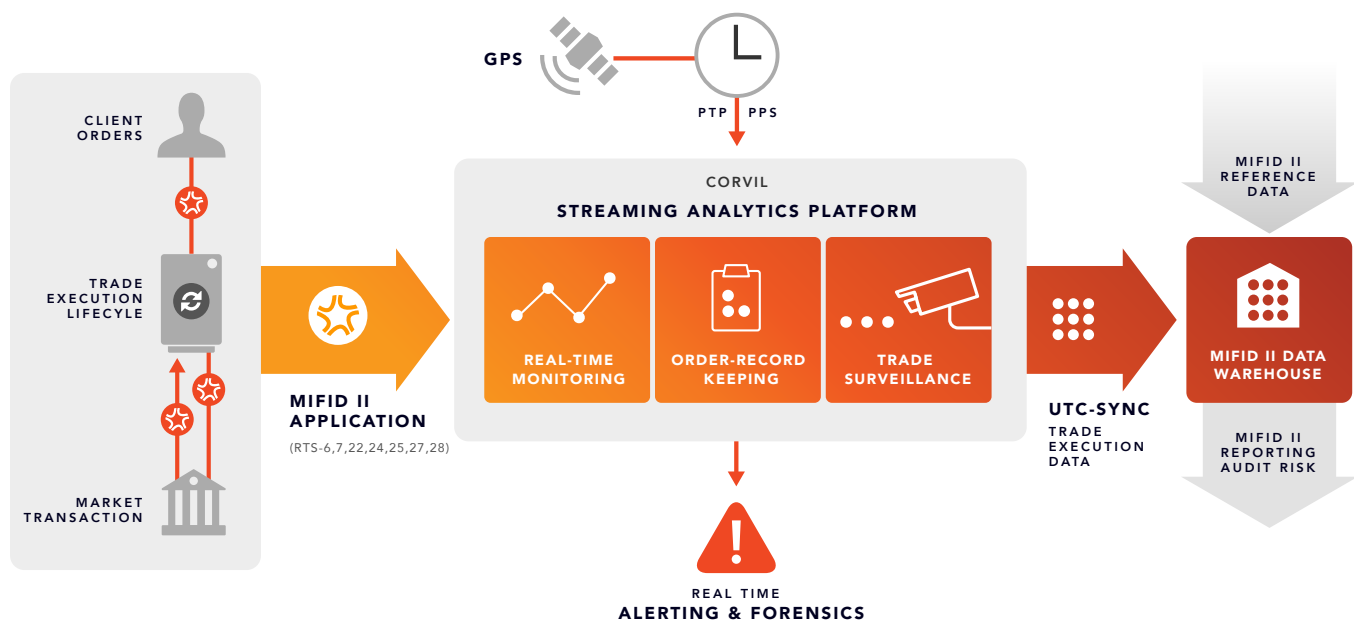


# CORVIL MIFID II SOLUTION

## Preparing for Compliance with ESMA RTS



### Introduction

Corvil's MiFID II solution is a foundational data platform approach to provide critical functionality and data required for compliance with RTS-6, RTS-7, RTS-22, RTS-24, RTS-25, RTS-27 and RTS-28.

### Solution Architecture

Corvil's unique approach uses a dedicated independent system to gather the machine-time data needed for ESMA RTS reporting and forensics. The Corvil platform is deployed non-intrusively as an overlay on existing infrastructure, seeing all trading activity without requiring configuration for systems or flows to opt in. This removes the need for trading venues and participants to overhaul internal IT systems. Other proposed solutions to meeting MiFID II requirements necessitate costly and time-intensive hardware and server upgrades, in addition to coding changes to dozens or hundreds of applications and databases.

Corvil's support for wire-based data collection and timestamp measurements drastically reduces the size of the PTP distribution infrastructure required. It also reduces the need for extensive application and database development efforts to support implementation and ongoing maintenance of a home-grown solution.

// Access to accurate, reliable and timely data will be critical to demonstrate the provision of best execution; as such, the majority of respondents to a recent TABB survey highlighted data concerns as their main challenge.

