

The Power of Real-time Continuous Intelligence™ with ESP

Using CEP Technology for Market and Big Data
Intelligence and Response

TABLE CONTENTS

- 1 The Power of Real-time or Continuous Intelligence™
- 3 Reaping the benefits of Continuous Intelligence
 - 3 Validating market data
 - 4 Trade, algorithm monitoring and analytics
 - 5 Real-time risk aggregation
 - 5 Compliance and surveillance
- 6 Sybase CEP Powers High-speed Surveillance Applications
 - 6 Real-time P&L
 - 6 Derived data creation
 - 6 Continuous real-time ETL
 - 7 Integration hub/message broke
 - 7 Network performance and latency monitoring
 - 7 Security pricing
- 8 Sybase ESP
- 9 Conclusion

INTRODUCTION

For businesses, the lasting lesson of recent military intelligence operations is that they show the value of focusing on patterns of events, even over a number of years, to determine whether taking an action is worth the risk.

Just as every newsroom in the world today must react in real-time, competitive businesses likewise must seize on the scraps of information that wire services and intelligence agencies, for example, use to project whatever their view is of the world.

This requires dealing with “big” data — meaning messy data incoming from everywhere and everything — from disparate sources in real-time such as smartphones, networks, sensors, tweets, emails, stock trades, watch-lists, and even from — to use the military term — boots on the ground.

THE POWER OF REAL-TIME OR CONTINUOUS INTELLIGENCE™

The volume of data amassing in organizations rises, and rises to almost beyond comprehension.

By 2015, Cisco’s Visual Networking Index suggests that global mobile data traffic alone will reach 6.3 exabytes each month, that’s 75 exabytes every year.

For perspective, a transcript of every word ever spoken would run to 5 exabytes. Given 75 exabytes of annual global mobile data traffic, we’d have the equivalent of 19 billion DVDs or 536 quadrillion SMS text messages. To put these large numbers into the securities trading context, the Aite Group says trade and quota data for the New York Stock Exchange (which logs about half a trillion trades a month) has exploded from an average of six to seven million transactions a day in 2000 to 500 to 600 million a day in 2010.

Effectively this means that the financial services industry is in the business of monetizing information to generate new sources of value. The smartest companies in the financial services industry have accepted this fact with 22.1 percent of them embedding analytics to transform information into insight and action, according to a recent report in the MITSloan Management Review. In a key finding, the report identifies lower performers as those that apply analytics less than the average rate of 5.5 percent, with low performing financial services organizations falling as low 4.75 percent.

These low performers are struggling to update and connect complex legacy systems to manage the overwhelming stream of incoming data, according to the Boston Consulting Group. As a result, though IT budgets rise, several studies show that throwing more money at the problem has not driven differential performance.

Agile information savvy competitors are already leaving behind those low performing companies that don’t mine the value of their data to collect, verify and analyze it in real-time and detect highly commercially valuable patterns to improve their performance, as shown by the MITSloan Management Review first annual New Intelligent Enterprise Global Executive study.

Top performing organizations identified in the study were twice as likely to use analytics to guide day-to-day operations and future strategies as the lower performers. In contrast, the top performers are building and using real-time or Continuous Intelligence™ systems that can see dynamic business opportunities and threats with enough context to act immediately.

The demand for more intelligent applications for a range of industries from financial services, e-commerce industries, telecommunications, to government revenue, defense, and intelligence agencies is stretching the capacity of conventional business to keep up. Needing to adapt to incessant change these, organizations use Continuous Intelligence capabilities to analyze avalanches of event data in real-time to generate immediate insight and enable instantaneous, often automated, responses to conditions as they change.

WHAT DEFINES “BIG” DATA

The McKinsey Global Institute, the research group within the consulting firm, defines big data as “datasets whose size is beyond the ability of typical database software tools to capture, store, and analyze.” The authors of the McKinsey report *The challenge — and opportunity — of “big data”* explain that this definition purposely excludes quantifying big data by a number of terabytes (thousands of gigabytes), because over time the size of big data datasets will rise. They also note that the definition can vary by sector, depending on the software tools used and the sizes of datasets common in a particular industry.

