221,785,608	4,050,309,960	563,604,778	11,835,700,346	11,284,125,416	12,029,848	29,544,120	29,544,120
TRADE_HISTORY	145,173,403,455	4,366,978,544	11,389,112	218,918,383	4,597,286,039	4,392,305,096	13,937,440	34,228,978	34,228,978
TRADE_REQUEST	0	0	0	0	0	1,344,640	1,344,640	3,302,304	3,302,304
TRADE_TYPE	5	8	1,032	52	1,092	1,040	0	0	52
WATCH_ITEM	350,010,375	9,834,328	37,720	493,602	10,365,650	9,872,320	272	669	493,602
WATCH_LIST	3,500,000	87,264	81,416	8,434	177,114	168,680	0	0	8,434
ZIP_CODE	14,741	488	64	28	580	552	0	0	28
Growing Tables		Initial Database Size			Settlements		80,968,425		
		29,457,605 (MB)			Grown Database Size				
		28,767 (GB)			29,526,961 (MB)				
	number	partition size (MB)	file size (MB)	alloc total (MB)	loaded (MB)	required (MB)			
filegroup1	8	104,960	824,000	839,680	533,874	560,567		space OK	
filegroup2	8	5,228,544	41,520,000	41,828,352	28,923,731	29,094,057		space OK	
		Number of disks	120						
		Disk Capacity (MB)	381,024						
		RAID5 Overhead	7%						
Initial Growing Space (MB)	28,923,731	Total Space-1 (MB)	42,674,688						
Final Growing In Space (MB)	28,993,085	Number of disks	-	Initial Log Size (MB)	97,796	Log units	1		
Delta (MB)	69,354	Disk Capacity (MB)	-	Final Log Size (MB)	633,683	Disks per unit	6		
Data Space per Trade (MB)	0.000857	RAID5 Overhead	-	Log Grow th (MB)	535,887	Disk Capacity (MB)	571,808		
1 Day Data Grow th (MB)	170,326	Total Space-2 (MB)	-	Log Space per Trade	0.006618	RAID10 Overhead	50.0%		
60 Day Space (MB)	39,677,180	Total Space (MB)	42,674,688	1 Day Log Space (MB)	1,316,086	Log Space (MB)	1,715,424		

Table 8-1: Space Requirements

Attestation Letter

The Auditor's Attestation Letter, which indicates compliance, must be included in the Report (9.3.8.2).



Detlev Seidel
Fujitsu Technology Solutions
Heinz-Nixdorf-Ring 1
33106 Paderborn, Germany

May 7, 2015

I verified the TPC Benchmark™ E v1.13.0 performance of the following configuration:

Platform: PRIMERGY RX4770 M2
Operating System: Microsoft Windows Server 2012 R2 Standard Edition
Database Manager: Microsoft SQL Server 2014 Enterprise Edition

The results were:

Performance Metric 6,904.53 tpsE
Trade-Result 90th %-tile 0.02 Seconds

<u>Tier B (Server)</u>	<u>PRIMERGY RX4770 M2</u>		
CPU	4 x Intel Xeon E7-8890 v3 (2.50 GHz, 18-core, 45 MB L3)		
Memory	2048 GB		
Storage	Qty	Size	Type
	2	300 GB	15K rpm SAS HDD
	6	600 GB	15K rpm SAS HDD
	120	400 GB	SAS SSD

<u>Tier A (Client)</u>	<u>PRIMERGY RX2530 M1</u>
CPU	2 x Intel Xeon E5-2697 v3 (2.60 GHz, 14-core, 35 MB L3)
Memory	64 GB
Storage	2 x 300 GB 15K rpm SAS HDD

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark.

