Financial Fusion
A SYBASE COMPANY
FUSION POWERED e-FINANCE™

IBM® Business Partner™

PERFORMANCE TEST

CONSUMER E-FINANCE SUITE 4.5

Performed at the IBM Solution Partnership Center, San Mateo, California

EXECUTIVE SUMMARY

The number of Web banking users is projected to grow to 30 million total users by 2004. Retail customers of major financial institutions are demanding ready access to their personal and business accounts with increasing frequency.

As financial institutions have implemented online banking, major operational support considerations such as availability, performance and scalability have arisen as issues in on-going application support and capacity planning.

As financial institutions have consolidated, capacity planning and scalability have increased in importance as merged organizations work to determine capacity requirements that were not foreseen when initial online banking applications were first installed. In addition, the increased adoption of online banking customers has affected system performance and projected stability.

This white paper provides planning and sizing information which will enable customers to make accurate initial and long term hardware capacity plans to operate Internet online banking applications at levels that meet and exceed their customers expectations.

Two IBM @server configurations were tested: the IBM @server pSeries™ servers for maximum performance and the IBM @server xSeries™ servers for an affordable entry point.

Performance testing of the IBM @server pSeries and conclusions in this white paper demonstrate the...

—Ability to support 10,000,000 online banking users with the Financial Fusion® Consumer e-Finance Suite running on IBM pSeries models 640 and 680

—Ability to achieve 4,166 application page views per second/14,997,600 per hour

—Scalable to 84 CPU's in a clustered application server environment

—An end user page view response time of 4 seconds or less

Performance testing of the IBM @server x Series and conclusions demonstrate the...

—Ability to support 415,000 on-line banking users with Financial Fusion Consumer e-Finance Suite running on the xSeries model 330 or 350

—Ability to achieve 173 page views per second

—Better than linear scalability when upgrading from a 2 way to 4 way processor

—End user transaction response time of less than 4 seconds per page view

The Financial Fusion Consumer e-Finance Suite offers banks a complete set of online banking software for retail and small business customers that can meet the most demanding requirements for user population and performance. The IBM @server xSeries and pSeries servers each offer potential users the reliability of IBM clustered high availability. Respectively, the IBM @server xSeries offers attractive entry points for online banking and the pSeries provides robust performance and linear scalability for high levels of user population and performance.

TABLE OF CONTENTS

INTRODUCTION

This white paper presents an overview on the IBM @server xSeries and pSeries servers along with Financial Fusion's Consumer e-Finance suite of online banking applications. A powerful combination of software and hardware to meet the increasing demands of the online banking customers.

This benchmark test was designed to simulate common tasks performed each day by customers of leading online financial institutions. Tested tasks consist of five typical transactions:

—Banking

—Funds Transfer

—View Bill Payments

—Add Bill Payments

—Account Register

As a financial institution looking to attract and retain customers, these typical banking transactions encompass the majority of transaction activity to a financial institutions' retail banking Web site. One needs to truly understand the following scenarios.

—How many transactions in a "real world" suite of applications can be performed?

—How many online users dynamically integrating with all channels may be supported?

The typical workload was generated using Mercury LoadRunner for the five sessions described above. Each session was comprised of multiple transactions and was run as many times as possible for the duration of the test. This testing procedure allowed sufficient workload to be generated to determine the capacity of Financial Fusion's Consumer e-Finance Suite while minimizing the number of load-generating clients required. During the tests, LoadRunner gathered transaction response times and successful completion data, which were used to analyze the performance of the components in the test configuration.

OVERVIEW OF THE IBM AND FINANCIAL FUSION SOLUTION

In order to meet the changing needs of the financial services marketplace, IBM and Financial Fusion offer a robust suite of applications for consumers and small business users that are available on either a UNIX or Intel platform. Today's businesses rely more and more on open system and security rich e-business solutions to achieve faster, more efficient results for end-to-end applications.

