



EBOOK

# Upshift Automotive Development to Overtake the Competition

**Your Guide to Accelerating Without Compromise**

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# Shifts in the Automotive Development Landscape

The automotive industry is undergoing a profound transformation. Software now drives innovation, reshaping everything from design and testing to ongoing enhancements after the vehicle leaves the lot. Effective, secure collaboration across hardware and software teams - often distributed across the globe - is now a necessity. Teams must integrate across disciplines, embracing new tools, technologies, and workflows for virtual prototyping, visualization and simulation, over-the-air (OTA) updates, and next-gen testing to outpace the competition.

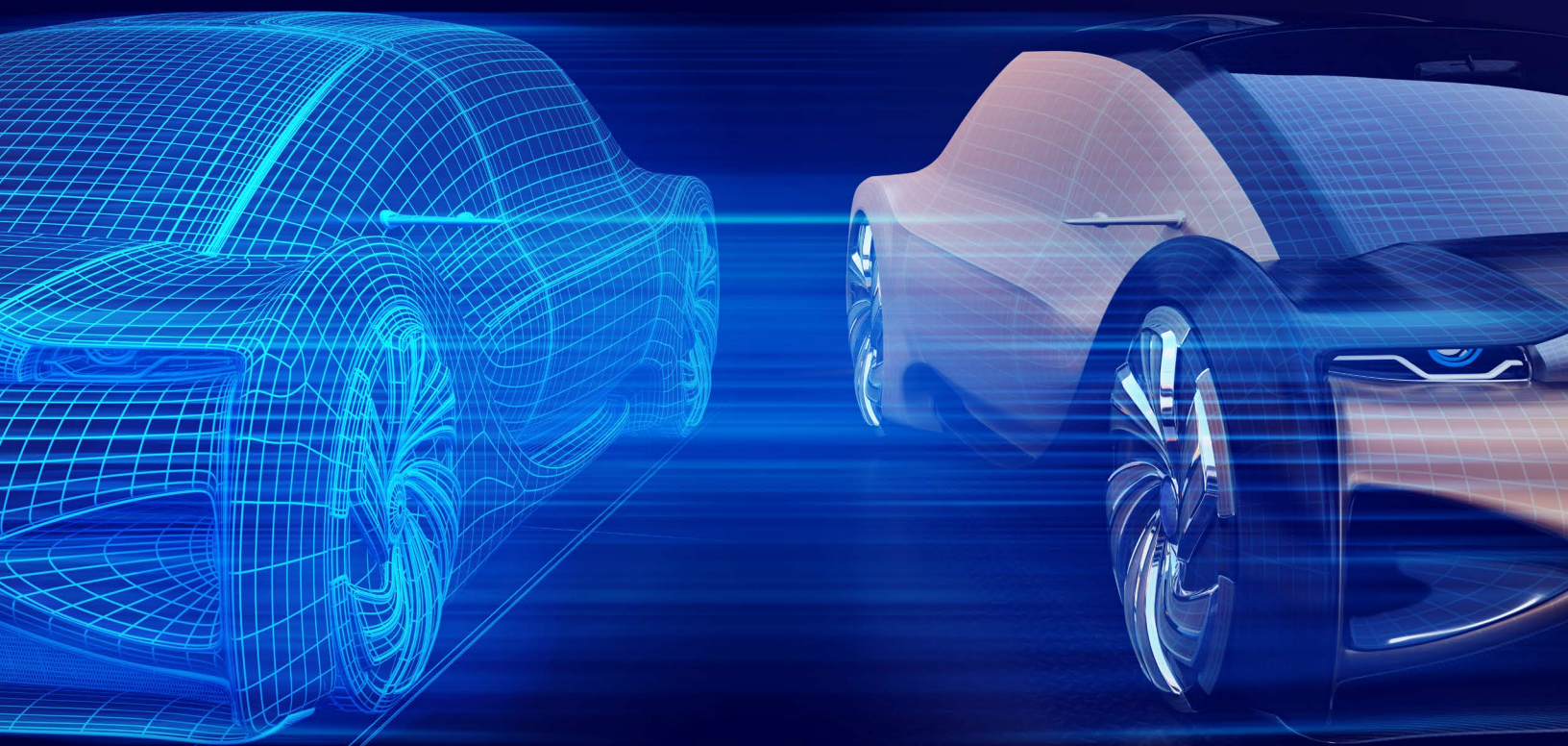
At the same time, safety and reliability remain paramount. Automotive OEMs and suppliers thus face a daunting challenge: to remain competitive, they must accelerate delivery of increasingly complex, connected, intelligent vehicles - without compromising quality, safety, and security.

