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UNISYS

TPC Benchmark™ E Report

Unisys ES7000/one Enterprise Server (16s)

using

Microsoft SQL Server 2005 Enterprise Edition SP2 (64-bit)

on

Microsoft Windows Server 2003 R2 Datacenter Edition (64-bit)

First Edition
July 11, 2007

First Edition - July 2007

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Benchmark results are highly dependent upon workload, specific application requirements, and systems 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, and therefore results obtained in other operating environments may vary significantly. Unisys Corporation and Microsoft Corporation do not warrant or represent that a user can or will achieve similar performance expressed in transaction per second (tpsE) or normalized price/performance ($/tpsE). No warranty of system performance or price/ performance is expressed or implied in this report.

Printed in USA, July 2007.

Abstract

Overview

This report documents the methodology and results of the TPC Benchmark™ E (TPC-E) conducted on the Unisys Corporation ES7000/one Enterprise Server (16s). The operating system on the server was Microsoft Windows Server 2003 R2 Datacenter Edition (64-bit). The DBMS used was Microsoft SQL Server 2005 Enterprise Edition SP2 (64-bit). The TPC applications, which included TPC provided EGEN software, was built using Visual Studio 2005 Express Edition. The operating system on the clients was Microsoft Windows Server 2003. 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.

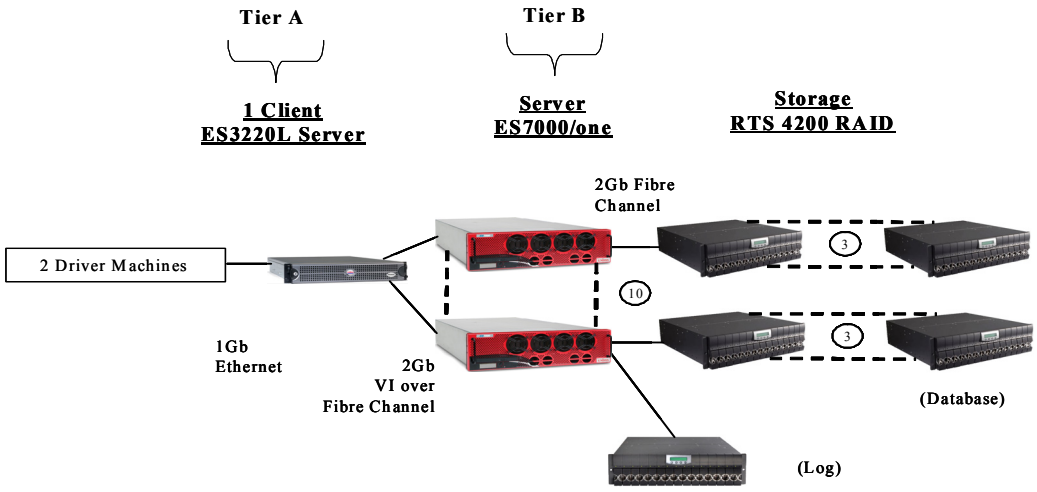
Executive Summary

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 cost per tpsE.

UNISYS	ES7000/one Enterprise (16s)		TPC-E 1.1.0 TPC Pricing 1.2 **Report Date** July 11, 2007
TPC-E Throughput	Price/Performance	Availability Date	Total System Cost
660.85 tpsE	**$1,777.18 USD per tpsE**	**September 28, 2007**	**$1,174,446 USD**
Database Server Configuration			
Operating System **Microsoft Windows Server 2003 R2 Datacenter Edition**	Database Manager **Microsoft SQL Server 2005 Enterprise Edition (64-bit)**	Processors/Cores/ Threads **16/32/64**	Memory **128GB**



Client
ES3220L Server
2 x 1.66GHz Intel® Quad-core Xeon™ w/ 4MB L2 cache,
2 GB memory,
1 x 73GB internal disk,
1 x PCI VI-over-FC cntlr,
2 Inbuilt 1Gb Eth. cntrls. (1 used).

Server
ES7000/one
16 x Intel® Dual-Core Xeon™ 3.4GHz w/ 16MB L3 cache, 128 GB memory,
2 x 73GB SAS disk, internal ,
1 x PCI SAS RAID cntrl, internal,
11 x PCI Fibre Channel cntrls,
1 x PCI VI-over-FC cntrl,
8 Inbuilt 1Gb Eth. cntrls. (0 used).

Storage
RTS 4200 RAID Storage
450 x 73GB
6 x 146GB
External Fibre Channel disks,
12 x FC RAID controllers

Initial Database Size	Redundancy Level: 1	Database Storage
2,753 GB	**RAID-10**	**450 x 73GB 15K rpm** **6 x 146GB 15K rpm**

UNISYS

ES7000/one Enterprise (16s)

TPC-E 1.1.0
TPC Pricing 1.2
Report Date
July 11, 2007
Revision Date

Description	Part Number	Price Source	Unit Price	Qty.	Extended Price	3-yr.Maint. Price
Server Hardware:						
ES7000/one 16 Socket ,16 GB Memory	ES7111166-100	1	$147,250	1	$147,250	$13,680
40U Rack with top and rear door	RCK4019421-FSS	1	$2,470	1	$2,470	
40U Rack front door	RCK4019421-FDR	1	$1,283	1	$1,283	
4 Outlet PDU	PWR4201-220	1	$189	4	$756	
2 x 72 GB LSI Boot Drive	FAC7100722-IDK	1	$1,853	1	$1,853	
Initial Memory Style (4 GB)	FAC7102202-ICA	1	$2,280	4	$9,120	
32 GB Memory Expansion	FAC7116202-32G	1	$11,552	3	$34,656	
Disk HBA	FC76222-P64	1	$2,850	11	$31,350	
PCI VI-over-FC controller (Dual Port)	FCH752323-PCX	1	$2,138	1	$2,138	
				Subtotal	**$230,876**	**$13,680**
Server Software:						
Windows 2003 Srvr, DC x64 Edtn, 16P, 1yr Lsub.	WNX6416-TSP	1	$35,112	1	$35,112	
Windows 2003 Server, DC Lmtd Sbscrptn, 1yr.	DUS200316-TSP	1	$3,173	2	$6,346	
Microsoft SQL Server 2005 Enterprise x64 Edtn.	810-03134	2	$23,432	16	$374,912	
SRVC: Microsoft Problem Resolution Services **		2		1		$245
				Subtotal	**$416,370**	**$245**
Storage Hardware:						
Basic Enclosure - 20 Pack	RTS412880-P20	1	$139,109	1	$139,109	
RAID Controller 1x1	RTS422880-1X1	1	$13,544	2	$27,088	
RAID Controller 1x1 - 10 Pack	RTS42288011-P10	1	$90,828	1	$90,828	
Cable to Daisy Chain Enclosures (1 Meter) - 20 Pac	RTS400650-P20	1	$1,776	1	$1,776	
Optical Transceiver	RTS400150-SFP	1	$203	2	$406	
Optical Transceiver -50 Pack	RTS400150-P50	1	$5,878	1	$5,878	
Battery Backup for RAID Controllers	RTS420020-BAT	1	$542	1	$542	
SAN Manager Software	RTS44101-SAN	1	$4,334	1	$4,334	
UPS for Log Disk	RTS412120-UPS	1	$2,438	1	$2,438	
AC Power Cord	RTS400740-CBL	1	$13	64	$832	
Rack Mount Kit for Enclosures -20 Pack	RTS400012-P20	1	$7,915	1	$7,915	
15 Drive Sled of 73 GB Disk - 30 Pack	RTS4307315-P30	1	$333,210	1	$333,210	
146 GB Disk Drive	RTS4314615-4F	1	$1,571	6	$9,426	
CAB: 36U x 19" x 41" Open Front Cabinet	HRT361941-OFT	1	$1,425	4	$5,700	
Power Strip (8 Outlet)	SFR9-PWR	1	$162	12	$1,944	
Power Cord	USE1936-LC6	1	$86	12	$1,032	
				Subtotal	**$632,458**	
Infrastructure						
SWTCH: KVM 16-Port PS/2-Cat5	KVM9163101-SWC	1	$1,805	1	$1,805	
I/F: Monitor, 17-inch LCD, Kybrd, Mouse & Cable	ES70004-UIF	1	$618	1	$618	
Netgear 16 Port Switch	FS116	4	$61	3	$183	
FC Cable -20 Meter	GCFAZLLM20-M	3	$35	14	$486	
Ethernet Cable to Switch -25'	GCP0888925-BK	3	$4	12	$48	
				Subtotal	**$3,140**	
Client Hardware:						
ES3220L 1.66Ghz Clovertown Single Proc Server	ESL3220401-16L	1	$2,313	1	$2,313	$507
Brand Kit	ESL322001-UNI	1	$26	1	$26	
Bezel	ESL32201-BZL	1	$26	1	$26	
Processor Upgrade to Dual Proc System	CPL3220412-16L	1	$1,063	1	$1,063	
PCI-X Riser Card	PWA322001-PCX	1	$53	1	$53	
CD-ROM Drive	CDR3220650-INT	1	$40	1	$40	
Cable for CD-ROM Drive	CBL322001-CD	1	$26	1	$26	
73 GB Disk Drive	HDP73115-SAS	1	$398	1	$398	
2 GB Memory	DIM3220041-2GB	1	$808	1	$808	
SAS Controller	SAL322001-S5I	1	$91	1	$91	
PCI VI-over-FC controller (Dual Port)	FCH752323-PCX	1	$2,138	1	$2,138	
Adapter Cable to KVM Switch	KVM9002301-CNV	1	$238	1	$238	
Power Supply	RPU16120-DA	1	$120	1	$120	
				Subtotal	**$7,340**	**$507**
Client Software:						
O/S: Windows Server 2003, Standard Edition	P73-01972	2	$719	1	$719	
				Subtotal	**$719**	**$0**
Computer Resolutions Inc. 14% Volume Cash Discount (Ext.Price where Price Source =1)					$130,889	
				Total USD	**$1,160,014**	**$14,432**

