Financial institutions (FIs) are at the forefront of digital transformation (DX) given the role they play in the digital economy worldwide. Most FIs are accelerating their DX initiatives as a response to intense competitive pressure to offer innovative and differentiated products and services. They are constantly looking for ways to anticipate changes to improve user behavior, increase engagement, and grow their share of wallet. DX initiatives compel FIs to make internal and external operational changes to how they run their business. For example, IDC estimates that public cloud services spend by FIs will grow 3.5 times faster at a rate of 16.2% CAGR for 2019-2024, gaining a larger share of IT budgets at most FIs. At this rate, banks will be spending one-quarter of their IT budgets on public cloud services by 2024. Investments in newer digital engagement models also come with a slew of challenges such as external cybersecurity threats and newer regulations for data sovereignty.

These changes lead FIs to explore newer approaches for enhancing their visibility internally and externally and to increase the speed with which they can act upon insights gained from internally and externally sourced data sets. In recent times, FIs have turned to high-performance computing (HPC) infrastructure for running modeling and simulation (M&S) and artificial intelligence (AI)-based algorithms. IDC’s research finds that 92% of enterprises — including FIs — have already invested in HPC or HPC-like environments.

Traditional approaches for implementing HPC call for increased investments in on-premises infrastructure. Such approaches – where performance trumps everything – are also expensive to implement, let alone the operational costs associated with optimizing, maintaining, and even growing the environment in self-owned and/or operated datacenters. In the past, this has not been a problem for FIs. In a 2022 study on HPC adoption trends, IDC found 48.76% of respondents indicate that they will spend anywhere from $2.5 million to $25 million on HPC infrastructure, making spend on HPC a sizable portion of their IT budgets.

FIs are under pressure to find ways to "run the bank" more efficiently and to reduce capital expenses, energy dependence, and risks. They must do so while figuring out newer approaches for "creating the bank" in a scalable, secure, sustainable, and consistent manner. The emerging answer for striking a balance is for FIs to embrace HPC as a managed cloud service, including workload orchestration and high-performance storage bundled in with infrastructure. HPC as a cloud service removes the challenges associated with on-premises HPC environments. It provides FIs with access to an operationally friendlier environment that is always current, with their existing on-premises grids supplemented with additional capacity in the cloud, highly secure, and easily scalable elastically to quickly adopt to changing requirements backed by the provider’s service-level agreements (SLAs).
SITUATION OVERVIEW

The Need for High-Performance Computing

In recent times, FIs have risen to the top of the list of industries aggressively pursuing digital transformation. To make this manageable and scalable in the long term, these FIs often operate as two entities within the same firm:

- "Run the bank" activities are focused on maintaining revenue operations. These include ensuring that the firm meets its obligations to internal and external stakeholders, regulatory bodies, local governments, and to its institutional and retail customers.
- "Create the bank" activities are focused on differentiation in the market. The firm is constantly developing new products and services. There is constant pressure to innovate how they engage with their institutional and retail customers, always anticipating their changing needs and meeting their needs in as compressed time as possible.

Both sets of activities require FIs to increase their reliance on data-driven insights that can be delivered to the business as quickly as possible for quick internal or external actions. Examples include the ability to meet or perform:

- **Product and strategy development.** Extensive historical back testing and market simulations to develop new financial products targeted at the right demographic
- **High-frequency trading (HFT).** Trades executed in 1/100s of a millisecond with revenue in millions from trading for equities, foreign exchange, and commodities
- **Real-time fraud detection.** Analysis of millions of transactions in seconds, looking for trends and patterns of suspicious behavior across heterogeneous systems to prevent fraud
- **Securitized product pricing and valuation.** Simulations such as Monte Carlo for the pricing and valuation of financial products, including credit and interest rate derivatives and variable annuities
- **Risk management.** Portfolio simulations and scenario testing to identify potential risks and model the impact of hypothetical changes to the firm’s investments
- **Capital management and reporting.** Regulations such as Comprehensive Capital Analysis and Review (CCAR), Solvency II, MiFID II (EU regulation), Basel III, and Fundamental Review of Trading Book (FRTB) requiring organizations to undergo and withstand capital stress testing
- **Digitizing regulatory compliance.** Requirements such as FR 2052a to reduce risks, automate compliance policies, and enable execution in real time

Historically, FIs have maintained large IT environments in the industry to support revenue operations. However, even best-of-breed infrastructure cannot meet the performance-scaling requirements of applications that directly influence or lead to near-real-time internal and external action. With FIs under constant and increasing regulatory pressure and scrutiny, any changes the firm makes to their revenue operations invites more scrutiny, leading to more investments in data-driven insights.

