FSMTime
SECURE ENTERPRISE CLOCK SYNC™
by FSMLabs

SECURE ENTERPRISE TIME SYNC WHITEPAPER SERIES

TimeKeeper's Competitive Survey

Introduction

The TimeKeeper® suite of products are more accurate, more reliable and far more capable than CAPEX-free open source alternatives. TimeKeeper has a lower OPEX than alternatives, but more importantly, TimeKeeper has features found nowhere else. These features include the ability to verify time is correct, compare against many time sources, report when time is incorrect or when time sources fail, and much more. Standard logging and integration provide guarantees of accuracy whenever proof is needed in the future.

Some TimeKeeper customers previously built large in-house projects to try to make alternative solutions fit their needs. These expensive and very limited solutions were abandoned once they saw TimeKeeper gave them all they needed and more out of the box, saving valuable time and resources.

TimeKeeper in use throughout Wall Street & globally

TimeKeeper hardware and software is in use by financial institutions of all sizes, from exchanges and very large investment banks to small "prop shops". TimeKeeper is there because after rigorously evaluating the product, customers found it gave them capabilities they simply could not get anywhere else. In addition, TimeKeeper support is far better than any of the competition. A few comments from our customers:

"KCG has been using TimeKeeper Client and Server Software for two years in our trading environment with great success. TimeKeeper delivers accurate time, and has helped us to reduce operational risk with its built-in failover and event notification. We use TimeKeeper Client Software on our servers, using NTP or PTP to sync them to our GPS Based TimeKeeper Servers."
– Steve Newman, Managing Director, Corporate IT and Infrastructure, KCG

"Technology is readily accessible for synchronizing to the microsecond, and there is no excuse for not having this in place today. Without it, this surveillance system will suffer the same shortcomings as current systems such as OATS, where aggregation and sequencing is rendered impossible by timestamp resolution and the lack of any clock synchronization. A simple call to a firm such as FSMLabs will quickly and cost effectively solve this issue."
- Doug Lauer, President and Managing Partner, KOR Group LLC, testimony on "The Role of Regulation in Shaping Equity Market Structure and Electronic Trading", Senate Committee on Banking, Housing, and Urban Affairs

"We were reluctant to purchase TimeKeeper when we could download free software, but in the end the performance, reliability, and total cost of ownership advantages were too compelling to ignore."
- Tamir Nitzan, Partner/Lead Technologist Virtu Financial

TimeKeeper is used by TradeWorx, which was chosen by the SEC (Securities and Exchange Commission) to help develop MIDAS (Market Information Data Analytics System) to monitor market structure and trading. Many other firms, operating on a global scale, that rely on TimeKeeper consider it to be a competitive advantage that they want to keep confidential.

TimeCare℠ support for TimeKeeper is second to none

When you have a question about your network setup or which NIC cards give you better performance you can always contact us for prompt, reliable and expert support. TimeCare support from TimeKeeper's developers are available via phone and email – not support staff, who merely read from a script – so you get clear and certain answers from experts who are intimately familiar with the code, with the protocols, and with the financial sector's need for time sync. We have the latest network cards, drivers and other gear to test with. Our partnerships with hardware and software providers mean we work closely together to make sure you get a well-tested and verified solution. When you're looking to upgrade hardware/software or change your

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configuration, we're able to help you decide on expected accuracy based on our testing, tune that as appropriate for your needs, give you an idea of the cost/accuracy benefit and finally provide you with tools to test on your own before investing in infrastructure. That's just a regular part of what we do every day as experts in secure enterprise clock chain synchronization at scale.

