2nd Intl. ICSE Workshop on Software Engineering for Automotive Systems

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Abstract

This paper summarizes the second International Workshop on Software Engineering for Automotive Systems, held in conjunction with ICSE'05. We give a brief overview of the presented papers and pinpoint the highlights of the discussions.

Introduction

Automotive software is one of the emerging areas of software engineering and embedded systems. Within the next five years, premium cars are expected to host a cumulated amount of up to one gigabyte of binary code of software deployed via a set of interconnected embedded platforms. To design, implement and manage the complexity of such a huge, heterogeneous distributed system with increasingly short innovation cycles and a vast installed base, neither the techniques and methods of classical embedded systems are suitable, nor the known ones in the desktop and business software domain. To tackle this challenge, we need new adapted software engineering methods for the automotive domain that allow to specifically design the different software types, corresponding to their requirements, and to later on integrate the system parts into one reliable and manageable system.

These insights led to the continuation of a series of related events. A panel discussion at ICSE 2003 [Bro03] led to the organization of last year's workshop on Software Engineering for Automotive Systems in Edinburgh, co-located with ICSE 2004 [PSS04a, PSS04b, SSP04]. The extremely positive feedback was instrumental in setting up a second edition of this workshop [PSS05, SSP05]. About 40 participants contributed to very lively and controversial discussions.

Presentations

The program committee accepted 9 submissions out of a total of 17 submissions. Eleven papers were submitted from Europe, five from the US, and one from Japan. We received an equal number of submissions from academia and industry.

Bruce Emaus, pesident of Vector CANtech, Inc. and chair of the SAE Embedded Software Standards Committee accepted our invitation to give a keynote presentation. In his talk on *A Hitchhiker's Guide to the Automotive Embedded Software Universe or Don't Panic–There's Plenty of Tasks to Execute*, Bruce did an excellent job of highlighting the fundamental challenges in SW development for automotive systems. His presentation left the impression that European car manufactures acknowledged the strategic and operational importance of SW development and SW engineers in the car manufacturing process to a somewhat higher extent than their US American counterparts. The slides are available on the web.[1]

In addition, the following regular papers were presented.[2]

1. M. Dinkel and U. Baumgarten: *Modeling Nonfunctional Requirements: A Basis for dynamic Systems*
2. F. Pettersson, M. Ivarsson, and P. Öhmann: *Automotive use case standard for embedded systems*
3. T. Bauer, J. Herrmann, P. Liggesmeyer, and C. Robinson-Mallett: *A Flexible Integration Strategy for Automotive Telematics Systems*
4. E. Coste, C. Farcas, W. Pree, and J. Templ: *Real-Time Component Integration Based on Transparent Distribution*
5. J. Botaschanjan, L. Kof, C. Kühnel, and M. Spichkova: *Towards Verified Automotive Software*
6. I. Stürmer, D. Weinberg, and M. Conrad: *Overview of Existing Safeguarding Techniques for Automatically Generated Code*
7. B. Weide, P. Bucci, W. Heym, M. Sitaraman, and G. Rizzoni: *Issues in Performance Certification for High-Level Automotive Control*
8. U. Eklund, Ö. Askerdahl, J. Granholm, A. Alminger, and J. Axelsson: *Experience of Introducing Reference Architectures in the Development of Automotive Electronic Systems*

[1] www.inf.ethz.ch/personal/pretscha/events/seas05/bruce_emaus_keynote_050521.pdf

[2] Abstracts available at www.inf.ethz.ch/personal/pretscha/events/seas05/#abstracts

9. J. Fröberg, K. Sandström, and C. Norström: *Business Situation Reflected in Automotive Electronic Architectures: Analysis of Four Commercial Cases*

These papers [PSS05] cover almost all activities of the development process. *Requirements Engineering* is treated by papers 1 and 2. Dinkel and Baumgarten are concerned with the integration of non-functional requirements into RE activities. Pettersson and his colleagues report on experiences with use case specifications in the development of automotive systems. *Design and implementation/code generation* are discussed in papers 7, 4, and 6. Weide et al. present a contract-like formalism that allows the incorporation of complexity and performance issues into specifications. Coste and her colleagues report on extensions of the Giotto model for the specification of real-time systems on the grounds of the notion of logical time. Stürmer et al. report on code generation from continuous Matlab models, and in particular on differences between different code generators. *V&V activities* are the subject of papers 3 and 5. Bauer et al. report on integration testing strategies for an automotive infotainment system. Botaschanjan and his colleagues present a project that aims at incorporating formal verification technology–deductive theorem proving–into the different levels of abstraction of an automotive SW system. Finally, the *overall development process* is discussed by papers 8 and 9. In particular, Eklund et al. as well as Fröberg and his colleagues report on the importance of the business perspective in the SW development for automotive systems. Eklund stated that standardized components would increase quality but not necessarily safe time.

Discussion

In addition to the lively discussions that complemented each single talk, the participants used the final hour of the workshop to primarily engage in a discussion on the domain of "SW engineering for automotive systems" as such. In particular, we addressed the explicitly provocative question of how SW engineering for automotive SW engineering would differ from SW engineering for other domains.

Traditional arguments for the specificity of the domain essentially boil down to heterogeneity of the product, integration issues in a domain with many different third-party-suppliers, the unit-based cost structure–the cost of processors does matter, and the huge number of different variants that have to be managed [PSS04b].

Arguments against the specificity of these issues resulted in enumerations of domains where, in parts, exactly the same kind of problems could be found. In particular, it was highlighted that it was not entirely clear how the above mentioned criteria would be reflected in actual *SW engineering technology*. For instance, what exactly are the consequences of being committed to cheap and hence not-so-powerful processors?

Eventually, the participants agreed that the specificity of SW engineering for automotive systems was a result of the particular blend of requirements on process and product. There was a shy agreement on the point of view that the specifics would not so much lie in *technology* but rather in particular *organizational structures* and, related, methodologies.

In terms of future research, it was claimed that current unit-based cost models do not seem to faithfully map reality because of neglecting, for instance, maintenance cost. Technological innovation was claimed to be likely to be built on top of standardized platforms such as AutoSAR. A thorough investigation of automotive business processes, in particular as far as software is concerned, and its relationship with current SW engineering technology, seems to be missing to date.

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References

[Bro03] M. Broy. Panel session: Automotive Software Engineering. In *Proc. ICSE'03*, pages 719–720, 2003.

[PSS04a] A. Pretschner, C. Salzmann, and T. Stauner. Proc. 1st Intl. Workshop on Software Engineering for Automotive Systems, 2004. ISBN 0-86341-429-X.

[PSS04b] A. Pretschner, C. Salzmann, and T. Stauner. Software engineering for automotive systems at ICSE 2004–workshop summary. *ACM SIGSOFT Software Engineering Notes*, 29(5), September 2004.

[PSS05] A. Pretschner, C. Salzmann, and T. Stauner. Proc. 2nd Intl. Workshop on Software Engineering for Automotive Systems, 2005. ISBN 1-59593-128-7.

[SSP04] C. Salzmann, T. Stauner, and A. Pretschner. ICSE Workshop: Software Engineering for Automotive Systems. In *Proc. ICSE'04*, page 779, 2004.

[SSP05] C. Salzmann, T. Stauner, and A. Pretschner. 2nd international workshop on software engineering for automotive systems. In *Proc. ICSE'05*, page 695, 2005.