

BUILDING TRADING SYSTEMS FOR CRYPTO EXCHANGES

For Resilience & Scalability



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Introduction

Despite facing downturns in 2022 and 2023, the crypto market is seeing a resurgence in 2024, with growing interest from institutional investors, stricter regulation (such as MiCA) from global financial centers, and the SEC approval of spot bitcoin ETPs. As a result, Bitcoin surged to record highs in March 2024.

This surge reflects renewed confidence and interest in the cryptocurrency market, attracting attention from retail investors worldwide. Crypto exchanges operate in an environment that demands resilient and scalable systems.

Building resilient and scalable trading systems

This guide delves into the essential components for developing trading systems that can scale and withstand unforeseen disruptions while accommodating increasing transaction volumes. We'll examine the role of the RAFT protocol in ensuring consistency and fault tolerance. Plus, we'll explore automatic failover mechanisms and practices that maintain data integrity. Combining a solid architecture with rigorous testing is an effective method to mitigate risks.

THIS EBOOK WILL EXPLORE:

- The foundations of a robust trading system.
- How to combine modern architecture with rigorous testing.
- How event-driven architecture enables scalability and flexibility.
- Migrating from legacy systems and future-proofing your platform.



The foundations of a resilient trading system

Bitcoin continuing to break barriers and reach new milestones illustrates why during such market conditions only bullet-proof trading systems remain resilient and functional, serving the clients no matter what. Getting the technical foundations right is key to building fault-tolerant systems.

The three core pillars:

PILLAR 1

The RAFT protocol: ensuring data integrity and reliability

The RAFT protocol maintains a unanimous agreement on data truth across the system's components—crucial in environments where discrepancies can lead to significant financial implications.

At Devexperts, we leverage RAFT for running multiple matching engines, thereby replicating a single state of business data across all engines. This replication is achieved by reaching a consensus on the order and content of inbound messages processed, ensuring continuity even if one of the matching engines is down.

PILLAR 2

Automatic failover: A safety net for system failures

A resilient trading system's infrastructure should also include an automatic failover mechanism.

This setup is designed to automatically detect system failures, seamlessly switching operations to a standby system, ensuring zero downtime.

Devexperts uses a dual strategy to ensure high availability: the automatic failover, allowing the system to remain operational even if one application fails, and the implementation of the RAFT protocol. Running both strategies in parallel ensures that the trading platform is always available, which is key in the 24/7 crypto market landscape, where downtime equals missed opportunities and diminished trust.

PILLAR 3

The role of diligent testing in mitigating risks

Diligent testing, encompassing unit tests, integration tests, and stress tests, is essential to identify and rectify vulnerabilities before they impact the system's operation. In the context of crypto exchanges, where the volume of transactions is high and especially unpredictable, testing becomes a critical activity to ensure the system's resilience and reliability.

Through automated testing strategies, platforms can run thousands of tests to simulate various operational and market conditions. This level of testing ensures that the system can handle routine operations and extreme scenarios, such as market spikes or cyber-attacks, without faltering.

Key takeaway *Building a resilient and scalable trading system for crypto exchanges is based on several technical components: the RAFT protocol and automatic failover mechanisms provide the foundational support for maintaining system availability, while diligent testing ensures that potential risks are identified and mitigated.*



Event-driven architecture: Enabling scalability and flexibility

What is event-driven architecture?

At its core, an event-driven architecture (EDA) is built around the production, detection, and reaction to events. An event is any significant change in state, such as a new trade order or a price update.

This setup allows for loose coupling between components, boosting scalability by facilitating asynchronous event processing—a must-have for crypto exchanges where milliseconds matter.

For crypto exchanges, the adoption of EDA means transactions can be processed in near real-time, improving the user experience by providing pinpoint accuracy.

Another nuance to this architecture is that it allows for better scalability, as components can be scaled independently to meet demand. Whether it's a surge in trade orders or a flood of new users, an event-driven system can adjust dynamically, ensuring consistent performance.