If you pick one of the TimeKeeper alternatives, you may end up being supported by an internet mailing list, guided by anyone who wants to respond. Worse, your production network timing may rely on hobbyist projects developed like this:

"I'll be honest with you. I had two terminals open side by side when writing this. One was ptpd source, the other was ntpd source. The ntpd code relies on constants I could not find the definitions of, so I got scared and didn't copy the code as is. Apart from the open terminals, I also had a bottle open."
Source: click here

TimeKeeper features are unique and necessary

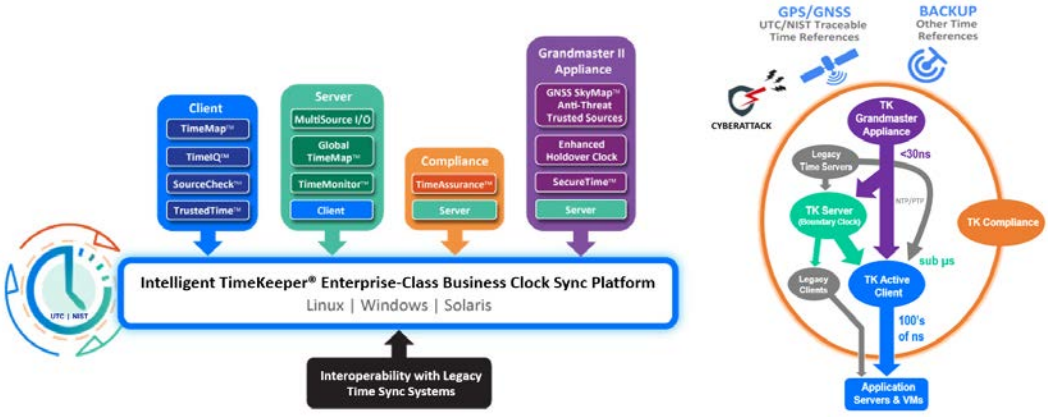
All-in-one solution

TimeKeeper is able to track and serve NTP, PTP and other protocols of choice. No other tool can do that, yet it is essential when bridging time technologies (legacy and next generation) into a single network. This avoids exposing users to protocol-specific failures like the error-prone and limited PTP BMC (best master clock) algorithm. This allows you to compare all of your PTP, NTP and other time sources so that you can be sure all systems have accurate time.

TimeKeeper is available on Linux, Windows and Solaris systems, as well as on the TimeKeeper GNSS Grandmaster II NTP/PTP time server. This means that you will have the same TimeKeeper Active Client on all your Linux distros and versions, on Windows and on Solaris, as well as on your TimeKeeper Grandmasters. This means one GUI and/or CLI to learn, one interface to your other systems (SNMP, interfaces to dashboards from log files, etc) for all your TimeKeeper time sync Clients and Grandmasters. Your IT staff will solve problems, not waste time learning yet another interface. And your DevOps team will have time to write advanced tools instead of learning many different interface and file formats.

The end result is cost savings from reduced software and hardware purchases along with greater productivity of your IT staff and DevOps teams.

Clock Chain Synchronization



Best available accuracy performance & control

TimeKeeper is able to transparently take advantage of any hardware timestamp-assisted technology you have, such as a NIC, to achieve accuracy in the low 100's of nanoseconds, and graph its performance against multiple UTC/NIST or GNSS traceable sources. Even without hardware assist it can maintain sub-microsecond level synchronization in many cases using PTP and NTP. That's something you won't find elsewhere. TimeKeeper also includes the tools to verify that accuracy and alert when it is out of your spec.

