

Report Working Conference on Requirements Engineering: Foundation for Software Quality (REFSQ'08)

Barbara Paech¹, Patrick Heymans² and Anne Persson³

¹University of Heidelberg, Im Neuenheimer Feld 326, D-61920 Heidelberg

paech@informatik.uni-heidelberg.de

²University of Namur, PReCISE, B-5000 Namur

patrick.heyman@fundp.ac.be

³University of Skovde, S-Skovde 541 28

Anne.Persson@his.se

DOI: 10.1145/1402521.1402529

<http://doi.acm.org/10.1145/1402521.1402529>

Abstract

REFSQ'08 took place over the 16th and 17th June 2008 in the lively French city of Montpellier. 40 participants spent two days very intensively discussing the contributions of 17 papers, their implications and combinations. In these discussions some recurrent topics and new trends were emphasized: the importance of understanding the context and effectiveness of RE techniques, the multiplicity of requirements representations and their integration, the support for creativity, the necessity to make the body of knowledge better accessible e.g. through an open source RE tool community, and the challenges of RE for innovative or large-scale systems as well as of RE decision making in an uncertain environment.

Keywords: Requirements, software quality

Introduction

The annual series of REFSQ workshops was founded in 1994 (www.refsq.org). Located in Europe but with an emphatically international outlook, REFSQ has been unique among all the conferences and workshops on Requirements Engineering (RE) to have an explicit mission to investigate the many roles of quality in RE. REFSQ is concerned with the quality of the processes, practices and tools that help all the actors involved in RE achieve their missions, as well as the quality of the skills possessed by, and the training available to, these actors. It also concerns the qualities that the software must exhibit and the requirements that address these qualities.

Over the years, REFSQ had acquired a reputation for the excellence of the research reported and the success of its event format—structured discussions involving predefined discussants, facilitators and the rest of the audience. After REFSQ 2005 it was felt that there was sufficient demand for an expanded format, still located within Europe and still attracting contributions from all over the world.

As a first step, REFSQ evolved into a working conference for 2006. For the first time, attendance was opened beyond the set of accepted paper authors, but in other respects the format was little changed from earlier years. 2007 marked the next incremental shift, with the decision to publish the REFSQ proceedings as a volume of Springer LNCS. Essener Informatik Beiträge had served REFSQ well, but it was recognized that publication in a volume of LNCS would bring more visibility to authors' work and, we hoped, stimulate increased interest from the RE community world-wide. Both the 2007 and 2008 editions successfully

achieved those goals.

REFSQ'08 received 50 submissions and the Program Committee worked very hard to finally select 17 high-quality papers, yielding an acceptance rate of 34%.

As usual, REFSQ'08 was co-located with the Conference on Advanced information Systems Engineering (CAiSE) which, in 2008, was held in the beautiful and usually sunny French city of Montpellier. 42 people attended REFSQ and enjoyed two days of stimulating discussions with the other attendees; academics working in RE, practitioners reporting experience of applying RE techniques or simply there to learn from the community and pass on their own knowledge.

The attendees came from 17 different countries¹, with Sweden and UK being particularly strongly represented as shown below.

Sweden	6
UK	6
Germany	5
The Netherlands	4
France	4
Italy	3
Austria	2
Belgium	2
Japan	2
Algeria	1
Brasil	1
Canada	1
Luxemburg	1
New Zealand	1
Norway	1
Switzerland	1
USA	1

This report briefly summarizes the papers that were presented and the outcomes of the discussions. The proceedings containing the papers in full are available from Springer [REFSQ 08].

Keynote

The REFSQ'08 keynote was given by Professor Sjaak Brink-

¹ According to affiliation.

kemper from Utrecht University. The talk was entitled *Process improvement in Requirements Management: A Method Engineering Approach*. He presented the view that there are many new RE techniques, which are scattered small innovations. He stated that he could not find any clear approach when it comes to implementing RE innovations in an overall development process or method. In response to this he proposed a method engineering approach to selecting and implementing RE techniques. The approach comes with a product software knowledge infrastructure (PSKI) that is an online systematic collection of methodical knowledge for improving process maturity in a product software company.

One view emerging from the discussion was that the approach in essence was a knowledge management approach. One question in connection with this was how the repository of techniques would be managed over time. The question was also raised regarding which are the research challenges in this area? In response to that and after some discussion it was concluded that the following two questions are important to solve: What is a good format to realize this kind of infrastructure? How to fill the method base with situational factors?

Fitness

The papers in the first session of the conference focused on this years' specific topic, in particular the assessment of fitness in terms of RE technique and RE tool selection. All approaches presented give experience-based guidance for this assessment.