UNIX Platform

Today's pace of business transformation requires an enterprise server that offers the flexibility and power needed to quickly adapt to change. The IBM @server pSeries 680 model is a powerful UNIX symmetric multiprocessor (SMP) system. It excels at many diverse e-business applications, including Web serving and hosting, mission-critical enterprise resource planning, supply chain management and data warehousing support.

The pSeries 680 server is the first UNIX platform to feature RS64 IV microprocessors, based on the IBM state-of-the-art copper SOI technology. It delivers more power for business a pplications with a total aggregate internal bandwidth of 43.2GB/second that can enhance throughput and help eliminate potential bottlenecks such as insufficient I/O, memory, or processor bandwidth.

The pSeries 680 system is matched with AIX®, the advanced UNIX operating system from IBM. Providing real value in reliability, availability and security, AIX is tuned for e-business application performance and is widely recognized as state-of-the-art in systems and network management.

AIX delivers Java™ technology, Web performance and scalability enhancements for managing large, complex e-business installations. Web-based remote management tools control the system and monitor key resources such as network availability, file system status and processor workload. AIX incorporates Workload Manager, which can help ensure that critical applications remain responsive even during periods of peak system demand.

With a powerful combination of performance, scalable growth options, investment protection, reliability and flexibility, the pSeries 680 offers a comprehensive solution for business-critical computing environments today and into the future. It is a strategic solution for mid- to large-size companies.

Intel Processor-Based Platform

Choosing the ideal hardware to support your e-business needs is just the beginning of implementing a complete IT solution. To get the most value out of your technology investment throughout its life cycle, you need smart, effective systems management. Smart systems management is the most efficient way to keep your availability high and costs low. IBM @server xSeries systems management tools are the best in the industry and can help save you time and lower your total cost of ownership by increasing availability, tracking assets, optimizing performance and enabling remote management. And the comprehensive portfolio of systems management tools not only helps you solve problems quickly, it also helps you avert downtime altogether.

In addition to testing on a UNIX platform, we ran our benchmark tests on the IBM @server xSeries model 350, an Intel high performance, 4-way enterprise server designed for speed, configurability and scalability. This 4-way capable SMP server integrates leading technology for exceptional performance, availability and affordability. Packaged in a sleek 4U configuration with convenient "tool-free" access and maintenance.

Leveraging proven, innovative IBM technologies to build the most powerful, scalable, reliable Intel processor-based servers in the world provides some of the following benefits.

   —Enhance and extend industry standards

   —Drive down the total cost of IT

   —Deliver OnForever™ computing (come as close as possible to achieving ZERO outages—scheduled or unscheduled)

In addition the xSeries supports multiple operating environment and provides the ideal platform for Microsoft Windows 2000. Built upon IBM X-Architecture the xSeries draws from the IBM vast storehouse of experience and innovative technologies to provide enterprise-class, reliability, scalability and security to Intel-base servers.

IBM WebSphere® Middleware

IBM WebSphere is infrastructure software for dynamic e-business, delivering a proven, secure and reliable software portfolio. Providing comprehensive e-business leadership, WebSphere evolves to meet the demands of companies faced with challenging business environments such as the need for increasing operations efficiencies, strengthening customer loyalty, and integrating disparate systems.

WebSphere application servers were an integral component of this performance test and provided a key infrastructure with highly integrated tools and Web Services.

The WebSphere platform is a leader in the Financial Services industry.

   —100% of the global top 10 banks invested in WebSphere

   —90% of the top commercial banks in the US use WebSphere

   —70% of the top 100 NA/European banks use WebSphere

   —Two thirds of the world's leading banks use WebSphere MQ for messaging
     and integration

Leveraging these core software assets allows you to capitalize on existing investments, shorten deployment time for new e-business applications and create real competitive advantage.

