

WHITE PAPER



Streaming  
Analytics to Run  
Electronic  
Trading Systems  
in the Now

## 1. Introduction

Electronic trading firms use information technology to automate business operations at every stage of the trading

Automation reduces trading costs and delays. It also makes firms more dependent on the performance and reliability of IT Operations

process, from dissemination of news and market data, to order processing and forwarding, to trade execution and clearing. Automation makes these operations faster and more efficient, reducing trading costs and delays. It also makes firms more dependent on the performance and reliability of IT Operations, and creates challenges for application and network performance management. The close connection between IT Operations performance and business outcomes means that mismanaged networks and applications can translate directly to poor business results. The faster pace of automated systems also means that firms are exposed to larger data volumes and more diverse and variable

When things go wrong, negative outcomes can accumulate rapidly. Predictability of outcome becomes critical to safe-guarding business performance

IT Operations performance management must underpin and safeguard the successful execution of business operations

operating environments. When things go wrong, negative outcomes can accumulate rapidly. As a result, it has become critical to provide tight control over processes executing over shorter time-frames, and to ensure precision in the predictability of outcomes, in order to safeguard and optimize business performance.

In this environment, the role of IT Operations performance management takes on a new significance as it must underpin and safeguard the successful execution of business operations. Traditionally, IT Operations has relied on more or less narrowly-focused network and application performance monitoring disciplines (NPM and APM), often working in isolation, which don't account well for business context. The task of monitoring and optimizing business processes has instead been taken on by operational and business intelligence solutions – but these lack the detailed insight into IT infrastructure performance that NPM and APM can provide, and that high performance operations demand.

## 2. The Emergence of Streaming Analytics

Electronic trading firms can benefit from a new approach that combines business-level data and visibility with advanced performance management for the IT infrastructure. At Corvil, we call this

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Streaming Analytics combines business-level data and visibility with advanced application and network performance management

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approach Streaming Analytics for IT Operational Intelligence.

Streaming Analytics integrates precise and granular performance monitoring at the network, application, and transaction layers with the ability to capture and analyze business context and impact. Streaming Analytics correlates business outcomes with performance across infrastructure layers in real time, to help users detect and solve critical problems quickly. Streaming Analytics also acts as a source of data that can be leveraged to optimize trading processes and manage operational risks.

Traditional network performance monitoring serves many purposes in financial trading, ranging from troubleshooting IT systems, to managing operational risks, to solving simple client support issues, to verifying regulatory compliance. Today's complex IT Operations have new requirements to better see, understand, and act on business and operational changes and issues that arise on a daily basis. Today's electronic trading firms and, in general, the financial markets, have a growing desire to manage technology risks more precisely and in true real-time. In addition, regulatory requirements are driving transparency across more sections of the industry, and trading systems continue to get faster and more complex. Modern Streaming Analytics platforms, tapping into the data flowing through the network, help firms to