In *Elicitation Technique Selection Process in Cooperative Distributed Environment: Why is it Different?* by Hakim Bendjenna, Nacereddine Zarour and Pierre-Jean Charrel, the first author presented an extension to existing work on elicitation technique selection to handle stakeholder conflicts and to take into account more stakeholder characteristics like the language. This is especially important in global software development. Through a formal approach they additionally aim at improving the accuracy of the selection. The discussants highlighted many more factors which need to be taken into account for the selection like the level of domain knowledge of the stakeholders or the experiences made in previous projects.

Samuel Fricker presented a joint paper with Paul Grünbacher: *Negotiation Constellations – Method Selection Framework for Requirements Negotiation*. They addressed for the first time the problem of negotiation technique selection. The idea is to base the selection on negotiation constellations which capture the negotiation characteristics of the software organization and of the negotiating parties, and differentiate negotiation tactics and methods. One important assumption of this work is that although the framework is more general, the negotiation during RE should always focus on problem-solving and compromises and not on yielding or dominating. The discussants welcomed the framework as an important checklist for meeting preparations. Therefore it should on the one hand be better packaged and on the other hand more details on the tactics, the methods and their rationale should be given.

In the position paper *DESCRY: An Evaluation Method for Assess-*

ing Decision-supporting Capabilities of RE Tools, by Beatrice Alenljung and Anne Persson, the first author proposed 9 criteria for evaluating RE tools wrt. decision support. The criteria presented apply similarly to other decision tool support. The specific issues of RE decision making are captured in detailed questions which need to be answered for the criteria. In the discussion it was highlighted that negotiation is an important part of decision making. Furthermore it was agreed that there are too few tools for RE decision support. While the presented approach is important as a guideline, there should be more research in providing adequate tool support for decision making. This is also the focus of the current work of the authors.

As a discussion facilitator Patrick Heymans provoked the audience with a formal framing of the selection question as a function between the domain to be treated and the co-domain of techniques or tools to be chosen. The main question was whether we will ever be able to adequately define this function – given the diversity of factors in RE. In a lively discussion experiences from situated method engineering were reported which underline the difficulty of adequately characterizing the domain. The audience questioned the usefulness of a total function for the selection as the discussion process involved with the adequate choice is very important in itself. So the aim should rather be a partial function or a relation. Furthermore, rich descriptions such as case studies need to be provided. The work presented in the keynote is one step in this direction.

Elicitation

The session on elicitation started with Neil Maiden's presentation of the paper *Inventing Requirements: Experiences with an Airport Operation System* by Neil Maiden, Cornelius Ncube and James Lockerbie. The talk opened on the provocative claim: "I do not believe in elicitation!". With the idea that requirements are not just 'out there' to be found, Neil motivated the need for creativity techniques in RE. The presentation then proceeded to its central topic: the evaluation of the effectiveness of the RESCUE creativity techniques during the course of a European project that studies the environmental impact of airport operations. By following a well defined evaluation protocol, three research questions had been investigated. The results demonstrate the effectiveness of creativity workshops but, beyond that, also pinpoint several challenges such as finding the right balance between "divergent" (e.g., brainstorming) and "convergent" (e.g., storyboarding) techniques, or the need for "non sticky" notations that are flexible enough to be adapted on the fly according to the specific needs of a creative workshop. The discussion revealed that although creativity must be unleashed as much as possible, there are inevitably topics that must remain unaddressed so as to guarantee some focus. In this case, non-functional requirements and solutions that lied outside the realm of airport operations were not considered. A suggestion made during the discussion was to also investigate the longer-term outcomes of creativity workshops.

In their paper *Search-based Requirements Optimization*, Yuanyuan Zhang, Anthony Finkelstein and Mark Harman take a radically different approach to elicitation. Their proposal is to reduce RE problems, like requirements selection and prioritization, to search problems, and then apply multi-objective search-based techniques to lead the search of an optimum. This short

paper presentation enumerated a series of possible applications, advantages and challenges of search-based techniques applied to RE, thereby delivering an agenda for future research. The discussant thanked the presenter for having “raised a flag” on new tool capabilities that have great potential in facilitating RE. Matching requirements to services is an obvious application, but there are many others for the community to address.

