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Transforming Financial Institutions by Harnessing High Performance Computing (HPC)

How HPC can assist financial institutions in achieving speed, agility, scalability, cost-effectiveness and compliance

Introduction

In the fast-paced and data-driven world of finance, institutions must constantly innovate to stay ahead of the game. They must accelerate digital transformation, combat fraud, and improve operational efficiency.

With unprecedented challenges and opportunities, financial institutions need to develop new products and services, experiment with new algorithms, models, and strategies and increase regulatory compliance. To meet these demands, they require high-performance computing (HPC) solutions that can handle large volumes of data, complex calculations, and real-time processing.

HPC can enable faster and more accurate analysis of large and complex data sets, such as market data, customer behavior, and regulatory compliance. This can improve the quality and speed of services in areas such as trading, pricing, portfolio optimization, and fraud detection.

Client needs and challenges

Traditional on-premises computing solutions are often costly, inflexible, and difficult to scale and manage. They necessitate significant upfront investment, maintenance, and security and may need specialized resources to keep pace with the evolving needs and expectations of the customers and regulators. Moreover, they may restrict the ability of financial institutions to access and use the latest technologies and innovations in the market.

Solutions that modernize on-premises computing, such as cloud, hybrid, and edge computing, can help financial institutions use HPC for their business needs. This white paper explores the various HPC solutions available to financial institutions, helping you choose the right one for your business needs.

Use cases for HPC in financial institutions

High performance computing is a transformative platform for the financial industry, providing intriguing solutions for investment banks, brokerage firms, capital markets, insurance companies, credit unions, retail banking and mortgage companies. The platform is vital in enabling institutions to modernize their existing technical systems and address complex challenges to gain a competitive edge. Here are some of the critical use cases:

Fraud detection

HPC can identify intricate patterns and correlations within vast amounts of structured and unstructured data. This helps uncover complex fraud schemes that might be harder to detect with traditional methods.

According to a Nasdaq report about financial crime[1], illicit money flows totaled USD 3.1 trillion globally in 2023. That total doesn't include fraud, which cost almost half a trillion US dollars, including close to USD 450 billion from payments, check and credit card fraud and more than USD 40 billion in scams targeting individuals and companies.

Machine learning models can be trained on vast datasets of historical fraudulent activity. HPC accelerates the training process, enabling the creation of more robust predictive models that accurately detect fraudulent transactions with low false-positive rates.

A real-life example: FraudNet is an HPC platform developed by PayPal to detect and prevent online fraud in real time. FraudNet uses machine learning and artificial intelligence to analyze billions of transactions and customer behavior data, as well as to identify and block fraudulent transactions and accounts. FraudNet also uses HPC to scale and adapt to the changing fraud patterns and scenarios and to provide feedback and insights to the fraud analysts and investigators.

Risk management

Financial institutions face a constant array of risks that involves identifying, measuring, and mitigating the potential losses and uncertainties that may arise from various sources, such as market fluctuations, credit defaults, operational failures, regulatory changes, and cyberattacks. It requires the analysis of large and complex data sets, for example, historical transactions, market data, customer profiles, and regulatory reports, to assess the risk exposure and performance of various portfolios, products, and strategies.

HPC can be used to perform complex risk calculations, such as value at risk (VaR) and stress testing, which require massive computational power. By harnessing HPC power, financial institutions can better understand their risk profile, make informed decisions, and ensure their long-term sustainability and success in the dynamic financial landscape.

For example, HPC can speed up Monte Carlo simulations by using parallel processing and distributed computing techniques, such as multi-core CPUs, GPUs, or cloud computing[2]. This can reduce the simulation time from hours or days to minutes or seconds and enable more frequent and detailed risk analyses.

Compliance

Financial institutions generate massive amounts of complex data for regulatory reporting purposes, including transaction details, customer information, and risk assessments. HPC can efficiently process and analyze these large datasets, ensuring timely and accurate reporting. The advanced analytics capabilities of HPC can enhance the accuracy of compliance processes, reducing the risk of errors and regulatory penalties.

While the initial investment in HPC systems can be significant, they can ultimately reduce costs by streamlining compliance processes and minimizing non-compliance risk. Overall, HPC can significantly improve compliance operations in financial institutions by providing faster, more accurate, and scalable solutions for meeting regulatory requirements.

Algorithmic trading

Trading is the essence of the financial services sector, emphasizing both the instruments involved and the data-driven approach crucial for success. It involves buying and selling various financial instruments, such as stocks, bonds, currencies, commodities, and derivatives, to generate profits or hedge risks. To identify and execute optimal trading strategies and orders, trading requires analyzing high-frequency and high-resolution data, such as market prices, volumes, trends, and news.

