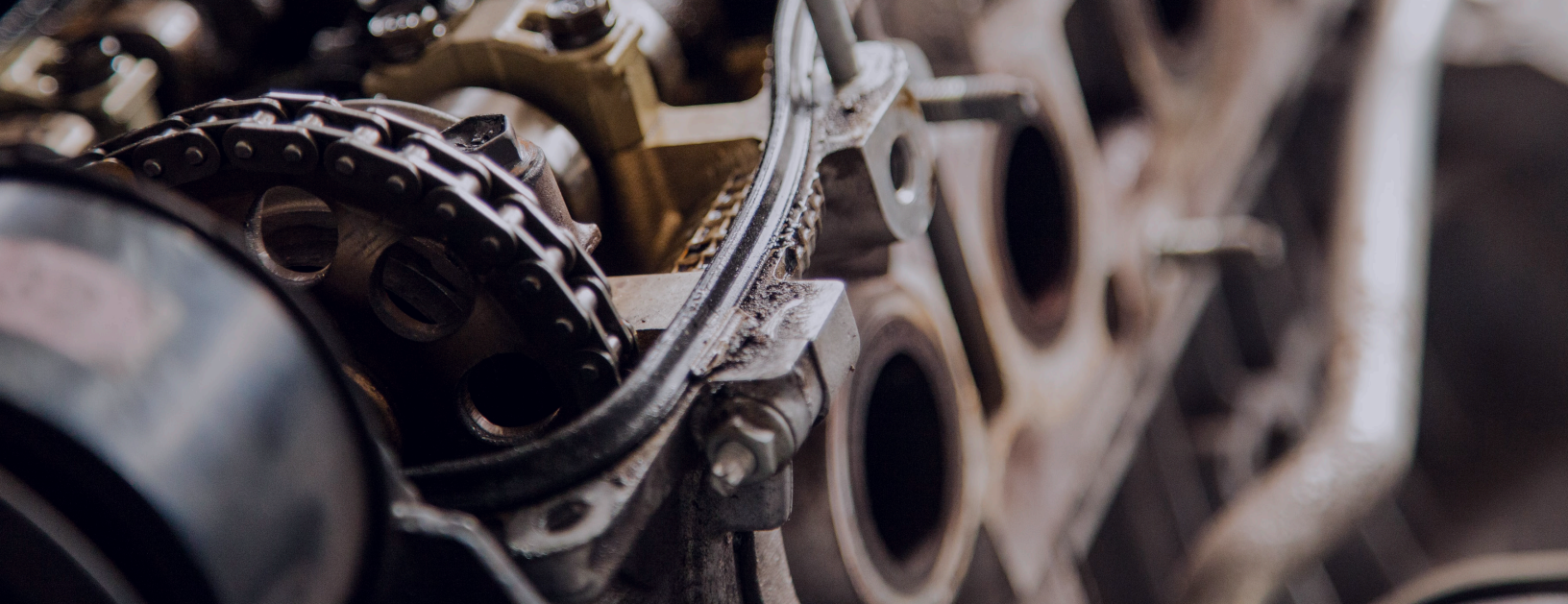


Maximizing compliance  
in the automotive industry  
— **without sacrificing  
innovation, speed, or quality.**



Despite outward appearances, few mainstream consumer products have changed as much over the last two decades as the automobile — which is remarkable considering the first mass production passenger car rolled off the assembly line more than a century ago.

Hybrid drivetrains, integrated GPS systems, backup cameras, proximity sensors and wireless connectivity have all reached widespread use since 2000, which has led to steep increases in the amount of software needed to ensure all these features and functions operate as intended.

In 2010, the average passenger vehicle rolled off the assembly line with 10 million lines of software code onboard. **By 2016, that number had grown to an average of 150 million lines for the most popular pickup truck in the U.S.**

Today, the navigation system of a typical passenger car alone requires **20 million lines of code** and the fully-autonomous electric vehicles of the near future are expected to require **one billion lines of code to operate safely.**

**Increased complexity drives increasing compliance requirements.**

The more complex systems become, however, the greater the chances for errors. In the case of automobiles, even the slightest systems error can have catastrophic consequences for all involved — the vehicle's occupants and others affected, the automobile manufacturer, and suppliers of the subsystems at fault.

Software and component failures have triggered some of the largest product liability settlements in U.S. history, due to the highly visible nature of the failures and the volumes of products that can be impacted. For example, in 2014 Toyota paid **\$1.2 billion in settlements** due to unintended acceleration behaviors in more than 10 million Toyota and Lexus vehicles.

