

TPC Benchmark™ E
Full Disclosure Report for



PRIMERGY RX600 S5

Using

**Microsoft SQL Server 2008 R2
Enterprise x64 Edition**

Using

**Microsoft Windows Server 2008 R2
Enterprise x64 Edition**

TPC-E Version 1.10.0

Submitted for Review

June 17, 2010

First Edition June 2010

Fujitsu believes that the information in this document is accurate as of the publication date. The information in this document is subject to change without notice. We assume no responsibility for any errors that may appear in this document. The pricing information in this document is believed to accurately reflect the current prices as of the publication date. However, we provide no warranty of the pricing information in this document.

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.

Copyright © 2010 Fujitsu. All rights reserved.

Permission is hereby granted to reproduce this document in whole or in part provided the copyright notice printed above is set forth in full text on the title page of each item reproduced.

PRIMERGY RX600 S5, PRIMERGY RX200 S6 and PRIMERGY RX200 S5 are trademarks of Fujitsu.

Microsoft Windows Server 2008 R2, Microsoft SQL Server 2008 R2 and BenchCraft are registered trademarks of Microsoft Corporation.

Intel® Xeon® Processor is a registered trademark of Intel.

TPC Benchmark™ is a trademark of the Transaction Processing Performance Council (TPC).

Other product names mentioned in this document may be trademarks and/or registered trademarks of their respective companies.

Abstract

This report documents the TPC Benchmark™ E results achieved by Fujitsu using Microsoft SQL Server 2008 R2 Enterprise x64 Edition.

The TPC Benchmark™ E tests were run on a PRIMERGY RX600 S5 system using the Microsoft Windows Server 2008 R2 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 RX600 S5	Microsoft SQL Server 2008 R2 Enterprise x64 Edition Microsoft Windows Server 2008 R2 Enterprise x64 Edition	\$ 396,435 USD	2,046.96	\$ 193.68 USD	September 1, 2010

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 RX600 S5

TPC-E 1.10.0
TPC Pricing 1.5.0

Report Date
June 18, 2010

Availability Date
September 1, 2010

Description	Part Number	Price Source	Unit Price	Qty	Extended Price	3-yr. Maint. Price
Database Server Hardware						
FSCR6S5_S26361-K1287-V400_101912-05		1	60,104.35	1	60,104.35	
PY RX600S5	S26361-K1287-V400			1		
Intel Xeon X7560 8C/16T 2.26 GHz 24 MB	S26361-F3999-E560			4		
Memory Board RX600 S5	S26361-F3990-E100			6		
32GB (4x8) DDR3 1333 MHz PC3-10600 rg d	S26361-F4003-E645			16		
DVD-RW supermulti slimline SATA	S26361-F3269-E2			1		
HD SAS 6G 73GB 15K HOT PLUG 2.5" EP	S26361-F4006-E573			2		
HD SAS 6G 300GB 10K HOT PLUG 2.5" EP	S26361-F4006-E130			6		
RAID Ctrl SAS 6G 5/6 512MB (D2616)	S26361-F3554-E512			1		
Rack installation ex works	SNP:SY-F1647E301-P			1		
RMK-F2_3-xU-Servers_13mm-Drop-in Rails	S26361-F2735-E202			1		
Cable mgmt. for 19" DC- PC- Rack	S26361-F2735-E7			1		
Power Supply Module 850W	S26113-F561-E10			2		
RAID Ctrl SAS 6G 8Port ex 512M FH/LP LSI	S26361-F3593-L501	1	493.85	8	3,950.80	
PYRX600 S5 Warranty Uplift, 36 Months,Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PYR6S5-U004361-ONA	1	1,575.00	1		1,575.00
PYRX600 S5 during normal business hours, Primergy Installation, Midrange Server, w/o OS, One Time billing	PYR6S5-N038005-ONA	1	350.00	1		350.00
				Subtotal	64,055.15	1,925.00
Server Storage						
FSCPCTR_S26361-K826-V212_101912-01		1	1,995.80	1	1,995.80	
PRIMECENTER Rack 24U, 1100mm deep	S26361-K826-V212			1		
Dummy panel, plastics, 1U + assembly	S26361-F2735-E130			1		
Dummy panel, plastics, 2U + assembly	S26361-F2735-E131			2		
Socket strip 3phase 3x 8 sockets	S26361-F2262-L31	1	157.25	1	157.25	
PYPCTR Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PYPCTR-U004361-ONA	1	720.00	1		720.00
FSCJX40_FTS:ETJXS11BG_101912-02		1	2,611.20	8	20,889.60	
ETERNUS JX40	FTS:ETJXS11BG			8		
SSD SATA 3G 64GB SLC HOT PLUG 2.5" EP	S26361-F3298-L64	1	1,031.90	192	198,124.80	
PYJX40 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	PYJX40-U004121-ONA	1	609.00	8		4,872.00
PYJX40 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	PYJX40-P004241-ONA	1	1,218.00	8		9,744.00
PYJX40 during normal business hours, Primergy storage installation, One Time billing	PYJX40-N043005-ONA	1	450.00	8		3,600.00



PRIMERGY RX600 S5

TPC-E 1.10.0
TPC Pricing 1.5.0

Report Date
June 18, 2010

Availability Date
September 1, 2010

FSCSX40_S26361-K1122-V200_101912-03		1	2,334.95	1	2,334.95	
FibreCAT SX40 SAS Disk Subsystem	S26361-K1122-V200			1		
HD SATA 3Gb/s 750GB 7.2k hot p 3.5" SX40	S26361-F3245-E750			4		
Rack installation ex works, SX10, 1U Nod	S26361-F1647-E302			1		
PYSX40 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PYSX40-U004361-0NA	1	1,827.00	1		1,827.00
PYSX40 during normal business hours, Primergy storage installation, One Time billing	PYSX40-N043005-0NA	1	450.00	1		450.00
SAS CABLE 1X SFF 8088-1X SFF 8088 2M	D:KBSAS1S-1S-2M	1	66.30	8	530.40	
SAS CBL EXT 2m 8088-8470	S26361-F3246-L203	1	62.90	1	62.90	
				Subtotal	224,095.70	21,213.00
Server Software						
SQL Server 2008 R2 Enterprise x64 Edition Per Processor License		2	19,188.00	4	76,752.00	
Windows Server 2008 R2 Enterprise x64 Edition	P72-04217	2	2,280.00	1	2,280.00	
Microsoft Problem Resolution Services	n/a	2	259.00	1		259.00
				Subtotal	79,032.00	259.00
Tier A Client Hardware						
FSCR2S6_S26361-K1342-V101_101912-04		1	3,490.10	1	3,490.10	
PY RX200 S6, 6HD-bays 2.5"	S26361-K1342-V101			1		
Intel Xeon E5620 4C/8T 2.40 GHz 12 MB	S26361-F4419-E240			2		
2 GB DDR3 1333 MHz PC3-10600 rg s	S26361-F3604-E513			6		
CD-RW/DVD slimline SATA	S26361-F3269-E2			1		
HD SAS 6G 73GB 15K HOT PLUG 2.5" EP	S26361-F4006-E573			1		
RAID 0/1 SAS based on LSI MegaRAID 4Port	S26361-F3257-E4			1		
Eth Ctrl 2x1Gbit PCIe PRO/1000PT Cu lp	S26361-F3228-E201			2		
Rack installation ex works, SX10, 1U Nod	S26361-F1647-E302			1		
RMK-P_1-2U servers (new)	S26361-F2735-E110			1		
Power Supply Module 770W silver hp	S26113-F539-E1					
PYRX200 S6 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	PYR2S6-U004361-0NA	1	550.00	1		550.00
PYRX200 S6 during normal business hours, Primergy installation, Low-end Server, w/o OS, One Time billing	PYR2S6-N039005-0NA	1	200.00	1		200.00
				Subtotal	3,490.10	750.00
Tier A Client Software						
Windows Server 2008 R2 Standard x64 Edition	P73-04980	2	711.00	1	711.00	
Infrastructure or Connectivity						
DISPLAY A19-5 ECO (incl. 2 spares)	S26361-K1339-V140	1	176.80	4	707.20	
KB SLIM MF USA (incl. 2 spares)	S26381-K370-V510	1	20.40	4	81.60	
Mini Optical Mouse (incl. 2 spares)	S26381-K452-L100	1	10.20	4	40.80	
LAN-CAT 5 Enhanced, l=3m	S26361-F3417-L3	1	18.70	4	74.80	
				Total	372,288.35	24,147.00