The challenge is to capture, filter, clean, organize, analyze, and process this streaming real-time information into an all-embracing real-time perspective to help trigger faster, better decisions and actions.

Smart companies are already raising the competitive bar in financial services and other industries by pursuing big data and using the innovative technology known as complex event processing (CEP) or as another derivation, event stream processing (ESP) — to give them the ability to speedily capture, interpret, and act upon signals harvested from active, productive data.

It is a sophisticated form of technology — one that fuses intelligence feeds from Reuters, Comstock, direct exchanges, other aggregate providers, ECNs, block trade services, a seemingly endless list — with expert trade specialists. The ability to call upon news, social networks such as Twitter, market data, last prices, order books, internal executions and correlate this information in real-time across all of these streams is immensely valuable. With its incredible advance in processing speed, ESP technology pushes the use of data right up against the edge of the trade.

“Real-time,” in these circumstances takes on new meaning. To respond in hours or minutes is often too late. Even seconds, in some cases, are too long. Rather, real-time increasingly means sub-second - milliseconds or less. Time constraints in many organizations have eliminated past and future tense from acceptable operational parameters. Now, there is only, well, now or real-time.

High frequency traders (HFT) — continuous optimizers of their systems and infrastructure — squeeze millisecond delays from a trade in the hope of making a profit using Continuous Intelligence. Since the credit crunch on Wall Street that led to the Great Recession, the financial services industry today uses Continuous Intelligence to analyze risk and mitigation. E-commerce companies, dealing with customers who make buy or move on mouse-click decisions, study customer behavior and reaction to marketing offers in real-time to maximize the numbers and profitability of transactions.

Telecommunications companies in a competitive, ever-churning environment, rely on Continuous Intelligence to monitor and manage network traffic to optimize bandwidth capacity and keep customers happy. In the military and in homeland security, where the ability to spot ominous trends or imminent threats can make the difference between life and death, Continuous Intelligence is essential.

As technology evolves to enable faster data analysis, and at least for as long as low stock market volatility limits a trader’s ability to simply cash in on market movement, some professionals see a greater demand for real-time market analysis to reveal real insight a step ahead of the market. There may be less “high frequency” as some diminution among practitioners is beginning to show now, they say, but traders will still need to move quickly. Significantly, perhaps, there may be a shift coming, albeit a slight one, with “smart” catching up to “speed” and becoming equal partners.

Speed, even in HFT is not the only important factor. A top speed and smarter system may uncover more profitable opportunities than one built simply for speed. For example, take Formula One car racing. It’s a generation since winning was solely about the best car and driver.

Today, scores of built-in sensors in Formula One cars continuously capture a multiplicity of variables — including RPMS, weather, road conditions, the angles on a track’s s-bends, wear on tires, to pit stop now or next lap — and process it into data for active simulation models that inform a drivers’ instantaneous decisions. Formula One racing today is as much about deriving Continuous Intelligence and decision-making as it is about engine speed and driving expertise.

A more thoughtful approach by trading firms can pay dividends in cases where latencies are unavoidable. Complex trading strategies increasingly incorporate cross-asset class decisions, which often involve multiple trades occurring across different execution venues. Firms can productively use time-delays resulting from the speed-of-light latency issue.

REAPING THE BENEFITS OF CONTINUOUS INTELLIGENCE

Leading financial services companies are already reaping the benefits of Continuous Intelligence to converge on the right information, refine relevant signals, and speedily act upon them.

Consider, for example, the steps the following Continuous Intelligence players have taken:

Validating market data

Needing to capture and process tick data — the intra-day stream recording each market transaction (buy or sell) — combining it with historically rich market data and develop models to enable traders to take advantage of market opportunities, London-based Mitsubishi UFJ Securities International plc (MUSI) stream enriched data to a real-time cache and historical repository using Continuous Intelligence.

Active in worldwide capital markets as specialists in fixed income, equity, derivatives and structured financial markets, MUSI is one of the world's largest financial institutions, measured by total assets.

