From RE Cares to SE Cares: Software Engineering for Social Good, One Venue at a Time

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ABSTRACT

As software practitioners, we can help society by using our communities of experts to address a software need of a socially-conscious organization. Doing so can benefit society in the locale of a software engineering conference, and provides access to international experts for local organizations which may otherwise not have access. Furthermore, established Software Engineering (SE) researchers as well as practitioners and students have the opportunity for a unique learning experience. In this paper, we argue that the SE community should use SE conferences as the focal points for activities that benefit society at the locations of the conferences, and make such activities an integral, valued, and recognized part of the conference programs. The proposed series of events, termed SE Cares, can follow and learn from the model of Requirements Engineering (RE) Cares events that took place in 2018 and 2019, and can be a co-located event at all interested SE-related conferences.

CCS CONCEPTS

• **Software and its engineering → Requirements analysis**; *Software prototyping*; *Collaboration in software development*.

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1 INTRODUCTION

The Software Engineering (SE) research community has an opportunity to apply its expertise and talents to addressing a need of a deserving, socially-conscious organization in the locale of a given SE conference. In this paper, we present our vision for the SE Cares initiative designed to take advantage of this opportunity. The idea is simple. SE conferences gather the cream of the crop among SE researchers and practitioners. Our community – the academics, the students, the industry researchers, and practitioners – jointly possess an enormous intellectual capacity: the knowledge of how to build software *properly*, and the ability to do so. SE conferences gather and concentrate this capacity at a single location. SE Cares is the way to direct this capacity towards helping local stakeholders who otherwise would *never* have had access to software designers and developers of similar caliber.

Our prototype for the SE Cares initiative, RE Cares was inspired by experiences at our individual universities, such as capstone projects with societal impact, student organization projects

assisting society (addressing issues such as homelessness, food waste), as well as "coding for good" endeavors and social software engineering [1]. Launched at RE 2018 by a group of requirements engineering (RE) researchers, the inaugural event resulted in the development of a communication application named *Crier* (https://crier.herokuapp.com/) [2]. At RE Cares 2018 and 2019, the stakeholders benefited from the elicited requirements, design, and other artifacts as well as the information gathered and knowledge gained from the conference work and from a small prototype of their desired product.

At its core, a <Conference> Cares event is a two-year process with three main stages. *Pre-conference planning*, the first stage, consists of identifying the organizers of the event, finding the appropriate stakeholder local to the conference venue (or with strong ties to the conference location), determining what software will be developed, and making preparations for the actual event at the conference. The second stage takes place at the conference and is the *<Conference> Cares* event itself: with organizers, stakeholders, and volunteer conference attendees participating in a hackathon-style software analysis and design experience. The third and final stage is the *post-conference work* on the project, including the post-mortem event analysis, and the software development efforts to build and release the software product.

Our overarching goal is to establish a full-scale SE Cares movement consisting of numerous, coordinated but independently run <Conference> Cares events, and to establish an SE Cares organization to support this movement.

2 VISION AND MISSION

The vision put forward in this paper is that *the SE community uses SE conferences as the focal points for activities that benefit society at the locations of the conferences, and makes such activities an integral, valued, and recognized part of the conference programs.*

This initiative is not limited to a single conference series but rather spans a broad spectrum of SE conferences. The mission is to help stakeholders at a conference location, who often struggle to find help with their software needs and desires, and to develop open-source software solutions with positive societal impact.

In addition, we envision *SE Cares as a learning experience for established SE researchers, practitioners, and students.* With proper organization, this experience can extend beyond the conference to senior projects, capstones, and SE coursework at the home universities of faculty and students involved with the SE Cares events. This will provide students and faculty with real-life opportunities to learn and implement multidisciplinary practices while giving back to society, in addition to allowing initial prototypes from conferences to be developed into more mature open-source products provided to the stakeholders.

3 RUNNING RE CARES

As a blueprint for a <Conference> Cares event at any SE conference we offer the experience of the two RE Cares events, held at RE 2018 in Banff (Alberta, Canada) and at RE 2019 in Jeju City (Jeju Island, South Korea). Each took place over the course of three conference days: one pre-conference workshop day, and two full days of the conference itself.

For both events, the RE Cares organizers worked closely with the General Chairs of the conference and with the organizing committees to find local stakeholders, determine event logistics, and secure space during the conference.

Below, we discuss in detail the organization of the most recent event (RE Cares 2019) including comparisons to the 2018 event, highlighting differences and noting lessons learned. For more detail on the 2018 event we refer the reader to [2].

Stakeholder and Problem Discovery. We received great help from Dr. Seok-Won Lee, the RE 2019 General Chair, and his local team in finding local stakeholders. Our customer, the Jeju Center for Creative Economic Innovation (J-CCEI) assists local government with addressing important problems in Jeju Island, including economic development, training, and entrepreneur support. Along with the Director of J-CCEI, a group of high school and college students interested in social good became our stakeholders. They named their project *Gochi Gochi*, meaning 'let's get together' in the Jeju language.

