



White Paper

Performance Benchmarks

Premier Banking Software on the Unisys FS1800 Platform

Unisys Engineering Evaluation Lab
Malvern, Pennsylvania

November 2006

As part of an ongoing commitment to ensure that our *Premier*[®] suite of banking software operates at the highest performance levels, ITI has conducted tests to measure performance on the Unisys FS1800 enterprise server. This document details the objectives, configurations, methodology and results of the established benchmarks, and demonstrates the exceptional performance and scalability of *Premier* on this powerful Unisys platform.

Table of Contents

Executive Summary	4
Objectives	4
Configurations	4
System Hardware	4
System Software.....	4
Database	5
Methodology.....	6
Application Software.....	6
Interactive Benchmarks.....	6
Interactive Workloads	7
Update Benchmarks	7
Update Workloads.....	8
Update Process Flow	8
Results.....	8
Interactive Benchmark Results.....	8
Isolated Premier Inquiry Interactive Benchmark Results.....	9
Isolated Connect ³ (Premierecom) Interactive Benchmark Results.....	10
Concurrent Interactive Benchmark Results.....	11
Update Benchmark Results	12
Conclusions.....	13
About the Unisys ClearPath FS Series Servers.....	13
About ITI's Premier Software and Services	13
About Unisys and the Engineering Evaluation Lab.....	14
About Information Technology, Inc.	14
For More Information	14
Notice.....	15

Executive Summary

Information Technology, Inc. (ITI) is committed to ensuring that *Premier*[®] software operates at the highest levels of performance for financial institutions. As part of this commitment, ITI recently conducted a number of tests at the Unisys Engineering Evaluation Lab in Malvern, Pennsylvania. These tests measured *Premier*'s performance on the Unisys FS1800 enterprise server. This document details the objectives, configurations, methodology and results of the established benchmarks, and demonstrates the exceptional performance and scalability of ITI's *Premier* software on this Unisys platform.

Objectives

Performance benchmarks for ITI's *Premier* software on Unisys FS1800 were established by ITI at the Unisys Engineering Evaluation Lab in October and November 2006. The project had three primary objectives:

- 1) Benchmark the performance and scalability of *Premier* update application software using multiple databases on a standard Unisys FS1800 configuration.
- 2) Benchmark the performance and scalability of *Premier* and *Connect*³ data tier application software, supporting *Premier* customer inquiries and *Premierecom* Internet banking activity on a standard Unisys FS1800 configuration.
- 3) Evaluate the performance and scalability of ITI's application software on the Unisys FS1800 platform and determine additional methods of gaining efficiencies.

Configurations

System Hardware

Benchmarks were established on the following standard Unisys FS1800 system hardware configuration.

Processors	2@158N (0-24835 RPM)
Memory	16 GB (4 GB memory disk, 4 GB software disk cache, 8 GB system memory)
Disk Subsystem	EMC CX3-40 (CLARiiON Multipath, VSS2, 30 RAID-1 groups, 60 drives, 4 GB LUNs)

System Software

Benchmarks were established on an FS1800 platform running Unisys ClearPath MCP Release 11.0.

Database

Benchmarks were established with three different database configurations offering a range of processing requirements in terms of account volume and transaction posting activity.

Database A Configuration (One Physical Database)	Total Number of Accounts	Total Number of On-Us Items	Total Number of Transit Items
Demand Deposit	24,073	47,361	15,806
Savings	20,233	2,052	
Certificate of Deposit	9,994	11	
Loans	24,927	606	
General Ledger	4,450	3,983	
Totals	83,677	54,013	15,806

Database B Configuration (One Physical Database)	Total Number of Accounts	Total Number of On-Us Items	Total Number of Transit Items
Demand Deposit	68,791	82,821	67,006
Savings	44,526	2,223	
Certificate of Deposit	6,713	10	
Loans	48,318	744	
General Ledger	11,250	8,829	
Totals	179,598	94,627	67,006

