TATA CONSULTANCY SERVICES

Building on belief

Fast-tracking digital transformation in BFSI with HPC

Abstract

In today’s highly competitive environment, banking, financial services, and insurance (BFSI) firms face enormous challenges to simultaneously meet the demands of scalability and performance, and to build resilient systems that withstand disruptions. BFSI firms also need to meet demands of customers switching to digital banking, deliver superior user experience, offer mass personalized services, and adhere to stringent compliance norms. At the same time, BFSI firms are pursuing their digital transformation agenda by transitioning to the cloud as well as embracing micro services, automation, and data-driven decision-making systems to realize benefits such as economies of cost, enhanced agility, and faster time-to-market. However, this creates performance issues due to less powerful servers in the cloud environment and network latency overheads.

High-performance computing (HPC) for business applications on low-cost commodity servers and on the cloud help meet this ever-growing demand for superior performance and higher scalability. This white paper provides a holistic view of the HPC architecture and the implementation challenges involved. BFSI firms will need a paradigm shift and a structured approach to analyze HPC requirements, with a focus on finding appropriate solutions.

Enabling superior performance at the core of digital

Customers are increasingly switching to digital banking and demanding frictionless user experiences across various channels including branch, web, and mobile. BFSI firms are compelled to scale and modernize all user-facing and other performance-critical systems including payment, remittance, real-time order processing, and batch processing of transaction records. On the other hand, estimating intraday risks, deducting financial crimes and ensuring data security have become standard activities to meet compliance norms. These processes are compute- and memory-intensive. In general, BFSI firms are migrating from mainframes to low-cost commodity and cloud servers, but these alternatives are not as powerful and hence pose performance challenges.

BFSI firms are leveraging new-age systems to reap benefits including lower cost, improved agility, and faster time-to-market. However, transformation poses performance challenges due to less powerful cloud servers and network communication overhead across applications in distributed systems. Thus, BFSI firms are caught in the middle of various opposing forces including rising demand for scalability and performance, as well as performance challenges (Figure 1).

We believe that BFSI firms must adopt high-performance computing systems to overcome the performance challenges. Additionally, the business benefits of cloud, automation, modernization, and transition to new age systems far outweigh the challenges.

Figure 1: Business and Operational Drivers to Transition to HPC Systems

Leverage HPC architecture to meet demands of high performance

Ensuring high performance will require a paradigm shift to HPC architecture. BFSI firms can achieve high performance in many ways including parallel processing, in-memory input/output (caching), or stream processing. For example, in batch processing systems, to process millions of records in a few minutes, HPC architecture federates multiple machines to work on subsets of records in parallel. In online systems with thousands of concurrent users, caching data in-memory can help provide faster access. Similarly, trading platforms can leverage stream processing to gain a performance edge.

To implement HPC architecture, BFSI firms need to build software systems with the capability to federate central processing unit (CPU) and memory resources from multiple machines. However, this can lead to multiple points of failure. Developing a failure recovery mechanism becomes critical to implement HPC systems in addition to framing non-functional and technical aspects such as parallel processing, managing data in memory, and stream processing for every application-specific scenario. This not only results in increased complexity, reduced time-to-market and high maintenance costs but also diverts the focus of developers from creating actual business solutions to framing non-functional aspects. To overcome this challenge, BFSI firms must leverage pre-built, commercial or free high-performance computing platforms referred to as HPC enablers, which could be proprietary or open-source software.

HPC enablers act as middleware between applications and operating systems, provisioning ready-to-use tools, utilities, configurations, libraries, and services. Leveraging these enablers can help applications perform functions requiring low-latency input or output from memory, parallel processing, or processing streams of messages. HPC enablers also deliver high availability, improved failure recovery, and enhanced security. Distributed HPC enablers can federate and pool CPU and memory resources from multiple machines to enable massive parallelism and high-speed data access.

Implementing HPC solutions

HPC solution capabilities are typically categorized into in-memory databases (IMDB), in-memory data grids (IMDG) and in-memory computing platforms (IMCP). Other categories include distributed stream processing framework, field programmable gate arrays (FPGAs), distributed data stores or No SQLs, and frameworks to process data in-parallel such as Hadoop. In each of the above categories, many competing vendors offer HPC enablers with overlapping set of capabilities and features. Every vendor offering has its own strengths and weaknesses. Just as individual applications have multiple use cases with specific set of high-performance requirements and growth projections, BFSI firms with thousands of applications cannot have a single enterprise-wide HPC architecture. It is imperative to evolve a structured framework to analyze business requirements and evaluate suitable technology solutions that meet the current and future scaling needs of BFSI firms.

In our view, a large number of business use cases can converge into smaller number of finite patterns of technical use cases with measurable technical workloads, as per requirements. The capabilities and features of HPC enablers can also be specified and benchmarked on different kinds of workloads.

HPC enablers from multiple vendors can then be evaluated and compared to identify the solution with the capability to most efficiently and cost effectively provision all the required workloads. Choosing the right solution involves tradeoffs and prioritization. The framework should simplify and accelerate both requirement analysis and solution evaluation. It should also support specifications on comparable parameters such as workload and cost, to aid the decision-making process.