Project Selection. During the months leading up to the conference, the international organizers and the *Gochi Gochi* team held a number of teleconferences and exchanged documentation. We aimed to make the purpose and plans of the event clear and to settle on a problem of focus. The General Chair of RE 2019 met with the *Gochi Gochi* team on several occasions and assisted them in providing four project ideas to the RE Cares organizers. After careful consideration based on the feasibility of the project, the skills of the identified participants, and the fit into the RE Cares vision, we chose to devote the RE Cares 2019 event to the mobile public transportation app that concentrates on people with mobility impairment.

Jeju is a popular tourist destination with a far-reaching system of public transportation; however, not all buses are wheel-chair friendly. While Jeju Island has a variety of apps describing transportation routes to tourist destinations, no existing app is aimed for the needs of the mobility-impaired.

Event Preparation. The event organizers started active teleconferences with the stakeholders and among themselves four months prior to the event. This involved communication about the project, discussion of stakeholder interests, available data, and desired outcomes for the *Gochi Gochi* mobile app. Organizing committee discussions concentrated on putting the schedule of the event in place, selecting people responsible for different aspects of the event, and planning for individual RE Cares sessions.

The plan of RE Cares 2019 comprised three days, with Day 1 (Monday) devoted to requirements elicitation and capture, Day 2 (Wednesday) devoted to software design, and Day 3 (Thursday) to an all-day hackathon for building a small prototype of the app.

Elicitation Day. The Monday requirements elicitation day went largely as planned. The day started with a short introduction from the event organizers, a short presentation on the nature of requirements elicitation for our stakeholders, a presentation of the software product vision by the *Gochi Gochi* team, and a short summary of what the organizing committee already had discovered about the proposed application.

From there, the real work commenced with a question and answer session with the stakeholders. During this session, multiple participants captured questions and answers on a series of post-it

notes. Following the Q&A session we held a creativity session for deriving ideas which could feed into requirements. During this session, the stakeholders and the RE Cares participants worked through a number of creativity exercises to capture ideas and user stories for the app. All elicited information from these two sessions was also captured on a series of post-it notes and pasted around the room. Following this, the participants sorted the requirements into nine categories, (e.g., routing, disability support), and created five teams, each tasked to address one or more category.

Each team had at least one RE expert present, and at least one stakeholder fluent in English. Each team prepared a short written summary of their ideas translated into high-level requirements for their domain(s), and toward the end of the day gave a short presentation to all participants summarizing their work.

At the end of the day, event organizers decided to finalize captured requirements as a Feature List document, merged the team contributions into a single file and organized it into general, routing, offline mode, user profiles, ratings and feedback, regulations, disability, language, social and gamification, and data categories of features. The Feature List was edited for consistency and clarity on Tuesday and presented to RE Cares event participants on Wednesday. Our RE Cares 2018 experience showed that scheduling the first day on Tuesday did not leave a lot of time for organizers to prepare for the second day on Wednesday. Scheduling the first day on Monday was an improvement for RE Cares 2019.

The Elicitation Day events were reasonably well-attended. In addition to 10 local stakeholders, around 20 conference attendees participated in the event, with about 25-27 people present in the event room during each session.

Design Day. Wednesday, the first official day of the conference, was Design Day. RE Cares received a shout out during the plenary session in the morning. Immediately following the plenary session, the RE Cares event proceeded with a short summary of the Elicitation Day for those who joined for the first time, followed by a second Q&A session – this one involving both senior members of the *Gochi Gochi* team, and some of the organizers – another improvement over the 2018 event, when only stakeholders were put on stage.

In the afternoon, the participants split into two design teams. The first team worked on use cases and UI for the *Gochi Gochi* app. It produced drawings of the UI wireframes. The second team worked on design of GGDB, the *Gochi Gochi* application database. The team produced an ER diagram of the database and descriptions of all major entity and relationship sets. The local stakeholders participating on the DB team helped the team map the entity and relationship sets from GGDB to a variety of data resources they had procured for the project.

The Design Day was not as well attended as the Elicitation Day. Although some of the RE Cares organizers rejoined the event, most conference attendees participated in parallel paper tracks. Around 20 people actively participated in design (half of them – our stakeholders).

Development Day. An all-day hackathon was held Thursday to develop a prototype of the application. During the hackathon, three separate small on-site teams worked on three different aspects of the application, while a remote team at Shenkar College of Engineering, Design, Art (Israel) worked on design for the application's gamification layer.

The first team continued the design exercise from the Design Day and created a number of detailed use case descriptions and class diagrams. The second team used the GGDB ER model to build the CREATE TABLE statements for all tables in the database. The third team worked on a simple prototype of the app. The prototype incorporated both a back end web application API and a mobile application front end.

Prior to the event, the lead developer, together with the RE Cares organizers, carefully selected the development language and framework for the app. The decisions were made based on the expertise of the RE Cares organizers and lead developer and were informed by a survey of the *Gochi Gochi* team, many college students with programming experience. In addition, the ease of development and maintenance was taken into consideration as well as ease of developing a mobile app for multiple OSes. Specifically, Google's Flutter SDK was selected for developing the mobile front end. Flutter allows for an application with a single codebase to be deployed on multiple mobile platforms. Ruby on Rails was chosen to develop the back end API.

