



**TPC Benchmark™ E**  
**Full Disclosure Report**

**INSPUR® NF520D2**

**using**

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

**and**

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

**TPC-E Version 1.5.1**

**Submitted for Review**  
**August 29 2008**

**INSPUR Group**

## **First Edition – August 2008**

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# Abstract

Inspur Group conducted the TPC Benchmark <sup>TM</sup> E on the INSPUR NF520D2 configured as a client/server system with attached SANbloc S50. This report documents the full disclosure information required by the TPC-E Standard Specification, Revision 1.5.1, including the methodology used to achieve the reported results. All testing fully complied with this revision level.

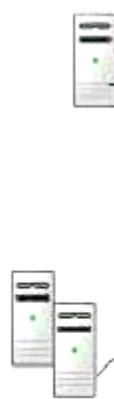
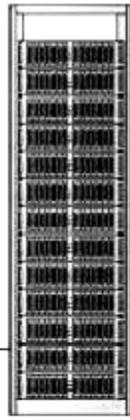
The software used on the Inspur NF520D2 system includes Microsoft Windows Server 2008 Enterprise x64 Edition operating system and Microsoft SQL Server 2008 Enterprise x64 Edition.

Standard metrics, transactions per second-E (tpsE), price per tpsE (\$/tpsE) and Availability Date, are reported as required by the TPC Benchmark E Standard Specification.

The benchmark results are summarized in the following table.

<b>Hardware</b>	<b>Software</b>	<b>Total System Cost</b>	<b>tpsE</b>	<b>\$ CNY /tpsE</b>	<b>Total Solution Availability Date</b>
<b>Inspur NF520D2</b>	<b>Microsoft SQL Server 2008 Enterprise x64 Edition</b> <b>Microsoft Windows Server 2008 Enterprise x64 Edition</b>	<b>¥3,353,791</b>	<b>702.90</b>	<b>¥4771.37</b>	<b>November 30, 2008</b>

The benchmark implementation and results were audited by Performance Metrics Inc. (<http://www.perfmetrics.com>). The auditor's attestation letter is contained in Section 9 of this report.

	<b>Inspur NF520D2</b> <b>Microsoft SQL Server 2008</b>		TPC-E Revision 1.5.1 TPC Pricing 1.3.0
			Report Date: August 29, 2008
TPC-E Throughput <b>702.90 tpsE</b>	Price/Performance <b>¥ 4771.37</b> <b>CNY per tpsE</b>	Availability Date <b>November 30, 2008</b>	Total System Cost <b>¥ 3,353,791 CNY</b>
<b>Database Server Configuration</b>			
Operating System <b>Microsoft Windows Server 2008 Enterprise x64 Edition</b>	Database Manager <b>Microsoft SQL Server 2008 Enterprise x64 Edition</b>	Processors/Cores/Threads <b>4/24/24</b>	Memory <b>128GB</b>
<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><b>Driver</b></p>  <p><b>Tier A client</b></p> <p>2 x Inspur NF280D Each contains : 2 x Intel Xeon E5410 Processor 2.33GHz ( 1 Processor , 4cores , 4 Theads ) 4GB of Memory 2 x 73GB SAS Drive ( raid-1 for OS , Onboard RAID Controller , Onboard Dual-Port Gigabit Ethernet Controller )</p> </div> <div style="text-align: center;"> <p><b>Cisco Switch</b></p>  <p><b>Tier B Server</b></p> <p>Inspur NF520D2 4 x Intel X7460 Processor 2.67GHz ( 1 Processor , 6cores,6 Theads ) 128GB of Memory 2 x 73GB SAS Drive ( raid-1 for OS , Onboard RAID Controller , Onboard Dual-Port Gigabit Ethernet Controller ) , 4 x LSI8888ELp SAS HBA</p> </div> <div style="text-align: center;"> <p><b>Storage</b></p>  <p>29 x Adaptec SANbloc S50 JBOD each contains: 12 x 73GB/146GB 15k rpm SAS driver (Total of 348 Drives Arrayed as: 1 x 12-Disk(146GB) RAID-1, 28 x 12-Disk(73GB) RAID-5)</p> </div> </div> <p style="text-align: center;">Ethernet Cables</p> <p style="text-align: center;">sas Cables</p>			
Initial Database Size <b>3,194.26 GB</b>	Redundancy Level: 1 <b>RAID-1 Log + RAID-5 Data</b>		Storage <b>336 x 73 GB 15K</b> <b>12 x 146 GB 15K</b>



# INSPUR NF520D2 Microsoft SQL Server 2008

TPC-E Revision 1.5.1  
TPC Pricing Spec 1.3.0

Report Date:  
August 29, 2008

Availability Date:  
November 30, 2008

Description	Part Number	Price Source	Unit Price	Qty	Extended Price	3 yr.Maint. Price
<b>Server Hardware</b>						
Inspur NF520D2 (4 x Intel X7460 Processor(2.67GHz), 128GB memory (32 x 4GB), Integrated RAID Controller, Onboard Dual-Port Gigabit Ethernet Controller, 2 x 73GB SAS driver ) plus ServicePac for 3-year 24 x 7 suport)	SNF5202DR111	1*	331,003	1	331,003	
LSI Logic MegaRAID 8888ELP, Dual-Port	SUN117	1	7,600	4	30,400	
mSASx4 to SASx4 4m external Cable	SUN404	1	300	8	2,400	
LSI MegaRAID 8888ELP Battery IBBU05	SUN405	1	2,100	1	2,100	
				Subtotal	¥ 365,903	
<b>Server Storage</b>						
Adaptec SANbloc s50 JBOD plus ServicePac for 3-year 24 x 7 suport	AS50JPR	1	50,920	29	1,476,680	
73GB SAS drive	BSA006	1	1,860	370	688,200	
146GB SAS drive	BSA007	1	2,304	14	32,256	
				Subtotal	¥ 2,197,136	
<b>Server Software</b>						
SQL Server 2008 Enterprise x64 Edition	BGL108	1	160,978	4	643,912	
Windows Server 2008 Enterprise x64 server	BGL109	1	15,870	1	15,870	
Microsoft Problem Resolution Services	BGL110	1	1,683	1	1,683	
				Subtotal	¥ 661,465	
<b>Client Hardware</b>						
Inspur NF280D (2 x Intel Xeon E5410 (2.33GHz), 4GB memory (2 x 2GB),2 x 73GB SAS driver, Integrated RAID Controller, Onboard Dual-Port Gigabit Ethernet Controller, plus ServicePac for 3-year 24 x 7 suport)	SNF2805PR734	1	26,740	2	53,480	
				Subtotal	¥ 53,480	
<b>Client Software</b>						
Windows Server 2008 Standard x64 Edition	BGL111	1	4,885	2	9,770	
				Subtotal	¥ 9,770	
<b>Infrastructure</b>						
Cisco Switch 4948	AS60EPR	1	65,967	1	65,967	
Ethernet Cables (2 spares)	SUN407	1	10	7	70	
				Subtotal	¥ 66,037	
				Total	¥ 3,353,791	
Note: Note1:* This component is not immediately orderable. See the FDR for more information. Note2: Price Source: 1=Inspur Note3: Order method: 800-860-6708 or 86 0531-85105430				Three-Year Cost of Ownership CNY: ¥ 3,353,791  TPC-E Throughput: 702.90 tpsE  ¥CNY/tpsE: ¥ 4771.37		

Audited by Lorna Livingtree, 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 permitted. Special prices based on assumptions about past or future purchase are not permitted. All discounts reflect standard pricing policies for the list components. For complete details, see the pricing sections of the TPC benchmark specifications. If you find that the stated prices are not available according to these items, please inform the TPC at pricing@tpc.org



**INSPUR NF520D2  
Microsoft SQL Server 2008**

TPC-E Revision 1.5.1  
TPC Pricing Spec 1.3.0

Report Date:  
August 29, 2008

Availability Date:  
November 30, 2008

<b>Reported Throughput: 702.90 tpsE</b>		<b>Configured Customers: 360,000</b>		
<b>Response Time (in seconds)</b>	<b>Minimum</b>	<b>Average</b>	<b>90<sup>th</sup> %-tile</b>	<b>Maximum</b>
Broker Volume	0.00	0.08	0.23	0.61
Customer Position	0.00	0.03	0.06	8.60
Market Feed	0.00	0.04	0.08	14.52
Market Watch	0.00	0.02	0.05	0.73
Security Detail	0.00	0.01	0.03	0.90
Trade Lookup	0.00	0.76	1.03	1.75
Trade Order	0.00	0.09	0.15	14.30
Trade Result	0.00	0.08	0.16	2.44
Trade Status	0.00	0.03	0.05	0.66
Trade Update	0.01	0.89	1.10	1.72
Data Maintenance	0.01	0.17	N/A	2.38
<b>Transaction Mix</b>		<b>Transaction count</b>		<b>Mix%</b>
Broker Volume		2,479,885		4.900
Customer Position		6,579,615		13.000
Market Feed		506,097		1.000
Market Watch		9,110,287		18.000
Security Detail		7,085,793		14.000
Trade Lookup		4,048,669		7.999
Trade Order		5,111,706		10.100
Trade Result		5,060,939		10.000
Trade Status		9,616,605		19.001
Trade Update		1,012,144		2.000
Data Maintenance		120		N/A
<b>Test Duration and Timings</b>				
Ramp-up Time			0:46:00	
Measurement Interval			2:00:00	
Business Recovery Time			04:13:54	
Total Number of Transactions Completed in Measurement Interval			50,611,740	

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# Clause 0 – Preface

## Introduction

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

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

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

## Goal of the TPC-E Benchmark

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

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

The benchmark defines:

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

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

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

the associated price-per-tpsE, and the **Availability Date** of the **Priced Configuration** (See Clause 6.7.3 for more detail).

Although this specification defines the implementation in terms of a relational data model, the database may be implemented using any commercially available **Database Management System (DBMS)**, **Database Server**, file system, or other data repository that provides a functionally equivalent implementation. The terms "table", "row", and "column" are used in this document only as examples of logical data structures.

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

### **Restrictions and Limitations**

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

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

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

# Clause 1 – Introduction

## Benchmark Sponsor

*A statement identifying the benchmark Sponsor(s) and other participating companies must be reported.*

This benchmark was sponsored by Inspur Group.

## Configuration Diagrams

*Diagrams of both the measured and priced configurations must be reported, accompanied by a description of the differences. A description of the steps taken to configure all of the hardware and software must be reported.*

There's no difference between the measured and priced configurations. The priced configuration is as same as measured configuration.

The configuration diagrams for the measured and priced system are provided on the following pages.

The TPC-E Driver used for these TPC Benchmark E tests is a Microsoft proprietary Driver. The Driver software needed to implement the Driving & Reporting is run on an INSPUR NF280D machine that is not part of the SUT. The Driver communicates with Tier A over an Ethernet network using the Driver machine's onboard 1Gb Ethernet card.

Tier A is on two Inspur NF280D servers, each with two Quad-Core Intel® Xeon® Processor E5410 (2.33GHz with 12MB L2 Cache), 4GB of memory, two internal 73GB SAS drives in a RAID-1 array for the operating system, which is Microsoft Windows Server 2008 Standard x64 Edition. Tier A communicates with Tier B and the Driver over an Ethernet network using the Inspur NF280D's onboard 1Gb Ethernet card.

Tier B is on an Inspur NF520D2. The NF520D2 has:

- Four Intel Processor X7460 (2.67GHz with 9MB L2 Cache)
- 128GB of memory
- Two 73GB 15K rpm 2.5" SAS internal drives in a RAID-1 array for the operating system, which is Microsoft Windows Server 2008 Enterprise x64 Edition with Microsoft SQL Server 2008 Enterprise x64 Edition
- Four LSI 8888ELP SAS HBA
- Onboard 1Gb Ethernet card.

Each LSI 8888ELP SAS HBA for INSPUR NF520D2 has two SAS cable connection. One of the cables is connected to only one Adaptec JBOD. Each of other server cables from the HBAs is connected to four cascaded Adaptec JBOD.

