



# Success Story: TimeKeeper™ Linux PTP Software + SecureSync Precise Sub-Microsecond Timing Solution Delivered for High Frequency Trading

## User Profile

Thesys Technologies LLC is the infrastructure affiliate of Tradeworx, serving 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 HFT firms.

## Business Situation & Challenge

Time synchronization quality has become increasingly important issue for Thesys and its customers. As the latency of hardware and trading infrastructure has improved over the years from milliseconds to microseconds, they became acutely aware of the need to improve the quality of their time synchronization to stay ahead of the game in the rapidly changing technological environment.

Initially, The Thesys servers used NTP (Network Time Protocol) to synchronize with the exchange's NTP server. The problem with using NTP was that the quality of the synchronization was limited to several hundred microseconds in the best case and several milliseconds in the worst case (See Figure 1). At this point, Thesys knew they needed a high-performance alternative to NTP.



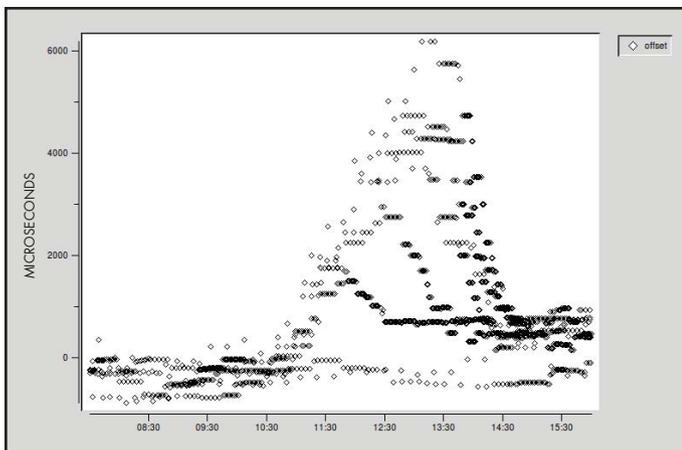
## Objectives

Thesys had the following requirements:

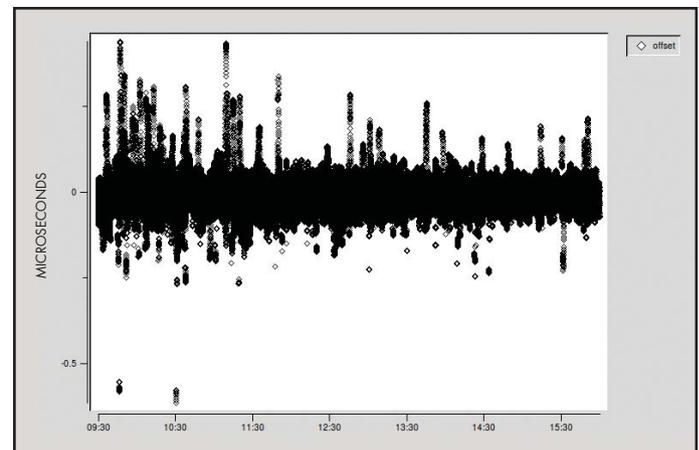
1. GPS time source must be highly reliable and accurate.
2. The ability for the GPS time server to distribute time to multiple networks and physical locations
3. Sub-microsecond synchronization between company servers and the GPS time server.
4. Solve the backward time adjustment problem. With previous solutions Thesys had tested (e.g., open source PTP), they found that data often got timestamped out of order. This was problematic.

## Solution

The Thesys absolute time problem was solved using the Spectracom SecureSync with a GPS time source (1204-012 PTP option card). The quality of the lock to GPS is consistently <100ns. In the



**Figure 1:**  
NTP offset vs. NTP server (Thesys) vs. time of day, 10 days of data



**Figure 2:**  
TimeKeeper offset vs. Time server (Thesys) vs. time of day, 14 days of data

unlikely event that the GPS time source fails, the SecureSync will turn over to its highly reliable rubidium oscillator – which maintains the time within approximately one microsecond per day – providing ample time to address the GPS problem should that situation arise.

The modular design of the SecureSync enabled Thesys to easily distribute time to multiple networks simultaneously – they simply used one PTP module per network.

Thesys distributed the time reliably using FSMLabs TimeKeeper from Spectracom. TimeKeeper was able to provide precise time to trading applications with no changes in applications or operating system and TimeKeeper’s ability to synchronize from multiple time sources allowed them to make time distribution resilient to hardware faults.

The Spectracom solution was selected after extensive and careful measurement to ensure the TimeKeeper PTP client reliably delivered sub-microsecond synchronization to out application programs.

## Results and Benefits

As shown in Figure 2, Thesys was able to achieve sub-microsecond synchronization between their servers and the GPS time server by using the Spectracom FSMLabs TimeKeeper solution. This is a vast improvement over what they had before (Figure 1).

The combination of the SecureSync’s time source quality and reliability and TimeKeeper’s superior time synchronization capabilities is helping keep Thesys and its clients stay on the forefront of HFT.

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