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Harald Hönninger
Reinhold Achatz
Manfred Broy (Eds.)

Model-Based Engineering of Embedded Systems

The SPES 2020 Methodology

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Roman Wölfel

Model Based Engineering Of Embedded Systems The Spes 2020 Methodology:
   Model-Based Engineering of Embedded Systems Klaus Pohl,Harald Hönninger,Reinhold Achatz,Manfred Broy,2012-11-08 Embedded systems have long become essential in application areas in which human control is impossible or infeasible The development of modern embedded systems is becoming increasingly difficult and challenging because of their overall system complexity their tighter and cross functional integration the increasing requirements concerning safety and real time behavior and the need to reduce development and operation costs This book provides a comprehensive overview of the Software Platform Embedded Systems SPES modeling framework and demonstrates its applicability in embedded system development in various industry domains such as automation automotive avionics energy and healthcare In SPES 2020 twenty one partners from academia and industry have joined forces in order to develop and evaluate in different industrial domains a modeling framework that reflects the current state of the art in embedded systems engineering The content of this book is structured in four parts Part I Starting Point discusses the status quo of embedded systems development and model based engineering and summarizes the key requirements faced when developing embedded systems in different application domains Part II The SPES Modeling Framework describes the SPES modeling framework Part III Application and Evaluation of the SPES Modeling Framework reports on the validation steps taken to ensure that the framework met the requirements discussed in Part I Finally Part IV Impact of the SPES Modeling Framework summarizes the results achieved and provides an outlook on future work The book is mainly aimed at professionals and practitioners who deal with the development of embedded systems on a daily basis Researchers in academia and industry may use it as a compendium for the requirements and state of the art solution concepts for embedded systems development   Advanced Model-Based Engineering of Embedded Systems Klaus Pohl,Manfred Broy,Heinrich Daembkes,Harald Hönninger,2016-11-29 This book provides a comprehensive introduction into the SPES XT modeling framework Moreover it shows the applicability of the framework for the development of embedded systems in different industry domains and reports on the lessons learned It also describes how the SPES XT modeling framework can be tailored to meet domain and project specific needs The book is structured into four parts Part I Starting Situation discusses the status quo of the development of embedded systems with specific focus on model based engineering and summarizes key challenges emerging from industrial practice Part II Modeling Theory introduces the SPES XT modeling framework and explains the core underlying principles Part III Application of the SPES XT Framework describes the application of the SPES XT modeling framework and how it addresses major industrial challenges Part IV Evaluation and Technology Transfer assess the impact of the SPES XT modeling framework and includes various exemplary applications from automation automotive and avionics Overall the SPES XT modeling framework offers a seamless model based engineering approach It addresses core challenges faced during the engineering of embedded systems Among others it offers aligned and integrated techniques for the early validation of engineering artefacts including requirements and

functional and technical designs the management of product variants and their variability modular safety assurance and deployment of embedded software   *Model-Based Engineering of Collaborative Embedded Systems* Wolfgang Böhm,Manfred Broy,Cornel Klein,Klaus Pohl,Bernhard Rumpe,Sebastian Schröck,2020-12-14 This Open Access book presents the results of the Collaborative Embedded Systems CrESt project aimed at adapting and complementing the methodology underlying modeling techniques developed to cope with the challenges of the dynamic structures of collaborative embedded systems CESs based on the SPES development methodology In order to manage the high complexity of the individual systems and the dynamically formed interaction structures at runtime advanced and powerful development methods are required that extend the current state of the art in the development of embedded systems and cyber physical systems The methodological contributions of the project support the effective and efficient development of CESs in dynamic and uncertain contexts with special emphasis on the reliability and variability of individual systems and the creation of networks of such systems at runtime The project was funded by the German Federal Ministry of Education and Research BMBF and the case studies are therefore selected from areas that are highly relevant for Germany s economy automotive industrial production power generation and robotics It also supports the digitalization of complex and transformable industrial plants in the context of the German government s Industry 4 0 initiative and the project results provide a solid foundation for implementing the German government s high tech strategy Innovations for Germany in the coming years

Embedded Systems: Design, Analysis and Verification Gunar Schirner,Marcelo Götz,Achim Rettberg,Mauro C. Zanella,Franz J. Rammig,2013-06-13 This book constitutes the refereed proceedings of the 4th IFIP TC 10 International Embedded Systems Symposium IESS 2013 held in Paderborn Germany in June 2013 The 22 full revised papers presented together with 8 short papers were carefully reviewed and selected from 42 submissions The papers have been organized in the following topical sections design methodologies non functional aspects of embedded systems verification performance analysis real time systems embedded system applications and real time aspects in distributed systems The book also includes a special chapter dedicated to the BMBF funded ARAMIS project on Automotive Railway and Avionics Multicore Systems