Implementing quality control through automated testing

As we've touched on already, a key part of event-driven architecture relies on the right quality control and testing. The benefit of this method is that it also shifts the QA engineers' role towards enhancing test coverage and refining testing processes, rather than performing manual tests. This is crucial for exchanges that must rapidly integrate a wide array of cryptocurrencies and trading tools. Applying custom validation rules to events ensures the integrity and reliability of processed data, reinforcing the system's overall robustness.

Scalability through horizontal expansion

In volatile crypto markets with fluctuating trading volumes, horizontal scaling architectures are also crucial for resilient and scalable trading systems. It allows for linear expansion by seamlessly integrating additional computational resources as independent matching engine segments. So as demand surges, new segments can be quickly added, ensuring consistent high throughput and low latency performance. This decouples system capabilities from single hardware constraints through intelligent load distribution across multiple segments. Horizontal scaling also provides a flexible, cost-effective growth path. Exchanges can incrementally provision more resources instead of costly overhauls, optimizing capital spending.

Key takeaway *Event-driven architecture stands as a fundamental component for crafting scalable and adaptable trading systems. By enabling asynchronous event processing, EDA caters to high-volume transactions and scalability demands, ensuring real-time data flow. As trading platforms evolve, the adoption of EDA, paired with advanced automated testing techniques, will be crucial for delivering a dependable, high-performance trading experience.*



5 strategies for effective architecture

Microservices architecture

1

means the trading system is segmented into smaller, independently deployable services. This design enhances resilience, as it localizes failures, preventing them from cascading through the system.

Load balancing and redundancy

2

The key to achieving continuous availability is implementing load balancing, which evenly distributes incoming traffic across several servers. This strategy, coupled with built-in redundancy across the system's layers, ensures operations can continue smoothly in the face of individual component failures.

Automated testing

3

Extensive automated testing ensures every aspect of the trading system, from the front-end to the back-end processes, operates flawlessly under various conditions. At Devexperts for instance, we run over 20,000 automated tests to vet every change.

Manual testing and real-world validation

4

It's important to back up automated testing with manual testing to validate the practical resilience of deployed systems. This step is critical for confirming theoretical resilience measures like the RAFT protocol truly enhance system reliability in real-world scenarios.

Continuous Integration (CI)

5

This process should begin with peer code reviews conducted by developers and QA engineers. Following this, changes need to undergo automatic integration tests to confirm compatibility and performance within the test environment. This comprehensive CI process includes several steps, from feature freezes and QA team testing phases (covering sanity checks, regression tests, and more) to version stabilization and final release, ensuring that each update enhances system resilience without introducing new vulnerabilities.

In summary

Building resilient trading systems for crypto exchanges works better with architectural strategies and well-established testing processes. By leveraging modular microservices, ensuring system redundancy, and conducting thorough testing—both automated and manual—platforms can withstand industry challenges.



Scalability in action: An Indonesian exchange's journey

To illustrate the previous steps, let's now look at a real-world implementation. Devexperts transforms architectural principles into tangible solutions that drive success for our clients. One such example is our collaboration with a [leading Indonesian crypto exchange](#), where our scalable exchange solution, [DXmatch](#), played a pivotal role in enabling their growth ambitions.

About the client

The client is one of the first and largest crypto exchanges in Indonesia, facilitating the buying and selling of crypto assets. Founded in 2014, their mission is to make crypto markets accessible to everyone. Currently, their platform enables over 5 million traders to engage in the trading of various crypto assets such as Bitcoin, Ethereum, Ripple, and more.

The business challenge

As the exchange's popularity soared, so did the demands on their trading infrastructure. The client recognized the need to substantially enhance their platform's throughput to accommodate their desired trading volume expansion. Specifically, the system needed to efficiently process a peak load of 10,000+ orders per second – a feat their existing software was incapable of handling.

