Back-Office FX Volume Processing & Performance

Broadridge FXL: Back-office volume test results

Broadridge®

Summary

Broadridge conducted a series of volume tests at Intel's® UK-based FasterLAB in order to validate FXL's foreign exchange back office transaction processing capacity.

The tests were designed to prove the scalability and high throughput of the FXL Back Office system. Test trades included spot, forward, swaps and futures using virtual machines running on industry standard low cost hardware. The FX processing workflow included validating data, applying standing instructions, generating and formatting MT300s for FX trades which were then passed out of FXL to an external queue, updating positions and publishing positions and exceptions to client blotters in real-time.

Test simulations were run on a single set of hardware and identified a peak performance of 450 trades per second and 405,000 trades processed through FXL's back office in a duration of 15 minutes.

Linear scaling was observed as more virtual servers were added across the physical host servers during testing, which is a significant and positive indication for overall system scalability.

These extraordinary performance benchmark results confirm FXL as the solution of choice for financial service organizations requiring a high-volume, large-scale FX solution.

Introduction

Broadridge is a specialist provider of global real-time FX, treasury cash management, limit monitoring and order management solutions designed for real-time, high-volume processing of an extensive set of financial asset classes across the front, middle and back offices. In order to validate FXL's foreign exchange back office transaction processing capacity, Broadridge partnered with Intel's® UK-based FasterLAB.

This white paper details the volume tests that were run at Intel's® facilities, the testing methodology used and benchmark results achieved. This paper also provides insight into the hardware components and system architecture used across the performance tests.

The test sets upon which these results are based were created using real-world trade and customer data.

Real-world results may vary depending on actual hardware, number of concurrent users, system configuration and user operations being performed.

Test Methodology

FXL volume tests spanned the major points of FX back office processing: transaction capture, data validation, position updates, standing instructions application, and the generation and formatting of MT300s.

Tests were conducted using the following components:

- Up to 12 virtual application servers running on 3 physical hosts and 1 physical database server.
  - One virtual server configured to validate data and update positions.
  - Up to 11 virtual servers configured to validate and apply standing instructions and generate confirmations.
- A Custom FX Trade Injector used to insert sets of trades into a front office message queue.

These components were distributed across a single set of hardware, as detailed below:

COMPUTER 1	FXL Front Office Interface, FX Flooder Application, WMI Monitor Application
COMPUTER 2-12	FXL Back Office Interface
COMPUTER 13	Database server

Broadridge built the FX Source Flooder specifically for these benchmark tests. The FX Source Flooder was designed to send timed batches of front office trades to a message queue for processing by the FXL Interface Engines.

Tests measured ongoing processor utilization and utilization spikes along with ongoing memory and disk utilization across the hardware in addition to transaction time metrics.

Volume Tests

The baseline test for the high throughput of the FXL Back Office involved feeding a combination of 12 FX and futures trades into the system through the FXL Interface Gateway per second. The baseline test was designed to show that the system (running on 1 server) could handle 1 million trades in a 24-hour period with no duress or stress on the system.

The second phase of testing consisted of running trade capture in parallel with the other processes, ramping up from 1 to ultimately 11 back office virtual servers.

The test system was pre-loaded with 100,000 customers and 1 million open trades composed of spot, forwards, swaps and futures in order to create a more true-to-life trading environment. After successfully completing the baseline tests representing typical trading activity, trading spikes and other forms of duress were then added to prove that the architecture could fully process high volumes of trade activity for extended periods of time under real-world conditions.

A custom FX trade injector generated trades and added them to the front office queue at 500 trades per second. The FXL Interface Gateway read messages from the queue and validated the data, updated the front office data model, and sent them to the FXL Back Office.