Each Adaptec JBOD has twelve 15Krpm SAS drives. One JBOD's drives are 146GB and others are 73GB. The 348 drives are organized as:

- One 12-disk(146GB) RAID-1 array for the database log
- Twenty-eight 12-disk(73GB) RAID-5 arrays for the database data

Each array is seen as one LUN by the operating system on the NF520D2. In Windows Disk Manager each of the LUNs from the RAID-5 arrays is configured to have a RAW partition for the big tables (CASH\_TRANSACTION, HOLDING, HOLDING\_SUMMARY, SETTLEMENT, TRADE, TRADE\_HISTORY, TRADE\_REQUEST) and another RAW partition for all the other TPC-E tables. The rest of the space on the LUN is an NTFS partition used for DB backups or the temp DB, or is not used at all.

Tier B communicates with Tier A over an Ethernet network using onboard Dual-port Ethernet card. One Ethernet cable comes out of on port and runs to a Cisco Ethernet switch that also has the Ethernet cables from the Tier A and Driver machines.

# Measured and Priced Configuration

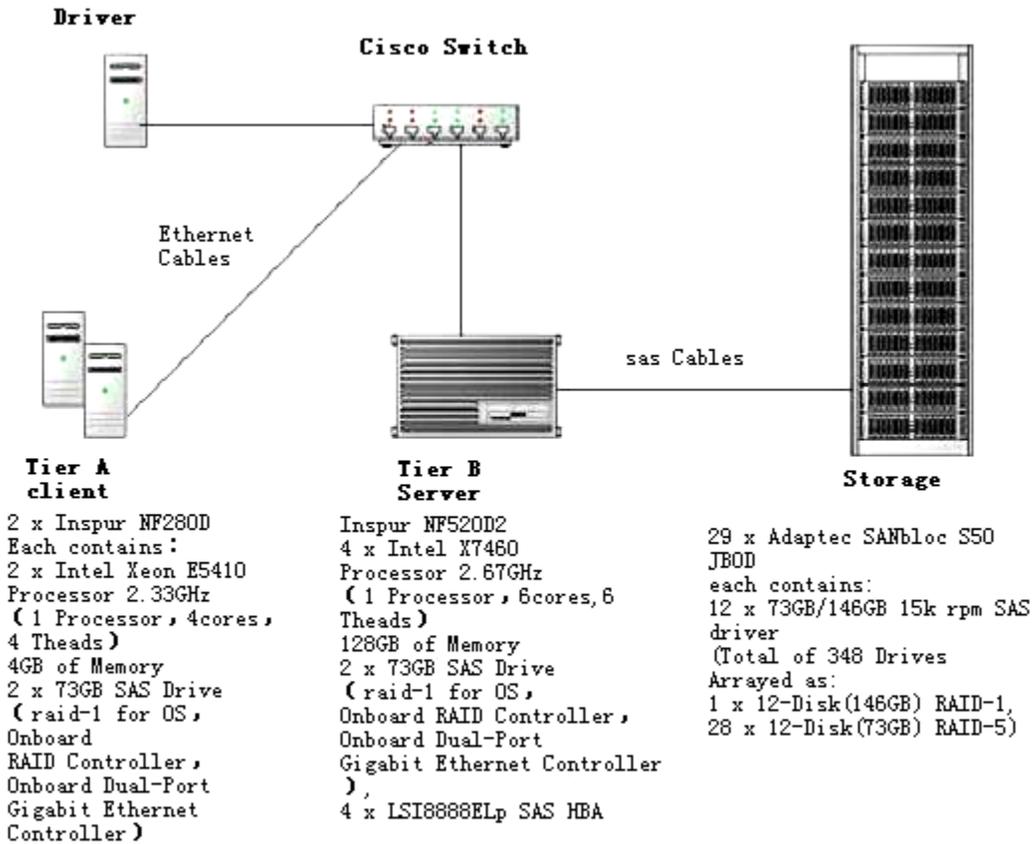


Figure 1-1 Measured Configuration

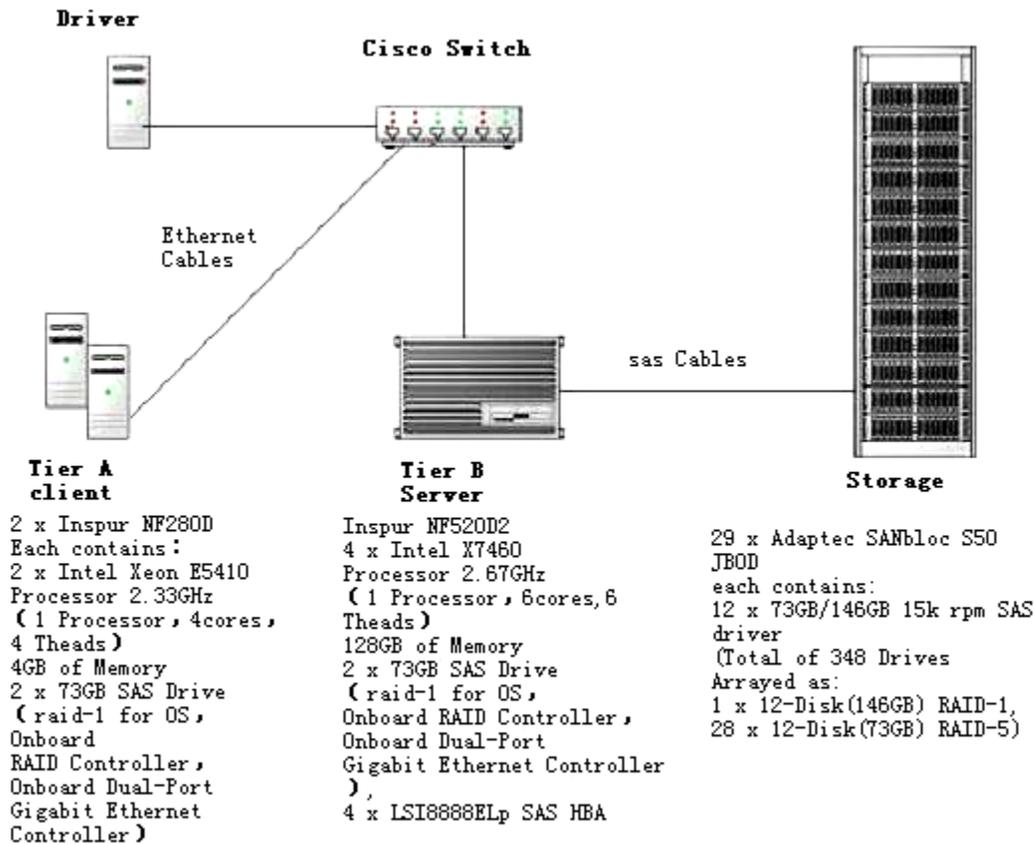


Figure 1-2 Priced Configuration

## Hardware and Software Configuration

A description of the steps taken to configure all the hardware must be **reported in the Report**.  
A description of the steps taken to configure all the software must be **reported in the Report**.

### Driver

The Driver is not part of the priced configuration/System Under Test. For this result an INSPUR NF280D machine running Microsoft Windows Server 2008 Standard x64 Edition was used. The Microsoft Benchcraft proprietary driver was installed on the machine. An Ethernet cable was run from the machine's onboard Ethernet controller to the Cisco switch. The driver machine was configured with an IP address of 192.168.0.70.

### Tier A – Inspur NF280D

The Inspur NF280D has two Quad-Core Intel Xeon E5410 Processors and 4GB of memory. Power on the Inspur NF280D.

- Install Windows Server 2008 Standard Edition
  1. As Bench machine doesn't have DVD drive, using the dvd drive from SUT-DB for the OS installation.
  2. Restart machine.
  3. Put "Windows Server 2008 RTM" DVD into the disc drive to boot into the installation procedure.
  4. Ignore the license input, and uncheck the automatical registration option.
  5. Choose the drive to install.
  6. Choose "Windows Server 2008 Standard Edition (Full installation)"
  7. Follow instructions to start installation.
  8. When installation is done, the NF280D will be restarted.
- Configure OS

1. The first time enter into Windows Server 2008 will be requested to change password, set password as “tpce.2008”
  2. The “Initial Configuration Tasks” window is displayed. On the Date and Time tab set the Time Zone to GMT+08:00 Eastern Time (Beijing) [OK]
  3. Switch to classic style,Right click on “Start” menu and choose “properties” item.In “Start menu” tab, choose “Classic start menu” and click “OK”.
  4. Computer description, set one computer name as “tpce-client-1”,another computer name as “tpce-client-2”.A message is displayed that says the server must be restarted for the change to take effect so save open files. [OK]. Still in “System Properties” “Computer Name” tab click the “Advanced” tab.
  5. Configure networking –Right click “Local Area Connection” – Properties – Select “Internet Protocol Version 4 (TCP/IP.4) – [Properties], Check the radio button “Use the following IP address” enter IP address 192.168.0.71 with a subnet mask of 255.255.255.0 for tpce-client-1. [OK] . And 192.168.0.72 for tpce-client-2 .
  6. In the System Properties Window change from the “Advanced” tab to the “Remote” tab.Check the radio button to “Allow connections from computers running any version of Remote Desktop”.A warning about enabling Remote Desk making the server less secure is displayed. [OK] [Close]. A message saying the computer must be restarted to apply these change is displayed. [Restart later]
  7. Back in Initial Configuration Tasks window. “2 Update This Server” – “Enable automatic updating and feedback – [Manually configure settings]– Windows automatic updating [Change Setting...] – check the radio button for “Never check fo updates” – [OK]
  8. Customer Experience Improvement Program – check the button “No, I don’t want to participate” – [OK] [Close]
  9. Download and install updates – leave as no checking for updates
  10. Right click “My Computer” – Properties – Advanced – Environment Variables – User variables for Administrator – New.... – variable name[ TPCE\_KIT\_DIR], variable value[C:\MSTPCE.1.5.1-1009] – [ok][close].
  11. Windows Firewall – Change settings – Advanced tabe – Network Connections – uncheck. General tab – check the button “Off” – [Apply] [OK]
  12. gpedit.msc (Global Policy Manager) – Computer Configuration – Windows Settings – Security Settings – Account Policies – Password Policy – Password must meet complexity requirements – disable – Maximum Password age – change from 42 to 0 which means your password never expires.
  13. Enable autologon,Run control userpasswords2,Uncheck the "Users must enter a user name and password to use this computer" ,press Ctrl+Shift+A,input user Name,Password
  14. Personal Settings – Screen Saver – Screen Save – (none).
  15. Edit c:\windows\system32\drivers\etc\hosts, add one line as below “192.168.0.80 tpce-dtn” on “tpce-client-1” and “192.168.0.81 tpce-dtn” on “tpce-client-2”, then save it.
- Install Microsoft SQL Server 2008 RC0
    1. Put “Microsoft SQL Server 2008 RC0” DVD into the disc drive.
    2. Firstly, installer will request to install .Net 3.5 and windows installer 4.5.
    3. Follow instruction to set each step.
    4. In the component selection, choose “Client Connectivity” and “Management Studio”
  - Install BenchCraft
    1. Navigate to “C:\MSTPCE.1.5.1-1009\BenchCraft”, double click “BenchcraftSetup.msi” ,choose “Benchcraft Slave” only.
    2. Navigate to “C:\MSTPCE.1.5.1-1009\VS\_Modules” and run “vcredist\_x86.exe”.

