Real-Time Payment Processing and Fraud Detection for the Mobile Age

Why In-Memory Technologies Are Essential for High-Performance Environments

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As payments are increasingly executed using mobile devices, the infrastructure is changing. As always, a multitude of banking channels, financial services providers, payment processors, and payment networks are jockeying for position in a highly competitive ecosystem.

Network participants must adapt to an increasingly wide variety of payment mechanisms, devices, and types. Not long ago, nearly all payments originated from a relatively small number of point-of-sale terminals. Now payment processors must efficiently handle requests from billions of mobile devices worldwide. These transactions must traverse a complex payment processing network at near real-time speeds (see Figure 1).

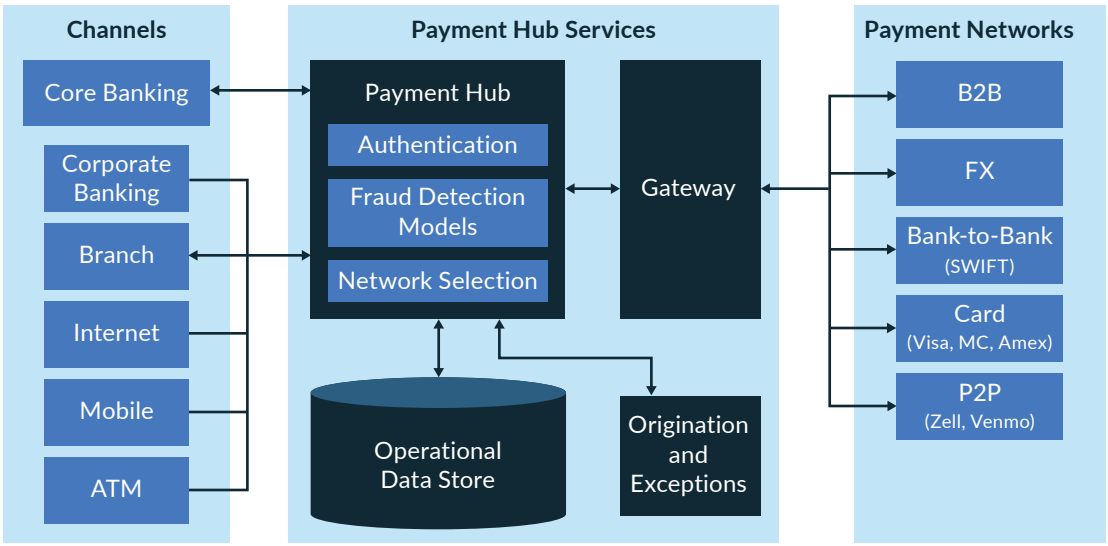


Figure 1
Architecture for Modern Payment Processing

Legacy payment processing infrastructure is not optimized for the new tsunami of transactions. Facing a massive increase in mobile payments and consumer demand for real-time processing, these systems are struggling to keep up with time-sensitive, high-volume data.

Slow processing speeds can frustrate customers and merchants, encouraging them to change payment methods or even vendors. Poor performance also increases the likelihood of potentially costly and catastrophic data processing failures. Large companies that process high volumes of data are especially sensitive to a server or system failure. Downtime can negatively affect user satisfaction and may result in fines, potential regulatory oversight, and a loss of business.

People expect to conduct transactions wherever they are, at any time, using their mobile devices. However, some payment processing systems lack adequate edge processing capabilities to meet these needs. Scalability can also be a problem, with legacy infrastructures unable to scale to handle traffic bursts. For example, seasonal traffic and peak loads—including spikes that occur during events such as Cyber Monday—can overload some systems.

In the payment hub, compute speeds must be exceptionally fast. The solution should include a high-performance operational data store for fast lookups, allowing the system to quickly and accurately assess transaction validity (see Figure 2). This store cannot be based on disk-based data platforms due to the overhead that negatively impacts latency.

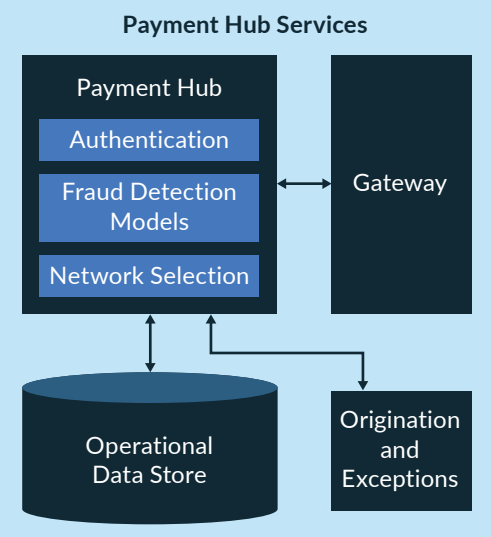


Figure 2
Focus on Payment Hub Services

Preventing Fraud Is a Balancing Act

Not only do consumers expect their purchase transactions to be completed without hassles or delays, but they also trust payment processors to protect their accounts, data, and assets from fraud. Yet the increasing volume of online and mobile transactions and payment methods drives up the number of fraud attempts.

