TPC Benchmark™ C Full Disclosure Report

Advanced Logic Research, Inc.

ALR Revolution 6X6 Client/Server

using

Microsoft NT Server 4.0 Enterprise Edition

and

Microsoft SQL Server 6.5 Enterprise Edition

Submitted for review
July 1997

ALR Part Number 65970070

First Edition - July 1997

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The pricing information in this document is believed to accurately reflect the current prices as of the publication date. However, ALR and Microsoft Corporation provide no warranty on the pricing information in this document.

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

All performance data contained in this report was obtained in a rigorously controlled environment, and therefore results obtained in other operating environments may vary significantly. ALR and Microsoft Corporation do not warrant or represent that a user can or will achieve similar performance expressed in transactions per minute (tpmC) or normalized price/performance ($/tpmC). No warranty of system performance or price/performance is expressed or implied in this report.

Printed in USA, July 1997.

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Abstract

Overview

This report documents the methodology and results of the TPC Benchmark C (TPC-C) conducted on the ALR Revolution 6X6. The operating system on the server was Microsoft Windows NT Server 4.0 Enterprise Edition. The DBMS used was Microsoft SQL Server 6.5 Enterprise Edition SP4. The operating system on the clients was Microsoft Windows NT Server 4.0 SP2. The clients ran Microsoft's Internet Information Server 3.0 and Tuxedo 6.3 CFS for NT.

TPC Benchmark Metrics

The standard TPC Benchmark C metrics, tpmC (transactions per minute), price per tpmC (five year capital cost per measured tpmC), and the availability date are reported as required by the benchmark specification.

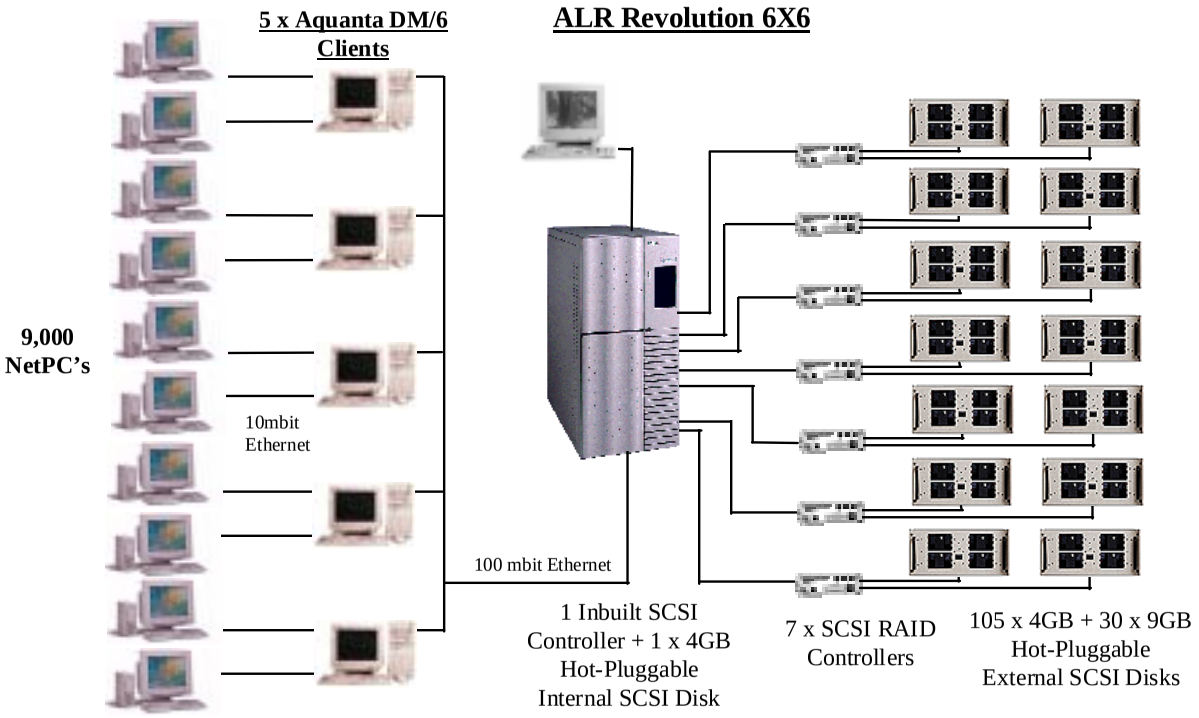
Executive Summary

The following pages contain the executive summary results of the benchmark.

Auditor

The benchmark configuration, environment, and methodology used to produce and validate the test results, along with the pricing model used to calculate the cost per tpmC, were audited by Richard Gimarc of Performance Metrics, Inc. to verify compliance with the relevant TPC specification.

ALR	ALR Revolution 6X6 Client/Server			TPC-C Rev. 3.3 Report Date: 09-Jul-1997
Total System Cost	TPC-C Throughput	Price/Performance		Availability Date
$513,001	**10,665.53 tpmC**	**$48.10 per tpmC**		**30-Nov-1997**
Processors	Database Manager	Operating System	Other Software	Number of Users
6 Pentium® Pro 200 MHz 512KB L2 cache	Microsoft SQL Server 6.5 Enterprise Edition	Microsoft NT Server 4.0 Enterprise Edition	Microsoft IIS. Tuxedo 6.3 CFS	**9,000**



System Components	Server		Clients	
	Quantity	Type	Quantity	Type
Processors	6	200 MHz Pentium® Pro with 512KB Level 2 Cache	5	200MHz Pentium® Pro with 256KB Level 2 Cache
Memory	1	4096MB	5	256MB
Disk Controllers	7 1	SCSI RAID Inbuilt SCSI	5	Inbuilt IDE
Disk Drives	106 30	4GB 9GB	5	1.5GB
Total Storage		684 GB		7.5GB
CD-ROM / Tape	1	CD-ROM Drive	5	CD-ROM Drive

Advanced Logic Research, Inc. FDR Pricing	ALR Revolution 6X6 Client/Server					TPC-C Rev 3.3 7/9/97
Description	Part Number	Third Party Brand Pricing		Unit List Price	Qty.	Extended Price	5 Years Maint.
Server Hardware							
Revolution 6X6 200/512 Model B (includes 1 CPU)	74636602			$14,995	1	$14,995	$25,093
200-MHz 512KB Pentium Pro Proc Upgrade Kit	12968621			$1,819	4	$7,278	
Tri-6 CPU Module (includes 1 200-MHz/512 CPU)	12900150-21			$2,595	1	$2,595	
ECC Memory Board, 0-MB memory	(included w/ 74636602)			$0	1	$0	
DIMM, 256-MB	34327602			$3,739	16	$59,824	
3-ch ADAC PCI SCSI Cacheing RAID Ctlr	11900984			$1,315	7	$9,205	
VGA Card	(included w/ 74636602)			$0	1	$0	
12X CD-ROM Drive	(included w/ 74636602)			$0	1	$0	
10/100 PCI Network Interface Card	(included w/ 74636602)			$0	1	$0	
Quick Hot Swap Cage Kit 6D	(included w/ 74636602)			$0	1	$0	
Quick Hot Swap Drawer II	11910190			$1,795	16	$28,720	
4-GB SCA F/W Ultra SCSI-2	11351430			$1,179	106	$124,974	
9-GB SCA F/W Ultra SCSI-2	11351910			$1,936	30	$58,080	
14-Inch Color Monitor	11001034			$295	1	$295	
Keyboard	(included w/ 74636602)			$0	1	$0	
Mouse, 2-button PS/2	11600203			$26	1	$26	
Rack Cabinet (44U)	11910170			$2,195	3	$6,585	
Rack Coupling Kit (44U)	82321506			$165	2	$330	
Rack Cabinet Bezel Kit (44U)	(included w/ 11910170)			$0	3	$0	
Rack Stabilizer Kit (44U)	(included w/ 11910170)			$0	3	$0	
Rack Cabinet Side Panel Kit (44U)	82321503			$245	1	$245	
Rack Cabinet Filler Panels (2U)	82321203			$22	6	$132	
					Subtotal	**$313,284**	**$25,093**
Server Software							
Microsoft NT Server 4.0 Enterprise Edition, incl 25 CALs		Microsoft	2	$3,999	1	$3,999	$0
Microsoft SQL Server 6.5 Enterprise Edtion, unlimited user license		Microsoft	2	$28,999	1	$28,999	$10,475
					Subtotal	**$32,998**	**$10,475**
Client Hardware							
SYS: Aquanta DM/6 II, 0 Proc, 0MB Mem	CMT60072-ZFA	Unisys	1	$628	5	$3,140	$5,550
PROC:1x200MHz PentiumPro/256KB Cache	PRC6200-256	Unisys	1	$842	5	$4,210	
MEM: 64 MB Memory Upgrade	MTP6-64M	Unisys	1	$746	20	$14,920	
CTRL: VGA, 64-bit with 2MB	PCV102-PCI	Unisys	1	$135	5	$675	
DISK: 1.6GB IDE 3.5 Internal	HDI1600-5	Unisys	1	$236	5	$1,180	
CDROM: Twelve Speed IDE	CDR1200-AI	Unisys	1	$160	5	$800	
ETHERNET: 100Mbit/sec, PCI 32-bit	ETH101007-PCI	Unisys	1	$119	5	$595	
ETHERNET: 10Mbit/sec, PCI 32-bit	ETH101-PCI	Unisys	1	$163	10	$1,630	
MONITOR:14-inch Color	EVG142-COL	Unisys	1	$264	5	$1,320	
KEYBD: 104 Key Spacesaver	PCK104-SKB	Unisys	1	$31	5	$155	
MOUSE: 2 Button PS2	PWM1-PS2	Unisys	1	$22	5	$110	
					Subtotal	**$28,735**	**$5,550**
Client Software							
Microsoft Windows NT Server 4.0, incl 5 CALs		Microsoft	2	$809	5	$4,045	$0
Microsoft SQL Workstation w/ Programmer's Toolkit		Microsoft	2	$499	1	$499	$0
Microsoft Visual C++ 32-bit edition (subscription)		Microsoft	2	$499	1	$499	$0
TUXEDO Core Functional Services 6.3 for NT		BEA	3	$3,000	5	$15,000	$11,250
					Subtotal	**$20,043**	**$11,250**
User Connectivity							
Ethernet Hub, 8-Port 100TX TrueFast (+ 10% spares)	NX-H8TX	Netlux	4	$399	3	$1,197	Spared
Ethernet Hub, 8-Port 10Base-T (+ 10% spares)	NX-H9+	Netlux	4	$52	1238	$64,376	Spared
					Subtotal	**$65,573**	**$0**
					Total	**$460,633**	**$52,368**

Notes:

1. All Microsoft maintenance is covered by the maintenance cost of Microsoft SQL Server.
2. 10% or minimum 2 spares are added in place of on-site service (products have a five year return-to-vendor warranty).
3. Pricing: 1=Unisys, 2=Microsoft, 3=BEA, 4=Netlux

Five Year Cost of Ownership	**$513,001**
TPC-C Throughput	**10,665.53**
$/tpmC	**$48.10**

The benchmark results and test methodology were audited by Richard Gimarc of Performance Metrics, Inc.

Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumption about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmarks specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org.

NUMERICAL QUANTITIES SUMMARY

ALR Revolution 6X6 Client/Server

Microsoft SQL Server 6.5 Enterprise Edition

MQTh, Computed Maximum Qualified Throughput: **10665.53**

% throughput difference, reported & reproducibility runs: 0.04%

Transaction Mix

New Order	44.78%
Payment	43.03%
Delivery	4.06%
Stock-Level	4.07%
Order-Status	4.07%

Response Times

Transaction	Average	Maximum	90th %ile
New-Order	1.27	16.30	2.63
Payment	1.31	15.12	2.60
Delivery	0.45	6.61	0.70
Stock-Level	2.32	15.72	4.00
Order Status	1.62	17.61	3.01
Menu	0.20	1.40	0.30
Delivery (Deferred)	0.84	7.19	1.19

Response time delay added for emulated components (seconds)

RT Response time	0.1
Menu Response time	0.1

Keying/Think Time Times (seconds)

Transaction	Minimum	Average	Maximum
New-Order	18.00/0	18.01/12.24	19.12/120
Payment	3.00/0	3.01/12.19	4.14/120
Delivery	2.00/0	2/5.07	3.08/50
Stock-Level	2.00/0	2/5.07	3.04/50
Order-Status	2.00/0	2/10.11	3.02/100

Test Duration

Ramp up time	33 minutes
Measurement interval (M)	30 minutes
Transactions (all types) completed during measurement interval	714574
Ramp-down time	16 minutes

Checkpointing:

Number of checkpoints	1
Checkpoint interval	30 minutes

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Document Structure

The TPC Benchmark C Standard Specification requires test sponsors to publish, submit to the TPC, and make available to the public, a full disclosure report for any result to be considered compliant with the specification. The required contents of the full disclosure report are specified in Clause 8.

This report is submitted to satisfy the specification's requirement for full disclosure. It documents the compliance of the benchmark implementation and execution reported for the ALR Revolution 6X6 using Microsoft SQL Server 6.5 Enterprise Edition.

TPC Benchmark C Overview

The TPC Benchmark™ C Standard Specification Revision 3.3.1 was developed by the Transaction Processing Council (TPC). It is the intent of the TPC to develop a suite of benchmarks to measure the performance of computer systems executing a wide range of applications.

TPC Benchmark™ C (TPC-C) is an OLTP workload. It is a mixture of read-only and update intensive transactions that simulate the activities found in complex OLTP application environments. It does so by exercising 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.
- On-line and deferred transaction execution modes.
- Multiple on-line terminal sessions.
- Moderate system and application execution time.
- Significant disk input/output.
- Transaction integrity (ACID properties).
- Non-uniform distribution of data access through primary and secondary keys.
- Databases consisting of many tables with a wide variety of sizes, attributes, and relationships.
- Contention on data access and update.

The performance metric reported by TPC-C is a "business throughput" measuring the number of orders processed per minute. Multiple transactions are used to simulate the business activity of processing an order, and each transaction is subject to a response time constraint. The performance metric for this benchmark is expressed in transactions-per-minute-C (tpmC). To be compliant with the TPC-C standard, all references to tpmC results must include the tpmC rate, the associated price-per-tpmC, and the availability date of the priced configuration.

Despite the fact that this benchmark offers a rich environment that emulates many OLTP environments, 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-C 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 system design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, TPC-C should not be used as a substitute for a specific customer application benchmarking when critical capacity planning and/or product evaluation decisions are contemplated.

0. General Items

0.1. Order and Titles

The order and titles of sections in the Test Sponsor's Full Disclosure report must correspond with the order and titles of sections from the TPC-C standard specification (i.e., this document). The intent is to make it as easy as possible for readers to compare and contrast material in different Full Disclosure reports.

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

0.2. Executive Summary Statement

The TPC Executive Summary Statement must be included near the beginning of the Full Disclosure report.

The TPC Executive Summary Statement is included near the beginning of this report.

0.3. Numerical Quantities Summary

The numerical quantities listed below must be summarized near the beginning of the Full Disclosure report :

- *measurement interval in minutes,*
- *number of checkpoints in the measurement interval,*
- *checkpoint interval in minutes,*
- *number of transactions (all types) completed within the measurement interval,*
- *computed Maximum Qualified Throughput in tpmC,*
- *percentage difference between reported throughput and throughput obtained in reproducibility run,*
- *ninetieth percentile, average and maximum response times for the New-Order, Payment, Order-Status, Stock-Level, Delivery (deferred and interactive) and Menu transactions,*
- *time in seconds added to response time to compensate for delays associated with emulated components,*
- *percentage of transaction mix for each transaction type.*

These numerical quantities are summarized near the beginning of this report.

0.4. Application Code Disclosure

The applicable program (as defined in Clause 2.1.7) must be disclosed. This includes, but is not limited to, the code implementing the five transactions and the terminal input and output functions.

Appendix A contains the client application code used in this TPC-C benchmark. Appendix B contains the SQL stored procedures which implement the TPC-C transactions.

0.5. Benchmark Sponsor

A statement identifying the benchmark sponsor(s) and other participating companies must be provided.

This TPC benchmark C was sponsored by ALR Corporation. The benchmark test was developed by Microsoft and Unisys. The benchmark was conducted at Unisys, Mission Viejo, California.

0.6. Parameter Settings

Settings must be provided for all customer-tunable parameters and options which have been changed from the defaults found in actual products, including but not limited to:

- *Data Base tuning options*
- *Recovery/commit options*
- *Consistency/locking options*
- *Operating system and application configuration parameters*

Appendix C contains the configuration and system parameters used in running these TPC-C tests. It also contains all the client and server OS, and SQL Server tunable parameters.

0.7. Configuration Diagrams

Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:

- *Number and type of processors.*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test.*
- *Number and type of disk units (and controllers, if applicable).*
- *Number of channels or bus connections to disk units, including their protocol type.*
- *Number of LAN (e.g., Ethernet) connections, including routers, workstations, terminals, etc., that were physically used in the test or are incorporated into the pricing structure (see Clause 8.1.8).*
- *Type and the run-time execution location of software components (e.g., DBMS, client processes, transaction monitors, software drivers, etc.).*

The Remote Terminal Emulator (RTE) software used for these TPC-C tests is proprietary to Unisys. The benchmark configuration is illustrated in Figure 0.1. Tables 4.3, 4.4 and 4.5 contain a detailed explanation of the disk configuration.

The benchmarked configuration for the ALR Revolution 6X6 is shown in Figure 0.1.

The priced configuration for the ALR Revolution 6X6 is shown in Figure 0.2.

Figure 0.1: Benchmarked Configuration

ALR Revolution 6X6- Benchmarked Configuration

5 RTEs
emulating
9,000 users

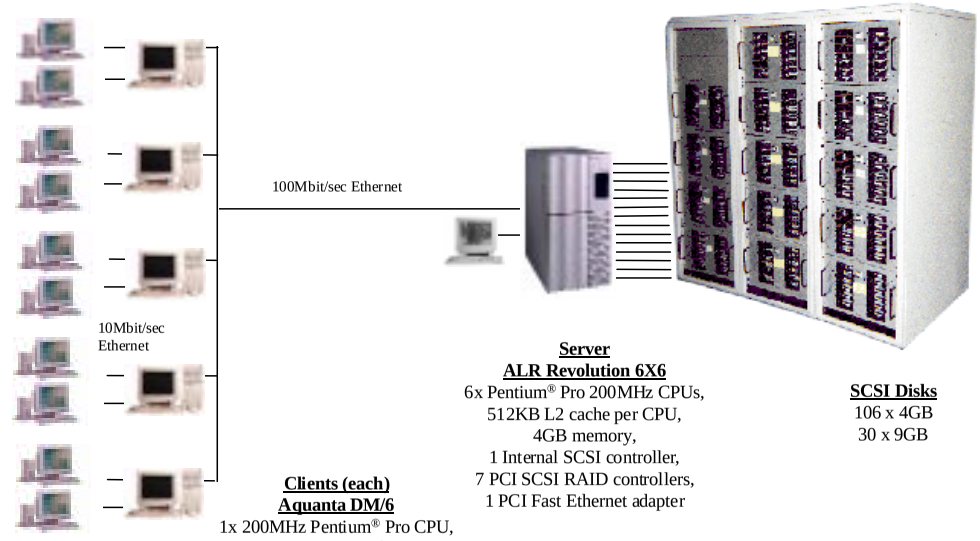
Clients (each)
Aquanta DM/6
1x 200MHz Pentium® Pro CPU,
256KB L2 cache
256MB memory,
1 x 1.5GB disk,
1 PCI Fast Ethernet adapter for Server connection,
2 PCI Ethernet adapters for RTE connections

Server
ALR Revolution 6X6
6x Pentium® Pro 200MHz CPUs,
512KB L2 cache per CPU,
4GB memory,
1 Internal SCSI controller,
7 PCI SCSI RAID controllers,
1 PCI Fast Ethernet adapter

SCSI Disks
106 x 4GB
30 x 9GB
12 x 9GB (backup)

Figure 0.2: Priced Configuration

ALR Revolution 6X6- Priced Configuration



9,000 NetPC's

Clients (each)
Aquanta DM/6
1x 200MHz Pentium® Pro CPU,
256KB L2 cache
256MB memory,
1 x 1.5GB disk,
1 PCI Fast Ethernet adapter for Server connection,
2 PCI Ethernet adapters for RTE connections

Server
ALR Revolution 6X6
6x Pentium® Pro 200MHz CPUs,
512KB L2 cache per CPU,
4GB memory,
1 Internal SCSI controller,
7 PCI SCSI RAID controllers,
1 PCI Fast Ethernet adapter

SCSI Disks
106 x 4GB
30 x 9GB

1. Clause 1: Logical Database Design

1.1. Table Definitions

Listings must be provided for all table definition statements and all other statements used to setup the data base.

Appendix B contains the SQL definitions of all the required database devices, tables, indexes and stored procedures, plus a listing of the program used to load the database and establish the required initial populations of each table.

1.2. Physical Organization of the Database

The physical organization of tables and indices, within the data base, must be disclosed.

The disk space was allocated to SQL Server according to the data in Table 4.4. The SQL definitions are contained in Appendix B.

1.3. Insert and/or Delete Operations

It must be ascertained that insert and/or delete operations to any of the tables can occur concurrently with the TPC-C transaction mix. Furthermore, any restriction in the SUT data base implementation that precludes inserts beyond the limits defined in Clause 1.4.11 must be disclosed. This includes the maximum number of rows that can be inserted and the maximum key value for these new rows.

There were no restrictions on insert and/or delete operations to any of the tables.

1.4. Partitioning

While there are few restrictions placed upon horizontal or vertical partitioning of tables and rows in the TPC-C benchmark, any such partitioning must be disclosed.

Partitioning was not used for any table in this implementation.

1.5. Replication, Duplication or Additions

Replication of tables, if used, must be disclosed.

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

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

2. Clause 2: Transaction & Terminal Profiles

2.1. Random Number Generation

The method of verification for the random number generation must be disclosed.

The drivers used the Unisys RTE program, which was independently audited. The initial population of the database was performed by the loader program from V3-02 of the Microsoft TPC-C toolkit, which was also independently audited. Furthermore, the auditor sampled various initial and runtime distributions produced by this implementation to verify correctness.

2.2. Input/Output Screen Layout

The actual layout of the terminal input/output screens must be disclosed.

The screen layouts are based on those in Clauses 2.4.3, 2.5.3, 2.6.3, 2.7.3. and 2.8.3 of the TPC Benchmark C Standard Specification. There are some minor differences in appearance due to the use of a web client implementation.

2.3. Priced Terminal Feature Verification

The method used to verify that the emulated terminals provide all the features described in Clause 2.2.2.4 must be explained. Although not specifically priced, the type and model of the terminals used for the demonstration in 8.1.3.3 must be disclosed and commercially available (including supporting software and maintenance).

This was verified by the auditor by a direct experiment during the onsite audit portion of this benchmark, using Microsoft Internet Explorer 3.0 as the web browser.

2.4. Presentation Managers or Intelligent Terminal

Any usage of presentation managers or intelligent terminals must be explained.

Application code running on the client implemented the TPC-C user interface. A listing of this code is included in Appendix A. No presentation manager was used on the client, as screen manipulation and data input/output was handled for each user by the Microsoft Internet Explorer web browser running on each user PC.

2.5. Transaction Statistics

The percentage of New-Order transactions that were rolled back as a result of an unused item number must be disclosed.

The number of items per order entered by New-Order transactions must be disclosed.

The percentage of home and remote Payment transactions must be disclosed.

The percentage of Payment and Order-Status transactions that used non-primary key (C_LAST) access to the database must be disclosed.

The percentage of Delivery transactions that were skipped as a result of an insufficient number of rows in the NEW-ORDER table must be disclosed.

The mix (i.e., percentages) of transaction types seen by the SUT must be disclosed.

Table 2.1 contains all these statistics.

Table 2.1: Transaction Statistics

Transaction Type	Statistics	Value
New Order	Rolledback transactions	1.01%
	Home warehouse	99.00%
	Remote warehouse	1.00%
	Average Items per Order	10.00
Payment	Home warehouse	85.00%
	Remote warehouse	15.00%
	Non-primary key access	59.98%
Order Status	Non-primary key access	59.83%
Delivery	Skipped transactions (Interactive)	0
	Skipped transaction counts (Deferred)	0
	Skipped District counts (Deferred)	0
Transaction Mix	New Order	44.78%
	Payment	43.03%
	Delivery	4.06%
	Stock-Level	4.07%
	Order-Status	4.07%

2.6. Queuing Mechanism of Delivery

The queuing mechanism used to defer execution of the Delivery transaction must be disclosed.

Tuxedo provides the queue for delivery servers. The client application process posts delivery transactions to the delivery queue using a Tuxedo asynchronous call with the TPNoReply option. Upon return from this call, the client application provides a 'delivery queued' response to the user. Delivery servers independently retrieve messages from their queue, submit them to the data base for processing, and log the result to a file upon completion. The source code for this delivery process is included in Appendix A.

3. Clause 3: Transaction & System Properties

3.1. Transaction System Properties (ACID)

The results of the ACID tests must be disclosed along with a description of how the ACID requirements were met. This includes disclosing which case was followed for the execution of Isolation Test 7.

The TPC Benchmark C Standard Specification defines a set of transaction processing system properties that a system under test (SUT) must support during the execution of the benchmark. Those properties are Atomicity, Consistency, Isolation, and Durability (ACID).

This section defines each of these properties, describes the steps taken to ensure that they were present during the test and describes a series of tests done to demonstrate compliance with the specification. All ACID property tests were executed successfully.

3.2. Atomicity

The system under test must guarantee that data base 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.

3.2.1. Completed Transaction

Perform the Payment transaction for a randomly selected warehouse, district, and customer (by customer number) and verify that the records in the CUSTOMER, DISTRICT, and WAREHOUSE tables have been changed appropriately.

The balances from a randomly selected warehouse, district, and customer row were retrieved by customer number from a script. A Payment transaction was submitted with the same warehouse, district and customer identifiers for a known amount. After completion of the Payment transaction, the balances of the selected warehouse, district, and customer were again retrieved to verify that the changes had been made correctly.

3.2.2. Aborted Transactions

Perform the Payment transaction for a randomly selected warehouse, district, and customer (by customer number) and substitute a ROLLBACK of the transaction for the COMMIT of the transaction. Verify that the records in the CUSTOMER, DISTRICT, and WAREHOUSE tables have NOT been changed.

The balances from a randomly selected warehouse, district, and customer row were retrieved by customer number from a script. A Payment transaction was submitted with the same warehouse, district and customer identifiers that issued a ROLLBACK command rather than a COMMIT. After the transaction completed, the balances of the selected warehouse, district, and customer were again retrieved to verify that no changes had been made to the database.

3.3. Consistency

Consistency is the property of the application that requires any execution of a data base transaction to take the data base from one consistent state to another, assuming that the data base is initially in a consistent state.

The benchmark specification requires explicit demonstration of the following four consistency conditions:

1. The sum of the district balances in a warehouse is equal to the warehouse balance;
2. For each district, the next order id minus one is equal to maximum order id in the ORDER table and equal to the maximum new order id in the NEW ORDER table;
3. For each district, the maximum order id minus minimum order id in the ORDER table plus one equals the number of rows in the NEW-ORDER table for that district;
4. For each district, the sum of the order line counts in the ORDER table equals the number of rows in the ORDER-LINE table for that district;

In order to demonstrate this consistency, the following steps were taken:

1. Prior to the start of a benchmark run, the consistency of the database was verified by testing successfully conditions 1-4 described above with a script.
2. A run under full user load was executed for over 10 minutes with a checkpoint during the run.
3. After completion of that test, the consistency of the database was again verified by successfully testing using the same consistency script as in step 1.

3.4. Isolation

Sufficient conditions must be enabled at either the system or application level to ensure the required isolation defined above (clause 3.4.1) is obtained.

The benchmark specification defines seven required tests to be performed to demonstrate that required levels of transaction isolation are met. These tests, described in Clauses 3.4.2.1 - 3.4.2.7, were all performed from a script and verified by the auditor. In Isolation Test 7, Case A was observed. In addition, the phantom tests and stock level tests were executed and verified to be successful.

3.5. Durability

The tested system must guarantee durability: the ability to preserve the effects of committed transactions and insure data base consistency after recovery from any one of the failures listed in Clause 3.5.3.

Three durability tests were executed to satisfy the requirements of the specification. The test for loss of memory and instantaneous interruption was combined and performed with a fully scaled database with 9,000 emulated users. The loss of log and loss of data tests were combined and performed on a separate ten warehouse database with 100 emulated users. To the best of our knowledge, these tests prove that the fully scaled configuration used for the throughput test would also meet all durability tests.

3.5.1. Loss of Log and Loss of Data Disk

The following steps were taken (using a ten warehouse database on the SUT) to demonstrate durability in the case of loss of a log and subsequent loss of a data disk:

1. The database was backed up to extra disks on a dump device.
2. The D_NEXT_O_ID fields for all rows in the district table were summed up to determine the initial count of orders present in the database.
3. The RTE was started with 100 users. On the driver systems, committed and rolled back New-Order transactions were recorded in a “success” file.
4. One of the mirrored hot-pluggable log disks was removed from the disk cabinet after five minutes of steady state.

5. Log disk mirroring is done by a RAID controller, so NT and SQL Server did not notice the disk loss. The benchmark run continued without interruption.
6. After another five minutes of running at steady state, a hot-pluggable database disk was removed from the disk cabinet.
7. NT and SQL Server encountered IO errors due to the missing disk and recorded these errors in the NT event log and SQL Server error log, respectively.
8. First, the RTEs and clients were stopped, then SQL Server was stopped, and finally the SUT was shutdown and restarted.
9. SQL Server was restarted and marked the database as 'suspect'. A dump of the transaction log was taken to extra disks on a dump device.
10. Next, scripts were executed to drop the database and all its devices. Then, SQL Server was shutdown again and the SUT shutdown.
11. A different data disk was inserted in the disk cabinet to replace the one removed. (The removed log disk was never replaced.) The RAID controller was used to recreate the stripe set containing the new data disk.
12. The SUT was restarted, and Disk Administrator was used to assign the proper drive letter to the new stripe set. SQL Server was then restarted and an empty database created. After space allocation had finished, the database was recovered by first reloading the entire initial database and log from backup, then by loading and applying the transaction log dump that was taken after the data disk failure. The latter step restored all committed transactions to the database.
13. Consistency condition 3 of Clause 3.3.2.3 was executed to verify database consistency.
14. Step 2 was repeated to determine the total number of orders. This number was subtracted from the count obtained previously in Step 2 to determine the number of additional orders added to the database.
15. The contents of the "success" files on the drivers were sampled to verify that the records in the "success" file for committed New-Order transactions had corresponding records in the ORDER table and no entries existed for rolled back transactions. Moreover, the counts were matched with those obtained in step 14.

3.5.2. Instantaneous Interruption and Loss of Memory

Instantaneous interruption and loss of memory tests were combined because the loss of power erased the contents of memory. This failure was induced by removing the primary power to the System Under Test while the benchmark was executing.

1. The D_NEXT_O_ID fields for all rows in the district table were summed up to determine the initial count of orders present in the database (count1).
2. On the driver systems, committed and rolled back New-Order transaction were recorded in a "success" file.
3. The benchmark was executed at full load with 9,000 emulated users for a minimum of 10 minutes.
4. Immediately after execution of a checkpoint completed, the system's primary power was turned off.
5. The test was aborted on the driver and client systems, and the RTEs and clients were shutdown.
6. Power was restored to the SUT, the system rebooted, SQL Server was restarted, and automatic database recovery was performed. The database recovery uses the transaction log to reapply all committed transactions and rollback any (in progress) uncommitted transactions, so that the database disks are correct.
7. After recovery finished, Consistency Condition of Clause 3.3.2.3 (no gaps in NO_O_ID) was executed to verify that the database was consistent..
8. Next, samples of the contents of the "success" file on the driver were compared against corresponding rows of the ORDER table to verify that records in the "success" file for committed New-Order transactions had corresponding records in the ORDER table and no entries existed for rolled back transactions.
9. Finally, step 1 was repeated to determine the total number of orders (count2). Count2 minus count1 was not less than the number of committed New-Order records in the "success" file.

4. Clause 4: Scaling & Database Population

4.1. Initial Cardinality of Tables

The Cardinality (e.g., the number of rows) of each table, as it existed at the start of the benchmark run, must be disclosed. If the database was over-scaled and inactive rows of the WAREHOUSE table were deleted (see Clause 4.2.2 and the Auditor's attestation letter) the cardinality of the WAREHOUSE table as initially configured and the number of rows deleted must be disclosed.

The TPC-C database for this test was configured with 900 warehouses. The cardinality of each table in the database is listed in Table 4.1

Table 4.1: Initial Cardinality of Database Table

Table	Occurrences
Warehouse	900
District	9,000
Customer	27,000,000
History	27,000,000
Order	27,000,000
New Order	8,100,000
Order Line	269,999,044
Stock	90,000,000
Item	100,000

4.2. Constant Values

The following values were used as the constant C input values to the NURand function during Build and Run time for this implementation.

Table 4.2: Constant C for NURand

Function	Value
C_LAST (Build)	123
C_LAST (Run)	223

4.3. Database Layout

The distribution of tables and logs across all media must be explicitly depicted for the tested and priced systems.

Tables 4.3, 4.4 and 4.5 list the distribution of the database over 127 disks and the transaction log over four mirrored pairs of disks for the benchmark configuration. In addition, there was one disk containing Windows NT and SQL Server code and the Master database plus the paging file. Database backup used an extra 12 disks. For Durability

testing with a smaller 10 warehouse database, another 9 disks were used: 4 for the database, 2 for a mirrored log and 3 for backup. All these 21 extra disks were excluded from the priced configuration. Apart from that, the measured and priced disk configurations are identical. (Note: Durability testing with the 10 warehouse database was performed first, then its 9 disks were removed from the measured system prior to the start of TPC-C measurements).

4.4. DBMS: Data Model and DBMS Interface/Access Language

A statement must be provided that describes:

1. *The data model implemented by the DBMS used (e.g., relational, network, hierarchical).*

2. *The database interface (e.g., embedded, call level) and access language (e.g., SQL, DL/1, COBOL, read/write) used to implement the TPC-C transactions. If more than one interface/access language is used to implement TPC-C, each interface/access language must be described and a list of which interface/access language is used with which transaction type must be disclosed.*

Microsoft SQL Server 6.5 Enterprise Edition is a relational DBMS.

The client software interfaced to SQL Server through Stored Procedures invoked through Remote Procedure Calls embedded in the C application code. Specifically, DBLIB and TCP/IP sockets were used.

4.5. DBMS Partitions/Replications

The mapping of database partitions/replications must be explicitly described.

No table partitioning or replication was done.

4.6. DBMS Space Requirements

Details of the 180 day space computation along with proof that the database is configured to sustain 8 hours of growth for dynamic tables (Order, Order-line, and History) must be disclosed (see Clause 4.2.3).

Appendix E lists the space requirements for the 180-day space as well as the logical log space for eight hours.

Table 4.3: Disk Cage Configuration

ALR Revolution 6X6 Disk Cage Configuration for TPCC

Adapter 1

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	4GB	4GB	6	13	4GB	4GB	6
12	empty	4GB	4	12	empty	4GB	4
11	4GB	4GB	3	11	4GB	4GB	3
10	4GB	4GB	2	10	4GB	4GB	2
9	4GB	4GB	1	9	4GB	4GB	1
8	4GB	4GB	0	8	4GB	4GB	0

Adapter 2

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	4GB	4GB	6	13	4GB	4GB	6
12	empty	4GB	4	12	empty	4GB	4
11	4GB	4GB	3	11	4GB	4GB	3
10	4GB	4GB	2	10	4GB	4GB	2
9	4GB	4GB	1	9	4GB	4GB	1
8	4GB	4GB	0	8	4GB	4GB	0

Adapter 3

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	9GB	4GB	6	13	9GB	4GB	6
12	empty	4GB	4	12	empty	4GB	4
11	4GB	4GB	3	11	4GB	4GB	3
10	4GB	4GB	2	10	4GB	4GB	2
9	4GB	4GB	1	9	4GB	4GB	1
8	4GB	4GB	0	8	4GB	4GB	0

Adapter 4

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	9GB	4GB	6	13	9GB	4GB	6
12	9GB	4GB	4	12	empty	4GB	4
11	4GB	4GB	3	11	4GB	4GB	3
10	4GB	4GB	2	10	4GB	4GB	2
9	4GB	4GB	1	9	4GB	4GB	1
8	4GB	4GB	0	8	4GB	4GB	0

Adapter 5

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	9GB	4GB	6	13	9GB	4GB	6
12	9GB	4GB	4	12	9GB	4GB	4
11	9GB	4GB	3	11	9GB	4GB	3
10	4GB	4GB	2	10	4GB	4GB	2
9	4GB	4GB	1	9	4GB	4GB	1
8	4GB	4GB	0	8	4GB	4GB	0

Adapter 6

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	9GB	9GB	6	13	9GB	4GB	6
12	9GB	9GB	4	12	9GB	4GB	4
11	9GB	9GB	3	11	9GB	4GB	3
10	empty	9GB	2	10	empty	4GB	2
9	9GB	9GB	1	9	empty	4GB	1
8	9GB	9GB	0	8	4GB	4GB	0

Adapter 7

Channel 1				Channel 2			
ID	Left Side	Right Side	ID	ID	Left Side	Right Side	ID
13	9GB	9GB	6	13	9GB	9GB	6
12	9GB	9GB	4	12	9GB	9GB	4
11	9GB	9GB	3	11	9GB	9GB	3
10	9GB	9GB	2	10	9GB	9GB	2
9	empty	9GB	1	9	empty	9GB	1
8	9GB	9GB	0	8	9GB	9GB	0

Table 4.4: Disk Usage/Size Totals

ALR Revolution 6X6 Disk Usage/Size Totals for TPCC										
Disk Usage	**Size (GB)**	**Adaptec**	**HA-1**	**HA-2**	**HA-3**	**HA-4**	**HA-5**	**HA-6**	**HA-7**	**Total**
system	4	1								1
tpcc - data	4		20	20	20	20	18	7		105
tpcc - data	9							8	14	22
tpcc - log	9								8	8
tpcc - backup	9						6	6		12
tpcc10 - data	4		2	2						4
tpcc10 - log	9				2					2
tpcc10 - backup	9					3				3
Total Measured	4 & 9	1	22	22	22	23	24	21	22	157
4GB drives	4	1	22	22	20	20	18	7		110
9GB drives	9				2	3	6	14	22	47
Total Priced	4 & 9		20	20	20	20	18	15	22	136
4GB drives	4	1	20	20	20	20	18	7		106
9GB drives	9							8	22	30

Table 4.5: Disk Administrator Configuration

Disk Administrator Configuration for ALR Revolution 6X6						
Disk	**Partition 1**	**Partition 2**	**Unused Capacity**	**AMI #**	**LD#**	**Usage**
0 82976 MB	E: (raw) 9507 MB	R: (raw) 5005 MB	 Free Space 68465 MB	1	1	 data tpcc
1 8291 MB	V: (raw) 8291 MB		 (none)	1	2	 data tpcc10
2 82976 MB	F: (raw) 9507 MB	O: (raw) 1004 MB	 Free Space 72465 MB	2	1	 data tpcc
3 8291 MB	W: (raw) 8291 MB		 (none)	2	2	 data tpcc10
4 82976 MB	G: (raw) 9507 MB	S: (raw) 5005 MB	 Free Space 68465 MB	3	1	 data tpcc
5 8676 MB	Z: (raw) 8676 MB		 (none)	3	2	 log tpcc10
6 82976 MB	H: (raw) 9507 MB	N: (raw) 1200 MB	 Free Space 72269 MB	4	1	 data tpcc
7 17359MB	Y: (raw) 17359 MB		 (none)	4	2	 backup tpcc10
8 74677 MB	I: (raw) 9507 MB	T: (raw) 5005 MB	 Free Space 60165 MB	5	1	 data tpcc
9 BACKUP1 43402 MB	P: NTFS 43402 MB		 (none)	5	2	 backup tpcc
10 62228 MB	J: (raw) 3608 MB	M: (raw) 1200 MB	 Free Space 57420 MB	6	1	 data tpcc
11 BACKUP2 43402 MB	Q: NTFS 43402 MB		 (none)	6	2	 backup tpcc
12 121546 MB	K: (raw) 2102MB	U: (raw) 4008 MB	 Free Space 115436 MB	7	1	 data tpcc
13 34726 MB	L: (raw) 32703 MB		 Free Space 2024 MB	7	2	 log tpcc
14 SYSTEM 4149 MB	C: NTFS 2047 MB	X: FILES NTFS 2102 MB	 (none)	Adaptec		 system files
CD-ROM	D:			Adaptec		

5. Clause 5: Performance Metrics & Response Time

5.1. Measured Throughput (tpmC)

Measured tpmC must be reported.

The measured tpmC was 10665.53.

5.2. Response Times

Ninetieth percentile, maximum and average response times must be reported for all transaction types as well as for the Menu response time.

Table 5.1: Response Time Data

Transaction	Average	Maximum	90th % ile
New-Order	1.27	16.30	2.63
Payment	1.31	15.12	2.60
Delivery	0.45	6.61	0.70
Stock-Level	2.32	15.72	4.00
Order Status	1.62	17.61	3.01
Menu	0.20	1.40	0.30
Delivery (Deferred)	0.84	7.19	1.19

5.3. Keying and Think Times

The minimum, the average, and the maximum keying and think times must be reported for each transaction type.

Table 5.2: Keying Times

Transaction	Minimum	Average	Maximum
New-Order	18.00	18.01	19.12
Payment	3.00	3.01	4.14
Delivery	2.00	2.00	3.08
Stock-Level	2.00	2.00	3.04
Order Status	2.00	2.00	3.02

Table 5.3: Think Times

Transaction	Minimum	Average	Maximum
New-Order	0.00	12.24	120.00
Payment	0.00	12.19	120.00
Delivery	0.00	5.07	50.00
Stock-Level	0.00	5.07	50.00
Order Status	0.00	10.11	100.00

5.4. Response Time Frequency Distribution Curves

Response Time frequency distribution curves (see Clause 5.6.1) must be reported for each transaction type.

Figure 5.1: New Order Response Time Distribution

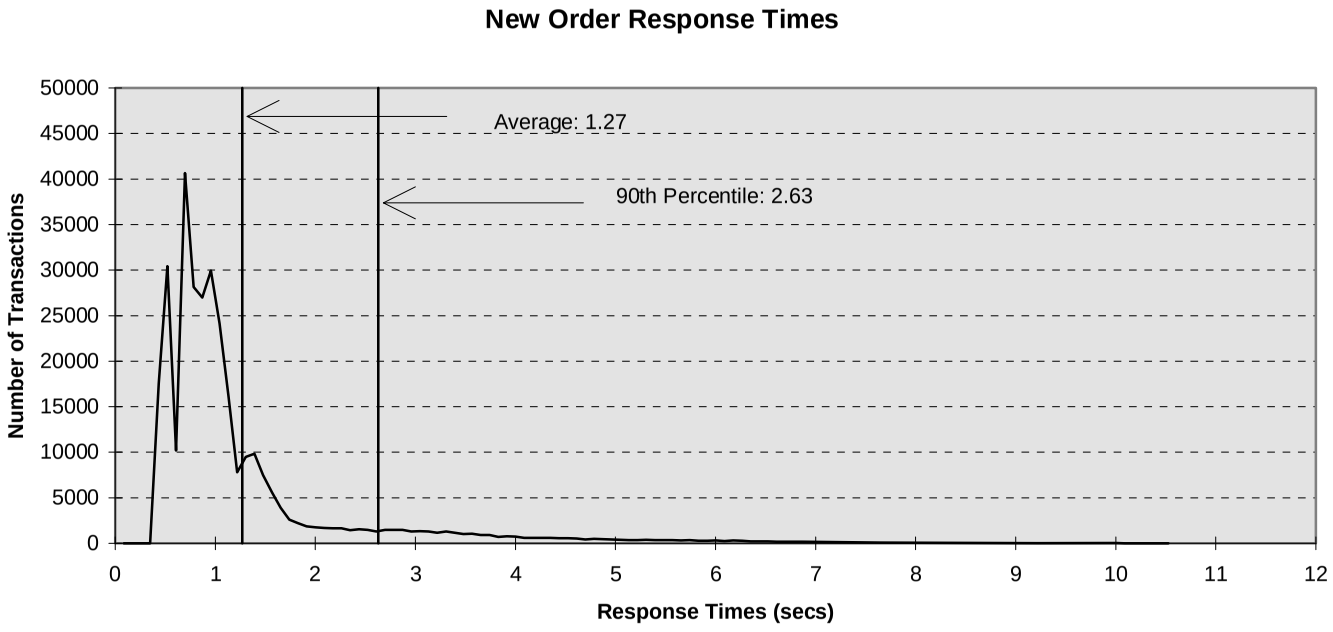


Figure 5.2: Payment Response Time Distribution

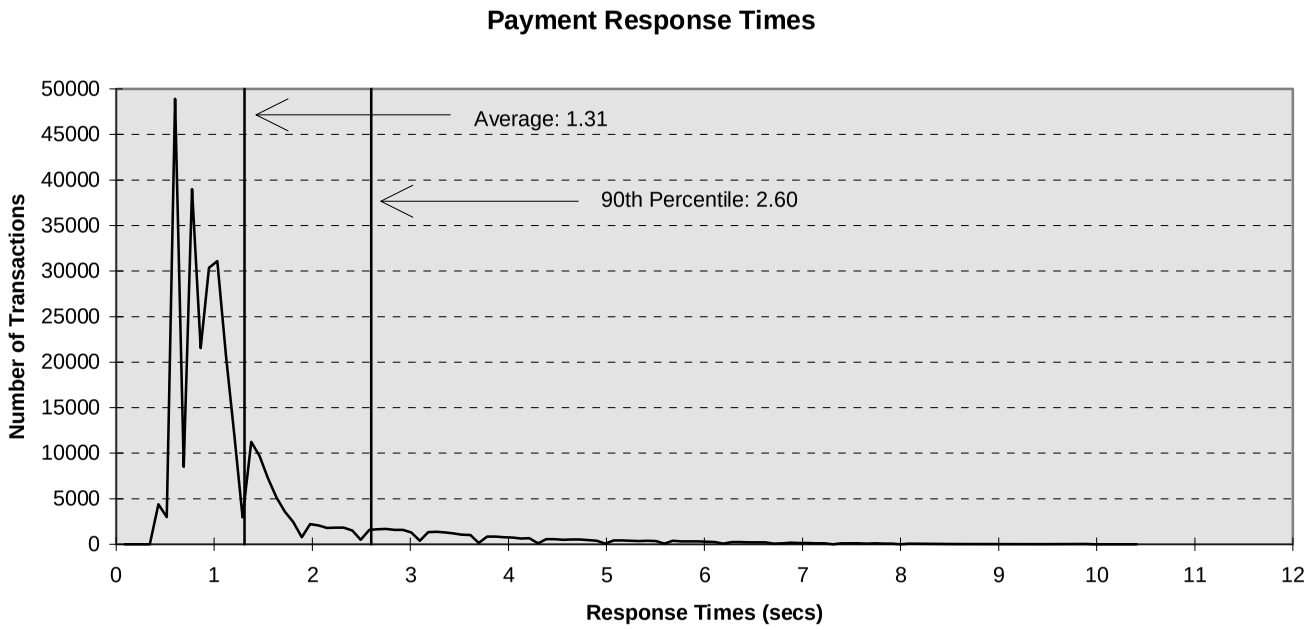


Figure 5.3: Order Status Response Time Distribution

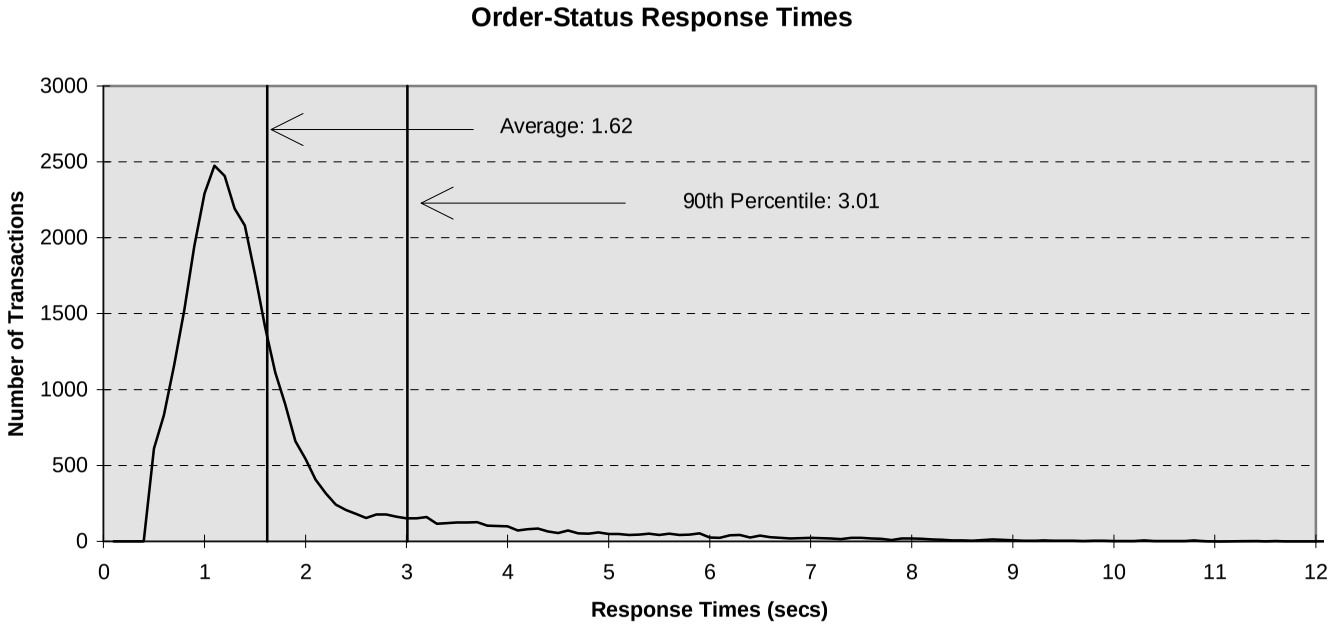


Figure 5.4: Delivery Response Time Distribution

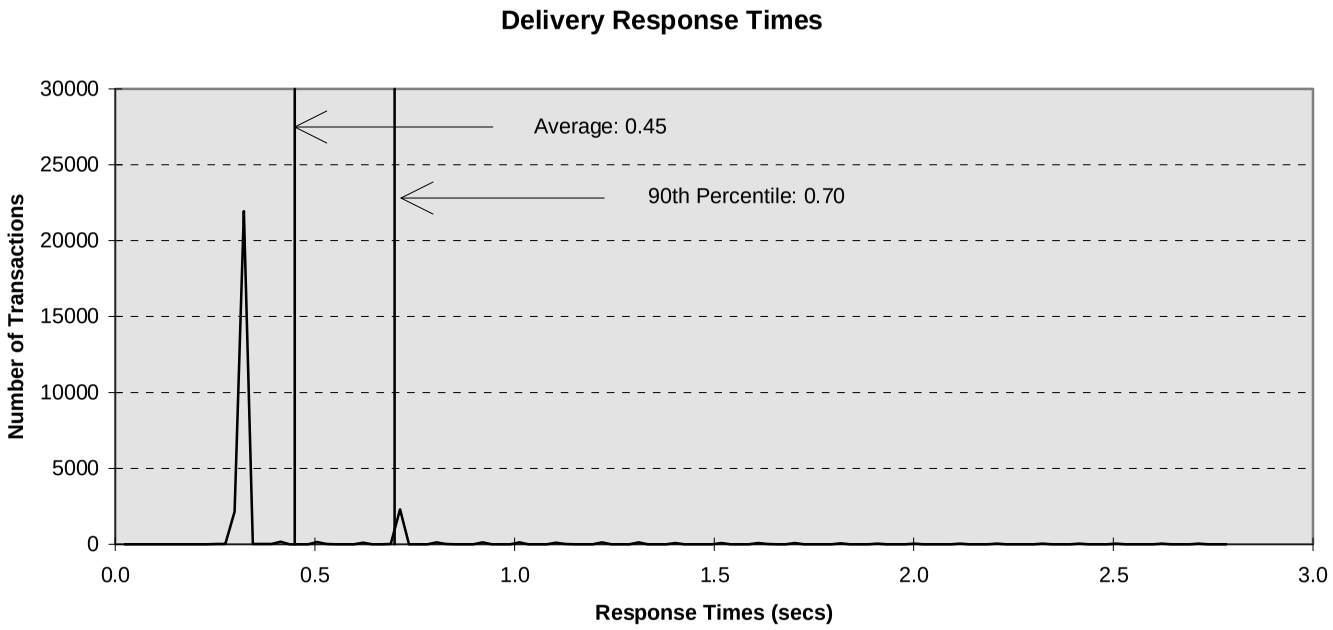
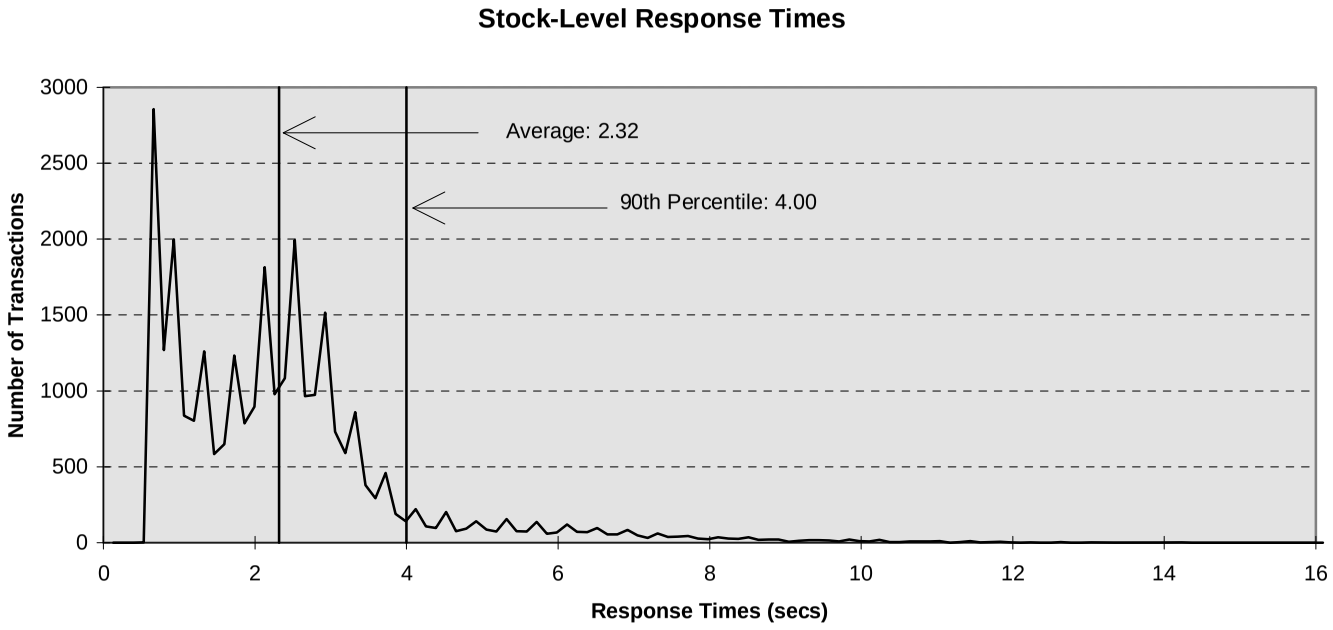


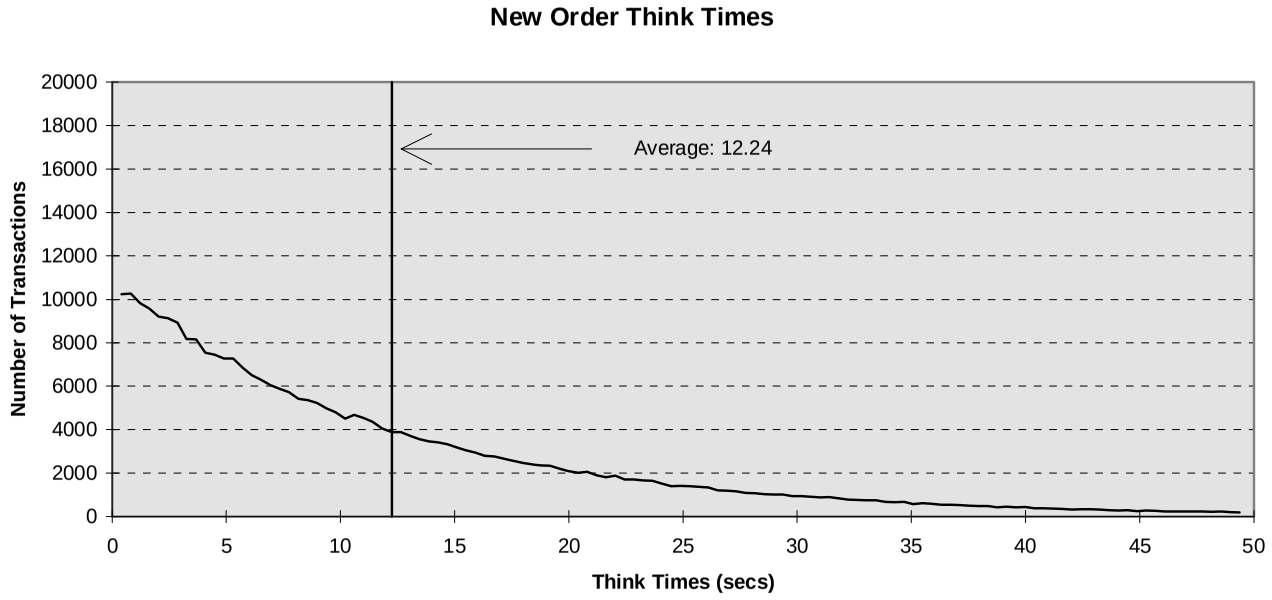
Figure 5.5: Stock Level Response Time Distribution



5.5. New Order Think Time Frequency Distribution Curve

Think Time frequency distribution curve (see Clause 5.6.3) must be reported for the New-Order transaction.

