# RE4SuSy: Requirements Engineering for Sustainable Systems

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*Abstract*—Research has started investigating the support of sustainability within systems and software engineering. Yet there are few workshops that explore the topic, and there is only one so far in requirements engineering: RE4SuSy.

The 1st International Workshop on Requirements Engineering for Sustainable Systems (RE4SuSy) was held at REFSQ in 2012. In order to involve a more international research community, the organisers are intending to hold the workshop at RE in 2013.

We plan an interactive workshop that engages with authors well before the deadlines and that produces new results already during the workshop and promote them throughout the conference. This is also the take-off point for new collaborations between participants.

## I. MOTIVATION AND OBJECTIVES

### A. Motivation

Researchers have recently started to explore the concept of "sustainability requirements", and how to support the elicitation and documentation of such requirements. They are showing that requirements engineers have indeed a very important role to play in order to ensure that future socio-technical systems are sustainable. For example, requirements have an important impact on the potential premature obsolescence of hardware, on the electricity consumption of software or on the number of servers needed to offer a service. Further, as ubiquitous socio-technical systems alter the way we live, the requirements of those systems have to be carefully written such that those new ways of living are more sustainable.

In the industry, companies not only want to be "ecologically trendy", but also become aware that sustainability requirements will have strategic impacts on business organization and value creation, as with zero paper projects that revolutionize enterprise architectures, or intelligent powergrids that lead to delivering innovative services.

This workshop provides an interactive stage for researchers to share and exchange about their latest works, to collaboratively define a research agenda in RE for sustainable systems, and also to jumpstart collaboration through the live creation of teams that commit to work together on concrete points of this agenda.

### B. Objective

The objective of the workshop is to establish a community of researchers interested in collaborating on the topic of sustainability in requirements engineering. The basis for this is provided by:

- the first RE4SuSy and its derived research agenda[1]
- various international research collaborations (i.a., with Germany, Spain, Belgium, Brazil, USA, Netherlands) that have started in the past two years

This objective is reached by the following actions:

- provide a platform for researchers where they can present their current work and trigger discussion
- revisit and add to last year's defined research agenda
- identify and link contributions to that agenda where there has already been work done or work is in progress
- trigger discussions in small groups on favored topics of the research agenda
- kickstart new collaborations in between the workshop participants
- spread the word about the workshop and its results at the main conference

How the actions are realized within the workshop is described in the following section.

## II. HISTORY OF THE WORKSHOP

Related workshop on sustainability, green software, and software engineering are GREENS[2] (at ICSE'12 and '13), WSRCC[3] (at OOPSLA'09, ICSE'10, CAISE'11), and GIBSE[4] (AOSD'13), but none of them explicitly considers requirements engineering.

The 1st Intl. Workshop on RE4SuSy[5] was held at the International Working Conference on REFSQ[6] in March 2012. We had 8 contributions that were presented at the workshop and 14 attendees.[7] Much of the workshop was dedicated to

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[1] Identified Research Agenda Items 2012 at https://sustainability.wiki.tum.de/Research+Agenda+Items
[2] http://greens.cs.vu.nl/
[3] http://www.cs.toronto.edu/wsrcc/Previous.html
[4] http://trese.ewi.utwente.nl/workshops/GIBSE/
[5] https://sustainability.wiki.tum.de/RE4SuSy
[6] http://refsq.org
[7] The results of the discussion on the research agenda are available at https://sustainability.wiki.tum.de/Research+Agenda+Items.

the collaborative building of a first research agenda for the discipline.

## III. WORKSHOP CONTRIBUTIONS AND EVALUATION

### A. Contribution types

The *types of contribution* are short papers of 6 pages, posters with a 2-page abstract, and videos of up to 5 minutes (also 2 pages abstract).

We encouraged the submission of new and interactive formats (e.g., we had an interactive poster realized with Flash at RE4SuSy'12), but are aware that publication in the standardised conference ways requires a textual version.

### B. Evaluation process

The evaluation was organised exclusively by our program chair, Camille Salinesi. This explicit role distinction will allow the organisers Birgit and Martin to submit their own contributions to RE4SuSy as authors, which is important to strengthen the growing community.