Given the stakes involved for manufacturer and consumer alike, it's no surprise that the automotive industry is one of the most highly regulated industries in the world, governed by a matrix of national, regional and local safety requirements. As automobiles themselves have rapidly increased complexity, so too have the regulations that guide their development and operation.

Addressing these collective compliance and audit requirements takes a toll on the automotive manufacturers and suppliers, often by

- \\ Stifling innovation
- \\ Slowing time to market
- \\ Increasing development costs
- \\ More time spent on value-enabling work, like audit preparation, and less time for value-added work, like product development.

However, there are several best practices that industrial organizations supporting the automobile industry can adopt to maximize compliance without sacrificing innovation, speed, or quality in the process.

# Best Practice #1 — Focus on Automotive SPICE® compliance

Automotive SPICE® — the Automotive Software Process Improvement and Capability dEtermination, commonly referred to as ASPICE — defines processes and best practices for software and software-based system development for the automotive industry. ASPICE differs significantly from typical regulations and compliance requirements because it evaluates more than just the products you manufacture — ASPICE evaluates your company as a whole relative based on six progressive levels of ASPICE certification, from Level 0 to Level 5.

In order to obtain ASPICE certification, your organization must be audited by external, certified ASPICE assessors. Every ASPICE assessment involves in-depth interviews and process audits that evaluate the support you can provide for your products, as well as how efficient and consistent your internal processes are.

Preparing for a successful ASPICE assessment is a significant undertaking, but the additional investment can be worth it for several reasons.

- ASPICE compliance also certifies compliance with two other important automotive standards: ISO-26262: Road Vehicles — Functional Safety in Automotive and ISO-21434: Road Vehicles — Cybersecurity Engineering.

- The ASPICE assessment process itself offers significant value, identifying strengths and weaknesses in your organization along with process areas that require improvement. This provides a clearer path to certification and delivers a third-party assessment of your core processes in one assessment.
- For OEMs and many of the Tier 1 suppliers that work directly with the OEMs, ASPICE compliance is a prerequisite for doing business with them. No ASPICE certification means no RFP opportunity.
- As products get more complex and development and life cycles shrink, OEMs continue to raise the bar, requiring higher levels of ASPICE certification — each of which requires additional resources, commitment, and preparation.

**By setting your sights on the ASPICE standard, you'll not only achieve two other vital automotive certifications as well, but you'll also position your organization as a trusted partner for the leading global OEMs and Tier 1 partners that support them directly.**

# Best Practice #2 — Automate traceability across your development processes

As hardware-based products have become more software-centric, product developers are adopting application lifecycle management (ALM) solutions created to aid the development of software applications.

These ALM platforms are far superior to the highly manual and disconnected legacy approaches that preceded them. Not only can they increase process efficiency and individual productivity by seamlessly supporting the specific needs of each phase of the software development process, but their ability to

unlock the potential for end-to-end traceability is essential in highly regulated industries.

For example, IBM's Enterprise Lifecycle Management (ELM) is one of the most trusted ALM solutions available, due in part to its ability to automate the creation and maintenance of relationships throughout the development lifecycle.

This includes automatically tracking every relationship between requirements, work items, architecture, design, and test plans through each

phase of the development process: plan, design, develop, test, deploy, and maintenance.

When compliance audits take place, ELM automates the regulatory compliance reporting process by delivering specific reports detailing every aspect of the software's development, including what users were involved, what exactly was changed, and when.

Critically, these results are delivered on demand with 100% traceability completion and accuracy,

since each action had been logged by ELM automatically, across all phases of development.

**Don't make traceability and audit preparation a separate area of focus from your daily development activities — that's a recipe for disaster.**

**Choose tools that handle the traceability requirements of ASPICE, ISO 26262, ISO 21434 and any other relevant standards automatically as you go, and can output the proper audit reports with the press of a button.**

## Best Practice #3 — Leverage industry-specific templates

In late 2019, IBM launched the **IBM Engineering Lifecycle Management Automotive Compliance Solution** to help reduce the burden on engineering teams to integrate ASPICE compliance within their regular engineering work.

The Automotive Compliance Solution integrates the knowledge of the ASPICE experts at Kugler Maag Cie — the consultancy responsible for adapting the SPICE standard ISO/IEC 15504 to the automotive industry — into a series of ELM-specific resources designed to ease and accelerate ASPICE compliance.

These resources include

- \\ Templates — Repeatable, compliant patterns that simplify the ASPICE compliance process.
- \\ Asset libraries — ELM comes pre-populated with ASPICE-compliant sample data, offering real-world examples to reference.