The company provides a wide range of services in the international securities and derivatives business to governments, their monetary authorities and central banks, supra-national and sub-national organizations, private banks, insurance companies and corporations.

With about 600 employees, MUSI works closely with Mitsubishi UFJ Financial Group (MUFG) and its corporate bank, the Bank of Tokyo-Mitsubishi UFJ.

MUSI uses a Sybase product suite including a scalable, flexible complex event processing (CEP) platform that supports a wide array of Continuous Intelligence applications used by the company's decision makers to execute business faster.

Using Sybase CEP technology, MUSI manages and analyzes high-volume, high-speed data sources and delivers on the critical requirements for data management and analysis that makes Continuous Intelligence possible.

The CEP platform's job is to take data from events, apply sets of event processing rules to those events in real-time, and, through the processing, determine which complex events companies need action.

A financial example would be a portfolio stop loss. In such a scenario, client stock portfolios encapsulate any number of stocks that might be traded in either US\$ or UK#. Portfolio valuations are recalculated dynamically each time an incoming stock ticker event results in a change to a given portfolio stock. If the aggregate valuation of a portfolio changes by more than 10 percent on a given trading day it raises an alert on a business-monitoring dashboard, or on an automatic trade application to sell some or all of the monitored stock.

Another example is the limit up, limit down condition in which an exchange sets the maximum gain or decline in a stock or commodity price a day. In the case of a commodity future, when it reaches the allowed price limit of 30 cents for the day an alert signals the exchange and the market may close. Should a commodity future in April, for example, close at \$4.30 the previous day, an alert goes out once the price rises to \$4.60 or falls to \$4.00 during the next day's trading. Rather than close the market, it is common for an exchange to allow sellers to hit limit bids or buyers to lift limit offers after reaching the limit. Occasionally, a market that is locked limit up or down early in a session will move from the limit in response to news and orders. In any case, the CEP platform has done its job for the exchange.

The CEP platform shifts the focus on patterns from what has happened to what is happening as of right now, at this very moment. Traders can then make decisions instantly about whether or not to make a stock trade, agents at Homeland Security can initiate surveillance on a potential terrorist, or retail bankers can put a hold on a suspicious credit-card transaction.

A concert featuring a popular band offers a glimpse of the advantage CEP provides over traditional analytics. As the first of 10,000 people stream into the arena, the famous lead singer sets out to ascertain their preferences for the songs they wish to hear that evening so he can determine the band's set list in advance.

The traditional database approach is to wait until everyone arrives then invite each audience member to state their preferences, collect the data and count the results. Obviously, this is time consuming.

Using CEP's streaming pattern, audience members state their preferences as they're walking in, or perhaps they respond to a mobile live real-time poll as they might for American Idol. Audience favorites become apparent using either one of these means as they're forming. A running tally immediately comes into focus so that the lead singer gets a list well before everyone's settled into their seats. The difference is immediacy.

MUSI's CEP technology captures streaming data from data feeds at high message rates, validated to flag anomalies, for example, bid price is higher than ask price, and filtered for significance before adding to the data set in another product of the Sybase suite, RAP—The Trading Edition for analysis and storage. This product allows multiple concurrent users to access vast histories of leaf-level market data stored in a columnar repository that provides greater speed and more efficient data compression than traditional row-based databases. RAP—The Trading Edition combines with the improved latency in-memory computing to perform real-time simulation, forecasting and analytics across a big data environment. The result is that MUSI realizes the value of faster decisions.

Since implementing the Sybase technology, MUSI has doubled the number of currencies it tracks allowing a richer view into market opportunities — without adding more storage.

Organizations that were planning to build real-time analytics applications from scratch, have reported that by using a CEP platform they were able to slash development and implementation time from an anticipated 18 months to less than four months! Other organizations have reported that CEP platforms have enabled them to cut their development time and costs by as much as 85 percent.

Trade, algorithm monitoring and analytics

An American arm of a large German bank found that in today's rapidly changing market conditions it needed to monitor market activity and current position using real-time data and historical analysis to help it decide the strategies to execute at various times throughout each trading day. Furthermore, the company wanted to maximize the efficiency and profitability of its traders and algorithms.