Database C Configuration (One Physical Database)	Total Number of Accounts	Total Number of On-Us Items	Total Number of Transit Items
Demand Deposit	241,135	227,498	95,360
Savings	152,957	13,364	
Certificate of Deposit	167,982	255	
Loans	216,810	6,557	
General Ledger	201,004	15,170	
Totals	979,884	262,844	95,360

Methodology

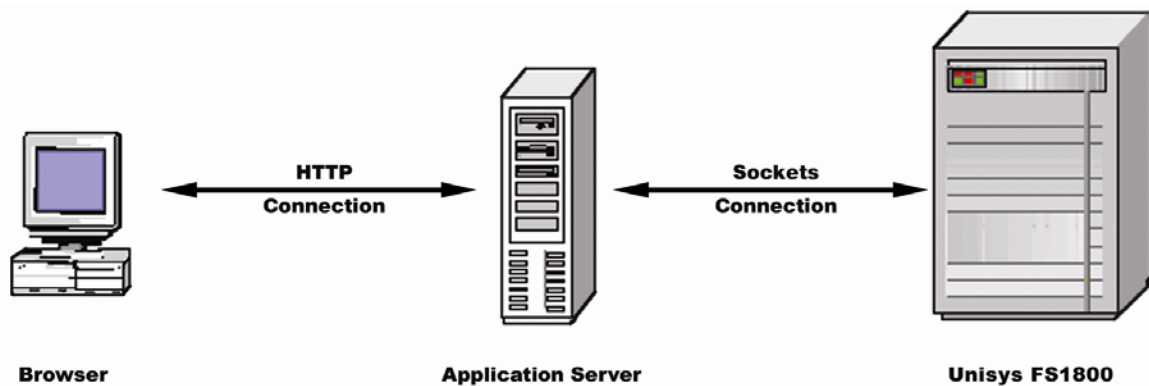
Application Software

Benchmarks were conducted using *Premier* database release level 19 and the following application software versions:

<i>Premier</i>	5.1
<i>Connect³</i>	3.7
<i>ATM</i>	2.9

Interactive Benchmarks

Interactive benchmarks were conducted with ITI's *Premier*, *Connect³* and *ATM* application software. Interactive applications are structured using classic three-tier architecture consisting of data, business and presentation tiers. Standard TCP/IP connections accommodate the communications between the components of this architecture.



The data tier includes programs retrieving information from a banking customer database on a Unisys system. The business tier includes programs on Windows[®] application servers, applying business rules to user requests and formatting responses. The presentation tier resides on the application server, accepts user requests and presents responses to a browser (e.g., Microsoft[®] Internet Explorer[®]) on a workstation.

The interactive benchmarks for this project focused on the performance and scalability of the data tier within the structure of these applications. *Connect³* middleware links an array of ITI electronic delivery systems with the ITI *Premier* and other customer databases in the data tier. A *Premierecom* Internet banking application server workload was used to benchmark *Connect³*.

Interactive Workloads

When benchmarking the performance of the data tier, the user requests and business rules were emulated to represent varying degrees of interactive workloads. The parameters used to emulate the application server workloads were based on transaction history reports from actual ITI clients.

Benchmarks were conducted for the following three types of interactive workloads, which typically represent the majority of online activity:

- 1) Isolated *Premier* customer and account inquiries
- 2) Isolated *Connect³ (Premierecom)* Internet banking activity
- 3) Concurrent *Premier* customer and account inquiries, *Connect³ (Premierecom)* Internet banking activity, and ATM activity

Standard *Premier* inquiry workloads, measured in terms of *Premier* users and their associated “transactions per hour,” were emulated to measure the data tier performance of the application. Only about 25% of user requests generate transactions to the data tier in standard *Premier* inquiry workloads. Most user requests are associated with more detailed presentation of information already retrieved from the customer database.

Standard *Connect³* online workloads, measured in terms of *Premierecom* electronic banking customers and their associated “transactions per hour,” were emulated to measure the data tier performance of the application. About 75% of user requests generate transactions to the data tier in standard *Connect³* online workloads, which is more characteristic of a maintenance application than an inquiry application.