- \\ Project dashboards — ELM's built-in data visualizations include ASPICE-specific modules with essential KPIs and metrics, ready to be customized for your specific needs.
- \\ Agile process guidance — Including process definitions, guidelines, and descriptions for systems engineering that support both Agile and ASPICE.
- \\ Detailed reports — Dedicated reporting to deliver insight into ASPICE compliance status for assessments.

**Use ASPICE-specific templates and sample data to ensure compliance is natural by-product of work outcomes, rather than a dedicated task or something to commit significant resources to before your assessment is due.**

## Best Practice #4 — Sewing with Digital Thread

As hardware-focused automobiles have become increasingly software reliant, the line is blurring between the ALM platforms software developers rely on and the product lifecycle management (PLM) application portfolios intended for hardware development processes.

This parallel model begins to buckle under the

strain of today's complex, hardware-based and sensor-laden machines that depend entirely on hundreds of millions of lines of code in order to function properly.

“Today our 20,000 developers are 90 percent hardware-oriented,” said Herbert Diess, CEO of Volkswagen AG in 2019. “That will change radically

by 2030. **Software will account for half of our development costs.**

Instead of helping engineers and developers be as efficient as they can be, the separate ALM and PLM siloed structure is having the opposite effect: it's forcing teams to waste a lot of time — **1 of every 3 hours**, according to one study — hunting all over the organization for the right data they need to do their jobs, just like in the examples above.

As noted in **Best Practice #2**, traceability is essential for automotive compliance. Automatic traceability and reporting capabilities deliver a competitive advantage for organizations looking to improve their compliance capabilities.

But if the traceability only applies to one side of the product development house, your ASPICE assessment efforts may be compromised — particularly as standards and regulations evolve to support increasingly automated vehicles.

**Truly integrated development platforms for truly integrated automotive solutions.**

In order to develop and deliver innovative, next-generation automobiles quickly and cost effectively, industrial organizations must be able to seamlessly link ALM and PLM processes and data end to end, allowing developers to quickly access the tools and information they need — anywhere and anytime — and that ensure industry-specific compliance every step of the way, automatically.

This concept, commonly known as Digital Thread, refers to the “communication framework that allows a connected data flow and integrated view of the asset’s data throughout its lifecycle across traditionally siloed functional perspectives,” **according to IndustryWeek.**

The ability to “locate, understand, access, and trust data” was considered a critical component of an organization’s regulatory compliance efforts by 78%

of global data professionals **surveyed by industry analyst firm IDC in 2018.** But integrating massive platforms with potentially hundreds of millions of artifacts, variants, relationships, etc. is no easy task.

To help accelerate that integration process, Persistent offers the **Persistent UNITE integration foundation**, a family of lightweight integration plugins that elegantly bring together IBM’s ELM platform with a growing portfolio of enterprise development tools, including Atlassian Jira®, Git (including GitLab, GitHub and BitBucket) and the ENOVIA® PLM platform from Dassault Systèmes®.

UNITE leverages **Open Services for Lifecycle Collaboration (OSLC)** to create relationships between artifacts, enabling integrations with IBM ELM tools without data synchronization.

By establishing standards across tools and teams, UNITE removes overhead and waste caused by duplicate data entry, establishing the digital thread across functions, processes, locations, teams, and projects that is so critical to current and future compliance efforts in the automotive industry.

**Traceability is an essential capability for any automotive supplier or manufacturer who seeks to meet and exceed compliance requirements without negatively impacting innovation, quality, time to market or development costs.**

**But if that capability only extends to the software development process, it runs counter to every trend in the industry that is rapidly preparing to deliver fully autonomous consumer and commercial vehicles in the near future. Organizations that want to gain or maintain a competitive edge will accelerate their own ALM and PLM integration efforts to deliver the Digital Thread that’s essential to compliance in so many industries today.**

**Learn more** about our recent Supercharging Engineering Series at: [www.persistent.com/ibm-engineering-lifecycle-management/webinar-supercharging-elm/#episode3](http://www.persistent.com/ibm-engineering-lifecycle-management/webinar-supercharging-elm/#episode3)

## About the Author



### **Bertrand Raillard**

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Bertrand Raillard is responsible for leading the Integration products and services offerings at Persistent Systems, enabling customers to create truly end-to-end digital solutions using their preferred engineering platform.

To accomplish this, Bertrand relies on 25 years of experience in the software industry, with the last two decades focused on supporting a variety of industries and manufacturers of everything from blast furnaces and grain silos to jet fighters and chewing gum.

Bertrand holds a bachelor's degree from ISTE, the Institute of Higher Education in Marketing and Commerce in Paris, France.

## About Persistent

Persistent Systems (BSE & NSE: PERSISTENT) builds software that drives our customers' business; enterprises and software product companies with software at the core of their digital transformation.

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