

OneChronos is a U.S. equities alternative trading system (ATS) that uses mathematical optimization to fundamentally address the growing gap between how traders want to execute and how traditional trading venues match orders.

**Industry:** Financial Services

**Location:** U.S.

**Use Cases:** U.S. Trading Venue Matching Protocol: Combinatorial Auctions

**Website:** [www.onechronos.com](http://www.onechronos.com)

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## Results

- Using mathematical optimization and Gurobi's powerful solver, the OneChronos 'Smart Market,' running 10 to 20 times every second throughout the trading day, brings the speed and scale of combinatorial auction matching up to the institutional-grade standard expected of the U.S. equities market.
- With OneChronos' approach, their clients consistently achieve excellent execution quality (compared to the more traditional price-time priority method) on standard metrics of performance (e.g., quote stability, price improvement).

# Using Optimization and Combinatorial Auctions to Innovate Modern Trading

With Gurobi, OneChronos brings their 'Smart Market' up to the speed, scale, and resiliency of the U.S. equities market to better meet the needs of today's traders and investors.

Exchange markets have been matching buyers with sellers for hundreds of years. Yet, in recent decades, trading has become more electronic, driving evolutionary change in both market structure and regulatory oversight. Meanwhile, the operational model and execution protocols of traditional trading venues have largely stayed the same. This mismatch has not only led to transactional inefficiencies, but also to greater execution risk.

Modern trading calls for modern solutions—like the OneChronos Smart Market, which uses point-in-time combinatorial auctions, powered by mathematical optimization, to better match counterparties.

Though Smart Markets have proven transformative in markets ranging from wireless spectrum licensing to display advertising, computational costs and workflow constraints have precluded their use in capital markets. But OneChronos is breaking the status quo by bringing their Smart Market to the speed, scale, and resiliency required by the institutional trading community and their executing brokers, which make up the U.S. equities marketplace.

Using Gurobi's mathematical optimizer to enhance their combinatorial auctions, OneChronos is able to better meet the needs of today's investors and traders.

## A Trading Venue for the 21st Century

Historically, the price-time priority-execution venues have been quite simple. However, their basic structure gave rise to a number of challenges once algorithmic trading was introduced, which is much deeper in scale and complexity.

"Traditional auction techniques arose organically and with the limitations of human auctioneers and market participants in mind," explains Kelly Littlepage, co-founder and CEO of OneChronos. "When capital markets started transitioning to become electronic, there wasn't much consideration for the things that humans do well and computers do poorly, or vice versa. That resulted in a needlessly complex market structure and inefficiencies whereby mutually beneficial trades can go unrecognized."

Realizing that traditional trading venues were no longer adequate for the problems at hand, Littlepage turned to the



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**Kelly Littlepage**

*Founder and CEO, OneChronos*



combinatorial auction paradigm, which he had initially studied academically. The only question was how to ‘dial it up’ to handle the speed and scale required by the institutional capital markets.

“That was just a technical impossibility at the time, and commercially, we weren’t there yet as a market, either,” he says. “But around 2016, my co-founders and I began to see the shifts that were happening with electronic trading, and how you could use machine learning to accelerate the solving time for these challenging combinatorial optimization problems. And that’s where we started working full-time to develop OneChronos.”

## **Finding Innovative Tactics with Gurobi**

In an effort to extend their range of solving tactics to accommodate the portfolio trading objectives of the institutional investing community, OneChronos began looking for an integer programming solver.

“When we were considering different solvers, Gurobi was an obvious starting point. Many of us were already familiar with it from our academic days, and familiar with its performance characteristics relative to other options,” says Littlepage. “We evaluated it against a handful of other domain-specific and general IP solvers, and concluded that it worked very well for the scope and size of our problem set.”

And with support from the Gurobi Experts team, OneChronos was able to work on the continuous improvement of their models.

“The Gurobi Experts were very responsive,” says Littlepage. “They

came up with creative ways to encode our problems differently, which led to significantly better performance for some of our model runs. We’re a small team, and so leveraging Gurobi’s expertise added velocity.”

## **Powering Intelligent Markets and Driving Growth**

Since launching just over a year ago, OneChronos has seen a very rapid growth curve, along with promising results for their customers.

“Our subscribers, who are broker-dealers representing their clients’ trading interests, are having a very good experience trading on the venue, which is why we continue to grow. And it’s really the power of our mathematical optimization and the approach we take to market design that’s driving the good experience folks are having,” says Littlepage.

With Gurobi’s optimization powering their combinatorial-auction approach to matching buyers and sellers, OneChronos is able to sustain a high level of performance that delivers significant improvement in execution quality for their clients over other trading venues.

According to Littlepage, “Our clients have seen meaningful execution quality performance with ample opportunities to trade, validating our thesis and their belief in our mission to directly optimize for outcomes based on a modern definition of best execution, rather than speed. That’s quite the quantum leap, thanks to this different type of auction that we’re running.”

As far as future plans, Littlepage says his team is “excited to continue leveraging mechanism design and the capabilities of modern solvers to design and operate markets that users can show up to, bid their true high-level intent, and get the best possible outcome.”

Through it all, OneChronos knows they can count on Gurobi to offer expert guidance.

“It’s a safe bet that no matter how much domain expertise you have around the problem that you’re trying to optimize, the team at Gurobi is going to have great insights into how you can get the most from their solver and use it effectively for your problem.”

## **Experience Gurobi for Yourself**

Our 30-day evaluation license includes:

- Free benchmarking services
- Free model tuning services
- Free access to our world-class technical guidance and support
- Two free hours of one-on-one consulting services

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