NTP Performance vs Korusync PTP Performance

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Confidential

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1 Introduction

Typically the performance of synchronisation systems within a PC/Server architecture has had to be interpolated from software metrics. This relies on a large amount of assumption and good faith in the generated data since a true reference is not available.

Korusys have implemented a test environment that allows us to measure the accuracy of the internal software clock of a server (disciplined from NTP or any other source) accurately against a reference using a hardware based mechanism.

This hardware based mechanism allows, for the first time, the accuracy of the clock within the server to be shown in a deterministic manner against a true reference. The resolution accuracy of the hardware mechanism is in the order of a few hundred nanoseconds (on average, individual measurements may have larger 'spikes' of resolution) allowing us to determine the true accuracy of the internal software clock down to this level.

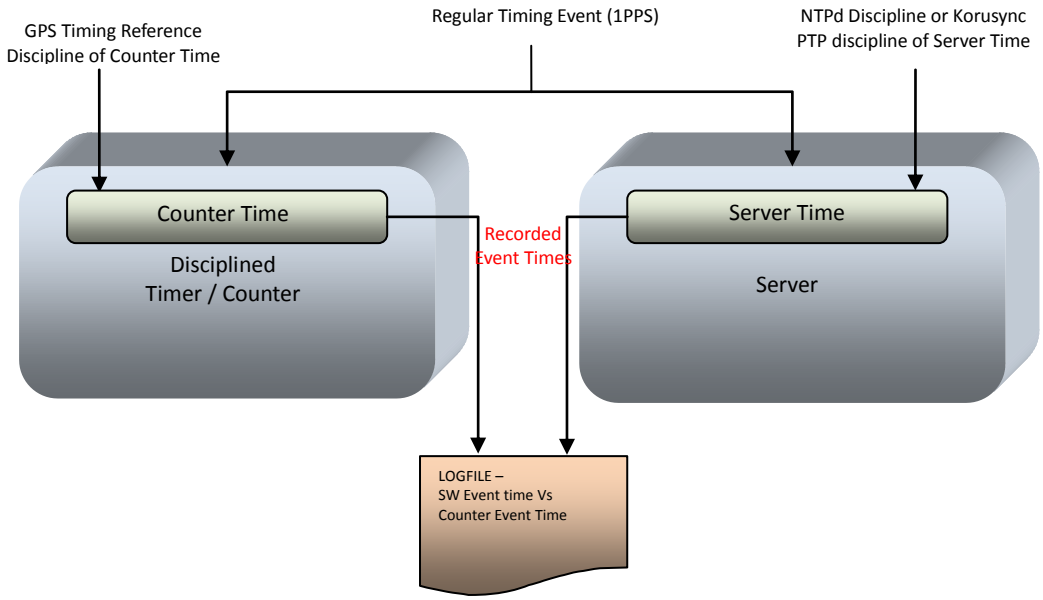


Figure 1 : Conceptual Diagram of Server Clock Performance Measurement System

2 The Results

We have used this mechanism to generate a logfile of data of the accuracy of the NTP disciplined Server clock against the accuracy of the Korusync PTP disciplined server clock to show the step change in performance that is available.

Note that the performance of the NTP results is the best possible performance that could be obtained by NTP as we used a hardware timestamped NTP server directly connected to the slave.

2.1 Overall Results

All results in the following sections have been presented to the equivalent scale range to allow for easy comparison.

The values plotted on the graphs are detailed as follows :

Red Line : Estimated 1PPS Offset
This is the estimated time error, generated by the NTPd or the Korusyncd daemons in software and logged to the standard stats files, that the daemons use as their best estimate of how close server time is to true time.

Blue Line : Measured 1PPS Offset
This is the MEASURED 1PPS offset as determined by the measured difference between the software clock and the external reference clock at the event time.

Green Line : Frequency Adjustment
This is the frequency adjustment figure in PPB, generated by the NTPd or the Korusyncd daemons in software, that the daemons feel is required to correct the internal server time.

