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From Transaction to 99.999% Uptime:

How to Build a Fault-Tolerant Payment Platform



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Introduction

Payment gateways are the backbone of modern financial infrastructure. In today's digital economy, even a single failed transaction can mean lost revenue, diminished customer trust, or exposure to regulatory scrutiny.

As global payment flows intensify and user expectations rise, building a platform that guarantees resilience, performance, and real-time scalability is no longer optional — it's strategic.

This white paper explores the design principles and real-world architecture patterns behind payment systems engineered for 99.999% uptime. You'll gain insights into the most common failure points, the high cost of DIY mistakes, and how integrating Akurateco's white-label payment orchestration platform with Cloudflare's robust edge network can help businesses achieve enterprise-grade reliability without the burden of managing complex infrastructure from scratch. These insights come directly from the founder and core management team at Akurateco — professionals with deep, hands-on expertise in building mission-critical fintech infrastructure. With years of experience powering global payment systems, they know exactly what it takes to achieve near-perfect uptime and scalability. This isn't theory — it's real-world knowledge, distilled.

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The Role of Payment Gateways in the Financial Stack

Payment gateways are not merely technical components embedded into websites — they are not just APIs for processing cards — they're critical enablers of omnichannel commerce, financial compliance, and customer satisfaction.

They manage payment authorization, acquirer communication, fraud detection, tokenization, and global regulation adherence — all while minimizing friction.

A stable, performant gateway architecture contributes directly to conversion rates, customer lifetime value, and advertising ROI. Conversely, poor routing logic, downtime, or latency can result in cascading issues: higher card declines, increased support overhead, and brand erosion. In fact, studies show that every additional 100ms in payment latency can reduce conversion rates by up to 2%.

That's why modern gateways, like Akurateco, take a holistic approach to transaction lifecycle management — from smart device detection and adaptive UI to intelligent routing, cascading retries, and real-time fraud prevention.

Akurateco's white-label platform allows you to meet regulatory demands and scale globally, without reinventing the wheel.

Let's talk. Book a free consultation.



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Why Akurateco Stands Out

Akurateco combines over 700 ready-to-use connectors, PCI DSS Level 1 certification, smart routing with cascading, and real-time analytics, enabling businesses to operate seamlessly across markets and verticals.

Unlike monolithic platforms that struggle under load, Akurateco is built with fault isolation and high availability in mind. Its architecture ensures that any component — be it tokenization, 3D Secure checks, or anti-fraud — can scale independently.

Combined with Cloudflare's global CDN and DDoS mitigation, the Akurateco platform ensures low-latency processing, bot protection, and continuous uptime even during high-traffic events.

> **A global eCommerce brand migrating to Akurateco saw its approval rate jump from 83% to 94% within the first quarter, thanks to improved acquirer routing and intelligent cascading. Using Akurateco's API-first architecture and Cloudflare-powered edge protection, they achieved zero downtime during Black Friday while serving 50K+ concurrent transactions.**



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Core Components of a Modern Payment Gateway

The vast majority imagine a payment system to be very simple - something calls our client to the bank, and that's it. But in fact, this is just the tip of the iceberg. Today's payment platform is a multi-level distributed system, where each component plays its own critical role.

Removing or failing even one level can lead to serious consequences: from data leakage and fraud to mass transaction failures and financial losses.

Transaction Processing Engine

This engine handles core transaction workflows — receiving requests, validating parameters, performing 3D Secure checks, forwarding to acquirers, and returning responses. Performance metrics like latency, TPS (transactions per second), and fault tolerance determine gateway efficiency.

