

Sun and SunGard

Delivering a powerful, integrated cross-asset trading solution



Highlights

- Handles complex financial instruments and growing transaction volumes
- Delivers a high-performance, modular system that integrates foreign exchange and money markets with capital markets trading, brokerage, and order management
- Supports end-to-end transactions including limit extractions, back-office ticketing, and recalculating positions in real time
- Eliminates resource contention in almost all the application components
- Leverages powerful and scalable Sun systems that combine datacenter reliability with mainframe-class computing for the open systems market
- Takes advantage of Solaris™ 10 Operating System features to perform higher numbers of transactions per second with zero lag time



Today's sophisticated investors are demanding a wider variety of asset classes, more complex financial instruments, and a broader geographical range of products. The result of these changing requirements is exponential growth in transaction volumes and trading complexity that is prompting the need for a powerful and responsive trading infrastructure. Sun and SunGard offer high-performance, modular Front Arena software running on Sun platforms to support global cross-asset trading with a system that integrates foreign exchange and money markets with capital markets trading, brokerage, and order management.

New market opportunities unfold

In the pursuit of aggressive, high-speed, sophisticated trading strategies, traders are leveraging global markets to exploit the variety of available asset classes and create new opportunities. Firms are also offering new hybrid or cross-asset class products that combine two or more single asset class financial instruments into a single product. The range and complexity of these potential combinations is vast. Where firms once operated self-contained desks with dedicated trading systems for individual asset classes such as equities and fixed income, cross-asset derivatives platforms now provide trading opportunities in all types of instruments.

Traders need solutions to meet demand

At the same time, currency trading in foreign exchange (FX) markets is the largest and fastest growing trading market in the world. Discrete legacy FX and money market (MM) solutions are struggling to handle increasing numbers of transactions. Indeed, the dramatic growth of the FX market is beginning to tax bank processing capabilities and traders are demanding consolidated, high-performance systems that can handle the risk and complexity of new financial instruments along with proliferating numbers of transactions.

The SunGard Treasury Trader and SunGard Front Arena Solutions

SunGard Front Arena is the definitive integrated cross-asset solution for sales, trading and risk management, operations, and distribution. The modular SunGard Front Arena software offers trading capabilities that integrate FX, money markets, and FX options with capital markets trading, brokerage, and order management.

SunGard offers its existing global foreign exchange and money markets system, Treasury Trader, as a module that can be used alone, in parallel, or within the Front Arena solution. The flexible, robust Front Arena solution makes it possible to eliminate standalone trading systems, lower total cost of ownership, reduce operational risk, and facilitate system consolidation.

Testing the performance and scalability of the SunGard Front Arena software

Exchange trading demands high performance while FX and MM trading requires systems capable of handling high volumes. Sun and SunGard engineers recently tested the Treasury Trader and Front Arena FX trading modules for a SunGard customer to assess capacity and scalability when performing high volumes of trades. The objective of the testing was to ascertain that SunGard's Treasury Trader solution can maintain satisfactory performance in keeping with the customer's forecasted trading volume growth. Should those levels be surpassed, companies can use the SunGard Front Arena software to support more diverse trading needs and even greater transaction volumes.

Test configurations

Three systems were used to create a test environment.

The Front Arena module was tested on a Sun SPARC® Enterprise M8000 server with 16 SPARC64® VI dual-core processors and 256 GB memory. Offering mainframe-class computing for the open systems market, Sun SPARC Enterprise M8000 servers combine datacenter reliability with the advantages of the Solaris™ 10 Operating System (OS). With massive compute power, Sun SPARC Enterprise M8000 servers are capable of scaling to 16 quad-core SPARC64 VII or dual-core SPARC64 VI processors and can accommodate to 512 GB of memory. An optional external I/O expansion unit provides 112 PCI Express or PCI-X expansion slots for extreme scalability and performance.