Enter HPC Infrastructure

FIs are increasingly turning to HPC infrastructure to address the requirements for faster data to insight. HPC infrastructure is purpose designed to execute simultaneous algorithms and workloads that require batch or streaming data ingest and analytics, with an infrastructure architecture that is often vastly different from approaches employed in general-purpose infrastructure.
HPC deployments tend to be complete and self-contained stacks with tightly integrated compute, storage, workload orchestrators, networks, software, and applications elements optimized for the highest levels of compute performance, lowest I/O latency, and highest bandwidth for storage with expansive scalability.

HPC approaches are constantly evolving and leveraging decades of best practices that require costly additional personnel to maintain and optimize the stack. The lack of agility to respond to more compliance requirements further increases inelasticity; the result is an extremely complex environment that is difficult and expensive to maintain.

**Challenges with Building and Managing HPC Platforms**

A defining characteristic of many HPC stacks and deployment choices is that they can be a niche and highly customized environment. The process of implementing and operating the stack is challenging as each component is "hyper-optimized." Once integrated, the system is maintained for regular operations with clear, well-defined service-level objectives.

Figure 1 illustrates the reasons why many HPC projects fail. IT organizations at FIs face a tough decision when it comes to build versus buy. A complete on-premises deployment may not be the right model for FIs that are increasing their reliance on HPC, given the risks associated with such deployments. These risks include:

- **Maintaining niche engineering skill sets.** Teams need individuals with specialized skills to design and operate the environment, though such talent is in dire shortage. These individuals must have years of operational knowledge and experience to scale the infrastructure with increasing demand.

- **Dealing with a lack of elasticity.** The infrastructure — unless planned out with excess capacity — may not be able to handle on-demand performance or additional workloads. Cloud bursting is an option but could be expensive.

- **Managing capital expenses associated with hardware and software.** Costs associated with buildup can also be prohibitive when added to the total cost of ownership.

- **Maintaining regulatory compliance.** This can be challenging and requires knowledge of the various regulatory requirements for the environments and auditing to ensure compliance. Exposure can be cost prohibitive.

- **Unplanned and unanticipated complications.** An in-house developed operating stack can increase the risk of unplanned downtime, create hurdles in meeting service-level objectives, and increase the total cost of ownership.
FIGURE 1

Major Reasons HPC Projects Fail

Making a Strategic Choice to Invest in Managed HPC Platforms

A recent IDC study found that 67% of organizations prefer the cloud as a deployment model for their performance-intensive workloads driven by M&S, AI, and big data and analytics (BDA) use cases (source: IDC’s Infrastructure for Compute Survey, 2021). This study also found that respondents agreed that performance-intensive workloads require different types of server and storage solutions, which in turn lead to a preference for managed cloud services.

Figure 2 illustrates how FIs can simplify their operations by shifting to a managed model for their off-premises HPC environments. For organizations and FIs, investing in a managed HPC platform from a trusted service provider offers several benefits:

- **An operational, scalable, geographically distributed, and efficient environment.** A nonlocal provider-managed, continuously optimized platform provides elasticity and ease of use and crucially does not carry the burden of expensive capital investments and periodic refreshes.

- **Faster time to insight with adaptive infrastructure.** FIs can avail themselves of a best-of-breed infrastructure stack that is optimized by the service provider. This compresses the time it takes to implement the workload in production and gain insights from the data.

- **Hybrid model with consistent levels of service.** IT can pass on workloads that are datacenter constrained to a managed service provider that in turn assumes responsibilities for meeting stringent service-level objectives.

- **People- and resource-friendly environment.** The scarce and highly specialized HPC talent can be reassigned to focus on higher-value application/algorithmic development that results in market-differentiating innovation and business outcomes.
**Budget-friendly options.** With the right investments, FIs can gain better return on investment within a two- to three-year time frame. HPCaaS investments can potentially pay for themselves when all direct and indirect cost savings are added up.

**FIGURE 2**

The Shift to Managed Service Platforms Simplifies the Environment

<table>
<thead>
<tr>
<th>Current State</th>
<th>Future State</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business needs</strong></td>
<td><strong>Business needs</strong></td>
</tr>
<tr>
<td>Spectrum orchestrator</td>
<td>Managed HPC platform – infrastructure, middleware, network, and ITIL services</td>
</tr>
<tr>
<td>Network</td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
</tr>
<tr>
<td>High-performance storage</td>
<td></td>
</tr>
<tr>
<td><strong>Significant capital investment</strong></td>
<td><strong>Scalable and flexible</strong></td>
</tr>
<tr>
<td><strong>Significant skills and teams needed</strong></td>
<td><strong>Continuous platform currency</strong></td>
</tr>
<tr>
<td><strong>Inability to handle peak workloads</strong></td>
<td><strong>Single point of ownership and support</strong></td>
</tr>
<tr>
<td><strong>High capital costs</strong></td>
<td><strong>Frees resources to focus on innovation and business outcomes</strong></td>
</tr>
<tr>
<td><strong>Regulatory change creating complexity and growth demands</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: IBM, 2022