Tokenization Vault

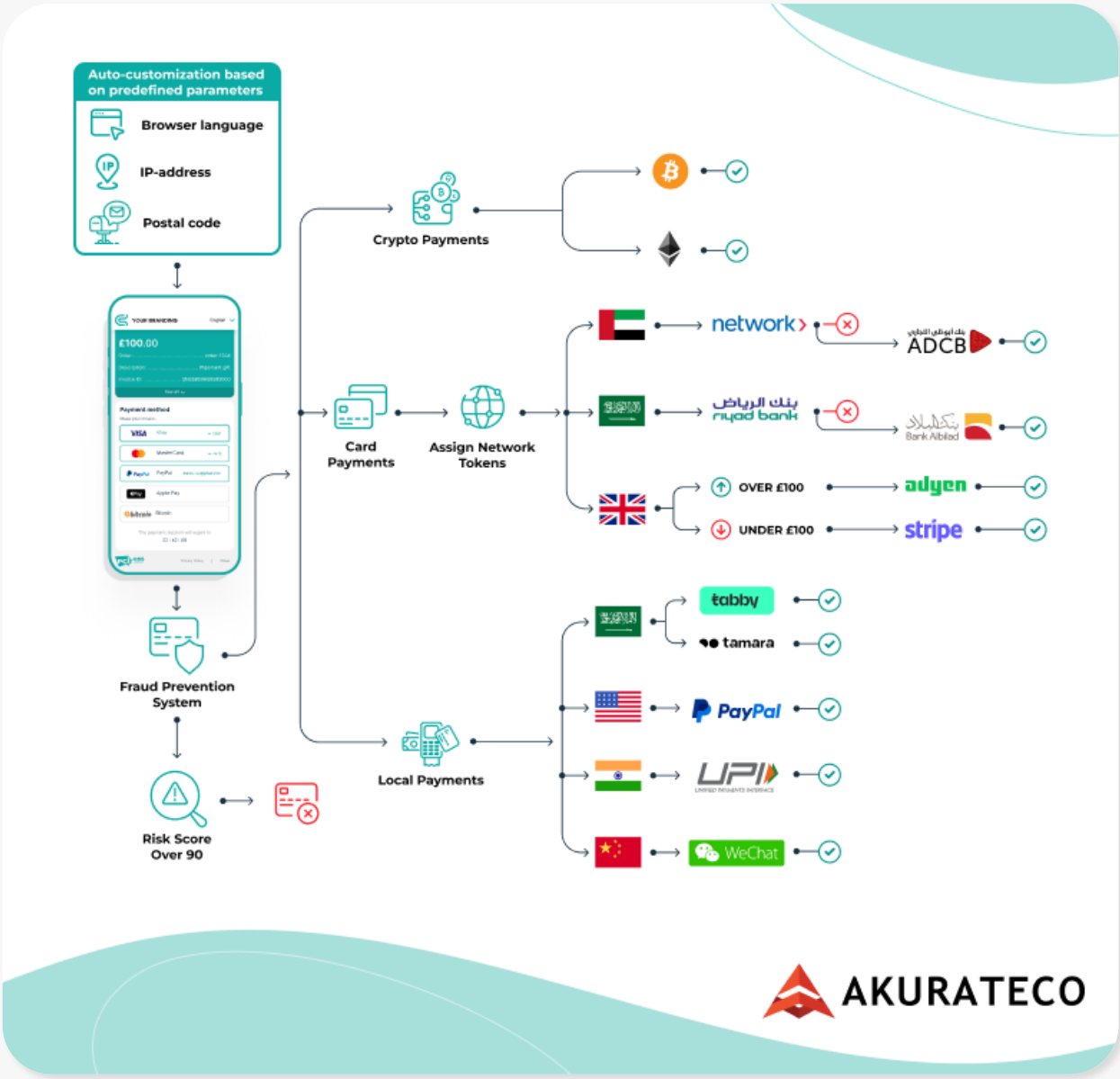
Cardholder data is stored as tokens in a secure vault. Tokenization mitigates the impact of data breaches and ensures PCI DSS scope reduction. This vault must support high availability and fast retrieval to avoid latency in repeat transactions.

Anti-Fraud & Risk Modules

These modules use:

- Machine learning to analyze transaction patterns.
- Blacklists/whitelists.
- Velocity rules.
- Device fingerprinting and geolocation have business value in minimizing chargebacks, reducing financial exposure, and protecting brand integrity.

Routing & Cascading Logic



Akurateco's smart routing engine dynamically chooses acquirers based on card type, cost, geography, and historical success rates. Cascading logic retries failed transactions through alternative routes, significantly boosting approval rates and minimizing drop-offs.

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Architecture Patterns for Fault Tolerance

The architectural design of a payment gateway determines its ability to scale, adapt, and perform under real-world business pressures.

As user expectations grow and transaction volumes spike, especially during sales periods, cross-border expansions, or app virality, rigid or outdated architectures can become bottlenecks.

