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Turning Water Into Wine:
Leveraging MiFID II
Time Synchronization to
Transform Transaction Data



Introduction

As they finalise their approaches to compliance with the EU's emerging Markets in Financial Instruments Directive (MiFID II), financial institutions are realising that the regulation's apparently innocuous references to time-synchronisation across trading-related applications in fact represent a set of serious logistical and technological challenges.

MiFID II sets out to apply a rigorous set of transparency requirements across all types of financial institution, from asset managers, hedge funds and other buy-side firms, to investment banks, brokerages and exchanges, clearing firms and competent authorities – the regulators themselves.

As well as extending the original 2008 MiFID's structural and reporting practices to non-equity instruments like fixed-income securities, foreign exchange and derivatives, MiFID II introduces a set of technical standards around time-stamping, latency, record-keeping and reporting that will impact all trading systems used by all market participants.

Moreover, the scale of the challenge – with significantly more data points to record across activities in substantially more asset classes – will require a sharp focus on governance for operating the architecture needed to calibrate clocks, synchronise the time-stamps and collect the data required in order to be compliant.

The time-stamping of transactions for cross-venue monitoring, best execution assessment and algorithmic trading platform audit is more complex than it first appears. Furthermore, the requirement underpins MiFID II's vision for establishing a level playing field for market information and trading access, as well as an accurate consolidated tape for European markets – key facets of the EU's drive for increased transparency.



Getting to grips with this ambitious requirement requires significant investment, financial institutions are finding as they plan for MiFID II's implementation date of January 3, 2018. Their early assessments are also finding that a piecemeal approach to addressing the issue just won't cut it. Without a holistic framework in place, firms run the risk of non-compliance – and the associated financial and reputational penalties that involves – and vast expense as haphazard IT initiatives fail to deliver.

Conversely, a holistic approach can bring major benefits that extend beyond MiFID II compliance, were that not motivation enough. As with MiFID II, accurate and consistent time-stamping can be used to underpin firms' responses to the EU Market Abuse Regulation (MAR), to best execution provisions of regulations like the US's Dodd Frank, and a host of other compliance-related issues. Perhaps more strategically, it can yield business performance metrics unavailable till now, offering insight into operational efficiency, profitability and risk management.

Financial services is not the first industry to make this discovery. Lessons can be learned, for example, from the experience of the telecommunications sector, where time-stamping is the norm – indeed, a base requirement – and the necessary infrastructure has been instituted on a massive scale.

With the MiFID II deadline looming, financial institutions need to get their time-stamping plans in place now. Without a coherent approach – and flawless execution – firms risk falling foul of regulators, and undermining the good work they are doing elsewhere to ensure compliance with this broad and complex directive.

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Time Synchronization under MiFID II: The Requirements

MiFID II's time synchronization requirements are embodied in Article 50(2) and specifically outlined in Regulatory Technical Standard (RTS) 25. The requirements have been specified to underpin many forms of reporting and record-keeping for all market participants: trading venues, their members, and their clients. The specifics of the reporting requirements are further governed by Articles 6, 7, 10, 11, 16 and 17.

In essence, the time synchronization requirements have three main purposes:

- 1) The MiFID II time-stamping rules will allow regulators to ensure there is a reliable consolidated price feed (or tape) to promote market transparency and a mechanism for accurate surveillance to aid in detection of market abuse. Specifically, regulators want to be able to build a consistent picture of a given market situation so they can understand what took place and when, to a high degree of granularity.
- 2) For exchange members and their clients, the rules are aimed at standardising record-keeping, particularly for other aspects of MiFID II (and other regulations) like best execution. Again, regulators are looking for firms to provide consistent evidence of adherence to their best execution policies, and an accurate view of when orders were sent, received and executed is integral to that.
- 3) Finally, the requirement governs the creation and storage of a full audit trail of all trading and investment activity for a period of five years (and, in some cases, beyond), once again enabling the regulator to reconstruct the entirety of an order's lifecycle in an accurate time sequence.