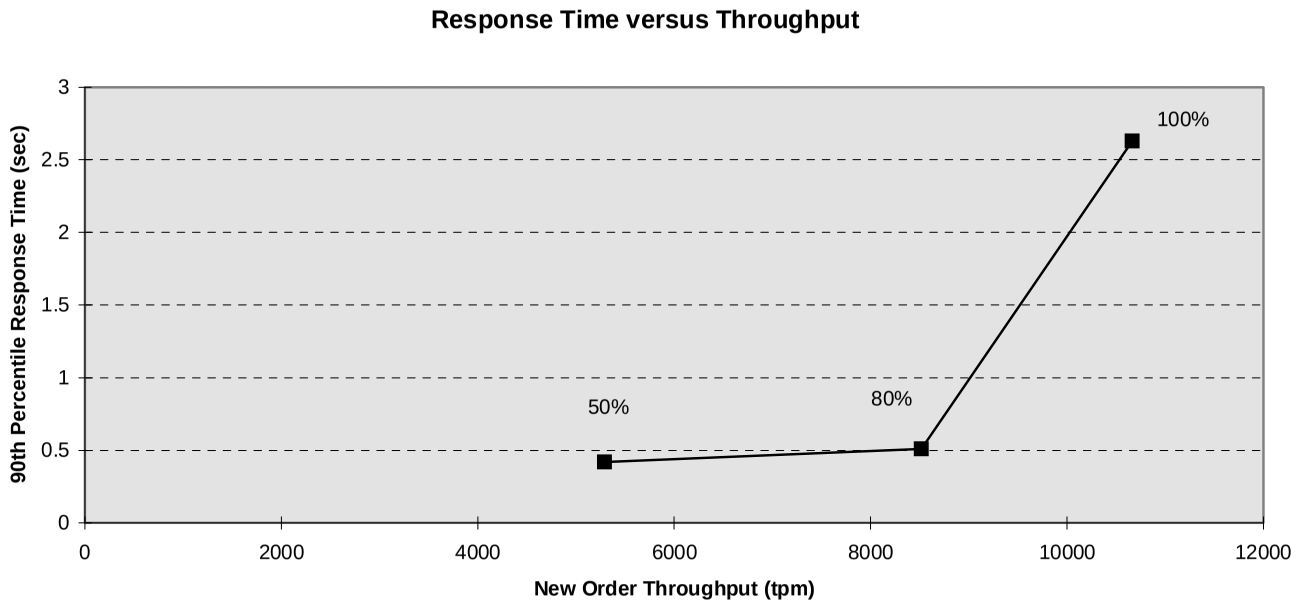
Figure 5.6: New Order Think Time Distribution



5.6. Response Time versus Throughput Performance Curve

The performance curve for response times versus throughput (Clause 5.6.2) must be reported for the New-Order transaction

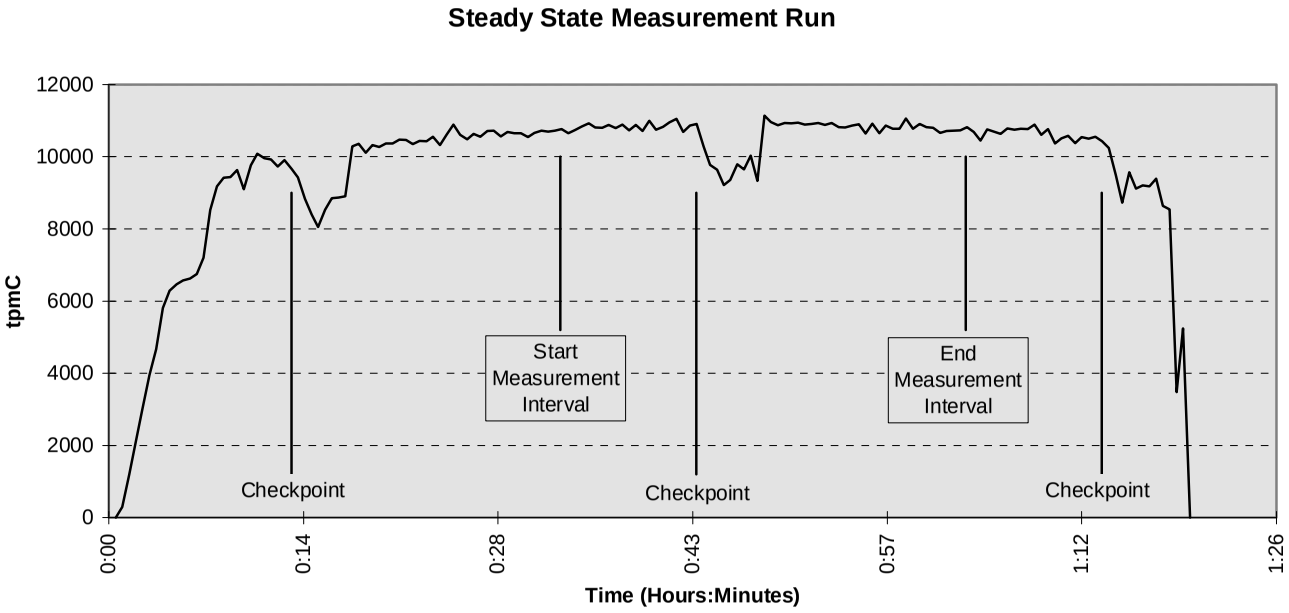
Figure 5.7: Response Time versus Throughput



5.7. New-Order Throughput vs. Time

A graph of throughput versus elapsed time (Clause 5.6.5) must be reported for the New-Order transaction.

Figure 5.8: Throughput (tpmC) versus Time



5.8. Determination of "Steady State"

The method used to determine that the SUT had reached a steady state prior to commencing the measurement interval (see Clause 5.5) must be described.

The transaction throughput rate (tpmC) and response time were relatively constant after the initial 'ramp up' period. The throughput and response time behavior were determined by examining data reported for each 30-second interval over the duration of the benchmark. Ramp-up, steady state, and ramp-down regions are discernible in the graph presented in Figure 5.8.

5.9. Work Performed During Steady State

A description of how the work normally performed during a sustained test (for example checkpointing, writing redo/undo log records, etc.) actually occurred during the measurement interval must be reported.

The RTE selects a transaction type from the menu and prepares to request the appropriate blank form. A timestamp is taken before the form request is sent and after the response is returned. The difference between the two is saved off as the menu response time. The RTE then generates input data for the transaction to create a completed form and waits the appropriate key time. A timestamp is taken before the completed form is sent and after the response is returned. The difference between these two is saved off as the transaction response time. Both response times are padded with a 0.1 second delay per spec to account for the web browser delay. The appropriate transaction data and response times are logged and the RTE waits the required think time interval before repeating the process. Each RTE driver maintains its own log file. Log file contents are consolidated for the reports.

The RTE emulates web browsers (not terminals) in this client-server implementation. The RTE sends and receives HTML formatted data using HTTP through Ethernet LANs to a client application running on the client machine. The

client application processes the request, sends the transaction to a Tuxedo TPC-C application server queue, waits for the transaction response (except for delivery), and returns an appropriately formatted HTML form back to the (emulated) web browser (RTE). The Tuxedo TPC-C application server retrieves a message from its queue, invokes request processing via a stored procedure on the database server using Microsoft SQL Server DBLIB and RPC through sockets over another Ethernet LAN, accepts the response, and returns a result to the client application (via Tuxedo). For delivery transactions, the client application does not wait for the Tuxedo TPC-C delivery server to respond. Each delivery server logs its results to its own file. The delivery report files are consolidated for reports.

To perform checkpoints at specific intervals, SQL Server's checkpoint interval was set to the maximum allowable value and a script was written to schedule checkpoints at 30 minute intervals and record the start and end time of each checkpoint. The checkpoint script was started manually on one of the client machines after the RTE had all users logged in and sending transactions and a steady state had been achieved. Using this information, the positioning of the checkpoint within the measurement interval was verified to be clear of the guard zones.

At each checkpoint, SQL Server wrote to disk all database pages in memory that had been updated but not yet physically written to the disk. Upon completion of the checkpoint, SQL Server also wrote records to the transaction log indicating that a checkpoint had completed.

5.10. Reproducibility

A description of the method used to determine the reproducibility of the measurement results must be reported.

In a repeat test, carried out in the same manner as the primary test, a throughput of 10661.70 tpmC was achieved on the same database during a 30-minute, steady state run. All required transaction statistics were met. See the Auditor's attestation letter for details.

5.11. Measurement Interval Duration

A statement of the duration of the measurement interval for the reported Maximum Qualified Throughput (tpmC) must be included.

The measurement interval was 30 minutes.

5.12. Regulation of Transaction Mix

The method of regulation of the transaction mix (e.g. card decks or weighted random distribution) must be described. If weighted distribution is used and the RTE adjusts the weights associated with each transaction type, the maximum adjustments to the weight from the initial value must be disclosed.

The RTE was given a weighed random distribution which was not adjusted during the run. The transaction weights were defined as follows:

NEW_ORDER_PROB	.4466
PAYMENT_PROB	.4313
DELIVER_PROB	.0407
STOCK_LEVEL_PROB	.0407
ORDER_STATUS_PROB	.0407

5.13. Transaction Statistics

The percentage of the total mix for each transaction type must be disclosed.

The percentage of New-Order transactions rolled back as a result of invalid item number must be disclosed.

The average number of order-lines entered per New-Order transaction must be disclosed.

The percentage of remote order-lines entered per New-Order transaction must be disclosed.

The percentage of remote Payment transactions must be disclosed.

The percentage of customer selections by customer last name in the Payment and Order-Status transactions must be disclosed.

The percentage of Delivery transactions skipped due to there being fewer than necessary orders in the New-Order table must be disclosed.

Table 5.4 shows this information.

Table 5.4: Transaction Statistics

Transaction Type	Statistics	Value
New Order	Rolledback transactions	1.01%
	Home warehouse	99.00%
	Remote warehouse	1.00%
	Average Items per Order	10.00
Payment	Home warehouse	85.00%
	Remote warehouse	15.00%
	Non-primary key access	59.98%
Order Status	Non-primary key access	59.83%
Delivery	Skipped transactions (Interactive)	0
	Skipped transaction counts (Deferred)	0
	Skipped District counts (Deferred)	0
Transaction Mix	New Order	44.78%
	Payment	43.03%
	Delivery	4.06%
	Stock-Level	4.07%
	Order-Status	4.07%

5.14. Checkpoint Statistics

The number of checkpoints in the measurement interval, the time in seconds from the start of the measurement interval to the first checkpoint, and the Checkpoint Interval must be disclosed.

There is one checkpoint in the measurement interval. The checkpoint starts nine minutes into the measurement interval. The checkpoint interval is 30 minutes (from the start of one to the start of the next) and a checkpoint lasts approximately four minutes. In conformance with Clause 5.2.2 there is no checkpoint within a span of 7.5 minutes before or after the beginning or end of the measurement interval.

6. Clause 6: SUT, Driver & Communications Definition

6.1. Remote Terminal Emulator (RTE) Description

The RTE input parameters, code fragments, functions, etc. used to generate each transaction input field must be disclosed.

The RTE used is proprietary to Unisys. Appendix D contains the profile used as input to this RTE.

6.2. Emulated Components

It must be demonstrated that the functionality and performance of the components being emulated in the Driver System are equivalent to that of the priced system.

There were no emulated components in the benchmark configuration other than the emulated web browsers on the users' PCs.

6.3. Functional Diagrams

A complete functional diagram of both benchmark and the configuration of the proposed (target) system must be disclosed. A detailed list of all hardware and software functionality being performed on the Driver System and its interface to the SUT must be disclosed.

Section 0.7 describes and shows functional diagrams of the benchmarked and priced systems.

6.4. Network Configuration

The network configuration of both the tested and proposed (target) services which are being represented and a thorough explanation of exactly which parts are being replaced with the Driver System must be disclosed.

Figures 0.1 and 0.2 in Section 0.7 also diagram the network configurations of the benchmark and configured systems and represent the RTEs connected via LAN replacing the user PCs that are directly connected via LAN.

6.5. Network Bandwidth

The bandwidth of the network(s) used in the tested/priced configuration must be disclosed.

Ethernet local area networks (LAN) with a bandwidth of 10 megabits per second are used in the tested/priced configurations between RTE/emulated web browsers and the client machines. A single Ethernet LAN with a bandwidth of 100 megabits per second is used between the client machines and the database server (SUT).

Each of the clients contains one 100 megabit per second LAN adapter and two 10 megabit per second LAN adapters. The 100 megabit per second LAN adapter is connected to a single LAN segment and to the database server in both priced and tested configurations.

In the priced configuration, the clients are each connected via two 10Mbit LAN segments to workstations (PCs running web browsers).

In the tested configuration, each client also contains two 10 megabit per second LAN adapters. Each LAN adapter connects to a LAN adapter on an RTE (driver) machine.

6.6. Operator Intervention

If the configuration requires operator intervention (see Clause 6.6.6), the mechanism and the frequency of this intervention must be disclosed.

No operator intervention was required to sustain eight hours of operation at the reported throughput.

7. Clause 7: Pricing

7.1. Pricing

A detailed list of hardware and software used in the priced system must be reported. Each separately orderable item must have vendor part number, description, and release/revision level, and either general availability status or committed delivery date. If package-pricing is used, vendor part number of the package and a description uniquely identifying each of the components of the package must be disclosed. Pricing source(s) and effective date(s) must also be reported.

The total 5-year price of the entire configuration must be reported, including: hardware, software, and maintenance charges. Separate component pricing is recommended. The basis of all discounts used must be disclosed.

System pricing should include subtotals for the following components: Server Hardware, Server Software, Client Hardware, Client Software, and Network Components used for terminal connection (see Clause 7.2.2.3). Clause 6.1 describes the Server and Client components.

System pricing must include line item indication where non-sponsoring companies' brands are used. System pricing must also include line item indication of third party pricing.

A detailed list of hardware and software components along with their part numbers and prices are given in the Executive Summary near the beginning of this document.

7.1.1. System Pricing

Each priced configuration consists of an integrated system package, additional options, and components. Prices for all ALR products are US list prices.

7.1.2. Maintenance Pricing

The ALR standard factory warranty covers major components for five (5) years, with associated labor costs covered for thirty-six (36) months. All other peripheral components (excluding monitors) are warranted for thirty-six (36) months from time of delivery to the original purchaser. The Microsoft support pricing is based on sixty (60) months of monthly support costs.

ALR ProCare extended coverage plan "G" is a five-year, four-hour response time, same business day plan.

Netlux provide return-to-factory replacement within seven (7) days. Appropriate spares are included in the priced configuration.

7.1.3. Discounts

No discounts were applied to the priced configuration.

7.2. Availability

The committed delivery date for general availability (availability date) of products used in the price calculation must be reported. When the priced system includes products with different availability dates, the reported availability date for the priced system must be the date at which all components are committed to be available.

The hardware, software and support/maintenance products priced in this benchmark are detailed on page vi.

Microsoft NT Server 4.0 Enterprise Edition and SQL Server 6.5 Enterprise Edition will be available by November 30th, 1997. RAID controllers/firmware and monolithic NT driver will also be available by November 30th, 1997 All other components are available.

7.3. Measured tpmC, Price/Performance, and Availability Date

A statement of the measured tpmC as well as the respective calculations for the 5-year pricing, price/performance (price/tpmC), and the availability date must be included.

ALR Revolution 6X6, with Microsoft Windows NT Server 4.0 Enterprise Edition and SQL Server 6.5 Enterprise Edition, achieved 10,665.53 tpmC at $48.10 per tpmC. All components will be available by November 30th, 1997.

7.4. Country-Specific Pricing

Additional Clause 7 related items may be included in the Full Disclosure Report for each country specific priced configuration. Country specific pricing is subject to Clause 7.1.7.

None.

7.5. Usage Pricing

For any usage pricing, the sponsor must disclose:

- *Usage level at which the component was priced.*
- *A statement of the company policy allowing such pricing.*

The component pricing based on usage is shown below:

- One (1) Microsoft Windows NT Server 4.0 Enterprise Edition license
- One (1) Microsoft SQL 6.50 Server Enterprise Edition license
- Five (5) Microsoft Windows NT 4.0 Licenses
- One (1) Microsoft SQL Server Programmers Toolkit
- One (1) Microsoft Visual C++ Subscription
- Five (5) BEA Tuxedo 6.3 CFS for NT licenses

Microsoft SQL Server & Internet Information Server and BEA Tuxedo were priced for an unlimited number of users.

8. Clause 8 : Full Disclosure Availability

8.1. Availability

The Full Disclosure Report must be readily available to the public at a reasonable charge, similar to charges for similar documents by that test sponsor.

Copies of this Full Disclosure Report may be obtained by contacting:

TPC Benchmark Administrator
Advanced Logic Research, Inc.
9401 Jeronimo Road
Irvine, CA 92618
USA

9. *Clause 9 : Audit*

9.1. Auditor's Report

The auditor's name, address, phone number and a copy of the auditor's attestation letter indicating compliance must be included in the Full Disclosure Report.

This implementation of the TPC Benchmark C on the ALR Revolution 6X6 was audited by Richard Gimarc, a TPC certified auditor of:

Performance Metrics Inc.,
2229 Benita Drive, Suite 101,
Rancho Cordova, CA 95670.

(916)635-2822 Fax: (916) 858-0109
e-mail: Richard@PerfMetrics.com

The attestation letter is shown on the next page.

PERFORMANCE METRICS INC.
TPC Certified Auditors

Cameron Spears
Software Engineering Manager
Advanced Logic Research, Inc.
9401 Jeronimo
Irvine, CA 92618

July 9, 1997

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

Platform: ALR Revolution 6X6 Server
Database Manager: Microsoft SQL Server 6.5 Enterprise Edition
Operating System: Microsoft Windows NT Server 4.0 Enterprise Edition
Transaction Manager: BEA Tuxedo CFS 6.3 for NT

CPUs	Memory	Disks	New-Order Response Time @ 90%	tpmC
Server: ALR Revolution 6X6 Server				
6 Pentium Pro @ 200 MHz	Main: 4 GB L2 Cache: 512 KB	106 @ 4.05 GB 42 @ 8.48 GB	2.63 sec.	10,665.53
5 Clients: Unisys Aquanta DM/6				
1 Pentium Pro @ 200 MHz	Main: 256 MB L2 Cache: 256 KB	1 @ 1.51 GB	n.a.	n.a.

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:

- The transactions were correctly implemented.
- The database files were properly sized and populated.
- The database was properly scaled with 900 warehouses.
- The ACID properties were met, including phantom protection.
- The durability data loss and log loss tests were performed on a 10-warehouse database.
- Input data was generated according to the specified percentages.
- Eight hours of mirrored log space was configured on the measured system.

2229 Benita Drive, Suite 101, Rancho Cordova, CA 95670
(916) 635-2822 Fax: (916) 858-0109 e-mail: Richard@PerfMetrics.com

PERFORMANCE METRICS INC.
TPC Certified Auditors

- The following disks contained backup data and were not active during measurement: twelve 8.48 GB disks. These twelve disks were not included in the priced configuration.
- The 180-day space calculation was verified. The measured system contained sufficient storage to satisfy this requirement.
- Measurement cycle times include a 0.1 second menu and a 0.1 second response time delay for an emulated Web browser.
- The steady state portion of the test was 30 minutes.
- One checkpoint was taken during the steady state portion of the test.
- Checkpoints were verified to be clear of the guard zones.
- There were 9,000 user contexts present on the system.
- Each emulated user started with a different random number seed.
- The NURand constants used for database load and at run time were verified.
- System pricing was checked for major components and maintenance.

Additional Audit Notes:

- The benchmark was executed on a Unisys Aquanta HS/6 Server. All active components on the Unisys Aquanta HS/6 Server and the ALR Revolution 6X6 Server are identical.

Regards,

Richard L. Gimarc

Richard L. Gimarc
Auditor

2229 Benita Drive, Suite 101, Rancho Cordova, CA 95670
(916) 635-2822 Fax: (916) 858-0109 e-mail: Richard@PerfMetrics.com

Appendix A - Client/Server Source

CLIENT MAKEFILE

```
# Microsoft Developer Studio Generated NMAKE File, Format Version 4.20
# ** DO NOT EDIT **

# TARGTYPE "Win32 (x86) Console Application" 0x0103

!IF "$(CFG)" == ""
CFG=tpcclisten - Win32 Debug
!MESSAGE No configuration specified.  Defaulting to tpcclisten - Win32
Debug.
!ENDIF

!IF "$(CFG)" != "tpcclisten - Win32 Release" && "$(CFG)" !=\
 "tpcclisten - Win32 Debug"
!MESSAGE Invalid configuration "$(CFG)" specified.
!MESSAGE You can specify a configuration when running NMAKE on this
makefile
!MESSAGE by defining the macro CFG on the command line.  For example:
!MESSAGE
!MESSAGE NMAKE /f "tpcclisten.mak" CFG="tpcclisten - Win32 Debug"
!MESSAGE
!MESSAGE Possible choices for configuration are:
!MESSAGE
!MESSAGE "tpcclisten - Win32 Release" (based on\
 "Win32 (x86) Console Application")
!MESSAGE "tpcclisten - Win32 Debug" (based on\
 "Win32 (x86) Console Application")
!MESSAGE
!ERROR An invalid configuration is specified.
!ENDIF

!IF "$(OS)" == "Windows_NT"
NULL=
!ELSE
NULL=nul
!ENDIF
################################################################################
######
# Begin Project
CPP=cl.exe
RSC=rc.exe

!IF  "$(CFG)" == "tpcclisten - Win32 Release"

# PROP BASE Use_MFC 0
# PROP BASE Use_Debug_Libraries 0
# PROP BASE Output_Dir "Release"
# PROP BASE Intermediate_Dir "Release"
# PROP BASE Target_Dir ""
# PROP Use_MFC 0
# PROP Use_Debug_Libraries 0
# PROP Output_Dir "Release"
# PROP Intermediate_Dir "Release"
# PROP Target_Dir ""
OUTDIR=.\Release
INTDIR=.\Release

ALL : "$(OUTDIR)\tpcclisten.exe"

CLEAN :
        -@erase "$(INTDIR)\diagio.obj"
        -@erase "$(INTDIR)\sockio.obj"
        -@erase "$(INTDIR)\tmon.obj"
        -@erase "$(INTDIR)\tpcchandler.obj"
        -@erase "$(INTDIR)\tpcclisten.obj"
        -@erase "$(OUTDIR)\tpcclisten.exe"

"$(OUTDIR)" :
    if not exist "$(OUTDIR)/$(NULL)" mkdir "$(OUTDIR)"

# ADD BASE CPP /nologo /W3 /GX /O2 /D "WIN32" /D "NDEBUG" /D "_CONSOLE"
/YX /c
# ADD CPP /nologo /MT /W3 /GX /D "WIN32" /D "NDEBUG" /D "_CONSOLE" /YX /c
CPP_PROJ=/nologo /MT /W3 /GX /D "WIN32" /D "NDEBUG" /D "_CONSOLE"\
 /Fp"$(INTDIR)/tpcclisten.pch" /YX /Fo"$(INTDIR)/" /c
CPP_OBJS=.\Release/
CPP_SBRS=.\.
# ADD BASE RSC /l 0x409 /d "NDEBUG"
# ADD RSC /l 0x409 /d "NDEBUG"
BSC32=bscmake.exe
# ADD BASE BSC32 /nologo
# ADD BSC32 /nologo
BSC32_FLAGS=/nologo /o"$(OUTDIR)/tpcclisten.bsc"
BSC32_SBRS= \

LINK32=link.exe
# ADD BASE LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib
comdlg32.lib advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib
odbc32.lib odbccp32.lib /nologo /subsystem:console /machine:I386
# ADD LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib
advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib
odbccp32.lib wsock32.lib libtux.lib libbuft.lib libtux2.lib libfml.lib
libfml32.lib libgp.lib /nologo /subsystem:console /machine:I386
LINK32_FLAGS=kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib\
 advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib\
 odbccp32.lib wsock32.lib libtux.lib libbuft.lib libtux2.lib libfml.lib\
 libfml32.lib libgp.lib /nologo /subsystem:console /incremental:no\
 /pdb:"$(OUTDIR)/tpcclisten.pdb" /machine:I386
/out:"$(OUTDIR)/tpcclisten.exe"
LINK32_OBJS= \
        "$(INTDIR)\diagio.obj" \
        "$(INTDIR)\sockio.obj" \
        "$(INTDIR)\tmon.obj" \
        "$(INTDIR)\tpcchandler.obj" \
        "$(INTDIR)\tpcclisten.obj"

"$(OUTDIR)\tpcclisten.exe" : "$(OUTDIR)" $(DEF_FILE) $(LINK32_OBJS)
    $(LINK32) @<<
```

```
  $(LINK32_FLAGS) $(LINK32_OBJS)
<<

!ELSEIF  "$(CFG)" == "tpcclisten - Win32 Debug"

# PROP BASE Use_MFC 0
# PROP BASE Use_Debug_Libraries 1
# PROP BASE Output_Dir "Debug"
# PROP BASE Intermediate_Dir "Debug"
# PROP BASE Target_Dir ""
# PROP Use_MFC 0
# PROP Use_Debug_Libraries 1
# PROP Output_Dir "Debug"
# PROP Intermediate_Dir "Debug"
# PROP Target_Dir ""
OUTDIR=.\Debug
INTDIR=.\Debug

ALL : "$(OUTDIR)\tpcclisten.exe"

CLEAN :
        -@erase "$(INTDIR)\diagio.obj"
        -@erase "$(INTDIR)\sockio.obj"
        -@erase "$(INTDIR)\tmon.obj"
        -@erase "$(INTDIR)\tpcchandler.obj"
        -@erase "$(INTDIR)\tpcclisten.obj"
        -@erase "$(INTDIR)\vc40.idb"
        -@erase "$(INTDIR)\vc40.pdb"
        -@erase "$(OUTDIR)\tpcclisten.exe"
        -@erase "$(OUTDIR)\tpcclisten.ilk"
        -@erase "$(OUTDIR)\tpcclisten.pdb"

"$(OUTDIR)" :
    if not exist "$(OUTDIR)/$(NULL)" mkdir "$(OUTDIR)"

# ADD BASE CPP /nologo /W3 /Gm /GX /Zi /Od /D "WIN32" /D "_DEBUG" /D
"_CONSOLE" /YX /c
# ADD CPP /nologo /MT /W3 /Gm /GX /Zi /D "WIN32" /D "_DEBUG" /D "_CONSOLE"
/YX /c
CPP_PROJ=/nologo /MT /W3 /Gm /GX /Zi /D "WIN32" /D "_DEBUG" /D "_CONSOLE"\
 /Fp"$(INTDIR)/tpcclisten.pch" /YX /Fo"$(INTDIR)/" /Fd"$(INTDIR)/" /c
CPP_OBJS=.\Debug/
CPP_SBRS=.\.
# ADD BASE RSC /l 0x409 /d "_DEBUG"
# ADD RSC /l 0x409 /d "_DEBUG"
BSC32=bscmake.exe
# ADD BASE BSC32 /nologo
# ADD BSC32 /nologo
BSC32_FLAGS=/nologo /o"$(OUTDIR)/tpcclisten.bsc"
BSC32_SBRS= \

LINK32=link.exe
# ADD BASE LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib
comdlg32.lib advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib
odbc32.lib odbccp32.lib /nologo /subsystem:console /debug /machine:I386
# ADD LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib
advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib
odbccp32.lib wsock32.lib libtux.lib libbuft.lib libtux2.lib libfml.lib
libfml32.lib libgp.lib /nologo /subsystem:console /debug /machine:I386
LINK32_FLAGS=kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib\
 advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib\
 odbccp32.lib wsock32.lib libtux.lib libbuft.lib libtux2.lib libfml.lib\
 libfml32.lib libgp.lib /nologo /subsystem:console /incremental:yes\
 /pdb:"$(OUTDIR)/tpcclisten.pdb" /debug /machine:I386\
 /out:"$(OUTDIR)/tpcclisten.exe"
LINK32_OBJS= \
        "$(INTDIR)\diagio.obj" \
        "$(INTDIR)\sockio.obj" \
        "$(INTDIR)\tmon.obj" \
        "$(INTDIR)\tpcchandler.obj" \
        "$(INTDIR)\tpcclisten.obj"

"$(OUTDIR)\tpcclisten.exe" : "$(OUTDIR)" $(DEF_FILE) $(LINK32_OBJS)
    $(LINK32) @<<
  $(LINK32_FLAGS) $(LINK32_OBJS)
<<

!ENDIF

.c{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.cpp{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.cxx{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.c{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

.cpp{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

.cxx{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

################################################################################
######
# Begin Target

# Name "tpcclisten - Win32 Release"
# Name "tpcclisten - Win32 Debug"

!IF  "$(CFG)" == "tpcclisten - Win32 Release"

!ELSEIF  "$(CFG)" == "tpcclisten - Win32 Debug"

!ENDIF

################################################################################
######
# Begin Source File

SOURCE=.\tpcclisten.c
DEP_CPP_TPCCL=\
        ".\diagio.h"\
        ".\sockio.h"\
        ".\tmon.h"\
        ".\tpcc.h"\
        ".\tpcchandler.h"\
        ".\tpcclisten.h"\
```

```
        {$(INCLUDE)}"\sqldb.h"\
        {$(INCLUDE)}"\sqlfront.h"\


"$(INTDIR)\tpcclisten.obj" : $(SOURCE) $(DEP_CPP_TPCCL) "$(INTDIR)"


# End Source File
################################################################################
######
# Begin Source File

SOURCE=.\sockio.c
DEP_CPP_SOCKI=\
        ".\diagio.h"\
        ".\sockio.h"\


"$(INTDIR)\sockio.obj" : $(SOURCE) $(DEP_CPP_SOCKI) "$(INTDIR)"


# End Source File
################################################################################
######
# Begin Source File

SOURCE=.\tmon.c
DEP_CPP_TMON_=\
        ".\diagio.h"\
        ".\tmon.h"\
        ".\tpcc.h"\
        {$(INCLUDE)}"\atmi.h"\
        {$(INCLUDE)}"\sqldb.h"\
        {$(INCLUDE)}"\sqlfront.h"\
        {$(INCLUDE)}"\sys\types.h"\
        {$(INCLUDE)}"\tmenv.h"\


"$(INTDIR)\tmon.obj" : $(SOURCE) $(DEP_CPP_TMON_) "$(INTDIR)"


# End Source File
################################################################################
######
# Begin Source File

SOURCE=.\tpcchandler.c
DEP_CPP_TPCCH=\
        ".\diagio.h"\
        ".\sockio.h"\
        ".\tmon.h"\
        ".\tpcc.h"\
        ".\tpcchandler.h"\
        {$(INCLUDE)}"\sqldb.h"\
        {$(INCLUDE)}"\sqlfront.h"\


"$(INTDIR)\tpcchandler.obj" : $(SOURCE) $(DEP_CPP_TPCCH) "$(INTDIR)"


# End Source File
################################################################################
######
# Begin Source File

SOURCE=.\diagio.c
DEP_CPP_DIAGI=\
        ".\diagio.h"\


"$(INTDIR)\diagio.obj" : $(SOURCE) $(DEP_CPP_DIAGI) "$(INTDIR)"


# End Source File
# End Target
# End Project
################################################################################
######
```

tpcc.h

```
// tpcc.h

#include <time.h>
#define DBNTWIN32
#include <sqlfront.h>
#include <sqldb.h>

// TPCCHandler return codes
#define TPCCSEND 1
#define TPCCSENDEND 2
#define TPCCENDNOW 3

// TPCC Service return codes
#define SVC_BADITEMID 1
#define SVC_NOERROR 0
#define SVCERR_DEADLOCK -1
#define SVCERR_NOCUSTOMER -2
#define SVCERR_NOORDERS -3
#define SVCERR_DBLIB -4

// Min/Max transaction data definitions
#define MIN_DId 1
#define MAX_DId 10
#define MIN_OL 5
#define MAX_OL 15
#define MIN_QUANTITY 1
#define MAX_QUANTITY 10
#define MIN_ITEM_ID 1
#define MAX_ITEM_ID 100000
#define MIN_CUST_ID 1
#define MAX_CUST_ID 3000
#define MIN_CARRIER 1
#define MAX_CARRIER 10
#define MIN_THRESHOLD 10
#define MAX_THRESHOLD 20
#define MAX_TM_CALLS 50

// pTPCC->iStatusId codes
```

```
#define INVALID_IID              1
#define STATUS_OK                0
#define ERR_CMD_UNKNOWN          -10
#define ERRTXT_CMD_UNKNOWN       "Unrecognized Command"
#define ERR_ALREADY_LOGGEDIN     -11
#define ERRTXT_ALREADY_LOGGEDIN  "Already Logged In"
#define ERR_TERMID               -12
#define ERRTXT_TERMID            "TermId or SyncId in Error"
#define ERR_FORM_UNKNOWN         -13
#define ERRTXT_FORM_UNKNOWN      "Unrecognized FormId"
#define ERR_WID_INVALID          -14
#define ERR_DID_INVALID          -15
#define ERR_MISSING_KEY          -16
#define ERR_NOT_NUMERIC          -17
#define ERR_THRESHOLD_RANGE      -18
#define ERR_EMBEDDED_EMPTY_OL    -19
#define ERR_QUANTITY_INVALID     -20
#define ERR_OL_INVALID           -21
#define ERR_OL_COUNT             -22
#define ERR_TM_INTERFACE         -23
#define ERR_SERVICE_RSLT         -24
#define ERR_INPUT_TOOLONG        -25
#define ERR_IDANDNAME_EMPTY      -26
#define ERR_IDANDNAME_ENTERED    -27
#define ERR_AMOUNT_BADFORM       -28
#define ERR_AMOUNT_INVALID       -29
#define ERR_CARRIER_INVALID      -30

#define STATUS_LEN 200
#define NAME_LEN 16
#define ADDR_LEN 20
#define STATE_LEN 2
#define ZIP_LEN 9

typedef struct
{
   short ol_supply_w_id;
   long ol_i_id;
   char ol_i_name[25];
   short ol_quantity;
   char ol_brand_generic[2];
   double ol_i_price;
   double ol_amount;
   short ol_stock;
} OL_NEW_ORDER_DATA;

typedef struct
{
   short w_id;
   short d_id;
   long        c_id;
   short o_ol_cnt;
   char c_last[NAME_LEN + 1];
   char c_credit[3];
   double c_discount;
   double w_tax;
   double d_tax;
   long o_id;
   short o_commit_flag;
   DBDATEREC o_entry_d;
   short o_all_local;
   double total_amount;
   char execution_status[STATUS_LEN];
   OL_NEW_ORDER_DATA Ol[MAX_OL];
} NEW_ORDER_DATA;

typedef struct
{
   short w_id;
   short d_id;
   long c_id;
   short c_d_id;
   short c_w_id;
   double h_amount;
   DBDATEREC h_date;
   char w_street_1[ADDR_LEN + 1];
   char w_street_2[ADDR_LEN + 1];
   char w_city[ADDR_LEN + 1];
   char w_state[STATE_LEN + 1];
   char w_zip[ZIP_LEN + 1];
   char d_street_1[ADDR_LEN + 1];
   char d_street_2[ADDR_LEN + 1];
   char d_city[ADDR_LEN + 1];
   char d_state[STATE_LEN + 1];
   char d_zip[ZIP_LEN + 1];
   char c_first[NAME_LEN + 1];
   char c_middle[3];
   char c_last[NAME_LEN + 1];
   char c_street_1[ADDR_LEN + 1];
   char c_street_2[ADDR_LEN + 1];
   char c_city[ADDR_LEN + 1];
   char c_state[STATE_LEN + 1];
   char c_zip[ZIP_LEN + 1];
   char c_phone[16];
   DBDATEREC c_since;
   char c_credit[3];
   double c_credit_lim;
   double c_discount;
   double c_balance;
   char c_data[200+1];
   char execution_status[STATUS_LEN];
} PAYMENT_DATA;

typedef struct
{
   long ol_i_id;
   short ol_supply_w_id;
   short ol_quantity;
   double ol_amount;
   DBDATEREC ol_delivery_d;
} OL_ORDER_STATUS_DATA;

typedef struct
{
   short w_id;
   short d_id;
   long c_id;
   char c_first[NAME_LEN + 1];
   char c_middle[3];
   char c_last[NAME_LEN + 1];
   double c_balance;
   long o_id;
```

```
   DBDATEREC o_entry_d;
   short o_carrier_id;
   OL_ORDER_STATUS_DATA OlOrderStatusData[MAX_OL];
   short o_ol_cnt;
   char execution_status[STATUS_LEN];
} ORDER_STATUS_DATA;

typedef struct
{
   short w_id;
   short o_carrier_id;
   long o_id[10];
   int iComplete;
   SYSTEMTIME QTime;                // time delivery was queued
   SYSTEMTIME EndTime;              // time delivery completed
   char execution_status[STATUS_LEN];
} DELIVERY_DATA;

typedef struct
{
   short w_id;
   short d_id;
   short thresh_hold;
   long low_stock;
   char execution_status[STATUS_LEN];
} STOCK_LEVEL_DATA;

typedef struct
{
   SHORT sWId;                      // TPCC WareHouse Id
   SHORT sDId;                      // TPCC District Id
   INT  iSyncId;                    // TPCC Sync Id
   INT  iTermId;                    // TPCC Term Id
   UINT uFormId;                    // TPCC Form Id
   INT  iStatusId;                  // TPCC Status Id
   BOOL bFormRqst;                  // TPCC Form requested
   CHAR ErrTxt[200];                // Error text
   CHAR szWork[100];                // Thread work area
   CHAR * pTMData;                  // TM buffer area
   LONG lTMDataLen;                 // TM buffer len
} TPCC_STATE;
```

tpcchandler.h

```
// tpcchandler.h

#include "tpcc.h"

BOOL TPCCInit(TPCC_STATE * pTPCC,INT iTermId,INT iSyncId,BOOL bProcess);
UINT TPCCHandler(SOCKET_STATE * pss,TPCC_STATE * pTPCC);
```