The following verification items were given special attention:

- All EGen components were verified to be v1.13.0
- The transaction were correctly implemented
- The database was properly scaled and populated for 3,500,000 customers
- The mandatory network between the driver and the SUT was configured

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- The ACID properties were met
- Input data was generated according to the specified percentages
- The reported response times were correctly measured
- All 90% response times were under the specified maximums
- The measurement interval was 120 minutes
- The implementation used Redundancy Level 1
- The Business Recovery Time of 00:28:51 was correctly measured
- The 60-day storage requirement was correctly computed
- The system pricing was verified for major components and maintenance

Additional Audit Notes:

EGen v1.13.0 introduces non-trivial constructors for certain classes defined in TxnHarnessStructs.h. As a consequence it is a compile-time error to use any of these classes as a member of a union. The TPC-E subcommittee has been informed of this situation. This change in EGen compile-time behavior is unintentional so the TPC-E subcommittee has classified this as a logic error (per TPC Policies v6.2 Clause 5.4.4) and will address it in a future release of EGen. In the interim, the TPC-E subcommittee recommends that affected test sponsors wishing to publish a result proceed according to TPC-E v1.13.0 Clause 5.3.6. Accordingly, EGen was modified for this publication by removing the constructors in question. The TPC-E subcommittee has discussed this solution and found no compliance issues with it.

Respectfully Yours,



Doug Johnson, Auditor



François Raab, President

Clause 9: Supporting Files

Supporting Files Index table

An index for all files required by Clause 9.4 Supporting Files must be provided in the Report. The Supporting Files index is presented in a tabular format where the columns specify the following:

- The first column denotes the clause in the TPC Specification
- The second column provides a short description of the file contents
- The third column contains the path name for the file starting at the SupportingFiles directory.

If there are no Supporting Files provided then the description column must indicate that there is no supporting file and the path name column must be left blank (9.3.9.1).

Clause	Description	Path	Filename
	overview	SupportingFiles	SupportingFiles.doc
Introduction	System Configuration	SupportingFiles/Introduction/	SysInfo_TierA.txt SysInfo_TierB.txt
	Disk Configuration	SupportingFiles/Introduction/Hardware/	DiskConfiguration.docx flatfilelocations.txt makehelpdirff.cmd Readme.txt tempdb11.sql
	Parameter OS Tunables Database Setup	SupportingFiles/Introduction/Software/	CountOperations.reg MemoryManagement.reg MSTPCE Database Setup Reference.doc SQL_IP.reg SQL_LargePages.req SQL_Nodes.reg SQL_Server_Configuration.ver TierA_MSSQL_ConnectTo.reg TierA_W32Time.reg
	Startup Scripts Tier A	SupportingFiles/Introduction/Software/	start_all_RX4770M2-16DR-affinity.cmd
	Startup Scripts Tier B	SupportingFiles/Introduction/Software/	Sqlstart2014.cmd
Clause 2	Create Database	SupportingFiles/Clause2	Backup_Database.sql Checkpoint_TPCE_Database.SQL Count_Customers.sql Create_Database.sql Create_DM_Audit_Table.sql Create_TID_Ranges_Table.sql Create_Timer_Table.sql Create_TL_TU_Warnings_Table.sql Create_TPCE_VERSIONS_Table.sql Database_Options_1.sql Database_Options_2.sql Drop_and_Create_TPCE_INFO.sql End_Load_Timer.sql Get_Next_T_ID.sql Install_Load_Timer_Proc.sql Load_TPCE_Info.sql Output_TPCE_VERSIONS_Table.SQL Remove_Database.sql Restore_Database.sql SQL_Server_Configuration.sql TPCE_Setup.cmd Trade_Cleanup.sql Version.sql
	Create Database output	SupportingFiles/Clause2/DB_setup	3500000Customers_Load_Timer.log Backup_Database.log BrokerVolume.log Build_Steps.log BulkInsert_1.out ... BulkInsert_140.out