IBM DB2® Data Management

In addition, this performance test was conducted using IBM DB2 Universal Database™. As the foundation for e-business, the DB2 product family is the industry's first multi-platform multimedia, Web-ready relational database management system, strong enough to meet the demands of large corporations and flexible enough to serve medium-sized and small e-businesses. Financial Institutions deploying IBM Data Management can expect to minimize costs, leverage existing resources, maximize return on investment, and exploit the power of the Internet in order to attract new customers and retain existing ones by offering easy access to your services virtually anytime, anywhere utilizing DB2.

DB2 Strengths—Lower Total Cost of Ownership

   —Built on open standards and supports multiple platforms to help customers leverage
     their existing IT investments now, and keep total costs to a minimum in the future

   —Extends to the web

   —DB2 advances speed and ease of migrations, development and management

   —Better price performance

Innovation and Technology Leadership

   —Scalability across multiple platforms, from desktop to mainframe positioning e-Finance
     applications for strategic growth

   —Mission critical reliability to process 7.7 billion transactions every day, managing 70%
     of the world's corporate data

   —High availability features for e-Finance means DB2 is open for business 24 x 7 x 365

Financial Fusion Consumer e-Finance Suite

The Financial Fusion Consumer e-Finance Suite integrates all the requirements for an outstanding financial destination including:

- —Consumer Banking
- —Wireless Banking
- —Electronic Bill Presentment and Payment (EBPP)
- —Bill Payment and Transfer Warehouse
- —Content Syndication
- —Account Aggregation
- —Account Register
- —One-to-One Marketing
- —Customer Care

The Consumer e-Finance Suite includes applications that provide complete end-to-end functionality to the Financial Institutions. The Consumer e-Finance Suite utilized in this benchmark consists of an extensive library of Web and wireless objects that enable essential financial transactions on the Internet.

Consumer Banking is a fully branded, customized banking application to fulfill all your customers' financial needs in one place. The entire application has been designed to keep the customer in mind throughout the online banking experience. By being the industry leader in the consumer experience, Financial Fusion can help your web site become the destination site of choice.

The Consumer Banking module tested transactions that included important activities such as:

- —Sign On
- —Sign Off
- —View Accounts
- —Review Account History
- —Edit Accounts

- —Export
- —Transfer Funds
- —Review Pending Transfers
- —Edit Pending Transfers
- —Delete Pending Transfers

The Account Register module provides customers with an intuitive way to manage financial transactions online without requiring the use of a personal financial manager (PFM) software package. The features of the Account Register work in a similar fashion to a standard checkbook, but quicker, easier, and with more accuracy. This is all done online from within the Financial Institution's web site enabling the user to reconcile their register with their account information from the institution.

The business benefits of providing an Account Register include the following:

—Reduced customer service inquiries as customers are better informed and empowered to track their own financial transactions

—Increased web site visits since enhanced user friendliness will encourage greater subscription rates

—Improved site stickiness

—Data mining of Account Register yielding cross-selling opportunities

Financial Fusion's Customer Care brings into alignment best practices among call centers, since it is the Financial Institutions' pre-existing service centers that, in most cases, will be using these tools. Four modules were tested to support the financial institutions' customer service efforts: Message Center, Enrollment and Application Center, Customer Profile Manager and Employee Profile Manager.

The Consumer e-Finance Suite's Web transactions are processed using Java Servlet technology, which is the foundation of Financial Fusion's Java-based, multi-tier, object-oriented architecture. This provides a fully customizable Web infrastructure. It separates and insulates the user interface and communication protocol layers from the core program code. This technology provides an unprecedented level of flexibility and control with respect to design and presentation of the user interface, as well as freedom of choice in the Financial Institution's selection of processors, middleware connections, transaction protocols, communication networks and server connections.

In addition to the Consumer e-Finance Suite, many of these same components and test results may be applied to the Financial Fusion Business e-Finance Suite. Financial Fusion's Business e-Finance Suite enables a full range of business banking and bill payment capabilities from a single point of access and includes ACH, wire transfers and cash management.