A Sun Fire™ E2900 server and Sun Fire V890 server, connected via a Gigabit Ethernet switch, were used for testing the SunGard Treasury Trader module. The Sun Fire E2900 server is a midrange system containing up to twelve 1.95 GHz UltraSPARC® IV+ processors, with 24 simultaneous compute threads. Memory capacity for the server can scale to 192 GB. The server comes in a 12 RU rack, offering the compute density that datacenters require. The Sun Fire E2900 server was configured with twelve 1.2 GHz dual-core UltraSPARC IV processors and 96 GB of memory. The Sun Fire V890 server was configured with four dual-core 1.5 GHz processors and 64 GB of memory.

Testing the SunGard Treasury Trader software

Using baseline usage and performance definitions, Sun and SunGard engineers devised specific test cases for key metrics. These cases corresponded to typical trading scenarios, including revaluation or end of day processing, transactional throughput, Electronic Broking Services (EBS) processing time, Reuters D2000 processing time for six simultaneous feeds, outbound back-office ticketing, and GUI application behavior.

Subtests performed additional stresses on the systems, such as drilling down to 800,000 trades, profit and loss (P&L) recalculation on all open positions, rate refreshes from a simulated Reuters rate publisher, and launching a forward ladder report (GAP report).

Based on 800,000 open positions and 100,000 external transactions with 160,000 value today deals, the testing simulated 160 different users running position and trade GUI applications. Test cases employed real-time limit exposure extraction, back-office ticketing, and rate simulations. The 13 feeds used to propagate live FX deals and update cash details and P&L were simulated in the test cases. End-to-end measurement of transactions was defined as the amount of elapsed time between inserting a deal into the ExternalFXTrade table and when the deal was displayed on all 160 connected user clients.

Testing the SunGard Front Arena solution and the FX module

After completing testing on the Treasury Trader application, engineers proceeded with the Front Arena FX software, assessing transactional throughput with all components running. The SunGard Front Arena software tests did not require the throttled and regulated flow of deals used for Treasury Trader because of the distributed Front Arena architecture and because the Sun SPARC Enterprise M8000 server is a larger and more powerful Sun server with much greater storage capacity.

Performance analysis and monitoring

The Solaris 10 OS contains various built-in performance monitoring tools that can be used to assess system events and identify performance bottlenecks. These tools were used to monitor system elements and functions during the testing effort.

Several utilities measured active processes (prstat), input/output (iostat), and virtual memory statistics (vmstat). The truss command was used to trace system and library calls.

Solaris Dynamic Tracing

Engineers also used the Solaris Dynamic Tracing (DTrace) framework during the testing effort. A key Solaris 10 OS feature, the DTrace software allows real-time data collection and analysis of production systems, making it possible for system and database administrators to optimize application performance. With a system-level view of application and kernel activities, the DTrace software runs dynamically without modifying or restarting applications or rebooting the system.

Sun and SunGard engineers used the DTrace software to look for excessive system calls, check memory allocation, and gather data on system timing that would otherwise be impossible to collect. Used to monitor end-to-end transaction time, the engineers wanted to determine how long it would take to display vital information to traders using the PRIME user front-end. The DTrace facility helped engineers track application performance without introducing additional overhead that could impact results.

SunGard Treasury Trader development changes

Based on a preliminary study, SunGard engineers theorized that maintaining system responsiveness and improving throughput in the Treasury Trader software depended on making a number of modifications. These modifications were made after the first baseline test stage was completed.

- Utilize the network to access data, instead of reading from database disks, to minimize database contention

- Leverage multiple threads to read and write data by converting single-threaded transaction-based processes to utilize multithreading and fine-tune the thread counts on each process
- Redesign the graphics to allow faster drawing and data handling, continually update graphics without compromising transaction throughput, and eliminate interference with updating the graphics
- Reduce computational inefficiencies and remove unnecessary duplication of work
- Utilize data caches and improve memory arrays and search criteria for efficient data retrieval on working processes
- Use CPU binding to provide sufficient compute resources for key processes
- Minimize TCP network overhead for the EBS and Reuters D2000 data feeds
- Replace clustered indexes with non-clustered indexes on high transaction volume database tables in order to eliminate extra disk I/O
- Improve the use of data page locking in the database to reduce table and index contention
- Implement cache tables in memory to improve cache hits for queries submitted by the database