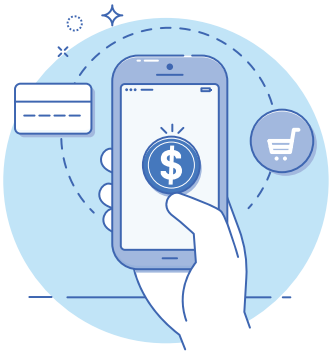
Businesses want to protect themselves from fraud, but they must strike the right balance between speed and accuracy. When making a purchase, consumers expect the transaction to be processed in two to three seconds. However, network transit time consumes much of this window, requiring payment processors to complete their part of the transaction within milliseconds.

Accuracy is the other critical objective when processors run checks for verification, authentication, and fraud. In the effort to return results quickly, processors might use simple fraud algorithms, but they frequently return false positives where a transaction is incorrectly flagged as fraudulent. When cardholders are delayed by the return of a false positive, they often switch to a different payment method, such as another card. The merchant still gets the sale, but when the processor's fraud detection algorithm is too strict, the card-issuing bank often loses the transaction fee.

As a result, today's payment processors need to turn to more sophisticated fraud algorithms. In many cases, they must rely on multiple fraud algorithms to assess several scores to most accurately predict fraud. This extra processing load requires enhanced performance to stay within service-level agreements and avoid overloading the system.

Even legacy payment processing solutions that work satisfactorily will soon be overwhelmed by burgeoning workloads and the resulting increases in latency. What's more, these last-generation solutions offer no competitive advantage or opportunities for innovation. That's unacceptable in a market that clearly rewards first-movers.

To handle increased volumes and workloads, companies need to modernize payment processing systems. You need solutions that can support the business and meet the industry's changing technology and consumer requirements—without imposing unnecessary delays processing backlogs.



15% of all cardholders
had at least one transaction incorrectly identified as fraudulent in the past year

$118 million per year
Estimated lost revenue by payment processors because of false-positive fraud identification

Source: Javelin Research, "False-Positive Card Declines Push Consumers to Abandon Issuers and Merchants," August 27, 2015

Choose Technology with Essential Functionality

A real-time payment processing and fraud detection solution should include the following capabilities and features.

Processing speeds at extreme scale. An operational, in-memory computing platform that manages data using in-memory storage is best to deliver microsecond-level speeds at scale. It also performs parallel execution for fast application speed and supports ultra-low latency.

Real-time processing. Processing should be integrated with an in-memory data store. This feature helps you process data at the moment it is generated or upon ingestion. It also offers real-time classification and prediction workloads at scale, which is especially important for live transactions.

Modern fraud detection methods. Solutions should be able to run multiple fraud detection algorithms and use the results to make the most accurate decisions rapidly. High-performance solutions can run multiple algorithms in less than 30 milliseconds, which is one-tenth of the time it takes to blink.

Elastic, seamless scalability. A solution that can scale up and down without interrupting jobs helps you keep pace with changing workloads. You should be able to upgrade it without delaying task processing to ensure continuous operation.

Low-latency batch and stream processing. An application-embeddable data processing engine ensures that all tasks are lightning fast. Since the collection of payment transactions is essentially a stream, a powerful stream processing engine can handle the transactions as they are delivered into the system. A complementary batch processing system lets you process historical data to leverage it as part of the payment verification and fraud analysis tasks.

Stability. To be reliable, solutions must always be available for processing. In-memory data replication provides a robust yet performant means of fault tolerance. In the case of a temporary outage of the entire cluster, a hot restart feature helps you get all nodes up and running again quickly without having to reread all data from the original sources.

Enterprise-grade security. As mobile payments introduce many more access points to the processing network, the need for security rises. Authentication and role-based access controls protect data from unauthorized viewers, while encrypted data transmission helps ensure data privacy.

Intuitive manageability. By providing tools to monitor your system, a management console can help you ensure service-level agreements are met. It also provides the tools needed to troubleshoot problems when they arise, reducing the cost of downtime.

In-the-Moment Processing Accelerates Time to Results

A modern, real-time payment processing solution offers valuable benefits across your organization.

From a business perspective, the right solution helps you deliver faster responses and improves time to results. Modern technology can ingest, categorize, and process vast amounts of data with ultra-low latency, helping you support continuous intelligence practices. It can also help you process time-sensitive data from numerous sources, where and when it is generated. With this unprecedented speed, you can make faster, smarter business decisions.

The ability to process increased volumes of high-frequency data also gives you the opportunity to use artificial intelligence and machine learning to enhance business insights. You can feed huge data volumes to powerful machine learning models, yielding valuable new correlations and patterns that can be beneficial to your business.

A modern payments processing solution also simplifies technology deployment and operation. A single, lightweight system can elegantly address even the most challenging architectural requirements. By choosing an integration-friendly solution, you can avoid adding further complexity or massive administrative overhead to your environment.

