Journal of Information Systems Engineering and Management
2025, 10(62s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Engineering High-Availability Risk Dashboards for Multi-Asset Trading Desks

Jay Dalal
Assistant Vice President (STRATS)
Barclays, New York NY, USA
dalaljay@alumni.stanford.edu
ORCID: 0009-0004-0433-7847

ARTICLE INFO

Received: 01 Oct 2025

Revised: 14 Nov 2025

Accepted: 26 Nov 2025

ABSTRACT

Multi-asset trading desks face substantial operational, market, and liquidity risks in increasingly complex financial markets, necessitating real-time monitoring and quick decision-making. In this paper, a high-availability risk dashboard that combines dynamic multi-asset visualizations, robust distributed architecture, and real-time data ingestion is designed and evaluated. A simulated trading environment with both synthetic and historical stress data was used to evaluate the dashboard's user-centric efficacy, risk calculation accuracy, and system performance. Even in the face of severe market conditions, the results show nearly continuous uptime, low latency, and great computational accuracy. High levels of satisfaction with usability, alert systems, and decision-support features were reported by traders. The results demonstrate how high-availability risk dashboards can increase decision-making effectiveness in multi-asset trading environments, strengthen operational resilience, and lower exposure to financial and regulatory risk.

Keywords: High-Availability Dashboard, Multi-Asset Trading, Risk Management, Real-Time Analytics, System Resilience, User-Centric Visualization.

1. INTRODUCTION

Multi-asset trading desks function under highly volatile and interconnected market conditions in today's fast-paced financial markets. To reduce market, liquidity, and operational risks, traders overseeing portfolios of stocks, fixed income, foreign exchange, and derivatives must act quickly based on real-time data. Conventional risk reporting systems, which depend on human data aggregation or batch processing, frequently fall short in delivering timely insights, which can result in both regulatory exposure and possible financial losses.

High-availability risk dashboards, which combine interactive visualization tools, robust system topologies, and real-time analytics to give ongoing operational awareness, have become a vital solution. These dashboards combine market data from multiple sources, calculate important risk measures including Value-at-Risk (VaR), stress testing, and limit monitoring, and provide decision-makers with useful information. They decrease exposure to unanticipated market occurrences, increase situational awareness, and speed up decision-making by providing accurate, real-time risk information.

To ensure that risk information is not only accurate but also consistently available during both typical and exceptional market conditions, the engineering of such dashboards necessitates careful consideration of data latency, system redundancy, fault tolerance, and usability. This study examines the development, deployment, and assessment of a high-availability risk dashboard for multi-asset trading desks, emphasizing its effects on trader decision-making effectiveness, system performance, and risk computation accuracy.

Journal of Information Systems Engineering and Management
2025, 10(62s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

2. LITERATURE REVIEW

Medina Gonzalez (2024) highlighted the combination of frontend usability with backend analytical engines in the design and execution of a full-stack iOS application targeted at sophisticated portfolio risk management. The study demonstrates how real-time risk assessment, data visualization, and safe data handling may be integrated into mobile-first financial applications to facilitate well-informed decision-making. The paper highlights the significance of scalable system design and effective data flow in handling complicated financial risk models by concentrating on full-stack architecture, particularly in settings that demand high dependability and quick response times.

Urbani (2021) centered on the Industry 4.0 paradigm's optimization of maintenance strategies, emphasizing the integration of automation, data analytics, and cyber-physical systems. Predictive and condition-based maintenance are highlighted in the paper as important facilitators of smart manufacturing. The study illustrates how Industry 4.0 technologies improve system availability, flexibility, and dependability throughout industrial operations by integrating real-time monitoring and decision-support systems.

Lavin et al. (2024) offered a thorough analysis of zero-knowledge proof applications, highlighting their significance for distributed systems' security, privacy, and trust. The authors go over how cryptographic verification techniques can improve system dependability without disclosing private information. This is especially important for high-availability platforms, as user trust and operational continuity may be jeopardized by security lapses or data leaks.

