RE@21 Spotlight: Most Influential Papers from the Requirements Engineering Conference

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Abstract—**Since 2003, an award has been presented annually at the IEEE International Requirements Engineering Conference for the Most Influential Paper presented at the conference 10 years previously. In 2013, we celebrate 21 years of the Requirements Engineering Conference, and we use this as an opportunity to reflect on the Most Influential Papers to date. Two sessions of the 2013 conference highlight the work of previous award winners and provide the authors with the opportunity to describe the trajectory of their work over the ten years that led to the award, and to discuss its impact since.**

Index Terms—**Most Influential Paper, Requirements Engineering Conference, RE@21.**

I. INTRODUCTION

The IEEE International Requirements Engineering Conference (RE) series started as two alternating biennial conference series. One series, in odd years starting in 1993, was the International Symposium on Requirements Engineering (RE). The other series, in even years starting in 1994, was the International Conference on Requirements Engineering (ICRE). The two series merged in 2002 with the holding of the Joint International Requirements Engineering Conference (RE'02), so named to announce the merger. However, starting in 2003, the name settled to the "International Requirements Engineering Conference" (RE). As major sponsors of the RE Conference Series, IEEE is pre-pended to its official name. A historical perspective on the RE Conference Series can be found as a separate paper in these proceedings [6].

Starting in 2003, an award has been given for the Most Influential Paper (MIP) from the conference held 10 years earlier, the judging undertaken by the current conference's Program Committee. In any year, there may be zero, one, or more such papers. If there are none, then in the opinion of the program committee, no papers from RE 10 years ago was influential. If there is more than one, then each will be in a different category, e.g., "research" and "experience". The MIP award winners to date are listed in Table I.

II. RE@21 SPOTLIGHT ON RE CONFERENCE MIPs

In 2013, the RE Conference is held for the 21st time. To mark this coming of age, the theme of the conference is RE@21. The objective of this theme is to investigate whether the field has made its transition from adolescence into adult-

hood, and to guide its onward journey. It is an opportunity to analyze our own achievements, and to explore whether we are addressing the *right* problems and providing *effective* solutions. It is an opportunity to reflect, discuss, and identify important topics still to tackle. The concept of this RE@21 session is to put our Most Influential Papers in the spotlight at RE'13 and to examine the trajectory of the work: from publication, to award, to present day.

TABLE I. RE Conference MIPs

Year	Category	Authors	Title of Paper
2003		Robyn Lutz	Analyzing Software Requirements Errors in Safety-Critical, Embedded Systems
2004		Orlena C.Z. Gotel and Anthony C.W. Finkelstein	An Analysis of the Requirements Traceability Problem
2005		Steve Fickas and Martin Feather	Requirements Monitoring in Dynamic Environments
2006	Research	Annie Antón	Goal-Based Requirements Analysis
	Experience	Barry Boehm and Hoh In	Identifying Quality-Requirement Conflicts
2007		Eric Yu	Towards Modelling and Reasoning Support for Early-Phase Requirements Engineering
2008		Neil A.M. Maiden and Cornelius Ncube	Acquiring COTS Software Selection Requirements
2009		Colin Potts	ScenIC: A Strategy for Inquiry-Driven Requirements Determination
2010		Carl A. Gunter, Elsa L. Gunter, Michael Jackson, and Pamela Zave	A Reference Model for Requirements and Specifications
2011		Axel van Lamsweerde	Goal-Oriented Requirements Engineering: A Guided Tour (Mini-Tutorial)
2012		Matthias Weber and Joachim Weisbrod	Requirements Engineering in Automotive Development --- Experience and Challenges
2013		Jane Huffman Hayes, Alex Dekhtyar, James Osborne	Improving Requirements Tracing via Information Retrieval

III. Session Objectives

At age 21, a design research discipline such as RE should have relevance in the real world, so its problems should have convincing relevance. And its research methods should be sound, so that results can be built on by other researchers and used by practitioners.

The aim of the MIP sessions is to explore these issues. Authors were asked to present the research topic of their award-winning paper for a wider audience and to discuss the dynamics of its development of the past 10 years. How did the topic spread to other academic research, and what impact did it have on the practice of requirements engineering? Conversely, how did other areas of RE research influence research on the topic, and how did practical experience in RE influence it? Is the line of research still active and what are the research topics and challenges today?

IV. Session Participants

All prior winners of MIP awards, and the new 2013 awardees, were invited to participate in the session. Six out of 11 MIPs are represented at RE'13. The session participants and the abstracts of their original papers are outlined below.

