axel van lamsweerde software requirements engineering

Axel Van Lamsweerde Software Requirements Engineering: Mastering the Art of Defining What Software Should Do

axel van lamsweerde software requirements engineering is a phrase that resonates deeply within the software development community, especially among those committed to creating robust, reliable, and user-centric systems. Axel Van Lamsweerde is a pioneering figure whose work has significantly shaped how software requirements are understood, modeled, and managed. If you've ever wondered how complex software projects avoid chaos and miscommunication in their early stages, the principles and methodologies championed by Van Lamsweerde offer compelling answers.

In this article, we'll dive into the essence of Axel Van Lamsweerde's contributions to software requirements engineering, exploring his methodologies, the importance of precise requirements, and how his ideas continue to influence software engineering practices today.

The Importance of Software Requirements Engineering

Before delving into Van Lamsweerde’s specific approaches, it's crucial to understand why software requirements engineering (SRE) deserves such focused attention. At its core, SRE is about capturing, analyzing, and specifying what a software system should accomplish. This involves identifying stakeholders’ needs, resolving conflicts, and ensuring that the final software product aligns with business goals and user expectations.

However, requirements are often ambiguous, incomplete, or contradictory. Without a rigorous approach, software projects can suffer from scope creep, budget overruns, or outright failure. Axel Van Lamsweerde’s work provides a structured framework to mitigate these risks by promoting clarity, formalism, and traceability in requirements engineering.

Axel Van Lamsweerde’s Goal-Oriented Requirements Engineering (GORE)

One of the most influential contributions by Axel Van Lamsweerde to software requirements engineering is the Goal-Oriented Requirements Engineering (GORE) approach. Unlike traditional methods that focus solely on documenting system functions, GORE emphasizes understanding the underlying goals that the

software must fulfill. This shift in perspective leads to a more holistic and flexible requirements specification.

Understanding GORE

At the heart of GORE is the idea that software requirements should be derived from higher-level goals — what the system is intended to achieve rather than just what it does. These goals can be functional (e.g., “process customer orders efficiently”) or non-functional (e.g., “ensure system availability 99.9% of the time”).

By decomposing broad goals into subgoals and eventually into precise requirements, developers gain a clearer roadmap that connects business objectives to technical specifications. This hierarchical goal model also helps identify conflicting requirements early on and provides a mechanism for prioritization.

Benefits of Goal-Oriented Techniques

- **Improved traceability:** Linking requirements back to original goals ensures that every feature contributes meaningfully to business value.
- **Conflict resolution:** By examining goals, teams can detect and resolve inconsistencies before coding begins.
- **Flexibility:** As goals evolve, GORE frameworks allow easier updating of requirements without losing coherence.
- **Enhanced communication:** Stakeholders can discuss goals more naturally than technical details, promoting better collaboration.

Formal Methods and the KAOS Framework

Axel Van Lamsweerde is also known for integrating formal methods into requirements engineering, particularly through the development of the KAOS framework. KAOS (Keep All Objectives Satisfied) combines goal modeling with formal specification techniques, bridging the gap between abstract goals and implementable requirements.

What is KAOS?

KAOS is a comprehensive methodology that guides the entire process of requirements engineering from goal elicitation to formal specification and verification. It uses graphical models to represent goals, obstacles, agents, and domain properties, facilitating clarity and rigor.

One of KAOS’s strengths lies in its use of formal logic to specify goals and constraints precisely. This precision enables automated reasoning about the requirements model, such as checking for conflicts or verifying that goals are achievable.

Practical Applications of KAOS

- **Risk management:** By identifying potential obstacles that prevent goal achievement, KAOS helps anticipate and mitigate risks early.
- **Requirements validation:** Formal specifications allow for rigorous checking, reducing ambiguities.
- **System design support:** KAOS models can guide architectural decisions by clarifying agent responsibilities and interactions.

Impact on Industry and Academia

Axel Van Lamsweerde’s software requirements engineering methodologies have seen widespread adoption in both industrial and academic settings. His work has influenced standards, textbooks, and tools that practitioners use to improve requirements quality.

Influence on Software Engineering Education

Many software engineering courses incorporate Van Lamsweerde’s goal-oriented techniques due to their emphasis on clarity and stakeholder alignment. Students learn to move beyond writing vague requirements and toward structured, goal-driven analysis that mirrors real-world complexity.

