DATA MANAGEMENT FOR TRADING, RISK AND REGULATORY COMPLIANCE IN INVESTMENT BANKING

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ABSTRACT

Data is growing enormously across all industries, banking and financial institutions are no exception. Financial organizations are increasingly interested in effectively managing and using day to day data to make business decisions and complying with new and existing regulations. There are general regulatory requirements for data retention of up to 7 years which makes the overall data management process challenging. To overcome this challenge banks and financial institutes rely on regular data backups of individual applications. With new regulations such as Fundamental Review of Trading Books being implemented in 2023-24, which impact multiple areas of bank, there is an immediate need for a centralized database to handle big data. In this paper author proposes a big data platform for a typical investment bank which can unify the data needs of Trading, Market Risk, Credit Risk, Counterparty Risk, Enterprise Risk Management and Model Risk Management and help with regulatory compliance.

KEYWORDS

Data management, Big Data, Banking Regulations, Market Risk and Trading Systems, Compliance, Models

1. INTRODUCTION

Traditionally developers use relational database management system (RDBMS) to store data. RDBMS is still a popular choice for many systems where input and output of data is limited and in a defined format. With the advancement of technology, massive amount of data is being generated and there is a need to store data from different systems with dynamic schema structure in an effective way and generate meaningful inferences and statistics out of it to make an informed business or a policy decision. Investment banking industry is not untouched with this challenge. In a typical investment bank, there are high number of trading and risk systems sending data feeds to each other. Due to data inter-dependency, it often introduces delays and incomplete data leading to data quality issues. These data quality issues impact regulatory reporting which may lead to heavy regulatory fines. There is no central data repository for all data needs. Departments, working in silos, spend hours investigating data reconciliation breaks based on data pulled from different data sources. Since these are mission critical systems, departments end up spending and allocating massive percentage of annual budget on support teams for each system. In most banks there is no set format of managing and integrating front office, risk, profit and loss and regulatory compliance in a single dataset. To overcome these challenges, we propose a big data solution that integrates all data elements of front office and risk department, leading to effectively manage and maintain trading, risk and regulatory reporting

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needs. In addition to massive cost savings and improved data quality, this solution will help data office to easily implement data lineage and data ownership leading to easy enforcement of data policy within critical functions of the bank.

2. BACKGROUND

As shown in Figure 1, in a typical investment banking environment all major functions own and maintain their repositories. There are multiple trading systems used within the same bank based on the type of business or product. After completion of trading activities for the day, which generally includes late bookings, market data system sends a validated data feed to all trading systems, which is used in valuation of the trades. On completion of official valuation, these trading systems send an end of the day feed of all trading activities to designated downstream systems and processes. Among others, typical recipients of this feed are Profit and Loss (PL) computation engine, Value at Risk (VaR) computation engine, Counterparty Risk computation engine, Credit Risk computation engine, and sensitivity validation engine. These computation engines also receive a market data feed from econometric engine. These engines use end of the day feed to generate highly critical matrices which are analysed by various departments including trading. Profit and Loss system is used in computation and validation of

