# RE4SuSy: 4th International Workshop on Requirements Engineering for Sustainable Systems, Part of the GREENS Alliance

Birgit Penzenstadler
California State University Long Beach
Long Beach, USA
birgit.penzenstadler@csulb.edu

Martin Mahaux
University of Namur
Namur, Belgium
martin.mahaux@fundp.ac.be

Camille Salinesi
Université Paris 1 - Sorbonne
Paris, France
camille@univ-paris1.fr

Ruzanna Chitchyan
University of Leicester
Leicester, UK
rc256@leicester.ac.uk

*Abstract*—Supporting sustainability has recently become a much discussed research topic and the RE4SuSy workshop series has established a strong and growing research community around the different aspects of sustainability. Software is increasingly the driver for change in business and social spheres of life: it changes life styles and business practices. Since requirements define how and what the software will do, we maintain that requirements engineering is the key point in software engineering through which sustainability can be fostered.

The International Workshops on Requirements Engineering for Sustainable Systems (RE4SuSy) is concerned with research on techniques, tools, and processes for sustainability through requirements engineering.

RE4SuSy is an interactive workshop: the contributors and prospective participants will engage well before the workshop date through on-line collaborative writing, discussion, and peer feedback. The workshop aims to foster community growth by supporting new collaborations, holding preliminary case studies, discussions, and continuous birds-of-a-feather group work.

## I. MOTIVATION AND OBJECTIVES

### A. Motivation

Software is a main driver for change in business and society, in changing life styles as well as business practices. Since requirements are the starting point for defining software, requirements engineering is the key point in software engineering through which sustainability can be fostered. Presently, researchers are exploring the concept of "sustainability requirements", and how to support the elicitation, documentation, and conflict resolution of such requirements. It has been shown that requirements engineering has indeed an important role to play to ensure that future socio-technical systems are sustainable. For example, requirements can impact on the style and quality of services to be delivered, along with the hardware needed to deliver them; the scale and pattern of software and systems electricity consumption; the potential premature obsolescence of hardware, etc. 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 industry, companies not only want to be "ecologically trendy", but also become aware that sustainability requirements have strategic impacts on business organization and value creation, as with zero paper projects that revolutionize enterprise architectures, or intelligent power grids that lead to delivering innovative services.

This workshop aims to provide an interactive stage for researchers and practitioners to share and exchange their latest work, to collaboratively work on expanding the body of knowledge in RE for sustainable systems, and to jumpstart new collaborations through the live creation of teams that commit to work together on concrete topics and in-workshop case studies and experiments.

### B. Objective

The objective of the workshop is to establish a community of researchers and practitioners interested in collaborating on the topic of sustainability in requirements engineering. This community will expand and build on the work already initiated in the past editions of this workshop, such as the research agendas identified in the past workshops, research collaborations started in the past three years, and work on the Karlskrona Manifesto on Sustainability Design initiated in 2014. This objective shall be supported in the workshop through the following actions:

- Provision of a platform for researchers and practitioners to present their current work and trigger discussion;
- Continued collaboration on the previously initiated topics (e.g., Karlskrona Manifesto on Sustainability Design);
- Support for group work and discussion on newly favored topics;
- Kickstart new collaborations between the workshop participants

- Dissemination of the workshop ideas and results at the main conference.

## II. History of the workshop

This is the only workshop that focuses on the topics of sustainability in and through RE. It has been held in 3 previous instances: The 1st Intl. Workshop on RE4SuSy[1] was held at the International Working Conference REFSQ in March 2012. It had 8 contributions that were presented at the workshop and 14 attendees. The 2nd Intl. Workshop on RE4SuSy[2] was held at the International Conference on Requirements Engineering in July 2013, with 7 contributions and 17 attendees. The 3rd Intl. Workshop on RE4SuSy[3] was held at the International Conference on Requirements Engineering in August 2014, with 8 contributions and 14 attendees [5]. The afternoon was dedicated to working on the Karlskrona Manifesto for Sustainability Design, which continued to be developed throughout the conference and was presented on the last day to the plenary. The working group established for this continues to collaborate actively on this topic.

Related workshops on sustainability, green software, and software engineering are GREENS[4] (at ICSE'12, '13, and '14), WSRCC[5] (at OOPSLA'09, ICSE'10, CAISE'11), and GIBSE[6] (AOSD'13), but none of them explicitly considers requirements engineering.

