TimeKeeper® and SFPTPd Comparison

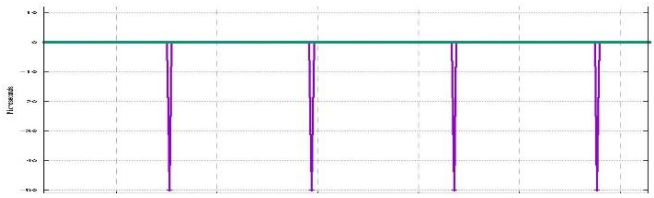
TimeKeeper time and clock synchronization sets the standard for Enterprise and for Financial Trading. TimeKeeper management, fault-tolerance, traceable audit, and superior accuracy are not matched by any other product. This technical note compares TimeKeeper's operation in the presence of a common network issue with the operation of free software provided to purchasers of Solarflare's PTP enabled network cards. Solarflare provides the free software as a customer benefit, so they can immediately enable time sync with the cards. TimeKeeper provides reliability and management for firms that need accurate time for operation of business process.

Executive summary of the tests is that introducing a slow time packet, a common occurrence in production networks, produces a time spike using the Solarflare provided free software. TimeKeeper successfully filters this packet out and maintains accurate time.

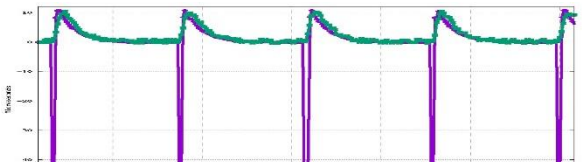
Most importantly, this test shows that the free software will continue to report high quality time sync even when it has failed: the kind of invisible failure that can produce mysterious and undetected failures in business process.

Test Results

These two graphs show a test setup using TimeKeeper and then the same test, graphed at the same scale, using the free software derivative SFPTPD. The purple line shows a PTP time source that has periodic errors. The green line compares the system time to a reference source (a super accurate GPS clock). TimeKeeper's system time shows no error: sophisticated filtering is able to detect and eliminate the effects of the errors in the feed. The same test using Solarflare's SFPTPd shows system time wobbling. SFPTPd does not filter out the errors and contains no management capability that would allow it to notify IT staff or network management software of the problem.



TimeKeeper Test



SFPTPD Test

Discussion

Solarflare provides excellent, high quality PTP enabled network cards that are capable of exceptionally high precision. Along with the hardware, Solarflare provides customers with a version of the PTPd free software client that has PTP client functionality, can access the Solarflare hardware and makes basic time synchronization available as a service.

TimeKeeper software includes client PTP functionality plus sophisticated filtering, error handling, audit, fault tolerance and management capabilities that go above and beyond basic PTP client functionality.

Firms that just need minimal time sync and do not need failover, alerting, high reliability, or higher levels of precision are able to take advantage of SolarFlare cards using the provided free software. Firms where, for business process or regulatory reasons, high quality time synchronization is an essential service should use TimeKeeper instead.

Time Synchronization is notoriously hard to test, therefore many users rely on the free software's self-reported numbers although these are proven to be unreliable. Additionally, there are a number of other errors that FSMLabs has found during our testing of free-software alternatives.

FSMLabs has invested a significant engineering effort in test and validation. If you would like to take advantage of our research, contact us at sales@fsmlabs.com for more information about the effects of synchronization errors and how they affect your compliance with existing and developing regulatory requirements.