Industry Adoption and Tools

Several requirements management tools have integrated goal modeling capabilities inspired by Van Lamsweerde’s research. Companies developing safety-critical or complex systems—such as aerospace, healthcare, and finance—find his approaches particularly valuable for ensuring compliance and reliability.

Tips for Applying Axel Van Lamsweerde’s Principles in Your Projects

If you’re a software engineer, project manager, or analyst looking to harness

the power of Axel Van Lamsweerde’s software requirements engineering concepts, here are some practical tips:

1. **Start with high-level goals:** Engage stakeholders in discussing what the system should achieve before jumping into technical details.
2. **Use goal decomposition:** Break down broad objectives into smaller, manageable subgoals to clarify requirements incrementally.
3. **Identify and model conflicts:** Explicitly represent conflicting goals and negotiate trade-offs early in the process.
4. **Incorporate formal specifications when possible:** Even simple formal models can reduce ambiguity and improve validation.
5. **Maintain traceability:** Link requirements back to their originating goals to ensure relevance and facilitate future changes.
6. **Leverage available tools:** Explore requirements engineering software that supports goal modeling and formal verification to streamline your workflow.

The Evolving Landscape of Requirements Engineering

While Axel Van Lamsweerde’s foundational work remains highly relevant, the field of software requirements engineering continues to evolve. Emerging trends like agile methodologies, DevOps, and AI-assisted requirements analysis are reshaping how teams capture and refine requirements. Yet, the core principles of clarity, goal orientation, and formal rigor championed by Van Lamsweerde provide a stable foundation amid these shifts.

In today’s fast-paced development environments, where requirements can change rapidly, having a well-structured goal model helps teams adapt without losing sight of the ultimate purpose. Moreover, as software systems grow increasingly complex and intertwined with critical infrastructure, the need for precise and analyzable requirements becomes even more pressing.

Axel Van Lamsweerde’s contributions to software requirements engineering offer a timeless lens through which to view the challenges of defining software systems. By focusing on goals, embracing formalism, and promoting stakeholder collaboration, his methodologies empower teams to build software that truly meets its intended purpose — a crucial step toward delivering

value and success in any software project.

Frequently Asked Questions

Who is Axel van Lamsweerde in the field of software requirements engineering?

Axel van Lamsweerde is a renowned researcher and professor known for his significant contributions to software requirements engineering, particularly in goal-oriented requirements engineering methodologies.

What is Axel van Lamsweerde's main contribution to software requirements engineering?

Axel van Lamsweerde is best known for developing the KAOS goal-oriented requirements engineering framework, which helps in systematically capturing, analyzing, and refining software requirements based on stakeholder goals.

What is the KAOS methodology developed by Axel van Lamsweerde?

KAOS is a goal-oriented requirements engineering methodology created by Axel van Lamsweerde that focuses on modeling and analyzing stakeholder goals to derive precise and verifiable software requirements.

How does Axel van Lamsweerde's work impact modern requirements engineering practices?

His work on goal-oriented requirements engineering provides structured techniques for understanding complex stakeholder needs, improving the clarity, consistency, and validation of software requirements in modern development processes.

Are there any influential books or papers by Axel van Lamsweerde on software requirements engineering?

Yes, Axel van Lamsweerde authored the influential book 'Requirements Engineering: From System Goals to UML Models to Software Specifications,' which is widely used for teaching and research in software requirements engineering.

Additional Resources

Axel Van Lamsweerde Software Requirements Engineering: A Deep Dive into Methodologies and Impact

axel van lamsweerde software requirements engineering stands as a cornerstone in the field of software development, particularly in the domain of requirements engineering (RE). Recognized globally for his seminal contributions, Axel Van Lamsweerde has shaped modern approaches to eliciting, modeling, and validating software requirements, influencing both academic research and industry practices. This article explores his methodologies, theoretical frameworks, and their lasting impact on software requirements engineering.

Axel Van Lamsweerde: A Pioneer in Software Requirements Engineering

Axel Van Lamsweerde is a Belgian computer scientist whose work has been central to formalizing the requirements engineering process. His influence is evident in how requirements are systematically analyzed and managed to reduce ambiguity, inconsistency, and incompleteness—common pitfalls in software projects that often lead to costly failures. His approach emphasizes goal-oriented requirements engineering (GORE), which shifts the focus from merely documenting system functionalities to understanding the underlying objectives that the system aims to fulfill.