So, how can banks and insurers transition to HPC systems? Let us consider the example of a credit card payment processing system (CCPPS) that needs to be transformed from a high-cost legacy core to a low-cost digital platform such as private cloud. The CCPPS needs to capture thousands of payment requests every second from across channels. For every request, the system accesses user and merchant profiles, and their credentials for validation and authentication. Further, each request needs to be analyzed for fraud, credit risk and merchant risk from the historical transactions database. The system then checks the balance, applies rules, and finally authorizes the payment. All these processing steps need to be completed within three to four seconds, irrespective of the number of concurrent requests. Thus, each request gets only a few milliseconds for processing. The system requires coordinated processing across three enterprises including the acquiring bank, the card network, and the issuing bank, and calls for predictable service level agreement-driven performance at every stage (see Figure 2). Moreover, the system should be able to meet future requirements that may include increased number of users and merchants, virtual cards or tokenization of card numbers for security, complex fraud-detection capabilities and superior user experience. In addition to requirement analysis, the framework should aid solution evaluation and architecture blueprint preparation for the technical workload distribution shown in Figure 2.

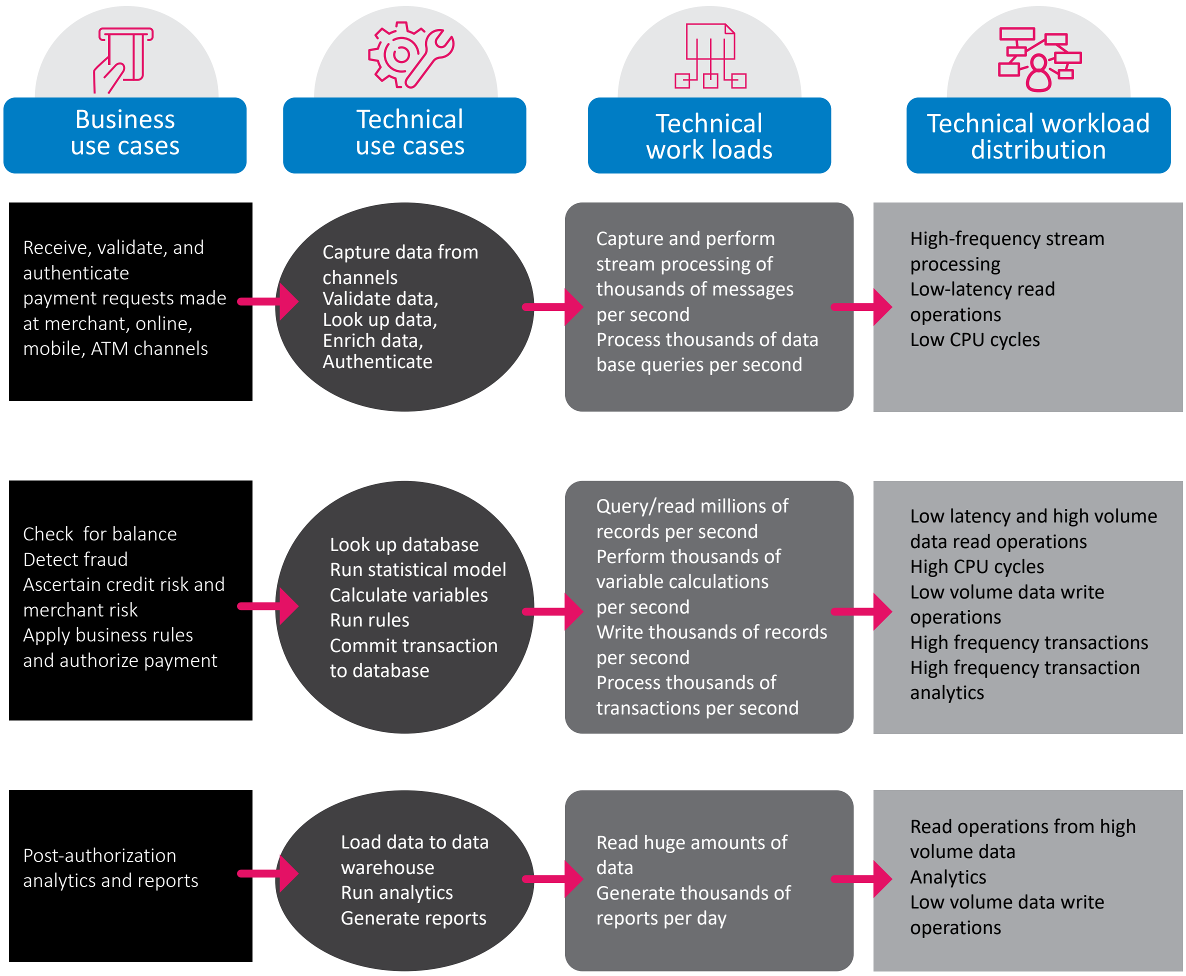

Figure 2: Simplifying Complex Business Processes in Credit Card Payment Processing

How BFSI firms are leveraging HPC

- For a large Asian stock exchange, we implemented a real-time trade surveillance system to detect suspicious trading events. Market data is buffered to IMDG for faster data access. Alerts are delivered in less than a second compared with the 10-minute turnaround time earlier.
- We helped a leading US insurance company transform its online bidding system, with thousands of concurrent users, from legacy to distributed systems leveraging the IMDG solution. The benefits reaped by the client included increased scalability, near real-time access, and cloud enablement.

Future-proofing systems for enhanced performance

Modernizing high-cost legacy systems and transforming systems demanding high performance to digital solutions on the cloud is crucial to offer new age services at low cost. This also helps build resilience against uncertainties and ensures regulatory compliance. Expert guidance backed by deep research in the HPC solution space is crucial for success in these complex transformation initiatives. Designing appropriate solutions and evolving a structured framework contextualized to the requirements of individual BFSI firms help simplify and accelerate HPC implementation. Finally, leveraging the ecosystem of HPC solution enablers and service providers, as well as using assessment tools, accelerators, garage services and deep contextual knowledge will lead to optimal decisions and help future-proof systems to deliver on the required levels of scalability and performance.

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