HIGH FINANCE: HARNESSING THE POWER OF HPC

How financial institutions can use high-performance computing to gain a market advantage.

EXECUTIVE SUMMARY

The financial industry engages in many technologically demanding operations: high-frequency trading, real-time analytics and complex financial modeling, as well as sophisticated fraud detection and security processing. Tasks such as these demand cutting-edge computing that can process large data flows, detect patterns, assess risk, project value and drive profit.

High-performance computing (HPC) systems arm financial firms with the resources they need to compete in fiercely competitive markets. Powerful, multicore processors and parallel storage combine with fast, low-latency networks, reducing time to action and enabling more effective analysis. For example, HPC enables instant execution of high-frequency, algorithmic trading to leverage fleeting market opportunities that result in gains. The technology delivers advanced analytics, allowing firms to detect, assess and manage risk factors in complex markets.

Powerful computing solutions help financial firms address heightened competition in the race to identify new market opportunities by enabling data analytics and predictive modeling. These capabilities can also verify transactions in real time, detect anomalous patterns and improve fraud detection.

The ABCs of HPC

Activities such as high-frequency trading, complex simulations and real-time analytics are essential to the success of capital markets brokerages and other financial firms. These institutions rely on HPC systems to gather, parse, analyze and act on vast amounts of data. In a keenly competitive environment, the imperative to bring top-end computing power to bear is greater than ever before. Among the challenges:

Instant execution: Success or failure in the financial sector can be measured in milliseconds. High-frequency, algorithmic trading relies on high-speed interconnections, ultra-low-latency switches and powerful servers to ensure immediate action.

Escalating risk: The global financial crisis of 2008 exposed deep structural flaws and risks in the sector. HPC deployments and advanced analytics allow firms to detect, assess and manage risk factors before they can damage business interests.

Heightened competition: Financial firms are in a constant race to identify new market opportunities and gain critical, first-mover advantages. Data analytics and predictive modeling reveal opportunities that might otherwise be missed.

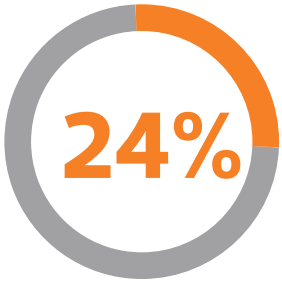
Evolving security: Every financial organization has a target on its back. HPC and data analytics combine to verify transactions in real time, detect anomalous patterns and improve fraud detection.

These challenges are driving the adoption of HPC solutions in the financial sector. In addition to growing activity around trading and options analysis, the research firm IDC cites advancing security solutions and the emergence of customer-facing channel services as key drivers of HPC adoption.

Subsequently, the adoption of this technology means growth in HPC-related spending in the financial sector. According to IDC, total global revenue for the HPC market (including servers, storage, software and services) will increase from $21 billion in 2014 to $31.3 billion by 2019.

From a hardware perspective, HPC build-outs break down into four components:

Servers: Multicore processors, low-latency networks and parallel storage infrastructures combine to let clustered HPC servers scale to the most demanding computing tasks. Compact 1U and 2U form factors allow servers such as the HPE Apollo 6000 System to host as many as 144 individual servers in a standard data center rack. Shared power and management infrastructure improve efficiency and reduce operating cost, yielding sharply higher performance within existing data center footprints and thermal envelopes.



The percentage of organizations that cited faster "time to solution" as the justification for their HPC expenditures[1]

Processors: Today's multicore processors provide parallel execution, streamlined memory access and cutting-edge processing techniques. The Intel Xeon E7-8800 family of processors, for example, is built on an advanced 22-nanometer process and incorporates as many as 18 processor cores, large secondary caches and 5.69 billion transistors for powerful performance. Often sitting next to these system CPUs are powerful coprocessors, such as the Intel Xeon Phi and Nvidia Tesla graphics processing unit (GPU). These accelerate specialized floating point, graphics and other computations, enabling robust parallel processing for complex tasks.

Low-latency networks: High-performance computing is the ultimate team game, employing hundreds or even thousands of rack-hosted servers linked via high-performance InfiniBand and 10 Gigabit Ethernet networks. To squeeze latency out of the environment, specialized hardware such as ultra-low-latency switches, message acceleration appliances and high-performance network monitoring and management tools combine to accelerate, streamline and manage the intense network traffic typical of HPC deployments. Network interface cards (NICs) from Exablaze, Myricom and Solarflare can squeeze round-trip latencies down to near a microsecond.