So what does the time synchronization requirement under MiFID II look like?

Essentially, the directive sets out specific levels of granularity of time measurement and stamping according to the activities of the entity under regulation. For trading venues, the requirement is specified in terms of gateway-to-gateway latency, which refers to the time measured from the moment a message is received by an outer gateway of the trading venue's systems, sent through the order submission protocol, processed by

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the matching engine, and then sent back, until an acknowledgment is sent from the original gateway.

Trading venues – exchanges, multilateral trading facilities (MTFs), swap execution facilities (SEFs) and systematic internalisers (dark pools) – offering gateway-to-gateway latency of more than one millisecond, the requirement is for time-stamping to a granularity of up to one millisecond, and allows maximum divergence from the benchmark Coordinated Universal Time (UTC) of one millisecond. For venues with gateway-to-gateway latency of less than one millisecond, required time-stamping granularity is one microsecond, with maximum divergence vs. UTC of 100 microseconds.


For **market participants** – exchange members and their clients – the picture is slightly different but again varies according to activity/function. For voice trading and request for quote (RFQ) activity, MiFID II requires a time-stamping granularity of one second, with maximum divergence from UTC of one second.

For other electronic trading flow, the bar is higher. For these activities, the audit points must be captured and time-stamped on the route of an order message from its original receipt by a firm's FIX engine, through order/execution management systems to

the venue's market access gateway. Here, the required time-stamp granularity is one millisecond, with one millisecond maximum UTC divergence for non-HFT firms. And for for **high frequency / algorithmic trading** the spec is for one microsecond time-stamp granularity and 100 microseconds' maximum divergence from UTC.

What emerges from these requirements is a hierarchy of reporting obligations that supports regulators' quest for transparency. At the least onerous end of the scale, voice recording and quotes for OTC instruments are governed by Article 16 and are subject to latency divergencies from UTC of up to a second.

At the opposite end of the scale, Articles 6, 7, 10, 11 and 26 govern trade reporting (near real-time reports to an exchange or Approved Publication Arrangement [APA]) and transaction reporting (more detailed reports, often with T+1 delivery), which in extreme cases are subject to microsecond accuracy requirements. Finally, Articles 17 and 25 cover record-keeping by investment firms, trading venue operators and systematic internalisers, with the requirement to store full audit trail for five years.



Time Synchronization under MiFID II: Issues and Challenges

This set of requirements poses a range of challenges for market participants. Some apply to all; others depend on the entity's market role and preferred activities. All require careful attention, significant investment and a firm focus of intent.

The time-stamping obligations introduced by MiFID II necessarily involves calibrating the clocks that measure activity on all internal systems involved in the trading process. At the most basic level, this requires a compliant trading system and connectivity architecture that provides accuracy throughout the full order lifecycle: from trading application to market access gateway to exchange gateway to matching engine and so on. In this way, firms need to generate a complete record of every new, amended, cancelled, partially traded and completely traded (filled) order.

Trading firms and venues will need to design their time synchronization capabilities at the one millisecond level as a bare minimum. The one millisecond and lower time-stamp requirement necessarily entails capture points either at the application level or at the network level.

The latest MiFID II RTS allows for either, but application-level data capture can present problems. With this approach, time is stamped at multiple points by individual recording devices. First, it is inevitable that individual clocks drift out of synchronisation, which creates the requirement for constant monitoring and realigning of the source as they do so.

Second, the calibration, testing and maintenance of a time stamp within the OS and application stack that's traceable to within 100 microseconds is inherently problematic – due to the drift from the clock on the server through the operating system to the application capturing the event. The challenge: Windows-based OSs in particular and Java-based applications have a problem maintaining the integrity of the clock source.

