WHITE PAPER

Graph Technology for FRTB Compliance

Future-Proof Your Internal Risk Models & Compliance

Nav Mathur, Senior Director, Global Solutions

Graph Technology for FRTB Compliance

Fundamental Review of the Trading Book (FRTB) regulations are part of the upcoming Basel IV set of reforms and create specific capital-reserve requirements for bank trading desks based on investment-risk models. The new regulations require banks to reserve sufficient capital to maintain solvency through market downturns and avoid the need for governmental bailouts.

Banks are using FRTB mandates as an opportunity to build a firm foundation for future risk management and compliance applications that lowers development and staffing expenses, optimizes reserve ratios, maximizes available capital and drives investment profits.

Graph Technology for FRTB Compliance

The #1 Platform for Connected Data

White Paper

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FRTB Raises Basel Reserve Requirements

In the financial crisis a decade ago, banks worldwide held large risk exposures in their trading books without sufficient capital reserves to weather the length and depth of the plunge in investment markets. As a result, regulators created new data management and capital-reserve requirements to avoid another market meltdown.

In turn, banks created risk compliance models that were tested and approved by regulators. But at many institutions, those models were not maintained, and as time passed, market and internal changes exposed the banks to new investment risks.

Today, risk-compliance problems are addressed by BCBS 239 (Basel Committee on Banking Supervision standard 239) and FRTB (Fundamental Review of the Trading Book) regulations. BCBS 239 puts forth principles for risk-data governance, aggregation and reporting, and associated IT infrastructure. FRTB standards – which are part of BCBS and the upcoming Basel IV set of reforms – create specific capital-reserve requirements for bank trading desks based on investment-risk models.

Intense Focus on the Trading Desk

FRTB regulators develop guidelines that require banks to reserve sufficient capital to maintain solvency through market downturns and avoid the need for governmental bailouts.

The reserve requirements for trading books are higher than banking books, tempting institutions to engage in regulatory arbitrage – the movement of assets between books to affect reserve requirements – a practice that is now being tightly scrutinized and regulated.

FRTB mandates higher default reserve requirements than those calculated by banks' internal risk models.

Trading Desks

Group of traders or accounts that execute their own strategies and have a dedicated risk management function

Trading Book

Regularly traded assets

Calculate fair market value daily

Higher reserve requirements

Banking Book

Assets to be held to maturity

Not required to be valued daily

Lower reserve requirements

The Role of Internal Risk Models

FRTB regulations include default reserve calculations that result in measurably higher capital requirements designed to account for new levels of trading-book risk unaccounted for by the Basel II risk framework. The higher capital requirements translate directly to lower levels of investment capital, flexibility, revenues and profits.

Banks may accept BCBS's reserve calculations or develop their own internal risk models to calculate capital-reserve requirements. To use internal-model results, banks must obtain the approval of national regulators by proving how well models represent risk in the banks' investment strategies.

The approval process requires a bank to forecast hypothetical profits and losses using its model's calculated capital reserves as well as to backtest the model with real pricing and holdings data. FRTB also requires that internal models implement expected shortfall calculations to address outlying tail risks in investment strategies.
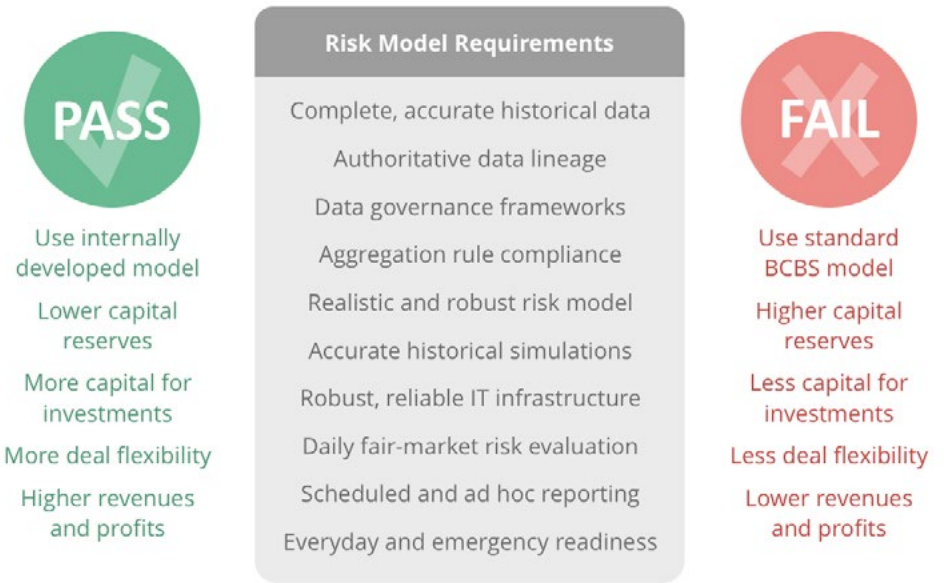
The Importance of Risk Model Approval