Choosing the correct architecture pattern is not just a technical decision; it directly influences time-to-market, operational efficiency, system resilience, and regulatory adaptability. Below, we explore the most relevant architectural approaches shaping modern gateway infrastructure.

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Monolithic vs Microservices

In modern software architecture, choosing between a monolithic and microservices approach can significantly impact scalability, flexibility, and maintainability.

Monolithic

Legacy payment systems are often built using monolithic architectures, where all core components — authorization, risk management, reporting, etc. — are tightly coupled and deployed as a single unit. While simpler to manage in early stages, monolithic systems become rigid over time: any update or scaling effort affects the entire system, increasing the risk of downtime and slowing development cycles.

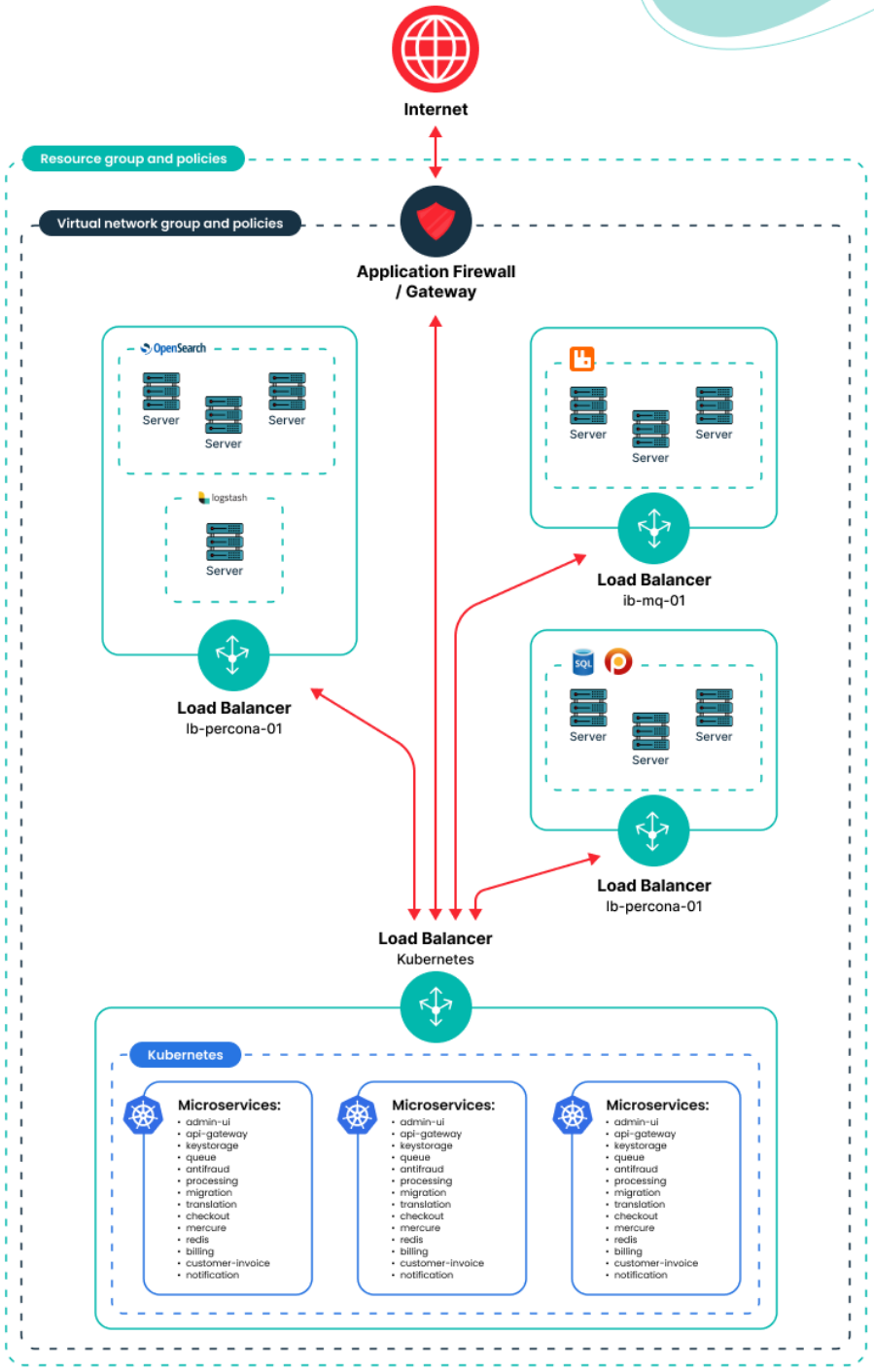
These architectures struggle to meet modern digital commerce's agility and uptime requirements, especially in high-growth or multi-region scenarios.

