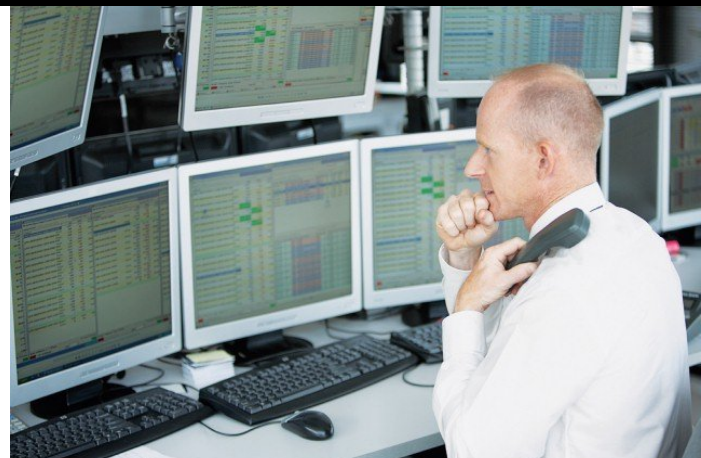


SYBASE®

SYBASE CEP

INTRODUCTION TO COMPLEX EVENT PROCESSING IN CAPITAL MARKETS

BUSINESS WHITE PAPER



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Introduction to Complex Event Processing

Complex Event Processing (CEP) has a developed specific meaning in financial services and other industries where a significant and strategic fraction of the business information arrives as a high-speed stream of data. In this case, Complex Event Processing is the ability to analyze this stream of data and identify significant events. These events are often a combination of multiple data points occurring in a specific sequence and within a given time window. The process of identifying these events is complex, and the results are valuable.

In Capital Markets Sybase CEP can identify valuable market events and then alert other systems, such as trading systems or risk management systems, to ensure that an organization can react quickly and efficiently to important business events in the market. In this respect, Sybase CEP is like the eyes of a business – constantly looking at the world in real-time and allowing the business to navigate past obstacles. Since it seems amazing to many people that businesses have managed to operate in the blind as well as they have so far, those businesses that are quickly adopting Sybase CEP are like the proverbial one-eyed king.