Van Lamsweerde’s research tackles the complexity of requirements specifications by integrating formal methods with practical modeling techniques. This blend has enabled clearer communication between stakeholders and developers, fostering better alignment of expectations and technical feasibility.

Key Contributions and Methodologies

Goal-Oriented Requirements Engineering (GORE)

One of Van Lamsweerde’s most significant contributions is the conceptualization and advancement of GORE. Unlike traditional approaches that focus on listing system requirements as isolated statements, GORE centers on identifying stakeholders’ goals and systematically decomposing them into refined sub-goals. This hierarchical goal decomposition ensures that every requirement is traceable back to a strategic objective, enhancing the rationale behind each system feature.

GORE facilitates conflict resolution by explicitly representing conflicting goals, allowing engineers to negotiate trade-offs early in the development cycle. This method also promotes the detection of missing requirements through structured refinement and consistency checks, making it a powerful tool for complex system design.

Formal Specification and Validation Techniques

Van Lamsweerde advocates for the use of formal methods in specifying requirements to avoid the ambiguities inherent in natural language descriptions. His approach integrates formal logic to define system properties unambiguously, which supports automated consistency checking and verification.

By applying formal specification languages, requirements engineers can detect contradictions and incomplete definitions before implementation begins. This early validation reduces costly rework and improves the reliability of the final software product.

The Impact of Van Lamsweerde’s Work on Modern Software Engineering

The methodologies developed by Axel Van Lamsweerde have been widely adopted in both academic curricula and industry practices. His goal-oriented approach has influenced popular requirements engineering tools and frameworks, providing software teams with structured processes to handle complex stakeholder demands.

In industries such as aerospace, healthcare, and finance—where system failures can have severe consequences—his techniques have been instrumental in ensuring rigorous and traceable requirements management. The clarity and precision introduced by his methods contribute to improved project outcomes, including reduced delays and budget overruns.

Comparative Perspective: Traditional vs. Goal-Oriented Requirements Engineering

Traditional requirements engineering often relies heavily on natural language specifications, which are prone to misinterpretation and incompleteness. In contrast, Van Lamsweerde’s goal-oriented framework introduces:

- **Traceability:** Every requirement links back to a higher-level goal, facilitating impact analysis when changes occur.

- **Conflict Management:** Explicit modeling of conflicting goals enables proactive resolution strategies.
- **Incremental Refinement:** Goals are progressively elaborated into operational requirements, improving clarity.

These advantages provide a more resilient foundation for managing evolving requirements in dynamic project environments.

Challenges and Considerations in Applying Van Lamsweerde’s Methods

Despite the benefits, implementing goal-oriented requirements engineering can present challenges. The formal rigor and abstraction levels may require steep learning curves for practitioners unfamiliar with formal methods or goal modeling languages. Additionally, the process demands active stakeholder engagement to accurately capture and validate goals.

Organizations must balance the overhead of thorough requirements analysis with project timelines and resources. However, when applied judiciously, these methods often yield a net gain by preventing misunderstandings and scope creep downstream.

Integrating Axel Van Lamsweerde’s Principles into Agile and DevOps Environments

Modern software development increasingly embraces Agile and DevOps methodologies, which emphasize iterative delivery and continuous feedback. Axel Van Lamsweerde’s software requirements engineering principles can complement these practices by providing a structured yet flexible framework for understanding user goals and system constraints.

In Agile contexts, goal-oriented models can guide user story development, ensuring alignment with strategic objectives. Moreover, the formalization of requirements supports automated testing and validation processes integral to DevOps pipelines, enhancing quality assurance.

Tools and Frameworks Inspired by Van Lamsweerde’s Research

Several software tools have incorporated goal-oriented and formal requirements engineering concepts, aiding practitioners in applying these

techniques. Examples include:

- **KAOS:** A goal-oriented modeling framework designed for requirements elicitation and analysis.
- **i* Framework:** Used for modeling and analyzing organizational dependencies and goal relationships.
- **Formal Specification Languages:** Such as Alloy and Z, which support the formalization and verification of requirements.

These tools facilitate the visualization, refinement, and validation of requirements, embodying the principles advocated by Axel Van Lamsweerde.

Future Directions in Software Requirements Engineering

As software systems grow increasingly complex and interconnected, the foundational work of Axel Van Lamsweerde continues to offer valuable insights. Emerging challenges such as requirements engineering for AI systems, Internet of Things (IoT), and adaptive systems necessitate robust frameworks capable of handling ambiguity and dynamic environments.