A very lively general discussion followed. Olly Gotel facilitated it by bringing the two presenters to the front and emphasizing the differences between their approaches. The discussion then focused on finding complementarities between Neil’s human-intensive requirements generation technique and Yuanyuan’s, which is more mechanistic and formalized. Interesting ideas emerged on how to use search-based techniques to support exploratory, transformational and combinatorial creativity, three kinds of techniques introduced in Neil’s talk. For example, early filtering might be helpful to keep the search space of combinatorial creativity manageable. Nevertheless, from the discussions it appeared that finding a good balance between requirements generation and requirements filtering is not a trivial task. The session ended with a poll asking the participants what their preferred requirements creation and filtering techniques were. The diversity of the responses confirmed the complexity of the requirements engineer’s task and the extent of the arsenal needed to perform it.

Industrial Experiences

Several papers in the conference report industrial experience. The papers in this session presented detailed insight into the challenges of real life RE.

In *Connecting Feature Models and AUTOSAR: An Approach Supporting Requirements Engineering in Automotive Industries*, by Wolfram Webers, Christer Thörn, and Kurt Sandkuhl, Christer Thörn discussed challenges for suppliers in the automotive domain. While AUTOSAR provides a standard for the exchange of requirements between OEM and supplier, the suppliers still face the problem of relating requirements documents of different customers to the assets of their product line. The paper presents a case study to bridge this gap based on feature models. The discussants agreed that the proposal was interesting and that it could potentially be transferable to other domains such as e.g. mobile phone development and development of medical devices. In the general discussion issues concerning scalability and transferability of the approach were in focus. Also, the audience agreed that forthcoming work heavily relies on the development and progress of the AUTOSAR initiative.

In *Using a Creativity Workshop to Generate Requirements for an Event Database Application* by Claudia Schlosser, Sara Jones and Neil Maiden, the first author presented lessons learned by performing a creativity workshop. On the one hand a detailed description of the workshop was given, and on the other hand the outcome in terms of number and quality of the generated requirements was analyzed. One of the discussants challenged the authors by arguing that they had neglected to refer to literature relating to collaborative modelling and the second discussant followed by asking how the results should be interpreted comparing

to other techniques. The audience challenged the authors by asking if productivity is the most important issue here. The author responded that the results from one workshop should be analysed in order to develop triggers that result in better requirements.

In *Can We Beat the Complexity of Very Large-Scale Requirements Engineering?* by Björn Regnell, Richard Svensson and Krzysztof Wnuk, the first author pinpointed a notorious problem of RE in industry: the size of the documents. The authors defined different scales and then focused on very large scale RE concerning over 10.000 requirements with strong interdependencies. Based on their experiences the authors proposed sustainable requirements architectures, effective requirements abstraction and emergent quality prediction as most promising future RE research topics. Judging by the reaction from discussants and audience, the topic is timely and interesting. The discussion targeted the issue of what really drives complexity.

As discussion facilitator, Nazim Madhavji triggered the session discussion by focusing on how we as researcher carry out industrial research. He argued that the RE community should become better in describing its case studies. We gather data from case studies but we don’t analyze the state of grounded theory and the ways in which the case study advances the theory. The audience agreed that we should provide more content data such as cost/benefit, time/effort and what are the specific improvements. We should also apply more rigor to empirical studies by stating our hypotheses and making our data analysis more explicit.

Research Preview

In this session, three short papers describing research at an early stage of development were presented. Stephen Morris and Olly Gotel presented *Macro-level Traceability via Media Transformations*. They depicted a framework whose purpose is to support requirements traceability when representations in various media need to be combined and transformed (merged, summarized, revised...). Besides supporting various kinds of media, the framework also supports multiple levels of traceability, advocating that macro-traceability is a necessary complement to current practice which focuses, and often struggles with, micro-traceability. The discussant pointed out that combining macro- and micro-traceability needs to be elaborated further, and so is it for scalability and the supporting tool, the authors concluded.

The second presentation in this session was by Vladimir A. Shekhovtsov and was entitled *Towards Simulation-based Quality Requirements Elicitation: A Position Paper* by Roland Kaschek, Christian Kop, Vladimir A. Shekhovtsov and Heinrich C. Mayr. Vladimir motivated and enumerated the main features of the so-called ‘Parametrized Online Simulation Environment’ (POSE), a tool that he and his colleagues are currently developing. Its purpose is to facilitate the elicitation of quality requirements through interactive simulation of the system to-be. The tool is fed with a description of both the business processes and the organizational environment in which the former are to take place. Then, through a ‘business game’, new requirements can be elicited, or various versions of the processes can be compared according to how they match some quality requirement. The discussion focused on the possibly high cost of the approach which requires complete proc-

ess and context specification and a non trivial set-up. Cost-benefit will be further investigated through case studies.