To satisfy supervisory authorities of the accuracy of an internally developed risk model, banks must prove all of the following:

- Their data is complete, accurate and consistent; and the components of the risk model can be traced back to original, authoritative data sources
- There is sufficient pricing and transaction history to test the model back to 2007
- Their aggregation rules are accurate and comply with BCBS regulations
- Their risk models are sufficiently realistic and robust to represent market realities in normal and emergency situations
- Their framework models historical, current and what-if market scenarios
- Their policies and procedures for data governance, aggregation and validation are complete and consistently enforced
- Their IT infrastructure handles inter-day fair-market evaluations, scheduled reports, and ad hoc requests from internal and external risk supervisors

If a bank fails the regulatory audit, regulators use standard BCBS formulas to determine substantially higher amounts of capital that the bank must reserve to cover potential losses.

If the internal model passes the audit, the model's calculated capital reserve requirements replace regulators' default reserve requirements as well as traditional value-at-risk (VaR) measures.

Internal risk model approval leads to lower reserves and higher levels of investment capital, flexibility, revenue and profits.

The Importance of Internal Risk Model Approval

PASS

Use internally developed model

Lower capital reserves

More capital for investments

More deal flexibility

Higher revenues and profits

Risk Model Requirements

Complete, accurate historical data

Authoritative data lineage

Data governance frameworks

Aggregation rule compliance

Realistic and robust risk model

Accurate historical simulations

Robust, reliable IT infrastructure

Daily fair-market risk evaluation

Scheduled and ad hoc reporting

Everyday and emergency readiness

FAIL

Use standard BCBS model

Higher capital reserves

Less capital for investments

Less deal flexibility

Lower revenues and profits
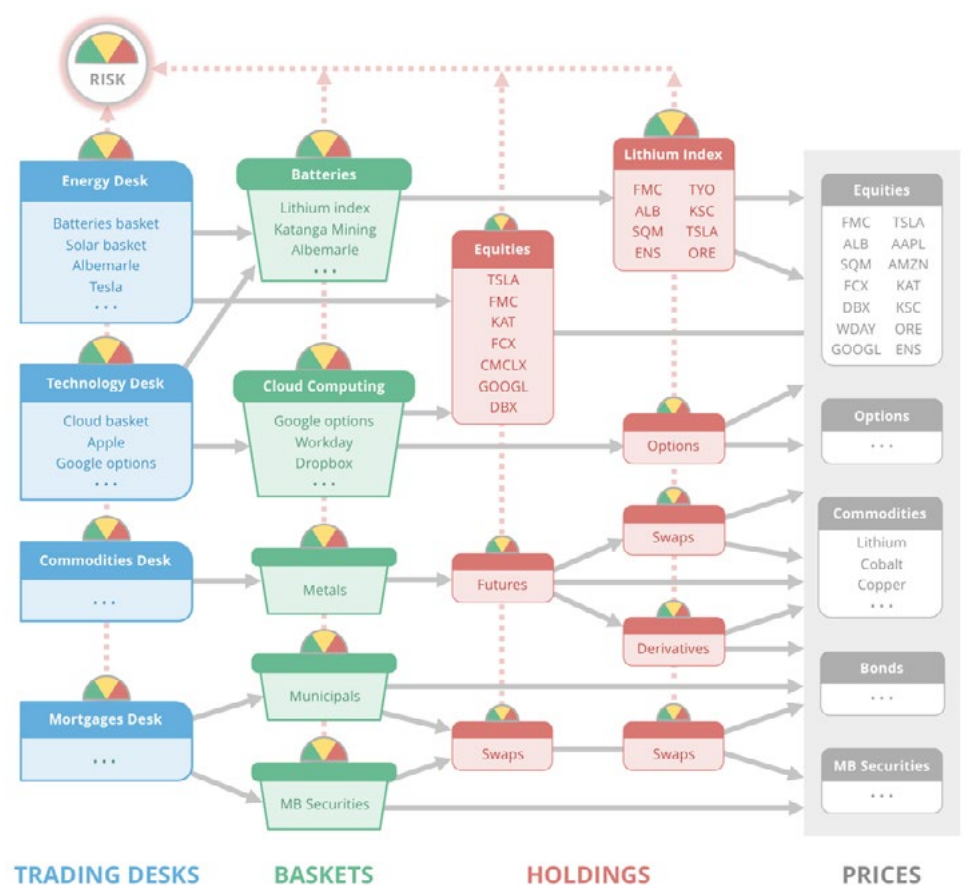
Risk Modeling Requires Data Lineage

