

ITEA Success story: EAST-EEA

# A revolution in automotive software development

For about fifteen years ITEA projects have created a ‘string of pearls’, successes that have laid the foundations for ITEA to be just as, if not more, successful in the future in a number of key domains. These are projects that have ‘seized the high ground’ and pushed the domain into the next phase of its development. One such domain is automotive and one such story of success is EAST-EEA, a project that began in 2001 and ended in 2004. Ended? No, because this project has generated a constant flow of results for projects and ‘pearls’ of success that have continued to this day and will continue on into the future.

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## A constant flow of results for projects and ‘pearls’ of success

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### The first ‘pearl’

To set the scene: the challenge posed at the beginning of the new millennium in the evolution of cars was the implementation of integral electronic control of in-vehicle and extra-vehicle functions in order to achieve active and predictive safety functions, enhanced comfort, improvements to the vehicle’s ability to make progress on existing roadways and protection of the environment. Twenty-three partners from across the European car industry joined forces in the EAST-EEA ITEA project in order to create the standard middleware, to define a high-level language to make it accessible and to develop specialist tools including test tools and demonstrators to tackle this challenge.

EAST-EEA provided an open and layered middleware architecture with interfaces and services that support the high-quality portability of embedded software modules. The middleware, as well as the communication layer concepts, were implemented and validated in demonstrators in the different automotive areas of body electronics, powertrain, chassis, telematics and human-machine interfaces. The software development model created by EAST-EEA consisted of successive development and validation processes that acted as a foundation into which all development phases and support software requirements could be incorporated for traceability. The techniques and tools developed in the project ensured conformity between requirements, design process and the

resulting products. The work also resulted in a publicly available dedicated ADL, Architecture Description Language. In addition to the technical work, EAST-EEA provided a widely accepted technical glossary and elaborated a general framework for a future reference architecture.

### Towards integration

The new software architecture allowed the easier integration of new electronics in cars through plug-and-play technology, dramatically reducing development time and costs to market. Not only that but new systems, such as new electronic steering systems, would be quicker to design and to market. Furthermore, the project also guaranteed a level of quality that

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is essential to the competitiveness of European cars. Immediate beneficiaries included the EU Framework 6 project EASIS and the car industry's AUTOSAR (AUTomotive Open System ARchitecture) initiative, the latter taking the Architecture Description Language (ADL) initially defined in the ITEA EAST-EEA project and subsequently refining to describe automotive electronic systems through an information model that captures engineering information in a standardised form.

Thanks to the EAST-EEA approach, vehicle manufacturers acquired an integrated framework for software and communication interfaces, tool environments and rules while suppliers benefited from standard solutions and re-use became possible, with new vehicle models able to be developed faster and product quality improved. However, with the advent of multi-core, a further leap was required in automotive

software development and here, too, an ITEA project took over the baton.

### AMALTHEA

While AUTOSAR defined a methodology for component-based development of automotive software and a standardised software architecture for automotive electronic control units, only limited support was offered for detailed behaviour descriptions that are indispensable for developing much more complex multi-core systems of sufficiently high quality. This requires an increased exchange between tools, especially in the case of multi-core optimisation that is based on additional information like the detailed timing behaviour. With its motto 'Tune up your software development', the ITEA 2 AMALTHEA project, which began in 2011, set about adapting existing development methods and tools and creating an open-source development platform with common data models and well-defined interfaces to achieve a remarkable increase in the efficiency of software development.

Dr. Christoph Kornmesser of VW has commented that "in order to reduce the effort for exchanging data, a platform with a common data model is a key. AMALTHEA and its data model provide the ideal platform for exchanging data with our suppliers in the production process." Several companies are already using the platform to create and exchange data models of their control units while others are investigating the benefits of this option compared to other solutions. A special focus in developing the platform is open interfaces to enable the integration of a variety of tools, whether open source, commercial or corporate-owned, using Eclipse as the basis for the development environment, which provides a plug-in mechanism and thus an easy integration with other tools. As an open source tool chain platform, AMALTHEA allows efficient data exchange not only between different cooperating companies but also between different tools used by a single organisation. Equally, each user can build a customised tool chain by choosing appropriate tools that work on the common AMALTHEA data model. In this context, the multi-core capability of the common AMALTHEA data model has already been proven to be appropriate for tools simulating multi-core systems.