tpcchandler.c

```
// tpcchandler.c
//
#include <windows.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "diagio.h"
#include "sockio.h"
#include "tpcchandler.h"
#include "tmon.h"

// pTPCC->iFormId - TPCC forms enumeration.
#define FORM_NULL        0
#define FORM_LOGON       1
#define FORM_MENU        2
#define FORM_NEWORDER    3
#define FORM_PAYMENT     4
#define FORM_DELIVERY    5
#define FORM_ORDERSTATUS 6
#define FORM_STOCKLEVEL  7
#define FORM_EXIT        8
#define FORM_MAX         9

// CMD= HTML Command Enumeration and Name
#define CMD_NULL               0
#define CMD_PROCESS            1
#define CMD_NEWORDER_FORM      2
#define CMD_PAYMENT_FORM       3
#define CMD_DELIVERY_FORM      4
#define CMD_ORDERSTATUS_FORM   5
#define CMD_STOCKLEVEL_FORM    6
#define CMD_EXIT               7
#define CMD_SUBMIT             8
#define CMD_MENU_FORM          9
#define CMD_MAX                10

static CHAR * szCmds[] =
{
   "Unknown",
   "Process",
   "..NewOrder..",
   "..Payment..",
   "..Delivery..",
   "..Order-Status..",
   "..Stock-Level..",
   "..Exit..",
   "Submit",
   "Menu"
};

static CHAR * szFormLogin =
   "<HTML>"
   "<HEAD><TITLE>Welcome To TPC-C</TITLE></HEAD><BODY>"
   "Please Identify your Warehouse and District for this session.<BR>"
   "<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
   "<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
   "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"1\">"
   "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"-2\">"
   "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"0\">"
   "Warehouse ID <INPUT NAME=\"w_id\" SIZE=4><BR>"
   "District ID <INPUT NAME=\"d_id\" SIZE=2><BR>"
   "<HR>"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Submit\">"
   "</FORM>";

static CHAR * szMenuList =
```

```
   "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\"VALUE=\"..Payment..\">"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\"VALUE=\"..Delivery..\">"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\"VALUE=\"..Order-Status..\">"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\"VALUE=\"..Stock-Level..\">"
   "<INPUT TYPE=\"submit\" NAME=\"CMD\"VALUE=\"..Exit..\">";

static CHAR * HTMLTrailer =
   "</BODY></HTML>\r\n\r\n";

static CHAR * TERMIDTOKEN = "TERMID=";
static CHAR * SYNCIDTOKEN = "SYNCID=";
static CHAR * FORMIDTOKEN = "FORMID=";
static CHAR * STATUSIDTOKEN = "STATUSID=";
static CHAR * CMDTOKEN = "CMD=";
static CHAR * NEWORDER_SERVICE = "NEWORDER";
static CHAR * PAYMENT_SERVICE = "PAYMENT";
static CHAR * ORDERSTATUS_SERVICE = "ORDERSTS";
static CHAR * DELIVERY_SERVICE = "DELIVERY";
static CHAR * STOCKLEVEL_SERVICE = "STOCKLVL";
static CHAR * ZIPPIC = "XXXXX-XXXX";

BOOL ProcessLogin(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessForm(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessNewOrder(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessPayment(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessDelivery(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessOrderStatus(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
BOOL ProcessStockLevel(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatLogin(CHAR * pMsg,CHAR * pAddText);
BOOL GetHidden(CHAR * pMsg,UINT * uFormId,INT * iSyncId,INT * iTermId);
BOOL GetCmd(CHAR * pMsg,CHAR * pWork,UINT uLen);
BOOL GetLongKey(LONG * lRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE * pTPCC);
BOOL GetIntKey(INT * iRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE * pTPCC);
BOOL GetShortKey(SHORT * sRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE *
pTPCC);
BOOL GetStringKey(CHAR * szRslt,CHAR * pHTML,CHAR * pKey,
                  TPCC_STATE * pTPCC,UINT uMax);
BOOL GetAmountKey(DOUBLE * dRslt,CHAR * pHTML,CHAR * pKey,
                  TPCC_STATE * pTPCC);
BOOL GetKeyValue(CHAR * pHTML,CHAR * pKey,CHAR * pValue,UINT uMax);
VOID FormatLogin(CHAR * pOut,CHAR * pAddText);
VOID FormatMenu(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatNewOrder(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatPayment(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatDelivery(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatOrderStatus(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatStockLevel(CHAR * pOut,TPCC_STATE * pTPCC);
VOID FormatFormHdr(CHAR * pOut,CHAR * pTitle,TPCC_STATE * pTPCC);
VOID FormatRespHdr(CHAR * pOut,CHAR * pTitle,TPCC_STATE * pTPCC);
VOID FormatHTMLString(CHAR * pOut,CHAR * pIn,UINT uLen);
VOID FormatString(CHAR * pOut,CHAR * pPic,CHAR * pIn);
VOID UtilStrCpy(CHAR * pDest,CHAR * pSrc,INT n);
BOOL CheckNumeric(CHAR * pNum);

//============================================================================
//
// Function name: TPCCInit
//
//============================================================================
BOOL TPCCInit(TPCC_STATE * pTPCC,INT iTermId,INT iSyncId,BOOL bProcess)
{
   pTPCC->sWId = 0;
   pTPCC->sDId = 0;
   pTPCC->iSyncId = iSyncId;
   pTPCC->iTermId = iTermId;
   pTPCC->uFormId = FORM_NULL;
   pTPCC->iStatusId = 0;
   pTPCC->bFormRqst = TRUE;
   pTPCC->pTMData = NULL;
   pTPCC->lTMDataLen = 0;
   strcpy(pTPCC->ErrTxt,"");
   return(FALSE);
};

//============================================================================
//
// Function name: TPCCHandler
//
//============================================================================
UINT TPCCHandler(SOCKET_STATE * pss,TPCC_STATE * pTPCC)
{
   INT iSyncId;
   INT iTermId;
   UINT uCmdId;
   UINT uRslt = TPCCSENDEND;  // default error handling

   strcpy(pTPCC->ErrTxt,"");
   pTPCC->iStatusId = STATUS_OK;
   // Was TMInit performed
   if (pTPCC->pTMData == NULL)
   {
      if (TMInit(pTPCC))
      {
         pTPCC->iStatusId = ERR_TM_INTERFACE;
         FormatLogin(pss->SendMsg,pTPCC->ErrTxt);
         goto HdlrXit;
      };
   };
   if (GetHidden(pss->RecvMsg,&pTPCC->uFormId,&iSyncId,&iTermId))
   {
      if (pTPCC->sWId != 0)
         strcpy(pTPCC->ErrTxt,"Decode hidden fields error");
      else
         uRslt = TPCCSEND;
      FormatLogin(pss->SendMsg,pTPCC->ErrTxt);
      goto HdlrXit;
   };
   uCmdId = GetCmd(pss->RecvMsg,pTPCC->szWork,sizeof(pTPCC->szWork));
   // Except for Submit(log in), sWId must already be set
   if (pTPCC->sWId == 0 && uCmdId != CMD_SUBMIT)
   {
      strcpy(pTPCC->ErrTxt,"Must log in first!");
      FormatLogin(pss->SendMsg,pTPCC->ErrTxt);
      uRslt = TPCCSEND;
      goto HdlrXit;
   };
   // Check for multiple log in attempts
   if (pTPCC->sWId != 0 && uCmdId == CMD_SUBMIT)
   {
      strcpy(pTPCC->ErrTxt,ERRTXT_ALREADY_LOGGEDIN);
      pTPCC->iStatusId = ERR_ALREADY_LOGGEDIN;
```

```
   FormatMenu(pss->SendMsg,pTPCC);
   uRslt = TPCCSEND;
   goto HdlrXit;
};
// If not logging in, validate hidden fields
if (uCmdId != CMD_SUBMIT)
{
   if (iTermId != pTPCC->iTermId || iTermId != iSyncId)
   {
      sprintf(pTPCC->ErrTxt,"%s: Received %ld, %ld (%ld)",
         ERRTXT_TERMID,iTermId,iSyncId,pTPCC->iTermId);
      pTPCC->iStatusId = ERR_TERMID;
      FormatMenu(pss->SendMsg,pTPCC);
      goto HdlrXit;
   };
};
// Process the command
switch (uCmdId)
{
   case CMD_SUBMIT:
      ProcessLogin(pss->RecvMsg,pss->SendMsg,pTPCC);
      break;
   case CMD_MENU_FORM:
      FormatMenu(pss->SendMsg,pTPCC);
      break;
   case CMD_PROCESS:
      ProcessForm(pss->RecvMsg,pss->SendMsg,pTPCC);
      break;
   case CMD_NEWORDER_FORM:
      FormatNewOrder(pss->SendMsg,pTPCC);
      break;
   case CMD_PAYMENT_FORM:
      FormatPayment(pss->SendMsg,pTPCC);
      break;
   case CMD_DELIVERY_FORM:
      FormatDelivery(pss->SendMsg,pTPCC);
      break;
   case CMD_ORDERSTATUS_FORM:
      FormatOrderStatus(pss->SendMsg,pTPCC);
      break;
   case CMD_STOCKLEVEL_FORM:
      FormatStockLevel(pss->SendMsg,pTPCC);
      break;
   case CMD_EXIT:
      pTPCC->sWId = 0;
      strcpy(pTPCC->ErrTxt,"Logged Off");
      FormatLogin(pss->SendMsg,pTPCC->ErrTxt);
      goto HdlrXit;
   default:
      strcpy(pTPCC->ErrTxt,ERRTXT_CMD_UNKNOWN);
      pTPCC->iStatusId = ERR_CMD_UNKNOWN;
      if (pTPCC->sWId == 0)
         FormatLogin(pss->SendMsg,pTPCC->ErrTxt);
      else
         FormatMenu(pss->SendMsg,pTPCC);
      break;
};   // switch (uCmdId)

uRslt = TPCCSEND;
```

```
HdlrXit:

   if (uRslt != TPCCSEND)
      TMDone(pTPCC);
   return(uRslt);

};   // TPCCHandler

//======================================================================
//
// Function name: ProcessLogin
//
//    ProcessLogin extracts WId and DId from the incoming form.  Assumes
//    log in has not previously completed (sWId == 0 already verified).
//
//    Result:
//       FALSE - log in successful, sWId and sDId set in pTPCC,
//               pOut contains menu.
//       TRUE - log in failed, pOut contains log in form with
//              error message.
//
//======================================================================
BOOL ProcessLogin(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   SHORT sWId;
   SHORT sDId;

   if (GetShortKey(&sWId,pIn,"w_id",pTPCC))
   {
     FormatLogin(pOut,pTPCC->ErrTxt);
     return(TRUE);
   };
   if (sWId < 1)
   {
      sprintf(pTPCC->ErrTxt,"Warehouse Id (%d) Invalid",sWId);
      pTPCC->iStatusId = ERR_WID_INVALID;
      FormatLogin(pOut,pTPCC->ErrTxt);
      return(TRUE);
   };
   if (GetShortKey(&sDId,pIn,"d_id",pTPCC))
   {
     FormatLogin(pOut,pTPCC->ErrTxt);
     return(TRUE);
   };
   if (sDId < MIN_DId || sDId > MAX_DId)
   {
      sprintf(pTPCC->ErrTxt,"DId Out of Range(%ld,%ld) - %ld",
         MIN_DId,MAX_DId,sDId);
      pTPCC->iStatusId = ERR_DID_INVALID;
      FormatLogin(pOut,pTPCC->ErrTxt);
      return(TRUE);
   };
   pTPCC->sWId = abs(sWId);
   pTPCC->sDId = abs(sDId);
   FormatMenu(pOut,pTPCC);
   return(FALSE);
};   // ProcessLogin

//======================================================================
//
```

```
// Function name: ProcessForm
//
//    ProcessForm uses pTPCC->uFormId to determine which form input is
//    present and ready for processing.  Actual processing is done by
//    the form specific routine.
//
//    Result:
//       FALSE - form processed, pOut contains response.
//       TRUE - error processing form input, pOut contains reason.
//
//============================================================================
BOOL ProcessForm(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   switch (pTPCC->uFormId )
   {
      case FORM_NEWORDER:
               return(ProcessNewOrder(pIn,pOut,pTPCC));
      case FORM_PAYMENT:
               return(ProcessPayment(pIn,pOut,pTPCC));
      case FORM_DELIVERY:
               return(ProcessDelivery(pIn,pOut,pTPCC));
      case FORM_ORDERSTATUS:
               return(ProcessOrderStatus(pIn,pOut,pTPCC));
      case FORM_STOCKLEVEL:
               return(ProcessStockLevel(pIn,pOut,pTPCC));
      default:
         sprintf(pTPCC->ErrTxt,"%s (%ld)",
            ERRTXT_FORM_UNKNOWN,pTPCC->uFormId);
         pTPCC->iStatusId = ERR_FORM_UNKNOWN;
         FormatMenu(pOut,pTPCC);
         break;
      }
   return(TRUE);
};   // ProcessForm

//============================================================================
//
// Function name: ProcessNewOrder
//
//    ProcessNewOrder extracts the input data fields from pIn, processes
//    the data, and returns a response in pOut.
//
//    Result:
//       FALSE - NewOrder processed successfully.
//       TRUE - NewOrder processing failed.
//
//============================================================================
BOOL ProcessNewOrder(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   NEW_ORDER_DATA * pnod;
   CHAR szKey[20];
   CHAR szCredit[14];
   UINT u;
   BOOL bDone = FALSE;
   BOOL bTMRslt;
   BOOL bTPRslt;
   INT iTPRslt;

   pTPCC->lTMDataLen = sizeof(NEW_ORDER_DATA);
   memset(pTPCC->pTMData,0,pTPCC->lTMDataLen);
   pnod = (NEW_ORDER_DATA *) pTPCC->pTMData;
   pnod->w_id = pTPCC->sWId;
   if (GetShortKey(&pnod->d_id,pIn,"DID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (pnod->d_id < MIN_DId || pnod->d_id > MAX_DId)
   {
      sprintf(pTPCC->ErrTxt,"DId Out of Range(%ld,%ld) - %ld",
         MIN_DId,MAX_DId,pnod->d_id);
      pTPCC->iStatusId = ERR_DID_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   if (GetLongKey(&pnod->c_id,pIn,"CID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   pnod->o_ol_cnt = 0;
   for(u=0; u < MAX_OL; u++)
   {
      sprintf(szKey,"IID%2.2d*",u);
      if (GetLongKey(&pnod->Ol[u].ol_i_id,pIn,szKey,pTPCC))
      {
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      sprintf(szKey,"SP%2.2d*",u);
      if (GetShortKey(&pnod->Ol[u].ol_supply_w_id,pIn,szKey,pTPCC))
      {
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      sprintf(szKey,"Qty%2.2d*",u);
      if (GetShortKey(&pnod->Ol[u].ol_quantity,pIn,szKey,pTPCC))
      {
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      if (pnod->Ol[u].ol_i_id != 0)
      {
         // Check for prior blank lines
         if (bDone)
         {
            strcat(pTPCC->ErrTxt,"Embedded Empty Order Lines");
            pTPCC->iStatusId = ERR_EMBEDDED_EMPTY_OL;
            FormatMenu(pOut,pTPCC);
            return(TRUE);
         };
         if (pnod->Ol[u].ol_supply_w_id < 1)
         {
            sprintf(pTPCC->ErrTxt,
               "Order Line %ld Contains Invalid WId %d",
               u,pnod->Ol[u].ol_supply_w_id);
            pTPCC->iStatusId = ERR_WID_INVALID;
            FormatMenu(pOut,pTPCC);
            return(TRUE);
         };
         if (pnod->Ol[u].ol_quantity < MIN_QUANTITY ||
             pnod->Ol[u].ol_quantity > MAX_QUANTITY)
```

```
      {
         sprintf(pTPCC->ErrTxt,
            "Order Line %ld Contains Invalid Qty %d",
            u,pnod->Ol[u].ol_quantity);
         pTPCC->iStatusId = ERR_QUANTITY_INVALID;
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      pnod->o_ol_cnt++;
   }   // if (ol_i_id !=0)
   else
   {
      if (pnod->Ol[u].ol_supply_w_id != 0)
      {
         sprintf(pTPCC->ErrTxt,
            "Order Line %ld WId Supplied with No Item",u);
         pTPCC->iStatusId = ERR_OL_INVALID;
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      if (pnod->Ol[u].ol_quantity != 0)
      {
         sprintf(pTPCC->ErrTxt,
            "Order Line %ld Qty Supplied with No Item",u);
         pTPCC->iStatusId = ERR_OL_INVALID;
         FormatMenu(pOut,pTPCC);
         return(TRUE);
      };
      bDone = TRUE;
   };   // empty order line
};   // for (u < MAX_OL)

if (pnod->o_ol_cnt < MIN_OL)
{
   sprintf(pTPCC->ErrTxt,"Too Few Order Lines %d",pnod->o_ol_cnt);
   pTPCC->iStatusId = ERR_OL_COUNT;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
bTMRslt = TMTran(NEWORDER_SERVICE,pTPCC,&bTPRslt,&iTPRslt);
pnod = (NEW_ORDER_DATA *) pTPCC->pTMData;
if (bTMRslt)
{
   pTPCC->iStatusId = ERR_TM_INTERFACE;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
// Exclude invalid item id case
if (bTPRslt && iTPRslt < SVC_NOERROR)
{
   sprintf(pTPCC->ErrTxt,
      "New Order Service Returned Error(%ld): %s",
      iTPRslt,pnod->execution_status);
   pTPCC->iStatusId = ERR_SERVICE_RSLT;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
if (iTPRslt == SVC_BADITEMID)
   pTPCC->iStatusId = INVALID_IID;
   FormatRespHdr(pOut,"TPC-C New Order",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                New Order<BR>"
      "Warehouse: %4.4d   District: %2.2d                          ",
      pnod->w_id,pnod->d_id);
   if (!bTPRslt)
      {
      sprintf(pOut + strlen(pOut),
         "Date: %2.2d-%2.2d-%4.4d %2.2d:%2.2d:%2.2d <BR>",
         pnod->o_entry_d.day,pnod->o_entry_d.month,
         pnod->o_entry_d.year,pnod->o_entry_d.hour,
         pnod->o_entry_d.minute,pnod->o_entry_d.second);
   }
   else
   {
      sprintf(pOut + strlen(pOut),"Date:<BR>");
   };
   FormatHTMLString(pTPCC->szWork,pnod->c_last,NAME_LEN);
   FormatHTMLString(szCredit,pnod->c_credit,2);
   sprintf(pOut + strlen(pOut),
      "Customer:  %4.4d   Name: %s   Credit: %s   ",
      pnod->c_id,pTPCC->szWork,szCredit);
   if (!bTPRslt)
   {
      sprintf(pOut + strlen(pOut),
         "%%Disc: %5.2f            <BR>",pnod->c_discount * 100);
      sprintf(pOut + strlen(pOut),
         "Order Number: %8.8d  Number of Lines: %2.2d        W_tax: %5.2f
D_tax: %5.2f  <BR><BR>",
         pnod->o_id,pnod->o_ol_cnt,pnod->w_tax * 100,pnod->d_tax * 100);
      strcat(pOut," Supp_W  Item_Id  Item Name                 Qty  Stock
B/G  Price    Amount<BR>");
      for (u = 0; u < (UINT) pnod->o_ol_cnt; u++)
      {
         FormatHTMLString(pTPCC->szWork,pnod->Ol[u].ol_i_name,24);
         sprintf(pOut + strlen(pOut),
            "  %4.4d   %6.6d   %s  %2.2d    %3.3d    %1.1s   $%6.2f
$%7.2f  <BR>",
            pnod->Ol[u].ol_supply_w_id,pnod->Ol[u].ol_i_id,
            pTPCC->szWork,pnod->Ol[u].ol_quantity,pnod->Ol[u].ol_stock,
            pnod->Ol[u].ol_brand_generic,pnod->Ol[u].ol_i_price,
            pnod->Ol[u].ol_amount );
      }
   }   // if (!bTPRslt)
   else
   {
      strcat(pOut,"%Disc:<BR>");
      sprintf(pOut + strlen(pOut),
         "Order Number: %8.8d  Number of Lines:              W_tax:
D_tax:<BR><BR>",
         pnod->o_id);
      strcat(pOut,
         " Supp_W  Item_Id  Item Name                 Qty  Stock  B/G
Price    Amount<BR>");
      u = 0;
   };
   for(; u < MAX_OL; u++)
      strcat(pOut,"<BR>");
   if (!bTPRslt)
   {
```

```
      sprintf(pOut + strlen(pOut),
         "Execution Status: %24.24s                    Total:  $%8.2f  ",
         pnod->execution_status,pnod->total_amount);
   }
   else
   {
      sprintf(pOut + strlen(pOut),
         "Execution Status: %24.24s                    Total:",
         pnod->execution_status);
   };
   sprintf(pOut + strlen(pOut),
      "</PRE><HR><BR>%s</FORM>%s",szMenuList,HTMLTrailer);

   return(FALSE);

};   // ProcessNewOrder

//============================================================================
//
// Function name: ProcessPayment
//
//    ProcessPayment extracts the input data fields from pIn, processes
//    the data, and returns a response in pOut.
//
//    Result:
//       FALSE - Payment processed successfully.
//       TRUE - Payment processing failed.
//
//============================================================================
BOOL ProcessPayment(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   PAYMENT_DATA * ppd;
   BOOL bTMRslt;
   BOOL bTPRslt;
   INT iTPRslt;
   CHAR * pCredit;
   INT iCDLines;
   CHAR szWork2[60];
   CHAR szWork3[60];
   CHAR szWork4[60];
   CHAR szZip1[20];
   CHAR szZip2[20];
   INT i;

   pTPCC->lTMDataLen = sizeof(PAYMENT_DATA);
   memset(pTPCC->pTMData,0,pTPCC->lTMDataLen);
   ppd = (PAYMENT_DATA *) pTPCC->pTMData;
   ppd->w_id = pTPCC->sWId;
   // Get and validate DId
   if (GetShortKey(&ppd->d_id,pIn,"DID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (ppd->d_id < MIN_DId || ppd->d_id > MAX_DId)
   {
      sprintf(pTPCC->ErrTxt,"DId Out of Range(%ld,%ld) - %ld",
         MIN_DId,MAX_DId,ppd->d_id);
      pTPCC->iStatusId = ERR_DID_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   // Get and validate customer Id and name
   if (GetLongKey(&ppd->c_id,pIn,"CID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (GetStringKey(ppd->c_last,pIn,"CLT*",pTPCC,NAME_LEN))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (ppd->c_id == 0 && ppd->c_last[0] == 0)
   {
      strcpy(pTPCC->ErrTxt,"Error - Customer Id and Name Empty");
      pTPCC->iStatusId = ERR_IDANDNAME_EMPTY;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   if (ppd->c_id != 0 && ppd->c_last[0] != 0)
   {
      strcpy(pTPCC->ErrTxt,
         "Error - Specify Customer Id or Name, not Both");
      pTPCC->iStatusId = ERR_IDANDNAME_ENTERED;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   // Get and validate customer DId
   if (GetShortKey(&ppd->c_d_id,pIn,"CDI*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (ppd->c_d_id < MIN_DId || ppd->c_d_id > MAX_DId)
   {
      sprintf(pTPCC->ErrTxt,"Cust DId Out of Range(%ld,%ld) - %ld",
         MIN_DId,MAX_DId,ppd->d_id);
      pTPCC->iStatusId = ERR_DID_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   // Get and validate customer WId
   if (GetShortKey(&ppd->c_w_id,pIn,"CWI*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (ppd->c_w_id < 1)
   {
      sprintf(pTPCC->ErrTxt,
         "Payment Contains Invalid Customer WId %d",
         ppd->c_w_id);
      pTPCC->iStatusId = ERR_WID_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   // Get and validate amount
   if (GetAmountKey(&ppd->h_amount,pIn,"HAM*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
```

```
};
if (ppd->h_amount <= 0)
{
   sprintf(pTPCC->ErrTxt,
      "Payment Amount Negative or Missing");
   pTPCC->iStatusId = ERR_AMOUNT_INVALID;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
bTMRslt = TMTran(PAYMENT_SERVICE,pTPCC,&bTPRslt,&iTPRslt);
ppd = (PAYMENT_DATA *) pTPCC->pTMData;
if (bTMRslt)
{
   pTPCC->iStatusId = ERR_TM_INTERFACE;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
if (bTPRslt)
{
   sprintf(pTPCC->ErrTxt,
      "Payment Service Returned Error(%ld): %s",
      iTPRslt,ppd->execution_status);
   pTPCC->iStatusId = ERR_SERVICE_RSLT;
   FormatMenu(pOut,pTPCC);
   return(TRUE);
};
FormatRespHdr(pOut,"TPC-C Payment",pTPCC);
sprintf(pOut + strlen(pOut),
       "<PRE>                                        Payment<BR>"
   "Date: %2.2d-%2.2d-%4.4d %2.2d:%2.2d:%2.2d <BR><BR>"
   "Warehouse: %4.4d"
   "                          District: %2.2d<BR>",
       ppd->h_date.day,ppd->h_date.month,
   ppd->h_date.year,ppd->h_date.hour,
   ppd->h_date.minute,ppd->h_date.second,
   ppd->w_id,ppd->d_id);

FormatHTMLString(szWork2,ppd->w_street_1,ADDR_LEN);
FormatHTMLString(szWork3,ppd->d_street_1,ADDR_LEN);
sprintf(pOut + strlen(pOut),
   "%s                        %s<BR>",szWork2,szWork3);
FormatHTMLString(szWork2,ppd->w_street_2,ADDR_LEN);
FormatHTMLString(szWork3,ppd->d_street_2,ADDR_LEN);
sprintf(pOut + strlen(pOut),
   "%s                        %s<BR>",szWork2,szWork3);
FormatHTMLString(pTPCC->szWork,ppd->w_city,ADDR_LEN);
FormatHTMLString(szWork2,ppd->d_city,ADDR_LEN);
FormatHTMLString(szWork3,ppd->w_state,STATE_LEN);
FormatHTMLString(szWork4,ppd->d_state,STATE_LEN);
FormatString(szZip1,ZIPPIC,ppd->w_zip);
FormatString(szZip2,ZIPPIC,ppd->d_zip);
sprintf(pOut +  strlen(pOut),
   "%s %s %10.10s       %s %s %10.10s<BR><BR>",
   pTPCC->szWork,szWork3,szZip1,szWork2,szWork4,szZip2);
FormatHTMLString(szWork2,ppd->c_first,NAME_LEN);
FormatHTMLString(szWork3,ppd->c_middle,2);
FormatHTMLString(szWork4,ppd->c_last,NAME_LEN);
sprintf(pOut + strlen(pOut),
   "Customer: %4.4d  Cust-Warehouse: %4.4d  Cust-District: %2.2d<BR>"
   "Name:   %s %s %s     Since:  %2.2d-%2.2d-%4.4d<BR>",
      ppd->c_id,ppd->c_w_id,ppd->c_d_id,
      szWork2,szWork3,szWork4,
      ppd->c_since.day,ppd->c_since.month,ppd->c_since.year);
   FormatHTMLString(pTPCC->szWork,ppd->c_street_1,ADDR_LEN);
   FormatHTMLString(szWork2,ppd->c_credit,2);
   FormatHTMLString(szWork3,ppd->d_street_2,ADDR_LEN);
   sprintf(pOut + strlen(pOut),
      "        %s                     Credit: %s<BR>"
      "        %s                     %%Disc:  %5.2f<BR>",
      pTPCC->szWork,szWork2,szWork3,ppd->c_discount * 100);
   FormatHTMLString(szWork2,ppd->c_city,ADDR_LEN);
   FormatHTMLString(szWork3,ppd->c_state,STATE_LEN);
   FormatString(szZip1,ZIPPIC,ppd->c_zip);
   FormatString(szWork4,"XXXXXX-XXX-XXX-XXXX",ppd->c_phone);
   sprintf(pOut + strlen(pOut),
      "        %s %s %10.10s       Phone:  %-19.19s<BR><BR>"
      "Amount Paid:          $%7.2f      New Cust Balance: $%14.2f<BR>"
      "Credit Limit:   $%13.2f<BR><BR>",
      szWork2,szWork3,szZip1,szWork4,
      ppd->h_amount,ppd->c_balance,ppd->c_credit_lim);
   pCredit = ppd->c_credit;
   if (*pCredit == 'B' && *(pCredit + 1) == 'C')
   {
      pCredit = ppd->c_data;
      iCDLines = strlen(pCredit) / 50;
      for(i = 0; i < 4; i++, pCredit += 50)
      {
         if (i <= iCDLines)
            UtilStrCpy(szWork2,pCredit,50);
         else
            szWork2[0] = 0;
         FormatHTMLString(szWork3,szWork2,50);
         if (!i)
            sprintf(pOut + strlen(pOut),
               "Cust-Data: %s<BR>",szWork3);
         else
            sprintf(pOut + strlen(pOut),
               "           %s<BR>",szWork3);
      };
   }
   else
      strcat(pOut,"Cust-Data: <BR><BR><BR><BR>");
   sprintf(pOut + strlen(pOut),
      "</PRE><HR><BR>%s</FORM>%s",szMenuList,HTMLTrailer);

   return(FALSE);

};   // ProcessPayment

//================================================================================
//
// Function name: ProcessDelivery
//
//    ProcessDelivery extracts the input data fields from pIn, processes
//    the data, and returns a response in pOut.
//
//    Result:
//       FALSE - Delivery processed successfully.
//       TRUE - Delivery processing failed.
//
```

```
//==============================================================================
BOOL ProcessDelivery(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   DELIVERY_DATA * pdd;
   BOOL bTMRslt;
   BOOL bTPRslt;
   INT iTPRslt;

   pTPCC->lTMDataLen = sizeof(DELIVERY_DATA);
   memset(pTPCC->pTMData,0,pTPCC->lTMDataLen);
   pdd = (DELIVERY_DATA *) pTPCC->pTMData;
   pdd->w_id = pTPCC->sWId;
   // Get and validate carrier id
   if (GetShortKey(&pdd->o_carrier_id,pIn,"OCD*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (pdd->o_carrier_id < MIN_CARRIER ||
       pdd->o_carrier_id > MAX_CARRIER)
   {
      sprintf(pTPCC->ErrTxt,"Carrier Id Out of Range(%ld,%ld) - %ld",
         MIN_CARRIER,MAX_CARRIER,pdd->o_carrier_id);
      pTPCC->iStatusId = ERR_CARRIER_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   GetLocalTime(&pdd->QTime);
   bTMRslt = PostDelivery(DELIVERY_SERVICE,pTPCC,&bTPRslt,&iTPRslt);
   if (bTMRslt)
   {
      pTPCC->iStatusId = ERR_TM_INTERFACE;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   strcpy(pdd->execution_status,"Delivery has been queued.");
   FormatRespHdr(pOut,"TPC-C Delivery",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                    Delivery<BR>"
      "Warehouse: %4.4d<BR><BR>"
      "Carrier Number: %2.2d<BR><BR>"
      "Execution Status: %25.25s<BR>",
      pdd->w_id,pdd->o_carrier_id,pdd->execution_status);
   sprintf(pOut + strlen(pOut),
      "</PRE><HR><BR>%s</FORM>%s",szMenuList,HTMLTrailer);

   return(FALSE);

};   // ProcessDelivery

//==============================================================================
//
// Function name: ProcessOrderStatus
//
//    ProcessOrderStatus extracts the input data fields from pIn,
//    processes the data, and returns a response in pOut.
//
//    Result:
//       FALSE - OrderStatus processed successfully.
//       TRUE - OrderStatus processing failed.
//
```

```
//==============================================================================
BOOL ProcessOrderStatus(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   ORDER_STATUS_DATA * posd;
   INT i;
   CHAR szWork2[50];
   CHAR szWork3[50];
   BOOL bTMRslt;
   BOOL bTPRslt;
   INT iTPRslt;

   pTPCC->lTMDataLen = sizeof(ORDER_STATUS_DATA);
   memset(pTPCC->pTMData,0,pTPCC->lTMDataLen);
   posd = (ORDER_STATUS_DATA *) pTPCC->pTMData;
   posd->w_id = pTPCC->sWId;
   if (GetShortKey(&posd->d_id,pIn,"DID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (posd->d_id < MIN_DId || posd->d_id > MAX_DId)
   {
      sprintf(pTPCC->ErrTxt,"DId Out of Range(%ld,%ld) - %ld",
         MIN_DId,MAX_DId,posd->d_id);
      pTPCC->iStatusId = ERR_DID_INVALID;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   if (GetLongKey(&posd->c_id,pIn,"CID*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (GetStringKey(posd->c_last,pIn,"CLT*",pTPCC,NAME_LEN))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (posd->c_id == 0 && posd->c_last[0] == 0)
   {
      strcpy(pTPCC->ErrTxt,"Error - Customer Id and Name Empty");
      pTPCC->iStatusId = ERR_IDANDNAME_EMPTY;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   if (posd->c_id != 0 && posd->c_last[0] != 0)
   {
      strcpy(pTPCC->ErrTxt,
         "Error - Specify Customer Id or Name, not Both");
      pTPCC->iStatusId = ERR_IDANDNAME_ENTERED;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   bTMRslt = TMTran(ORDERSTATUS_SERVICE,pTPCC,&bTPRslt,&iTPRslt);
   posd = (ORDER_STATUS_DATA *) pTPCC->pTMData;
   if (bTMRslt)
   {
      pTPCC->iStatusId = ERR_TM_INTERFACE;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
```

```
   if (bTPRslt)
   {
      sprintf(pTPCC->ErrTxt,
         "Order Status Service Returned Error(%ld): %s",
         iTPRslt,posd->execution_status);
      pTPCC->iStatusId = ERR_SERVICE_RSLT;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   FormatRespHdr(pOut,"TPC-C Order-Status",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                Order-Status<BR>"
      "Warehouse: %4.4d   District: %2.2d<BR>",
      posd->w_id,posd->d_id);
   FormatHTMLString(pTPCC->szWork,posd->c_first,NAME_LEN);
   FormatHTMLString(szWork2,posd->c_middle,2);
   FormatHTMLString(szWork3,posd->c_last,NAME_LEN);
   sprintf(pOut + strlen(pOut),
      "Customer: %4.4d   Name: %s %s %s<BR>"
      "Cust-Balance: $%9.2f<BR><BR>",
      posd->c_id,pTPCC->szWork,szWork2,szWork3,posd->c_balance);
   sprintf(pOut + strlen(pOut),
      "Order-Number: %8.8d   Entry-Date: %2.2d-%2.2d-%4.4d
%2.2d:%2.2d:%2.2d   Carrier-Number: %2.2d<BR>"
      "Supply-W     Item-Id    Qty     Amount      Delivery-Date<BR>",
      posd->o_id,posd->o_entry_d.day,posd->o_entry_d.month,
      posd->o_entry_d.year,posd->o_entry_d.hour,
      posd->o_entry_d.minute,posd->o_entry_d.second,
      posd->o_carrier_id);
   for(i = 0; i < posd->o_ol_cnt; i++)
   {
      sprintf(pOut + strlen(pOut),
         "  %4.4d       %6.6d     %2.2d     $%8.2f      %2.2d-%2.2d-
%4.4d<BR>",
         posd->OlOrderStatusData[i].ol_supply_w_id,
         posd->OlOrderStatusData[i].ol_i_id,
         posd->OlOrderStatusData[i].ol_quantity,
         posd->OlOrderStatusData[i].ol_amount,
         posd->OlOrderStatusData[i].ol_delivery_d.day,
         posd->OlOrderStatusData[i].ol_delivery_d.month,
         posd->OlOrderStatusData[i].ol_delivery_d.year);
   };
   sprintf(pOut + strlen(pOut),
      "<BR></PRE><HR><BR>%s</FORM>%s",szMenuList,HTMLTrailer);

   return(FALSE);

};   // ProcessOrderStatus

//============================================================================
//
// Function name: ProcessStockLevel
//
//    ProcessStockLevel extracts the input data fields from pIn,
//    processes the data, and returns a response in pOut.
//
//    Result:
//       FALSE - StockLevel processed successfully.
//       TRUE - StockLevel processing failed.
//
//============================================================================
BOOL ProcessStockLevel(CHAR * pIn,CHAR * pOut,TPCC_STATE * pTPCC)
{
   STOCK_LEVEL_DATA * psld;
   BOOL bTMRslt;
   BOOL bTPRslt;
   INT iTPRslt;

   pTPCC->lTMDataLen = sizeof(STOCK_LEVEL_DATA);
   memset(pTPCC->pTMData,0,pTPCC->lTMDataLen);
   psld = (STOCK_LEVEL_DATA *) pTPCC->pTMData;
   psld->w_id = pTPCC->sWId;
   psld->d_id = pTPCC->sDId;
   psld->low_stock = 0;
   psld->execution_status[0] = 0;
   if (GetShortKey(&psld->thresh_hold,pIn,"TT*",pTPCC))
   {
     FormatMenu(pOut,pTPCC);
     return(TRUE);
   };
   if (psld->thresh_hold < MIN_THRESHOLD ||
       psld->thresh_hold > MAX_THRESHOLD)
   {
      sprintf(pTPCC->ErrTxt,"Threshold Out of Range(%ld,%ld) - %ld",
         MIN_THRESHOLD,MAX_THRESHOLD,psld->thresh_hold);
      pTPCC->iStatusId = ERR_THRESHOLD_RANGE;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };

   bTMRslt = TMTran(STOCKLEVEL_SERVICE,pTPCC,&bTPRslt,&iTPRslt);
   psld = (STOCK_LEVEL_DATA *) pTPCC->pTMData;
   if (bTMRslt)
   {
      pTPCC->iStatusId = ERR_TM_INTERFACE;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };
   if (bTPRslt)
   {
      sprintf(pTPCC->ErrTxt,
         "Stock Level Service Returned Error(%ld): %s",
         iTPRslt,psld->execution_status);
      pTPCC->iStatusId = ERR_SERVICE_RSLT;
      FormatMenu(pOut,pTPCC);
      return(TRUE);
   };

   FormatRespHdr(pOut,"TPC-C Stock Level",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                Stock-Level<BR>"
      "Warehouse: %4.4d   District: %2.2d<BR><BR>"
      "Stock Level Threshold: %2.2d<BR><BR>"
      "low stock: %3.3ld</PRE><BR><HR>"
      "%s</FORM>%s",
      pTPCC->sWId,pTPCC->sDId,psld->thresh_hold,psld->low_stock,
      szMenuList,HTMLTrailer);

   return(FALSE);
```

```
};   // ProcessStockLevel

//==============================================================================
//
// Function name: GetHidden
//
//==============================================================================
BOOL GetHidden(CHAR * pMsg,UINT * uFormId,INT * iSyncId,INT * iTermId)
{
   CHAR * pPtr;
   BOOL bRslt = TRUE;

   // Extract TERMID
   pPtr = strstr(pMsg,TERMIDTOKEN);
   if (pPtr == NULL)
      goto xit;
   pPtr += strlen(TERMIDTOKEN);
   *iTermId = atoi(pPtr);

   // Extract SYNCID
   pPtr = strstr(pMsg,SYNCIDTOKEN);
   if (pPtr == NULL)
      goto xit;
   pPtr += strlen(SYNCIDTOKEN);
   *iSyncId = atoi(pPtr);

   // Extract FORMID
   pPtr = strstr(pMsg,FORMIDTOKEN);
   if (pPtr == NULL)
      goto xit;
   pPtr += strlen(FORMIDTOKEN);
   *uFormId = abs(atoi(pPtr));

   bRslt = FALSE;

xit:

   return(bRslt);

};   // GetHidden

//==============================================================================
//
// Function name: GetCmd
//
//==============================================================================
BOOL GetCmd(CHAR * pMsg,CHAR * pWork,UINT uLen)
{
   UINT u;
   CHAR * ptr;
   CHAR * pUpd;

   // Check for CMD key
   if (!(ptr = strstr(pMsg,CMDTOKEN)))
      return(CMD_NULL);
   ptr += sizeof(CMDTOKEN);
   pUpd = pWork;
   while (*ptr && *ptr != '&')
      *pUpd++ = *ptr++;
   *pUpd = 0;

   // Convert command name into command index
   for(u=0; u < CMD_MAX; u++)
   {
      if (!strcmp(szCmds[u],pWork))
         return(u);
   };

   // Command string not found
   return(CMD_NULL);

};   // GetCmd

//==============================================================================
//
// Function name: GetLongKey
//
//==============================================================================
BOOL GetLongKey(LONG * lRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE * pTPCC)
{
   if (GetKeyValue(pHTML,pKey,pTPCC->szWork,sizeof(pTPCC->szWork)))
   {
      sprintf(pTPCC->ErrTxt,"Error - Missing %s Key",pKey);
      pTPCC->iStatusId = ERR_MISSING_KEY;
      return(TRUE);
   };
   if (pTPCC->szWork[0] != 0 )
   {
      if (CheckNumeric(pTPCC->szWork))
      {
         sprintf(pTPCC->ErrTxt,"Error - %s Value Not Numeric",pKey);
         pTPCC->iStatusId = ERR_NOT_NUMERIC;
         return(TRUE);
      };
   };
   *lRslt = atol(pTPCC->szWork);
   return(FALSE);
};   // GetLongKey

//==============================================================================
//
// Function name: GetIntKey
//
//==============================================================================
BOOL GetIntKey(INT * iRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE * pTPCC)
{
   if (GetKeyValue(pHTML,pKey,pTPCC->szWork,sizeof(pTPCC->szWork)))
   {
      sprintf(pTPCC->ErrTxt,"Error - Missing %s Key",pKey);
      pTPCC->iStatusId = ERR_MISSING_KEY;
      return(TRUE);
   };
   if (pTPCC->szWork[0] != 0 )
   {
      if (CheckNumeric(pTPCC->szWork))
      {
         sprintf(pTPCC->ErrTxt,"Error - %s Value Not Numeric",pKey);
         pTPCC->iStatusId = ERR_NOT_NUMERIC;
         return(TRUE);
      };
   };
   *iRslt = atoi(pTPCC->szWork);
```

```
   return(FALSE);
};   // GetIntKey

//============================================================================
//
// Function name: GetShortKey
//
//============================================================================
BOOL GetShortKey(SHORT * sRslt,CHAR * pHTML,CHAR * pKey,TPCC_STATE *
pTPCC)
{
   if (GetKeyValue(pHTML,pKey,pTPCC->szWork,sizeof(pTPCC->szWork)))
   {
      sprintf(pTPCC->ErrTxt,"Error - Missing %s Key",pKey);
      pTPCC->iStatusId = ERR_MISSING_KEY;
      return(TRUE);
   };
   if (pTPCC->szWork[0] != 0 )
   {
      if (CheckNumeric(pTPCC->szWork))
      {
         sprintf(pTPCC->ErrTxt,"Error - %s Value Not Numeric",pKey);
         pTPCC->iStatusId = ERR_NOT_NUMERIC;
         return(TRUE);
      };
   };
   *sRslt = (SHORT) atoi(pTPCC->szWork);
   return(FALSE);
};   // GetShortKey

//============================================================================
//
// Function name: GetStringKey
//
//============================================================================
BOOL GetStringKey(CHAR * szRslt,CHAR * pHTML,CHAR * pKey,
                  TPCC_STATE * pTPCC,UINT uMax)
{
   UINT uLen;
   if (GetKeyValue(pHTML,pKey,pTPCC->szWork,sizeof(pTPCC->szWork)))
   {
      sprintf(pTPCC->ErrTxt,"Error - Missing %s Key",pKey);
      pTPCC->iStatusId = ERR_MISSING_KEY;
      return(TRUE);
   };
   uLen = strlen(pTPCC->szWork);
   if (uLen > uMax)
   {
      sprintf(pTPCC->ErrTxt,
         "Error - %s Key Input (%ld) Too Long (%ld)"
         ,pKey,uLen,uMax);
      pTPCC->iStatusId = ERR_INPUT_TOOLONG;
      return(TRUE);
   };
   _strupr(pTPCC->szWork);
   strcpy(szRslt,pTPCC->szWork);
   return(FALSE);
};   // GetStringKey

//============================================================================
//
// Function name: GetAmountKey
//
//============================================================================
BOOL GetAmountKey(DOUBLE * dRslt,CHAR * pHTML,CHAR * pKey,
                  TPCC_STATE * pTPCC)
{
   CHAR * ptr;
   BOOL bInvalid = FALSE;

   if (GetKeyValue(pHTML,pKey,pTPCC->szWork,sizeof(pTPCC->szWork)))
   {
      sprintf(pTPCC->ErrTxt,"Error - Missing %s Key",pKey);
      pTPCC->iStatusId = ERR_MISSING_KEY;
      return(TRUE);
   };
   ptr = pTPCC->szWork;
   while(*ptr)
   {
      if (*ptr == '.')
      {
         ptr++;
         if (!*ptr)
            break;
         if (*ptr < '0' || *ptr > '9')
         {
            bInvalid = TRUE;
            break;
         };
         ptr++;
         if (!*ptr)
            break;
         if (*ptr < '0' || *ptr > '9')
         {
            bInvalid = TRUE;
            break;
         };
         ptr++;
         if (*ptr)
         {
            bInvalid = TRUE;
            break;
         };
         break;
      }
      else
      if (*ptr < '0' || *ptr > '9')
      {
         bInvalid = TRUE;
         break;
      };
               ptr++;
       };   // while(!*ptr)

   if (!bInvalid)
      *dRslt = atof(pTPCC->szWork);
   else
   {
      sprintf(pTPCC->ErrTxt,
         "Error - Invalid Amount Format (%s)",pTPCC->szWork);
```

```
      pTPCC->iStatusId = ERR_AMOUNT_BADFORM;
   };

   return(bInvalid);

};   // GetAmountKey

//========================================================================
//
// Function name: GetKeyValue
//   This function parses an HTTP formatted string for specific key
//   values.  HTTP keys terminate with '='.  HTTP values terminate
//   with an '&' or '\0'.
//
//    Result:
//       FALSE - Key found, string value return in pValue
//       TRUE - Key not found
//
//========================================================================
BOOL GetKeyValue(CHAR * pHTML,CHAR * pKey,CHAR * pValue,UINT uMax)
{
   CHAR * ptr;
   if (!(ptr=strstr(pHTML,pKey)))
      return(TRUE);
   if (!(ptr=strchr(ptr,'=')))
      return(TRUE);
   ptr++;
   uMax--;
   while (*ptr && *ptr != '&' && uMax)
   {
      *pValue++ = *ptr++;
      uMax--;
   };
   *pValue = 0;
   return(FALSE);
};   // GetKeyValue

//========================================================================
//
// Function name: FormatLogin
//
//========================================================================
VOID FormatLogin(CHAR * pOut,CHAR * pAddText)
{
   sprintf(pOut,"%s<BR>%s<BR>%s",szFormLogin,pAddText,HTMLTrailer);
};   // FormatLogin

//========================================================================
//
// Function name: FormatMenu
//
//========================================================================
VOID FormatMenu(CHAR * pOut,TPCC_STATE * pTPCC)
{
   strcpy(pOut,"<HTML><HEAD><TITLE>TPC-C MainMenu</TITLE></HEAD><BODY>"
      "Select Desired Transaction.<BR><HR>"
      "<FORM ACTION=\"tpcc.dll\"METHOD=\"GET\">");
   sprintf(pOut + strlen(pOut),
      "<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"%d\">",
      pTPCC->iStatusId,pTPCC->iTermId,pTPCC->iSyncId,FORM_MENU);
   sprintf(pOut + strlen(pOut),"%s</FORM><BR>%s<BR>%s",
      szMenuList,pTPCC->ErrTxt,HTMLTrailer);
};   // FormatMenu

//========================================================================
//
// Function name: FormatNewOrder
//
//========================================================================
VOID FormatNewOrder(CHAR * pOut,TPCC_STATE * pTPCC)
{
   pTPCC->uFormId = FORM_NEWORDER;
   FormatFormHdr(pOut,"TPC-C New Order",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                   New Order<BR>"
      "Warehouse: %4.4d   District: <INPUT NAME=\"DID*\" SIZE=1>
Date:<BR>"
            "Customer:  <INPUT NAME=\"CID*\" SIZE=4>   Name:
Credit:      %Disc:<BR>"
      "Order Number:           Number of Lines:           W_tax:
D_tax:<BR><BR>"
      " Supp_W  Item_Id  Item Name                 Qty  Stock  B/G  Price
Amount<BR>"
      " <INPUT NAME=\"SP00*\" SIZE=4>  <INPUT NAME=\"IID00*\" SIZE=6>
<INPUT NAME=\"Qty00*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP01*\" SIZE=4>  <INPUT NAME=\"IID01*\" SIZE=6>
<INPUT NAME=\"Qty01*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP02*\" SIZE=4>  <INPUT NAME=\"IID02*\" SIZE=6>
<INPUT NAME=\"Qty02*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP03*\" SIZE=4>  <INPUT NAME=\"IID03*\" SIZE=6>
<INPUT NAME=\"Qty03*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP04*\" SIZE=4>  <INPUT NAME=\"IID04*\" SIZE=6>
<INPUT NAME=\"Qty04*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP05*\" SIZE=4>  <INPUT NAME=\"IID05*\" SIZE=6>
<INPUT NAME=\"Qty05*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP06*\" SIZE=4>  <INPUT NAME=\"IID06*\" SIZE=6>
<INPUT NAME=\"Qty06*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP07*\" SIZE=4>  <INPUT NAME=\"IID07*\" SIZE=6>
<INPUT NAME=\"Qty07*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP08*\" SIZE=4>  <INPUT NAME=\"IID08*\" SIZE=6>
<INPUT NAME=\"Qty08*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP09*\" SIZE=4>  <INPUT NAME=\"IID09*\" SIZE=6>
<INPUT NAME=\"Qty09*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP10*\" SIZE=4>  <INPUT NAME=\"IID10*\" SIZE=6>
<INPUT NAME=\"Qty10*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP11*\" SIZE=4>  <INPUT NAME=\"IID11*\" SIZE=6>
<INPUT NAME=\"Qty11*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP12*\" SIZE=4>  <INPUT NAME=\"IID12*\" SIZE=6>
<INPUT NAME=\"Qty12*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP13*\" SIZE=4>  <INPUT NAME=\"IID13*\" SIZE=6>
<INPUT NAME=\"Qty13*\" SIZE=1><BR>"
      " <INPUT NAME=\"SP14*\" SIZE=4>  <INPUT NAME=\"IID14*\" SIZE=6>
<INPUT NAME=\"Qty14*\" SIZE=1><BR>"
      "Execution Status:
Total:<BR><HR>"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Process\">"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Menu\">"
      "</FORM>%s",
      pTPCC->sWId,HTMLTrailer);
```

```
};   // FormatNewOrder

//================================================================================
//
// Function name: FormatPayment
//
//================================================================================
VOID FormatPayment(CHAR * pOut,TPCC_STATE * pTPCC)
{
   pTPCC->uFormId = FORM_PAYMENT;
   FormatFormHdr(pOut,"TPC-C Payment",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                    Payment<BR>"
      "Date:<BR><BR>"
      "Warehouse: %4.4d"
      "                          District: <INPUT NAME=\"DID*\"
SIZE=1><BR><BR><BR><BR><BR>"
      "Customer: <INPUT NAME=\"CID*\" SIZE=4>"
      "Cust-Warehouse: <INPUT NAME=\"CWI*\" SIZE=4>  "
      "Cust-District: <INPUT NAME=\"CDI*\" SIZE=1><BR>"
      "Name:                        <INPUT NAME=\"CLT*\" SIZE=16>
Since:<BR>"
      "                                                  Credit:<BR>"
      "                                                  Disc:<BR>"
      "                                                  Phone:<BR><BR>"
      "Amount Paid:          $<INPUT NAME=\"HAM*\" SIZE=7>      New Cust
Balance:<BR>"
      "Credit Limit:<BR><BR>Cust-Data: <BR><BR><BR><BR></PRE><HR>"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Process\">"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Menu\">"
      "</FORM>%s",
     pTPCC->sWId,HTMLTrailer);
};   // FormatPayment

//================================================================================
//
// Function name: FormatDelivery
//
//================================================================================
VOID FormatDelivery(CHAR * pOut,TPCC_STATE * pTPCC)
{
   pTPCC->uFormId = FORM_DELIVERY;
   FormatFormHdr(pOut,"TPC-C Delivery",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                    Delivery<BR>"
      "Warehouse: %4.4d<BR><BR>"
      "Carrier Number: <INPUT NAME=\"OCD*\" SIZE=1><BR><BR>"
      "Execution Status:<BR></PRE><HR>"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Process\">"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Menu\">"
      "</FORM>%s",
     pTPCC->sWId,HTMLTrailer);
};   // FormatDelivery

//================================================================================
//
// Function name: FormatOrderStatus
//
//================================================================================
VOID FormatOrderStatus(CHAR * pOut,TPCC_STATE * pTPCC)
{
   pTPCC->uFormId = FORM_ORDERSTATUS;
   FormatFormHdr(pOut,"TPC-C Order-Status",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                    Order-Status<BR>"
      "Warehouse: %4.4d   "
      "District: <INPUT NAME=\"DID*\" SIZE=1><BR>"
               "Customer: <INPUT NAME=\"CID*\" SIZE=4>   Name:
<INPUT NAME=\"CLT*\" SIZE=23><BR>"
      "Cust-Balance:<BR><BR>"
      "Order-Number:            Entry-Date:                         Carrier-
Number:<BR>"
      "Supply-W     Item-Id    Qty     Amount      Delivery-
Date<BR></PRE><HR>"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Process\">"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Menu\">"
      "</FORM>%s",
      pTPCC->sWId,HTMLTrailer);
};   // FormatOrderStatus

//================================================================================
//
// Function name: FormatStockLevel
//
//================================================================================
VOID FormatStockLevel(CHAR * pOut,TPCC_STATE * pTPCC)
{
   pTPCC->uFormId = FORM_STOCKLEVEL;
   FormatFormHdr(pOut,"TPC-C Stock Level",pTPCC);
   sprintf(pOut + strlen(pOut),
      "<PRE>                                    Stock-Level<BR>"
      "Warehouse: %4.4d   District: %2.2d<BR><BR>"
      "Stock Level Threshold: <INPUT NAME=\"TT*\"SIZE=2><BR><BR>"
      "low stock:    <BR><HR>"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Process\">"
      "<INPUT TYPE=\"submit\"NAME=\"CMD\" VALUE=\"Menu\">"
      "</FORM>%s",
      pTPCC->sWId,pTPCC->sDId,HTMLTrailer);
};   // FormatStockLevel

//================================================================================
//
// Function name: FormatFormHdr
//
//================================================================================
VOID FormatFormHdr(CHAR * pOut,CHAR * pTitle,TPCC_STATE * pTPCC)
{
   sprintf(pOut,
      "<HTML><HEAD><TITLE>%s</TITLE></HEAD>"
      "<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
      "<INPUT TYPE=\"hidden\" NAME=\"PI*\" VALUE=\"\">"
      "<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
      "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%d\">",
      pTitle,pTPCC->uFormId,pTPCC->iTermId,pTPCC->iSyncId);
};   // FormatFormHdr

//================================================================================
//
```

```
// Function name: FormatRespHdr
//
//==========================================================================
VOID FormatRespHdr(CHAR * pOut,CHAR * pTitle,TPCC_STATE * pTPCC)
{
   sprintf(pOut,
      "<HTML><HEAD><TITLE>%s</TITLE></HEAD>"
      "<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
      "<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%d\">"
      "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%d\">",
      pTitle,pTPCC->iStatusId,pTPCC->uFormId,
      pTPCC->iTermId,pTPCC->iSyncId);
};   // FormatRespHdr

//==========================================================================
//
// Function name: FormatHTMLString
//
//    Encodes HTML special characters.  If necessary, space fills
//    to pOut to total uLen characters.
//
//==========================================================================
VOID FormatHTMLString(CHAR * pOut,CHAR * pIn,UINT uLen)
{
   while (uLen && *pIn)
   {
      switch (*pIn)
      {
         case '>':
            *pOut++ = '&';
            *pOut++ = 'g';
            *pOut++ = 't';
            *pOut++ = ';';
            pIn++;
            break;
         case '<':
            *pOut++ = '&';
            *pOut++ = 'l';
            *pOut++ = 't';
            *pOut++ = ';';
            pIn++;
            break;
         case '&':
            *pOut++ = '&';
            *pOut++ = 'a';
            *pOut++ = 'm';
            *pOut++ = 'p';
            *pOut++ = ';';
            pIn++;
            break;
         case '\"':
            *pOut++ = '&';
            *pOut++ = 'q';
            *pOut++ = 'u';
            *pOut++ = 'o';
            *pOut++ = 't';
            *pOut++ = ';';
            pIn++;
            break;
         default:
            *pOut++ = *pIn++;
            break;
      };   // switch (*pIn)
      uLen--;
   };   // while (uLen && *pIn)
   while(uLen--)
      *pOut++ = ' ';
       *pOut = 0;
};   // FormatHTMLString

//==========================================================================
//
// Function name: FormatString
//
//    Encodes formatted string for HTML transmission.
//
//==========================================================================
VOID FormatString(CHAR * pOut,CHAR * pPic,CHAR * pIn)
{
   while(*pPic)
   {
      if (*pPic == 'X' )
      {
         if (*pIn)
            *pOut++ = *pIn++;
         else
            *pOut++ = ' ';
      }
      else
         *pOut++ = *pPic;
      pPic++;
   };
   *pOut = 0;
};   // FormatString

//==========================================================================
// FUNCTION: UtilStrCpy
//
//    Copies n characters from string pSrc to pDst and places a null
//    null character at the end of the destination string.  Unlike
//    strncpy this function ensures that the result string is always
//    null terminated.
//
//==========================================================================
VOID UtilStrCpy(CHAR * pDest,CHAR * pSrc,INT n)
{
   strncpy(pDest,pSrc,n);
   pDest[n] = '\0';
   return;
};   // UtilStrCpy

//==========================================================================
//
// Function name: CheckNumeric
//
//    Result
//       FALSE - string is all numeric
//       TRUE - sting contains non-numeric characters
//
//==========================================================================
```

```
BOOL CheckNumeric(CHAR * pNum)
{
   if (*pNum == 0 )
      return(TRUE);
   while (*pNum && isdigit(*pNum))
      pNum++;
   return(*pNum);
};   // CheckNumeric
```

tpcclisten.h

```
// tpcclisten.h

#define DEFAULTBASEPORT 1440
```

tpcclisten.c

```
// tpcclisten.c
//
// Copyright Unisys, 1997
//
#include <windows.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <process.h>

#include "diagio.h"
#include "sockio.h"
#include "tpcclisten.h"
#include "tpcchandler.h"
#include "tmon.h"

UINT uServerNo = 0;
UINT uServerPort = 0;
BOOL bThreads = TRUE;
INT iTMDelay = 200;
INT iTermId = 0;

BOOL ServerMgrThread(VOID);
BOOL WINAPI ServerHandler(SOCKET * s);
BOOL GetArgs(INT argc, CHAR **argv);
VOID GetArgsUsage(VOID);

//============================================================================
//
// Function name: main
//
//============================================================================

INT main(int argc, char **argv)
{
   CHAR szDiag[100];

   if (GetArgs(argc,argv))
   {
      return(1);
   };
   sprintf(szDiag,"TPCCListen%ld",uServerNo);
   DiagIoInit(szDiag);

   ServerMgrThread();

   return(1);
};   // End of main


//============================================================================
//
// Function name: ServerMgrThread
//
//============================================================================
BOOL ServerMgrThread(VOID)
{
   ULONG ulThreadId;
   ULONG hThread;
   SOCKET_LISTEN slListen;
   CHAR szDiag[100];

   TMonInit(iTMDelay);
   slListen.uPort = uServerPort;
   slListen.ulRecvBuffSz = MAX_BUFF_SZ;
   slListen.ulSendBuffSz = MAX_BUFF_SZ;

   SockioListen(&slListen);

   sprintf(szDiag,"Thread Mgr Waiting Connects on %ld\n",uServerPort);
   DiagIoWrite(szDiag,DIAG_FORCE);

   while (!SockioAccept(&slListen))
   {
          hThread =
          _beginthreadex(NULL,
                         0,
                         ServerHandler,
                         &slListen.sConnect,
                         0,
                         &ulThreadId);
      if (hThread == 0)
      {
         sprintf(szDiag,
            "ServerHandler Initiation Failed %ld\n",
            errno);
                DiagIoWrite(szDiag,DIAG_ERROR);
                return(TRUE);
      };
      // Wait for thread to pick off sConnect
      while (slListen.sConnect)
         Sleep(100);
      CloseHandle((HANDLE) hThread);
   };   // while !SockAccept

   TMonTerm();
   return(FALSE);

};   // ServerMgrThread

//============================================================================
```

```
//
// Function name: ServerHandler
//
//=============================================================================
BOOL WINAPI ServerHandler(SOCKET * s)
{
   SOCKET_STATE ssSocketState;
   SOCKET_STATE * pss;
   TPCC_STATE tsTPCC;
   UINT uRslt;
   BOOL bRslt;

   pss = &ssSocketState;
   pss->sSocket = *s;
   iTermId++;
   pss->uSocketNo = iTermId;
   // Let ServerMgr know it's clear to reuse the socket
   *s = 0;
   pss->ulRecvBuffSz = MAX_BUFF_SZ;
   pss->ulSendBuffSz = MAX_BUFF_SZ;
   pss->lBytesXfer = 0;

   sprintf(pss->szDiag,"Handler %ld Started\n",pss->uSocketNo);
   DiagIoWrite(pss->szDiag,DIAG_FORCE);

   if (TPCCInit(&tsTPCC,iTermId,iTermId,FALSE))
   {
      DiagIoWrite(tsTPCC.ErrTxt,DIAG_ERROR);
      goto SvrXit;
   };

   while (!SrvioRecv(pss))
   {
      // TPCCHandler parses message, calls either db or tm for
      // transaction, gets reply, and formats response.  Response
      // is located in pss->SendMsg.  It must be terminate by
      // /r/n/r/n.
      uRslt = TPCCHandler(pss,&tsTPCC);
      bRslt = FALSE;
      switch (uRslt)
      {
         case TPCCSEND:
            bRslt = SrvioSend(pss);
            break;
         case TPCCSENDEND:
            bRslt = SrvioSend(pss);
            bRslt = TRUE;
            break;
         case TPCCENDNOW:
         default:
            break;
      };   // switch (TPCCHandle result)
      if (bRslt)
      {
         Sleep(2000);
         break;
      };
   };   // while !SrvioRecv

   sprintf(pss->szDiag,"Handler %ld Terminating\n",pss->uSocketNo);
   DiagIoWrite(pss->szDiag,DIAG_FORCE);

SvrXit:

   SockioTerm(pss);
   return(FALSE);

};   // ServerHandler

//=============================================================================
//
// Function name: GetArgs
//
//=============================================================================
BOOL GetArgs(INT argc, CHAR **argv)
{
   INT j;
   CHAR * ptr;
   BOOL bRslt = TRUE;

   // Must be at least one command argument
   if (argc == 1)
        {
      printf("No Command Line Parameter Entered.\n");
      goto XitArgs;
        };

   for (j = 1; j < argc; ++j)
   {
      if (argv[j][0] != '-' && argv[j][0] != '/')
      {
         printf("Unrecognized Command Line Syntax '%s'\n",ptr);
         goto XitArgs;
      };
      ptr = argv[j];
      switch (ptr[1])
      {
         case 's':
         case 'S':
            uServerNo = abs(atoi(ptr+2));
            break;

         case 'h':
         case 'H':
            goto XitArgs;

         case 'p':
         case 'P':
            uServerPort = abs(atoi(ptr+2));
            break;

         case 'd':
         case 'D':
            iTMDelay = abs(atoi(ptr+2));
            break;

         case 't':
         case 'T':
            if (abs(atoi(ptr+2)) == 0)
               bThreads = FALSE;
            else
               bThreads = TRUE;
```

```
            break;

         default:
            printf("Unknown Switch '%s'\n",ptr);
            goto XitArgs;
      };   // switch(ptr[1])
   };   // for (j = 1; j < argc; ++j)

   if (uServerNo == 0)
   {
      printf("Server Number Not Set\n");
      goto XitArgs;
   };

   bRslt = FALSE;
   if (uServerPort == 0)
      uServerPort = DEFAULTBASEPORT + uServerNo;

XitArgs:

   if (bRslt)
      GetArgsUsage();
   return(bRslt);

};   // GetArgs

//=========================================================================
//
// Function name: GetArgsUsage
//
//=========================================================================
VOID GetArgsUsage(VOID)
{
   printf("Usage(defaults):\n\n");
   printf("tpcclisten\n"
          "   -s<listen server number>\n"
          "   [-p<listen port number(%ld + server number)>]\n"
          "   [-t<use threads{1} or processes{0} (%s)>]\n"
          "   [-d<TM retry delay in milliseconds(%ld)>]\n",
          DEFAULTBASEPORT,bThreads ? "Threads" : "Processes",
          iTMDelay);
   printf("TPCC Listen Server Number Required\n");
};   // GetArgsUsage
```

sockio.h

```
// sockio.h

#define MAX_MSG_SZ  20000
#define MAX_BUFF_SZ 3000

typedef struct
{
   UINT uSocketNo;
   SOCKET sSocket;
   ULONG ulMsgStart;
   ULONG ulMsgLen;
   LONG  lBytesXfer;
   ULONG ulSendBuffSz;
   ULONG ulRecvBuffSz;
   ULONG ulBytesRecvd;
   ULONG ulMsgsRecvd;
   ULONG ulBytesSent;
   ULONG ulMsgsSent;
   CHAR szIPAddr[20];
   USHORT uPort;
   CHAR SendBuffer[MAX_BUFF_SZ];
   CHAR RecvBuffer[MAX_BUFF_SZ];
   CHAR SendMsg[MAX_MSG_SZ];
   CHAR RecvMsg[MAX_MSG_SZ];
   CHAR szDiag[MAX_DIAG_SZ];
} SOCKET_STATE;

typedef struct
{
   SOCKET sListener;
   SOCKET sConnect;
   CHAR szIPAddr[20];
   USHORT uPort;
   ULONG ulSendBuffSz;
   ULONG ulRecvBuffSz;
} SOCKET_LISTEN;

BOOL SockioInit(SOCKET_STATE * pss);
BOOL SockioListen(SOCKET_LISTEN * psl);
BOOL SockioAccept(SOCKET_LISTEN * psl);
VOID SockioTerm(SOCKET_STATE * pss);
BOOL SockioSend(SOCKET_STATE * pss);
BOOL SockioRecv(SOCKET_STATE * pss);

BOOL WebioSend(SOCKET_STATE * pss);
BOOL WebioRecv(SOCKET_STATE * pss);
```

sockio.c

```
// sockio.c
//
// Copyright Unisys, 1997
//

#include <windows.h>
#include <winsock.h>
#include <stdio.h>
#include "diagio.h"
#include "sockio.h"

//=========================================================================
//
// Function name: SockioInit
//
//=========================================================================
BOOL SockioInit(SOCKET_STATE * pss)
{
   WSADATA WsaData;
   SOCKADDR_IN sinRemoteAddr;
   IN_ADDR INADDR_IPAddress;
   INT iErr;
```

```
pss->sSocket = 0;
pss->ulMsgStart = 0;
pss->ulMsgLen = 0;
pss->lBytesXfer = 0;
pss->ulRecvBuffSz = sizeof(pss->RecvBuffer);
pss->ulSendBuffSz = sizeof(pss->SendBuffer);
pss->ulBytesRecvd = 0;
pss->ulMsgsRecvd = 0;
pss->ulBytesSent = 0;
pss->ulMsgsSent = 0;

iErr = WSAStartup (0x0101, &WsaData);

if (iErr == SOCKET_ERROR)
{
   sprintf(pss->szDiag,"Sockio(%ld): WSAStartup Init failed %ld\n",
           pss->uSocketNo, GetLastError());
   DiagIoWrite(pss->szDiag,DIAG_ERROR);
   return(TRUE);
};

pss->sSocket = socket(AF_INET, SOCK_STREAM, 0);
if (pss->sSocket == INVALID_SOCKET)
{
   sprintf(pss->szDiag,"Sockio(%ld): Allocate Socket Failed %ld\n",
           pss->uSocketNo, GetLastError());
   DiagIoWrite(pss->szDiag,DIAG_ERROR);
   return(TRUE);
};

// Set the receive buffer size...
iErr = setsockopt(pss->sSocket, SOL_SOCKET, SO_RCVBUF,
                  (char *) &pss->ulRecvBuffSz,
                  sizeof (pss->ulRecvBuffSz));
if (iErr == SOCKET_ERROR)
{
   sprintf(pss->szDiag,"Sockio(%ld): Set SO_RCVBUF Init failed %ld\n",
           pss->uSocketNo, WSAGetLastError());
   DiagIoWrite(pss->szDiag,DIAG_ERROR);
   closesocket(pss->sSocket);
   return(TRUE);
};

// Set the send buffer size
iErr = setsockopt(pss->sSocket, SOL_SOCKET, SO_SNDBUF,
                  (char *) &pss->ulSendBuffSz,
                  sizeof (pss->ulSendBuffSz));
if (iErr == SOCKET_ERROR)
{
   sprintf(pss->szDiag,"Sockio(%ld): Set SO_SNDBUF Init failed %ld\n",
           pss->uSocketNo,WSAGetLastError());
   DiagIoWrite(pss->szDiag,DIAG_ERROR);
   closesocket(pss->sSocket);
   return(TRUE);
};

ZeroMemory(&sinRemoteAddr,sizeof(sinRemoteAddr));

INADDR_IPAddress.s_addr = inet_addr(pss->szIPAddr);
if (INADDR_IPAddress.s_addr == -1)
{
      sprintf(pss->szDiag,"Sockio(%ld): Bad IPAddr format %s\n",
              pss->uSocketNo,pss->szIPAddr);
      DiagIoWrite(pss->szDiag,DIAG_ERROR);
      closesocket(pss->sSocket);
      return(TRUE);
   };
   sinRemoteAddr.sin_family = AF_INET;
   sinRemoteAddr.sin_port = htons(pss->uPort);
   sinRemoteAddr.sin_addr = INADDR_IPAddress;

   iErr = connect(pss->sSocket,(PSOCKADDR) &sinRemoteAddr,
                  sizeof (sinRemoteAddr));
   if (iErr == SOCKET_ERROR)
   {
      sprintf(pss->szDiag,"Sockio(%ld): Connect failed %ld\n",
              pss->uSocketNo,WSAGetLastError());
      DiagIoWrite(pss->szDiag,DIAG_ERROR);
      closesocket(pss->sSocket);
      return(TRUE);
   };

   return(FALSE);

};   // SockioInit


//============================================================================
//
// Function name: SockioListen
//
//============================================================================
BOOL SockioListen(SOCKET_LISTEN * psl)
{
   WSADATA WsaData;
   SOCKADDR_IN sinLocalAddr;
   INT iErr;
   CHAR szDiag[MAX_DIAG_SZ];

   psl->sListener = 0;
   iErr = WSAStartup (0x0101, &WsaData);

   if (iErr == SOCKET_ERROR)
   {
      sprintf(szDiag,"Sockio: WSAStartup Listen failed %ld\n",
              GetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      return(TRUE);
   };

   psl->sListener = socket(AF_INET, SOCK_STREAM, 0);
   if (psl->sListener == INVALID_SOCKET)
   {
      sprintf(szDiag,"Sockio: Allocate Listener Failed %ld\n",
              GetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      return(TRUE);
   };

   // Set the receive buffer size...
   iErr = setsockopt(psl->sListener, SOL_SOCKET, SO_RCVBUF,
                     (char *) &psl->ulRecvBuffSz,
```

```
                    sizeof (psl->ulRecvBuffSz));
   if (iErr == SOCKET_ERROR)
   {
      sprintf(szDiag,"Sockio: Set SO_RCVBUF Listen failed %ld\n",
         WSAGetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      closesocket(psl->sListener);
      return(TRUE);
   };

   // Set the send buffer size
   iErr = setsockopt(psl->sListener, SOL_SOCKET, SO_SNDBUF,
                    (char *) &psl->ulSendBuffSz,
                    sizeof (psl->ulSendBuffSz));
   if (iErr == SOCKET_ERROR)
   {
      sprintf(szDiag,"Sockio: Set SO_SNDBUF Listen failed %ld\n",
         WSAGetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      closesocket(psl->sListener);
      return(TRUE);
   };

   ZeroMemory(&sinLocalAddr,sizeof(sinLocalAddr));
   sinLocalAddr.sin_family = AF_INET;
   sinLocalAddr.sin_port = htons(psl->uPort);

   iErr = bind(psl->sListener,(PSOCKADDR) &sinLocalAddr,
               sizeof(sinLocalAddr));
   if (iErr == SOCKET_ERROR)
   {
      sprintf(szDiag,"Sockio: Bind failed %ld\n",WSAGetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      closesocket(psl->sListener);
      return(TRUE);
   };

   iErr = listen(psl->sListener,5);
   if (iErr == SOCKET_ERROR)
   {
      sprintf(szDiag,"Sockio: Listen failed %ld\n",WSAGetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      closesocket(psl->sListener);
      return(TRUE);
   };

   return(FALSE);

};   // SockioListen

//=========================================================================
//
// Function name: SockioAccept
//
//=========================================================================
BOOL SockioAccept(SOCKET_LISTEN * psl)
{
   CHAR szDiag[MAX_DIAG_SZ];

   psl->sConnect = accept(psl->sListener, NULL, NULL);
   if (psl->sConnect == INVALID_SOCKET)
   {
      sprintf(szDiag,"Sockio: Accept Failed %ld\n",WSAGetLastError());
      DiagIoWrite(szDiag,DIAG_ERROR);
      return(TRUE);
   };

   return(FALSE);

};   // SockioAccept

//=========================================================================
//
// Function name: SockioTerm
//
//=========================================================================
VOID SockioTerm(SOCKET_STATE * pss)
{
   if (pss->sSocket)
      closesocket(pss->sSocket);
   pss->sSocket = 0;
        return;
};   // SockioTerm

//=========================================================================
//
// Function name: SockioSend
//
//=========================================================================
BOOL SockioSend(SOCKET_STATE * pss)
{
   LONG lErr;

   sprintf(pss->SendBuffer,"Content-Length: %ld\r\n\r\n%s\r\n\r\n",
               (strlen(pss->SendMsg) + 4),pss->SendMsg);
   pss->lBytesXfer = strlen(pss->SendBuffer);
   lErr = send(pss->sSocket,pss->SendBuffer,pss->lBytesXfer,0);
   if (lErr != pss->lBytesXfer)
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): Send Failed %ld, lErr %ld\n",
         pss->uSocketNo,WSAGetLastError(),lErr);
      DiagIoWrite(pss->szDiag,DIAG_ERROR);
      return(TRUE);
   };

   return(FALSE);

};   // SockioSend

//=========================================================================
// Function: SockioRecv retrieves messages from sSocket until
//    the entire message has been assembled.  The message starts with
//    Content-Length: <number of bytes> followed by \r\n\r\n;
//
// Procedure Result
//    False - RecvMsg correctly assembled
//    True - RecvMsg contruction error
//=========================================================================
BOOL SockioRecv(SOCKET_STATE * pss)
```

```
{
   LONG lErr;
   ULONG ulMsgSize = 0;
   BOOL bRslt = FALSE;
   BOOL bHdrPresent = FALSE;
   CHAR * pMsg;

   pss->ulMsgStart = 0;
   pss->ulMsgLen = 0;
   while (!bHdrPresent)
   {
      lErr = recv(pss->sSocket,pss->RecvBuffer,pss->ulRecvBuffSz,0);
      if (lErr == SOCKET_ERROR)
      {
         sprintf(pss->szDiag,"Sockio(%ld): Recv Hdr Failed %ld\n",
                 pss->uSocketNo, WSAGetLastError());
         bRslt = TRUE;
         goto xit;
      };
      if (lErr == 0)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Connection Closed during Hdr Recv\n",
            pss->uSocketNo);
         bRslt = TRUE;
         goto xit;
      };
      if ((ulMsgSize + lErr) >= MAX_MSG_SZ)   // save null pad spot
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): HdrInput of %ld >= MaxMsgSize of %ld\n",
            pss->uSocketNo, (ulMsgSize + lErr), MAX_MSG_SZ);
         bRslt = TRUE;
         goto xit;
      };
      // Successful recv looking for header
      pMsg = pss->RecvMsg + ulMsgSize;
      memcpy(pMsg,pss->RecvBuffer,lErr);
      ulMsgSize += lErr;
      *(pss->RecvMsg + ulMsgSize) = '\0';
      pMsg = strstr(pss->RecvMsg,"\r\n\r\n");
      if (pMsg != NULL)
         bHdrPresent = TRUE;
   };  // while (!bHdrPresent)

   // bHdrPresent, look for Content-Length info
   pss->ulMsgStart = (pMsg - pss->RecvMsg) + 4;
   pMsg = strstr(pss->RecvMsg,"Content-Length:");
   if (pMsg != NULL)
   {
      pMsg = pMsg + sizeof("Content-Length:");
      pss->ulMsgLen = abs(atol(pMsg));
      if (pss->ulMsgLen == 0)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Content Length Conversion Error\n",
            pss->uSocketNo);
         bRslt = TRUE;
         goto xit;
      };
      if ((pss->ulMsgStart + pss->ulMsgLen) >= MAX_MSG_SZ)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Hdr + Content %ld >= MaxMsgSize of %ld\n",
            pss->uSocketNo,(pss->ulMsgStart + pss->ulMsgLen),MAX_MSG_SZ);
         bRslt = TRUE;
         goto xit;
      };
   }
   else
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): Content Length String Not Found\n",
         pss->uSocketNo);
      bRslt = TRUE;
      goto xit;
   };

   // bHdrPresent and Content-Length found.  Get rest of message.
   while (ulMsgSize < (pss->ulMsgStart + pss->ulMsgLen))
   {
      lErr = recv(pss->sSocket,pss->RecvBuffer,pss->ulRecvBuffSz,0);
      if (lErr == SOCKET_ERROR)
      {
         sprintf(pss->szDiag,"Sockio(%ld): Recv Msg Failed %ld\n",
                 pss->uSocketNo,WSAGetLastError());
         bRslt = TRUE;
         goto xit;
      };
      if (lErr == 0)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Connection Closed during Msg Recv\n",
            pss->uSocketNo);
         bRslt = TRUE;
         goto xit;
      };
      if ((ulMsgSize + lErr) >= MAX_MSG_SZ)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): RecvMsg of %ld >= MaxMsgSize of %ld\n",
            pss->uSocketNo, (ulMsgSize + lErr), MAX_MSG_SZ);
         bRslt = TRUE;
         goto xit;
      };
      // Successful recv
      pMsg = pss->RecvMsg + ulMsgSize;
      memcpy(pMsg,pss->RecvBuffer,lErr);
      ulMsgSize = ulMsgSize + lErr;
   };   // while (ulMsgSize < (body + header))

   if (ulMsgSize != (pss->ulMsgStart + pss->ulMsgLen))
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): BytesRecv of %ld != Expected (%ld + %ld)\n",
         pss->uSocketNo,ulMsgSize,pss->ulMsgStart,pss->ulMsgLen);
      bRslt = TRUE;
      goto xit;
   };
   if ((pss->ulMsgStart == 0) || (pss->ulMsgLen == 0))
   {
      sprintf(pss->szDiag,
```

```
         "Sockio(%ld): MsgStart (%ld) or MsgLen (%ld) == 0\n",
         pss->uSocketNo,pss->ulMsgStart,pss->ulMsgLen);
      bRslt = TRUE;
      goto xit;
   };

xit:
   if (bRslt)
   {
      pss->ulMsgStart = 0;
      pss->ulMsgLen = 0;
      DiagIoWrite(pss->szDiag,DIAG_STATE);
      return(TRUE);
   }
   else
   {
      // Pad with null for string search protection
      *(pss->RecvMsg + ulMsgSize) = '\0';
      return(FALSE);
   };

};  // SockioRecv

//============================================================================
//
// Function name: WebioSend
//
//============================================================================
BOOL WebioSend(SOCKET_STATE * pss)
{
   LONG lErr;
   pss->lBytesXfer = strlen(pss->SendMsg);
   lErr = send(pss->sSocket,pss->SendMsg,pss->lBytesXfer,0);
   if (lErr != pss->lBytesXfer)
   {
      sprintf(pss->szDiag,"Sockio(%ld): Web Send Failed %ld, lErr %ld\n",
         pss->uSocketNo,WSAGetLastError(),lErr);
      DiagIoWrite(pss->szDiag,DIAG_ERROR);
      return(TRUE);
   };

   return(FALSE);

};   // WebioSend

//============================================================================
// Function: WebioRecv retrieves messages from sSocket until
//    WebPage has been assembled.  It first looks for the HTML
//    message header Content-Length field to determine how many
//    bytes of data are expected.  Once this is found, it then
//    stores bytes received until Header plus Content-Length
//    has arrived.
//
// Procedure Result
//    False - WebPage correctly assembled
//    True - WebPage contruction error
//============================================================================
BOOL WebioRecv(SOCKET_STATE * pss)
{
   LONG lErr;
   ULONG ulPageSize = 0;
   BOOL bHdrPresent = FALSE;
   BOOL bRslt = FALSE;
   CHAR * pPage;

   pss->ulMsgStart = 0;
   pss->ulMsgLen = 0;
   while (!bHdrPresent)
   {
      lErr = recv(pss->sSocket,pss->RecvBuffer,pss->ulRecvBuffSz,0);
      if (lErr == SOCKET_ERROR)
      {
         sprintf(pss->szDiag,"Sockio(%ld): Web Recv Hdr Failed %ld\n",
                 pss->uSocketNo,WSAGetLastError());
         bRslt = TRUE;
         goto xit;
      };
      if (lErr == 0)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Connection Closed during Web Hdr Recv\n",
            pss->uSocketNo);
         bRslt = TRUE;
         goto xit;
      };
      if ((ulPageSize + lErr) >= MAX_MSG_SZ)   // save null pad spot
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): WebHdrInput of %ld >= MaxMsgSize of %ld\n",
            pss->uSocketNo,(ulPageSize + lErr),MAX_MSG_SZ);
         bRslt = TRUE;
         goto xit;
      };
      // Successful recv looking for header
      pPage = pss->RecvMsg + ulPageSize;
      memcpy(pPage,pss->RecvBuffer,lErr);
               ulPageSize = ulPageSize + lErr;
               *(pss->RecvMsg + ulPageSize) = '\0';
               pPage = strstr(pss->RecvMsg,"\r\n\r\n");
               if (pPage != NULL)
         bHdrPresent = TRUE;
   };  // while (!bHdrPresent)

   // bHdrPresent, look for Content-Length info
   pss->ulMsgStart = (pPage - pss->RecvMsg) + 4;
   pPage = strstr(pss->RecvMsg,"Content-Length:");
   if (pPage == NULL)
      pPage = strstr(pss->RecvMsg,"Content-length:");
   if (pPage != NULL)
   {
      pPage = pPage + sizeof("Content-Length:");
      pss->ulMsgLen = abs(atol(pPage));
      if (pss->ulMsgLen == 0)
      {
         sprintf(pss->szDiag,
            "Sockio(%ld): Web Content Length Conversion Error\n",
            pss->uSocketNo);
         bRslt = TRUE;
         goto xit;
      };
```

```
   if ((pss->ulMsgStart + pss->ulMsgLen) >= MAX_MSG_SZ)
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): WebHdr + Content %ld >= MaxMsgSize of %ld\n",
         pss->uSocketNo,(pss->ulMsgStart + pss->ulMsgLen),MAX_MSG_SZ);
      bRslt = TRUE;
      goto xit;
   };
}   // if Content-Length found
else
{
   sprintf(pss->szDiag,
      "Sockio(%ld): Web Content Length String Not Found\n",
      pss->uSocketNo);
   bRslt = TRUE;
   goto xit;
};

// bHdrPresent and Content-Length found.  Get rest of WebPage.
while (ulPageSize < (pss->ulMsgStart + pss->ulMsgLen))
{
   lErr = recv(pss->sSocket,pss->RecvBuffer,pss->ulRecvBuffSz,0);
   if (lErr == SOCKET_ERROR)
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): Recv Web Msg Failed %ld\n",
              pss->uSocketNo,WSAGetLastError());
      bRslt = TRUE;
      goto xit;
   };
   if (lErr == 0)
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): Connection Closed during Web Msg Recv\n",
         pss->uSocketNo);
      bRslt = TRUE;
      goto xit;
   };
   if ((ulPageSize + lErr) >= MAX_MSG_SZ)
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): WebMsgRecv of %ld >= MaxMsgSize of %ld\n",
         pss->uSocketNo, (ulPageSize + lErr), MAX_MSG_SZ);
      bRslt = TRUE;
      goto xit;
   };
   // Successful receive
   pPage = pss->RecvMsg + ulPageSize;
   memcpy(pPage,pss->RecvBuffer,lErr);
   ulPageSize = ulPageSize + lErr;
};   // while (ulPageSize < (body + header))

if (ulPageSize != (pss->ulMsgStart + pss->ulMsgLen))
{
   sprintf(pss->szDiag,
      "Sockio(%ld): WebBytesRecv of %ld != Expected (%ld + %ld)\n",
      pss->uSocketNo,ulPageSize,pss->ulMsgStart,pss->ulMsgLen);
   bRslt = TRUE;
   goto xit;
};
if ((pss->ulMsgStart == 0) || (pss->ulMsgLen == 0))
   {
      sprintf(pss->szDiag,
         "Sockio(%ld): WebMsgStart (%ld) or WebMsgLen(%ld) == 0\n",
         pss->uSocketNo,pss->ulMsgStart,pss->ulMsgLen);
      bRslt = TRUE;
      goto xit;
   };

xit:
   if (bRslt)
   {
      pss->ulMsgStart = 0;
      pss->ulMsgLen = 0;
      DiagIoWrite(pss->szDiag,DIAG_ERROR);
      return(TRUE);
   }
   else
   {
      // Pad with null for string search protection
      *(pss->RecvMsg + ulPageSize) = '\0';
      return(FALSE);
   };

};  // WebioRecv
```