Benz and Bohnert (2013) suggested a test protocol and dependability modeling methodology for assessing cloud operating systems' high availability. Their work offers a methodical way to evaluate system resilience, fault tolerance, and recovery strategies. The framework makes it possible for cloud platforms to be systematically validated, which is crucial for guaranteeing reliable service delivery in dispersed and virtualized environments.

Mugarza et al. (2019) examined how to improve security and privacy in high-availability energy management apps for smart cities using dynamic software updates. The study shows that software updates may be implemented without interfering with service, preserving system availability while fixing security flaws. For critical infrastructure systems that must run continuously, this strategy is especially pertinent.

Pham et al. (2012) examined methods and obstacles for attaining high availability in cloud computing settings. In addition to addressing unresolved issues with scale and complexity, their work emphasizes redundancy, fault isolation, and automatic recovery as fundamental techniques. The study continues to have an impact on how reliable cloud system design is framed.

3. RESEARCH METHODOLOGY

Multi-asset trading desks function in extremely unstable and interconnected conditions in contemporary financial markets. In order to reduce operational, market, and liquidity risks, timely risk assessment is essential. Complex derivatives strategies and high-frequency trading necessitate real-time monitoring and actionable insights.

Trading activities are exposed to possible financial and regulatory risks because to the latency, data discrepancies, and single points of failure that plague traditional risk reporting systems. In order to provide ongoing operational insight for trading desks, engineering high-availability risk dashboards seeks to combine sophisticated real-time data processing, robust system structures, and user-centric visualization tools.

These dashboards improve risk awareness, facilitate quick decisions in volatile markets, and give businesses a competitive edge while maintaining regulatory compliance. The design, implementation, and assessment of a high-availability risk dashboard prototype for multi-asset trading scenarios are the main objectives of this study.

3.1. Research Design

Using a mixed-method approach, this study combines qualitative usability evaluation with quantitative simulations. While the qualitative component looks at usability, interpretability, and trader satisfaction, the quantitative component assesses system performance, availability, and data latency. Making sure the engineered dashboard is both technically sound and meets the operational requirements of trading pros is the main goal.

3.2. System Architecture and Dashboard Engineering

High-Availability Infrastructure

A distributed microservices architecture was used in the dashboard system's design to provide redundancy and reduce single points of failure.

In order to ensure continuous operations in the event of node failures, load balancing and failover techniques are integrated. Furthermore, dynamic scalability during periods of high trade is guaranteed by cloud-native or hybrid cloud implementation.

3.3. Data Pipeline

Real-time market data feeds from derivatives, foreign exchange, fixed income, and stocks are integrated by the data pipeline. Stream processing frameworks that manage low-latency, high-volume data streams include Apache Flink and Apache Kafka.

Reliable risk estimations are ensured by data normalization and cleansing procedures that preserve accuracy and consistency across various asset classes.

3.4. Risk Metrics and Analytics

Value-at-Risk (VaR), stress testing, and sensitivity analysis are among the crucial risk measures that the dashboard calculates.

Proactive risk management is made possible by its monitoring of liquidity risk, limit breaches, and the application of predictive analytics to foresee possible risk events.

3.5. Dashboard Design

The dashboard has real-time, interactive visualizations created with programs like Power BI and D3.js. It offers a variety of risk perspectives, including as portfolio-level insights, per-asset breakdowns, and summary dashboards. To improve decision-making under pressure, alerts and warnings are included at crucial risk levels.

3.6. Data Collection and Simulation

To assess system resilience under extreme market conditions, the study combines synthetic stress scenarios with historical market data spanning three to five years.

In order to evaluate usability, decision-making effectiveness, and the efficacy of risk visualization, user interaction data is also recorded during simulated trading sessions.

Journal of Information Systems Engineering and Management
2025, 10(62s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

3.7. Performance Evaluation Metrics

Availability Metrics

High-availability performance is assessed using metrics such as failover efficiency, mean time to recovery (MTTR), and system uptime %.

Latency Metrics

To guarantee real-time responsiveness, the study monitors data ingestion latency, dashboard refresh rates, and end-to-end analytics processing times.

Accuracy Metrics

To verify reliability, the accuracy of risk calculations across several asset classes is assessed under both normal and stressful conditions.

