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ICSSP 2015–Special Issue Introduction

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This special issue comprises the selected and revised versions of the following ICSSP 2015 conference papers:

- Piloting MDevSPICE®: The Medical Device Software Process Assessment Framework, [10]
- Development and Validation of the MedITNet Assessment Framework: Improving Risk Management of Medical IT Networks, [11]
- Integrated Systems Engineering and Software Requirements Engineering for Technical Systems, [7] **(Winner of the ICSSP Best Paper Award 2015)**
- Tailoring Process Requirements for Software Product Assurance, [13] **(Winner of the ICSSP Best Short Paper Award 2015)**
- Software Process Line Discovery, [2]
- Towards a Change-aware Process Environment for System and Software Process, [6]

Links to the extended journal versions of the comprised papers will be added as soon as available.

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1. INTRODUCTION

Modern systems consist of a complex mix of products and services—legacy, bespoke, COTS, open source, licensed, and user-developed—that must be designed to meet rapidly changing business needs [9]. Business processes must be agile to capture and maintain customers with rapidly evolving needs, tastes, and desires. Systems technology and development methods must be responsive to business needs to continuously support value creation. However, legacy and regulatory constraints, emerging requirements, enhanced interoperability, and the ascendancy of software have challenged system development processes, and has made many companies deploying so-called hybrid development approaches address these manifold constraints [14]. Just as systems are more necessary for business success, the ability to align systems and business goals and processes has become more difficult. In fact, in the field of software process development, deployment, and continuous improvement, we find a diversity of (competing) approaches, and we face a field that is still on the quest for the "optimal" approach to organize and improve software and system development [8]. In the past, the processes and underlying principles of business, system engineering and software engineering have independently evolved and are represented by languages and concepts that are tantalizingly similar and yet seem to be in conflict. This has led to confusion and often friction between and among these critical conceptual constituents [5].

The volume at hand presents the special issue of the *International Conference on Software and Systems Process* (ICSSP) 2015, which was held in Tallinn, Estonia from August 24-26, 2015. ICSSP as the premier venue for research related to software and systems development processes has become an important mediator for industry and academia. To answer questions like the one mentioned before, ICSSP brings together scientists and practitioners to discuss problems and solutions, and to present concrete experiences. Therefore, the six high-quality papers chosen for this special issue address both a solid scientific background and an industry focus. It is through publishing such papers that we can bridge the industry-research gap, ensuring that our research will have an impact, not only through our teaching and graduate programs but also by having a direct effect on the improvement of processes within industry.

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2. INTERNATIONAL CONFERENCE ON SOFTWARE AND SYSTEMS PROCESS

During the evolution of this conference series, from 1984 to 1996, the International Software Process Workshops (ISPW) attracted many academic researchers and industrial practitioners. Parallel to the ISPW emerged the International Conference on Software Process, (ICSP, from 1991 until 1996), followed by the International Workshop on Software Process Simulation and Modeling (from 1998 until 2006), and the SPW (in 2005 and 2006). The International Workshop on Software Process Simulation and Modeling and SPW were held together in 2006 and merged in 2007 to form the new International Conference on Software Process. In 2009, the third ICSP conference was held in Vancouver, Canada, on May 16-17, 2009, and was co-located with the International Conference on Software Engineering (ICSE). The ICSSP (International Conference on Software and System Process) conferences continue the successful ICSP conference series, while broadening ICSP's scope of software development processes to system development and explicitly including processes of other domains such as business, health care, and manufacturing. By sharing process development theories and practices from such domains, ICSSP 2015 aimed at investigating novel solutions to today's software and systems process challenges. The theme of ICSSP 2015 was *"Bridging the Gap: Reconciling Systems, Software and Business Processes"*.

3. ICSSP 2015

ICSSP 2015 welcomed its participants in Tallinn, the capital city of Estonia. The conference's program offered numerous events and activities to allow participants getting an overview of the current state of the field as well as attending focused workshops and tutorials, and meeting the community.

3.1. ICSSP Workshops and Tutorials

The first day was devoted to workshops and tutorials. ICSSP hosted two workshops and three tutorials:

1st International Workshop on Impact of Agile Practices (ImpAct)

The primary purpose of the ImpAct workshop was to discuss the current state of evidence on the impact of Agile Practices and to initiate the work on creating a knowledge base. In an active workshop model, participants collected material, discussed, and eventually created initial maps of the state of evidence concerning different aspects of Agile Practices. The workshop results were also summarized and published in the ACM SIGSOFT Software Engineering Notes [4].