diagio.h

```
// diagio.h

// Environment variable defaults
#define DEFAULTDIAGLEVEL DIAG_INFO
#define DEFAULTEVENTLOG 0

#define DIAGNOSTICS TRUE
#define MAX_DIAG_SZ 2000

// Severity level of diagnostic report
#define DIAG_FORCE 1
#define DIAG_ERROR 2
#define DIAG_STATE 3
#define DIAG_INFO 4

VOID DiagIoInit(CHAR * pDiagId);
VOID DiagIoTerm(VOID);
VOID DiagIoWrite(CHAR * pDiagBuffer, UINT uSeverity);
```

diagio.c

```
// diagio.c
//
// Copyright Unisys, 1997
//
#include <windows.h>
#include <stdio.h>
#include "diagio.h"

CRITICAL_SECTION csDiagIo;
HANDLE hEventLog = NULL;
```

```
UINT uDiagLevel;
BOOL bEventLog;
CHAR * pDiagHdr;
CHAR * pEventHost;
CHAR * pErrHdr =
   {"*** ERROR *** ERROR *** ERROR *** ERROR *** ERROR ***"};

INT WriteEventLog(CHAR * pDMsgs[],UINT uMsgCnt,UINT uSeverity);

//=========================================================================
//
// Function name: DiagIoInit
//
//=========================================================================
VOID DiagIoInit(CHAR * pDiagId)
{
   CHAR * pszEnvData;
   if (DIAGNOSTICS)
   {
      InitializeCriticalSection(&csDiagIo);

      if ((pszEnvData = getenv("WEBDIAGLEVEL")) == NULL)
         uDiagLevel = DEFAULTDIAGLEVEL;
      else
         uDiagLevel = abs(atoi(pszEnvData));
      if (uDiagLevel == 0)
         uDiagLevel = DIAG_ERROR;

      // Set up event log if requested
      if ((pszEnvData = getenv("WEBEVENTLOG")) == NULL)
         bEventLog = DEFAULTEVENTLOG;
      else
         bEventLog = abs(atoi(pszEnvData));
      if ((pszEnvData = getenv("WEBEVENTHOST")) == NULL)
      {
         pEventHost = (CHAR *) malloc(10);
         strcpy(pEventHost,"");  // local host
      }
      else
      {
         pEventHost = (CHAR *) malloc(strlen(pszEnvData) + 1);
         strcpy(pEventHost,pszEnvData);
      };
      pDiagHdr = (CHAR *) malloc(strlen(pDiagId) + 1);
      strcpy(pDiagHdr,pDiagId);

      if (bEventLog)
      {
         hEventLog = RegisterEventSource(pEventHost,pDiagId);
         if (hEventLog == NULL)
         {
            fprintf(stdout,
               "%s: Event Log Register Failed (%ld)\n"
               "Event Log Will NOT be Used\n",
               pDiagHdr,GetLastError());
            bEventLog = FALSE;
         }
         else
         {
            if (strlen(pEventHost))
               fprintf(stdout,"%s: Event Logging to %s as %s\n",
                  pDiagHdr,pEventHost,pDiagId);
            else
               fprintf(stdout,"%s: Event Logging to LocalHost as %s\n",
                  pDiagHdr,pDiagHdr);
         };
      };   // if bEventLog
   };   // if Diagnostics
};   // DiagIoInit


//=========================================================================
//
// Function name: DiagIoTerm
//
//=========================================================================
VOID DiagIoTerm(VOID)
{
   if (DIAGNOSTICS)
   {
      DeleteCriticalSection(&csDiagIo);
      if (hEventLog != NULL)
         DeregisterEventSource(hEventLog);
      free(pDiagHdr);
      free(pEventHost);
   };
};   // DiagIoTerm

//=========================================================================
//
// Function name: DiagIoWrite
//
//=========================================================================
VOID DiagIoWrite(CHAR * pDiagBuffer, UINT uSeverity)
{
   CHAR * pDMsgs[3];
   UINT uMsgCnt = 0;
   INT iERslt = 0;
   if (DIAGNOSTICS)
   {
      if (uDiagLevel >= uSeverity)
      {
         if (uSeverity == DIAG_ERROR)
         {
            pDMsgs[0] = pDiagHdr;
            pDMsgs[1] = pErrHdr;
            pDMsgs[2] = pDiagBuffer;
            uMsgCnt = 3;
         }
         else
         {
            pDMsgs[0] = pDiagHdr;
            pDMsgs[1] = pDiagBuffer;
            uMsgCnt = 2;
         };
         if (bEventLog)
            iERslt = WriteEventLog(pDMsgs,uMsgCnt,uSeverity);
         EnterCriticalSection(&csDiagIo);
         __try
         {
```

```
            if (uMsgCnt == 3)
               fprintf(stdout,"\n%s:
%s\n%s",pDMsgs[0],pDMsgs[1],pDMsgs[2]);
            else
               fprintf(stdout,"\n%s: %s",pDMsgs[0],pDMsgs[1]);
            if (iERslt != 0)
               fprintf(stdout,
                  "EventLog Write Failed (%ld), No Longer in Use\n",
                  iERslt);
         }
         __finally
         {
            LeaveCriticalSection(&csDiagIo);
         };
      };   // if uDiagLevel >= uSeverity
   };   // if Diagnostics
};   // DiagIoWrite

INT WriteEventLog(CHAR * pDMsgs[],UINT uMsgCnt,UINT uSeverity)
{
   WORD wType;
   WORD wCount;
   wCount = uMsgCnt;
   switch (uSeverity)
   {
      case DIAG_FORCE:
         wType = EVENTLOG_INFORMATION_TYPE;
         break;
      case DIAG_ERROR:
         wType = EVENTLOG_ERROR_TYPE;
         break;
      default:
         wType = 0;
         break;
   };
   if (wType != 0)
   {
      if (!ReportEvent(hEventLog,           // event log handle
                       wType,               // event type
                       0,                   // category zero
                       uSeverity,           // no event identifier
                       NULL,                // no user security identifier
                       wCount,              // # of substitution strings
                       0,                   // no binary data
                       (LPCTSTR *) pDMsgs,  // address of string array
                       NULL))               // address of binary
      {
         DeregisterEventSource(hEventLog);
         hEventLog = NULL;
         bEventLog = FALSE;
         return(GetLastError());
      };   // ReportEvent failed
   };   // if wType != 0
   return(0);
};   // WriteEventLog
```

SERVER MAKEFILES

```
SVR = tpccsvr
SRC = tpccsvr.c
DBG = /f "/Zi"
$(SVR).exe: $(SRC)
   erase $(SVR).exe
   $(TUXDIR)\bin\buildserver /f "$(SRC)" /o $(SVR).exe /s
NEWORDER:NEWORDER /s PAYMENT:PAYMENT /s ORDERSTS:ORDERSTS /s
STOCKLVL:STOCKLVL -l d:\mssql\dblib\lib\ntwdblib.lib
   copy $(SVR).exe $(APPDIR)

SVR = tpccdelv
SRC = tpccdelv.c
DBG = /f "/Zi"
$(SVR).exe: $(SRC)
   erase $(SVR).exe
   $(TUXDIR)\bin\buildserver /f "$(SRC)" /o $(SVR).exe /s
DELIVERY:DELIVERY  -l d:\mssql\dblib\lib\ntwdblib.lib
   copy $(SVR).exe $(APPDIR)
```

tpccsvr.h

```
// tpccsvr.h
//
// Copyright Unisys, 1997
// Copyright Microsoft, 1996

#include "tpcc.h"

#define DEFCLPACKSIZE            2000
#define DEADLOCKWAIT             10
#define LOGFILE_NAME             "delilog"

// String length constants
#define SERVER_NAME_LEN            20
#define DATABASE_NAME_LEN          20
#define USER_NAME_LEN              20
#define PASSWORD_LEN               20
#define TABLE_NAME_LEN             20
```

tpccsvr.c

```
// tpccsvr.c
//
// Copyright Unisys, 1997
// Copyright Microsoft, 1996

#include <windows.h>
#include <malloc.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <time.h>
#include <sys\timeb.h>

#include <atmi.h>
#include <userlog.h>

#include "tpccsvr.h"

char   szServer[32]   = "tpccserver";
```

```
char    szUser[32]              = { 0 };
char    szPassword[32] = { 0 };
char    szDatabase[32] = "tpcc";
char  szService[16]  = "tpccsvr";
char  szWork[200];
PDBPROCESS     dbproc;
int     spid;                                   // spid assigned from dblib
BOOL  bFailed;
BOOL  bDeadlock;
short   DeadlockRetry  = (short)3;

int err_handler(DBPROCESS *dbproc, int severity, int dberr, int oserr,
char *dberrstr, char *oserrstr);
int msg_handler(DBPROCESS *dbproc, DBINT msgno, int msgstate, int
severity, char *msgtext);
int SQLStockLevel(STOCK_LEVEL_DATA *psld);
int SQLNewOrder(NEW_ORDER_DATA * pnod);
int SQLPayment(PAYMENT_DATA *ppd);
int SQLOrderStatus(ORDER_STATUS_DATA * pOrderStatus);
void UtilStrCpy(char * pDest, char * pSrc, int n);
VOID GetArgs(INT argc, CHAR **argv);

//============================================================================
//
// Function name: tpsvrinit
//
//============================================================================
tpsvrinit(int argc, char *argv[])
{
   GetArgs(argc,argv);
   sprintf(szWork,"%s Started, DBServer=%s,DB=%s",
      szService,szServer,szDatabase);
   userlog(szWork);
   if (SQLInit(szServer,szDatabase,szUser,szPassword))
      return(-1);
   userlog("Database open, initialization complete");
   return(0);
};   // tpsvrinit

//============================================================================
//
// Function name: tpsvrdone
//
//============================================================================
void tpsvrdone()
{
   userlog("Shutdown request for tpcctux server");
   dbclose(dbproc);
   dbexit();
};   // tpsvrdone

//============================================================================
//
// Function name: NEWORDER
//
//    Entry point called by tuxedo for NEWORDER service requests.
//
//============================================================================
void NEWORDER(TPSVCINFO * svcinfo)
{
   int iRslt;
   NEW_ORDER_DATA * pnod;

   pnod = (NEW_ORDER_DATA *) svcinfo->data;
   iRslt = SQLNewOrder(pnod);

   // Check for DBLib termination error
   if (bFailed)
   {
      strcpy(pnod->execution_status,szWork);
      tpreturn(TPFAIL,SVCERR_DBLIB,svcinfo->data,svcinfo->len,0);
   }
   else
   if (iRslt == 0)
      tpreturn(TPSUCCESS,0,svcinfo->data,svcinfo->len,0);
   else
      tpreturn(TPFAIL,iRslt,svcinfo->data,svcinfo->len,0);
};   // NEWORDER

//============================================================================
//
// Function name: PAYMENT
//
//    Entry point called by tuxedo for PAYMENT service requests.
//
//============================================================================
void PAYMENT(TPSVCINFO * svcinfo)
{
   int iRslt;
   PAYMENT_DATA * ppd;

   ppd = (PAYMENT_DATA *) svcinfo->data;

   iRslt = SQLPayment(ppd);

   if (bFailed)
   {
      strcpy(ppd->execution_status,szWork);
      tpreturn(TPFAIL,SVCERR_DBLIB,svcinfo->data,svcinfo->len,0);
   }
   else
   if (iRslt == 0)
      tpreturn(TPSUCCESS,0,svcinfo->data,svcinfo->len,0);
   else
      tpreturn(TPFAIL,iRslt,svcinfo->data,svcinfo->len,0);
};   // PAYMENT

//============================================================================
//
// Function name: ORDERSTS
//
//    Entry point called by tuxedo for ORDERSTS service requests.
//
//============================================================================
void ORDERSTS(TPSVCINFO * svcinfo)
{
   int iRslt;
   ORDER_STATUS_DATA * posd;

   posd = (ORDER_STATUS_DATA *) svcinfo->data;
```

```
   iRslt = SQLOrderStatus(posd);

   // Check for DBLib termination error
   if (bFailed)
   {
      strcpy(posd->execution_status,szWork);
      tpreturn(TPFAIL,SVCERR_DBLIB,svcinfo->data,svcinfo->len,0);
   }
   else
   if (iRslt == 0)
      tpreturn(TPSUCCESS,0,svcinfo->data,svcinfo->len,0);
   else
      tpreturn(TPFAIL,iRslt,svcinfo->data,svcinfo->len,0);
};   // ORDERSTS

//================================================================================
//
// Function name: STOCKLVL
//
//    Entry point called by tuxedo for STOCKLVL service requests.
//
//================================================================================
void STOCKLVL(TPSVCINFO * svcinfo)
{
   int iRslt;
   STOCK_LEVEL_DATA * psld;

   psld = (STOCK_LEVEL_DATA *) svcinfo->data;
   iRslt = SQLStockLevel(psld);

   // Check for DBLib termination error
   if (bFailed)
   {
      strcpy(psld->execution_status,szWork);
      tpreturn(TPFAIL,SVCERR_DBLIB,svcinfo->data,svcinfo->len,0);
   }
   else
   if (iRslt == 0)
      tpreturn(TPSUCCESS,0,svcinfo->data,svcinfo->len,0);
   else
      tpreturn(TPFAIL,iRslt,svcinfo->data,svcinfo->len,0);

};   // STOCKLVL

//================================================================================
//
// Function name: SQLInit
//
//    Set global dbproc and spid.
//
//    Result:
//       FALSE - database open, dbproc valid
//       TRUE - database open failed
//
//================================================================================
BOOL SQLInit(CHAR * pSvr,CHAR * pDB,CHAR * pUsr,CHAR * pPW,CHAR * pSvc)
{
   char szApp[32];
   char server[256];
   char database[256];
   char user[256];
   char password[256];
   LOGINREC    *login;

   dbinit();
   // install error and message handlers
   dbmsghandle((DBMSGHANDLE_PROC)msg_handler);
   dberrhandle((DBERRHANDLE_PROC)err_handler);

   dbproc = NULL;
   strcpy(server,pSvr);
   strcpy(database,pDB);
   strcpy(user,pUsr);
   strcpy(password,pPW);
   sprintf(szApp,"%s%ld",pSvc,_getpid());

   login = dblogin();
   if (!*user )
      DBSETLUSER(login,"sa");
   else
      DBSETLUSER(login,user);
   DBSETLPWD(login,password);
   DBSETLHOST(login,szApp);
// DBSETLPACKET(login,(unsigned short)DEFCLPACKSIZE);

   if ((dbproc = dbopen(login,server)) == NULL)
   {
      userlog("dbopen failed");
      return TRUE;
   };
   // Use the the right database
   dbuse(dbproc,database);
   dbcmd(dbproc,"select @@spid");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      dbbind(dbproc,1,SMALLBIND,(DBINT) 0,(BYTE *) spid);
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };

   dbcmd(dbproc,"set nocount on");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };

   //rollback transaction on abort
   dbcmd(dbproc,"set XACT_ABORT ON");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };

   return(FALSE);

};   // SQLInit
```

```
//==============================================================================
// FUNCTION: err_handler
//
//    Handles DB-Library errors
//
// ARGUMENTS:
//    DBPROCESS   *dbproc     DBPROCESS id pointer
//    int         severity    severity of error
//    int         dberr       error id
//    int         oserr       operating system specific error code
//    char        *dberrstr   printable error description of dberr
//    char        *oserrstr   printable error description of oserr
//
// RETURNS:
//    int      INT_CANCEL
//
// COMMENTS:   None
//
//==============================================================================
int err_handler(DBPROCESS *dbproc, int severity, int dberr, int oserr,
char *dberrstr, char *oserrstr)
{
   if ((dbproc == NULL) || (DBDEAD(dbproc)))
   {
      userlog("ErrHandler: DBPROC is invalid");
      return INT_CANCEL;
   };
   if (bFailed)
      return INT_CANCEL;
   if (oserr != DBNOERR)
   {
      sprintf(szWork,"ErrHandler: OSErr(%ld) - %s",oserr,oserrstr);
      userlog(szWork);
      bFailed = TRUE;
   };

   return INT_CANCEL;

};   // err_handler

//==============================================================================
// FUNCTION: msg_handler
//
//    Handles DB-Library SQL Server error messages
//
// ARGUMENTS:
//    DBPROCESS   *dbproc     DBPROCESS id pointer
//    DBINT       msgno       message number
//    int         msgstate    message state
//    int         severity    message severity
//    char        *msgtext    printable message description
//
// RETURNS:    int   INT_CONTINUE   continue operation
//                   INT_CANCEL      cancel operation
//
// COMMENTS:   This function also sets the dead lock dbproc
//             variable if necessary.
//
//==============================================================================
int msg_handler(DBPROCESS *dbproc, DBINT msgno, int msgstate, int
severity, char *msgtext)
{

   if ((msgno == 5701) || (msgno == 2528) ||
       (msgno == 5703) || (msgno == 6006))
      return INT_CONTINUE;

   // deadlock message
   if (msgno == 1205)
   {
      // set the deadlock indicator
      bDeadlock = TRUE;
      return INT_CONTINUE;
   };

   if (bFailed)
      return INT_CANCEL;

   if (msgno == 0)
      return INT_CONTINUE;
   else
   {
      sprintf(szWork,"MsgHandler: MsgNo(%ld) - %s",msgno,msgtext);
      userlog(szWork);
      bFailed = TRUE;
   };

   return INT_CANCEL;

};   // msg_handler

//==============================================================================
// FUNCTION: SQLStockLevel
//
//    Handles the stock level transaction.
//
// ARGUMENTS:
//    STOCK_LEVEL_DATA  StockLevel input / output data structure
//    dbdata (global)
//    bDeadlock (global)
//
// RETURNS:
//    SVC_NOERROR  success
//    !SVC_NOERROR failure
//
// COMMENTS:   None
//
//==============================================================================
int SQLStockLevel(STOCK_LEVEL_DATA * psld)
{
   int tryit;
   short num_deadlocks = 0;
   RETCODE rc;
   BYTE * pData;

   bFailed = FALSE;
   bDeadlock = FALSE;

   for (tryit=0; tryit < DeadlockRetry; tryit++)
```

```
   {
      if (dbrpcinit(dbproc,"tpcc_stocklevel",0) == SUCCEED)
      {
         dbrpcparam(dbproc, NULL, 0, SQLINT2, -1, -1,
            (BYTE *) &psld->w_id);
         dbrpcparam(dbproc, NULL, 0, SQLINT1, -1, -1,
            (BYTE *) &psld->d_id);
         dbrpcparam(dbproc, NULL, 0, SQLINT2, -1, -1,
            (BYTE *) &psld->thresh_hold);

         if (dbrpcexec(dbproc) == SUCCEED)
         {
            while (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) &&
                   (rc != FAIL))
            {
               if (DBROWS(dbproc))
               {
                  while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) &&
                         (rc != FAIL))
                  {
                     if(pData=dbdata(dbproc,1))
                        psld->low_stock = *((long *) pData);
                  };
               };   // if (DBROWS(dbproc)
            };   // while (dbresults)
         };   // if (dbrpcexec)
      };   // if (dbrpcinit)
      if (bDeadlock)
      {
         num_deadlocks++;
         bDeadlock = FALSE;
         userlog("StockLevel Deadlock Retry (%d)",num_deadlocks);
         Sleep(10 * tryit);
      }
      else
      {
         strcpy(psld->execution_status,"Transaction commited.");
         return(SVC_NOERROR);
      };
   };  // for (tryit)

   // If we reached here, it means we quit after MAX_RETRY deadlocks
   strcpy(psld->execution_status,"Hit deadlock max.");
   userlog("StockLevel Deadlock Failure (%d)",num_deadlocks);
       return(SVCERR_DEADLOCK);

};   // SQLStockLevel

//============================================================================
// FUNCTION: SQLNewOrder
//
//    Handles the new order transaction.
//
// ARGUMENTS:
//    NEW_ORDER_DATA    NewOrder structure for input/output data
//    dbdata (global)
//    bDeadlock (global)
//
// RETURNS:
//    SVC_NOERROR  success
//    !SVC_NOERROR failure
//
// COMMENTS:   None
//
//============================================================================
int SQLNewOrder(NEW_ORDER_DATA * pnod)
{
   RETCODE rc;
   int i;
   DBINT commit_flag;
   short num_deadlocks = 0;
   int tryit;
   DBDATETIME datetime;
   BYTE * pData;

   bFailed = FALSE;
   bDeadlock = FALSE;

   for (tryit=0; tryit < DeadlockRetry; tryit++)
   {
      if (dbrpcinit(dbproc,"tpcc_neworder",0) == SUCCEED)
      {
         dbrpcparam(dbproc, NULL, 0, SQLINT2, -1, -1,
            (BYTE *) &pnod->w_id);
         dbrpcparam(dbproc, NULL, 0, SQLINT1, -1, -1,
            (BYTE *) &pnod->d_id);
         dbrpcparam(dbproc, NULL, 0, SQLINT4, -1, -1,
            (BYTE *) &pnod->c_id);
         dbrpcparam(dbproc, NULL, 0, SQLINT1, -1, -1,
            (BYTE *) &pnod->o_ol_cnt);

         pnod->o_all_local = 1;
         for (i = 0; i < pnod->o_ol_cnt; i++)
         {
            if (pnod->o_all_local &&
                pnod->Ol[i].ol_supply_w_id != pnod->w_id )
               pnod->o_all_local = 0;
         };
         dbrpcparam(dbproc, NULL, 0, SQLINT1, -1, -1,
            (BYTE *) &pnod->o_all_local);

         for (i = 0; i < pnod->o_ol_cnt; i++)
         {
            dbrpcparam(dbproc, NULL, 0, SQLINT4, -1, -1,
               (BYTE *) &pnod->Ol[i].ol_i_id);
            dbrpcparam(dbproc, NULL, 0, SQLINT2, -1, -1,
               (BYTE *) &pnod->Ol[i].ol_supply_w_id);
            dbrpcparam(dbproc, NULL, 0, SQLINT2, -1, -1,
               (BYTE *) &pnod->Ol[i].ol_quantity);
         };

         if (dbrpcexec(dbproc) == SUCCEED)
         {
            pnod->total_amount=0;
            // Get results from order line
            for (i = 0; i<pnod->o_ol_cnt; i++)
            {
               if (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) &&
                    (rc != FAIL))
               {
                  if (DBROWS(dbproc) && (dbnumcols(dbproc) == 5))
                  {
```

```
                    while (dbnextrow(dbproc) != NO_MORE_ROWS)
                    {
                       if(pData=dbdata(dbproc, 1))
                          UtilStrCpy(pnod-
>Ol[i].ol_i_name,pData,dbdatlen(dbproc, 1));
                       if(pData=dbdata(dbproc, 2))
                          pnod->Ol[i].ol_stock = (*(DBSMALLINT *) pData);
                       if(pData=dbdata(dbproc, 3))
                          UtilStrCpy(pnod-
>Ol[i].ol_brand_generic,pData,dbdatlen(dbproc, 3));
                       if(pData=dbdata(dbproc, 4))
                          pnod->Ol[i].ol_i_price = (*(DBFLT8 *) pData);
                       if(pData=dbdata(dbproc, 5))
                          pnod->Ol[i].ol_amount = (*(DBFLT8 *) pData);
                       pnod->total_amount = pnod->total_amount + pnod-
>Ol[i].ol_amount;
                    };   // while (dbnextrow)
                 };   // if (DBROWS && dbnumcols)
              };   // if (dbresults)
           };   // for (o_ol_cnt)
           while (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) &&
                  (rc != FAIL))
           {
              if (DBROWS(dbproc) && (dbnumcols(dbproc) == 8))
              {
                 while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) &&
                        (rc != FAIL))
                 {
                    if(pData=dbdata(dbproc, 1))
                       pnod->w_tax = (*(DBFLT8 *) pData);
                    if(pData=dbdata(dbproc, 2))
                       pnod->d_tax = (*(DBFLT8 *) pData);
                    if(pData=dbdata(dbproc, 3))
                       pnod->o_id = (*(DBINT *) pData);
                    if(pData=dbdata(dbproc, 4))
                       UtilStrCpy(pnod->c_last,pData,dbdatlen(dbproc,4));
                    if(pData=dbdata(dbproc, 5))
                       pnod->c_discount = (*(DBFLT8 *) pData);
                    if(pData=dbdata(dbproc, 6))
                       UtilStrCpy(pnod-
>c_credit,pData,dbdatlen(dbproc,6));
                    if(pData=dbdata(dbproc, 7))
                    {
                       datetime = *((DBDATETIME *) pData);
                       dbdatecrack(dbproc,&pnod->o_entry_d,&datetime);
                    };
                    if(pData=dbdata(dbproc, 8))
                       commit_flag = (*(DBTINYINT *) pData);
                 };   // while (dbnextrow)
              };   // if (DBROWS && dbnumcols)
           };   // while (dbresults)
        };   // if (dbrpcexec)
     };   // if (dbrpcinit)
     if (bDeadlock)
     {
        num_deadlocks++;
        bDeadlock = FALSE;
        userlog("NewOrder Deadlock Retry (%d)",num_deadlocks);
        Sleep(10 * tryit);
     }
     else
     {
        if (commit_flag == 1)
        {
           pnod->total_amount = pnod->total_amount *
              ((1 + pnod->w_tax + pnod->d_tax) * (1 - pnod->c_discount));
           strcpy(pnod->execution_status,"Transaction commited.");
           return(SVC_NOERROR);
        }
        else
        {
           strcpy(pnod->execution_status,"Item number is not valid.");
           return(SVC_BADITEMID);
        };
     };   // !bDeadlock
  };   // for (tryit)

  // If we reached here, it means we quit after MAX_RETRY deadlocks
  strcpy(pnod->execution_status,"Hit deadlock max.");
  userlog("NewOrder Deadlock Failure (%d)",num_deadlocks);
  return(SVCERR_DEADLOCK);

};   // SQLNewOrder

//========================================================================
// FUNCTION: SQLPayment
//
//    Handles the payment transaction.
//
// ARGUMENTS:
//    PAYMENT_DATA      Payment input/output data structure
//    dbdata (global)
//    bDeadlock (global)
//
// RETURNS:
//    SVC_NOERROR  success
//    !SVC_NOERROR failure
//
// COMMENTS:   None
//
//========================================================================
int SQLPayment(PAYMENT_DATA *ppd)
{
  RETCODE rc;
  int tryit;
  short num_deadlocks = 0;
  DBDATETIME datetime;
  BYTE * pData;

  bFailed = FALSE;
  bDeadlock = FALSE;

  for (tryit=0; tryit < DeadlockRetry; tryit++)
  {
     if (dbrpcinit(dbproc,"tpcc_payment",0) == SUCCEED)
     {
        dbrpcparam(dbproc,NULL,0,SQLINT2,-1,-1,(BYTE *) &ppd->w_id);
        dbrpcparam(dbproc,NULL,0,SQLINT2,-1,-1,(BYTE *) &ppd->c_w_id);
        dbrpcparam(dbproc,NULL,0,SQLFLT8,-1,-1,(BYTE *) &ppd->h_amount);
        dbrpcparam(dbproc,NULL,0,SQLINT1,-1,-1,(BYTE *) &ppd->d_id);
```

```
         dbrpcparam(dbproc,NULL,0,SQLINT1,-1,-1,(BYTE *) &ppd->c_d_id);
         dbrpcparam(dbproc,NULL,0,SQLINT4,-1,-1,(BYTE *) &ppd->c_id);
         if (ppd->c_id == 0)
         {
            dbrpcparam(dbproc,NULL,0,SQLCHAR,-1,strlen(ppd->c_last),ppd-
>c_last);
         };
      };
      if (dbrpcexec(dbproc) == SUCCEED)
      {
         while (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) && (rc !=
FAIL))
         {
            if (DBROWS(dbproc) && (dbnumcols(dbproc) == 27))
            {
               while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc !=
FAIL))
               {
                  if(pData=dbdata(dbproc,1))
                     ppd->c_id = *((DBINT *) pData);
                  if(pData=dbdata(dbproc,2))
                     UtilStrCpy(ppd->c_last,pData,dbdatlen(dbproc,2));
                  if(pData=dbdata(dbproc,3))
                  {
                     datetime = *((DBDATETIME *) pData);
                     dbdatecrack(dbproc,&ppd->h_date,&datetime);
                  };
                  if(pData=dbdata(dbproc,4))
                     UtilStrCpy(ppd->w_street_1,pData,dbdatlen(dbproc,4));
                  if(pData=dbdata(dbproc,5))
                     UtilStrCpy(ppd->w_street_2,pData,dbdatlen(dbproc,5));
                  if(pData=dbdata(dbproc,6))
                     UtilStrCpy(ppd->w_city,pData,dbdatlen(dbproc,6));
                  if(pData=dbdata(dbproc,7))
                     UtilStrCpy(ppd->w_state,pData,dbdatlen(dbproc,7));
                  if(pData=dbdata(dbproc,8))
                     UtilStrCpy(ppd->w_zip,pData,dbdatlen(dbproc,8));
                  if(pData=dbdata(dbproc,9))
                     UtilStrCpy(ppd->d_street_1,pData,dbdatlen(dbproc,9));
                  if(pData=dbdata(dbproc,10))
                     UtilStrCpy(ppd-
>d_street_2,pData,dbdatlen(dbproc,10));
                  if(pData=dbdata(dbproc,11))
                     UtilStrCpy(ppd->d_city,pData,dbdatlen(dbproc,11));
                  if(pData=dbdata(dbproc,12))
                     UtilStrCpy(ppd->d_state,pData,dbdatlen(dbproc,12));
                  if(pData=dbdata(dbproc,13))
                     UtilStrCpy(ppd->d_zip,pData,dbdatlen(dbproc,13));
                  if(pData=dbdata(dbproc,14))
                     UtilStrCpy(ppd->c_first,pData,dbdatlen(dbproc,14));
                  if(pData=dbdata(dbproc,15))
                     UtilStrCpy(ppd->c_middle,pData,dbdatlen(dbproc,15));
                  if(pData=dbdata(dbproc,16))
                     UtilStrCpy(ppd-
>c_street_1,pData,dbdatlen(dbproc,16));
                  if(pData=dbdata(dbproc,17))
                     UtilStrCpy(ppd-
>c_street_2,pData,dbdatlen(dbproc,17));
                  if(pData=dbdata(dbproc,18))
                     UtilStrCpy(ppd->c_city,pData,dbdatlen(dbproc,18));
                  if(pData=dbdata(dbproc,19))
                     UtilStrCpy(ppd->c_state,pData,dbdatlen(dbproc,19));
                  if(pData=dbdata(dbproc,20))
                     UtilStrCpy(ppd->c_zip,pData,dbdatlen(dbproc,20));
                  if(pData=dbdata(dbproc,21))
                     UtilStrCpy(ppd->c_phone,pData,dbdatlen(dbproc,21));
                  if(pData=dbdata(dbproc,22))
                  {
                     datetime = *((DBDATETIME *) pData);
                     dbdatecrack(dbproc,&ppd->c_since, &datetime);
                  };
                  if(pData=dbdata(dbproc,23))
                     UtilStrCpy(ppd->c_credit,pData,dbdatlen(dbproc,23));
                  if(pData=dbdata(dbproc,24))
                     ppd->c_credit_lim = (*(DBFLT8 *) pData);
                  if(pData=dbdata(dbproc,25))
                     ppd->c_discount = (*(DBFLT8 *) pData);
                  if(pData=dbdata(dbproc,26))
                     ppd->c_balance = (*(DBFLT8 *) pData);
                  if(pData=dbdata(dbproc,27))
                     UtilStrCpy(ppd->c_data,pData,dbdatlen(dbproc,27));
               };   // while (dbnextrow)
            };   // if (DBROWS && dbnumcols)
         };   // while (dbresults)
      };   // if (dbrpcexe)
      if (bDeadlock)
      {
         num_deadlocks++;
         bDeadlock = FALSE;
         userlog("Payment Deadlock Retry (%d)",num_deadlocks);
         Sleep(10 * tryit);
      }
      else
      {
         if (ppd->c_id == 0)
         {
            strcpy(ppd->execution_status,"Invalid Customer id,name.");
                           return(SVCERR_NOCUSTOMER);
         }
         else
            strcpy(ppd->execution_status,"Transaction commited.");
         return(SVC_NOERROR);
      };   // !bDeadlock
   };   // for (tryit)

   // If we reached here, it means we quit after MAX_RETRY deadlocks
   strcpy(ppd->execution_status,"Hit deadlock max.");
   userlog("Payment Deadlock Failure (%d)",num_deadlocks);
   return(SVCERR_DEADLOCK);

};   // SQLPayment

//================================================================================
// FUNCTION: SQLOrderStatus
//
//    Handles the Order Status transaction.
//
// ARGUMENTS:
//    ORDER_STATUS_DATA      Payment input/output data structure
//    dbdata (global)
//    bDeadlock (global)
//
```

```
// RETURNS:
//    SVC_NOERROR  success
//    !SVC_NOERROR failure
//
// COMMENTS:   None
//
//========================================================================
int SQLOrderStatus(ORDER_STATUS_DATA * posd)
{
   RETCODE rc;
   int tryit;
   short num_deadlocks = 0;
   int i;
   DBDATETIME datetime;
   BYTE * pData;

   bFailed = FALSE;
   bDeadlock = FALSE;

   for (tryit=0; tryit < DeadlockRetry; tryit++)
   {
      if (dbrpcinit(dbproc,"tpcc_orderstatus", 0) == SUCCEED)
      {
         dbrpcparam(dbproc,NULL,0,SQLINT2,-1,-1,(BYTE *) &posd->w_id);
         dbrpcparam(dbproc,NULL,0,SQLINT1,-1,-1,(BYTE *) &posd->d_id);
         dbrpcparam(dbproc,NULL,0,SQLINT4,-1,-1,(BYTE *) &posd->c_id);
         if (posd->c_id == 0)
         {
            dbrpcparam(dbproc,NULL,0,SQLCHAR,-1,strlen(posd->c_last),posd-
>c_last);
         };
      };
      if (dbrpcexec(dbproc) == SUCCEED)
      {
         while (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) && (rc !=
FAIL))
         {
            if (DBROWS(dbproc) && (dbnumcols(dbproc) == 5))
            {
               i = 0;
               while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc !=
FAIL))
               {
                  if(pData=dbdata(dbproc,1))
                     posd->OlOrderStatusData[i].ol_supply_w_id =
(*(DBSMALLINT *) pData);
                  if(pData=dbdata(dbproc,2))
                     posd->OlOrderStatusData[i].ol_i_id = (*(DBINT *)
pData);
                  if(pData=dbdata(dbproc,3))
                     posd->OlOrderStatusData[i].ol_quantity =
(*(DBSMALLINT *) pData);
                  if(pData=dbdata(dbproc,4))
                     posd->OlOrderStatusData[i].ol_amount = (*(DBFLT8 *)
pData);
                  if(pData=dbdata(dbproc,5))
                  {
                     datetime = *((DBDATETIME *) pData);
                     dbdatecrack(dbproc,&posd-
>OlOrderStatusData[i].ol_delivery_d,&datetime);
                  };
                  i++;
               };   // while (dbnextrow)
               posd->o_ol_cnt = i;
            }   // if (DBROWS && dbnumcols == 5)
            else
            if (DBROWS(dbproc) && (dbnumcols(dbproc) == 8))
            {
               while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc !=
FAIL))
               {
                  if(pData=dbdata(dbproc,1))
                     posd->c_id = (*(DBINT *) pData);
                  if(pData=dbdata(dbproc,2))
                     UtilStrCpy(posd->c_last,pData,dbdatlen(dbproc,2));
                  if(pData=dbdata(dbproc,3))
                     UtilStrCpy(posd->c_first,pData,dbdatlen(dbproc,3));
                  if(pData=dbdata(dbproc,4))
                     UtilStrCpy(posd->c_middle,pData,dbdatlen(dbproc,4));
                  if(pData=dbdata(dbproc,5))
                  {
                     datetime = *((DBDATETIME *) pData);
                     dbdatecrack(dbproc,&posd->o_entry_d,&datetime);
                  };
                  if(pData=dbdata(dbproc,6))
                     posd->o_carrier_id = (*(DBSMALLINT *) pData);
                  if(pData=dbdata(dbproc,7))
                     posd->c_balance = (*(DBFLT8 *) pData);
                  if(pData=dbdata(dbproc,8))
                     posd->o_id = (*(DBINT *) pData);
               };   // while (dbnextrow)
            };   // if (DBROWS && dbnumcols == 8)
            if (i==0)
               return(SVCERR_NOORDERS); //"No orders found for customer"
         };   // while (dbresults)
      };   // if (dbrpcexec)
      if (bDeadlock)
      {
         num_deadlocks++;
         bDeadlock = FALSE;
         userlog("OrderStatus Deadlock Retry (%d)",num_deadlocks);
         Sleep(10 * tryit);
      }
      else
      {
         if (posd->c_id == 0 && posd->c_last[0] == 0)
         {
            strcpy(posd->execution_status,"Invalid Customer id,name.");
            return(SVCERR_NOCUSTOMER);
         }
         else
            strcpy(posd->execution_status,"Transaction commited.");
         return(SVC_NOERROR);
      };  // !bDeadlock
   };   // for (tryit)

   // If we reached here, it means we quit after MAX_RETRY deadlocks
   strcpy(posd->execution_status,"Hit deadlock max.");
   userlog("OrderStatus Deadlock Failure (%d)",num_deadlocks);
   return(SVCERR_DEADLOCK);
```

```
};   // SQLOrderStatus

//==============================================================================
// FUNCTION: UtilStrCpy
//
//    Copies n characters from string pSrc to pDst and places a null
//    null character at the end of the destination string.  Unlike
//    strncpy this function ensures that the result string is always
//    null terminated.
//
//==============================================================================
void UtilStrCpy(char * pDest, char * pSrc, int n)
{
   strncpy(pDest, pSrc, n);
   pDest[n] = '\0';
   return;
};   // UtilStrCpy

//==============================================================================
//
// Function name: GetArgs
//
//==============================================================================
VOID GetArgs(INT argc, CHAR **argv)
{
   INT j;
   CHAR * ptr;
   BOOL bRslt = TRUE;

   for (j = 1; j < argc; ++j)
   {
      ptr = argv[j];
      switch (ptr[1])
      {
         case 's':
         case 'S':
            strcpy(szServer,ptr+2);
            break;

         case 'd':
         case 'D':
            strcpy(szDatabase,ptr+2);
            break;

      };   // switch(ptr[1])
   };   // for (j = 1; j < argc; ++j)
};   // GetArgs
```

tpccdelv.c

```
// tpccdelv.c
//
// Copyright Unisys, 1997
// Copyright Microsoft, 1996

#include <windows.h>
#include <malloc.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <time.h>
#include <sys\timeb.h>

#include <atmi.h>
#include <userlog.h>

#include "tpccsvr.h"

int   iServerNo = 0;
char   szServer[32]   = "tpccdelv";
char   szUser[32]             = { 0 };
char   szPassword[32] = { 0 };
char   szDatabase[32] = "tpcc";
char  szService[16]  = "tpccdelv";
char  szWork[200];

PDBPROCESS     dbproc;
int    spid;                                  // spid assigned from dblib
BOOL  bFailed;
BOOL  bDeadlock;
short   DeadlockRetry  = (short)10;

FILE *fpLog;
char  szLogTitle[32];
BOOL  bFlush = FALSE;               // flush after every write

int err_handler(DBPROCESS *dbproc,int severity,int dberr,int oserr,
                char *dberrstr, char *oserrstr);
int msg_handler(DBPROCESS *dbproc,DBINT msgno,int msgstate,
                int severity,char *msgtext);
void WriteLog(DELIVERY_DATA * pdd);
BOOL OpenLogFile(void);
void CalculateElapsed(int * pElapsed,LPSYSTEMTIME lpBegin,
                      LPSYSTEMTIME lpEnd);
void UtilStrCpy(char * pDest, char * pSrc, int n);
void GetArgs(INT argc, CHAR **argv);

//==============================================================================
//
// Function name: tpsvrinit
//
//==============================================================================
tpsvrinit(int argc, char *argv[])
{
   GetArgs(argc,argv);
   if (iServerNo == 0)
   {
      userlog("Error - Server Number (-n option) Not Set");
      return(-1);
   };
   sprintf(szWork,"%s%ld Started, DBServer=%s,DB=%s",
      szService,iServerNo,szServer,szDatabase);
   userlog(szWork);
   if (OpenLogFile())
      return(-1);
   if (SQLInit(szServer,szDatabase,szUser,szPassword))
      return(-1);
   userlog("Database open, initialization complete");
   return(0);
```

```
};   // tpsvrinit

//============================================================================
//
// Function name: tpsvrdone
//
//============================================================================
void tpsvrdone()
{
   userlog("Shutdown request for tpccdelv server");
   if ( fpLog )
      fclose(fpLog);
   dbclose(dbproc);
   dbexit();
};   // tpsvrdone

//============================================================================
//
// Function name: DELIVERY
//
//    Entry point called by tuxedo for DELIVERY service requests.
//
//============================================================================
void DELIVERY(TPSVCINFO * svcinfo)
{
   int iRslt;
   DELIVERY_DATA * pdd;

   pdd = (DELIVERY_DATA *) svcinfo->data;
   iRslt = SQLDelivery(pdd);
   WriteLog(pdd);

   // Check for DBLib termination error
   if (bFailed)
   {
      strcpy(pdd->execution_status,szWork);
      userlog(szWork);
      tpreturn(TPFAIL,SVCERR_DBLIB,svcinfo->data,svcinfo->len,0);
   }
   else
   if (iRslt == 0)
      tpreturn(TPSUCCESS,0,svcinfo->data,svcinfo->len,0);
   else
      tpreturn(TPFAIL,iRslt,svcinfo->data,svcinfo->len,0);

};   // DELIVERY

//============================================================================
//
// Function name: SQLInit
//
//    Set global dbproc and spid.
//
//    Result:
//       FALSE - database open, dbproc valid
//       TRUE - database open failed
//
//============================================================================
BOOL SQLInit(CHAR * pSvr,CHAR * pDB,CHAR * pUsr,CHAR * pPW,CHAR * pSvc)
{
   char szApp[32];
   char server[256];
   char database[256];
   char user[256];
   char password[256];
   LOGINREC    *login;

   dbinit();
   // install error and message handlers
   dbmsghandle((DBMSGHANDLE_PROC)msg_handler);
   dberrhandle((DBERRHANDLE_PROC)err_handler);

   dbproc = NULL;
   strcpy(server,pSvr);
   strcpy(database,pDB);
   strcpy(user,pUsr);
   strcpy(password,pPW);
   sprintf(szApp,"%s%ld",pSvc,_getpid());

   login = dblogin();
   if (!*user )
      DBSETLUSER(login,"sa");
   else
      DBSETLUSER(login,user);
   DBSETLPWD(login,password);
   DBSETLHOST(login,szApp);
// DBSETLPACKET(login,(unsigned short)DEFCLPACKSIZE);

   if ((dbproc = dbopen(login,server)) == NULL)
   {
      userlog("dbopen failed");
      return TRUE;
   };
   // Use the the right database
   dbuse(dbproc,database);
   dbcmd(dbproc,"select @@spid");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      dbbind(dbproc,1,SMALLBIND,(DBINT) 0,(BYTE *) spid);
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };

   dbcmd(dbproc,"set nocount on");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };

   //rollback transaction on abort
   dbcmd(dbproc,"set XACT_ABORT ON");
   dbsqlexec(dbproc);
   while (dbresults(dbproc) != NO_MORE_RESULTS)
   {
      while (dbnextrow(dbproc) != NO_MORE_ROWS)
         ;
   };
```

```
   return(FALSE);

};   // SQLInit

//============================================================================
// FUNCTION: err_handler
//
//    Handles DB-Library errors
//
// ARGUMENTS:
//    DBPROCESS   *dbproc     DBPROCESS id pointer
//    int         severity    severity of error
//    int         dberr       error id
//    int         oserr       operating system specific error code
//    char        *dberrstr   printable error description of dberr
//    char        *oserrstr   printable error description of oserr
//
// RETURNS:
//    int      INT_CANCEL
//
// COMMENTS:   None
//
//============================================================================
int err_handler(DBPROCESS *dbproc, int severity, int dberr, int oserr,
char *dberrstr, char *oserrstr)
{
   if ((dbproc == NULL) || (DBDEAD(dbproc)))
   {
      userlog("ErrHandler: DBPROC is invalid");
      return INT_CANCEL;
   };
   if (bFailed)
      return INT_CANCEL;
   if (oserr != DBNOERR)
   {
      sprintf(szWork,"ErrHandler: OSErr(%ld) - %s",oserr,oserrstr);
      userlog(szWork);
      bFailed = TRUE;
   };

   return INT_CANCEL;

};   // err_handler

//============================================================================
// FUNCTION: msg_handler
//
//    Handles DB-Library SQL Server error messages
//
// ARGUMENTS:
//    DBPROCESS   *dbproc     DBPROCESS id pointer
//    DBINT       msgno       message number
//    int         msgstate    message state
//    int         severity    message severity
//    char        *msgtext    printable message description
//
// RETURNS:    int   INT_CONTINUE   continue operation
//                   INT_CANCEL      cancel operation
//
// COMMENTS:   This function also sets the dead lock dbproc
//             variable if necessary.
//
//============================================================================
int msg_handler(DBPROCESS *dbproc, DBINT msgno, int msgstate, int
severity, char *msgtext)
{

   if ((msgno == 5701) || (msgno == 2528) ||
       (msgno == 5703) || (msgno == 6006))
      return INT_CONTINUE;

   // deadlock message
   if (msgno == 1205)
   {
      // set the deadlock indicator
      bDeadlock = TRUE;
      return INT_CONTINUE;
   };

   if (bFailed)
      return INT_CANCEL;

   if (msgno == 0)
      return INT_CONTINUE;
   else
   {
      sprintf(szWork,"MsgHandler: MsgNo(%ld) - %s",msgno,msgtext);
      userlog(szWork);
      bFailed = TRUE;
   };

   return INT_CANCEL;

};   // msg_handler

//============================================================================
// FUNCTION: SQLDelivery
//
// ARGUMENTS:
//    pdd      delivery transaction structure
//    dbdata (global)
//    bDeadlock (global)
//
// RETURNS:
//    SVC_NOERROR  success
//    !SVC_NOERROR failure
//
// COMMENTS:   None
//
//============================================================================
int SQLDelivery(DELIVERY_DATA * pdd)
{
   RETCODE rc;
   int i;
   short num_deadlocks = 0;
   int tryit;
   DBDATETIME datetime;
   BYTE * pData;

   bFailed = FALSE;
   bDeadlock = FALSE;
```

```
   pdd->iComplete = 0;

   for (tryit=0; tryit < DeadlockRetry; tryit++)
   {
      if (dbrpcinit(dbproc,"tpcc_delivery",0) == SUCCEED)
      {
         dbrpcparam(dbproc,NULL,0,SQLINT2,-1,-1,(BYTE *) &pdd->w_id);
         dbrpcparam(dbproc,NULL,0,SQLINT1,-1,-1,(BYTE *) &pdd-
>o_carrier_id);

         if (dbrpcexec(dbproc) == SUCCEED)
         {
            while (((rc = dbresults(dbproc)) != NO_MORE_RESULTS) && (rc !=
FAIL))
            {
               while (((rc = dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc !=
FAIL))
               {
                  for (i = 0; i < 10; i++)
                  {
                     if(pData = dbdata(dbproc,i + 1))
                        pdd->o_id[i] = *((DBINT *)pData);
                     else
                        pdd->o_id[i] = 0;
                  };
               };   // while (dbnextrow)
            };   // while (dbresults)
         };   // if (dbrpcexec)
      };   // if (dbrpcinit)
      if (bDeadlock)
      {
         num_deadlocks++;
         bDeadlock = FALSE;
         userlog("Delivery Deadlock Retry (%d)",num_deadlocks);
         Sleep(10 * tryit);
      }
      else
      {
         GetLocalTime(&pdd->EndTime);
         pdd->iComplete = 1;
         strcpy(pdd->execution_status,"Transaction commited.");
         return(SVC_NOERROR);
      };
   };  // for (tryit)

   // If we reached here, it means we quit after MAX_RETRY deadlocks
   strcpy(pdd->execution_status,"Hit deadlock max.");
   userlog("Delivery Deadlock Failure (%d)",num_deadlocks);
   return(SVCERR_DEADLOCK);

};   // SQLDelivery

//======================================================================
// FUNCTION: WriteLog
//
//    Writes the delivery results to a log file.
//
// ARGUMENTS:
//    pDelivery   delivery information.
//
// RETURNS:
//
// COMMENTS:
//    Record format:
//       QTime,EndTime,Elapsed,w_id,o_carrier_id,o_id1, ... o_id10
//
//======================================================================
void WriteLog(DELIVERY_DATA * pdd)
{
   int elapsed = 9999999;
   if (pdd->iComplete)
      CalculateElapsed(&elapsed,&pdd->QTime,&pdd->EndTime);
   fprintf(fpLog,
      "%2.2d/%2.2d/%2.2d,%2.2d:%2.2d:%2.2d:%3.3d,%2.2d:%2.2d:%2.2d:%3.3d,"
      "%d,%d,%d,%d,%d,%d,%d,%d,%d,%d,%d,%d,%d\r\n",
      pdd->EndTime.wYear - 1900,pdd->EndTime.wMonth,pdd->EndTime.wDay,
      pdd->QTime.wHour,pdd->QTime.wMinute,
      pdd->QTime.wSecond,pdd->QTime.wMilliseconds,
      pdd->EndTime.wHour,pdd->EndTime.wMinute,
      pdd->EndTime.wSecond,pdd->EndTime.wMilliseconds,
      elapsed,pdd->w_id,pdd->o_carrier_id,
      pdd->o_id[0],pdd->o_id[1],pdd->o_id[2],pdd->o_id[3],pdd->o_id[4],
      pdd->o_id[5],pdd->o_id[6],pdd->o_id[7],pdd->o_id[8],pdd->o_id[9] );
       if (bFlush)
             fflush(fpLog);
};   // WriteLog

//======================================================================
// FUNCTION: OpenLogFile
//
//    Opens the delivery log file.
//
// ARGUMENTS:
//    None.
//
// RETURNS:
//    FALSE    Log file successfully opened
//    TRUE     Failed to open log file
//
// COMMENTS:
//
//======================================================================
BOOL OpenLogFile(void)
{
   sprintf(szLogTitle,"%s%ld",LOGFILE_NAME,iServerNo);
   fpLog = fopen(szLogTitle,"ab");
       if (!fpLog)
   {
      sprintf(szWork,"LogFile %s Open Failed (%ld)",
         szLogTitle,GetLastError());
      userlog(szWork);
      return(TRUE);
   };
   return(FALSE);
};   // OpenLogFile

//======================================================================
// FUNCTION: CalculateElapsed
//
//    Calculates the elapsed time of the delivery transaction.
```

```
//
// ARGUMENTS:
//    lpBegin  time delivery was queued
//    lpEnd            time delivery update completed
//
// RETURNS:
//    int            pElapsed elapsed time result (in milliseconds)
//
// COMMENTS:
//    None
//
//=========================================================================
void CalculateElapsed(int * pElapsed,LPSYSTEMTIME lpBegin,
                      LPSYSTEMTIME lpEnd)
{
   int tmBegin;
   int tmEnd;

   tmBegin = (lpBegin->wHour * 3600000) + (lpBegin->wMinute * 60000) +
      (lpBegin->wSecond * 1000) + lpBegin->wMilliseconds;
   tmEnd = (lpEnd->wHour * 3600000) + (lpEnd->wMinute * 60000) +
      (lpEnd->wSecond * 1000) + lpEnd->wMilliseconds;
   *pElapsed = tmEnd - tmBegin;

   // Check for day boundry, this will function for 24 hour period but
   // will fail over a 48 hours period.
   if (*pElapsed < 0)
      *pElapsed = *pElapsed + (24 * 60 * 60 * 1000);
   return;
};   // CalculateElapsed

//=========================================================================
// FUNCTION: UtilStrCpy
//
//    Copies n characters from string pSrc to pDst and places a null
//    null character at the end of the destination string.
//
// ARGUMENTS:
//    char     *pDest   destination string pointer
//    char     *pSrc    source string pointer
//    int      n        number of characters to copy
//
// RETURNS:           None
//
// COMMENTS:
//    Unlike strncpy this function ensures that the result string is
//    always null terminated.
//
//=========================================================================
void UtilStrCpy(char * pDest, char * pSrc, int n)
{
   strncpy(pDest, pSrc, n);
   pDest[n] = '\0';
   return;
};   // UtilStrCpy

//=========================================================================
//
// Function name: GetArgs
//
//=========================================================================
void GetArgs(INT argc, CHAR **argv)
{
   INT j;
   CHAR * ptr;
   BOOL bRslt = TRUE;

   for (j = 1; j < argc; ++j)
   {
      ptr = argv[j];
      switch (ptr[1])
      {
         case 's':
         case 'S':
            strcpy(szServer,ptr+2);
            break;

         case 'd':
         case 'D':
            strcpy(szDatabase,ptr+2);
            break;

         case 'n':
         case 'N':
            iServerNo = atoi(ptr+2);
            break;

         case 'F':
         case 'f':
            bFlush = TRUE;    //turn on delilog flush when written.
            break;

      };   // switch(ptr[1])
   };   // for (j = 1; j < argc; ++j)
};   // GetArgs
```