Benchmark results and test methodology audited by Lorna Livingtree of Performance Metrics, Inc.

Notes:

1. * 10% or minimum 2 spares are added in place of onsite service.
2. HW & SW maintenance at 24 x 7 w/ 4 hr. max. response time for spares.
3. Price Source: 1 = CRI Product Price, Unisys Maintenance Price
   2 = Microsoft 3 = GoCables 4 = NewEgg

3-Year Cost of Ownership: $1,174,446 USD
TPC-E Throughput: 660.85 tpsE
Price/Performance: $1,777.18 USD

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/one Enterprise (16s)	TPC-E 1.1.0 **Report Date** July 11, 2007

Numerical Quantities Summary

Reported Throughput:	**660.85**
Configured Customers:	**350,000**

Response Time (in seconds)	Minimum	Average	90th %tile	Maximum
Broker-Volume	0.01	0.12	0.21	0.58
Customer-Position	0.00	0.02	0.05	3.27
Market-Feed	0.00	0.07	0.15	3.31
Market-Watch	0.00	0.08	0.20	1.55
Security-Detail	0.00	0.02	0.03	3.26
Trade-Lookup	0.00	0.63	0.83	3.76
Trade-Order	0.01	0.07	0.11	2.48
Trade-Result	0.00	0.11	0.18	2.42
Trade-Status	0.01	0.04	0.06	2.27
Trade-Update	0.03	0.75	0.91	3.59
Data-Maintenance	0.01	0.11	N/A	0.43

Transaction Mix (in percent of total transactions)	Transaction Count	Mix
Broker_Volume	2,331,286	4.900%
Customer-Position	6,185,564	13.000%
Market-Feed	475,819	1.000%
Market-Watch	8,564,647	18.000%
Security-Detail	6,661,282	14.000%
Trade-Lookup	3,806,391	8.000%
Trade-Order	4,805,933	10.100%
Trade-Result	4,758,179	10.000%
Trade-Status	9,040,612	19.000%
Trade-Update	951,663	2.000%
Data-Maintenance	120	N/A

Test Duration and Timing	
Ramp-up Time (hh:mm:ss)	0:24:00
Measurement Interval (hh:mm:ss)	2:00:00
Business Recovery Time (hh:mm:ss)	1:14:20
Total Number of Transactions Completed in Measurement Interval	47,581,376

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Preface

Document Structure

The TPC Benchmark™ E Standard 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/one Enterprise Server (16s) using Microsoft SQL Server 2005 Enterprise Edition SP2 (64-bit) on Microsoft Windows Server 2003 R2 Datacenter Edition (64-bit).

TPC Benchmark™ E Overview

The Transaction Processing Performance Council (TPC) developed The TPC Benchmark™ E Standard Specification Revision 1.1.0. 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 TPC **Executive Summary Statement** is included in the *ExecutiveSummaryStatement* folder and near the beginning of this report.

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.

The *SupportingFiles* Directory contains the configuration and system parameters used in running these TPC-E tests, plus all the client and server OS and SQL Server tunable parameters.

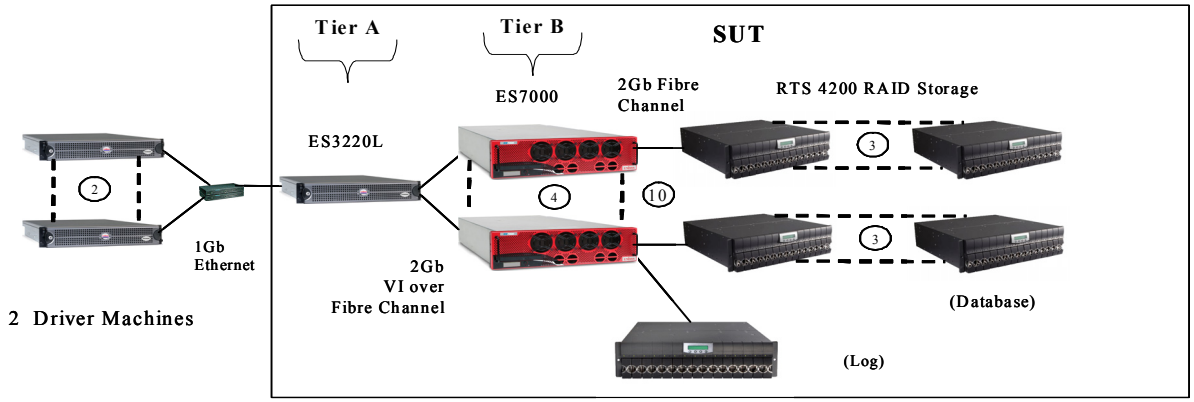
1.4. Configuration Diagrams

*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)*

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

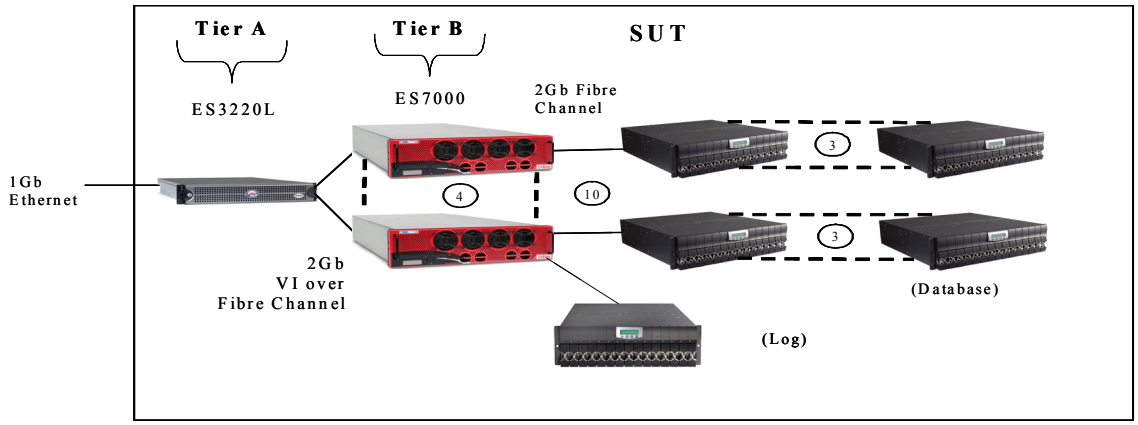
The **Benchmarked Configuration** of the driver and Unisys ES7000/one Enterprise Server (16s) is illustrated in Figure 1.1. The **Priced Configuration** is shown in figure 1.2. Table 2.2 contains a detailed explanation of the disk configuration.

