# Beyond compliance

Microsecond timing is present in several areas of financial services, but most activities use clocks which are accurate only to the millisecond and, crucially, these clocks are unsynchronized. They do not show the same time (especially at the microsecond level) either across servers within data centres where they are located or relative to the venue upon which they trade. So instead of time putting the various components of trading into a consistent relatable framework to enable analysis, these unsynchronized clocks actually increase fragmentation and add to inefficiency.

It is possible to change this situation by installing atomic clocks disciplined by multiple external reference time sources and software that will ensure constant accurate synchronization. Such a system makes it possible to timestamp, to microsecond accuracy, the high volumes of activity passing through data centre. Then not only will the relations between components within the data centre become measurable at great accuracy, but so will interactions between different trading venues. This will yield benefits in many different areas that will more than justify the investment to install and maintain the system:

↗ Internal systems efficiency improvements

↗ Trading insights to identify when others exploit your latency profile

↗ Masking aspects of your latency profile from other market participants

↗ Data insights that can leveraged across the business in marketing to clients, dispute resolution and regulatory compliance

Microsecond accurate time synchronization is an established technology with extensive applications in the defence, energy generation and telecoms industries where accurate synchronization is essential for market participation.

It is time for financial institutions to begin to utilize the advantages of advanced time-synchronized timekeeping to improve operational efficiency and develop strategic insights that can be leveraged across the business

## The importance of microsecond accuracy

Machines now operate so that fast trading patterns are very hard to see. Seen second by second markets look liquid. *(1)*
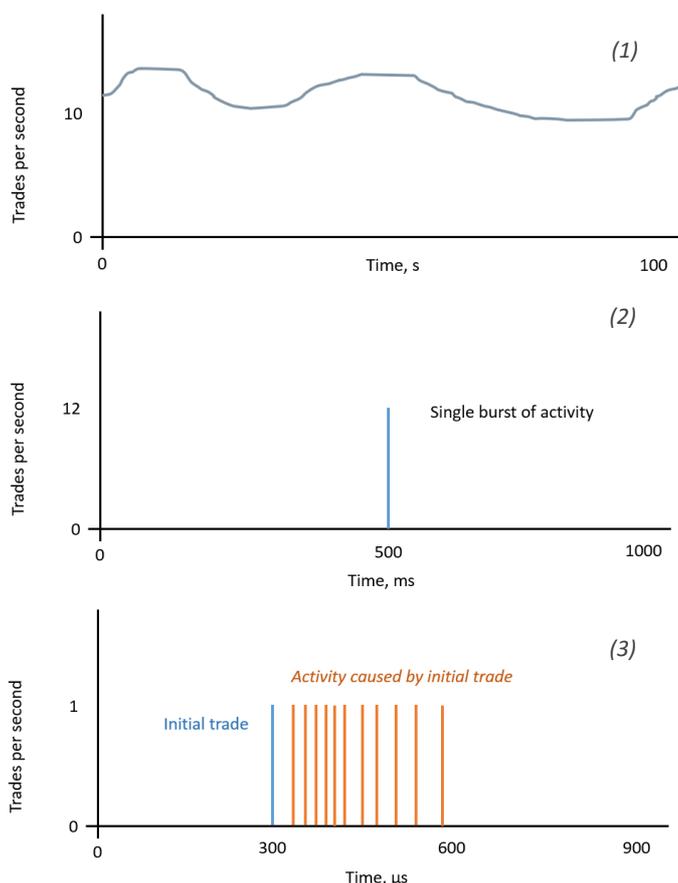
However, seen millisecond by millisecond you can see they are characterised by bursts of activity. *(2)*

Only when you look at the market on a microsecond by microsecond basis can you see and sequence the activity triggered by an initial trade. *(3)*

If you do not have an accurate microsecond timing system you cannot sequence the trades and if it is not synchronized accurately, you cannot put this information into a meaningful context in relation to the latency of your systems.