Camille assigned peer reviews by three PC members and moderate the discussion between PC members in case of strongly diverging reviews or borderline assessments. The submission, review process, and communication was performed via the Easychair system. The contribution ratings included the option of a conditional accept as we consider it more sustainable to request specific improvements instead of rejections of potentially good contributions.

### C. Program committee

The program committee is a mixture of academia and industry, experienced and young researchers, and the two domains that the workshop combines: requirements engineering and sustainability.

- Wolfgang Lohmann, University of Zürich, Switzerland
- Debra Richardson, University of California, Irvine
- Ruzanna Chitchyan, Leicester University, UK
- Stefan Naumann, FH Trier, Germany
- Emmanuel Letier, University College London, UK
- Alistair Mavin, Rolls Royce, UK
- Xavier Franch, UPC Barcelona, Spain
- Letícia Duboc, State Univ. of Rio de Janeiro, Brasil
- Jean-Christophe Deprez, CETIC, France
- Konstantin Hoesch-Klohe, Univ. Wollongong, Australia
- Christian Manteuffel, Univ. of Groningen, Netherlands
- Patricia Lago, VU University Amsterdam, Netherlands
- Henning Femmer, TUM, Germany

## IV. WORKSHOP FORMAT AND NEEDED SERVICES

### A. Pre-workshop activities

There are two phases of pre-workshop activities: First, from April 9th - 28th (submission deadline), we invited authors to upload preliminary abstracts, outlines, or papers for a constructive feedback phase. Other authors and interested PC members can comment on them so the authors can improve their papers before the actual submission.

Second, in a pre-workshop reading phase from June 7th (CR deadline) until the workshop, we provided the camera-ready version papers in a protected download area for authors and PC members. Apart from encouraging them to read the papers before coming to the workshop, we will assign two discussants to each paper that kick off an online discussion. The discussion furthermore facilitated providing a framework of 3-4 topics that mirror a coarse-grained classification of submitted contribution topics. That way participants already engaged with the contents before the actual workshop and discussion is facilitated. Consequently, we assign shorter slots for presentation by the authors and can thereby leave more room for discussion.

### B. Workshop format

*a) Warm-up and intro:* The workshop is kicked off with an *interactive warm-up* exercise to let the participants get into an active workshop mode and make them feel like a group. We start with a short introduction by the organisers on the history of the workshop and the agenda for the day, which consists of contribution presentations and discussion in the morning, and interactive sessions in the afternoon.

*b) Contribution presentations:* The format of last year with lightning talks and assigned discussants has allowed for allocating time to presentations as well as discussion. As we have a full day in our second iteration of the workshop, we have presentations of 10 to 15 minutes for each contribution plus 10 to 15 minutes of discussion. To facilitate discussion, we will make the papers available in advance as password-secured download and assign two *discussants* for each paper. In parallel, we are taking notes in a shared online document as *living protocol* of the workshop. Presenters of papers are encouraged to use a poster instead of a slideshow to support their presentation. This ensures the presentation is more oriented towards the audience and, as we hang all workshop posters to walls, this enables participants to add ideas and comments to them during breaks, lunchtime, or after the workshop. This increases the likelihood of identifying new collaboration potential.

*c) Intermediate Wrap-up:* Before lunch, we wrap up the presentations with a recapitulation of the discussions in the online protocol and review whether we can include some of these in the afternoon breakout sessions.

*d) Research Agenda and BOK:* In the afternoon, there is a short review of the research agenda of 2012 and then an update and/or extension of that research agenda. In a second step, we identify contributions that have already been made to a specific topic, thereby providing a very first draft of an emerging body of knowledge.

*e) Concepts, Collaboration, and Studies:* We prepare topics for breakout sessions with discussion facilitation (e.g. creativity techniques like the Osborne checklist, role-play, etc.) but also include topics that arose during discussion at the workshop. The breakout sessions are also used to identify new collaborations amongst attendees. Specific attention is also given to study design to evaluate concepts early on.