## Storage Configuration

Documentation on how to configure the RAID can be obtained online:

### RAID Configuration

#### MegaRAID SAS 8888 ELP: Installation

[http://www.lsi.com/files/docs/techdocs/storage\\_stand\\_prod/sas/mr\\_sas\\_ug.pdf](http://www.lsi.com/files/docs/techdocs/storage_stand_prod/sas/mr_sas_ug.pdf)

#### MegaRAID SAS 8888 ELP: Configuration

## Storage Enclosure Configuration

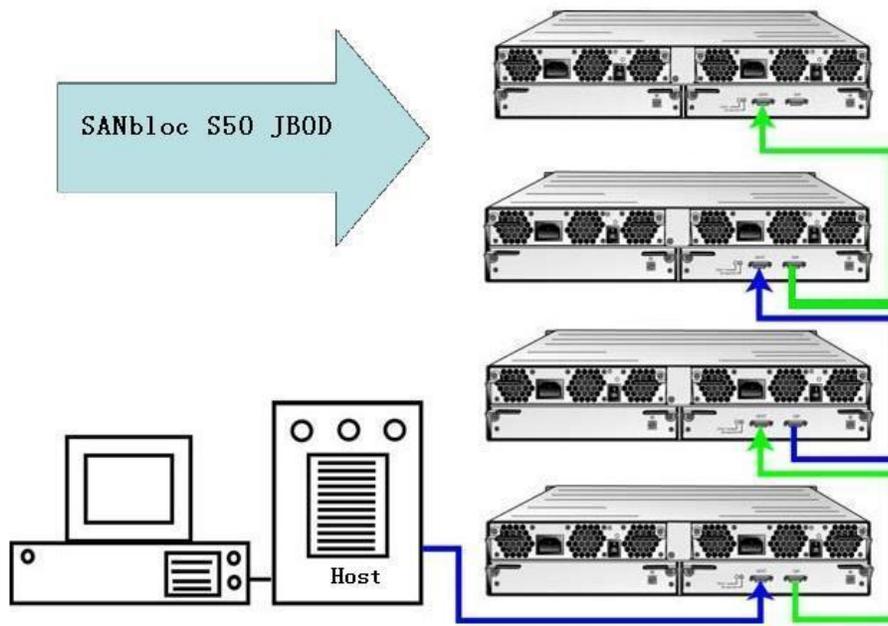
Documentation on how to configure the SA2120 JBOD can be obtained in supporting files :

### SANbloc S50 JBOD: Installation

[http://download.adaptec.com/pdfs/quick\\_start\\_guides/sanbloc\\_S50\\_jbod\\_qsg.pdf](http://download.adaptec.com/pdfs/quick_start_guides/sanbloc_S50_jbod_qsg.pdf)

### SANbloc S50 JBOD: Configuration

[http://download.adaptec.com/pdfs/user\\_guides/sanbloc\\_S50\\_jbod\\_ug.pdf](http://download.adaptec.com/pdfs/user_guides/sanbloc_S50_jbod_ug.pdf)



**Figure 1-3. SANbloc S50 JBOD cascaded cabling diagram**

Start the MegaRAID Storage Manager on the NF520D2 and discover all the devices. In MegaRAID Storage Manager do the following:

1. Doubleclick the MegaRAID Storage Manager icon.
2. Create one 12-driver(146GB) RAID-1 arrays for database log. Twenty-eight 12-drive(73GB) RAID-5 arrays for the database data.
3. The key RAID-5 arrays configuration:  
cache I/O [direct], Write Policy [ write through ], Stripe size [ 64KB ]
4. The key RAID-1 arrays configuration:  
cache I/O [direct], Write Policy [ write back ], Stripe size [ 64KB ]

## Tier B - INSPUR NF520D2

### ➤ BIOS settings

Press F2 while the NF520D2 is going through POST. This causes the server to drop into BIOS Setup. In BIOS Setup change the following from their default values:

1. Set the correct date and time.
2. Advanced– Processor Configuration– make sure all items Disable.

3. Advanced– Memory Configuration– Memory RAS and Performance Configuration– FSB High Bandwidth Optimization [ Enable ]
4. Press <F10> to save the BIOS change and restart NF520D2.

➤ **Install Windows Server 2008 Enterprise Edition**

Put the Microsoft Windows Server 2008 Enterprise x64 Edition DVD in the NF520D2's DVD/CDROM drive. Boot the NF520D2 from the DVD.

1. Select Boot section 0
2. Language to install – English
3. Time and currency format – English (United States)
4. Keyboard or input method – U.S. [Next]
5. [Install Now]
6. Enter Product Key
7. Deselect “Automatically activate Windows when I’m online.” [Next]
8. Windows Server 2008 Enterprise (Full Installation) x64 [Next]
9. Check “I accept the license terms” [Next]
10. Custom (advanced) install not upgrade
11. Where do you want to install Windows?
12. Disk 0 Unallocated Space 67GB
13. Disk 0 Partition 1 67GB Primary [ Next ]
14. Installing Windows... Your computer will restart several times during installation.
15. Before the first reboot remove the DVD. There are two reboots.

➤ **Configure OS**

1. The first time enter into Windows Server 2008 will be requested to change password, set password as “tpce.2008”
2. The “Initial Configuration Tasks” window is displayed. On the Date and Time tab set the Time Zone to GMT+08:00 Eastern Time (Beijing) [OK]
3. Switch to classic style, Right click on “Start” menu and choose “properties” item. In “Start menu” tab, choose “Classic start menu” and click “OK”.
4. Configure networking – Right click “Local Area Connection” – Properties – Select “Internet Protocol Version 4 (TCP/IP.4) – [Properties], Check the radio button “Use the following IP address” enter IP address 192.168.0.80, another port 192.168.0.81 with a subnet mask of 255.255.255.0 [OK]
5. Computer description, set computer name as “tpce-dtn”. A message is displayed that says the server must be restarted for the change to take effect so save open files. [OK].
6. After reboot, Still in “System Properties” “Computer Name” tab click the “Advanced” tab.
7. On the “Advanced” tab - Performance – [Settings...] – Visual Effects tab – check radio button for “Adjust for best performance”. On the “Advanced” leave the radio button for programs checked.
8. Startup and Recovery – [Settings...] – change the time to display a list of operating systems to 10 seconds instead of the default 30 seconds. In the System Failure section uncheck “Automatically restart”. Change “Write debugging information” to “(none)”. [OK]
9. In the System Properties Window change from the “Advanced” tab to the “Remote” tab. Check the radio button to “Allow connections from computers running any version of Remote Desktop”. A warning about enabling Remote Desk making the server less secure is displayed. [OK] [Close]. A message saying the computer must be restarted to apply these change is displayed. [Restart later]
10. Back in Initial Configuration Tasks window. “2 Update This Server” – “Enable automatic updating and feedback – [Manually configure settings]– Windows automatic updating [Change Setting...] – check the radio button for “Never check for updates” – [OK]
11. Windows Error Reporting – [Change Setting...] – check the button “I don’t want to participate, and don’t ask me again” – [OK]
12. Customer Experience Improvement Program – check the button “No, I don’t want to participate” – [OK] [Close]
13. Download and install updates – leave as no checking for updates

14. Right click “My Computer” – Properties – Advanced – Environment Variables – User variables for Administrator – New.... – variable name[ TPCE\_KIT\_DIR], variable value[C:\MSTPCE.1.5.1-1009] – [ok][close].
15. Windows Firewall – Change settings – Advanced tabe – Network Connections – uncheck. General tab – check the button “Off” – [Apply] [OK]
16. gpedit.msc (Global Policy Manager) – Computer Configuration – Windows Settings – Security Settings – Account Policies – Password Policy – Password must meet complexity requirements – disable – Maximum Password age – change from 42 to 0 which means your password never expires.
17. Still in gpedit.msc – Computer Configuration – Administrative Templates – System – right panel – Display shutdown event tracker – disable
18. Still in gpedit.msc – Computer Configuration – Windows Setting – Security Settings – Local Policies – User rights assignment – lock pages in memory add Administrators group.
19. Back on the initial settings page – check “do not show again”
20. Personal Settings – Screen Saver – Screen Save – (none) – Change power settings... - select the “High Performance” power plan – Choose when to turn off the display – Never – [Save Changes]
21. Regedit – HKLM\SYSTEM\CurrentControlSet\Services\TPCIP\Parameters – added DWORD MaxUserPort 40000 decimal
22. Enable autologon,Run control userpasswords2,Uncheck the "Users must enter a user name and password to use this computer" ,press Ctrl+Shift+A,input user Name,Password
23. Run regedit and set the keys below:  
 [HKEY\_LOCAL\_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sqlservr.exe] "UseLargePages"=dword:00000001  
 [HKEY\_LOCAL\_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sqlservr.exe] "UseLargePages"=dword:00000001

### ➤ **SQL Server 2008 Installation**

Install Microsoft SQL Server 2008 Enterprise x64 Edition.

1. Install – Server components, tools, Book online and samples
2. SQL Server 2008 Setup – accept the license terms [Next]
3. Setup Support Files [Install]
4. SQL Server Installation Center – New Installation – System Configuration Check – Execution completed – Passed: 7 Failed: 0, Warning 0 Skipped 0 [Next]
5. Feature Selection – check Database Engine Services
6. Shared Features – check Client Tools and SQL Server Book online [Next]
7. Instance Configuration – check Default instance, MSSQLServer, C:\Program Files\Microsoft SQL Server [Next]
8. Service Accounts – SQL Server Agent left as manual, change SQL Server (MSSQL..) from automatic to manual, change SQL Server Browser from Disabled to Manual, picked Administrator as the account and applied it to all [Next]
9. Collation – check Windows Collation designator and sort order, Collation designation – Latin1\_General, check Binary sort order [OK]
10. Database Engine Configuration – Account Provisioning tab – check Mixed Mode, Built-in SQL Server system administrator account, enter sa password and confirm the password. Specify SQL Server administrators – [Add Current User] – IBMSERVA\Administrator
11. Left the defaults on Data Directories and FILESTREAMING tabs [Next]
12. Error and Usage Reporting – uncheck “Send error reports to Microsoft or your corporate report server” and “Send anonymous feature usage data to Microsoft”, [Next]
13. Ready to Install [Next]
14. Shows progress, when finished [Next]
15. Installation complete so [Close]

### ➤ **Connect NF520D2 to External Storage**

Power off the NF520D2.

1. Install LSI 8888ELP SAS Dual-Port PCI-E HBA in PCI-E slots.
2. Run a 3Gb SAS cable from each LSI 8888ELP Dual-Port PCI-E HBA to a Adaptec JBOD. Each 8888ELP controller has two external ports. So there are 8 ports in total. One port is connected to only one Adaptec

JBOD which contains database log. And each of other 7 external ports are connected to four cascaded JOBDs.

Power on the NF520D2. Download MegaRAID Storage Manager and the latest firmware and drivers for LSI 8888ELP SAS HBA from www.lsi.com. Install MegaRAID Storage Manager on the NF520D2, use MegaCLI to update the firmware on each HBA. Open Device Manager and under the Storage Controllers find the HBAs. Update the driver for each HBA. Reboot the NF520D2.

### ➤ **Mount Points and Disk Partitions**

1. In a command window, create mount points:  
Run c-mp.cmd (c-mp.cmd provided in the SupportingFiles)
2. Open Windows Disk Manager.
3. If the Wizard prompts you to initialize disks, do so; don't upgrade the disks.
4. From a command prompt, run diskpart.exe /s c-part-init.out (c-part-init.out provided in the SupportingFiles).
5. From a command prompt, run formats.cmd (formats.cmd provided in the SupportingFiles).
6. Close Windows Disk Manager: the disk partitions for the database have been created.

### ➤ **SQL Server configuration**

Start Microsoft SQL Server from the command line using sqlservr -c -x.

Run runconfig.sql to set the SQL Server sp\_configure settings (the file is included in the SupportingFiles). Run tempdb.sql to increase the size of the temporary database, which is used during database load (the file is included in the SupportingFiles). After database load, run tempdb-ext.sql to extend tempdb (the file is included in the SupportingFiles).

### ➤ **SQL Server softNUMA configuration**

1. To do so edit the registry:
  - HKEY\_LOCAL\_MACHINE\SOFTWARE\Microsoft\Microsoft SQLServer\100\NodeConfiguration
  - Add keys named "Node0", "Node1", "Node2", "Node3".
  - Under each of those keys, add a DWORD value called "CPUMask" and set it to the CPU mask of the node.
    - . Node0 -> CPUMask = dword:0000003F
    - . Node1 -> CPUMask = dword:00000FC0
    - . Node2 -> CPUMask = dword:0003F000
    - . Node3 -> CPUMask = dword:00FC0000
2. Now configure the TCP/IP ports so that one listens for each softNUMA node
  - Open the SQL Server Configuration Manager
  - Expand the SQL Server Network Configuration
  - Select "Protocols for MSSQLSERVER"
  - Shared Memory and TCP/IP should be enabled; the rest disabled
  - Open TCP/IP, Protocol tab
    - . Enabled = yes
    - . KeepAlive = 30000
    - . Listen All = Yes
  - IP Addresses Tab
    - . IPx(IP1,IP2,IP3,etc.)shouldallbedisabled(theyareonlyused ifListenAll=No)
    - . IPAll tab
      - TCPPort.Thisiswhereyousestheport->softNUMA nodeaffinities.Inthisbenchmarkweuse1433,2001[0x1],2002[0x2],2003[0x4],2004[0x8]

## Clause 2 –Database Design, Scaling and Population

### Database Creation and Table Definitions

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

Create a folder 360000.cust\database. In the folder, create a create\_database.sql script to create a TPC-E database with two filegroups. One filegroup called big\_fg for the big size TPC-E tables and the other filegroup called small\_fg for all the other TPC-E tables. Big\_fg uses all the c:\tpce\b\* disk partitions. small\_fg uses all the c:\tpce\s\* disk partitions. The database log is on c:\tpce\tpcelog. Modify the files provided by Microsoft:

- Create\_Tables\_Fixed.sql
- Create\_Tables\_Scaling\_Flat.sql
- Create\_Tables\_Growing.sql
- Create\_Clustered\_Indexes\_Fixed.sql
- Create\_Clustered\_Indexes\_Scaling.sql
- Create\_Clustered\_Indexes\_Growing.sql
- Create\_NC\_Indexes\_Fixed.sql
- Create\_NC\_Indexes\_Scaling.sql
- Create\_NC\_Indexes\_Growing.sql
- Create\_TID\_Ranges\_Table.sql

Run the Microsoft file TPCE\_Setup.cmd to start the database load (the file is included in the supportingFiles). When prompted, fill in 360000 for the number of customers to be loaded. TPCE\_Setup.cmd calls files that are included in the SupportingFiles to create and load the TPC-E database.