Safety and Security of Cyber-Physical Systems Frank J. Furrer,2022-07-20 Cyber physical systems CPSs consist of software controlled computing devices communicating with each other and interacting with the physical world through sensors and actuators Because most of the functionality of a CPS is implemented in software the software is of crucial importance for the safety and security of the CPS This book presents principle based engineering for the development and operation of dependable software The knowledge in this book addresses organizations that want to strengthen their methodologies to build safe and secure software for mission critical cyber physical systems The book Presents a successful strategy for the management of vulnerabilities threats and failures in mission critical cyber physical systems Offers deep practical insight into principle based software development 62 principles are introduced and cataloged into five categories

Business Provides direct guidance on architecting and operating dependable cyber physical systems for software managers and architects **Engineering Trustworthy Software Systems** Jonathan P. Bowen,Zhiming Liu,Zili Zhang,2020-07-31 This book constitutes the refereed proceedings of the 5th International School on Engineering Trustworthy Software Systems SETSS 2019 held in Chongqing China in April 2019 The five chapters in this volume provide lectures on leading edge research in methods and tools for use in computer system engineering The topics covered in these chapter include Seamless Model based System Development Foundations From Bounded Reachability Analysis of Linear Hybrid Automata to Verification of Industrial CPS and IoT Weakest Preexpectation Semantics for Bayesian Inference Conditioning Continuous Distributions and Divergence K A Semantic Framework for Programming Languages and Formal Analysis Tools and Software Abstractions and Human Cyber Physical Systems Architecture Modelling Leveraging Applications of Formal Methods, Verification and Validation: Applications Tiziana Margaria,Bernhard Steffen,2020-10-26 The three volume set LNCS 12476 12478 constitutes the refereed proceedings of the 9th International Symposium on Leveraging Applications of Formal Methods ISoLA 2020 which was planned to take place during October 20 30 2020 on Rhodes Greece The event itself was postponed to 2021 due to the COVID 19 pandemic The papers presented were carefully reviewed and selected for inclusion in the proceedings Each volume focusses on an individual topic with topical section headings within the volume Part I Verification Principles Modularity and De Composition in Verification X by Construction Correctness meets Probability 30 Years of Statistical Model Checking Verification and Validation of Concurrent and Distributed Systems Part II Engineering Principles Automating Software Re Engineering Rigorous Engineering of Collective Adaptive Systems Part III Applications Reliable Smart Contracts State of the art Applications Challenges and Future Directions Automated Verification of Embedded Control Software Formal methods for DIStributed COmputing in future RAILway systems *Complex Systems Design & Management* Eric Bonjour,Daniel Krob,Luca Palladino,François Stephan,2018-11-19 This book contains all refereed papers accepted during the ninth edition of the conference that took place at the Cit Internationale Universitaire de Paris on December 18 19 2018 Mastering complex systems requires an integrated understanding of industrial practices as well as sophisticated theoretical techniques and tools This explains the creation of an annual go between forum in Paris dedicated to academic researchers industrial actors working on complex industrial systems architecture modeling engineering These proceedings cover the most recent trends in the emerging field of Complex Systems both from an academic and a professional perspective A special focus is put on Products services development in a digital world The CSD M Paris 2018 conference is organized under the guidance of CESAM Community http cesam community en CESAM Community has been developed since 2010 by the non profit organization CESAMES Association to organize the sharing of good practices in Enterprise and Systems Architecture and to certify the level of knowledge and proficiency in this field through CESAM certification **Engineering Trustworthy Software Systems** Zhiming Liu,Zili Zhang,2016-02-29 This volume contains the