TEST DESIGN

The tests were designed to simulate real-world conditions in a banking environment. Typical transactions performed by customers include:

Task Name	Description
Sign On	Used to authenticate a user onto the system based on a unique user name
Account List	Returns to the user a listing of all accounts at the institution associated with the user name
DDA Balances	Returns to the user a listing of all account balances
DDA History	Returns to the user a historical transaction record for one of the associated accounts for a given period of time
Transfer Funds	Allows the user to transfer funds between accounts— e.g. checking and savings
View Payees	Displays a complete list of payees available within the users' accounts for direct electronic payments
View Payment History	Displays a list of all payments previously processed
View Scheduled Payments	Displays a list of all payments not yet processed
Create Payments	Allows the user to create a new payment to be made to existing payees in the customer payee list
Account Register	Allows the user to maintain an online account register with a running balance for categorizing checks, payments, ATM withdrawals, etc.
Sign-off	Closes all active communication sessions between the customer's computer (Web browser) and the banking systems when they press a 'logout' button

Session Matrix

To accomplish a realistic test, we used five different transaction sequences to emulate customer interactions with a bank's web site. These individual sequences range from simple to complex.
The session mix used in these tests was based on data gathered from existing customer's banking sites.

| Session Name	% Total Transactions	Included Tasks
Typical Banking *(no sign-off)*	89%	• Sign-on • Account List • DDA Balances • DDA History • Sign-off
Funds Transfer	6%	• Account List • DDA Balances • DDA History • Funds Transfer • Sign-off
Bill Payment	2%	• Sign-on • Account List • DDA Balances • DDA History • View Payees • View Pending Payments • Sign-off
Add Payments	2%	• Sign-on • Account List • DDA Balances • DDA History • View Payees • View Pending Payments • Create Payments (3 payments) • Sign-off
Account Register	1%	• Sign-on • Account List • DDA Balances • View Account Register • Reconcile New DDA Items • View Register Categories • View Register Payees • Add Payments (3 payments) • Sign-off

Assumptions

—The maximum percentage of enrolled users active within the system during any given hour was 10%.

—The servers will perform at peak capacity during peak traffic loads.

—Sessions that were not completed by users performing a sign-off were timed out after 15 minutes of inactivity.

—The daily traffic load, as a percent of total traffic load, is a peak of roughly 7.5% occurring in early morning and a second peak of about 5.5% in the early evening. An additional margin of 2.5% was given to reflect a maximum percentage of active registered users during any given hour which equates to 10%.

—Average response time of host system: < 1 second

—Average transaction response time < 4 seconds

—Average number of page views during a user session is 15

SYSTEM CONFIGURATION

Hardware Topology

Testing was done on IBM @server pSeries and xSeries servers. Tests were first completed on pSeries servers running AIX 4.3.3, and then replaced with xSeries servers running Microsoft Windows 2000. The network configuration (topology) remained the same for both tests, only the servers were swapped for testing.

Load Generating Clients

Load Balancer (F5 BigIP LB)