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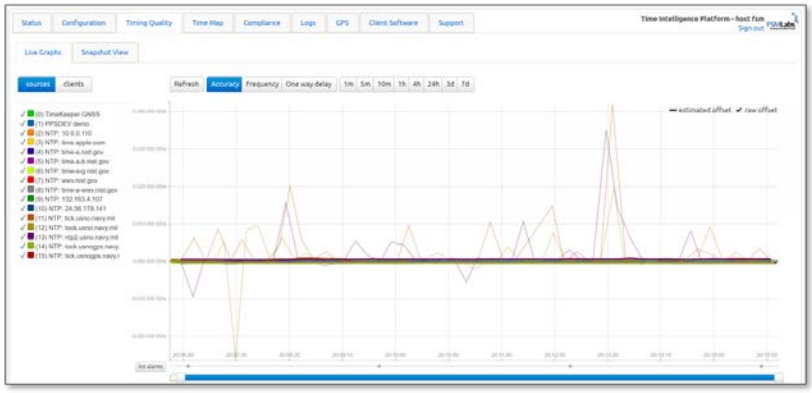
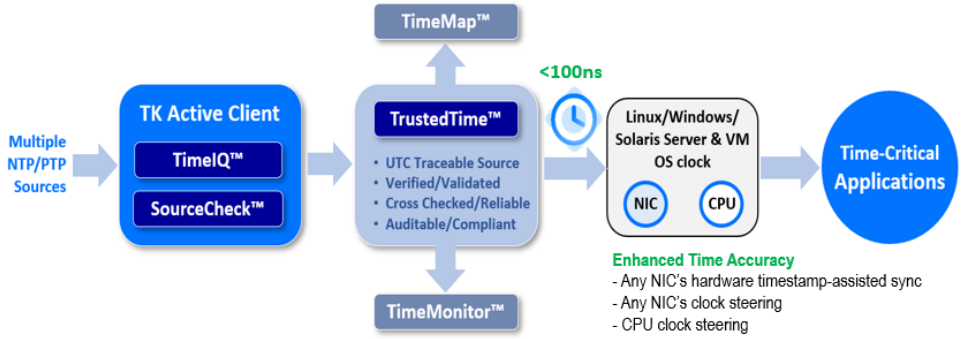
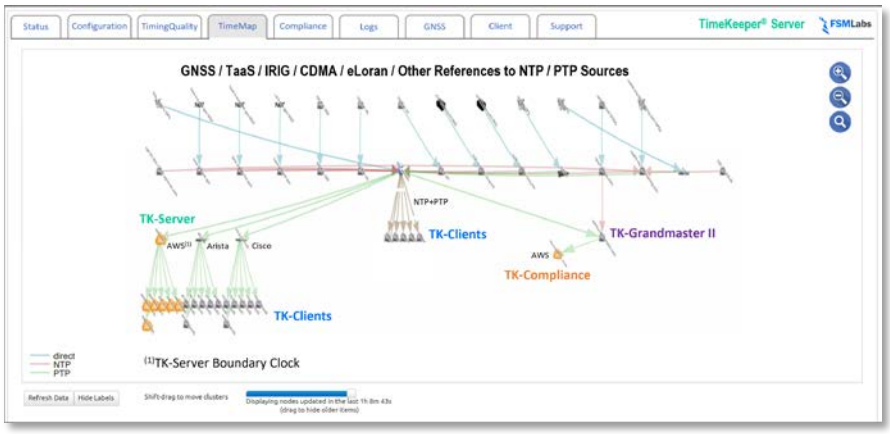


Moreover, TimeKeeper uses a TrustedTime consensus model in real-time, including: multisource NPT/PTP; source verification; SourceCheck comparison and validation; UTC/NIST TimeMap traceability check; ML-optimized TimeIQ accuracy; TimeMonitor analytics; enhanced NIC hardware timestamp-assisted sync; enhanced CPU clock steering; log storing; and self-healing fault tolerance.



Visibility & control of your clock chain synchronization network

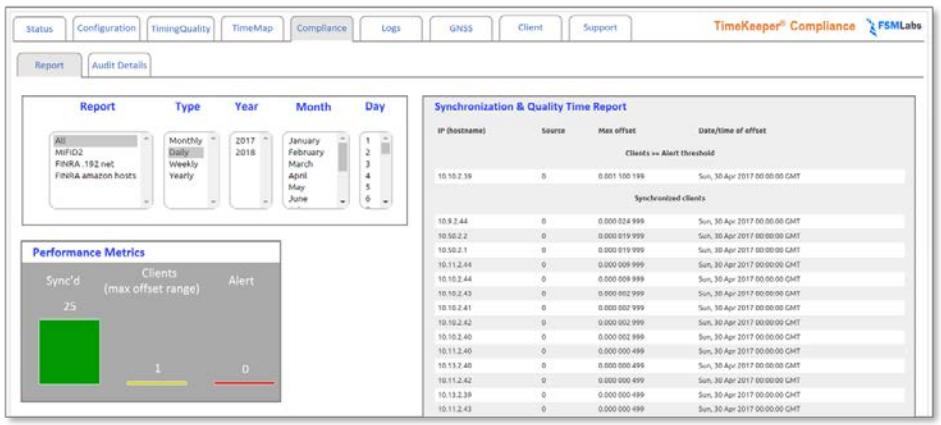
TimeKeeper provides a TimeMap GUI tool that allows you to fully visualize the accuracy of all the places or nodes you're receiving time from and compare them directly, quickly and easily. The same interface allows you to do that for systems that you are providing time to. So, on one "pane of glass" you can see your whole network and how it's behaving. At the same time TimeKeeper creates a map of your timing network. This auto-discovers resources (hardware and software), problems and network layout without you needing to enter information by hand. When something changes – see it immediately.