Test setup to demonstrate accuracy

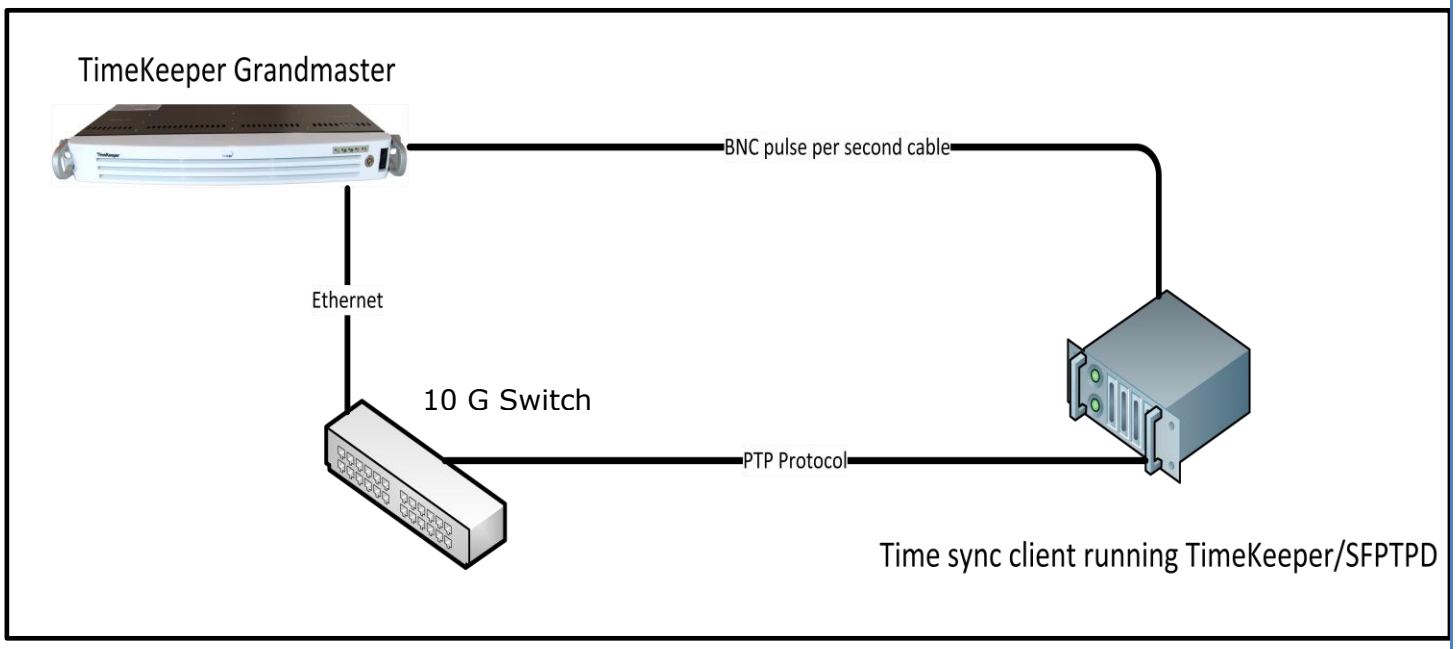
Our test setup used a TimeKeeper PTP grandmaster to serve time over a 10G fiber connection to a Solarflare card through a mid-grade switch. The grandmaster was configured to send out a time sync message every second.

TimeKeeper grandmaster

PPS input card

In order to cross-check and validate system time independently we connected a PPS (pulse-per-second) signal from the grandmaster to a PPS input card on the client system. This allowed us to measure system time on the client against the time on the grandmaster with an accuracy of a few tens of nanoseconds. This served as our cross-check to see how each client did at synchronizing the system clock to validate the quality of the time sync.

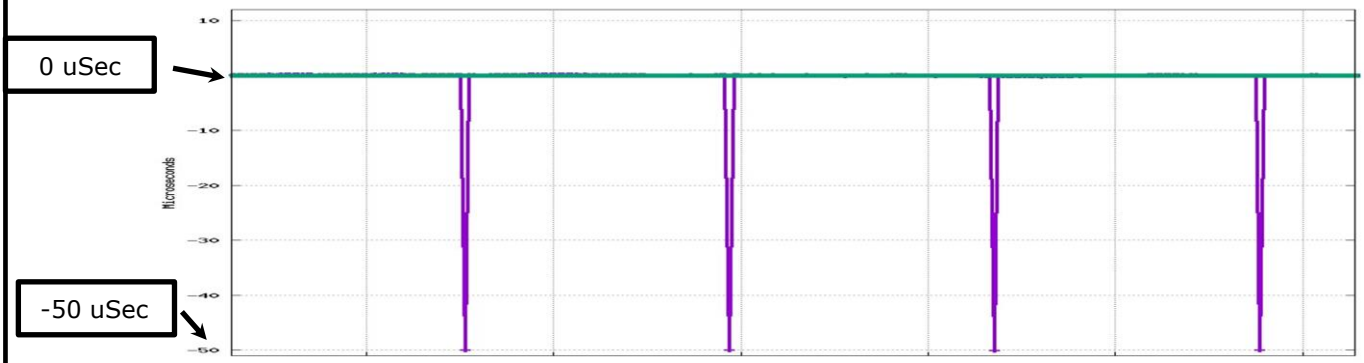
We ran separate tests, first with TimeKeeper and then with SFPTPD (Solarflare's PTP daemon), and graphed the PTP feed and the system time produced by the PTP client. We used a GPS module and a Rubidium Atomic Clock to determine the correct time.



Tolerance of jitter

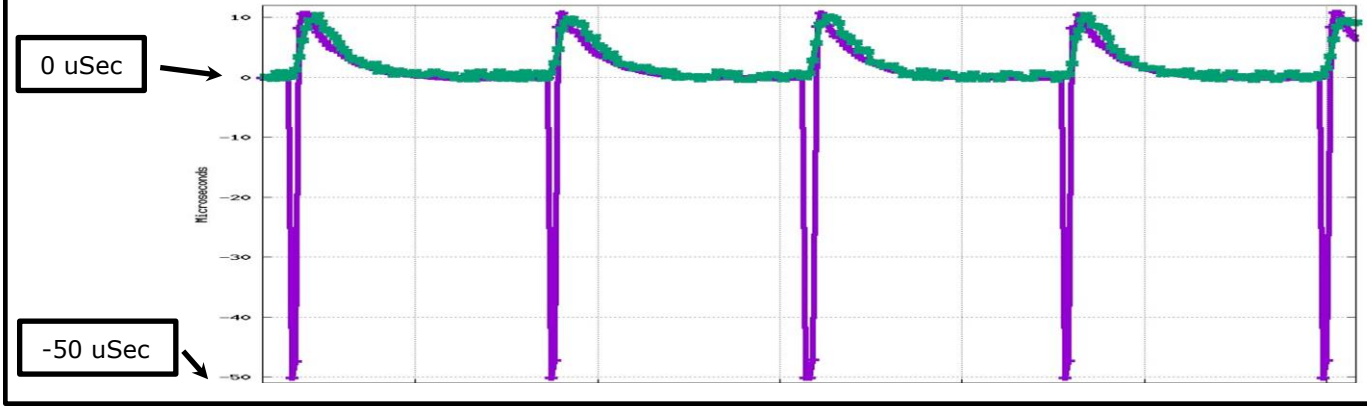
In this test we setup the grandmaster to insert a delayed packet of 50 microseconds every 60 seconds. This simulates a typical shared network where switches are overloaded, network congestion causes queueing and packet delays which skews a single time sync message. We have found that these are common network issues.

