



TPC Benchmark™ E Report

**Unisys ES7000 Model 7600R
Enterprise Server (8s)**

using

**Microsoft SQL Server 2008
Enterprise x64 Edition**

on

**Microsoft Windows Server 2008
Enterprise Edition (x64)**

**First Edition
April 13, 2009**

First Edition - April 2009

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Abstract

Overview

This report documents the methodology and results of the TPC Benchmark™ E (TPC-E) conducted on the Unisys Corporation ES7000 Model 7600R Enterprise Server (8s). The operating system on the server was Microsoft Windows Server 2008 Enterprise Edition (x64). The DBMS used was Microsoft SQL Server 2008 Enterprise x64 Edition. The TPC applications, which included TPC provided EGen software, were provided by Microsoft Corporation. The operating system on the clients was Microsoft Windows Server 2008 Standard Edition (x64). The standard TPC Benchmark™ E metrics, tpsE (transactions per second), price per tpsE (three year capital cost per reported tpsE), and the availability date are reported as required by the benchmark specification.

Executive Summary

The following pages contain the **Executive Summary** results of the benchmark. The **Executive Summary Statement (ExecutiveSummary.pdf)** and the **(ES.xml)** file can be found in the *ExecutiveSummaryStatement* folder.

Auditor

Lorna Livingtree of Performance Metrics, Inc., verified compliance with the relevant TPC specifications, audited the benchmark configuration, environment, and methodology used to produce and validate the test results, along with the pricing model used to calculate the price per tpsE.

UNISYS	ES7000 Model 7600R Enterprise Server (8s)		TPC-E 1.7.0 TPC Pricing 1.4.0
			Report Date April 13, 2009
TPC-E Throughput	Price/Performance	Availability Date	Total System Cost
1165.56 tpsE	\$783.56 USD per tpsE	April 13, 2009	\$913,284 USD
Database Server Configuration			
Operating System Microsoft Windows Server 2008 Enterprise Edition (x64)	Database Manager Microsoft SQL Server 2008 Enterprise x64 Edition	Processors/Cores/ Threads 8/48/48	Memory 256GB
The diagram illustrates the database server configuration. It shows a Tier A client (ES3220L Server) connected to a Tier B server (ES7000 Model 7600R) via a 1Gb Ethernet connection. The server is connected to a storage system (RTS 4200 RAID) via an 8Gb VI over Fibre Channel connection. The storage system consists of two RAID controllers (labeled 2 and 15) and six disks (labeled 3 and 3). The disks are labeled (Database) and (Log).			
Client ES3220L Server 2 x 2.00GHz Intel® Quad-core Xeon™ w/ 4MB L2 cache, 4 GB memory, 1 x 73GB internal disk, 1x PCI VI-over-FC cntrls, 2 Inbuilt 1Gb Eth. cntrls.		Server ES7000 Model 7600R 8 x Intel® Hex-core Xeon™ X7460 2.66GHz w/ 16MB L3 cache 256 GB memory, 2 x 36GB SAS disk, internal , 1 x PCI SAS RAID cntrl, internal, 8 x PCI Fibre Channel cntrls, 1x PCI VI-over-FC cntrls, 4 Inbuilt 1Gb Eth. cntrls. (0 used).	
		Storage RTS 4200 RAID Storage 675 x 73GB 6 x 146GB External Fibre Channel disks, 17 x FC RAID controllers	
Initial Database Size	Redundancy Level: 1		Database Storage
4,568 GB	RAID-10		675 x 73GB 15K rpm 6 x 146GB 15K rpm

	ES7000 Model 7600R Enterprise Server (8s)			TPC-E 1.7.0 TPC Pricing 1.4.0		
				Report Date April 13, 2009		
Description	Part Number	Price Source	Unit Price	Qty.	Extended Price	3-yr.Maint. Price
Server Hardware:						
ES7/7600R 8x X7460, 16GB	ES7763083-100	1	\$66,729	1	\$66,729	\$3,384
Snap-in 1U Filler	RCK4219421-1UP	1	\$20	7	\$140	
Snap-In 3U Filler	RCK4219421-3UP	1	\$22	9	\$198	
42U Shipping Config	RCK4219421-SC1	1	\$115	1	\$115	
Power Strip	PWR4243001-SD	1	\$392	1	\$392	
Power Strip	PWR4243001-SVD	1	\$403	1	\$403	
42U Rack	RCK4219421-FSS	1	\$2,769	1	\$2,769	
Rack Trim Kit	RCK4219421-OTK	1	\$350	1	\$350	
2 x 36GB Hard Drive	FAC7760361-IDK	1	\$2,083	1	\$2,083	
Initial Memory - 8GB	FAC7102403-ICA	1	\$1,378	2	\$2,756	
Memory Expansion - 8GB	FAC7102403-8GB	1	\$585	28	\$16,380	
Emulex LPe12002 - Disk HBA and VI	FCH9540231-PCE	1	\$3,986	10	\$39,860	
	Subtotal				\$132,175	
Server Software:						
Windows Server 2008 Enterprise Edition (x64)	P72-03168	2	\$2,310	1	\$2,310	\$245
SQL Server 2008 Enterprise x64 Edition	810-07507	2	\$23,432	8	\$187,456	
SRVC: Microsoft Problem Resolution Services		2		1		
	Subtotal				\$189,766	\$245
Storage Hardware:						
Rack Mount Kit	RTS400012-RK	1	\$220	16	\$3,520	\$566,001
Disk Enclosure with (15) 73GB Disk - 30 Pack	RTS4307315-30P	S	\$333,144	1	\$333,144	
Disk for RAID Controller	RTS4307315-4FH	S	\$484	210	\$101,640	
Dual RAID Controller for Log	RTS422880-T2	1	\$15,840	1	\$15,840	
UPS for Log Disk	UPS120	5	\$1,000	1	\$1,000	
SAN Manager Software	RTS44101-SAN	1	\$2,246	1	\$2,246	
146 GB Disk Drive	RTS4314615-4FH	1	\$660	6	\$3,960	
RAID Controller 1x1 - 15 Pack	RTS4228801-P15	1	\$104,277	1	\$104,277	
AC Power Cord	RTS400740-CBL	1	\$11	34	\$374	
	Subtotal				\$566,001	
Infrastructure						
8 port KVM switch	KVM9083101-SWC	1	\$1,300	1	\$1,300	\$1,203
16 Port Ethernet Switch (Netgear)	FS116	4	\$65	1	\$65	
Rack mount LCD w/1U Drawer	MON2145-LCD	1	\$2,700	1	\$2,700	
Rack mount keyboard, w/touchpad, USB	KBR210501-USB	1	\$275	1	\$275	
42U Rack - No Doors	RM421940-FRM	1	\$1,286	5	\$6,429	
8 Outlet Power Strip	SFR9-PWR	1	\$170	20	\$3,400	
Power Cord	USE1936-LC6	1	\$90	20	\$1,800	
Fiber Channel Cable	GCFAZLLM20-M	3	\$35	17	\$590	
Ethernet Cable	GCP0888650-BL	3	\$12	17	\$202	
	Subtotal				\$16,760	
Client Hardware:						
ESL3220 Quad Core Server 2.0 GHz	ESL3220611-200	1	\$787	1	\$787	\$1,203
ESL:3220 Brand Kit	ESL322001-UNI	1	\$19	1	\$19	
VersaRail Mount Kit	ESL322001-RVR	1	\$249	1	\$249	
Processor Upgrade	CPL3220612-200	1	\$369	1	\$369	
Hard Drive - 73GB 15K SAS	HDP73115-SAS	1	\$299	1	\$299	
Memory - 4GB (8 x 512 DIMMs)	DIM3220083-4GB	1	\$628	1	\$628	
Bezel	ESL322001-BZL	1	\$19	1	\$19	
SAS RAID Controller	RAD322004-P61	1	\$299	1	\$299	
CD/DVD Drive	DVW322001-INT	1	\$99	1	\$99	
CD/DVD Drive Cable	CBL322001-CD	1	\$20	1	\$20	
USB to Cat5 KVM Adapter	KVM9002301-CNV	1	\$250	1	\$250	
	Subtotal				\$3,038	
Client Software:						
Windows Server 2008 Standard Edition (x64)	P73-04165	2	\$711	1	\$711	\$0
			Subtotal		\$711	
Unisys Product Pricing (List Pricing) - Michael Heifner (215)-986-4757 where Price Source = 1 or S						
Total USD					\$908,451	\$4,832
Benchmark results and test methodology audited by Lorna Livingtree of Performance Metrics, Inc.						
Notes:				3-Year Cost of Ownership: \$913,284 USD		
1. HW & SW maintenance at 24 x 7 w/ 4 hr. max. response time for spares.				TPC-E Throughput: 1,165.56 tpsE		
2. Price Source: 1 = Unisys Product Price, Unisys Maintenance Price				Price/Performance: \$783.56 USD		
2 = Microsoft 3 = GoCables 4 = NewEgg						
5 = IQstor						
S One or more components of the measured configuration have been have been substituted in the Priced Configuration - see FDR for details						
Benchmark results and test methodology audited by Lorna Livingtree of Performance Metrics, Inc.						
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 assumption about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmarks specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank You.						

UNISYS	ES7000 Model 7600R Enterprise Server (8s)			TPC-E 1.7.0	
				Report Date April 13, 2009	
Numerical Quantities Summary					
Reported Throughput:				1165.56	
Configured Customers:				590,000	
Response Time (in seconds)		Minimum	Average	90 th %tile	Maximum
Broker-Volume		0.01	0.07	0.12	4.79
Customer-Position		0.00	0.03	0.05	2.86
Market-Feed		0.00	0.04	0.10	4.63
Market-Watch		0.00	0.04	0.09	1.13
Security-Detail		0.00	0.02	0.04	1.95
Trade-Lookup		0.00	0.58	0.79	3.88
Trade-Order		0.00	0.07	0.11	4.86
Trade-Result		0.00	0.08	0.13	1.36
Trade-Status		0.00	0.03	0.06	1.69
Trade-Update		0.02	0.69	0.86	2.31
Data-Maintenance		0.01	0.15	N/A	1.05
Transaction Mix (in percent of total transactions)			Transaction Count		Mix
Broker_Volume			4,111,878		4.900%
Customer-Position			10,909,488		13.000%
Market-Feed			839,215		1.000%
Market-Watch			15,104,817		18.000%
Security-Detail			11,748,866		14.001%
Trade-Lookup			6,712,772		7.999%
Trade-Order			8,475,634		10.100%
Trade-Result			8,392,101		10.000%
Trade-Status			15,944,125		19.000%
Trade-Update			1,678,169		2.000%
Data-Maintenance			120		N/A
Test Duration and Timing					
Ramp-up Time (hh:mm:ss)			0:48:42		
Measurement Interval (hh:mm:ss)			2:00:00		
Business Recovery Time (hh:mm:ss)			0:53:36		
Total Number of Transactions Completed in Measurement Interval			83,917,065		

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Preface

Document Structure

The TPC Benchmark™ E Specification requires test sponsors to publish, submit to the TPC, and make available to the public a full disclosure report for any result to be considered compliant with the specification. The required contents of the full disclosure report are specified in Clause 9.

This report is submitted to satisfy the specification's requirement for full disclosure. It documents the compliance of the benchmark implementation and execution reported for the Unisys ES7000 Model 7600R Enterprise Server (8s) using Microsoft SQL Server 2008 Enterprise x64 Edition on Microsoft Windows Server 2008 Enterprise Edition (x64).