A solution designed for simplicity reduces the cost and complexity associated with multi-component and multi-system architectures. It also lowers your need for multiple skill sets, simplifying staffing.

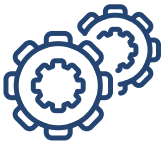
USE CASE:

Real-Time Stream Processing for Better Business Insight

A global information technology solutions company wanted to modernize its payment processing systems.

CHALLENGE:

The company wanted to deliver a better customer experience when processing payments. But before settling a transaction, its payment processing systems had to check the merchant details by forwarding them to the card's issuing bank or association for verification. Then the systems executed anti-fraud measures, which took additional time. The company had to find a way to balance accuracy with customer desires for rapid transaction completion.



SOLUTION:

The company deployed a new payment processing solution to address its workload requirements while meeting customer expectations for fast, secure, and accurate payment processing.

Within the payment processing application, the streaming solution acts as a pipeline for each payment process step. The payment management application orchestrates payment instructions and forwards them to the issuing bank or association for verification. Then it executes anti-fraud measures before settling the transactions.

Multiple processing jobs act as pipeline components. The distributed data structures in the operational, in-memory computing platform enable transaction ingestion and messaging.

RESULTS:

High-performance connectors between the stream processing engine and the in-memory computing platform enable low-latency operations—allowing the company to process tens of thousands of payments per second. With consistently low latency, the payment management application can meet even the strictest service-level agreements.

Built-in data replication in the stream processing engine cluster helps the company realize high availability even during server failures. The replication mechanism shares copies of data across the cluster. If any node goes down, there are copies elsewhere, so the system can continue running—preventing data and financial losses.

The Hazelcast In-Memory Computing Platform

Hazelcast delivers the System of Now™, an industry-leading in-memory computing platform that provides Global 2000 enterprises, including the world's top financial institutions, with ultra-high performance for time-sensitive, cloud-native applications.

The Hazelcast In-Memory Computing Platform is comprised of **Hazelcast IMDG**, the most widely deployed in-memory data grid, and **Hazelcast Jet,** the industry's most advanced in-memory stream processing solution. This technology is uniquely designed to allow you to gain computing insights faster, enable actions within shorter durations, and engage new data at the speed with which it is arriving. In addition, a distributed caching architecture allows you to scale up to hundreds of terabytes and scale out for maximum efficiency when dealing with remote data or edge processing.

Built for ultra-fast processing at extreme scale, Hazelcast's cloud-native in-memory data grid and event stream processing technologies are trusted by leading companies such as JPMorgan Chase, Charter Communications, Ellie Mae, UBS, and National Australia Bank to accelerate business-critical applications. The world's largest e-commerce sites rely on Hazelcast for sub-millisecond response times to support massive volume spikes associated with Black Friday, Cyber Monday, or Singles' Day. Leading banks rely on the Hazelcast Platform to drive their fraud detection to new levels of performance, resulting in millions of dollars in fraud avoidance each year.

Intel® Optane™ DC Persistent Memory

Since many of the payment processing requirements around performance are dependent on in-memory processing, the one big hurdle that emerges is the cost of random-access memory (RAM). In many cases, the investment in more RAM-heavy hardware servers is justifiable, and as RAM prices continue to decrease, the use of in-memory processing becomes more accessible.

Recent innovations make the adoption of in-memory processing even more practical. The Intel Optane DC Persistent Memory technology offers two ways in which in-memory processing can be more cost-effective. The first way is in volatile memory mode, in which Optane chips act as an alternative to RAM, and run at nearly the same speed but at a much lower cost and much higher capacities. This lets businesses more easily justify in-memory technologies and thus take advantage of the performance benefits that in-memory processing offers.

The second way in which Optane supports in-memory technologies is in the persistent mode. In this mode, Optane can be used as a faster alternative to solid state drives (SSDs). For example, Hazelcast provides a hot restart capability in which in-memory data is persisted in non-volatile memory so that if a cluster goes down temporarily (or if an individual node requires offline maintenance), the in-memory contents can be restored quickly by reading data from the hot restart store. If the hot restart data is stored in Optane in persistence mode, recovery of that node can be up to 3.5x faster than using SSDs.

Immediate Insights Spur Action and Innovation

In a shifting payment processing landscape, the right payment processing solution represents a critical global business opportunity. To remain competitive in this dynamic industry, business needs the following core enablers:

- **Speed** at a rate that can only be delivered by in-memory systems
- **Scalability** using cloud-based solutions that allow businesses to scale up and down instantly in response to changing market conditions
- **Stability** with a distributed architecture that protects against downtime and related financial impacts
- **Security** so companies can protect sensitive data from unauthorized users

Regardless of where you are in the payments ecosystem, the speed delivered by an in-memory solution will help you stay ahead of a fast-moving curve. To learn how in-memory processing can help, visit www.hazelcast.com.

LEARN MORE

To understand how Hazelcast can help you improve payment processing, read the following white papers:

- Fraud Detection in Payment Processing
- High Performance Payment Processing and In-Memory Computing
- Advancements in High-Speed, In-Memory Systems

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