The latest Perforce [State of Automotive Software Development Report](#) confirms this reality. When asked about the main challenges they're facing today, the majority of respondents highlighted the need to maintain competitiveness (57%). Many are also struggling to modernize their tech stack (30%) and find ways to ease compliance (26%).

When asked about their single biggest development concern, responses were equally split between quality (29%) and safety (29%), with security (23%) close behind. While only 8% noted team productivity as their *primary* concern, it is worth noting that 46% consider maximizing existing resources to be a challenge. Improving productivity is essential to squeezing more out of existing resources.

The need to maximize existing resources also speaks to the large investments OEMs and suppliers have made in technologies like digital twins, CI/CD tools, and AI and machine learning (ML). These technologies are essential to accelerating design and testing through visualization and simulation, improving development agility, and advancing vehicle intelligence.

Maximizing investments in these advanced technologies is also tied to the above-mentioned challenges of modernizing tech stacks. Without a modern, scalable, high performance data management foundation that can integrate with the rest of their toolchain, companies cannot fully leverage these transformative technologies.



# 3 Key Automotive Trends and Their Impact on Development

Let's take a look at some of the main trends driving the transformation of automotive development, and how they're demanding new ways of working and the adoption of new tools and workflows.

## The SDV and OTA Transformation

The shift to software-defined vehicles (SDVs) is fundamentally changing how automotive development teams operate, transforming both OEMs and suppliers into software-centric organizations. Vehicles now contain massive amounts of code, spanning safety, infotainment, and connectivity systems. Adding over-the-air (OTA) updates to the mix requires development teams to deliver modular, scalable software platforms designed for continuous evolution and long-term maintainability.

This transformation is driving teams to adopt agile development methods as well as DevOps workflows from the tech industry, including CI/CD pipelines and automated testing, to increase agility and accelerate development. Unlike the tech industry, this agility and speed must be balanced with the rigorous safety and regulatory compliance required for automotive development. Every update must be secure, traceable, and validated against real-time performance requirements.

## The Evolution of HMI / IVI Systems

Advancements in human-machine interface (HMI) and in-vehicle infotainment (IVI) systems are creating more immersive, personalized, and connected in-cabin experiences, from AR-enhanced heads-up displays to AI-driven personalization. HMI and IVI systems often intersect with vehicle safety, such as integration with safety-critical features like ADAS and vehicle monitoring.

Developing these systems requires teams to balance consumer-tech expectations with stringent functional safety and reliability standards. This requires close collaboration between UX/UI designers, embedded software engineers, and system integrators, as well as comprehensive traceability to ensure compliance.

## The Rise of Digital Twins & Visualization

Automotive companies are leveraging digital twin technology across the design and development pipeline, from prototyping, visualization, and simulation, to enhancing the customer experience. By pairing digital twins with the powerful rendering capabilities and advanced physics engines found in game engines (also referred to as 3D engines) like Unreal Engine and Unity, teams can run complex testing scenarios without costly prototypes and time-consuming live runs, accelerating product validation.