Microservices (Preferred by Akurateco):

Modern payment gateways are shifting to microservices-based architectures, where each core function, such as payment orchestration, tokenization, risk engine, or analytics, is encapsulated in an independent service. This allows teams to deploy, scale, and maintain services autonomously, improving fault isolation and reducing time-to-market for new features. For instance, the fraud module can be updated without redeploying the payment processor. This modular approach also supports geo-distributed deployments and facilitates compliance in regulated markets.

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Microservices (Preferred by Akurateco):



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API-First Design

As businesses increasingly rely on external integrations and need to support a variety of platforms, API-first design has become crucial for enhancing connectivity and simplifying development.

Akurateco uses an API-first approach, exposing services through secure, well-documented REST and gRPC endpoints with OAuth2 (high-performance API communication points using Google's Remote Procedure Call protocol, secured with the OAuth 2.0 authorization framework for safe, token-based access control). This model accelerates partner integration, supports mobile-first experiences, and reduces development cycles by providing developers with standardized, secure, and easy-to-consume interfaces.

3/3

Real-Time vs Batch Processing

When designing payment systems, it is essential to understand the needs for processing speed and timing. Real-time and batch processing models each have their strengths depending on the application.

Real-time: Used for payment authorization, fraud detection, and transaction routing. These processes require instant feedback to ensure a seamless customer experience and mitigate risks immediately.

Batch: Used for reconciliation, settlements, and reporting. These processes can be handled periodically without immediate responses, making them ideal for backend operations that don't require real-time updates.

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Scalability & High Availability

In the context of modern systems, scalability and high availability are critical to ensuring performance and reliability, especially during periods of high demand or failure. These concepts help ensure the system remains responsive and operational under varying conditions.

Load Balancing & Redundancy

Load balancers distribute traffic across service nodes to prevent overloading individual servers. Active-active clusters and auto-scaling groups guarantee zero downtime during peak loads and software updates. By dynamically adjusting the infrastructure based on traffic, these mechanisms ensure optimal performance even during traffic spikes or failure events.

Geo-distributed Deployments

Deploying services across multiple geographical regions has become common to meet global demand. This approach provides numerous benefits, including lower latency, regulatory compliance, and fault tolerance.

Deploying instances in multiple regions:

Reduces latency: Placing services closer to end users ensures faster response times and enhances the user experience.

Enables jurisdictional compliance: For example, adhering to GDPR data residency requirements ensures that sensitive data remains within designated regions.

Improves fault tolerance: In the event of a regional failure, services can fail over to another region, ensuring continued availability.

Queueing & Failover Strategies

High availability and resilience often rely on how systems handle spikes in demand and recover from failures. Effective queueing and failover mechanisms are crucial to maintaining system reliability during expected and unexpected situations.

Message queues (Kafka, RabbitMQ) absorb load surges and ensure ordered message delivery, which is particularly useful for maintaining consistency in asynchronous processes. Failover strategies (circuit breakers, retries, DR nodes) help guarantee availability, even during partial outages, by rerouting traffic or retrying failed operations, ensuring the system remains functional despite issues.

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Security & Compliance by Design

In today's digital landscape, designing systems with security and compliance in mind is essential. This approach protects data and ensures legal and regulatory requirements are met. Adhering to PCI DSS, GDPR, and PSD2 standards is crucial for maintaining trust and avoiding potential legal risks.

PCI DSS, GDPR, PSD2

Akurateco adheres to all major regulatory frameworks:

- **PCI DSS Level 1:** Guarantees the highest standard of cardholder data protection.
- **GDPR:** Built-in consent and privacy controls.
- **PSD2:** Strong customer authentication (SCA) and secure open banking APIs.

Role-Based Access Control

As systems become more complex, ensuring that only authorized personnel can access sensitive data and perform critical operations becomes even more important. Role-based access Control (RBAC) helps enforce this principle by restricting access based on user roles.