### A SAFE market boost

With the state-of-the-art a dynamic moving target, the ITEA 2 SAFE project brings the results of EAST-EEA and successive projects up to date, especially in respect of the latest ISO 26262 standard for functional safety in automotive electrical and electronic systems published in November 2011. This project focuses on accelerating the efficient development of safety features in cars by extending the AUTOSAR architectural model now widely used in production vehicles and throughout the automotive supply chain.

As many of today's innovations focus on active or passive safety, the tough demands on systems reliability and functionality put pressure on development processes. SAFE addresses the demands of these new standards, reducing software development efforts while ensuring a technological advantage for Europe through the fast realisation of innovative and high-quality yet affordable products. The extension of the AUTOSAR architecture model will enable the effective integration of artefacts associated with the application of ISO 26262 and be implemented in a technology reference platform that will itself be extended with a set of appropriate plug-ins to allow evaluation of the methods within significant industrial case studies, with the involvement of the complete automotive supply chain. By including carmakers, their tier-one suppliers, chipmakers and tool suppliers as well as research organisations, the impact of the SAFE project will be felt on several levels.

### Benefits throughout the chain

Car manufacturers will acquire methods and tools that provide the flexibility to develop new architectures with a Safety-In-the-Loop approach while first tier suppliers will be able to demonstrate safety conformity and optimise development costs. In their turn, semiconductor manufacturers can develop new architectures for safe hardware components and tool vendors gain an opportunity to provide an integrated tool-chain including design and safety analysis. Finally, research organisations benefit from the possibility to subject their conceptual work to methods of analysis. Certification bodies can gain accreditation for automotive certification of functional safety assessment.

Another ‘grandchild’ of EAST-EEA is the ITEA 2 TIMMO-2-USE project that enables an advanced timing framework to complement and extend AUTOSAR. It significantly improves automation for more predictable development cycles, thereby cutting development risks and time to market. The result is much increased reliability, safety, robustness and fault tolerance with better early quality control.

#### Significant automation advance

A first step in the efficient exchange of timing information between OEM and Tier-1 suppliers, for instance, was the development of the Timing Augmented Description Language (TADL) and the description of timing information on higher abstraction levels by referencing discrete events, or event chains. To increase reliability, safety, robustness, fault tolerance through a much higher degree of design automation, TIMMO-2-USE took in hand the specification, transition and exchange of relevant timing information throughout different steps of the AUTOSAR-based development process and tool chain.

The participation of leading automotive organisations in TIMMO-2-USE not only guaranteed a high level of automotive engineering expertise but also excellent exploitation of the project’s results. Given that the vast majority of TIMMO-2-USE partners are AUTOSAR members, the project results will be deployed in the respective AUTOSAR working groups and has given TIMMO-2-USE an excellent internationally competitive position. The impact that such results have generated include shortened, predictable development cycles, reduced time-to-market through massive reuse, more efficient communication and collaboration between different parties involved in development, and less development risk with improved quality.

#### Pearls of success rooted in two decades

The successes of AMALTHEA, SAFE and TIMMO-2-USE, in terms of revolutionising software development in the automotive industry and the impact they have had and will have on subsequent related projects, can be traced back over the past two decades to EAST-EEA. They are projects that have added something new, something extra in response to the state of the industry and market demands. As Stefan Voget,



project leader for the SAFE project, suggests, “the results of the EAST-EEA project, although it finished a decade ago, acts like a reference platform for further development in new projects. Today there is more formalisation in the exchange of communication through models rather than through language. New, model-based technologies are penetrating the market to make things more standardised, clear and less complex. Which reduces not only the costs of development but also the complexity and organisation throughout the chain. It is making life easier for both OEMs and suppliers.”

EAST-EEA provided the fertile foundation for the successful ITEA projects to grow into the string of pearls it has become and make the automotive industry and the users of its products happier – in the knowledge that they will continue to benefit from the ongoing innovation of future ITEA-based projects that ‘seize the high ground’.

#### More information:

[www.amalthea-project.org](http://www.amalthea-project.org)  
[www.safe-project.eu](http://www.safe-project.eu)  
[www.timmo-2-use.org](http://www.timmo-2-use.org)

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