HPC plays a critical role in high-frequency trading (HFT) by enabling the execution of high-volume, rapid-fire trades based on complex algorithms. It allows traders to rapidly assess different strategies and improve trading performance.

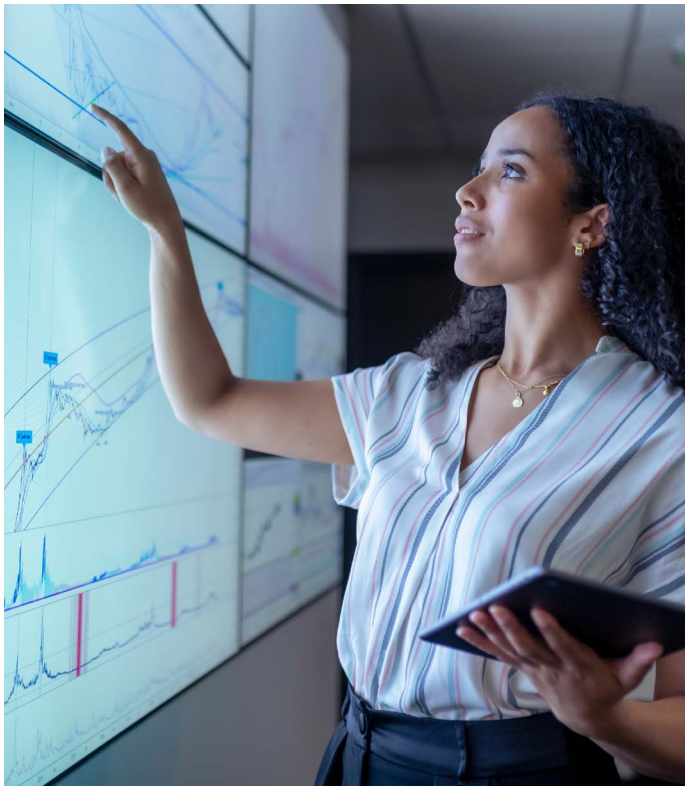
HPC systems can run orders in microseconds or nanoseconds, possibly giving firms using HFT an edge over slower competitors. According to a study by the TABB Group[3], a 5-millisecond delay in trading can result in a loss of USD 4 million per millisecond for a large HFT firm. Conversely, a 1-millisecond advantage can generate an extra USD 100 million in annual profits for an HFT firm. According to another study by Brogaard, Hendershott, and Riordan[4], HFT firms earn an average of USD 21,000 per day per stock, accounting for about 50% of the trading volume and 70% of the trading profits in the US equity markets.

Customer analytics and predictive modeling

Data analytics and predictive modeling using HPC play a transformative role in the financial services industry. HPC scalability and elasticity allow for rapid analysis of vast amounts of customer data, including transaction history, demographics, and online behavior. By harnessing the power of high performance computing, financial institutions can accelerate the training and execution of complex predictive models, enabling faster generation of valuable insights from their data, optimizing operations, mitigating risks, and navigating the ever-evolving financial landscape with greater agility and success.

Portfolio optimization

HPC facilitates exploring a broader range of potential portfolios, potentially leading to investments with better risk-adjusted returns. Investment firms can use HPC to optimize complex portfolios with diverse asset classes, including stocks, bonds, and derivatives. Individual clients can apply HPC using robo-advisors to personalize investment strategies. HPC can be employed to managed pension funds to manage large and long-term investment portfolios by optimizing asset allocation and minimizing risk exposure. HPC can also support scenario analysis, which can help financial institutions evaluate the impact of different market conditions, events, or strategies on their portfolios.



Optimizing HPC use cases for financial services

High-performance computing (HPC) offers immense potential for financial services. Still, it requires strategic optimization to deliver the desired results, maximize return on investment and gain a competitive edge in the ever-evolving financial landscape.

Identifying the right use case

- **Focus on high-value tasks:** Prioritize use cases with the highest potential impact on business objectives, such as risk management, automated trading, fraud detection, or portfolio optimization.
- **Consider data volume and complexity:** Choose use cases that involve massive datasets or require complex calculations beyond the capabilities of traditional computing systems.
- **Align with strategic goals:** Ensure the chosen use case aligns with the financial institution's overall strategic business objectives and contributes to long-term growth and success.

