

TPC Benchmark™ E
Full Disclosure Report for



PRIMERGY RX300 S5

Using

**Microsoft SQL Server 2008
Enterprise x64 Edition**

Using

**Microsoft Windows Server 2008
Enterprise x64 Edition**

TPC-E Version 1.7.0

Submitted for Review

March 30, 2009

First Edition March 2009

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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


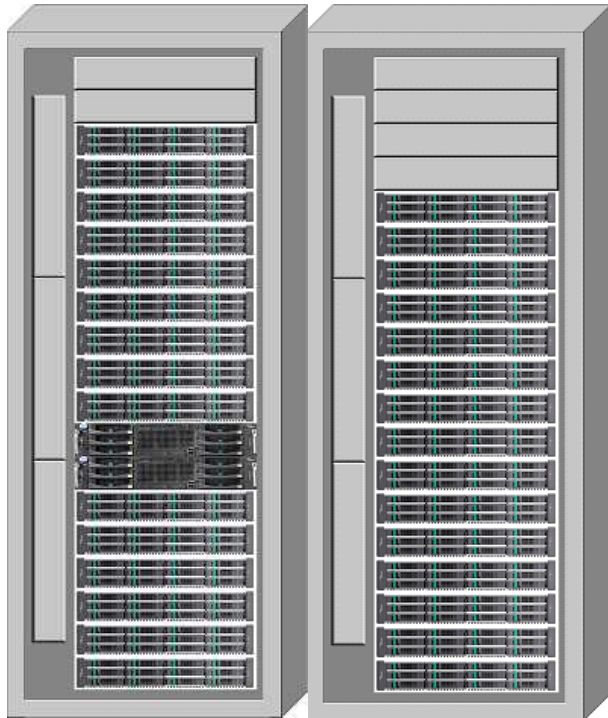
This report documents the TPC Benchmark™ E results achieved by Fujitsu using Microsoft SQL Server 2008 Enterprise x64 Edition.

The TPC Benchmark™ E tests were run on a PRIMERGY RX300 S5 system using the Microsoft Windows Server 2008 Enterprise x64 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 RX300 S5	Microsoft SQL Server 2008 Enterprise x64 Edition Microsoft Windows Server 2008 Enterprise x64 Edition	\$ 275,131 USD	800.00	\$ 343.91 USD	April 1, 2009

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

		PRIMERGY RX300 S5		TPC-E 1.7.0 TPC Pricing 1.3.0
				Report Date March 30, 2009
TPC-E Throughput 800.00 tpsE	Price/Performance \$ 343.91 USD per tpsE	Availability Date April 1, 2009	Total System Cost \$ 275,131	
Database Server Configuration				
Operating System Microsoft Windows Server 2008 Enterprise x64 Edition	Database Manager Microsoft SQL Server 2008 Enterprise x64 Edition	Processors/Cores/Threads 2/8/16	Memory 96 GB	
SUT				
		Tier A PRIMERGY RX300 S4 2x Intel Xeon E5420 2.50 GHz 4 GB Memory 1x 250 GB SATA Drive Onboard 2x 1 Gb/s Dual Port LAN 1 Gb/s		
		Tier B PRIMERGY RX300 S5 2x Intel Xeon X5570 2.93 GHz 96 GB Memory 2x 73 GB 15K SAS Drives 4x 300 GB 15K SAS Drives Onboard SAS RAID Controller 5x SAS RAID Controller Onboard 2x 1 Gb/s		
		Storage 2x PRIMECENTER Rack 30x FibreCat SX40 192x 73 GB 15K SAS Drives 168x 146 GB 15K SAS Drives		
Initial Database Size 3,093 GB	Redundancy Level 1 RAID-10		Storage 192 x 73 GB 15K 168 x 146GB 15K 4 x 300GB 15K	



PRIMERGY RX300 S5

TPC-E 1.7.0
TPC Pricing 1.3.0

Report Date
March 30, 2009

Availability Date
April 1, 2009

Description	Part Number	Price Source	Unit Price	Qty	Extended Price	3-yr. Maint. Price
Database Server Hardware						
FSCR3S4_S26361-K1237-V101_80039-01		1	21,621.45	1	21,621.45	
PRIMERGY RX300 S5 Basic unit with	S26361-K1237-V101			1		
6x 3.5" hard disk drive bays Rack version for 19				1		
Xeon DP X5570 (2.93GHz/8MB/4GT) / 95W	S26361-F3280-E293			2		
Memory SP 24GB (3x 8GB dual rank)	S26361-F3284-E535			4		
DVD-RW supermulti slimline SATA	S26361-F3269-E1			1		
HD SAS 3Gb/s 72GB 15k hot plug 3.5"	S26361-F3204-E573			2		
HD SAS 3Gb/s 300GB 15k hot plug 3.5"	S26361-F3204-E530			4		
RAID 5/6 SAS based on LSI MegaRAID 256MB	S26361-F3257-E256			1		
RAID Ctrl SAS 8Port 512M w/o BBU LP LSI	S26361-F3890-E201			5		
RMK-P_1-2U servers (new)	S26361-F2735-E110			1		
SCENICVIEW A17-3	S26361-K1146-V150	1	191.25	1	191.25	
KB SLIM MF USA	S26381-K370-V510	1	22.10	1	22.10	
Optical Wheelmouse USB silver	S26381-K355-L400	1	15.30	1	15.30	
PYR3S4 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	PYR3S4-U004361-0NA	1	854.10	1		854.10
				Subtotal	21,850.10	854.10
Server Storage						
FSCPCTR_S26361-K826-V103_80041-01		1	2,343.45	1	2,343.45	
PRIMECENTER Rack 38 U, 1000 deep	S26361-K826-V103			1		
Dummy panel, plastics, 2U + assembly	S26361-F2735-E131			6		
Socket strip 3phase 3x 8 sockets	S26361-F2262-E31			2		
FSCPCTR_S26361-K826-V103_80041-05		1	2,357.05	1	2,357.05	
PRIMECENTER Rack 38 U, 1000 deep	S26361-K826-V103			1		
Dummy panel, plastics, 2U + assembly	S26361-F2735-E131			7		
Socket strip 3phase 3x 8 sockets	S26361-F2262-E31			2		
FSCSX40_S26361-K1122-V200_80041-02/06		1	4,460.80	16	71,372.80	
FibreCAT SX40 SAS Disk Subsystem	S26361-K1122-V200			16		
HD SAS 3Gb/s 73GB 15k hot pl 3.5" SX40	S26361-F3244-E573			192		
Rack installation ex works, SX10, 1U Nod	S26361-F1647-E302			16		
FSCSX40_S26361-K1122-V200_80041-03		1	5,001.40	14	70,019.60	
FibreCAT SX40 SAS Disk Subsystem	S26361-K1122-V200			14		
HD SAS 3Gb/s 146GB 15k hot pl 3.5" SX40	S26361-F3244-E514			168		
Rack installation ex works, SX10, 1U Nod	S26361-F1647-E302			14		
PYSX40 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months,	PYSX40-U004361-0NA	1	1,644.30	30		49,329.00
SAS CBL EXT 6m 8088-8470	S26361-F3246-L603	1	107.95	5	539.75	
SAS CBL EXT 2m 8088-8470	S26361-F3246-L203	1	62.90	5	314.50	
SAS cable external 0.5 m	S26361-F3246-L5	1	59.50	20	1,190.00	
				Subtotal	148,137.15	49,329.00