Premier inquiry and *Connect³ (Premierecom)* online workloads were benchmarked in isolation and concurrently. Isolated benchmarks provide effective analysis of exclusive utilization of system resources by particular applications. Concurrent benchmarks are designed to demonstrate system resource utilization with multiple applications competing for system resources simultaneously. ATM activity was also added to the concurrent online benchmarks to enhance this effect.

Update Benchmarks

Update benchmarks were conducted with *Premier* software processing representative databases on the Unisys systems. Benchmarks were established by scaling the size of the database configurations to the processing capability/capacity of the system configuration and are designed to measure the performance of system and database configurations considered typical for current ITI clients.

Although an organized database contributes to optimal update performance, no explicit attempt was made to reorganize these databases using the ITI standard database reorganization program prior to benchmarks. Rather, benchmarks were established by essentially updating these representative databases “as-is” in attempt to simulate real-world processing conditions.

Update Workloads

Update workloads consisted of standard update processing requirements including daily extract, sort, update and report generation programs. Standard update processing for the following ITI applications were included in all benchmarks:

- Demand Deposit Account (DDA)
- Loan Accounting System (LAS)
- Savings Account (SAV)
- Central Information System (CIS)
- Certificate of Deposit (COD)
- General Ledger/Financial Management System (FMS)

Benchmarks did not include additional processes generally regarded as daily requirements such as database backups, *Premier Prime* database population and *Premier Director* downloads.

Update Process Flow

Standard update process flows were used for all benchmarks, leveraging the multithreading capabilities of ITI software, while ensuring that application update programs ran in proper progression.

Results

Interactive Benchmark Results

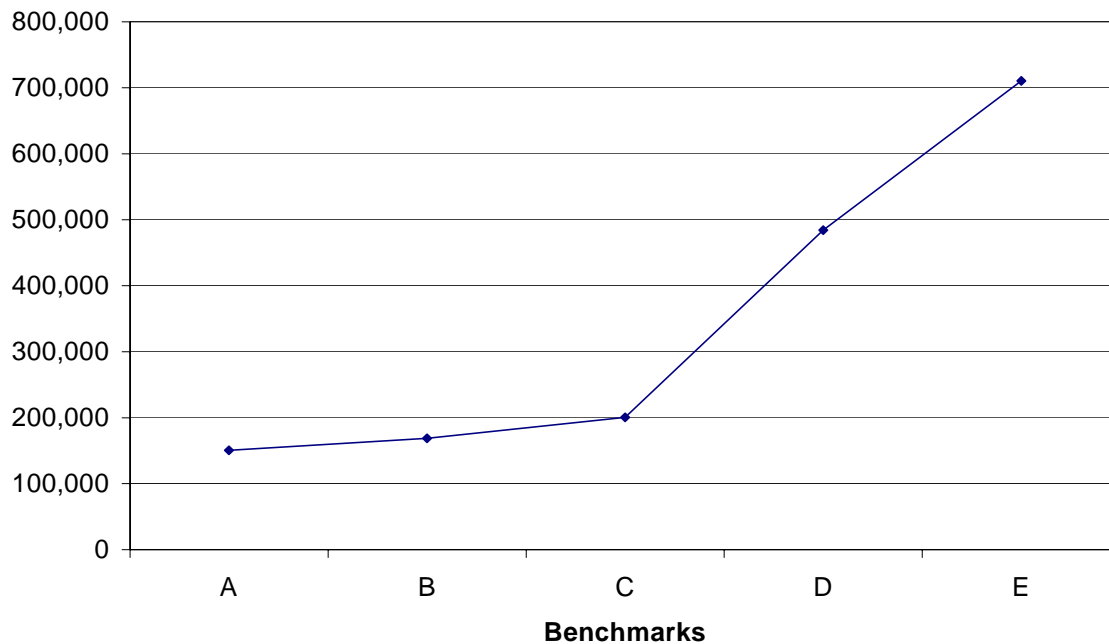
Interactive benchmark results were organized in terms of benchmark parameters (i.e., primarily by data tier system configuration, and secondarily by the number of supported online users and transactions per hour). The number of supported online users is estimated based on the number of transactions per hour achieved during each benchmark. Estimates were determined based on analysis of ITI client transaction history including the number of users authorized for online services, percentage of logins occurring at peak hours, average session length, and the percentage of traffic during peak hours.