The last paper in the session, *Classifying Assumptions Made during Requirements Verification of Embedded System* by Jelena Marinčić, Angelika Mader and Roel Wieringa, was presented by Jelena Marinčić. The reported work extends Zave and Jackson's framework in the context of embedded systems. In addition to checking the satisfaction of the requirements with respect to a model of the future system and a model of its environment ('the plant'), the authors seek to increase the confidence in, and reusability of, such models and proofs. They proposed to achieve this by further differentiating between several kinds of assumptions, most of which often remain unstated modeling hypotheses, a practice which can lead to system failures. Five categories of assumptions were introduced — (i) about system components, (ii) about system aspects, (iii) necessary (e.g. natural laws) vs. (iv) contingent assumptions, and (v) constraints on the plant — and an illustrative example was described. As usual with formal methods, scalability and cost-effectiveness issues were raised by the discussants. Those issues will require particular attention from the authors in their future work.

The three presentations are symptomatic of a move to rethink the way media and representations are used in RE, which is actually a good thing! This is the main issue Neil Maiden addressed, acting as a discussion facilitator for this session. "To text or not to text?" was a simple way to put it, also raising the question of how much text is needed? Novel media such as interactive simulations seem to be a promising path to overcome the limitations of textual descriptions, for example to facilitate predictions related to quality requirements. But then, shouldn't the community take a closer look at how media professionals work in teams, e.g. in the movie industry, and maybe think about introducing new roles in RE (film makers, animators...)? Another question that crosscuts the three presentation topics was how much context can be captured — respectively traced, simulated and formalized.

Empirical Studies

The two presentations focused on empirical evaluation of new techniques.

Maya Daneva evaluated data from two industrial sites in her paper *Integrating Portfolio Management and Monte Carlo Simulation Concepts in ERP Project Estimation Practice: a Case Study*. The focus of the paper was ERP project estimation. ERP projects are known for being notoriously expensive. The author presented a number of challenges that prevail in this area as a motivation for the work. One of them is method support for estimating the effort, functional size, productivity, schedule etc. As a solution the authors propose to integrate COCOMO II, Monte Carlo simulation and portfolio management. The discussion circled around the issue of uncertainty and how we can capture it to better predict future outcomes, e.g. in project management.

A case study and an experiment were the basis of *Can Patterns improve i^* Modeling? Two Exploratory Studies* by Markus Strohmaier, Jennifer Horkoff, Eric Yu, Jorge Aranda, and Steve

Easterbrook. The first author described an exploratory, empirical study, trying to answer the following questions: Does i^* with patterns help reduce the modeling effort? Does it help increase model coverage? Does it help decrease complexity? In this context patterns are reusable i^* models. The collected data does not support the expected reduction of effort or complexity, but shows improved model coverage. In the discussion the audience discussed how pattern models could be used when developing. Should the modeller start with a pattern and extend from that or should patterns be integrated into developed models? They also discussed the complexity of the i^* patterns presented and how that could challenge the use of patterns in an i^* context.

Björn Regnell started the session discussion by stating that RE is stochastic – we don't know what will happen and there are numerous uncertainties. We use estimations and predictions but we are not explicit about uncertainty, if we look to the past to predict what will happen in e.g. a project. Therefore we should ask ourselves what in the past is really relevant to capture information about. Björn argued that if we can characterize the uncertainties we can define what is relevant to know about the past. The audience discussed whether using patterns could be one way of reducing uncertainty because they capture previous experiences in a systematic manner. It was also agreed that empirical studies should help characterize uncertainty. The audience responded that RE should not too much see RE as a predictive discipline because then we take the E(engineering) out of RE. RE is both predicting and creating the future.

Innovation

This session collected the papers asking how RE needs are to be adapted to innovative systems. Web services were the focus of *Discovering Web Services to Improve Requirements Specifications: Does It Help?* by Konstantinos Zachos, Neil Maiden and Rhydian Howells-Morris. The paper investigates the usefulness of requirements-based tools supporting the specification of queries and the search in service registries. In previous work it had been shown that the tools can successfully used by the researchers. Neil Maiden presented further insight from two companies which showed that analysts from the companies could use the tools successfully to retrieve appropriate services for a given specification. In one case this also helped to improve the specification itself, while in the other case the information retrieved about the services was not helpful for the analyst. The discussants pointed to the fact that the latter might be due to the usability of the tools. In addition it was emphasized that using information about existing services is definitely only one way to perform requirements elicitation which needs to be augmented with creativity-techniques. The presented approach can be extended in this way as the tools can also be used for analogical search.