PRIMERGY RX300 S5

TPC-E 1.7.0
TPC Pricing 1.3.0

Report Date
March 30, 2009

Availability Date
April 1, 2009

Server Software						
SQL Server 2008 Enterprise x64 Edition Per Processor License	810-07509	2	23,911.00	2	47,822.00	
Windows Server 2008 Enterprise Edition (x64)	P72-03195	2	2,357.00	1	2,357.00	
Microsoft Problem Resolution Services	n/a	2	245.00	1		245.00
				Subtotal	50,179.00	245.00
Tier A Client Hardware						
FSCR3S4_S26361-K1151-V101_80041-04						
PY RX300S4 6x3.5	S26361-K1151-V101	1	2,531.30	1	2,531.30	
Xeon DP E5420 2.50 GHz 2x6MB 1333MHz	S26361-F3882-E250			2		
2GB 2x1GB FBD667 PC2-5300F d ECC	S26361-F3263-E522			2		
CD-RW/DVD slimline SATA	S26361-F3268-E1			1		
HD SATA 3Gb/s 250GB 7.2k hot plug 3.5"	S26361-F3265-E250			1		
RAID 0/1 SAS based on LSI MegaRAID 8Port	S26361-F3257-E8			1		
Rack installation ex works	SNP:SY-F1647E301-P			1		
RMK-P_1-2U servers (new)	S26361-F2735-E110			1		
Eth Ctrl 2x1 Gbit PCIe PRO/1000PT Cu lp	S26361-F3228-L201	1	161.50	1	161.50	
SCENICVIEW A17-3	S26361-K1146-V150	1	191.25	1	191.25	
KB SLIM MF USA	S26381-K370-V510	1	22.10	1	22.10	
Optical Wheelmouse USB silver	S26381-K355-L400	1	15.30	1	15.30	
PYR3S4 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months,	PYR3S4-U004361-0NA	1	854.10	1		854.10
				Subtotal	2,921.45	854.10
Tier A Client Software						
Windows Server 2003 R2 Standard x64 Edition	P73-01664	2	719.00	1	719.00	
Infrastructure or Connectivity						
LAN_crossover-Cat 5e, l=5m	S26361-F3482-L5	1	21.25	2	42.50	
				Total	223,849.20	51,282.20
Notes:				Three-Year Cost of Ownership USD		\$275,131
Price Source: 1=Fujitsu, 2=Microsoft Corporation				TPC-E Throughput		800.00
				\$ USD/tpsE		\$343.91

The benchmark results and test methodology were audited by Francois Raab of 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



PRIMERGY RX300 S5

TPC-E 1.7.0
TPC Rev 1.3.0

Report Date
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Numerical Quantities Summary				
Reported Throughput:		Configured Customers:		
	800.00 tpsE			400,000
Response Times (in seconds)	Minimum	Average	90th%tile	Maximum
Broker Volume	0.00	0.04	0.07	0.28
Customer Position	0.00	0.05	0.08	2.44
Market Feed	0.00	0.05	0.15	4.16
Market Watch	0.00	0.03	0.06	1.30
Security Detail	0.00	0.02	0.04	2.94
Trade Lookup	0.00	0.65	0.83	2.12
Trade Order	0.00	0.13	0.19	5.76
Trade Result	0.00	0.14	0.21	7.92
Trade Status	0.00	0.04	0.07	0.89
Trade Update	0.03	0.76	0.90	8.44
Data Maintenance	0.00	0.16	N/A	2.93
Transaction Mix		Transaction Count		Mix %
Broker Volume		2,825,616		4.900%
Customer Position		7,496,502		13.000%
Market Feed		576,682		1.000%
Market Watch		10,379,872		18.000%
Security Detail		8,073,259		14.000%
Trade Lookup		4,612,800		7.999%
Trade Order		5,824,314		10.100%
Trade Result		5,766,750		10.000%
Trade Status		10,956,357		19.000%
Trade Update		1,153,083		2.000%
Data Maintenance		120		N/A
Test Duration and Timings				
Ramp-up Time (hh:mm:ss)		00:18:25		
Measurement Interval (hh:mm:ss)		02:00:00		
Business Recovery Time (hh:mm:ss)		00:27:30		
Total Number of Transactions Completed in Measurement Interval		57,665,235		

Table of Contents

ABSTRACT	3
CLAUSE 0: PREAMBLE	10
Introduction.....	10
Goal of the TPC-E Benchmark.....	10
Restrictions and Limitations.....	11
CLAUSE 1: OVERVIEW	12
Order and Titles.....	12
Executive Summary Statement.....	12
Benchmark Sponsor.....	12
Configuration Diagram.....	13
Hardware Configuration.....	13
Software Configuration.....	14
CLAUSE 2: DATABASE DESIGN, SCALING AND POPULATION	15
Database Creation.....	15
Partitioning.....	15
Replication and Duplicated Attributes.....	15
Cardinality of Tables.....	16
Distribution of Tables, Partitions and Logs.....	17
Database Interface, Data Model and Load Methodology.....	19
CLAUSE 3: TRANSACTIONS	20
Vendor-Supplied Code.....	20
Database Footprint Requirements.....	20
CLAUSE 4: SUT, DRIVER AND NETWORK	21
Network Configuration.....	21
CLAUSE 5: EGEN	22
EGen Version.....	22
EGen Code.....	22
EGen Modifications.....	22
CLAUSE 6: PERFORMANCE METRICS AND RESPONSE TIME	23
EGen Driver.....	23
Measured Throughput.....	23
Test Run Graph.....	23
Steady State.....	24
Work Performed During Steady State.....	24
Transaction Input Parameter Averages.....	25
CLAUSE 7: TRANSACTION AND SYSTEM PROPERTIES	26
ACID Tests.....	26
Redundancy Level and Data Accessibility.....	26
Business Recovery.....	27
CLAUSE 8: PRICING RELATED ITEMS	29
60-Day Space.....	29
Attestation Letter.....	30
CLAUSE 9: SUPPORTING FILES	32

Supporting Files Index table.....	32
APPENDIX: THIRD PARTY PRICE QUOTATIONS.....	37

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 anytime, 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).

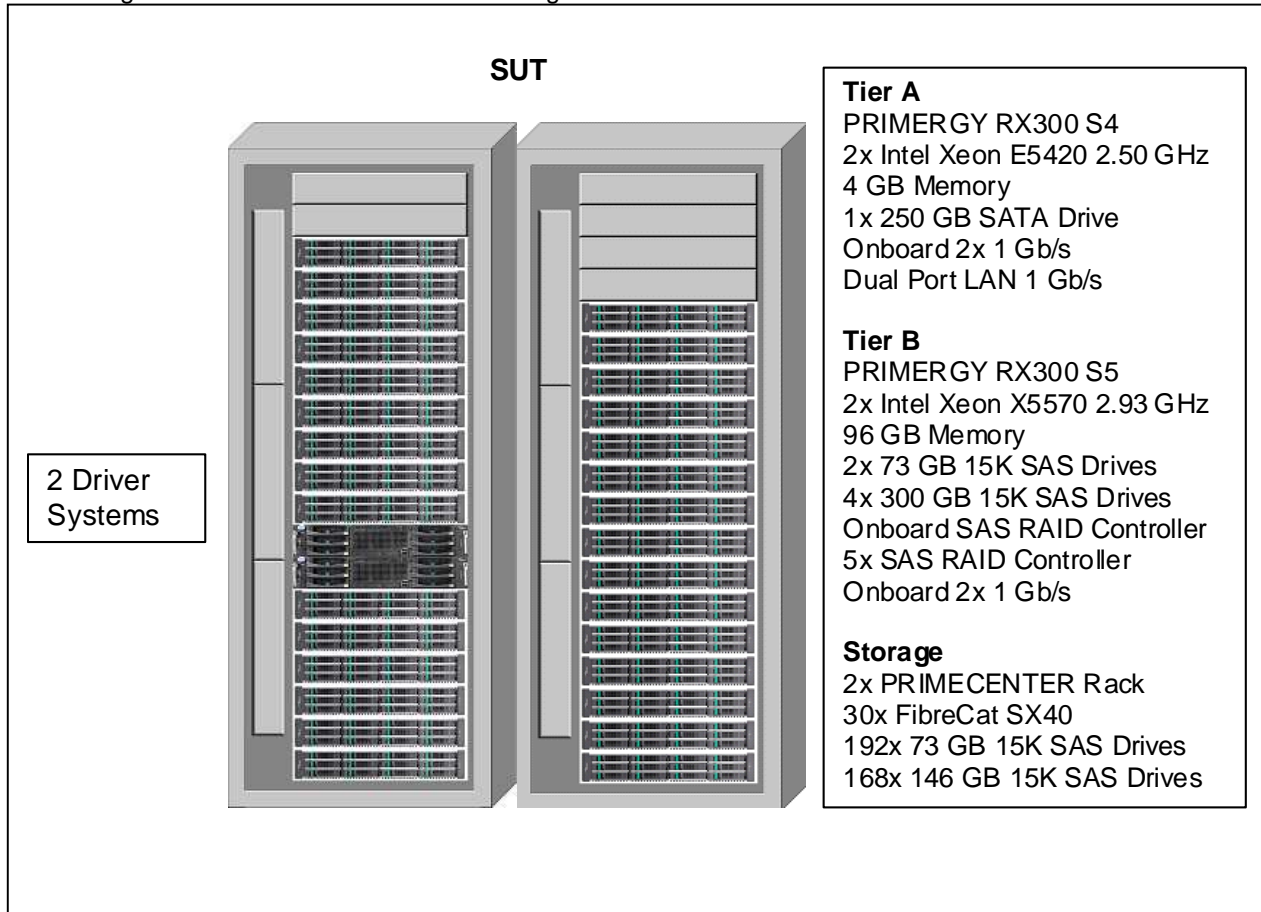
Fujitsu is the sponsor of this TPC Benchmark™ E result.