DELIVERY REPORT MAKEFILE

```
# Microsoft Developer Studio Generated NMAKE File, Format Version 4.20
# ** DO NOT EDIT **

# TARGTYPE "Win32 (x86) Console Application" 0x0103

!IF "$(CFG)" == ""
CFG=delirpt - Win32 Debug
!MESSAGE No configuration specified.  Defaulting to delirpt - Win32 Debug.
!ENDIF

!IF "$(CFG)" != "delirpt - Win32 Release" && "$(CFG)" !=\
 "delirpt - Win32 Debug"
!MESSAGE Invalid configuration "$(CFG)" specified.
!MESSAGE You can specify a configuration when running NMAKE on this
makefile
!MESSAGE by defining the macro CFG on the command line.  For example:
!MESSAGE
!MESSAGE NMAKE /f "delirpt.mak" CFG="delirpt - Win32 Debug"
!MESSAGE
!MESSAGE Possible choices for configuration are:
!MESSAGE
!MESSAGE "delirpt - Win32 Release" (based on "Win32 (x86) Console
Application")
```

```
!MESSAGE "delirpt - Win32 Debug" (based on "Win32 (x86) Console
Application")
!MESSAGE
!ERROR An invalid configuration is specified.
!ENDIF

!IF "$(OS)" == "Windows_NT"
NULL=
!ELSE
NULL=nul
!ENDIF
################################################################################
######
# Begin Project
CPP=cl.exe
RSC=rc.exe

!IF  "$(CFG)" == "delirpt - Win32 Release"

# PROP BASE Use_MFC 0
# PROP BASE Use_Debug_Libraries 0
# PROP BASE Output_Dir "delirpt_"
# PROP BASE Intermediate_Dir "delirpt_"
# PROP BASE Target_Dir ""
# PROP Use_MFC 0
# PROP Use_Debug_Libraries 0
# PROP Output_Dir "delirpt_"
# PROP Intermediate_Dir "delirpt_"
# PROP Target_Dir ""
OUTDIR=.\delirpt_
INTDIR=.\delirpt_

ALL : "$(OUTDIR)\delirpt.exe"

CLEAN :
        -@erase "$(INTDIR)\DELIRPT.OBJ"
        -@erase "$(OUTDIR)\delirpt.exe"

"$(OUTDIR)" :
    if not exist "$(OUTDIR)/$(NULL)" mkdir "$(OUTDIR)"

# ADD BASE CPP /nologo /W3 /GX /O2 /D "WIN32" /D "NDEBUG" /D "_CONSOLE"
/YX /c
# ADD CPP /nologo /W3 /GX /O2 /D "WIN32" /D "NDEBUG" /D "_CONSOLE" /YX /c
CPP_PROJ=/nologo /ML /W3 /GX /O2 /D "WIN32" /D "NDEBUG" /D "_CONSOLE"\
 /Fp"$(INTDIR)/delirpt.pch" /YX /Fo"$(INTDIR)/" /c
CPP_OBJS=.\delirpt_/
CPP_SBRS=.\.
# ADD BASE RSC /l 0x409 /d "NDEBUG"
# ADD RSC /l 0x409 /d "NDEBUG"
BSC32=bscmake.exe
# ADD BASE BSC32 /nologo
# ADD BSC32 /nologo
BSC32_FLAGS=/nologo /o"$(OUTDIR)/delirpt.bsc"
BSC32_SBRS= \

LINK32=link.exe
# ADD BASE LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib
comdlg32.lib advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib
odbc32.lib odbccp32.lib /nologo /subsystem:console /machine:I386
# ADD LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib
advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib
odbccp32.lib /nologo /subsystem:console /machine:I386
LINK32_FLAGS=kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib\
 advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib\
 odbccp32.lib /nologo /subsystem:console /incremental:no\
 /pdb:"$(OUTDIR)/delirpt.pdb" /machine:I386 /out:"$(OUTDIR)/delirpt.exe"
LINK32_OBJS= \
        "$(INTDIR)\DELIRPT.OBJ"

"$(OUTDIR)\delirpt.exe" : "$(OUTDIR)" $(DEF_FILE) $(LINK32_OBJS)
    $(LINK32) @<<
  $(LINK32_FLAGS) $(LINK32_OBJS)
<<

!ELSEIF  "$(CFG)" == "delirpt - Win32 Debug"

# PROP BASE Use_MFC 0
# PROP BASE Use_Debug_Libraries 1
# PROP BASE Output_Dir "Debug"
# PROP BASE Intermediate_Dir "Debug"
# PROP BASE Target_Dir ""
# PROP Use_MFC 0
# PROP Use_Debug_Libraries 1
# PROP Output_Dir "Debug"
# PROP Intermediate_Dir "Debug"
# PROP Target_Dir ""
OUTDIR=.\Debug
INTDIR=.\Debug

ALL : "$(OUTDIR)\delirpt.exe"

CLEAN :
        -@erase "$(INTDIR)\DELIRPT.OBJ"
        -@erase "$(INTDIR)\vc40.idb"
        -@erase "$(INTDIR)\vc40.pdb"
        -@erase "$(OUTDIR)\delirpt.exe"
        -@erase "$(OUTDIR)\delirpt.ilk"
        -@erase "$(OUTDIR)\delirpt.pdb"

"$(OUTDIR)" :
    if not exist "$(OUTDIR)/$(NULL)" mkdir "$(OUTDIR)"

# ADD BASE CPP /nologo /W3 /Gm /GX /Zi /Od /D "WIN32" /D "_DEBUG" /D
"_CONSOLE" /YX /c
# ADD CPP /nologo /W3 /Gm /GX /Zi /Od /D "WIN32" /D "_DEBUG" /D "_CONSOLE"
/YX /c
CPP_PROJ=/nologo /MLd /W3 /Gm /GX /Zi /Od /D "WIN32" /D "_DEBUG" /D
"_CONSOLE"\
 /Fp"$(INTDIR)/delirpt.pch" /YX /Fo"$(INTDIR)/" /Fd"$(INTDIR)/" /c
CPP_OBJS=.\Debug/
CPP_SBRS=.\.
# ADD BASE RSC /l 0x409 /d "_DEBUG"
# ADD RSC /l 0x409 /d "_DEBUG"
BSC32=bscmake.exe
# ADD BASE BSC32 /nologo
# ADD BSC32 /nologo
BSC32_FLAGS=/nologo /o"$(OUTDIR)/delirpt.bsc"
BSC32_SBRS= \
```

```
LINK32=link.exe
# ADD BASE LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib
comdlg32.lib advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib
odbc32.lib odbccp32.lib /nologo /subsystem:console /debug /machine:I386
# ADD LINK32 kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib
advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib
odbccp32.lib /nologo /subsystem:console /debug /machine:I386
LINK32_FLAGS=kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib\
 advapi32.lib shell32.lib ole32.lib oleaut32.lib uuid.lib odbc32.lib\
 odbccp32.lib /nologo /subsystem:console /incremental:yes\
 /pdb:"$(OUTDIR)/delirpt.pdb" /debug /machine:I386
/out:"$(OUTDIR)/delirpt.exe"
LINK32_OBJS= \
        "$(INTDIR)\DELIRPT.OBJ"

"$(OUTDIR)\delirpt.exe" : "$(OUTDIR)" $(DEF_FILE) $(LINK32_OBJS)
    $(LINK32) @<<
  $(LINK32_FLAGS) $(LINK32_OBJS)
<<

!ENDIF

.c{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.cpp{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.cxx{$(CPP_OBJS)}.obj:
   $(CPP) $(CPP_PROJ) $<

.c{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

.cpp{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

.cxx{$(CPP_SBRS)}.sbr:
   $(CPP) $(CPP_PROJ) $<

################################################################################
######
# Begin Target

# Name "delirpt - Win32 Release"
# Name "delirpt - Win32 Debug"

!IF  "$(CFG)" == "delirpt - Win32 Release"

!ELSEIF  "$(CFG)" == "delirpt - Win32 Debug"

!ENDIF

################################################################################
######
# Begin Source File

SOURCE=.\DELIRPT.C

"$(INTDIR)\DELIRPT.OBJ" : $(SOURCE) "$(INTDIR)"

# End Source File
# End Target
# End Project
################################################################################
######
```

delirpt.c

```
/*      FILE:           DELIRPT.C
 *                              Microsoft TPC-C Kit Ver. 3.00.000
 *
 *                              Copyright Microsoft, 1996
 *
 *      PURPOSE:        Delivery report processing application
 *      Author:         Philip Durr
 *                              philipdu@Microsoft.com
 */

#include <windows.h>
#include <stdio.h>
#include <stdlib.h>

#define LOGFILE_READ_EOF      0
                        //check log file flag return current state
#define LOGFILE_CLEAR_EOF     1
                        //clear end of log file flag
#define LOGFILE_SET_EOF               2
                                //set flag end of log file reached

#define INTERVAL                      .01
                                //90th percentile calculation bucket
interval

#define ERR_SUCCESS                                             1000
                        //success no error
#define ERR_READING_LOGFILE                             1001
                //io errors occured reading delivery log file
#define ERR_INSUFFICIENT_MEMORY                         1002
                //insuficient memory to process 90th percentile report
#define ERR_CANNOT_OPEN_RESULTS_FILE 1005
        //Cannot open delivery results file delilog.

typedef struct _RPTLINE
{
        SYSTEMTIME      start;
                                //delilog report line start time
        SYSTEMTIME      end;
                                //delilog report line end time
        int                     response;
                                        //delilog report line time delivery
took in milliseconds
        int                     w_id;
                                        //delilog report line warehouse id
for delivery
        int                     o_carrier_id;
                                //delilog report line carier id for delivery
        int                     items[10];
                                        //delilog report line delivery line
items
```

```
} RPTLINE, *PRPTLINE;

//error message structure used in ErrorMessage API
typedef struct _SERRORMSG
{
        int             iError;                         //error id of message
        char    szMsg[80];                      //message to sent to browser
} SERRORMSG;

int                             versionMS = 4;
                //delirpt version
int                             versionMM = 0;
int                             versionLS = 0;
int                             iReport;
                        //delirpt report to process
int                             iStartTime;
                        //begin times to accept for report
int                             iEndTime;
                        //end times to accept for report
FILE                    *fpLog;
                //log file stream
CHAR szLogFileTitle[100];
#define DEFAULTLOGTITLE "delilog."

//Local function prototypes
void            main(int argc, char *argv[]);
static int      Init(void);
static void     Restore(void);
static int      DoReport(void);
int                     AverageResponse(void);
int                     SkippedDelivery(void);
int                     Percentile90th(void);
BOOL            CheckTimes(PRPTLINE pRptLine);
static int      OpenLogFile(void);
static void     CloseLogFile(void);
static void     ResetLogFile(void);
static BOOL     LogEOF(int iOperation);
static BOOL     ReadReportLine(char *szBuffer, PRPTLINE pRptLine);
static BOOL     ParseReportLine(char *szLine, PRPTLINE pRptLine);
static BOOL     ParseDate(char *szDate, LPSYSTEMTIME pTime);
static BOOL     ParseTime(char *szTime, LPSYSTEMTIME pTime);
static void     ErrorMessage(int iError);
static BOOL     GetParameters(int argc, char *argv[]);
static void     PrintParameters(void);
static void     PrintHeader(void);
static void     cls(void);
static BOOL     IsNumeric(char *ptr);


/* FUNCTION: int main(int argc, char *argv[])
 *
 * PURPOSE:    This function is the beginning execution point for the
delivery executable.
 *
 * ARGUMENTS:  int             argc    number of command line arguments
passed to delivery
 *                             char    *argv[] array of command line
argument pointers
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

void main(int argc, char *argv[])
{
        int     iError;

        PrintHeader();

        if ( GetParameters(argc, argv) )
        {
                PrintParameters();
                return;
        }

        if ( (iError=Init()) != ERR_SUCCESS )
        {
                ErrorMessage(iError);
                Restore();
                return;
        }

        if ( (iError = DoReport()) != ERR_SUCCESS )
                ErrorMessage(iError);

        Restore();

        return;
}

/* FUNCTION: static int Init(void)
 *
 * PURPOSE:    This function initializes the delirtp application.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static int Init(void)
{
        int iError;

        if ( (iError = OpenLogFile()) )
                return iError;
        return TRUE;
}

/* FUNCTION: static void Restore(void)
 *
 * PURPOSE:    This function cleans up the delirpt application before
termination.
 *
 * ARGUMENTS:  None
 *
```

```
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static void Restore(void)
{
        CloseLogFile();
        return;
}

/* FUNCTION: static int DoReport(void)
 *
 * PURPOSE:            This function dispatches the requested report.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            ERR_SUCCESS if successfull or error code if an
error occurs.
 *
 * COMMENTS:   None
 *
 */

static int DoReport(void)
{
        int iRc;

        switch(iReport)
        {
                case 1:
                        iRc = AverageResponse();
                        break;
                case 2:
                        iRc = Percentile90th();
                        break;
                case 3:
                        iRc = SkippedDelivery();
                        break;
                case 4:
                        if ( (iRc = AverageResponse()) != ERR_SUCCESS )
                                break;
                        if ( (iRc = Percentile90th()) != ERR_SUCCESS )
                                break;
                        if ( (iRc = SkippedDelivery()) != ERR_SUCCESS )
                                break;
                        break;
        }
        return iRc;
}

/* FUNCTION: int AverageResponse(void)
 *
 * PURPOSE:            This function processes the AverageResponse report.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            ERR_SUCCESS if successfull or error code if an
error occurs.
 *
 * COMMENTS:   None
 *
 */

int AverageResponse(void)
{
        RPTLINE reportLine;
        int             iTotalResponse;
        int             iLines;
        double  fAverage;
        char    szDelivery[128];

        ResetLogFile();

        iTotalResponse = 0;
        iLines = 0;
        printf("\n\n******** Average Response Time Report *******\n");
        while ( !LogEOF(LOGFILE_READ_EOF) )
        {
                if ( ReadReportLine(szDelivery, &reportLine) )
                        return ERR_READING_LOGFILE;
                if ( !LogEOF(LOGFILE_READ_EOF) )
                {
                        if ( CheckTimes(&reportLine) )
                                continue;
                        iLines++;
                        iTotalResponse += reportLine.response;

                        if ( iLines % 10 == 0 )
                                printf("Reading Report Line:\t%d\r",
iLines);
                }
        }
        printf("                                                \r");
        if ( iLines == 0 )
        {
                printf("No deliveries found.\n");
        }
        else
        {
                fAverage = ((double)iTotalResponse /
(double)iLines)/(double)1000;
                printf("Total Deliveries:      %10.0f\n", (float)iLines);
                printf("Total Response Times:  %10.3f\n",
((float)iTotalResponse/(float)1000));
                printf("Average Response Time: %10.3f\n", fAverage);
        }

        return ERR_SUCCESS;
}

/* FUNCTION: int Percentile90th(void)
 *
 * PURPOSE:            This function processes the 90th percentile report.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            ERR_SUCCESS if successfull or error code if an
error occurs.
 *
 * COMMENTS:   This function requires enough space to allocate needed
```

```
 *                              buckets which will be 2 * max response time
in
 *                              deci-seconds.
 *
 */

int Percentile90th(void)
{
        RPTLINE reportLine;
        int             iBucketSize;
        int             i;
        int             iResponseSeconds;
        int             iMaxSeconds;
        int             iTotalBuckets;
        double  iTotal;
        double  i90thPercent;
        short   *psBuckets;
        char    szDelivery[128];

        printf("\n\n******** 90th Percentile *******\n");
        printf("Calculating Max Response Seconds...\n");

        ResetLogFile();

        iMaxSeconds = -1;
        while ( !LogEOF(LOGFILE_READ_EOF) )
        {
                if ( ReadReportLine(szDelivery, &reportLine) )
                        return ERR_READING_LOGFILE;
                if ( szDelivery[0] == '*' )
                        continue;
                if ( !LogEOF(LOGFILE_READ_EOF) )
                {
                        if ( iMaxSeconds < reportLine.response )
                                iMaxSeconds = reportLine.response;
                }
        }

   iTotalBuckets = iMaxSeconds + 1;

        printf("Allocating Buckets...\n");

        iBucketSize = iTotalBuckets * sizeof(short);

        if ( !(psBuckets = (short *)malloc(iBucketSize)) )
                return ERR_INSUFFICIENT_MEMORY;

        ZeroMemory(psBuckets, iBucketSize);

        iTotal = 0;

        ResetLogFile();
        printf("Calculating Distribution...\n");

        iMaxSeconds = -1;
        while ( !LogEOF(LOGFILE_READ_EOF) )
        {
                if ( ReadReportLine(szDelivery, &reportLine) )
                        return ERR_READING_LOGFILE;
                if ( szDelivery[0] == '*' )
                        continue;
                if ( !LogEOF(LOGFILE_READ_EOF) )
                {
                        if ( CheckTimes(&reportLine) )
                                continue;
                        psBuckets[reportLine.response]++;
                        iTotal++;
                        if ( iMaxSeconds < reportLine.response )
                                iMaxSeconds = reportLine.response;
                }
        }

        printf("Max Response Time = %d.%d\n",
      (iMaxSeconds / 1000),(iMaxSeconds % 1000));

        i90thPercent = iTotal * .9;

        for(i=0, iTotal = 0.0; iTotal < i90thPercent; iTotal +=
(double)psBuckets[i] )
                i++;

        printf("90th Percentile = %d.%d\n", i/1000, (i % 1000));

        free(psBuckets);

        return ERR_SUCCESS;
}

/* FUNCTION: int SkippedDelivery(void)
 *
 * PURPOSE:             This function processes the Skipped Deliveries
report.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:             ERR_SUCCESS if successfull or error code if an
error occurs.
 *
 * COMMENTS:    None
 *
 */

int SkippedDelivery(void)
{
        RPTLINE reportLine;
        char    szDelivery[128];
        int             i;
        int             items[10];

        ResetLogFile();

        printf("\n\n******** Skipped Delivery Report *******\n");
        memset(items, 0, sizeof(items));
        printf("Reading Delivery Log File...");

        while ( !LogEOF(LOGFILE_READ_EOF) )
        {
                if ( ReadReportLine(szDelivery, &reportLine) )
                        return ERR_READING_LOGFILE;
                if ( !LogEOF(LOGFILE_READ_EOF) )
```

```
                {
                        if ( CheckTimes(&reportLine) )
                                continue;
                        for(i=0; i<10; i++)
                        {
                                if ( !reportLine.items[i] )
                                        items[i]++;
                        }
                }
        }
        printf("\n");
        printf("Skipped delivery table.\n");
        printf("  1    2    3    4    5    6    7    8    9   10 \n");
        printf("---- ---- ---- ---- ---- ---- ---- ---- ---- ----\n");
        for(i=0; i<10; i++)
                printf("%4.4d ", items[i]);
        printf("\n");

        return ERR_SUCCESS;
}

/* FUNCTION: BOOL CheckTimes(PRPTLINE pRptLine)
 *
 * PURPOSE:    This function checks to see of the delilog record falls
withing the
 *                      begin and end time from the command line.
 *
 * ARGUMENTS:  PRPTLINE       pRptLine       delilog processed report
line.
 *
 * RETURNS:            BOOL    FALSE   if report line is not within the
 *                                                         requested
start and end times.
 *                                         TRUE    if the report line is
within the
 *                                                         requested
start and end times.
 *
 * COMMENTS:   If startTime and endTime are both 0 then the user requested
 *                              the default behavior which is all records in
delilog are
 *                              valid.
 */

BOOL CheckTimes(PRPTLINE pRptLine)
{
        int     iRptEndTime;
        int     iRptStartTime;

        iRptStartTime = (pRptLine->start.wHour * 3600000) + (pRptLine-
>start.wMinute * 60000) + (pRptLine->start.wSecond * 1000) + pRptLine-
>start.wMilliseconds;
        iRptEndTime = (pRptLine->end.wHour * 3600000) + (pRptLine-
>end.wMinute * 60000) + (pRptLine->end.wSecond * 1000) + pRptLine-
>end.wMilliseconds;

        if ( iStartTime == 0 && iEndTime == 0 )
                return FALSE;

        if ( iStartTime <= iRptStartTime && iEndTime >= iRptEndTime )
                return FALSE;

        return TRUE;
}

/* FUNCTION: int OpenLogFile(void)
 *
 * PURPOSE:    This function opens the delivery log file for use.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            int     ERR_CANNOT_OPEN_RESULTS_FILE  Cannot create
results log file.
 *                                     ERR_SUCCESS
 *                     Log file successfully opened
 *
 *
 * COMMENTS:   None
 *
 */

static int OpenLogFile(void)
{

        fpLog = fopen(szLogFileTitle, "rb");

        if ( !fpLog )
                return ERR_CANNOT_OPEN_RESULTS_FILE;

        return ERR_SUCCESS;
}

/* FUNCTION: int CloseLogFile(void)
 *
 * PURPOSE:    This function closes the delivery log file.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static void CloseLogFile(void)
{
        if ( fpLog )
                fclose(fpLog);

        return;
}


/* FUNCTION: static void ResetLogFile(void)
 *
 * PURPOSE:    This function prepares the delilog. file for reading
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
```

```
 *
 */

static void ResetLogFile(void)
{
        fseek(fpLog, 0L, SEEK_SET);
        LogEOF(LOGFILE_CLEAR_EOF);

        return;
}

/* FUNCTION: static BOOL LogEOF(int iOperation)
 *
 * PURPOSE:    This function tracks and reports the end of file condition
 *                      on the delilog file.
 *
 * ARGUMENTS:  int iOperation requested operation this can be:
 *
        LOGFILE_READ_EOF        check log file flag return current state
 *
        LOGFILE_CLEAR_EOF       clear end of log file flag
 *
        LOGFILE_SET_EOF                 set flag end of log file reached
 *
 *
 * RETURNS:             None
 *
 * COMMENTS:   None
 *
 */

static BOOL LogEOF(int iOperation)
{
        static BOOL bEOF;

        switch(iOperation)
        {
                case LOGFILE_READ_EOF:
                        return bEOF;
                        break;
                case LOGFILE_CLEAR_EOF:
                        bEOF = FALSE;
                        break;
                case LOGFILE_SET_EOF:
                        bEOF = TRUE;
                        break;
        }
        return FALSE;
}

/* FUNCTION: static BOOL ReadReportLine(char *szBuffer, PRPTLINE pRptLine)
 *
 * PURPOSE:    This function reads a text line from the delilog file.
 *                      on the delilog file.
 *
 * ARGUMENTS:  char             *szBuffer       buffer to placed read delilog
file line into.
 *                              PRPTLINE        pRptLine        returned
structure containing parsed delilog
 *
        report line.
 *
 * RETURNS:             FALSE   if successfull or TRUE if an error occurs.
 *
 * COMMENTS:   None
 *
 */

static BOOL ReadReportLine(char *szBuffer, PRPTLINE pRptLine)
{
        int i = 0;
        int ch;
        int iEof;

        while( i < 128 )
        {
                ch = fgetc(fpLog);
                if ( iEof = feof(fpLog) )
                        break;
                if ( ch == '\r' )
                {
                        if ( i )
                                break;
                        continue;
                }
                if ( ch == '\n' )
                        continue;
                szBuffer[i++] = ch;

        }

        //delivery item format is to long cannot be a valid delivery item
        if ( i >= 128 )
                return TRUE;

        szBuffer[i] = 0;
        if ( iEof )
        {
                LogEOF(LOGFILE_SET_EOF);
                if ( i == 0 )
                        return FALSE;
        }
        return ParseReportLine(szBuffer, pRptLine);
}

/* FUNCTION: static BOOL ParseReportLine(char *szLine, PRPTLINE pRptLine)
 *
 * PURPOSE:    This function reads a text line from the delilog file.
 *                      on the delilog file.
 *
 * ARGUMENTS:  char             *szLine         buffer containing the delilog
file line to be parsed.
 *                              PRPTLINE        pRptLine        returned
structure containing parsed delilog
 *
        report line values.
 *
 * RETURNS:             FALSE   if successfull or TRUE if an error occurs.
 *
```

```
 * COMMENTS:   None
 *
 */

static BOOL ParseReportLine(char *szLine, PRPTLINE pRptLine)
{
        int i;

        if ( ParseDate(szLine, &pRptLine->start) )
                return TRUE;

        pRptLine->end.wYear = pRptLine->start.wYear;
        pRptLine->end.wMonth = pRptLine->start.wMonth;
        pRptLine->end.wDay = pRptLine->start.wDay;

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        if ( ParseTime(szLine, &pRptLine->start) )
                return TRUE;

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        if ( ParseTime(szLine, &pRptLine->end) )
                return TRUE;

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        if ( !IsNumeric(szLine) )
                return TRUE;
        pRptLine->response = atoi(szLine);

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        if ( !IsNumeric(szLine) )
                return TRUE;
        pRptLine->w_id = atoi(szLine);

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        if ( !IsNumeric(szLine) )
                return TRUE;
        pRptLine->o_carrier_id = atoi(szLine);

        if ( !(szLine = strchr(szLine, ',')) )
                return TRUE;
        szLine++;

        for(i=0; i<10; i++)
        {
                if ( !IsNumeric(szLine) )
                        return TRUE;
                pRptLine->items[i] = atoi(szLine);

                if ( i<9 && !(szLine = strchr(szLine, ',')) )
                        return TRUE;
                szLine++;
        }

        return FALSE;
}

/* FUNCTION: static BOOL ParseDate(char *szDate, LPSYSTEMTIME pTime)
 *
 * PURPOSE:    This function validates and extracts a date string in the
format
 *                     yy/mm/dd into an SYSTEMTIME structure.
 *
 * ARGUMENTS:  char                    *szDate        buffer containing the
date to be parsed.
 *                             LPSYSTEMTIME   pTime          system time
structure where date will be placed.
 *
 * RETURNS:            FALSE if successfull or TRUE if an error occurs.
 *
 * COMMENTS:   None
 *
 */

static BOOL ParseDate(char *szDate, LPSYSTEMTIME pTime)
{
        if ( !isdigit(*szDate) || !isdigit(*(szDate+1)) || *(szDate+2) !=
'/' ||
                !isdigit(*(szDate+3)) || !isdigit(*(szDate+4)) ||
*(szDate+5) != '/' ||
                !isdigit(*(szDate+6)) || !isdigit(*(szDate+7)) )
                return TRUE;

        pTime->wYear = atoi(szDate);

        pTime->wMonth = atoi(szDate+3);

        pTime->wDay = atoi(szDate+6);

        if ( pTime->wMonth > 12 || pTime->wMonth < 0 || pTime->wDay > 31
|| pTime->wDay < 0 )
                return TRUE;

        return FALSE;
}

/* FUNCTION: static BOOL ParseTime(char *szTime, LPSYSTEMTIME pTime)
 *
 * PURPOSE:    This function validates and extracts a time string in the
format
 *                     hh:mm:ss:mmm into an SYSTEMTIME structure.
 *
 * ARGUMENTS:  char                    *szTime        buffer containing the
time to be parsed.
 *                             LPSYSTEMTIME   pTime          system time
structure where date will be placed.
 *
 * RETURNS:            FALSE if successfull or TRUE if an error occurs.
```

```
 *
 * COMMENTS:   None
 *
 */

static BOOL ParseTime(char *szTime, LPSYSTEMTIME pTime)
{
        if ( !isdigit(*szTime) || !isdigit(*(szTime+1)) || *(szTime+2) !=
':' ||
             !isdigit(*(szTime+3)) || !isdigit(*(szTime+4)) ||
*(szTime+5) != ':' ||
             !isdigit(*(szTime+6)) || !isdigit(*(szTime+7)) ||
*(szTime+8) != ':' ||
             !isdigit(*(szTime+9)) || !isdigit(*(szTime+10)) ||
!isdigit(*(szTime+11)) )
              return TRUE;

        pTime->wHour = atoi(szTime);
        pTime->wMinute = atoi(szTime+3);
        pTime->wSecond = atoi(szTime+6);
        pTime->wMilliseconds  = atoi(szTime+9);

        if ( pTime->wHour > 23 || pTime->wHour < 0 ||
               pTime->wMinute > 59 || pTime->wMinute < 0 ||
               pTime->wSecond > 59 || pTime->wSecond < 0 ||
               pTime->wMilliseconds < 0 )
               return TRUE;

        if ( pTime->wMilliseconds > 999 )
        {
               pTime->wSecond += (pTime->wMilliseconds/1000);
               pTime->wMilliseconds = pTime->wMilliseconds  % 1000;
        }

        return FALSE;
}

/* FUNCTION: void ErrorMessage(int iError)
 *
 * PURPOSE:    This function displays an error message in the delivery
executable's console window.
 *
 * ARGUMENTS:  int            iError  error id to be displayed
 *
 * RETURNS:           None
 *
 * COMMENTS:   None
 *
 */

static void ErrorMessage(int iError)
{
        int i;

        static SERRORMSG errorMsgs[] =
        {
               {       ERR_SUCCESS,
               "Success, no error."
                                              },
               {       ERR_CANNOT_OPEN_RESULTS_FILE,
        "Cannot open delivery results log file."
               },
               {       ERR_READING_LOGFILE,
        "Reading delivery log file, Delivery item format incorrect."
        },
               {       ERR_INSUFFICIENT_MEMORY,
        "insufficient memory to process 90th percentile report."
        },
               {       0,
                              ""

               }
        };

        for(i=0; errorMsgs[i].szMsg[0]; i++)
        {
               if ( iError == errorMsgs[i].iError )
               {
                      printf("\nError(%d): %s\n", iError,
errorMsgs[i].szMsg);
                      return;
               }
        }
        printf("Error(%d): %s", errorMsgs[0].szMsg);
        return;
}

/* FUNCTION: BOOL GetParameters(int argc, char *argv[])
 *
 * PURPOSE:    This function parses the command line passed in to the
delivery executable, initializing
 *                     and filling in global variable parameters.
 *
 * ARGUMENTS:  int            argc    number of command line arguments
passed to delivery
 *                            char    *argv[] array of command line
argument pointers
 *
 * RETURNS:           BOOL    FALSE   parameter read successfull
 *                                                TRUE    user has requested
parameter information screen be displayed.
 *
 * COMMENTS:   None
 *
 */

static BOOL GetParameters(int argc, char *argv[])
{
        int                    i;
        SYSTEMTIME     startTime;
        SYSTEMTIME     endTime;
   UINT uLogTitleLen;

        iStartTime = 0;
        iEndTime = 0;
        iReport = 4;
   strcpy(szLogFileTitle,DEFAULTLOGTITLE);

        for(i=0; i<argc; i++)
```

```
        {
                if ( argv[i][0] == '-' || argv[i][0] == '/' )
                {
                        switch(argv[i][1])
                        {
                                case 'S':
                                case 's':
                                        if ( ParseTime(argv[i]+2,
&startTime) )
                                                return TRUE;
                                        iStartTime = (startTime.wHour *
3600000) + (startTime.wMinute * 60000) + (startTime.wSecond * 1000) +
startTime.wMilliseconds;
                                        break;
                                case 'E':
                                case 'e':
                                        if ( ParseTime(argv[i]+2, &endTime)
)
                                                return TRUE;
                                        iEndTime = (endTime.wHour * 3600000)
+ (endTime.wMinute * 60000) + (endTime.wSecond * 1000) +
endTime.wMilliseconds;
                                        break;
                                case 'R':
                                case 'r':
                                        iReport = atoi(argv[i]+2);
                                        if ( iReport > 4 || iReport < 1 )
                                                iReport = 4;
                                        break;
                                case 'F':
                                case 'f':
                uLogTitleLen = strlen(argv[i] - 2);
                if (uLogTitleLen > 0 && uLogTitleLen <
sizeof(szLogFileTitle))
                {
                   strcpy(szLogFileTitle,argv[i]+2);
                   printf("Log File Title set to %s",szLogFileTitle);
                };
                                        break;
                                case '?':
                                        return TRUE;
                        }
                }
        }
        return FALSE;
}

/* FUNCTION: void PrintParameters(void)
 *
 * PURPOSE:    This function displays the supported command line flags.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static void PrintParameters(void)
{
        PrintHeader();
        printf("DELIRPT:\n\n");
        printf("Parameter
Default\n");
        printf("-----------------------------------------------------------
-------------\n");
        printf("-S Start Time HH:MM:SS:MMM
All     \n");
        printf("-E End Time HH:MM:SS:MMM
All     \n");
        printf("-R 1)Average Response, 2)90th 3) Skipped 4) All
All     \n");
        printf("-? This help screen\n\n");
        printf("Note:  Command line switches are NOT case sensitive.\n");

        return;
}

/* FUNCTION: void PrintHeader(void)
 *
 * PURPOSE:    This function displays the delivery report applications
banner information.
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static void PrintHeader(void)
{
        //cls();

        printf("************************************************\n");
        printf("*                                              *\n");
        printf("*  Microsoft SQL Server 6.5                    *\n");
        printf("*                                              *\n");
        printf("*  HTML TPC-C BENCHMARK KIT: Delivery Report    *\n");
        printf("*  Version %d.%2.2d.%3.3d
*\n", versionMS, versionMM, versionLS);
        printf("*                                              *\n");
        printf("************************************************\n\n");

        return;
}

/* FUNCTION: void cls(void)
 *
 * PURPOSE:    This function clears the console window
 *
 * ARGUMENTS:  None
 *
 * RETURNS:            None
 *
 * COMMENTS:   None
 *
 */

static void cls(void)
```

```
{
        HANDLE  hConsole;
        COORD   coordScreen = { 0, 0 };                      //here's where
we'll home the cursor
        DWORD   cCharsWritten;
        CONSOLE_SCREEN_BUFFER_INFO    csbi;          //to get buffer info
        DWORD                                        dwConSize;
        //number of character cells in the current buffer

        hConsole = GetStdHandle(STD_OUTPUT_HANDLE);

        //get the number of character cells in the current buffer

        GetConsoleScreenBufferInfo( hConsole, &csbi );
        dwConSize = csbi.dwSize.X * csbi.dwSize.Y;

        //fill the entire screen with blanks
        FillConsoleOutputCharacter( hConsole, (TCHAR) ' ', dwConSize,
coordScreen, &cCharsWritten );
        GetConsoleScreenBufferInfo( hConsole, &csbi );

        //now set the buffer's attributes accordingly
        FillConsoleOutputAttribute( hConsole, csbi.wAttributes,dwConSize,
coordScreen, &cCharsWritten );

        //put the cursor at (0, 0)
        SetConsoleCursorPosition( hConsole, coordScreen );

        return;
}

/* FUNCTION: BOOL IsNumeric(char *ptr)
 *
 * PURPOSE:    This function determines if a string is numeric. It fails
if any characters other
 *                     than numeric and null terminator are present.
 *
 * ARGUMENTS:  char                  *ptr   pointer to string to check.
 *
 * RETURNS:            BOOL    FALSE   if string is not all numeric
 *                                       TRUE    if string contains
only numeric characters i.e. '0' - '9'
 *
 * COMMENTS:   A comma is counted as a valid delimiter.
 *
 */

static BOOL IsNumeric(char *ptr)
{
        if ( *ptr == 0 )
                return FALSE;

        while( *ptr && isdigit(*ptr) )
                ptr++;
        if ( !*ptr || *ptr == ',' )
                return TRUE;
        else
                return FALSE;
}
```

Appendix B - Database Design

Build Scripts

CREATEDB.SQL

```
/*  TPC-C Benchmark Kit                                */
/*                                                     */
/*  CREATEDB.SQL                                       */
/*                                                     */
/*  This script is used to create the database         */
/*  for a 900 warehouse tpcc database.                 */


use master
go

if exists ( select name from sysdatabases where name = "tpcc" )
        drop database tpcc
go

/* tpcc database size                                 */
/*        52,500 MB on cs segment                     */
/*         3,000 MB on misc segment                   */
/*        18,500 MB on ol segment                     */
/*        28,000 MB on syslogs segment                */
/* total 102,000 MB (99.61 GB)                        */

/* total of 27 device fragments                       */

create database tpcc

        on tpc_cs1 = 8577,   tpc_cs2 = 8577,   tpc_cs3 = 8577,
           tpc_cs4 = 8577,   tpc_cs5 = 8577,
           tpc_cs6 = 2500,   tpc_cs7 = 1500,
           tpc_cs1 =  306,   tpc_cs2 =  306,   tpc_cs3 =  306,
           tpc_cs4 =  306,   tpc_cs5 =  306,
           tpc_cs6 = 1000,   tpc_cs7 =  500,
           tpc_cs1 =  517,   tpc_cs2 =  517,   tpc_cs3 =  517,
           tpc_cs4 =  517,   tpc_cs5 =  517,

           tpc_misc2=1060,   tpc_misc1=1060,   tpc_misc3= 880,

           tpc_ol2 = 4886,   tpc_ol3 = 4886,
           tpc_ol1 = 4886,   tpc_ol4 = 3842

    log on tpc_log1=28000

go
```

DBOPT1.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  DBOPT1.SQL
*/
/*
*/
/*  Set database options for database load
*/


use master
go

sp_dboption tpcc,'select into/bulkcopy',true
go

sp_dboption tpcc,'trunc. log on chkpt.',true
go

use tpcc
go

checkpoint
go

use tpcc_admin
go

sp_dboption tpcc,'trunc. log on chkpt.',true
go
```

DBOPT2.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  DBOPT2.SQL
*/
/*
*/
/*  Reset database options after database load
*/
```

```
use master
go

sp_dboption tpcc,'select ',false
go

sp_dboption tpcc,'trunc. ',false
go

use tpcc
go

checkpoint
go
```

DISKINIT.SQL

```
/*  TPC-C Benchmark Kit                              */
/*                                                   */
/*  DISKINIT.SQL                                     */
/*                                                   */
/*  This script is used create devices               */
/*  for 900 warehouse tpcc database           */


use master
go


/* devices for customer and stock tables                    */
/*  9,400MB = 4,812,800 pages of 2KB per device             */
/*  3,500MB = 1,792,000 pages of 2KB per device             */
/*  2,000MB = 1,024,000 pages of 2KB per device             */
/* 52,500MB total (51.27GB)                           */

disk init name = "tpc_cs1",
       physname = "E:",
       vdevno   = 14,
       size     = 4812800
go

disk init name = "tpc_cs2",
       physname = "F:",
       vdevno   = 15,
       size     = 4812800
go

disk init name = "tpc_cs3",
       physname = "G:",
       vdevno   = 16,
       size     = 4812800
go

disk init name = "tpc_cs4",
       physname = "H:",
       vdevno   = 17,
       size     = 4812800
go

disk init name = "tpc_cs5",
       physname = "I:",
       vdevno   = 18,
       size     = 4812800
go

disk init name = "tpc_cs6",
       physname = "J:",
       vdevno   = 19,
       size     = 1792000
go

disk init name = "tpc_cs7",
       physname = "K:",
       vdevno   = 20,
       size     = 1024000
go


/* Log device                                                */
/* 28,000MB = 14,336,000 pages of 2KB                */
/* 28,000MB total (27.34GB)                          */

disk init name = "tpc_log1",
       physname = "L:",
       vdevno   = 21,
       size     = 14336000
go


/* device for warehouse, district, item, history,        */
/* orders and new-order tables                           */
/* 1,060MB =   542,720 pages of 2KB per device              */
/*   880MB =   450,560 pages of 2KB per device              */
/* 3,000MB total (2.93GB)                            */

disk init name = "tpc_misc1",
       physname = "M:",
       vdevno   = 22,
       size     = 542720
go

disk init name = "tpc_misc2",
       physname = "N:",
       vdevno   = 23,
       size     = 542720
go

disk init name = "tpc_misc3",
       physname = "O:",
       vdevno   = 24,
       size     = 450560
go


/* devices for order-line                                */
/*  4,886MB =  2,501.632 pages of 2KB per volume         */
/*  3,842MB =  1,967,104 pages of 2KB per volume         */
/* 18,500MB total (18.07GB)                              */

disk init name = "tpc_ol1",
       physname = "R:",
```

```
        vdevno   = 25,
        size     = 2501632
go

disk init name = "tpc_ol2",
        physname = "S:",
        vdevno   = 26,
        size     = 2501632
go

disk init name = "tpc_ol3",
        physname = "T:",
        vdevno   = 27,
        size     = 2501632

disk init name = "tpc_ol4",
        physname = "U:",
        vdevno   = 28,
        size     = 1967104
go
```

IDXCUSCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXCUSCL.SQL
*/
/*
*/
/*  Creates clustered index on customer (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where name = 'customer_c1' )
        drop index customer.customer_c1
go

select getdate()
go
create unique clustered index customer_c1 on customer(c_w_id, c_d_id,
c_id)
        with sorted_data on cs_seg
go
select getdate()
go
```

IDXCUSNC.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXCUSNC.SQL
*/
/*
*/
/*  Creates non-clustered index on customer (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'customer_nc1' )
        drop index customer.customer_nc1
go

select getdate()
go
create unique nonclustered index customer_nc1 on customer(c_w_id, c_d_id,
c_last, c_first, c_id)
        on cs_seg
go
select getdate()
go
```

IDXDISCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXDISCL.SQL
*/
/*
*/
/*  Creates clustered index on district (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where name = 'district_c1' )
        drop index district.district_c1
go

select getdate()
go
create unique clustered index  district_c1 on district(d_w_id, d_id)
        with fillfactor=1 on misc_seg
go
```

```
select getdate()
go
```

IDXITMCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXITMCL.SQL
*/
/*
*/
/*  Creates clustered index on item (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'item_c1' )
       drop index item.item_c1
go

select getdate()
go
create unique clustered index item_c1 on item(i_id)
       with sorted_data on misc_seg
go
select getdate()
go
```

IDXNODCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXNODCL.SQL
*/
/*
*/
/*  Creates clustered index on new-order (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'new_order_c1' )
       drop index new_order.new_order_c1
go

select getdate()
go
create unique clustered index new_order_c1 on new_order(no_w_id, no_d_id,
no_o_id)
       with sorted_data on misc_seg
go
select getdate()
go
```

IDXODLCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXODLCL.SQL
*/
/*
*/
/*  Creates clustered index on order-line (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'order_line_c1' )
       drop index order_line.order_line_c1
go

select getdate()
go
create unique clustered index order_line_c1 on order_line(ol_w_id,
ol_d_id, ol_o_id, ol_number)
       with sorted_data on ol_seg
go
select getdate()
go
```

IDXORDCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXORDCL.SQL
*/
/*
*/
/*  Creates clustered index on orders (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'orders_c1' )
```

```
        drop index orders.orders_c1
go

select getdate()
go
create unique clustered index orders_c1 on orders(o_w_id, o_d_id, o_id)
        with sorted_data on misc_seg
go
select getdate()
go
```

IDXSTKCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXSTKCL.SQL
*/
/*
*/
/*  Creates clustered index on stock (seg)
*/


use tpcc
go


if exists ( select name from sysindexes where  name = 'stock_c1' )
        drop index stock.stock_c1
go

select getdate()
go
create unique clustered index stock_c1 on stock(s_i_id, s_w_id)
        with sorted_data on cs_seg
go
select getdate()
go
```

IDXWARCL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  IDXWARCL.SQL
*/
/*
*/
/*  Creates clustered index on warehouse (seg)
*/


use tpcc
go

if exists ( select name from sysindexes where name = 'warehouse_c1' )
        drop index warehouse.warehouse_c1
go

select getdate()
go
create unique clustered index warehouse_c1 on warehouse(w_id)
        with fillfactor=1 on misc_seg
go
select getdate()
go
```

PINTABLE.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  PINTABLE.SQL
*/
/*
*/
/*  This script file is used to 'pin' certain tables in the data cache
*/

use tpcc
go

exec sp_tableoption "district","pintable",true
exec sp_tableoption "warehouse","pintable",true
exec sp_tableoption "new_order","pintable",true
exec sp_tableoption "item","pintable",true
go
```

SEGMENT.SQL

```
/*  TPC-C Benchmark Kit                          */
/*                                               */
/*  SEGMENT.SQL                                  */
/*                                               */
/*  This script is used create segments          */

use tpcc
go

exec sp_dropsegment cs_seg
go
exec sp_dropsegment misc_seg
go
exec sp_dropsegment ol_seg
go


/* create segment for customer and stock tables */
```

```
sp_addsegment    cs_seg, tpc_cs1
go
sp_extendsegment cs_seg, tpc_cs2
go
sp_extendsegment cs_seg, tpc_cs3
go
sp_extendsegment cs_seg, tpc_cs4
go
sp_extendsegment cs_seg, tpc_cs5
go
sp_extendsegment cs_seg, tpc_cs6
go
sp_extendsegment cs_seg, tpc_cs7
go

/* create segment for miscellaneous tables (warehouse, */
/* district, item, orders, new_order, and history)     */

sp_addsegment    misc_seg, tpc_misc1
go
sp_extendsegment misc_seg, tpc_misc2
go
sp_extendsegment misc_seg, tpc_misc3
go

/* create segment for order-line table */

sp_addsegment    ol_seg, tpc_ol1
go
sp_extendsegment ol_seg, tpc_ol2
go
sp_extendsegment ol_seg, tpc_ol3
go
sp_extendsegment ol_seg, tpc_ol4
go
```

TABLES .SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  TABLES.SQL
*/
/*
*/
/*  Creates TPC-C tables (seg)
*/


use tpcc
go

checkpoint
go
```

```
if exists ( select name from sysobjects where name = 'warehouse' )
       drop table warehouse
go

create table warehouse
(
       w_id                          smallint,
       w_name                        char(10),
       w_street_1                    char(20),
       w_street_2                    char(20),
       w_city                        char(20),
       w_state                       char(2),
       w_zip                         char(9),
       w_tax                         numeric(4,4),
       w_ytd                         numeric(12,2)
) on misc_seg
go


if exists ( select name from sysobjects where name = 'district' )
       drop table district
go

create table district
(
       d_id                          tinyint,
       d_w_id                        smallint,
       d_name                        char(10),
       d_street_1                    char(20),
       d_street_2                    char(20),
       d_city                        char(20),
       d_state                       char(2),
       d_zip                         char(9),
       d_tax                         numeric(4,4),
       d_ytd                         numeric(12,2),
       d_next_o_id                   int
) on misc_seg
go


if exists ( select name from sysobjects where name = 'customer' )
       drop table customer
go

create table customer
(
       c_id                          int,
       c_d_id                        tinyint,
       c_w_id                        smallint,
       c_first                       char(16),
       c_middle                      char(2),
       c_last                        char(16),
       c_street_1                    char(20),
       c_street_2                    char(20),
       c_city                        char(20),
       c_state                       char(2),
       c_zip                         char(9),
       c_phone                       char(16),
       c_since                       datetime,
       c_credit                      char(2),
```

```
        c_credit_lim            numeric(12,2),
        c_discount                      numeric(4,4),
        c_balance                       numeric(12,2),
        c_ytd_payment           numeric(12,2),
        c_payment_cnt           smallint,
        c_delivery_cnt          smallint,
        c_data_1                        char(250),
        c_data_2                        char(250)
) on cs_seg
go


if exists ( select name from sysobjects where name = 'history' )
        drop table history
go

create table history
(
        h_c_id                          int,
        h_c_d_id                        tinyint,
        h_c_w_id                        smallint,
        h_d_id                          tinyint,
        h_w_id                          smallint,
        h_date                          datetime,
        h_amount                        numeric(6,2),
        h_data                          char(24)
) on misc_seg
go


if exists ( select name from sysobjects where name = 'new_order' )
        drop table new_order
go

create table new_order
(
        no_o_id                         int,
        no_d_id                         tinyint,
        no_w_id                         smallint
) on misc_seg
go


if exists ( select name from sysobjects where name = 'orders' )
        drop table orders
go

create table orders
(
        o_id                            int,
        o_d_id                          tinyint,
        o_w_id                          smallint,
        o_c_id                          int,
        o_entry_d                       datetime,
        o_carrier_id            tinyint,
        o_ol_cnt                        tinyint,
        o_all_local                     tinyint
) on misc_seg
go
```

```
if exists ( select name from sysobjects where name = 'order_line' )
        drop table order_line
go

create table order_line
(
        ol_o_id                         int,
        ol_d_id                         tinyint,
        ol_w_id                         smallint,
        ol_number                       tinyint,
        ol_i_id                         int,
        ol_supply_w_id          smallint,
        ol_delivery_d           datetime,
        ol_quantity                     smallint,
        ol_amount                       numeric(6,2),
        ol_dist_info            char(24)
) on ol_seg
go


if exists ( select name from sysobjects where name = 'item' )
        drop table item
go

create table item
(
        i_id                            int,
        i_im_id                         int,
        i_name                          char(24),
        i_price                         numeric(5,2),
        i_data                          char(50)
) on misc_seg
go


if exists ( select name from sysobjects where name = 'stock' )
        drop table stock
go

create table stock
(
        s_i_id                          int,
        s_w_id                          smallint,
        s_quantity                      smallint,
        s_dist_01                       char(24),
        s_dist_02                       char(24),
        s_dist_03                       char(24),
        s_dist_04                       char(24),
        s_dist_05                       char(24),
        s_dist_06                       char(24),
        s_dist_07                       char(24),
        s_dist_08                       char(24),
        s_dist_09                       char(24),
        s_dist_10                       char(24),
        s_ytd                           int,
        s_order_cnt                     smallint,
        s_remote_cnt            smallint,
        s_data                          char(50)
) on cs_seg
```

```
go
```

TPCCBCP.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  TPCCBCP.SQL
*/
/*
*/
/*  This script file sets the table lock option for bulk load
*/


use tpcc
go

exec sp_tableoption "warehouse","table lock on bulk load",true
exec sp_tableoption "district","table lock on bulk load",true
exec sp_tableoption "stock","table lock on bulk load",true
exec sp_tableoption "item","table lock on bulk load",true
exec sp_tableoption "customer","table lock on bulk load",true
exec sp_tableoption "history","table lock on bulk load",true
exec sp_tableoption "orders","table lock on bulk load",true
exec sp_tableoption "order_line","table lock on bulk load",true
exec sp_tableoption "new_order","table lock on bulk load",true
go
```

TPCCIRL.SQL

```
/*  TPC-C Benchmark Kit
*/
/*
*/
/*  TPCCIRL.SQL
*/
/*
*/
/*  This script file sets the insert row lock option on selected tables
*/


use tpcc
go

exec sp_tableoption "history","insert row lock",true
exec sp_tableoption "new_order","insert row lock",true
exec sp_tableoption "orders","insert row lock",true
exec sp_tableoption "order_line","insert row lock",true
go
```

WARMUP.SQL

```
/* Warm-up TPC-C database */

use tpcc
go

update sysobjects set cache= 2 from sysobjects where name='stock'
go

update sysobjects set cache= 5 from sysobjects where name='customer'
go

select name, id, cache from sysobjects where id > 100
go

dbcc gaminit
go

select "tpcc database GAMINIT finished!"
go
```