Notes:

Price Source: 1=Fujitsu, 2=Microsoft Corporation

Three-Year Cost of Ownership USD \$396,435

TPC-E Throughput 2046.96

\$ USD/tpsE \$193.68

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



PRIMERGY RX600 S5

TPC-E 1.10.0
TPC Rev 1.5.0

Report Date
June 18, 2010

Availability Date
September 1, 2010

Numerical Quantities Summary

Reported Throughput:		2046.96 tpsE		Configured Customers:		1,050,000			
Response Times (in seconds)		Minimum		Average		90th%tile		Maximum	
Broker Volume		0.01		0.07		0.11		3.11	
Customer Position		0.00		0.05		0.07		3.40	
Market Feed		0.00		0.03		0.05		17.78	
Market Watch		0.00		0.05		0.09		3.25	
Security Detail		0.00		0.03		0.04		2.75	
Trade Lookup		0.00		0.12		0.19		18.53	
Trade Order		0.00		0.11		0.15		3.63	
Trade Result		0.00		0.14		0.19		3.37	
Trade Status		0.00		0.03		0.05		3.22	
Trade Update		0.01		0.14		0.19		3.53	
Data Maintenance		0.01		0.07		N/A		2.49	
Transaction Mix				Transaction Count				Mix %	
Broker Volume				7,221,370				4.900%	
Customer Position				19,159,129				13.000%	
Market Feed				1,473,839				1.000%	
Market Watch				26,527,584				18.000%	
Security Detail				20,632,736				14.000%	
Trade Lookup				11,790,040				8.000%	
Trade Order				14,884,816				10.100%	
Trade Result				14,738,164				10.000%	
Trade Status				28,001,435				19.000%	
Trade Update				2,947,457				2.000%	
Data Maintenance				120				N/A	
Test Duration and Timings									
Ramp-up Time (hh:mm:ss)				00:22:03					
Measurement Interval (hh:mm:ss)				02:00:00					
Business Recovery Time (hh:mm:ss)				00:48:22					
Total Number of Transactions Completed in Measurement Interval				147,376,570					

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.....	14
Software Configuration	15
CLAUSE 2: DATABASE DESIGN, SCALING AND POPULATION	16
Database Creation	16
Partitioning	16
Replication and Duplicated Attributes.....	16
Cardinality of Tables	17
Distribution of Tables, Partitions and Logs	18
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 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 system PRIMERGY RX200 S6 has been substituted for pricing with PRIMERGY RX200 S6.

Figure 1-1: Priced Configuration

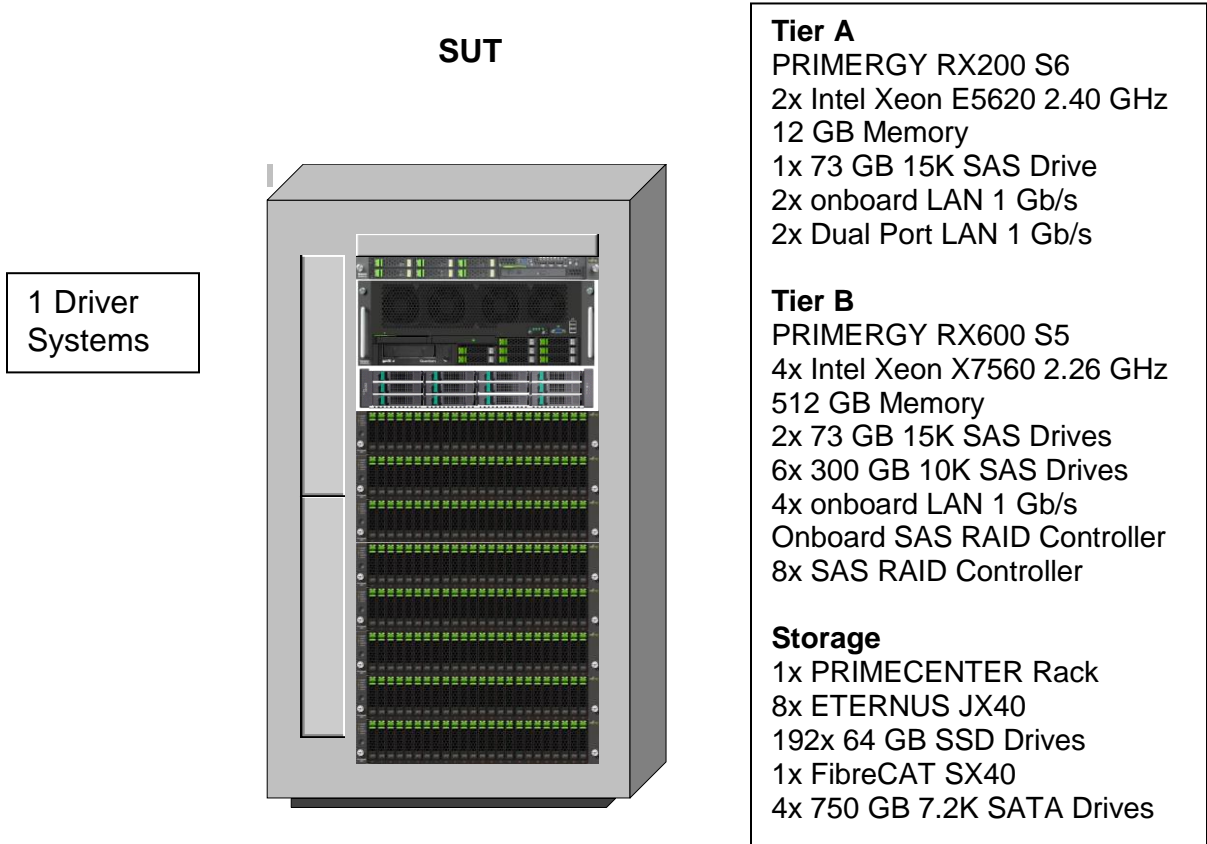
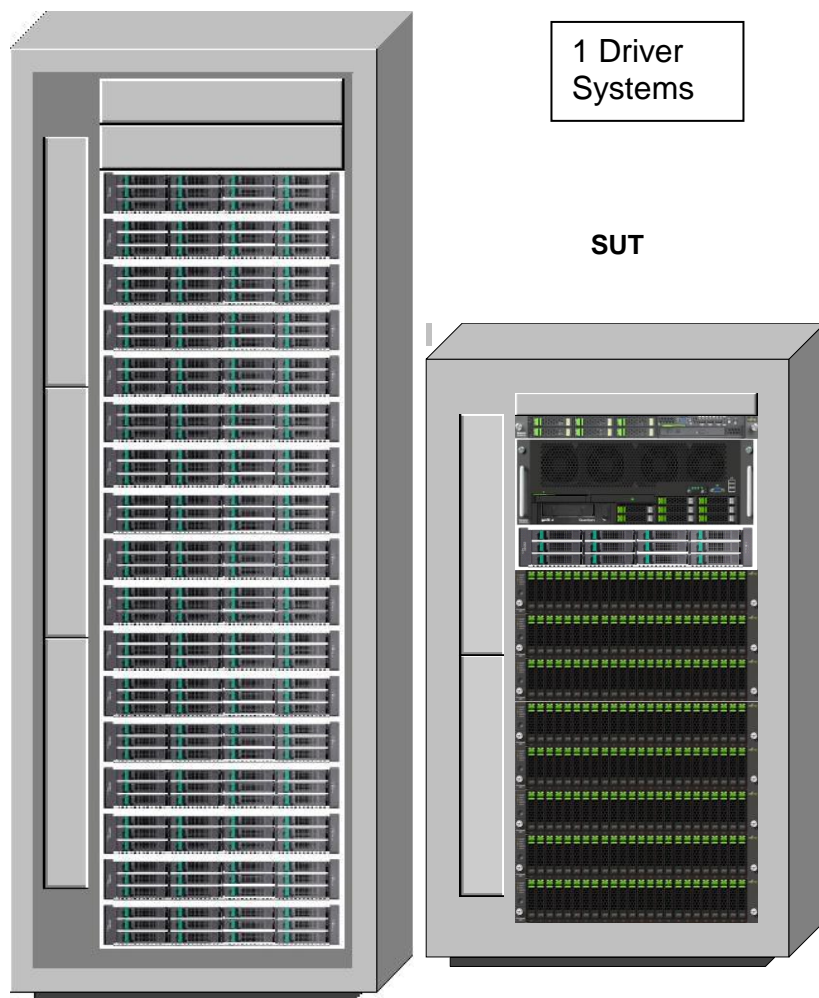


