Solution Brief
Intel® Xeon® Processor E5 Family
High-Performance Computing
Server Performance
Financial Services

Intel® Xeon® processor speeds up low-latency trading

Tata Consultancy Services (TCS) doubles throughput and reduces latency for its TCS BaNCS* securities trading application by up to 86 percent with Intel Xeon processor E5-2670-based high-performance computing solution

TATA CONSULTANCY SERVICES

"With the globalization of the markets and increase in liquidity, trading platforms now require very low latency to quickly grab market opportunities. TCS BaNCS* securities trading application has been used by leading institutional brokerage firms for algorithmic trading and is working towards delivering microsecond-latency trading. With the help of the Intel Xeon processor E5-2670-based cluster, we have been able to reduce the latency by up to 86 percent and offer faster trading platforms to dealers. The Intel Xeon processor E5-2670-based solution provides higher number of cores, better cache and memory speed, as well as advanced features such as Intel® Turbo Boost and Intel® Hyper-Threading technologies. It not only helps to reduce latency, but also doubles the transaction throughput with fewer processors and less hardware."

– Bharat Shah
Solution Head – Capital Markets
TCS BaNCS
TCS

TCS is a global IT services, consulting, and business solutions organization that offers a consulting-led, integrated portfolio of IT, business process outsourcing (BPO), infrastructure, engineering, and assurance services.

TCS Financial Solutions is a strategic business unit of TCS. Dedicated to providing business application solutions to financial institutions globally, TCS Financial Solutions has compiled a comprehensive product portfolio under the brand name of TCS BaNCS*. With a global customer base of more than 300 institutions operating in over 80 countries, TCS Financial Solutions delivers state-of-the-art software solutions for the banking, insurance, and capital markets industries worldwide. TCS BaNCS Securities Trading application is one of the products it offers to the broker dealer segment of capital markets.

Challenges

- **Reduce latency in algorithmic trading.** Reduce the time to process transactions to the sub-millisecond level with the TCS BaNCS securities trading application, allowing investors to route orders much faster and increase trading profitability.
- **Increase transaction throughput.** Allow computing resources to be utilized efficiently to double throughput and reduce latency of processing transactions.
- **Reduce data access time.** Reduce the time spent in accessing in-memory, relational database management systems, lowering the end-to-end application latency.

Solutions

- **Take advantage of the latest generation of Intel® platforms.** Refresh servers and enable the TCS BaNCS securities trading application to utilize parallel processing with the multi-core, multi-socket platforms to achieve low latency and higher-throughput performance during trading transactions.
- **Use various Intel® technologies.** Allow processor frequency to scale dynamically, boost overall system scalability and performance by using technologies like Intel Turbo Boost and Hyper-Threading technologies.
- **Make the overall application aware of non-uniform memory access (NUMA).** Enable NUMA awareness at the BIOS level, allowing the application to be fine-controlled for NUMA awareness at the operating system level. Processes and their memory references were affinitized using numactl commands.
- **Improve database access efficiency.** Reduce memory access times and shift bottleneck towards memory utilization while improving software algorithms and optimizing data structures to take advantage of the underlying architecture.

Technology Result

- **Significantly improved system performance.** With a combination of the new platform features, parallel processing (with a configurable number of processes), and multiple optimizations, TCS reduced the time to perform transaction processing in algorithm trading by up to 86 percent and made the application highly scalable, with more cores in future.

Business Value

- **Reduce TCO.** Reduced the number of servers to save on data center space and equipment acquisition by better harnessing the increased number of cores and sockets on the latest Intel Xeon processor E5-2670-based platform.
- **Protect current investment.** Save re-engineering costs in the future since adopting a parallel processing paradigm ensures the application seamlessly ports to and scales with future generations of Intel processors.
- **Provide investors with competitive edge.** With the reduced latency, financial institutions that utilize this application enjoy a huge competitive advantage, since having the lowest latency enables them to execute orders faster.

Algorithmic trading (algo trading) — which uses electronic platforms for entering trading orders with an algorithm that takes trade decisions on behalf of the trader based on pre-programmed parameters — has grown exponentially in the last few years. Major trends driving this growth include increasing use of electronic trading, decreasing margins, high market volatility, and low latency. With intense competition in algo trading, traders are looking to reduce the latency of transactions sent to liquidity points such as exchanges and electronic communication networks (ECNs).

With more cores and cache and higher memory speeds, the Intel® Xeon® processor E5-2670 reduces the latency and doubles the throughput performance of the TCS BaNCS to enhance transaction processing

In algo trading, large investment banks use the TCS BaNCS securities trading application to execute high-value orders from their institutional clients. This application is a multi-asset and multi-market trading solution offering complete integration between front and back offices and real-time risk management.