A. From RE 1993: Lutz – Engineering for Safety

"The root causes of safety-related software errors in safety-critical embedded systems are analyzed. The results show that software errors identified as potentially hazardous to the system tend to be produced by different error mechanisms than those that produce nonsafety-related software errors. Safety-related software errors are shown to arise most commonly from: discrepancies between the documented requirements specifications and the requirements needed for correct functioning of the system; and misunderstandings of the interface of the software with the rest of the system. These results are used to identify methods by which requirements errors can be prevented. The goal is to reduce safety-related software errors and to enhance the safety of complex, embedded systems." [4]

B. From ICRE 1994: Gotel and Finkesletin – Getting Us to Think About Traceability

"In this paper, we investigate and discuss the underlying nature of the requirements traceability problem. Our work is based on empirical studies, involving over 100 practitioners, and an evaluation of current support. We introduce the distinction between pre-requirements specification (pre-RS) traceability and post-requirements specification (post-RS) traceability, to demonstrate why an all-encompassing solution to the problem is unlikely, and to provide a framework through which to understand its multifaceted nature. We report how the majority of the problems attributed to poor requirements traceability are due to inadequate pre-RS traceability and show the fundamental need for improvements here. In the remainder of the paper, we present an analysis of the main barriers confronting such improvements in practice, identify relevant areas in which advances have been (or can be) made, and make recommendations for research." [2]

C. From ICRE 1996: Antón – Highlighting Goal-Based Requirements Methods

"Goals are a logical mechanism for identifying, organizing and justifying software requirements. Strategies are needed for the initial identification and construction of goals. We discuss goals from the perspective of two themes: goal analysis and goal evolution. We begin with an overview of the goal-based method we have developed and summarize our experiences in applying our method to a relatively large example. We illustrate some of the issues that practitioners face when using a goal-based approach to specify the requirements for a system and close the paper with a discussion of needed future research on goal-based requirements analysis and evolution." [1]

D. From RE 1997: Yu – The Emergence of i*

"Requirements are usually understood as stating what a system is supposed to do, as opposed to how it should do it. However, understanding the organizational context and rationales (the "Whys") that lead up to systems requirements can be just as important for the ongoing success of the system. Requirements modelling techniques can be used to help deal with the knowledge and reasoning needed in this earlier phase of requirements engineering. However, most existing requirements techniques are intended more for the later phase of requirements engineering, which focuses on completeness, consistency, and automated verification of requirements. In contrast, the early phase aims to model and analyze stakeholder interests and how they might be addressed, or compromised, by various system-and-environment alternatives. This paper argues, therefore, that a different kind of modelling and reasoning support is needed for the early phase. An outline of the framework is given as an example of a step in this direction. Meeting scheduling is used as a domain example." [7]

E. From ICRE 1998: Maiden and Ncube – Make Versus Buy Decisions in Focus

"An increasing number of organisations are procuring off-the-shelf systems from commercial suppliers. However, successful selection of off-the-shelf systems to fit customer requirements remains problematic. The London Ambulance Service fiasco in 1992 is a well-known example of system failure due, at least in part, to poor product selection. New methods and techniques for requirements acquisition and product selection are needed. The authors propose a new method which integrates techniques from several disciplines in response to lessons learned from a complex commercial off-the-shelf product selection exercise undertaken by the authors. They report on a recent experience in selecting a complex commercial off-the-shelf software system to be compliant with over 130 customer requirements, and lessons learned from the experience. These lessons learned inform design of PORE (Procurement-Oriented Requirements Engineering), a template-based method for requirements acquisition. This paper reports 11 of these lessons. Particular focus is put on the typical problems which arose during acquisition of requirements to enable this selection, and solutions to avoid these problems in the future." [5]

F. From RE 2003: Hayes, Dekhtyar, and Osborne – Applying Information Retrieval Techniques to Traceability

"We present an approach for improving requirements tracing based on framing it as an information retrieval (IR) problem. Specifically, we focus on improving recall and precision in order to reduce the number of missed traceability links as well as to reduce the number of irrelevant potential links that an analyst has to examine when performing requirements tracing. Several IR algorithms were adapted and implemented to address this problem. We evaluated our algorithms by comparing their results and performance to those of a senior analyst who traced manually as well as with an existing requirements tracing tool. Initial results suggest that we can retrieve a significantly higher percentage of the links than analysts, even when using existing tools, and do so in much less time while achieving comparable signal-to-noise levels." [3]

V. Session Chairs

Two sessions at RE'13 put the spotlight on the RE MIPs, each session being chaired by a former Steering Committee Chair for the RE Conference Series.

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Roel Wieringa (http://www.cs.utwente.nl/~roelw) is Chair of Information Systems at the University of Twente, the Netherlands. His research interests include requirements engineering, risk assessment, and design research methodology. He has written two books, on Requirements Engineering and on the Design of Reactive Systems. His next book, *Design Science Methodology for Information Systems and Software Engineering* will appear in 2014 with Springer. He chaired the RE Conference Steering Committee from 2004-2006.

Acknowledgments

We would like to thank Orlena Gotel, the RE'13 Program Chair, for organizing the MIP sessions and assembling all the facts about the past and present MIP awards presented in this paper.

We also thank all recipients of RE MIP awards for considering the invitation to participate in this special RE@21 session. While the cost and logistics may have been prohibitive for some MIP authors to travel to Rio de Janeiro for RE'13, we hope that the remaining MIP authors will have an opportunity to discuss the trajectory of their work at future RE conferences.

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