



# Embedded software lifecycle management for the automotive industry with TCS and Siemens

## Abstract

The automotive industry is going through a radical transformation driven by trends such as electrification, autonomous driving, connected vehicles, etc. These changes increase the complexity of their development, in particular the software that powers them. Compliance to industry standards, addressing cyber security and safety norms adds another dimension to this challenge. An integrated ALM platform is essential to harmonize the lifecycle processes and deliver error free software faster. Siemens Polarion software and TCS embedded software development expertise makes a compelling proposition for organizations desiring to achieve these benefits.

# Radical changes in the automotive industry

Automotive product development is undergoing a vast change driven by five key trends - electrification, autonomous driving, connected vehicles, shared mobility, and continuous updation. While electrification is focused on ensuring emission-free mobility and reduced carbon footprint, autonomous will make mobility easier and secure. Connected vehicles will provide C2C and C2X connectivity, enhancing user experience with 'In Vehicle Internet Solutions'. Shared mobility will provide on-demand and economically viable services. Continuous updation will allow users to upgrade to new vehicle features which will enhance their experience. These trends are technology driven, predominantly by electronics and software, which are now becoming the most prominent aspects of automotive product development.

The E/E (Electrical / Electronics) architecture is still on the path of evolution. The trend is to transition from decentralized architecture (3rd Generation) to domain centric (4th Generation) and finally to virtual domains (5th Generation). Hardware components like sensors, Electronic Control Units (ECU), harnesses, etc. will become standardized with the transition to software defined functions. New functionality will be realized by updating software using the same hardware. With ECUs and software getting separated, pureplay software vendors who provide software only are taking centre stage. In order to offer differentiated solutions with their own IP, original equipment manufacturers (OEMs) have started strengthening their software development capabilities to build critical functionalities for autonomous solutions inhouse. OEMs are also collaborating directly with chip manufacturers for design, manufacture, and supply of chips with their own brands. All of this is leading to a sea change in the automotive product development ecosystem.

## Implications of this radical change – challenges in embedded software development

The trends mentioned above imply an exponential increase in complexity of vehicle software. Managing the lifecycle of these software is one of the biggest challenge auto manufacturers face today.

An automobile is a complex system-of-systems that needs a 'systems thinking' mindset with a model-based systems engineering approach that is missing today.

Safety norms like General Safety Requirements (GSR), test protocols like Euro/Global NCAP (New Car Assessment Program) add to the challenge by demanding increasing levels of verification and validation. Testing for autonomous features demand virtual validation to cover complex test scenarios requiring on-demand test environments and large space to store the validation results for long durations for audit purposes.

Addressing cybersecurity risks is one of the key requirements of connected vehicles. ISO/SAE 21434 automotive cybersecurity standard provides a secure-by-design approach to protect critical features from cyberattacks. The software on an automobile must align with these standards.

Real time collaboration among stakeholders such as OEM, suppliers, chip manufacturers, and service providers is crucial to meet new product introduction timelines. Most organizations still face challenges here, leading to large amount of time spent in communication with methods that do not arrest errors.

Customers expect product features in a vehicle to be enhanced regularly. Shorter software release cycles are the key to provide these regular updates and will be one of the primary competitive differentiators.

Automotive companies must transform into 'Software Centric' companies. While many of them have adopted PLM as a platform to manage the mechanical and electronics product development, software development is still managed using disconnected tools and loosely coupled processes. This leads to limited traceability and reusability, reduced agility in development, inability to quickly introduce changes, and decreased overall engineering productivity.