For high frequency trading firms this entire process has 100 microseconds of wiggle room, and the trading infrastructure and time-stamping equipment must be designed to handle that. This represents a significantly greater technical challenge than the one millisecond threshold, with a requirement for high-performance monitoring systems to keep track of order flow at high speed and high volume.



The definition of an HFT algo market participant remains unclear. MiFID II's HFT time-stamping requirement of 100 microseconds could apply to those sending as few as four orders per second per market. This represents a low threshold for eligibility for this requirement, which means most DEA providers will be held to that 100 microsecond maximum divergence and microsecond granularity record.

An added challenge is the requirement to benchmark time across multiple applications, systems and lines of business. Where a trading firm may be on top of electronic access – and requisite time-stamping – for a specific market or asset class, as MiFID II opens up additional instrument types to its transparency requirements, firms will be required to replicate their time-stamping capabilities across all areas of business activity. Moreover, firms will also be required to ensure consistency of approach and synchronisation across these various lines of business.

Finally, MiFID II's record-keeping requirements are extensive. Article 50 requires firms to store order records – including client name, venue ID, instrument ID, date/time and/or date range – for five years.

As they design and implement their time-stamping capabilities for MiFID II compliance, firms need to assure regulators of certain specific aspects of their systems. They need to specify whether they are benchmarking their system to UTC as certified by the BIPM (Bureau International des Poids et Mesures), or via a third-party satellite-based services. They also need to document their system design, how it functions and the specification of its time measurement capabilities, including exact point of time capture. Finally, these all need to be reviewed and reconfirmed to the regulators on an annual basis.

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The Dangers of a Piecemeal Application-Layer Approach

Firms subject to MiFID II compliance are faced with the daunting challenge of time-stamping, collecting, consolidating and reconstructing millions of execution records. This process needs to be performed for perhaps hundreds of clients, and necessarily with little or no impact on the business.

The obvious impulse for many practitioners will be to try to fine-tune existing structures within the trading technology IT stack – essentially at the application level – in order to synchronise processes to meet the new requirement. As well as appearing to avoid short-term capital expenditure, this approach has the additional appeal of breaking down the broad task of MiFID II time-stamping into manageable chunks that can be assigned to individual business units given the responsibility of managing their own part of the order lifecycle.

This kind of piecemeal approach, however, is likely not to succeed, for several reasons. First of all, the task is a difficult one. Orchestrating a workable solution across the vast range of technology platforms and trading applications that underpin the activities of today's trading organisation is not a trivial task.

MiFID II mandates data collection across more than 60 fields, and requires that data is stored for five years or more post-execution. This applies to 'transparent' markets like equities as well as to over-the-counter securities involving any MiFID II-liable entity, whether traded on or off exchange.

The time-stamping mechanism needs to be calibrated in the context of the 'time budget' appropriate to entity type and activity. For trading venues, for example, stamps need to illustrate the flow of an order message through the various network and gateway 'hops' to ensure the variance from designated latency is within permitted thresholds.

The MiFID II regulation also specifies the need for market participants to document the make and model of their chosen GPS clock and confirm that it has been set up correctly according to the manufacturer's instructions. Regulated entities also need to account for their set-

This scale and complexity points to the second major reason a piecemeal approach will fail: it's expensive



ups if checked by regulators, and are calibrated to deal with any GPS equipment re-sets (e.g. leap seconds). The overhead of governance – the documentation, internal audit, testing and procedures around ensuring traceability to multiple disparate methods of time capture – is a compliance function that is both significant and ongoing.

This scale and complexity points to the second major reason a piecemeal approach will fail: it's expensive. Tying together the disparate technologies involved in the trading work flow would require a significant investment in time and resource, and potentially in new technologies in order integrate incompatible systems to create a single standardised audit record with the level of accuracy mandated by MiFID II.