Stored Procedures

NEWORD.SQL

```
/*  File:       NEWORD.SQL
*/
/*              Microsoft TPC-C Kit Ver. 3.00.000
*/
/*              Audited 08/23/96, By Francois Raab
*/
/*
*/
/*              Copyright Microsoft, 1996
*/
/*
*/
/*  Purpose:    New-Order transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer
*/
/*              damienl@Microsoft.com
*/


use tpcc
go

/* new-order transaction stored procedure */

if exists ( select name from sysobjects where name = "tpcc_neworder" )
        drop procedure tpcc_neworder
go

/*  Modified by rick vicik, 2/4/97  */
/*  Combined initialization of local variables into district update
statement  */
```

```
/*  Combined 3 huge case select statements into a single one  */

create proc tpcc_neworder
                                                        @w_id
smallint,
                                                        @d_id
tinyint,
                                                        @c_id           int,
                                                        @o_ol_cnt
tinyint,
                                                        @o_all_local
tinyint,
                                                        @i_id1  int = 0,
@s_w_id1 smallint = 0, @ol_qty1 smallint = 0,
                                                        @i_id2  int = 0,
@s_w_id2 smallint = 0, @ol_qty2 smallint = 0,
                                                        @i_id3  int = 0,
@s_w_id3 smallint = 0, @ol_qty3 smallint = 0,
                                                        @i_id4  int = 0,
@s_w_id4 smallint = 0, @ol_qty4 smallint = 0,
                                                        @i_id5  int = 0,
@s_w_id5 smallint = 0, @ol_qty5 smallint = 0,
                                                        @i_id6  int = 0,
@s_w_id6 smallint = 0, @ol_qty6 smallint = 0,
                                                        @i_id7  int = 0,
@s_w_id7 smallint = 0, @ol_qty7 smallint = 0,
                                                        @i_id8  int = 0,
@s_w_id8 smallint = 0, @ol_qty8 smallint = 0,
                                                        @i_id9  int = 0,
@s_w_id9 smallint = 0, @ol_qty9 smallint = 0,
                                                        @i_id10 int = 0,
@s_w_id10 smallint = 0, @ol_qty10 smallint = 0,
                                                        @i_id11 int = 0,
@s_w_id11 smallint = 0, @ol_qty11 smallint = 0,
                                                        @i_id12 int = 0,
@s_w_id12 smallint = 0, @ol_qty12 smallint = 0,
                                                        @i_id13 int = 0,
@s_w_id13 smallint = 0, @ol_qty13 smallint = 0,
                                                        @i_id14 int = 0,
@s_w_id14 smallint = 0, @ol_qty14 smallint = 0,
                                                        @i_id15 int = 0,
@s_w_id15 smallint = 0, @ol_qty15 smallint = 0


as
declare @w_tax          numeric(4,4),
        @d_tax          numeric(4,4),
        @c_last         char(16),
        @c_credit       char(2),
        @c_discount     numeric(4,4),
        @i_price        numeric(5,2),
        @i_name         char(24),
        @i_data         char(50),
        @o_entry_d      datetime,
        @remote_flag    int,
        @s_quantity     smallint,
        @s_data         char(50),
        @s_dist         char(24),
              @li_no          int,
              @o_id                   int,
              @commit_flag    int,
        @li_id          int,
        @li_s_w_id      smallint,
        @li_qty         smallint,
              @ol_number              int,
              @c_id_local             int

begin

begin transaction n

/*  get district tax and next availible order id and update */
/*  plus initialize local variables  */

    update district
       set @d_tax      = d_tax,
           @o_id       = d_next_o_id,
              d_next_o_id = d_next_o_id + 1,
        @o_entry_d = getdate(),
        @li_no=0,
        @commit_flag = 1
           where d_w_id = @w_id and
                 d_id   = @d_id

       /*  process orderlines */
    while (@li_no < @o_ol_cnt)
       begin

        select @li_no = @li_no + 1

           /*  Set i_id, s_w_id, and qty for this lineitem */

           select @li_id = case @li_no
                  when 1 then @i_id1
                         when 2 then @i_id2
                         when 3 then @i_id3
                         when 4 then @i_id4
                         when 5 then @i_id5
                         when 6 then @i_id6
                         when 7 then @i_id7
                         when 8 then @i_id8
                         when 9 then @i_id9
                         when 10 then @i_id10
                         when 11 then @i_id11
                         when 12 then @i_id12
                         when 13 then @i_id13
                         when 14 then @i_id14
                         when 15 then @i_id15
                         end,

                         @li_s_w_id = case @li_no
                         when 1 then @s_w_id1
                         when 2 then @s_w_id2
                         when 3 then @s_w_id3
                         when 4 then @s_w_id4
                         when 5 then @s_w_id5
                         when 6 then @s_w_id6
                         when 7 then @s_w_id7
                         when 8 then @s_w_id8
                         when 9 then @s_w_id9
```

```
                        when 10 then @s_w_id10
                        when 11 then @s_w_id11
                        when 12 then @s_w_id12
                        when 13 then @s_w_id13
                        when 14 then @s_w_id14
                        when 15 then @s_w_id15
                        end,

                        @li_qty = case  @li_no
                        when 1 then @ol_qty1
                        when 2 then @ol_qty2
                        when 3 then @ol_qty3
                        when 4 then @ol_qty4
                        when 5 then @ol_qty5
                        when 6 then @ol_qty6
                        when 7 then @ol_qty7
                        when 8 then @ol_qty8
                        when 9 then @ol_qty9
                        when 10 then @ol_qty10
                        when 11 then @ol_qty11
                        when 12 then @ol_qty12
                        when 13 then @ol_qty13
                        when 14 then @ol_qty14
                        when 15 then @ol_qty15
                        end

        /* get item data (no one updates item) */

        select @i_price = i_price,
               @i_name  = i_name,
               @i_data  = i_data
        from item (tablock holdlock)
            where i_id = @li_id

          /* if there actually is an item with this id, go to work */

              if (@@rowcount > 0)
              begin
            update stock set s_ytd        = s_ytd + @li_qty,
                             @s_quantity  = s_quantity,
                             s_quantity   = s_quantity - @li_qty +
                                 case when (s_quantity - @li_qty < 10)
then 91 else 0 end,
                             s_order_cnt  = s_order_cnt + 1,
                             s_remote_cnt = s_remote_cnt + case
                                 when (@li_s_w_id = @w_id) then 0 else 1
end,
                             @s_data      = s_data,
                             @s_dist      = case @d_id
                                               when 1  then s_dist_01
                                          when 2  then s_dist_02
                                          when 3  then s_dist_03
                                          when 4  then s_dist_04
                                          when 5  then s_dist_05
                                          when 6  then s_dist_06
                                          when 7  then s_dist_07
                                          when 8  then s_dist_08
                                          when 9  then s_dist_09
                                          when 10 then s_dist_10
                                      end
            where s_i_id = @li_id and
                                  s_w_id = @li_s_w_id

                             /* insert order_line data (using data from item and
stock) */

                   insert into order_line values(@o_id,              /* from
district update */
                                                 @d_id,                  /* input
param          */
                                                 @w_id,              /* input
param          */
                                                 @li_no,             /* orderline
number     */
                                                 @li_id,             /* lineitem
id          */
                                                 @li_s_w_id,         /* lineitem
warehouse   */
                                                 "dec 31, 1889",     /* constant
*/
                                                 @li_qty,            /* lineitem
qty         */
                                                 @i_price * @li_qty, /* ol_amount
*/
                                                 @s_dist)            /* from
stock           */

                   /* send line-item data to client */

                         select @i_name,
                         @s_quantity,
                         b_g = case when ( (patindex("%ORIGINAL%",@i_data) > 0)
and
                                           (patindex("%ORIGINAL%",@s_data) > 0)
)
                               then "B" else "G" end,
                         @i_price,
                         @i_price * @li_qty

              end
              else
                     begin

                         /*  no item found - triggers rollback condition */


                            select "",0,"",0,0
                            select @commit_flag = 0

                     end
             end

          /* get customer last name, discount, and credit rating */

          select @c_last     = c_last,
                 @c_discount = c_discount,
                 @c_credit   = c_credit,
                       @c_id_local = c_id
          from customer holdlock
          where c_id   = @c_id and
                c_w_id = @w_id and
                c_d_id = @d_id
```

```
    /* insert fresh row into orders table */

    insert into orders values (@o_id,
                               @d_id,
                                  @w_id,
                                         @c_id_local,
                                         @o_entry_d,
                                             0,
                                             @o_ol_cnt,
                                             @o_all_local)

       /* insert corresponding row into new-order table */

       insert into new_order values (@o_id,
                                                                  @d_id,
                                                                  @w_id)

       /*  select warehouse tax */

       select @w_tax = w_tax
       from warehouse holdlock
       where w_id = @w_id

       if (@commit_flag = 1)
              commit transaction n
       else
              /* all that work for nuthin!!! */
              rollback transaction n

       /* return order data to client */
       select @w_tax,
              @d_tax,
                 @o_id,
                 @c_last,
                 @c_discount,
                 @c_credit,
                 @o_entry_d,
                 @commit_flag

end

go
```

PAYMENT.SQL

```
/*  File:       PAYMENT.SQL
*/
/*              Microsoft TPC-C Kit Ver. 3.00.000
*/
/*              Audited 08/23/96, By Francois Raab
*/
/*
*/
/*              Copyright Microsoft, 1996
*/
/*
*/
/*  Purpose:    Payment transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer
*/
/*              damienl@Microsoft.com
*/


use tpcc
go

if exists (select name from sysobjects where name = "tpcc_payment" )
       drop procedure tpcc_payment
go

create proc tpcc_payment @w_id           smallint,
                                             @c_w_id         smallint,
                                             @h_amount
numeric(6,2),
                                             @d_id           tinyint,
                                             @c_d_id         tinyint,
                                             @c_id           int,
                                             @c_last         char(16) =
""


as
declare  @w_street_1     char(20),
         @w_street_2     char(20),
         @w_city         char(20),
         @w_state        char(2),
         @w_zip          char(9),
         @w_name         char(10),
         @d_street_1     char(20),
         @d_street_2     char(20),
         @d_city         char(20),
         @d_state        char(2),
         @d_zip          char(9),
         @d_name         char(10),
         @c_first        char(16),
         @c_middle       char(2),
         @c_street_1     char(20),
         @c_street_2     char(20),
         @c_city         char(20),
         @c_state        char(2),
         @c_zip          char(9),
         @c_phone        char(16),
         @c_since        datetime,
         @c_credit       char(2),
         @c_credit_lim   numeric(12,2),
         @c_balance      numeric(12,2),
         @c_discount     numeric(4,4),
         @data1          char(250),
         @data2          char(250),
         @c_data_1       char(250),
         @c_data_2       char(250),
         @datetime       datetime,
         @w_ytd          numeric(12,2),
         @d_ytd          numeric(12,2),
         @cnt            smallint,
```

```
        @val            smallint,
        @screen_data   char(200),
               @d_id_local    tinyint,
               @w_id_local    smallint,
               @c_id_local    int

select @screen_data = ""

begin tran p

        /* get payment date */

        select @datetime = getdate()

        if (@c_id = 0)
        begin
               /* get customer id and info using last name */

               select @cnt = count(*)
               from customer holdlock
               where c_last = @c_last and
                     c_w_id = @c_w_id and
                     c_d_id = @c_d_id


               select @val = (@cnt + 1) / 2
               set rowcount @val

               select @c_id = c_id
               from customer holdlock
               where c_last = @c_last and
                     c_w_id = @c_w_id and
                     c_d_id = @c_d_id
               order by c_w_id, c_d_id, c_last, c_first

               set rowcount 0
        end

        /* get customer info and update balances */

        update customer set
               @c_balance     = c_balance = c_balance - @h_amount,
               c_payment_cnt  = c_payment_cnt + 1,
               c_ytd_payment  = c_ytd_payment + @h_amount,
               @c_first       = c_first,
               @c_middle      = c_middle,
            @c_last        = c_last,
            @c_street_1    = c_street_1,
               @c_street_2    = c_street_2,
               @c_city        = c_city,
               @c_state       = c_state,
               @c_zip         = c_zip,
               @c_phone       = c_phone,
               @c_credit      = c_credit,
               @c_credit_lim  = c_credit_lim,
               @c_discount    = c_discount,
               @c_since       = c_since,
               @data1         = c_data_1,
               @data2         = c_data_2,
               @c_id_local    = c_id
        where c_id   = @c_id and
              c_w_id = @c_w_id and
              c_d_id = @c_d_id

        /* if customer has bad credit get some more info */

        if (@c_credit = "BC")
        begin

               /* compute new info */

               select @c_data_2 = substring(@data1,209,42) +
                                                substring(@data2, 1, 208)
               select @c_data_1 = convert(char(5),@c_id) +
                                                convert(char(4),@c_d_id) +
                                        convert(char(5),@c_w_id) +
                                        convert(char(4),@d_id) +
                                        convert(char(5),@w_id) +
                                        convert(char(19),@h_amount) +
                                        substring(@data1, 1, 208)

               /* update customer info */

               update customer set
                      c_data_1 = @c_data_1,
                         c_data_2 = @c_data_2
               where c_id   = @c_id and
                        c_w_id = @c_w_id and
                     c_d_id = @c_d_id

               select @screen_data = substring (@c_data_1,1,200)
        end



        /* get district data and update year-to-date */

        update district
               set d_ytd       = d_ytd + @h_amount,
                      @d_street_1 = d_street_1,
                      @d_street_2 = d_street_2,
                      @d_city     = d_city,
                      @d_state    = d_state,
                      @d_zip      = d_zip,
                      @d_name     = d_name,
                      @d_id_local = d_id
               where d_w_id = @w_id and
                     d_id   = @d_id

        /* get warehouse data and update year-to-date */

        update warehouse
        set w_ytd       = w_ytd + @h_amount,
               @w_street_1 = w_street_1,
            @w_street_2 = w_street_2,
            @w_city     = w_city,
            @w_state    = w_state,
            @w_zip      = w_zip,
            @w_name     = w_name,
               @w_id_local = w_id
        where w_id = @w_id
```

```
        /* create history record */

        insert into history values  (@c_id_local,
                                                        @c_d_id,
                                                            @c_w_id,
                                                            @d_id_local,
                                                            @w_id_local,
                                                            @datetime,
                                                            @h_amount,
                                                            @w_name + "
" + @d_name)

commit tran p

/* return data to client */

select  @c_id,
                @c_last,
                @datetime,
                @w_street_1,
                @w_street_2,
                @w_city,
                @w_state,
                @w_zip,
                @d_street_1,
                @d_street_2,
                @d_city,
                @d_state,
                @d_zip,
                @c_first,
                @c_middle,
                @c_street_1,
                @c_street_2,
                @c_city,
                @c_state,
                @c_zip,
                @c_phone,
                @c_since,
                @c_credit,
                @c_credit_lim,
                @c_discount,
                @c_balance,
                @screen_data

go
```

DELIVERY.SQL

```
/*  File:       DELIVERY.SQL
*/
/*              Microsoft TPC-C Kit Ver. 3.00.000
*/
/*              Audited 08/23/96, By Francois Raab
*/
/*
*/
/*              Copyright Microsoft, 1996
*/
/*
*/
/*  Purpose:    Delivery transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer
*/
/*              damienl@Microsoft.com
*/


use tpcc
go

/* delivery transaction */

if exists (select name from sysobjects where name = "tpcc_delivery" )
        drop procedure tpcc_delivery
go

create proc tpcc_delivery                       @w_id           smallint,

                                                                @o_carrier_id
smallint
as

declare @d_id tinyint,
        @o_id int,
        @c_id int,
        @total numeric(12,2),
        @oid1 int,
        @oid2 int,
        @oid3 int,
        @oid4 int,
        @oid5 int,
        @oid6 int,
        @oid7 int,
        @oid8 int,
        @oid9 int,
        @oid10 int

select @d_id = 0

begin tran d

    while (@d_id < 10)
    begin

        select @d_id  = @d_id + 1,
               @total = 0,
               @o_id  = 0

        select @o_id = min(no_o_id)
        from new_order holdlock
        where no_w_id = @w_id and
                        no_d_id = @d_id

        if (@@rowcount <> 0)
        begin

            /* claim the order for this district */
```

```
            delete new_order
            where no_w_id = @w_id and
                        no_d_id = @d_id and
                           no_o_id = @o_id

            /* set carrier_id on this order (and get customer id) */

            update orders
                   set o_carrier_id = @o_carrier_id,
                @c_id        = o_c_id
            where o_w_id = @w_id and
                        o_d_id = @d_id and
                           o_id   = @o_id

            /* set date in all lineitems for this order (and sum amounts)
*/

            update order_line
                   set ol_delivery_d = getdate(),
                    @total        = @total + ol_amount
            where ol_w_id = @w_id and
                  ol_d_id = @d_id and
                           ol_o_id = @o_id

            /* accummulate lineitem amounts for this order into customer
*/

                   update customer
                      set c_balance      = c_balance + @total,
                          c_delivery_cnt = c_delivery_cnt + 1

            where c_w_id = @w_id and
                        c_d_id = @d_id and
                           c_id   = @c_id

        end

        select @oid1 = case @d_id when  1  then @o_id else @oid1 end,
               @oid2 = case @d_id when  2  then @o_id else @oid2 end,
               @oid3 = case @d_id when  3  then @o_id else @oid3 end,
               @oid4 = case @d_id when  4  then @o_id else @oid4 end,
               @oid5 = case @d_id when  5  then @o_id else @oid5 end,
               @oid6 = case @d_id when  6  then @o_id else @oid6 end,
               @oid7 = case @d_id when  7  then @o_id else @oid7 end,
               @oid8 = case @d_id when  8  then @o_id else @oid8 end,
               @oid9 = case @d_id when  9  then @o_id else @oid9 end,
               @oid10 = case @d_id when 10 then @o_id else @oid10 end

    end

commit tran d

select @oid1,
       @oid2,
       @oid3,
       @oid4,
       @oid5,
       @oid6,
       @oid7,
       @oid8,
       @oid9,
       @oid10

go
```

ORDSTAT.SQL

```
/*  File:       ORDSTAT.SQL
*/
/*              Microsoft TPC-C Kit Ver. 3.00.000
*/
/*              Audited 08/23/96, By Francois Raab
*/
/*
*/
/*              Copyright Microsoft, 1996
*/
/*
*/
/*  Purpose:    Order-Status transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer
*/
/*              damienl@Microsoft.com
*/


use tpcc
go

if exists ( select name from sysobjects where name = "tpcc_orderstatus" )
       drop procedure   tpcc_orderstatus
go

/*  Modified by rick vicik, 2/4/97  */
/*  Eliminated @val local variable  */

create proc tpcc_orderstatus @w_id           smallint,
                                                    @d_id
       tinyint,
                                                    @c_id         int,
                                                    @c_last
       char(16) = ""

as

declare @c_balance            numeric(12,2),
        @c_first              char(16),
        @c_middle             char(2),
        @o_id                 int,
        @o_entry_d            datetime,
        @o_carrier_id smallint,
        @cnt                  smallint

begin tran o

       if (@c_id = 0)
              begin
```

```
        /* get customer id and info using last name */


        select @cnt = (count(*)+1)/2
        from customer holdlock
        where c_last = @c_last and
          c_w_id = @w_id and
          c_d_id = @d_id
        set rowcount @cnt

        select @c_id = c_id,
                  @c_balance = c_balance,
                  @c_first   = c_first,
                  @c_last    = c_last,
                  @c_middle  = c_middle
        from customer holdlock
        where c_last = @c_last and
          c_w_id = @w_id and
          c_d_id = @d_id
        order by c_w_id, c_d_id, c_last, c_first

        set rowcount 0
        end

    else
        begin

        /*  get customer info if by id*/

        select @c_balance = c_balance,
               @c_first   = c_first,
               @c_middle  = c_middle,
               @c_last    = c_last
        from customer holdlock
        where c_id   = @c_id and
              c_d_id = @d_id and
              c_w_id = @w_id

        select @cnt = @@rowcount

        end

    /* if no such customer */
    if (@cnt = 0)
    begin
        raiserror("Customer not found",18,1)
        goto custnotfound
    end

    /*  get order info */

    select @o_id = o_id,
              @o_entry_d    = o_entry_d,
       @o_carrier_id = o_carrier_id
    from orders holdlock
where o_w_id = @w_id and
      o_d_id = @d_id and
       o_c_id = @c_id

    /*  select order lines for the current order */

        select ol_supply_w_id,
           ol_i_id,
               ol_quantity,
               ol_amount,
               ol_delivery_d
        from order_line holdlock
        where ol_o_id = @o_id and
              ol_d_id = @d_id and
              ol_w_id = @w_id

custnotfound:

commit tran o

/*  return data to client  */

select @c_id,
          @c_last,
          @c_first,
          @c_middle,
          @o_entry_d,
          @o_carrier_id,
          @c_balance,
          @o_id

go
```

STOCKLEV.SQL

```
/*  File:       STOCKLEV.SQL
*/
/*              Microsoft TPC-C Kit Ver. 3.00.000
*/
/*              Audited 08/23/96, By Francois Raab
*/
/*
*/
/*              Copyright Microsoft, 1996
*/
/*
*/
/*  Purpose:    Stock-Level transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer
*/
/*              damienl@Microsoft.com
*/


use tpcc
go

/* stock-level transaction stored procedure */

if exists (select name from sysobjects where name = "tpcc_stocklevel" )
        drop procedure tpcc_stocklevel
go
```

```
/* Modified by rick vicik, 2/4/97 */
/* Eliminate 1 local variable, use derived table to eliminate duplicate
item#'s */

create proc tpcc_stocklevel   @w_id          smallint,
                                             @d_id          tinyint,
                                             @threshhold    smallint
as
declare @o_id int

select @o_id = d_next_o_id
from district
where d_w_id = @w_id and
         d_id   = @d_id

select count(*) from stock,
    (select distinct(ol_i_id) from order_line
     where ol_w_id    =  @w_id and
              ol_d_id    =  @d_id and
              ol_o_id between (@o_id-20) and (@o_id-1)) OL

where s_w_id     =  @w_id and
      s_i_id     =  OL.ol_i_id and
      s_quantity <  @threshhold
go
```

Loader Source

TPCCLDR.C

```
/*      FILE:           TPCCLDR.C
 *                      Microsoft TPC-C Kit Ver. 3.00.000
 *                      Audited 08/23/96, By Francois Raab
 *
 *                      Copyright Microsoft, 1996
 *
 *      PURPOSE:        Database loader for Microsoft TPC-C Benchmark Kit
 *      Author:         Damien Lindauer
 *                      damienl@Microsoft.com
 */


// Includes
#include "tpcc.h"
#include "search.h"

// Defines
#define MAXITEMS                100000
#define CUSTOMERS_PER_DISTRICT  3000
#define DISTRICT_PER_WAREHOUSE  10
#define ORDERS_PER_DISTRICT     3000
#define MAX_CUSTOMER_THREADS    2
#define MAX_ORDER_THREADS       3
#define MAX_MAIN_THREADS        4

// Functions declarations
long NURand();
void LoadItem();
void LoadWarehouse();

void Stock();
void District();

void LoadCustomer();
void CustomerBufInit();
void CustomerBufLoad();
void LoadCustomerTable();
void LoadHistoryTable();

void LoadOrders();
void OrdersBufInit();
void OrdersBufLoad();
void LoadOrdersTable();
void LoadNewOrderTable();
void LoadOrderLineTable();
void GetPermutation();
void CheckForCommit();
void OpenConnections();

void BuildIndex();

void CurrentDate();

// Shared memory structures

typedef struct
{
    long                ol;
    long                ol_i_id;
    short               ol_supply_w_id;
    short               ol_quantity;
    double              ol_amount;
    char                ol_dist_info[DIST_INFO_LEN+1];
       // Added to insure ol_delivery_d set properly during load
       char                         ol_delivery_d[30];
} ORDER_LINE_STRUCT;

typedef struct
{
    long                o_id;
    short               o_d_id;
    short               o_w_id;
    long                o_c_id;
    short               o_carrier_id;
    short               o_ol_cnt;
    short               o_all_local;
       ORDER_LINE_STRUCT   o_ol[15];
} ORDERS_STRUCT;

typedef struct
{
    long                                c_id;
    short                               c_d_id;
    short                               c_w_id;
       char                             c_first[FIRST_NAME_LEN+1];
    char                                c_middle[MIDDLE_NAME_LEN+1];
    char                                c_last[LAST_NAME_LEN+1];
    char                                c_street_1[ADDRESS_LEN+1];
    char                                c_street_2[ADDRESS_LEN+1];
```

```
    char                            c_city[ADDRESS_LEN+1];
    char                            c_state[STATE_LEN+1];
    char                            c_zip[ZIP_LEN+1];
    char                            c_phone[PHONE_LEN+1];
    char                            c_credit[CREDIT_LEN+1];
    double                          c_credit_lim;
    double                          c_discount;
    double                          c_balance;
    double                          c_ytd_payment;
        short                       c_payment_cnt;
        short                       c_delivery_cnt;
        char                        c_data_1[C_DATA_LEN+1];
    char                            c_data_2[C_DATA_LEN+1];
        double                      h_amount;
    char                            h_data[H_DATA_LEN+1];
} CUSTOMER_STRUCT;

typedef struct
{
        char                        c_last[LAST_NAME_LEN+1];
        char                        c_first[FIRST_NAME_LEN+1];
    long                            c_id;
} CUSTOMER_SORT_STRUCT;

typedef struct
{
    long                time_start;
} LOADER_TIME_STRUCT;


// Global variables
char            errfile[20];
DBPROCESS       *i_dbproc1;
DBPROCESS       *w_dbproc1, *w_dbproc2;
DBPROCESS       *c_dbproc1, *c_dbproc2;
DBPROCESS       *o_dbproc1, *o_dbproc2, *o_dbproc3;
ORDERS_STRUCT   orders_buf[ORDERS_PER_DISTRICT];
CUSTOMER_STRUCT customer_buf[CUSTOMERS_PER_DISTRICT];
long            main_threads_completed;
long            customer_threads_completed;
long            order_threads_completed;
long            orders_rows_loaded;
long            new_order_rows_loaded;
long            order_line_rows_loaded;
long            history_rows_loaded;
long            customer_rows_loaded;
long            stock_rows_loaded;
long            district_rows_loaded;
long            item_rows_loaded;
long            warehouse_rows_loaded;
long            main_time_start;
long            main_time_end;
TPCCLDR_ARGS    *aptr, args;


//============================================================================
//
// Function name: main
//
//============================================================================
```

```
int main(int  argc, char **argv)
{

        DWORD           dwThreadID[MAX_MAIN_THREADS];
        HANDLE          hThread[MAX_MAIN_THREADS];
        FILE            *fLoader;
        char            buffer[255];
        int             main_threads_started;
        RETCODE retcode;
        LOGINREC *login;

    printf("\n*************************************************");
        printf("\n*                                               *");
        printf("\n*  Microsoft SQL Server 6.5                     *");
        printf("\n*                                               *");
        printf("\n*  TPC-C BENCHMARK KIT:  Database loader        *");
        printf("\n*  Version %s                                *",
TPCKIT_VER);
        printf("\n*                                               *");
        printf("\n*************************************************\n\n"
);

    // process command line arguments

    aptr = &args;
    GetArgsLoader(argc, argv, aptr);

        if (aptr->build_index = 0)
                printf("data load only\n");
        if (aptr->build_index = 1)
                printf("data load and index creation\n");

        // install dblib error handlers

        dbmsghandle((DBMSGHANDLE_PROC)SQLMsgHandler);
        dberrhandle((DBERRHANDLE_PROC)SQLErrHandler);

        // open connections to SQL Server

        OpenConnections();

        // open file for loader results
    fLoader = fopen(aptr->loader_res_file, "a");

    if (fLoader == NULL)
        {
                printf("Error, loader result file open failed.");
                exit(-1);
        }

    // start loading data

    sprintf(buffer,"TPC-C load started for %ld warehouses:  ", aptr-
>num_warehouses);
        if(aptr->build_index = 0)
                strcat(buffer, "data load only\n");
        if (aptr->build_index = 1)
                strcat(buffer, "data load and index creation\n");
```

```
        printf("%s",buffer);
        fprintf(fLoader,"%s",buffer);

        main_time_start = (TimeNow() / MILLI);

        // start parallel load threads

        main_threads_completed = 0;
        main_threads_started = 0;

        if ((aptr->table == NULL) || !(strcmp(aptr->table,"item")))
        {
                fprintf(fLoader, "\nStarting loader threads for: item\n");

                hThread[0] = CreateThread(NULL,
                                                                0,
(LPTHREAD_START_ROUTINE) LoadItem,
                                                                NULL,
                                                                0,
&dwThreadID[0]);

                if (hThread[0] == NULL)
                {
                        printf("Error, failed in creating creating thread =
0.\n");
                        exit(-1);
                }

                main_threads_started++;

        }

        if ((aptr->table == NULL) || !(strcmp(aptr->table,"warehouse")))
        {
                fprintf(fLoader, "Starting loader threads for:
warehouse\n");

                hThread[1] = CreateThread(NULL,
                                                                0,
(LPTHREAD_START_ROUTINE) LoadWarehouse,
                                                                NULL,
                                                                0,
&dwThreadID[1]);

                if (hThread[1] == NULL)
                {
                        printf("Error, failed in creating creating thread =
1.\n");
                        exit(-1);
                }

                main_threads_started++;
        }

    if ((aptr->table == NULL) || !(strcmp(aptr->table,"customer")))
        {
                fprintf(fLoader, "Starting loader threads for:
customer\n");

                hThread[2] = CreateThread(NULL,
                                                                0,
(LPTHREAD_START_ROUTINE) LoadCustomer,
                                                                NULL,
                                                                0,
&dwThreadID[2]);

                if (hThread[2] == NULL)
                {
                        printf("Error, failed in creating creating main
thread = 2.\n");
                        exit(-1);
                }

                main_threads_started++;
        }

    if ((aptr->table == NULL) || !(strcmp(aptr->table,"orders")))
        {
                fprintf(fLoader, "Starting loader threads for: orders\n");

                hThread[3] = CreateThread(NULL,
                                                                0,
(LPTHREAD_START_ROUTINE) LoadOrders,
                                                                NULL,
                                                                0,
&dwThreadID[3]);

                if (hThread[3] == NULL)
                {
                        printf("Error, failed in creating creating main
thread = 3.\n");
                        exit(-1);
                }

        main_threads_started++;

        }

        while (main_threads_completed != main_threads_started)
                Sleep(1000L);

    main_time_end = (TimeNow() / MILLI);

    sprintf(buffer,"\nTPC-C load completed successfully in %ld
minutes.\n",
                        (main_time_end - main_time_start)/60);

        printf("%s",buffer);
        fprintf(fLoader, "%s", buffer);

        fclose(fLoader);

        dbexit();
```

```
    exit(0);
}


//========================================================================
//
// Function name: LoadItem
//
//========================================================================

void LoadItem()
{
    long   i_id;
       long   i_im_id;
    char   i_name[I_NAME_LEN+1];
    double i_price;
    char   i_data[I_DATA_LEN+1];
       char   name[20];
       long   time_start;

       printf("\nLoading item table...\n");

       // Seed with unique number
       seed(1);

       InitString(i_name, I_NAME_LEN+1);
       InitString(i_data, I_DATA_LEN+1);

       sprintf(name, "%s..%s", aptr->database, "item");
       bcp_init(i_dbproc1, name, NULL, "logs\\item.err", DB_IN);

       bcp_bind(i_dbproc1, (BYTE *) &i_id,      0, -1,         NULL, 0,
0, 1);
       bcp_bind(i_dbproc1, (BYTE *) &i_im_id,   0, -1,         NULL, 0,
0, 2);
       bcp_bind(i_dbproc1, (BYTE *) i_name,     0, I_NAME_LEN, NULL, 0,
0, 3);
       bcp_bind(i_dbproc1, (BYTE *) &i_price,   0, -1,         NULL, 0,
SQLFLT8, 4);
       bcp_bind(i_dbproc1, (BYTE *) i_data,     0, I_DATA_LEN, NULL, 0,
0, 5);

       time_start = (TimeNow() / MILLI);

       item_rows_loaded = 0;

       for (i_id = 1; i_id <= MAXITEMS; i_id++)
       {
              i_im_id = RandomNumber(1L, 10000L);

              MakeAlphaString(14, 24, I_NAME_LEN, i_name);

              i_price = ((float) RandomNumber(100L, 10000L))/100.0;

              MakeOriginalAlphaString(26, 50, I_DATA_LEN, i_data, 10);

              if (!bcp_sendrow(i_dbproc1))
                     printf("Error, LoadItem() failed calling
bcp_sendrow().  Check error file.\n");
              item_rows_loaded++;
              CheckForCommit(i_dbproc1, item_rows_loaded, "item",
&time_start);
       }

       bcp_done(i_dbproc1);
       dbclose(i_dbproc1);

       printf("Finished loading item table.\n");

       if (aptr->build_index == 1)
              BuildIndex("idxitmcl");

       InterlockedIncrement(&main_threads_completed);
}


//========================================================================
//
// Function   : LoadWarehouse
//
// Loads WAREHOUSE table and loads Stock and District as Warehouses are
created
//
//========================================================================

void LoadWarehouse()
{
    short  w_id;
    char   w_name[W_NAME_LEN+1];
    char   w_street_1[ADDRESS_LEN+1];
    char   w_street_2[ADDRESS_LEN+1];
    char   w_city[ADDRESS_LEN+1];
    char   w_state[STATE_LEN+1];
    char   w_zip[ZIP_LEN+1];
    double w_tax;
    double w_ytd;
       char   name[20];
       long   time_start;


       printf("\nLoading warehouse table...\n");

       // Seed with unique number
       seed(2);

       InitString(w_name, W_NAME_LEN+1);
       InitAddress(w_street_1, w_street_2, w_city, w_state, w_zip);

       sprintf(name, "%s..%s", aptr->database, "warehouse");
       bcp_init(w_dbproc1, name, NULL, "logs\\whouse.err", DB_IN);

       bcp_bind(w_dbproc1, (BYTE *) &w_id,         0, -1,           NULL,
0, 0, 1);
       bcp_bind(w_dbproc1, (BYTE *) w_name,        0, W_NAME_LEN,   NULL,
0, 0, 2);
       bcp_bind(w_dbproc1, (BYTE *) w_street_1,    0, ADDRESS_LEN,  NULL,
0, 0, 3);
       bcp_bind(w_dbproc1, (BYTE *) w_street_2,    0, ADDRESS_LEN,  NULL,
0, 0, 4);
```

```
        bcp_bind(w_dbproc1, (BYTE *) w_city,        0, ADDRESS_LEN,  NULL,
0, 0, 5);
        bcp_bind(w_dbproc1, (BYTE *) w_state,       0, STATE_LEN,    NULL,
0, 0, 6);
        bcp_bind(w_dbproc1, (BYTE *) w_zip,         0, ZIP_LEN,      NULL,
0, 0, 7);
        bcp_bind(w_dbproc1, (BYTE *) &w_tax,        0, -1,           NULL,
0, SQLFLT8, 8);
        bcp_bind(w_dbproc1, (BYTE *) &w_ytd,        0, -1,           NULL,
0, SQLFLT8, 9);

        time_start = (TimeNow() / MILLI);

        warehouse_rows_loaded = 0;

        for (w_id = aptr->starting_warehouse; w_id < aptr-
>num_warehouses+1; w_id++)
        {

                MakeAlphaString(6,10, W_NAME_LEN, w_name);

                MakeAddress(w_street_1, w_street_2, w_city, w_state,
w_zip);

                w_tax = ((float) RandomNumber(0L,2000L))/10000.00;

                w_ytd = 300000.00;

                if (!bcp_sendrow(w_dbproc1))
                printf("Error, LoadWarehouse() failed calling
bcp_sendrow().  Check error file.\n");
                warehouse_rows_loaded++;
                CheckForCommit(i_dbproc1, warehouse_rows_loaded,
"warehouse", &time_start);
        }

        bcp_done(w_dbproc1);
        dbclose(w_dbproc1);

        printf("Finished loading warehouse table.\n");

        if (aptr->build_index == 1)
                BuildIndex("idxwarcl");

        stock_rows_loaded = 0;
        district_rows_loaded = 0;

        District(w_id);
        Stock(w_id);

        InterlockedIncrement(&main_threads_completed);
}


//==============================================================================
//
// Function   : District
//
//==============================================================================

void District()
{
    short  d_id;
    short  d_w_id;
    char   d_name[D_NAME_LEN+1];
    char   d_street_1[ADDRESS_LEN+1];
    char   d_street_2[ADDRESS_LEN+1];
    char   d_city[ADDRESS_LEN+1];
    char   d_state[STATE_LEN+1];
    char   d_zip[ZIP_LEN+1];
    double d_tax;
    double d_ytd;
       char   name[20];
    long   d_next_o_id;
    int    rc;
       long   time_start;
       int        w_id;

       for (w_id = aptr->starting_warehouse; w_id < aptr-
>num_warehouses+1; w_id++)
       {

               printf("...Loading district table: w_id = %ld\n", w_id);

               // Seed with unique number
               seed(4);

               InitString(d_name, D_NAME_LEN+1);

               InitAddress(d_street_1, d_street_2, d_city, d_state,
d_zip);

               sprintf(name, "%s..%s", aptr->database, "district");
               rc = bcp_init(w_dbproc2, name, NULL, "logs\\district.err",
DB_IN);

               bcp_bind(w_dbproc2, (BYTE *) &d_id,          0, -1,
NULL, 0, 0, 1);
               bcp_bind(w_dbproc2, (BYTE *) &d_w_id,        0, -1,
NULL, 0, 0, 2);
               bcp_bind(w_dbproc2, (BYTE *) d_name,         0, D_NAME_LEN,
NULL, 0, 0, 3);
               bcp_bind(w_dbproc2, (BYTE *) d_street_1,     0,
ADDRESS_LEN,   NULL, 0, 0, 4);
               bcp_bind(w_dbproc2, (BYTE *) d_street_2,     0,
ADDRESS_LEN,   NULL, 0, 0, 5);
               bcp_bind(w_dbproc2, (BYTE *) d_city,         0,
ADDRESS_LEN,   NULL, 0, 0, 6);
               bcp_bind(w_dbproc2, (BYTE *) d_state,        0, STATE_LEN,
NULL, 0, 0, 7);
               bcp_bind(w_dbproc2, (BYTE *) d_zip,          0, ZIP_LEN,
NULL, 0, 0, 8);
               bcp_bind(w_dbproc2, (BYTE *) &d_tax,         0, -1,
NULL, 0, SQLFLT8, 9);
               bcp_bind(w_dbproc2, (BYTE *) &d_ytd,         0, -1,
NULL, 0, SQLFLT8, 10);
               bcp_bind(w_dbproc2, (BYTE *) &d_next_o_id,   0, -1,
NULL, 0, 0, 11);

               d_w_id = w_id;

               d_ytd  = 30000.0;
```

```
                d_next_o_id = 3001L;

                time_start = (TimeNow() / MILLI);

                for (d_id = 1; d_id <= DISTRICT_PER_WAREHOUSE; d_id++)
                {
                        MakeAlphaString(6,10,D_NAME_LEN, d_name);

                        MakeAddress(d_street_1, d_street_2, d_city,
d_state, d_zip);

                        d_tax = ((float) RandomNumber(0L,2000L))/10000.00;

                        if (!bcp_sendrow(w_dbproc2))
                                printf("Error, District() failed calling
bcp_sendrow().  Check error file.\n");
                        district_rows_loaded++;
                        CheckForCommit(w_dbproc2, district_rows_loaded,
"district", &time_start);
                }

                rc = bcp_done(w_dbproc2);
        }

        printf("Finished loading district table.\n");

        if (aptr->build_index == 1)
                BuildIndex("idxdiscl");

    return;
}


//============================================================================
//
// Function   : Stock
//
//============================================================================

void Stock()
{
    long  s_i_id;
    short s_w_id;
    short s_quantity;
    char  s_dist_01[S_DIST_LEN+1];
    char  s_dist_02[S_DIST_LEN+1];
    char  s_dist_03[S_DIST_LEN+1];
    char  s_dist_04[S_DIST_LEN+1];
    char  s_dist_05[S_DIST_LEN+1];
    char  s_dist_06[S_DIST_LEN+1];
    char  s_dist_07[S_DIST_LEN+1];
    char  s_dist_08[S_DIST_LEN+1];
    char  s_dist_09[S_DIST_LEN+1];
    char  s_dist_10[S_DIST_LEN+1];
    long  s_ytd;
    short s_order_cnt;
    short s_remote_cnt;
    char  s_data[S_DATA_LEN+1];
    short i;
    short len;
    int   rc;
        char  name[20];
        long  time_start;

        // Seed with unique number
        seed(3);

        sprintf(name, "%s..%s", aptr->database, "stock");
        rc = bcp_init(w_dbproc2, name, NULL, "logs\\stock.err", DB_IN);

        bcp_bind(w_dbproc2, (BYTE *) &s_i_id,       0, -1,         NULL,
0, 0, 1);
        bcp_bind(w_dbproc2, (BYTE *) &s_w_id,       0, -1,         NULL,
0, 0, 2);
        bcp_bind(w_dbproc2, (BYTE *) &s_quantity,   0, -1,         NULL,
0, 0, 3);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_01,     0, S_DIST_LEN, NULL,
0, 0, 4);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_02,     0, S_DIST_LEN, NULL,
0, 0, 5);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_03,     0, S_DIST_LEN, NULL,
0, 0, 6);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_04,     0, S_DIST_LEN, NULL,
0, 0, 7);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_05,     0, S_DIST_LEN, NULL,
0, 0, 8);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_06,     0, S_DIST_LEN, NULL,
0, 0, 9);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_07,     0, S_DIST_LEN, NULL,
0, 0, 10);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_08,     0, S_DIST_LEN, NULL,
0, 0, 11);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_09,     0, S_DIST_LEN, NULL,
0, 0, 12);
        bcp_bind(w_dbproc2, (BYTE *) s_dist_10,     0, S_DIST_LEN, NULL,
0, 0, 13);
        bcp_bind(w_dbproc2, (BYTE *) &s_ytd,        0, -1,         NULL,
0, 0, 14);
        bcp_bind(w_dbproc2, (BYTE *) &s_order_cnt,  0, -1,         NULL,
0, 0, 15);
        bcp_bind(w_dbproc2, (BYTE *) &s_remote_cnt, 0, -1,         NULL,
0, 0, 16);
        bcp_bind(w_dbproc2, (BYTE *) s_data,        0, S_DATA_LEN,   NULL,
0, 0, 17);

        s_ytd = s_order_cnt = s_remote_cnt = 0;

        time_start = (TimeNow() / MILLI);

        printf("...Loading stock table\n");

        for (s_i_id=1; s_i_id <= MAXITEMS; s_i_id++)
        {

                for (s_w_id = aptr->starting_warehouse; s_w_id < aptr-
>num_warehouses+1; s_w_id++)
                {

                        s_quantity = RandomNumber(10L,100L);
```

```
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_01);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_02);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_03);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_04);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_05);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_06);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_07);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_08);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_09);
                        len = MakeAlphaString(24,24,S_DIST_LEN, s_dist_10);

                        len = MakeOriginalAlphaString(26,50, S_DATA_LEN,
s_data,10);

                        if (!bcp_sendrow(w_dbproc2))
                        printf("Error, Stock() failed calling
bcp_sendrow().  Check error file.\n");
                        stock_rows_loaded++;
                        CheckForCommit(w_dbproc2, stock_rows_loaded,
"stock", &time_start);

                }
        }

        bcp_done(w_dbproc2);
        dbclose(w_dbproc2);

        printf("Finished loading stock table.\n");

        if (aptr->build_index == 1)
                BuildIndex("idxstkcl");

        return;
}


//============================================================================
//
// Function   : LoadCustomer
//
//============================================================================

void LoadCustomer()
{
        LOADER_TIME_STRUCT      customer_time_start;
        LOADER_TIME_STRUCT      history_time_start;
        short                           w_id;
    short                       d_id;
        DWORD                           dwThreadID[MAX_CUSTOMER_THREADS];
        HANDLE                          hThread[MAX_CUSTOMER_THREADS];
        char                            name[20];
        char                                    buf[250];

        printf("\nLoading customer and history tables...\n");

        // Seed with unique number
        seed(5);

        // Initialize bulk copy
        sprintf(name, "%s..%s", aptr->database, "customer");
        bcp_init(c_dbproc1, name, NULL, "logs\\customer.err", DB_IN);

        sprintf(name, "%s..%s", aptr->database, "history");
        bcp_init(c_dbproc2, name, NULL, "logs\\history.err", DB_IN);

        customer_rows_loaded    = 0;
        history_rows_loaded     = 0;

        CustomerBufInit();

        customer_time_start.time_start = (TimeNow() / MILLI);
        history_time_start.time_start = (TimeNow() / MILLI);

        for (w_id = aptr->starting_warehouse; w_id <= aptr-
>num_warehouses; w_id++)
        {
                for (d_id = 1L; d_id <= DISTRICT_PER_WAREHOUSE; d_id++)
                {

                        CustomerBufLoad(d_id, w_id);

                        // Start parallel loading threads here...

                        customer_threads_completed=0;

                        // Start customer table thread

                        printf("...Loading customer table for: d_id = %d,
w_id = %d\n", d_id, w_id);

                        hThread[0] = CreateThread(NULL,
                                                                                0,

(LPTHREAD_START_ROUTINE) LoadCustomerTable,

&customer_time_start,
                                                                                0,

&dwThreadID[0]);

                        if (hThread[0] == NULL)
                        {
                                printf("Error, failed in creating creating
thread = 0.\n");
                                exit(-1);
                        }

                        // Start History table thread

                        printf("...Loading history table for: d_id = %d,
w_id = %d\n", d_id, w_id);

                        hThread[1] = CreateThread(NULL,
                                                                                0,

(LPTHREAD_START_ROUTINE) LoadHistoryTable,

&history_time_start,
                                                                                0,

&dwThreadID[1]);
```

```
                        if (hThread[1] == NULL)
                        {
                                printf("Error, failed in creating creating
thread = 1.\n");
                                exit(-1);
                        }

                        while (customer_threads_completed != 2)
                                Sleep(1000L);
                }
        }

        // flush the bulk connection
        bcp_done(c_dbproc1);
        bcp_done(c_dbproc2);

    sprintf(buf,"update customer set c_first = 'C_LOAD = %d' where c_id =
1 and c_w_id = 1 and c_d_id = 1",LOADER_NURAND_C);
        dbcmd(c_dbproc1, buf);
        dbsqlexec(c_dbproc1);
        while (dbresults(c_dbproc1) != NO_MORE_RESULTS);

        dbclose(c_dbproc1);
        dbclose(c_dbproc2);

        printf("Finished loading customer table.\n");

        if (aptr->build_index == 1)
                BuildIndex("idxcuscl");

        if (aptr->build_index == 1)
                BuildIndex("idxcusnc");

        InterlockedIncrement(&main_threads_completed);

    return;

}


//============================================================================
//
// Function   : CustomerBufInit
//
//============================================================================

void CustomerBufInit()
{
        int     i;

        for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
        {
                customer_buf[i].c_id = 0;
                customer_buf[i].c_d_id = 0;
                customer_buf[i].c_w_id = 0;

                strcpy(customer_buf[i].c_first,"");
                strcpy(customer_buf[i].c_middle,"");
                strcpy(customer_buf[i].c_last,"");
                strcpy(customer_buf[i].c_street_1,"");
                strcpy(customer_buf[i].c_street_2,"");
                strcpy(customer_buf[i].c_city,"");
                strcpy(customer_buf[i].c_state,"");
                strcpy(customer_buf[i].c_zip,"");
                strcpy(customer_buf[i].c_phone,"");
                strcpy(customer_buf[i].c_credit,"");

                customer_buf[i].c_credit_lim = 0;
                customer_buf[i].c_discount = (float) 0;
                customer_buf[i].c_balance = 0;
                customer_buf[i].c_ytd_payment = 0;
                customer_buf[i].c_payment_cnt = 0;
                customer_buf[i].c_delivery_cnt = 0;

                strcpy(customer_buf[i].c_data_1,"");
                strcpy(customer_buf[i].c_data_2,"");

                customer_buf[i].h_amount = 0;

                strcpy(customer_buf[i].h_data,"");

        }


}


//============================================================================
//
// Function   : CustomerBufLoad
//
// Fills shared buffer for HISTORY and CUSTOMER
//============================================================================

void CustomerBufLoad(int d_id, int w_id)
{
        long                                    i;
    CUSTOMER_SORT_STRUCT    c[CUSTOMERS_PER_DISTRICT];


        for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
        {
                if (i < 1000)
                        LastName(i, c[i].c_last);
                else
                        LastName(NURand(255,0,999,LOADER_NURAND_C),
c[i].c_last);

                MakeAlphaString(8,16,FIRST_NAME_LEN, c[i].c_first);

                c[i].c_id = i+1;

        }

        printf("...Loading customer buffer for: d_id = %d, w_id = %d\n",
                        d_id, w_id);

        for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
        {
```

```
                customer_buf[i].c_d_id = d_id;
                customer_buf[i].c_w_id = w_id;
                customer_buf[i].h_amount = 10.0;
                customer_buf[i].c_ytd_payment  = 10.0;
                customer_buf[i].c_payment_cnt  = 1;
                customer_buf[i].c_delivery_cnt = 0;

                // Generate CUSTOMER and HISTORY data

                customer_buf[i].c_id = c[i].c_id;

                strcpy(customer_buf[i].c_first, c[i].c_first);
                strcpy(customer_buf[i].c_last, c[i].c_last);

                customer_buf[i].c_middle[0] = 'O';
                customer_buf[i].c_middle[1] = 'E';

                MakeAddress(customer_buf[i].c_street_1,
                                customer_buf[i].c_street_2,
                                customer_buf[i].c_city,
                                customer_buf[i].c_state,
                                customer_buf[i].c_zip);

                MakeNumberString(16, 16, PHONE_LEN,
customer_buf[i].c_phone);

                if (RandomNumber(1L, 100L) > 10)
                        customer_buf[i].c_credit[0] = 'G';
                else
                        customer_buf[i].c_credit[0] = 'B';
                customer_buf[i].c_credit[1] = 'C';

                customer_buf[i].c_credit_lim = 50000.0;
                customer_buf[i].c_discount = ((float) RandomNumber(0L,
5000L)) / 10000.0;
                customer_buf[i].c_balance = -10.0;

                MakeAlphaString(250, 250, C_DATA_LEN,
customer_buf[i].c_data_1);
                MakeAlphaString(50, 250, C_DATA_LEN,
customer_buf[i].c_data_2);

                // Generate HISTORY data
                MakeAlphaString(12, 24, H_DATA_LEN,
customer_buf[i].h_data);

        }
}

//============================================================================
//
// Function   : LoadCustomerTable
//
//============================================================================

void LoadCustomerTable(LOADER_TIME_STRUCT *customer_time_start)
{
        int         i;
    long        c_id;
    short       c_d_id;
    short       c_w_id;
    char        c_first[FIRST_NAME_LEN+1];
    char        c_middle[MIDDLE_NAME_LEN+1];
    char        c_last[LAST_NAME_LEN+1];
    char        c_street_1[ADDRESS_LEN+1];
    char        c_street_2[ADDRESS_LEN+1];
    char        c_city[ADDRESS_LEN+1];
    char        c_state[STATE_LEN+1];
    char        c_zip[ZIP_LEN+1];
    char        c_phone[PHONE_LEN+1];
    char        c_credit[CREDIT_LEN+1];
    double      c_credit_lim;
    double      c_discount;
    double      c_balance;
    double      c_ytd_payment;
    short       c_payment_cnt;
    short       c_delivery_cnt;
    char        c_data_1[C_DATA_LEN+1];
    char        c_data_2[C_DATA_LEN+1];
       char        name[20];
       char           c_since[50];

    bcp_bind(c_dbproc1, (BYTE *) &c_id,          0, -1,
NULL,0,0, 1);
    bcp_bind(c_dbproc1, (BYTE *) &c_d_id,        0, -1,
NULL,0,0, 2);
    bcp_bind(c_dbproc1, (BYTE *) &c_w_id,        0, -1,
NULL,0,0, 3);
    bcp_bind(c_dbproc1, (BYTE *) c_first,        0, FIRST_NAME_LEN,
NULL,0,0, 4);
    bcp_bind(c_dbproc1, (BYTE *) c_middle,       0,
MIDDLE_NAME_LEN,NULL,0,0, 5);
    bcp_bind(c_dbproc1, (BYTE *) c_last,         0, LAST_NAME_LEN,
NULL,0,0, 6);
    bcp_bind(c_dbproc1, (BYTE *) c_street_1,     0, ADDRESS_LEN,
NULL,0,0, 7);
    bcp_bind(c_dbproc1, (BYTE *) c_street_2,     0, ADDRESS_LEN,
NULL,0,0, 8);
    bcp_bind(c_dbproc1, (BYTE *) c_city,         0, ADDRESS_LEN,
NULL,0,0, 9);
    bcp_bind(c_dbproc1, (BYTE *) c_state,        0, STATE_LEN,
NULL,0,0,10);
    bcp_bind(c_dbproc1, (BYTE *) c_zip,          0, ZIP_LEN,
NULL,0,0,11);
    bcp_bind(c_dbproc1, (BYTE *) c_phone,        0, PHONE_LEN,
NULL,0,0,12);
       bcp_bind(c_dbproc1, (BYTE *) c_since,        0, 50,
NULL,0,SQLCHAR,13);
    bcp_bind(c_dbproc1, (BYTE *) c_credit,       0, CREDIT_LEN,
NULL,0,0,14);
    bcp_bind(c_dbproc1, (BYTE *) &c_credit_lim,  0, -1,
NULL,0,SQLFLT8,15);
    bcp_bind(c_dbproc1, (BYTE *) &c_discount,    0, -1,
NULL,0,SQLFLT8,16);
    bcp_bind(c_dbproc1, (BYTE *) &c_balance,     0, -1,
NULL,0,SQLFLT8,17);
    bcp_bind(c_dbproc1, (BYTE *) &c_ytd_payment, 0, -1,
NULL,0,SQLFLT8,18);
    bcp_bind(c_dbproc1, (BYTE *) &c_payment_cnt, 0, -1,
NULL,0,0,19);
    bcp_bind(c_dbproc1, (BYTE *) &c_delivery_cnt,0, -1,
NULL,0,0,20);
```

```
    bcp_bind(c_dbproc1, (BYTE *) c_data_1,       0, C_DATA_LEN,
NULL,0,0,21);
    bcp_bind(c_dbproc1, (BYTE *) c_data_2,       0, C_DATA_LEN,
NULL,0,0,22);

    for (i = 0; i < CUSTOMERS_PER_DISTRICT; i++)
    {
            c_id = customer_buf[i].c_id;
            c_d_id = customer_buf[i].c_d_id;
            c_w_id = customer_buf[i].c_w_id;

            strcpy(c_first, customer_buf[i].c_first);
            strcpy(c_middle, customer_buf[i].c_middle);
            strcpy(c_last, customer_buf[i].c_last);
            strcpy(c_street_1, customer_buf[i].c_street_1);
            strcpy(c_street_2, customer_buf[i].c_street_2);
            strcpy(c_city, customer_buf[i].c_city);
            strcpy(c_state, customer_buf[i].c_state);
            strcpy(c_zip, customer_buf[i].c_zip);
            strcpy(c_phone, customer_buf[i].c_phone);
            strcpy(c_credit, customer_buf[i].c_credit);

            CurrentDate(&c_since);

            c_credit_lim = customer_buf[i].c_credit_lim;
            c_discount = customer_buf[i].c_discount;
            c_balance = customer_buf[i].c_balance;
            c_ytd_payment = customer_buf[i].c_ytd_payment;
            c_payment_cnt = customer_buf[i].c_payment_cnt;
            c_delivery_cnt = customer_buf[i].c_delivery_cnt;

            strcpy(c_data_1, customer_buf[i].c_data_1);
            strcpy(c_data_2, customer_buf[i].c_data_2);

            // Send data to server
            if (!bcp_sendrow(c_dbproc1))
            printf("Error, LoadCustomerTable() failed calling
bcp_sendrow().  Check error file.\n");
            customer_rows_loaded++;
            CheckForCommit(c_dbproc1, customer_rows_loaded, "customer",
&customer_time_start->time_start);
    }

        InterlockedIncrement(&customer_threads_completed);

}


//============================================================================
//
// Function   : LoadHistoryTable
//
//============================================================================

void LoadHistoryTable(LOADER_TIME_STRUCT *history_time_start)
{
        int         i;
    long        c_id;
    short       c_d_id;
    short       c_w_id;
        double          h_amount;
    char        h_data[H_DATA_LEN+1];
        char            h_date[50];

    bcp_bind(c_dbproc2, (BYTE *) &c_id,          0, -1,           NULL, 0,
0, 1);
    bcp_bind(c_dbproc2, (BYTE *) &c_d_id,        0, -1,           NULL, 0,
0, 2);
    bcp_bind(c_dbproc2, (BYTE *) &c_w_id,        0, -1,           NULL, 0,
0, 3);
    bcp_bind(c_dbproc2, (BYTE *) &c_d_id,        0, -1,           NULL, 0,
0, 4);
    bcp_bind(c_dbproc2, (BYTE *) &c_w_id,        0, -1,           NULL, 0,
0, 5);
    bcp_bind(c_dbproc2, (BYTE *) h_date,         0, 50,           NULL, 0,
SQLCHAR, 6);
    bcp_bind(c_dbproc2, (BYTE *) &h_amount,      0, -1,           NULL, 0,
SQLFLT8, 7);
    bcp_bind(c_dbproc2, (BYTE *) h_data,         0, H_DATA_LEN,   NULL, 0,
0, 8);

    for (i = 0; i < CUSTOMERS_PER_DISTRICT; i++)
    {
                c_id = customer_buf[i].c_id;
                c_d_id = customer_buf[i].c_d_id;
                c_w_id = customer_buf[i].c_w_id;
                h_amount = customer_buf[i].h_amount;
                strcpy(h_data, customer_buf[i].h_data);
                CurrentDate(&h_date);

                // send to server
                if (!bcp_sendrow(c_dbproc2))
                printf("Error, LoadHistoryTable() failed calling
bcp_sendrow().  Check error file.\n");
                history_rows_loaded++;
                CheckForCommit(c_dbproc2, history_rows_loaded, "history",
&history_time_start->time_start);
    }

        InterlockedIncrement(&customer_threads_completed);

}


//============================================================-
===============
//
// Function   : LoadOrders
//
//============================================================================
====

void LoadOrders()
{
        LOADER_TIME_STRUCT      orders_time_start;
        LOADER_TIME_STRUCT      new_order_time_start;
        LOADER_TIME_STRUCT      order_line_time_start;
        short                       w_id;
    short                   d_id;
        DWORD                       dwThreadID[MAX_ORDER_THREADS];
```

```
        HANDLE                          hThread[MAX_ORDER_THREADS];
        char                            name[20];


        printf("\nLoading orders...\n");

        // seed with unique number
        seed(6);

        // initialize bulk copy
        sprintf(name, "%s..%s", aptr->database, "orders");
        bcp_init(o_dbproc1, name, NULL, "logs\\orders.err", DB_IN);

        sprintf(name, "%s..%s", aptr->database, "new_order");
        bcp_init(o_dbproc2, name, NULL, "logs\\neword.err", DB_IN);

        sprintf(name, "%s..%s", aptr->database, "order_line");
        bcp_init(o_dbproc3, name, NULL, "logs\\ordline.err", DB_IN);

        orders_rows_loaded      = 0;
        new_order_rows_loaded   = 0;
        order_line_rows_loaded  = 0;

        OrdersBufInit();

        orders_time_start.time_start = (TimeNow() / MILLI);
        new_order_time_start.time_start = (TimeNow() / MILLI);
        order_line_time_start.time_start = (TimeNow() / MILLI);

        for (w_id = aptr->starting_warehouse; w_id <= aptr-
>num_warehouses; w_id++)
        {
                for (d_id = 1L; d_id <= DISTRICT_PER_WAREHOUSE; d_id++)
                {

                        OrdersBufLoad(d_id, w_id);

                        // start parallel loading threads here...

                        order_threads_completed=0;

                        // start Orders table thread

                        printf("...Loading Order Table for: d_id = %d, w_id
= %d\n", d_id, w_id);

                        hThread[0] = CreateThread(NULL,
                                                                        0,

(LPTHREAD_START_ROUTINE) LoadOrdersTable,

&orders_time_start,
                                                                        0,

&dwThreadID[0]);

                        if (hThread[0] == NULL)
                        {
                                printf("Error, failed in creating creating
thread = 0.\n");
                                exit(-1);
                        }

                        // start NewOrder table thread

                        printf("...Loading New-Order Table for: d_id = %d,
w_id = %d\n", d_id, w_id);

                        hThread[1] = CreateThread(NULL,
                                                                        0,

(LPTHREAD_START_ROUTINE) LoadNewOrderTable,

&new_order_time_start,
                                                                        0,

&dwThreadID[1]);

                        if (hThread[1] == NULL)
                        {
                                printf("Error, failed in creating creating
thread = 1.\n");
                                exit(-1);
                        }

                        // start Order-Line table thread

                        printf("...Loading Order-Line Table for: d_id = %d,
w_id = %d\n", d_id, w_id);

                        hThread[2] = CreateThread(NULL,
                                                                        0,

(LPTHREAD_START_ROUTINE) LoadOrderLineTable,

&order_line_time_start,
                                                                        0,

&dwThreadID[2]);

                        if (hThread[2] == NULL)
                        {
                                printf("Error, failed in creating creating
thread = 2.\n");
                                exit(-1);
                        }

                        while (order_threads_completed != 3)
                                Sleep(1000L);

                }
        }

        printf("Finished loading orders.\n");

        InterlockedIncrement(&main_threads_completed);

    return;
}

//============================================================================
```

```
//
// Function   : OrdersBufInit
//
// Clears shared buffer for ORDERS, NEWORDER, and ORDERLINE
//
//============================================================================

void OrdersBufInit()
{
        int     i;
        int             j;

        for (i=0;i<ORDERS_PER_DISTRICT;i++)
        {
                orders_buf[i].o_id = 0;
                orders_buf[i].o_d_id = 0;
                orders_buf[i].o_w_id = 0;
                orders_buf[i].o_c_id = 0;
                orders_buf[i].o_carrier_id = 0;
                orders_buf[i].o_ol_cnt = 0;
                orders_buf[i].o_all_local = 0;

                for (j=0;j<=14;j++)
                {
                        orders_buf[i].o_ol[j].ol = 0;
                        orders_buf[i].o_ol[j].ol_i_id = 0;
                        orders_buf[i].o_ol[j].ol_supply_w_id = 0;
                        orders_buf[i].o_ol[j].ol_quantity = 0;
                        orders_buf[i].o_ol[j].ol_amount = 0;
                        strcpy(orders_buf[i].o_ol[j].ol_dist_info,"");
                }
        }


}


//============================================================================
//
// Function   : OrdersBufLoad
//
// Fills shared buffer for ORDERS, NEWORDER, and ORDERLINE
//
//============================================================================

void OrdersBufLoad(int d_id, int w_id)
{

        int     cust[ORDERS_PER_DIST+1];
        long    o_id;
        short   ol;

        printf("...Loading Order Buffer for: d_id = %d, w_id = %d\n",
                        d_id, w_id);

        GetPermutation(cust, ORDERS_PER_DIST);

        for (o_id=0;o_id<ORDERS_PER_DISTRICT;o_id++)
        {
                // Generate ORDER and NEW-ORDER data

                orders_buf[o_id].o_d_id = d_id;
                orders_buf[o_id].o_w_id = w_id;
                orders_buf[o_id].o_id = o_id+1;
                orders_buf[o_id].o_c_id = cust[o_id+1];
                orders_buf[o_id].o_ol_cnt = RandomNumber(5L, 15L);

                if (o_id < 2100)
                {
                        orders_buf[o_id].o_carrier_id = RandomNumber(1L,
10L);
                        orders_buf[o_id].o_all_local  = 1;
                }
                else
                {
                        orders_buf[o_id].o_carrier_id = 0;
                        orders_buf[o_id].o_all_local  = 1;
                }

                for (ol=0;ol<orders_buf[o_id].o_ol_cnt;ol++)
                {

                        orders_buf[o_id].o_ol[ol].ol = ol+1;
                        orders_buf[o_id].o_ol[ol].ol_i_id =
RandomNumber(1L, MAXITEMS);
                        orders_buf[o_id].o_ol[ol].ol_supply_w_id = w_id;
                        orders_buf[o_id].o_ol[ol].ol_quantity = 5;
                        MakeAlphaString(24, 24, OL_DIST_INFO_LEN,
&orders_buf[o_id].o_ol[ol].ol_dist_info);

                        // Generate ORDER-LINE data
                        if (o_id < 2100)
                        {
                                orders_buf[o_id].o_ol[ol].ol_amount = 0;
                                // Added to insure ol_delivery_d set
properly during load

        CurrentDate(&orders_buf[o_id].o_ol[ol].ol_delivery_d);
                        }
                        else
                        {
                                orders_buf[o_id].o_ol[ol].ol_amount =
RandomNumber(1,999999)/100.0;
                                // Added to insure ol_delivery_d set
properly during load

        strcpy(orders_buf[o_id].o_ol[ol].ol_delivery_d,"Dec 31, 1889");
                        }
                }
        }
}


//============================================================================
//
// Function   : LoadOrdersTable
//
//============================================================================
```

```
void LoadOrdersTable(LOADER_TIME_STRUCT *orders_time_start)
{
        int         i;
    long        o_id;
        short           o_d_id;
        short           o_w_id;
    long        o_c_id;
    short       o_carrier_id;
    short       o_ol_cnt;
    short       o_all_local;
        char            o_entry_d[50];

        // bind ORDER data
    bcp_bind(o_dbproc1, (BYTE *) &o_id,          0, -1,          NULL, 0,
0, 1);
    bcp_bind(o_dbproc1, (BYTE *) &o_d_id,        0, -1,          NULL, 0,
0, 2);
    bcp_bind(o_dbproc1, (BYTE *) &o_w_id,        0, -1,          NULL, 0,
0, 3);
    bcp_bind(o_dbproc1, (BYTE *) &o_c_id,        0, -1,          NULL, 0,
0, 4);
    bcp_bind(o_dbproc1, (BYTE *) o_entry_d,      0, 50,          NULL, 0,
SQLCHAR, 5);
    bcp_bind(o_dbproc1, (BYTE *) &o_carrier_id,  0, -1,          NULL, 0,
0, 6);
    bcp_bind(o_dbproc1, (BYTE *) &o_ol_cnt,      0, -1,          NULL, 0,
0, 7);
    bcp_bind(o_dbproc1, (BYTE *) &o_all_local,   0, -1,          NULL, 0,
0, 8);

    for (i = 0; i < ORDERS_PER_DISTRICT; i++)
    {
                o_id         = orders_buf[i].o_id;
                o_d_id       = orders_buf[i].o_d_id;
                o_w_id       = orders_buf[i].o_w_id;
                o_c_id       = orders_buf[i].o_c_id;
                o_carrier_id = orders_buf[i].o_carrier_id;
                o_ol_cnt     = orders_buf[i].o_ol_cnt;
                o_all_local  = orders_buf[i].o_all_local;
                CurrentDate(&o_entry_d);

                // send data to server
                if (!bcp_sendrow(o_dbproc1))
                printf("Error, LoadOrdersTable() failed calling
bcp_sendrow().  Check error file.\n");
                orders_rows_loaded++;
                // CheckForCommit(o_dbproc1, orders_rows_loaded, "ORDERS",
&orders_time_start->time_start);
    }

        bcp_batch(o_dbproc1);

        if ((o_w_id == aptr->num_warehouses) && (o_d_id == 10))
        {
                bcp_done(o_dbproc1);
                dbclose(o_dbproc1);

                if (aptr->build_index == 1)
                        BuildIndex("idxordcl");
        }

        InterlockedIncrement(&order_threads_completed);

}


//============================================================================
//
// Function   : LoadNewOrderTable
//
//============================================================================

void LoadNewOrderTable(LOADER_TIME_STRUCT *new_order_time_start)
{
    int         i;
    long        o_id;
    short       o_d_id;
    short       o_w_id;

        // Bind NEW-ORDER data
    bcp_bind(o_dbproc2, (BYTE *) &o_id,          0, -1, NULL, 0, 0, 1);
    bcp_bind(o_dbproc2, (BYTE *) &o_d_id,        0, -1, NULL, 0, 0, 2);
    bcp_bind(o_dbproc2, (BYTE *) &o_w_id,        0, -1, NULL, 0, 0, 3);

        for (i = 2100; i < 3000; i++)
        {
                o_id    = orders_buf[i].o_id;
                o_d_id  = orders_buf[i].o_d_id;
                o_w_id  = orders_buf[i].o_w_id;

                if (!bcp_sendrow(o_dbproc2))
                printf("Error, LoadNewOrderTable() failed calling
bcp_sendrow().  Check error file.\n");
                new_order_rows_loaded++;
                // CheckForCommit(o_dbproc2, new_order_rows_loaded,
"NEW_ORDER", &new_order_time_start->time_start);
        }

        bcp_batch(o_dbproc2);

        if ((o_w_id == aptr->num_warehouses) && (o_d_id == 10))
        {
                bcp_done(o_dbproc2);
                dbclose(o_dbproc2);

                if (aptr->build_index == 1)
                        BuildIndex("idxnodcl");
        }

        InterlockedIncrement(&order_threads_completed);

}


//============================================================================
//
// Function   : LoadOrderLineTable
//
//============================================================================

void LoadOrderLineTable(LOADER_TIME_STRUCT *order_line_time_start)
{
```

```
        int         i,j;
    long        o_id;
        short           o_d_id;
        short           o_w_id;
    long        ol;
        long            ol_i_id;
    short       ol_supply_w_id;
    short       ol_quantity;
    double      ol_amount;
    short       o_all_local;
    char        ol_dist_info[DIST_INFO_LEN+1];
        char            ol_delivery_d[50];

        // bind ORDER-LINE data
    bcp_bind(o_dbproc3, (BYTE *) &o_id,                 0, -1, NULL, 0, 0,
1);
    bcp_bind(o_dbproc3, (BYTE *) &o_d_id,               0, -1, NULL, 0, 0,
2);
    bcp_bind(o_dbproc3, (BYTE *) &o_w_id,               0, -1, NULL, 0, 0,
3);
    bcp_bind(o_dbproc3, (BYTE *) &ol,                   0, -1, NULL, 0, 0,
4);
    bcp_bind(o_dbproc3, (BYTE *) &ol_i_id,              0, -1, NULL, 0, 0,
5);
    bcp_bind(o_dbproc3, (BYTE *) &ol_supply_w_id,       0, -1, NULL, 0, 0,
6);
        bcp_bind(o_dbproc3, (BYTE *) ol_delivery_d,                 0, 50,
NULL, 0, SQLCHAR, 7);
    bcp_bind(o_dbproc3, (BYTE *) &ol_quantity,          0, -1, NULL, 0, 0,
8);
    bcp_bind(o_dbproc3, (BYTE *) &ol_amount,            0, -1, NULL, 0,
SQLFLT8, 9);
    bcp_bind(o_dbproc3, (BYTE *) ol_dist_info,          0, DIST_INFO_LEN,
NULL, 0, 0, 10);

        for (i = 0; i < ORDERS_PER_DISTRICT; i++)
    {
                o_id    = orders_buf[i].o_id;
                o_d_id  = orders_buf[i].o_d_id;
                o_w_id  = orders_buf[i].o_w_id;

                for (j=0; j < orders_buf[i].o_ol_cnt; j++)
                {
                        ol              = orders_buf[i].o_ol[j].ol;
                        ol_i_id         = orders_buf[i].o_ol[j].ol_i_id;
                        ol_supply_w_id =
orders_buf[i].o_ol[j].ol_supply_w_id;
                        ol_quantity     = orders_buf[i].o_ol[j].ol_quantity;
                        ol_amount       = orders_buf[i].o_ol[j].ol_amount;
                        //  Changed to insure ol_delivery_d set properly
(now set in OrdersBufLoad)
                        //  CurrentDate(&ol_delivery_d);

        strcpy(ol_delivery_d,orders_buf[i].o_ol[j].ol_delivery_d);


        strcpy(ol_dist_info,orders_buf[i].o_ol[j].ol_dist_info);

                        if (!bcp_sendrow(o_dbproc3))
                                printf("Error, LoadOrderLineTable() failed
calling bcp_sendrow().  Check error file.\n");
                        order_line_rows_loaded++;
                        // CheckForCommit(o_dbproc3,
order_line_rows_loaded, "ORDER_LINE", &order_line_time_start->time_start);
                }

        }

        bcp_batch(o_dbproc3);

        if ((o_w_id == aptr->num_warehouses) && (o_d_id == 10))
        {
                bcp_done(o_dbproc3);
                dbclose(o_dbproc3);

                if (aptr->build_index == 1)
                        BuildIndex("idxodlcl");
        }

        InterlockedIncrement(&order_threads_completed);

}


//==============================================================================
//
// Function   : GetPermutation
//
//==============================================================================

void GetPermutation(int perm[], int n)
{
        int i, r, t;

        for (i=1;i<=n;i++)
                perm[i] = i;

        for (i=1;i<=n;i++)
        {
                r = RandomNumber(i,n);
                t = perm[i];
                perm[i] = perm[r];
                perm[r] = t;
        }

}


//==============================================================================
//
// Function   : CheckForCommit
//
//==============================================================================

void CheckForCommit(DBPROCESS *dbproc,
                                int rows_loaded,
                                        char *table_name,
                                long *time_start)
{
```

```
    long       time_end, time_diff;

    // commit every "batch" rows

    if ( !(rows_loaded % aptr->batch) )
    {
                bcp_batch(dbproc);

                time_end = (TimeNow() / MILLI);
                time_diff = time_end - *time_start;

                printf("-> Loaded %ld rows into %s in %ld sec - Total = %d
(%.2f rps)\n",
                        aptr->batch,
                        table_name,
                                time_diff,
                        rows_loaded,
                                (float) aptr->batch / (time_diff ? time_diff
: 1L));

                *time_start = time_end;
    }

    return;
}


//=============================================================================
//
// Function   : OpenConnections
//
//=============================================================================

void OpenConnections()
{
        RETCODE retcode;

        LOGINREC *login;

    login = dblogin();

    retcode = DBSETLUSER(login, aptr->user);
        if (retcode == FAIL)
        {
                printf("DBSETLUSER failed.\n");
        }
        retcode = DBSETLPWD(login, aptr->password);
        if (retcode == FAIL)
        {
                printf("DBSETLPWD failed.\n");
        }

        retcode = DBSETLPACKET(login, (USHORT) aptr->pack_size);
        if (retcode == FAIL)
        {
                printf("DBSETLPACKET failed.\n");
        }

        printf("DB-Library packet size: %ld\n",aptr->pack_size);

    // turn connection into a BCP connection
    retcode = BCP_SETL(login, TRUE);
        if (retcode == FAIL)
        {
                printf("BCP_SETL failed.\n");
        }

    // open connections to SQL Server */

    if ((i_dbproc1 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 1 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((w_dbproc1 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 2 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((w_dbproc2 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 3 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((c_dbproc1 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 4 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((c_dbproc2 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 5 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((o_dbproc1 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 6 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((o_dbproc2 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 7 to server %s.\n", aptr->server);
                exit(-1);
    }

    if ((o_dbproc3 = dbopen(login, aptr->server)) == NULL)
    {
                printf("Error on login 8 to server %s.\n", aptr->server);
                exit(-1);
    }

}
```

```
//=============================================================================
//
// Function name: SQLErrHandler
//
//=============================================================================

int SQLErrHandler(SQLCONN *dbproc,
                              int     severity,
                              int     err,
                              int     oserr,
                              char    *dberrstr,
                              char    *oserrstr)
{

        char msg[256];
        FILE *fp1;
        char timebuf[128];
        char datebuf[128];

        _strtime(timebuf);
        _strdate(datebuf);

        sprintf(msg, "%s %s : DBLibrary (%ld) %s\n", datebuf, timebuf,
err, dberrstr);
    printf("%s",msg);

        fp1 = fopen("logs\tpccldr.err","a");
        if (fp1 == NULL)
        {
                printf("Error in opening errorlog file.\n");
        }
        else
        {
                fprintf(fp1, msg);
                fclose(fp1);
        }

    if (oserr != DBNOERR)
    {
                sprintf(msg, "%s %s : OSError (%ld) %s\n", datebuf,
timebuf, oserr, oserrstr);
                printf("%s",msg);

                fp1 = fopen("logs\\tpccldr.err","a");
                if (fp1 == NULL)
                {
                        printf("Error in opening errorlog file.\n");
                }
                else
                {
                        fprintf(fp1, msg);
                        fclose(fp1);
                }
    }

        if ((dbproc == NULL) || (DBDEAD(dbproc)))
        {
                exit(-1);
        }

        return (INT_CANCEL);

}


//=============================================================================
//
// Function name: SQLMsgHandler
//
//=============================================================================

int SQLMsgHandler(SQLCONN   *dbproc,
                                DBINT     msgno,
                                    int       msgstate,
                                    int       severity,
                                    char      *msgtext)
{
    char msg[256];
        FILE    *fp1;
        char timebuf[128];
        char datebuf[128];

    if ( (msgno == 5701) || (msgno == 2528) || (msgno == 5703) || (msgno
== 6006) )
        {
                return(INT_CONTINUE);
        }

        if (msgno == 0)
        {
                return(INT_CONTINUE);
        }
        else
        {
                _strtime(timebuf);
                _strdate(datebuf);

                sprintf(msg, "%s %s : SQLServer (%ld) %s\n", datebuf,
timebuf, msgno, msgtext);


                printf("%s",msg);

                fp1 = fopen("logs\\tpccldr.err","a");
                if (fp1 == NULL)
                {
                        printf("Error in opening errorlog file.\n");
                }
                else
                {
                        fprintf(fp1, msg);
                        fclose(fp1);
                }

                exit(-1);
        }

        return (INT_CANCEL);
}
```

```
//==============================================================================
//
// Function name: CurrentDate
//
//==============================================================================

void CurrentDate(char *datetime)
{

        char timebuf[128];
        char datebuf[128];

        _strtime(timebuf);
        _strdate(datebuf);

        sprintf(datetime, "%s %s", datebuf, timebuf);

}


//==============================================================================
//
// Function name: BuildIndex
//
//==============================================================================

void BuildIndex(char  *index_script)
{
        char    cmd[256];

        printf("Starting index creation:  %s\n",index_script);

        sprintf(cmd, "isql -S%s -U%s -P%s -e -i%s\\%s.sql >>
logs\\%s.out",
                                aptr->server,
                                aptr->user,
                                aptr->password,
                                aptr->index_script_path,
                                index_script,
                                index_script);

        system(cmd);

        printf("Finished index creation:  %s\n",index_script);
}
```

