



## Software erosion protection for automotive embedded software

TRW uses the Axivion Suite to protect the UML-based architecture of its electric parking brake (EPB) – and the applications based on it – against erosion. This enables **consistently fast development speeds to be achieved in the field of safety-critical control devices with consistently high levels of quality.**

**THE CHALLENGE ++** The electric parking brake (EPB) from TRW has proved very successful in the market and is being used in more and more vehicle models. Today, the specific customer requirements and the necessary flexibility are mainly achieved and ensured by software. The growing customer base and **the ever-increasing number of customer- and model-specific variants is therefore a major challenge for software development.** For the OEM, perceptions of quality and flexibility are influenced directly by software development at TRW. Development speeds and adherence to deadlines for new variants are critical for TRW's success. Software development based on **ISO 26262 also places high demands on the components and associated documentation from the perspective of quality, which has to be consistently high.** These include, in addition to requirements for the software architecture and its

documentation, the establishment of and **compliance with coding guidelines such as MISRA-C.**

TRW-EPB systematically relies on the implementation of a UML-based architecture when developing its electric parking brake (EPB). The major challenge here lies in keeping the UML models and the implementation continuously synchronised. Manual checking is not an option because of the large number of projects and variants.

**THE SOLUTION ++** The existing tool chain was extended to include the Axivion Suite, whose XMI interface is tailored to the popular CASE tools. The architecture of the UML models is now checked during the development phase itself. As a result, specific change requests for improving the quality are automatically triggered on an ongoing basis. As soon as the implemented components differ from the models, the software developers receive

warning messages. In most cases, developers can quickly resolve the discrepancy themselves. **Because the solution was easy to integrate into daily business and the individual developers could be included, it has made the architects' job easier,** as they only have to intervene when changes to the architecture are actually required. In a further step, the coding

*“The Axivion Suite helps us implement our architectural concepts flawlessly. The seamless integration into our UML tool chain went without a hitch and it has made our everyday work easier.”*

Thomas Kremer, Teamleader Integration & Configuration, EPB Software System Development, TRW Automotive GmbH



*“Our innovations are increasingly dependent on software. At the same time, the customer and market requirements are changing faster and faster, and the number of different versions is increasing. This calls for fast response times and the Axivion Suite helps us significantly in this respect.”*

Gundolf Schmidt, Global Chief Engineer  
Braking Software, TRW Automotive GmbH

guidelines were revised with the assistance of Axivion and these are now likewise automatically checked during the development phase using the Axivion Suite.

**THE SUCCESS ++** The constant checking of the architecture specifications and modelling rules has made the entire development team more aware of architectural issues. The importance of the architecture and the architects in the project has grown and been generally accepted. Collaboration between architects and developers has been greatly improved and has become much smoother. Day-to-day tasks involve resolving discrepancies, sometimes in the implementation and sometimes in the architecture. Work is concentrated on finding the optimal solution in each individual case. As a result, not only are the requirements met in full, but lessons can also be learnt in the area of architectural design, thereby allowing overall architectures to be improved more and more. Hence it has been possible to establish new architectures so that – for example – parts of the software are easier to integrate into third-party control units, as is increasingly being stipulated by OEMs.

The perfect interaction and intermeshing of the UML models and the component implementations also enhanced the ability to reuse certain sub-components in several variants.

The automated checking of the coding guidelines in the background reduces the manual workload, increases acceptance among the developers and is more con-

ducive to learning, since there is immediate feedback.

The software erosion problems of the past were successfully eliminated right from the start of the EPB project at TRW by using the Axivion Suite. The resulting overall increase in efficiency in development has made it possible to mitigate, to some extent, the impact of the much-quoted lack of skilled professionals and the associated shortage of personnel capacity.

**ABOUT TRW ++** With a turnover of 16.2 billion US dollars in 2011, TRW Automotive is one of the world’s leading suppliers to the automotive industry. The company, with its headquarters in Livonia (Michigan, USA), has a global presence through its subsidiaries in 26 countries and employs approximately 60,000 people worldwide.

TRW Automotive’s product portfolio includes integrated vehicle control and driver assist systems, braking systems, steering systems, suspension systems, occupant safety systems (seat belts and airbags), electronics, engine components, fastening systems and aftermarket replacement parts and services.

**ABOUT AXIVION ++** Axivion, based in Stuttgart, Germany, is a provider for innovative software solutions for static code analysis and for protection from software erosion. The core product of Axivion is the Axivion Suite, a tool suite for the improvement of software quality and maintainability of software systems implemented in the programming languages C, C++ and C#. In addition to static code analysis,

the tool suite includes innovative software tools for architecture verification and clone management. Moreover, the tool suite detects software erosion factors such as cycles, dead code and violations of programming rules.

Axivion’s MISRA checker covers 100% of all automatically testable MISRA rules for the standards MISRA C:2004, MISRA C:2012, and MISRA C++:2008. Furthermore, the AUTOSAR C++14 styleguide as well as the CERT® programming rules for secure software development are supported.

The Professional Services Team of Axivion offers methods and training concepts as well as service and consulting to support customers to assure an effective and efficient rollout of the tools.

Axivion’s customers are companies that develop innovative technical software across different industries, e.g. industrial automation, automotive, railway, electronics, information and telecommunication, avionics, medical, mechanical engineering, as well as measurement, control and regulation technology.

Sources of images: TRW Automotive



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stopping software erosion