

Innovation in vehicle software

Results of the mobileSoft research association/ESG in requirements management subproject

Competition on the global automotive market is driven by software in motor vehicles. On the one hand, the trend is towards ever more software and increasingly complex systems integrated into cars while, on the other hand, development times are becoming ever shorter. In order to remain competitive on the market, software development must be supported by new and innovative methods.

Over the past two and a half years, the mobileSoft research association has been developing methods and processes for breaking new ground in the development of vehicle software. This is why the automotive manufacturer BMW, the two supplier companies Siemens VDO and ESG Elektroniksystem- und Logistik-GmbH as well as Professor Klaus Bender and Professor Manfred Broy from the Technical University in Munich have joined forces as project partners in the requirements management subproject of the mobileSoft association. Supplying the methods developed for the formalisation of requirements facilitates the creation of high-quality systematic and efficient specifications. In the future, newly developed structuring concepts will systematically support the reuse of requirements.

Requirements management subproject

Contemporary specifications are usually written in natural language. This has the benefit of being easy to understand. However, it simultaneously has the disadvantage that, as a rule, it fails to achieve such criteria as completeness, freedom from discrepancies and clarity. In addition, analysis and system design are difficult using such requirements. The formalisation approach used by mobileSoft transfers requirements in natural language

into a uniform, precise and coherent form. It allows the transition from requirements management to design to be structured as smoothly and faultlessly as possible.

The second focal point of the subproject is the 'reuse of requirements'. The objective is to assist the development of reusable requirement specifications of a high quality by supplying appropriate supporting concepts. This will close the break between the reuse of characteristics and technical implementations. The development work falls accordingly, and the entire development will be structured efficiently.

Formalising requirements

The key to the formalisation approach is to formalise informal requirements in three simple, interlinked steps. In the first step, classification, the requirements are first classified appropriately. In the second step, analysis and formulation, the specific components of the requirement are identified and class-specific models applied. In the third formalisation step, transition, the highly standardised and structured requirements, which are however still in natural language, are translated into design elements. As the system model which forms the basis of the requirements formulation is identical to that of the design, and differs solely in the representation, the comprehensibility of the reformulated requirement and the precision and translation into design can be simultaneously guaranteed.

Reuse of requirements

Thanks to the current basic conditions of the automotive industry (e. g. an extremely high number of product requirements, a rapid increase in the degree of innovation, the consideration of several alternative solutions and the enormous variety of variants), the reuse of requirements and technical implementations poses a challenge. The most important task of requirements management, the representation of different linking types between different requirements and to the solutions in system design, can only be achieved with a great deal of effort. The links help to represent dependencies, take into account influences, identify logically related parts, comprehend decisions and to create valid configurations. In order to efficiently organise the systematic reuse of requirements, expenditure on the creation and amendment of links must be considerably reduced. The three supporting

concepts are aimed at reducing expenditure on the management of links and at efficient reuse.

Structuring of requirements by means of a defined, two-stage classification which first groups the requirements according to requirement classification and then according to decomposition levels. The classification primarily helps to make the structuring of large quantities of requirements manageable.

The systematic requirement derivation which is achieved by the definition of the interface between the requirement management and system design processes. The interface forms the basis of the function-oriented development. This means that the entire system comprises logical functions independent of the technical implementation, which may in turn contain further functions, and subsequently implementation-relevant details. The division between logical functions and implementation-relevant details increases the degree of reuse and adaptation of the functions.

The variability model supports both the identification of requirement variants as well as the selection of requirements relevant for the reuse from the entire requirement volume. The variability model developed caters in particular to the needs of requirements management in the automotive industry. It is managed independently of the requirements model and is simply linked to it. This means that it has zero redundancy and supports efficient algorithms for searching for particular variants. At its core, the variability model groups variants to variability aspects and describes connections between individual variants. These may be both market-driven variants (e.g. USA, EU, Japan) or implementation variants (e. g. different voltages ranges) of a function. On the one hand, these connections provide support for requirements developers in the promotion of requirements. On the other hand, the connections are also important in reuse. So the variants which are to be considered as optional, imperative or excluded for reuse are displayed.

Summary

The importance of precise and reusable requirements will continue to increase with the complexity of systems. ESG Elektroniksystem- und Logistik-GmbH was able to bring its

expertise to the 'requirements management' subproject of the mobileSoft association. The experience gained enables ESG to continue supplying its customers with state-of-the-art services in the field of requirements management.

Authors: Vadym Alyokhin und Norbert Neuendorf, ESG

Reprint free of charge, please forward a copy.

You can download some pictures from www.esg.eu/press/downloads.

Jörg Riedle, Head of Corporate Communications

Tel.: +49 (89) 9216-2850

Mobile: +49 (0)172 1007085

joerg.riedle@esg.eu

www.esg.eu