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 no differences between both configurations.

Figure 1-1: Measured and Priced 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 systems are not part of the System Under Test (SUT) and priced configuration. Two systems are connected with system Tier A onboard LAN controller using 1 Gb/s Ethernet. There are two LAN segments for these connections.

Tier A

The Tier A server is a Fujitsu PRIMERGY RX300 S4 with two Intel Xeon E5420 Quad-Core Processor and 4 GB of memory. One 250 GB SATA disk drive is connected to the onboard controller. A 1 Gb/s dual port Ethernet LAN card is plugged in a PCI-E slot. Each of the two ports is directly connected with one of the 1 Gb/s Ethernet onboard LAN ports of Tier B using a LAN crossover cable. There are two LAN segments for these connections.

Tier B

The Tier B or database server is a Fujitsu PRIMERGY RX300 S5 with two Intel Xeon X5570 Quad-Core Processors and 96 GB memory. All of the six 3.5" disk bays are used with 2x SAS 72GB 15K disk drives 3.5" RAID1 for OS and database and 4x SAS 300GB 15K disk drives 3.5" RAID10 for database log. All drives are connected to a LSI SAS RAID Controller and configured with the MegaRAID BIOS Configuration Utility (enter with <CTRL>H at boot). Five RAID controllers LSI MegaRAID SAS8880E with 512MB cache are used to connect the 360 external disk drives to the server. The LAN connection of the two onboard 1 Gb/s Ethernet ports is described above.

Storage

16 Fujitsu PRIMERGY SX40 are used, each with 12x SAS 73GB 15K disk drives 3.5" and 14 Fujitsu PRIMERGY SX40 are used, each with 12x SAS 146GB 15K disk drives 3.5". Three enclosures are linked and connected to the LSI MegaRAID SAS8880E. Each controller has two external chains with 3x SX40. For details see table 2-2 Disk Configuration. The disk configuration can be done with the MegaRAID BIOS Configuration Utility or 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. 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 400,000 customers. The SQL Server scripts and setup command files are included in the SupportingFiles\Clause2 folder. Two file groups are used for 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 400,000 customers. The cardinality of the tables after database load is as shown in the following table 2-1.

Table 2-1: Table Cardinality and Filegroups

Table	Cardinality after database load	Filegroup
ACCOUNT_PERMISSION	2840015	2
ADDRESS	600004	2
BROKER	4000	2
CASH_TRANSACTION	6359035497	1
CHARGE	15	2
COMMISSION_RATE	240	2
COMPANY	200000	2
COMPANY_COMPETITOR	600000	2
CUSTOMER	400000	2
CUSTOMER_ACCOUNT	2000000	2
CUSTOMER_TAXRATE	800000	2
DAILY_MARKET	357570000	2
EXCHANGE	4	2
FINANCIAL	4000000	2
HOLDING	353876585	2
HOLDING_HISTORY	9263259270	2
HOLDING_SUMMARY	19899625	2
INDUSTRY	102	2
LAST_TRADE	274000	2
NEWS_ITEM	400000	2
NEWS_XREF	400000	2
SECTOR	12	2
SECURITY	274000	2
SETTLEMENT	6912000000	1
STATUS_TYPE	5	2
TAXRATE	320	2
TRADE	6912000000	1
TRADE_HISTORY	1.6589E+10	1
TRADE_REQUEST	0	2
TRADE_TYPE	5	2
WATCH_ITEM	40030356	2
WATCH_LIST	400000	2
ZIP_CODE	14741	2

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).

Table 2-2: Disk Configuration

HBA - Port	Disk	Drives	Partition	Size	Use
Ctrl 0	0 – onboard	2x73GB, 15K SAS, RAID0	C:\	~69,469 MB	OS, DB
	1 – onboard	4x300GB, 15K SAS, RAID10	L:\	~570,000 MB	DB Log
Ctrl 1 Port 0	2 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst01 C:\jp\else01 C:\jp\data01	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	3 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst02 C:\jp\else02 C:\jp\data02	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	4 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst03 C:\jp\else03 C:\jp\data03	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
Ctrl 1 Port 1	5 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst04 C:\jp\else04 C:\jp\data04	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	6 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst05 C:\jp\else05 C:\jp\data05	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	7 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst06 C:\jp\else06 C:\jp\data06	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
Ctrl 2 Port 0	8 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst07 C:\jp\else07 C:\jp\data07	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	9 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst08 C:\jp\else08 C:\jp\data08	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	10 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst09 C:\jp\else09 C:\jp\data09	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
Ctrl 2 Port 1	11 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst10 C:\jp\else10 C:\jp\data10	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	12 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst11 C:\jp\else11 C:\jp\data11	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	13 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst12 C:\jp\else12 C:\jp\data12	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup

Ctrl 3 Port 0	14 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst13 C:\jp\else13 C:\jp\data13	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	15 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst14 C:\jp\else14 C:\jp\data14	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	16 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst15 C:\jp\else15 C:\jp\data15	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
Ctrl 3 Port 1	17 – SX40	12x73GB, 15K SAS, RAID10	C:\jp\cst16 C:\jp\else16 C:\jp\data16	113,000 MB 37,000 MB ~261,980 MB	Filegroup1 Filegroup2 Backup
	18 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst17 C:\jp\else17 C:\jp\data17	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	19 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst18 C:\jp\else18 C:\jp\data18	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
Ctrl 4 Port 0	20 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst19 C:\jp\else19 C:\jp\data19	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	21 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst20 C:\jp\else20 C:\jp\data20	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	22 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst21 C:\jp\else21 C:\jp\data21	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
Ctrl 4 Port 1	23– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst22 C:\jp\else22 C:\jp\data22	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	24– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst23 C:\jp\else23 C:\jp\data23	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	25– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst24 C:\jp\else24 C:\jp\data24	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
Ctrl 5 Port 0	26– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst25 C:\jp\else25 C:\jp\data25	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	27– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst26 C:\jp\else26 C:\jp\data26	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	28– SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst27 C:\jp\else27 C:\jp\data27	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
Ctrl 5 Port 1	29 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst28 C:\jp\else28 C:\jp\data28	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	30 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst29 C:\jp\else29 C:\jp\data29	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup
	31 – SX40	12x146GB, 15K SAS, RAID10	C:\jp\cst30 C:\jp\else30 C:\jp\data30	123,000 MB 40,000 MB ~672,410 MB	Filegroup1 Filegroup2 Backup

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 2008 Enterprise x64 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):

Figure 1-1 shows the configuration of the measured and priced configurations. Both are identical. Tier B system PRIMERGY RX300 S5 has an onboard Ethernet controller with two 1Gb/s ports. Tier A system PRIMERGY RX300 S4 has an onboard Ethernet controller with two 1Gb/s ports and was extended with a two port 1Gb/s Ethernet controller card. These two ports of the tier A card were directly connected with the two onboard port of tier B using different LAN segments. The two onboard ports of tier A and the two driver systems were directly connected via 1Gb/s using different LAN segments.

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 1.7.0.

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).

There were no modifications to the EGen. EGenLoader was not extended for this benchmark.

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).

Two driver systems were used, each configured to drive one EGenDriverMEE and one EGenDriverCE. Tier A system run two EGenDriverMEE and two EGenDriverCE.