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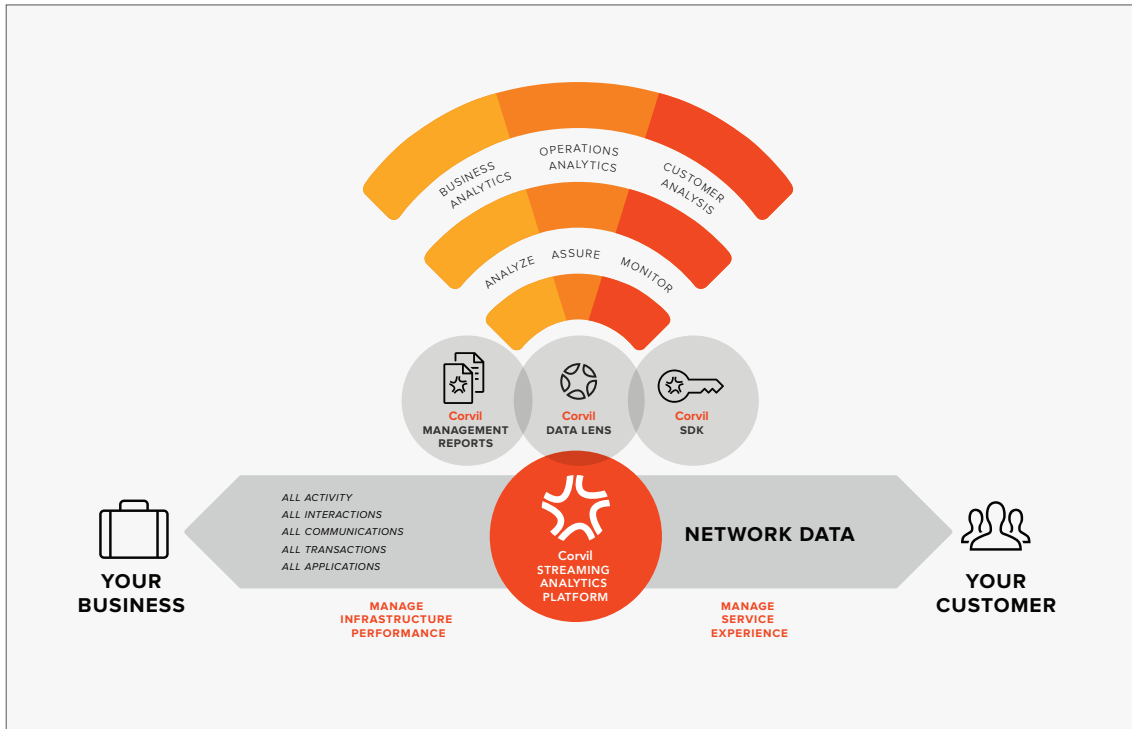
Streaming Analytics acts as a scalable platform that supports a broad range of sophisticated use cases

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address these trends by acting as a scalable big data analytics platform that can also include data from other systems and correlate with network data to deliver IT Operational Intelligence to support a broad range of sophisticated use cases. Corvil Streaming Analytics Appliances tap non-intrusively into rich sources of data within the trading environment, providing broad IT Operational Analytics without impacting system performance. It decodes and analyzes this data to create high-level, independent views of activity and performance at the network, application, transactions, and trading layers. It also makes this decoded and enriched data available across the financial enterprise.

### **3. The Corvil Streaming Analytics Platform**

Developed over several years in close collaboration with the financial trading community, Corvil's Streaming Analytics platform is the market leader and has been widely deployed by exchanges, broker-dealers, market data distributors and financial service providers, and is uniquely suitable for use in low-latency, high-performance or data-intensive environments. The high-level architecture of the platform, depicted in figure 1, illustrates some of the major features and capabilities required to deliver Streaming Analytics.



**Figure 1**  
**Functional components of the Streaming Analytics Platform**

Streaming Analytics correlates business outcomes with performance across infrastructure layers in real time

#### 4. Tapping Into Network Data

Many traditional forms of performance data, such as utilization statistics, netflow records, and even application response time metrics, have their uses but don't provide the high-level trading and market data visibility needed to support business use cases. Analysis solutions must tap into much richer sources of information about what is happening within IT Operations. As shown in figure 1, Corvil uses network data that is passively copied from the infrastructure as its principal data source.

Since all business-impacting events ultimately cross the network, it acts as a natural aggregation point for data from many IT processes and components: both known and unknown. This makes network data an authoritative and highly scalable information source.

Network data can be obtained non-intrusively, which means that it can be used to drive advanced, granular analytics and operational intelligence with zero impact on trading system resilience or

Network data is an authoritative and highly-scalable source of information about business-impacting events

latency. It is also highly accurate, since it can be time-stamped in hardware at the point of acquisition. The Corvil Streaming Analytics Appliances include support for timestamps inserted by aggregation tap devices, so that data can be collected from multiple network instrumentation points with no loss of accuracy.

## 5. From Raw Data to Real-time Operational Intelligence

Traditionally, solutions based on passive data capture from the network have suffered from the low-level, unstructured and opaque nature of the data they provide. Raw data from the wire does not expose application data fields or messages, and cannot easily be searched, filtered, or processed based on business-relevant terms such as transactions, clients, or security symbols or prices. Unfiltered network data is often too voluminous to be economically transported or permanently archived. Therefore, a key function of Streaming Analytics is to analyze



The transformed data produced by Corvil provides a flexible platform for analytics that report directly on trading activity



and transform this raw data into meaningful business information and analytics suitable for use in higher-level monitoring functions.