			Check_Constraints_Fixed.log Check_Constraints_Growing.log Check_Constraints_Scaling.log Convert_NI_ITEM_Data.log Create_DB_Audit_Tables.log Create_DM_Audit_Tables.log Create_Indexes_Fixed_Tables.log Create_Indexes_Growing_Tables.log Create_Indexes_Scaling_Tables.log Create_TID_Ranges_Table.log Create_TL_TU_Warnings_Table.log Create_TPCE_VERSIONS_Table.log CreatedB.log CustomerPosition.log Database_Options_1.log Database_Options_2.log DataMaintenance.log DB_Check.log DB_FK_Constraints.log DB_Primary_Key_Check.log DB_Tables.log Drop_DB_Audit_Tables.log Drop_Fixed_Tables.log Drop_FK_Constraints.log Drop_Growing_Tables.log Drop_Scaling_Tables.log EGenLoaderFrom1To25000.log EGenLoaderFrom25001To50000.log EGenLoaderFrom3475001To3500000.log ERRORLOG.txt FK_Constraints.log Get_Next_T_ID.log Insert_Duplicates_Tests.log Load_Timer.log Load_Timer_Proc.log Load_TPCE_Info.log MarketFeed.log MarketWatch.log Referential_Integrity_Tests.log RemoveDB.log SecurityDetail.log spfiles.ver splog.ver spused.ver SQL_Server_Configuration.log Tables_Fixed.log Tables_Growing.log Tables_Scaling.log TPCE_VERSIONS.log TradeLookup.log TradeOrder.log TradeResult.log TradeStatus.log TradeUpdate.log Version.log
	Index Creation Scripts	SupportingFiles/Clause2/DDL	BulkInsert_<1..140>.sql Convert_NI_ITEM_Data.SQL Create_Check_Constraints_Fixed.sql Create_Check_Constraints_Growing.sql Create_Check_Constraints_Scaling.sql Create_FK_Constraints.sql Create_Indexes_Fixed_Tables.sql Create_Indexes_Growing_Tables.sql Create_Indexes_Scaling_Tables.sql Create_Tables_Fixed.sql Create_Tables_Growing.sql Create_Tables_Scaling.sql Drop_FK_Constraints.sql Drop_Tables_Fixed.sql Drop_Tables_Growing.sql Drop_Tables_Scaling.sql

	Database Audit Scripts	SupportingFiles/Clause2/Audit_Scripts/Database	Create_DB_Audit_Tables.SQL DB_Check.sql DB_FK_Constraints.sql DB_Primary_Key_Check.SQL DB_Tables.sql Drop_DB_Audit_Tables.SQL Insert_Duplicates_Tests.sql Referential_Integrity_Tests.sql
	Database Space Scripts	SupportingFiles/Clause2/Audit_Scripts/Space	SPFiles.sql SPLog.sql SPUsed.sql
Clause3	Transaction Frames	SupportingFiles/Clause3	BrokerVolume.sql CustomerPosition.sql DataMaintenance.sql MarketFeed.sql MarketWatch.sql SecurityDetail.sql TradeLookup.sql TradeOrder.sql TradeResult.sql TradeStatus.sql TradeUpdate.sql
	BaseServer	SupportingFiles/Clause3/BaseServer	BaseServer.cpp BaseServer.h BaseServer.vcproj BaseServer.vcxproj stdafx.cpp stdafx.h SUTServersLocals.h
	SUT_CE_Server	SupportingFiles/Clause3/SUT_CE_Server	Release\SUT_CE_Server.exe CEServer.cpp CEServer.h CEServerMain.cpp PortDefinitions.h stdafx.cpp stdafx.h SUT_CE_Server.vcproj SUT_CE_Server.vcxproj SUTServer.sln SUTStructs.h
	SUT_MEE_Server	SupportingFiles/Clause3/SUT_MEE_Server	Release\SUT_MEE_Server.exe MEEServer.cpp MEEServer.h MEEServerMain.cpp stdafx.cpp stdafx.h SUT_MEE_Server.vcproj SUT_MEE_Server.vcxproj
	TransactionsSP	SupportingFiles/Clause3/TransactionsSP	BrokerVolumeDB_SP.cpp BrokerVolumeDB_SP.h CheckpointDB_SP.cpp CheckpointDB_SP.h CustomerPositionDB_SP.cpp CustomerPositionDB_SP.h DataMaintenanceDB_SP.cpp DataMaintenanceDB_SP.h MarketFeedDB_SP.cpp MarketFeedDB_SP.h MarketWatchDB_SP.cpp MarketWatchDB_SP.h SecurityDetailDB_SP.cpp SecurityDetailDB_SP.h stdafx.cpp stdafx.h TradeLookupDB_SP.cpp TradeLookupDB_SP.h TradeOrderDB_SP.cpp TradeOrderDB_SP.h TradeResultDB_SP.cpp TradeResultDB_SP.h TradeStatusDB_SP.cpp