lecture notes of the five courses and one seminar given at the School on Engineering Trustworthy Software Systems SETSS 2014 held in September 2014 at Southwest University in Chongqing China The material is useful for postgraduate students researchers academics and industrial engineers who are interested in the theory and practice of methods and tools for the design and programming of trustworthy software systems The common themes of the courses include the design and use of theories techniques and tools for software specification and modeling analysis and verification The courses cover sequential programming component and object software hybrid systems and cyber physical systems with challenges of termination security safety security fault tolerance and real time requirements The techniques include model checking correctness by construction through refinement and model transformations synthesis and computer algebra *Software Architectures* Manfred Nagl,Bernhard Westfechtel,2024-04-26 This textbook concentrates on processes activities and results related to software architectures It describes the separation of architecture artefacts corresponding to their nature their logical or their modeling level on one hand and at the same time emphasizes their integration based on their mutual relations Design or development processes demand for integration as different artifacts must be elaborated which are mutually dependent and need to be in a consistent form The book is structured in four parts The introductory Part I deals with the relevance of architectures the central role of the design subprocess both in development or maintenance and the importance of the decisions and artefacts in the overall result Another topic is the spectrum of views an architecture language has to offer and that there are different architectures to be regarded from abstract and static to detailed technical and specific Part II then discusses important topics onthe architecture level It deals with adaptability especially for embedded systems with integrating styles pattern notations with different reuse forms and how to find them with the role of architectures for integrating different existing systems and with reverse and reengineering of legacy systems Next Part III covers architecture modeling and its relation to surrounding activities as well as architectures to surrounding other results The single chapters are on transformation between requirements and architectures architectures and programming architectures and project management and organization as well as architectures and their relations to quality assurance or documentation Eventually Part IV summarizes the main messages and presents open problems both for every single chapter and across chapters Every chapter focuses on a specific problem it addresses a question it answers the attention it demands a message it conveys and further open questions it raises The chapters are mostly independent which implies a certain redundancy yet it allows lecturers and their students to either use the book as the basis of teaching software architecture or design or to just pick those aspects that need special attention in a more advanced course **Handbook of Model-Based Systems Engineering** Azad M. Madni,Norman Augustine,Michael Sievers,2023-07-25 This handbook brings together diverse domains and technical competences of Model Based Systems Engineering MBSE into a single comprehensive publication It is intended for researchers practitioners and students educators who require a wide ranging and authoritative reference on MBSE with a

multidisciplinary global perspective It is also meant for those who want to develop a sound understanding of the practice of systems engineering and MBSE and or who wish to teach both introductory and advanced graduate courses in systems engineering It is specifically focused on individuals who want to understand what MBSE is the deficiencies in current practice that MBSE overcomes where and how it has been successfully applied its benefits and payoffs and how it is being deployed in different industries and across multiple applications MBSE engineering practitioners and educators with expertise in different domains have contributed chapters that address various uses of MBSE and related technologies such as simulation and digital twin in the systems lifecycle The introductory chapter reviews the current state of practice discusses the genesis of MBSE and makes the business case Subsequent chapters present the role of ontologies and meta models in capturing system interdependencies reasoning about system behavior with design and operational constraints the use of formal modeling in system model verification and validation ontology enabled integration of systems and system of systems digital twin enabled model based testing system model design synthesis model based tradespace exploration design for reuse human system integration and role of simulation and Internet of Things IoT within MBSE **Analysis, Estimations, and Applications of Embedded Systems** Marco A. Wehrmeister,Márcio Kreutz,Marcelo Götz,Stefan Henkler,Andy D. Pimentel,Achim Rettberg,2023-02-16 This book constitutes the refereed proceedings of the 6th IFIP TC 10 International Embedded Systems Symposium IESS 2019 which took place in Friedrichshafen Germany in September 2019 The 16 full papers and 4 short papers presented in this book were carefully reviewed and selected from 32 submissions The papers were organized in topical sections on embedded real time systems estimations architecture and applications algorithms and System C and analysis **Embedded Systems for Biomedical Applications** Rishabha Malviya,Selcan Karakuş,Mukesh Roy,2025-03-18 This book is an essential guide to the constantly changing environment of embedded systems in healthcare in a world where the convergence of technology and healthcare is becoming increasingly important It further explains different scenarios corresponding to the latest technologies in the healthcare system for early diagnosis enhanced treatment and cure of diseases including remote patient monitoring cardiac monitoring and deep learning for remediation Features Emphasizes how embedded systems contribute to clinical care by facilitating personalized treatment and informed decision making for healthcare professionals Highlights the role of embedded systems in tracking treatment progress enabling healthcare professionals to monitor patient responses and adjust treatment plans accordingly Explores the application of embedded systems in remote patient monitoring allowing for continuous health monitoring outside traditional healthcare settings Presents the integration of deep learning and telecommunication technology with embedded systems optimizing their efficiency and utilization in biomedical applications Offers insights into future prospects for advancing biomedical applications through embedded systems providing a roadmap for further innovation and development in the field This reference work is useful for scholars and professionals interested in the applications and optimization of emerging smart

