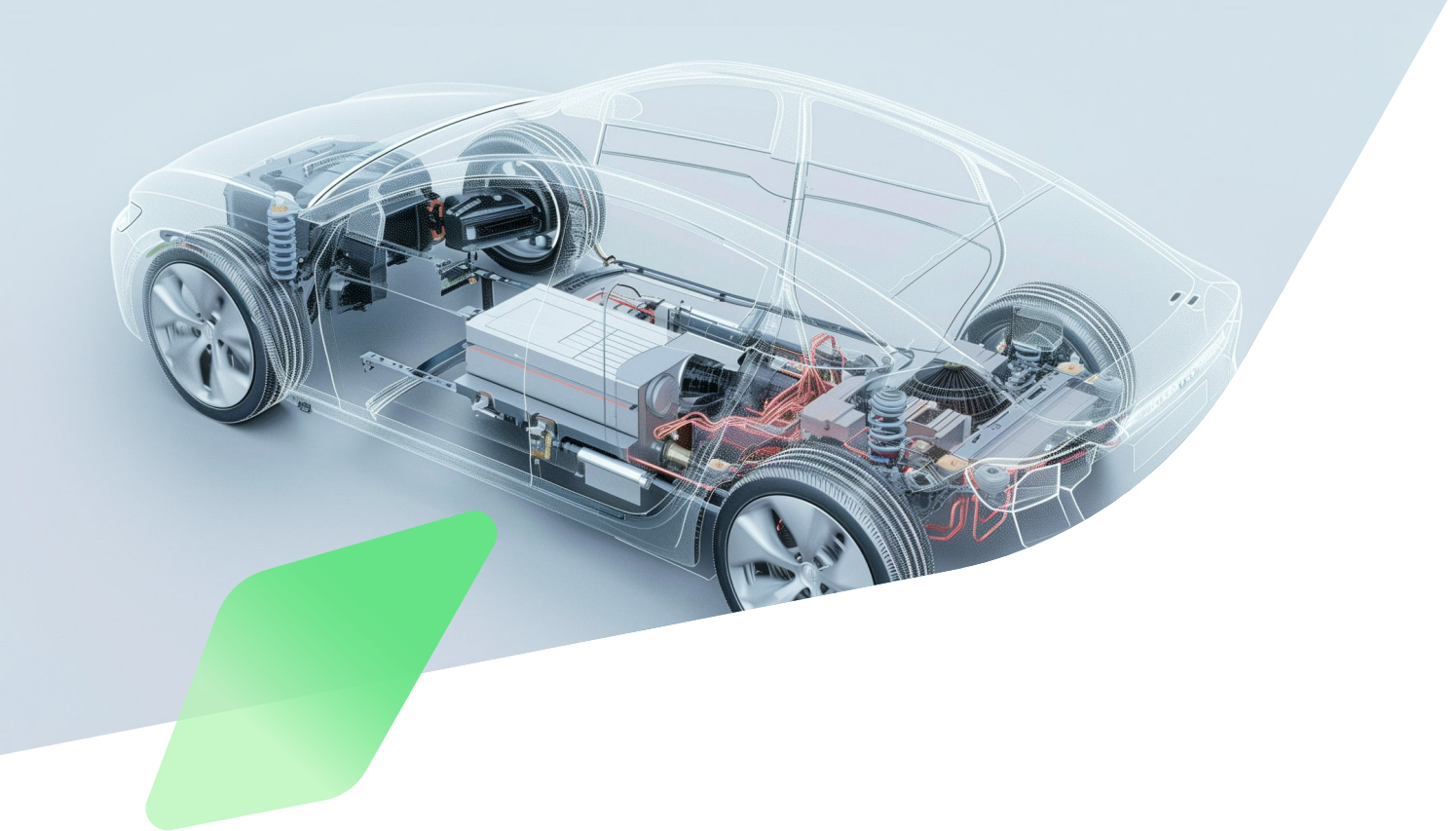

VIRTUSLAB

Success story

Modernizing a car configurator engine: driving efficiency and scalability

A global leader in the automotive industry faced the challenge of ensuring consistent and efficient vehicle configuration across its brands. The complexity of managing car configurations—from transmission types to navigation systems—across different data sources and markets necessitated a more unified approach.

This led to the development of a centralized, real-time buildability check for all vehicles within its organization. The manufacturer sought a technology partner with deep expertise in building and maintaining scalable and reliable systems in Scala to expand this solution.

They partnered with VirtusLab to modernize and enhance the performance of its car configurator engine. Together, they drastically improved the technical excellence of the implemented solution by addressing key non-functional requirements.

The Challenge

The automotive giant's mission to provide highly individualized vehicle configurations for its customers presented several key challenges.