### Database Physical Organization

*The physical organization of tables and indexes within the database must be reported in the Report.*

Physical space was allocated to Microsoft SQL Server 2008 on the server disks as detailed in Table 2-2.

### Horizontal/Vertical Partitioning

*While there are few restrictions placed upon horizontal or vertical partitioning of tables and rows in the PC-E benchmark, any such partitioning must be reported.*

Partitioning was not used in this benchmark. However, the TPC-E tables were distributed over multiple disk arrays by SQL Server because the file groups were spread over 28 disk arrays.

### Replication

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

Replication was not used in this benchmark.

## Table Attributes

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

No additional attributes were used in this benchmark.

## 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.

The database was built with 360000 customers. Table 2-1 is on the following page.

Table Name	Rows
ACCOUNT_PERMISSION	2,555,672
ADDRESS	540,004
BROKER	3,600
CASH_TRANSACTION	5,723,149,115
CHARGE	15
COMMISSION_RATE	240
COMPANY	180,000
COMPANY_COMPETITOR	540,000
CUSTOMER	360,000
CUSTOMER_ACCOUNT	1,800,000
CUSTOMER_TAXRATE	720,000
DAILY_MARKET	321,813,000
EXCHANGE	4
FINANCIAL	3,600,000
HOLDING	318,576,550
HOLDING_HISTORY	8,336,913,474
HOLDING_SUMMARY	17,910,923
INDUSTRY	102
LAST_TRADE	246,600
NEWS_ITEM	360,000
NEWS_XREF	360,000
SECTOR	12
SECURITY	246,600
SETTLEMENT	6,220,800,000
STATUS_TYPE	5
TAXRATE	320
TRADE	6,220,800,000
TRADE_HISTORY	14,929,960,797
TRADE_REQUEST	0
TRADE_TYPE	5
WATCH_ITEM	36,004,138

WATCH_LIST	360,000
ZIP_CODE	14,741

**Table 2-1. Initial Cardinality of Table**

## Distribution of Tables and Logs

*The distribution of tables, partitions and logs across all media must be explicitly depicted for the measured and priced configurations.*

The NF520D2 has four LSI 8888ELP SAS Dual-Port HBAs. Four MegaRAID SAS 8888ELP HBA were installed in 4 PCI-e slots and connected to 29 Adaptec JBODs , which can hold 12 disks each. Each LSI 8888ELP controller has two external ports. So there are 8 ports in total. One port is connected to only one Adaptec JBOD which contains database log. And each of other 7 external ports are connected to four casecaed JOBDS. Each LUN had 12 physical drives. The total number of physical drives used for the database was 348 SAS disks. In the measured and priced configuration 12 drives are 146GB 15K rpm 3Gbps SAS drives. Other 336 drives are 73GB 15K rpm 3Gbps SAS drives.

In the measured and priced configuration, the 12-Disk RAID-1 database log array has 146GB 15K rpm 3Gbps SAS drives. The other twenty-eight 12-disk RAID-5 arrays have 73GB 15K rpm 3Gbps SASI drives. Figure 2-2 and Figure 2-3 depict the database configuration of the measured and priced systems to meet the 8-hour steady state requirement.

**Table 2-2. Data Distribution for the Measured Configuration**

Disk #	Controller #	Target #	Drives Enclosure model RAID level	Partition/file system	Size(GB)	Use
0	2A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B0\(\RAW)	236.32	BIG0
				c:\tpce\S0\(\RAW)	25.49	SMALL0
				c:\tpce\backup\k0(NTFS)	475.8	Backup0 Flat_out
1	2A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B1\(\RAW)	236.32	BIG1
				c:\tpce\S1\(\RAW)	25.49	SMALL1
				c:\tpce\backup\k1(NTFS)	475.8	Backup1 Flat_out
2	2A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32	BIG2
				c:\tpce\S2\(\RAW)	25.49	SMALL2
				c:\tpce\backup\k2(NTFS)	475.8	Backup2 Flat_out
3	2A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32	BIG3
				c:\tpce\S2\(\RAW)	25.49	SMALL3
				c:\tpce\backup\k3(NTFS)	475.8	Backup3 Flat_out
4	2B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG4
				c:\tpce\S2\(\RAW)	25.49GB	SMALL4
				c:\tpce\backup\k4(NTFS)	475.80GB	Backup4 Flat_out
5	2B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG5
				c:\tpce\S2\(\RAW)	25.49GB	SMALL5
				c:\tpce\backup\k5(NTFS)	475.80GB	Backup5 Flat_out

6	2B	6	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG6
				c:\tpce\S2\ (RAW)	25.49GB	SMALL6
				c:\tpce\backup\k6(NTFS)	475.80GB	Backup6 Flat_out
7	2B	7	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG7
				c:\tpce\S2\ (RAW)	25.49GB	SMALL7
				c:\tpce\backup\k7(NTFS)	475.80GB	Backup7 Flat_out
8	1	0	12 x 73GB SAS Seagate 15Krpm RAID-10	C: (NTFS)	67.05GB	OS
9	4A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG9
				c:\tpce\S2\ (RAW)	25.49GB	SMALL9
				c:\tpce\backup\k9(NTFS)	475.80GB	Backup9 Flat_out
10	4A	1	12x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG10
				c:\tpce\S2\ (RAW)	25.49GB	SMALL10
				c:\tpce\backup\k10(NTFS)	475.80GB	Backup10 Flat_out
11	4A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG11
				c:\tpce\S2\ (RAW)	25.49GB	SMALL11
				c:\tpce\backup\k11(NTFS)	475.80GB	Backup11 Flat_out
12	4A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG12
				c:\tpce\S2\ (RAW)	25.49GB	SMALL12
				c:\tpce\backup\k12(NTFS)	475.80GB	Backup12 Flat_out
13	4B	4	12 x 73GB SAS SANbloc S50 RAID-10	c:\tpce\tpcelog\ (RAW)	345.15GB	LOG
				U: (NTFS)	470.69GB	TempDB
14	5A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG14
				c:\tpce\S2\ (RAW)	25.49GB	SMALL14
				c:\tpce\backup\k14(NTFS)	475.80GB	Backup14 Flat_out
15	5A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG15
				c:\tpce\S2\ (RAW)	25.49GB	SMALL15
				c:\tpce\backup\k15(NTFS)	475.80GB	Backup15 Flat_out
16	5A	2	12x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG16
				c:\tpce\S2\ (RAW)	25.49GB	SMALL16
				c:\tpce\backup\k16(NTFS)	475.80GB	Backup16 Flat_out
17	5A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG17
				c:\tpce\S2\ (RAW)	25.49GB	SMALL17
				c:\tpce\backup\k17(NTFS)	475.80GB	Backup17 Flat_out
18	5B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG18
				c:\tpce\S2\ (RAW)	25.49GB	SMALL18
				c:\tpce\backup\k18(NTFS)	475.80GB	Backup18 Flat_out
19	5B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG19
				c:\tpce\S2\ (RAW)	25.49GB	SMALL19
				c:\tpce\backup\k19(NTFS)	475.80GB	Backup19 Flat_out
20	5B	6	12 x 73GB SAS	c:\tpce\B2\ (RAW)	236.32GB	BIG20

			SANbloc S50 RAID-5	c:\tpce\S2\RAW	25.49GB	SMALL20
				c:\tpce\backup\k20(NTFS)	475.80GB	Backup20 Flat_out
21	6A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG21
				c:\tpce\S2\RAW	25.49GB	SMALL21
				c:\tpce\backup\k21(NTFS)	475.80GB	Backup21 Flat_out
22	6A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG22
				c:\tpce\S2\RAW	25.49GB	SMALL22
				c:\tpce\backup\k22(NTFS)	475.80GB	Backup22 Flat_out
23	6A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG23
				c:\tpce\S2\RAW	25.49GB	SMALL23
				c:\tpce\backup\k23(NTFS)	475.80GB	Backup23 Flat_out
24	6A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG24
				c:\tpce\S2\RAW	25.49GB	SMALL24
				c:\tpce\backup\k24(NTFS)	475.80GB	Backup24 Flat_out
25	6B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG25
				c:\tpce\S2\RAW	25.49GB	SMALL25
				c:\tpce\backup\k25(NTFS)	475.80GB	Backup25 Flat_out
26	6B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG26
				c:\tpce\S2\RAW	25.49GB	SMALL26
				c:\tpce\backup\k26(NTFS)	475.80GB	Backup26 Flat_out
27	6B	6	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG27
				c:\tpce\S2\RAW	25.49GB	SMALL27
				c:\tpce\backup\k27(NTFS)	475.80GB	Backup27 Flat_out
28	6B	7	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG28
				c:\tpce\S2\RAW	25.49GB	SMALL28
				c:\tpce\backup\k28(NTFS)	475.80GB	Backup28 Flat_out
29	5B	7	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG29
				c:\tpce\S2\RAW	25.49GB	SMALL29
				c:\tpce\backup\k29(NTFS)	475.80GB	Backup29 Flat_out

**Table 2-3. Data Distribution for the Priced Configuration**

Disk #	Controller #	Target #	Drives Enclosure model RAID level	Partition/file system	Size(GB)	Use
0	2A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B0\RAW	236.32	BIG0
				c:\tpce\S0\RAW	25.49	SMALL0
				c:\tpce\backup\k0(NTFS)	475.8	Backup0

						Flat_out
1	2A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B1\ (RAW)	236.32	BIG1
				c:\tpce\S1\ (RAW)	25.49	SMALL1
				c:\tpce\backup\k1 (NTFS)	475.8	Backup1 Flat_out
2	2A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32	BIG2
				c:\tpce\S2\ (RAW)	25.49	SMALL2
				c:\tpce\backup\k2 (NTFS)	475.8	Backup2 Flat_out
3	2A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32	BIG3
				c:\tpce\S2\ (RAW)	25.49	SMALL3
				c:\tpce\backup\k3 (NTFS)	475.8	Backup3 Flat_out
4	2B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG4
				c:\tpce\S2\ (RAW)	25.49GB	SMALL4
				c:\tpce\backup\k4 (NTFS)	475.80GB	Backup4 Flat_out
5	2B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG5
				c:\tpce\S2\ (RAW)	25.49GB	SMALL5
				c:\tpce\backup\k5 (NTFS)	475.80GB	Backup5 Flat_out
6	2B	6	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG6
				c:\tpce\S2\ (RAW)	25.49GB	SMALL6
				c:\tpce\backup\k6 (NTFS)	475.80GB	Backup6 Flat_out
7	2B	7	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG7
				c:\tpce\S2\ (RAW)	25.49GB	SMALL7
				c:\tpce\backup\k7 (NTFS)	475.80GB	Backup7 Flat_out
8	1	0	12 x 73GB SAS Seagate 15Krpm RAID-10	C: (NTFS)	67.05GB	OS
9	4A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG9
				c:\tpce\S2\ (RAW)	25.49GB	SMALL9
				c:\tpce\backup\k9 (NTFS)	475.80GB	Backup9 Flat_out
10	4A	1	12x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG10
				c:\tpce\S2\ (RAW)	25.49GB	SMALL10
				c:\tpce\backup\k10 (NTFS)	475.80GB	Backup10 Flat_out
11	4A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG11
				c:\tpce\S2\ (RAW)	25.49GB	SMALL11
				c:\tpce\backup\k11 (NTFS)	475.80GB	Backup11 Flat_out
12	4A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\ (RAW)	236.32GB	BIG12
				c:\tpce\S2\ (RAW)	25.49GB	SMALL12
				c:\tpce\backup\k12 (NTFS)	475.80GB	Backup12 Flat_out
13	4B	4	12 x 73GB SAS SANbloc S50 RAID-10	c:\tpce\tpcelog\ (RAW)	345.15GB	LOG
				U: (NTFS)	470.69GB	TempDB
14	5A	0	12 x 73GB SAS SANbloc S50	c:\tpce\B2\ (RAW)	236.32GB	BIG14
				c:\tpce\S2\ (RAW)	25.49GB	SMALL14