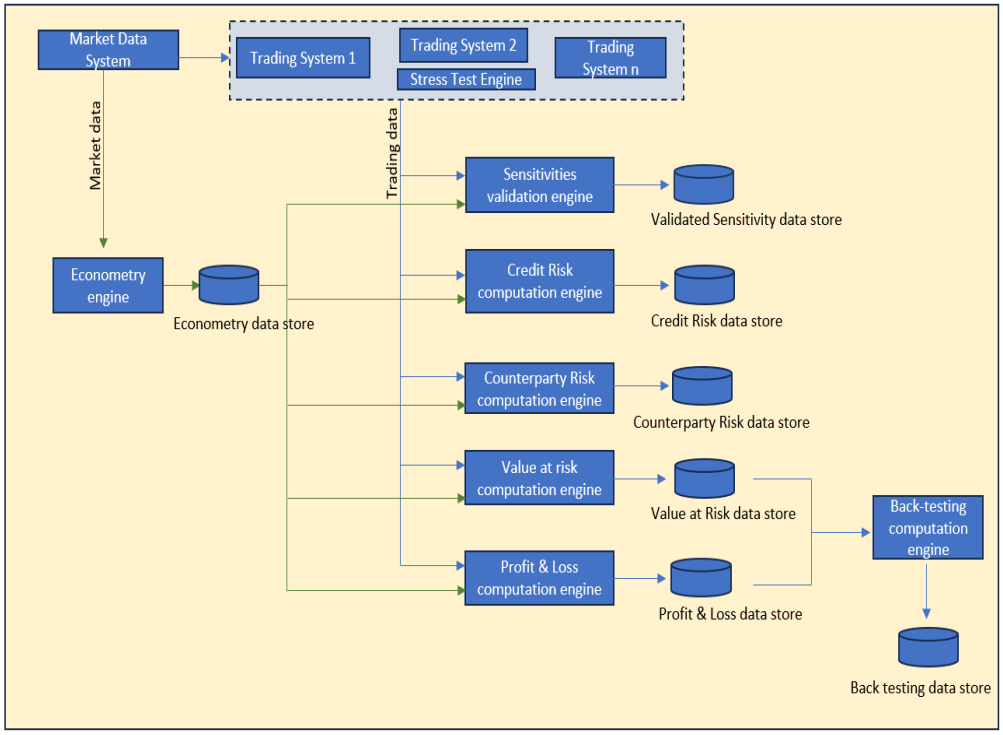

Figure1. Typical system flow of trading and risk

profit and loss across different businesses and trading desks. Value at Risk (VaR) computation engine computes value at risk based on data feeds. Credit and Counterparty risk computation engines generate respective matrices for credit and counterparty risk based on different portfolios under trading. Sensitivity validation engine helps business teams to validate the sensitivity exposures at the book and desk level. Back Testing computation engine receives a feed from Value at Risk and Profit & Loss computation engines to compute back testing results and breaches. All data from relevant systems should be retained for up to 7 years or more as per SEC rule [1] for auditing purposes.

2.1. Challenges

Both PL and VaR systems have similar needs of data but generally these systems typically work in silos, with separate independent development processes and data stores. These systems are extremely complicated and given multiple feeds between upstream and downstream systems leaves room for data errors. The same is valid for Credit risk, counterparty risk and sensitivity validation engines. Moreover, to monitor limits on the different portfolios, traders need intraday VaR which is not possible in a classical set up. IT teams implement lot of checks on incoming and outgoing feeds. With enormous number of feeds from trading systems to all critical downstream systems, incompleteness and incorrectness of data is still a very big challenge. Loss of time in recovering missing or erroneous data leads to loss of business opportunity for trading. Accuracy and timeliness of such banking systems is extremely critical due to regulatory reporting needs and helping traders and different control teams to make an informed decision. There is also no sync between different repositories and trade reporting such as FINRA TRACE reporting [2] with mandates Equities and OTC transactions to be reported to FINRA within 15 minutes of trade execution. Differences in the data repositories and trade reporting systems can lead to differences in reconciliation for critical regulatory metrics which leads to lot of effort in investigation and resolution and if ignored may lead to audit points, reputational risk and heavy fines. The latest regulation of Fundamental Review of Trading Books (FRTB) is being implemented across different banking institutions in 2023-24. If banking institutions want to use Internal Models approach to compute capital requirements based on an expected shortfall methodology, then they should meet back testing and profit and loss attribution requirements. As per [4] and [5] to achieve these requirements for Internal Models approach of FRTB regulation, banks need historic time series data, reference data and real price observations. With different system working in silos, it is extremely difficult to meet and comply with FRTB requirements. This may lead to regulatory objections.