Parallel storage: Data analytics requires robust storage. A survey by Research and Markets found that 31 percent of all HPC storage systems contain more than a petabyte of capacity. Parallel file systems running across multiple nodes can erase bottlenecks for large file transfers and ensure performance on even the busiest storage infrastructures and networks. Solid-state disk storage sharply improves response time, throughput and reliability, while hybrid storage arrays position data across tiers of solid-state and spinning media to balance cost and performance. Leading providers include NetApp, EMC, HPE, Hitachi Data Systems and IBM.

Foiling Fraud: How PayPal Uses HPC to Secure Transactions

PayPal is one of the world's largest providers of online payment services, processing on average more than 13 million financial transactions each day. Like virtually all organizations in the financial space, PayPal contends with a host of security challenges — chief among them, fraud. To combat the threat, PayPal deployed an HPC cluster to help detect fraudulent charges.

In 2013, PayPal deployed three SGI Altix servers equipped with Intel Xeon X5650 processors and linked to SGI InfiniteStorage arrays via high-speed InfiniBand network hardware.

The HPC system transformed PayPal's fraud detection efforts. Detection that previously took two weeks now happens in real time, while predictive fraud analysis affords visibility into emerging threats. The results: PayPal says its anti-fraud efforts stymied more than $700 million in fraudulent transactions in the first year alone.

SOURCE: [1]Council on Competitiveness, "The Exascale Effect: the Benefits of Supercomputing Investment for U.S. Industry," October 2014

Using HPC

HPC addresses a host of core activities in the financial sector, making it a compelling solution for banks, brokerage houses, insurance companies, capital markets and other organizations.

Data Analytics and Predictive Modeling

Data analytics and predictive modeling leverage historical data, statistical algorithms and machine-learning techniques to detect trends and drive insight into likely future outcomes. In short, they help financial firms predict the future and make better decisions about trades, market movements, credit risk and a host of other issues. The algorithms used to achieve these ends are sophisticated and often proprietary, mandating scalable computing infrastructures tuned for high levels of parallelism.

First-mover advantage is a core benefit, enabling high-frequency trading scenarios where profits accrue by leveraging fleeting opportunities before others can execute. Speedy processing and communications serve to improve outcomes, with real-time market analysis, risk analytics and portfolio calculations combining to assess exposure and risk before transactions are finalized. The ability to crunch reams of data yields a host of other benefits as well. Improved trading models and the ability to find new market opportunities combine to drive down cost and improve overall business performance.

Improved Compliance

The financial sector operates in a rigorous compliance environment, where failure to meet standards can lead to stiff fines. From the 2008 global financial crisis through August 2013, the Securities and Exchange Commission levied $2.68 billion in penalties against 157 firms and individuals. The burden — and potential risk — that falls on financial firms is growing as regulatory mandates expand. These include Basel-III, the Dodd-Frank Act and Comprehensive Capital Analysis and Review, as well as oversight by agencies such as the Consumer Financial Protection Bureau, the Financial Industry Regulatory Authority and the Office of the Comptroller of Currency.

These regulations create a lot of work for financial firms. In 2013, JPMorgan Chase & Co. said it created 4,000 staff positions and spent $1 billion on additional controls to address compliance activities.

HPC deployments help financial organizations meet rising compliance thresholds, without impairing time-sensitive business operations. They also help manage the overhead cost of compliance operations through robust integration and automation of data flows.

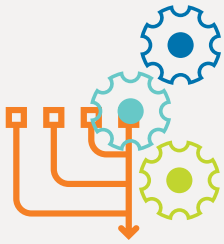
Enhanced Risk Management

Success in the financial sector is determined by how well organizations manage risk. Firms must fully understand all the factors in a transaction, investment, customer or strategy — increasingly in real time — before making a decision.

HPC deployments are effective in addressing risk management across credit, market, liquidity and operational risk categories. HPC can be applied to operations such as basis risk computation to address changes in floating rates and their impact on assets and liabilities. It can also be used to evaluate the market or credit risk of a portfolio, estimate default risk by counterparties in derivative contracts and conduct Monte Carlo analyses to assess broad operational risk.