			RAID-5	c:\tpce\backup\k14(NTFS)	475.80GB	Backup14 Flat_out
15	5A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG15
				c:\tpce\S2\(\RAW)	25.49GB	SMALL15
				c:\tpce\backup\k15(NTFS)	475.80GB	Backup15 Flat_out
16	5A	2	12x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG16
				c:\tpce\S2\(\RAW)	25.49GB	SMALL16
				c:\tpce\backup\k16(NTFS)	475.80GB	Backup16 Flat_out
17	5A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG17
				c:\tpce\S2\(\RAW)	25.49GB	SMALL17
				c:\tpce\backup\k17(NTFS)	475.80GB	Backup17 Flat_out
18	5B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG18
				c:\tpce\S2\(\RAW)	25.49GB	SMALL18
				c:\tpce\backup\k18(NTFS)	475.80GB	Backup18 Flat_out
19	5B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG19
				c:\tpce\S2\(\RAW)	25.49GB	SMALL19
				c:\tpce\backup\k19(NTFS)	475.80GB	Backup19 Flat_out
20	5B	6	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG20
				c:\tpce\S2\(\RAW)	25.49GB	SMALL20
				c:\tpce\backup\k20(NTFS)	475.80GB	Backup20 Flat_out
21	6A	0	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG21
				c:\tpce\S2\(\RAW)	25.49GB	SMALL21
				c:\tpce\backup\k21(NTFS)	475.80GB	Backup21 Flat_out
22	6A	1	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG22
				c:\tpce\S2\(\RAW)	25.49GB	SMALL22
				c:\tpce\backup\k22(NTFS)	475.80GB	Backup22 Flat_out
23	6A	2	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG23
				c:\tpce\S2\(\RAW)	25.49GB	SMALL23
				c:\tpce\backup\k23(NTFS)	475.80GB	Backup23 Flat_out
24	6A	3	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG24
				c:\tpce\S2\(\RAW)	25.49GB	SMALL24
				c:\tpce\backup\k24(NTFS)	475.80GB	Backup24 Flat_out
25	6B	4	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG25
				c:\tpce\S2\(\RAW)	25.49GB	SMALL25
				c:\tpce\backup\k25(NTFS)	475.80GB	Backup25 Flat_out
26	6B	5	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG26
				c:\tpce\S2\(\RAW)	25.49GB	SMALL26
				c:\tpce\backup\k26(NTFS)	475.80GB	Backup26 Flat_out
27	6B	6	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\(\RAW)	236.32GB	BIG27
				c:\tpce\S2\(\RAW)	25.49GB	SMALL27
				c:\tpce\backup\k27(NTFS)	475.80GB	Backup27 Flat_out
28	6B	7	12 x 73GB SAS	c:\tpce\B2\(\RAW)	236.32GB	BIG28

			SANbloc S50 RAID-5	c:\tpce\S2\RAW	25.49GB	SMALL28
				c:\tpce\backup\k28(NTFS)	475.80GB	Backup28 Flat_out
29	5B	7	12 x 73GB SAS SANbloc S50 RAID-5	c:\tpce\B2\RAW	236.32GB	BIG29
				c:\tpce\S2\RAW	25.49GB	SMALL29
				c:\tpce\backup\k29(NTFS)	475.80GB	Backup29 Flat_out

## Database Interface and Model Implemented

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

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

Microsoft SQL Server 2008 Enterprise x64 Edition is a relational database. The interface used was Microsoft SQL Server stored procedures accessed with Remote Procedure Calls embedded in C++ code using the Microsoft ODBC interface.

## Database Load Methodology

The methodology used to load the database must be reported in the **Report**.

The database was loaded using the FlatFiles option on the EGenLoader command line. This direct loads into a Microsoft SQL Server database. A further description is provided in the SupportingFiles in the file MSTPCE Database Setup Reference.pdf.

## **Clause 3 – Transaction Related Items**

### **Vendor-Supplied Code**

*A statement that vendor-supplied code is functionally equivalent to Pseudo-code in the specification (see Clause 3.2.1.5) must be reported.*

The SQL in the stored procedures for the transactions is functionally equivalent to the pseudo-code.

### **Database Footprint of Transactions**

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

The database footprint requirements are met by the stored procedure code for the transactions.

## Clause 4 – SUT, Driver and Network Related Items

### EGen Instances

*The number of EGenDriverMEE and EGenDriverCE instances used in the benchmark must be reported(see Clause 4.1.3).*

A total of 744 EGenDriverCE instances was used in the benchmark. Four EGenDriverMEE instances were used in the benchmark.

### Network Configuration

*The Network configurations of both the measured and priced configurations must be described and reported. 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).*

The Network configurations of both the measured and priced configurations were the same. The Driver machine used one of the ports on the onboard dual-port Gigabit Ethernet card. The port's IP address was 192.168.0.70. The port was connected to the Cisco switch via an Ethernet cable. Other Ethernet cables ran from the Cisco Switch to a port on the onboard dual-port Gigabit Ethernet card in the two INSPUR NF280D machines that were used as the Tier A machines. That port on one NF280D was configured with the IP address 192.168.0.71 and 192.168.0.72 on the other NF280D. The network connection between the port with IP address 192.168.0.70 on the Driver and the ports with IP addresses 192.168.0.71 and 192.168.0.72 on the Tier A machines was the mandatory network.

There was also a network connection between the Tier A machines and the Tier B machine. The Tier B machine was the NF520D2. Two ports on the onboard dual-port Gigabit Ethernet card in the NF520D were configured with IP address 192.168.0.80 and 192.168.0.81 and were connected via an Ethernet cable to the Cisco switch.

Tier A used ODBC calls to Tier B.

## **Clause 5 – EGen Related Items**

### **EGen Version**

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

EGen v1.5.1 was used in the benchmark.

### **EGen Code and Modifications**

*A statement that all required TPC-provided EGen code was used in the benchmark must be reported. If the Test Sponsor modified EGen, a statement EGen has been modified must be reported in the Report. All formal waivers from the TPC documenting the allowed changes to EGen must also be reported. If any of the changes to EGen do not have a formal waiver, that must also be reported. If the Test Sponsor extended EGenLoader, the use of the extended EGenLoader and the audit of the extension code by an Auditor must be reported (see Clause 5.7.3).*

All required TPC-provided EGen code was used in the benchmark. EGen was not modified for use in this benchmark. EGenLoader was not extended for this benchmark.

## Clause 6 – Performance Metrics and Response Time

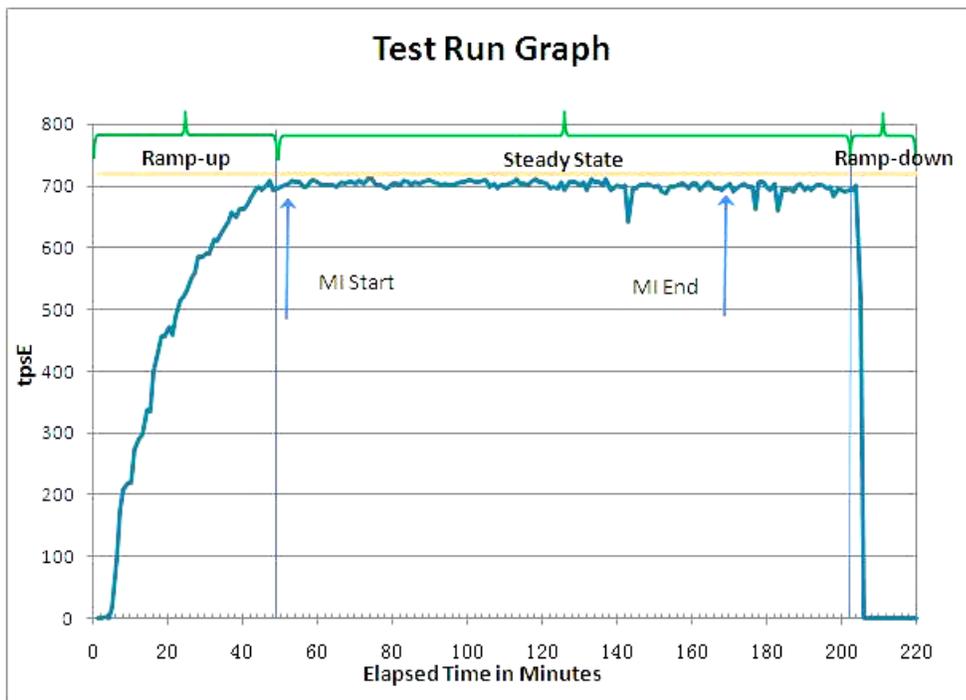
### Measured Throughput

*The Measured Throughput must be reported (see Clause 6.7.1.2).*

Measured tpsE: 702.90 tpsE  
Price per tpsE: ¥4771.37 CNY per tpsE

### Throughput vs. Elapsed Time for Trade-Result Transaction

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



**Figure 6-1. Test Run Graph**

### Steady State Methodology

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

During the run, observation of the tpsE as the benchmark ran was used to determine steady state. After the run, Steady State was confirmed by:

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

## Work Performed during Steady State

A description of how the work normally performed during a Test Run, actually occurred during the Measurement Interval must be reported (e.g., checkpointing, writing Undo/Redo Log records).

Checkpoints were run once every 7 ½ minutes. Data-Maintenance was run every 60 seconds.

## Transaction Statistics

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

Table 6-1 contains the transaction statistics.

Input Parameter	Value	Actul Pct	Required Range
<b>Customer-Position</b>			
by_tax_id	1	50.00%	48% to 52%
get_history	1	49.99%	48% to 52%
<b>Market-Watch</b>			
Securities chosen by	Watch list	59.99%	57% to 63%
	Account ID	35.00%	33% to 37%
	Industry	5.01%	4.5% to 5.5%
<b>Security-Detail</b>			
access_lob	1	1.01%	0.9% to 1.1%
<b>Trade-Lookup</b>			
frame_to_execute	1	29.99%	28.5% to 31.5%
	2	30.01%	28.5% to 31.5%
	3	29.97%	28% to 31.5%
	4	10.04%	9.5% to 10.5%
<b>Trade-Order</b>			
Transactions requested by a third party		10.00%	9.5% to 10.5%
Security chosen by company name and issue		39.99%	38% to 42%
type_is_margin	1	8.01%	7.5% to 8.5%
roll_it_back	1	0.98%	0.94% to 1.04% (*)
is_lifo	1	35.02%	33% to 37%
trade_qty	100	25.01%	24% to 26%
	200	25.02%	24% to 26%
	400	25.01%	24% to 26%
	800	24.96%	24% to 26%
	TMB	30.02%	29.7% to 30.3%
	TMS	30.00%	29.7% to 30.3%
	TLB	20.02%	19.8% to 20.2%

trade_type	TLS	9.98%	9.9% to 10.1%
	TSL	9.98%	9.9% to 10.1%
<b>Trade-Update</b>			
frame_to_execute	1	33.05%	31% to 35%
	2	32.98%	31% to 35%
	3	33.97%	32% to 36%

**Table 6-1. Transaction Statistics**

## Clause 7 – Transaction and System Properties Related Items

*The ACID (Atomicity, Consistency, Isolation, and Durability) properties of transaction processing systems must be supported by the System Under Test during the running of this benchmark. It is the intent of this section to define the ACID properties informally and to specify a series of tests that must be performed to demonstrate that these properties are met.*

### Atomicity Requirements

*The system under test must guarantee that database transactions are atomic; the system will either perform all individual operations on the data, or will assure that no partially completed operations leave any effects on the data.*

All ACID tests were conducted according to specification. The following steps were performed to verify the Atomicity of the Trade-Order transactions.