RBAC restricts access to sensitive operations by user role, ensuring that employees or partners can only access what is necessary for their tasks. Logs and audits track and verify access, helping enforce accountability and support regulatory compliance, particularly in industries with strict privacy and data protection regulations.

Tokenization & Encryption

Protecting sensitive data is a fundamental part of building secure systems. Tokenization and encryption are key techniques for ensuring that data is protected during transmission and storage.

- **Encryption:** All sensitive data is encrypted in transit (TLS 1.2+) and at rest (AES-256), ensuring that data is unreadable to unauthorized parties.
- **Tokenization** reduces compliance burdens and isolates cardholder data from application logic. Replacing sensitive data with non-sensitive tokens minimizes the risk of data exposure while maintaining system functionality.

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Integration Models

When building payment solutions, choosing the right integration model is crucial in determining the system's efficiency, scalability, and flexibility. Different models offer distinct benefits and challenges, depending on the business's needs.

Direct Acquirer Integrations

This integration model connects gateways directly to acquirers, bypassing intermediaries and offering a more streamlined, customizable solution.

Benefits:

- Lower transaction fees: Direct integrations help eliminate middlemen, reducing processing costs.
- Complete control over routing: Enables businesses to customize transaction routing based on their specific needs.
- Higher customization: More flexibility in configuring solutions to meet unique requirements.

Drawbacks:

- Higher compliance and certification costs: Direct connections require adherence to stricter compliance standards.
- Increased maintenance: Managing direct integrations can be resource-intensive over time.

By offering direct integration with 200+ acquirers and PSPs, Akurateco removes intermediaries, reducing fees and increasing transparency and control over the transaction flow.

PSP Aggregation Layer

The PSP Aggregation Layer model aggregates multiple Payment Service Providers (PSPs) under a unified interface. This approach particularly benefits businesses aiming for global reach and simplified management.

This model simplifies the complexities of managing multiple payment providers by offering several key advantages:

- **Simplifies global expansion:** A single integration facilitates access to various PSPs and markets.
- **Offers intelligent routing:** Automatically routes transactions to the most efficient or cost-effective provider based on predefined criteria.
- **Reduces time-to-market:** Integrating multiple PSPs at once accelerates product deployment.

- **Mitigates vendor lock-in:** Businesses use multiple providers to reduce dependence on a single vendor.

Merchant & Partner Interfaces

Merchants and partners must effectively interact with the payment system through various user interfaces. These interfaces ensure smooth operations and provide transparency and control. Merchant dashboards offer merchants a central place to manage transactions, monitor activity, and configure fraud rules.

SDKs/APIs:

These tools enable easy integration across server-to-server, web, mobile, and POS platforms, providing developers with the resources to integrate payments seamlessly.

Partner Portals:

These portals offer white-labeled options and controlled access for third-party partners, allowing secure collaboration and interaction with the system.

Would you like to know how we can help your business?

Contact our experts to learn more

Data & Observability

Effective data monitoring and observability are critical for ensuring optimal performance, identifying issues early, and making data-driven decisions in modern systems. This requires the right tools to track, analyze, and respond to performance and security signals.

