

How to Gather Requirements from the Crowd with Hackathons – Challenges, Experiences and Opportunities

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Abstract

[Context and motivation] Today’s software systems become more and more complex, especially when we think about connected systems such as cyber-physical systems or digital ecosystems. Customers thereby demand flawless apps and have several needs in mind that such solutions should provide. If these are not fulfilled, they do not use the solution. In such connected environments, usually many different stakeholders exist that all have different requirements. **[Question/problem]** In complex cyber-physical systems, the manifold requirements and possible solutions can overstrain requirements engineers and developers. What are ways to consider needs and requirements from different stakeholders? How can such input be used for requirements engineering? **[Principal ideas/results]** In order to gather ideas, issues and requirements from several different stakeholders, we propose to consider hackathons besides well-known and established requirements engineering methods. With these, one gets to know his stakeholders, get real needs from his stakeholders, and get early ideas and prototypical solutions. **[Contribution]** We share our experiences with two hackathons we performed in a research project that aims at developing a climate neutral city district with supporting digital services. We discuss opportunities and challenges and how results might be used for requirements engineering.

1 Context and Motivation

The world we live in today is becoming increasingly connected. Connected cars, households and factories, intelligent and mobile devices and even combinations of these are just a few examples. This trend runs through both the private life and business sectors and today is often referred to as digital transformation. For companies there are new opportunities to develop new or offer their products and services in such connected systems, and the chances for innovative products and new businesses are increasing. In this context, terms such as Internet of Things (IoT), digital ecosystems or cyber-physical systems have become established.

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While such connected systems offer enormous opportunities for companies, there are also many challenges in the development and operation of such systems. The development of embedded systems or information systems as such is often already characterized by high complexity, but their integration into highly connected systems increases this complexity considerably. Challenges are e.g., the high heterogeneity, organizational questions like opposing motivation of the actors, evolutionary aspects or contradictory quality requirements. In addition to these challenges, the pressure to be fast on the market is increasing, i.e. a goal for companies is often to achieve a short time-to-market in order to remain competitive. Furthermore, quality plays a decisive role in user acceptance, but also in the innovative power and thus the sustainability of such systems.

From the perspective of requirements engineering (RE), one big question is what are the “right” requirements. While this was always a relevant question that a requirements engineer asks their customers, the number of stakeholders in the sketched connected systems is much higher. Therefore, additional ways of gathering requirements from different stakeholders become more relevant [2].

Currently, we are working in the “EnStadt:Pfaff”¹ research project which goal is to build a climate-neutral Smart City district with the help of digital solutions. There, several stakeholders such as citizens, companies, research institutions, business companies have to be considered. From our perspective, different ways of involving such stakeholders are needed to provide digital solutions that really offer a benefit and fulfill the needs of the different stakeholders. Living labs and hackathons are means for citizen involvement [1].

One way we started with, involving people outside our project partners, was performing hackathons. A hackathon is a hacking marathon where a group of people develops some kind of prototypes in a short amount of time [3]. Such hackathons exist since the early 2000. From our perspective, they are not used broadly, and rather on conferences as some kind of additional event or by bigger companies mainly for recruiting and marketing goals. Applying these hackathons to involve of stakeholders, especially citizens, allows interested stakeholders to participate in elicitation and solution finding activities. Apart from social and business benefits, technical benefits are expected [4]. This raises the question how the results of the hackathon can be used for further RE activities. Organizing public hackathons is time consuming and costly, however many stakeholders can participate at once. Making use of the results in an efficient manner is crucial for considering them successful. From a research perspective, we are considering two questions:

- How can the results from a hackathon be efficiently used for RE?
- How suitable are hackathons for bringing together “usual people” with limited IT background but relevant issues, requirements, and questions together with the more technic affine requirements engineers, developers and product owners, in the RE process?

Until now, we performed two hackathons in the last two years in the given research project. We got great input for our research project content-wise. Furthermore, we involved several people (more than 80) and therefore got ideas (and prototypes) that are relevant for different stakeholders in the future.

In this contribution, we share experiences we made during the planning, execution and follow-up activities of the hackathons. We further discuss the two research questions and provide an outlook on further ideas for hackathons. With this contribution, we want to motivate other researchers and companies to start with hackathons to get further input for their requirements engineering with the overall goal to develop services and apps that fit the needs of the stakeholders even better. In addition, we want to discuss with other researchers how results from a hackathon can be better included in requirements engineering activities.

2 Organization of Hackathons

In the following section, we explain our approaches for planning, executing and following up the two hackathons, enabling the readers to understand and replicate the approach. The first hackathon was performed in June 2018, the second one in October 2019. While many aspects are the same or similar, there were also some differences between the two hackathons, based on our experiences from the first.