*Perform a market Trade-Order Transaction with the roll\_it\_back flag set to false. Verify that the appropriate rows have been inserted in the TRADE and TRADE\_HISTORY tables.*

*Perform a market Trade-Order Transaction with the roll\_it\_back flag set to true. Verify that no rows associated with the rolled back Trade-Order have been added to the TRADE and TRADE\_HISTORY tables.*

#### Execution of Atomicity Tests

1. Open a command prompt.
2. Change to MSTPCE.1.5.1-1009\ACID\Atomicity directory.
3. Run Atomicity.cmd
4. The output will be in Atomicity\_C.out and Atomicity\_RB.out

Atomicity.cmd runs a Trade-Order with a commit and notes the new T\_ID. Then it does a select on TRADE and TRADE\_HISTORY to return the rows in those tables with the new T\_ID.

Atomicity.cmd runs a Trade-Order with a roll back and notes the new T\_ID. Then it does a select on TRADE and TRADE\_HISTORY to return the rows in those tables with the new T\_ID. No rows should be returned.

### Consistency Requirements

*Consistency is the property of the application that requires any execution of a database transaction to take the database from one consistent state to another. A TPC-E database when first populated by EGenLoader must meet these consistency conditions. The three consistency conditions must be tested after initial database population and after any Business Recovery tests.*

Consistency conditions 1, 2 and 3 were tested using a batch file to issue queries to the database after the database was loaded and after the Business Recovery Test. The results of the queries demonstrated that the database was consistent for all three tests.

The specific procedure was:

1. Open a command prompt.
2. Change to the MSTPCE.1.5.1-1009\ACID\Consistency directory.
3. Run Consistency.cmd

4. The output will be in Consistency.out

*Entries in the BROKER and TRADE tables must satisfy the relationship:*

$B\_NUM\_TRADES = count(*)$

*For each broker defined by:*

$(B\_ID = CA\_B\_ID) \text{ and } (CA\_ID = T\_CA\_ID) \text{ and } (T\_ST\_ID = 'CMPT')$

*Entries in the BROKER and TRADE tables must satisfy the relationship:*

$B\_COMM\_TOTAL = SUM(T\_COMM)$

*For each broker defined by:*

$(B\_ID = CA\_B\_ID) \text{ and } (CA\_ID = T\_CA\_ID) \text{ and } (T\_ST\_ID = 'CMPT')$

*Entries in the HOLDING\_SUMMARY and HOLDING tables must satisfy the relationship:  $HS\_QTY = sum(H\_QTY)$*

*For each holding summary defined by:*

$(HS\_CA\_ID = H\_CA\_ID) \text{ and } (HS\_S\_SYMB = H\_S\_SYMB)$

## Isolation Requirements

*Systems that implement Transaction isolation using a locking and/or versioning scheme must demonstrate compliance with the isolation requirements by executing the tests described in Clause 7.4.2.*

### Execution of Isolation Test #1 (P3 Test in Read-Write)

The isolation tests require that you use the SQL Server Management Studio. You are required to copy values from one session to another and the Management Studio facilitates this. The instructions below assume that you are using the Management Studio.

1. Open the SQL Server Management Studio.
2. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation1\_S1.sql in the Management Studio. When prompted, connect to the database server.
3. Ctrl-T to convert results to text.
4. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation1\_S2.sql in the Management Studio. When prompted, connect to the database server.
5. Ctrl-T to convert results to text.
6. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation1\_S3.sql in the Management Studio. When prompted, connect to the database server.
7. Ctrl-T to convert results to text.
8. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation1\_S4.sql in the Management Studio. When prompted, connect to the database server.
9. Ctrl-T to convert results to text.
10. Execute Isolation1\_S1.
11. Scroll to the bottom of the Results window and record the “Trade ID Returned.”
12. Copy the Customer Account Used to the @acct\_id variable near the top of Isolation1\_S2.
13. Copy the Symbol Used to the @symbol variable near the top of Isolation1\_S2.
14. Execute Isolation1\_S2.
15. Scroll to the bottom of the Results window and record the “Trade ID Returned.”
16. Copy the Trade ID Used in the Isolation1\_S1 results window to the @trade\_id variable near the top of Isolation1\_S3.
17. Copy the Trade ID Used in the Isolation1\_S2 results window to the @trade\_id variable near the top of Isolation1\_S4.
18. Execute Isolation1\_S3 and then immediately execute Isolation1\_S4. Note that the SQL code and the instrumented stored procedure will do the appropriate pausing as required in the specification.

### Verification of Isolation Test #1 (P3 Test in Read-Write)

1. Record the “Holding Summary After First Execution of Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation1\_S3. Verify that this is set to 0.
2. Record the “Holding Summary After Second Execution of Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation1\_S3. Verify that this is set to 0.
3. Record the “Holding Summary After Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation1\_S4. Verify that this is set to 0.
4. The Trade-Result in S4 completed, and the Trade-Result in S3 was selected as a deadlock victim.

### Execution of Isolation Test #2 (P2 Test in Read-Write)

The isolation tests require that you use the SQL Server Management Studio. You are required to copy values from one session to another and the Management Studio facilitates this. The instructions below assume that you are using the Management Studio.

1. Open the SQL Server Management Studio.

2. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation2\_S1.sql in the Management Studio. When prompted, connect to the database server.
3. Ctrl-T to convert results to text.
4. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation2\_S2.sql in the Management Studio. When prompted, connect to the database server.
5. Ctrl-T to convert results to text.
6. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation2\_S3.sql in the Management Studio. When prompted, connect to the database server.
7. Ctrl-T to convert results to text.
8. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation2\_S4.sql in the Management Studio. When prompted, connect to the database server.
9. Ctrl-T to convert results to text.
10. Execute Isolation2\_S1.
11. Scroll to the bottom of the Results window of Isolation2\_S1 and record the “Holding Summary Quantity” and the “Trade ID Returned.”
12. Copy the Customer Account Used from the Results window of Isolation2\_S1 to the @acct\_id variable near the top of Isolation2\_S2.
13. Copy the Symbol Used from the Results window of Isolation2\_S1 to the @symbol variable near the top of Isolation2\_S2.
14. Execute Isolation2\_S2.
15. Scroll to the bottom of the Results window of Isolation2\_S2 and record the Trade ID Returned.
16. Copy the Trade ID Used in the Isolation2\_S1 results window to the @trade\_id variable near the top of Isolation2\_S3.
17. Copy the Trade ID Used in the Isolation2\_S2 results window to the @trade\_id variable near the top of Isolation2\_S4.
18. Execute Isolation2\_S3 and then immediately execute Isolation2\_S4. Note that the SQL code and the instrumented stored procedure will do the appropriate pausing as required in the specification

#### **Verification of Isolation Test #2 (P2 Test in Read-Write)**

1. Record the “Holding Summary After First Execution of Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation2\_S3.
2. Record the “Holding Summary After Second Execution of Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation2\_S3. This value should match the value returned in step 1 above.
3. Record the “Holding Summary After Trade Result Frame 1”: value of HS\_QTY. This is found near the top of the results window of Isolation2\_S4. This value should match the value returned in step 1 above.
4. The Trade-Result in S4 ran to completion. The Trade-Result in S3 was selected as a deadlock victim.

#### **Execution of Isolation Test #3 (P1 Test in Read-Write)**

The isolation tests require that you use the SQL Server Management Studio. You are required to copy values from one session to another and the Management Studio facilitates this. The instructions below assume that you are using the Management Studio.

1. Open the SQL Server Management Studio.
2. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation3\_S1.sql in the Management Studio. When prompted, connect to the database server.
3. Ctrl-T to convert results to text.
4. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation3\_S2.sql in the Management Studio. When prompted, connect to the database server.
5. Ctrl-T to convert results to text.
6. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation3\_S3.sql in the Management Studio. When prompted, connect to the database server.
7. Ctrl-T to convert results to text.

8. Execute Isolation3\_S1. This script will initiate the Customer Position and execute two Trade Orders for the remainder of this isolation test to access.
9. Scroll to the bottom of the Results window of Isolation3\_S1 and record the “Customer ID Used” and the “Customer Account Balance.”
10. Copy the first Trade ID Returned from Isolation3\_S1 to the top of Isoaltion3\_S2.sql.
11. Copy the Customer Account Used from Isolation3\_S1 to the top of Isoaltion3\_S2.sql.
12. Copy the second Trade ID Returned from Isolation3\_S1 to the top of Isoaltion3\_S3.sql.
13. Copy the Customer Account Used from Isolation3\_S1 to the top of Isoaltion3\_S3.sql.
14. Execute Isolation3\_S2, then immediately execute Isolation3\_S3. Note that the SQL code and the instrumented stored procedure will do the appropriate pausing as required in the specification.
15. Scroll to the bottom of the Results window of Isolation3\_S2 and record the Customer Account Balance and the Settlement Amount.
16. Scroll to the bottom of the Results window of Isolation3\_S3 and record the Customer Account Balance and the Settlement Amount.

#### **Verification of Isolation Test #3 (P1 Test in Read-Write)**

1. Record the Customer Account Balance from the bottom of the Results window of Isolation3\_S1.
2. Record the Customer Account Balance and the Settlement Amount from the bottom of the Results window of Isolation3\_S2.
3. Record the Customer Account Balance and the Settlement Amount from the bottom of the Results window of Isolation3\_S3.
4. Since the Trade Result in Isolation3\_S3 blocks until Isolation3\_S2 completes, you may verify the results as follows:
  - a.  $CA\_BAL$  (from Isolation3\_S1) + Settlement Amount (from Isolation3\_S2) + Settlement Amount (from Isolation3\_S3) = Customer Account Balance (from Isoaltion3\_S3)

#### **Execution of Isolation Test #4 (P1 Test in Read-Only)**

The isolation tests require that you use the SQL Server Management Studio. You are required to copy values from one session to another and the Management Studio facilitates this. The instructions below assume that you are using the Management Studio.

1. Open the SQL Server Management Studio.
2. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation4\_S1.sql in the Management Studio. When prompted, connect to the database server.
3. Ctrl-T to convert results to text.
4. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation4\_S2.sql in the Management Studio. When prompted, connect to the database server.
5. Ctrl-T to convert results to text.
6. Open MSTPCE.1.5.1-1009\ACID\Isolation\Scripts\Isolation4\_S3.sql in the Management Studio. When prompted, connect to the database server.
7. Ctrl-T to convert results to text.
8. Execute Isolation4\_S1. This script will initiate the Customer Position and execute a Trade Order for the remainder of this isolation test to access.
9. Scroll to the bottom of the Results window of Isolation4\_S1 and record the “Customer ID Used,” “Customer Account Used,” “Customer Account Balance,” and the “Trade ID Returned.”
10. Copy the “Customer Account Used” from the Results window of Isolation4\_S1 to the @acct\_id variable near the top of Isolation4\_S2.
11. Copy the “Trade ID Returned” from the Results window of Isolation4\_S1 to the @trade\_id variable near the top of Isolation4\_S2.
12. Copy the “Customer ID” from the Results window of Isolation4\_S1 to the @cust\_id variable near the top of Isolation4\_S3.
13. Copy the “Customer Account Used” from the Results window of Isolation4\_S1 to the @acct\_id variable near the top of Isolation4\_S3.

14. Execut Isolation4\_S2 and after a few seconds to make sure Isolation4\_S2 has started execute Isolation4\_S3.

#### Verification of Isolation Test #4 (P1 Test in Read-Only)

1. Record the Customer Account Balance from the bottom of the Results window of Isolation4\_S1.
2. Record the Customer Account Balance and the Settlement Amount from the bottom of the Results window of Isolation4\_S2.
3. Record the Customer Account Balance from the bottom of the Results window of Isolation4\_S3.
4. Since the Customer Position in Isolation4\_S3 blocks until Isolation4\_S2 completes, you may verify the results as follows:
  - a.  $CA\_BAL$  (from Isolation4\_S1) + Settlement Amount (from Isolation4\_S2) = Customer Account Balance (from Isoaltion4\_S3)

## Durability Requirements

*The tested system must guarantee durability: the ability to preserve the effects of committed transactions and ensure database consistency after recovery from any one of the failures listed in Clauses 7.5.2.2, 7.5.2.3 and 7.5.2.4.*

- v *Permanent irrecoverable failure of any single durable medium*
- v *Instantaneous interruption (system crash/system hang) in processing that requires system reboot to recover*
- v *Failure of all or part of memory (loss of contents)*
- v *Loss of all external power to the SUT for an indefinite time period (power failure). This must include at least all portions of the SUT that participate in the database portions of Transactions.*

## Data Accessibility Tests

This benchmark result used Redundancy Level 1.