Measured Throughput

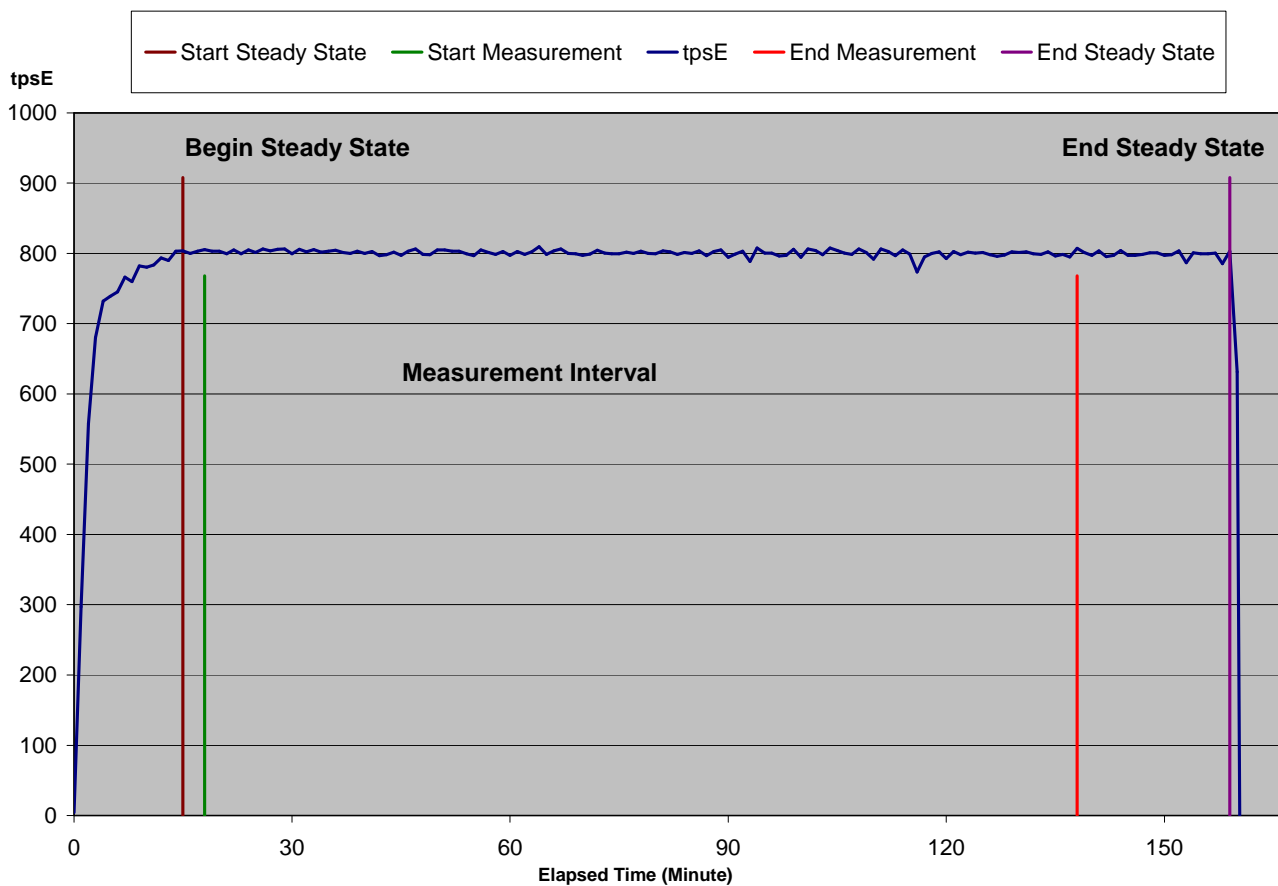
The Measured Throughput must be reported in the Report (see Clause 6.7.1.2) (9.3.6.2).

The measured throughput was 800.00 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.
4. Two completed full checkpoints.

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 (450 seconds) and specified duration (420 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).

Table 6-2: Transaction Input Parameter Averages.

Transaction	Parameter	Range Min	Range Max	Value	Check
Customer Position	By Tax ID	48.00%	52.00%	50.02%	Ok
	Get History	48.00%	52.00%	50.00%	Ok
	Overall				Ok
Market Watch	By Watch List	57.00%	63.00%	59.97%	Ok
	By Customer Account	33.00%	37.00%	35.01%	Ok
	By Industry	4.50%	5.50%	5.01%	Ok
	Overall				Ok
Security Detail	Access LOB	0.90%	1.10%	1.00%	Ok
	Overall				Ok
Trade Lookup	Frame 1	28.50%	31.50%	29.97%	Ok
	Frame 2	28.50%	31.50%	30.06%	Ok
	Frame 3	28.50%	31.50%	29.99%	Ok
	Frame 4	9.50%	10.50%	9.98%	Ok
	Overall				Ok
Trade Update	Frame 1	31.00%	35.00%	33.00%	Ok
	Frame 2	31.00%	35.00%	32.94%	Ok
	Frame 3	32.00%	36.00%	34.06%	Ok
	Overall				Ok
Trade Order	By Non-Owner	9.50%	10.50%	9.99%	Ok
	By Company Name	38.00%	42.00%	40.01%	Ok
	Buy On Margin	7.50%	8.50%	8.00%	Ok
	Rollback	0.94%	1.04%	0.99%	Ok
	LIFO	33.00%	37.00%	34.98%	Ok
	Trade Qty 100	24.00%	26.00%	25.00%	Ok
	Trade Qty 200	24.00%	26.00%	24.99%	Ok
	Trade Qty 400	24.00%	26.00%	24.97%	Ok
	Trade Qty 800	24.00%	26.00%	25.03%	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%	9.99%	Ok
Overall				Ok	

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).

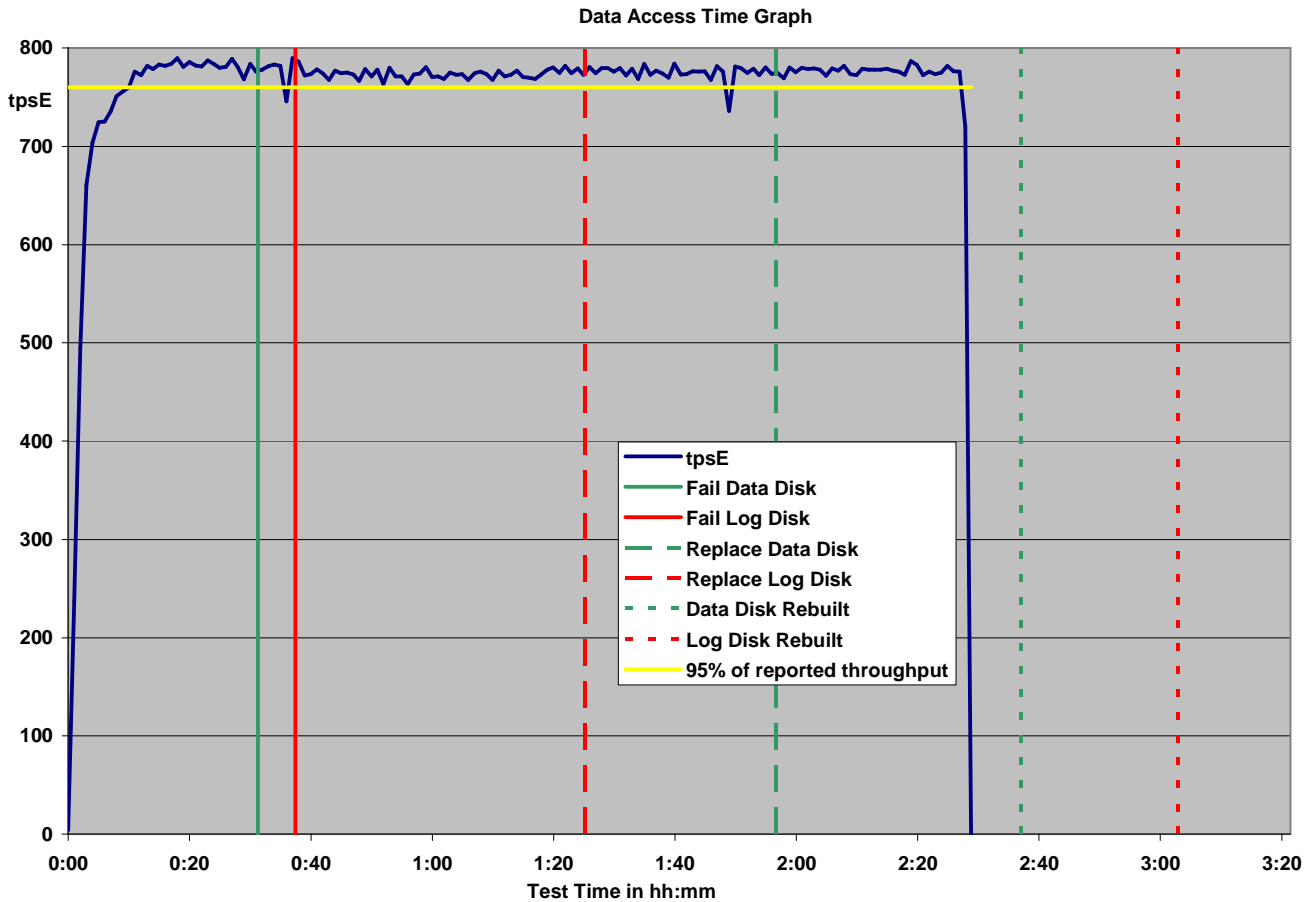
A Data Accessibility Graph for each run demonstrating a Redundancy Level must be reported in the Report (see Clause 7.5.7.2) (9.3.7.3).