*f) Experiments:* Furthermore, we provide authors with the option to perform small experiments with their research work if applicable, i.e., they may try out a specific technique that they presented in the morning with willing participants of the audience. For example, if an author presents a goal modeling technique specifically designed to model sustainability goals, an experiment could be modeling a small case study within half an hour among a group of 5 workshop attendees.

*g) Final Wrap-up:* In a final come together, we recollect the major discussion points and contributions of the day on a poster to be presented at the main conference.

*h) Results:* The results of the day are:

- Posters augmented with ideas and discussion notes
- A readily available online protocol of the workshop
- An extended research agenda for RE4SuSy
- A very first draft of a body of knowledge on RE4SuSy
- New research collaborations
- New concepts and study designs
- Small experiments with case studies
- A wrap-up of results in form of a poster to be presented at the main conference (most likely in a designated area along with the poster sessions)
- An emerging community of actively collaborating researchers

### C. Post-workshop activities

The post-workshop activities involve spreading the word at the conference and intensifying collaborations that originated during the workshop. "Spreading the word" will be facilitated by a poster in the Posters and Demos session and by providing the results online for download by participants and other interested community members. We will lead a joint effort for all interested contributors for collecting an emerging body of knowledge.

"Intensifying collaborations" is initiated during the workshop in the breakout sessions and their wrap-up presentations. From there on, participants will be encouraged to follow up on the discussions and strengthen the growing community by networking and joining forces on intersecting research topics.

## V. Workshop publication plans

In a first step, we make the workshop results visible at the conference along with the poster sessions. In a second step, the organising team will write a workshop report and make it available in an adequate publication. The workshop report is based on the protocol elaborated collectively online during the day and participants are welcome to co-author.



Fig. 1. "SuSy" reminds us of why we want to develop sustainable systems

[5] Birgit Penzenstadler. Towards a definition of sustainability in and for software engineering. In *28th Annual ACM Symposium on Applied Computing (SAC)*, 2013.

[6] Birgit Penzenstadler. What does sustainability mean in and for software engineering? In *1st International Conference on ICT for Sustainability (ICT4S)*, 2013.

[7] Birgit Penzenstadler and Veronika Bauer. Jumpstart sustainability in seminars: Hands-on experiences in class. In *2nd Intl. Computer Science Education Research Conference (CSERC)*, 2012.

[8] Birgit Penzenstadler, Veronika Bauer, Coral Calero, and Xavier Franch. Sustainability in software engineering: A systematic literature review. In *International Conference on Evaluation and Assessment in Software Engineering (EASE)*, 2012.

[9] Birgit Penzenstadler and Henning Femmer. A generic model for sustainability. Technical report, Technische Universität München, November 2012.

[10] Birgit Penzenstadler and Andreas Fleischmann. Teach sustainability in software engineering? In *24th IEEE Conf. on Software Engineering Education and Training*, 2011.

[11] Birgit Penzenstadler, Bill Tomlinson, and Debra Richardson. Support environmental sustainability by requirements engineering. In *International Workshop on Requirements Engineering for Sustainable Systems*, 2012.

[12] Penzenstadler, B., Fleischmann, A. and Bauer, V. (eds.). Sustainability in software engineering. Technical report, Technische Universität München, 2011.

[13] Alejandra Rodriguez and Birgit Penzenstadler. An assessment technique for sustainability: Applying the imagine approach to software systems. Technical report, Technische Universität München, November 2012.

## References

[1] Oliver Feldmann. Sustainability aspects in specifying a car sharing platform, 2012.

[2] Martin Mahaux, Patrick Heymans, and Germain Saval. Discovering Sustainability Requirements: an Experience Report. In *17th REFSQ*, 2011.

[3] Birgit Penzenstadler. *DeSyRe - Decomposition of Systems and their Requirements*. PhD thesis, Technische Universität München, 2011.

[4] Birgit Penzenstadler. Supporting sustainability aspects in software engineering. In *3rd International Conference on Computat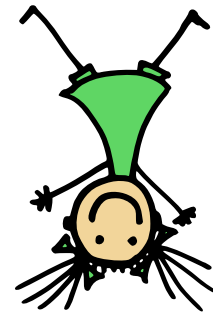ional Sustainability (CompSust)*, 2012.