Risk modeling – especially at large banks, hedge funds and aggressive investment houses – has complex requirements and requires organizations to trace data connections across a web of investment baskets, holdings, financial instruments and pricing data.

FRTB requirements for historical testing require banks to decompose risk models into their individual risk components and trace back through time to available pricing and position information. This requires data managers to uncover the lineage of their investment information, including:

- Which data is relevant

- How the data is sourced or calculated

- Whether data sources are authentic and authoritative

- What risk factors affect all upstream information dependencies

- Whether all calculations are based on approved BCBS aggregation rules

- Where and how the data maps into the bank's risk model

Banks must be able to trace data dependencies through many levels of complexity before reaching original, authoritative data sources – a crucial requirement that existing bank systems simply can't address. This shortcoming is a key reason why FRTB compliance requirements have been delayed from 2019 to January 2022.

FRTB rules require banks to decompose risk models to uncover the lineage of investment data.

The previous diagram illustrates the connectedness of investment data, but it is a gross simplification of the actual interdependencies that exist among trading desks, investment baskets, investment instruments and market prices.

The image below drills down deeper on the Batteries Basket but still presents a high-level picture of the connected data that drives investment risk analysis.

By the 2020s, Accenture predicts current banking business models will be swept away by a tide of ever-evolving technology and other rapidly occurring changes.
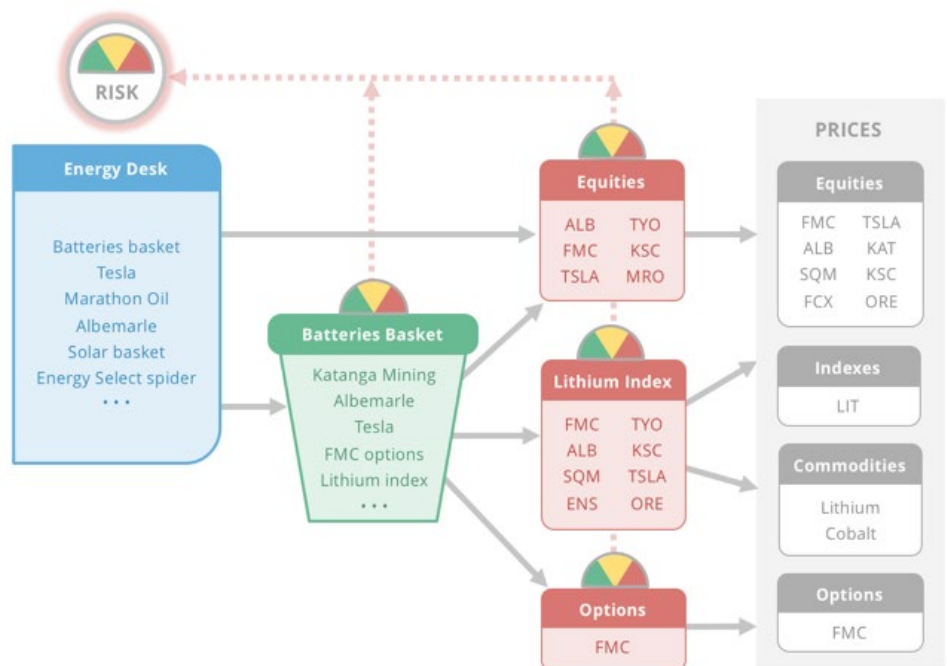
Building and Testing Internal Risk Models