Figure 1-2: Measured Configuration



Tier A

PRIMERGY RX200 S5
2x Intel Xeon E5530 2.40 GHz
12 GB Memory
1x 73 GB 15K SAS Drive
2x onboard LAN 1 Gb/s
2x Dual Port LAN 1 Gb/s

Tier B

PRIMERGY RX600 S5
4x Intel Xeon X7560 2.26 GHz
512 GB Memory
2x 73 GB 15K SAS Drives
6x 300 GB 10K SAS Drives
4x onboard LAN 1 Gb/s
Onboard SAS RAID Controller
8x SAS RAID Controller

Storage

1x PRIMECENTER Rack
8x ETERNUS JX40
192x 64 GB SSD Drives
1x FibreCat SX40
4x 750 GB 7.2K SATA Drives
1x FibreCAT SX40
12x 2 TB 7.2K SATA Drives
8x FibreCAT SX40
12x 73 GB 15K SAS Drives
8x FibreCAT SX40
12x 146 GB 15K SAS Drives

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. One system was connected with system Tier A onboard LAN controller using 2 x 1 Gb/s Ethernet. There are two LAN segments for these connections.

Tier A

The Tier A server is a Fujitsu PRIMERGY RX200 S5 with two Intel Xeon E5530 Quad-Core Processor and 12 GB of memory. One SAS 73 GB 15K disk drive is connected to the onboard controller. Two 1 Gb/s dual port Ethernet LAN cards are plugged in the PCI-E slots. Each of the four 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 four LAN segments for these connections.

Tier B

The Tier B or database server is a Fujitsu PRIMERGY RX600 S5 with four Intel Xeon X7560 Eight-Core Processors and 512 GB memory. The eight 2.5" disk bays are used with 2x SAS 73 GB 15K disk drives RAID1 for OS and database and 6x SAS 300GB 10K disk drives 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). Eight RAID controllers LSI MegaRAID SAS9280-8e with 512MB cache are used to connect the external disk drives to the server. The controller cache is configured with Write Through. The LAN connection of the four onboard 1 Gb/s Ethernet ports is described above.

Storage

8 Fujitsu ETERNUS JX40 are used, each with 24x 64GB SSD 2.5" RAID5 and 1 Fujitsu FibreCAT SX40 with 4x 750GB 7.2K HDD 3.5" RAID 5. The enclosures are connected to the LSI MegaRAID SAS9280-8e. 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 1,050,000 customers. The SQL Server scripts and setup command files are included in the SupportingFiles\Clause2 folder. One file group is used for all tables and indices. The distribution is shown in table 2-1. For creating the database additional storage was assigned to the database (see Figure 1-2 Measured Configuration) and removed at the end before backing up the database.

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 1,050,000 customers. The cardinality of the tables after database load is as shown in the following table 2-1.

Table 2-1: Table Cardinality and File Groups

Table	Cardinality after database load	File Group
ACCOUNT_PERMISSION	7454828	1
ADDRESS	1575004	1
BROKER	10500	1
CASH_TRANSACTION	16692481567	1
CHARGE	15	1
COMMISSION_RATE	240	1
COMPANY	525000	1
COMPANY_COMPETITOR	1575000	1
CUSTOMER	1050000	1
CUSTOMER_ACCOUNT	5250000	1
CUSTOMER_TAXRATE	2100000	1
DAILY_MARKET	938621250	1
EXCHANGE	4	1
FINANCIAL	10500000	1
HOLDING	928855578	1
HOLDING_HISTORY	24316103321	1
HOLDING_SUMMARY	52216631	1
INDUSTRY	102	1
LAST_TRADE	719250	1
NEWS_ITEM	1050000	1
NEWS_XREF	1050000	1
SECTOR	12	1
SECURITY	719250	1
SETTLEMENT	18144000000	1
STATUS_TYPE	5	1
TAXRATE	320	1
TRADE	18144000000	1
TRADE_HISTORY	43545559454	1
TRADE_REQUEST	0	1
TRADE_TYPE	5	1
WATCH_ITEM	104941231	1
WATCH_LIST	1050000	1
ZIP_CODE	14741	1