The true line of interest is the blue line which is a representation of the true accuracy of the server clock. The test environment does have a limit on the accuracy of this line which is in the order of hundred of nanoseconds on average. Spikes of inaccuracy do occasionally occur up to 5 uS of inaccuracy. Thus the true averaged representation of the accuracy of the server clock is with these outliers removed. Interestingly the performance of the NTP disciplined server is so poor that these small percentage of spikes in measurement accuracy are not discernible in the results. Only when applied to the Korusync results does the accuracy of the test environment approach the accuracy of the server clock.

It can clearly be seen that the performance of the Korusyncd algorithm in disciplining the Server time has resulted in an order of magnitude performance improvement in the accuracy of the server clock.

Over the period of the test NTP's measured performance is greater than 40uS peak to peak. Korusync's performance over the same time period is less than 2uS peak to peak. It is worth noting how optimistically NTP's estimate of its accuracy is against its real accuracy.

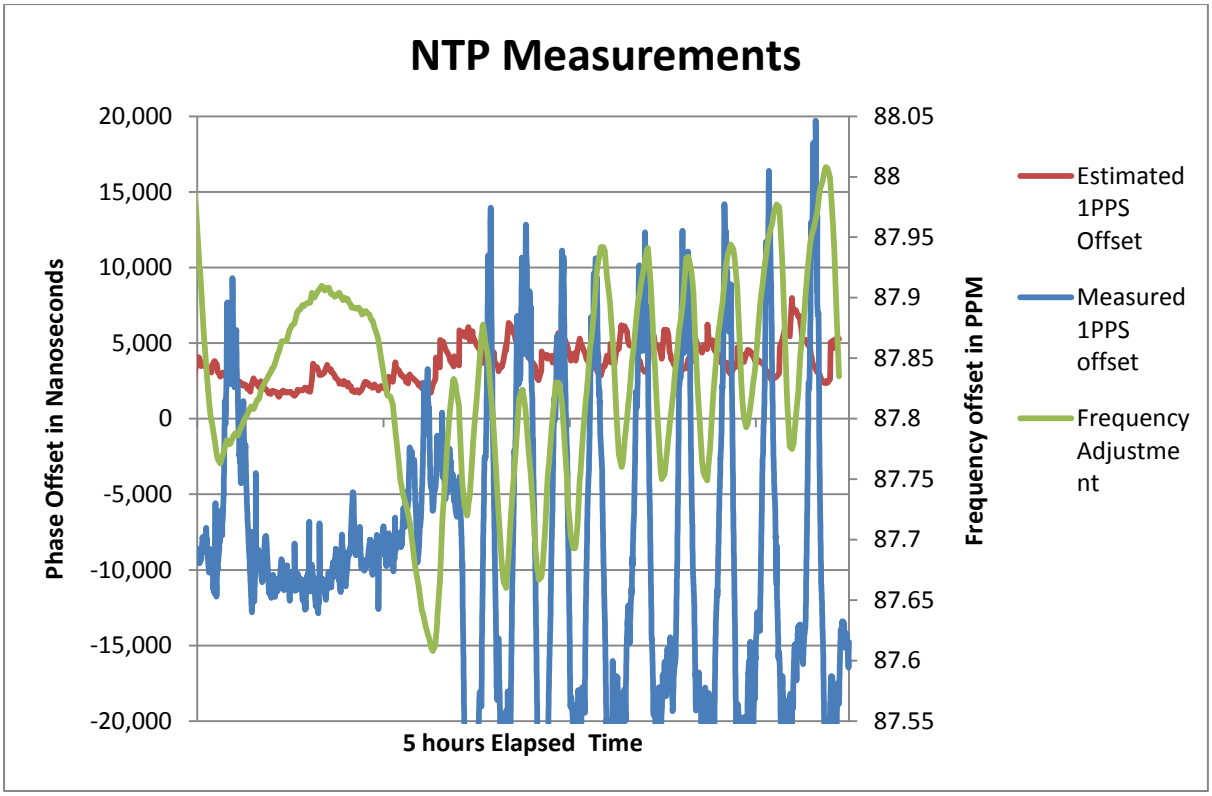