technologies in the field of healthcare   *Automotive Systems Engineering II* Hermann Winner,Günther Prokop,Markus Maurer,2017-11-30 This book is the second volume reflecting the shift in the design paradigm in automobile industry It presents contributions to the second and third workshop on Automotive Systems Engineering held in March 2013 and Sept 2014 respectively It describes major innovations in the field of driver assistance systems and automated vehicles as well as fundamental changes in the architecture of the vehicles   **Model-Based Safety and Assessment** Marc Zeller,Kai Höfig,2020-09-03 This book constitutes the proceedings of the 7th International Symposium on Model Based Safety and Assessment IMBSA 2020 held in Lisbon Portugal in September 2020 The conference was held virtually due to the COVID 19 pandemic The 15 revised full papers and 4 short papers presented were carefully reviewed and selected from 30 initial submissions The papers are organized in topical sections on safety models and languages state space modeling dependability analysis process safety assessment in automotive domain AI and safety assurance   **Intelligent Computing** Kohei Arai,Supriya Kapoor,Rahul Bhatia,2018-11-01 This book gathering the Proceedings of the 2018 Computing Conference offers a remarkable collection of chapters covering a wide range of topics in intelligent systems computing and their real world applications The Conference attracted a total of 568 submissions from pioneering researchers scientists industrial engineers and students from all around the world These submissions underwent a double blind peer review process Of those 568 submissions 192 submissions including 14 poster papers were selected for inclusion in these proceedings Despite computer science s comparatively brief history as a formal academic discipline it has made a number of fundamental contributions to science and society in fact along with electronics it is a founding science of the current epoch of human history the Information Age and a main driver of the Information Revolution The goal of this conference is to provide a platform for researchers to present fundamental contributions and to be a premier venue for academic and industry practitioners to share new ideas and development experiences This book collects state of the art chapters on all aspects of Computer Science from classical to intelligent It covers both the theory and applications of the latest computer technologies and methodologies Providing the state of the art in intelligent methods and techniques for solving real world problems along with a vision of future research the book will be interesting and valuable for a broad readership   **Conceptual Modeling** Alberto H. F. Laender,Barbara Pernici,Ee-Peng Lim,José Palazzo M. de Oliveira,2019-10-28 This book constitutes the refereed proceedings of the 38th International Conference on Conceptual Modeling ER 2019 held in Salvador Brazil in November 2019 The 22 full and 22 short papers presented together with 4 keynotes were carefully reviewed and selected from 142 submissions This events covers a wide range of topics covered in the following sessions conceptual modeling big data technology I process modeling and analysis query approaches big data technology II domain specific models I domain specific models II decision making complex systems modeling model unification big data technology III and requirements modeling   <u>Computer Safety, Reliability, and Security. SAFECOMP 2022 Workshops</u> Mario Trapp,Erwin Schoitsch,Jérémie Guiochet,Friedemann

Bitsch,2022-09-06 This book constitutes the proceedings of the Workshops held in conjunction with SAFECOMP 2022 which took place in Munich Germany in September 2022 The 23 full papers included in this volume were carefully reviewed and selected from 27 submissions 17th International ERCIM EWICS ARTEMIS Workshop on Dependable Smart Embedded Cyber Physical Systems and Systems of Systems DECSoS 2021 3rd International Workshop on Dependable Development Operation Continuum Methods for Dependable Cyber Physical System DepDevOps 2022 9th International Workshop on Next Generation of System Assurance Approaches for Critical Systems SASSUR 2022 1st International Workshop on Security and Safety Interaction SENSEI 2022 3rd International Workshop on Underpinnings for Safe Distributed Artificial Intelligence USDAI 2022 5th International Workshop on Artificial Intelligence Safety Engineering WAISE 2022 **Model-Based Engineering of Embedded Systems** ,2012-11-10 **Computer Safety, Reliability, and Security** António Casimiro,Frank Ortmeier,Friedemann Bitsch,Pedro Ferreira,2020-08-19 This book constitutes the proceedings of the 39th International Conference on Computer Safety Reliability and Security SAFECOMP 2020 held in Lisbon Portugal in September 2020 The 27 full and 2 short papers included in this volume were carefully reviewed and selected from 116 submissions They were organized in topical sections named safety cases and argumentation formal verification and analysis security modelling and methods assurance of learning enabled systems practical experience and tools threat analysis and risk mitigation cyber physical systems security and fault injection and fault tolerance The conference was held virtually due to the COVID 19 pandemic The chapter Assurance Argument Elements for Off the Shelf Complex Computational Hardware is available open access under an Open Government License 3 0 via link springer com

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