As of 2015, RE4SuSy is part of the newly formed GREENS alliance that brings together all these workshops around sustainability in software engineering (each focused on different areas of Software Engineering) .

## III. Workshop contributions and evaluation

### A. Contribution types

The workshop solicits a number of *contribution types*:
- full papers of 10 pages,
- short papers of 6 pages,
- posters with a 2-page abstract,
- videos of up to 5 minutes (also with 2 pages abstract),
- user studies/experiments for the duration of an hour with a maximum description of 6 pages,
- open collaboration papers (long or short) (new submission format). Here the author(s) can solicit for open collaboration on a paper. The solicitation starts at least two months before submission deadline, via a form on the RE4SuSy webpage. The paper will be hosted and written via a collaborative edition platform (framapad, overleaf, pirate pad, etc.), see also pre-workshop activities.

We encourage the submission of new and interactive formats, which can be presented as such at the workshop, and published in the workshop proceedings with textual descriptions.

[1]https://sustainability.wiki.tum.de/RE4SuSy
[2]http://www4.in.tum.de/~penzenst/re4susy/2013/
[3]http://www.ics.uci.edu/~bpenzens/2014re4susy/
[4]http://greens.cs.vu.nl/
[5]http://www.cs.toronto.edu/wsrcc/Previous.html
[6]http://trese.ewi.utwente.nl/workshops/GIBSE/

### B. Evaluation process

The submission, review process, and communication will be performed via the Easychair system. The contribution ratings will include the option of a conditional accept as we consider it more sustainable to request specific improvements instead of rejections of potentially good contributions. In case one or more of the organizers decide to submit a contribution, the reviews will be handled in an adequate way to preserve blind review rules.

### C. Program committee

The program committee we plan to invite is a mix of representatives from different domains of requirements engineering and sustainability.
- Davor Svetinovic, Masdar Institute of Science and Technology, United Arab Emirates
- Letícia Duboc, State Univ. of Rio de Janeiro, Brasil
- Jean-Christophe Deprez, CETIC, France
- Patricia Lago, VU University Amsterdam, Netherlands
- Steve Easterbrook, University of Toronto, Canada
- Eric Dubois, PRC Henri Tudor, Luxembourg
- Timo Johann, University of Hamburg, Germany
- Coral Calero, Universidad Castilla La Mancha, Spain
- Norbert Seyff, university of Zürich, Switzerland
- Sedef Akinli, Ryerson University, Canada
- Christoph Becker, University of Toronto, Canada
- Colin Venters, University of Leeds, UK
- Stefanie Betz, Karlsruhe Institute of Technology, Germany
- Ana Moreira, New University of Lisbon, Portugal
- Effie Law, University of Leicester, UK

## IV. Workshop format and needed services

### A. Pre-workshop activities

There are three phases of pre-workshop activities:
1) Open collaboration: We solicit open collaboration papers that start at least two months before the deadline on an open collaboration platform. Authors are encouraged to advertise this on the workshop website.
2) Shepherding: Four weeks before the submission deadline, authors are invited to upload the 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.
3) Reading: In a pre-workshop reading phase from the CR deadline until the workshop, we provide the camera-ready version papers in a protected download area for authors and PC members. That way participants are already engaging with the contents before the actual workshop and discussion is facilitated.

### B. Workshop format

*1) Warm-up and intro:* Before the workshop each attendee will be asked to submit a single slide that summarises their

research interest and work related to the workshop. A copy of this slide-set will be share with all attendees. The workshop will be kicked off with an *interactive warm-up* exercise where the participants are introduce themselves and their slide. This is aimed at facilitating introductions, clarifying the positions, and identifying discussion topics and collaboration opportunities.

*2) Keynote:* The workshop will have an interactive keynote speech by Prof. Steve Easterbrook.

*3) Contribution presentations:* A selected subset of accepted papers will be presented to provide further input into the subsequent discussion sessions. All accepted papers will be available in advance of the workshop as password-secured download. In parallel, we will be taking notes in a shared online document as a *living protocol* of the workshop. Authors of accepted papers will be encouraged to prepare a *poster*. These will be displayed in the workshop room on the walls to enable further discussions and collaboration during breaks, lunchtime, or after the workshop.