2.1 Planning

Main topics to consider during the planning phase were: Finance, location, technology equipment, marketing, registration, t-shirts, catering, event schedule and follow-up activities. Figure 1 shows an overview of work

¹<https://pfaff-reallabor.de>

Management	Financing	Marketing	Location	Schedule	Follow-Up
Kick-Off	Person Days Efforts	E-Mail	Booking	Registration	Questionnaires
Regular Meetings	Catering	Posters	Furniture	Pre-Event Information Distribution	Feedback Sessions
Planning Team Organization	Prizes	Flyers	Electricity	General Information	Follow-Up Meetings
Supervisor Management	Giveaways	Personal Marketing	Wifi	Additional Hardware	Capturing of Results
	T-Shirts	Social Media	Additional Hardware	Topics Goals	
	Partners Sponsors	Networking	Recreation Area	Event Schedule	
		Website	Decoration	Projection	
			Signs		

Figure 1: Activity plan for the organization of hackathons.

	Hackathon 1	Hackathon 2
Number of participants	more than 30, no special experience required	more than 50, targeted specifically at participants with at least some development experience
Teams	Pre-assigned to teams by organizers	By choice of participants
Focus of results	New ideas, new scenarios, paper prototypes	Connected scenarios, prototypes
Time	Friday, 4 pm — Saturday, 5 pm	Friday, 2 pm — Saturday, 3 pm
Schedule	Registration (1 h) Introduction and topics (1 h) Ideation (5.5 h) Intermediate pitch (0.5 h) Prototyping and development (15.5 h) Final presentations and award ceremony (1.5 h)	Registration (1 h) Introduction (0.75 h) Ideation, prototyping and development (21.25 h) Final presentations and award ceremony (2 h)

Table 1: Overview of main differences between the first and second hackathon.

packages and activities required to perform during the planning stage. Both the planning of marketing activities and event schedule have been crucial activities for the shape of the hackathons, while follow-up activities are important for the usage of the results within the project context. Inviting stakeholders to participate in such type of event requires serious investment in marketing activities. We have reached out via posters, flyers (e.g., at universities, public library, town hall) email marketing, social media campaigns and through our professional network. For the first hackathon, we started planning around three months before the event. Due to our limited experience with this type of event in our organization, the schedule was ambitious. The planning of the second iteration began around eight months before the event, hence being a lot less demanding, thus it could be integrated better with other project work.

2.2 Execution

Table 1 shows a comparison of differences in the shape of the first and second hackathon. Our hackathons² were 24-hour events (except registration). We started Friday 5 pm (respectively 3 pm at the second hackathon)

²Pictures taken during the hackathons can be found under <https://pfaffhack.iese.de/pfaffhacks>.

and ended the next day. Officially, the participants could arrive one hour earlier to get their info package and material such as badges and t-shirts.

At the time of the first hackathon, the research project was in a phase where the focus was on finding general ideas and scenarios how to support different stakeholders with digital services in the city district. Therefore, we motivated the participants to think into this direction. We presented the project, its scope and challenges and provides a set of general topics that the teams could select to further elaborate on. Afterwards, we guided them with design activities such as brainstorming and paper prototyping to come to initial ideas that they could refine during the night and the morning. During the night, some participants left and came back the next morning, which had some influence on the development of the results. During the latter morning, the teams began to start with their presentations that were about 15 minutes. Three teams presented their results, and the solutions were judged by a jury of three experts. Due to the small number of remaining participants, all teams got some prizes.

During the second hackathon, we focused much more on elaborating concrete ideas and ensured that the participants had at least some basic programming skills. The introduction was shorter and the teams started with elaborating ideas after 45 minutes of describing the project and the goals. Consequently, they had much more time to come to concrete solutions, but were also more responsible on their own. Supervisors though supported to the different groups with general and technical advice and reflected the progress together. In addition, some technical intros were given by the supervisors regarding solutions and technology the teams could use, especially about the technical platform prototype provided. This is a simplified version of the system that is used in the “EnStadt: Pfaff” project to flatten the required learning curve. As we had eleven teams during the second hackathon which were mainly working on solutions (i.e. also during night, most people stayed awake), the teams only had four minutes time for the presentation the next day. These were prepared during the morning by the teams, and presented at 1 pm, Saturday. The best three teams, again judged by a jury of three experts (providing technical, business and smart city expertise) received some prizes.

Besides all working times, we had some breaks in between: Experts gave short inspiring talks about technologies and topics related to the climate neutral smart city district. Short fitness sessions were held to energize the participants. Meals were provided in the evening, the night, the morning and for lunch. Tired participants could use a dedicated area with comfortable seats for short recreation.

2.3 Follow-Up

Immediately after the events, the supervisors have tidied up the location and captured any results. Paper prototypes, sketches, paper cards with ideas and the like were photographed to conserve them for later use. At the first hackathon, the teams’ presentations were recorded (video and audio). Due to organizational problems, we only took pictures of the presenting teams and their solutions at the second hackathon. Shortly after both events, review meetings with all supervisors and relevant project members were held. The initial reaction was the same for both hackathons: all agreed that the events’ results provided valuable benefits for the project, the publicity works were improved and pursuing another iteration is worthwhile. The required effort for the planning and execution was mentioned as a negative aspect of the hackathon event format.