To fully leverage the power of digital twins, teams need to invest in game engine technology and establish a robust, integrated pipeline to get the most out of their investment. A scalable data management platform is key, as building and working with digital twins requires large amounts of data and massive files that must be carefully managed and versioned to ensure the accuracy of the digital twin and keep up with rapid iteration.

*Watch the On-Demand Webinar: [Leveraging Game Engines for Design, Development, and Manufacturing](#)*

# 5 Smart Steps Successful Teams are Taking

## 1. Building Integrated Toolchains & Pipelines

Top-performing teams are leveraging connected toolchains to break down silos. By integrating CAD models, simulation platforms, and software repositories, engineers can seamlessly iterate on designs while ensuring alignment between design, mechanical, electrical, and digital domains. This holistic view accelerates decision-making and reduces costly late-stage design conflicts.

In addition, successful organizations are adopting DevOps practices. Adapted to the automotive context, CI/CD pipelines now include embedded software, ECU firmware, and safety-critical validation. Instead of waiting weeks for integration, developers can push incremental updates through automated builds, hardware-in-the-loop testing, and compliance checks.

## 2. Adopting Model-Based Systems Engineering (MBSE)

By integrating system design, simulation, and verification in a unified workflow, MBSE ensures that requirements traceability, functional safety analysis, and design validation happen in parallel. Instead of relying on disconnected tools (or spreadsheets and documents), teams use models to drive decisions. This allows engineers to test scenarios early, manage complexity across vehicle domains, and continuously validate against evolving requirements.

## 3. Structuring Teams for Success

Organizational structure is just as important as implementing the right tools and workflows. Leaders are increasingly structuring cross-functional teams to allow hardware and software engineers to collaborate in parallel rather than sequential silos. This approach shortens iteration cycles and improves system-level thinking.

High-performing teams also establish clear roles around data stewardship and systems integration. By designating experts to manage data pipelines, compliance records, and integration testing, organizations prevent gaps that could otherwise lead to safety risks or regulatory setbacks.

## 4. Leveraging Digital Twins Effectively

Successful teams synchronize digital twins with real-world data from test fleets and connected vehicles. This continuous feedback loop allows engineers to identify performance issues earlier, optimize designs, and even predict maintenance needs. From using digital twins to refine aerodynamics before physical prototyping, to applying predictive analytics to improve performance, successful teams are leveraging their digital twin investment to reduce costs, improve safety, and accelerate innovation.

## 5. Establishing a Future-Proof Foundation for Innovation

The most innovative teams aren't wasting time fighting with outdated legacy systems or insufficient tools that can't meet the demands of modern development. Time spent figuring out workarounds, waiting for the files they need, hunting down support or proper documentation, or otherwise wrestling with tools that aren't up for the job is time taken away from innovation.

Forward-thinking leaders set their teams up for success with enterprise-grade tools that are purpose-built to support large teams and complex projects as well as advanced, integrated development workflows. They select future-proof tools that not only meet the scalability, security, and integration requirements of today, but are also continuously enhanced and updated to meet the needs of tomorrow. Finally, they make sure the solutions they implement are backed by world-class support and comprehensive documentation to ensure they get the most out of their investment.

## The Importance of Data Management

Unified, integrated, and traceable data management is key to meeting automotive design and production deadlines and accelerating innovation. Build your success on a foundation of secure data management that scales with your operations.

### Unified Data Management Accelerates Success

Modern automobiles require tens to hundreds of thousands of design files and run on over [100 million lines of code](#). Without a unified approach to data management, a minor software change can have significant implications for hardware performance and vice versa. Disjointed, siloed data puts you at risk for costly errors, safety issues, and security vulnerabilities.

Unified data management allows development teams to:

- **Manage component versions, variants, and configurations** in a single, coherent workflow throughout the entire product lifecycle.
- **Enable cross-functional collaboration** across distributed teams without overwriting or losing critical work, even when working with massive files and large, complex codebases.
- **Ensure compliance** through built-in traceability, including meeting functional safety standards like [ISO 26262](#).