Test results

Table 1 illustrates the test results for the SunGard Treasury Trader and Front Arena software on Sun servers. The column labeled Treasury Trader Baseline indicates results using the defined test cases using the Treasury Trader software and the production database on the Sun Fire E2900 server. The column labeled Stage One shows the results of the same Treasury Trader software running on the Sun Fire E2900 server tested with simulated volume growth.

The column labeled Stage Two contains results obtained by making changes to the Treasury Trader software as described in the SunGard Treasury Trader development changes section above. The bottom row of the table depicts tests that did not regulate or throttle down the flow of deals in order to provide an indication of the kind of throughput that could be expected. The last column shows results attained for two specific test cases using the Front Arena FX software running on the Sun SPARC Enterprise M8000 server. Note that the testing did not restrict trades to 20 per second, but allowed deals to flow in at the same capacity as listed in the last row.

The design of the Treasury Trader software is capable of guaranteeing pre-defined end-to-end transactional throughput of 20 transactions per second, including real-time limit extractions, back-office ticketing, and all 160 clients recalculating positions in real time. Front Arena is suited to connecting greater numbers of users in a global solution, however, as its architecture eliminates resource contention in almost all the application components.

The solution leverages the performance of the Solaris 10 OS, and use of distributed and rich client front-end applications allows the server-based back-end processes to perform higher numbers of transactions per second with zero lag time. In addition, the Front Arena FX software design utilizes multiple transaction engines to achieve greater scalability.

About Sun and SunGard

A global leader in software and processing solutions for financial services, higher education, and the public sector, SunGard solutions support the business continuity of information-dependent enterprises in multiple industries. SunGard serves more than 25,000 customers in more than 50 countries, including the world's 50 largest financial services companies.

With years of experience in financial services, Sun's advanced technologies and solutions are designed to help financial services IT departments adapt swiftly, deliver extreme performance, and scale with growing business needs. Together, Sun and SunGard offer a flexible and configurable high-volume trading solution that provides online, real-time trading and processing that can scale to support local and global operations.

Learn More

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Table 1: Test results for SunGard Treasury Trader and SunGard Front Arena running on Sun servers.

Test Case	Treasury Trader Baseline	Stage One, Treasury Trader Simulated Growth	Stage Two, Treasury Trader Software Changes	Stage Three, Treasury Trader Performance Tuned	Next Stage: Front Arena FX
Test Case 2.0 End of Day (Time)	1:00:00	> 3 hours	1:45:00	00:45:00	
Test Case 3.0 End-to-End (tps ¹)	1.51	1.18	20.0	~20.0	239 (Sun SPARC Enterprise M8000 server, 200 clients)
Test Case 4.0 EBS Server (tps)	4.37	4.37	23.8	~50.0	
Test Case 5.0 D2000 Servers (tps)	4.37	4.37	23.8	~40.0	
Test Case 7.0 Outbound Tickets (tps)	5.29	3.10	20.0	~20.0	
Test Case 8.1 GUI Drilldown (Time)	00:00:21	00:35:09	00:00:07	00:00:06	
Test Case 8.1 PL Update (Time)	00:00:08	00:00:42	00:00:23	00:00:25	
Test Case 8.1 Rate Update (Time)	00:00:12	00:00:15	00:01:15	00:01:13	
Test Case 8.1 GAP Report (Time)	00:00:03	00:00:10	00:00:10	00:00:12	
Test Case 8.2 GUI Launch (Time)	00:00:53	00:02:46	00:02:04	00:02:58	
Transaction Throughput	1.51	1.18	33.0	121.0	280 (Sun Fire E2900 server) 405 (Sun SPARC Enterprise M8000 server)

1. Transactions per second

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