			TradeStatusDB_SP.h TradeUpdateDB_SP.cpp TradeUpdateDB_SP.h TransactionsSP.vcxproj TransactionsSP.vcxproj TxnHarnessDBBase.cpp TxnHarnessDBBase.h TxnHarnessDBConn.cpp TxnHarnessDBConn.h
	TxnHarness	SupportingFiles/Clause3/TxnHarness	TxnHarness.vcxproj TxnHarness.vcxproj TxnHarness_stdafx.cpp TxnHarness_stdafx.h TxnHarnessSendToMarket.cpp TxnHarnessSendToMarket.h
Clause4			
Clause5	EGen Driver Configuration	SupportingFiles/Clause5	RX4770_3500KCus_4x51_12x53_spiderc.xml EGenTxnHarnessStructs.h
	EGenLoader Parameter	SupportingFiles/Clause5	BuildSteps.log EGenLoaderFrom1To25000.log EGenLoaderFrom25001To50000.log EGenLoaderFrom3475001To3500000.log
	EGenLogger Output	SupportingFiles/Clause5	TxnReportE-MI.xls
Clause6	EGenValidate	SupportingFiles/Clause6	EGenValidate.txt
Clause7	ACID	SupportingFiles/Clause7	MSTPCE ACID Procedures.doc
	ACID Procedures	SupportingFiles/Clause7/AcidProcs	AcidProc.cmd AcidProc.out Remove_AcidProcs.cmd
	ACID Scripts	SupportingFiles/Clause7/AcidProcs/Scripts	AcidProc.vbs CustomerPosition_Iso3.sql CustomerPosition_Iso4.sql Drop_SPROC.sql Remove_AcidProcs.vbs TradeOrder_C.sql TradeOrder_Iso1_1.sql TradeOrder_Iso1_2.sql TradeOrder_Iso2.sql TradeOrder_Iso3.sql TradeOrder_Iso4.sql TradeOrder_RB.sql TradeResult_Iso1_1.sql TradeResult_Iso1_2.sql TradeResult_Iso2_1.sql TradeResult_Iso2_2.sql TradeResult_Iso3.sql TradeResult_Iso4.sql
	Atomicity	SupportingFiles/Clause7/Atomicity	Atomicity.cmd Atomicity_C.out Atomicity_RB.out
		SupportingFiles/Clause7/Atomicity/Scripts	atom.vbs Atomicity_C.sql Atomicity_RB.sql
	Consistency	SupportingFiles/Clause7/Consistency	Consistency.cmd Consistency.out
		SupportingFiles/Clause7/Consistency/Scripts	Consistency.sql Consistency.vbs
	Durability Business Recovery	SupportingFiles/Clause7/Durability/BusinessRecovery	BR_BenchCraft_Config.xml BR_Consistency.out BR_Count_Settlement1.ver BR_Count_Settlement2.ver BR_ERRORLOG1.txt BR_ERRORLOG2.txt BR_ERRORLOG3.txt BR_SystemEvents_TierB.txt BusinessRecov_Part1_step60.xlt BusinessRecov_Part1_TxnReportE_20.xlsx BusinessRecov_Part1_TxnReportE_all.xlsx