Researchers are extending goal-oriented approaches to incorporate probabilistic reasoning, machine learning-based requirement elicitation, and real-time validation. Van Lamsweerde’s emphasis on formalization and goal analysis provides a solid base for these innovations.

Axel Van Lamsweerde’s software requirements engineering methodologies represent a significant evolution in how software projects are conceptualized and executed. By focusing on underlying goals and formalizing requirements, his work addresses fundamental issues of clarity, consistency, and stakeholder alignment that have long challenged software development. As the software industry advances, the principles he championed remain highly relevant, guiding practitioners toward more reliable and successful system designs.

Axel Van Lamsweerde Software Requirements Engineering

https://espanol.centerforautism.com/archive-th-119/files?trackid=BaY31-0262&title=make-your-own-electric-guitar-by-melvyn-hiscock.pdf

axel van lamsweerde software requirements engineering: *Requirements Engineering* Axel van Lamsweerde, 2009-02-09 Essential comprehensive coverage of the fundamentals of requirements engineering Requirements engineering (RE) deals with the variety of prerequisites that must be met by a software system within an organization in order for that system to produce stellar results. With that explanation in mind, this must-have book presents a disciplined approach to the engineering of high-quality requirements. Serving as a helpful introduction to the fundamental concepts and principles of requirements engineering, this guide offers a comprehensive review of the aim, scope, and role of requirements engineering as well as best practices and flaws to avoid. Shares state-of-the-art techniques for domain analysis, requirements elicitation, risk analysis, conflict management, and more Features in-depth treatment of system modeling in the specific context of engineering requirements Presents various forms of reasoning about models for requirements quality assurance Discusses the transitions from requirements to software specifications to software architecture In addition, case studies are included that complement the many examples provided in the book in order to show you how the described method and techniques are applied in practical situations.

axel van lamsweerde software requirements engineering: Requirements Engineering , 2009

axel van lamsweerde software requirements engineering: *Entwurf einer konzeptuellen Modellierungsmethode zur Unterstützung rationaler Zielplanungsprozesse in Unternehmen* Christian Köhling, 2013-04-24 Wirtschaftliches Handeln in Unternehmen empfiehlt die Berücksichtigung von Zielen. Diese Feststellung gehört gleichsam zum Inventar eines jeden betriebswirtschaftlichen Lehrbuchs. Auch in der Praxis scheint die Bedeutung dezidiert zielorientierten Handelns an Bedeutung zu gewinnen. Als Indiz dafür mag die zunehmende Verbreitung von Kennzahlensystemen dienen. Gleichzeitig ist die Entwicklung von Zielen in Unternehmen mit erheblichen Herausforderungen verbunden. Die vorliegende Dissertation setzt sich mit der Herausforderung auseinander, eine neuartige Methode zur konzeptuellen Modellierung des Umgangs mit Zielen in Unternehmen zu entwickeln. Dabei bewegt sie sich auf dem Forschungsgebiet der Unternehmensmodellierung, die grundsätzlich darauf abzielt, eine ineinander verzahnte Gestaltung von Handlungssystem und Informationssystem eines Unternehmens zu unterstützen. Dazu werden Modelle von Handlungssystemen, wie etwa Geschäftsprozessmodelle, mit solchen von Informationssystemen integriert. Der intendierte Anwendungsbereich dieser speziellen Modellierungsmethode reicht noch weiter, als es die Formulierung des Dissertationsthemas vermuten lässt. Er erstreckt sich nicht nur auf die rationale Planung von Zielen in Unternehmen, die im Vordergrund der Ausführungen steht, sondern umfasst daneben ebenso die Erfassung und Beurteilung der Zielerreichung sowie Rückkopplungen zum zukünftigen Umgang mit einem Ziel, die aus dem Vergleich zwischen der ursprünglich geplanten mit der tatsächlich erfassten Zielerreichung resultieren. Die Arbeit ist in sieben Kapitel gegliedert. Nach dem einleitenden Kapitel 1 findet in Kapitel 2 zunächst eine wissenschaftstheoretische Einordnung des Forschungsvorhabens statt. Anschließend wird in Kapitel 3 über den Zielbegriff und seine Verwendung in Theorie und Praxis reflektiert. Aufbauend auf den daraus gewonnenen Erkenntnissen wird in Kapitel 4 eine Ausgangsbasis für das nachfolgende Konstruktionsvorhaben geschaffen, indem zugrunde gelegte Annahmen, Einsatzzweck und Anforderungen für eine Methode zur Modellierung von Zielen in Unternehmen dargelegt sowie bereits existierende Ansätze diskutiert werden. Die eigentliche Entwicklung der Modellierungsmethode wird in Kapitel 5 geleistet, ihre Evaluation erfolgt in Kapitel 6. Abgeschlossen wird die Arbeit in Kapitel 7 mit einem Fazit der erzielten Forschungsergebnisse und einem Ausblick auf mögliche Anschlussforschung.