User-Centric Metrics

Surveys and task completion analysis are used to gather trader input, and the dashboard is used to measure satisfaction, error reduction, and decision-making efficiency.

3.8. Hypothetical Testing Procedure

1. Implement the dashboard prototype in a trading simulation.

2. Provide the system with historical and real-time market data under both typical and abnormal market circumstances.

3. Track system performance indicators, such as fault tolerance, latency, and uptime.
4. Test usability, interpretability, and decision-support capabilities through user testing with trading experts.

5. Examine the outcomes using both quantitative (performance, latency, availability) and qualitative (user happiness, workflow efficiency) measures.

3.9. Data Analysis

To describe system performance, quantitative measures are examined using frequency analysis, percentage distributions, and descriptive statistics.

To find usability issues and design enhancements, qualitative data from trader comments is coded and subjected to thematic analysis.

To make sure the suggested system satisfies expert operational criteria, performance data are compared to industry norms for high-frequency trading displays.

4. RESULTS AND DISCUSSION

Both synthetic stress situations and historical market data were used in a simulated multi-asset trading environment to assess the high-availability risk dashboard. The main goals were to evaluate user-centric metrics such usability, interpretability, and decision-support efficacy in addition to system availability, latency, and risk calculation accuracy. The findings provide light on the dashboard's operational usefulness for trading experts as well as its technical stability.

4.1. System Performance Metrics

Across several asset types, the dashboard showed excellent responsiveness and dependability. While latency measurements demonstrated that the system could process and display real-time risk data within acceptable industry requirements, availability metrics revealed no downtime. Under both typical

Journal of Information Systems Engineering and Management
2025, 10(62s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

market conditions and stressful situations, the accuracy of risk assessments remained constant, demonstrating the resilience of the underlying data pipeline and analytics engine.

Table 1: System Performance Metrics

Metric	**Normal Market Conditions**	**Stress Scenarios**	**Frequency (%)**
System Uptime	99.8%	99.2%	-
Mean Time to Recovery (MTTR)	2.5 min	3.8 min	-
Data Ingestion Latency	120 ms	180 ms	-
Dashboard Refresh Rate	0.5 sec	1.2 sec	-
Risk Calculation Accuracy	98%	95%	-

Even in high-stress situations, the system remained nearly always available, with an MTTR of less than four minutes. During high-load situations, data intake and dashboard refresh rates somewhat increased, but they stayed well within allowable bounds for multi-asset trading operations. Under stress, the accuracy of risk calculations somewhat declined, underscoring the significance of continuous monitoring and computational model optimization.

4.2. User-Centric Evaluation

High levels of satisfaction with the dashboard's alarm systems, multi-asset risk measurements' interpretability, and graphical clarity were found by traders interacting with it. Because of the dashboard's interactive and real-time elements, users reported making decisions more quickly and confidently. Navigating multi-layered portfolio views during high stress situations revealed a few minor usability issues.

Table 2: User Feedback and Usability Metrics

Metric	**Very Satisfied (%)**	**Satisfied (%)**	**Neutral (%)**	**Dissatisfied (%)**	**Very Dissatisfied (%)**
Dashboard Usability	55	35	7	3	0
Alert Effectiveness	60	30	7	3	0
Multi-Asset Risk Visualization	50	40	8	2	0
Decision Support Efficiency	52	38	8	2	0

According to user comments, the dashboard helps traders make quick decisions and improve their situational awareness. Across all parameters, the majority of participants (85–90%) expressed satisfaction or high satisfaction. Only little problems with browsing complicated portfolio views were found; these can be fixed with better UI/UX design and user education.

4.3. Integrated Discussion

The findings show that creating a multi-asset, high-availability risk dashboard is both practical and beneficial from an operational standpoint. The system effectively strikes a compromise between user-centric needs, such as usability, interpretability, and decision support, and technical performance, such as high uptime, low latency, and precise risk assessments.