Examples of the benefits that could result include:

↗ Measuring your latency profile to increase efficiency

↗ Identifying the exploitative behaviour of others

↗ Actively managing the latency profile you present

↗ Leveraging the data to manage reputation with clients, resolve disputes, comply with regulators and audit internal trading standards



*(1)* Trades per second vs Time, s

*(2)* Trades per second vs Time, ms — Single burst of activity

*(3)* Trades per second vs Time, µs — Initial trade; Activity caused by initial trade

# Defining your latency profile

Every market participant has a latency profile derived from a data pattern consisting of variables such as; location, areas of activity, telecoms and routing arrangements. This profile is visible to other market participants, particularly if they looking for it, and it allows you to be identified. *(4)*



*(4) Latency profile*

*Millisecond timing cannot sequence these events*
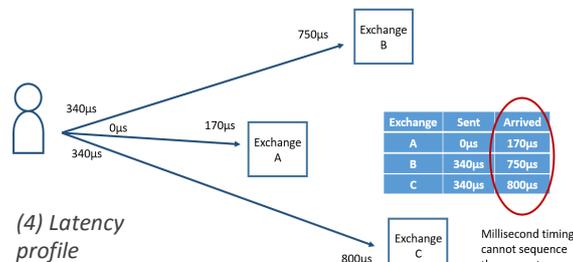
# Identifying latency arbitrage

Just as synchronized timestamping can help a financial institution to understand its own latency profile, so it can also help identify the systematic behaviour of others based on their latency profile.

Microsecond accurate timing can identify a profile where the market moves away from you as you seek to trade at certain venues where you have high latency, after trading with low latency venues. *(5)*



*(5) Latency arbitrage*
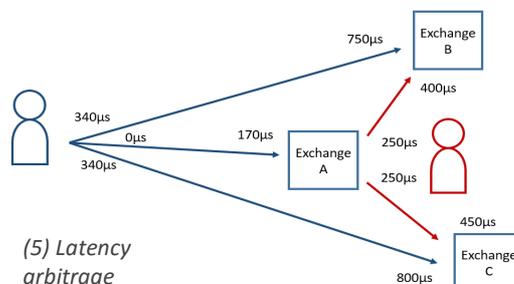
# Increasing efficiency in legacy systems

Over decades, banking software has evolved, slowly building up interface complexity and creating bottlenecks in systems that are difficult to identify.

If all the components in a system share synchronized time to the microsecond, the flow of data through a complex system can be sequenced and bottlenecks localized. This minimizes the cost of latency improvement by pinpointing the few components in the complex legacy system need attention. *(6)*



*(6) Increasing efficiency*

# Controlling your latency profile

Highly accurate timestamping can also help you actively manage the latency profile you present to the market. Once you have defined your latency profile you will know exactly how long it takes for orders to reach trading venues. It is then possible to synchronize your orders to arrive at major trading venues at the same time, or at least with so little variance that it is not possible for another party to systematically exploit your behaviour. *(7)*
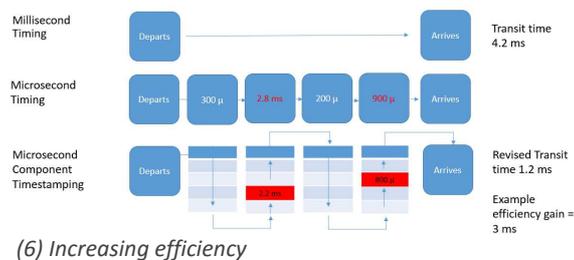
# Leveraging the timestamp data

The timestamping system will build into a rich data record that can be mined and leveraged across the business to different and valuable purposes:

↗ *Reputational Management / Marketing* The timestamped data will provide a definitive record of the market behaviour of a financial institution. This data can be selectively shared with clients to demonstrate the competitive efficiency of an institution and offer transparency to key customers.

↗ *Dispute Resolution* In a case of dispute, the timestamping data will provide definitive evidence of behaviour, not just for internal systems, but also with external venues. Accuracy of a timing could be a vital factor in any dispute involving delays.

↗ *"Speed Camera" Deterrent* The knowledge that an institution operates a microsecond accurate timestamping system that can identify and document latency patterns acts as a deterrent in the same way as a speed camera does to motorists. In this case, though, records are kept indefinitely and behaviour now can be scrutinized at any time in the future.
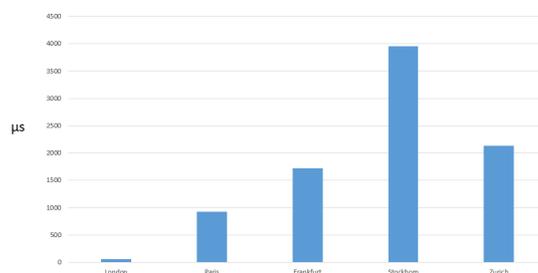


*(7) Above: Unsynchronized arrival time Below: Synchronizing arrival time (blue) by introducing synchronization delays (orange)*



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