Benchmarks were conducted on a single Unisys FS1800 configuration considered a possible solution for *Premier* and *Connect*³ data tier processing requirements. Metrics used for interactive benchmark evaluation included the average data tier latency (response time per transaction from the Unisys FS1800 system) and system resource utilization.

Isolated Premier Inquiry Interactive Benchmark Results

	Supported Users	Transactions Per Hour	Average Data Tier Latency (seconds)	Average CPU Utilization (%)	Average Disk Utilization (IO/sec)
Benchmark A	50,000	150,804	0.563	19.8	786
Benchmark B	56,000	168,588	0.909	21.4	888
Benchmark C	65,000	200,448	2.000	27.2	1,096
Benchmark D	160,000	484,200	0.850	63.5	2,688
Benchmark E	240,000	710,325	1.230	96.7	4,177

Premier Inquiry Transactions Per Hour



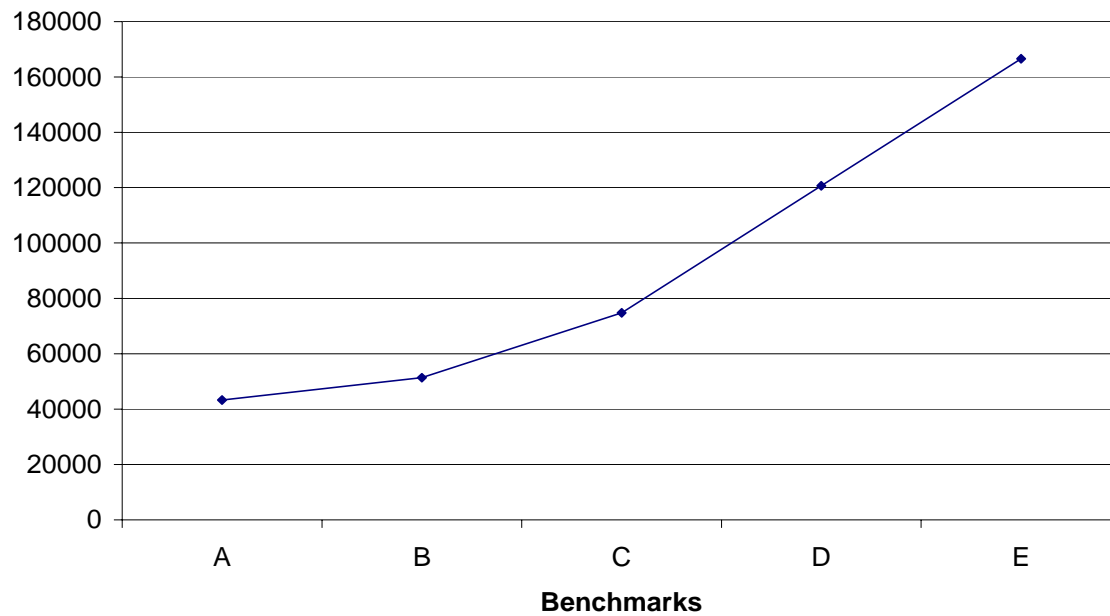
Observations:

- Throughput rates surpassed 700,000 transactions per hour
- Average data tier latency did not surpass 2 seconds
- Average CPU utilization for benchmarks D and E exceeded ITI recommended levels and may limit additional interactive or update workloads