Optimizing hardware and software

- **Right-sizing infrastructure:** Choose hardware configurations tailored to the specific use case requirements, balancing performance needs with cost constraints. Consider using hybrid and multi-cloud deployments for increased flexibility, scalability, and redundancy. Use a range of advanced cloud services and tools for HPC, such as managed HPC clusters, job schedulers, and orchestration tools, making it easier to manage and scale your HPC workloads.
- **Software optimization:** Use specialized libraries and frameworks designed for financial applications and HPC environments. This can significantly improve performance and efficiency.
- **Containerization:** Apply containerization technologies to package applications and their dependencies, ensuring consistent and portable deployment across different HPC environments.

Effective data and risk management

- **Access control and encryption:** Implement strict access controls using identity and access management (IAM) tools to ensure that only authorized users and applications can access sensitive data. Encrypt data both at rest and in transit. Use strong encryption standards such as AES-256 for data at rest and TLS for data in transit.
- **Data governance and security:** Minimize the amount of sensitive data stored in the cloud and only retain data necessary for business purposes. Establish robust data governance and security protocols to protect sensitive financial data throughout the HPC lifecycle. Key management is crucial to manage encryption keys securely and implement robust key rotation practices to prevent unauthorized access.
- **Data masking and tokenization:** Mask or tokenize sensitive data to protect it from unauthorized access. This can help maintain data privacy while allowing certain operations to be performed on the data.
- **Data residency and compliance:** Ensure that data residency requirements and compliance standards (such as GDPR, HIPAA, and more) are met. Use cloud providers with data centers in regions that comply with these regulations.

Monitoring and performance evaluation

- Continuously monitor performance: Regularly monitor HPC system performance and resource utilization to identify bottlenecks and inefficiencies.
- Benchmarking and performance tuning: Conduct periodic benchmarking and performance tuning exercises to ensure optimal system performance and identify opportunities for further optimization.
- Measuring ROI: Track and measure the return on investment of HPC projects to demonstrate their value and justify further investments in technology and resources.

Looking forward

The demonstrably positive impact across risk management, customer experience, and innovation positions HPC as a cornerstone technology for financial institutions seeking to thrive in a complex and dynamic marketplace. Gartner predicts the global HPC market will reach USD 11.5 billion by 2026, signifying continuous growth driven by the increasing demand for data processing capabilities across various industries.

The rise of artificial intelligence (AI) and machine learning (ML) workloads is a significant factor fueling the demand for HPC, as these applications require significant computing power to train and run complex algorithms. Cloud-based HPC solutions are gaining traction as they offer scalability, flexibility, and cost-effectiveness for organizations of all sizes.

Kyndryl can help with HPC at any stage of the journey

Kyndryl understands the complex technology environments that underpin financial services institutions in a way few other partners can. For more than 30 years, we have helped our banking customers optimize the efficiency of existing IT and capitalize on emerging technologies to create business value. We've led complex core banking modernization initiatives to drive growth and architected simpler, more frictionless journeys to the cloud. Customers trust our decades of experience applying operational data patterns and IP, powered by AI and automation, to deliver exceptional customer and employee experiences.

Consulting

Kyndryl can provide strategic guidance and best practices for planning, designing, and implementing your high performance computing environment. Our experts can help you define your HPC goals, assess your current state, identify gaps and opportunities, and recommend the optimal solutions for your needs and budget.

Integration

Kyndryl integrates your HPC environment with your existing, on-premises, hybrid or public cloud IT infrastructure and systems, as well as with external data sources and platforms. We work together with you to help ensure the compatibility and interoperability of your HPC components and the compliance and governance of your HPC data and processes.

Management

Kyndryl can manage your HPC environment on your behalf or in collaboration with your IT team. We monitor, maintain, and optimize HPC performance, reliability and a security-rich environment. Kyndryl can also provide support, troubleshooting, and incident resolution services.

Innovation

Kyndryl can help you adopt the latest technologies and trends in HPC, such as cloud, edge, hybrid, and quantum computing. We work together with you to explore new possibilities and opportunities for your HPC applications and outcomes.

For more information

To learn more about how high performance computing can help your organization, visit kyndryl.com.

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1. Global Financial Crime Report, Nasdaq Verafin 2024 Global Financial Crime Report, January 16, 2024.
2. High Burst CPU Compute for Monte Carlo Simulations on AWS, AWS HOC Blog, September 2021.
3. The Value of a Millisecond: Finding the Optimal Speed of a Trading Infrastructure, Tabb Group, April 2008.
4. Equity Market Structure Literature Review Part II: High Frequency Trading, Division of Trading and Markets, U.S. Securities and Exchange Commission, March 18, 2014.

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