- **Buildability Consistency:** With a wide range of vehicle options available to customers, from engine types to add-ons, ensuring that selected configurations were technically feasible and producible became increasingly difficult.
- **Scalability:** The legacy system struggled to support the company's growing need to process configuration data for multiple brands and markets simultaneously. They needed a solution to unify this data across 40 system interfaces and ensure consistent production planning.
- **Error-Prone Manual Processes:** Manual checks for production consistency led to errors and lacked a streamlined way to verify that customer-selected configurations matched production capabilities.
- **Cost and Maintenance:** The old system was not only slow and prone to errors but was also becoming increasingly expensive to maintain, year after year.

The automotive group needed a solution that could process vast amounts of configuration data, ensure scalability, and integrate seamlessly into critical business functions such as order management and production planning. They built an initial solution using an agile, "move fast and break things" approach, achieving widespread success across multiple departments.

However, maintaining technical excellence became increasingly challenging as new features expanded rapidly and business requirements evolved. This resulted in several issues:

- **Manual, Error-Prone Client Integration:** Client onboarding was lengthy and unreliable, requiring a new software version deployment for each change.
- **Performance Inconsistencies:** The solution showed instability under different workflows and load conditions.
- **Technical Debt:** Key system elements lacked robustness and required improvements and refactoring.
    - Binary client-server communication,
    - UI out of sync with corporation standards,
    - A deployment process causing downtime,
    - An inefficient code architecture,
    - Minimal, often obsolete documentation for external interfaces, lacking automated updates.

The solution

The automotive company partnered with VirtusLab to utilize its specialized software engineering expertise, especially in Scala-based solutions, to achieve comprehensive system improvements. They modernized a consistency rule engine that forms the backbone of their car configurator system.

VirtusLab's tailored improvement was designed to optimize the engine's performance, scalability, and quality while ensuring it could handle the complexity of vehicle configurations across multiple markets.

- **Versatile Client Integration:** The solution enables easy integration of any team or app through simple configuration adjustments, removing the need for code modifications or new version deployments.
- **Built-in Configuration Safety:** VirtusLab implemented comprehensive safety measures to ensure API reliability and foundational logic accuracy, which requires technical excellence on a high level.
- **Quality Focus:** As the engine is a business-critical application, VirtusLab prioritized software quality through extensive code refactoring, addressing technical debt, and conducting thorough integration and performance tests. These measures help prevent disruptions to production or sales operations.
- **System Performance and Scalability:** VirtusLab identified and resolved multiple performance bottlenecks within critical system components. They also implemented a high-performance global caching layer using Redis, significantly improving efficiency compared to the previous file-based, node-local cache.
- **System Robustness:** VirtusLab contributed to a more robust and efficient solution, enhancing overall system effectiveness through multiple key initiatives.
    - **Eliminating Deployment Downtime:** Rewriting the entire orchestration process for new system version delivery, effectively eliminating deployment downtime.
    - **Migration to Scala 3:** Upgrading the giant's technology stack to Scala 3, leveraging advanced features, and improving overall code efficiency and safety through, for example, custom compiler plugins. Scala's flexibility also improved system maintainability, facilitating future expansions.
    - **Enhanced Server-Client Communication:** VirtusLab optimized server-client interactions to ensure smoother and more reliable data exchanges.
    - **Autogenerated Documentation:** Adding autogenerated documentation for all external interfaces.
    - **UI Refresh and Reorganization:** Executing a comprehensive UI update aligned with the automotive giant's internal guidelines and improving the user experience by analyzing and enhancing various functionalities across the whole application.

The results

The upgraded engine significantly improved the automotive group's operations. The group has successfully transformed the engine into a central, business-critical application that optimizes configuration, production, and cost efficiency across its entire vehicle lineup.

VirtusLab's work enabled the solution to mature, stabilize, and effectively adapt to the system's rapidly evolving development needs.

1. **Seamless Integrations:** With an enhanced configuration mechanism, new integrations can be added within minutes instead of hours, ensuring accuracy and accompanied by comprehensive, out-of-the-box documentation. To date, over 40 system interfaces have been successfully integrated into this centralized solution.

2. **Enhanced Stability:** Extensive performance optimizations, architectural adjustments, and an improved deployment process – with deployment downtime elimination – have elevated system stability to meet the company's highest standards.

3. **Increased Maintainability:** The enhanced system combines flexibility with built-in validation mechanisms, supporting agile development and enabling the team to adapt swiftly to new requirements or market changes without disrupting operations.istent sbt servers, resulting in higher productivity and satisfaction.

The tech stack

- **Programming languages:** Scala, Java
- **Libraries:** Pekko, Avro
- **Infrastructure:** redis, IBM DB2, IBM MQ, docker, amazon S3, amazon EC2

About VirtusLab

At VirtusLab, we aim to lead in software technology, working consistently to enhance efficiency. Our profound commitment to research and development and a dedicated focus on emerging trends and inspirations fuels an innovative culture. This ethos precisely guides advancing our cutting-edge solutions, inviting collaboration to expand the boundaries of software technology collectively. We welcome you to be a part of this transformative journey.

Let’s connect

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