WebServers

AppServer
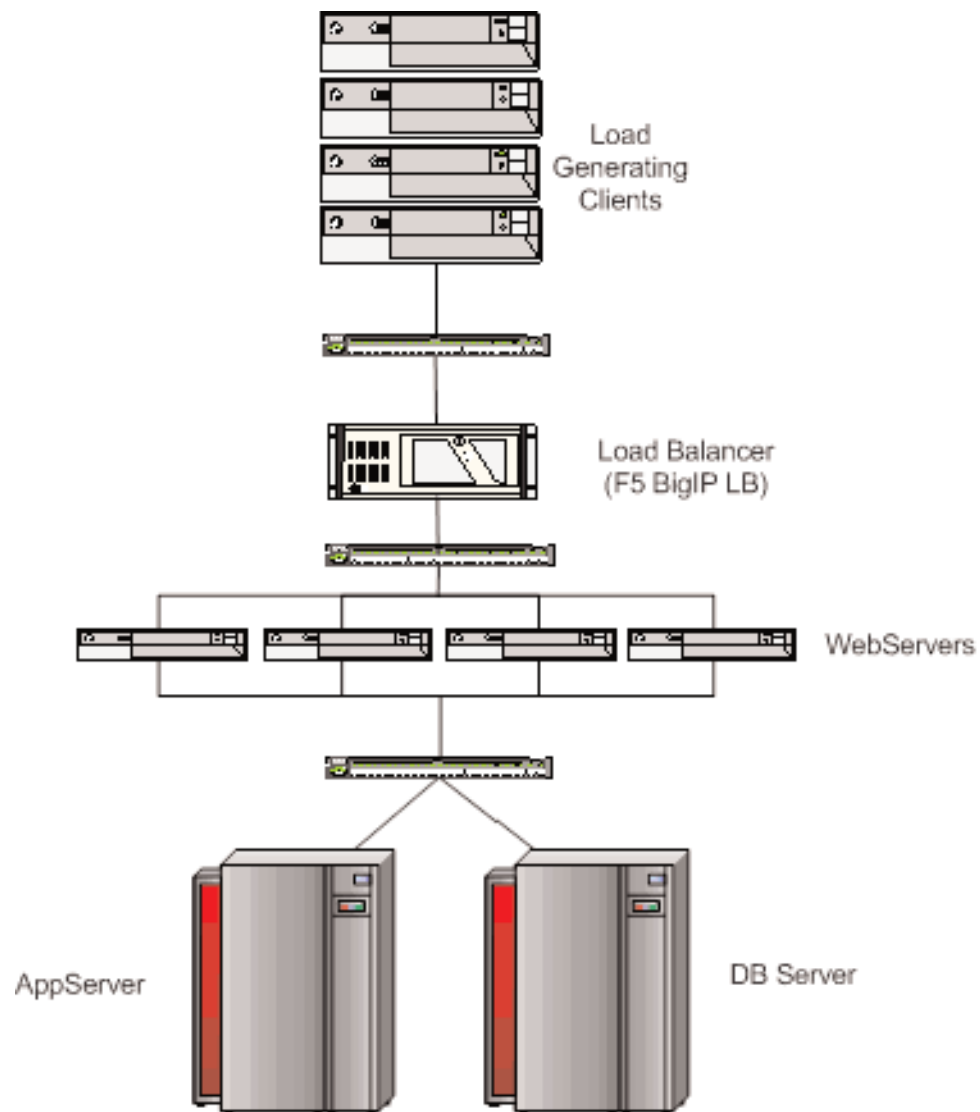
DB Server

HARDWARE CONFIGURATION

IBM @server *pSeries*

Web Servers: p640 w/ Power 3 500 MHz CPUs

>—AIX 4.3.3.09

>—IBM HTTP Server 1.3.19

Application Server: p680/S85 w/ Power 3 500 MHz CPUs

>—AIX 4.3.3.09

>—WebSphere Application Server Advanced Edition 4.0.2

Database Server: p680/S85 w/ Power 3 500 MHz CPUs

>—AIX 4.3.3.09

>—DB2 7.2

IBM @server *xSeries*

Web Servers: x330 w/ Pentium III 900MHz

>—Microsoft Windows 2000 SP 2

>—IBM HTTP Server 1.3.19

Application Servers: x350 w/ Pentium III Xeon 900MHz CPUs

>—Microsoft Windows 2000 SP2

>—WebSphere Application Server Advanced Edition 4.0.2

Database Server: x350 w/ Pentium III Xeon 900 MHz CPUs

>—Microsoft Windows 2000 SP2

>—DB2 7.2

TEST RESULTS & CONCLUSIONS

IBM @server *pSeries*

Testing for pSeries was performed with an incremental number of CPU's in the application server (starting with 2). As tests were run, the workload on the Web servers and database server were monitored and the number of CPU's were re-configured as needed to match the performance of the application server.

According to the benchmark results, the pSeries servers demonstrate linear scalability from a 4 to 32 CPU application server environment. And vertical scalability in a clustered application server environment. The following table contains the results for pSeries servers with the number of CPU's recommended for each area.