Finally, given the difficulty and potential expense, the risk of failure is high. Aside from the obvious outcome – non-compliance, and the possible incurring of significant financial penalties as a result – there may be other unintended consequences that could hurt the business in various ways, including errors in demonstrating best execution for clients, missed opportunities to identify market abuse and inaccurate transaction and trade reporting



The Benefits of a Holistic Network-Layer Approach

With so much at stake, firms are exploring how to take a more holistic approach to time-stamping to ensure compliance with their MiFID II obligations. They are looking at how to implement a uniform data capture and stamping facility across all platforms in the hope of reducing the number of calibration and audit points.

This approach is analogous to the use by airlines of a minimal number of makes and models of jet engine. By minimising variance from the uniform model, airline operators can reduce operational costs in terms of staff knowledge base, tooling and servicing inconsistencies, and number of suppliers to deal with. This approach also makes the constant technical monitoring of engine performance easier to achieve, improving safety and overall efficiency.

In a similar way, a uniform time-stamping platform, deployed at the network level, can ease the process of calibrating, testing and auditing that is required. The exception – audit points from applications whose decisions may not end up on the wire – can be architected to drop into the same capture fabric. The result of this approach is the ability to reconstitute and compare transaction activity across the board. For many firms, this will mean getting a grip on their internal transaction data for the first time, and this yields several benefits.

First and most obvious is regulatory compliance. As of today, MiFID II is a primary driver, with firms' eyes firmly fixed in the January 2018 implementation date. But a holistic time-stamping and transaction data management approach is integral to meeting the compliance requirements of the EU's Market Abuse Regulation (MAR).

Other ongoing regulatory initiatives also will require granular and sequential oversight of transaction data. Most specifically this includes the US Consolidated Audit Tape (CAT) project – now in progress with the recent selection of Thesys Technologies to build out the delivery mechanism – and similar embryonic plans in Europe, under the auspices of the European Securities Markets Association (ESMA).



For many firms, however, the true benefits may come from new uses of this transaction audit data, which offers a set of powerful metrics not previously available. The uses of this data are manifold, but could include key trading metrics such as total consideration traded and fill rates per day, instrument or market for each individual client.

Latest performance data could be benchmarked relative to the client's performance over previous hours, days, weeks and months, on a per-instrument, per market or per account basis. In short, the data can be used to improve transparency around what's been traded and provide empirical evidence of the nature and direction of a client's business performance. Firms can gain a greater understanding of clients' activities and use that knowledge to improve strategic client relationships.

The platform can also be used to provide visibility of infrastructure utilisation and reliability. By tracking message flow through trading platforms, firms can identify bottlenecks and other technical issues before they disrupt activities, thereby improving system resilience.

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How to Get Started on Building a Transaction Data Lake

Reliable transaction data enables regulators and market participants to reconstitute and compare transaction activity across venues and markets and against contemporaneous market prices. Aside from regulatory compliance, the uses are manifold and valuable, extending to detecting cross-venue market abuse, execution quality analysis and beyond.

So how do firms go about building a transaction data lake?

What's needed is a single technology implementation that sources and stores transaction records, time-stamped to microsecond accuracy directly from the network with no latency or software/infrastructure overhead. Today, state-of-the-art platforms based on packet capture technology are available to meet this need.

This approach is being co-opted by firms and venues as they seek answers to the MiFID II compliance challenge

Interpretation of this low-level data into meaningful sequential transaction information is critical at this point. Using sophisticated correlation and association techniques, the underlying data points must be linked together to form chains of events that represent a meaningful audit trail. The resultant chaining, with its sequential integrity turns a data lake into valuable transactional insight.

This approach is being co-opted by firms and venues as they seek answers to the MiFID II compliance challenge. Using GPS as the central industry-wide benchmark time source, firms are deploying a network-layer solution that allows them to build an accurate, synchronised view of the data. This approach enables time-stamping at microsecond granularity and deep pack analysis at an affordable price, offering high levels of transparency for business and regulatory purposes and reducing risk across all activities.