After internal analysts identify risk factors in investment strategies, banks must link all interrelated risk data to ensure they can trace risk inherent in their models now and in the future. In the diagram below, tracing data lineage starts at the trading desk and moves to the right through baskets, holdings and prices, eventually reaching authoritative data sources on the right.

Once the lineage of each investment position is modeled back to its most basic components, risk applications plug prices into the model and move back to the left, aggregating risk back up to the level of the trading desk. At the end of the analysis, the risk model calculates a capital reserve ratio that mitigates the risk inherent in the investment strategy.
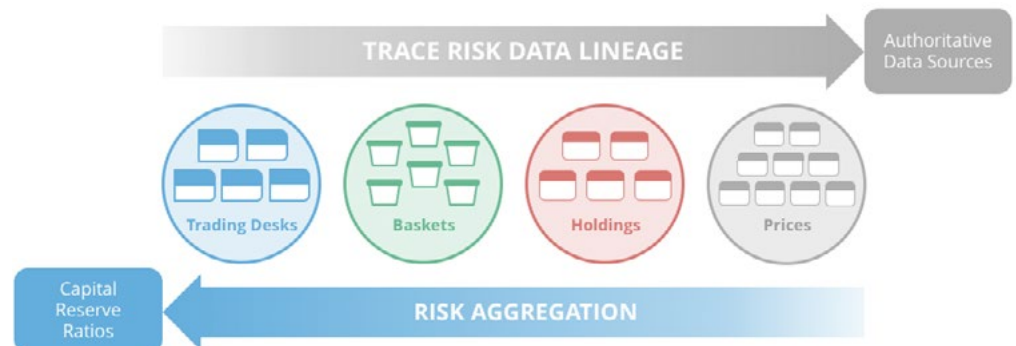
Banks must then prove the accuracy of those models all the way back to 2007 using real data for each individual risk factor to which trading desks are exposed.

After the internal risk models are backtested historically and approved by regulators, banks must continuously maintain them by evaluating 24 dates from the last year using real position and pricing data with no two evaluations more than one month apart.

When banks fail to meet this requirement for any risk, it is deemed a *non-modellable* risk factor (NMRF), and the bank must set aside capital to offset the increased risk.

Evaluating Model Risk Against One Year of Market Prices
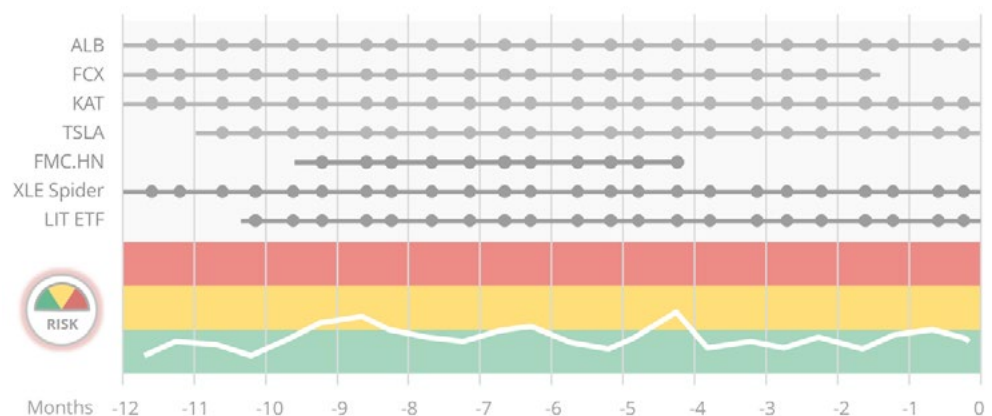
As prices and positions change in everyday operations, internal models must reevaluate risk multiple times a day, and more often during market events.