The Devexperts solution

In their search for a scalable solution, the client discovered DXmatch, Devexperts' advanced software designed to address high-throughput and low-latency challenges. DXmatch boasts a comprehensive set of features, including a matching engine, reliable market data delivery, storage capabilities, risk controls, and WebSocket and REST APIs. Crucially, DXmatch's system design allows for horizontal scaling, linearly adding computational power with each new matching segment. To meet the client's needs, the Devexperts team:

- Deployed the DXmatch software within the client's infrastructure.
- Trained the client's personnel on effective system operation.
- Provided consulting during the integration process.

Notably, DXmatch required no customization, seamlessly integrating with the client's ecosystem and immediately fulfilling its intended purpose.

Results and looking ahead

Through close collaboration, the Devexperts team delivered a scalable and flexible solution within a few months, meeting all project goals, including desired performance, reliability, and security characteristics. This move solidified the client's position providing a strong technological foundation for continued customer base expansion. As Sergey Samushin, Head of Delivery Unit at Devexperts, noted, "It's fantastic to see how the client is using the vanilla product, without any customization, along with the documentation on how to operate the system, to achieve their goal of ultra-low latency and high burstable throughput on GCP."



Migration to modernity: From legacy to leading-edge

A move from legacy systems to modern, scalable platforms enhances efficiency, security, and adaptability.

Let's take a look at key considerations for a smooth transition.

3 considerations for effective migration:

Maintaining API continuity

1

Maintaining continuity for market participants by preserving existing APIs is achieved by wrapping new system APIs and adapting them to legacy ones, thereby avoiding a complete overhaul that could disrupt internal and external operations. This approach allows for a smoother transition, allowing for changes without imposing them abruptly.

Phased approach

2

Embracing a phased transition from legacy to modern systems minimizes operational disruptions and enables continuous refinement. This allows for the gradual introduction of new functionalities, ensuring system integrity and user adaptability throughout the migration process.

Data integrity and continuity

3

Paramount to the migration is the preservation of data integrity and continuity. Meticulous planning for data transfer, coupled with validation checks, ensures consistency and the seamless handling of real-time data flows, preventing loss or corruption.

Migrating to modern trading platforms, while complex, offers significant benefits in terms of performance, scalability, and agility for crypto exchanges. With phased implementation and a focus on maintaining API continuity, exchanges can overcome migration challenges.



Building for the future: Scalability and beyond

As the digital currency markets continue their rapid evolution, the adaptability of trading systems, particularly for crypto exchanges, is a priority.

Key elements for future-proofing trading systems

Devexperts uses a multifaceted approach to ensure trading systems remain at the forefront of technology and business needs—both today and in the future.

Plugin system for customization

At Devexperts, we support plugin systems. This enables customization of the system behavior to meet specific business requirements. When the product is not a 100% fit for a client, there's always an opportunity to customize a set of entity fields, system responses, or anything else without starting an expensive and long-term custom development project.

Industry standard integration protocols

The use of industry-standard protocols, such as FIX, allows for smoother interactions with the system for external market participants and custom services, enhancing interoperability and ease of integration.

Continuous product improvement

Continuous enhancement through new features, performance improvements, bug fixes, and security updates keeps Devexperts' products at the forefront of service provision.

Architectural design and market analysis

Devexperts dedicates significant effort to the architectural design of each feature, incorporating analysis of other exchanges' APIs and functionalities. This precise approach leads to the development of best-of-breed solutions that not only meet current market needs but are also poised to adapt to future trends and technologies.

Did you know?

With three stable releases annually, we ensure support for the latest operating systems and hardware, maintaining technological relevance.

Build a resilient and scalable exchange with Devexperts

At Devexperts, we focus on customization to tailor the software to clients' unique business needs, flexibility with integrations to market participants, and numerous testing.

While obstacles will inevitably arise, our future-focused architectural approach and commitment to excellence mean crypto exchanges can depend on Devexperts' trading platforms to thrive.

If this sounds interesting, we invite you to contact us for a demo of Devexperts' exchange solution.

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