*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)*

To prove Redundancy Level 1, the following steps were successfully performed.

1. Count the current number of completed trades in the database by running CountSettlement.sql (included in SupportingFiles), record the settlement count as count1.
2. Start submitting Transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3).
3. Runing at steady state for at least five minutes. Induce the failure described for the redundancy level being demonstrated. In this case fail a disk in a database log array, then fail a disk in the database data array. Transactions should continue processing since the database log array has mirrored drives and the database data array uses RAID-5.
4. Begin the necessary recovery process, by replacing the failed drives in the database log array and the database data array. Wait a few minutes, rebuild on each replaced drive should start automatically.
5. Keep running for 20 minutes. Then terminate the run gracefully from the Driver.
6. Retrieve the new number of completed trades in the database by running CountSettlement.sql (included in SupportingFiles), record the settlement count as count2.
7. Compare the number of executed Trade-Result Transactions on the Driver to (count2 – count1). Verify that (count2 - count1) is equal to the number of successful Trade-Result Transaction records in the Driver log file.
8. Allow recovery process to complete.

Following is a graph of the measured throughput versus elapsed time that must be reported for the run portions of the Data Accessibility tests:

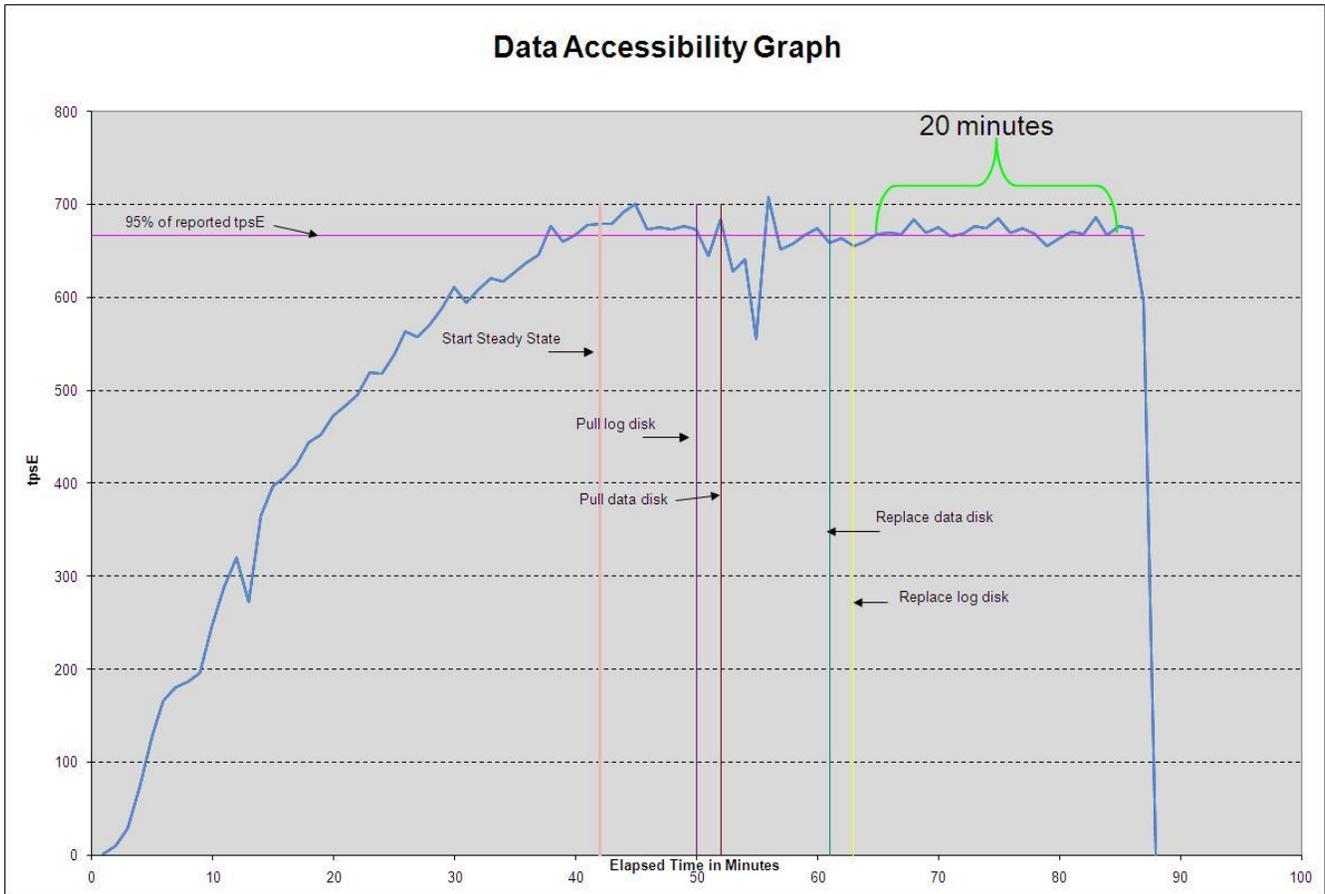


Figure 7-1. Data Accessibility Graph

## Business Recovery Tests

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

The tests for “Instantaneous interrupt,” “Failure of all or part of memory,” and “Loss of external power to the SUT” were combined.

The following steps were successfully performed to meet the Durability Throughput Requirements of Clause 7.5.3:

1. Count the current number of completed trades in the database by running CountSettlement.sql (included in SupportingFiles).
2. Start submitting Transactions and ramp up to the Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes.
3. The primary power to the Tier B server and the Tier A client was removed in the same time.
4. Stop the Driver.
5. Re-power and restart the NF520D2. Re-power and restart the two NF280D clients.
6. On the NF520D2 when Windows has started run StartSQL.cmd to start SQL Server and database recovery will automatically start. SQL Server writes timestamps out to the errorlog when it is started. This timestamp can be used as the time when Business Recovery starts (see Clause 7.5.6.4).
7. Once the SUT will accept Transactions, start submitting Transactions and ramp up to a Durability Throughput Requirements (as defined in Clause 7.5.3) and satisfy those requirements for at least 20 minutes.
8. Note this time as the end of Business Recovery (see Clause 7.5.6.6).
9. The Driver was terminated gracefully.
10. No errors were reported by the Driver during steps 7 through 9.
11. Retrieve the new number of completed trades in the database by running CountSettlement.sql (included in SupportingFiles).

12. Compare the number of completed Trade-Result Transactions on the Driver to (count2 – count1). Verify that (count2 - count1) is 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.

The Business Recovery Time was 04:13:54.

Following is a graph of the measured throughput versus elapsed time that must be reported for the run portions of the Business Recover Time test:

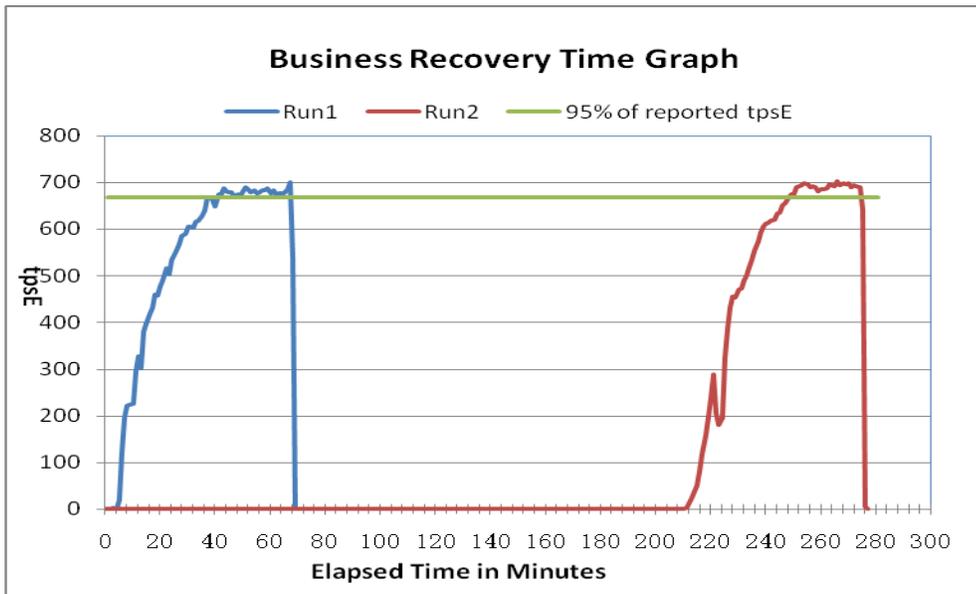


Figure 7-2. Business Recovery Time Graph



**Table 8-1. Ordering and Pricing Information**

<b>Description</b>	<b>Part Number</b>	<b>Order Date</b>	<b>Availability Date</b>	<b>Order Method</b>	<b>Price Verification</b>
Inspur NF520D2 (4 x Intel X7460 Processor(2.67GHz), 128GB memory (32 x 4GB), Integrated RAID Controller, Onboard Dual-Port Gigabit Ethernet Controller, 2 x 73GB SAS driver) plus ServicePac for 3-year 24 x 7 suport	SNF5202DR 111	11-30-08	11-30-08	See Note 1	See Note 2

Note 1: INSPUR 800-860-6708 or 86 0531-85105430

Note 2: This component is not immediately orderable. For price verification before order date, call 86 0531-85105430.

# Auditor's Attestation Letter

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

August 22, 2008

Mr. Dujidong

Inspur Group Co. Ltd.  
1<sup>st</sup> Flor of Building C, No.2 xinxi Road  
Shangdi,Haidian district, Beijing  
P.C. 100085

I have verified on-site and by remote the TPC Benchmark™ E for the following configuration:

Platform: Inspur NF520D2  
Database Manager: Microsoft SQL Server 2008 Enterprise x64 Edition  
Operating System: Microsoft Windows Sever 2008 Enterprise x64 Edition

Server (Tier B): NF520D2			
CPU's	Memory	Disks (total)	tpsE
4 Intel Xeon 6 core @ 2.66 Ghz	128 GB	336 @ 73 GB 12 @ 146 GB 2 @ 73GB (OS)	<b>702.90</b>
Clients (Tier A): 2			
2 Intel quad core @ 2.33 Ghz	4 GB	2 @ 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 1.5.1.
- The database files were properly sized and populated for 360,000 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.
- 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 744 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 equal to or less than 7.5 minutes.
- The system pricing was checked for major components and maintenance.
- The FDR was reviewed and verified as required.

Auditor Notes: None

Sincerely,

A handwritten signature in cursive script that reads "Lorna Livingtree".

Lorna Livingtree  
Auditor

## Supporting Files Index Table

The **Supporting Files Index** file can be found in the *SupportingFiles* directory (SupportingFiles.doc).