Figure 1-1: Benchmarked Configuration



Client	Server	Storage
ES3220L Server	**ES7000**	**RTS 4200 RAID Storage**
2 x 1.66GHz Intel® Quad-core Xeon™ w/ 2 x 4MB L2 cache, 2 GB memory, 1 x 73GB internal disk, 1 x PCI VI controller, 2 Inbuilt 1Gb Eth. cntrls. (1 used).	16 x Intel® Dual-Core Xeon™ 3.4GHz w/ 16MB L3 cache, 128 GB memory, 2 x 73GB SAS disk, internal , 1 x PCI SAS RAID cntrl, internal, 11 x PCI Fibre Channel cntrls, 1 x PCI VI-over-FC cntrls, 8 Inbuilt 1Gb Eth. cntrls. (0 used).	440 x 73GB 6 x 146GB External Fibre Channel disks, 12 x FC RAID controllers

Figure 1-2: Priced Configuration



Client	Server	Storage
ES3220L Server	**ES7000/one**	**RTS 4200 RAID Storage**
2 x 1.66GHz Intel® Quad-core Xeon™ w/ 4MB L2 cache, 2 GB memory, 1 x 73GB internal disk, 1 x PCI VI-over-FC cntlr, 2 Inbuilt 1Gb Eth. cntrls. (1 used).	16 x Intel® Dual-Core Xeon™ 3.4GHz w/ 16MB L3 cache, 128 GB memory, 2 x 73GB SAS disk, internal , 1 x PCI SAS RAID cntrl, internal, 11 x PCI Fibre Channel cntrls, 1 x PCI VI-over-FC cntrl, 8 Inbuilt 1Gb Eth. cntrls. (0 used).	450 x 73GB 6 x 146GB External Fibre Channel disks, 12 x FC RAID controllers

1.5. Hardware Configuration

A description of the steps taken to configure all of the hardware must be reported. Any and all configuration scripts or step by step GUI instructions are reported in the Supporting Files. 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:

A description of any firmware updates or patches to the hardware.

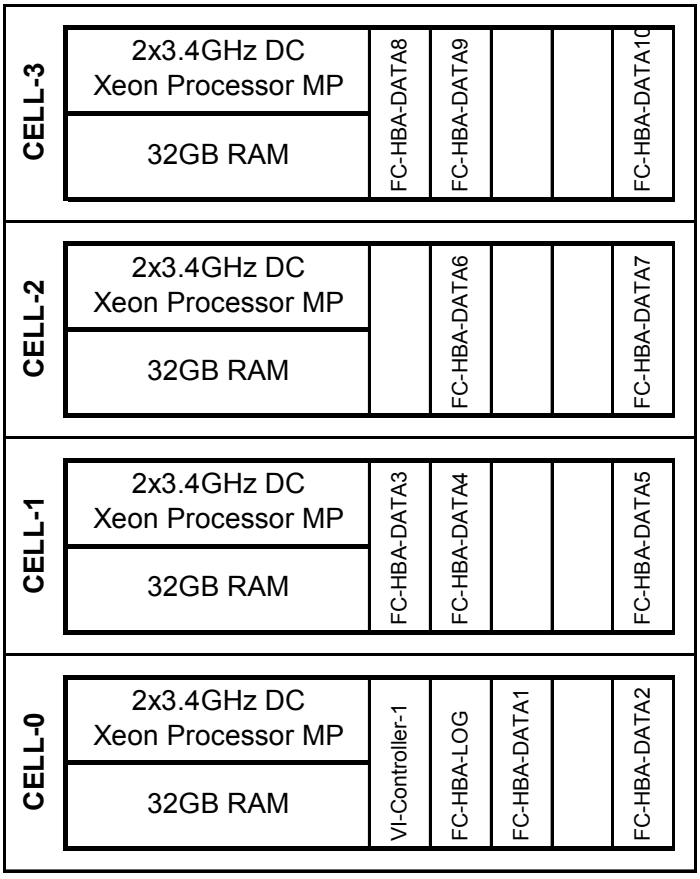
A description of any GUI configuration used to configure the system hardware.

A description of exactly how the hardware is combined to create the complete system.

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. (9.3.1.4)

The file ***HardwareConfiguration.pdf*** in the *SupportingFiles* Directory ("Introduction") contains the hardware configuration 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/one server.

Figure 1.3: ES7000/one Server Layout



1.6. Software Configuration

A description of the steps taken to configure all software must be reported. Any and all configuration scripts or step by step GUI instructions are reported in the Supporting Files. 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:

A description of any updates or patches to the software.

A description of any changes to the software.

A description of any GUI configurations used to configure the software. (9.3.1.5)

The file ***SoftwareConfiguration.pdf*** in the *SupportingFiles* Directory ("Introduction") contains the configuration and system parameters used in running these TPC-E tests. It also contains all the client and server OS and SQL Server tunable parameters.

Clause 2: Database Design, Scaling & Population

2.1. Physical Database Organization

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

The database tables and their corresponding indexes 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	

2.2. Table and Row Partitioning

Any horizontal or vertical partitioning of tables and rows must be reported. (9.3.2.2)

No partitioning was done for this implementation.

2.3. Replications, Duplications, or Additions

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

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

No replications, duplications or additional attributes were used in this implementation.

2.4. Initial Cardinality of Tables

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

The TPC-E database for this test was configured with 350,000 customers. The cardinality of each table the database is listed in Table 2.2

Table 2.2: Initial Cardinality of Database

Table	Rows
ACCOUNT_PERMISSION	2,484,593
ADDRESS	525,004
BROKER	3,500
CASH_TRANSACTION	5,564,146,955
CHARGE	15
COMMISSION_RATE	240
COMPANY	175,000
COMPANY_COMPETITOR	525,000
CUSTOMER	350,000
CUSTOMER_ACCOUNT	1,750,000
CUSTOMER_TAXRATE	700,000
DAILY_MARKET	312,873,750
EXCHANGE	4
FINANCIAL	3,500,000
HOLDING	309,737,215
HOLDING_HISTORY	8,105,244,325
HOLDING_SUMMARY	17,414,693
INDUSTRY	102
LAST_TRADE	239,750
NEWS_ITEM	350,000
NEWS_XREF	350,000
SECTOR	12
SECURITY	239,750
SETTLEMENT	6,048,000,000
STATUS_TYPE	5
TAXRATE	320
TRADE	6,048,000,000
TRADE_HISTORY	14,515,225,710
TRADE_REQUEST	0
TRADE_TYPE	5
WATCH_ITEM	34,987,514
WATCH_LIST	350,000
ZIP_CODE	14,741

2.5. 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 440 73GB disks and the transaction log over 3 mirrored pairs of 146GB disks for both the priced and tested databases. In addition, there were two 73GB mirrored disks in the host server containing Windows Server 2003 R2 Datacenter Edition (64-bit) and SQL Server 2005 Enterprise Edition SP2 (64-bit) 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 20 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 2.2: Disk Rack Configuration