Isolated Connect³ (Premier@com) Interactive Benchmark Results

	Supported Users	Transactions Per Hour	Average Data Tier Latency (seconds)	Average CPU Utilization (%)	Average Disk Utilization (IO/sec)
Benchmark A	120,000	43,236	0.037	0.1	724
Benchmark B	150,000	51,372	0.037	16.1	868
Benchmark C	200,000	74,736	0.040	24.9	1,311
Benchmark D	350,000	120,650	0.235	50.1	1,979
Benchmark E	500,000	166,565	0.510	70.6	2,629

Connect³ (Premier@com) Transactions Per Hour



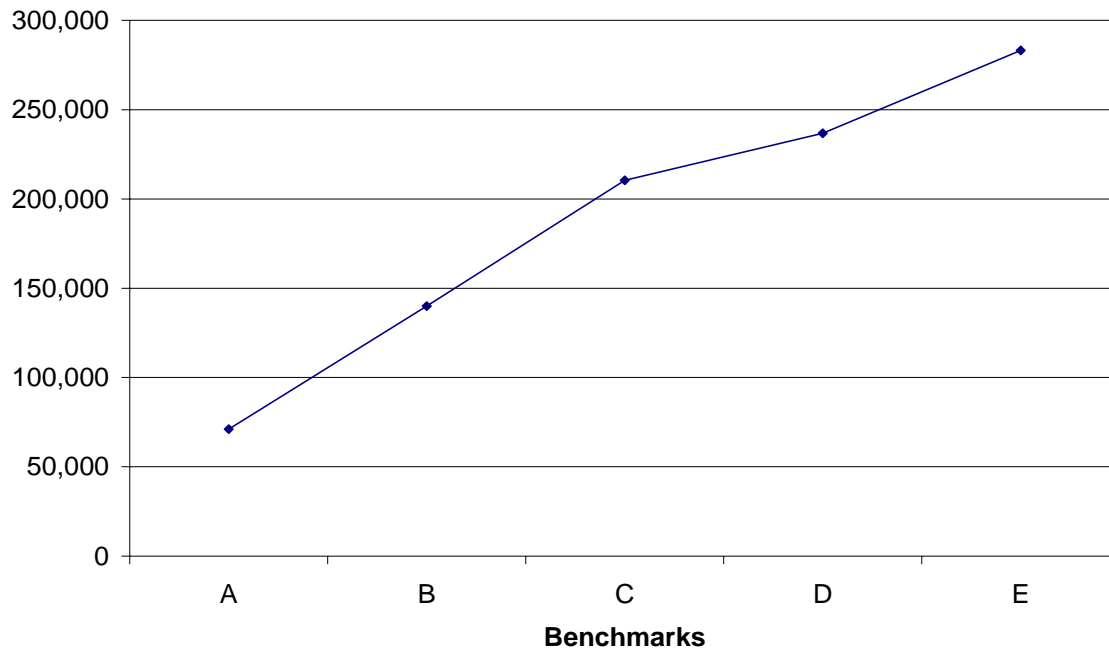
Observations:

- Throughput rates surpassed 165,000 transactions per hour
- Average data tier latency did not surpass 0.510 seconds
- Average CPU utilization for benchmark E exceeded ITI recommended levels and may limit additional interactive or update workloads

Concurrent Interactive Benchmark Results

	<i>Premier Inquiry</i> Transactions Per Hour	<i>Connect³</i> Transactions Per Hour	Average Data Tier Latency (seconds)	Average CPU Utilization (%)	Average Disk Utilization (IO/sec)
Benchmark A	29,621	30,906	0.230	15.7	741
Benchmark B	51,948	68,940	0.250	34.3	1,584
Benchmark C	82,404	99,288	0.297	54.6	2,106
Benchmark D	85,944	121,968	0.540	82.8	3,143
Benchmark E	88,766	144,648	1.109	89.7	3,454

Concurrent Transactions Per Hour



Observations:

