



Banking and Financial Services

White Paper

# Real-Time Risk Monitoring for Banks: What, Why, and How

## About the Author

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# Abstract

The credit crisis of 2008-2009 brought to the fore the need for real-time or near real-time risk monitoring. During the crisis, national regulators and senior executives at several banks sought real-time information on risk levels relative to the enterprise's risk limits to facilitate decision making. However, such information was not forthcoming since risk management departments back then were not adequately equipped to respond to this need.

While technological advances have acted as a catalyst in the development of real-time risk monitoring solutions, their implementation has posed a few challenges as well. Despite these challenges, banks should strive toward achieving real-time integrated risk management at the enterprise level considering the myriad benefits it offers. This paper discusses the need for, and the benefits of, real-time risk monitoring at banks, as well as the challenges involved in its implementation. We also propose a real-time risk monitoring framework that incorporates recent technological advancements in this area.

For the purpose of this paper, intraday risk reporting requirement has been clubbed with real-time risk monitoring requirement since both require real-time aggregation of data and are generally backed by similar IT applications. Also, no distinction has been made between real-time and near real-time risk monitoring due to the negligible time difference between the two.

# Contents

|  |           |
|--|-----------|
| <b>1. The Need for Real-Time Risk Monitoring</b> | <b>5</b>  |
| <b>2. Application Areas</b>                      | <b>5</b>  |
| <b>3. Benefits</b>                               | <b>6</b>  |
| <b>4. Implementation Challenges</b>              | <b>7</b>  |
| <b>5. Proposed Framework</b>                     | <b>8</b>  |
| <b>6. Leveraging Emerging Technologies</b>       | <b>9</b>  |
| <b>7. Conclusion</b>                             | <b>10</b> |

# The Need for Real-Time Risk Monitoring

The credit crisis of 2008-2009 has reinforced the need for banks to gain easy access to risk related information to make timely and informed decisions. During times of market stress, the capability to understand counterparty credit risk, and carry out scenario analysis on an intraday basis, has become particularly important. Realizing this need, industry regulators have now mandated banks to build real-time risk monitoring and intraday risk reporting capabilities at the enterprise level, the same being specified by the Basel Committee on Banking Supervision, the European Securities and Markets Authorities (ESMA), and the Dodd-Frank Act.

Technological advancements like high performance computing, in-memory databases, complex event processing, and Big Data technologies have made this a realistic possibility that will help banks build a robust risk management system. However, if banks are to successfully implement such a system, they will need to pay considerable attention to issues related to data quality and aggregation, system complexity, operational changes, and stakeholder agreement.

## Application Areas

Real-time risk monitoring can be implemented for various scenarios in a bank and listed below are some regulatory and non-regulatory scenarios where it can prove useful.

**Intraday liquidity risk management under Basel:** Although regulators have not enforced real-time tracking, banks and financial institutions have adopted it to derive strategic benefits from their intraday liquidity risk management capabilities. Real-time tracking of currency-wise intraday liquidity position at the enterprise level enables running of intraday liquidity stress tests and scenarios, which are regulatory requirements under Basel <sup>1</sup>.

**Liquidity risk management under Basel:** The Basel committee requires banks to calculate enterprise-wise, currency-wise funding liquidity risk for current and future settlement dates, and compare it against operating limits for each currency. This is best achieved with real-time tracking of cash-flow events and comparison with pre-defined limits.

**Real-time risk data aggregation and intraday reporting under Basel:** Regulations related to risk data aggregation requires banks to have the capability to generate intraday reports for counterparty credit risk, should there be a market stress situation. This requires a real-time aggregation of all derivatives trade data, post which the counterparty credit risk is computed. The regulation also requires banks to have the capability to generate intraday reports for computing the aggregated credit exposure to a large corporate borrower and related entities or a country or region. This requires a real-time aggregation of loans data, and generates borrower-wise, country-wise, and region-wise reports.

**Real-time reporting of swaps data under the Dodd-Frank Act:** Data reporting for swaps is required for real-time public dissemination and confidential regulatory use. Dissemination to the public is to be done for price and

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[1] Bank for International Settlements, "Monitoring tools for intraday liquidity management" (April 2013), accessed March 5, 2013, <http://www.bis.org/publ/bcbs248.pdf>

volume transparency without counterparty detail. Confidential regulatory reporting involves real-time reporting along with counterparty information for the regulator to conduct market oversight, assess systemic risk build-up, and enforce position limits.