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, RAID1	C:\	68 GB	OS, DB
	1 – onboard	6x300GB 10K SAS, RAID10	L:\	837 GB	DB Log
Ctrl 1 Port 0	2 – JX40	24x64GB SSD, RAID5	C:\jpltpce01	1360 GB	Filegroup1
Ctrl 1 Port 1	3 – SX40	4x750GB, 7.2K SATA, RAID5	C:\jpladdsize	2094 GB	DB Data
	4 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp01	1635 GB	DB setup Backup
	5 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp02	814 GB	DB setup Backup
Ctrl 2 Port 0	6 – JX40	24x64GB, SSD, RAID5	C:\jpltpce02	1360 GB	Filegroup1
Ctrl 2 Port 1	7 – SX40	12x2TB, 7.2K SATA, RAID10	C:\jplbig02	11174 GB	Backup
	8 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp04	814 GB	DB setup Backup
	9 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp04	814 GB	DB setup Backup
Ctrl 3 Port 0	10 – JX40	24x64GB, SSD, RAID5	C:\jpltpce03	1360 GB	Filegroup1
Ctrl 3 Port 1	11 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp05	1635 GB	DB setup Backup
	12 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp06	814 GB	DB setup Backup
Ctrl 4 Port 0	13 – JX40	24x64GB, SSD, RAID5	C:\jpltpce04	1360 GB	Filegroup1
Ctrl 4 Port 1	14 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp07	1635 GB	DB setup Backup
	15 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp08	814 GB	DB setup Backup
Ctrl 5 Port 0	16 – JX40	24x64GB, SSD, RAID5	C:\jpltpce05	1360 GB	Filegroup1
Ctrl 5 Port 1	17 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp09	1635 GB	DB setup Backup
	19 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp10	814 GB	DB setup Backup
Ctrl 6 Port 0	19 – JX40	24x64GB, SSD, RAID5	C:\jpltpce06	1360 GB	Filegroup1
Ctrl 6 Port 1	20 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp11	1635 GB	DB setup Backup
	21 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp12	814 GB	DB setup Backup
Ctrl 7 Port 0	22 – JX40	24x64GB, SSD, RAID5	C:\jpltpce07	1360 GB	Filegroup1
Ctrl 7 Port 1	23 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp13	1635 GB	DB setup Backup
	24 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp14	814 GB	DB setup Backup
Ctrl 8 Port 0	25 – JX40	24x64GB, SSD, RAID5	C:\jpltpce08	1360 GB	Filegroup1
Ctrl 8 Port 1	26 – SX40	12x146GB, 15K SAS, RAID0	C:\jplhelp15	1635 GB	DB setup Backup
	27 – SX40	12x73GB, 15K SAS, RAID0	C:\jplhelp16	814 GB	DB setup 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 R2 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):

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 RX600 S5 has onboard Ethernet controllers with four 1Gb/s ports. Tier A system PRIMERGY RX200 S5 has an onboard Ethernet controller with two 1Gb/s ports used for driver system connection. Tier A system was extended with two dual-port 1Gb/s Ethernet controller cards. These four ports were directly connected with the four onboard ports of Tier B 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 1.10.0.

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).

One Tier A system was used and configured to drive 4 EGenDriverMEE and 4 EGenDriverCE instances.

Measured Throughput

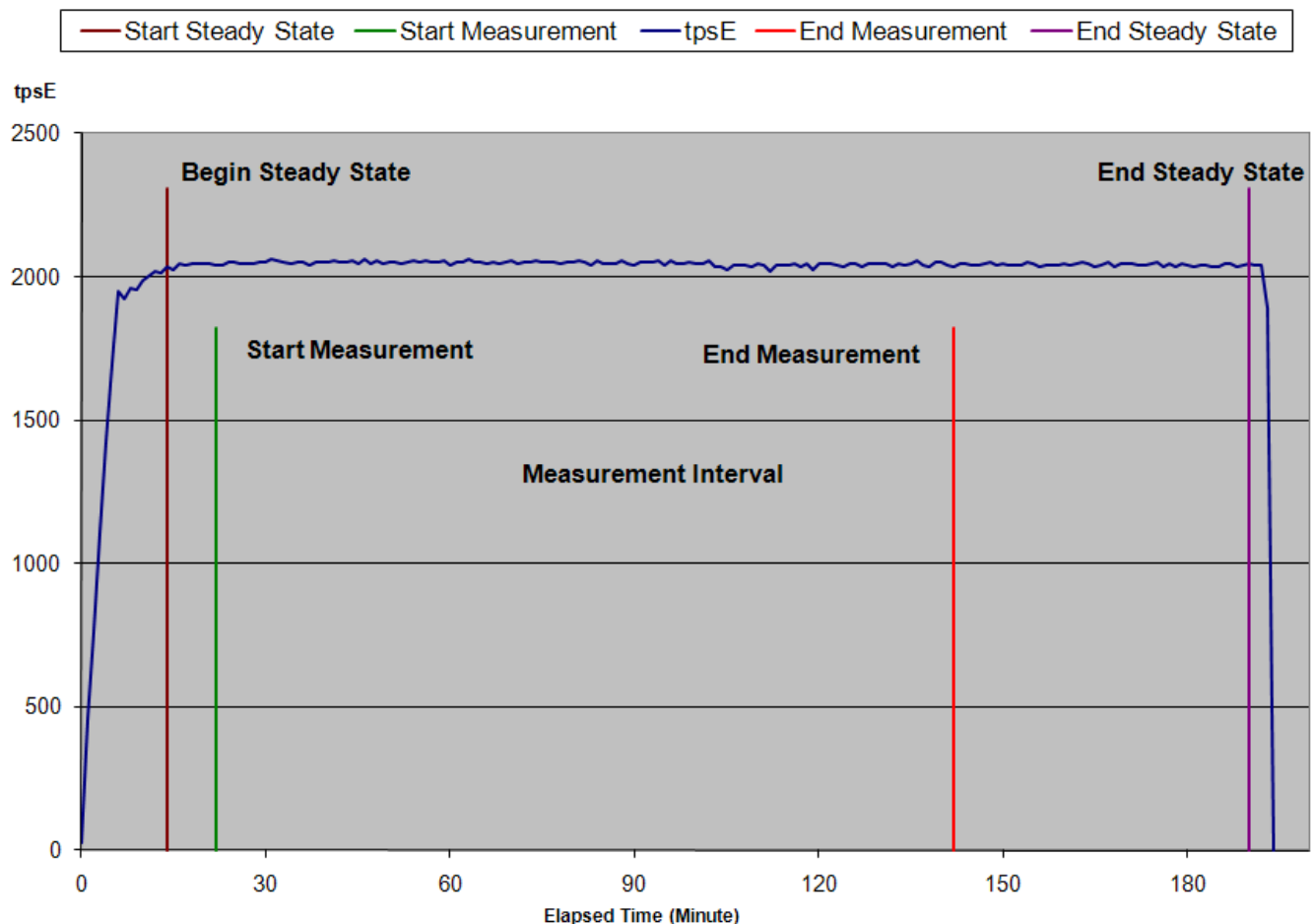
The Measured Throughput must be reported in the Report (see Clause 6.7.1.2) (9.3.6.2).

The measured throughput was 2046.96 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 (449 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%	49.97%	Ok
	Get History	48.00%	52.00%	50.01%	Ok
	Overall				Ok
Market Watch	By Watch List	57.00%	63.00%	60.00%	Ok
	By Customer Account	33.00%	37.00%	34.99%	Ok
	By Industry	4.50%	5.50%	5.00%	Ok
	Overall				Ok
Security Detail	Access LOB	0.90%	1.10%	0.99%	Ok
	Overall				Ok
Trade Lookup	Frame 1	28.50%	31.50%	30.00%	Ok
	Frame 2	28.50%	31.50%	29.97%	Ok
	Frame 3	28.50%	31.50%	30.02%	Ok
	Frame 4	9.50%	10.50%	10.01%	Ok
	Overall				Ok
Trade Update	Frame 1	31.00%	35.00%	33.01%	Ok
	Frame 2	31.00%	35.00%	32.99%	Ok
	Frame 3	32.00%	36.00%	33.99%	Ok
	Overall				Ok
Trade Order	By Non-Owner	9.50%	10.50%	9.99%	Ok
	By Company Name	38.00%	42.00%	40.02%	Ok
	Buy On Margin	7.50%	8.50%	7.99%	Ok
	Rollback	0.94%	1.04%	0.99%	Ok
	LIFO	33.00%	37.00%	35.01%	Ok
	Trade Qty 100	24.00%	26.00%	24.99%	Ok
	Trade Qty 200	24.00%	26.00%	25.02%	Ok
	Trade Qty 400	24.00%	26.00%	24.99%	Ok
	Trade Qty 800	24.00%	26.00%	24.99%	Ok
	Market Buy	29.70%	30.30%	29.99%	Ok
	Market Sell	29.70%	30.30%	30.00%	Ok
	Limit Buy	19.80%	20.20%	20.00%	Ok
	Limit Sell	9.90%	10.10%	10.00%	Ok
	Stop Loss	9.90%	10.10%	10.01%	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).