As prices and positions change in everyday operations, internal models must reevaluate risk multiple times a day – and more often during market events. This requires a high-performance, near-real-time system to address regulatory requirements.

Data Governance Is Key to Risk Modeling

Modeling bank risk is challenging due to a variety of investment, regulatory and data management factors. At virtually all banks, investment data detailing trades, holdings, historical prices and market prices reside in discrete data silos. And those silos often exist at various trading desks or other locations rather than centralized at the institutional level – making risk data management all the more daunting.

More importantly, the demands of bank risk modeling go far beyond the calculations used in traditional financial and analytic models. The added complexity stems from the interrelatedness and complexity of market information and the ever-rising diversity and complexity of investment instruments and positions.

Those dependencies can cascade many levels deep, making their associated risks all but impossible to visualize or calculate. That very interdependence brought many funds and trading desks down like a house of cards in the wake of the Lehman Brothers collapse a decade ago.

These complexities demand that compliance efforts begin with a bullet-proof data governance foundation. Without such a framework, risk aggregation, reserve calculations and required reporting are nearly impossible to achieve.

The Aggressive Demands of FRTB Compliance Applications

The complexity of the FRTB models requires a software platform that enables banks to:

- Trace the lineage of risk factors back to their original, authoritative data sources
- Span pricing, position, cash management and other data silos into a unified dataset
- Work with regulators to visualize and modify risk model graph diagrams
- Enable the easy modification of risk models to keep pace with changing market conditions, organizational changes and investment strategies
- Handle mergers, divestitures and reorganizations that affect the historical and future operation and performance of trading desks

These strict demands require a technology platform that understands connected data and that models the interdependence and complexity of data lineage in modern markets and investment instruments.

Traditional Technologies Can't Handle Lineage and Modeling

Traditional spreadsheet, relational database and data warehousing technologies can't address the requirements of investment risk modeling because they:

- Cannot handle the complexity and connectedness of modern investment instruments and markets
- Cannot trace multi-tiered data lineage efficiently
- Cannot produce computational results in near real-time across the risk chain
- Cannot help risk managers and regulators visualize, understand and evolve risk models as market and bank conditions change

For all these reasons and more, traditional technologies are simply unfit for creating and maintaining investment risk models and compliance reporting applications.
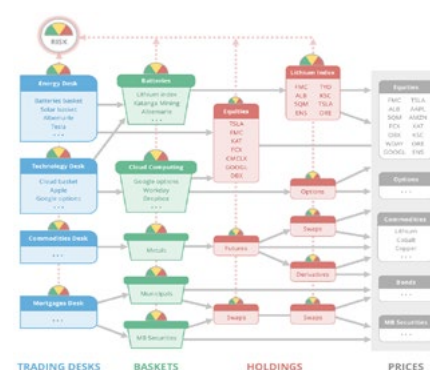
Modern Graph Technology Is the Answer

The right foundation for building compliance solutions is graph database technology.

A native graph database stores, accesses and processes information not in tables, but as directly connected data – which is the precise way that data must be managed to build efficient, reliable risk models.

Compliance applications using native graph technology iterate back and forth through data connections to produce lightning-fast risk assessments.

Such high performance provides the agility that trading desks need to take full advantage of market opportunities while remaining compliant with the ever-changing and dynamic nature of risk regulations.

The right foundation for building compliance solutions is graph database technology.

Neo4j: The World's Leading Graph Platform

As the world's leading native graph database platform, Neo4j is the ideal solution for effectively capturing investment data lineage across internal and external applications and data sources.

