

Creating a Microsecond Matching Engine

Thesys Technologies delivers industry-leading performance for its new matching engine with the Intel® Xeon® processor E5 family



“The Intel® Xeon® processor E5 family provides the right balance of large core counts, high clock speed, and strong I/O performance to support a huge volume of transactions and deliver results to traders rapidly.”

– Mike Beller,
CTO,
Thesys Technologies

The Thesys Technologies high-performance trading platform is among the fastest commercially available trading platforms in the world. Recently, the company decided to expand its portfolio of offerings by launching a matching engine platform for financial exchanges. For the hardware infrastructure, the organization selected Supermicro® servers based on the Intel® Xeon® processor E5 family. With the Intel® processor-based servers, Thesys offers a solution that is twice as fast as the next-fastest matching engine, enabling most traders to receive responses within 35 microseconds. Lightning-fast response times help traders maximize profitability and give Thesys a strong competitive edge.

Challenges

- **Facilitate microsecond matching.** Deliver order acknowledgments to traders in a matter of microseconds to optimize pricing.
- **Control costs.** Offer a cost-effective platform to attract and retain customers.

Solution

- **Supermicro servers based on the Intel Xeon processor E5 family.** Thesys launched its new matching engine platform with Supermicro servers based on the Intel Xeon processor E5 family. The servers use Intel® Solid-State Drives (Intel® SSDs) for logging functions.

Technology Results

- **Rapid response times.** The Thesys matching engine returns 95 percent of order acknowledgments within 35 microseconds.
- **Large-volume trading.** The matching engine processes tens of millions of shares for the Level ATS* trading venue every day.

Business Value

- **Lower operations costs.** Combining high-performance, high-density hardware with a cost-saving business model allows Thesys to keep pricing low, attract new customers, and improve the bottom line.
- **Competitive edge.** Providing a high-performance, cost-effective platform gives Thesys a strong competitive edge in an industry that measures success in microseconds.

Thesys Technologies—the infrastructure affiliate of Tradeworx—is growing rapidly. In the last two years alone, the company has doubled the number of shares its trading platform processes every day, from 200 to 400 million. That volume represents approximately 5 percent of all U.S. and Canadian equities traded daily. The company is diversifying as well, expanding from its successful high-performance trading platform to data feed distribution, microwave data feeds, and more.

In 2013, the company began development of a new matching engine platform. “After building the high-performance trading

platform and other solutions for trading customers, it was a natural evolution to create a matching engine platform for exchanges and other trading venues,” says Arzhang Kamarei, president of Tradeworx and managing partner of Thesys. Matching engines match bids and offers, and then process trades.

Given the company’s success in building an ultra-fast trading platform, the technology team at Thesys was ready to take on the challenge of a matching engine. “We saw an opportunity to produce something that could deliver world-leading performance,” says Mike Beller, chief technology officer at Thesys.



The Intel® Xeon® processor E5 family provides breakthrough performance for the Thesys matching engine

Building the Matching Engine on Intel Xeon Processors

Delivering breakthrough performance required the right combination of hardware components. After evaluating available options, the Thesys team chose Supermicro servers equipped with the Intel Xeon processor E5 family. "In selecting a processing architecture, our goal was to maximize the number of processing cores without sacrificing clock speed or I/O," says Beller. "The Intel Xeon processor E5 family provides the right balance of large core counts, high clock speed, and strong I/O performance to support a huge volume of transactions and deliver results to traders rapidly."

Several value-added features of the processing architecture contribute to that performance. For example, Thesys uses Intel® Turbo Boost Technology to increase the processor frequency. In addition, Intel® Data Direct I/O Technology (Intel® DDIO) helps improve bandwidth and reduce latency. "Intel DDIO allows us to move data straight from the network cards to the cache of the appropriate processor," says Beller. "That is very helpful to us in maximizing I/O performance."

The Supermicro servers are also equipped with Intel SSDs, which Thesys uses to enhance uptime for logging functions. "Exchanges can't afford downtime because of a hard-drive failure," says Beller. "Intel SSDs give us the reliability we need to provide a highly available platform."

Delivering Twice the Performance of Other Matching Engines

Selecting the right components and optimizing software efficiency have helped Thesys achieve its performance goals for the matching engine. "We've created a matching engine that is approximately twice as fast as the next-fastest platform," says Kamarei.

The first trading venue to implement the Thesys matching engine was Level ATS—a "dark pool" that processes orders anonymously for institutional traders, unlike a public exchange. The matching engine processes tens of millions of shares for Level ATS every day.

Deploying the Thesys platform has enhanced Level ATS performance dramatically. "Today, Level ATS has the fastest matching engine in the world," says Beller. "Ninety-five percent of order acknowledgments are processed within 35 microseconds. That speed helps traders optimize pricing for trades, improve the certainty of their position, and ultimately maximize profitability."

Keeping Costs Under Control

The Intel Xeon processors help keep costs low for the matching engine. "With the Intel Xeon processors, we're able to build a very dense infrastructure that reduces collocation costs and management complexity," says Beller. "We can pass along additional savings for customers by enabling them to use the racks we already deployed in collocation facilities and the low-latency, high-bandwidth network we established to support our trading platform. Our matching engine is currently one of the least expensive available."

Running a New Testing Environment on Intel Xeon Processors

Given the success of using Intel Xeon processors for the company's trading and matching engine platforms, it should be no surprise that Thesys is launching another new venture based on Intel technologies. "We have partnered with NASDAQ OMX to provide a unique environment for testing algorithmic trading strategies," says Kamarei. "Traders will be able to evaluate their strategies against real, historical data so they can better estimate the performance and

Spotlight on Thesys Technologies

Thesys Technologies LLC, the infrastructure affiliate of Tradeworx, serves the high-performance technology needs of all market participants, including institutional investors, professional traders, brokerage firms, exchanges, and regulatory agencies. Thesys offers the fastest and most comprehensive front-to-back trading solution on the market, putting investors and traders on a level playing field with the world's top-tier high-performance trading firms.

stability of these algorithms before using them in the marketplace. All of the data used for these simulations is parsed, captured, and time-stamped on servers powered by Intel Xeon processors."

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