GETARGS.C

```
// TPC-C Benchmark Kit
//
// Module:  GETARGS.C
// Author:  DamienL


// Includes
#include "tpcc.h"
```

```
//==============================================================================
//
// Function name: GetArgsLoader
//
//==============================================================================

void GetArgsLoader(int argc, char **argv, TPCCLDR_ARGS *pargs)
{
    int        i;
    char       *ptr;

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsLoader()\n", (int)
GetCurrentThreadId());
#endif

    /* init args struct with some useful values */
    pargs->server                    =  SERVER;
    pargs->user                      =  USER;
    pargs->password                  =  PASSWORD;
    pargs->database                  =  DATABASE;
    pargs->batch                     =  BATCH;
    pargs->num_warehouses            =  UNDEF;
    pargs->table                     =  NULL;
       pargs->loader_res_file              =  LOADER_RES_FILE;
       pargs->pack_size                    =  DEFLDPACKSIZE;
       pargs->starting_warehouse     =  DEF_STARTING_WAREHOUSE;
       pargs->build_index                  =  BUILD_INDEX;
       pargs->index_script_path      =  INDEX_SCRIPT_PATH;

    /* check for zero command line args */
    if ( argc == 1 )
               GetArgsLoaderUsage();

    for (i = 1; i < argc; ++i)
    {
               if (argv[i][0] != '-' && argv[i][0] != '/')
               {
               printf("\nUnrecognized command");
               GetArgsLoaderUsage();
               exit(1);
               }

               ptr = argv[i];

               switch (ptr[1])
               {
               case 'h':     /* Fall throught */
               case 'H':
                              GetArgsLoaderUsage();
                              break;

               case 'D':
                              pargs->database = ptr+2;
                              break;

               case 'P':
                              pargs->password = ptr+2;
                              break;
```

```
            case 'S':
                        pargs->server = ptr+2;
                        break;

            case 'U':
                        pargs->user = ptr+2;
                        break;

            case 'b':
                        pargs->batch = atol(ptr+2);
                        break;

            case 'W':
                        pargs->num_warehouses = atol(ptr+2);
                        break;

            case 's':
                        pargs->starting_warehouse = atol(ptr+2);
                        break;

            case 't':
                        pargs->table = ptr+2;
                        break;

                   case 'f':
                        pargs->loader_res_file = ptr+2;
                        break;

                   case 'p':
                        pargs->pack_size = atol(ptr+2);
                        break;

                   case 'i':
                        pargs->build_index = atol(ptr+2);


            case 'd':
                        pargs->index_script_path = ptr+2;
                        break;

            default:
                   GetArgsLoaderUsage();
                   exit(-1);
                   break;
            }
    }

    /* check for required args */
    if (pargs->num_warehouses == UNDEF )
    {
            printf("Number of Warehouses is required\n");
            exit(-2);
    }

    return;
}


//=============================================================================
//
// Function name: GetArgsLoaderUsage
//
//=============================================================================

void GetArgsLoaderUsage()
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsLoaderUsage()\n", (int)
GetCurrentThreadId());
#endif


    printf("TPCCLDR:\n\n");
       printf("Parameter
Default\n");
       printf("-------------------------------------------------------------
----\n");
    printf("-W Number of Warehouses to Load                         Required
\n");
    printf("-S Server                                               %s\n",
SERVER);
    printf("-U Username                                             %s\n",
USER);
    printf("-P Password                                             %s\n",
PASSWORD);
    printf("-D Database                                             %s\n",
DATABASE);
       printf("-b Batch Size
%ld\n", (long) BATCH);
       printf("-p TDS packet size
%ld\n", (long) DEFLDPACKSIZE);
       printf("-f Loader Results Output Filename
%s\n", LOADER_RES_FILE);
       printf("-s Starting Warehouse
%ld\n", (long) DEF_STARTING_WAREHOUSE);
       printf("-i Build Option (data = 0, data and index = 1)
%ld\n", (long) BUILD_INDEX);
       printf("-d Index Script Path
%s\n", INDEX_SCRIPT_PATH);
       printf("-t Table to Load                                          all
tables \n");
    printf("   [item|warehouse|customer|orders]\n");

       printf("\nNote:  Command line switches are case sensitive.\n");

    exit(0);
}


//=============================================================================
//
// Function name: GetArgsMaster
//
//=============================================================================

void GetArgsMaster(int argc, char **argv, MASTER_DATA *pargs)
{
    int        i;
```

```
    char       *ptr;

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsMaster()\n", (int)
GetCurrentThreadId());
#endif

    pargs->server                   = SERVER;
    pargs->database                 = DATABASE;
       pargs->admin_database           = ADMIN_DATABASE;
    pargs->user                     = USER;
    pargs->password                 = PASSWORD;
    pargs->ramp_up                  = RAMP_UP;
    pargs->steady_state             = STEADY_STATE;
    pargs->ramp_down                = RAMP_DOWN;
    pargs->num_users                = NUM_USERS;
    pargs->num_warehouses           = NUM_WAREHOUSES;
    pargs->think_times              = THINK_TIMES;
    pargs->display_data             = DISPLAY_DATA;
       pargs->deadlock_retry           = DEADLOCK_RETRY;
    pargs->tran                     = TRANSACTION;
       pargs->client_mode              = CLIENT_MODE;
       pargs->comment                  = NULL;
       pargs->load_multiplier        = DEF_LOAD_MULTIPLIER;
       pargs->checkpoint_interval      = DEF_CHECKPOINT_INTERVAL;
       pargs->first_checkpoint         = DEF_FIRST_CHECKPOINT;
       pargs->delivery_backoff         = DELIVERY_BACKOFF;
       pargs->num_deliveries           = NUM_DELIVERIES;
       pargs->disable_90th                     = DISABLE_90TH;
       pargs->enable_sqlstat                = ENABLE_SQLSTAT;
       pargs->resfilename                      = RESFILENAME;
       pargs->sqlstat_filename                 = SQLSTAT_FILENAME;
       pargs->sqlstat_period                = SQLSTAT_PERIOD;
       pargs->shutdown_server               = SHUTDOWN_SERVER;
       pargs->auto_run                                 = AUTO_RUN;
       pargs->disable_sqlperf               = DISABLE_SQLPERF;

    /* check for zero command line args */
    if ( argc == 1 )
               GetArgsMasterUsage();

    for (i = 1; i < argc; ++i)
    {
               if (argv[i][0] != '-' && argv[i][0] != '/')
               {
               printf("\nUnrecognized command");
               GetArgsMasterUsage();
               exit(1);
               }

               ptr = argv[i];

               switch (ptr[1])
               {
               case 'h':     /* Fall throught */
                              GetArgsMasterUsage();
                              break;

               case 'S':
                              pargs->server = ptr+2;
                              break;

               case 'D':
                              pargs->database = ptr+2;
                              break;

               case 'A':
                              pargs->admin_database = ptr+2;
                              break;

               case 'U':
                              pargs->user = ptr+2;
                              break;

               case 'P':
                              pargs->password = ptr+2;
                              break;

               case 'u':
                              pargs->ramp_up = atol(ptr+2);
                              break;

               case 's':
                              pargs->steady_state = atol(ptr+2);
                              break;

               case 'd':
                              pargs->ramp_down = atol(ptr+2);
                              break;

               case 'c':
                              pargs->num_users = atol(ptr+2);
                              break;

               case 'w':
                              pargs->num_warehouses = atol(ptr+2);
                              break;

               case 'T':
                              pargs->think_times = atol(ptr+2);
                              break;

               case 'o':
                              pargs->display_data = atol(ptr+2);
                              break;

              case 'm':
                              pargs->load_multiplier = atof(ptr+2);
                              break;

               case 'f':
                              pargs->first_checkpoint = atol(ptr+2);
                              break;

               case 'i':
                              pargs->checkpoint_interval = atol(ptr+2);
                              break;

               case 'C':
                              pargs->comment = ptr+2;
                              break;
```

```
            case 'B':
                        pargs->client_mode = atol(ptr+2);
                        break;

            case 'n':
                        pargs->num_deliveries = atol(ptr+2);
                   break;

            case 'b':
                        pargs->delivery_backoff = atol(ptr+2);
                        break;

                   case 'r':
                        pargs->deadlock_retry = (short) atol(ptr+2);
                   break;

                   case 't':
                        pargs->tran = atol(ptr+2);
                        break;

                   case 'E':
                        pargs->enable_sqlstat = atol(ptr+2);
                        break;

            case 'e':
                        pargs->sqlstat_filename = ptr+2;
                        break;

                   case 'g':
                        pargs->shutdown_server = atol(ptr+2);
                        break;

            case 'F':
                        pargs->resfilename = ptr+2;
                        break;

                   case 'N':
                        pargs->disable_90th = atol(ptr+2);
                        break;

                   case 'a':
                        pargs->auto_run = atol(ptr+2);
                        break;

                   case 'q':
                        pargs->disable_sqlperf = atol(ptr+2);
                        break;

                   case 'W':
                        pargs->sqlstat_period = atol(ptr+2);
                        break;

            default:
                        GetArgsMasterUsage();
                        exit(-1);
                        break;
            }
    }

    return;
}


//============================================================================
//
// Function name: GetArgsMasterUsage
//
//============================================================================

void GetArgsMasterUsage()
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsMasterUsage()\n", (int)
GetCurrentThreadId());
#endif

    printf("MASTER:\n\n");
        printf("Parameter
Default\n");
        printf("-----------------------------------------------------------
-------------\n");
        printf("-S Server
%s\n", SERVER);
    printf("-D Database
%s\n", DATABASE);
        printf("-A Admin Database
%s\n", ADMIN_DATABASE);
    printf("-U Username
%s\n", USER);
    printf("-P Password
%s\n", PASSWORD);
        printf("-u Ramp Up Time (seconds)
%ld\n", (long) RAMP_UP);
        printf("-s Steady State Time (seconds)
%ld\n", (long) STEADY_STATE);
        printf("-d Ramp Down Time (seconds)
%ld\n", (long) RAMP_DOWN);
    printf("-c Number of Users
%ld\n", (long) NUM_USERS);
        printf("-w Number of Warehouses
%ld\n", (long) NUM_WAREHOUSES);
        printf("-f First Checkpoint (seconds)
%ld\n", (long) DEF_FIRST_CHECKPOINT);
        printf("-i Checkpoint Interval (seconds)
%ld\n", (long) DEF_CHECKPOINT_INTERVAL);
        printf("-B Client mode (TPC-C Scaled = 0, TPC-C Batch = 1)
%ld\n", (long) CLIENT_MODE);
        printf("-n Number of Delivery Threads per Client Driver
%ld\n", (long) NUM_DELIVERIES);
        printf("-b Delivery Queue Backoff Delay (seconds)
%ld\n", (long) DELIVERY_BACKOFF);

        printf("-r Deadlock Retries
%ld\n", (long) DEADLOCK_RETRY);
        printf("-T Use Think Times (no = 0, yes = 1)
%ld\n", (long) THINK_TIMES);
        printf("-m Think Time Load Multiplier
%0.4f\n", DEF_LOAD_MULTIPLIER);
```

```
        printf("-o Display Data to Console (no = 0, yes = 1)
%ld\n", (long) DISPLAY_DATA);
        printf("-t Transaction (0, 1, 2, 3, 4, 5)
%ld\n", (long) TRANSACTION);

        printf("-N Disable 90th Per. Calc. (no = 0, yes = 1)
%ld\n",(long) DISABLE_90TH);
        printf("-E Enable Steady State Sqlstats Collection (no = 0, yes =
1)    %ld\n",(long) ENABLE_SQLSTAT);
        printf("-W Sqlstats Collection Period (seconds)
%ld\n",(long) SQLSTAT_PERIOD);
        printf("-e Sqlstats File Name
%s\n", SQLSTAT_FILENAME);
        printf("-g Shutdown SQL Server at End of Test (no = 0, yes = 1)
%ld\n",(long) SHUTDOWN_SERVER);
        printf("-F Result File Name
%s\n", RESFILENAME);
    printf("-a Automated Test Run (no = 0, yes = 1)
%ld\n",(long) AUTO_RUN);
        printf("-C Comment to Include in Result File
None\n");
        printf("\nNote:  Command line switches are case sensitive.\n");

    exit(0);
}


//==============================================================================
//
// Function name: GetArgsClient
//
//==============================================================================

void GetArgsClient(int argc, char **argv, GLOBAL_CLIENT_DATA *pClient)
{
    int        i;
    char       *ptr;

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsClient()\n", (int)
GetCurrentThreadId());
#endif

        pClient->num_threads              = NUM_THREADS;
    pClient->server                   = SERVER;
    pClient->database                 = DATABASE;
        pClient->admin_database           = ADMIN_DATABASE;
    pClient->user                     = USER;
    pClient->password                 = PASSWORD;
        pClient->pack_size                = (long) DEFCLPACKSIZE;
        pClient->synch_servername         = SYNCH_SERVERNAME;
        pClient->disable_delivery_resfiles = DISABLE_DELIVERY_RESFILES;
        pClient->enable_qj                              = ENABLE_QJ;

    /* check for 1 or more command line args */
    if ( argc != 1 )
    {
                for (i = 1; i < argc; ++i)
                {
                if (argv[i][0] != '-' && argv[i][0] != '/')
                {
                        printf("\nUnrecognized command");
                        GetArgsClientUsage();
                        exit(1);
                }

                ptr = argv[i];

            switch (ptr[1])
            {
                        case 'S':
                                pClient->server = ptr+2;
                        break;

                        case 'D':
                                pClient->database = ptr+2;
                        break;

                        case 'A':
                                pClient->admin_database = ptr+2;
                        break;

                        case 'U':
                                pClient->user = ptr+2;
                        break;

                        case 'P':
                                pClient->password = ptr+2;
                        break;

                        case 'c':
                                pClient->num_threads = atol(ptr+2);
                        break;

                        case 'p':
                                pClient->pack_size = atol(ptr+2);
                                break;

                        case 'd':
                                pClient->disable_delivery_resfiles =
atol(ptr+2);
                                break;

                        case 's':
                                pClient->synch_servername = ptr+2;
                                break;

                        case 'q':
                                pClient->enable_qj = atol(ptr+2);
                                break;

                        default:
                                GetArgsClientUsage();
                                exit(-1);
                                break;
            }
            }
        }

    return;
}
```

```
//============================================================================
//
// Function name: GetArgsClientUsage
//
//============================================================================

void GetArgsClientUsage()
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsClientUsage()\n", (int)
GetCurrentThreadId());
#endif

    printf("CLIENT:\n\n");
        printf("Parameter
Default\n");
        printf("-------------------------------------------------------------
-\n");
        printf("-S Server                                                %s\n",
SERVER);
    printf("-D Database                                              %s\n",
DATABASE);
        printf("-A Admin Database                                        %s\n",
ADMIN_DATABASE);
    printf("-U Username                                              %s\n",
USER);
    printf("-P Password                                              %s\n",
PASSWORD);
        printf("-c Number of User Connections
%ld\n",(long) NUM_THREADS);
        printf("-p TDS Packet Size
%ld\n",(long) DEFCLPACKSIZE);
        printf("-d Disable Delivery Result Files (no = 0, yes = 1)
%ld\n",(long) DISABLE_DELIVERY_RESFILES);
        printf("-s Master Driver Servername                              %s\n",
SYNCH_SERVERNAME);

    printf("\nNote:  Command line switches are case sensitive.\n");

    exit(0);
}


//============================================================================
//
// Function name: GetArgsDelivery
//
//============================================================================
void GetArgsDelivery(int argc, char **argv, DELIVERY_ARGS *pDelivery)
{
    int        i;
    char       *ptr;

#ifdef DEBUG
    printf("[%ld]DBG: Entering GetArgsDelivery()\n", (int)
GetCurrentThreadId());
#endif

        pDelivery->pipe_num = 0;

    /* check for 1 or more command line args */
    if ( argc != 1 )
        {
                for (i = 1; i < argc; ++i)
                {
                if (argv[i][0] != '-' && argv[i][0] != '/')
                {
                                printf("\nUnrecognized command");
                                GetArgsClientUsage();
                                exit(1);
                }

                ptr = argv[i];

                    switch (ptr[1])
                    {
                                case 'p':
                                        pDelivery->pipe_num = (long)
atol(ptr+2);
                                        break;

                                default:
                                        printf("ERROR:  No pipe number
specified.");
                                        exit(-1);
                                        break;
                }
                }
    }

    return;
}


//============================================================================
//
// Function name: GetArgsSQLStat
//
//============================================================================

void GetArgsSQLStat(int argc, char **argv, SQLSTAT_ARGS *pargs)
{
    int        i;
    char       *ptr;

    /* init args struct with some useful values */
    pargs->server                    =  SERVER;
    pargs->user                   =  USER;
    pargs->password                  =  PASSWORD;
    pargs->admin_database       =  ADMIN_DATABASE;
        pargs->sqlstat_filename     =  SQLSTAT_FILENAME;
        pargs->run_id                        =  UNDEF;

    /* check for zero command line args */
    if ( argc == 1 )
                GetArgsSQLStatUsage();

    for (i = 1; i < argc; ++i)
```

```
    {
            if (argv[i][0] != '-' && argv[i][0] != '/')
            {
            printf("\nUnrecognized command");
            GetArgsSQLStatUsage();
            exit(1);
            }

            ptr = argv[i];

            switch (ptr[1])
            {

            case 'S':
                        pargs->server = ptr+2;
                        break;

            case 'U':
                        pargs->user = ptr+2;
                        break;

            case 'P':
                        pargs->password = ptr+2;
                        break;

            case 'A':
                        pargs->admin_database = ptr+2;
                        break;

                   case 'i':
                        pargs->run_id = atol(ptr+2);
                        break;

                   case 'f':
                        pargs->sqlstat_filename = ptr+2;
                        break;

            default:
                   GetArgsSQLStatUsage();
                   exit(-1);
                   break;
            }
    }

    /* check for required args */
    if (pargs->run_id == UNDEF )
    {
            printf("Error, Run ID is required.\n");
            exit(-2);
    }

    return;
}


//==============================================================================
//
// Function name: GetArgsSQLStatUsage
//
//==============================================================================
void GetArgsSQLStatUsage()
{

    printf("SQLSTAT:\n\n");
       printf("Parameter
Default\n");
       printf("-------------------------------------------------------------
----\n");
    printf("-S Server                                                  %s\n",
SERVER);
    printf("-U Username                                                %s\n",
USER);
    printf("-P Password                                                %s\n",
PASSWORD);
    printf("-A Admin Database                                          %s\n",
ADMIN_DATABASE);
       printf("-i Run ID
(required)\n");
       printf("-f Statistics Result file
%s\n", SQLSTAT_FILENAME);

       printf("\nNote:  Command line switches are case sensitive.\n");

    exit(0);
}
```

RANDOM.C

```
/*      FILE:           RANDOM.C
 *                              Microsoft TPC-C Kit Ver. 3.00.000
 *                              Audited 08/23/96, By Francois Raab
 *
 *                              Copyright Microsoft, 1996
 *
 *      PURPOSE:        Random number generation functions for Microsoft
TPC-C Benchmark Kit
 *      Author:         Damien Lindauer
 *                              damienl@Microsoft.com
 */

// Includes
#include "tpcc.h"
#include "math.h"

// Defines
#define A            16807
#define M       2147483647
#define Q           127773      /* M div A */
#define R             2836      /* M mod A */
#define Thread         __declspec(thread)

// Globals
long    Thread Seed = 0;       /* thread local seed */

/*****************************************************************************
*****
*
*
```

```
* random -
*
*       Implements a GOOD pseudo random number generator.  This generator
*
*       will/should? run the complete period before repeating.
*
*
*
* Copied from:
*
*       Random Numbers Generators: Good Ones Are Hard to Find.
*
*       Communications of the ACM - October 1988 Volume 31 Number 10
*
*
*
* Machine Dependencies:
*
*       long must be 2 ^ 31 - 1 or greater.
*
*
*
*************************************************************************
****/

/*************************************************************************
*****
* seed - load the Seed value used in irand and drand.  Should be used
before  *
*       first call to irand or drand.
*
*************************************************************************
****/

void seed(long val)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering seed()...\n", (int) GetCurrentThreadId());
       printf("Old Seed %ld New Seed %ld\n",Seed, val);
#endif

    if ( val < 0 )
            val = abs(val);

    Seed = val;

}


/*************************************************************************
****
*
*
* irand - returns a 32 bit integer pseudo random number with a period of
*
*       1 to 2 ^ 32 - 1.
*
*
*
* parameters:
*
*       none.
*
*
*
* returns:
*
*       32 bit integer - defined as long ( see above ).
*
*
*
* side effects:
*
*       seed get recomputed.
*
*************************************************************************
***/

long irand()
{
    register long    s;      /* copy of seed */
    register long    test;   /* test flag */
    register long    hi;     /* tmp value for speed */
    register long    lo;     /* tmp value for speed */

#ifdef DEBUG
    printf("[%ld]DBG: Entering irand()...\n", (int) GetCurrentThreadId());
#endif

    s = Seed;
    hi = s / Q;
    lo = s % Q;

    test = A * lo - R * hi;
    if ( test > 0 )
                Seed = test;
    else
                Seed = test + M;

    return( Seed );
}


/*************************************************************************
****
*
*
* drand - returns a double pseudo random number between 0.0 and 1.0.
*
*       See irand.
*
*************************************************************************
***/
double drand()
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering drand()...\n", (int) GetCurrentThreadId());
#endif
```

```
    return( (double)irand() / 2147483647.0);
}


//==============================================================================
// Function   : RandomNumber
//
// Description:
//==============================================================================
long RandomNumber(long lower, long upper)
{
    long rand_num;

#ifdef DEBUG
    printf("[%ld]DBG: Entering RandomNumber()...\n", (int)
GetCurrentThreadId());
#endif

        if ( upper == lower )  /* pgd 08-13-96 perf enhancement */
                return lower;

        upper++;

    if ( upper <= lower )
                rand_num = upper;
    else
                rand_num = lower + irand() % (upper - lower); /* pgd 08-13-
96 perf enhancement */


#ifdef DEBUG
    printf("[%ld]DBG: RandomNumber between %ld & %ld ==> %ld\n",
                            (int) GetCurrentThreadId(), lower, upper,
rand_num);
#endif


    return rand_num;
}


#if 0

//Orginal code pgd 08/13/96

long RandomNumber(long lower,
                                long upper)
{
    long rand_num;

#ifdef DEBUG
    printf("[%ld]DBG: Entering RandomNumber()...\n", (int)
GetCurrentThreadId());
#endif

        upper++;

    if ((upper <= lower))
                rand_num = upper;
    else
                rand_num = lower + irand() % ((upper > lower) ? upper -
lower : upper);


#ifdef DEBUG
    printf("[%ld]DBG: RandomNumber between %ld & %ld ==> %ld\n",
                                (int) GetCurrentThreadId(), lower, upper,
rand_num);
#endif


    return rand_num;
}
#endif

//==============================================================================
// Function   : NURand
//
// Description:
//==============================================================================
long NURand(int iConst,
            long x,
            long y,
            long C)
{
    long rand_num;

#ifdef DEBUG
    printf("[%ld]DBG: Entering NURand()...\n", (int)
GetCurrentThreadId());
#endif

    rand_num = (((RandomNumber(0,iConst) | RandomNumber(x,y)) + C) % (y-
x+1))+x;

#ifdef DEBUG
    printf("[%ld]DBG: NURand: num = %d\n", (int) GetCurrentThreadId(),
rand_num);
#endif

    return rand_num;
}
```

UTIL.C

```
// TPC-C Benchmark Kit
//
// Module:  UTIL.C
// Author:  DamienL


// Includes
#include "tpcc.h"


//==============================================================================
//
// Function name: UtilSleep
```

```
//
//============================================================================

void UtilSleep(long  delay)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilSleep()\n", (int)
GetCurrentThreadId());
#endif

#ifdef DEBUG
    printf("[%ld]DBG: Sleeping for %ld seconds...\n", (int)
GetCurrentThreadId(), delay);
#endif

    Sleep(delay * 1000);

}


//============================================================================
//
// Function name: UtilSleep
//
//============================================================================

void UtilSleepMs(long  delay)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilSleepMs()\n", (int)
GetCurrentThreadId());
#endif

#ifdef DEBUG
    printf("[%ld]DBG: Sleeping for %ld milliseconds...\n", (int)
GetCurrentThreadId(), delay);
#endif

    Sleep(delay);

}

//============================================================================
//
// Function name: UtilPrintNewOrder
//
//============================================================================
void UtilPrintNewOrder(NEW_ORDER_DATA *pNewOrder)
{
    int i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintNewOrder()\n", (int)
GetCurrentThreadId());
#endif

       EnterCriticalSection(&ConsoleCritSec);

       printf("\n[%04ld]\tNewOrder Transaction\n\n", (int)
GetCurrentThreadId());

    printf("Warehouse: %ld\n"
                "District: %ld\n"
                "Date: %02ld/%02ld/%04ld %02ld:%02ld:%02ld\n\n"
                "Customer Number:  %ld\n"
                "Customer Name: %s\n"
                "Customer Credit: %s\n"
                "Cusotmer Discount: %02.2f%%\n\n"
                "Order Number: %ld\n"
                "Warehouse Tax: %02.2f%%\n"
                "District Tax: %02.2f%%\n\n"
                "Number of Order Lines: %ld\n\n",
                     (int)    pNewOrder->w_id,
                     (int)    pNewOrder->d_id,
                     (char *) pNewOrder->o_entry_d.month,
                     (char *) pNewOrder->o_entry_d.day,
                     (char *) pNewOrder->o_entry_d.year,
                     (char *) pNewOrder->o_entry_d.hour,
                     (char *) pNewOrder->o_entry_d.minute,
                     (char *) pNewOrder->o_entry_d.second,
                     (int)    pNewOrder->c_id,
                     (char *) pNewOrder->c_last,
                     (char *) pNewOrder->c_credit,
                     (float)  pNewOrder->c_discount,
                     (int)    pNewOrder->o_id,
                     (float)  pNewOrder->w_tax,
                     (float)  pNewOrder->d_tax,
                     (int)    pNewOrder->o_ol_cnt);

       printf("Supp_W Item_Id Item Name                  Qty Stock B/G
Price    Amount   \n");
       printf("------ ------- ------------------------ --- ----- --- --
------ ---------\n");

    for (i=0;i < pNewOrder->o_ol_cnt;i++)
    {
               printf("%04ld   %06ld  %24s   %02ld   %03ld   %1s  %8.2f
%9.2f\n",
                (int)    pNewOrder->Ol[i].ol_supply_w_id,
                (int)    pNewOrder->Ol[i].ol_i_id,
                        (char *) pNewOrder->Ol[i].ol_i_name,
                (int)    pNewOrder->Ol[i].ol_quantity,
                (int)    pNewOrder->Ol[i].ol_stock,
                (char *) pNewOrder->Ol[i].ol_brand_generic,
                (float)  pNewOrder->Ol[i].ol_i_price,
                (float)  pNewOrder->Ol[i].ol_amount);
    }

       printf("\nTotal: $%05.2f\n\n",
                        (float)  pNewOrder->total_amount);

       printf("Execution Status: %s\n\n",
                        (char *) pNewOrder->execution_status);

       LeaveCriticalSection(&ConsoleCritSec);

}
```

```
//============================================================================
//
// Function name: UtilPrintPayment
//
//============================================================================

void UtilPrintPayment(PAYMENT_DATA *pPayment)
{

        char    tmp_data[201];
    char    data_line_1[51];
        char    data_line_2[51];
        char    data_line_3[51];
        char    data_line_4[51];

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintPayment()\n", (int)
GetCurrentThreadId());
#endif

    EnterCriticalSection(&ConsoleCritSec);

        printf("\n[%04ld]\tPayment Transaction\n\n", (int)
GetCurrentThreadId());

    printf("Date: %02ld/%02ld/%04ld %02ld:%02ld:%02ld\n\n",
               (int)    pPayment->h_date.month,
                      (int)    pPayment->h_date.day,
               (int)    pPayment->h_date.year,
                      (int)    pPayment->h_date.hour,
                      (int)    pPayment->h_date.minute,
                      (int)    pPayment->h_date.second);

        printf("Warehouse: %ld\n"
                  "District: %ld\n\n",
                      (int)    pPayment->w_id,
                      (int)    pPayment->d_id);

        printf("Warehouse Address Street 1: %s\n"
                  "Warehouse Address Street 2: %s\n",
                      (char *) pPayment->w_street_1,
                      (char *) pPayment->w_street_2);

        printf("Warehouse Address City: %s\n"
               "Warehouse Address State: %s\n"
               "Warehouse Address Zip: %s\n\n",
                      (char *) pPayment->w_city,
                      (char *) pPayment->w_state,
                      (char *) pPayment->w_zip);

        printf("District Address Street 1: %s\n"
                  "District Address Street 2: %s\n",
                      (char *) pPayment->d_street_1,
                    (char *) pPayment->d_street_2);

        printf("District Address City: %s\n"
               "District Address State: %s\n"
               "District Address Zip: %s\n\n",
                    (char *) pPayment->d_city,
                      (char *) pPayment->d_state,
                      (char *) pPayment->d_zip);

        printf("Customer Number: %ld\n"
                  "Customer Warehouse: %ld\n"
                  "Customer District: %ld\n",
                      (int)    pPayment->c_id,
                      (int)    pPayment->c_w_id,
                      (int)    pPayment->c_d_id);

        printf("Customer Name:   %s %s %s\n"
                  "Customer Since:  %02ld-%02ld-%04ld\n",
                      (char *) pPayment->c_first,
                      (char *) pPayment->c_middle,
                      (char *) pPayment->c_last,
                      (int)    pPayment->c_since.month,
                      (int)    pPayment->c_since.day,
                      (int)    pPayment->c_since.year);

        printf("Customer Address Street 1: %s\n"
               "Customer Address Street 2: %s\n"
               "Customer Address City: %s\n"
               "Customer Address State: %s\n"
               "Customer Address Zip: %s\n"
                  "Customer Phone Number: %s\n\n"
               "Customer Credit: %s\n"
               "Customer Discount: %02.2f%%\n",
                      (char *) pPayment->c_street_1,
                      (char *) pPayment->c_street_2,
                      (char *) pPayment->c_city,
                      (char *) pPayment->c_state,
                      (char *) pPayment->c_zip,
                      (char *) pPayment->c_phone,
                      (char *) pPayment->c_credit,
                      (double) pPayment->c_discount);

        printf("Amount Paid: $%04.2f\n"
               "New Customer Balance: $%10.2f\n",
                      (float)  pPayment->h_amount,
                      (double) pPayment->c_balance);

    printf("Credit Limit: $%10.2f\n\n",
                      (double) pPayment->c_credit_lim);

    if (strcmp(pPayment->c_data," ") != 0)
        {
               strcpy(tmp_data, pPayment->c_data);
               strncpy(data_line_1, tmp_data, 50);       data_line_1[50] =
'\0';
               strncpy(data_line_2, &tmp_data[50], 50);  data_line_2[50] =
'\0';
               strncpy(data_line_3, &tmp_data[100], 50); data_line_3[50] =
'\0';
               strncpy(data_line_4, &tmp_data[150], 50); data_line_4[50] =
'\0';

        }
        else
        {
               strcpy(data_line_1, " "); strcpy(data_line_2, " ");
               strcpy(data_line_3, " "); strcpy(data_line_4, " ");
        }
```

```
        printf("                -----------------------------------------
--------\n");
    printf("Customer Data: |%50s|\n", data_line_1);
        printf("               |%50s|\n", data_line_2);
        printf("               |%50s|\n", data_line_3);
        printf("               |%50s|\n", data_line_4);
        printf("                -----------------------------------------
--------\n\n");

        printf("Execution Status: %s\n\n",
                        (char *) pPayment->execution_status);

        LeaveCriticalSection(&ConsoleCritSec);

}


//============================================================================
//
// Function name: UtilPrintOrderStatus
//
//============================================================================

void UtilPrintOrderStatus(ORDER_STATUS_DATA *pOrderStatus)
{
    int i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintOrderStatus()\n", (int)
GetCurrentThreadId());
#endif

        EnterCriticalSection(&ConsoleCritSec);

        printf("\n[%04ld]\tOrder-Status Transaction\n\n", (int)
GetCurrentThreadId());

        printf("Warehouse: %ld\n"
               "District: %ld\n\n",
                        (int) pOrderStatus->w_id,
                        (int) pOrderStatus->d_id);

        printf("Customer Number: %ld\n"
               "Customer Name: %s %s %s\n\n",
                        (int) pOrderStatus->c_id,
                        (char *) pOrderStatus->c_first,
                        (char *) pOrderStatus->c_middle,
                        (char *) pOrderStatus->c_last);

        printf("Customer Balance: $%5.2f\n\n",
                        (double) pOrderStatus->c_balance);

        printf("Order Number: %ld\n"
               "Entry Date: %02ld/%02ld/%04ld %02ld:%02ld:%02ld\n"
               "Carrier Number: %ld\n\n"
               "Number of order lines: %ld\n\n",
                        (int) pOrderStatus->o_id,
                        (int) pOrderStatus->o_entry_d.month,
                        (int) pOrderStatus->o_entry_d.day,
                        (int) pOrderStatus->o_entry_d.year,
                        (int) pOrderStatus->o_entry_d.hour,
                        (int) pOrderStatus->o_entry_d.minute,
                        (int) pOrderStatus->o_entry_d.second,
                        (int) pOrderStatus->o_carrier_id,
                        (int) pOrderStatus->o_ol_cnt);

    printf ("Supply-W    Item-Id    Delivery-Date    Qty   Amount    \n");
        printf ("--------    -------    -------------    ---   ----------
\n");

    for (i=0;i < pOrderStatus->o_ol_cnt; i++)
    {
                printf("%04ld        %06ld     %02ld/%02ld/%04ld
%02ld     %9.2f\n",
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_supply_w_id,
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_i_id,
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.month,
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.day,
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.year,
                                (int) pOrderStatus-
>OlOrderStatusData[i].ol_quantity,
                                (double) pOrderStatus-
>OlOrderStatusData[i].ol_amount);
    }

        if (pOrderStatus->o_ol_cnt == 0)
                printf("\nNo Order-Status items.\n\n");

        printf("\nExecution Status: %s\n\n",
                        (char *) pOrderStatus->execution_status);

        LeaveCriticalSection(&ConsoleCritSec);

}


//============================================================================
//
// Function name: UtilPrintDelivery
//
//============================================================================

void UtilPrintDelivery(DELIVERY_DATA *pQueuedDelivery)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintDelivery()\n", (int)
GetCurrentThreadId());
#endif

        EnterCriticalSection(&ConsoleCritSec);

        printf("\n[%04ld]\tDelivery Transaction\n\n", (int)
GetCurrentThreadId());
```

```
    printf("Warehouse: %ld\n", (int) pQueuedDelivery->w_id);

        printf("Carrier Number: %ld\n\n", (int) pQueuedDelivery-
>o_carrier_id);

    printf("Execution Status: %s\n\n", (char *) pQueuedDelivery-
>execution_status);

        LeaveCriticalSection(&ConsoleCritSec);

}


//============================================================================
//
// Function name: UtilPrintStockLevel
//
//============================================================================

void UtilPrintStockLevel(STOCK_LEVEL_DATA *pStockLevel)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintStockLevel()\n", (int)
GetCurrentThreadId());
#endif

        EnterCriticalSection(&ConsoleCritSec);

        printf("\n[%04ld]\tStock-Level Transaction\n\n", (int)
GetCurrentThreadId());

        printf("Warehouse: %ld\nDistrict: %ld\n",
                        (int) pStockLevel->w_id,
                        (int) pStockLevel->d_id);

        printf("Stock Level Threshold: %ld\n\n", (int) pStockLevel-
>thresh_hold);

        printf("Low Stock Count: %ld\n\n", (int) pStockLevel->low_stock);

        printf("Execution Status: %s\n\n", (char *) pStockLevel-
>execution_status);

        LeaveCriticalSection(&ConsoleCritSec);
}

//============================================================================
//
// Function name: UtilError
//
//============================================================================
void UtilError(long threadid, char * header, char *msg)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilError()\n", (int)
GetCurrentThreadId());
#endif

    printf("[%ld] %s: %s\n", (int) threadid, header, msg);
}


//============================================================================
//
// Function name: UtilFatalError
//
//============================================================================

void UtilFatalError(long threadid, char * header, char *msg)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilFatalError()\n", (int)
GetCurrentThreadId());
#endif

    printf("[Thread: %ld]... %s: %s\n", (int) threadid, header, msg);
    exit(-1);
}


//============================================================================
//
// Function name: UtilStrCpy
//
//============================================================================
void UtilStrCpy(char * pDest, char * pSrc, int n)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilStrCpy()\n", (int)
GetCurrentThreadId());
#endif

    strncpy(pDest, pSrc, n);
    pDest[n] = '\0';
}


#ifdef USE_CONMON
//============================================================================
//
// Function name: WriteConsoleString
//
//============================================================================
void WriteConsoleString(HANDLE hConMon, char *str, short x, short y, short
color, BOOL pad)
{
        COORD   dwWriteCoord = {0, 0};
        DWORD   cCharsWritten;
        LPVOID  dummy;
        int     len, i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering WriteConsoleString()\n", (int)
GetCurrentThreadId());
#endif

        dwWriteCoord.X = x;
```

```
        dwWriteCoord.Y = y;

        if (pad)
        {
                len = strlen(str);
                if (len < CON_LINE_SIZE)
                {
                        for(i=1;i<CON_LINE_SIZE-len;i++)
                        {
                                strcat(str," ");
                        }
                }
        }

        EnterCriticalSection(&ConsoleCritSec);

        switch (color)
    {
                case YELLOW:
                        SetConsoleTextAttribute(hConMon,
                                FOREGROUND_INTENSITY | FOREGROUND_GREEN |
FOREGROUND_RED | BACKGROUND_BLUE);
                break;

                case RED:
                        SetConsoleTextAttribute(hConMon,
                                FOREGROUND_INTENSITY | FOREGROUND_RED |
BACKGROUND_BLUE);
                break;

                case GREEN:
                        SetConsoleTextAttribute(hConMon,
                                FOREGROUND_INTENSITY | FOREGROUND_GREEN |
BACKGROUND_BLUE);
                        break;
    }

        SetConsoleCursorPosition(hConMon, dwWriteCoord);
        WriteConsole(hConMon, str, strlen(str), &cCharsWritten, dummy);

        LeaveCriticalSection(&ConsoleCritSec);

}
#endif


//============================================================================
//
// Function name: AddDeliveryQueueNode
//
//============================================================================

BOOL AddDeliveryQueueNode(DELIVERY_PTR node_to_add)
{

        DELIVERY_PTR   local_node;
#ifdef DEBUG
        DELIVERY_PTR   ptrtmp;
        short           i;
#endif

        EnterCriticalSection(&QueuedDeliveryCritSec);

        if ((local_node = malloc(sizeof(struct delivery_node)) ) == NULL)
        {
                printf("ERROR:  problem allocating memory for delivery
queue.\n");
                exit(-1);
        }
        else
        {
                memcpy(local_node, node_to_add, sizeof (struct
delivery_node));

                if (queued_delivery_cnt == 0)
                {
                        delivery_head = local_node;
                        delivery_head->next_delivery = NULL;
                        delivery_tail = delivery_head;
                }
                else
                {
                        local_node->next_delivery = NULL;
                        delivery_tail->next_delivery = local_node;
                        delivery_tail = local_node;
                }
        }

        queued_delivery_cnt++;

#ifdef DEBUG
        i=0;
        printf("Add to delivery list: %ld\n",queued_delivery_cnt);
        ptrtmp=delivery_head;
        while (ptrtmp != NULL)
        {
                i++;
                printf("%ld - w_id %ld - o_carrier_id %ld - queue_time
%d/%d/%d %d:%d:%d:%d\n",
                                i, ptrtmp->w_id, ptrtmp->o_carrier_id,
                                ptrtmp->queue_time.wMonth,
                                ptrtmp->queue_time.wDay,
                                ptrtmp->queue_time.wYear,
                                ptrtmp->queue_time.wHour,
                                ptrtmp->queue_time.wMinute,
                                ptrtmp->queue_time.wSecond,
                                ptrtmp->queue_time.wMilliseconds);

                ptrtmp=ptrtmp->next_delivery;
        }
#endif

        LeaveCriticalSection(&QueuedDeliveryCritSec);

    return TRUE;

}


//============================================================================
```

```
//
// Function name: GetDeliveryQueueNode
//
//============================================================================

BOOL GetDeliveryQueueNode(DELIVERY_PTR node_to_get)
{

        DELIVERY_PTR           local_node;
        BOOL                          rc;
#ifdef DEBUG
        DELIVERY_PTR           ptrtmp;
        short                         i;
#endif

        EnterCriticalSection(&QueuedDeliveryCritSec);

        if (queued_delivery_cnt == 0)
        {

#ifdef DEBUG
                printf("No delivery nodes found.\n");
#endif
                rc = FALSE;
        }
        else
        {

                memcpy(node_to_get, delivery_head, sizeof(struct
delivery_node));

                if (queued_delivery_cnt == 1)
                {
                        free(delivery_head);
                        delivery_head = NULL;
                        queued_delivery_cnt = 0;
                }
                else
                {
                        local_node = delivery_head;
                        delivery_head = delivery_head->next_delivery;
                        free(local_node);
                        queued_delivery_cnt--;
                }

#ifdef DEBUG
                i=0;
                printf("Get from delivery list:
%ld\n",queued_delivery_cnt);
                ptrtmp=delivery_head;
                while (ptrtmp != NULL)
                {
                        i++;
                        printf("%ld - w_id %ld - o_carrier_id %ld -
queue_time %d/%d/%d %d:%d:%d:%d\n",
                                        i, ptrtmp->w_id, ptrtmp-
>o_carrier_id,
                                        ptrtmp->queue_time.wMonth,
                                        ptrtmp->queue_time.wDay,
                                        ptrtmp->queue_time.wYear,
                                        ptrtmp->queue_time.wHour,
                                        ptrtmp->queue_time.wMinute,
                                        ptrtmp->queue_time.wSecond,
                                        ptrtmp->queue_time.wMilliseconds);

                        ptrtmp=ptrtmp->next_delivery;
                }
#endif

                rc = TRUE;

        }

        LeaveCriticalSection(&QueuedDeliveryCritSec);

    return rc;

}


//============================================================================
//
// Function name: WriteDeliveryString
//
//============================================================================

void WriteDeliveryString(char   buf[255])
{

        DWORD   bytesWritten;
        DWORD   retCode;

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilDeliveryMsg()\n", (int)
GetCurrentThreadId());
#endif

        EnterCriticalSection(&WriteDeliveryCritSec);

    retCode = WriteFile (hDeliveryMonPipe, buf, PLEASE_WRITE,
                         &bytesWritten, NULL);

        LeaveCriticalSection(&WriteDeliveryCritSec);

}
```

Appendix C - Tunable Parameters

Microsoft Windows NT 4.0 Configuration Parameters

There were no Windows NT Registry parameters that were changed from their default settings. The following services were disabled in the Windows NT Control Panel/ Services on the Server:

- License Logging Service
- NT LM Security Support Provider
- Plug and Play
- Spooler

Microsoft SQL Server Startup Parameters

```
c:\ mssql\binn\sqlservr -c -x -t1081 -Cd1450000 -Cp5000 -T812 -T3502
```

Where:

- -c Start SQL Server independently of the Service Control Manager
- -x Disables the keeping of CPU time and cache hit ratio statistics
- -t1081 Allows the index pages a “second” trip through the cache
- -Cd1450000 Defines the number of 2KB database cache buffers
- -Cp5000 Defines the number of buffers for the procedure cache
- -T812 Disables checkpoint buffer sorting
- -T3502 Writes a message to the SQL Server Errorlog showing the beginning and ending time of each checkpoint

SQL Server Stack Size

The default stack size for Microsoft SQL Server 6.5.SP4 (6.50.253) was changed using the EDITBIN utility. The EDITBIN utility ships with Microsoft Visual C++ V4.0. The command used to change the stack size is:

```
editbin /S: 65536 sqlservr.exe
```

This command is fully documented as an article in the Microsoft Knowledge Base on the Microsoft Web Site at www.microsoft.com/support.