TPC Benchmark™ E Overview

The Transaction Processing Performance Council (TPC) developed The TPC Benchmark™ E Standard Specification Revision 1.7.0. It is the intent of the TPC to develop a suite of benchmarks to measure the performance of computer systems executing a wide range of applications. Unisys and Microsoft Corporations are active participants in the TPC to define and develop such a suite of benchmarks. TPC Benchmark™ E (TPC-E) is an online 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 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 benchmark simulates the OLTP workload of a brokerage firm. The focus of the benchmark is the central database that exercises 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.

Clause 1: General Items

1.1. 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 the different **Reports**. (9.1.1.1)*

The order and titles of the sections in this report correspond with those from the TPC-E standard specification.

1.2. Executive Summary Statement

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

The schema of the ES.xml document is defined by the XML schema document tpce-es.xsd (available from www.tpc.org). The ES.xml file must conform to the tpce-es.xsd (established by XML schema validation). (9.2.3.1)

The TPC **Executive Summary Statement** is included in the *ExecutiveSummaryStatement* folder. The TPC **Executive Summary Statement** is located near the beginning of this report.

The **ES.xml** file conforms to the tpce-es-xsd specification and is included in the **ExecutiveSummaryStatement** folder.

1.3. Benchmark Sponsor

*A statement identifying the benchmark **sponsor(s)** and other participating companies must be **reported** in the **Report**. (9.3.1.1)*

Unisys Corporation sponsored this TPC benchmark™ E. Microsoft and Unisys developed the benchmark test. The benchmark was conducted at Unisys, Mission Viejo, California.

1.4. Configuration Diagrams

*Diagrams of both the Measured and **Priced Configurations** must be **reported** in the **Report**, accompanied by a description of the differences. This includes, but is not limited to: (9.3.1.2)(9.3.1.3)*

- o Number and type of processors, number of cores, and number of threads.*
- o Size of allocated memory, and any specific mapping/partitioning of memory unique to the test.*
- o Number and type of disk units (and controllers, if applicable).*
- o Number of channels or bus connections to disk units, including their protocol type.*
- o Number of LAN (e.g., Ethernet) connections, including routers, workstations, etc., that were physically used in the test or are incorporated into the pricing structure.*
- o Type and the run-time execution location of software components (e.g., **DBMS**, client, processes, transaction monitors, software drivers, etc.).*

The **Benchmarked Configuration** of the drivers and Unisys ES7000 Model 7600R Enterprise Server (8s) is illustrated in Figure 1.1. The **Priced Configuration** is shown in figure 1.2. Table 2.2 contains a detailed description of the disk configuration.

Figure 1-1: Benchmarked Configuration

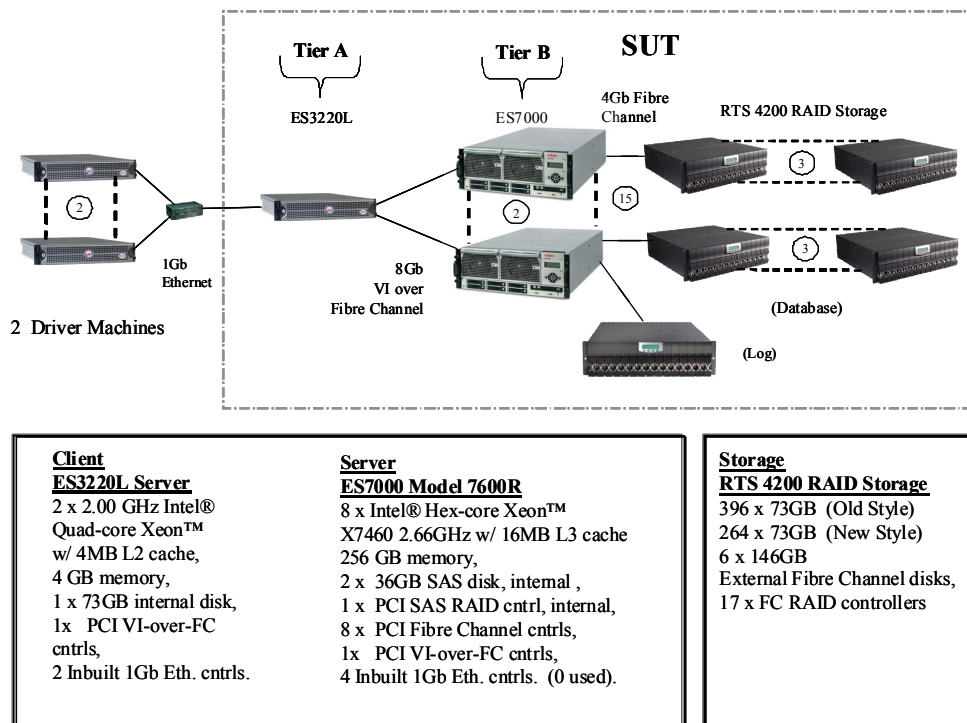
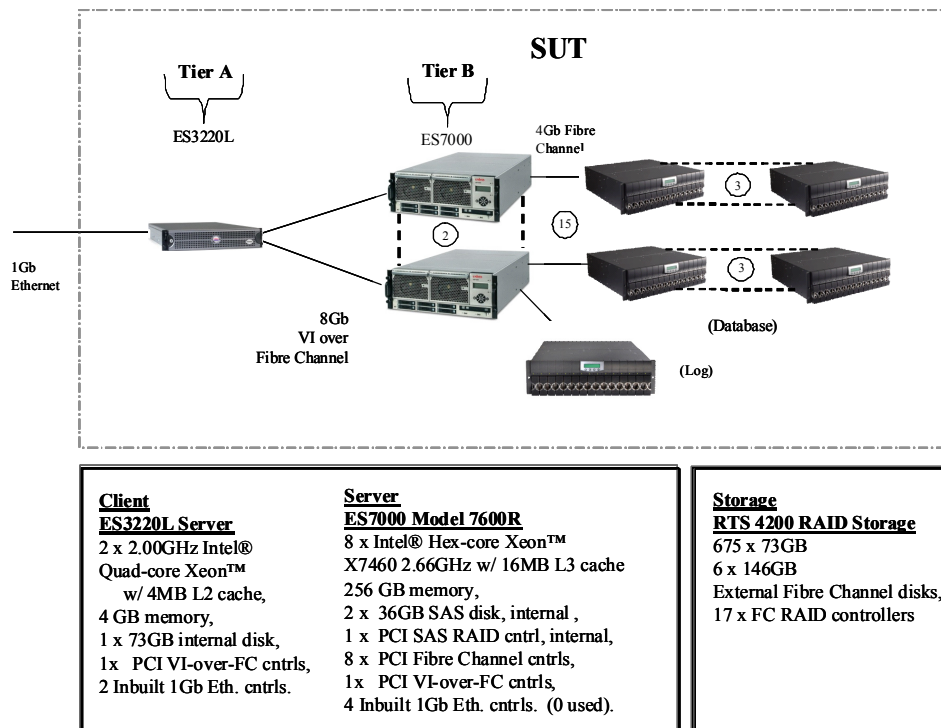


Figure 1-2: Priced Configuration



The difference between the two diagrams lies in the configuration of the RAID controllers. Each RTS 4200 Storage subsystem contains 45 disk across three racks. Each RAID controller was configured with two RAID 1/0 LUNs using 22 drives each. The 45th drive is left unconfigured, but priced.

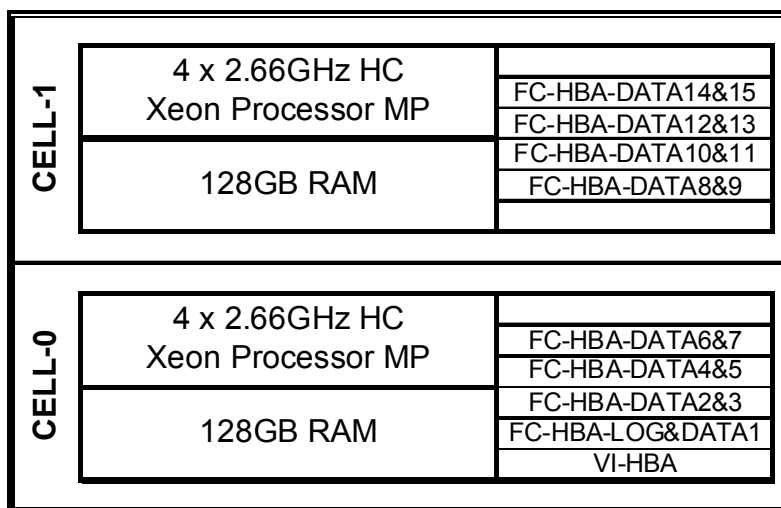
1.5. Hardware Configuration

*A description of the steps taken to configure all of the hardware must be **reported** in the **Report**. Any and all configuration scripts or step by step GUI instructions are **reported** in the **Supporting Files** (see Clause 9.4.1.1). The description, scripts and GUI instructions must be sufficient such that a reader knowledgeable of computer systems and the TPC-E specifications could recreate the hardware environment. This includes but is not limited to: (9.3.1.4)*

- o A description of any firmware updates or patches to the hardware.*
- o A description of any GUI configuration used to configure the system hardware.*
- o A description of exactly how the hardware is combined to create the complete system.*
- o A description of how the hardware components are connected. The description can assume the reader is knowledgeable of computer systems and the TPC-E specification.*

The file **HardwareConfiguration.pdf** in the **SupportingFiles** Directory (“Introduction”) contains the steps taken to configure all of the hardware used in running these TPC-E tests. It also contains the disk subsystem configuration in the file **RAID_Hardware_config.pdf** in the **DiskSubsystem** directory. Figure 1.3 shows the layout of the ES7000 Model 7600R server.

Figure 1.3: ES7000 Model 7600R Server Layout



1.6. Software Configuration

*A description of the steps taken to configure all software must be **reported** in the **Report**. Any and all configuration scripts or step by step GUI instructions are **reported** in the **Supporting Files** (see Clause 9.4.1.2). The description, scripts and GUI instructions must be sufficient such that a reader knowledgeable of computer systems and the TPC-E specifications could recreate the software environment. This includes but is not limited to: (9.3.1.5)*

- o A description of any updates or patches to the software.*
- o A description of any changes to the software.*
- o A description of any GUI configurations used to configure the software.*

The file **SoftwareConfiguration.pdf** in the *SupportingFiles* Directory (“Introduction”) contains the steps taken to configure all software and system parameters used in running these TPC-E tests. It also contains all the client and server OS and SQL Server tunable parameters.

Clause2: Database Design, Scaling & Population

2.1. Physical Database Creation

*A description of the steps taken to create the database for the **Reported Throughput** must be **reported** in the **Report**. Any and all scripts or step by step GUI instructions are **reported** in the **Supporting Files** (see Clause 9.4.2). The description, scripts and GUI instructions must be sufficient such that a reader knowledgeable of database software environments and the TPC-E specification could recreate the database. (9.3.2)*

All the steps required to create the database are described in **MSTPCE Database Setup Reference.pdf** (included in *SupportingFiles\Clause2*). The Unisys customized scripts are located in *Supportingfiles\Clause2\Database*. These include:

- o Tempdb.sql (used to increase the size of tempdb)
- o Create_Database.sql (used to create the customer TPCE database)
- o Backup.sql (used to backup the database once it has been built)
- o Restore.sql (used to restore the TPCE database from the backup)

2.2. Physical Database Organization

*The physical organization of tables and **User-Defined Objects**, within the database, must be **reported** in the **Report**. (9.3.2.1)*

The database tables and their corresponding User-Defined Objects were organized into four file groups as shown in Table 2.1 below. The *SupportingFiles/Clause2* folder contains the SQL definitions of all the required filegroups, tables and indexes.