HBA #	Slot #	Controller #	Disk #	Drives Enclosure model RAID level	FileSystem Partition	Size	Use
1-port 0,1	PCI_BUS_0_4	1, 2	1	6 X 146 GB RTS422880 RAID 10	C:\Bigdb\dblogs\tpcelog1\ (RAW)	405.93 GB	DB Log
2-port0	PCI_BUS_0_5	3	2	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabA\market1 (RAW) C:\Bigdb\cabA\customer1 (RAW) C:\Bigdb\cabA\broker1 (RAW) C:\Bigdb\dbbackups\backupA1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb, Misc_FG
			3	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabA\market2 (RAW) C:\Bigdb\cabA\customer2 (RAW) C:\Bigdb\cabA\broker2 (RAW) C:\Bigdb\dbbackups\backupA2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
3-port0	PCI_BUS_0_7	4	4	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabB\market1 (RAW) C:\Bigdb\cabB\customer1 (RAW) C:\Bigdb\cabB\broker1 (RAW) C:\Bigdb\dbbackups\backupB1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			5	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabB\market2 (RAW) C:\Bigdb\cabB\customer2 (RAW) C:\Bigdb\cabB\broker2 (RAW) C:\Bigdb\dbbackups\backupB2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
4-port0	PCI_BUS_1_3	5	6	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabC\market1 (RAW) C:\Bigdb\cabC\customer1 (RAW) C:\Bigdb\cabC\broker1 (RAW) C:\Bigdb\dbbackups\backupC1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			7	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabC\market2 (RAW) C:\Bigdb\cabC\customer2 (RAW) C:\Bigdb\cabC\broker2 (RAW) C:\Bigdb\dbbackups\backupC2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
5-port0	PCI_BUS_1_4	6	8	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabD\market1 (RAW) C:\Bigdb\cabD\customer1 (RAW) C:\Bigdb\cabD\broker1 (RAW) C:\Bigdb\dbbackups\backupD1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			9	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabD\market2 (RAW) C:\Bigdb\cabD\customer2 (RAW) C:\Bigdb\cabD\broker2 (RAW) C:\Bigdb\dbbackups\backupD2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
6-port0	PCI_BUS_1_7	7	10	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabE\market1 (RAW) C:\Bigdb\cabE\customer1 (RAW) C:\Bigdb\cabE\broker1 (RAW) C:\Bigdb\dbbackups\backupE1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			11	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabE\market2 (RAW) C:\Bigdb\cabE\customer2 (RAW) C:\Bigdb\cabE\broker2 (RAW) C:\Bigdb\dbbackups\backupE2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
7-port0	PCI_BUS_2_4	8	12	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabF\market1 (RAW) C:\Bigdb\cabF\customer1 (RAW) C:\Bigdb\cabF\broker1 (RAW) C:\Bigdb\dbbackups\backupF1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			13	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabF\market2 (RAW) C:\Bigdb\cabF\customer2 (RAW) C:\Bigdb\cabF\broker2 (RAW) C:\Bigdb\dbbackups\backupF2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb

Table 2.2: Disk Rack Configuration (Cont)

HBA #	Slot #	Controller #	Disk #	Drives Enclosure model RAID level	FileSystem Partition	Size	Use
8-port0	PCI_BUS_2_7	9	14	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabG\market1 (RAW) C:\Bigdb\cabG\customer1 (RAW) C:\Bigdb\cabG\broker1 (RAW) C:\Bigdb\dbbackups\backupG1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			15	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabG\market2 (RAW) C:\Bigdb\cabG\customer2 (RAW) C:\Bigdb\cabG\broker2 (RAW) C:\Bigdb\dbbackups\backupG2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
9-port0	PCI_BUS_3_3	10	16	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabH\market1 (RAW) C:\Bigdb\cabH\customer1 (RAW) C:\Bigdb\cabH\broker1 (RAW) C:\Bigdb\dbbackups\backupH1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			17	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabH\market2 (RAW) C:\Bigdb\cabH\customer2 (RAW) C:\Bigdb\cabH\broker2 (RAW) C:\Bigdb\dbbackups\backupH2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
10-port0	PCI_BUS_3_4	11	18	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabI\market1 (RAW) C:\Bigdb\cabI\customer1 (RAW) C:\Bigdb\cabI\broker1 (RAW) C:\Bigdb\dbbackups\backupI1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			19	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabI\market2 (RAW) C:\Bigdb\cabI\customer2 (RAW) C:\Bigdb\cabI\broker2 (RAW) C:\Bigdb\dbbackups\backupI2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
11-port0	PCI_BUS_3_7	12	20	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabJ\market1 (RAW) C:\Bigdb\cabJ\customer1 (RAW) C:\Bigdb\cabJ\broker1 (RAW) C:\Bigdb\dbbackups\backupJ1 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb
			21	22 x 73GB RTS422880 RAID 10	C:\Bigdb\cabJ\market2 (RAW) C:\Bigdb\cabJ\customer2 (RAW) C:\Bigdb\cabJ\broker2 (RAW) C:\Bigdb\dbbackups\backupJ2 (NTFS)	4.11 GB 37.61 GB 153.82 GB 544.39 GB	Market_FG Customer_FG Broker_FG backup, tempdb

2.6. Database Interface

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 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. (9.3.2.8)

Microsoft SQL Server 2005 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 is described in **Clause2** of the *SupportingFiles* directory (***MSTPCE Database Setup Steps.pdf***)

Clause 3: Transaction Items

3.1. Code Functionality

A statement that vendor-supplied code is functionally equivalent to Pseudo-code in the specification must be reported. (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 were met must be reported. (9.3.3.2)

The database footprint requirements were met.

Clause 4: SUT, Driver, and Network

4.1. EGenDriver Items

The number of EGenDriverMEE and EGenDriverCE instances used in the benchmark must be reported. (9.3.4.1)

There were four instances of EGenDriverMEE and 700 instances of EGenDriverCE in this benchmark run.

4.2. 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). (9.3.4.2).*

Figures 1.1 and 1.2 in clause 1 of this report diagram the network configurations of the benchmark and configured systems 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 2 gigabit-per-second LAN adapter. Each port was directly connected to a VI adapter in the client. The client also contains two (2) 10/100/1000 megabit-per-second inbuilt LAN controllers of which one was used in the tested configuration. A 10/100/1000 megabit-per-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 1000 megabits-per-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. (9.3.5.1)

The EGen version used in this test was 1.1.0.

5.2. EGen Code

A statement that all required TPC-provided EGen code was used in the benchmark must be reported. (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. all formal waivers from the TPC documenting the allowed changes to EGen must also be reported. If any changes to EGen do not have a formal waiver, that must also be reported. (9.3.5.3)

No modifications were made to EGen.

5.4. EGenLoader Extension Code

If the Test Sponsor extended EGenLoader, the use of the extended EGenLoader and the audit of the extended code by an auditor must be reported. (9.3.5.4)

No extensions were made to the EGenLoader for this test.

Clause 6: Performance Metrics & Response Time

6.1. Measured Throughput (tpsE)

The Measured throughput must be reported. (9.3.6.1)

The measured tpsE was 660.85.