**IBM CLOUD HPC MANAGED SERVICE**

IBM, a trusted IT consulting and service provider to FIs for seven decades, now offers IBM Cloud HPC Managed Service, a fully managed service that provides a full-stack HPC environment with 365 x 24 x 7 operations to reduce capital and operational burdens and speed time to insight for compute-intensive calculations, simulation modeling, and meeting regulatory requirements. IBM manages deployment, operations, and application performance with predictable monthly pricing and continuity of business assured with SLAs. IBM’s service – delivered via its own public and hybrid cloud – is built using the company’s own software and hardware stack.

The IBM Cloud HPC Managed Service offering is well suited for clients with hybrid requirements that cannot expand their datacenters, are capacity constrained with the growing regulation, and are facing huge resource/skills shortage. IBM performs engineering services, installation of the HPC platform with specific endpoints to interact with the system, and day 2 operations as shown in Figure 3. Pricing is a predictable per core per month with service-level agreements for incident and resolution management and HPC platform availability.
Further, IBM’s service is a compelling option for IT organizations with limited budgets. They can pass the operational benefits of this service – which include on-demand scaling, consistent service quality, and low management overhead – to their business users, data scientists, and developers, which in turn benefit from increased productivity. Figure 4 illustrates key elements of the IBM service:

- IBM Cloud services for building HPC environments include a virtual private cloud (VPC) to enable FIs to create a segregated collection of performance-optimized compute instances, storage, and networking components. Multiple connectivity options up to 100Gbps and robust security and encryption with FIPS 140-2 Level 4 certification make the service attractive to FIs that deal with sensitive data. Finally, IBM Cloud Code Engine, a fully managed serverless platform, enables FIs to run containers, applications, or batch jobs on the same service.

- IBM Spectrum Computing provides an intelligent, dynamic, and highly elastic hybrid cloud environment. It enables FIs to use cloud resources according to defined policies. Spectrum LSF and Spectrum Symphony allow users to run workloads on cloud, dynamically provision cloud resources, and intelligently move data to manage egress costs. It provides users the option to enable auto-scaling, thus taking full advantage of cloud capacity and achieving faster job completion times.

- IBM Spectrum Scale is an enterprise-grade, performance-intensive distributed(scale-out file system that provides scalable capacity and performance to manage demanding data analytics, content repositories, and HPC workloads. Spectrum Scale has been a bedrock of modern HPC environments for over four decades. Its architecture supports tens of thousands of clients, billions of files, and petabytes of data written and retrieved as files or objects with low latency. Optionally, IBM Aspera can be used for high-speed data movement using the FASP protocol.

Source: IBM, 2022
The IBM Cloud HPC Managed Service is a compelling option for FIs that are seeking to accelerate their digital transformation efforts. Specifically, the benefits IBM HPCaaS offers to FIs include:

- **Improved time to market.** Shorter provisioning times for incremental capacity to run modeling and simulation workloads allow organizations to launch new products and services faster.

- **Improved regulatory posture.** Ability to quickly address new and evolving regulatory requirements (such as capital stress tests) by providing better turnaround time for performance-intensive calculations helps with regulatory posture.

- **Capital cost avoidance.** FIs can avoid costs for hardware procurement and datacenter expansion and scale capacity as needed.

- **Single accountability.** An engineered platform stack with optimized application performance, simplified full-stack platform support, and service quality targets enable FIs to accelerate their deployment and go-live timelines.

- **HPC expertise.** The service is managed by IBM-badged HPC specialists who are well trained on the nuances of the infrastructure, workload schedulers, high-performance storage and networking, and work around the clock to maintain the operational health of the system.

- **Improved operations costs.** With IBM responsible for the platform life cycle, FIs benefit from better utilization with compute cores and shortened run times leading to reduced costs and improved time to market.

**FIGURE 4**

**IBM Cloud HPC Managed Service Offering**

Source: IBM, 2022
ESSENTIAL GUIDANCE FOR IT DECISION MAKERS

IDC predicts that by 2025, 25% of tier 1 banks globally will deploy their data warehouses and analytics operations in the cloud. When this scenario is extended to all FIs, the percentage is much higher. Figure 5 illustrates the main trigger events that are driving FIs to the cloud. The top 3 events are budget constraints, access to newer or better technology, and limitations of the current infrastructure to manage growing data sets. These trigger events amplify the urgency for the use of cloud for performance-intensive environments such HPC, AI, and analytics in which business outcomes and competitive differentiation are directly tied to compressing the time to data-driven insights.