Table 2.1: Physical Database Organization

Broker File Group	Customer File Group	Market File Group	Misc File Group
BROKER	ACCOUNT_PERMISSION	COMPANY	ADDRESS
CASH_TRANSACTION	CUSTOMER	COMPANY_COMPETITOR	TAXRATE
CHARGE	CUSTOMER_ACCOUNT	DAILY_MARKET	ZIP_CODE
COMMISSION_RATE	CUSTOMER_TAXRATE	EXCHANGE	
SETTLEMENT	HOLDING	FINANCIAL	
TRADE	HOLDING_HISTORY	INDUSTRY	
TRADE_HISTORY	HOLDING_SUMMARY	LAST_TRADE	
TRADE_REQUEST	WATCH_ITEM	NEWS_ITEM	
TRADE_TYPE	WATCH_LIST	NEWS_XREF	
		SECTOR	
		SECURITY	
		STATUS_TYPE	

2.3. Table and Row Partitioning

*Any horizontal or vertical partitioning of tables and rows in the TPC-E benchmark (see Clause 2.3.3), must be **reported** in the **Report**. (9.3.2.2)*

No partitioning was done for this implementation.

2.4. Replications, Duplications, or Additions

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

*Additional and/or duplicate columns in any table must be **reported** in the **Report** along with a statement on the impact on performance. (see Clause 2.3.5) (9.3.2.4)*

Replication of tables was not used in this implementation. No additional and/or duplicated columns were assigned to any TPC-E table.

2.5. Initial Cardinality of Tables

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

The TPC-E database for this test was configured with 590,000 customers. The cardinality of each table the database is listed in Table 2.2

Table 2.2: Initial Cardinality of Database

Table	Rows
BROKER	5,900
CASH_TRANSACTION	9,379,560,050
CHARGE	15
COMMISSION_RATE	240
SETTLEMENT	10,195,200,000
TRADE	10,195,200,000
TRADE_HISTORY	24,468,430,230
TRADE_REQUEST	0
TRADE_TYPE	5
ACCOUNT_PERMISSION	4,188,507
CUSTOMER	590,000
CUSTOMER_ACCOUNT	2,950,000
CUSTOMER_TAXRATE	1,180,000
HOLDING	521,976,054
HOLDING_HISTORY	13,663,287,110
HOLDING_SUMMARY	29,346,262
WATCH_ITEM	59,018,816
WATCH_LIST	590,000
COMPANY	295,000
COMPANY_COMPETITOR	885,000
DAILY_MARKET	527,415,750
EXCHANGE	4
FINANCIAL	5,900,000
INDUSTRY	102
LAST_TRADE	404,150
NEWS_ITEM	590,000
NEWS_XREF	590,000
SECTOR	12
SECURITY	404,150
STATUS_TYPE	5
ADDRESS	885,004
TAXRATE	320
ZIP_CODE	14,741

2.6. Disk Configuration Data

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 lists the distribution of the database over 660 73GB disks for the measured configuration, of which, 396 disks were style RTS4307315-4F and 264 disks were style RTS4307315-4FH. The Priced configuration contains 675 73GB disks, of which 15 are unused. The transaction log and tempdb log were distributed over 3 mirrored pairs of 146GB disks for both the priced and measured configurations. There were two 73GB mirrored disks in the host server containing Windows Server 2008 Enterprise Edition (x64) and SQL Server 2008 Enterprise x64 Edition code and the master database plus the paging file.

Each database disk volume, as seen by the Windows operating system, was configured as a RAID-10 disk array with 22 physical disks. There were a total of 30 such disk volumes. Each disk volume was configured in Windows as four partitions, one for broker, one for market, one for customer and the last partition was used by the *tempdb* during the measurements.

Table 2.3: Disk Rack Configuration

Cell #	Slot #	HBA #	Controller #	Disk #	Drives Enclosure model RAID level	File System Partition	Size	Use
Cell 0	PCISlot 1	HBA #1 port 1	RTS4200 #1, 2	1	6 X 146 GB RTS422880 RAID 10	C:\Bigdb\dblogs\tpclog1\ (RAW) C:\Bigdb\dblogs\tpclog2\ (NTFS)	366.22 GB 39.71 GB	TPCE database Log Tempdb Log
		HBA #1 port 2	RTS4200 #3	2	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabA\Broker1 (RAW) C:\Bigdb\cabA\Customer1 (RAW) C:\Bigdb\cabA\Market1 (RAW) C:\Bigdb\dbbackups\backupA1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb, Misc_FG
				3	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabA\Broker2 (RAW) C:\Bigdb\cabA\Customer2 (RAW) C:\Bigdb\cabA\Market2 (RAW) C:\Bigdb\dbbackups\backupA2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
	PCISlot 2	HBA #2 port 1	RTS4200 #4	4	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabB\Broker1 (RAW) C:\Bigdb\cabB\Customer1 (RAW) C:\Bigdb\cabB\Market1 (RAW) C:\Bigdb\dbbackups\backupB1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				5	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabB\Broker2 (RAW) C:\Bigdb\cabB\Customer2 (RAW) C:\Bigdb\cabB\Market2 (RAW) C:\Bigdb\dbbackups\backupB2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #2 port 2	RTS4200 #5	6	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabC\Broker1 (RAW) C:\Bigdb\cabC\Customer1 (RAW) C:\Bigdb\cabC\Market1 (RAW) C:\Bigdb\dbbackups\backupC1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				7	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabC\Broker2 (RAW) C:\Bigdb\cabC\Customer2 (RAW) C:\Bigdb\cabC\Market2 (RAW) C:\Bigdb\dbbackups\backupC2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
	PCISlot 3	HBA #3 port 1	RTS4200 #6	8	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabD\Broker1 (RAW) C:\Bigdb\cabD\Customer1 (RAW) C:\Bigdb\cabD\Market1 (RAW) C:\Bigdb\dbbackups\backupD1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				9	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabD\Broker2 (RAW) C:\Bigdb\cabD\Customer2 (RAW) C:\Bigdb\cabD\Market2 (RAW) C:\Bigdb\dbbackups\backupD2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #3 port 2	RTS4200 #7	10	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabE\Broker1 (RAW) C:\Bigdb\cabE\Customer1 (RAW) C:\Bigdb\cabE\Market1 (RAW) C:\Bigdb\dbbackups\backupE1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				11	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabE\Broker2 (RAW) C:\Bigdb\cabE\Customer2 (RAW) C:\Bigdb\cabE\Market2 (RAW) C:\Bigdb\dbbackups\backupE2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb

Table 2.3: Disk Rack Configuration (Cont)

Cell #	Slot #	HBA #	Controller #	Disk #	Drives Enclosure model RAID level	FileSystem Partition	Size	Use
Cell 0	PCI Slot 4	HBA #4 port 1	RTS4200 #8	12	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabF\Broker1 (RAW) C:\Bigdb\cabF\Customer1 (RAW) C:\Bigdb\cabF\Market1 (RAW) C:\Bigdb\dbbackups\backupF1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				13	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabF\Broker2 (RAW) C:\Bigdb\cabF\Customer2 (RAW) C:\Bigdb\cabF\Market2 (RAW) C:\Bigdb\dbbackups\backupF2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #4 port 2	RTS4200 #9	14	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabG\Broker1 (RAW) C:\Bigdb\cabG\Customer1 (RAW) C:\Bigdb\cabG\Market1 (RAW) C:\Bigdb\dbbackups\backupG1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				15	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabG\Broker2 (RAW) C:\Bigdb\cabG\Customer2 (RAW) C:\Bigdb\cabG\Market2 (RAW) C:\Bigdb\dbbackups\backupG2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
Cell 1	PCI Slot 1	HBA #5 port 1	RTS4200 #10	16	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabH\Broker1 (RAW) C:\Bigdb\cabH\Customer1 (RAW) C:\Bigdb\cabH\Market1 (RAW) C:\Bigdb\dbbackups\backupH1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				17	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabH\Broker2 (RAW) C:\Bigdb\cabH\Customer2 (RAW) C:\Bigdb\cabH\Market2 (RAW) C:\Bigdb\dbbackups\backupH2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #5 port 2	RTS4200 #11	18	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabI\Broker1 (RAW) C:\Bigdb\cabI\Customer1 (RAW) C:\Bigdb\cabI\Market1 (RAW) C:\Bigdb\dbbackups\backupI1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				19	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabI\Broker2 (RAW) C:\Bigdb\cabI\Customer2 (RAW) C:\Bigdb\cabI\Market2 (RAW) C:\Bigdb\dbbackups\backupI2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		PCI Slot 2	HBA #6 port 1	RTS4200 #12	20	C:\Bigdb\cabJ\Broker1 (RAW) C:\Bigdb\cabJ\Customer1 (RAW) C:\Bigdb\cabJ\Market1 (RAW) C:\Bigdb\dbbackups\backupJ1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
					21	C:\Bigdb\cabJ\Broker2 (RAW) C:\Bigdb\cabJ\Customer2 (RAW) C:\Bigdb\cabJ\Market2 (RAW) C:\Bigdb\dbbackups\backupJ2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #6 port 2	RTS4200 #13	22	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabK\Broker1 (RAW) C:\Bigdb\cabK\Customer1 (RAW) C:\Bigdb\cabK\Market1 (RAW) C:\Bigdb\dbbackups\backupK1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				23	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabK\Broker2 (RAW) C:\Bigdb\cabK\Customer2 (RAW) C:\Bigdb\cabK\Market2 (RAW) C:\Bigdb\dbbackups\backupK2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
	PCI Slot 3	HBA #7 port 1	RTS4200 #14	24	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabL\Broker1 (RAW) C:\Bigdb\cabL\Customer1 (RAW) C:\Bigdb\cabL\Market1 (RAW) C:\Bigdb\dbbackups\backupL1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				25	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabL\Broker2 (RAW) C:\Bigdb\cabL\Customer2 (RAW) C:\Bigdb\cabL\Market2 (RAW) C:\Bigdb\dbbackups\backupL2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
		HBA #7 port 2	RTS4200 #15	26	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabM\Broker1 (RAW) C:\Bigdb\cabM\Customer1 (RAW) C:\Bigdb\cabM\Market1 (RAW) C:\Bigdb\dbbackups\backupM1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb
				27	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabM\Broker2 (RAW) C:\Bigdb\cabM\Customer2 (RAW) C:\Bigdb\cabM\Market2 (RAW) C:\Bigdb\dbbackups\backupM2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup, tempdb

Table 2.3: Disk Rack Configuration (Cont)

Cell #	Slot #	HBA #	Controller #	Disk #	Drives Enclosure model RAID level	FileSystem Partition	Size	Use
Cell 1	PCI Slot 4	HBA #8 port 1	RTS4200 #16	28	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabN\Broker1 (RAW) C:\Bigdb\cabN\Customer1 (RAW) C:\Bigdb\cabN\Market1 (RAW) C:\Bigdb\dbbackups\backupN1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup_tempdb
				29	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabN\Broker2 (RAW) C:\Bigdb\cabN\Customer2 (RAW) C:\Bigdb\cabN\Market2 (RAW) C:\Bigdb\dbbackups\backupN2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup_tempdb
		HBA #8 port 2	RTS4200 #17	30	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabO\Broker1 (RAW) C:\Bigdb\cabO\Customer1 (RAW) C:\Bigdb\cabO\Market1 (RAW) C:\Bigdb\dbbackups\backupO1 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup_tempdb
				31	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabO\Broker2 (RAW) C:\Bigdb\cabO\Customer2 (RAW) C:\Bigdb\cabO\Market2 (RAW) C:\Bigdb\dbbackups\backupO2 (NTFS)	176.08 GB 42.98 GB 7.24 GB 513.64 GB	Broker_FG Customer_FG Market_FG backup_tempdb

2.7. Database Interface

A statement must be provided in the **Report** that describes:

- o The **Database Interface** (e.g. embedded, call level) and access language (e.g. SQL, COBOL, read/write) used to implement 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**.
- o 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. (9.3.2.8)

Microsoft SQL Server 2008 is a relational database.