			BusinessRecov_Part2_step60.xlt BusinessRecov_Part2_TxnReportE_20.xlsx BusinessRecov_Part2_TxnReportE_all.xlsx BusinessRecov_TimeGraph.xls
	Durability Data Accessibility	SupportingFiles/Clause7/Durability/Data Accessibility	DA_BenchCraft_Config.xml DA_Count_Settlement1.ver DA_Count_Settlement2.ver DA_ERRORLOG.txt DataAccess_TimeGraph.xls DataAccess_TxnReportE_5min1.xls DataAccess_TxnReportE_5min2.xls DataAccess_TxnReportE_20min.xls DataAccess_TxnReportE_all.xls SystemEvents_Application.txt
	Isolation	SupportingFiles/Clause7/Isolation	Isolation1_S1.rpt Isolation1_S2.rpt Isolation1_S3.rpt Isolation1_S4.rpt Isolation2_S1.rpt Isolation2_S2.rpt Isolation2_S3.rpt Isolation2_S4.rpt Isolation3_S1.rpt Isolation3_S2.rpt Isolation3_S3.rpt Isolation4_S1.rpt Isolation4_S2.rpt Isolation4_S3.rpt
		SupportingFiles/Clause7/Isolation/Scripts	Isolation1_S1.sql Isolation1_S2.sql Isolation1_S3.sql Isolation1_S4.sql Isolation2_S1.sql Isolation2_S2.sql Isolation2_S3.sql Isolation2_S4.sql Isolation3_S1.sql Isolation3_S2.sql Isolation3_S3.sql Isolation4_S1.sql Isolation4_S2.sql Isolation4_S3.sql
Clause8	60-Day Space Calculations	SupportingFiles/Clause8	tpce_space.xls

Appendix: Third Party Price Quotations

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Tel 425 882 8080
Fax 425 936 7329
<http://www.microsoft.com/>

Microsoft

May 4, 2015

Fujitsu
Detlev Seidel
Heinz-Nixdorf-Ring 18001
Paderborn, Germany 33126

Here is the information you requested regarding pricing for several Microsoft products to be used in conjunction with your TPC-E benchmark testing.

All pricing shown is in US Dollars (\$).

Part Number	Description	Unit Price	Quantity	Price
Database Management System				
7JQ-00750	SQL Server 2014 Enterprise Edition 2 Core License Open Program - Level C	\$13,472.50	36	\$485,010.00
Database Server Operating System				
P72-06284	Windows Server 2012 R2 Standard Edition 2 Processor License Open Program - Level C Unit Price reflects a 17% discount from the retail unit price of \$882.	\$735.00	2	\$1,470.00
Tier-A Operating System(s)				
P72-06284	Windows Server 2012 R2 Standard Edition 2 Processor License Open Program - Level C Unit Price reflects a 17% discount from the retail unit price of \$882.	\$735.00	1	\$735.00
Support				
N/A	Microsoft Problem Resolution Services Professional Support (1 Incident).	\$259.00	1	\$259.00

SQL Server 2014 Enterprise Edition and Windows Server 2012 Standard Edition are currently orderable and available through Microsoft's normal distribution channels. A list of Microsoft's resellers can be found in the Microsoft Product Information Center at **<http://www.microsoft.com/products/info/render.aspx?view=22&type=how>**

Defect support is included in the purchase price. Additional support is available from Microsoft PSS on an incident by incident basis at \$259 call.

This quote is valid for the next 90 days.
Reference ID: TPCE_qhtplyIGYLKTVUKf28479ddlw_2015_fds.


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StarTech.com Shielded Cat6a Molded STP Patch Cable – patch cable – 7 ft – b



Mfg. Part: C6ASPAT7BL | CDW Part: 1973556 | UNSPSC: 26121609

★★★★★

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1

\$12.99
Advertised Price

Availability: In Stock
 Ships today if ordered within **13 hrs 19 mins**

- Patch cable
- RJ-45 (M)
- RJ-45 (M)
- 7 ft
- STP
- CAT 6a
- molded

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<http://www.cdw.com/shop/products/StarTech.com-Shielded-Cat6a-Molded-STP-Patch-Cable-patch-cable-7-ft-b/1973556.aspx>

 [Product Overview](#)