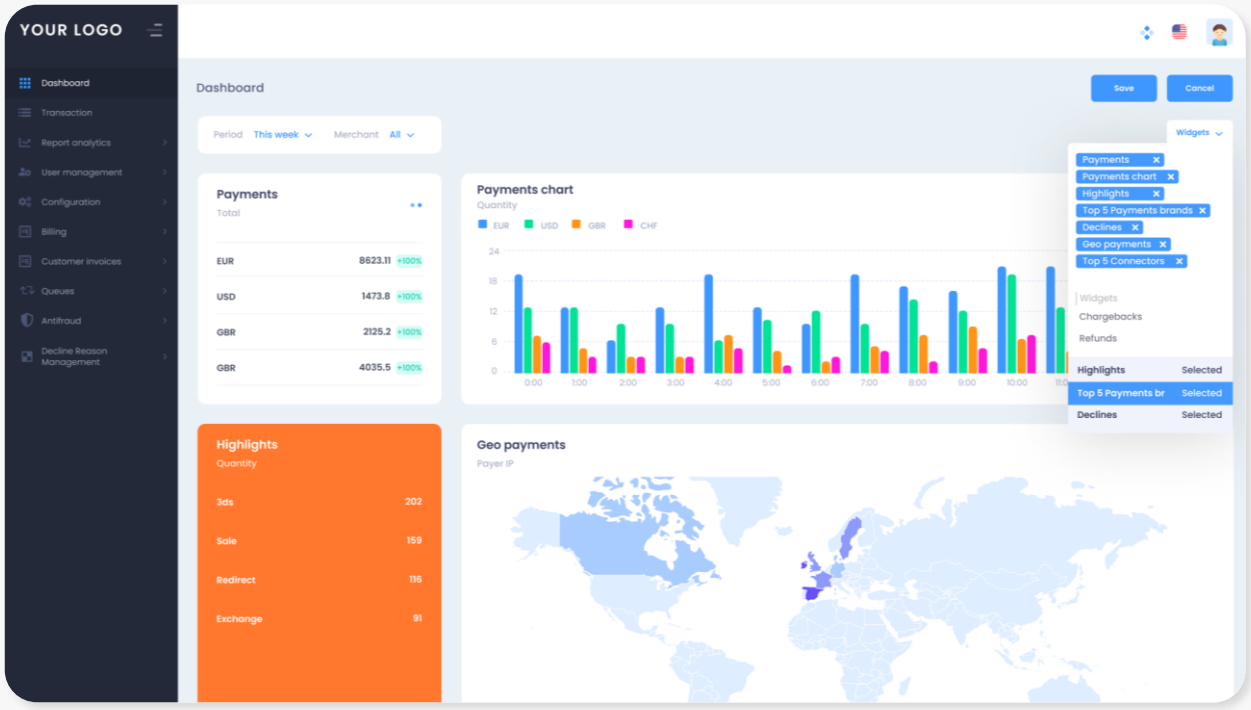
Monitoring & Logging

Centralized logging and monitoring tools provide a comprehensive view into system health and performance, ensuring you can detect and address issues proactively.

- Centralized logging (e.g., ELK stack) aggregates logs from multiple services for easier troubleshooting and error diagnostics.

- Monitoring tools like Prometheus + Grafana track system performance, uptime, and metrics, ensuring visibility into SLAs (Service Level Agreements) and performance over time.

Real-Time Analytics



Real-time analytics are essential for staying on top of key metrics and quickly reacting to trends, threats, or opportunities. Dashboards that help live insights businesses make informed decisions and optimize their operations.

Dashboards offer:

- Transaction volume trends: Visualize transaction activity over time, identifying peaks, valleys, and patterns.
- Conversion rates by region/acquirer: Assess performance across different markets and payment processors to identify areas of improvement.
- Fraud detection accuracy: Measure the effectiveness of fraud detection systems in real-time.
- Authorization success rates: Track how often transactions are successfully authorized, offering insights into potential payment methods or routing issues.

BI Integrations

Business Intelligence (BI) integrations allow you to leverage advanced analytics for deeper insights into your business performance. These integrations offer powerful capabilities for decision-making, forecasting, and understanding customer behavior.

Export capabilities and APIs support:

- Custom reporting: Generate tailored reports for different stakeholders or business units.
- Financial forecasting: Using historical data to predict future revenue and expenses improves planning.
- Customer behavior insights: Analyze customer interactions to identify trends and opportunities.
- Revenue attribution modeling: Attribute sales to specific marketing efforts or channels to understand ROI and optimize campaigns.

Deployment Flexibility

Choosing the right deployment model is crucial for balancing performance, control, scalability, and regulatory compliance. Companies can choose between cloud, on-premises, or hybrid deployment models depending on their business needs and compliance requirements.



Cloud

Pros: Offers elastic scaling, managed services, and faster deployment, making it ideal for companies that need quick scaling and minimal infrastructure management.

Cons: May face regulatory constraints or reliance on a vendor for critical services and uptime.



On-Premises

Pros: Provides complete control over infrastructure and can meet strict data residency requirements, ensuring sensitive data remains within the organization's boundaries.