The client software interfaced to SQL Server through Stored Procedures invoked through ODBC calls embedded in the C++ application code.

The methodology used to load the database used the flat files option on the EGenLoader command line. This generates flat files then a bulk insert of the data into the tables. For a more detailed description, refer to **Clause2** of the *SupportingFiles* directory (**MSTPCE Database Setup Steps.pdf**)

Clause 3: Transaction Related Items

3.1. Code Functionality

*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)*

Secondary sponsor-supplied code is functionally equivalent to the Pseudo-code in the specification.

3.2. Database 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)*

The database footprint requirements were met.

Clause 4: SUT, Driver, and Network Items

4.1. Network Configurations

*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 (see Clause 4.1.3.12). (9.3.4.1).*

Figures 1.1 and 1.2 in Clause 1 of this report diagram the network configurations of the measured and priced configurations and represent the drivers connected via LAN replacing the user PCs that are directly connected via LAN.

Local area networks (LANs) are used in the priced and tested configurations. The database server contains one dual-port VI 8Gb/second adapter. Each port was directly connected to the dual-port VI 8Gb/second adapter in the client. The client also contains two (2) 10/100/1000Mb/second inbuilt LAN controllers of which one was used in the tested configuration. A 10/100/1000Mb/second switch was used to connect the client to driver systems in the tested configuration. The 10/100/1000 LAN connection between the client and switch runs at 1000Mb/second in the priced and tested configurations.

Clause 5: EGen Items

5.1. EGen Version

*The version of **EGen** used in the benchmark must be **reported** in the **Report** (see Clause 5.3.1). (9.3.5.1)*

The EGen version used in this test was 1.7.0.

5.2. EGen Code

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

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

5.3. EGen Modifications

*If the **Test Sponsor** modified the **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** in the **Report**. (9.3.5.3)*

No modifications were made to EGen.

5.4. EGenLoader Extension Code

*If the **Test Sponsor** extended **EGenLoader** (as described in Appendix A.6), the use of the extended **EGenLoader** and the audit of the extended code by an **Auditor** must be **reported** in the **Report** (see Clause 5.7.4). (9.3.5.4)*

No extensions were made to the EGenLoader for this test.

5.5. EGenLoader Make/Project Files

*The make/project files used to compile/link **EGenLoader** and **EGen Validate** must be **reported** in the **Supporting Files**. The compiler/linker options and flags used to compile/link **EGen** Objects for the **SUT** must be **reported** in the **Supporting Files**. (9.3.5.5)*

The project files (and solution file) for EGen are located in the “SupportingFiles\Clause3\prj\VS2008\” folder. The project files (and solution file) for the SUT CE_Server are located in the SupportingFiles\Clause3\SUT_CE_Server\ folder. The project files (and solution file) for the SUT MEE_Server are located in the SupportingFiles\Clause3\SUT_MEE_Server\ folder.

Clause 6: Performance Metrics & Response Time

6.1. EGenDriver Instances

*The number of **EGenDriverMEE** and **EGenDriverCE** instances used in the benchmark must be **reported** in the **Report**. (see Clause 6.2.5) (9.3.6.1)*

There were four EGenDriverMEEs with a dynamic number of instances and four EGenDriverCEs with a total of 1100 instances used in this benchmark run.

6.2. Measured Throughput (tpsE)

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

The measured tpsE was 1165.56.

6.3. Test Run Times/Steady State Measurement

*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)*

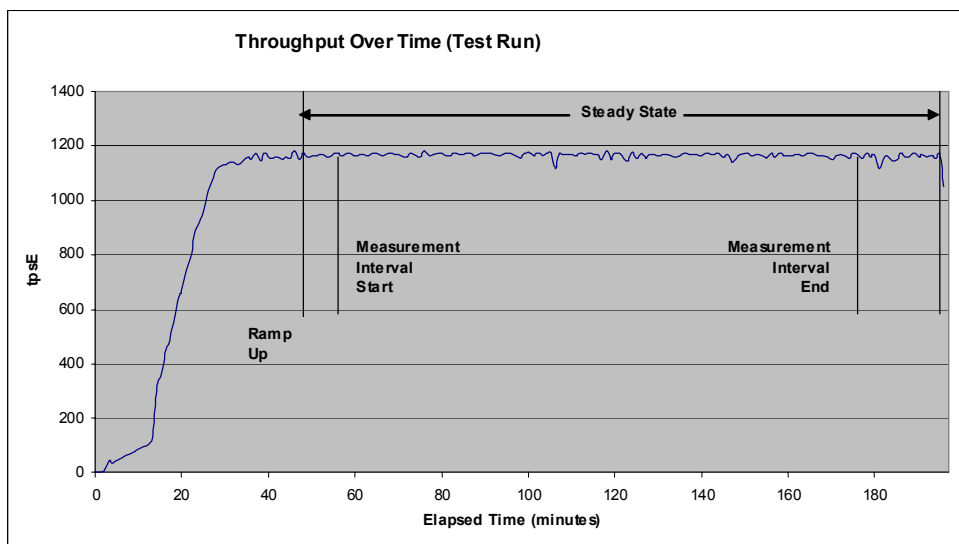
*The method used to determine that the **SUT** had reached a **Steady State** prior to commencing the **Measurement Interval** must be **reported** in the **Report**. (9.3.6.4)*

The transaction throughput rate (tpsE) and response time were relatively constant after the initial ramp-up period. The throughput and response time behavior were determined by examining data reported for each 60-second interval over the duration of the benchmark. Ramp-up and steady state are discernible in the graph presented in Figure 6.1

After the run, Steady State was confirmed by:

- Looking at the Test Run Graph and verifying that tpsE was steady prior to commencing the Measurement Interval.
- Calculating 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.
- Calculating 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 the maximum 10-minute average tpsE was not greater than 120% of the Reported Throughput.

Figure 6.1: Test Run Graph



6.4. Work Measurements (Test Run)

*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**, etc.). (9.3.6.5)*

The driver engines generated the required transactions and their input data. This data was timestamped. The response for the requested transaction was verified and time-stamped in the driver log files. Each driver engine maintains its own log file. Log file contents are consolidated for the reports.

The driver engines transactions were sent to the SUT processes running on the Tier A machines through Ethernet LANs. These Tier A SUT processes handled all requests to the database on the server. The SUT processes communicated with the database server over a VI network using Microsoft SQL Server ODBC library and RPC calls.

To perform checkpoints at specific intervals, the SQL Server recovery interval was set to 32767. Continuous checkpoints every 450 seconds were performed during the steady state before and during the measurement interval by a script running on the database server. SQL Server was started with trace flag 3502, which caused it to log the occurrence and duration of the checkpoints. This information was used to verify that the checkpoints occurred at the appropriate times during the test run.

During a checkpoint, SQL Server flushes all dirty pages from its cache to disk. It places a record in the database transaction log indicating that the checkpoint has completed and that all dirty pages for transactions which were committed prior to the checkpoint have been written to disk.

Data Maintenance was run every 60 seconds.

6.5. Transaction Report (Averages)

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

Table 6.3 shows the **Transaction Report** Averages.

Table 6.3: Transaction Parameters (Averages)

Transaction	Overall	Parameter	Value	Range Check	Acceptable Range	
					Min	Max
Customer Position	Ok	By Tax ID	49.98%	Ok	48.00%	52.00%
		Get history	49.99%	Ok	48.00%	52.00%
Trade Lookup	Ok	Frame 1	30.05%	Ok	28.50%	31.50%
		Frame 2	29.98%	Ok	28.50%	31.50%
		Frame 3	29.98%	Ok	28.50%	31.50%
		Frame 4	9.99%	Ok	9.50%	10.50%
Market Watch	Ok	By Watch List	59.99%	Ok	57.00%	63.00%
		By Customer Account	35.01%	Ok	33.00%	37.00%
		By Industry	4.99%	Ok	4.50%	5.50%
Trade Update	Ok	Frame 1	33.04%	Ok	31.00%	35.00%
		Frame 2	32.95%	Ok	31.00%	35.00%
		Frame 3	34.01%	Ok	32.00%	36.00%
Security Detail	Ok	Access LOB	1.00%	Ok	0.90%	1.10%
Trade Order	Ok	By Non-Owner	9.98%	Ok	9.50%	10.50%
		By Company Name	39.98%	Ok	38.00%	42.00%
		Buy on Margin	7.99%	Ok	7.50%	8.50%
		Rollback	0.99%	Ok	0.94%	1.04%
		LIFO	35.00%	Ok	33.00%	37.00%
		Trade Quantity 100	25.01%	Ok	24.00%	26.00%
		Trade Quantity 200	24.99%	Ok	24.00%	26.00%
		Trade Quantity 400	25.00%	Ok	24.00%	26.00%
		Trade Quantity 800	25.00%	Ok	24.00%	26.00%
		Market Buy	30.01%	Ok	29.70%	30.30%
		Market Sell	30.00%	Ok	29.70%	30.30%
		Limit buy	20.00%	Ok	19.80%	20.20%
		Limit sell	9.98%	Ok	9.90%	10.10%
		Stop Loss	10.00%	Ok	9.90%	10.10%

Clause 7: Transaction and System Properties

7.1. Transaction System Properties (ACID)

*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 Transaction System Properties (ACID) and Redundancy.

This section defines each of these properties, describes the steps taken to ensure that they were present during the test and describes a series of tests done to demonstrate compliance with the specification. See file **MSTPCE ACID Procedures.pdf** in the *SupportingFiles* directory (Clause 7).

7.2. Redundancy Level

*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)*

Redundancy level 1 was used for all tests.