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 20 minutes.
3. Induce the failure described for the redundancy level being demonstrated. In this case fail a disk in a database data array and after 6 minutes a disk in the database log array. The transactions continue since RAID10 is used for at least 10 minutes.
4. Begin the necessary recovery process, by replacing the failed drives in the database log array and start the rebuild.
5. Begin the necessary recovery process, by replacing the failed drives in the database data array and start the rebuild process.
6. Continue running the Driver for at least 20 minutes with throughput above 95% of reported throughput.
7. Terminate the run gracefully from the Driver.
8. Wait until rebuild process has finished.
9. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
10. 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.

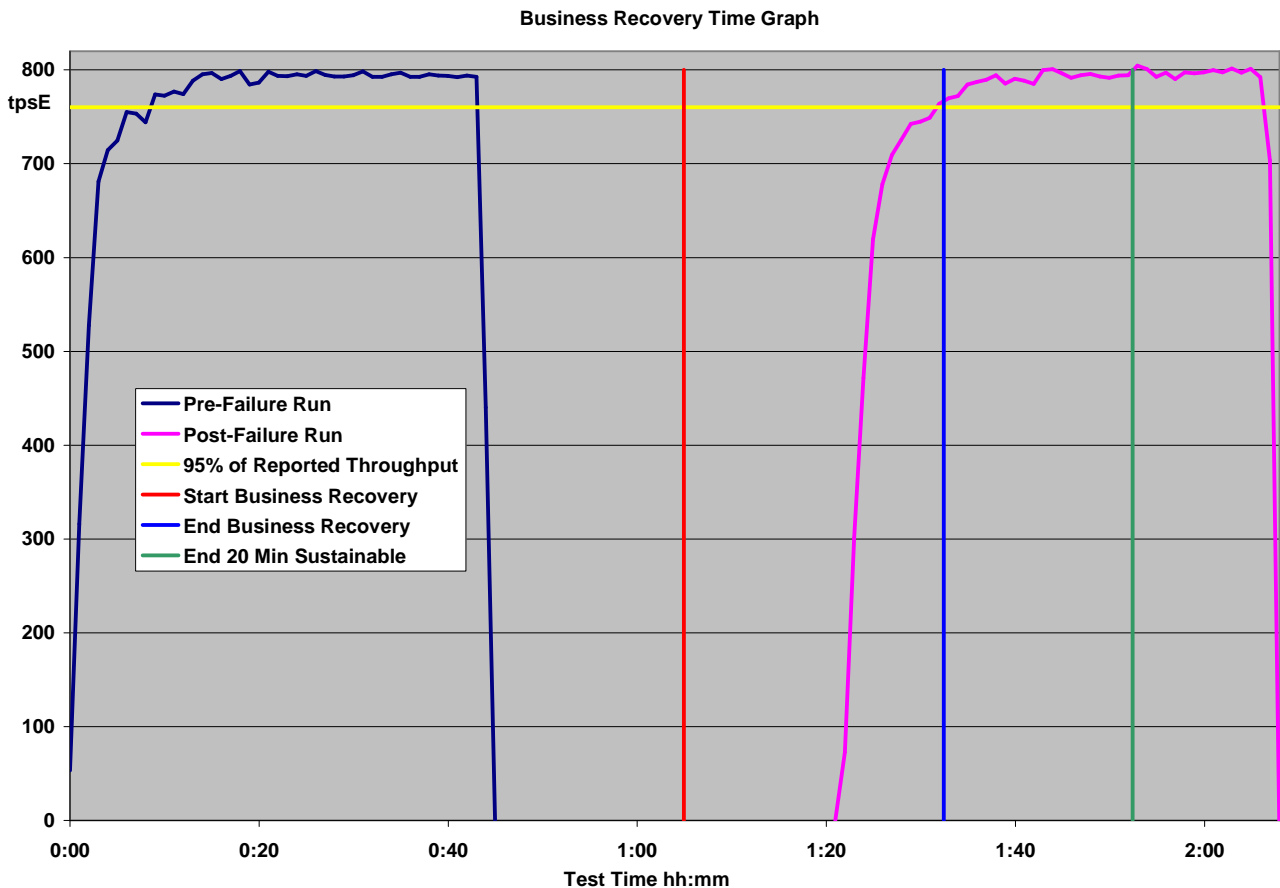
1. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
2. Start submitting transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes.
3. Induce the failures by simultaneously power off Tier A and 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 A and B.
6. When restarting the database on Tier B, it automatically starts the recovery and records timestamps. The first timestamp defines the beginning of Business Recovery.
7. After recovery completes start a Trade-Cleanup. Just after finishing this start 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 start of this interval is the end of the Business Recovery.
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 was 00:27:30 (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 (see Clause 8.2.2) along with proof that the database is configured to sustain a Business Day of growth (see Clause 6.6.6.1) must be reported (9.3.8.1).

Table 8-1: Space Requirements

TPC-E Disk Space Requirements							
Customers Used	400,000						
Performance	800.00 TpsE		settlements after 8 hours (Business Day)			23,040,000	
					initial size	grow size	
Table	Initial Rows	Data (KB)	Index size (KB)	Extra 5% (KB)	Total + 5% (KB)	After run (KB)	Growth (KB)
ACCOUNT_PERMISSION	2840015	241760	1672	12172	255604	243656	224
ADDRESS	600004	34616	512	1756	36884	35168	40
BROKER	4000	224	408	32	664	872	240
CASH_TRANSACTION	6359035497	630016824	1329664	31567324	662913812	644769488	13423000
CHARGE	15	8	8	1	17	16	0
COMMISSION_RATE	240	16	16	2	34	32	0
COMPANY	200000	43496	12488	2799	58783	56008	24
COMPANY_COMPETITOR	600000	16128	13568	1485	31181	29696	0
CUSTOMER	400000	67768	18152	4296	90216	85944	24
CUSTOMER_ACCOUNT	2000000	185744	221304			407048	0
CUSTOMER_TAXRATE	800000	16696	504	860	18060	17320	120
DAILY_MARKET	357570000	18368688	7783432	1307606	27459726	26153216	1096
EXCHANGE	4	8	8	1	17	16	0
FINANCIAL	4000000	470632	1728	23618	495978	472616	256
HOLDING	353876585	18856736	13981256	1641900	34479892	43308976	10470984
HOLDING_HISTORY	9263259270	336845856	175547728	25619679	538013263	513876008	1482424
HOLDING_SUMMARY	19899625	676480	2888	33968	713336	1360600	681232
INDUSTRY	102	8	40	2	50	48	0
LAST_TRADE	274000	12744	512	663	13919	26160	12904
NEWS_ITEM	400000	43367480	912			43368408	16
NEWS_XREF	400000	9976	512	524	11012	10488	0
SECTOR	12	8	24	2	34	32	0
SECURITY	274000	43072	19128	3110	65310	62200	0
SETTLEMENT	6912000000	339201312	715360	16995834	356912506	352163568	12246896
STATUS_TYPE	5	8	8	1	17	16	0
TAXRATE	320	24	16	2	42	56	16
TRADE	6912000000	766426088	410737664	58858188	1236021940	1190277648	13113896
TRADE_HISTORY	16588808173	475664816	1240400	23845261	500750477	478337128	1431912
TRADE_REQUEST	0	0	0	0	0	17360	17360
TRADE_TYPE	5	8	1032	52	1092	1040	0
WATCH_ITEM	40030356	1099192	4360	55178	1158730	1103776	224
WATCH_LIST	400000	9960	8592	928	19480	18552	0
ZIP_CODE	14741	488	176	33	697	664	0
			Initial Database Size			Settlements	7,579,363
			3,167,306 (MB)			Grown Database Size	
			3,093 (GB)			3,218,949 (MB)	
DB filegroups	partition size (MB)	file size (MB)	alloc total (MB)	loaded (MB)	loaded +5% (MB)	after run (MB)	Business Day (MB)
16x filegroup1	113,000	110,000	1,808,000				
14x filegroup1	123,000	118,000	1,722,000	2,563,801	2,691,991	2,603,074	2,683,185
16x filegroup2	37,000	29,000	592,000				
14x filegroup2	40,000	31,000	560,000	603,505	633,680	615,875	641,108
Initial Growing Space (MB)	3,096,917	Number of disks	192				
Final Growing Space (MB)	3,148,546	Disk Capacity (MB)	68,664	Initial Log Size (MB)	5,455	Log units	1
Delta (MB)	51,629	Number of disks	168	Final Log Size (MB)	82,698	Disks per unit	4
Data Space per Trade (MB)	0.006812	Disk Capacity (MB)	139,236	Log Growth (MB)	77,243	Disk Capacity (MB)	285,568
1 Day Data Growth (MB)	156,942	RAID10 Overhead	50%	Log Space per Trade	0.010191	RAID10 Overhead	50.0%
60 Day Space (MB)	12,583,849	Total Space (MB)	18,287,568	1 Day Log Space (MB)	234,806	Log Space (MB)	571,136