3. PROPOSED ARCHITECTURE

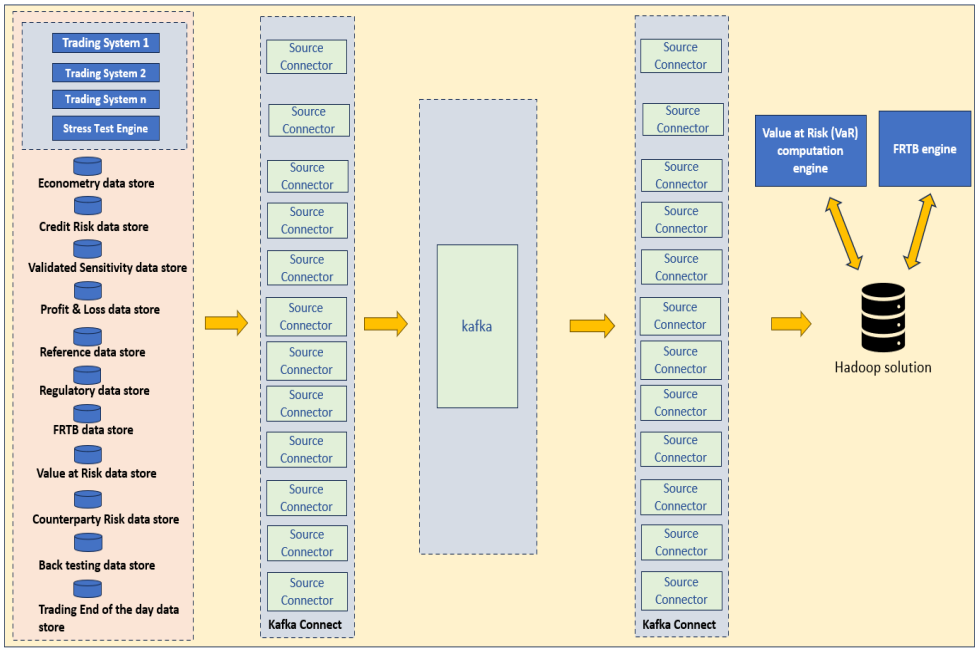

Figure 2. Proposed architecture for Trading and Risk

To overcome above challenges, this paper proposes development of a central big data platform, Apache Hadoop to effectively manage trading, Risk, regulatory and compliance needs. Hadoop is open-source platform with excellent fault tolerance and offers distributed file system, HDFS which has ability to store huge amount of unstructured data. Different data stores available in the bank will connect via Kafka connect [9] to kafka which in turn will connect to a Hadoop solution. As per [9] [10] we can use kafka for live updates and batch processing and as shown in Figure2, all financial data will be aggregated in Apache Hadoop solution. This solution will be connected to Value at Risk computation engine and FRTB engine to process and generate results for regulatory purpose.

This platform will receive:

- a daily batch for validated trading data after end of the day process for all trading activities in the bank on previous business day
- live intraday activities i.e. current day trading activities as trades are booked in trading systems
- a daily batch for econometric data (market data) based on previous business day's activities
- a daily batch for Credit Risk metrics based on previous business day's activities
- a daily batch for validated sensitivities based on trading desks for previous business day's activities
- a daily batch for Profit and Loss metrics based on previous business day's activities
- a daily batch for any new or amended reference data based on previous business day's activities
- a daily batch for regulatory metrics based on current and previous business day's activities
- a daily batch for FRTB data based on previous business day's activities
- a daily batch for Value at Risk metrics based on previous business day's activities
- a daily batch for Counterparty risk metrics based on previous business day's activities
- a daily batch for back testing metrices based on profit and loss and value at risk

3.1. Benefits of Proposed Architecture

Proposed architecture serves below benefits:

1) Intra-day VaR computation: This solution will be capable of computing intra-day Value at Risk (VaR) which will be very useful for traders to monitor limits before performing any trading activities and avoid any limit breaches. This will help to minimize regulatory objections.
2) Central data availability: As shown in Fig3 all trading and risk data is available centrally minimizing number of hops to retrieve data.
3) Improved data quality: As all data is centrally loaded and monitored. Hence, data governance rules can be easily applied which will help to improve overall quality of the data.
4) Easy reconciliation with regulatory data: Daily and intraday regulatory data will be available in Hadoop which will make reconciliations easier and reduce time for management reporting.
5) FRTB compliance: This Hadoop platform will help with FRTB compliance as historic time series, reference data and real price observations will be received by econometric datastore, reference datastore and trading system feeds respectively. As per [11] data will help with computation of P&L attribution VaR back testing, expected shortfall, stressed expected shortfall, non-modellable Risk factor determination and IMA default charges.

6) Easy data availability for Enterprise Risk Management (ERM): Enterprise Risk management monitors all business lines and determine overall risk exposure of the bank irrespective of the desk. Figure3 shows data which ERM team can use for risk computation at enterprise level and make an informed business or a policy decision.

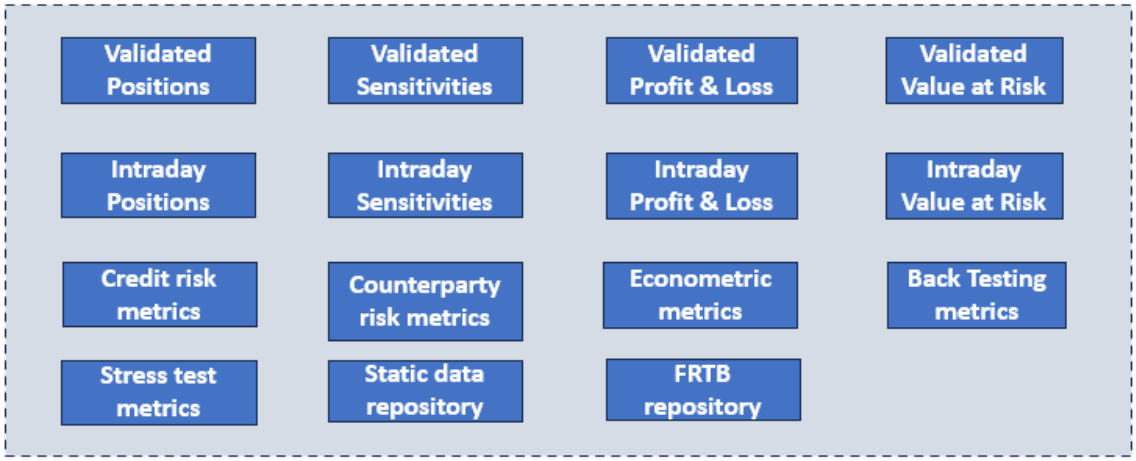

Figure3. Datasets in proposed architecture

4. FUTURE RESEARCH

This paper is a proposed architecture to attempt integration of mission critical processes within investment bank. The study can be further extended by doing implementation of such a platform within the bank. The solution has lot of potential for further research. Data office can utilize this platform to implement data governance such as identifying critical data elements, defining ownership of data elements, defining controls on data and establishing data lineage. As per [12] this data source can be used by Model Risk management team to use data for validation of different risk and pricing models across the organization. Further research can be done to evaluate if the same dataset can be used to maintain a repository for model risk management. Enterprise risk management can further review and utilize data and assess the need for controls within the bank. The data available in the platform can be further reviewed to address any future regulatory requirements.

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AUTHOR

Hemendra has an extensive experience working in trading and market risk area with top bulge banks. He currently heads Market Risk IT in a French investment bank, Natixis North America in NYC. He has been a part of various regulatory projects and remediations and understands challenges and data quality issues that makes the entire implementation very complicated which leads to astronomical costs and effort. From his prior experience and knowledge, he has suggested a simplified approach for managing data which can be used by various critical trading and risk functions within the bank and can serve all needs for regulatory compliance. Author is currently pursuing PhD in Computer Science from New York University in NYC, NY.