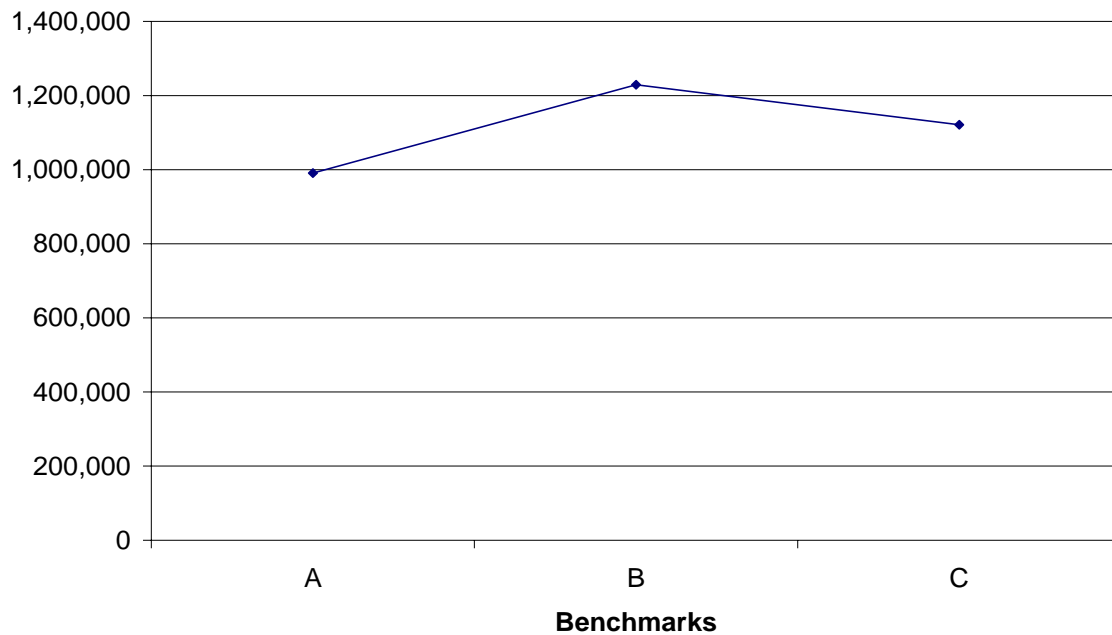
- Throughput rates surpassed 280,000 transactions per hour (including ATM activity not referenced in the Results table)
- Average data tier latency did not surpass 1.109 seconds
- Refer to the isolated *Premier Inquiry* and *Connect³ (Premierecom)* interactive benchmark results to determine approximate number of supported users for corresponding throughput (transactions per hour)
- Average CPU utilization for benchmarks D and E exceeded ITI recommended levels, and may limit additional interactive or update workloads

Update Benchmark Results

Update benchmark results were organized in terms of database size. Metrics used for evaluation included the total elapsed time of the update run, overall throughput and system resource utilization.

	Database Configuration	Accounts Updated Per Hour	Elapsed Time	Average CPU Utilization (%)	Average Disk Utilization (IO/sec)
Benchmark A	A	990,912	00:05:04	41.9	1,376
Benchmark B	B	1,229,188	00:08:46	58.2	3,523
Benchmark C	C	1,108,954	00:53:01	44.0	2,672

Accounts Updated Per Hour



Observations:

- Throughput rates surpassed 1.2 million accounts per hour

Conclusions

These benchmark results solidly demonstrate that ITI's *Premier* and *Connect*³ application software, together with the Unisys FS1800 platform, is more than capable of accommodating the processing requirements of most financial institutions in the nation. The interactive benchmark results demonstrate that 240,000 *Premier* users (financial institution employees performing inquiries) and 500,000 active *Premierecom* Internet banking customers can be accommodated. The *Premier* update benchmark results demonstrate that more than 1 million accounts can be updated in less than one hour.

ITI clients who choose the Unisys ClearPath FS1800 can expect outstanding performance. Benchmark results show that high levels of update throughput and online activity can be achieved with optimal levels of resource utilization for a wide range of processing requirements.