Within its Sybase suite of technology, the bank employs CEP and CEP-based solutions that address specific challenges and enables the company to respond faster to changing conditions and make better decisions through up-to-the-moment information.

The combined product family offers a comprehensive software suite for developing, implementing and delivering real-time analytics and Continuous Intelligence for time-critical business decisions plus these benefits:

- End-to-end real-time management of cash and liquid assets to reduce short term liquidity risk and ensure optimal funding;
- Consolidation and analysis of multiple order book feeds from individual exchanges to provide a powerful tool for trading in fragmented markets;
- Provides a template for rapid implementation of a customized, comprehensive solution for consolidating positions, limits and exposures across asset classes in real-time to manage both credit and market risk;
- Provides a flexible liquidity stress-testing environment that enables banks to model stress events and gain insight into how different scenarios would affect the bank's liquidity exposure.

Real-time risk aggregation

Since the credit crunch on Wall Street in 2008, investments in systems for managing risk are increasing. In the same time, as market volatility rises counterparty risk increasingly comes into focus. Another factor drawing traders' attentions is the inadequacy of previous risk models that makes it necessary to invest in tools giving a more comprehensive view of exposure. Added to this regulatory pressure coupled with meeting the Dodd-Frank law requirements enacted in the U.S. to strengthen the capital markets, and further safeguards imposed for trading in Europe by the Basel III agreement are increasing the requirement for technology to ensure that liquidity remains optimal.

All firms have risk systems across their front and middle offices performing market, credit and counterparty risk analysis either at the point of the transaction or in processing of large batches overnight. Today, traders need to get an intra-day, holistic view of their exposures. This requires collecting data from the front office systems and aggregating it into a consolidated view.

Barclays Bank plc UK employs a Sybase suite of tools including Sybase IQ, a data analytics server designed specifically to deliver faster results for mission-critical business intelligence, data warehouse and reporting solutions on any standard hardware and operating systems. It works with diverse data — including unstructured data — and diverse data sources to delivery query performance at a low price: performance ratio.

Using the combined Sybase IQ and Sybase CEP, Barclays develops and executes real-time risk analytics accurately and in timely fashion. As position and exposures change, Barclays staff gains immediate insight into positions and exposures as they change, and is able to consolidate trade and market data across multiple sources to make decisions with complete understanding of what's happening right now, rather than what happened yesterday.

Armed with the Sybase suite, Barclays has a scalable CEP engine that analyzes a high volume of live data at high throughput rates of up to 400,000 messages a second per CPUcore. Latency is critical to Barclays, of course, and Sybase delivers it sub-millisecond low-latency analysis.

Compliance and surveillance

The combination of simplicity and power of Continuous Computation Language and the rapid integration capabilities of Sybase CEP, gave Turkish Derivative Exchange, Inc.'s developers the tools it needed to create the sophisticated applications to meet regulatory and corporate needs in a highly challenging environment.

The Turkish Derivatives Exchange, Inc. (TurkDEX) is the first private exchange in Turkey. To manage market and trading risk effectively, TurkDEX sought to establish a comprehensive trading system to detect abusive trading patterns at high-speed market rates. TurkDEX turned CEP software to speed the development and deployment of its surveillance applications. After an extensive evaluation of CEP platforms, TurkDEX choose Sybase CEP as the cornerstone of its surveillance application.

Using Sybase CEP TurkDEX implemented an essential surveillance application, significantly reducing the time to get it deployed, as compared to building it with other options. The result reduced operating costs with an application that handles the data volumes and expected growth of the business.

As TurkDEX establishes itself as a strong derivatives exchange and trading platform, the firm had to face three specific challenges. First, TurkDEX needed to maintain a fair and honest trading environment that protects investors and helps sustain corporate credibility. Secondly, it also needed to provide a highly competitive trading platform similar to other derivatives exchanges and over-the-counter (OTC) markets. Lastly, TurkDEX needed to integrate with international markets to become a truly global exchange. This final challenge was a critical foundation to TurkDEX's overall strategy. To establish TurkDEX as a strong competitive offering for derivatives trading, the firm required an effective surveillance solution to swiftly detect and act upon market abuse attempts.