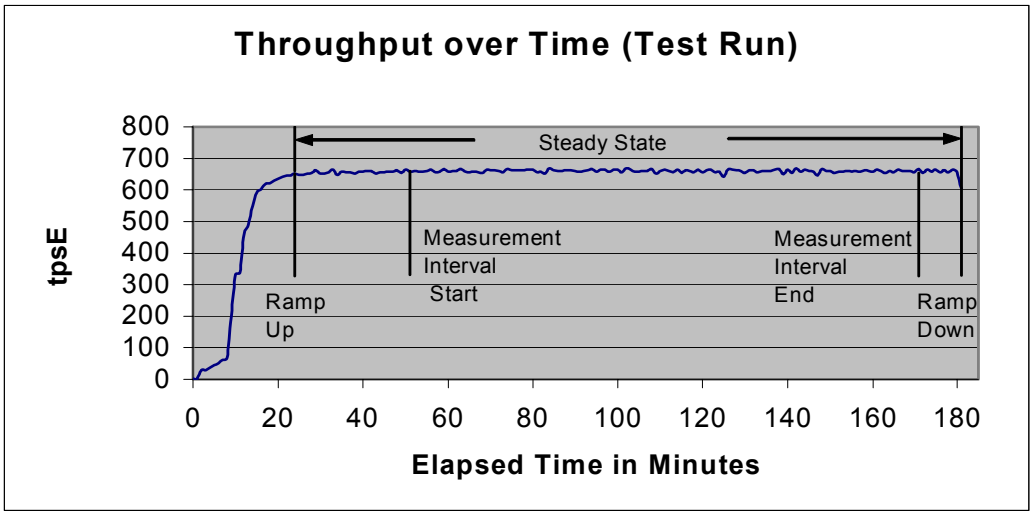
6.2. Test Run Times/Steady State Measurement

*A **Test Run Graph** of throughput versus elapsed wall clock time must be reported for the **Trade-Result Transaction**. (9.3.6.2)*

The method used to determine that the SUT had reached a Steady State prior to commencing the Measurement Interval must be reported. (9.3.6.3)

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

Figure 6.1: Test Run Time/Steady State Measurement Data.



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.). (9.3.6.4)*

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 transmissions were sent to application processes running on the client machines through Ethernet LANs. These client application processes handled all requests to the database on the server. The applications 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 of 450 seconds were performed during the steady state before and during the measurement interval by a driver engine. 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 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.

6.5. Transaction Report (Averages)

The recorded averages over the Measurement Interval for each of the transaction input parameters must be reported. (9.3.6.5)

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

Table 6.3: Transaction Parameter (Averages)

Transaction	Overall	Parameter	Value	Range Check	Acceptable Range Min	Acceptable Range Max
Customer Position	Ok	By Tax ID	50.00%	Ok	48.00%	52.00%
		Get history	49.97%	Ok	48.00%	52.00%
Trade Lookup	Ok	Frame 1	30.03%	Ok	28.50%	31.50%
		Frame 2	29.98%	Ok	28.50%	31.50%
		Frame 3	30.01%	Ok	28.50%	31.50%
		Frame 4	9.98%	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	33.02%	Ok	31.00%	35.00%
		Frame 2	33.00%	Ok	31.00%	35.00%
		Frame 3	33.98%	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	40.04%	Ok	38.00%	42.00%
		Buy on Margin	8.02%	Ok	7.50%	8.50%
		Rollback	0.99%	Ok	0.94%	1.04%
		LIFO	34.98%	Ok	33.00%	37.00%
		Trade Quantity 100	25.00%	Ok	24.00%	26.00%
		Trade Quantity 200	24.99%	Ok	24.00%	26.00%
		Trade Quantity 400	25.01%	Ok	24.00%	26.00%
		Trade Quantity 800	25.00%	Ok	24.00%	26.00%
		Market Buy	29.98%	Ok	29.70%	30.30%
		Market Sell	29.97%	Ok	29.70%	30.30%
		Limit buy	20.03%	Ok	19.80%	20.20%
		Limit sell	9.99%	Ok	9.90%	10.10%
		Stop Loss	10.02%	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 test(s) used to demonstrate compliance. (9.3.7.2)*

Redundancy level 1 was used for the Data Accessibility Tests.

7.3. Data Accessibility Tests

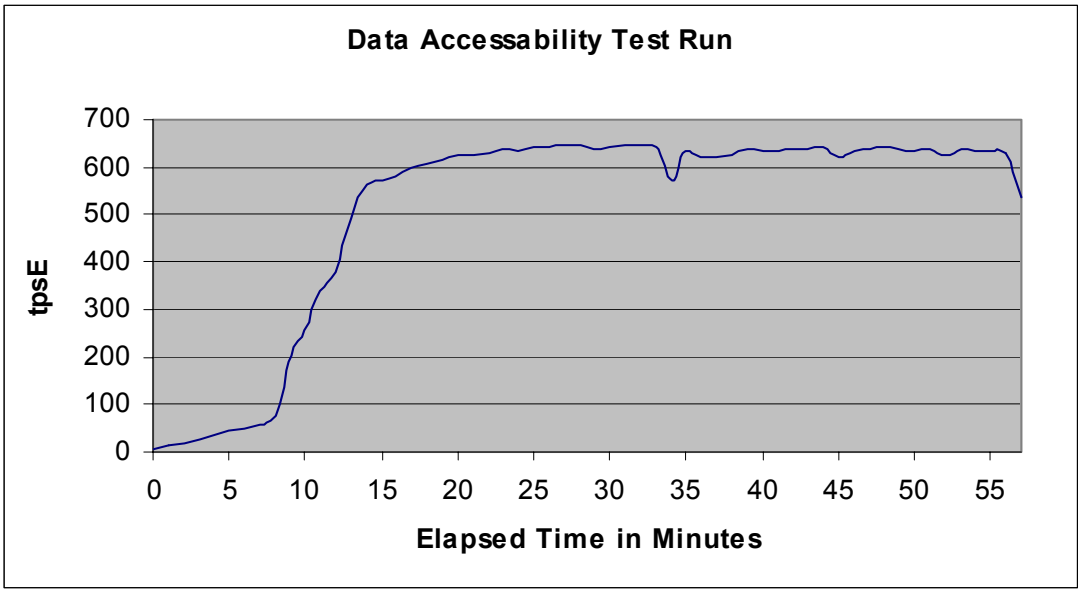
*A description of the **Data Accessibility** tests run and the **Redundancy Level** they were demonstrating must be reported in the **Report**. (9.3.7.3)*

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 started with the same number of configured customers and drivers load used for the measurement interval, ramped up, and executed at or above 95% of Reported Throughput.
3. After five minutes of running at steady state, a hot-pluggable data disk was removed from the disk cabinet. Redundancy level 1 was used for the Data Accessibility Tests.
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.
6. The run was terminated gracefully from the Driver. No errors were reported by the Drivers during steps 2 through 5.
7. Step 1 was repeated to determine the total number of completed trades present in the database (count2).
8. Count2 minus count1 was verified to be equal to the number of successful Trade-Result transaction records in the driver log file.
9. The recovery process completed.

7.4. Data Accessibility Graph

*A **Data Accessibility Graph** for each run demonstrating a Redundancy Level must be reported in the **Report**. (9.3.7.4)*

Figure 7-2: Data Accessibility Test Run



7.5. Business Recovery Tests

*The **Test Sponsor** must describe in the **Report** the test(s) used to demonstrate **Business Recovery**. (9.3.7.5)*

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 'tpsE'". Database recovery ended when SQL Server reported "Recovery is complete".

7. After recovery 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. The Trade-Cleanup **Transaction** was not executed during the **Business Recovery** test.
8. **Business Recovery** ended successfully.
9. The **drivers were stopped** gracefully.
10. No errors were reported by the **Drivers** during steps 7 through 9.
11. Step 1 was repeated to determine the total number of completed trades present in the database (count2).
12. 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 7.
13. Finally, consistency conditions as specified in Clause 7.3.1.1 were executed to verify that the database was consistent.