Introducing Velocimetrics

Velocimetrics is helping financial institutions and trading venues meet their time synchronisation and transaction reporting obligations under MiFID II, and at the same time realise business insights from heretofore unavailable metrics around trading performance and client behaviours.

Velocimetrics' time-stamping platform facilitates audit trail capture, transaction data management and storage with on-demand access for regulatory compliance. Using tried and tested high performance data capture devices deployed at the network layer, Velocimetrics' time-stamping is fast, accurate and non-intrusive. It monitors transaction flow at microsecond granularity, and supports the ability to slice and filter flow to optimise capacity.

The system's analytics layer offers business-level transaction analysis, giving users insights into trading, client and infrastructure performance. Specifically, it supports insight into order volumes, trade fill rates and client performance, as well as trade and order performance, connectivity latencies and throughputs, client-level SLAs and tick-to-trade statistics.

Using Velocimetrics' centralised transaction monitoring, firms are able to meet their regulatory obligations while unleashing business analytics to improve client experience and financial performance.

The system's analytics layer offers business-level transaction analysis, giving users insights into trading, client and infrastructure performance



About Velocimetrics

Velocimetrics enables firms to increase profitability, manage emerging operational risks and address expanding regulatory demands by tracking and analysing exactly what's happening to every trade or payment in real-time.

Instead of monitoring infrastructure health or IT processes, Velocimetrics focuses on what matters most to your firm's clients – the actual payments and trades being processed. The result: real-time, business flow performance tracking and analysis solutions that deliver as much value to business and client-facing groups, as they do to technology teams.

Velocimetrics' innovative technology will continuously track and assess the real-time status of every single market data tick, order, trade or payment traversing your environment. Delivering uncompromised operational oversight, users are immediately alerted to any changes to the way in which these items are flowing that could indicate emerging performance, financial or operational risk, client experience or regulatory concerns.

The instant a potential issue is detected, all teams involved in the incident's management can access the real-time, relevant and actionable insight they require to make quick and effective decisions. Often enabling steps to be taken to avoid the issue entirely, and when this isn't possible bring the incident to its resolution in a swift and controlled manner, whilst simultaneously quantifying the business and client impact.

Innovative business flow insight exceeding expectations

Setting the benchmark for uncompromised end-to-end visibility across complex environments, accompanied by immediate access to powerful, actionable insights, Velocimetrics' innovative technology presents the future potential for business flow tracking and performance analysis solutions. As one client exclaimed, on realising the opportunities Velocimetrics presents, 'There's nothing else like this!'.

Velocimetrics' technology is incredibly flexible and has been applied to address a multitude of different business needs. Some clients, for instance, use the technology to assess the quality of the market data they are receiving and others to identify risks in their HFT and algorithmic trading processes. Then at the other end of the spectrum it's used in settlements and payments processing.



This extensively proven technology is now being used to increasingly support an expanding client base that currently extends across 6 continents and includes global and regional investment banks, banks operating payment platforms, prime-brokers, asset managers, trading venues, a spread betting company and technology providers.

End-to-End business flow tracking built by industry experts

Velocimetrics was formed in 2009 and its products and solutions have been designed by industry specialists with decades of technical expertise, gained in the front, middle and back-offices of the world's leading investment banks. These products and solutions are then implemented by a dedicated professional services team to ensure optimal deployment results.

Velocimetric's technology is continuously enhanced to help firms effectively address not only their current demands, but as business needs evolve and volumes increase, to also support future requirements. To learn about Velocimetrics' most recent developments take a look at our news releases.

Detailed analysis and actionable insight designed for your environment

Built on the principle of maximum flexibility, Velocimetrics' technology is asset class agnostic, highly customisable, agile, scalable and effective in distributed environments, in addition to being open to numerous integration and extension possibilities – presenting a solution readily able to quickly adapt to changing business requirements, an essential ingredient in an industry that never stays still.

For more information about the ideas in this white paper, please contact: info@velocimetrics.com



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