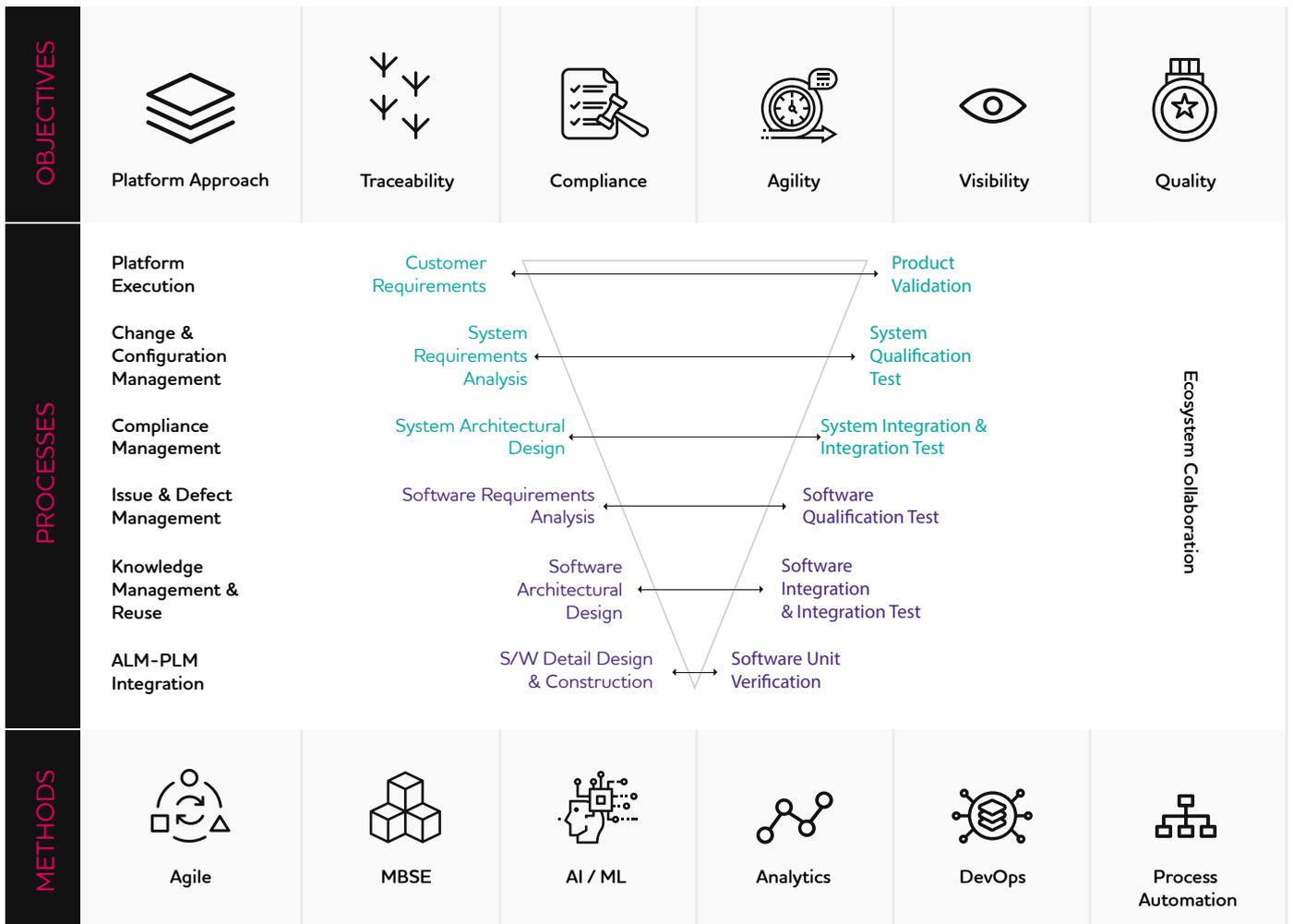
Failure to manage the complex process of embedded software development effectively results in defective products, recalls, penalties, and inability to meet regulatory compliance requirements.

## Integrated ALM Platform – The way forward

**Addressing these challenges requires adoption of an integrated ALM platform based approach to manage embedded software lifecycle management with the following key characteristics:**

- ➔ Strategizing model-based development
- ➔ Enable re-use and product line engineering
- ➔ Leveraging cloud capabilities (e.g., cloud-based test benches-as-a-service)
- ➔ Manage large data sets in Peta bytes – Exchange, Store, Archive
- ➔ Agility in collaboration
- ➔ AI/ML based solutions enabling predictability and productivity
- ➔ ALM-PLM integration to enable multi-disciplinary collaboration

Figure 1: TCS ALM Solution Approach



## Siemens & TCS – a compelling value proposition

Siemens Polarion ALM platform offers product features and functionalities in line with TCS’ vision of an integrated ALM environment. The platform orchestrates core processes like requirements management, validation management, model and design management, continuous integration, agile execution, and reporting. It integrates with various test tools as well as modelling tools. Polarion also integrates seamlessly with Teamcenter, another software platform, enabling the foundation for multi-domain product development.

TCS has been working with customers across industries helping them successfully adopt Siemens Polarion for their ALM needs. TCS has strong embedded software domain experience which it leverages to help customers in their transformation programs. TCS’ notable experiences in Siemens Polarion include

- **Transforming an Electric Vehicle (EV) OEM to orchestrate their Automotive SPICE processes on Polarion:** In this greenfield implementation at this EV start-up, TCS helped to streamline the embedded software development processes across the organization. This strategy enabled an integrated product development environment to enable 'System & Software' Engineering
- **Embedded software lifecycle management for global automotive tier one supplier:** The customer wanted to establish a harmonized ALM environment to support development of their next generation software driven products. TCS helped to deploy the tools necessary to enable 'Continuous Integration (CI)' which paved the way for automation, standardization and improved engineering efficiency
- **Risk management solution for a medical devices major:** To address the growing regulatory norms and increase in business demand, TCS helped the customer to replace their excel based risk management process with an electronic risk management platform. The solution provided efficient & traceable risk management process aligned with ISO14971
- **Enabling automotive SPICE compliance for an automotive major:** TCS was instrumental in deploying a solution which established Automotive SPICE processes and artifacts in a single integrated ALM environment. This helped to implement and improve Automotive SPICE maturity

## Benefits

The solution has the potential to deliver the following benefits:

- Accelerate product development time
- Reduce software issues by **30% to 50%**
- Establish audit compliance
- Eliminate rework up to **70%**
- Reduce change cycle time by **20% to 30%**
- Improve engineering efficiency

Siemens Polarion software and TCS' skills in embedded software development together offer a credible proposition to customers looking to address their embedded software lifecycle management challenges.