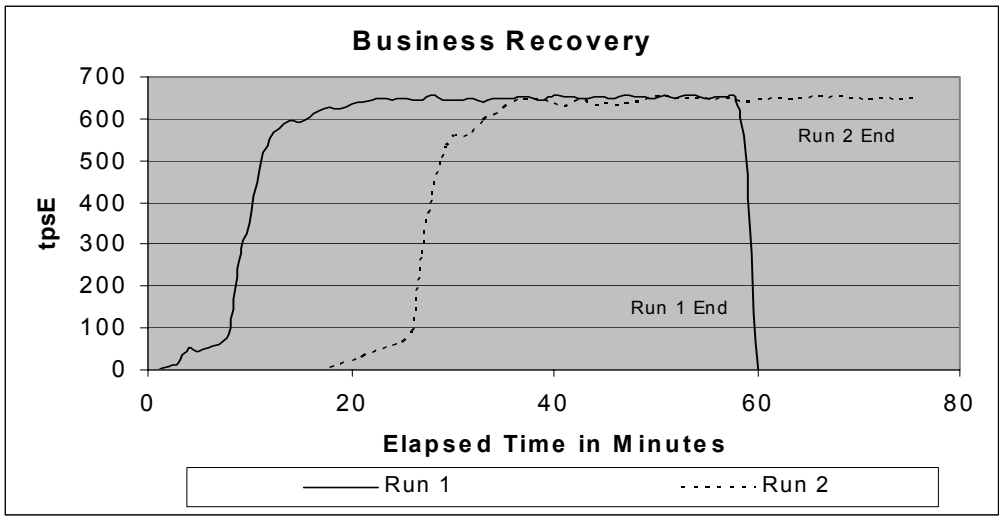
7.6. Business Recovery Time

*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.** (9.3.7.6)*

*A **Business Recovery Graph** (see clause 7.5.7.4) must be reported in the **Report f**or all **Business Recovery** Tests. (9.3.7.7)*

Business Recovery time will be reported here and 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 along with proof that the database is configured to sustain a Business Day of growth must be reported. (9.3.8.1)

Figure 8.1 contains the details of the 60-Day Space Requirements.

Figure 8-1: Disk Space Requirements

Customers Used	350,000	Performance	660.85	TpsE			
Broker File Group	**Initial Rows**	**Data (KB)**	**Index size (KB)**	**Extra 5% (KB)**	**Total + 5% (KB)**	**After run (KB)**	**Growth (KB)**
BROKER	3,500	200	400	30	630	816	216
CASH_TRANSACTION	5,564,146,955	551,015,456	1,163,816	27,608,964	579,788,236	564,463,096	12,283,824
CHARGE	15	8	8	1	17	16	-
COMMISSION_RATE	240	16	16	2	34	32	-
SETTLEMENT	6,048,000,000	296,801,352	626,136	14,871,374	312,298,862	308,690,984	11,263,496
TRADE	6,048,000,000	669,831,768	408,743,848	53,928,781	1,132,504,397	1,093,470,976	14,895,360
TRADE_HISTORY	14,515,225,710	416,207,432	1,085,536	20,864,648	438,157,616	418,606,120	1,313,152
TRADE_REQUEST	-	-	-	-	-	15,200	15,200
TRADE_TYPE	5	8	1,032	52	1,092	1,040	-
Customer File Group							
ACCOUNT_PERMISSION	2,484,593	248,712	1,552	12,513	262,777	250,264	-
CUSTOMER	350,000	59,480	16,464	3,797	79,741	75,976	32
CUSTOMER_ACCOUNT	1,750,000	131,512	194,056	16,278	341,846	457,200	131,632
CUSTOMER_TAXRATE	700,000	14,792	600	770	16,162	15,552	160
HOLDING	309,737,215	16,471,384	12,204,288	1,433,784	30,109,456	38,603,600	9,927,928
HOLDING_HISTORY	8,105,244,325	294,736,416	153,602,368	22,416,939	470,755,723	449,712,408	1,373,624
HOLDING_SUMMARY	17,414,693	590,352	2,472	29,641	622,465	1,186,736	593,912
WATCH_ITEM	34,987,514	957,416	3,920	48,067	1,009,403	961,584	248
WATCH_LIST	350,000	8,712	7,696	820	17,228	16,408	-
Market File Group							
COMPANY	175,000	38,272	11,336	2,480	52,088	49,608	-
COMPANY_COMPETITOR	525,000	14,296	12,448	1,337	28,081	26,744	-
DAILY_MARKET	312,873,750	16,041,952	6,778,640	1,141,030	23,961,622	22,821,864	1,272
EXCHANGE	4	8	8	1	17	16	-
FINANCIAL	3,500,000	412,048	1,432	20,674	434,154	413,720	240
INDUSTRY	102	8	40	2	50	48	-
LAST_TRADE	239,750	11,328	536	593	12,457	22,824	10,960
NEWS_ITEM	350,000	38,548,648	680	1,927,466	40,476,794	38,549,344	16
NEWS_XREF	350,000	8,744	536	464	9,744	9,280	-
SECTOR	12	8	24	2	34	32	-
SECURITY	239,750	37,864	17,712	2,779	58,355	55,584	8
STATUS_TYPE	5	8	8	1	17	16	-
Misc File Group							
ADDRESS	525,004	30,448	464	1,546	32,458	30,936	24
TAXRATE	320	24	16	2	42	56	16
ZIP_CODE	14,741	488	16	25	529	504	-
TOTALS (KB)		**2,302,219,160**	**584,478,104**	**144,334,863**	**3,031,032,127**		
Initial Database Size (MB)		**2,819,040**	**2.753 GB**				

Db/Filegroups	**LUN Count**	**Partition Size(KB)**	**MB allocated**	**MB Loaded**	**MB Loaded+5%**	**Ending size**	**8 Hours**
misc_fg	1	512,000	500	31	32	31	31
broker_fg	20	161,292,288	3,150,240	2,290,505	2,405,030	2,329,344	2,396,594
market_fg	20	4,313,088	84,240	60,485	63,509	60,497	60,518
customer_fg	20	39,439,360	770,300	468,020	491,421	479,765	500,103
Settlements	**6,967,753**						
Initial Growing Space (MB)	2,756,917						
Final Growing Space (MB)	2,807,372	**Data LUNS**	20	**Initial Log size (MB)**	17,406	**Log LUNS**	1
Delta (MB)	50,456	**Disks per LUN**	22	**Final Log size (MB)**	89,552	**Log Disks**	6
Data Space per Trade (MB)	0.007241296	**Disk Capacity (MB)**	68,881	**Log Growth (MB)**	72,146	**Disk Capacity (MB)**	129,165
1 Day Data Growth (MB)	137,820	**RAID10 overhead**	50%	**Log Growth/trade (MB)**	0.010354328975	**RAID10 overhead**	50%
60 Day Space (MB)	**11,088,230**	**Total Space (MB)**	**15,153,820**	**1 Day log space (MB)**	**197,069**	**Log Space (MB)**	**387,496**

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/one Enterprise Server (16s) representing:

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

Phone: (707) 482-0575
Fax: (707) 482-0115
Email: Lorna@PerfMetrics.com
The attestation letter is shown near the end of this section.

PERFORMANCE METRICS INC.
TPC Certified Auditors

July 11, 2007

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/one Enterprise (16s)
Database Manager: Microsoft SQL Server 2005 Enterprise Edition
Operating System: Microsoft Windows Server 2003 R2 Datacenter Edition (64bit)

Server (Tier B): ES7000/one			
CPU's	Memory	Disks (total)	tpsE
16 Intel @ 3.4 Ghz	128 GB	6 @ 146 GB 450 @ 36 GB	**660.85**
Clients (Tier A):ES3220L			
2 Intel @ 1.66 Ghz	2 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 1.1.0.
- The database files were properly sized and populated for 350,000 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.
- Input data was generated according to the specified percentages.

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- 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 700 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 exchange.txt file in the flat_in directory located on the Tier A machine did not match the files used on the TierB machine. This file is not used to generate input during the test run and was demonstrated to have no effect on the performance.