Web Server CPU's	Application Server CPU's	Database Server CPU's	# Users Supported**	Page Views /Second	Active Sessions	Sessions in Memory	Memory Required (gb)
2	4	2	480,000	200	4000	16800	6.408
4	6	2	720,000	300	6000	25200	9.613
6	8	2	960,000	400	8000	33600	12.817
8	12	4	1,440,000	600	12000	50400	19.226
12	16	4	1,920,000	800	16000	67200	25.634
14	20	4	2,400,000	1000	20000	84000	32.040
58	84*	18	10,000,000	4166	83333	350000	134.514

*scalable to an 84 CPU clustered application server environment

**Users supported is calculated from Page Views per Second with the following formula:
Supported Users = Page Views per Second * 3600 / Page Views per Session / 10%

Based on the assumptions stated we can assume the following. The IBM pSeries servers scale very well from a 4 CPU application server environment, supporting 480,000 users, to a 32 CPU application server environment scalable to an 84 CPU clustered application server environment supporting 10 million users.

IBM @server *xSeries*

Testing for xSeries was performed using two distinctly different machine types. The first being a 8500 Pentium Xeon 500 MHz based machine capable of running 1—8 CPUs, and the second being a x350 Pentium III 900 MHz with 4 CPUs. The 8500 tests were run using an incremental number of CPU's in the application server (starting with 1). As tests were run, the workload on the Web servers and database server were monitored and the number of CPU's were re-configured as needed to match the performance of the application server. Testing on the @server x350 were run using a single configuration of 4 CPU's.

The following table contains the results for the xSeries test:

Web Server CPU's	Application Server CPU's	Database Server CPU's	# Users Supported*	Page Views /Second	Active Sessions	Sessions in Memory	Memory Required (gb)
2	1	1	69,600	29	580	2436	0.929
2	2	1	127,200	53	1060	4452	1.698
4	4	1	271,200	113	2260	9492	3.62
6	8	2	415,200	173	3460	14532	5.545

*Users supported is calculated from Page Views per Second with the following formula:
Supported Users = Page Views per Second * 3600 / Page Views per Session / 10%

CONCLUSION

Financial Fusion and IBM are leading providers of applications, middleware and hardware to the world's most demanding financial institutions. Together, using leading application software built on Java and industry leading high availability and high performance servers, Financial Fusion and IBM completed performance and sizing efforts.

Based on the assumptions stated we can assume the following. The IBM @server pSeries servers scale very well from a 4 CPU application server environment supporting 480,000 users to a 32 CPU application server environment scalable to an 84 CPU clustered application environment supporting 10 million users. The IBM @server xSeries and the Consumer e-Finance Suites also provide an ideal platform for reliable, scalable on line transaction processing.

These efforts set a new threshold in online banking capacity planning and tested the full set of Financial Fusion's Consumer e-Finance Suite's modules. This provides existing and prospective customers with a real world planning tool to estimate the hardware capacity required to deliver a robust set on online banking applications that satisfy the performance requirements of today's demanding consumers.

THE COMPANIES

Financial Fusion, Inc.

Financial Fusion provides integrated financial solutions to more than 200 of the world's leading financial institutions. Global alliance partners include IBM, Sun Microsystems, and SWIFT. The company supplies service and support in 60 countries and is a wholly owned subsidiary of Sybase, Inc. (NYSE: SY).

Retail Banking Segment

Financial Fusion's Retail Banking Solutions are designed to meet the online banking needs of the financial services industry. Our solutions offer multiple delivery channel banking services for both consumers and small businesses. We support account aggregation, banking and bill payment, customer care, EBPP, OFX/IFX, and cash management.

IBM Corporation

IBM is the world's largest information technology company, offering a powerful blend of products and services to their customers using the world's most advanced information technologies. IBM is dedicated to helping customers, business partners, and developers across a wide range of industries meet their information technology needs and leverage the power of the internet for e-business. More information about IBM is available at www.ibm.com.

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