

Hoptroff London Limited's Hoptroff Time solution delivers time accurately to servers in data centres with a traceable route to established UTC sources such as NPL and NIST via satellite and fibre time distribution networks, arriving at our Hoptroff Time HT-GMC clocks located in the data centre. From there we use *ResilientPTP™* technology to distribute UTC robustly across the data centre over existing network infrastructure.

Latency within servers

Within a server there is a latency in getting time from the clock to the application itself. Such latencies are difficult to predict, especially with Java and .NET using virtual machine execution.

Hoptroff London has developed a patent-pending PacketPrecision™ solution to address this problem that measures the clock-to-application latency as it happens, in real time: If you know your latency, you can control your latency.

Time Management Suite™ contains several, patent pending innovations:

- ↗ Second-by-second latency statistics are collated to measure clock-to-application latency and establish if it is significant relative to other latencies.
- ↗ After-the-fact packet-by-packet timestamp correction adjusts for any measured latency, enabling accurate post event analysis and finer granularity for bottleneck profiling.

Measuring application-level time

Our primary solution for measuring application-level latency is a small set of client libraries, including source code, for .NET, Linux and Java. They link into applications engaged in market participation, and can even be used where data packets are encrypted and/or do not carry their own timecode. The library allows the latency of test packets to be calculated.

In addition to second-by-second recording of latency, *PacketPrecision™* timestamping can also create individual hardware timestamp records for each packet as it enters or departs the gateway with nanosecond precision. With clock-to-application second-by-second monitoring in place, this supplementary individual packet recording allows finer granularity analysis where needed, both for business improvement or post-event audit.

<i>Performance Measure</i>	<i>Traceability to UTC</i>
<i>Hoptroff Time Grandmasters</i>	<i>~ 0.000 000 050 s</i>
<i>Server clock via software NTP/PTP</i>	<i>~ 0.000 500 000 s</i>
<i>Server clock via ResilientPTP™ retaining legacy network switches</i>	<i>~ 0.000 000 300 s</i>
<i>Accurate steering of the system clock available to applications</i>	<i>~ 0.000 300 000 s</i>
<i>Regular application timestamp from system clock</i>	<i>~ 0.002 000 000 s</i>
<i>Application timestamp with PacketPrecision™ latency data</i>	<i>~ 0.000 005 000 s</i>
<i>Application timestamp with PacketPrecision™ correction</i>	<i>~ 0.000 000 500 s</i>
<i>MiFID II low frequency requirement</i>	<i>0.001 000 000 s</i>
<i>MiFID II high frequency requirement</i>	<i>0.000 100 000 s</i>

Figures are indicative and may vary. We measure performance for each individual system

Our Time Management Suite™ software doesn't just deliver time. It delivers it resiliently, measurably and verifiably right down to the application timestamp.

The PacketPrecision™ software component measures the latency between the application's timestamp and the hardware timestamp, resolving the execution time with precision.



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