TABB GROUP

### HIGHLIGHTS

- Independent, trusted, 3rd party platform
- Non-intrusive / low-overhead data capture & monitoring of multiple data sources
- Best-in-class, proven data analytics platform for trade execution life cycle
- Better data precision and accuracy than specified in RTS-25
- Historical reporting of UTC synchronization availability and accuracy

### BENEFITS

- Lowers regulatory tail risk from non-compliance and/or forensic audit
- Reduces cost to meet RTS rules
- Minimizes changes to trading systems
- Reduces implementation complexity
- Future-proofed

## MIFID II Transaction Monitoring, Reporting and Surveillance

MiFID II Transaction Reporting and Order Record Keeping regulations requires precise record keeping of all messages and events involved in transaction life cycle and reporting of transactions executed.

Reportable events such as transmission, receipt of orders, and decisions to trade need to be accurately timestamped and made available to regulators for reporting, either continuously (transaction reports) or on-demand with a 5 year history (order record keeping).

Corvil reduces the complexity and cost of compliance. Corvil offers a minimally disruptive and scalable, data acquisition, correlation, analysis and publishing platform, with support for accurate timestamping and collection from all required data sources: network, application agents and logs.

### Solution Overview

With Corvil, many MiFID II reportable events can be captured directly from the network, meaning you don't have to synchronize servers or update your applications. This reduces hardware and software changes, making it faster and cheaper to build a MiFID-compliant environment. Off-loading logging also minimizes application overhead to keep you trading fast.

Corvil timestamps in hardware and continuously assures synchronization to UTC, alerting on outages and deviations and providing detailed reports on clock quality over time.

Where applications need to be instrumented, Corvil offers an ultra-low overhead Application Agent for event timestamping and forwarding, and can collect existing logging data.

Data is normalized and made available via a streaming API that supports ingestion by databases and message brokers to support reporting and storage (such as kdb+, Hadoop and SQL Server).

With support for capture, normalization and streaming of network, application and log events, Corvil assists with many MiFID II requirements, including RTS-6 (algo trading record keeping), RTS-7 (gateway-gateway latency), RTS-22, RTS-24 (transaction reporting for firms and venues), and RTS-25 (time synchronization).

In a single deployment, Corvil delivers the MiFID solution plus all the benefits of our best-in-class performance, troubleshooting, and security suite.

### KEY CHALLENGES

- Major upgrades to IT systems
- PTP distribution network to every server for accurate UTC sync
- Server hardware and OS upgrades to support PTP input
- Application code changes and/or software re-architecture
- Database changes to handle precision timestamps and storage
- Test and calibration system for UTC compliance (RTS-25, Article 4)

### SOLUTION FOCUS

- UTC clock-synchronized data capture
- Real-time monitoring of order life cycle
- Precision order record keeping and publication
- Trade execution surveillance and analytics
- Watchdog over cyber threat to IT systems
- Health monitoring of network time distribution

The screenshot shows the Corvil Nanosecond UTC Timestamps interface. On the left, there are three numbered callouts: 1. Nanosecond UTC Timestamps, 2. All Order Events Captured, and 3. Full Decode Of Order Fields. The main dashboard displays 'Order Record Capture' with a search bar and a timeline. Below the timeline, a table shows 10,000 events found. The table has columns for Timestamp, Event Name, Location, ClOrdID, OrderID, Symbol, and OrderQuant. A detailed view of an event is shown on the right, including fields like Event Name, Location, ClOrdID, OrderID, LastPrice, Side, SendingTime, FilledPct, Complete, LastQty, LastValue, Filled\_Vol, Bought\_USD (\$), and Sold\_USD (\$).

Timestamp	Event Name	Location	ClOrdID	OrderID	Symbol	OrderQuant
2016/03/02 11:24:40.027549.666	Replaced	Client	7845MK-45	2009062520757		
2016/03/02 11:24:41.4227110.658	Fills	OrderRouter	2EYV96-6	ETSJ20620090625	AAL LN	
2016/03/02 11:24:41.4272259.668	Fills	Client	7RIL41-1	ETSJ20620090625	AAL LN	
2016/03/02 11:24:41.640522.657	Ack	OrderRouter	2EYV2A-6	20090625220757		
2016/03/02 11:24:41.640586.657	Ack	Client	7RIT7N-1	20090625220757		
2016/03/02 11:24:41.640751.658	Fills	OrderRouter	2EYV2A-6	20090625220757		
2016/03/02 11:24:41.640912.657	Fills	Client	7RIT7N-1	20090625220757		
2016/03/02 11:24:41.641179.657	Fills	OrderRouter	2EYV2A-6	20090625220757		
2016/03/02 11:24:41.641340.657	Fills	Client	7RIT7N-1	20090625220757		
2016/03/02 11:24:41.648244.657	Fills	OrderRouter	2EYV2A-6	20090625220757		
2016/03/02 11:24:41.648289.657	Fills	OrderRouter	2EYV2A-6	20090625220757		
2016/03/02 11:24:41.648406.657	Fills	Client	7RIT7N-1	20090625220757		
2016/03/02 11:24:41.648496.657	Fills	Client	7RIT7N-1	20090625220757		
2016/03/02 11:24:43.378400.667	Cancelled	OrderRouter	SUL721-7		B16NQM3	