TimeKeeper



The TimeKeeper graph shows the periodic 50us spikes of the PTP feed (in purple) which are properly ignored by TimeKeeper which keeps the system time (green line) in the 100's of nanoseconds range as measured by the PPS card.

SFPTPD

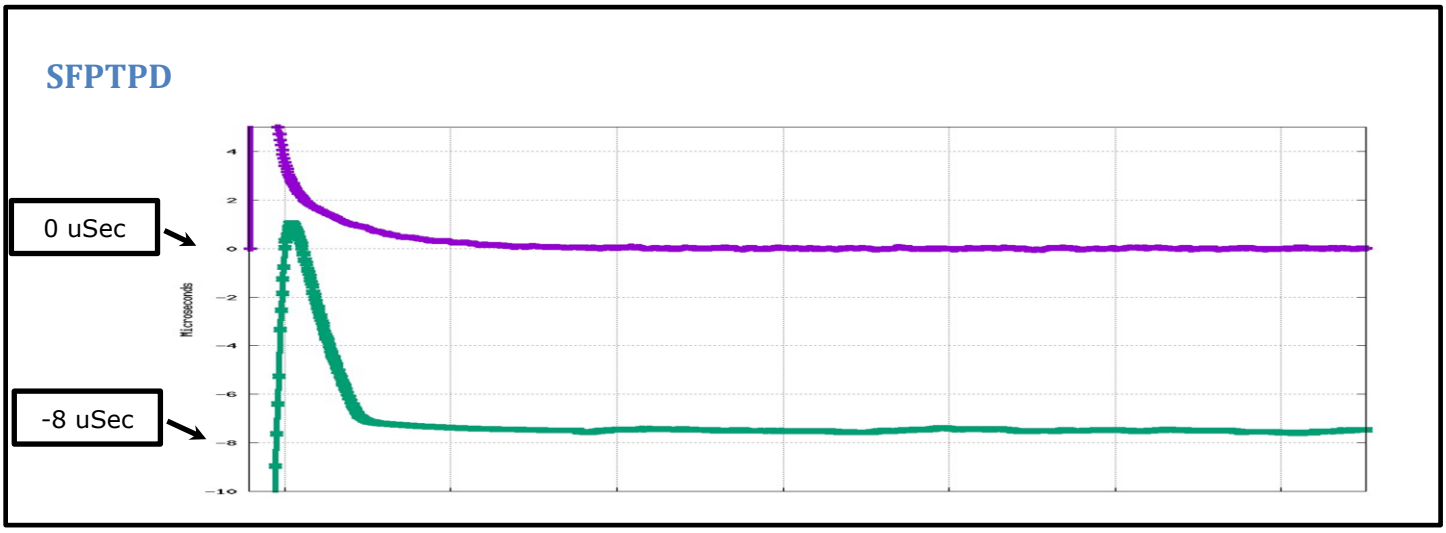


The SFPTPD graph shows the same spikes in time from the simulated network delays (purple line). It responds differently and does not ignore the obvious jitter but instead over-corrects which you can see in the measured system time offset (green line). It swings up toward +10us quickly then slowly corrects over the next ~60 seconds.

In a live system, the delays on the PTP feed (purple line) are not regularly spaced, nor are they all 50 microseconds. This causes random and unpredictable changes in the system time provided to applications if those spikes are not properly handled as they are by TimeKeeper.

Protocol failure

In this test we simulated a typical network misconfiguration that we see at many sites. TimeKeeper detects this problem and will alert, generate alarm messages and will not claim that it has a good sync. SFPTPD however will continue to falsely claim a good sync within several nanoseconds (shown by the purple line below). However, the time SFPTPD provides



is many microseconds off of the actual time (the green line below).

This shows how much care and attention is necessary to both produce accurate time and also to test and measure for that accurate time. Many programs that are freely available print very small numbers when reporting time but it's easy to print a number. Ensuring that those numbers are correct is what TimeKeeper does well.

How to Purchase TimeKeeper

TimeKeeper, TimeKeeper Server Software, and TimeKeeper Client Software are all available from FSMLabs and FSMLabs' resellers. For purchase information or for a live demonstration of TimeKeeper please contact FSMLabs at sales@fsmlabs.com.