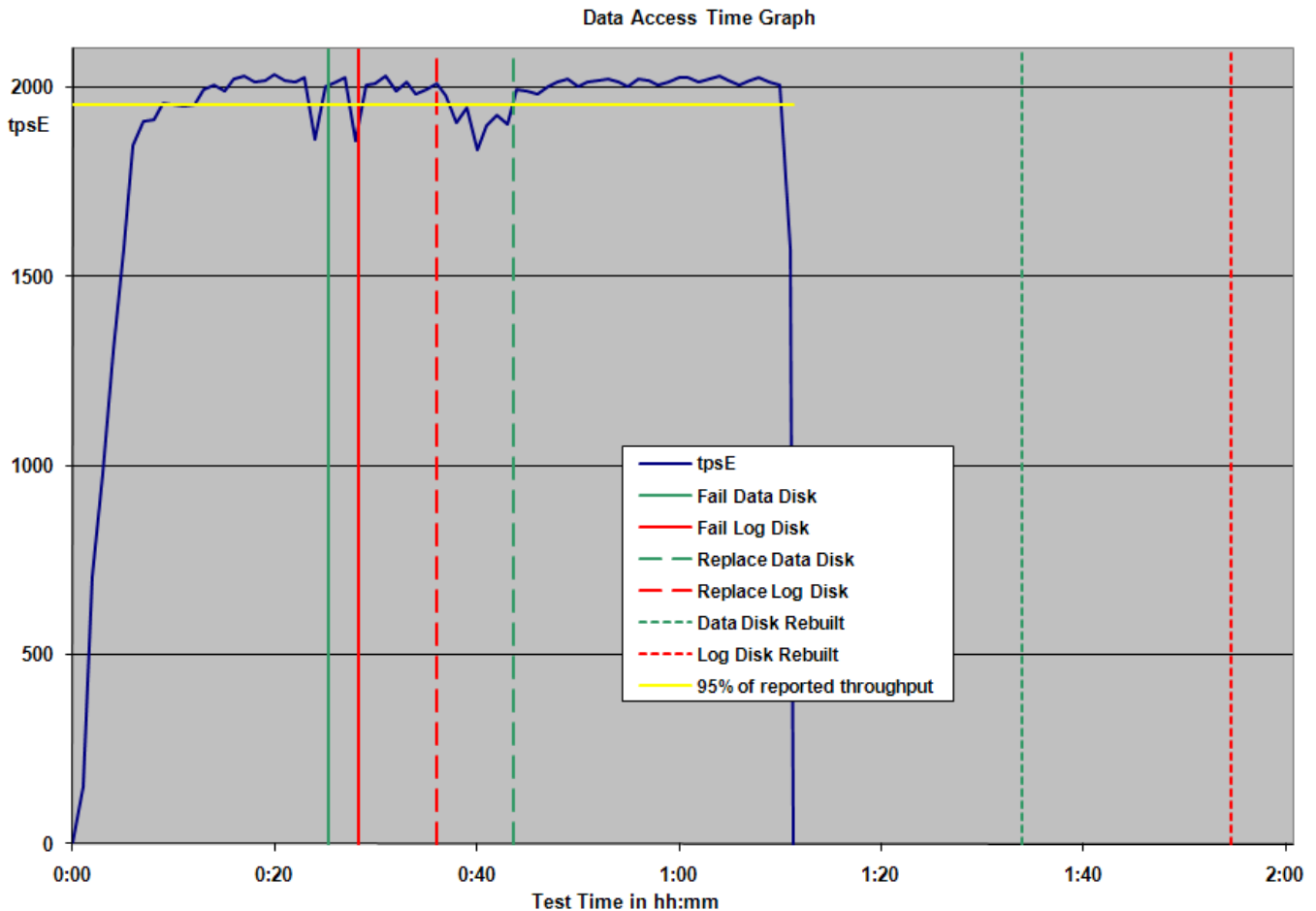
A Data Accessibility Graph for each run demonstrating a Redundancy Level must be reported in the Report (see Clause 7.5.7.2) (9.3.7.3).

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 5 minutes.
3. Induce the failure described for the redundancy level being demonstrated. In this case fail a disk in a database data array and then a disk in the database log array. The transactions continue since RAID5 or RAID10 is used for at least 8 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.

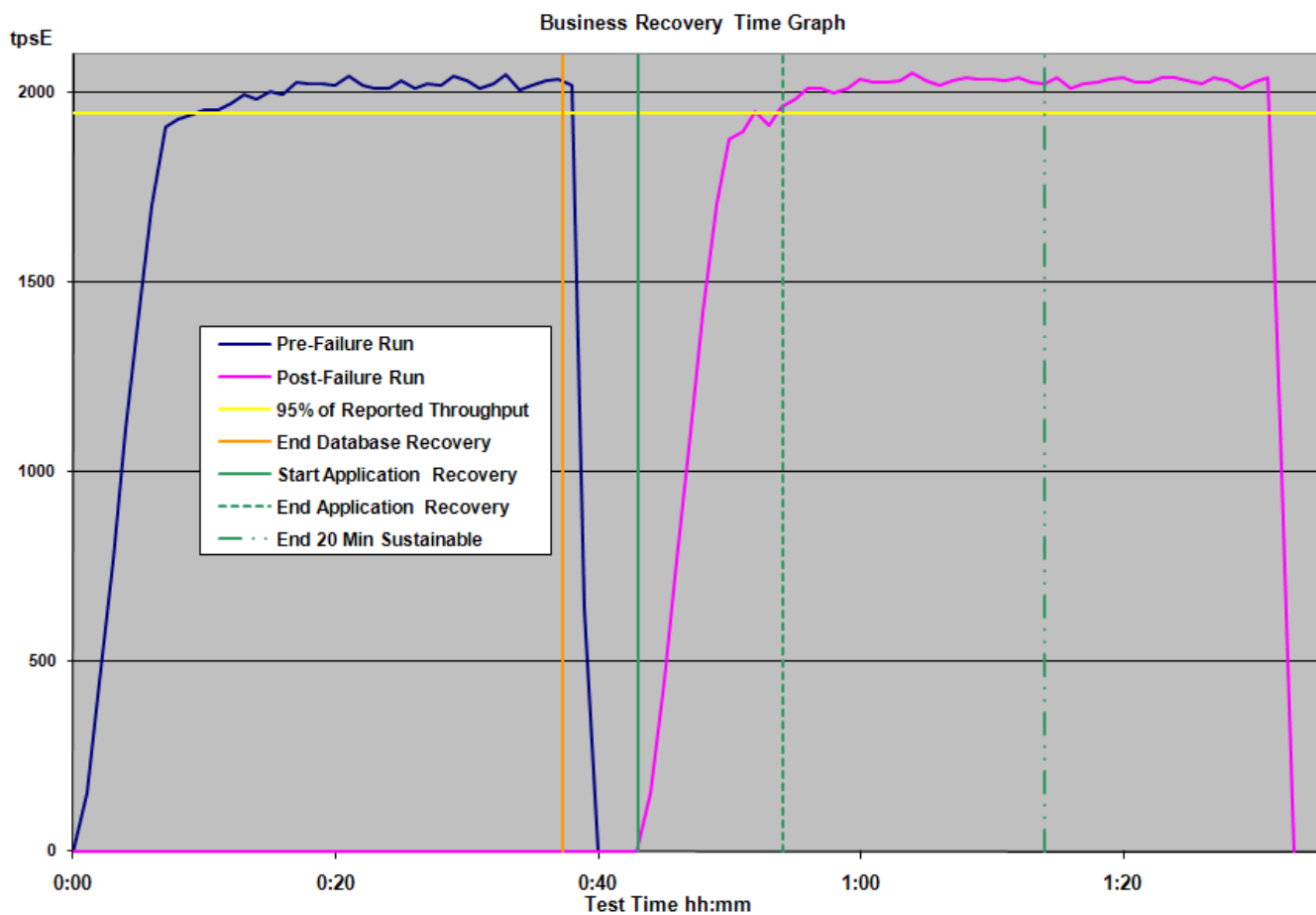
1. Determine the current number of completed trades in the database by counting the rows in SETTLEMENT.
2. Start submitting transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes.
3. Induce the failures by 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 Database Recovery Time was 00:37:20 (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 00:11:02 (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 00:48:22 (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).