FXL Back Office services read messages from the back office queue and processed the messages through the FXL workflow engine which validated the data, applied standing settlement instructions, generated a SWIFT MT 300 confirmation for FX trades and sent these to an external system message queue and generated the full trade model (trade details, confirmations, and payment information) on the database. All data was published to FXL blotters, updating in real-time.
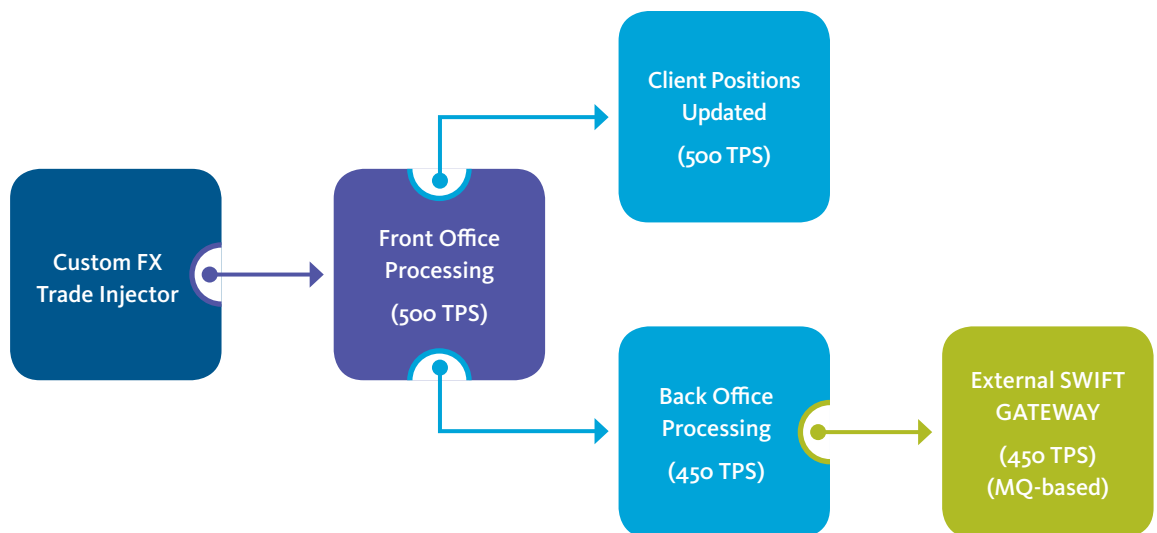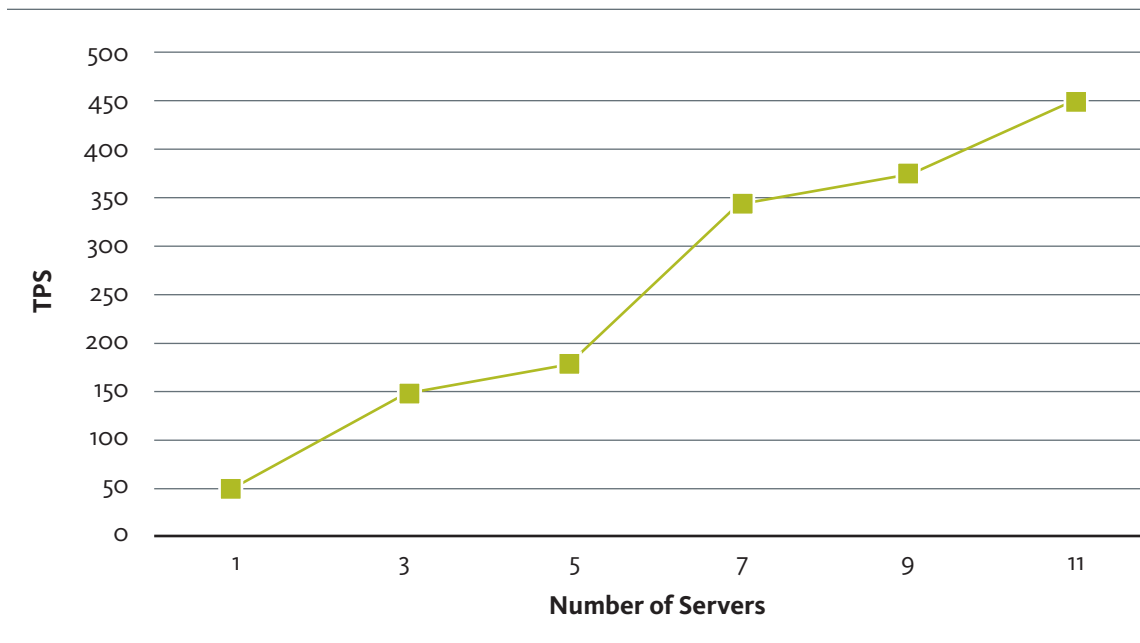
Test Results – 450 Trades / 11 Servers – Success

FXL successfully proved that the system is linearly scalable across 11 back office servers. Concurrent processing of confirmations and payments stayed current as trades moved through the system. Further, manual tasks, such as trade entry and trade search from client applications were not affected by the continuous high-volume load placed on the servers and database.

Based on the hardware in the test, 405,000 trades were processed in 15 minutes. This is a rate of 450 trades per second that were processed and had SWIFT messages sent to an external system. FXL processed, on average, 40.9 trades per second on each of the 11 back office virtual servers used in the test.

During the series of tests that FXL ran, Broadridge was able to show linear scalability across application servers. Additional server processing could be utilized to increase throughput.