**Real-time monitoring of trading under the Dodd-Frank Act:** The swap execution facility should conduct a real-time monitoring of trading.

**Real-time monitoring of trading under ESMA:** The trading platform and investment firms should monitor their electronic trading systems including trading algorithms, in real-time, to identify and address issues like disorderly trading.

**Real-time pre-deal check:** Before the execution of a deal, information regarding risk adjusted pricing needs to be provided to the front office. This can be achieved by analyzing the rating volatility of the counterparty, credit valuation adjustment (CVA), risk weighted asset position, the impact on capital requirement, and so on.

**Real-time simulation:** Real-time simulation of scenarios related to macroeconomic variable changes, extreme events, special market conditions, and the resultant impact on counterparty exposure, liquidity position, portfolio value, and more.

**Online computation of independent amount for OTC derivative trades:** In the over-the-counter (OTC) derivatives market, banks need to conduct online computations of independent amount (initial margin) on each trade receipt and intraday mark-to-market (MTM) value. In addition, they need to compare the MTM margin with the collateral value, as well as generate margin calls if applicable.

**Real-time tracking of trading pattern:** Mid-office concerns relate to monitoring for the identification – and consequent mitigation – of operational risks.

## Benefits

Recent trends in the regulatory environment have been indicative of a gradual shift to an era where real-time integrated risk management at the enterprise level will become the norm for banks and financial services institutions. Some benefits that banks can accrue by deploying a real-time risk monitoring system are:

**Enhanced competitive advantage:** Real-time risk monitoring capabilities offer banks a competitive advantage by helping them safeguard themselves against an impending threat or leverage an upcoming opportunity. Timely information about emerging risk lets a bank take protective actions faster than competition. For example, if a counterparty is facing a financial challenge, then the associated bank may calculate the counterparty credit risk on the intraday basis, check available collateral, and make margin calls to safeguard itself against counterparty default. Real-time tracking of intraday liquidity position helps banks divert excess liquidity to more productive uses.

Real-time integrated risk management at the enterprise level will soon become the norm for banks and financial services institutions.

**Better risk pricing:** One of the main reasons for the credit crisis of 2008-09 was the mispricing of risk in financial instruments like collateralized debt obligations (CDO), credit default swaps (CDS), and mortgage backed securities (MBS). The loss in these instruments far exceeded their price. With pre-deal checks in place, a bank will be better

equipped to accurately price the risk in any counterparty transaction, thereby averting uncompensated risks.

**Better tracking and enforcement of risk limits:** In the absence of real-time tracking, risk limits can be compared with actual exposure only at end of the trading session – typically end of day – irrespective of when a certain breach occurred. This essentially means that a breach that occurs at the start of a day remains undetected till the end. With a real-time risk monitoring system, deviations can be identified almost as they occur, making it possible to take timely corrective actions.

**Reduced operational risk:** Real-time tracking helps identify trading patterns, making it easier to detect rogue trading and initiate corrective actions to reduce potential loss.

**Comprehensive regulatory compliance:** With multiple regulations underscoring the need for real-time risk monitoring at banks, organizations need to ensure full compliance by,

- providing regulatory reports on an intraday basis at the time of market stress,
- real-time tracking of trades for identifying disorderly trading, and
- timely dissemination of trade information to the market and regulatory bodies for transparency and surveillance.

Once implemented, the system makes it a lot easier to accommodate any new regulations that may come by or to address a bank's internal requirements.

**Improved confidence among stakeholders:** The benefits delivered by a comprehensive real-time risk monitoring system help increase stakeholder confidence in the long term viability and profitability of the bank.

With a real-time risk monitoring system, deviations can be identified almost as they occur, making it possible to take timely corrective actions.

## Implementation Challenges

While a real-time risk monitoring system extends several advantages to a bank, implementing it poses several challenges. Some challenges are related to technology and others pertain to organizational and operational realignment.

Reliability of information obtained from a real-time risk monitoring system depends on the quality of data that is fed to it. In several banks, data quality has been a legacy issue and is one of the most important challenges that need to be tackled. Aggregation of data at the enterprise level is another notable challenge because in most banks information is stored in silos. With applications at various levels – business line, product, or geography – storing the same data, but often in different formats, data redundancy becomes a major roadblock.

Reliability of information obtained from a real-time risk monitoring system depends on the quality of data that is fed into it.