*4) Manifesto:* Continuation of the work on the Karlskrona Manifesto on Sustainability Design will be one of the discussion topic options for group discussion.

*5) Concepts, Collaboration, and Studies:* Topics for work in breakout sessions with discussion facilitation (e.g. creativity techniques like the Osborne checklist, roleplay, etc.) will be collected from accepted papers during the review stage as well as during the workshop itself. The afternoon will be dedicated to group work, with each group focusing on one or two selected topic. The breakout sessions will be also used to facilitate new collaborations amongst attendees. Specific attention will be given to study design to evaluate concepts early on.

*6) Experiments:* Furthermore, we will 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.

*7) Final Wrap-up:* In a final come together, we will gather and share the major discussion points of the day and group work results all workshop.

*a) Results:* The workshop results will include:

- A workshop report, formatted as an online protocol of the workshop;
- Updated research agenda and challenges;
- New research collaborations initiated through discussion groups and collaborative writing;
- Experiments / user studies and study designs carried out at the workshop. The results of these will be shared with the participants and the workshops as a whole.
- A wrap-up of results to be presented at the main conference
- An emerging community of actively collaborating researchers

## C. Post-workshop activities

The post-workshop activities will be focused around intensifying collaborations that originated during the workshop, having informal working sessions both in person and online. The workshop results will also be shared with the main conference. Results of the workshop will be shared via the online protocol for all interested parties.

## D. Needed Services

- Room with 20 chairs and tables for them as well as a projector. The preferred setting is a U-shape. The room shall provide enough space so we can move around along the walls during interactive sessions.
- Free walls for the posters of the workshop.
- More free walls where we are allowed to (temporarily) stick many post-its and pieces of papers to collect and organise ideas.
- Harmonized feedback forms would be welcome.

## V. Workshop publication plans

We will publish workshop proceedings with the free and public CEUR WS proceedings.

The organising team will write a workshop report and make it available in an adequate publication. The workshop report will be based on the protocol elaborated collectively online during the day and participants are welcome to co-author.

## VI. Target audience

The workshop is aimed to researchers and practitioners working on/with requirements engineering or broader software and systems engineering topics and with interest in sustainability. As this is a particularly interdisciplinary topic, we also hope to encourage interdisciplinary contributions.

## VII. Workshop duration

Re4SuSy 2014 is planned for one full day.

## VIII. Short biography of organizers

*1) Birgit Penzenstadler:* Birgit Penzenstadler is Assistant Professor at the California State University Long Beach. She did her PhD in the area of requirements engineering [3] at Technische Universität München (TUM), where she also lead research projects with BMW, Daimler, Siemens, Bosch, Lufthansa, and others. She has organized and moderated events of over 100 participants from different domains at TUM. After two years as postdoctoral fellow at TUM, she spent two years as postdoctoral researcher on a DFG fellowship at the University of California, Irvine, to deepen her knowledge in the area of sustainability.

Dr Penzenstadler has been investigating on sustainability from a point of view of software engineering during the past four years, working on a body of knowledge with two SLRs and concepts of how to support sustainability from within RE [6], [7], [10], [8]. She also included the topic into the curriculum of her department [4] and has established industrial cooperations for case studies [1]. She held a seminar series on the topic

with seminars at TUM [9] and the Universitat Politècnica de Catalunya (UPC) in Barcelona.

*2) Martin Mahaux:* Martin Mahaux is currently a PhD student and researcher at the University of Namur (FUNDP). He published at REFSQ'11 one of the first studies on sustainability and RE [2]. Having graduated as a Computer Science Engineer from the University of Louvain (UCL), Martin started his career as an IT consultant. During five years, he enjoyed many positions in the software development life cycle, in particular Requirements Engineering. During that period he developed a training technique for teaching soft skills to RE teams that is based on improvisational theater. This has inspired him to return to the university to start a PhD on the topic of collaboration and creativity in RE. His interest in sustainability led him to explore the links between collaboration, creativity and sustainability, leading to several publications, in particular at RE4SuSy. His industry experience and the emphasis on collaboration and creativity provide a solid background for animating workshops.

*3) Camille Salinesi:* Camille Salinesi is Professor at Université Paris 1 where he is the head of the Centre de Recherche en Informatique, specialized in Information Systems Engineering. He published over a hundred refereed papers in international conferences and scientific journals on various topics such as requirements engineering, strategic alignment, or product lines.