axel van lamsweerde software requirements engineering: Knowledge-based Software Engineering Joint Conference on Knowledge-Based Software Engineering, 2012 As knowledge-based software engineering matures and increasingly automates the software engineering life cycle, software engineering resources are shifting towards knowledge acquisition and the automated reuse of expert knowledge for developing software artifacts. This book summarizes the work and new research results presented at the Tenth Joint Conference on Knowledge-based Software Engineering (JCKBSE 2012), held on the island of Rhodes, Greece, in August 2012. The biennial Joint Conference on Knowledge-Based Software Engineering brings together researchers and practitioners to share ideas on the foundations, techniques, tools, and applications of knowledge-based software engineering theory and practice. Topics addressed include theoretical foundations, practical techniques, software tools, applications and/or experience reports in knowledge-based software engineering. This book is published in the subseries Knowledge-Based Intelligent Engineering Systems (KBIES).

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axel van lamsweerde software requirements engineering: From Object-Orientation to Formal Methods Olaf Owe, Stein Krogdahl, Tom Lyche, 2004-03-31 This book is dedicated to the memory of Ole-Johan Dahl who passed away in June 2002 at the age of 70, shortly after he had received, together with his colleague Kristen Nygaard, the ACM Alan M. Turing Award: For ideas fundamental to the emergence of object-oriented programming, through their design of the programming languages Simula I and Simula 67. This Festschrift opens with a short biography and a bibliography recollecting Ole-Johan Dahl's life and work, as well as a paper he wrote entitled: The Birth of Object-Orientation: the Simula Languages. The main part of the book consists of 14 scientific articles written by leading scientists who worked with Ole-Johan Dahl as students or colleagues. In accordance with the scope of Ole-Johan Dahl's work and the book's title, the articles are centered around object-orientation and formal methods.

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axel van lamsweerde software requirements engineering: Fundamental Approaches to Software Engineering Leen Lambers, Sebastián Uchitel, 2023-04-19 This open access book constitutes the proceedings of the 26th International Conference on Fundamental Approaches to Software Engineering, FASE 2023, which was held during April 22-27, 2023, in Paris, France, as part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2023. The 12 regular papers presented in this volume were carefully reviewed and selected from 50 submissions. The proceedings also contain 2 tool papers, 2 NIER papers, and 2 competition papers from the Test-Comp Competition. The papers deal with the foundations on which software engineering is built, including topics like software engineering as an engineering discipline, requirements engineering, software architectures, software quality, model-driven development, software processes, software evolution, AI-based software engineering, and the specification, design, and implementation of particular classes of systems, such as (self-)adaptive, collaborative, AI, embedded, distributed, mobile, pervasive, cyber-physical, or service-oriented applications. .

axel van lamsweerde software requirements engineering: Requirements Engineering for Safety-Critical Systems Luiz Eduardo G. Martins, Tony Gorschek, 2022-09-01 Safety-Critical Systems (SCS) are increasingly present in people's daily activities. In the means of transport, in medical treatments, in industrial processes, in the control of air, land, maritime traffic, and many other situations, we use and depend on SCS. The requirements engineering of any system is crucial

for the proper development of the same, and it becomes even more relevant for the development of SCS. Requirements Engineering is a discipline that focuses on the development of techniques, methods, processes, and tools that assist in the design of software and systems, covering the activities of elicitation, analysis, modeling and specification, validation, and management of requirements. The complete specification of system requirements establishes the basis for its architectural design. It offers a description of the functional and quality aspects that should guide the implementation and system evolution. In this book, we discuss essential elements of requirements engineering applied to SCS, such as the relationship between safety/hazard analysis and requirements specification, a balance between conservative and agile methodologies during SCS development, the role of requirements engineering in safety cases, and requirements engineering maturity model for SCS. This book provides relevant insights for professionals, students, and researchers interested in improving the quality of the SCS development process, making system requirements a solid foundation for improving the safety and security of future systems.