Sincerely,

Lorna Livingtree
Auditor

PO Box 984, Klamath, CA 95548
(707) 482-0523 fax: (707) 482-0575 email: LornaL@PerfMetrics.com

Clause 9: Supporting Files

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 not corresponding script is available for a GUI, then the Supporting Files must contain a step-by-step description of how to manipulate the GUI. (9.3.9.1) (9.4)

The **Supporting Files Index** file can be found in the *SupportingFiles* Directory (**SupportingFilesIndex.htm**). Individual files within the htm file can be viewed by clicking on the active links under *Pathname* in the file.

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

June 27, 2007

Unisys Corporation
Steve Barrish
2470 Highcrest Rd
Roseville, MN 55113

Mr. Weeks:

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
810-03134	**SQL Server 2005 Enterprise x64 Edition** *Per Processor License* *Discount Schedule: Open Program - Level C* *Unit Price reflects a 6% discount from the retail unit price of $24,999.*	$23,432	16	$374,912
P73-01972	**Windows Server 2003 R2 Standard Edition** *Server License Only - No CALs* *Discount Schedule: Open Program - No Level* *Unit Price reflects a 28% discount from the retail unit price of $999.*	$719	1	$719
N/A	**Microsoft Problem Resolution Services** *Professional Support* *(1 Incident)*	$245	1	$245

All products are currently orderable through Microsoft's normal distribution channels. A list of Microsoft's resellers can be found at http://www.microsoft.com/products/info/render.aspx?view=22&type=mnp&content=22/licensing>/b>

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.

If we can be of any further assistance, please contact Jamie Reding at (425) 703-0510 or jamiere@microsoft.com.

Reference ID: PEStBa0706274819.
Please include this Reference ID in any correspondence regarding this price quote.

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SALES QUOTE

SQ-24382	Jun 29,2007

Customer	Contact	Ship To
UNISYS CORPORATION 25725 JERONIMO RD MISSION VIEJO CA 92691 UNITED STATES		UNISYS CORPORATION 25725 JERONIMO RD MISSION VIEJO CA 92691 UNITED STATES

Account	Terms	Due Date	Account Rep	Schedule Date
UNIMISSI	NET 30	Jul 29, 2007	John Palmieri	

Quotation	PO #	Reference	Ship VIA	Page	Printed
SQ-24382			UPS GROUND	1	07/10/07 15:05

L	Item	Description	Qty	Ship	Price	M	Discount	Amount
1		Server Hardware						
2	ES7111166-100	ES7000/ONE 16 SOCKET , 16 GB MEMORY	1		147250.00	EA		147250.00
3	RCK4019421-FSS	RCK: 40U W/TOP REAR DOORS SKINS	1		2470.00	EA		2470.00
4	RCK4019421-FDR	RCK:40U RACK FRONT DOOR	1		1283.00	EA		1283.00
5	PWR4201-220	PWR:PDU & CORD, 4 OUTLET, 20A, 200	4		189.00	EA		756.00
6	FAC7100722-IDK	DISK:ES7/ONE 2X72GB LSI SAS	1		1853.00	EA		1853.00
7	FAC7102202-ICA	MEM:ES7/ONE 4GB/2 INITIAL	4		2280.00	EA		9120.00
8	FAC7116202-32G	32 GB MEMORY EXPANSION	3		11552.00	EA		34656.00
9	FC76222-P64	CTRL: 2 GB FC, INTELLIFIBRE	11		2850.00	EA		31350.00
10	FCH752323-PCX	CTRL:2 CHANNEL FIB CTRL	1		2138.00	EA		2138.00
11		Server Software						
12	WNX6416-TSP	O/S: WIN2K3 SRVR, DCX64 EDM, 16P	1		35112.00	EA		35112.00
13		1 yr Lsub						
14	DUS200316-TSP	O/S:DC 16X LTD. SUB 1 YR	2		3173.00	EA		6346.00
15		Storage						
16	RTS412880-P20	BASIC ENCLOSURE - 20 PACK	1		139109.00	EA		139109.00
17	RTS422880-1X1	RAID CONTROLLER 1X1	2		13544.00	EA		27088.00
18	RTS42288011-P10	RAID CONTROLLER 1X1 - 10 PACK	1		90828.00	EA		90828.00
19	RTS400650-P20	CABLE/ DAISY CHAIN ENCLOS (1 M) 20PACK	1		1776.00	EA		1776.00
20	RTS400150-SFP	OPTICAL TRANSCEIVER	2		203.00	EA		406.00
21	RTS400150-P50	OPTICAL TRANSCEIVER -50 PACK	1		5878.00	EA		5878.00
22	RTS420020-BAT	BATTERY BACKUP	1		542.00	EA		542.00
23	RTS44101-SAN	SAN MANAGER SOFTWARE	1		4334.00	EA		4334.00
24	RTS412120-UPS	UPS FOR LOG DISK	1		2438.00	EA		2438.00
25	RTS400740-CBL	AC POWER CORD	64		13.00	EA		832.00
26	RTS400012-P20	RACK MOUNT KIT (20 UNIT BUNDLE)	1		7915.00	EA		7915.00
27	RTS4307315-P30	15 DRIVE SLED OF 73 GB DISK - 30 PACK	1		333210.00	EA		333210.00
28	RTS4314615-4F	146 GB DISK DRIVE	6		1571.00	EA		9426.00
29	HRT361941-OFT	ACC:36U 19X41 OPEN FRT CAB, HRT COLOR	4		1425.00	EA		5700.00

Page 1	
SubTotal	901816.00

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SQ-24382	Jun 29,2007

Customer	Contact	Ship To
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Account	Terms	Due Date	Account Rep	Schedule Date
UNIMISSI	NET 30	Jul 29, 2007	John Palmieri	

Quotation	PO #	Reference	Ship VIA	Page	Printed
SQ-24382			UPS GROUND	2	07/01/07 20:53

L	Item	Description	Qty	Ship	Price	M	Discount	Amount
30	SFR9-PWR	ACC: 9-PLUG POWER STRIP	12		162.00	EA		1944.00
31	USE1936-LC6	PWR CORD:C20/NEMA L6-20P	12		86.00	EA		1032.00
32		Infrastructure						
33	KVM9163101-SWC	SWITCH:KVM 16-PORT PS/2-CAT 5	1		1805.00	EA		1805.00
34	ES70004-UIF	I/F: MONITOR, 17-INCH LDC, KYBRD, MSE	1		618.00	EA		618.00
35		Clients						
36	ESL3220401-16L	ES3220L 1.66GHZ WOODCRESTSINGLE PROC	1		2313.00	EA		2313.00
37	ESL322001-UNI	BRAND KIT	1		26.00	EA		26.00
38	ESL32201-BZL	BEZEL	1		26.00	EA		26.00
39	CPL3220412-16L	PROCESSOR UPGRADE TO DUAL PROC SYSTEM	1		1063.00	EA		1063.00
40	PWA322001-PCX	PCI-X RISER	1		53.00	EA		53.00
41	CDR3220650-INT	INTERNAL CD ROM	1		40.00	EA		40.00
42	CBL322001-CD	CD ROM CABLE	1		26.00	EA		26.00
43	HDP73115-SAS	DISK:73GB 15K 3.5" SAS	1		398.00	EA		398.00
44	DIM3220041-2GB	2 GB MEMORY	1		808.00	EA		808.00
45	SAL322001-S5I	SAS DISK CONTROLLER	1		91.00	EA		91.00
46	FCH752323-PCX	CTRL: FIBRE CHANNEL HBA, 2-PORT, 6 BIT	1		2138.00	EA		2138.00
47	KVM9002301-CNV	ADPTR:USB TO CAT5 KVM CONVERTER	1		238.00	EA		238.00
48	RPU16120-DA	ES3020 POWER STRIP 13C13	1		120.00	EA		120.00
49								
50	DISCOUNT	Volume Cash Discount for similar	1		-128038.00	EA		-128038.00
51		configurations & quantities.						
52		Disks come with a 3 year 24x7 warranty						
53		with 4 hr Response.						
54		Quote valid for 90 days.						
55								