Norbert Seyff presented the paper *In-situ Discovery of Requirements for Mobile and Context-aware Systems: How Scenario-based Approaches Can Help?*, by Norbert Seyff, Florian Graf, Paul Grünbacher and Neil Maiden. The authors explored how RE tools based on ubiquitous technology can support RE for ubiquitous systems. The first question was how they help to discover context-specific requirements. The second question was how existing RE-methods and tools benefit from context-aware tech-

nologies and contextual information. Several successful case studies were presented and the lessons learned gave rise to a number of requirements for ubiquitous RE tools, such as on-site usage, unobtrusive use and detection of context change. Furthermore, research challenges were derived. The discussants acknowledged the improvement of requirements completeness by capturing context-specific requirements. They also pointed to the fact that providing an infrastructure for the tools to detect the context already during the requirements phase might be quite costly. Future work should include a richer context definition which not only includes time and location, but other sensor data like sound or light.

Context dependencies were also the focus of the last paper of the conference: *When to Adapt? Identification of Problem Domains for Adaptive Systems* by Kristopher Welsh and Pete Sawyer. In their position paper Kristopher Welsh argued that dynamically adaptive systems are needed especially in case of context-dependent variation in the acceptable trade-offs between non-functional requirements. An example is the choice between different mechanisms for communication between various devices gathering data for flood prediction and monitoring. In case of an immediate danger the more costly communication mechanisms should be chosen by the system. So the idea is to integrate the definition of policy adaptations into requirements specification. The discussion centered around the adequacy of i^* as modelling formalism for this purpose.

Anne Persson was the last discussion facilitator of the conference. She focussed on the problem of discovering relevant requirements in a complex and dynamic world. This question was apparent not only in the last session. While research is good at providing new techniques and tools for this discovery, there is the question of cost and effectiveness. Given the constraints of industry there is still a huge gap between what is proposed and what is applied. To close this gap three challenges need to be tackled: find good shortcuts, construct techniques and tools that help RE practitioners to keep up in a dynamic environment, and help practitioners find the appropriate techniques and tools. In the discussion it was pointed out that practitioners often define the shortcuts themselves. So researchers should study more intensively which shortcuts are used and why. Furthermore the practitioners emphasized the fact that tools are the most crucial point. This brought up the idea of an open source community for RE tools where researchers and practitioners work together to consolidate and integrate the ideas.

Conclusions

Barbara Paech moderated the last session looking back at the topics of last years' REFSQ and identifying the topics emphasized and emerging during this years' REFSQ.

- Last year the observed trends had been product lines and the focus on value. These were not retained explicitly. The paper topics responded more to requests made by last years' participants, e.g. RE for services or automatic systems.
- Understanding the context of RE techniques and tools is important. We need more research on which insights

from one domain can be transferred to another domain. Cost-effectiveness is also very important.

- There will always be multiple representations for requirements. Their trade-offs should be more explicit and their combination should be better investigated.
- Creativity is an important part of requirements elicitation and there are techniques for that which are applied successfully in industry. Some empirical results provide insights on its usefulness, but there is still much to be done, especially to focus the creativity and to combine these techniques with more traditional RE.
- It is still difficult for practitioners (and researchers) to access the body of knowledge of RE research. We should work harder to make the contributions of our papers explicit. This comprises content issues (e.g. increments wrt existing work) and procedure issues (e.g. characterizing exactly the situation where data was gained). One step in this direction is to provide structured abstracts for publications. This will be part of next years' Call for Papers. Another step in this direction would be the open source RE tools mentioned before.
- There are many diverse challenges for RE: RE is influenced by and needed for innovative systems like service-centric or ubiquitous systems. Other challenges are very large-scale systems or the uncertainty of decision making in RE. We would like to see more research in these areas.

In the end, again topics for next years' REFSQ were brainstormed. Besides the challenges mentioned above, RE for system engineering or co-evolution were mentioned.

Thus, there are many opportunities for RE research. The next REFSQ will be together with CAiSE'09 in Amsterdam, The Netherlands on 8th and 9th of June 2009 (<http://caise09.thenetworkinstitute.eu/>). We would be very happy to see many old and new faces there!

Acknowledgement

The format of REFSQ in general, and the structure and style of this post event report in particular have been shaped by all the previous REFSQ co-chairs. We thank them very much for their contributions on which we could build this year' REFSQ.

References

[REFSQ 08] Paech, B., Colette R. (Eds): Requirements Engineering: Foundation for Software Quality – Proceedings of the 14th International Working Conference (REFSQ 08), Lecture Notes in Computer Science 5025, Springer, Heidelberg, Germany. ISSN 0302-9743

ICSE 2009
May 16-24, 2009
Vancouver, BC

<http://www.cs.uoregon.edu/events/icse2009/home>