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axel van lamsweerde software requirements engineering: Formal Methods for Software Architectures Marco Bernardo, 2003-09-12 In the past ten years or so, software architecture has emerged as a central notion in the development of complex software systems. Software architecture is now accepted in the software engineering research and development community as a manageable and meaningful abstraction of the system under development and is applied throughout the software

development life cycle, from requirements analysis and validation, to design and down to code and execution level. This book presents the tutorial lectures given by leading authorities at the Third International School on Formal Methods for the Design of Computer, Communication and Software Systems, SFM 2003, held in Bertinoro, Italy, in September 2003. The book is ideally suited for advanced courses on software architecture as well as for ongoing education of software engineers using formal methods in their day-to-day professional work.

axel van lamsweerde software requirements engineering: Software Architecture Jan Bosch, Morven Gentleman, Christine Hofmeister, Juha Kuusela, 2002-07-31 For more and more systems, software has moved from a peripheral to a central role, replacing mechanical parts and hardware and giving the product a competitive edge. Consequences of this trend are an increase in: the size of software systems, the variability in software artifacts, and the importance of software in achieving the system-level properties. Software architecture provides the necessary abstractions for managing the resulting complexity. We here introduce the Third Working IEEFlIFIP Conference on Software Architecture, WICSA3. That it is already the third such conference is in itself a clear indication that software architecture continues to be an important topic in industrial software development and in software engineering research. However, becoming an established field does not mean that software architecture provides less opportunity for innovation and new directions. On the contrary, one can identify a number of interesting trends within software architecture research. The first trend is that the role of the software architecture in all phases of software development is more explicitly recognized. Whereas initially software architecture was primarily associated with the architecture design phase, we now see that the software architecture is treated explicitly during development, product derivation in software product lines, at run-time, and during system evolution. Software architecture as an artifact has been decoupled from a particular lifecycle phase.

axel van lamsweerde software requirements engineering: *Software Architecture: System Design, Development and Maintenance* Jan Bosch, Morven Gentleman, Christine Hofmeister, Juha Kuusela, 2013-06-29 For more and more systems, software has moved from a peripheral to a central role, replacing mechanical parts and hardware and giving the product a competitive edge. Consequences of this trend are an increase in: the size of software systems, the variability in software artifacts, and the importance of software in achieving the system-level properties. Software architecture provides the necessary abstractions for managing the resulting complexity. We here introduce the Third Working IEEFlIFIP Conference on Software Architecture, WICSA3. That it is already the third such conference is in itself a clear indication that software architecture continues to be an important topic in industrial software development and in software engineering research. However, becoming an established field does not mean that software architecture provides less opportunity for innovation and new directions. On the contrary, one can identify a number of interesting trends within software architecture research. The first trend is that the role of the software architecture in all phases of software development is more explicitly recognized. Whereas initially software architecture was primarily associated with the architecture design phase, we now see that the software architecture is treated explicitly during development, product derivation in software product lines, at run-time, and during system evolution. Software architecture as an artifact has been decoupled from a particular lifecycle phase.

axel van lamsweerde software requirements engineering: Enterprise Information Systems V Olivier Camp, Joaquim Filipe, Slimane Hammoudi, Mario G. Piattini, 2006-02-27 This book comprises a set of papers selected from those presented at the fifth « International Conference on Enterprise Information Systems », (ICEIS'2003) held in Angers, France, from 23 to 26 April 2003. The conference was organised by École Supérieure d'Électronique de l'Ouest (ESEO) of Angers, France and the Escola Superior de Tecnologia of Setúbal, Portugal. Since its first edition in 1999, ICEIS focuses on real world applications and aims at bringing together researchers, engineers and practitioners interested in the advances and business applications of information systems. As in previous years, ICEIS'2003 held four simultaneous tracks covering different aspects of enterprise computing: Databases and Information Systems Integration, Artificial Intelligence and Decision

Support Systems, Information Systems Analysis and Specification and Software Agents and Internet Computing. Although ICEIS'2003 received 546 paper submissions from over 50 countries, only 80 were accepted as full papers and presented in 30-minutes oral presentations. With an acceptance rate of 15%, these numbers demonstrate the intention of preserving a high quality forum for future editions of this conference. From the articles accepted as long papers for the conference, only 32 were selected for inclusion in this book Additional keynote lectures, tutorials and industrial sessions were also held during ICEIS'2003, and, for the first time this year, the 1st Doctoral Consortium on Enterprise Information Systems gave PhD students an opportunity to present their work to an international audience of experts in the field of information systems.