Taxable	0.00
Tax	0.00
Exempt	786517.00
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Paid	0.00
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Amount shown in
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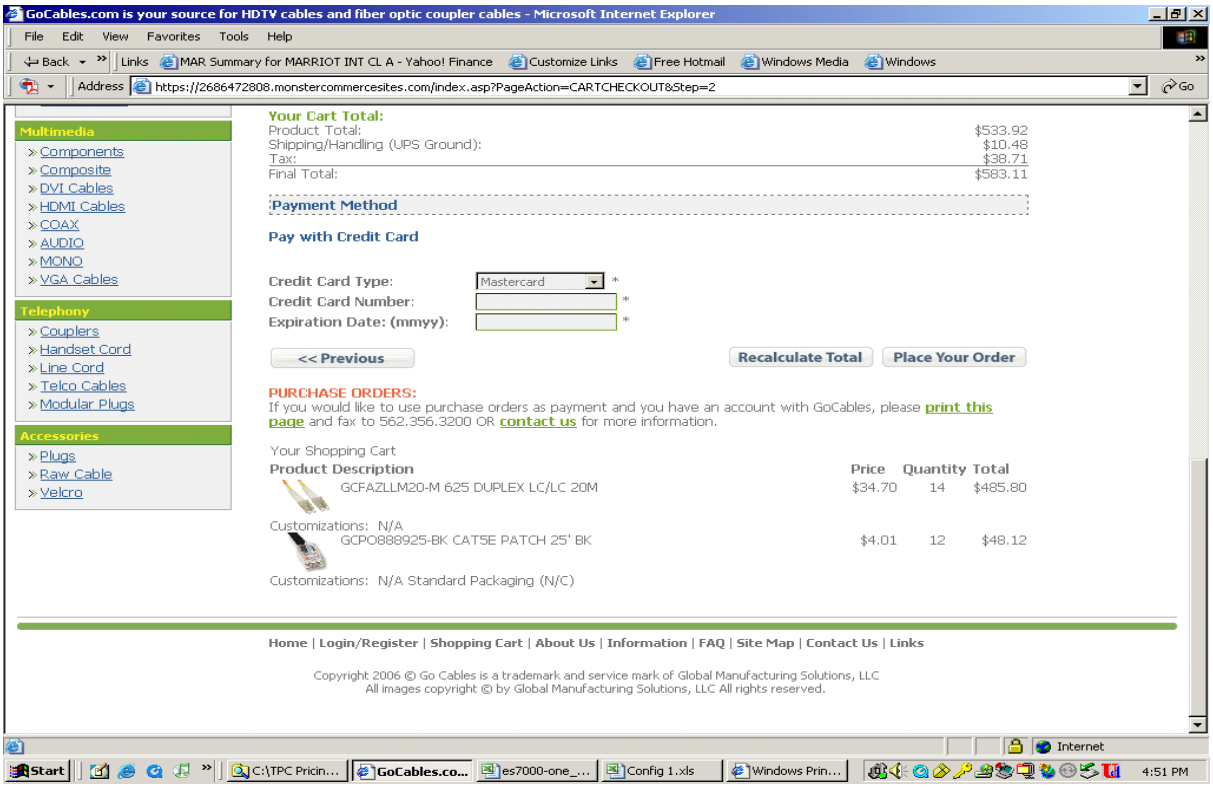
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Shipping/Handling (UPS Ground): $10.48
Tax: $38.71
Final Total: $583.11
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Credit Card Type: Mastercard
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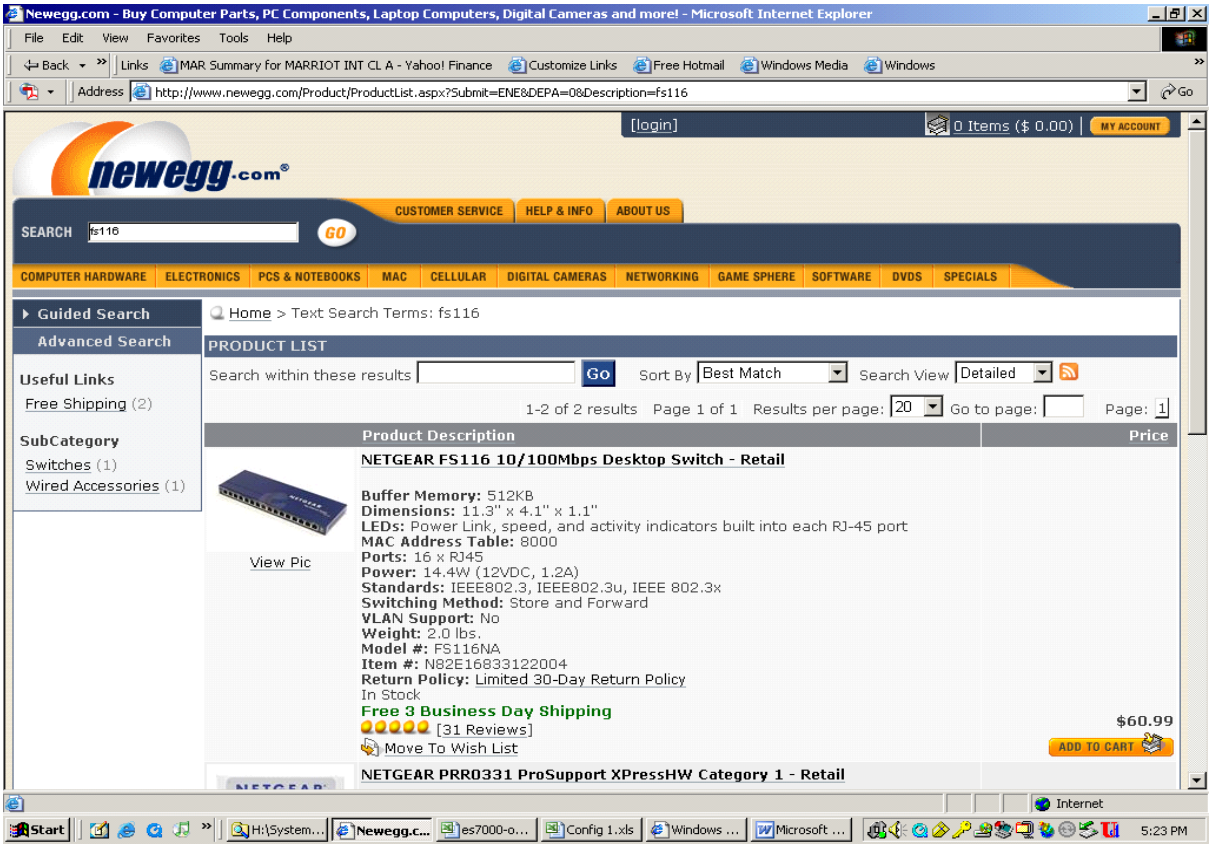
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Guided Search
Advanced Search
Useful Links
Free Shipping (2)
SubCategory
Switches (1)
Wired Accessories (1)
Home > Text Search Terms: fs116
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Product Description
Price
NETGEAR FS116 10/100Mbps Desktop Switch - Retail
View Pic
Buffer Memory: 512KB
Dimensions: 11.3" x 4.1" x 1.1"
LEDs: Power Link, speed, and activity indicators built into each RJ-45 port
MAC Address Table: 8000
Ports: 16 x RJ45
Power: 14.4W (12VDC, 1.2A)
Standards: IEEE802.3, IEEE802.3u, IEEE 802.3x
Switching Method: Store and Forward
VLAN Support: No
Weight: 2.0 lbs.
Model #: FS116NA
Item #: N82E16833122004
Return Policy: Limited 30-Day Return Policy
In Stock
Free 3 Business Day Shipping
[31 Reviews]
Move To Wish List
$60.99
ADD TO CART
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Internet
Start
H:\System...
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es7000-o...
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