Table 8-1: Space Requirements

		TPC-E Disk Space Requirements					
Customers Used	1,050,000						
Performance	2046.96	TpsE	settlements after 8 hours (Business Day)			58,952,448	
					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	7454828	634752	4472	31961	671185	639520	296
ADDRESS	1575004	90944	1296	4612	96852	92304	64
BROKER	10500	768	848	81	1697	1616	0
CASH_TRANSACTION	16692481567	1723585136	3634080	86360961	1813580177	1731541320	4322104
CHARGE	15	8	8	1	17	16	0
COMMISSION_RATE	240	16	16	2	34	32	0
COMPANY	525000	114408	32616	7351	154375	147048	24
COMPANY_COMPETITOR	1575000	42400	34360	3838	80598	76760	0
CUSTOMER	1050000	177952	45632	11179	234763	223592	8
CUSTOMER_ACCOUNT	5250000	475856	102688			578544	0
CUSTOMER_TAXRATE	2100000	43864	1272	2257	47393	45264	128
DAILY_MARKET	938621250	48618272	172336	2439530	51230138	48791872	1264
EXCHANGE	4	8	8	1	17	16	0
FINANCIAL	10500000	1235544	4632	62009	1302185	1240472	296
HOLDING	928855578	61933416	39226352	5057988	106217756	102571728	1411960
HOLDING_HISTORY	24316103321	884222192	511079864	69765103	1465067159	1399902976	4600920
HOLDING_SUMMARY	52216631	2277984	9432	114371	2401787	2287416	0
INDUSTRY	102	8	24	2	34	32	0
LAST_TRADE	719250	44840	1248	2304	48392	46088	0
NEWS_ITEM	1050000	113905336	3216			113908552	0
NEWS_XREF	1050000	26256	1208	1373	28837	27464	0
SECTOR	12	8	24	2	34	32	0
SECURITY	719250	113680	27216	7045	147941	140896	0
SETTLEMENT	18144000000	961819272	2028688	48192398	1012040358	966387304	2539344
STATUS_TYPE	5	8	8	1	17	16	0
TAXRATE	320	24	16	2	42	56	16
TRADE	18144000000	2164943088	1089209960	162707652	3416860700	3265465200	11312152
TRADE_HISTORY	43545559454	1309641168	3415312	65652824	1378709304	1317333632	4277152
TRADE_REQUEST	0	8	40	2	50	0	0
TRADE_TYPE	5	8	1032	52	1092	1040	0
WATCH_ITEM	104941231	2928504	11816	147016	3087336	2940624	304
WATCH_LIST	1050000	26248	22376	2431	51055	48624	0
ZIP_CODE	14741	488	72	28	588	560	0
		Initial Database Size				Settlements	23,354,715
		8,716,772 (MB)				Grown Database Size	
		8,512 (GB)				8,744,571 (MB)	
DB filegroups	partition size (MB)	file size (MB)	alloc total (MB)	loaded (MB)	loaded +5% (MB)	after run (MB)	Business Day (MB)
	8	1,392,512	1,390,000	11,140,096	8,716,772	9,152,611	8,744,571
		Number of disks	192				
		Disk Capacity (MB)	60,544				
		RAIDS Overhead	4%				
Initial Growing Space (MB)	8,551,783	Total Space (MB)	11,140,096				
Final Growing Space (MB)	8,579,580	Number of disks	4	Initial Log Size (MB)	4,602	Log units	1
Delta (MB)	27,796	Disk Capacity (MB)	715,404	Final Log Size (MB)	156,996	Disks per unit	6
Data Space per Trade (MB)	0.001190	RAIDS Overhead	25%	Log Growth (MB)	152,394	Disk Capacity (MB)	285,568
1 Day Data Growth (MB)	70,164	Total Space (MB)	2,146,212	Log Space per Trade	0.006525	RAID10 Overhead	50.0%
60 Day Space (MB)	12,926,637	Total Space (MB)	13,286,308	1 Day Log Space (MB)	384,676	Log Space (MB)	856,704

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

June 16, 2010

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

Platform: PRIMERGY RX600 S5
Operating System: Microsoft Windows Server 2008 R2 Enterprise x64 Edition
Database Manager: Microsoft SQL Server 2008 R2 Enterprise x64 Edition

The results were:

CPU's Speed	Memory	Disks	Trade-Result 90% Response Time	tpsE
Tier B, Server: PRIMERGY RX600 S5				
4 x Intel Xeon X7560 (2.26GHz)	512 GB (4 x 24 MB L3)	192 x 64GB SSD 4 x 750GB 7.2K SATA 6 x 300GB 10K SAS	0.19 Seconds	2046.96
Tier A, OneClient: PRIMERGY RX200 S6				
2 x Intel Xeon E5620 (2.40 GHz)	12 GB (2 x 12 MB L3)	1 x 73 GB 15K SAS	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 v1.10.0.
- The transactions were correctly implemented.
- The database was properly scaled and populated for 1,050,000 customers.
- The mandatory network between the driver and the SUT was configured.
- The ACID properties were met.

125 WEST MONROE STREET • COLORADO SPRINGS, CO 80907 • 719 473 7553 • WWW.SIZING.COM

- 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 00:48:22 was correctly measured.
- The 60 day storage requirement was correctly computed.
- The system pricing was verified for major components and maintenance.

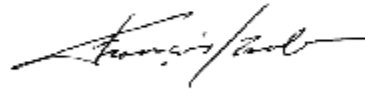
Additional Audit Notes:

The measured configuration included (1) PRIMERGY RX200 S5 Tier A client system that was substituted by (1) PRIMERGY RX200 S6 Tier A client system in the priced configuration. Based on the specifications of these systems, it is my opinion that this substitution has no significant effect on performance.