axel van lamsweerde software requirements engineering: *Design Requirements Engineering: A Ten-Year Perspective* Kalle Lyytinen, Pericles Loucopoulos, John Mylopoulos, William N. Robinson, 2009-01-20 Since its inception in 1968, software engineering has undergone numerous changes. In the early years, software development was organized using the waterfall model, where the focus of requirements engineering was on a frozen requirements document, which formed the basis of the subsequent design and implementation process. Since then, a lot has changed: software has to be developed faster, in larger and distributed teams, for pervasive as well as large-scale applications, with more flexibility, and with ongoing maintenance and quick release cycles. What do these ongoing developments and changes imply for the future of requirements engineering and software design? Now is the time to rethink the role of requirements and design for software intensive systems in transportation, life sciences, banking, e-government and other areas. Past assumptions need to be questioned, research and education need to be rethought. This book is based on the Design Requirements Workshop, held June 3-6, 2007, in Cleveland, OH, USA, where leading researchers met to assess the current state of affairs and define new directions. The papers included were carefully reviewed and selected to give an overview of the current state of the art as well as an outlook on probable future challenges and priorities. After a general introduction to the workshop and the related NSF-funded project, the contributions are organized in topical sections on fundamental concepts of design; evolution and the fluidity of design; quality and value-based requirements; requirements intertwining; and adapting requirements practices in different domains.

axel van lamsweerde software requirements engineering: *Ein Referenzmodell für die Serienentwicklung mechatronischer Systeme in der Automobilindustrie* Thomas Reiß, 2014-01-16 In der Automobilindustrie werden innovative Funktionen zunehmend über mechatronische Systeme realisiert. Die Entwicklungsprozesse müssen daher an die Mechatronikentwicklung angepasst werden, um eine effiziente Umsetzung neuartiger Funktionen bei gleichbleibend hoher Produktqualität zu gewährleisten. In der vorliegenden Arbeit wird ein Referenzmodell für die Entwicklungsabläufe der Serienentwicklung erarbeitet, wobei neben verschiedenen Entwicklungsmodellen die unterschiedlichen Herangehensweisen der an einer Mechatronikentwicklung beteiligten Fachdisziplinen berücksichtigt werden. Mit der Darstellung der für Planung und Steuerung erforderlichen Supportprozesse zusätzlich zu den Abläufen von Engineeringprozessen wird ein umfassendes Vorgehen für die Serienentwicklung bereitgestellt, welches sich positiv auf Produktqualität sowie Entwicklungszeit und -kosten auswirkt.

axel van lamsweerde software requirements engineering: *From Requirements to Java in a Snap* Michał Śmiałek, Wiktor Nowakowski, 2015-01-14 This book provides a coherent methodology for Model-Driven Requirements Engineering which stresses the systematic treatment of requirements within the realm of modelling and model transformations. The underlying basic assumption is that detailed requirements models are used as first-class artefacts playing a direct role in constructing software. To this end, the book presents the Requirements Specification Language (RSL) that allows precision and formality, which eventually permits automation of the process of turning requirements into a working system by applying model transformations and code generation to RSL. The book is structured in eight chapters. The first two chapters present the main concepts and give an introduction to requirements modelling in RSL. The next two chapters concentrate on presenting RSL in a formal way, suitable for automated processing. Subsequently,

chapters 5 and 6 concentrate on model transformations with the emphasis on those involving RSL and UML. Finally, chapters 7 and 8 provide a summary in the form of a systematic methodology with a comprehensive case study. Presenting technical details of requirements modelling and model transformations for requirements, this book is of interest to researchers, graduate students and advanced practitioners from industry. While researchers will benefit from the latest results and possible research directions in MDRE, students and practitioners can exploit the presented information and practical techniques in several areas, including requirements engineering, architectural design, software language construction and model transformation. Together with a tool suite available online, the book supplies the reader with what it promises: the means to get from requirements to code “in a snap”.

axel van lamsweerde software requirements engineering: 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 & organization, general principles, safety, security, and risk management principles); • Provides direct guidance on architecting and operating dependable cyber-physical systems for software managers and architects.

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