1st International Workshop on Open Innovation in Software Engineering (OISE)

The OISE workshop aimed at bridging the gap between Open Innovation in the business domain and its applicability in the software engineering domain by establishing a community of researchers. Among others, presenters in this workshop addressed the different topics regarding fostering open innovation, conducting evidence-based research, and envisioning future research directions.

ICSSP Tutorials

The three ICSSP tutorials focused on different perspectives of process modeling:

- The Incremental Commitment Spiral Model (ICSM): Principles and Practices for Successful Systems and Software
- Strategic Business Process Management
- Tackling the Incompleteness of Software Engineering Education with the ESSENCE Kernel

3.2. ICSSP Main Program

The ICSSP main program on the second and third days comprised three keynote talks, a panel session, a poster session, and, of course the presentation of the accepted papers. In total, ICSSP received 57 submissions from 20 different countries and regions of which 24 were full research papers and another 26 were short- and work in progress papers. Furthermore, ICSSP received 7 poster submissions. This special issue contains a selection of research papers from the conference's main track, including the two award-winning papers [7, 13]. The papers included in this issue were ranked highest by reviewers among all the papers submitted to the ICSSP 2015 conference.

3.3. ICSSP Keynote Talks

Big Software on the Run: In Vivo Software Analytics Based on Process Mining In his talk, Wil van der Aalst (TU Eindhoven, The Netherlands; [1]) addressed the growing complexity, scale, and diversity of software. Since software is evolving and operates in a changing environment, one cannot anticipate all problems at design-time. He proposes to analyze software "in vivo", i.e., studying systems in their natural habitat rather than through testing or software design. Running systems should be observed to collect and analyze data, generate descriptive models, and use these to respond to failures. Process mining serves as a tool for in vivo software analytics. The alignment of models and real software behavior can be used to predict problems related to performance or conformance. This keynote provides pointers to process mining literature and introduces the "Big Software on the Run" (BSR) research program that just started.

How is the software development process impacted when a large company goes agile? In his talk, Lars-Ola Damm (Ericsson, Sweden; [3]) described how Ericsson as one of the largest software development companies in the world has introduced agile ways of working. The company develops large software systems with high requirements on aspects such as time-to-market, quality, performance, security and usability. Therefore, the company has faced several challenges regarding how to adopt agile ways of working while still ensuring that the large-scale development and delivery environment is governed properly. In his talk, Lars-Ola Damm elaborated on these challenges and how they impacted the software development process.

Software Development as an Experiment System In his presentation, Jürgen Münch (Reutlingen University, Germany and University of Helsinki, Finland; [12]) addressed process engineers, researchers, product managers, startup founders, business people, software developers, and anyone who is interested in making an impact with their products. He discussed the relevance of experimentation in software development and how it influences the software process. In addition, Jürgen Münch presented new methods and practices that have been tested in different industry environments. He put special emphasis on answering questions like:

- How do we rapidly and effectively create value for users and customers by integrating experimentation into software processes?
- How do we identify the relevant experiments we need to conduct for making good product decisions?
- What are the components of a good hypothesis?
- How do we link the experimental findings with product decisions and dynamically change a product roadmap?
- What are the key obstacles when introducing continuous experimentation in an organization and how can we address them?
- What are future avenues for software process research?

3.4. ICSSP Panel

The ICSSP 2015 panel entitled "*Leveled Out – Have Agile and Lean Changed Process Improvement?*" was moderated by Richard Turner (Stevens Institute). 25 years after the first version of the Software Capability Maturity Model (SW-CMM) and the original SPICE standards, there

have been significant changes in the way we view processes in software and systems engineering. A broad set of approaches have followed, including SECAM, CMMI, ISO/IEC standards, agile manifesto, lean-six sigma, lean principles applied to knowledge work, MBSE, and even fundamental changes to the revered PMI Guide to the PMBOK. The panel discussed the impact these diverse and often contradictory concepts have had on improving engineering processes in industry, government, and academia. Each of the following panelists represented an arena where these ideas have played both with and against each other: Lars-Ola Damm (Ericsson), Philipp Diebold (Fraunhofer IESE), Anton Keks (Codeborne), Rory O'Connor (Lero), Lee Osterweil (University of Massachusetts).

The overall consensus of the discussion was that the evolution of both the system development environment and the way systems are developed have had a significant impact on the mechanics of process engineering and improvement. At the same time, this evolution has strengthened the influence of fundamental principles, as found in both traditional (e.g., PDCA, OODA) and more recent (Kaizen, adaptive project management, Lean Startup) philosophies. Together they incorporate both planned experimentation and rapid adaptation, increase focus on outcomes and stakeholders, and move away from organizational control and conformance.