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.doc flatfilelocation.txt makehelpdirff.cmd Readme.txt Remove_Addon_Files.sql tempdb16.sql
	Parameter OS Tunables Database Setup	SupportingFiles/Introduction/Software/	CountOperations.reg MemoryMamagement.reg MSTPCE Database Setup Reference.docx SQL_Server_Configuration.ver SQLNodeConfig.reg sqlservr_LargePages.reg SQLSocketAndIP.reg
	Startup Scripts Tier A	SupportingFiles/Introduction/Software/	start_all_RX600.cmd start_CE1_RX600S5.cmd start_CE2_RX600S5.cmd start_CE3_RX600S5.cmd start_CE4_RX600S5.cmd start_MEE1_RX600S5.cmd start_MEE2_RX600S5.cmd start_MEE3_RX600S5.cmd start_MEE4_RX600S5.cmd
	Startup Scripts Tier B	SupportingFiles/Introduction/Software/	sqlstartR2.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_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 tempdb16.sql Trade_Cleanup.cmd Trade_Cleanup.sql Version.sql

	Create Database output	SupportingFiles/Cause2/DB_setup	1050000Customers_Load_Timer2.log 1050000Customers_Load_Timer3.log 1050000Customers_Load_Timer.log Backup_Database.log BrokerVolume.log BulkInsert_1.out BulkInsert_2.out ... BulkInsert_64.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_Build_Steps1.log DB_Build_Steps2.log DB_Build_Steps3.log DB_Check.log DB_Dups_Check.log DB_FK_Constraints.log DB_Primary_Key_Check.log DB_RI_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 EGenLoaderFrom1To16000.log EGenLoaderFrom16001To33000.log EGenLoaderFrom1034001To1050000.log ERRORLOG1.txt ERRORLOG2.txt ERRORLOG3.txt FK_Constraints.log Get_Next_T_ID.log Load_Timer.log Load_Timer_Proc.log Load_TPCE_Info.log MarketFeed.log MarketWatch.log Remove_Addon_Files.sql RemoveDB.log SecurityDetail.log spfiles.ver spfiles_setup.ver splog.ver splog_setup.ver spused.ver spused_setup.ver SQL_Server_Configuration.log Tables_Fixed.log Tables_Growing.log Tables_Scaling.log TPCE_Types.log TPCE_VERSIONS1.log TPCE_VERSIONS2.log TPCE_VERSIONS3.log TradeLookup.log
--	------------------------	---------------------------------	---

			TradeOrder.log TradeResult.log TradeStatus.log TradeUpdate.log Version1.log Version2.log Version3.log
	Index Creation Scripts	SupportingFiles/Cause2/DDL	BulkInsert_<1..64>.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.sql Create_Indexes_Growing.sql Create_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/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/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 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 SUTServer.sln SUTServer.suo SUTStructs.h
	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_stdafx.cpp TxnHarness_stdafx.h TxnHarnessSendToMarket.cpp TxnHarnessSendToMarket.h
Clause4			
Clause5	EGen Driver Configuration	SupportingFiles/Cause5	RX600S5_1050KCus_8x135X1user_spiderb_RTE01.xml
	EGenLoader Parameter	SupportingFiles/Cause5	BuildSteps1.log BuildSteps2.log BuildSteps3.log EGenLoaderFrom1To16000.log EGenLoaderFrom16001To33000.log EGenLoaderFrom1034001To1050000.log
	EGenLogger Output	SupportingFiles/Cause5	TxnReportE-MI.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 Remove_AcidProcs.out
	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	DA_BenchCraft_Config.xml DA_Count_Settlement1.ver DA_Count_Settlement2.ver DA_ERRORLOG.txt DataAccess_TimeGraph.xls DataAccess_TxnReportE_20min.xls DataAccess_TxnReportE_all.xls 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

June 1, 2010

Fujitsu Technology Solutions
Detlev Seidel
Heinz Nixdorf Ring 1
Paderborn, DE 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
*	SQL Server 2008 R2 Enterprise Edition <i>Per Processor License Open Program - Level C Unit Price reflects a 33% discount from the retail unit price of \$28,749.</i>	\$19,188	4	\$76,752
P72-04217	Windows Server 2008 R2 Enterprise Edition <i>Server License with 25 CALs Open Program - Level C Unit Price reflects a 43% discount from the retail unit price of \$3,999.</i>	\$2,280	1	\$2,280
P73-04980	Windows Server 2008 R2 Standard Edition <i>Server License with 5 CALs Open Program - Level C Unit Price reflects a 31% discount from the retail unit price of \$1,029.</i>	\$711	1	\$711
N/A	Microsoft Problem Resolution Services <i>Professional Support (1 Incident).</i>	\$259	1	\$259

All Microsoft products above are currently orderable and available through Microsoft's normal distribution channels. A list of Microsoft's resellers can be found at 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 per call.

This quote is valid for the next 90 days.

Reference ID: TPCE_g3wOpiq6ZAsO8VDKoHcl5+VFhXN+2f+B_V1.0.0.



Fujitsu America, Inc.
1250 E. Arques Avenue
MS125
Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **95964-1**
Valid through: **12/31/2010**

Quote Date: 06/14/2010		
Customer: Fujitsu Technology Solutions		Reference:
Address: 1250 E. Arques Ave. Sunnyvale, CA 94085		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	FSCPCTR_S26361-K826-V212_101912-01		1	\$1,995.80	\$1,995.80
	1	PRIMECENTER Rack 24U, 1100mm deep (S26361-K826-V212)			
	1	Dummy panel, plastics, 1U + assembly (S26361-F2735-E130)			
	2	Dummy panel, plastics, 2U + assembly (S26361-F2735-E131)			
2	PYPCTR-W036360-0NA	PYPCTR Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays	1	\$0.00	\$0.00
3	PYPCTR-U004361-0NA	PYPCTR Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	1	\$720.00	\$720.00
4	FSCJX40_FTS:ETJXS11BG_101912-02		8	\$2,611.20	\$20,889.60
	8	ETERNUS JX40 (FTS:ETJXS11BG)			
	8	PRIMERGY Rackinstallation SX/DX ex works (D:FCSX-INPSR)			
5	PYJX40-W036120-0NA	PYJX40 Warranty, 12 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays	8	\$0.00	\$0.00
6	PYJX40-U004121-0NA	PYJX40 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	8	\$609.00	\$4,872.00
7	PYJX40-P004241-0NA	PYJX40 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	8	\$1,218.00	\$9,744.00
8	PYJX40-N043005-0NA	PYJX40 during normal business hours, Primergy storage installation, One Time billing	8	\$450.00	\$3,600.00
9	FSCSX40_S26361-K1122-V200_101912-03		1	\$2,334.95	\$2,334.95
	1	FibreCAT SX40 SAS Disk Subsystem (S26361-K1122-V200)			
	4	HD SATA 3Gb/s 750GB 7.2k hot p 3.5" SX40 (S26361-F3245-E750)			
	1	Rack installation ex works, SX10, 1U Nod (S26361-F1647-E302)			
10	PYSX40-W036360-0NA	PYSX40 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time,	1	\$0.00	\$0.00



Fujitsu America, Inc.
1250 E. Arques Avenue
MS125
Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **95964-1**
Valid through: **12/31/2010**