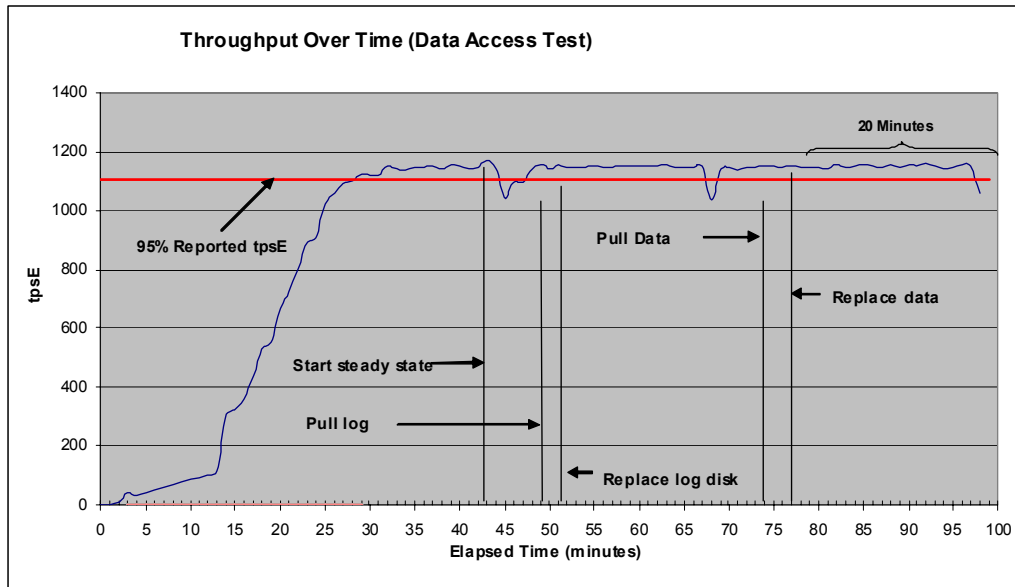
The following is a description of the Data Accessibility Tests:

1. The rows in the Settlement table were counted to determine the initial count of completed trades present in the database (count1).
2. The benchmark was executed above 95% load with the same number of configured customers and drivers load used for the measurement interval.
3. After five minutes of running at steady state, a hot-pluggable log disk was removed from the disk cabinet.
4. A spare disk drive installed in the RAID subsystem was configured to replace the faulty drive.
5. The Drivers continued running for a minimum of 20 minutes with no errors on the OS or SQL Server. The performance was at or above 95% of Reported throughput this period.
6. A hot-pluggable data disk was removed from the disk cabinet.
7. A spare disk drive installed in the RAID subsystem was configured to replace the faulty drive.
8. The Drivers continued running for a minimum of 20 minutes with no errors on the OS or SQL Server.
9. The Drivers were stopped gracefully.
10. No errors were reported by the Drivers during steps 2 through 8.
11. Step 1 was repeated to determine the total number of completed trades present in the database (count2).
12. Count2 minus count1 was verified to be equal to the number of successful Trade-Result transaction records in the driver log file.
13. The recovery process completed.
14. Finally, consistency conditions as specified in Clause 7.3.3 were executed to verify that the database was consistent.

7.3. Data Accessibility Graph

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)

Figure 7-2: Data Accessibility Test Run



7.4. Business Recovery Tests

The **Test Sponsor** must describe in the **Report** the test(s) used to demonstrate **Business Recovery**. (9.3.7.4)

Removing the primary power to the SUT while the benchmark was executing induced this failure:

1. The rows in the Settlement table were summed up to determine the initial count of completed trades present in the database (count1).
2. The benchmark was executed above 95% load with the same number of configured customers and drivers load used for the measurement interval for a minimum of twenty minutes.
3. The primary power to the Tier B server and the Tier A client was removed.
4. After transaction failures were noted by the drivers, the drivers were stopped.
5. Power was restored to the SUT, the system rebooted, SQL Server was restarted, and automatic database recovery was performed. The database recovery used the transaction log to reapply all committed transactions and rollback any (in progress) uncommitted transactions, so that the database disks were correct.
6. Business Recovery starts when SQL Server reports "Starting up database 'master'". Database recovery ended when SQL Server reported "Recovery is complete".
7. The Trade-Cleanup Transaction was executed.
8. After Trade-Cleanup finished, the benchmark was executed above 95% load with same number of configured customers and drivers load used for the measurement interval for a minimum of twenty minutes.

9. Business Recovery ended successfully.
10. The drivers were stopped gracefully.
11. No errors were reported by the Drivers during steps 8 through 9.
12. Step 1 was repeated to determine the total number of completed trades present in the database (count2).
13. Count2 minus count1 was not less than the aggregate number of successful Trade-Result transaction records in the driver log file for the runs performed in step 2 and step 8.
14. Finally, consistency conditions as specified in Clause 7.3.3 were executed to verify that the database was consistent.

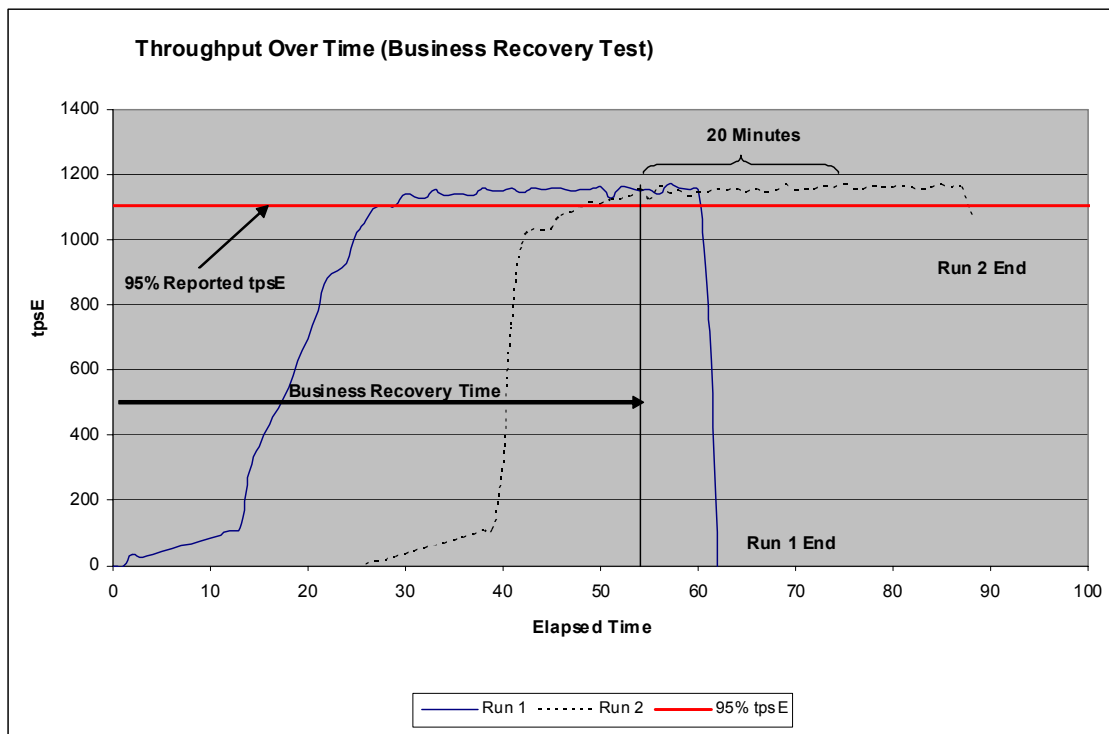
7.5. Business Recovery Time

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 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**. (9.3.7.5)

A **Business Recovery Time Graph** (see Clause 7.5.7.4) must be **reported** in the **Report** for all **Business Recovery Tests**. (9.3.7.6)

Business Recovery time was 00:53:36. This time is also reported in the Executive Summary Statement.

Figure 7-2: Business Recovery Time



Clause 8: Pricing

8.1. 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** in the **Report**. (9.3.8.1)

Figure 8-1: Details of the 60-Day Disk Space Requirements

Customers Used		Performance		1165.56 TpsE			
Broker File Group	Initial Rows	Data (KB)	Index size (KB)	Extra 5% (KB)	Total + 5% (KB)	After run (KB)	Growth (KB)
BROKER	5,900	328	584	46	958	1,264	352
CASH_TRANSACTION	9,379,560,050	930,247,200	1,961,696	46,610,445	-	988,600,576	56,391,680
CHARGE	15	8	8	1	17	16	0
COMMISSION_RATE	240	16	16	2	34	32	0
SETTLEMENT	10,195,200,000	500,322,224	1,055,592	25,068,891	-	555,610,304	54,232,488
TRADE	10,195,200,000	1,132,229,120	608,305,808	87,026,746	-	1,793,882,760	53,347,832
TRADE_HISTORY	24,468,430,230	701,603,952	1,829,960	35,171,696	-	709,850,320	6,416,408
TRADE_REQUEST	0	0	0	0	-	24,712	24,712
TRADE_TYPE	5	8	1,032	52	1,092	1,040	0
Customer File Group							
ACCOUNT_PERMISSION	4,188,507	356,656	2,848	17,975	377,479	360,160	656
CUSTOMER	590,000	100,048	27,464	6,376	133,888	127,568	56
CUSTOMER_ACCOUNT	2,950,000	274,048	327,784	30,092	631,924	601,864	32
CUSTOMER_TAXRATE	1,180,000	24,720	1,024	1,287	27,031	26,104	360
HOLDING	521,976,054	27,930,792	20,751,272	2,434,103	-	81,436,936	32,754,872
HOLDING_HISTORY	13,663,287,110	496,846,968	258,933,040	37,789,000	-	763,123,096	7,343,088
HOLDING_SUMMARY	29,346,262	1,004,808	4,704	50,476	-	2,021,168	1,011,656
WATCH_ITEM	59,018,816	1,634,464	6,896	82,068	1,723,428	1,642,048	688
WATCH_LIST	590,000	14,816	13,304	1,406	29,526	28,120	0
VIEW_CX_TX	0	0	0	0	0	0	0
VIEW_WL_WI_S	0	0	0	0	0	0	0
Market File Group							
COMPANY	295,000	64,288	19,480	4,188	87,956	83,816	48
COMPANY_COMPETITOR	885,000	23,856	20,480	2,217	46,553	44,336	0
DAILY_MARKET	527,415,750	27,210,872	11,605,360	1,940,812	40,757,044	38,819,728	3,496
EXCHANGE	4	8	8	1	17	16	0
FINANCIAL	5,900,000	694,296	2,936	34,862	732,094	697,984	752
INDUSTRY	102	8	40	2	50	48	0
LAST_TRADE	404,150	19,000	1,024	1,001	21,025	39,000	18,976
NEWS_ITEM	590,000	63,967,216	1,760	3,198,449	67,167,425	63,969,152	176
NEWS_XREF	590,000	14,808	1,024	792	16,624	15,832	0
SECTOR	12	8	24	2	34	32	0
SECURITY	404,150	63,776	29,328	4,655	97,759	93,144	40
STATUS_TYPE	5	8	8	1	17	16	0
Misc File Group							
ADDRESS	885,004	51,168	784	2,598	54,550	52,104	152
FAXRATE	320	24	16	2	42	56	16
ZIP_CODE	14,741	488	16	25	529	504	0
TOTALS (KB)		3,884,700,000	904,905,320	239,480,266	111,907,093		
Initial Database Size (MB)		4,677,349	4,568 GB	4.46 TB			
Db/Filegroups	LUN Count	Partition Size (KB)	MB allocated	MB Loaded	MB Loaded+5%	Ending size	8 Hours
misc_fg	1	512,000	500	51	54	51	51
broker_fg	30	184,627,200	5,409,000	3,786,677	2	3,953,097	3,949,498
market_fg	30	7,577,600	222,000	101,308	106,374	101,331	101,331
customer_fg	30	45,056,000	1,320,000	789,312	2,855	829,460	828,592
Settlements	34,310,056						
Initial Growing Space (MB)	4,573,269						
Final Growing Space (MB)	4,779,834	Data LUNS	30	Initial Log size (MB)	11,557	Log Disks	6
Delta (MB)	206,565	Disks per LUN	22	Final Log size (MB)	339,049	Disk Capacity (MB)	138,558
Data Space per Trade (MB)	0.006020543	Disk Capacity (MB)	68,881	Log Growth (MB)	327,493	RAID10 overhead	50%
1 Day Data Growth (MB)	202,098	RAID10 overhead	50%	Log Growth/trade (MB)	0.009545096269	Tempdb Log	40,667
60 Day Space (MB)	16,803,251	Total Space (MB)	22,730,730	1 Day Log space (MB)	320,411	Log Space (MB)	375,007