Other data related issues include availability, accessibility, granularity, format inconsistency, technology disparity, and a large number of data sources. It is precisely to address these challenges that the Basel Committee introduced the regulation pertaining to risk data aggregation. Different banks are in different stages of implementing this



regulation. Banks that are nearing completion of the risk data aggregation program are undoubtedly better placed to implement real-time risk monitoring solutions. The ones that have just embarked on this program and are planning to establish a real-time risk monitoring system as well, should evaluate data related challenges and put remedial measures in place to ensure a successful implementation.

The implementation of a real-time risk monitoring solution also requires extensive use of various emerging technologies, which means that the existing infrastructure and IT complexity could come across as a significant challenge. Coupled with the increased regulatory oversight and stringent deadlines, this could result in increased implementation costs and timeline pressures.

Not all challenges are technical or monetary – some are more to do with the way organizations have functioned till now. For instance, real-time risk adjusted pricing requires integration of the front office with the middle office. Beyond the regular technology consideration, this task also requires a buy-in from all stakeholders and operational changes in the way the front office works. While working with some leading banks and financial institutions, we have observed that building an internal consensus is an important prerequisite – and quite a challenging one at that – to execute a successful real-time risk monitoring program.

## Proposed Framework

Based on our engagements with leading financial firms across the globe, we propose a framework (see Figure 1) that can help organizations deploy a comprehensive and well integrated risk management system. The framework incorporates the key aspects of a data mart, risk functionality, computation, output, user accessibility, as well as implementation. A risk data mart houses data from various sources, which is used by the organization for providing risk related functionalities like limit monitoring, counterparty exposure calculations, and so on.

As seen in Figure 1, the risk data layer forms the foundation of the real-time risk monitoring framework. The risk data mart contains real-time data including trade data, reference data, market data, and more, which is aggregated from all enterprise applications and is required for calculating and monitoring risk metrics of interest. In the

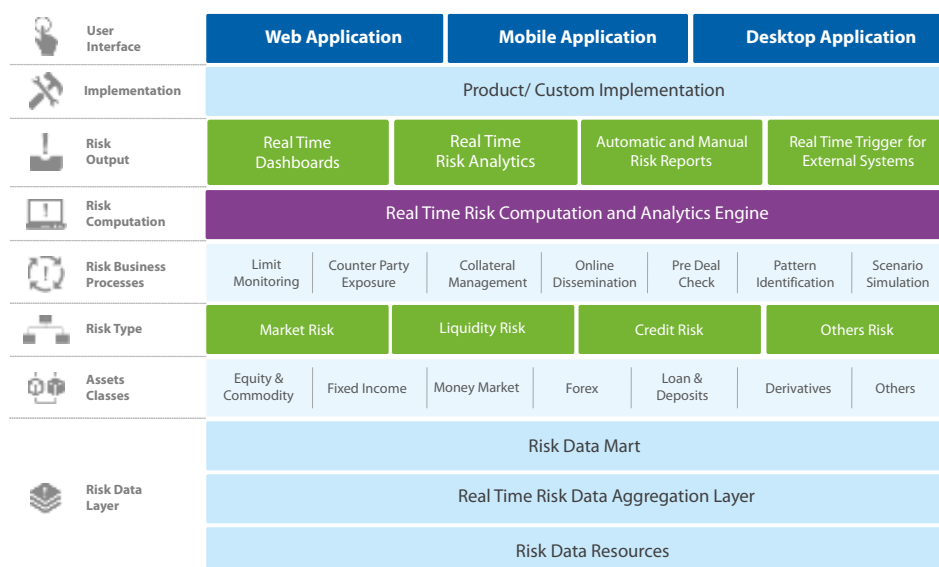


Figure 1: Components of a Real-Time Risk Monitoring Framework (Source: TCS Internal)



framework, a particular functionality is represented as a combination of a business process, a risk type, and one or more asset classes. For instance, if a bank wants to build the functionality to compute and generate intraday reports for counterparty credit risk exposure that requires valuing derivative contracts, counterparty exposure should be set as the risk business process, credit risk should be the risk type, and derivatives should be the asset class. With this combination selected, first the data required for providing this functionality will be listed, post which the risk data mart will need to be created.

The real-time risk and analytics engine computes the aggregated risk data, and is therefore regarded as the core of the framework. The risk output layer of the framework provisions an automatic notification process that sends real-time alerts. For instance, an alert is sent to the trading system in case of inadequate availability of margin money, thereby notifying it to move into the pre-deal check mode to allow only those deals to enter the order book that will reduce the margin requirement – a possible scenario in case of portfolio margining. The risk output layer also has the provision to generate risk dashboards. The user interface layer is responsible for ensuring the system is accessible to end users across devices and platforms.