SYBASE CEP POWERS HIGH-SPEED SURVEILLANCE APPLICATIONS

The Sybase CEP engine has SQL-like Continuous Computation Language (CCL) offering a rapid, adaptable means to develop applications. It also provides the advanced pattern matching functionality that is the most flexible means to define and monitor the required trading patterns. TurkDEX now has an easy means to integrate myriad data sources required in the applications. Finally, the dynamic, configurable deployment model the Sybase CEP server offers means that TurkDEX can easily deploy and interconnect new patterns and applications. In addition, the open availability of the Developer Edition and flexible Sybase licensing model made it easy for TurkDEX to adopt the product.

TurkDEX management and the market regulator needed to create an extremely tight schedule to complete the surveillance application. Using Sybase CEP, the TurkDEX team delivered the surveillance application on time with all the requested functionality. According to Abdullah Akoglu, lead development engineer at TurkDEX, "We would not have been able to deliver the project on-time with the tight schedules involved if we had not chosen to use Sybase CEP."

The new surveillance applications, provides TurkDEX many benefits. The effective real-time monitoring provides a simplified surveillance mechanism through pattern detection that identifies market abnormalities. Utilizing the CEP-driven surveillance application creates a reliable, secure trading environment. With derivative market investments and trading volumes increasing, TurkDEX actually reduced the operational cost of its surveillance and trade monitoring.

Real-time P&L

The financial services industry currently faces numerous challenges one of which is dealing with real-time P&L.

Firms have trading data distributed across many systems, lines of business or geographies and, as a result, struggle to see a single view of P&L across all trading activities. In certain cases, some data may even be contained in Excel spreadsheets.

To resolve the problem, a Sybase suite combining CEP and Replication Server, for example source data from multiple sources such as trading desks and market data feeds without disrupting current activities that the CEP can then integrate and normalize in real-time to create a combined view of P&L.

Derived data creation

A firm that needs to integrate in-house trading and related data and to combine it with real-time market data to provide and add value to services to its customers can look to Sybase to provide the whole stack.

Combining Sybase CEP technology and Replication Server, firms can gather and integrate data from multiple sources in real-time to provide some form of benefit insight through correlation analysis, risk profiling or momentum guidance.

Continuous real-time ETL

An organization's business activities risk severe loss of data due to inefficient overnight batch processes or potential increased pressure due to integrating another company, or through other expansion to cover more lines of business or geographies.

Using a Sybase CEP engine, firms such as Mitsubishi UFJ Securities (MUSI, see above) in the U.K. mobilize data in real-time regardless of time or source. Additional products such as Sybase Replication Server® and Sybase PowerDesigner® enable firms to quickly, and confidently achieve this requirement through improved data mapping technology.

Integration hub/message broke

Company integration that brings additional systems or reduces SLA to move data from the source to a target system produces challenges in a firm that already has numerous source systems distributing to target system.

Sybase CEP technology enables such firms to integrate best-of-breed systems as needed and over time add more functionality and sources by introducing other Sybase technologies.

Network performance and latency monitoring

Performance bottlenecks in a firm's trading systems, particularly in FX and other high flow markets will lose clients and revenues. The opposite is true for firms whose competitive performance stands up to the pressures. Some firms will be monitoring their networks and systems but it is difficult to monitor everything and identify causes for performance bottlenecks, especially during high market activity.

Using Sybase CEP technology firms can monitor performance relative to the markets and ensure the ability of system resources to meet demand. The CEP's real-time analysis is the key to managing sudden spikes in market volatility that may require an increase of 10 times in burst capacity.

Security pricing

In situations of market volatility, competitive advantage goes to firms who exercise flexibility in pricing, particularly in the OTC markets for FX, derivatives, and fixed income. Most Tier 1 firms build their own engines that are slow to develop while commercially available solutions are often functionally restrictive.