Attestation Letter

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



Benchmark Sponsors: Detlev Seidel
Primary TPC Representative
Fujitsu Siemens Computer GmbH
Heinz-Nixdorf-Ring 1
33106 Paderborn, Germany

March 16, 2008

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

Platform: PRIMERGY RX300 S5
Operating system: Microsoft Windows Server 2008 Enterprise x64 Edition
Database Manager: Microsoft SQL Server 2008 Enterprise x64 Edition

The results were:

CPU's Speed	Memory	Disks	Trade-Result 90% Response Time	tpsE
Tier B: PRIMERGY RX300 S5				
2 x Intel Xeon X5570 (2.93 GHz)	96 GB	2 x 73 GB 15K SAS (int.) 4 x 300 GB 15K SAS (int.) 192 x 73 GB 15K SAS 168 x 146 GB 15K SAS	0.21 Seconds	800.00
Tier A: PRIMERGY RX300 S4				
2 x Intel Xeon E5420 (2.5GHz)	4 GB	1 x 250 GB SATA	n/a	n/a

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 v1.7.0
- The transactions were correctly implemented.
- The database was properly scaled and populated for 400,000 Customers.

- The mandatory network between the driver and the SUT was configured.
- 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 representative of steady state conditions.
- The reported measurement interval was 120 minutes.
- The implementation used Redundancy Level 1.
- The Business Recovery Time of 00:27:30 was correctly measured.
- The 60 day storage requirement was correctly computed and configured.
- The system pricing was verified for major components and maintenance.

Additional Audit Notes:

None.

Respectfully Yours,



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/	DataDisks.txt DiskConfiguration.doc FormatDisks.cmd HowToConfigure.txt input.txt RAIDConfiguration.xml rc.bat tempdb.sql
	Parameter OS Tunables Database Setup	SupportingFiles/Introduction/Software/	MSTPCE Database Setup Reference.doc SQL IP Config.reg SQL Node Config.reg SQL Page Config.reg SQL_param.rpt
	Startup Scripts Tier A	SupportingFiles/Introduction/Software/	start_all.cmd start_CE.cmd start_CE2.cmd start_CE3.cmd start_CE4.cmd start_MEE.cmd start_MEE2.cmd start_MEE3.cmd start_MEE4.cmd
	Startup Scripts Tier B	SupportingFiles/Introduction/Software/	sqlstart.cmd
Clause 2	Create Database	SupportingFiles/Cause2	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_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 tempdb.sql Trade_Cleanup.cmd Trade_Cleanup.sql Version.sql

Create Database output	SupportingFiles/Cause2/DB_setup	400000Customers_Load_Timer.log Backup_Database.log BrokerVolume.log BuildSteps.log BulkInsert_1.out BulkInsert_2.out ... BulkInsert_16.out Check_Constraints_Fixed.log Check_Constraints_Growing.log Check_Constraints_Scaling.log Convert_NI_ITEM_Data.log CreateDB.log Create_Clustered_Indexes_Fixed.log Create_Clustered_Indexes_Growing.log Create_Clustered_Indexes_Scaling.log Create_DB_Audit_Tables.log Create_DM_Audit_Table.log Create_TID_Ranges_Table.log Create_TPCE_VERSIONS_Table.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 EGenLoaderFrom375001To400000.log 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 NC_Indexes_Fixed.log NC_Indexes_Growing.log NC_Indexes_Scaling.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_Types.log TPCE_VERSIONS.log TradeLookup.log TradeOrder.log TradeResult.log TradeStatus.log TradeUpdate.log Version.log
Index Creation Scripts	SupportingFiles/Cause2/DDL	BulkInsert_<1..16>.sql Convert_NI_ITEM_Data.SQL Create_Check_Constraints_Fixed.sql Create_Check_Constraints_Growing.sql Create_Check_Constraints_Scaling.sql Create_Clustered_Indexes_Fixed.sql

			Create_Clustered_Indexes_Growing.sql Create_Clustered_Indexes_Scaling.sql Create_FK_Constraints.sql Create_NC_Indexes_Fixed.sql Create_NC_Indexes_Growing.sql Create_NC_Indexes_Scaling.sql Create_Tables_Fixed.sql Create_Tables_Growing.sql Create_Tables_Scaling.sql Create_Tables_Scaling_Flat.sql Create_TPCE_Types.sql Drop_FK_Constraints.sql Drop_Tables_Fixed.sql Drop_Tables_Growing.sql Drop_Tables_Scaling.sql
	Database Audit Scripts	SupportingFiles/Cause2/DDL/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/Cause2/DDL/Audit_Scripts/Space	SPFiles.sql SPLog.sql SPUsed.sql
Clause3	Transaction Frames	SupportingFiles/Cause3	BrokerVolume.sql CustomerPosition.sql DataMaintenance.sql MarketFeed.sql MarketWatch.sql SecurityDetail.sql TradeLookup.sql TradeOrder.sql TradeResult.sql TradeStatus.sql TradeUpdate.sql
	BaseServer	SupportingFiles/Cause3/BaseServer	BaseServer.cpp BaseServer.h BaseServer.vcproj mssccprj.scc stdafx.cpp stdafx.h SUTServersLocals.h
	SUT_CE_Server	SupportingFiles/Cause3/SUT_CE_Server	Release\SUT_CE_Server.exe CEServer.cpp CEServer.h CEServerMain.cpp PortDefinitions.h stdafx.cpp stdafx.h SUTServer.sln SUTServer.suo SUTStructs.h SUT_CE_Server.vcproj
	SUT_MEE_Server	SupportingFiles/Cause3/SUT_MEE_Server	Release\SUT_MEE_Server.exe MEEServer.cpp MEEServer.h MEEServerMain.cpp stdafx.cpp stdafx.h SUT_MEE_Server.vcproj
	TransactionsSP	SupportingFiles/Cause3/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.vcproj TxnHarnessDBBase.cpp TxnHarnessDBBase.h TxnHarnessDBConn.cpp TxnHarnessDBConn.h
	TxnHarness	SupportingFiles/Cause3/TxnHarness	TxnHarness.vcproj TxnHarness.vcproj.user TxnHarnessSendToMarket.cpp TxnHarnessSendToMarket.h TxnHarness_stdafx.cpp TxnHarness_stdafx.h
Clause4			
Clause5	EGen Driver Configuration	SupportingFiles/Cause5	RX300S5_400KCus_4x210X1user_CKPT_C.xml
	EGenLoader Parameter	SupportingFiles/Cause5	BuildSteps.log EGenLoaderFrom1To25000.log EGenLoaderFrom25001To50000.log EGenLoaderFrom375001To400000.log
	EGenLogger Output	SupportingFiles/Cause5	TxnReportE_ML.xls
Clause6	EGenValidate	SupportingFiles/Cause6	EGenValidate.txt
Clause7	ACID	SupportingFiles/Cause7	MSTPCE ACID Procedures.doc
	ACID Procedures	SupportingFiles/Cause7/AcidProcs	AcidProc.cmd AcidProc.out Remove_AcidProcs.cmd
	ACID Scripts	SupportingFiles/Cause6/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/Cause7/Atomicity	Atomicity.cmd Atomicity_C.out Atomicity_RB.out
		SupportingFiles/Cause7/Atomicity/Scripts	atom.vbs Atomicity_C.sql Atomicity_RB.sql
Consistency	SupportingFiles/Cause7/Consistency	Consistency.cmd Consistency.out	
	SupportingFiles/Cause7/Consistency/Scripts	Consistency.sql Consistency.vbs	