8.2. Attestation Letter

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

Lorna Livingtree, a TPC certified auditor, audited this implementation of the TPC Benchmark™ E on the Unisys ES7000 Model 7600R Enterprise Server (8s) representing:

Performance Metrics, Inc.
P.O. Box 984
Klamath, CA 95548-0984

Phone: (707) 482-0523
Fax: (707) 482-0575
Email: LornaL@PerfMetrics.com



PERFORMANCE METRICS INC.
TPC Certified Auditors

February 23, 2008

Mr. Jerrold Buggert
Director of Product Development & Technology Performance Group
Unisys Corporation
25725 Jeronimo Road
Mission Viejo, CA 92691

I have verified the TPC Benchmark™ E for the following configuration:

Platform: Unisys ES7000 Model 7600R Enterprise (8s)
Database Manager: Microsoft SQL Server 2008 Enterprise x64 Edition
Operating System: Microsoft Windows Server 2008 Enterprise Edition (x64)

Server (Tier B): ES7000 Model 7600R			
CPU's	Memory	Disks (total)	tpsE
8 Intel @ 2.66 GHz	256 GB	6 @ 146 GB 675 @ 73 GB 2 @ 36 GB	1165.56
Client (Tier A): ES3220L			
2 Intel @ 2.00 GHz	4 GB	1 @ 73 GB	Na

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark. The following attributes of the benchmark were given special attention:

- All EGen components were verified to be version 1.7.0.
- The database files were properly sized and populated for 590,000 customers.
- The transaction components were properly implemented.
- The required network between the driver and the transaction harness was configured.
- The ACID properties were successfully demonstrated.
- The database was verified to have no Trade-Request rows prior to the start of the test run.
- The test run met all the requirements for timing, mix, and response times.

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TPC Certified Auditors

- Input data was generated according to the specified percentages.
- One and only one Data-Maintenance process was running during the test run.
- There were no inactive load units during the test run.
- Eight hours of mirrored log space was present on the measured system.
- Eight hours of growth space was present on the measured system.
- The data for the 60 day space calculation was verified.
- There were 1100 user contexts present on the system.
- The steady state portion of the test was 120 minutes.
- One checkpoint was taken after steady state and before the measured interval.
- Checkpoint interval was verified to be less than 7.5 minutes.
- The system pricing was checked for major components and maintenance.
- Third party quotes were verified for compliance.
- The FDR was reviewed and verified as required.

Auditor Notes:

The tested system had 660 disks at 73GB. Of these, 396 were older style 73GB drives and are no longer orderable. The technical specifications were reviewed and the new drives meet or exceed all technical details. Data collected during a TPC-E performance run demonstrated the priced disks were performing better than the obsolete disks. Therefore 396 disks of the new style were substituted one for one in the priced configuration. This disks substitution meets the substitution requirements.

Sincerely,



Lorna Livingtree
Auditor

Clause 9: Supporting Files

9.0. 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:

- o The first column denotes the clause in the TPC Specification
- o The second column provides a short description of the file contents
- o 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)

The **Supporting Files** Index Table must be provided in the **Report**. (9.3.9.1)

The **Supporting Files** Index table is shown below. Individual files within the htm file can be viewed by clicking on the active links under *Pathname* in the file.

Table 9.1: Index of Supporting Files

Clause	Description	Pathname
Introduction	Disk Configuration	SupportingFiles\Introduction\DatabaseDisks\disks.txt
		SupportingFiles\Introduction\DatabaseDisks\formats.cmd
		SupportingFiles\Introduction\DatabaseDisks\input.txt
		SupportingFiles\Introduction\DatabaseDisks\mkdir.cmd
		SupportingFiles\Introduction\DatabaseDisks\Mounts.txt
	Hardware Configuration	SupportingFiles\Introduction\Hardware_Configuration\RAID_Hardware_config.pdf
		SupportingFiles\Introduction\Hardware_Configuration\HardwareConfiguration.pdf
	Software Configuration Document	SupportingFiles\Introduction\Software_Configuration\SoftwareConfiguration.pdf
	Checkpoint scripts	SupportingFiles\Introduction\Software_Configuration\Checkpoint Loop.sql SupportingFiles\Introduction\Software_Configuration\Checkpoint.cmd
Clause 2	Database Tunables	SupportingFiles\Introduction\Software_Configuration\sql_config.sql
		SupportingFiles\Introduction\Software_Configuration\STARTSQL.CMD
	Tier-A Scripts	SupportingFiles\Introduction\Software_Configuration\ClientAlias.reg
		SupportingFiles\Introduction\Software_Configuration\ServerNodeConfiguration.reg
		SupportingFiles\Introduction\Software_Configuration\TierA_Start-CE.cmd
	System Information	SupportingFiles\Introduction\Software_Configuration\TierA_Start-MEE.cmd
		SupportingFiles\Introduction\Software_Configuration\systeminfo_DBMS.txt
	Database Setup Procedure	SupportingFiles\Introduction\Software_Configuration\systeminfo_TierA.txt
		SupportingFiles\Clause2\MSTPCE Database Setup Reference.pdf
	Database Audit Scripts	SupportingFiles\Clause2\TPCE_Setup.cmd
		SupportingFiles\Clause2\Audit_Scripts\Database\Create_DB_Audit_Tables.SQL
	Database Space Scripts	SupportingFiles\Clause2\Audit_Scripts\Database\DB_Check.sql
		SupportingFiles\Clause2\Audit_Scripts\Database\DB_FK_Constraints.sql
		SupportingFiles\Clause2\Audit_Scripts\Database\DB_Primary_Key_Check.SQL
		SupportingFiles\Clause2\Audit_Scripts\Database\DB_Tables.sql
		SupportingFiles\Clause2\Audit_Scripts\Database\Drop_DB_Audit_Tables.SQL
		SupportingFiles\Clause2\Audit_Scripts\Database\Insert_Duplicates_Tests.sql
		SupportingFiles\Clause2\Audit_Scripts\Database\Referential_Integrity_Tests.sql
	Database Creation Scripts	SupportingFiles\Clause2\Audit_Scripts\Space\SPFiles.sql
		SupportingFiles\Clause2\Audit_Scripts\Space\SPLog.sql
		SupportingFiles\Clause2\Audit_Scripts\Space\SPUsed.sql
	Database Creation Scripts	SupportingFiles\Clause2\590000.Cust\Database\Backup_database.sql
		SupportingFiles\Clause2\590000.Cust\Database\Create_Database.sql
	Database Creation Scripts	SupportingFiles\Clause2\590000.Cust\Database\flatfiles.txt
		SupportingFiles\Clause2\590000.Cust\Database\Remove_Database.sql
		SupportingFiles\Clause2\590000.Cust\Database\Restore_Database.sql
		SupportingFiles\Clause2\590000.Cust\Database\tempdb.sql

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
		SupportingFiles\Clause2\Utility\Checkpoint_TPCE_Database.SQL SupportingFiles\Clause2\Utility\Count_Customers.sql SupportingFiles\Clause2\Utility\Create_DM_Audit_Table.sql SupportingFiles\Clause2\Utility\Create_TID_Ranges_Table.sql SupportingFiles\Clause2\Utility\Create_Timer_Table.sql SupportingFiles\Clause2\Utility\Create_TPCE_VERSIONS_Table.sql SupportingFiles\Clause2\Utility\Database_Options_1.sql SupportingFiles\Clause2\Utility\Database_Options_2.sql SupportingFiles\Clause2\Utility\Drop_and_Create_TPCE_INFO.sql SupportingFiles\Clause2\Utility\End_Load_Timer.sql SupportingFiles\Clause2\Utility\Get_Next_T_ID.sql SupportingFiles\Clause2\Utility\Install_Load_Timer_Proc.sql SupportingFiles\Clause2\Utility\Load_TPCE_Info.sql SupportingFiles\Clause2\Utility\Output_TPCE_VERSIONS_Table.SQL SupportingFiles\Clause2\Utility\SQL_Server_Configuration.sql SupportingFiles\Clause2\Utility\Trade_Cleanup.sql SupportingFiles\Clause2\Utility\Version.sql
	Table Creation Scripts	SupportingFiles\Clause2\DDL\BulkInsert_1.sql SupportingFiles\Clause2\DDL\BulkInsert_10.sql SupportingFiles\Clause2\DDL\BulkInsert_11.sql SupportingFiles\Clause2\DDL\BulkInsert_12.sql SupportingFiles\Clause2\DDL\BulkInsert_13.sql SupportingFiles\Clause2\DDL\BulkInsert_14.sql SupportingFiles\Clause2\DDL\BulkInsert_15.sql SupportingFiles\Clause2\DDL\BulkInsert_16.sql SupportingFiles\Clause2\DDL\BulkInsert_17.sql SupportingFiles\Clause2\DDL\BulkInsert_18.sql SupportingFiles\Clause2\DDL\BulkInsert_19.sql SupportingFiles\Clause2\DDL\BulkInsert_2.sql SupportingFiles\Clause2\DDL\BulkInsert_20.sql SupportingFiles\Clause2\DDL\BulkInsert_21.sql SupportingFiles\Clause2\DDL\BulkInsert_22.sql SupportingFiles\Clause2\DDL\BulkInsert_23.sql SupportingFiles\Clause2\DDL\BulkInsert_24.sql SupportingFiles\Clause2\DDL\BulkInsert_25.sql SupportingFiles\Clause2\DDL\BulkInsert_26.sql SupportingFiles\Clause2\DDL\BulkInsert_27.sql SupportingFiles\Clause2\DDL\BulkInsert_28.sql SupportingFiles\Clause2\DDL\BulkInsert_29.sql SupportingFiles\Clause2\DDL\BulkInsert_3.sql SupportingFiles\Clause2\DDL\BulkInsert_30.sql SupportingFiles\Clause2\DDL\BulkInsert_4.sql SupportingFiles\Clause2\DDL\BulkInsert_5.sql SupportingFiles\Clause2\DDL\BulkInsert_6.sql SupportingFiles\Clause2\DDL\BulkInsert_7.sql SupportingFiles\Clause2\DDL\BulkInsert_8.sql SupportingFiles\Clause2\DDL\BulkInsert_9.sql SupportingFiles\Clause2\DDL\Convert_NI_ITEM_Data.SQL SupportingFiles\Clause2\DDL\Create_Check_Constraints_Fixed.sql SupportingFiles\Clause2\DDL\Create_Check_Constraints_Growing.sql SupportingFiles\Clause2\DDL\Create_Check_Constraints_Scaling.sql SupportingFiles\Clause2\DDL\Create_FK_Constraints.sql SupportingFiles\Clause2\DDL\Create_Tables_Fixed.sql SupportingFiles\Clause2\DDL\Create_Tables_Growing.sql SupportingFiles\Clause2\DDL\Create_Tables_Scaling.sql SupportingFiles\Clause2\DDL\Create_Tables_Scaling_Flat.sql SupportingFiles\Clause2\DDL\Create_TPCE_Types.sql SupportingFiles\Clause2\DDL\Drop_FK_Constraints.sql SupportingFiles\Clause2\DDL\Drop_Tables_Fixed.sql SupportingFiles\Clause2\DDL\Drop_Tables_Growing.sql SupportingFiles\Clause2\DDL\Drop_Tables_Scaling.sql
	Index Creation Scripts	SupportingFiles\Clause2\DDL\Create_Clustered_Indexes_Fixed.sql SupportingFiles\Clause2\DDL\Create_Clustered_Indexes_Growing.sql SupportingFiles\Clause2\DDL\Create_Clustered_Indexes_Scaling.sql SupportingFiles\Clause2\DDL\Create_NC_Indexes_Fixed.sql SupportingFiles\Clause2\DDL\Create_NC_Indexes_Growing.sql SupportingFiles\Clause2\DDL\Create_NC_Indexes_Scaling.sql