The Corvil Appliances transform network data in several successive stages. Firstly, the system tracks network flows, analyzes flow quality, and performs full flow reassembly.

Secondly, the platform decodes application-level messages and data fields, using an extensible protocol discovery and decoding framework that supports hundreds of market data, order-flow and middleware protocols. The decoded application data is made available for search, filtering and correlation within the Streaming Analytics platform and via external APIs. It also used to analyze the integrity and quality of application data streams, to identify application-level transactions and to recognize and track persistent client orders.

## 6. Integrated Network, Application, and Transaction Layer Analytics

At each stage of this transformation, the Streaming Analytics platform applies advanced capabilities specifically developed for complex trading and market data environments.

For example at the **network layer**, these capabilities include:

- Detection of network microbursts and saturated network links.
- Distributed monitoring of one-way and round-trip network latency and loss, either within sites, between sites, between regions or between different trading firms.
- Analysis of TCP protocol behavior, with detection of retransmitted and reordered data.
- Congestion analysis revealing the potential for delays and losses on critical network links.
- Flow analysis including identification of top conversations and unexpected data

flows.

- Analysis of network capacity requirements in light of microburst activity and targeted latency and loss thresholds.

At the **application and transaction layers**, Streaming Analytics provides support for:

- Analysis of application-level message microbursts, message latency and data integrity.
- Identification of sequence gaps in multicast market data message flows.
- Comparative analysis of latency and quality between different market data feeds.
- Transaction latency and success rate monitoring; identification of rejected or unacknowledged transactions.
- Hop-by-hop tracking of transaction progress across multiple processing steps.
- Support for complex message transformations, including order-to-acknowledgement, order-to-tick, tick-to-order, one-to-many and many-to-one relationships.

The decoded and transformed data produced by the system also provides a flexible platform for analytics that report directly on trading activity. Examples of **business metrics** that can be implemented at this layer include:

- Order life cycle tracking: identifying long-lived orders that may have multiple low-level messages and transactions occurring against them. Tracking order evolution and ultimate fate, whether filled, partially filled,

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The deep and precise integration of NPM and APM with business visibility makes it easy to grasp the relationships between the performance of business processes and IT infrastructure

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rejected or cancelled.

- Analysis of trading behavior in terms of order types and style. Monitoring of cancel-replace ratios, order and trade volumes.
- Analysis of trading outcomes, in terms of fill-rates, miss-rates and currency amounts traded.

## 7. Integrated IT and Business Performance

Integrating application and network performance with business-level visibility makes it easy to grasp the relationships between the performance of business processes and IT infrastructure. Modern Streaming Analytics platforms record all of the data and metrics at every level, allowing users to inspect the state of the infrastructure and determine root cause during episodes where process performance is sub-par or when business-impacting events are detected. Integration also means that users have access to the business-level data associated with anomalous IT events. That makes it straightforward to check which customers, transactions, or orders were affected by an IT infrastructure problem. It also helps users investigate whether anomalies and sub-optimal behavior are associated with particular business process pathways.

In fact the richness of the data produced by Corvil's Streaming Analytics, and the fact that it is generated independently of the monitored infrastructure by using data from the network and other data sources, means that many of our customers seek to leverage it as input to their own customized surveillance functions. Use cases range from offering enhanced customer visibility via support portals, to safeguarding against operational and financial risk, to verifying compliance with business regulations. To support these use cases, the Streaming Analytics platform provides access via an analytics feed for live data and events, and via a data API for captured data and metrics. The system also includes a centralized GUI and customizable dashboards and reporting facilities.

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Corvil illustrates how advanced application and network performance management and business visibility can be integrated to create a highly scalable Streaming Analytics platform to run business in the Now

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Corvil illustrates how advanced application and network performance management and business-level visibility can be integrated to create a highly scalable Streaming Analytics platform based on non-intrusive analysis of network and other IT data. By providing data and analytics correlating the state of business processes with the state of IT infrastructure at each layer of the stack, Streaming Analytics provides both superior business and IT Operations visibility and a firm foundation for the sophisticated enterprise requirements of today's financial trading environments, and other businesses that run in the NOW.



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