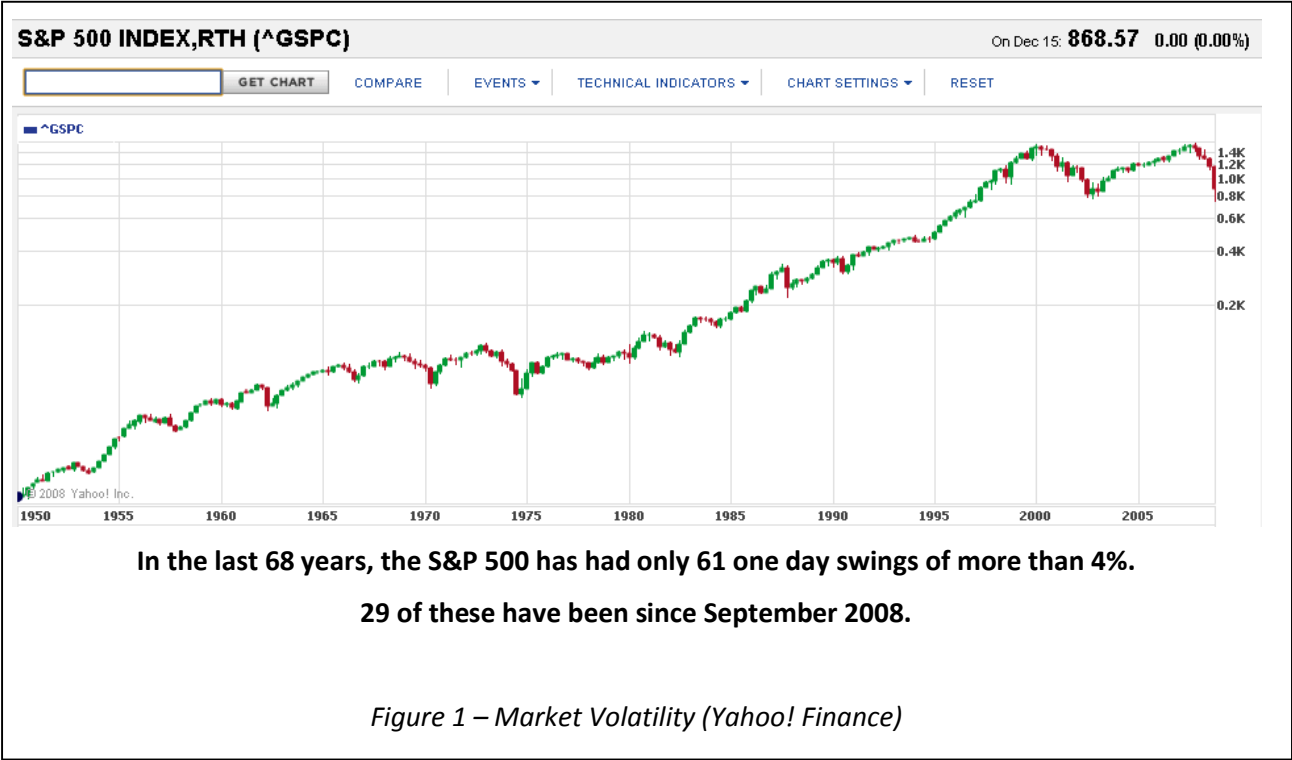
Twenty-first Century Titanic

History may judge the failure of Lehman Brothers as the event that caused the most changes in financial services institutions in the credit crisis of 2007 to 2009. Lehman Brothers seemed especially unlikely to fail because as one of the Wall Street giants, it was thought to have the risk management systems and balance sheet management practices to weather any storm. And even if the company itself failed, the government was there to step in. Lehman Brothers were unsinkable.

The tip of the iceberg that sank Lehman Brothers was mortgage backed securities. This had the attention of the market's 'lookouts' since mid 2007, but the underlying problem involved more than just one class of instrument. There were deeper problems and Lehman Brothers sailed unaware into them.

Here the similarity to the Twentieth century titanic ends – the sinking of Lehman Brothers was only the beginning, not the end. A signal that the markets had changed dramatically and that new dangers existed. And new opportunities. This paper will look at the impact of the dramatic increase in the speed at which the markets moves, the exponential growth in the volume of data in the market, and the complexity of the instruments and data, and describe how a new technology, *Complex Event Processing* (CEP) enhanced market analytics platforms, can help financial services organizations identify and profit on new opportunities and mitigate dangers.

CEP solutions are especially valuable in high velocity, high volume situations, such as today's financial markets. Compounding this need currently are unprecedented market events (see box "The Twenty-first Century Titanic") and the historically high volatility (see figure 1). Add the additional complexity that new instruments such as derivatives have introduced into the market, and it is obvious that market analysis has never been more difficult or more valuable than it is today. The ability to perform complex trading and risk analytics in real time is now essential for all capital markets institutions.



The Value of Sybase CEP

Sybase CEP's event-driven approach tells users when they need to take action. "Even in the current down market, this change (to the event driven approach) will accelerate because it is clear that asking is not working," say the authors of a recent IDC report. Using CEP, businesses will be more dynamic, agile and able to manage their risks based on real-time information. This will enable more frequent, more informed decision-making, according to the IDC study "Complex Events Processing Opportunity Analysis and Assessment of Key Products," by Maureen Fleming and Jeff Silverstein.

Sybase CEP software absorbs new data from multiple sources and creates a relationship within the data to detect patterns that represent opportunities and problems. Using the raw material of large data streams, the software takes less than milliseconds to detect patterns.

Real-time Analytics

Sybase CEP performs analysis on data in a completely different way than traditional business intelligence systems. Instead of capturing the data, structuring it into a fixed format, storing the data into a disk-based data warehouse, then periodically running a report on the data, Sybase CEP looks at the data as it arrives, *even before it is stored to disk*. The ability of Sybase CEP to identify material events almost instantly, and to extract business intelligence from the latest data, has a variety of uses.

The Value of Real-time Market Analytics

Real-time Risk Management

“the [Counterparty Risk Management Policy Group] recommends that all large integrated financial intermediaries must have, or be developing, the capacity (1) to monitor risk concentrations to asset classes as well as estimated exposures, both gross and net, to all institutional counterparties in a matter of hours and (2) to provide effective and coherent reports to senior management regarding such exposures to high-risk counterparties.”