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
	Load Transaction Frames	SupportingFiles\Clause2\DML\BrokerVolume.sql SupportingFiles\Clause2\DML\CustomerPosition.sql SupportingFiles\Clause2\DML\DataMaintenance.sql SupportingFiles\Clause2\DML\MarketFeed.sql SupportingFiles\Clause2\DML\MarketWatch.sql SupportingFiles\Clause2\DML\SecurityDetail.sql SupportingFiles\Clause2\DML\TradeLookup.sql SupportingFiles\Clause2\DML\TradeOrder.sql SupportingFiles\Clause2\DML\TradeResult.sql SupportingFiles\Clause2\DML\TradeStatus.sql SupportingFiles\Clause2\DML\TradeUpdate.sql
Clause 3	Transaction Frames	SupportingFiles\Clause3\BrokerVolume.sql SupportingFiles\Clause3\CustomerPosition.sql SupportingFiles\Clause3\DataMaintenance.sql SupportingFiles\Clause3\Get_Next_T_ID.sql SupportingFiles\Clause3\MarketFeed.sql SupportingFiles\Clause3\MarketWatch.sql SupportingFiles\Clause3\SecurityDetail.sql SupportingFiles\Clause3\TradeLookup.sql SupportingFiles\Clause3\TradeOrder.sql SupportingFiles\Clause3\TradeResult.sql SupportingFiles\Clause3\TradeStatus.sql SupportingFiles\Clause3\TradeUpdate.sql SupportingFiles\Clause3\Trade_Cleanup.sql
	BaseServer	SupportingFiles\Clause3\BaseServer\BaseServer.cpp SupportingFiles\Clause3\BaseServer\BaseServer.h SupportingFiles\Clause3\BaseServer\BaseServer.vcproj SupportingFiles\Clause3\BaseServer\msccprj.scc SupportingFiles\Clause3\BaseServer\stdafx.cpp SupportingFiles\Clause3\BaseServer\stdafx.h SupportingFiles\Clause3\BaseServer\SUTServersLocals.h
	EGen Make/Project files	SupportingFiles\Clause3\prj\VS2008\EGen.sln SupportingFiles\Clause3\prj\VS2008\EGenBaseLoader.vcproj SupportingFiles\Clause3\prj\VS2008\EGenDriverCELlib.vcproj SupportingFiles\Clause3\prj\VS2008\EGenDriverDMLib.vcproj SupportingFiles\Clause3\prj\VS2008\EGenDriverMEELib.vcproj SupportingFiles\Clause3\prj\VS2008\EGenFlatFileLoad.vcproj SupportingFiles\Clause3\prj\VS2008\EGenGenerateAndLoad.vcproj SupportingFiles\Clause3\prj\VS2008\EGenLoader.vcproj SupportingFiles\Clause3\prj\VS2008\EGenLogger.vcproj SupportingFiles\Clause3\prj\VS2008\EGenMSSQLLoader.vcproj SupportingFiles\Clause3\prj\VS2008\EGenNullLoader.vcproj SupportingFiles\Clause3\prj\VS2008\EGenTables.vcproj SupportingFiles\Clause3\prj\VS2008\EGenUtilities.vcproj SupportingFiles\Clause3\prj\VS2008\EGenValidate.vcproj
	SUT_CE_Server	SupportingFiles\Clause3\SUT_CE_Server\CEServer.cpp SupportingFiles\Clause3\SUT_CE_Server\CEServer.h SupportingFiles\Clause3\SUT_CE_Server\CEServerMain.cpp SupportingFiles\Clause3\SUT_CE_Server\PortDefinitions.h SupportingFiles\Clause3\SUT_CE_Server\stdafx.cpp SupportingFiles\Clause3\SUT_CE_Server\stdafx.h SupportingFiles\Clause3\SUT_CE_Server\SUTServer.sln SupportingFiles\Clause3\SUT_CE_Server\SUTServer.suo SupportingFiles\Clause3\SUT_CE_Server\SUTStructs.h SupportingFiles\Clause3\SUT_CE_Server\SUT_CE_Server.vcproj SupportingFiles\Clause3\SUT_CE_Server\SUT_CE_Server.vcproj.user
	SUT_MEE_Server	SupportingFiles\Clause3\SUT_MEE_Server\MEEserver.cpp SupportingFiles\Clause3\SUT_MEE_Server\MEEserver.h SupportingFiles\Clause3\SUT_MEE_Server\MEEserverMain.cpp SupportingFiles\Clause3\SUT_MEE_Server\stdafx.cpp SupportingFiles\Clause3\SUT_MEE_Server\stdafx.h SupportingFiles\Clause3\SUT_MEE_Server\SUT_MEE_Server.vcproj SupportingFiles\Clause3\SUT_MEE_Server\SUT_MEE_Server.vcproj.user
	TransactionsSP	SupportingFiles\Clause3\TransactionsSP\BrokerVolumeDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\BrokerVolumeDB_SP.h

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
		SupportingFiles\Clause3\TransactionsSP\CheckpointDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\CheckpointDB_SP.h SupportingFiles\Clause3\TransactionsSP\CustomerPositionDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\CustomerPositionDB_SP.h SupportingFiles\Clause3\TransactionsSP\DataMaintenanceDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\DataMaintenanceDB_SP.h SupportingFiles\Clause3\TransactionsSP\MarketFeedDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\MarketFeedDB_SP.h SupportingFiles\Clause3\TransactionsSP\MarketWatchDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\MarketWatchDB_SP.h SupportingFiles\Clause3\TransactionsSP\SecurityDetailDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\SecurityDetailDB_SP.h SupportingFiles\Clause3\TransactionsSP\stdafx.cpp SupportingFiles\Clause3\TransactionsSP\stdafx.h SupportingFiles\Clause3\TransactionsSP\TradeLookupDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\TradeLookupDB_SP.h SupportingFiles\Clause3\TransactionsSP\TradeOrderDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\TradeOrderDB_SP.h SupportingFiles\Clause3\TransactionsSP\TradeResultDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\TradeResultDB_SP.h SupportingFiles\Clause3\TransactionsSP\TradeStatusDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\TradeStatusDB_SP.h SupportingFiles\Clause3\TransactionsSP\TradeUpdateDB_SP.cpp SupportingFiles\Clause3\TransactionsSP\TradeUpdateDB_SP.h SupportingFiles\Clause3\TransactionsSP\TransactionsSP.vcproj SupportingFiles\Clause3\TransactionsSP\TxnHarnessDBBase.cpp SupportingFiles\Clause3\TransactionsSP\TxnHarnessDBBase.h SupportingFiles\Clause3\TransactionsSP\TxnHarnessDBConn.cpp SupportingFiles\Clause3\TransactionsSP\TxnHarnessDBConn.h
	TxnHarness	SupportingFiles\Clause3\TxnHarness\TxnHarness.vcproj SupportingFiles\Clause3\TxnHarness\TxnHarness.vcproj.user SupportingFiles\Clause3\TxnHarness\TxnHarnessSendToMarket.cpp SupportingFiles\Clause3\TxnHarness\TxnHarnessSendToMarket.h SupportingFiles\Clause3\TxnHarness\TxnHarness_stdafx.cpp SupportingFiles\Clause3\TxnHarness\TxnHarness_stdafx.h
Clause 4	No Requirements	
Clause 5	No EGen Modifications	
	No EGenLoader Extensions	
	EGenDriver Configuration	SupportingFiles\Clause5\590k.xml
	EGenLoader Parameters	SupportingFiles\Clause5\BuildSteps.log SupportingFiles\Clause5\EGenLoaderFrom118001To138000.log SupportingFiles\Clause5\EGenLoaderFrom138001To157000.log SupportingFiles\Clause5\EGenLoaderFrom157001To177000.log SupportingFiles\Clause5\EGenLoaderFrom177001To197000.log SupportingFiles\Clause5\EGenLoaderFrom197001To216000.log SupportingFiles\Clause5\EGenLoaderFrom1To20000.log SupportingFiles\Clause5\EGenLoaderFrom20001To39000.log SupportingFiles\Clause5\EGenLoaderFrom216001To236000.log SupportingFiles\Clause5\EGenLoaderFrom236001To256000.log SupportingFiles\Clause5\EGenLoaderFrom256001To275000.log SupportingFiles\Clause5\EGenLoaderFrom275001To295000.log SupportingFiles\Clause5\EGenLoaderFrom295001To315000.log SupportingFiles\Clause5\EGenLoaderFrom315001To334000.log SupportingFiles\Clause5\EGenLoaderFrom334001To354000.log SupportingFiles\Clause5\EGenLoaderFrom354001To374000.log SupportingFiles\Clause5\EGenLoaderFrom374001To393000.log SupportingFiles\Clause5\EGenLoaderFrom39001To59000.log SupportingFiles\Clause5\EGenLoaderFrom393001To413000.log SupportingFiles\Clause5\EGenLoaderFrom413001To433000.log SupportingFiles\Clause5\EGenLoaderFrom433001To452000.log SupportingFiles\Clause5\EGenLoaderFrom452001To472000.log SupportingFiles\Clause5\EGenLoaderFrom472001To492000.log SupportingFiles\Clause5\EGenLoaderFrom492001To511000.log SupportingFiles\Clause5\EGenLoaderFrom511001To531000.log SupportingFiles\Clause5\EGenLoaderFrom531001To551000.log