About the Unisys ClearPath FS Series Servers

The Unisys FS1800 platform is part of the ClearPath Financial Services (FS) Series of enterprise servers. The FS Series is Unisys' premier line of vertical-customized server solutions designed, packaged and priced specifically for financial institutions. These new platforms are specialized, integrated, high-value servers that deliver real business value – now and for the future. ClearPath FS Series servers offer the capabilities needed to pursue aggressive growth and respond to changing market demands. As clients develop new products and services, grow their customer base and build the bottom line, these servers support them with specialized capabilities that fit their business perfectly.

About ITI's Premier Software and Services

Premier's comprehensive suite of software and services is the solution of choice at financial institutions nationwide, from de novos and community banks to those with many billions in assets. No matter where they can be found on the technology curve, *Premier* clients gain every opportunity to leverage their existing systems and processes to the greatest extent possible – with powerful results. A continuous cycle of research, development, implementation and feedback delivers the most advanced software on the market, available on the client's choice of two popular hardware platforms. Careful design delivers results that are sophisticated, yet easy to use. Expert service enhances your technology and fine-tunes your banking processes. The result is widespread recognition of *Premier* as the industry's finest and most flexible solution – one that helps clients compete and thrive in an always-changing financial services environment.

About Unisys and the Engineering Evaluation Lab

Unisys is a worldwide technology services and solutions company. The company's consultants apply Unisys expertise in consulting, systems integration, outsourcing, infrastructure, and server technology to help their clients achieve secure business operations. They build more secure organizations by creating visibility into clients' business operations. Leveraging the Unisys 3D Visible Enterprise approach, Unisys makes visible the impact of clients' decisions – ahead of investments, opportunities and risks. For more information, visit www.unisys.com.

The Unisys Engineering Evaluation Lab provides services, facilities, and expertise to help achieve success with Unisys ClearPath platforms. The Center enables their customers to quickly develop prototype solutions that best address their specific requirements. Unisys benchmarking services involve specialized groups of experts that can help with performance or functionality testing on servers and storage products that mirror planned deployments. They have industry best-of-breed technologies that can be custom configured to meet any requirements.

About Information Technology, Inc.

Serving more U.S. banks and savings institutions than any other software and services vendor, ITI offers several core solutions, including the service-oriented architecture-based *Premier*[®] and *PCS Vision*[™] suites, and a broad range of supporting products and services available on the nation's most popular IBM and Unisys hardware platforms for in-house and outsourced account processing. Founded in 1976, ITI works closely with some of the best-known technology companies in the world, and has grown to incorporate businesses and offices nationwide, including its Premier, Precision Computer Systems (PCS), Branch Automation, eSolutions, Digital Solutions, Decision Metrics and Professional Services operating units. ITI is a subsidiary of Fiserv, Inc.

Fiserv, Inc. (NASDAQ: FISV), a Fortune 500 company, provides information management systems and services to the financial and insurance industries. Leading services include transaction processing, outsourcing, business process outsourcing (BPO), software and systems solutions. The company serves more than 17,000 clients worldwide and is the leading provider of core processing solutions for U.S. banks, credit unions and thrifts. Fiserv was ranked the largest provider of information technology services to the financial services industry worldwide in the 2004, 2005 and 2006 FinTech 100 surveys. Headquartered in Brookfield, Wis., Fiserv reported more than \$4.5 billion in total revenue for 2006. For more information, visit www.fiserv.com.

For More Information

For more information about these tests or the *Premier* product suite, call ITI at 402.421.4207 or e-mail partner@iti.fiserv.com. ITI can also be found on the Internet at www.itiwnet.com.

Notice

© 2007 Information Technology, Inc. (ITI). All rights reserved. *Premier* is a registered trademark of Information Technology, Inc. (ITI). The information in this document represents the views of ITI at the time of publication. The contents of this document should in no way be interpreted as a commitment, and are for information purposes only. ITI makes no warranties, express or implied, in this document. Although these benchmarks were designed to simulate typical financial institution processing conditions, actual performance levels will vary depending on the relative system resource utilization of additional applications (both *Premier* and non-*Premier*) not included in typical benchmark workloads.