	Durability Business Recovery	SupportingFiles/Cause7/Durability/BusinessRecovery	BR_BenchCraft_Config.xml BR_Consistency.out BR_Count_Settlement1.ver BR_Count_Settlement2.ver BR_ERRORLOG_1.txt BR_ERRORLOG_2.txt BR_Systemevents_TierA.txt BR_Systemevents_TierB.txt BusinessRecov_Part1_step60.xlt BusinessRecov_Part1_TxnReportE_20.xl BusinessRecov_Part1_TxnReportE_all.xl BusinessRecov_Part2_step60.xlt BusinessRecov_Part2_TxnReportE_20.xl BusinessRecov_Part2_TxnReportE_all.xl BusinessRecov_TimeGraph.xls
	Durability Data Accessibility	SupportingFiles/Cause7/Durability/Data Accessibility	DataAccess_TimeGraph.xls DataAccess_TxnReportE_all.xls DA_BenchCraft_Config.xml DA_Count_Settlement1.ver DA_Count_Settlement2.ver DA_ERRORLOG.txt SystemEvents_Application.txt
	Isolation	SupportingFiles/Cause7/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/Cause7/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/Cause8	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

March 3, 2009

Fujitsu Siemens Computers
Detlev Seidel
Heinz Nixdorf Ring 1
Paderborn, Germany 33106

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
810-07509	SQL Server 2008 Enterprise x64 Edition <i>Per Processor License</i> <i>Discount Schedule: Open Program - No Level</i> <i>Unit Price reflects a 4% discount from the retail unit price of \$24,999.</i>	\$23,911	2	\$47,822
P72-03195	Windows Server 2008 Enterprise Edition (x64) <i>Server License with 25 CALs</i> <i>Discount Schedule: Open Program - No Level</i> <i>Unit Price reflects a 41% discount from the retail unit price of \$3,999.</i>	\$2,357	1	\$2,357
P73-01664	Windows Server 2003 R2 Standard x64 Edition <i>Server License Only - No CALs</i> <i>Discount Schedule: Open Program - No Level</i> <i>Unit Price reflects a 28% discount from the retail unit price of \$999.</i>	\$719	1	\$719
N/A	Microsoft Problem Resolution Services <i>Professional Support</i> <i>(1 Incident)</i>	\$245	1	\$245

A list of Microsoft's resellers can be found at
<http://www.microsoft.com/products/info/render.aspx?view=22&type=mpn&content=22/licensing>

All products listed above are currently orderable and available.

Defect support is included in the purchase price. Additional support is available from Microsoft PSS on an incident by incident basis at \$245 per call.

This quote is valid for the next 90 days.

Reference ID: PEdese0903030000009843.



Fujitsu Computer Systems Corporation
 1250 E. Arques Avenue
 MS125
 Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **78719-0**
 Valid through: **10/01/2009**

Quote Date: 03/12/2009		
Customer: PRIMERGY RX300 S5	Reference:	
Address: TPC Benchmark Configuration Sunnyvale, CA 94303	ATTN: Detlev Seidel Phone: 1	
Freight Terms: FOB US Shipping Point, Prepaid and billed	Payment Terms: NET30	
Sales Rep Name: JON RODRIGUEZ	Sales Rep Email: jrodriguez@fujitsupc.com	Sales Rep Phone: 408-764-9586

Item	Part Number	Description	Qty	Sell Price	Ext. Price
1	FSCR3S4_S26361-K1237-V101_80039-01		1	\$21,621.45	\$21,621.45
	1	PRIMERGY RX300 S5 Basic unit with 6x 3.5" hard disk drive bays Rack version for 19 (S26361-K1237-V101)			
	2	Xeon DP X5570 (2.93GHz/8M/6,4GT) / 95W (S26361-F3280-E293)			
	4	Memory SP 24GB (3x 8GB dual rank) (S26361-F3284-E535)			
	1	DVD-RW supermulti slimline SATA (S26361-F3269-E1)			
	2	HD SAS 3Gb/s 73GB 15k hot plug 3.5" (S26361-F3204-E573)			
	4	HD SAS 3Gb/s 300GB 15k hot plug 3.5" (S26361-F3204-E530)			
	1	RAID 5/6 SAS based on LSI MegaRAID 256MB (S26361-F3257-E256)			
	5	RAID Ctrl SAS 8Port 512M w/o BBU LP LSI (S26361-F3890-E201)			
	1	RMK-P_1-2U servers (new) (S26361-F2735-E110)			
2	PYR3S4-W036360-0NA	PYR3S4, Standard Warranty, 9 x 5, NBD response time, 36 Months	1	\$0.00	\$0.00
3	PYR3S4-U004361-0NA	PYR3S4 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	1	\$854.10	\$854.10
4	FSCPCTR_S26361-K826-V103_80041-01		1	\$2,343.45	\$2,343.45
	1	PRIMECENTER Rack 38 U, 1000 deep (S26361-K826-V103)			
	6	Dummy panel, plastics, 2U + assembly (S26361-F2735-E131)			
	2	Socket strip 3phase 3x 8 sockets (S26361-F2262-E31)			
5	PYPCTR-W036360-0NA	PYPCTR, Standard Warranty, 9 x 5, NBD response time, 36 Months	1	\$0.00	\$0.00
6	PYPCTR-U004361-0NA	PYPCTR Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	1	\$648.00	\$648.00
7	FSCSX40_S26361-K1122-V200_80041-02		1	\$4,460.80	\$4,460.80
	1	FibreCAT SX40 SAS Disk Subsystem (S26361-K1122-V200)			
	12	HD SAS 3Gb/s 73GB 15k hot pl 3.5" SX40 (S26361-F3244-E573)			
	1	Rack installation ex works, SX10, 1U Nod (S26361-F1647-E302)			
8	PYSX40-W036360-0NA	PYSX40, Standard Warranty, 9 x 5, NBD response time, 36 Months	1	\$0.00	\$0.00
9	PYSX40-U004361-0NA	PYSX40 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	1	\$1,644.30	\$1,644.30
10	FSCSX40_S26361-K1122-V200_80041-03		14	\$5,001.40	\$70,019.60



Fujitsu Computer Systems Corporation
 1250 E. Arques Avenue
 MS125
 Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **78719-0**
 Valid through: **10/01/2009**

Quote Date: 03/12/2009		
Customer: PRIMERGY RX300 S5	Reference:	
Address: TPC Benchmark Configuration Sunnyvale, CA 94303	ATTN: Detlev Seidel Phone: 1	
Freight Terms: FOB US Shipping Point, Prepaid and billed	Payment Terms: NET30	
Sales Rep Name: JON RODRIGUEZ	Sales Rep Email: jrodriguez@fujitsupc.com	Sales Rep Phone: 408-764-9586