Monitoring & compliance reporting

TimeKeeper monitors the sources it uses for time and reports their accuracy. It also optionally alerts via SNMP, email, syslog and other methods when there is a problem. Other solutions silently let time drift. All TimeKeeper data is logged to human readable and documented files so you can integrate data into your

network monitoring system and archive data for auditing and compliance reporting. When something happens on your network or you're required to prove accuracy of your time sync – it's all stored and available for you. TimeKeeper can also monitor clients that receive time downstream – so that you can alert on threshold violations in client systems without needing to access them directly meaning that you can see problems before anyone else does.



Security

TimeKeeper has built-in failover when a source has problems or shows incorrect behavior. Failover sources can be mixed and matched between PTP (multiple profiles), NTP and nearly any other time format. This allows you to detect and repair failed equipment, correct misconfiguration and even mitigate malicious attacks, while keeping accurate time on your trading server machines.

TimeKeeper alternatives

RedHat PTP support using open-source tools

RedHat has made some changes to make PTP (and only PTP) support part of their distribution. The first attempt packaged the open-source program "ptpd2". Later RedHat versions tried another open-source program "ptp4l" and made some required driver and kernel changes required by that program. Each program requires a sdifferent setup, different configuration arguments and supports different sets of hardware with different capabilities. You, as a user, end up testing those tools and keeping track of which version requires which configuration file and what capabilities each has on your network. Part of these RedHat enhancements include back-porting experimental changes from more recent kernels that include the message:

TECH PREVIEW: IEEE 1588 (PTP) may not be fully supported.
Please review provided documentation for limitations.

And that's just RedHad. What about Debian, SUSE, Ubuntu and other Linux distros and versions, and Windows and Solaris?

TimeKeeper supports PTP, NTP, GPS, TIME, PPS (along with others) and taken advantage of hardware assist and been in production for years and continues to support all RedHat versions past, current and future (and other Linux distributions) with a single uniform configuration.

Our own testing has shown that open-source packages respond erratically to periodic errors on the network and can even cause time to jump backwards sometimes (See *FSMLabs' "Time Should Not Go Backwards" Case Report)*. There are even documented cases of time jumps of 34 seconds in production systems. This is something that TimeKeeper never allows.

RedHat has a great deal of experience producing a Linux distribution but has no timing expertise and you'll likely end up on a mailing list looking for solutions to problems or advice on setup. Note the 2-year effort that was required to install and setup an open-source system at IMC in "Challenges deploying PTPv2 in a Global Financial Company" that ultimately had significant limitations and vulnerabilities.

SFptpd (from Solarflare)

Solarflare provides an excellent set of network cards that have great time synchronization assist. They also provide a program for tracking PTP when used with their NICs that is a modified copy of an open-source program. TimeKeeper is able to take advantage of all the features of the Solarflare NIC, expanding far beyond SFptpd's capabilities but does not have the SFptpd limitations:

- Single PTP time source (no failover)
- No monitoring, GUI graphing or visibility into what is happening in the clock chain synchronization
- No NTP support
- Based on an open-source project that RedHat has abandoned
- Solarflare only – no support for other network hardware
- Linux only

Have questions? Simply contact us	TimeKeeper Platform Solution, TimeKeeper Grandmaster II Appliance, TimeKeeper Server or Boundary Clock Software, and TimeKeeper Active Client Software are available from www.FSMTime.com and FSMTime's resellers. If you have any questions or would like a live demo of TimeKeeper products, simply contact us at sales@fsmtime.com.

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