Monte Carlo simulations provide a good example of risk-focused computation that demands the specific capabilities of HPC. These simulations perform concurrent computations on large sets of historical data and projected variables to determine future risk probabilities. Parallel processing, coprocessor acceleration, high-performance data storage and streamlined memory I/O and throughput all play a role in enabling rapid simulation and reporting.

High-Performance Challenges



For all its benefits, HPC poses a number of challenges that must be addressed to ensure optimal return. From early planning stages, IT and business management must work together closely to develop a plan that meets the functional requirements of the business and results in an HPC build-out that can adapt to changing needs. Among other considerations:

Software first: HPC can deliver advanced performance, but it needs advanced software to do it. Tailored management and security tools tuned for parallel processing are required. Existing applications may need significant upgrades or replacement to thrive in an HPC environment.

Heat, space and power: Many large HPC deployments are limited by the physical plant. Firms should carefully assess their data center facilities (and potential future needs, out to five or 10 years) and consider improvements to thermal management and power delivery.

Skills challenge: HPC clusters can place major demands on IT staff. Hiring skilled, HPC-savvy administrators, programmers and scientists remains a steep challenge.

High-Performance Return on Investment

How compelling are the benefits of HPC? In a survey on HPC deployments by the Council on Competitiveness, 86 percent of respondents agreed with the statement "HPC is critical to the future direction of our business." These findings resonate in the financial sector, where institutions often compete on the quality and sophistication of internally developed (and fiercely protected) software and algorithms.

In fact, the use of many complex financial instruments is enabled only by advanced computation. The modern derivatives market, for instance, was an outgrowth of the Black–Scholes mathematical model developed in the 1970s. Computational burden grows by orders of magnitude as organizations innovate and apply analyses that account for the passage of time, variability in markets and effects of third-party relationships.

The return on investment (ROI) can be impressive. A 2015 IDC study of 329 HPC deployments found that, across all sectors, every dollar invested in HPC returns an average of $515 in revenue and an average of $43 in profit.

The gains boil down to two broad categories: speed and awareness. HPC enables real-time processing and analysis that accelerates the pace of business. From instant fraud detection to high-frequency trading, processes and tasks that were once impossible now create revenue and profit opportunities. For instance, more than half of all transactions on the New York Stock Exchange and NASDAQ are high-frequency trades. Autonomous systems are making millisecond-scale buy/sell/hold decisions, applying first-mover advantage to obtain the best possible price and position. Speed equals profit, and clustered HPC systems offer the best solution to the equation.

Speed also drives big yields in operational awareness. HPC enables financial firms to build more robust models, account for a greater range of variables and leverage vastly larger data sets to sharpen and broaden insight across the board. Among the processes enabled by HPC deployments:

Proactive compliance: Firms can detect fraud and breaches through constant monitoring of transactions, communications and network traffic. Automated risk analysis and mitigation ensure rapid response to minimize periods of noncompliance.

Granular drill-down: Using real-time analytics, firms can plumb vast data sets for items of interest, down to individual transactions or instruments. This enables computational steering, where analysts can interact with models and data in real time to explore behaviors based on dynamic inputs.

Predictive analytics: Financial institutions can project future outcomes and inform decision-making by applying historical data to complex models, achieving early insight into emerging trends.

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CDW: A Financial Industry Partner That Gets IT

CDW understands high-performance computing and the related technologies required by capital markets, brokerages and other financial services firms. Our account managers are dedicated to the financial services sector and thoroughly understand the challenges it faces. Our solution architects offer mastery in designing customized solutions, while CDW advanced technology engineers assist with implementations and long-term management of these solutions.

CDW's high-performance computing offerings for the financial services market include technologies such as InfiniBand architecture, 10-Gigabit Ethernet switching, solid-state memory, high-availability/high-volume storage, high-performance servers, power management systems and more.

The CDW Approach

ASSESS
Evaluate business objectives, technology environments and processes; identify opportunities for performance improvements and cost savings.

DESIGN
Recommend relevant technologies and services, document technical architecture, deployment plans, "measures of success," budgets and timelines.

DEPLOY
Assist with product fulfillment, configuration, broad-scale implementation, integration and training.

MANAGE
Proactively monitor systems to ensure technology is running as intended and provide support when and how you need it.

For more information on CDW's solutions and services for capital markets firms, visit CDW.com/capitalmarkets.

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