## Why Legacy Data Management Systems Lag Behind

While many organizations still rely on legacy version control systems like Subversion (SVN) and ClearCase, these tools were not designed for the demands of today's automotive development cycles. They haven't scaled adequately and struggle with large file sizes and increased codebase complexity. Additionally, their cumbersome branching and merging capabilities make collaboration and parallel development slow and prone to error.

**Further Reading:** [Supercharge Embedded Development](#)

## The Limitations of Git

Git is a proven solution for small, fast-moving teams but it quickly buckles on the test track when gigabytes of binary files, code repositories, and visualization assets are in the trunk. In fact, Git [limits the size of files](#) and repositories. It also lacks built-in compliance standards, making it harder to meet strict functional safety requirements.

Automotive teams working with dispersed design files, digital twins, and crucial simulation data need a robust, scalable data management solution that supports complex workflows without degrading under repeated iterations or becoming lost in individual siloes. They also require clear traceability with strict security permissions to ensure that safety standards are clearly met and intellectual property is protected.

**Further Reading:** [Git vs. Perforce P4: How to Choose \(and When to Use Both\)](#)

## Perforce P4: A Data Powertrain for Smooth Performance

Perforce P4 was built to meet the performance, security, integration, and compliance needs of the world's most advanced automotive producers. With P4, the rubber meets the road through:

- **Unified Data Management:** Un-silo your hardware, software, and visualization/simulation data by working from a single source of truth.
- **Efficient Interoperability:** Easily integrate across your tool chain, including CI/CD tools, game engines, and IDEs to maximize your technology investments.
- **Streamlined Branching & Merging:** Improve code quality and reduce manual errors with [clear, intuitive branching](#) so that developers can focus on innovation instead of managing merge conflicts.
- **Limitless Scalability:** Manage all digital assets, including binaries, source code, and large 3D/game engine files with unmatched speed and performance.
- **Full Traceability:** Achieve functional safety compliance with effortless audit history and the only ISO 26262-certified data management solution on the market.
- **Security & Granular Access Controls:** Empower global teams without compromising data security by sharing only the files each member needs.
- **Unparalleled Performance:** P4's federated architecture supports advanced server topologies—including proxy and edge servers—so collaborators worldwide can access files seamlessly and nearly instantaneously.

## Today's Challenges, Tomorrow's Opportunities

Effective data management goes beyond solving current issues to ensure future success. P4 provides a strong foundation for efficient development cycles and new product releases. In a competitive market where speed, safety, and quality make or break companies, P4 injects the fuel needed to:

- **Maximize existing resources** by unifying tools and teams through smarter, integrated workflows.
- **Support concurrent hardware/software development** for better vehicle architecture and faster time to market.
- **Rapidly iterate and refine digital twins** through accurate and traceable versioning of all assets.
- **Maintain compliance-ready audit trails** that satisfy regulatory requirements without manual overhead.

## A Roadmap for Development Leaders

The shift to scalable, integrated data management starts with a clear roadmap that divides your journey into manageable phases.

1. **Begin** by assessing your current development environment. Pinpoint where bottlenecks or inefficiencies slow delivery in your tool chains, processes, and data flows.
2. **Next**, identify gaps in collaboration and data management—whether it's siloed Git repos, merge conflicts, security gaps, or compliance blind spots.
3. **Finally**, prioritize high-value pilot projects and then scale across your organization. Reduce risk, demonstrate ROI, and build momentum toward a fully connected development ecosystem that hums like a well-tuned V8.

You'll hone a development edge that enables your teams to deliver safer, smarter vehicles that leave the competition in the dust.

## Get Started with Perforce P4

Upshift your development and accelerate innovation with a strong data management foundation that checks all the boxes for performance, security, ease of integration, and compliance. Connect with our data management experts today to learn how your team can benefit from Perforce P4.

**Talk to an Expert** ►