3 Discussion and Experiences

The planning and execution of the first iteration of the hackathon was challenging due to short time until the event and lack of experience. In order to incorporate the hackathon’s results into the project, no later date could be chosen. We have strong experience with regular project work and other participation formats, but the open nature and long duration of the event required special attention. For the planning of the second hackathon we could rely on the experiences from the first, hence starting earlier, extending the available time and allowing us to focus on improvements. It shall be noted that the planning of the second hackathon was significantly simpler. Organizations seeking to hold their own hackathons might reach out to experienced partners or plan for building their own body of experience. This type of event might be more suitable when aiming for several iterations.

Most important of all was that we see both hackathons as very successful events, meaning a hackathon is indeed a good way to bring people with a different background together (though, of course, not the only way). Due to the local nature of the given research project, stakeholders have a strong interest in the (preliminary) project results and the overall developments. The hackathons provided a way of integrating citizens into the project, enabling them to provide requirements, ideas and solution concepts by themselves. Strong interest in the project goals, hence the hackathons’ goals, might be an influencing factor for their participation. As the events were held over 24 hours, participants that signed up had a strong internal motivation to contribute with

valuable input. Due to the relaxed nature of the hackathons, participants and supervisors had a lot of fun. This is an aspect that sometimes falls short in other participation formats.

During both hackathons, after the teams have pitched their results to the jury, three winning teams were chosen and awarded prizes. These were given by partners of the hackathon (e.g., vouchers for an exit game). No cash prize was given to any participant. Still, their motivation to pitch the solution was high and the winning teams showed joy and pride after receiving a prize. We believe that the cash equivalent of the prizes is less important to the participants than the honor of actually receiving it.

Legal aspects need to be considered when planning and conducting such an event. General terms and conditions for the usage of participants' data, photographs and the results produced need to be prepared and agreed upon by all participants. It shall also be noted that occupational health and security regulations apply that restrict the availability of supervisors during the event (e.g., by German law, employees are not allowed to regularly work for more than ten hours per day and rest periods need to be adhered to). This can be circumnavigated either by special agreements or thorough planning of working schedules.

The results were integrated into the concepts developed in the "EnStadt:Pfaff" project. For us as the executing organization, the hackathons provided an opportunity to integrate supervisors and project members from various departments in the planning and execution, leading to a strong increase in communication about the project and its results.

Regarding the first research question, we have some open questions remaining. During both hackathons, a total of 14 teams created individual results that were presented in front of the whole audience and the jury. In short time, a large number of results is presented that were previously created over 24 hours. The results created during a hackathon are by far neither created by requirements engineers nor by professional software engineers. They are focused on meeting the hackathon goal and producing tangible as well as likeable output rather than having their documentation in mind. Recording the presentations conserves at least the core essence of the solutions, but many intermediate results from the thought processes participants go through are lost. This also holds true when keeping access to source code and other artefacts created during the hackathons, as participants typically focus on creating solutions rather than writing down supporting information. It remains unclear, how participants can be supported in documentation efforts without this leading to cognitive overload.

In the first hackathon, the focus was much broader than in the second. This resulted in a much more diverse background and age distribution of participants in the first. During the night, many participants left the event location to return the next day. We assume this was due to less resistance to sleep deprivation or family obligations (due to the overall higher age of participants). Participants of the second hackathon were younger and their background was less diverse (mainly computer science students). We assume that this led to mostly all of them staying overnight and working all the time. This aligned with the intended audience, as we advertised the second hackathon to participants with, at least, some development experience due to the focus of results. Shorter event schedules or two-day events with a night-break seem to align better with expectations of a more general public audience. However, the second hackathon led to results that better aligned with the project goals and intended use of a software ecosystem for smart-cities. One needs to carefully plan, advertise, schedule and execute (i.e. design) the event for the intended audience and expected type of results. Hackathons seem to be suitable event formats for incorporating general citizens and experienced stakeholders alike.

In the two hackathons performed, we had to consolidate the results afterwards. Of the results of the first hackathon, many ideas were also already thought of before in the project by the researchers, but some new ideas came from the participants of the hackathons. This changed during the second hackathon, where many new ideas emerged (maybe simply due to the higher number of participants). However, the initial goal of the second hackathon, namely to create more connected solutions, did not work out very well, as the teams had enough to do with creating and realizing their concrete services. This is again up to us researchers and project partners to base new solutions on the results of the participants, hence incorporating the vision of a connected ecosystem more strongly into the design of the hackathon.

Comparing the results of the first and the second hackathon, the sheer number of teams, hence individual results, differs (three vs. eleven). What is still open to us which and how to exactly transfer the many ideas into concrete services. This is one of our future tasks.

4 Summary and Future Work

In this poster paper, we presented our experience with two hackathons we planned, organized and performed in scope of the "EnStadt:Pfaff" project. The goal was to generate initial ideas and prototypical solutions for

digital services within a climate-neutral city district. Our main research questions thereby focused on how to get information and requirements from a diverse crowd in that environment.

We believe and experienced that hackathons are a great source for new ideas and initial prototypes for software services. Though they do not fit for all purposes and in all situations, hackathons can often be used to gather and explore concrete requirements and to evaluate early implementations of services and apps. The two hackathons conducted were beneficial to the overall project goal and the involvement of stakeholders in the requirements engineering and development activities. Hence, we plan to continue this type of an event on an annual basis, at minimum during the remaining project duration.

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