## KEY FEATURES



### Data Source

- Transaction Records – collects execution reports off the network, and extracts data including the embedded transaction time
- Network Events – collects order receipt and transmission events directly off the network, timestamped in hardware, removing the need for software logging of these events
- Application Events – Corvil Application Agent offers ultra-low overhead event publishing for collection by Corvil appliances, while meeting the MiFID II requirements for timestamping accuracy
- Logging Events – ingests existing streams of log messages and extracts data and timestamps



### Extensible

- Support for 400 data protocols, an SDK and APIs, user-configurable dashboards, and flexible publishing of real-time streaming analytics to external big data systems



### Timestamping

- Hardware timestamping with support for PPS and PTP synchronization, with alerting for outages
- Independently validates the consistency of PTP distribution and application timestamping
- On-demand and scheduled reports of UTC synchronization availability and accuracy over time



### Data Quality

- Deep Buffering for drop-free acquisition during bursts of activity
- Leading support for Aggregation Taps, including timestamps and unique stacking support
- Alerts for missing data and overloaded monitoring paths



### Correlation

- Each appliance is capable of millions of correlations per second, and supports distributed multi-event correlation. Correlation supports the reporting of Gateway-Gateway latency at the 99th percentile, as required by RTS-25



### Normalization

- Convert events into a common format, regardless of the original message format or protocol
- Systems receiving streams from Corvil need only support a single format, independent of the original venue, vendor, or in-house message content and encoding



### Publishing

- Corvil streams make the collected data available in near-real time via an API
- Corvil Connectors make it easy to connect to streams and insert into specific receiving systems such as kdb, Hadoop, Microsoft SQL Server, Kafka and Flume



## CORVIL SOLUTION COMPONENTS



### Streaming Analytics Appliance

- Performs key timestamping, decode, correlation, normalization and publishing functions
- All data sources – network events, agent events, log events
- Highly scalable – single appliances scale to millions of events per second, and can ingest from hundreds of network points via unique stacked aggregation tap support
- Timestamping – hardware timestamping with support for PTP and PPS synchronization, alerting for any sync outages, and reporting of sync accuracy over time
- Streaming – normalize and stream reportable via an open API



### Corvil Decoders and SDK

- Support for 400 trading, market data and messaging protocols
- SDK and Corvil Professional Services for supporting in-house formats
- Updated monthly to track Exchange Driven changes and introduce new analytics
- Install on Corvil appliances



### Corvil Application Agents

- Acquire accurately timestamped application events
- Ultra-low application overhead
- Software library for Java and C++, Windows and Linux
- Requires UTC-synchronized hosts



### Corvil Connectors

- Corvil Connectors are API clients that allow streams to be easily ingested by specific systems as kdb, Hadoop, Kafka, Flume, Microsoft SQL Server, Splunk
- Clients can connect directly to the API (example code provided)
- Reconnect to streams when disconnected



### Time Synchronization Source

- (not provided by Corvil)
- An accurate source of UTC time is required for timestamping
- Appliances support PPS (pulse-per-second) and PTP (Precision Time Protocol) inputs, and alert if inputs are interrupted. Appliances also detect if the signals are inconsistent, as can happen if PTP is delivered over congested networks
- A historical record is maintained of the stability and accuracy of all clock sources (PPS, PTP), and this record is used for reporting and available via API
- Application Agent uses the server system time, which should be synchronized to the MiFID requirements. The Agent may also directly read any good source of time (e.g., from an on-board PTP-synchronized NIC)

**//** You can sleep much better at night knowing you have an independent watchdog system that sees everything. The scary situations are the events no one has imagined, and Corvil helps protect us from those.

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