Item	Part Number	Description	Qty	Sell Price	Ext. Price
	14	FibreCAT SX40 SAS Disk Subsystem (S26361-K1122-V200)			
	168	HD SAS 3Gb/s 146GB 15k hot pl 3.5" SX40 (S26361-F3244-E514)			
	14	Rack installation ex works, SX10, 1U Nod (S26361-F1647-E302)			
11	PYSX40-W036360-0NA	PYSX40, Standard Warranty, 9 x 5, NBD response time, 36 Months	14	\$0.00	\$0.00
12	PYSX40-U004361-0NA	PYSX40 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	14	\$1,644.30	\$23,020.20
13	FSCR3S4_S26361-K1151-V101_80041-04		1	\$2,531.30	\$2,531.30
	1	PY RX300S4 6x3.5 (S26361-K1151-V101)			
	2	Xeon DP E5420 2.50 GHz 2x8MB 1333MHz (S26361-F3882-E250)			
	2	2GB 2x1GB FBD667 PC2-5300F d ECC (S26361-F3263-E522)			
	1	CD-RW/DVD slimline SATA (S26361-F3268-E1)			
	1	HD SATA 3Gb/s 250GB 7.2k hot plug 3.5" (S26361-F3265-E250)			
	1	RAID 0/1 SAS based on LSI MegaRAID 8Port (S26361-F3257-E8)			
	1	Rack installation ex works (SNP:SY-F1647E301-P)			
	1	RMK-P_1-2U servers (new) (S26361-F2735-E110)			
14	PYR3S4-W036360-0NA	PYR3S4, Standard Warranty, 9 x 5, NBD response time, 36 Months	1	\$0.00	\$0.00
15	PYR3S4-U004361-0NA	PYR3S4 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	1	\$854.10	\$854.10
16	FSCPCTR_S26361-K826-V103_80041-05		1	\$2,357.05	\$2,357.05
	1	PRIMECENTER Rack 38 U, 1000 deep (S26361-K826-V103)			
	7	Dummy panel, plastics, 2U + assembly (S26361-F2735-E131)			
	2	Socket strip 3phase 3x 8 sockets (S26361-F2262-E31)			
17	PYPCTR-W036360-0NA	PYPCTR, Standard Warranty, 9 x 5, NBD response time, 36 Months	1	\$0.00	\$0.00
18	PYPCTR-U004361-0NA	PYPCTR Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	1	\$648.00	\$648.00
19	FSCSX40_S26361-K1122-V200_80041-06		15	\$4,460.80	\$66,912.00
	15	FibreCAT SX40 SAS Disk Subsystem (S26361-K1122-V200)			
	180	HD SAS 3Gb/s 73GB 15k hot pl 3.5" SX40 (S26361-F3244-E573)			
	15	Rack installation ex works, SX10, 1U Nod (S26361-F1647-E302)			



Fujitsu Computer Systems Corporation
 1250 E. Arques Avenue
 MS125
 Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **78719-0**
 Valid through: **10/01/2009**

Quote Date: 03/12/2009		
Customer: PRIMERGY RX300 S5	Reference:	
Address: TPC Benchmark Configuration Sunnyvale, CA 94303	ATTN: Detlev Seidel Phone: 1	
Freight Terms: FOB US Shipping Point, Prepaid and billed	Payment Terms: NET30	
Sales Rep Name: JON RODRIGUEZ	Sales Rep Email: jrodriguez@fujitsupc.com	Sales Rep Phone: 408-764-9586

Item	Part Number	Description	Qty	Sell Price	Ext. Price
20	PYSX40-W036360-0NA	PYSX40, Standard Warranty, 9 x 5, NBD response time, 36 Months	15	\$0.00	\$0.00
21	PYSX40-U004361-0NA	PYSX40 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing	15	\$1,644.30	\$24,664.50
22	S26361-F3228-L201	Eth Ctrl 2x1Gbit PCIe PRO/1000PT Cu Ip	1	\$161.50	\$161.50
23	S26361-F3482-L5	LAN_crossover-Cat 5e, l=5m	2	\$21.25	\$42.50
24	S26381-K370-V510	KB SLIM MF USA	2	\$22.10	\$44.20
25	S26361-F3246-L5	SAS cable external 0.5 m	20	\$59.50	\$1,190.00
26	S26361-F3246-L203	SAS CBL EXT 2m 8088-8470	5	\$62.90	\$314.50
27	S26361-F3246-L603	SAS CBL EXT 6m 8088-8470	5	\$107.95	\$539.75
28	S26361-K1146-V150	SCENICVIEW A17-3	2	\$191.25	\$382.50
29	S26381-K355-L400	Optical Wheelmouse USB silver	2	\$15.30	\$30.60
Total (w/o Freight Charges and Applicable Tax):					\$225,284.40
Estimated Freight Charges:					\$0.00

Notes:

- * Freight and Sales Tax will be added as applicable.
- * FOB US Shipping Point, Prepaid - Title of goods and risk of loss pass from seller to buyer at the shipping point. Seller pays freight charges to destination.
- * FOB US Shipping Point, Prepaid and Billed - Title of goods and risk of loss pass from seller to buyer at the shipping point. Seller pays freight charges and invoices buyer.
- * All products subject to availability.
- * PLEASE STATE THIS QUOTE NUMBER WHEN PLACING A PURCHASE ORDER—THIS WILL ENSURE PROMPT HANDLING TO SPEED PROCESSING AND SHIPMENT.

Warranty/Service Programs

Part No.	Description
PYPCTR-U004361-0NA	PYPCTR Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing
PYPCTR-W036360-0NA	PYPCTR, Standard Warranty, 9 x 5, NBD response time, 36 Months
PYR3S4-U004361-0NA	PYR3S4 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing



Fujitsu Computer Systems Corporation
1250 E. Arques Avenue
MS125
Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **78719-0**
Valid through: **10/01/2009**

Quote Date: 03/12/2009		
Customer: PRIMERGY RX300 S5		Reference:
Address: TPC Benchmark Configuration Sunnyvale, CA 94303		ATTN: Detlev Seidel Phone: 1
Freight Terms: FOB US Shipping Point, Prepaid and billed		Payment Terms: NET30
Sales Rep Name: JON RODRIGUEZ	Sales Rep Email: jrodriguez@fujitsupc.com	Sales Rep Phone: 408-764-9586

Item	Part Number	Description	Qty	Sell Price	Ext. Price
	PYR384-W036360-QNA	PYR384, Standard Warranty, 9 x 5, NBD response time, 36 Months			
	PYSX40-U004361-QNA	PYSX40 Enhanced +, 24 x 7 Phone Support; 24 x 7, 4-hour On-Site Resp.(Sev-1), Warranty Uplift Maintenance, 36 Months, Prepaid billing			
	PYSX40-W036360-QNA	PYSX40, Standard Warranty, 9 x 5, NBD response time, 36 Months			

Terms and Conditions of Order

Special Provisions (if any):

FCS reserves the right to substitute equivalent or better items based upon availability at the time of shipment

Quote Expiration - Unless otherwise agreed to in writing by FCS, this quote is only valid through 10/01/2009

Server Purchase: Customer's acceptance of this Quote by the issuance of an authorized Purchase Order that references said Quote shall constitute Customer's acknowledgement that it has read and understands the terms and conditions set forth in the FCS Products and Services Agreement (FCS-1) and that such Agreement shall exclusively govern the subject matter of the authorized Purchase Order, regardless of any varying or additional terms in any Customer documents. A complete copy of the FCS Products and Services Agreement is available at <http://www.computers.us.fujitsu.com/downloads/FCS-1.pdf>. If a Master Agreement or a Federal Government GSA Schedule exists between Customer and FCS and it is referenced on the authorized Purchase Order, then and only then will the terms of said Master Agreement or GSA Schedule apply.

Mobile Purchase: Customer's acceptance of this Quote by the issuance of an authorized Purchase Order that references said Quote shall constitute Customer's acknowledgement that it has read and understands the terms and conditions set forth in (Terms and Conditions of Mobile Sale) and that such Agreement shall exclusively govern the subject matter of the authorized Purchase Order, regardless of any varying or additional terms in any Customer documents. A complete copy of the FCS Mobile Products Agreement is available at <http://www.computers.us.fujitsu.com/termsandconditions.shtml>. If a reseller Agreement or other mutually executed Agreement (including a Federal Government GSA Schedule) exists between Customer and FCS and it is referenced on the authorized Purchase Order, then and only then will the terms of said Agreement or GSA Schedule apply.

Server/Mobile Evaluation: This Evaluation Order is subject to the terms and conditions set forth in FCS Product Evaluation Agreement (FCS-2), which are an integral part hereof and are incorporated herein by reference. A complete copy of the FCS Products Evaluation Agreement is available at http://www.computers.us.fujitsu.com/downloads/FCS-2_EVAL.pdf. Customer's acceptance of this Evaluation Order shall constitute Customer's acknowledgement that it has read and understands the terms and conditions of the FCS Product Evaluation Agreement, and that such terms shall exclusively govern the subject matter of this Order, regardless of any varying or additional terms in any Customer documents.

Non FCS Products Notice: Notwithstanding any contrary terms or conditions in any Agreement between the parties, or any Purchase Order submitted by Buyer, Buyer is hereby notified that all products distributed by FCS pursuant to those Non FCS Products are pass-through products only, and are not covered by any warranty obligation from FCS, are not covered by any indemnification provision from FCS, are not covered by any maintenance or service provision by FCS, and FCS does not assume any liability to Buyer for such Non FCS Products or service whatsoever. Buyer shall have recourse only to the manufacturer, not FCS, for all such warranty, indemnity, service or support obligations. Buyer's Purchase Order for Non FCS Products signifies agreement to these terms.