Real-time risk management has quickly become one of the most urgent requirements in today’s top capital market firms. All types of risk management, from credit and counterparty risk to portfolio and liquidity risk, are impacting businesses. Key market events that can materially impact the risk profile of an organization need to be monitored in real time. But it is not enough to simply identify a potentially dangerous incident; risk analysis needs to be performed at a rate far in excess of the overnight

reporting processes that are all too common. This is where the combination of Sybase CEP and Sybase RAP – The Trading Edition come into play. Sybase RAP – The Trading Edition speeds up the risk analysis process by up to 1,000 times, measuring risk in minutes instead of days.

The Counterparty Risk Management Policy Group recommends that counterparty risk across asset classes and all counterparties be calculated in hours. With some very high profile organizations coming under pressure, the government’s willingness to let organizations fail, and historically high price volatility, many organizations are looking to perform risk assessment in minutes rather than hours, to ensure they can react more quickly and effectively.

Consequently, within many organizations, risk management as a discipline is undergoing an upheaval. The fear of a failing counterparty, with clear implications for profitability and liability, has led to a heightened interest in counterparty risk analysis. For counterparty risk, organizations need to calculate exposure multiple times during the day, and to drive business decisions by properly adjusting product pricing at inception. This degree of counterparty risk analysis has been resisted within many organizations in the past. Internal managers were reluctant to purchase and implement state-of-the-art counterparty risk analysis solutions. They also felt that as the only organization raising prices to cover counterparty risk, they would be undercut by the rest of the market and their traders would object vehemently. Recent events, described above, have radically altered their thinking. Risk managers are being given the budget to improve their systems, and pricing of counterparty risk is now seen as prudent and essential rather than a competitive disadvantage.

“The risk analytics market has barely been tapped. There’s a huge growth opportunity to be seized for vendors providing innovative offerings to optimize performance. Wall Street is hurting and they need to look at solutions that will provide them with better efficiencies in their trade lifecycles.” --Tom Price, Senior Analyst, TowerGroup

Real-time Trading

Electronic trading has enabled markets to speed up to previously unimaginable velocities with message rates exceeding one million per second and trading windows of often less than one millisecond. Obviously, humans cannot make trading decisions at this rate, so algorithmic trading systems are making many of the trading decisions instead. Algorithmic trading systems automatically route or execute orders based on pre-defined models. Often these models rely on metrics such as Volume Weighted Average Price (VWAP) or Time Weighted Average Price (TWAP). It is much more efficient to calculate these types of metrics on the data as it streams into the enterprise than to store the data on disk and then perform a complex database calculation. Sybase CEP dramatically outperforms traditional database technology in these situations, and is able to handle data streaming at the speed of today's markets. This allows Sybase CEP, coupled with Sybase RAP – The Trading Edition, to identify trading opportunities, enrich the decision making process and allow trading systems to generate and execute orders with less risk and more profit.

Another valuable benefit of Sybase CEP coupled with Sybase RAP – The Trading Edition is the creation of new risk models and trading strategies. It is possible to take historical data out of Sybase RAP – The Trading Edition and feed it into Sybase CEP at many times real market data rates for backtesting. This allows continual improvement of trading algorithms and risk models – essential in winning the arms race between algorithmic systems from competing organizations.

Market Data Cleansing and Enrichment

To react as quickly as possible to market events, it is important to use very low latency data feeds. There are two potential drawbacks to getting the fastest data – first, it may contain errors, and second, it is often very basic. To obtain the most value from these high speed, low latency feeds, it is necessary to cleanse and enrich them. With Sybase CEP, organizations can create sophisticated filters to identify erroneous data and insert estimates. In addition, as we have seen earlier, Sybase CEP can calculate moving averages and other, more complicated derived data values such as indexes, risk models, and so on. Client applications can employ this enriched data with very little additional programming, and can quickly and effectively improve trading decisions, execution and risk management.

Conclusion

Sybase CEP allows financial services institutions to analyze and react to material market events in near real-time, as well as enrich the incoming market data. Sybase CEP in conjunction with Sybase RAP – The Trading Edition, allows an even greater depth of analysis at very high speed, to further improve trading decisions and risk management. In addition, the high-speed backtesting capability of Sybase CEP and Sybase RAP – The Trading Edition allows continual incremental improvement of trading strategies and risk models, keeping Sybase's customers ahead of the market and ahead of the competition.

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