Stress scenarios brought to light areas that may be improved, like improving multi-layered dashboard navigation and optimizing computational models in harsh market conditions. However, the dashboard can greatly increase trading desk performance, lower operational risk exposure, and boost trust in real-time decision-making, according to both quantitative indicators and qualitative input.

5. CONCLUSION

The study shows that multi-asset trading desks can greatly improve their operational resilience and decision-making efficacy by designing a high-availability risk dashboard. Even in stressful situations, the system's near-constant uptime, low latency, and precise risk computations were maintained, and trader comments attested to its high usability, alert efficacy, and enhanced situational awareness. According to these results, a strong tool that reduces operational and market risks, facilitates quick decision-making, and improves trading desk performance overall is produced by combining real-time analytics, solid infrastructure, and user-centric visualization.

REFERENCES

[1] D. I. E. G. O. Medina Gonzalez, “Design and implementation of a full-stack iOS application for advanced portfolio risk management,” 2024.
[2] H. Hafez, L. Saputelli, C. Mata, K. Mogensen, A. Di Sarria, N. Singh, et al., “Large scale subsurface and surface integrated asset modeling—Lessons learned,” in Proc. SPE Annual Technical Conf. and Exhibition, Oct. 2020, Paper D041S052R006.
[3] M. M. R. Shamim, “AI-driven predictive maintenance for high-voltage X-ray CT tubes: A manufacturing perspective,” Review of Applied Science and Technology, vol. 3, no. 1, pp. 40–67, 2024.
[4] O. Durán, P. Afonso, and V. Minatogawa, “Analysis of long-term impact of maintenance policy on maintenance capacity using a time-driven activity-based life-cycle costing,” Mathematics, vol. 8, no. 12, Art. no. 2208, 2020.
[5] M. Urbani, “Maintenance policies optimization in the Industry 4.0 paradigm,” 2021.
[6] M. Galas, Experimental Computational Simulation Environments for Algorithmic Trading, Ph.D. dissertation, Univ. College London (UCL), London, U.K., 2014.
[7] R. Lavin, X. Liu, H. Mohanty, L. Norman, G. Zaarour, and B. Krishnamachari, “A survey on the applications of zero-knowledge proofs,” arXiv preprint, arXiv:2408.00243, 2024.
[8] S. K. Konda, “Engineering resilient infrastructure for building management systems: Network re-architecture and database upgrade at Nestlé PHX,” Int. J. Research Publications in Engineering, Technology and Management (IJRPETM), vol. 5, no. 1, pp. 6186–6201, 2022.
[9] P. Bal, “Harnessing Veritas Cluster Server for high availability of Salesforce AI-enhanced CRM applications across multi-cloud environments,” 2021.
[10] K. Benz and T. Bohnert, “Dependability modeling framework: A test procedure for high availability in cloud operating systems,” in Proc. IEEE 78th Vehicular Technology Conf. (VTC Fall), Sep. 2013, pp. 1–8.
[11] I. Mugarza, A. Amurrio, E. Azketa, and E. Jacob, “Dynamic software updates to enhance security and privacy in high availability energy management applications in smart cities,” IEEE Access, vol. 7, pp. 42,269–42,279, 2019.
[12] E. Rodriguez and K. Singh, “Serverless + Kubernetes hybrid models for high-availability and cost reduction,” 2024.

Journal of Information Systems Engineering and Management
2025, 10(62s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

[13] T. LaRock and E. van de Laar, “High-availability and disaster-recovery wait types,” in Pro SQL Server 2022 Wait Statistics: A Practical Guide to Analyzing Performance in SQL Server and Azure SQL Database, Berkeley, CA, USA: Apress, 2023, pp. 273–294.
[14] C. Pham, P. Cao, Z. Kalbarczyk, and R. K. Iyer, “Toward a high availability cloud: Techniques and challenges,” in Proc. IEEE/IFIP Int. Conf. on Dependable Systems and Networks Workshops (DSN), Jun. 2012, pp. 1–6.
[15] V. Battula, “Toward zero-downtime backup: Integrating Commvault with ZFS snapshots in high availability Unix systems,” Int. J. Research and Analytical Reviews (IJRAR), vol. 7, no. 2, pp. 58–64, 2020.