Clause	Description	PathName
Introduction	Disk Configuration	SupportingFiles/Introduction/Hardware/formats.cmd
		SupportingFiles/Introduction/Hardware/input.txt
		SupportingFiles/Introduction/Hardware/c-mp.cmd
		SupportingFiles/Introduction/Hardware/c-part-init.out
		SupportingFiles/Introduction/Hardware/StorageSetup.doc
	Tier B-NF520D2 Configuration	SupportingFiles/Introduction/Hardware/TierB_NF520D2_setup.doc
	TierA-NF280D setup	SupportingFiles/Introduction/Hardware/TierA_NF280D_setup.doc
	Database Tunable Parameters	SupportingFiles/Introduction/software/runconfig.sql
		SupportingFiles/Introduction/software/tempdb.sql
		SupportingFiles/Introduction/software/tempdb-ext.sql
SupportingFiles/Introduction/software/StartSQL.cmd		
SupportingFiles/Introduction/software/StartSQL-noFlags.cmd		
SupportingFiles/Introduction/software/backup.cmd		
SupportingFiles/Introduction/software/restore.cmd		
SupportingFiles/Introduction/software/StopSQL.cmd		
SupportingFiles/Introduction/software/Trade-cleanup.cmd		
SupportingFiles/Introduction/software/sp.cmd		
SupportingFiles/Introduction/software/softnuma-ipall.reg		
SupportingFiles/Introduction/software/softnuma-node.reg		
SupportingFiles/Introduction/software/ts.reg		
SupportingFiles/Introduction/software/tcpip.reg		
SupportingFiles/Introduction/software/sp_configure.txt		
SupportingFiles/Introduction/software/services.csv		
Checkpoint Scripts	SupportingFiles/Introduction/software/checkpoint.cmd	
	SupportingFiles/Introduction/software/checkpoint_TPCE_Database.sql	
Tier A Scripts	SupportingFiles/Introduction/software/StartClient-12.cmd	
	SupportingFiles/Introduction/software/StartClient-34.cmd	
OS Tunable Parameters	SupportingFiles/Introduction/software/TierB_OSConf.doc	
	SupportingFiles/Introduction/software/server-sysInfo.txt	
	SupportingFiles/Introduction/software/client2-sysinfo.txt	
	SupportingFiles/Introduction/software/client1-sysinfo.txt	
Clause 2	Table creation scripts	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
	Load Transaction Frames	SupportingFiles/Clause2/DML/BrokerVolume.sql SupportingFiles/Clause2/DML/CustomerPosition.sql SupportingFiles/Clause2/DML/DataMaintenance.sql SupportingFiles/Clause2/DML/Get_Next_T_ID.sql SupportingFiles/Clause2/DML/MarketFeed.sql SupportingFiles/Clause2/DML/MarketWatch.sql SupportingFiles/Clause2/DML/SecurityDetail.sql SupportingFiles/Clause2/DML/Trade_Cleanup.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
	Create Database	SupportingFiles/Clause2/Backup_Database.sql SupportingFiles/Clause2/Checkpoint_TPCE_Database.SQL SupportingFiles/Clause2/Count_Customers.sql SupportingFiles/Clause2/Create_Database.sql SupportingFiles/Clause2/Create_DM_Audit_Table.sql SupportingFiles/Clause2/Create_TID_Ranges_Table.sql SupportingFiles/Clause2/Create_Timer_Table.sql SupportingFiles/Clause2/Create_TPCE_VERSIONS_Table.sql SupportingFiles/Clause2/Database_Options_1.sql SupportingFiles/Clause2/Database_Options_2.sql SupportingFiles/Clause2/Drop_and_Create_TPCE_INFO.sql SupportingFiles/Clause2/End_Load_Timer.sql SupportingFiles/Clause2/Get_Next_T_ID.sql SupportingFiles/Clause2/Install_Load_Timer_Proc.sql SupportingFiles/Clause2/Load_TPCE_Info.sql SupportingFiles/Clause2/MSTPCE Database Setup Reference.pdf

		SupportingFiles/Clause2/Remove_Database.sql SupportingFiles/Clause2/Restore_Database.sql SupportingFiles/Clause2/runconfig.sql SupportingFiles/Clause2/SQL_Server_Configuration.sql SupportingFiles/Clause2/startSQL.cmd SupportingFiles/Clause2/tempdb.sql SupportingFiles/Clause2/tempdb-ext.sql SupportingFiles/Clause2/TPCE_Setup.cmd SupportingFiles/Clause2/Trade_Cleanup.sql SupportingFiles/Clause2/Version.sql
	Database Space Scripts	SupportingFiles/Clause2/audit_scripts/Space/SPFiles.sql SupportingFiles/Clause2/audit_scripts/Space/SPLog.sql SupportingFiles/Clause2/audit_scripts/Space/SPUsed.sql
	Database Audit Scripts	SupportingFiles/Clause2/audit_scripts/database/Create_DB_Audit_Tables.sql SupportingFiles/Clause2/audit_scripts/database/DB_Check.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
Clause 3	Transaction Frames	SupportingFiles/Clause3/BrokerVolume.sql SupportingFiles/Clause3/CustomPosition.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/Trade_Cleanup.sql SupportingFiles/Clause3/TradeLookup.sql SupportingFiles/Clause3/TradeOrder.sql SupportingFiles/Clause3/TradeResult.sql SupportingFiles/Clause3/TradeStatus.sql SupportingFiles/Clause3/TradeUpdate.sql
	BaseServer	SupportingFiles/Clause3/BaseServer/BaseServer.cpp SupportingFiles/Clause3/BaseServer/BaseServer.h SupportingFiles/Clause3/BaseServer/BaseServer.vcproj SupportingFiles/Clause3/BaseServer/stdafx.cpp SupportingFiles/Clause3/BaseServer/stdafx.h SupportingFiles/Clause3/BaseServer/SUTServersLocals.h
	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/SUT_CE_Server.vcproj SupportingFiles/Clause3/SUT_CE_Server/SUTServer.sln SupportingFiles/Clause3/SUT_CE_Server/SUTServer.suo SupportingFiles/Clause3/SUT_CE_Server/SUTStructs.h
	SUT_MEE_Server	SupportingFiles/Clause3/SUT_MEE_Server/MEESEServer.cpp SupportingFiles/Clause3/SUT_MEE_Server/MEESEServer.h SupportingFiles/Clause3/SUT_MEE_Server/MEESEServerMain.cpp SupportingFiles/Clause3/SUT_MEE_Server/stdafx.cpp SupportingFiles/Clause3/SUT_MEE_Server/stdafx.h SupportingFiles/Clause3/SUT_MEE_Server/SUT_MEE_Server.vcproj
	TransactionsSP	SupportingFiles/Clause3/TransactionsSP/BrokerVolumeDB_SP.cpp SupportingFiles/Clause3/TransactionsSP/BrokerVolumeDB_SP.h SupportingFiles/Clause3/TransactionsSP/CheckpointDB_SP.cpp SupportingFiles/Clause3/TransactionsSP/CheckpointDB_SP.h SupportingFiles/Clause3/TransactionsSP/CustomPositionDB_SP.cpp SupportingFiles/Clause3/TransactionsSP/CustomPositionDB_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_stdafx.cpp

		SupportingFiles/Clause3/TxnHarness/TxnHarness_stdafx.h SupportingFiles/Clause3/TxnHarness/TxnHarnessSendToMarket.cpp SupportingFiles/Clause3/TxnHarness/TxnHarnessSendToMarket.h
Clause 4	No Requirements	
Clause 5	No EGen modifications	
	No EGenLoader extensions	
	EGenDriver Configuration	SupportingFiles/Clause5/benchcraft.xml SupportingFiles/Clause5/txnreport-120.xls
	EGenLoader Parameters	SupportingFiles/Clause5/EGenLoaderFlags.txt SupportingFiles/Clause5/EGenLoaderFrom1To15000.log SupportingFiles/Clause5/EGenLoaderFrom15001To30000.log SupportingFiles/Clause5/EGenLoaderFrom30001To45000.log SupportingFiles/Clause5/EGenLoaderFrom45001To60000.log SupportingFiles/Clause5/EGenLoaderFrom60001To75000.log SupportingFiles/Clause5/EGenLoaderFrom75001To90000.log SupportingFiles/Clause5/EGenLoaderFrom90001To105000.log SupportingFiles/Clause5/EGenLoaderFrom105001To120000.log SupportingFiles/Clause5/EGenLoaderFrom120001To135000.log SupportingFiles/Clause5/EGenLoaderFrom135001To150000.log SupportingFiles/Clause5/EGenLoaderFrom150001To165000.log SupportingFiles/Clause5/EGenLoaderFrom165001To180000.log SupportingFiles/Clause5/EGenLoaderFrom180001To195000.log SupportingFiles/Clause5/EGenLoaderFrom195001To210000.log SupportingFiles/Clause5/EGenLoaderFrom210001To225000.log SupportingFiles/Clause5/EGenLoaderFrom225001To240000.log SupportingFiles/Clause5/EGenLoaderFrom240001To255000.log SupportingFiles/Clause5/EGenLoaderFrom255001To270000.log SupportingFiles/Clause5/EGenLoaderFrom270001To285000.log SupportingFiles/Clause5/EGenLoaderFrom285001To300000.log SupportingFiles/Clause5/EGenLoaderFrom300001To315000.log SupportingFiles/Clause5/EGenLoaderFrom315001To330000.log SupportingFiles/Clause5/EGenLoaderFrom330001To345000.log SupportingFiles/Clause5/EGenLoaderFrom345001To360000.log
Clause 6	EGenValidate Output	SupportingFiles/Clause6/Validate.ver

Clause 7	Scripts of ACID procedures	SupportingFiles/Clause7/AcidProcs/AcidProc.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 SupportingFiles/Clause7/AcidProcs/Remove_AcidProcs.cmd
	ACID procedures output	SupportingFiles/Clause7/AcidProcs/AcidProc.out
	Atomicity Scripts	SupportingFiles/Clause7/Atomicity/Atomicity.cmd SupportingFiles/Clause7/Atomicity/Scripts/Atomicity_C.sql SupportingFiles/Clause7/Atomicity/Scripts/Atomicity_RB.sql SupportingFiles/Clause7/Atomicity/Scripts/atom.vbs
	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.out SupportingFiles/Clause7/Consistency/Consistency_after.out
	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 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.rpt SupportingFiles/Clause7/Isolation/Isolation1_S2.rpt SupportingFiles/Clause7/Isolation/Isolation1_S3.rpt SupportingFiles/Clause7/Isolation/Isolation1_S4.rpt SupportingFiles/Clause7/Isolation/Isolation2_S1.rpt SupportingFiles/Clause7/Isolation/Isolation2_S2.rpt SupportingFiles/Clause7/Isolation/Isolation2_S3.rpt SupportingFiles/Clause7/Isolation/Isolation2_S4.rpt SupportingFiles/Clause7/Isolation/Isolation3_S1.rpt SupportingFiles/Clause7/Isolation/Isolation3_S2.rpt SupportingFiles/Clause7/Isolation/Isolation3_S3.rpt SupportingFiles/Clause7/Isolation/Isolation4_S1.rpt SupportingFiles/Clause7/Isolation/Isolation4_S2.rpt SupportingFiles/Clause7/Isolation/Isolation4_S3.rpt
	Durability Business Recovery	SupportingFiles/Clause7/Durability/BusinessRecovery/BusinessRecoveryTime.txt SupportingFiles/Clause7/Durability/BusinessRecovery/run2/Consistency_After.out SupportingFiles/Clause7/Durability/BusinessRecovery/CountSettlement.BeforeBusinessRecovery.txt SupportingFiles/Clause7/Durability/BusinessRecovery/CountSettlement.AfterBusinessRecovery.txt SupportingFiles/Clause7/Durability/BusinessRecovery/run1/run1_step_all.xls SupportingFiles/Clause7/Durability/BusinessRecovery/run2/run2_step_all.xls SupportingFiles/Clause7/Durability/BusinessRecovery/run1/run1_txnreport_20.xls SupportingFiles/Clause7/Durability/BusinessRecovery/run2/run2_txnreport_20.xls SupportingFiles/Clause7/Durability/BusinessRecovery/run1/run1_txnreport_all.xls SupportingFiles/Clause7/Durability/BusinessRecovery/run2/run2_txnreport_all.xls SupportingFiles/Clause7/Durability/BusinessRecovery/CountSettlement.sql SupportingFiles/Clause7/Durability/BusinessRecovery/run2/run2_dblog_businessrecovery.txt SupportingFiles/Clause7/Durability/BusinessRecovery/run1/run1_dblog_businessrecovery.txt SupportingFiles/Clause7/Durability/BusinessRecovery/BusinessRecovery_TimeGraph.xls SupportingFiles/Clause7/Durability/BusinessRecovery/businessrecovery-client1-sysinfo.txt SupportingFiles/Clause7/Durability/BusinessRecovery/businessrecovery-client2-sysinfo.txt SupportingFiles/Clause7/Durability/BusinessRecovery/businessrecovery-server-sysinfo.txt
	Durability Data Accessibility	SupportingFiles/Clause7/Durability/DataAccessibility/CountSettlement.AfterDataAccessibility.txt SupportingFiles/Clause7/Durability/DataAccessibility/CountSettlement.BeforeDataAccessibility.txt SupportingFiles/Clause7/Durability/DataAccessibility/CountSettlement.sql SupportingFiles/Clause7/Durability/DataAccessibility/txnreport-all.xls SupportingFiles/Clause7/Durability/DataAccessibility/DataAccessibilityGraph.xls SupportingFiles/Clause7/Durability/DataAccessibility/dblog.txt SupportingFiles/Clause7/Durability/DataAccessibility/oslog.txt
	ACID Procedures Document	SupportingFiles/Clause7/MSTPCE ACID Procedures.doc
Clause 8	60-Day Space	SupportingFiles/Clause8/Space-TPCE-Inspur.xls

	Calculations	SupportingFiles/Clause8/Seagate_ds_cheetah_15k_5.pdf.pdf SupportingFiles/Clause8/Seagate_po_cheetah_15k_5.pdf.pdf
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