With proper fit-for-purpose investments in managed HPC platforms, FIs can gain benefits that they have seen with their cloud investments. As shown in Figure 5, these benefits include improved customer experience, IT security, regulatory compliance posture, business agility, and resiliency, all of which are critical for FIs that seek to maintain their leadership position.

FIGURE 5

Reasons FIs Adopt Cloud and Benefits That Result

Q. Where have you seen the greatest benefits in your cloud journey?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT budgets constrained or reduced</td>
<td>50</td>
</tr>
<tr>
<td>Need functionality or services found in cloud offerings</td>
<td>45</td>
</tr>
<tr>
<td>Data has grown beyond the capacity of existing systems</td>
<td>41</td>
</tr>
<tr>
<td>Remote workforce</td>
<td>37</td>
</tr>
<tr>
<td>Support digital transformation initiatives</td>
<td>37</td>
</tr>
<tr>
<td>Maintaining compliance across regions (e.g., GDPR)</td>
<td>34</td>
</tr>
<tr>
<td>Failing to meet demands of business due to legacy systems</td>
<td>34</td>
</tr>
<tr>
<td>Software reaching end of life</td>
<td>33</td>
</tr>
<tr>
<td>Hardware reaching end of life</td>
<td>31</td>
</tr>
<tr>
<td>Reducing number of datacenters</td>
<td>29</td>
</tr>
<tr>
<td>Data breach</td>
<td>27</td>
</tr>
<tr>
<td>Improved customer experience</td>
<td>38</td>
</tr>
<tr>
<td>Improved IT security</td>
<td>38</td>
</tr>
<tr>
<td>Improved business agility and resiliency</td>
<td>33</td>
</tr>
<tr>
<td>Simplified and standardized IT infrastructure and applications</td>
<td>32</td>
</tr>
<tr>
<td>Faster access to new functionality</td>
<td>29</td>
</tr>
<tr>
<td>Helped drive innovation and/or digital transformation initiatives</td>
<td>29</td>
</tr>
<tr>
<td>Reduced size of IT budget</td>
<td>28</td>
</tr>
<tr>
<td>Improved IT staff productivity and/or optimize staff size</td>
<td>27</td>
</tr>
<tr>
<td>More direct control to business units</td>
<td>25</td>
</tr>
<tr>
<td>Improved time to market and/or expand to new market segments</td>
<td>20</td>
</tr>
</tbody>
</table>

n = 100

Source: IDC's Worldwide Industrial CloudPath Survey, June 2021

OPPORTUNITIES FOR IBM

IBM is uniquely suited to service the needs of the financial services industry with a comprehensive portfolio of trusted hardware, software, security, public cloud, and managed services offerings. The financial services industry is highly regulated with specialized needs. FIs migrating critical HPC
workflows to the cloud are often concerned with rigorous security controls to ensure strict adherence to regulatory guidelines. This adherence requires skills and resources that are in limited supply. FIs can leverage cloud services to improve their value chain, from regulatory reporting, securities pricing underwriting, policy issuance, and renewals to claims processing and servicing, enabling easier, more convenient interactions with customers and partners.

Accordingly, IDC advises IBM to focus on solving pressing pain points of IT decision makers, thus enabling a seamless transition to a managed HPC service. These are:

- Capital costs needed to procure infrastructure hardware and software (e.g., servers, storage systems, scheduling software)
- Operational costs to build and maintain in-house subject matter expertise to run HPC environments, which are often hard to find or retain in today’s competitive market
- Inability to maintain demand driven by market conditions, which can often require the IT organization to stand up new environments or scale existing ones
- Challenges with maintaining the technology currency of the environment and incrementally adding new functionality without capital-intensive upgrades or replacements
- Challenges with ongoing demand fluctuations that can lead to latency and jobs taking longer than normal
- Data logistics challenges, which include meeting regulatory and compliance standards for data in use, in flight, and at rest; ensuring that preprocessed data is protected and post-processed data is archived or disposed of in a compliant manner
- Lack of control for integrated access management and the ability to manage identity and access management policies in line with compliance guidelines and requirements

**CONCLUSION**

High-performance computing environments are becoming a mainstay in FI’s IT environments, given the role they play in transforming the business today and in the future. At the same time, these environments are hard to implement and even harder to maintain. This is where the convergence of cloud and HPC, manifested as a managed HPC platform from vendors such as IBM, can help CIOs and ITDMs at FIs gain a crucial berth in the organization's IT strategy.

IBM can assist FIs with digital transformation by accelerating innovation and agility using a SaaS-like IBM Spectrum Symphony-based HPC platform for risk management, regulatory reporting, portfolio optimization, and securities pricing, thereby improving speed to market, lowering operating costs, and achieving revenue growth.
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