Quote Date: 06/14/2010		
Customer: Fujitsu Technology Solutions		Reference:
Address: 1250 E. Arques Ave. Sunnyvale, CA 94085		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
Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays					
11	PYSX40-U004361-0NA	PYSX40 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	1	\$1,827.00	\$1,827.00
12	PYSX40-N043005-0NA	PYSX40 during normal business hours, Primergy storage installation, One Time billing	1	\$450.00	\$450.00
13	FSCR2S6_S26361-K1342-V101_101912-04		1	\$3,490.10	\$3,490.10
	1	PY RX200 S6, 6HD-bays 2.5" (S26361-K1342-V101)			
	2	Intel Xeon E5620 4C/8T 2.40 GHz 12 MB (S26361-F4419-E240)			
	6	2 GB DDR3 1333 MHz PC3-10600 rg s (S26361-F3604-E513)			
	1	DVD-RW supermulti slimline SATA (S26361-F3269-E2)			
	1	HD SAS 6G 73GB 15K HOT PLUG 2.5" EP (S26361-F4006-E573)			
	1	RAID 0/1 SAS based on LSI MegaRAID 4Port (S26361-F3257-E4)			
	2	Eth Ctrl 2x1Gbit PCIe PRO/1000PT Cu lp (S26361-F3228-E201)			
	1	Rack installation ex works, SX10, 1U Nod (S26361-F1647-E302)			
	1	RMK-P_1-2U servers (new) (S26361-F2735-E110)			
	1	Power Supply Module 770W silver hp (S26113-F539-E1)			
14	PYR2S6-W036360-0NA	PYRX200 S6 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays	1	\$0.00	\$0.00
15	PYR2S6-U004361-0NA	PYRX200 S6 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	1	\$550.00	\$550.00
16	PYR2S6-N039005-0NA	PYRX200 S6 during normal business hours, Primergy installation, Low-end Server, w/o OS, One Time billing	1	\$200.00	\$200.00
17	FSCR6S5_S26361-K1287-V400_101912-05		1	\$60,104.35	\$60,104.35
	1	PY RX600S5 (S26361-K1287-V400)			
	4	Intel Xeon X7560 8C/16T 2.26 GHz 24 MB (S26361-F3990-E560)			
	6	Memory Board RX600 S5 (S26361-F3990-E100)			
	16	32GB (4x8) DDR3 1333 MHz PC3-10600 rg d (S26361-F4003-E645)			



Fujitsu America, Inc.
1250 E. Arques Avenue
MS125
Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **95964-1**
Valid through: **12/31/2010**

Quote Date: 06/14/2010		
Customer: Fujitsu Technology Solutions		Reference:
Address: 1250 E. Arques Ave. Sunnyvale, CA 94085		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		DVD-RW supermulti slimline SATA (S26361-F3269-E2)			
6		HD SAS 6G 300GB 10K HOT PLUG 2.5" EP (S26361-F4006-E130)			
2		HD SAS 6G 73GB 15K HOT PLUG 2.5" EP (S26361-F4006-E573)			
1		RAID Ctrl SAS 6G 5/6 512MB (D2616) (S26361-F3554-E512)			
1		Rack installation ex works (SNP:SY-F1647E301-P)			
1		RMK-F2_3-xU-Servers_13mm-Drop-in Rails (S26361-F2735-E202)			
1		Cable mgmt. for 19" DC- PC- Rack (S26361-F2735-E7)			
2		Power Supply Module 850W (S26113-F561-E10)			
18	PYR6S5-W036360-0NA	PYRX600 S5 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays	1	\$0.00	\$0.00
19	PYR6S5-U004361-0NA	PYRX600 S5 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing	1	\$1,575.00	\$1,575.00
20	PYR6S5-N038005-0NA	PYRX600 S5 during normal business hours, Primergy Installation, Midrange Server, w/o OS, One Time billing	1	\$350.00	\$350.00
21	S26361-F3298-L64	SSD SATA 3G 64GB SLC HOT PLUG 2.5" EP	192	\$1,031.90	\$198,124.80
22	S26361-F3593-L501	RAID Ctrl SAS 6G 8Port ex 512M FH/LP LSI	8	\$493.85	\$3,950.80
23	S26361-F3417-L3	LAN-CAT 5 Enhanced, l=3m	4	\$18.70	\$74.80
24	S26361-F2262-L31	Socket strip 3phase 3x 8 sockets	1	\$157.25	\$157.25
25	S26381-K370-V510	KB SLIM MF USA	2	\$20.40	\$40.80
26	D:KBSAS1S-1S-2M	SAS CABLE 1X SFF 8088-1X SFF 8088 2M	8	\$66.30	\$530.40
27	S26361-F3246-L203	SAS CBL EXT 2m 8088-8470	1	\$62.90	\$62.90
28	S26361-K1339-V140	DISPLAY A19-5 ECO	2	\$176.80	\$353.60
29	S26381-K452-L100	Mini Optical Mouse	2	\$10.20	\$20.40
Total (w/o Freight Charges and Applicable Tax):					\$316,018.55
Estimated Freight Charges:					\$0.00

QUOTATION

Quote #: **95964-1**
Valid through: **12/31/2010**

Quote Date: 06/14/2010				
Customer: Fujitsu Technology Solutions			Reference:	
Address: 1250 E. Arques Ave. Sunnyvale, CA 94085			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

Notes: No Freight Included per TPC Benchmark Guidelines

* 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
PYJX40-P004241-QNA	PYJX40 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
PYJX40-U004121-QNA	PYJX40 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
PYJX40-W036120-QNA	PYJX40 Warranty, 12 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays
PYPCTR-U004361-QNA	PYPCTR Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing
PYPCTR-W036360-QNA	PYPCTR Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays
PYRX200-S6-U004361-QNA	PYRX200 S6 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing
PYRX200-S6-W036360-QNA	PYRX200 S6 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays
PYRX600-S5-U004361-QNA	PYRX600 S5 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing
PYRX600-S5-W036360-QNA	PYRX600 S5 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays
PYSX40-U004361-QNA	PYSX40 Warranty Uplift, 36 Months, Enhanced Plus Level, 24x7x365 Phone Support (Sev1 - Live Transfer), 24x7x365 Onsite and Parts (Sev1 Resp. Time - 4 Hours), Incl. Holidays, Prepaid billing
PYSX40-W036360-QNA	PYSX40 Warranty, 36 Months, Standard Level, Mon-Fri, Phone Support 8AM-5PM Local Time, Onsite and Parts 8AM-5PM Local Time (Sev1 Resp. Time - Next Bus. Day), Excl. Holidays

Terms and Conditions of Order

Special Provisions (If any):

FAI 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 FAI, this quote is only valid through 12/31/2010

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 FAI Products and Services Agreement (FAI Master Agreement, Rev. 4-1-2009) 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 FAI Products and Services Agreement is available at <http://solutions.us.fujitsu.com/downloads/FAI-Master-Agreement.pdf>. If a Master Agreement or a Federal Government GSA Schedule exists between Customer and FAI 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 FAI Mobile Products Agreement is available at



Fujitsu America, Inc.
1250 E. Arques Avenue
MS125
Sunnyvale, CA 94088-3470

QUOTATION

Quote #: **95964-1**
Valid through: **12/31/2010**

Quote Date: 06/14/2010		
Customer: Fujitsu Technology Solutions		Reference:
Address: 1250 E. Arques Ave. Sunnyvale, CA 94085		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

<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 FAI 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 FAI Product Evaluation Agreement (FAI-2), which are an integral part hereof and are incorporated herein by reference. A complete copy of the FAI Products Evaluation Agreement is available at <http://solutions.us.fujitsu.com/downloads/FAI-Product-Eval-Agreement.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 FAI 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 FAI 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 FAI pursuant to those Non FAI Products are pass-through products only, and are not covered by any warranty obligation from FAI, are not covered by any indemnification provision from FAI, are not covered by any maintenance or service provision by FAI, and FAI does not assume any liability to Buyer for such Non FAI Products or service whatsoever. Buyer shall have recourse only to the manufacturer, not FAI, for all such warranty, indemnity, service or support obligations. Buyer's Purchase Order for Non FAI Products signifies agreement to these terms.