Due to its ability to store this lineage as a graph of connected data, Neo4j traverses the connections in real time to assess risk factors and compute capital requirements across all positions and trading desks.

Additionally, the Neo4j graph platform has data visualization tools that enable analysts, supervisors and regulators to visualize the lineage of risk factors to create compliance models, and later, to run what-if scenarios to test and improve them.

Trace Risk Data Lineage across Data Silos

The greatest challenge in developing and maintaining investment-risk models is integrating information that resides in many discrete silos across the enterprise. These data silos exist because trading, fund management, accounting, cash management and pricing systems operate and store data independently of each other.

It is impractical and prohibitively expensive to integrate all these investment applications into a single compliance solution. Instead, Neo4j enables an organization to use a federated metadata model to unite investment data silos into a unified dataset.

Neo4j Traces Data Lineage across Data Silos
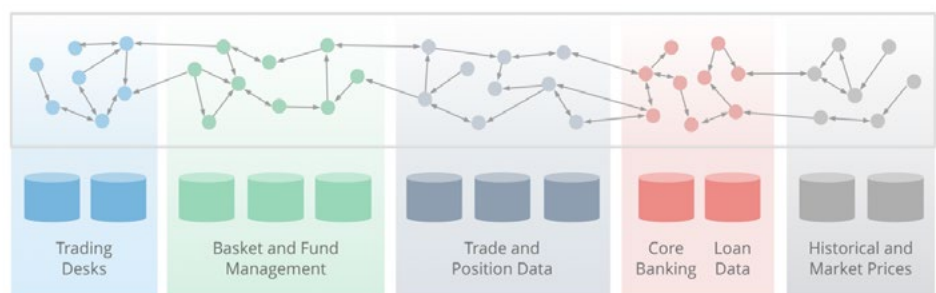
Neo4j creates a federated metadata layer that connects investment data into a unified data resource for compliance applications

Build a Foundation for Compliance Applications

Once the federated metadata layer exists in Neo4j, risk supervisors can trace the lineage of risk factors back to their original, authoritative data sources, thereby solving the number one problem in building compliance systems.

But this new, connected data foundation can also support a full spectrum of innovative uses – including credit risk analysis, value-at-risk calculations, fundamental research, market and sector analysis, investment-desk performance studies, return on invested capital analysis, and many more mission-critical systems.

Neo4j is the world's leading graph database platform and the ideal solution for tracking investment data lineage.

Neo4j answers the demands of FRTB regulations while building a foundation for future investment and risk compliance applications.

Visualize and Modify Risk Models Easily

Neo4j includes a variety of data visualization tools that enable organizations to build, understand and improve even the most complex investment risk models. By using Neo4j to build risk compliance solutions, organizations:

- Create and evolve models to keep pace with changing market conditions, organizational changes and investment strategies
- Work with regulators to improve and certify risk models
- Handle mergers, divestitures and reorganizations that affect the historical and future operation and performance of trading desks
- Build a foundation for analyzing performance across trading desks, departments, markets, business sectors and investment strategies

Use Risk Models to Drive Higher Profits

While BCBS's current deadline for achieving FRTB compliance is January 2022, banks are acting now to use FRTB mandates to streamline their internal systems and build a firm foundation for future compliance applications.

By investing in compliance now, organizations answer the demands of Basel and FRTB regulations while building an infrastructure that produces remarkable savings in software development and staffing expenses.

By using their compliance foundation to determine optimal reserve ratios on a continual basis, financial institutions of all sizes maximize available capital and drive investment profits.

For more information on how Neo4j provides a flexible foundation for FRTB compliance applications, or for an in-depth conversation about your specific requirements, contact Nav Mathur at nav@neo4j.com.

Neo4j is the leader in graph database technology. As the world's most widely deployed graph database, we help global brands – including Comcast, NASA, UBS, and Volvo Cars – to reveal and predict how people, processes and systems are interrelated.

Using this relationships-first approach, applications built with Neo4j tackle connected data challenges such as analytics and artificial intelligence, fraud detection, real-time recommendations, and knowledge graphs. Find out more at neo4j.com.

Questions about Neo4j?

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