Figure 2 : NTP Performance

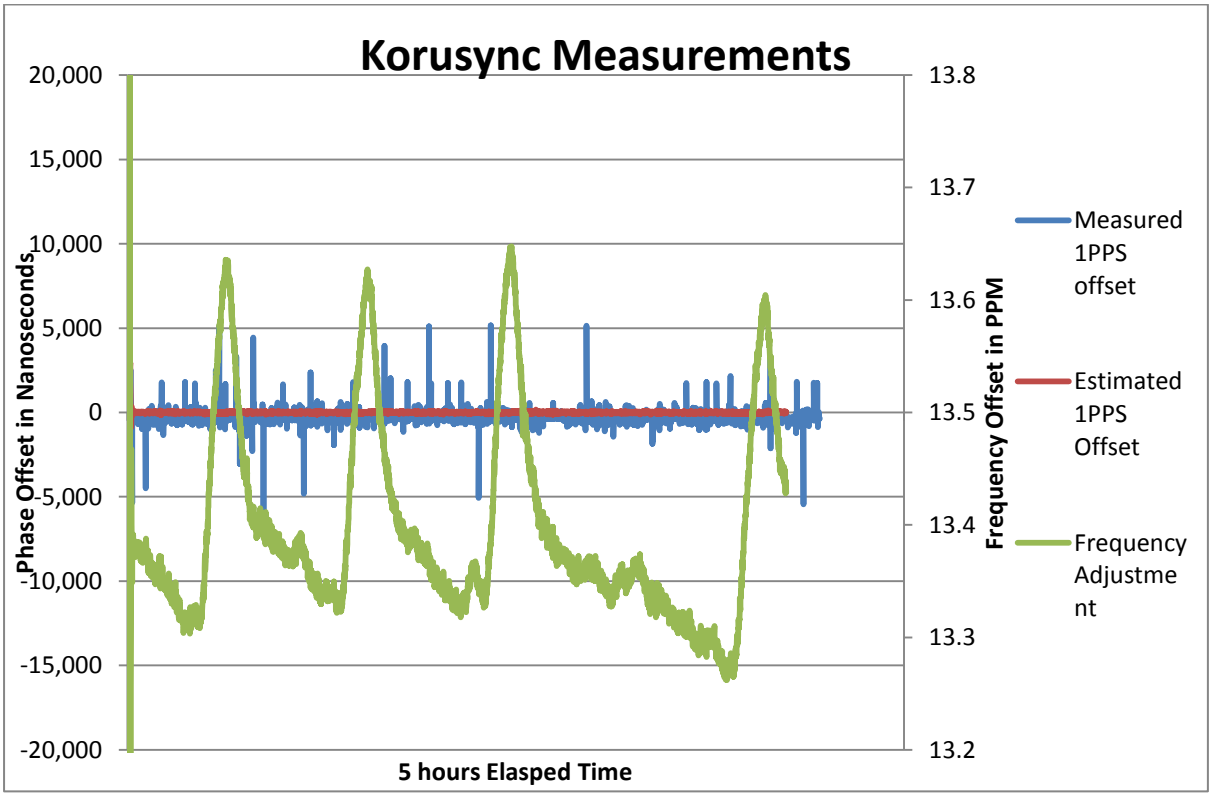


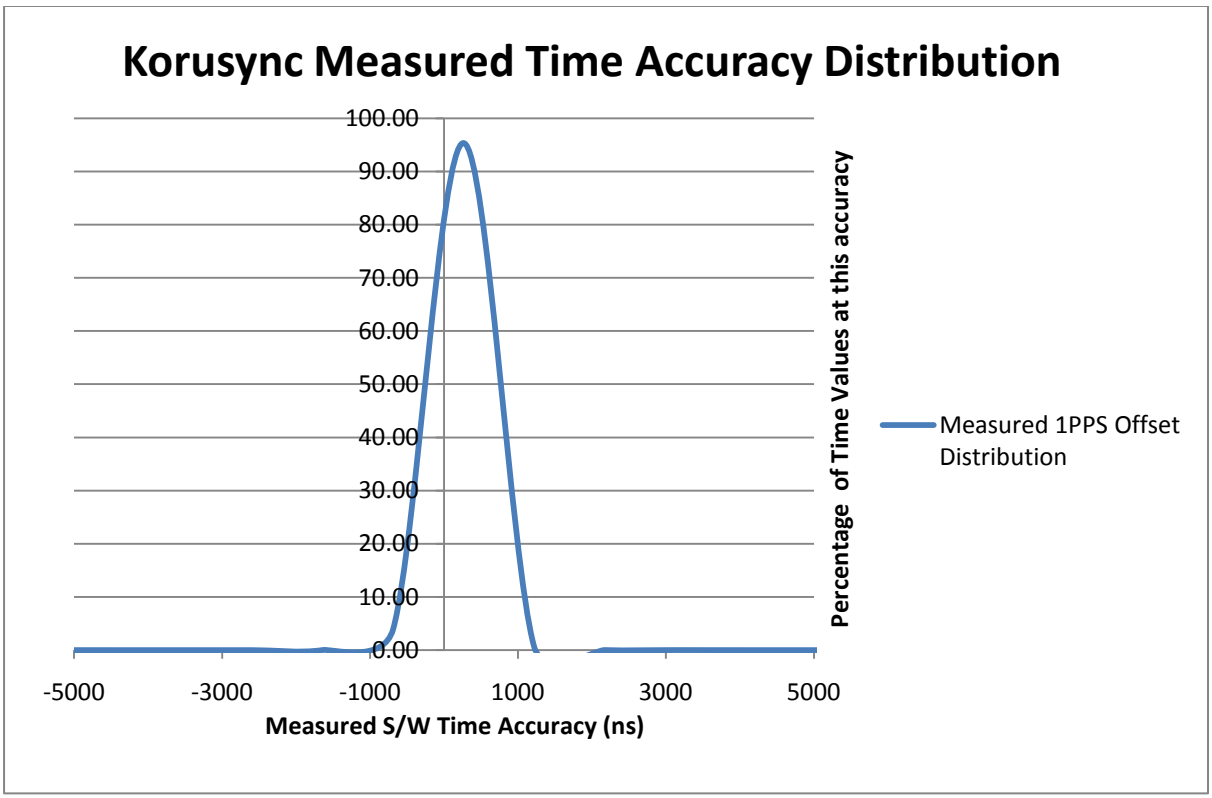
Figure 3 : Korusync Performance

2.2 Korusync Time Accuracy Distribution

In order to more accurately show the performance of the Korusyncd measured performance a distribution has been plotted and is shown below. Please note that the 5 uS outlier spikes due to the test environment have been removed from this plot to show the true performance curve.

Also note that the accuracy of the test environment is in the order of hundreds of nanoseconds and so the true accuracy of the clock itself is masked somewhat by the limitations of the test environment.

It can be seen that the accuracy of the server time is measurable within +/- 1 uS. Given the limitations of the test environment and our experience with timing and timing algorithms we confidently feel the true performance of the server time is in the order of +/- 250nS



3 Summary

By implementing a true reference hardware based measurement platform we have been able to show the differentiation in performance attainable by replacing standard NTPd with a Korusync PTP PCIe card and the Korusyncd timing daemon.

Server or PC based software systems which rely on time accuracy as part of their core function can benefit from a performance enhancement related to the increased clock accuracy.

Korusys also provides a Timing Toolkit of software functions that can be used to consume this super accurate server time in a much more lightweight manner. So for applications where performance is critical and the overhead associated with a Linux *gettimeofday()* call is killing performance then Korusys has a replacement clock which provides super low overhead access to this highly accurate time for critical applications.

For more details on the Korusync Timing Toolkit please read our other White Paper "Consuming Time in Financial Servers".

4 About Korusys Ltd

Korusys Ltd are leading experts in packet based synchronisation techniques providing both consultancy services and synchronisation products to various market segments.

Korusys Ltd is also a trusted provider of Electronics Design Services. Focused primarily on FPGA, ASIC, and Embedded Software design and development, Korusys Ltd has earned a reputation for high quality, right first time developments for a wide variety of clients.

Please visit us at http://www.korusys.com for contact and product information.