Our RE Cares 2018 experience showed that most development was done by organizers, or pre-arranged dedicated students as opposed to conference attendees. When drop-in participants were not familiar with the development environment, they began installing the software and working on tutorials to gain knowledge to assist. Other participants instead assisted with other design tasks such as UI and database design.

All participants were welcomed by us at both RE Cares events, we had no minimum profile. We found that synergistic effects occurred, e.g. researchers (also professors) who had wandered into the room were soon sitting with students and showing them how to draw certain UML diagrams and helping them express their design ideas more formally. We had participants who came and worked with us the entire time, and we had participants who came and sat in on half of a two hour session. In both 2018 and 2019 we received great contributions from the student volunteers assigned to the room. We had useful contributions (in the form of questions, observations, as well as full requirements, design, code) from both extremes of participation length. We do not have a desired maximum number of participants and have found that our organizing group easily comprises a minimum level, but we rarely had just the organizers in the room.

In 2019, by the end of the hackathon, the development team implemented several application views to present to stakeholders, including user registration, sign-in, and a map view that utilized the Google Maps API. The remote team at Shenkar, consisting of a game design student, worked for two days to develop a gamification design concept for the *Gochi Gochi* app, resulting in an animation video (https://wsrecares.wixsite.com/recares2019).

Reporting, stakeholder feedback and artifacts. At the final plenary session of RE 2019 on Friday, we presented the results of RE Cares to the RE 2019 attendees. The short presentation went over the core activities of each day of the event, listed the constructed artifacts, and played the animation video built at Shenkar.

Follow-up. The *Gochi Gochi* team provided feedback to the RE Cares organizers on the impact of their experience at RE Cares 2019 as well as the usefulness of the small prototype provided to them (https://github.com/RECares/). They stated that they learned new methods, shared them with others and applied them to other projects. They also persuaded others to join in.

To follow-up the events of RE Cares 2019, we are pursuing three goals. First, we are continuing development of the *Gochi Gochi* app so that a minimum viable product (MVP) can be turned over to J-CCEI and can be released to the open source community for further development. Toward that end, two senior developers have been contacted and at least one will assist the project lead developer (a University of Kentucky student) with development of the MVP. After this is complete, it is anticipated that a "coding for good" organization will agree to complete its development.

Second, the event will be evaluated and best practices and lessons learned will be documented to improve our RE Cares 2020. A survey has been distributed to attendees and participants and organizers, and preliminary results will soon be available.

Third, the RE Cares organizers have commenced work on RE Cares 2020 in Zurich. Initial contact has been made with RE organizers, alerting them to the need for assistance in identifying an appropriate local stakeholder.

4 TOWARDS A GLOBAL SE CARES MOVEMENT

Since the RE Cares events, we have explored spreading the SE Cares movement to create ISSRE Cares [3] and ICSME Cares. Each conference agreed to at least hear about the idea and those interested in organizing and/or participating provided their contact information. These experiences have further served to highlight that it is important to understand the focus and culture of the potential SE Cares conference hosts. An important part of a Global SE Cares movement is finding individuals and groups willing to educate the SE Cares organizers and assist them in tailoring the SE Cares idea as appropriate for specific conferences.

The RE Cares model can be extended from short conference-related events to year-long endeavors taken back to the participating researchers' home universities and continued with extended participation of students and faculty in related courses. This would provide students and faculty with real-life opportunity to learn and implement multidisciplinary practices while giving back to society and empathising with sustainability and societal-related causes. The same opportunities for continuation can also be offered to industrial participants in their companies. This can result in extending the initial prototype developed in the conference to a more mature product provided to the stakeholders.

As such, we propose to extend our RE Cares experience to a wide range of independently run, but centrally coordinated, <Conference> Cares events. To support them, we propose to establish a coordinating body, tentatively called SE Cares, to play the role of a Steering Committee to all Cares events across different SE conferences.

Compared to academic "software for social good" projects, the <Conference> Cares concept described in this paper has a number of unique advantages. It is designed to leverage the collective intellectual capacity of researchers and practitioners in various fields of SE to give back to the communities that help organize and support their conferences. Distributed over multiple conferences in a given year, the Cares events, when paired with appropriate local stakeholders, can go a long way towards giving access to software engineers to organizations that are typically deprived of such opportunity.

A "software for social good" endeavor is worth establishing and supporting if it (a) is capable of succeeding and (b) actually achieves the "software for social good" goal. We can state that the RE Cares events discussed in this paper achieved both goals. The RE Cares 2018 event has successfully culminated in release of the *Crier* software, while RE Cares 2019 has produced a prototype of the *Gochi Gochi* app. Thus, both RE Cares 2018 and 2019 projects pass the "software for social good" bar. Based on how these events went, we have a good understanding of how to run future <Conference> Cares events, and our initial recruitment attempts at additional SE conferences appear to generate interest.

In conclusion, we believe that the new era of a society dependent on software for almost everything can be turned to society's advantage with one small change to how we run our conferences – adding a little bit of caring via <Conference> Cares. The RE Cares community stands ready to assist.

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