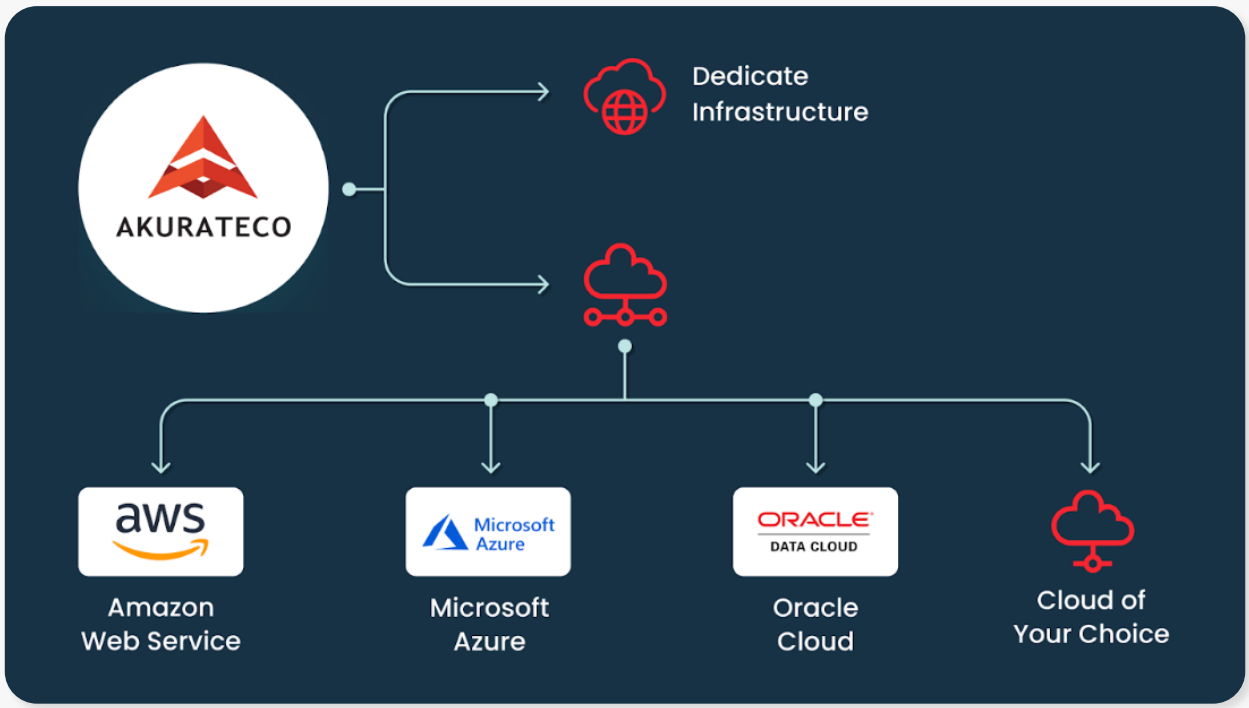
Cons: Slower to scale and may require higher CapEx for infrastructure investments.



Hybrid

It combines the agility of the cloud with the control of on-premises infrastructure. It's ideal for regulated enterprises that must balance performance with compliance requirements.

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Case Study: Scalable Gateway Implementation in Travel Industry

A leading online travel aggregator (OTA) faced challenges managing payments across multiple countries, dealing with fluctuating transaction volumes, and ensuring fast, secure processing during peak booking seasons.

To address these issues, the company deployed a microservices-based payment gateway across 20 countries, enabling better scalability, fault tolerance, and enhanced user experience.

The new architecture was designed to improve transaction performance, reduce latency, and optimize payment costs, supporting rapid international growth and higher customer satisfaction.

Key Results:

9% increase in successful transactions via intelligent routing: By optimizing transaction routing based on regional acquirers, the company saw a significant increase in approval rates, especially during high-demand periods.

30% latency reduction using regional data centers: The payment gateway minimized transaction delays by strategically deploying data centers in key regions, offering customers a faster and more reliable experience.

$2M annual savings from acquirer fee optimization: The company saved significant costs by streamlining acquirer relationships and negotiating better terms, leading to a more cost-effective payment processing strategy.

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> **This transformation enabled rapid market expansion, allowing the OTA to scale seamlessly across borders. Moreover, it improved user trust, especially during peak booking seasons, as customers experienced faster, more reliable payment processing.**

Case Study: Regulatory-Compliant Payment Infrastructure for Financial Institutions

A licensed payment service provider (PSP) in Saudi Arabia must launch a compliant payment gateway under tight regulatory constraints set by the Saudi Arabian Monetary Authority (SAMA).