Trade Capture Transaction Throughput as Virtual Servers are Added

Hardware Specifications

PHYSICAL SERVER HOSTS 1-3
• Intel® Xeon 3.33 GHz x64 • Dual Processor • 12 cores per processor • 60 GB RAM • 15K RPM Hard Drive

DATABASE SERVER
• Intel® Xeon 3.33 GHz X64 • Dual Processor • 6 cores per processor • 24 GB RAM • 15K RPM Hard Drive • 2 RAID controllers • 6 x 30 GB SSD per controller

VIRTUAL SERVER 1:	VIRTUAL SERVERS 2-12:
• Intel® Xeon 3.33 GHz x64 • 4 cores per processor • 8GB RAM	• Intel® Xeon 3.33 GHz x64 • 4 cores per processor • 8GB RAM

Software Specifications

VIRTUAL SERVER 1:	VIRTUAL SERVERS 2-12:
• FXL Front Office Interface • FX Flooder Application • WMI Monitor Application • Websphere MQ Server • Windows Server 2008 R2 x64 Edition	• FXL Back Office Interface • Windows Server 2008 R2 x64 Edition

DATABASE SERVER	
• Windows Server 2003 R2 x64 • SQL 2008 R2	

Conclusions

Broadridge set out to prove its FX back office processing is linearly scalable. FXL showed this by increasing the number of servers and achieving the processing of 450 trades per second, running the FXL system hosted on virtual application servers at a level of 405,000 trades in a 15 minute period, including concurrent requisite processing. Broadridge FXL was able to successfully demonstrate this level of activity in the stated amount of time at Intel's® FasterLAB UK-based facilities.

These tests demonstrate that a Microsoft .NET solution running on Intel® technology will outperform traditional higher cost architectures. The ability to scale horizontally by simply configuring additional virtual application servers as needed in an inexpensive and incredibly fast process.

Additional servers were added while the system was still processing activity. This further proves that as client's volume increases, expensive system migration projects or upgrade efforts will not be required with FXL. Just simply add additional VM slices and improve throughput.

These performance benchmark results emphasize FXL's ability to consistently deliver realtime, high performance processing and to support FX organizations with global, high-volume operations.

Broadridge will continue to partner with Intel® to capture scalability metrics and to identify peak performance capacity in order to continue to deliver the technology that the market demands.

FXL

FXL is an integrated, n-tier client-server application based on Window's .NET framework. As the only new market entrant in more than 10 years, FXL truly addresses today's market needs using the latest, state-of-the-art technology.

FXL is designed from the ground up to address the key challenges faced by financial services organizations today:

- Global 24*7 trading and operations
- Front-to-back Straight through Processing (STP)
- Unattended end-of-day processing
- Flexible and Configurable Information Views
- Cross-product processing
- High-volume transaction support
- Real-time distribution of information
- State-of-the-art .NET technology
- Multi-organization and multi-entity (MEMO) support
- Workflow-based processing
- Integrated automated testing to improve software quality
- Internationalization

FXL Key Features

Introducing a new processing platform into an organization's existing – and typically complex – technical infrastructure is difficult. Many of the issues that technologists face when selecting a new system have to do with ensuring a smooth transition, minimizing operational inefficiencies and providing tangible benefits for the business. FXL addresses these issues by providing:

- **Seamless integration with existing systems:** FXL integrates smoothly with a diverse set of corporate support systems, regardless of technology, data type and format, or communication requirements. The Interface

Engine is the gateway for all incoming and outgoing data, linking FXL with internal and external systems. The Interface Engine ensures data integrity and consistency, and supports high volumes of activity.

- **Built-in support for global operations:** FXL is designed to facilitate operations for a global organization. This is a central feature of the system, and has specifically determined the way data is organized, distributed, accessed and updated. Company structures are defined using a flexible N-tier hierarchical model, data security is managed at an organizational level, and multi-user mechanisms ensure information integrity.

- **Cross-product processing support:** FXL is a multi-asset class transaction processing system. Traders can view consolidated positions information across all financial products, improving productivity and enabling them to make better decisions faster. Broadridge's core data model uses one set of tables to consistently support all product types. Additional products can be added to the system with minimal effort and without compromising FXL's ability to view consolidated positions information, process settlements and confirmations, and manage accounting across all asset classes.

- **High availability for business continuity:** FXL is designed to provide a high availability environment. It supports a number of server configurations that automatically and transparently provide business continuity to users. Because FXL is built using industry standard technology, it is also compatible with a number of 'off-the-shelf' business continuity tools, including application server clustering and hot-backups of the database to an offsite location. Redundant application servers can also be configured to run against backup databases.

- **Customizable and extensible development environment:** The FXL Development Kit enables organizations using FXL to create components in-house to modify, replace or extend application functionality.

Contact us

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About Broadridge FX & Liquidity Solutions

FXL offers, global, workflow-based transaction processing software solutions in FX, treasury cash management, limit monitoring, and order management across multiple asset classes. FXL products enable real-time, high volume trading–around the clock, and are used by leading financial services organizations to improve speed and agility, enable better decision-making, reduce risk and drive down costs. Designed for quick implementation and integration, FXL uses the latest technologies, including C# and Microsoft's .NET framework, to ensure the highest levels of scalability and flexibility.

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