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
		SupportingFiles\Clause5\EGenLoaderFrom551001To570000.log SupportingFiles\Clause5\EGenLoaderFrom570001To590000.log SupportingFiles\Clause5\EGenLoaderFrom59001To790000.log SupportingFiles\Clause5\EGenLoaderFrom79001To980000.log SupportingFiles\Clause5\EGenLoaderFrom98001To118000.log
	EGenLogger Output	SupportingFiles\Clause5\EGenLogs.xlt
Clause 6	EGenValidate Output	SupportingFiles\Clause6\EGenValidate.out
Clause 7	ACID Procedure document	SupportingFiles\Clause7\MSTPCE ACID Procedures.pdf
	ACID Procedure Scripts	SupportingFiles\Clause7\AcidProcs\AcidProc.cmd SupportingFiles\Clause7\AcidProcs\Remove_AcidProcs.cmd SupportingFiles\Clause7\AcidProcs\Scripts\AcidProc.vbs SupportingFiles\Clause7\AcidProcs\Scripts\CustomerPosition_Iso3.sql SupportingFiles\Clause7\AcidProcs\Scripts\CustomerPosition_Iso4.sql SupportingFiles\Clause7\AcidProcs\Scripts\Drop_SPROC.sql SupportingFiles\Clause7\AcidProcs\Scripts\Remove_AcidProcs.vbs SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_C.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_Iso1_1.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_Iso1_2.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_Iso2.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_Iso3.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_Iso4.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeOrder_RB.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso1_1.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso1_2.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso2_1.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso2_2.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso3.sql SupportingFiles\Clause7\AcidProcs\Scripts\TradeResult_Iso4.sql
	ACID Procedure output	SupportingFiles\Clause7\AcidProcs\AcidProc.out
	Atomicity Scripts	SupportingFiles\Clause7\Atomicity\Atomicity.cmd SupportingFiles\Clause7\Atomicity\Scripts\atom.vbs SupportingFiles\Clause7\Atomicity\Scripts\Atomicity_C.sql SupportingFiles\Clause7\Atomicity\Scripts\Atomicity_RB.sql
	Atomicity Output	SupportingFiles\Clause7\Atomicity\Atomicity_C.out SupportingFiles\Clause7\Atomicity\Atomicity_RB.out
	Consistency Scripts	SupportingFiles\Clause7\Consistency\Consistency.cmd SupportingFiles\Clause7\Consistency\Scripts\Consistency.sql SupportingFiles\Clause7\Consistency\Scripts\Consistency.vbs
	Consistency Output	SupportingFiles\Clause7\Consistency\Consistency_ACID.out
	Durability Business Recovery	SupportingFiles\Clause7\Durability\BusinessRecovery\590k.xml SupportingFiles\Clause7\Durability\BusinessRecovery\applog.txt SupportingFiles\Clause7\Durability\BusinessRecovery\BusinessRecovery_SUT_application-eventlog.txt SupportingFiles\Clause7\Durability\BusinessRecovery\BusinessRecovery_SUT_system-eventlog.txt SupportingFiles\Clause7\Durability\BusinessRecovery\cntb.txt SupportingFiles\Clause7\Durability\BusinessRecovery\cnte.txt SupportingFiles\Clause7\Durability\BusinessRecovery\Consistency_business_recovery_b.out SupportingFiles\Clause7\Durability\BusinessRecovery\Consistency_business_recovery_e.out SupportingFiles\Clause7\Durability\BusinessRecovery\CountSettlement.sql SupportingFiles\Clause7\Durability\BusinessRecovery\ERRORLOG_Run1.txt SupportingFiles\Clause7\Durability\BusinessRecovery\ERRORLOG_Run2.txt SupportingFiles\Clause7\Durability\BusinessRecovery\Power_pull.JPG SupportingFiles\Clause7\Durability\BusinessRecovery\Power_pull_1.JPG SupportingFiles\Clause7\Durability\BusinessRecovery\SQL_Server_Configuration_business_recovery.txt SupportingFiles\Clause7\Durability\BusinessRecovery\syslog.txt SupportingFiles\Clause7\Durability\BusinessRecovery\TradeRequest_cntb.ver SupportingFiles\Clause7\Durability\BusinessRecovery\Tradese.txt SupportingFiles\Clause7\Durability\BusinessRecovery\trade_cleanup_after_database_recovery.txt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnErrorlog_BusinessRecovery_Run1.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnErrorlog_BusinessRecovery_Run2.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReportE_BusinessRecovery_Run1-20min.xls SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReportE_BusinessRecovery_Run2-20min.xls SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReport_BusinessRecovery_Run1-20min.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReport_BusinessRecovery_Run1-All.xlt

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
		SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReport_BusinessRecovery_Run2-20min.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnReport_BusinessRecovery_Run2-all.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnStep_BusinessRecovery_Run1.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\TxnStep_BusinessRecovery_Run2.xlt SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\DRIVER1.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\DRIVER2.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\DRIVER3.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\DRIVER4.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\MEE1.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\MEE2.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\MEE3.log SupportingFiles\Clause7\Durability\BusinessRecovery\run1_logs\MEE4.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\DRIVER1.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\DRIVER2.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\DRIVER3.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\DRIVER4.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\MEE1.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\MEE2.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\MEE3.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\MEE4.log SupportingFiles\Clause7\Durability\BusinessRecovery\run2_logs\MEE4.log
	Durability Data Accessibility	SupportingFiles\Clause7\Durability\DataAccessibility\590k.xml SupportingFiles\Clause7\Durability\DataAccessibility\app_log_data_acces.txt SupportingFiles\Clause7\Durability\DataAccessibility\cntb.txt SupportingFiles\Clause7\Durability\DataAccessibility\cnte.txt SupportingFiles\Clause7\Durability\DataAccessibility\Consistency_data loss_b.out SupportingFiles\Clause7\Durability\DataAccessibility\Consistency_data loss_e.out SupportingFiles\Clause7\Durability\DataAccessibility\Data_drive_pull_1.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Data_drive_pull_2.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Data_drive_pull_3.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Data_drive_pull_4.JPG SupportingFiles\Clause7\Durability\DataAccessibility\ERRORLOG.txt SupportingFiles\Clause7\Durability\DataAccessibility\Log_drive_pull_1.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Log_drive_pull_2.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Log_drive_pull_3.JPG SupportingFiles\Clause7\Durability\DataAccessibility\Log_drive_pull_4.JPG SupportingFiles\Clause7\Durability\DataAccessibility\SQL_Server_Configuration.txt SupportingFiles\Clause7\Durability\DataAccessibility\sys_log_data_acces.txt SupportingFiles\Clause7\Durability\DataAccessibility\TradeRequest_cntb.ver SupportingFiles\Clause7\Durability\DataAccessibility\TxnReportE_DataAccessibility-5min.xls SupportingFiles\Clause7\Durability\DataAccessibility\TxnReportE_DataAccessibility-data-recovery-20min.xls SupportingFiles\Clause7\Durability\DataAccessibility\TxnReportE_DataAccessibility-log-recovery-20min.xls SupportingFiles\Clause7\Durability\DataAccessibility\TxnReport_DataAccessibility-5min.xlt SupportingFiles\Clause7\Durability\DataAccessibility\TxnReport_DataAccessibility-All.xlt SupportingFiles\Clause7\Durability\DataAccessibility\TxnReport_DataAccessibility-data-recovery-20min.xlt SupportingFiles\Clause7\Durability\DataAccessibility\TxnReport_DataAccessibility-log-recovery-20min.xlt SupportingFiles\Clause7\Durability\DataAccessibility\TxnStep_DataAccessibility.xlt SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\DRIVER1.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\DRIVER2.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\DRIVER3.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\DRIVER4.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\MEE1.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\MEE2.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\MEE3.log SupportingFiles\Clause7\Durability\DataAccessibility\DriverLogs\MEE4.log
	Isolation Scripts	SupportingFiles\Clause7\Isolation\Scripts\Isolation1_S1.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation1_S2.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation1_S3.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation1_S4.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation2_S1.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation2_S2.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation2_S3.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation2_S4.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation3_S1.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation3_S2.sql

Table 9.1: Index of Supporting Files (cont.)

Clause	Description	Pathname
		SupportingFiles\Clause7\Isolation\Scripts\Isolation3_S3.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation4_S1.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation4_S2.sql SupportingFiles\Clause7\Isolation\Scripts\Isolation4_S3.sql
	Isolation Output	SupportingFiles\Clause7\Isolation\Isolation1_S1.ver SupportingFiles\Clause7\Isolation\Isolation1_S2.ver SupportingFiles\Clause7\Isolation\Isolation1_S3.ver SupportingFiles\Clause7\Isolation\Isolation1_S4.ver SupportingFiles\Clause7\Isolation\Isolation2_S1.ver SupportingFiles\Clause7\Isolation\Isolation2_S2.ver SupportingFiles\Clause7\Isolation\Isolation2_S3.ver SupportingFiles\Clause7\Isolation\Isolation2_S4.ver SupportingFiles\Clause7\Isolation\Isolation3_S1.ver SupportingFiles\Clause7\Isolation\Isolation3_S2.ver SupportingFiles\Clause7\Isolation\Isolation3_S3.ver SupportingFiles\Clause7\Isolation\Isolation4_S1.ver SupportingFiles\Clause7\Isolation\Isolation4_S2.ver SupportingFiles\Clause7\Isolation\Isolation4_S3.ver
Clause 8	60-day Space Calculation	SupportingFiles\Clause8\tpce_space.xls

9.1. Supporting Files

*The **Supporting Files** contain human readable and machine executable (i.e., able to be performed by the appropriate program without modification) scripts that are required to recreate the benchmark **Result**. If there is a choice of using a GUI or a script, then the machine executable script must be provided in the **Supporting Files**. If no corresponding script is available for a GUI, then the **Supporting Files** must contain a step-by-step description of how to manipulate the GUI. (9.4)*

All **Supporting Files** can be found in the *SupportingFiles* Directory.

Appendix A - 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

February 11, 2009

Unisys Corporation
Steve Barrish
25725 Jeronimo Road
Mission Viejo, CA 92691

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
810-07507	SQL Server 2008 Enterprise x64 Edition <i>Per Processor License</i> <i>Discount Schedule: Open Program - Level C</i> <i>Unit Price reflects a 6% discount from the retail unit price of \$24,999.</i>	\$23,432	8	\$187,456
P73-04165	Windows Server 2008 Standard Edition (x64) <i>Server License with 5 CALs</i> <i>Discount Schedule: Open Program - Level C</i> <i>Unit Price reflects a 29% discount from the retail unit price of \$999.</i>	\$711	1	\$711
P72-03168	Windows Server 2008 Enterprise Edition (x64) <i>Server License with 25 CALs</i> <i>Discount Schedule: Open Program - Level C</i> <i>Unit Price reflects a 42% discount from the retail unit price of \$3,999.</i>	\$2,310	1	\$2,310
N/A	Microsoft Problem Resolution Services <i>Professional Support (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=mn&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: PEstba0902110000004657.

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Discounts calculated automatically

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- Cisco/Type
- SFP Transceiver

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☐ GCP088650-BL CAT6 PATCH 50' BL Customizations: N/A, Standard Packaging (N/C)	\$11.86	17	\$201.62
Subtotal			\$791.52
Shipping: Zip Code: Calculate Shipping			
Shipping & Handling			--
Total (excluding tax)			\$791.52

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Subtotal:			\$64.99
Calculate Shipping Zip Code: UPS Guaranteed 3 Day Service GO			Shipping: \$0.00
Redeem Gift Certificates Claim Code: Security Code: Redeem			Gift Certificates: \$0.00
Apply Promo Codes: Enter up to 5 promo codes, however stacking is not permitted. Promo Code: Apply (For Example: code1,code2,code3,code4,code5)			Promo Code: \$0.00
Grand Total:*			\$64.99

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Date: March 19, 2009
Sales Person: Richard Eng
email: reng@iqstor.com
Phone: (805) 376-1000 x102
Fax: (805) 376-1004

Customer: Unisys Corp
Address:
Contact / email: steve.barrish@unisys.com
Phone / Fax:

REO Number:
Payment: Prepay by wire transfer

LINE	QUANTITY	PRODUCT CODE	DESCRIPTION	UNIT PRICE	AMOUNT
1	1	UPS120	1000VA/640W UPS with network management card, 19" 1U, 120V AC, US	1,000.00	1,000.00
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
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28	SERVICE AND SUPPORT OPTIONS (partner product not covered)			TOTAL:	\$1,000.00
29		HM1	9x5 annual hardware support, next business day on-site		
30		SM2	24x7 annual software/firmware support, 4-hour phone response		
31		TS1	Remote service and system installation per system		
32					
33					
34					

Three years hardware and one year software warranty with 9x5 telephone support. One year warranty on UPS, and battery. Partner product warranty subject to manufacturer's policy.
Quotation valid for 30 days. Delivery 30 days after receipt of PO. FOB Newbury Park, California, USA. Product subject to availability.

For and on behalf of iQstor

Confirmed and accepted by