Allowing for gradual upscaling, the system can start with limited functionality, data aggregation, and computation scope, and be subsequently ramped up to match the desired pace as and when the organization demands. Banks and financial institutions can either choose to implement a commercial-of-the-shelf (COTS) product like SAP Liquidity Risk Management on HANA, Sybase, Calypso and SunGuard or custom develop a solution to meet specific functional and technical requirements.

Take the first step now! Start with a limited functionality system and gradually flesh out a full-fledged real-time risk monitoring setup.

## Leveraging Emerging Technologies

Recent advances in technology have made it easier and far more feasible for banks and financial organizations to implement real-time risk monitoring.

While some of these technologies are still in a stage of infancy, there are others that have been around for some time now and are being applied to different scenarios. In the context of the current discussion, we will focus on technologies that support real-time aggregation of data to develop an enterprise-level data mart, enable faster computation, and ensure processing of both structured and unstructured data.

**Enterprise messaging:** Enterprise-level reports that are used by internal business stakeholders and external regulators require aggregation of data from multiple sources. Aside of residing in different systems, the data itself might be stored in different ways – based on the line of business, product, geography, or a combination of these. By way of transporting any type of data as messages across different technology platforms, enterprise messaging systems like IBM MQ and Oracle GoldenGate can help organizations consolidate data available in disparate formats – and from disparate sources – and create the enterprise risk data mart.

**High performance computing (HPC):** Computation time involved in the generation of intraday reports is another challenge. For example, consider the generation of a counterparty credit risk report that requires mark-to-market computation of all OTC derivative trades and long dated contracts. This type of computation involves complex and

time consuming procedures like the Monte Carlo simulation. Moreover, the number of active trades in a bank's portfolio that operate in the derivatives market, can be quite large in number, which increases the computation time even more. This is where high performance computing (HPC), with its capability to execute independent computations in parallel on multiple servers, can help. For a leading bank we worked with, the computation of principal component analysis could be done eleven times faster on an HPC platform that used Hyper-Q on Graphics Processing Unit (GPU). For another organization, fast Fourier transform computation could be done twenty five times faster on an HPC platform using parallel GPU implementation.

**In-memory database:** In addition to significantly improving the computation speed owing to internal optimization algorithms that involve fewer CPU instructions, this technology can also provide real-time analytics for the purpose of risk management. In-memory database technology – like SAP HANA or Oracle TimesTen – allows faster processing of a large number of incoming cash-flows, thereby helping banks to calculate the liquidity risk in real-time. This technology is also being used by some banks to considerably reduce the intraday report generation time.

**Complex event processing (CEP):** This is a software infrastructure that aggregates data from multiple sources and detects pre-defined patterns in real-time. CEP can be deployed in trading rooms to detect patterns that suggest rouge trading, thereby minimizing fraudulent activities. It can also be used to process huge volumes of data including unstructured data. For instance, CEP can be used to analyze social media posts to gauge the general public sentiment about a company, especially in the event of some 'breaking news', which is bound to impact the company's share price. This information can thereby help a trader quickly assess whether to stick with or to exit the position currently held. TIBCO CEP and HP Haven Big Data are some platforms which can be used to build this functionality.

Want to deploy a comprehensive real-time risk monitoring system? Explore emerging technologies like enterprise messaging, high-performance computing, in-memory database, and complex event processing.

## Conclusion

The banking industry is gradually shifting its focus from end-of-day reporting to real-time risk monitoring and intraday reporting. As markets become increasingly dynamic and organizations face the relentless pressure of ensuring profitable performance amid crisis situations, the importance of real-time risk monitoring is magnified even further. Banks that do not build sufficient capabilities to address this aspect will be at a competitive disadvantage. A big bang approach may not be necessary, but it's about time that organizations initiate embryonic efforts in this regard, starting with a limited functionality system that paves the way for a full-fledged enterprise-level program for real-time integrated risk management.

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TCS has been ranked #2 in the 2014 FinTech Rankings Top 100 of global technology providers to the financial services industry, by both - FinTech Forward™ (a collaboration of American Banker and BAI) and IDC Financial Insights. TCS has also been recognized as a 'Leader' and a 'Star Performer' in Everest Group's 2014 PEAK Matrix reports for Banking and Capital Markets Application Outsourcing (AO).

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