DBCC GAMINIT

Prior to the execution of the benchmark, the following script was run to proactively populate the Global Allocation Map (GAM) rather than allowing it to be populated on an as- needed basis.

```
Use tpcc
go
dbcc gaminit
go
```

This command is fully documented as an article in the Microsoft Knowledge Base on the Microsoft Web Site at www.microsoft.com/support.

‘Cache’ Column of Sysobjects Table

Prior to the execution of the benchmark, the following script was run and SQL Server was restarted to improve cache performance of tables which are accessed non-uniformly. Use of this feature is being documented as an article in the Microsoft Knowledge Base on the Microsoft Web Site at www.microsoft.com/support.

```
Use tpcc
go
update sysobjects set cache=2 from sysobjects where name='stock'
go
update sysobjects set cache=5 from sysobjects where name='customer'
go
```

BOOT.INI

The /3gb switch was added to the boot.ini file to cause NT Server to allow 3GB of user and 1GB of kernel virtual address space, rather than the usual 2GB of virtual address space for each.

Microsoft SQL Server Startup Parameters

```
Key Name:           SOFTWARE\Microsoft\MSSQLServer\MSSQLServer\Parameters
Class Name:         <NO CLASS>
Last Write Time:    6/25/97 - 9:42 PM
Value 0
  Name:             SQLArg0
  Type:             REG_SZ
  Data:             -dC:\MSSQL\DATA\MASTER.DAT

Value 1
  Name:             SQLArg1
  Type:             REG_SZ
  Data:             -eC:\MSSQL\LOG\ERRORLOG
```

Microsoft SQL Server Configuration Parameters

```
1> 2> 3> 4> 5> 6> 7> 8> 9> 10> 11> 12> 13> 14>
/*    File:    VERSION.SQL
*/
/*             Microsoft TPC-C Kit Ver. 3.00.000
*/
/*             Audited 08/23/96, By Francois Raab
*/
/*
*/
/*             Copyright Microsoft, 1996
*/
/*
*/
/*    Author:  Damien Lindauer
*/
/*             damienl@Microsoft.com
*/
print " "
select convert(char(30), getdate(),9)
print " "

 ------------------------------
 Jun 25 1997 10:44:45:716AM

(1 row affected)

1> 2> 3>
select @@version


 ------------------------------------------------------------------------------
-----
        ------------------------------------------
 Microsoft SQL Server  6.50 - 6.50.253 (Intel X86)
       May  9 1997 13:38:26
       Cop
       yright (c) 1988-1997 Microsoft Corporation

(1 row affected)
1> 2>
1> 2> 3> 4> 5> 6> 7> 8> 9> 10> 11> 12> 13> 14>
/*    File:    CONFIG.SQL
*/
/*             Microsoft TPC-C Kit Ver. 3.00.000
*/
/*             Audited 08/23/96, By Francois Raab
*/
/*
*/
/*             Copyright Microsoft, 1996
*/
/*
*/
/*    Author:  Damien Lindauer
*/
/*             damienl@Microsoft.com
*/


print " "
select convert(char(30), getdate(),9)
print " "

 ------------------------------
 Jun 25 1997 10:44:46:513AM

(1 row affected)

1> 2> 3> Configuration option changed. Run the RECONFIGURE command to
install.

sp_configure "show advanced",1
1> 2> reconfigure with override
1> 2> sp_configure
```

name	minimum	maximum	config_value	run_value
affinity mask	0	2147483647	63	63
allow updates	0	1	1	1
backup buffer size	1	32	1	1
backup threads	0	32	5	5
cursor threshold	-1	2147483647	-1	-1
database size	2	10000	2	2
default language	0	9999	0	0
default sortorder id	0	255	50	50
fill factor	0	100	0	0
free buffers	20	524288	4000	4000
hash buckets	4999	1000003	749011	749011
language in cache	3	100	3	3
LE threshold maximum	2	500000	301	301
LE threshold minimum	2	500000	20	20
LE threshold percent	1	100	0	0
locks	5000	2147483647	8000	8000
LogLRU buffers	0	2147483647	1850	1850
logwrite sleep (ms)	-1	500	-1	-1
max async IO	1	1024	100	100
max lazywrite IO	1	1024	70	70
max text repl size	0	2147483647	65536	65536
max worker threads	10	1024	210	210
media retention	0	365	0	0
memory	2800	1048576	950000	950000
nested triggers	0	1	1	1
network packet size	512	32767	4096	4096
open databases	5	32767	10	10
open objects	100	2147483647	450	450
priority boost	0	1	0	0
procedure cache	1	99	1	1
Protection cache size	1	8192	15	15
RA cache hit limit	1	255	4	4
RA cache miss limit	1	255	3	3
RA delay	0	500	15	15
RA pre-fetches	1	1000	2	2
RA slots per thread	1	255	5	5
RA worker threads	0	255	0	0
recovery flags	0	1	0	0
recovery interval	1	32767	32767	32767
remote access	0	1	0	0
remote conn timeout	-1	32767	10	10
remote login timeout	0	2147483647	5	5
remote proc trans	0	1	0	0
remote query timeout	0	2147483647	0	0
remote sites	0	256	0	0
resource timeout	5	2147483647	10	10
set working set size	0	1	1	1
show advanced options	0	1	1	1
SMP concurrency	-1	64	-1	-1
sort pages	64	511	64	64
spin counter	1	2147483647	10000	10000
tempdb in ram (MB)	0	2044	5	5
time slice	50	1000	100	100
user connections	5	32767	225	225
user options	0	4095	0	0

HS/6 Array Configuration for TPCC -- 6/24/97

Adapter

1

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A2-1	2
3	A2-2	A2-3	3
4	A2-4	A2-5	4
5			5
6	A3-1	A3-2	6
8	A3-3	A3-4	8
9	A3-5	A4-1	9
10	A4-2	A4-3	10
11	A4-4	A4-5	11
12	empty	empty	12
13	A5-1	A5-2	13
14			14
15			15

LD #	1	2
RAID	0	0
Size (MB)	82,980	8,298
Stripes	5	2
Spans	4	1
Arrays	1, 2, 3, 4	5
StripeSz	32KB	32KB
Write	WrThru	WrThru
Read	Normal	Normal
Caching	DirectIO	DirectIO
Usage	Data	Data
Database	tpcc	tpcc10

2

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A2-1	2
3	A2-2	A2-3	3
4	A2-4	A2-5	4
5			5
6	A3-1	A3-2	6
8	A3-3	A3-4	8
9	A3-5	A4-1	9
10	A4-2	A4-3	10
11	A4-4	A4-5	11
12	empty	empty	12
13	A5-1	A5-2	13
14			14
15			15

LD #	1	2
RAID	0	0
Size (MB)	82,980	8,298
Stripes	5	2
Spans	4	1
Arrays	1, 2, 3, 4	5
StripeSz	32KB	32KB
Write	WrThru	WrThru
Read	Normal	Normal
Caching	DirectIO	DirectIO
Usage	Data	Data
Database	tpcc	tpcc10

3

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A2-1	2
3	A2-2	A2-3	3
4	A2-4	A2-5	4
5			5
6	A3-1	A3-2	6
8	A3-3	A3-4	8
9	A3-5	A4-1	9
10	A4-2	A4-3	10
11	A4-4	A4-5	11
12	empty	empty	12
13	A5-1	A5-2	13
14			14
15			15

LD #	1	2
RAID	0	1
Size (MB)	82,980	8,682
Stripes	5	2
Spans	4	1
Arrays	1, 2, 3, 4	5
StripeSz	32KB	64KB
Write	WrThru	WrThru
Read	Normal	ReadAhead
Caching	DirectIO	DirectIO
Usage	Data	Log
Database	tpcc	tpcc10

4

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A2-1	2
3	A2-2	A2-3	3
4	A2-4	A2-5	4
5			5
6	A3-1	A3-2	6
8	A3-3	A3-4	8
9	A3-5	A4-1	9
10	A4-2	A4-3	10
11	A4-4	A4-5	11
12	A5-1	empty	12
13	A5-3	A5-2	13
14			14
15			15

LD #	1	2
RAID	0	5
Size (MB)	82,980	17,364
Stripes	5	3
Spans	4	1
Arrays	1, 2, 3, 4	5
StripeSz	32KB	64KB
Write	WrThru	WrThru
Read	Normal	ReadAhead
Caching	DirectIO	DirectIO
Usage	Data	Backup
Database	tpcc	tpcc10

5

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A1-6	2
3	A2-1	A2-2	3
4	A2-3	A2-4	4
5			5
6	A2-5	A2-6	6
8	A3-1	A3-2	8
9	A3-3	A4-4	9
10	A3-5	A3-6	10
11	A4-1	A4-2	11
12	A4-3	A4-4	12
13	A4-5	A4-6	13
14			14
15			15

LD #	1	2
RAID	0	5
Size (MB)	74,682	43,410
Stripes	6	6
Spans	3	1
Arrays	1, 2, 3	4
StripeSz	32KB	64KB
Write	WrThru	WrThru
Read	Normal	ReadAhead
Caching	DirectIO	CachedIO
Usage	Data	Backup
Database	tpcc	tpcc

6

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A2-1	2
3	A2-2	A2-3	3
4	A2-4	A2-5	4
5			5
6	A3-1	A3-2	6
8	A3-3	A3-4	8
9	A3-5	empty	9
10	empty	empty	10
11	A4-1	A4-2	11
12	A4-3	A4-4	12
13	A4-5	A4-6	13
14			14
15			15

LD #	1	2
RAID	0	5
Size (MB)	121,548	43,410
Stripes	5	6
Spans	3	1
Arrays	1, 2, 3	4
StripeSz	32KB	64KB
Write	WrThru	WrThru
Read	Normal	ReadAhead
Caching	DirectIO	CachedIO
Usage	Data	Backup
Database	tpcc	tpcc

7

ID	Channel 1	Channel 2	ID
0	A1-1	A1-2	0
1	A1-3	A1-4	1
2	A1-5	A1-6	2
3	A1-7	A2-1	3
4	A2-2	A2-3	4
5			5
6	A2-4	A2-5	6
8	A2-6	A2-7	8
9	empty	empty	9
10	A3-1	A3-2	10
11	A4-2	A4-1	11
12	A5-1	A5-2	12
13	A6-2	A6-1	13
14			14
15			15

LD #	1	2
RAID	0	10
Size (MB)	121,548	34,728
Stripes	7	2
Spans	2	4
Arrays	1, 2	3, 4, 5, 6
StripeSz	32KB	64KB
Write	WrThru	WrThru
Read	Normal	ReadAhead
Caching	DirectIO	DirectIO
Usage	Data	Log
Database	tpcc	tpcc

Internet Information Server Registry Parameters

```
Key Name:          SYSTEM\CurrentControlSet\Services\InetInfo
       Class Name:         <NO CLASS>
       Last Write Time:    5/2/97 - 9:12 AM

       Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters
       Class Name:         <NO CLASS>
       Last Write Time:    5/6/97 - 4:18 PM
       Value 0
         Name:             BandwidthLevel
         Type:             REG_DWORD
         Data:             0xffffffff

       Value 1
         Name:             ListenBackLog
         Type:             REG_DWORD
         Data:             0x9c4

       Value 2
         Name:             PoolThreadLimit
         Type:             REG_DWORD
         Data:             0x9c4

       Value 3
         Name:             ThreadTimeout
         Type:             REG_DWORD
         Data:             0x15180


       Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\Filter
       Class Name:         <NO CLASS>
       Last Write Time:    5/2/97 - 9:12 AM
       Value 0
         Name:             FilterType
         Type:             REG_DWORD
         Data:             0

       Value 1
         Name:             NumDenySites
         Type:             REG_DWORD
         Data:             0

       Value 2
         Name:             NumGrantSites
         Type:             REG_DWORD
         Data:             0


       Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\MimeMap
       Class Name:         <NO CLASS>
       Last Write Time:    5/2/97 - 9:12 AM
       Value 0
         Name:             application/envoy,evy,,5
         Type:             REG_SZ
         Data:

       Value 1
         Name:             application/mac-binhex40,hqx,,4
         Type:             REG_SZ
         Data:

       Value 2
         Name:             application/msword,doc,,5
         Type:             REG_SZ
         Data:

       Value 3
         Name:             application/msword,dot,,5
         Type:             REG_SZ
         Data:

       Value 4
         Name:             application/octet-stream,*,,5
         Type:             REG_SZ
         Data:

       Value 5
         Name:             application/octet-stream,bin,,5
         Type:             REG_SZ
         Data:

       Value 6
         Name:             application/octet-stream,exe,,5
         Type:             REG_SZ
         Data:

       Value 7
         Name:             application/oda,oda,,5
         Type:             REG_SZ
         Data:
```

```
Value 8
  Name:           application/pdf,pdf,,5
  Type:           REG_SZ
  Data:

Value 9
  Name:           application/postscript,ai,,5
  Type:           REG_SZ
  Data:

Value 10
  Name:           application/postscript,eps,,5
  Type:           REG_SZ
  Data:

Value 11
  Name:           application/postscript,ps,,5
  Type:           REG_SZ
  Data:

Value 12
  Name:           application/rtf,rtf,,5
  Type:           REG_SZ
  Data:

Value 13
  Name:           application/winhlp,hlp,,5
  Type:           REG_SZ
  Data:

Value 14
  Name:           application/x-bcpio,bcpio,,5
  Type:           REG_SZ
  Data:

Value 15
  Name:           application/x-cpio,cpio,,5
  Type:           REG_SZ
  Data:

Value 16
  Name:           application/x-csh,csh,,5
  Type:           REG_SZ
  Data:

Value 17
  Name:           application/x-director,dcr,,5
  Type:           REG_SZ
  Data:

Value 18
  Name:           application/x-director,dir,,5
  Type:           REG_SZ
  Data:

Value 19
  Name:           application/x-director,dxr,,5
  Type:           REG_SZ
  Data:

Value 20
  Name:           application/x-dvi,dvi,,5
  Type:           REG_SZ
  Data:

Value 21
  Name:           application/x-gtar,gtar,,9
  Type:           REG_SZ
  Data:

Value 22
  Name:           application/x-hdf,hdf,,5
  Type:           REG_SZ
  Data:

Value 23
  Name:           application/x-latex,latex,,5
  Type:           REG_SZ
  Data:

Value 24
  Name:           application/x-msaccess,mdb,,5
  Type:           REG_SZ
  Data:

Value 25
  Name:           application/x-mscardfile,crd,,5
  Type:           REG_SZ
  Data:

Value 26
  Name:           application/x-msclip,clp,,5
  Type:           REG_SZ
  Data:

Value 27
  Name:           application/x-msexcel,xla,,5
  Type:           REG_SZ
  Data:

Value 28
  Name:           application/x-msexcel,xlc,,5
  Type:           REG_SZ
  Data:

Value 29
  Name:           application/x-msexcel,xlm,,5
  Type:           REG_SZ
  Data:

Value 30
  Name:           application/x-msexcel,xls,,5
  Type:           REG_SZ
  Data:

Value 31
  Name:           application/x-msexcel,xlt,,5
  Type:           REG_SZ
```

```
  Data:

Value 32
  Name:           application/x-msexcel,xlw,,5
  Type:           REG_SZ
  Data:

Value 33
  Name:           application/x-msmediaview,m13,,5
  Type:           REG_SZ
  Data:

Value 34
  Name:           application/x-msmediaview,m14,,5
  Type:           REG_SZ
  Data:

Value 35
  Name:           application/x-msmetafile,wmf,,5
  Type:           REG_SZ
  Data:

Value 36
  Name:           application/x-msmoney,mny,,5
  Type:           REG_SZ
  Data:

Value 37
  Name:           application/x-mspowerpoint,ppt,,5
  Type:           REG_SZ
  Data:

Value 38
  Name:           application/x-msproject,mpp,,5
  Type:           REG_SZ
  Data:

Value 39
  Name:           application/x-mspublisher,pub,,5
  Type:           REG_SZ
  Data:

Value 40
  Name:           application/x-msterminal,trm,,5
  Type:           REG_SZ
  Data:

Value 41
  Name:           application/x-msworks,wks,,5
  Type:           REG_SZ
  Data:

Value 42
  Name:           application/x-mswrite,wri,,5
  Type:           REG_SZ
  Data:

Value 43
  Name:           application/x-netcdf,cdf,,5
  Type:           REG_SZ
  Data:

Value 44
  Name:           application/x-netcdf,nc,,5
  Type:           REG_SZ
  Data:

Value 45
  Name:           application/x-perfmon,pma,,5
  Type:           REG_SZ
  Data:

Value 46
  Name:           application/x-perfmon,pmc,,5
  Type:           REG_SZ
  Data:

Value 47
  Name:           application/x-perfmon,pml,,5
  Type:           REG_SZ
  Data:

Value 48
  Name:           application/x-perfmon,pmr,,5
  Type:           REG_SZ
  Data:

Value 49
  Name:           application/x-perfmon,pmw,,5
  Type:           REG_SZ
  Data:

Value 50
  Name:           application/x-sh,sh,,5
  Type:           REG_SZ
  Data:

Value 51
  Name:           application/x-shar,shar,,5
  Type:           REG_SZ
  Data:

Value 52
  Name:           application/x-sv4cpio,sv4cpio,,5
  Type:           REG_SZ
  Data:

Value 53
  Name:           application/x-sv4crc,sv4crc,,5
  Type:           REG_SZ
  Data:

Value 54
  Name:           application/x-tar,tar,,5
  Type:           REG_SZ
  Data:

Value 55
```

```
  Name:           application/x-tcl,tcl,,5
  Type:           REG_SZ
  Data:

Value 56
  Name:           application/x-tex,tex,,5
  Type:           REG_SZ
  Data:

Value 57
  Name:           application/x-texinfo,texi,,5
  Type:           REG_SZ
  Data:

Value 58
  Name:           application/x-texinfo,texinfo,,5
  Type:           REG_SZ
  Data:

Value 59
  Name:           application/x-troff,roff,,5
  Type:           REG_SZ
  Data:

Value 60
  Name:           application/x-troff,t,,5
  Type:           REG_SZ
  Data:

Value 61
  Name:           application/x-troff,tr,,5
  Type:           REG_SZ
  Data:

Value 62
  Name:           application/x-troff-man,man,,5
  Type:           REG_SZ
  Data:

Value 63
  Name:           application/x-troff-me,me,,5
  Type:           REG_SZ
  Data:

Value 64
  Name:           application/x-troff-ms,ms,,5
  Type:           REG_SZ
  Data:

Value 65
  Name:           application/x-ustar,ustar,,5
  Type:           REG_SZ
  Data:

Value 66
  Name:           application/x-wais-source,src,,7
  Type:           REG_SZ
  Data:

Value 67
  Name:           application/zip,zip,,9
  Type:           REG_SZ
  Data:

Value 68
  Name:           audio/basic,au,,<
  Type:           REG_SZ
  Data:

Value 69
  Name:           audio/basic,snd,,<
  Type:           REG_SZ
  Data:

Value 70
  Name:           audio/x-aiff,aif,,<
  Type:           REG_SZ
  Data:

Value 71
  Name:           audio/x-aiff,aifc,,<
  Type:           REG_SZ
  Data:

Value 72
  Name:           audio/x-aiff,aiff,,<
  Type:           REG_SZ
  Data:

Value 73
  Name:           audio/x-pn-realaudio,ram,,<
  Type:           REG_SZ
  Data:

Value 74
  Name:           audio/x-wav,wav,,<
  Type:           REG_SZ
  Data:

Value 75
  Name:           image/bmp,bmp,,:
  Type:           REG_SZ
  Data:

Value 76
  Name:           image/cis-cod,cod,,5
  Type:           REG_SZ
  Data:

Value 77
  Name:           image/gif,gif,,g
  Type:           REG_SZ
  Data:

Value 78
  Name:           image/ief,ief,,:
  Type:           REG_SZ
  Data:
```

```
Value 79
  Name:             image/jpeg,jpe,,:
  Type:             REG_SZ
  Data:

Value 80
  Name:             image/jpeg,jpeg,,:
  Type:             REG_SZ
  Data:

Value 81
  Name:             image/jpeg,jpg,,:
  Type:             REG_SZ
  Data:

Value 82
  Name:             image/tiff,tif,,:
  Type:             REG_SZ
  Data:

Value 83
  Name:             image/tiff,tiff,,:
  Type:             REG_SZ
  Data:

Value 84
  Name:             image/x-cmu-raster,ras,,:
  Type:             REG_SZ
  Data:

Value 85
  Name:             image/x-cmx,cmx,,5
  Type:             REG_SZ
  Data:

Value 86
  Name:             image/x-portable-anymap,pnm,,:
  Type:             REG_SZ
  Data:

Value 87
  Name:             image/x-portable-bitmap,pbm,,:
  Type:             REG_SZ
  Data:

Value 88
  Name:             image/x-portable-graymap,pgm,,:
  Type:             REG_SZ
  Data:

Value 89
  Name:             image/x-portable-pixmap,ppm,,:
  Type:             REG_SZ
  Data:

Value 90
  Name:             image/x-rgb,rgb,,:
  Type:             REG_SZ
  Data:

Value 91
  Name:             image/x-xbitmap,xbm,,:
  Type:             REG_SZ
  Data:

Value 92
  Name:             image/x-xpixmap,xpm,,:
  Type:             REG_SZ
  Data:

Value 93
  Name:             image/x-xwindowdump,xwd,,:
  Type:             REG_SZ
  Data:

Value 94
  Name:             text/html,htm,,h
  Type:             REG_SZ
  Data:

Value 95
  Name:             text/html,html,,h
  Type:             REG_SZ
  Data:

Value 96
  Name:             text/html,stm,,h
  Type:             REG_SZ
  Data:

Value 97
  Name:             text/plain,bas,,0
  Type:             REG_SZ
  Data:

Value 98
  Name:             text/plain,c,,0
  Type:             REG_SZ
  Data:

Value 99
  Name:             text/plain,h,,0
  Type:             REG_SZ
  Data:

Value 100
  Name:             text/plain,txt,,0
  Type:             REG_SZ
  Data:

Value 101
  Name:             text/richtext,rtx,,0
  Type:             REG_SZ
  Data:

Value 102
  Name:             text/tab-separated-values,tsv,,0
```

```
  Type:             REG_SZ
  Data:

Value 103
  Name:             text/x-setext,etx,,0
  Type:             REG_SZ
  Data:

Value 104
  Name:             video/mpeg,mpe,,;
  Type:             REG_SZ
  Data:

Value 105
  Name:             video/mpeg,mpeg,,;
  Type:             REG_SZ
  Data:

Value 106
  Name:             video/mpeg,mpg,,;
  Type:             REG_SZ
  Data:

Value 107
  Name:             video/quicktime,mov,,;
  Type:             REG_SZ
  Data:

Value 108
  Name:             video/quicktime,qt,,;
  Type:             REG_SZ
  Data:

Value 109
  Name:             video/x-msvideo,avi,,<
  Type:             REG_SZ
  Data:

Value 110
  Name:             video/x-sgi-movie,movie,,<
  Type:             REG_SZ
  Data:

Value 111
  Name:             x-world/x-vrml,flr,,5
  Type:             REG_SZ
  Data:

Value 112
  Name:             x-world/x-vrml,wrl,,5
  Type:             REG_SZ
  Data:

Value 113
  Name:             x-world/x-vrml,wrz,,5
  Type:             REG_SZ
  Data:

Value 114
  Name:             x-world/x-vrml,xaf,,5
  Type:             REG_SZ
  Data:

Value 115
  Name:             x-world/x-vrml,xof,,5
  Type:             REG_SZ
  Data:


Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Performance
Class Name:         <NO CLASS>
Last Write Time:    5/2/97 - 9:12 AM
Value 0
  Name:             Close
  Type:             REG_SZ
  Data:             CloseINFOPerformanceData

Value 1
  Name:             Collect
  Type:             REG_SZ
  Data:             CollectINFOPerformanceData

Value 2
  Name:             First Counter
  Type:             REG_DWORD
  Data:             0x738

Value 3
  Name:             First Help
  Type:             REG_DWORD
  Data:             0x739

Value 4
  Name:             Last Counter
  Type:             REG_DWORD
  Data:             0x756

Value 5
  Name:             Last Help
  Type:             REG_DWORD
  Data:             0x757

Value 6
  Name:             Library
  Type:             REG_SZ
  Data:             infoctrs.DLL

Value 7
  Name:             Open
  Type:             REG_SZ
  Data:             OpenINFOPerformanceData
```

World Wide Web Server Registry Parameters

```
Key Name:           SYSTEM\CurrentControlSet\Services\W3SVC
Class Name:         <NO CLASS>
```

```
Last Write Time:   5/2/97 - 9:12 AM
Value 0
  Name:            DependOnGroup
  Type:            REG_MULTI_SZ
  Data:

Value 1
  Name:            DependOnService
  Type:            REG_MULTI_SZ
  Data:            RPCSS
                   NTLMSSP


Value 2
  Name:            DisplayName
  Type:            REG_SZ
  Data:            World Wide Web Publishing Service

Value 3
  Name:            ErrorControl
  Type:            REG_DWORD
  Data:            0

Value 4
  Name:            ImagePath
  Type:            REG_EXPAND_SZ
  Data:            C:\WINNT\System32\inetsrv\inetinfo.exe

Value 5
  Name:            ObjectName
  Type:            REG_SZ
  Data:            LocalSystem

Value 6
  Name:            Start
  Type:            REG_DWORD
  Data:            0x2

Value 7
  Name:            Type
  Type:            REG_DWORD
  Data:            0x20


Key Name:          SYSTEM\CurrentControlSet\Services\W3SVC\Enum
Class Name:        <NO CLASS>
Last Write Time:   5/15/97 - 10:04 AM
Value 0
  Name:            0
  Type:            REG_SZ
  Data:            Root\LEGACY_W3SVC\0000

Value 1
  Name:            Count
  Type:            REG_DWORD
  Data:            0x1

Value 2
  Name:            NextInstance
  Type:            REG_DWORD
  Data:            0x1


Key Name:          SYSTEM\CurrentControlSet\Services\W3SVC\HTMLA
Class Name:        <NO CLASS>
Last Write Time:   5/2/97 - 9:12 AM

Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters
Class Name:        <NO CLASS>
Last Write Time:   5/6/97 - 4:18 PM
Value 0
  Name:            AcceptExOutstanding
  Type:            REG_DWORD
  Data:            0x9c4

Value 1
  Name:            AccessDeniedMessage
  Type:            REG_SZ
  Data:            Error: Access is Denied.

Value 2
  Name:            AdminEmail
  Type:            REG_SZ
  Data:            Admin@corp.com

Value 3
  Name:            AdminName
  Type:            REG_SZ
  Data:            Administrator

Value 4
  Name:            AnonymousUserName
  Type:            REG_SZ
  Data:            IUSR_XR6-CLIENT2

Value 5
  Name:            Authorization
  Type:            REG_DWORD
  Data:            0x5

Value 6
  Name:            CacheExtensions
  Type:            REG_DWORD
  Data:            0x1

Value 7
  Name:            CheckForWAISDB
  Type:            REG_DWORD
  Data:            0

Value 8
  Name:            ConnectionTimeOut
  Type:            REG_DWORD
  Data:            0x1c20

Value 9
  Name:            DebugFlags
```

```
  Type:             REG_DWORD
  Data:             0x8

Value 10
  Name:             Default Load File
  Type:             REG_SZ
  Data:             Default.htm

Value 11
  Name:             Dir Browse Control
  Type:             REG_DWORD
  Data:             0x4000001e

Value 12
  Name:             Filter DLLs
  Type:             REG_SZ
  Data:             C:\WINNT\System32\inetsrv\sspifilt.dll

Value 13
  Name:             GlobalExpire
  Type:             REG_DWORD
  Data:             0xffffffff

Value 14
  Name:             InstallPath
  Type:             REG_SZ
  Data:             C:\WINNT\System32\inetsrv

Value 15
  Name:             LogFileDirectory
  Type:             REG_EXPAND_SZ
  Data:             %SystemRoot%\System32\LogFiles

Value 16
  Name:             LogFileFormat
  Type:             REG_DWORD
  Data:             0

Value 17
  Name:             LogFilePeriod
  Type:             REG_DWORD
  Data:             0x1

Value 18
  Name:             LogFileTruncateSize
  Type:             REG_DWORD
  Data:             0x1388000

Value 19
  Name:             LogSqlDataSource
  Type:             REG_SZ
  Data:             HTTPLOG

Value 20
  Name:             LogSqlPassword
  Type:             REG_SZ
  Data:             sqllog

Value 21
  Name:             LogSqlTableName
  Type:             REG_SZ
  Data:             Internetlog

Value 22
  Name:             LogSqlUserName
  Type:             REG_SZ
  Data:             InternetAdmin

Value 23
  Name:             LogType
  Type:             REG_DWORD
  Data:             0

Value 24
  Name:             MajorVersion
  Type:             REG_DWORD
  Data:             0x2

Value 25
  Name:             MaxConnections
  Type:             REG_DWORD
  Data:             0x186a0

Value 26
  Name:             MinorVersion
  Type:             REG_DWORD
  Data:             0

Value 27
  Name:             NTAuthenticationProviders
  Type:             REG_SZ
  Data:             NTLM

Value 28
  Name:             ScriptTimeout
  Type:             REG_DWORD
  Data:             0x384

Value 29
  Name:             SecurePort
  Type:             REG_DWORD
  Data:             0x1bb

Value 30
  Name:             ServerComment
  Type:             REG_SZ
  Data:

Value 31
  Name:             ServerSideIncludesEnabled
  Type:             REG_DWORD
  Data:             0x1

Value 32
  Name:             ServerSideIncludesExtension
  Type:             REG_SZ
  Data:             .stm
```

```
       Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\
                        Script Map
       Class Name:      <NO CLASS>
       Last Write Time: 5/2/97 - 9:12 AM
       Value 0
         Name:          .idc
         Type:          REG_SZ
         Data:          C:\WINNT\System32\inetsrv\httpodbc.dll


       Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\
                        Virtual Roots
       Class Name:      <NO CLASS>
       Last Write Time: 5/6/97 - 4:04 PM
       Value 0
         Name:          /,
         Type:          REG_SZ
         Data:          C:\InetPub\wwwroot,,5

       Value 1
         Name:          /iisadmin,
         Type:          REG_SZ
         Data:          C:\WINNT\System32\inetsrv\iisadmin,,1

       Value 2
         Name:          /Scripts,
         Type:          REG_SZ
         Data:          C:\InetPub\scripts,,4


       Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Performance
       Class Name:      <NO CLASS>
       Last Write Time: 5/2/97 - 9:12 AM
       Value 0
         Name:          Close
         Type:          REG_SZ
         Data:          CloseW3PerformanceData

       Value 1
         Name:          Collect
         Type:          REG_SZ
         Data:          CollectW3PerformanceData

       Value 2
         Name:          First Counter
         Type:          REG_DWORD
         Data:          0x758

       Value 3
         Name:          First Help
         Type:          REG_DWORD
         Data:          0x759

       Value 4
         Name:          Last Counter
         Type:          REG_DWORD
         Data:          0x790

       Value 5
         Name:          Last Help
         Type:          REG_DWORD
         Data:          0x791

       Value 6
         Name:          Library
         Type:          REG_SZ
         Data:          w3ctrs.DLL

       Value 7
         Name:          Open
         Type:          REG_SZ
         Data:          OpenW3PerformanceData


       Key Name:        SYSTEM\CurrentControlSet\Services\W3SVC\Security
       Class Name:      <NO CLASS>
       Last Write Time: 5/2/97 - 9:12 AM
       Value 0
         Name:          Security
         Type:          REG_BINARY
         Data:
       00000000   01 00 14 80 c0 00 00 00 - cc 00 00 00 14 00 00 00
........
       ........
       00000010   34 00 00 00 02 00 20 00 - 01 00 00 00 02 80 18 00
4..... .
       ........
       00000020   ff 01 0f 00 01 01 00 00 - 00 00 00 01 00 00 00 00
........
       ........
       00000030   20 02 00 00 02 00 8c 00 - 05 00 00 00 00 00 18 00
.......
       ........
       00000040   8d 01 02 00 01 01 00 00 - 00 00 00 01 00 00 00 00
........
       ........
       00000050   00 00 00 00 00 00 1c 00 - fd 01 02 00 01 02 00 00
........
       ........
       00000060   00 00 00 05 20 00 00 00 - 23 02 00 00 00 00 00 00  ....
...
       #.......
       00000070   00 00 1c 00 ff 01 0f 00 - 01 02 00 00 00 00 00 05
........
       ........
       00000080   20 00 00 00 20 02 00 00 - 00 00 00 00 00 00 1c 00   ...
...
       ........
       00000090   ff 01 0f 00 01 02 00 00 - 00 00 00 05 20 00 00 00
........
       .... ...
       000000a0   25 02 00 00 00 00 00 00 - 00 00 18 00 fd 01 02 00
%.......
       ........
```

```
       000000b0   01 01 00 00 00 00 00 05 - 12 00 00 00 25 02 00 00
........
       ....%...
       000000c0   01 01 00 00 00 00 00 05 - 12 00 00 00 01 01 00 00
........
       ........
       000000d0   00 00 00 05 12 00 00 00 -
........


       Key Name:          SYSTEM\CurrentControlSet\Services\W3SVC\W3SAMP
       Class Name:        <NO CLASS>
       Last Write Time:   5/2/97 - 9:12 AM
```

Tuxedo Configuration

Note: this configuration file is repeated on each of the other 4 clients with the exception of the Hostname, "XR6-CLIENT1", which is replaced by "XR6-CLIENT2" thru "XR6-CLIENT5".

```
*RESOURCES
IPCKEY          133133

MAXACCESSERS    1900
MAXSERVERS      210
MAXSERVICES     1800
MODEL           SHM
MASTER          tpcctm
LDBAL           Y
SCANUNIT        15
BLOCKTIME       60
BBLQUERY        60

*MACHINES
DEFAULT:

"XR6-CLIENT1"   LMID=tpcctm
                TUXDIR="c:\tuxedo"
                APPDIR="c:\tuxedo\runtime"
                TUXCONFIG="c:\tuxedo\runtime\tuxconfig"
                ULOGPFX="c:\tuxedo\runtime\ulog\ULOG"
                TYPE="WinNT"
                UID=0
                GID=0

*GROUPS
GROUPNT
        LMID=tpcctm     GRPNO=1    OPENINFO=NONE

*SERVERS
DEFAULT:
                CLOPT="-A -- -sHS6SUT -dtpcc"

tpccsvr         SRVGRP=GROUPNT
                SRVID=100
                MIN=35 MAX=200
                REPLYQ=Y

tpccdelv        SRVGRP=GROUPNT
                SRVID=301
                MIN=1 MAX=1
                CLOPT="-A -- -sHS6SUT -dtpcc -n301"
                RQADDR=delivery REPLYQ=Y

tpccdelv        SRVGRP=GROUPNT
                SRVID=302
                MIN=1 MAX=1
                CLOPT="-A -- -sHS6SUT -dtpcc -n302"
                RQADDR=delivery REPLYQ=Y

tpccdelv        SRVGRP=GROUPNT
                SRVID=303
                MIN=1 MAX=1
                CLOPT="-A -- -sHS6SUT -dtpcc -n303"
                RQADDR=delivery REPLYQ=Y

tpccdelv        SRVGRP=GROUPNT
                SRVID=304
                MIN=1 MAX=1
                CLOPT="-A -- -sHS6SUT -dtpcc -n304"
                RQADDR=delivery REPLYQ=Y

*SERVICES
```

Appendix D - RTE Code

Admin Environment

```
set WEBADMINCFG=web900-5.cfg
set WEBMAXDRIVERS=20
set WEBDIAGLEVEL=4
set WEBEVENTLOG=0
set WEBEVENTHOST=
set WEBCHECKLEVEL=2

webadmin.exe
```

Profiles used for Performance Run

web900.cfg

```
//
//  Common Driver Configuration
//
INITBASEPORT 4300
INITSYNCMAX 4
INITPAUSE 1
INITRSCALE 100
INITTSCALE 100
INITRWID 1, 900
INITFIXEDWID 1
INITCCLAST 223
INITCCID 223
INITCITEMID 223
//
//  Configuration Driver 1
//
1 INITIPADDR 192.59.13.228
1 INITIISADDR 192.168.83.1
1 INITIISPORT 1441
1 INITBROWSERS 450
1 INITMYWID 1,45
//
//  Configuration Driver 2
//
2 INITIPADDR 192.59.13.228
2 INITIISADDR 192.168.83.1
2 INITIISPORT 1442
2 INITBROWSERS 450
2 INITMYWID 46,90
//
//  Configuration Driver 3
//
3 INITIPADDR 192.59.13.228
3 INITIISADDR 192.168.84.1
3 INITIISPORT 1443
3 INITBROWSERS 450
3 INITMYWID 91,135
//
//  Configuration Driver 4
//
4 INITIPADDR 192.59.13.228
4 INITIISADDR 192.168.84.1
4 INITIISPORT 1444
4 INITBROWSERS 450
4 INITMYWID 136,180
//
//  Configuration Driver 5
//
5 INITIPADDR 192.59.13.229
5 INITIISADDR 192.168.85.2
5 INITIISPORT 1441
5 INITBROWSERS 450
5 INITMYWID 181,225
//
//  Configuration Driver 6
//
6 INITIPADDR 192.59.13.229
6 INITIISADDR 192.168.85.2
6 INITIISPORT 1442
6 INITBROWSERS 450
6 INITMYWID 226,270
//
//  Configuration Driver 7
//
7 INITIPADDR 192.59.13.229
7 INITIISADDR 192.168.86.2
7 INITIISPORT 1443
7 INITBROWSERS 450
7 INITMYWID 271,315
//
//  Configuration Driver 8
//
8 INITIPADDR 192.59.13.229
8 INITIISADDR 192.168.86.2
8 INITIISPORT 1444
8 INITBROWSERS 450
8 INITMYWID 316,360
//
//  Configuration Driver 9
```

```
//
9 INITIPADDR 192.59.13.230
9 INITIISADDR 192.168.87.3
9 INITIISPORT 1441
9 INITBROWSERS 450
9 INITMYWID 361,405
//
//  Configuration Driver 10
//
10 INITIPADDR 192.59.13.230
10 INITIISADDR 192.168.87.3
10 INITIISPORT 1442
10 INITBROWSERS 450
10 INITMYWID 406,450
//
//  Configuration Driver 11
//
11 INITIPADDR 192.59.13.230
11 INITIISADDR 192.168.88.3
11 INITIISPORT 1443
11 INITBROWSERS 450
11 INITMYWID 451,495
//
//  Configuration Driver 12
//
12 INITIPADDR 192.59.13.230
12 INITIISADDR 192.168.88.3
12 INITIISPORT 1444
12 INITBROWSERS 450
12 INITMYWID 496,540
//
//  Configuration Driver 13
//
13 INITIPADDR 192.59.13.231
13 INITIISADDR 192.168.89.4
13 INITIISPORT 1441
13 INITBROWSERS 450
13 INITMYWID 541,585
//
//  Configuration Driver 14
//
14 INITIPADDR 192.59.13.231
14 INITIISADDR 192.168.89.4
14 INITIISPORT 1442
14 INITBROWSERS 450
14 INITMYWID 586,630
//
//  Configuration Driver 15
//
15 INITIPADDR 192.59.13.231
15 INITIISADDR 192.168.90.4
15 INITIISPORT 1443
15 INITBROWSERS 450
15 INITMYWID 631,675
//
//  Configuration Driver 16
//
16 INITIPADDR 192.59.13.231
16 INITIISADDR 192.168.90.4
16 INITIISPORT 1444
16 INITBROWSERS 450
16 INITMYWID 676,720
//
//  Configuration Driver 17
//
17 INITIPADDR 192.59.13.223
17 INITIISADDR 192.59.32.5
17 INITIISPORT 1441
17 INITBROWSERS 450
17 INITMYWID 721,765
//
//  Configuration Driver 18
//
18 INITIPADDR 192.59.13.223
18 INITIISADDR 192.59.32.5
18 INITIISPORT 1442
18 INITBROWSERS 450
18 INITMYWID 766,810
//
//  Configuration Driver 19
//
19 INITIPADDR 192.59.13.223
19 INITIISADDR 192.59.33.5
19 INITIISPORT 1443
19 INITBROWSERS 450
19 INITMYWID 811,855
//
//  Configuration Driver 20
//
20 INITIPADDR 192.59.13.223
20 INITIISADDR 192.59.33.5
20 INITIISPORT 1444
20 INITBROWSERS 450
20 INITMYWID 856,900
//
```

Driver Environment

Note: this configuration file is repeated on each of the other 19 drivers with the exception of `WEBDRIVERNO`, which is replaced by 2 thru 20.

```
set WEBDRIVERNO=1
set WEBADMBASEPORT=4300
set WEBDIAGLEVEL=2
set WEBEVENTLOG=1
set WEBEVENTHOST=
set WEBLOGLEVEL=1
set WEBSINGLETRAN=0
set WEBTPCCAUDIT=0
set WEBRTFUDGETM=110
set WEBNEWORDERPROB=4466
set WEBPAYMENTPROB=4313
set WEBORDERSTATUSPROB=407
set WEBDELIVERYPROB=407
set WEBSTOCKLEVELPROB=407
```

```
webdriver.exe
exit
```

Appendix E - Disk Storage

TPC-C 180-Day Disk Space Requirements					
Warehouses	**900**	tpmC	**10665.53**		
Table	**Initial Rows**	**Data KB**	**Index KB**	**Extra 5% KB**	**Total With 5% KB**
Warehouse	900	1,800	12	91	1,903
District	9,000	18,000	76	904	18,980
Customer	27,000,000	18,003,600	1,397,328	970,046	20,370,974
History (D)	27,000,000	1,350,002	0		1,350,002
Order (D)	27,000,000	702,000	4,234		706,234
New-Order	8,100,000	90,000	548	4,527	95,075
Order-Line (D)	269,999,044	15,008,724	98,104		15,106,828
Item	100,000	9,100	46	457	9,603
Stock	90,000,000	30,006,000	165,786	1,508,589	31,680,375
Totals KB		65,189,226	1,666,134	2,484,615	69,339,975
Dbspaces	**Count**	**Size MB**	**MB Allocated**	**MB Loaded +5%**	**MB Loaded + 8 hrs**
master, model, tempdb & msdb		43	43		
tpc_cs	5	8,577	52,500	50,831	50,831
	1	2,500			
	1	1,500			
	5	306			
	1	1,000			
	1	500			
	5	517			
tpc_misc	2	1,060	3,000	2,131	2,521
	1	880			
tpc_ol	3	4,886	18,500	14,753	17,578
	1	3,842			
Total Allocated MB			74,043	67,715	70,930
Dynamic Space MB	16,661	Sum of data for orders, order_line & history			
Static Space	51,054	Sum of data+index+5% - Dynamic Space			
Free Space	6,328	Total allocated space - (Dynamic & Static Spaces)			
Daily Growth	3,159	(Dynamic Space / (W * 62.5)) * tpmC			
Daily Spread	1,590	Free space - 1.5 * Daily growth (zero if negative)			
	0	SQL Server can be configured to eliminate Daily Spread			
180 Day Space MB	619,684	Static Space + 180 * (Daily Growth + Daily Spread)			
180 Day Space GB	**605.16**				
8 hr log GB	**27.11**	(need double for mirroring)			
Disk Capacity MB	4149	**4.0518 GB**	Capacity of 4GB disks		
	8682	**8.4785 GB**	Capacity of 9GB disks		
Space Usage	**GB Needed**	**Disks Priced**	**GB Priced**		
180-day space DB	605.16 GB	105	425.43 GB	4GB drives	
		22	186.53 GB	9GB drives	
		127	611.96 GB		
8-hr log+mirror	54.22 GB	8	67.83 GB	9GB drives	
OS, SQL Server	4.00 GB	1	4.05 GB	4GB drives	
	663.38 GB	**136**	**683.84 GB**		

TPC-C Actual Dynamic Table Growth Rates				
Table	**Initial (KB)**	**Final (KB)**	**Change(KB)**	**KB per New-Order**
History	1350002	1537360	187358	0.0488
Orders	706234	818448	112214	0.0293
misc_seg	2056236	2355808	299572	0.0781
Order_line	15106828	17273944	2167116	
ol_seg	15106828	17273944	2167116	0.5650
Syslog	660	21298544	21297884	
logsegment	660	21298544	21297884	5.5528
SUM(d_next_o_id)	27009000	30844527	3835527	
New_order	90548	110948	20400	0.0053

Appendix F - Third-Party Price Quotations

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
Tel 206 882 8080
Telex 160520
Fax 206 936 7329

Microsoft

July 3, 1997

Mr. Cameron Spears
Software Engineering Manager
Advanced Logic Research, Inc.
9401 Jeronimo
Irvine, CA 92618

via FAX # 714-581-7951

Dear Cameron,

Here is the information you requested regarding pricing of certain Microsoft products:

Microsoft SQL Server 6.5, Enterprise Edition, unlimited user licence	$28999
Microsoft Windows NT Server 4,0, Enterprise Edition, incl 25 CALs	$3999
Windows NT Server 4.0 software, incl 5 CALs	$809
Microsoft SQL Workstation (includes programmers toolkit)	$499
Visual C++ 32-bit edition (subscription)	$499
5-yr maintenance for above software @ $2095/yr	$10475

This quote is valid for the next 60 days. Please let me know if I can be of any further assistance.

Best regards,

Sid Arora
Product Manager, Microsoft SQL Server
Personal and Business Systems Group

Microsoft

July 3, 1997

Mr. Cameron Spears
Software Engineering Manager
Advanced Logic Research, Inc.
9401 Jeronimo
Irvine, CA 92618

via FAX # 714-581-7951

Dear Cameron,

Microsoft has received your request for permission to disclose the results of TPC-C benchmark tests conducted by ALR with Microsoft SQL Server 6.5, Enterprise Edition on the following system:

ALR Revolution 6X6, 6 processors, Pentium Pro, 200 MHz
Test results: approx. 10600 tpmC; approx. $47/tpmC

Microsoft hereby grants ALR permission to disclose these results to third parties and acknowledges that ALR has formally requested permission to do so in accordance with the license agreement for Microsoft SQL Server software.

Best regards,

Sid Arora
Product Manager, Microsoft SQL Server
Personal and Business Systems Group

BEA ENTERPRISE MIDDLEWARE SOLUTIONS

July 7, 1997

Mr. Cameron Spears
ALR
9401 Geronimo
Irvine, CA 92618

Dear Cameron,

Per your request I am enclosing the pricing information regarding TUXEDO 6.x that you requested. This pricing applies to Tuxedo 6.1, 6.2 and 6.3. Please note that Tuxedo 6.3 is our most recent version of Tuxedo but that all 6.x releases are generally available. Core functionality services pricing is appropriate for your activities.

Tuxedo Core Functionality Services (CFS) Program Product Pricing and Description

TUX CFS is a limited function product from BEA that offers a subset of TUXEDO 6.3/6.2/6.1 capabilities. The following standard 6.x features ARE NOT AVAILABLE WITH TUX-Core AND CANNOT BE SUPPORTED BY TUX-Core:

1. /WS
2. /Q
3. /COBOL
4. /DCE
5. Transaction
6. Events
7. DOMAINS
8. Admin API
9. ACLs (Access Control List security option)
10. Link Level Encryption
11. Web Browser GUI Admin

TUX-CFS provides a basic level of middleware support for distributed computing, and is best used by organizations with substantial resources and knowledge for advanced distributed computing implementations.

TUX-CFS prices are server only and are based on the overall performance characteristics of the server and uses the same five tier computer classification as TUXEDO 6.3. Prices range from $3,000 for Tier 1 to $250,000 for Tier 5. Under this pricing option EVERY system running TUX-CFS at the user site must have a TUXEDO license installed and pay the appropriate per server license fees.

BEA Tux/CFS Unlimited User License Fees Per Server

Unlimited User License fees per server	Number of Users	Dollar Amount	Maintenance (5 x 8) per year	Maintenance (7 x 24) per year
Tier 1 -- PC Servers with 1 or 2 CPUs, entry level RISC Uni-processor workstations and servers (Class 1and Class 2)	Unlimited	$3,000.00	$450.00	$660.00
Tier 2 - PC Servers with 3 or 4 CPUs, Midrange RISC Uni-processor servers and workstations (class 3)	Unlimited	$12,000.00	$1,800.00	$2,640.00
Tier 3 - Midrange Multiprocessors, up to 8 CPUs per system capacity (Class 4 and 5)	Unlimited	$30,000.00	$4,500.00	$6,600.00
Tier 4 - Large (more than 8, less than 32 CPUs) and Mainframe Systems (Class 6)	Unlimited	$100,000.00	$15,000.00	$22,000.00
Tier 5 - Massively Parallel Systems, > 32 processors	Unlimited	$250,000.00	$37,500.00	$55,000.00

Intel based server tier classifications:

		Tier 1	Tier 1	Tier 2	Tier 3	Tier 3
Platform	**Operating System**	**Class 1**	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Intel Pentium/ Pentium Pro PCs	Interactive R3.2 ESIX SVR 4.0 SCO UNIX 3.2.2 and 3.2.4 SCO ODT 2.x,3.x Solaris x86 2.X UnixWare, Windows NT 3.5/4.0	All 386/486 PCs are Class 1	ALL Pentium and Pentium Pro PCs with 1 or 2 CPUs are Class 2	ALL Pentium and Pentium Pro PCs with 3 or 4 CPUs are Class 3		ALL Pentium and Pentium Pro PCs with 5,6,7, or 8 CPUs are Class 5

Please feel free to call me if you require additional information.

Sincerely,

Bob Bartzoff
BEA Systems, Inc.
(408) 542-4363

NETLUX

14180 Live Oak Ave., Unit E
Baldwin Park, Ca. 91760

1-800-789-1780
Phone #818-851-9737
Fax #818-851-9837

July 8, 1997

Cameron Spears
Advanced Logic Research, Inc.
9401 Jeronimo
Irvine, CA 92618
714-581-7951

Quotation

Quantity	Description	Unit Price	Total
1238	NX-H9+ (8+1) 9-Port 10BASE-T Ethernet Hub	$52.00	$64,376.00
300	NX-H24 24-Port 10BASE-T Ethernet Hub	$220.00	$66,000.00
3	NX-H8TX 8-Port 100BASE-TX FAST Ethernet Hub	$399.00	$1,197.00
		Shipping	TBD

Terms and Conditions:

FOB Origin
5 Year Warranty
Prices good for 60 Days

Sincerely,
Martin Parry
NETLUX

Unisys Corporation
3199 Pilot Knob Road
Eagan MN 55121

UNISYS

July 8, 1997

Mr. Cameron Spears
Advanced Logic Research
9401 Jeronimo Road
Irvine, CA 92618

Sent via FAX: 714-581-7951

Dear Mr. Spears:

Mr. Scott Canter of our San Jose, CA facility sent you pricing for five (5) Aquanta DM/6 II Desktop units, per your request. This price of $28,736 did not include your request for five year maintenance.

The five year, on-site, Monday through Friday maintenance for the Aquanta DM/6 II Systems and peripherals quoted by Mr. Canter would be $1,110.00 per system, for a total of $5,550.00.

Thanks Cameron, and please feel free to contact me if you need further price quotations. All Unisys prices quoted are in effect until August 15, 1997.

Sincerely,

William G. Schuett
National Account Manager
(612) 687-2515

WGS/ns/alr2

Unisys Corporation
2700 North First Street
San Jose CA 95134-2028

UNISYS

July 8, 1997

Cameron Spears
Advanced Logic Research, Inc.
9401 Jeronimo
Irvine, CA 92718

via FAX: 714 581 7951

Dear Mr. Spears:

Here is the information you requested regarding pricing for quantity 5 Aquanta DM/6 II desktops:

	Qty	Unit Price	Ext. Price
SYS: Aquanta DM/6 II, 0 Proc. 0MB Mem	5	$628	$3140
PROC: 1x200MHz Pentium Pro/256KB Cache	5	$842	$4210
MEM: 64 MB Memory Upgrade	20	$746	$14,920
CTRL: VGA, 64-bit with 2MB	5	$135	$675
DISK: 1.6 GB IDE 3.5 Internal	5	$236	$1180
CDROM: Twelve Speed IDE	5	$160	$800
ETHERNET: 100Mbit/sec, PCI 32-bit	5	$119	$595
ETHERNET: 10Mbit/sec, PCI 32-bit	10	$163	$1630
MONITOR: 14-Inch color	5	$264	$1320
KEYBD: 104 Key Spacesavor	5	$31	$155
MOUSE: 2 Button PS2	5	$22	$110
Total Configuration:			$28,735

Sincerely,

Scott Canter

Scott Canter