"Since trading today is nearly completely electronic, banks with the lowest-latency platform enjoy a huge competitive advantage in terms of better execution of orders. Thus, TCS sought to enable the TCS BaNCS security trading application to reduce latency and enhance processing of transactions for our clients," said Bharat Shah, solution head – capital markets, TCS BaNCS.

Meeting the requirements of low-latency trading

The TCS BaNCS security trading solution was earlier designed for a distributed environment clustered with Intel Xeon processor X5355-based servers. With growing processing power on Intel processor-based servers, and the programming paradigm shifting to increased parallelism, the solution was enabled for an Intel Xeon processor E5-2670-based server.

Harnessing the parallel processing capability of the Intel Xeon processor E5-2670 reduced the latency by up to 86 percent while doubling the throughput performance of the solution with fewer processors and 25 percent fewer servers. With the higher clock speed and improved microarchitecture, TCS was able to bring down the latency to the sub-millisecond level.

Intel Processor	Stage	Latency	Improvement
Intel Xeon processor X5355	Application deployed on Intel Xeon processor X5355	10.50 ms	-
Intel Xeon processor E5-2670	Application/ System re-architecting	4.80 ms	54.00 %
	Application parallelization	1.97 ms	81.28 %
	BIOS and OS Tuning	1.72 ms	83.61 %
	NUMA aware optimization	1.47 ms	86.00 %
	Use Intel® Compiler	1.45 ms	86.19 %

Reduced latency and improved performance of the TCS BaNCS security trading solution using Intel Xeon processor E5-2670

Deploying servers based on the Intel Xeon processor E5-2670 also allowed TCS BaNCS to tune the solution's system for better performance and future scalability using Intel Hyper-Threading Technology (Intel HT Technology), which uses processor resources efficiently by enabling multiple threads to run on each core.

Utilizing Intel Turbo Boost Technology 2.0 also helped TCS maximize performance and energy efficiency. Enabling Intel Turbo-Boost Technology on a busy system like the one running this application boosts the overall system to the highest frequency possible under operating limits.

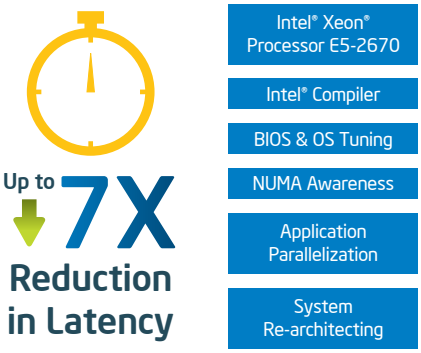
Improving NUMA awareness of the overall application also greatly benefitted the performance. With processor systems scaling from multi-cores to multi-sockets, non-uniform access of memory by different sockets has become the norm. Although logically it stays transparent to the programmer, the latency of accessing memory physically connected to a remote socket can become considerable if the application frequently accesses memory. The latest LInux* kernel supports NUMA, not only allowing affinitization of processes to certain core and sockets but also affinitization of memory references by those processes to the same socket. NUMA awareness was enabled at the BIOS level. The application was fine-controlled for NUMA awareness at the operating system level. Processes and their memory references were affinitized using numactl commands.

Reduced latency for faster, more efficient algo trading

"With the application, operating system, and system tuned to better utilize the Intel Xeon processor E5-2670, the latency for transaction processing was greatly reduced, creating a unique low-latency engineering system with a co-location ability for investment banks," explained Shah.

TCS was also able to reduce the number of servers to save on data center space and equipment. The improved performance allows the TCS BaNCS securities trading application to perform better and serve large investment banks more efficiently.

- Tuning a platform and operating system for any application is the lowest-hanging fruit for performance engineering.
- Further optimize low-latency platform using an Intel® Compiler and other tools and libraries optimized for the Intel Xeon processor E5-2670.
- Designing a scalable software architecture and following the right coding practices will allow easy porting and scalability of the application on future Intel generations (since the x86 instruction set architecture underlies ever-evolving Intel platforms).
- Intel® VTune™ Amplifier is a good application performance analysis tool for identifying and analyzing performance bottlenecks.



The TCS BaNCS securities trading solution with parallel processing on the Intel Xeon processor E5-2670 significantly reduced latency, improved performance, and reduced datacenter infrastructure

Find a solution that's right for your organization. Contact your Intel representative, visit Intel's Business Success Stories for IT Managers (www.intel.com/itcasestudies) or explore the Intel.com IT Center (www.intel.com/itcenter).

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