The company faced strict requirements for local data residency, rapid time-to-market, and enterprise-grade reliability — all without building the infrastructure in-house.

The PSP partnered with Akurateco to deploy a white-label payment orchestration platform on Oracle Cloud Infrastructure with a fully compliant on-premises setup to address these challenges. The architecture allowed them to meet data sovereignty rules, achieve high availability, and avoid the burden of managing custom code or integrations.

Key Results:

2.5-month go-live timeline with zero development costs. By leveraging Akurateco's ready-made infrastructure, the PSP launched a fully functional gateway in under 10 weeks without hiring developers or building core components from scratch.

100% compliance with SAMA data localization regulations. Akurateco's on-premises model ensured that all data remained within Saudi Arabia, enabling seamless alignment with local legal and security requirements.

Reduced operational overhead. With no need to maintain or update infrastructure internally, the institution lowered costs while maintaining full control over configurations, transaction flows, and reporting.

> **This transformation allowed the PSP to enter the market faster, meet stringent regulatory standards, and scale securely — all while focusing resources on business development, not tech maintenance.**

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Build vs. Buy: Considerations for Financial Institutions

When designing a payment gateway strategy, financial institutions must weigh the trade-offs between building a custom solution in-house or partnering with a third-party provider. The right choice depends on organizational priorities, market dynamics, and long-term goals.

	Akurateco	In-house
Time to market (MVP)	Immediate	1 year with 16 full-time engineers
Capital expenditure (MVP)	Minimal	$1.2m
Operating costs (3 years)	$400K	$2.4m
Operating costs (3 years)	$400K	$3.6m



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Build

Opting to build a gateway from scratch gives institutions full control over system design, technology stack, and roadmap.

Pros: Enables total customization, intellectual property (IP) ownership, and strategic differentiation, allowing institutions to tailor the solution to unique business models or innovation roadmaps.

The cons are that it involves high upfront investment, longer development cycles, and ongoing compliance and certification burdens, which can slow go-to-market speed and stretch internal resources.

Buy/Partner

Leveraging third-party platforms or technology partners can accelerate launch timelines while offering built-in reliability and regulatory alignment.

Pros: Delivers faster time-to-market, reduced architectural complexity, and pre-certified compliance frameworks, allowing businesses to focus on core value propositions.

Cons: It may introduce limited customization options and increase the risk of vendor lock-in, especially if the provider tightly controls APIs and roadmaps.

Decision factors should include an institution's technical capabilities, budget limitations, regulatory exposure, and urgency to scale or expand globally. There's no universal answer — only a context-driven choice that aligns architecture with business vision.

At Akurateco, we offer a white-label payment orchestration platform designed for rapid deployment, with zero development costs on your side. Our clients go live in weeks, not months, and gain instant access to 200+ integrations, smart routing, cascading, and real-time analytics — all under their brand.

Ready to launch fast and scale smart?
Let's orchestrate your payments, your way.

Talk to our team

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Conclusion & Recommendations

As payments evolve from a back-office function into a core revenue and customer experience driver, modern payment gateways must be designed as resilient, extensible, and globally aware platforms.

To remain competitive, financial institutions must adopt modular, API-first, and cloud-native architectures that support ongoing innovation and adaptability. By default, solutions should embed compliance capabilities across jurisdictions and enable rapid expansion into new markets through geo-distributed deployments and intelligent routing.

Building a truly fault-tolerant payment system isn't just about tech stacks — it's about strategic design, modular scalability, global infrastructure, and intelligent orchestration. With Akurateco's PCI DSS-certified platform, smart routing with cascading, and seamless integration with Cloudflare's global edge network, businesses can confidently scale payment infrastructure with 99.999% availability and enterprise-grade security.

Whether you're an enterprise scaling across borders or a fast-growing fintech startup, the right platform turns your payment operations from a bottleneck into a competitive edge.

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It’s time to optimize your payment gateway strategy

Whether you choose to build or partner, ensure that your solution can scale, adapt to new market demands, and meet compliance requirements.

Contact us today to explore how you can leverage our ready-made, enterprise-grade payment infrastructure — available as SaaS, on-premises, or cloud — to accelerate your growth without the overhead of building from scratch.


wp@akurateco.com


+31 618444038




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