Sybase CEP technology, on the other hand, enables Tier 1 companies to improve pricing model development times quite dramatically, and maintain them quickly. For Tier 2 firms the payoff is in higher functionality and the absence of restrictions.

Organizations that were planning to build real-time analytics applications from scratch have reported that they slashed development time from an anticipated 18 months to less than four months by implementing Sybase CEP technology. Some firms report that development time and costs are up to 85 percent lower due to bringing their Sybase CEP platform online.

SYBASE ESP

Event stream processing (ESP) takes real-time information and models it just as a real flowing stream of events. An event can be a nanosecond, a tick, a fill, an execution, or a combination of events such as “when Intel’s price rises >3% in <1 hour send an alert”.

ESP operates on the premise of the ironic Hollywood phrase — don’t call us, we’ll call you.

That’s not the case using a traditional database and file storage technology, where a user typically queries or “polls” information. To get an answer from a traditional database the user asks for, say, “all the option trades executed with Apple® as the underlying security within the past 1 day”. And back comes the response. If the user wants to aggregate or correlate the information from a traditional database, she asks the question again. And again.

ESP normalizes all incoming data into streams that a processor understands, events in turn are correlated across streams and time and there is no need to poll since data will continuously update for the information specifically required. This is the principle of Continuous Intelligence.

Sybase ESP when coupled with the dramatic speed improvements of wired and wireless networks, provides substantial information technology capacity to deal with big data. The technology also takes advantage of the economic inflection point in the price erosion of core IT building blocks like high-end storage and DRAM memory. Firms today can choose to observe much larger data sets directly in-memory because of the price drop in DRAM is now comparable to high-end storage costs as recent as three years ago.

At this level of economy, firms can start looking at in-memory centric computing as a first-class platform for creating high frequency or low latency applications for dealing with big data.

Sybase ESP in-memory centric computing is an advance over traditional application architectures that used disk-based storage to process data. These older systems emphasized optimally storing and accessing data to the detriment of flexibility and efficiency of processing the information. The benefit for new applications lies in the improved latency in-memory computing provides while performing real-time simulation, forecasting and analytics across a big data environment. The result is that firms realize the value of faster decisions.

All this has evolved into Sybase’s ESP new technology stack that supports big data — however it is defined.

Looking further into Sybase’s technology for effectively handling big data are the column stores in Sybase IQ that improve the performance of the application and at the same time, decrease the storage overheads incurred in managing these very large environments.

Real-time analysis is possible with Sybase CEP engines at the heart of the new infrastructure to deal with machine-to-machine input or any high-frequency environment that generates big data.

The CEP engine pushes data analysis down closer to where the data is actually stored and accessed closer to where the user sits. This also calls on data grid technology and cloud computing.

The challenge of big data is not about using one form or the other; as Sybase ESP demonstrates with its coalition of different technologies that is creating the next generation information platform it offers.

CONCLUSION

“The major issue slowing down advances in risk management and trading systems is data access and data quality. This limitation also creates a huge need for FSIs to improve risk management by consolidating real-time data across multiple systems and link those systems to an application that can cleanse, cross-reference, and enrich data across asset classes and locations,” said Stephen Bruel, Research Director, Capital Markets at TowerGroup. “A solution designed to eliminate the latency and performance issues commonly found when trying to continuously collect and analyze data stored in silos will help FSIs make smarter decisions in the highly competitive capital market industry.”

In the financial markets, firms are already using Sybase ESP for real-time analysis of trade and risk exposure across various asset classes. In many cases, trade and position data is fragmented - stored in a variety of relational databases located in multiple geographies. Sybase ESP users can overcome this fragmentation and consolidate heterogeneous data in real-time. Of particular interest is that this is a non-intrusive approach, which will allow the ESP engine to tap into existing systems without requiring changes to those systems.

Sybase’s leading financial solutions — used by each of the top 50 global banks and securities firms – include advanced data management and analytics that improve trading, risk management, compliance and market data management across the enterprise.

It’s obvious that merely possessing information is no longer sufficient. The advantage today is increasingly with those firms equipped with event stream processing to rapidly interpret and act on signals.



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