3.5. ICSSP Selected and Revised Papers

From the 57 papers submitted to the different tracks, 10 full research papers, 12 short- and work in progress papers, and 4 poster submissions were selected for presentation. The five highest ranked full research papers and the awarded best short paper were selected for this special issue. In particular, we sought to select papers for this special issue that have meaningful insights for the broader Systems Engineering Community as well.

Among the many high-quality papers selected for presentation at the conference, reviewers selected the following six papers for inclusion in this special issue:

- Piloting MDevSPICE®: The Medical Device Software Process Assessment Framework, [10]
- Development and Validation of the MedITNet Assessment Framework: Improving Risk Management of Medical IT Networks, [11]
- Integrated Systems Engineering and Software Requirements Engineering for Technical Systems, [7] (*Winner of the ICSSP Best Paper Award 2015*)
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- Software Process Line Discovery, [2]
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All selected papers were invited to re-submit revised and enhanced versions to this special issue.

3.5.1. Lepmets et al.: In times of increasing integration, software has become more and more important for a multitude of safety-critical systems. A framework to assess the software development is presented by Lempets and her colleagues in their paper "*Practical Benefits of MDevSPICE®, the Medical Device Software Process Assessment Framework*". To help companies working in the field of medical devices to ground their business in a solid set of best practices and to aid assessments, the presented MDevSPICE® framework comprises lifecycle processes for the software and the whole system, and complementing support processes. The article focuses on introducing the MDevSPICE® framework and discussing benefits for practical applications.

3.5.2. MacMahon et al.: In the paper "*The MedITNet Assessment Framework: Development and Validation of a Framework for Improving Risk Management of Medical IT Networks*", MacMahon and her colleagues present a specialized risk assessment framework. The goal of the presented framework is to support Healthcare Delivery Organizations in applying the IEC 80001-1 standard to assess and manage risks in medical IT networks, by providing companies with a process reference model, a process assessment model, and an assessment method that complies with the ISO/IEC 15504-2 standard.

3.5.3. Holtmann et al.: In the field of automotive software, in their paper "*Integrated Systems Engineering and Software Requirements Engineering for Technical Systems*", Holtmann and his colleagues present an approach to overcome systematic refinement gaps between model-based Software Engineering and model-based requirements engineering. The overall goal of the presented approach is to avoid error-prone and time-consuming manual tasks necessary for refining interdisciplinary models for discipline-specific development approaches. Providing an Eclipse-based SysML derivate called SysML4Consens and a complementing case study, authors demonstrate the applicability of their approach in the domain of automotive software.

3.5.4. Prause et al.: Although modern software development is shaped by fast development and tight release cycles, software projects should always embrace change. In fact, in some domains, there is just no second attempt. In their article "*Software Product Assurance at the German Space Agency*", Prause and his colleagues provide insights how software product assurance is implemented in the mission-critical Space domain. The article describes the rigorous requirements regarding compliant software processes in this domain, and how processes are tailored in order to best fit particular mission requirements.

3.5.5. Blum et al.: As the software business is diverse, researchers and practitioners are on the quest for efficient instruments to improve the flexibility of processes. In their paper "*The v-algorithm for Discovering Software Process Lines*", Blum and his colleagues present an algorithm that helps distilling entire process lines from process logs. The presented v-algorithm takes into account the frequency of the relations between activities found in the log to allow for generating a process line, which comprises a base process and the required variabilities that eventually form the different process variants. Moreover, the v-algorithm serves the validation of the defined process, and helps identifying its variability whenever it was not previously identified. Despite all automation opportunities, the process engineer is still in charge of defining how the discovered variability is resolved before a process is enacted.

3.5.6. Hajmoosaei et al.: in their article "*A Process Environment to Manage Runtime Changes in System and Software Development*", Tran and colleagues address the problems coming along with changes in processes that are in operation. By presenting the 'Change-Aware Process Environment', they provide a combination of both process management and change management. This combination helps working out interdependencies among processes at runtime, even if such dependencies are not reflected in the underlying models thus enabling process engineers, e.g., analyzing the impact of particular changes.

4. CONCLUSION

We believe the selected papers represent a good sample of the work presented at the ICSSP conference and that the work presented in these papers is relevant to both Software and Systems Engineering communities. Further information about the ICSSP conference series as well as links to conference papers can be found at http://www.icsp-conferences.org.

Finally, ICSSP 2016 is knocking at the door. ICSSP in 2016 is again co-located with the International Conference on Software Engineering, this time in Austin, Texas, and has a focus on "Process in Action". Find further information about ICSSP 2016 at http://users.ece.utexas.edu/~perry/icssp2016.

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