Dr Salinesi was involved in fundamental research projects (FP4 NATURE, FP5 CREWS) and was the leader for collaborations and consultancy works for various companies such as France Telecom, SNCF, Renault, MediaScience, and EDF). Nowadays, he is in particular working with Renault for the specification of the new product line of electrical and hybrid vehicles, dealing with a number of issues such as business alignment between sustainability goals and the product line, and taking into account the sustainability requirements in the design of individual vehicles.

Dr Salinesi was involved in the animation of research through the organisation of a number of international research events. Prof Salinesi belongs to the Program Board of the CAiSE and to the PC of IEEE RE. Prof Salinesi was Organisation Chair at RE'05, Program Chair of REFSQ'01, '02, '03 and '14 and of CAiSE'13, General Chair of REP'99 and REP'00; he belonged to the program board of CAiSE, and to the Program Committee of RE, and several other events. He has also been guest editor of the Requirements Engineering Journal and of the Information and Software Technology Journal and was referee in several other journals such as Telecommunication Systems or IEEE Software.

*4) Ruzanna Chitchyan:* Dr. Ruzanna Chitchyan is a lecturer in Software Engineering at the University of Leicester, UK. Her current researched is mainly focused on topics of software engineering for sustainability and advanced software modularization techniques (such as product-line based and aspect-oriented development). Dr. Chitchyan has worked on a number of EU and UK projects(such EPSRC projects on Informaing Energy Choices through Ubiquitous Computing

and "All-in-One" project on future sustainaible infrasturctures, EU FP7 DiVA project on dynamic product lines, EU FP6 AOSD-Europe and AMPLE projects on apspects and product lines). She has a particular interest in effects of sustainability requirements on software design. Dr. Chitchyan has a substantial conference and workshop organization. She has served, for instance, as the organizing co-chair of ECOOP 2011, and (lead) (co-) organizer on a number of workshops on aspect-oriented development (e.g., at AOSD, ICSE, RE, ECOOP conferences) as well as workshops on Software Challenges and Climate Change (ECOOP 2011 and ICSE 2010).
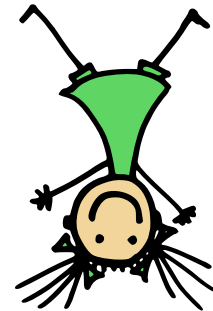


Fig. 1. "SuSy" reminds us of why we want to develop sustainable systems

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

[5] Birgit Penzenstadler, Martin Mahaux, and Camille Salinesi, editors. *Third International Workshop on Requirements Engineering for Sustainable Systems (RE4SuSy)*, 2014. http://ceur-ws.org.

[6] Birgit Penzenstadler, Ankita Raturi, Debra Richardson, Coral Calero, Henning Femmer, and Xavier Franch. Systematic Mapping Study on Software Engineering for Sustainability (SE4S). In *18th Intl. Conf. on Evaluation and Assessment in Software Engineering*, 2014.

[7] Birgit Penzenstadler, Ankita Raturi, Debra Richardson, and Bill Tomlinson. Safety, security, now sustainability: The non-functional requirement of the 21st century. *IEEE Software Special Issue on Green Software*, 2014.

[8] Birgit Penzenstadler, Bill Tomlinson, Eric Baumer, Marcel Pufal, Ankita Raturi, Debra Richardson, Baki Cakici, Ruzanna Chitchyan, Georges Da Costa, Lynn Dombrowski, Malin Picha Edwardsson, Elina Eriksson, Xavier Franch, Gillian R. Hayes, Christina Herzog, Wolfgang Lohmann, Martin Mahaux, Alistair Mavin, Melissa Mazmanian, Sahand Nayebaziz, Juliet Norton, Daniel Pargman, Donald J. Patterson, Jean-Marc Pierson, Kristin Roher, M. Six Silberman, Kevin Simonson, Andrew W. Torrance, and Andre van der Hoek. ICT4S 2029: What will be the Systems Supporting Sustainability in 15 Years? In *2nd Intl Conf on ICT for Sustainability (ICT4S 2014) Stockholm, Sweden, August 2014*, 2014.

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

[10] Ankita Raturi, Birgit Penzenstadler, Debra Richardson, and Bill Tomlinson. Developing a Sustainability Non-Functional Requirements Framework. In *3rd Intl. Workshop on Green Software*, 2014.