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Mobile Probing Kit:
User centered development of personal networks services and applications

Jakob Eg Larsen, Lene Sørensen, Jannick K. Sørensen and Nette Schultz

Abstract—**Mobile Probing Kit is a low tech and low cost methodology for obtaining inspiration and insights into user needs, requirements and ideas in the early phases of a system's development process. The methodology is developed to identify user needs, requirements and ideas among knowledge workers characterized as being highly nomadic and thus potential users of mobile and ubiquitous technologies. The methodology has been applied in the IST MAGNET Beyond project in order to obtain user needs and requirements in the process of developing pilot services. We report on the initial findings from applying this methodology in the early phases of this large scale research and development process.**

Index Terms— **Participatory design, user centered design, user requirements, personal networks, mobile services and applications.**

I. Introduction

INVOLVING users in application development has a long tradition within software engineering. Application of user centered design may involve the users in the process of development in several stages. The involvement of users can serve several purposes, but typically to communicate information about their needs, usage situations and requirements to system designers. A general problem is to bridge the gap between the user domain and the designers' understanding of it. It can be difficult for the users to express their needs and requirements, therefore methodologies facilitating the process have been proposed within participatory design [1], [2] and [3]. In a specific context and familiar usage situation users may be able to provide useful insights to problems, wishes and requirements, which can serve as useful input for designers of software applications and services. However, traditional methods can be insufficient if applied to obtain requirements in an unfamiliar context. In general it is difficult for users to relate to unfamiliar situations if asked to provide information that can help explore new possibilities brought forward by completely novel technologies. How to potentially imagine such technologies and what would be useful services and applications can be a

mystery to users. The dilemma is to have the users think forward and at the same time understand and explain potential emerging problems in a new and unfamiliar domain. Enabling them to communicate such problems is therefore a challenge.

The well-established participatory design methodologies do not take into account the focus on nomadic usage situations and novel mobile technologies. These problems require development of new methodologies especially tailored towards gathering of user requirements for novel technologies that can be applied in nomadic usage situations.

In this paper we describe such a methodology and the initial findings for obtaining inspiration and insights into user ideas, needs and requirements at a very early stage in the development process of novel technologies which may have a potential high impact on future user behavior and society. Moreover the methodology targets to facilitate the process of capturing the special user requirements for systems aiming to support nomadic knowledge workers. The methodology has been applied in order to identify initial user ideas, needs and requirements in the IST EU MAGNET Beyond project.

II. User Centricity in the MAGNET Beyond project

MAGNET Beyond is a large scale EU IST-funded project that research different aspects of the concept of 'Personal Networks' (PNs) as the future interconnectedness of personal mobile devices and clusters of devices from a technological, business, and user perspective [4]. The overall vision is to provide a general framework for a user friendly interconnection of the vast number of digital devices being used by individuals now and in the future (where the number of devices are expected to raise significantly compared with today). Furthermore, there is an emphasis on location based services and context aware information and how it in a secure way can facilitate the needs of the user in particular situations. Thus the introduction of these concepts implies a paradigm shift for users' understanding and use of devices and services. The interconnectedness between devices and context information about use situation is expected to facilitate novel types of use.

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User-centricity has been emphasized from the beginning of the project, in terms of applying participatory design and creativity as core elements for deriving user requirements [5]. In order to develop an understanding of the user needs and to capture requirements for the technologies being developed, users have been involved in the process from an early stage. As the technological emphasis has been on wireless technologies and mobile devices, the focus has been on users that can be characterized as highly nomadic in their everyday and working lives such as nomadic knowledge workers. Special attention was given to nomadic knowledge workers requirements in relation to the aspects being researched in the project, such as ad hoc and long term networking, context awareness, security and trust, privacy, personalization, and simplicity of use.

The overall purpose of the early user involvement was that the obtained ideas and user needs expressed would serve as a means communicating the needs and requirements of nomadic knowledge workers to the designers of the core technologies and pilot services in an iterative design process. After several iterations the aim is to ensure that the users' needs and visions would be met in the final design to the extent possible.

However, the dilemma that involved users have to imagine the possibilities provided by novel technologies under development is evident in this project. A key challenge is to obtain realistic requirements from the nomadic knowledge workers and go beyond the requirements of today and reach the future technologies and ubiquitous networks of the future. Therefore a methodology addressing these issues have been developed and applied with eleven nomadic knowledge workers. The methodology aims at involving the users in the development of innovative concepts for future personal mobile applications and services.

III. MOBILE PROBING KIT METHODOLOGY

The fundamental problem of dealing with nomadic users contrary to users in a static usage environment had to be dealt with. Overall the mobility aspect is dealt with by making the tools for obtaining user requirements mobile as well. At the same time, it had to be emphasized that the user requirements should associate to the concept of personal networks which still lies in the future. For this particular purpose a so-called probing kit, with inspiration from [6] and [7], was designed: a method that would especially facilitate capturing requirements of nomadic users. The fundamental idea was to let a probing kit follow a group of nomadic knowledge workers in order to capture their ideas, needs and requirements based on problems encountered in everyday situations.

The inspiration for the probing kit originated in the design process behind the original PalmPilot PDA project. The designer – Jeff Hawkins – had an interesting approach to the design, especially in terms of gathering requirements in the early design phase [8]. His approach was to carve up a piece of wood that would fit in his shirt pocket. Then he walked around with this piece of wood pretending it was the actual device he was using. For instance he would pretend he was entering information. This meant that he would "use it" in situations where the device was likely to be used in the future. That way it was possible to gather user requirements for the device based on simulated use of the device mockup in "real-life" situations.

Similarly, the mobile probing kit was developed in order to capture ideas, user requirements and needs for the nomadic workers as they would encounter needs or ideas in their everyday. That is, to facilitate the idea-generation in everyday situations and capture the ideas and requirements in the situations they would occur.

Applied in the MAGNET Beyond project the probing kit was referred to as the so-called IDEA-MAGNET. The probing kit was a notebook (inspired by the Hawkins lump-of-wood). The size of the notebook was 5 cm times 7 cm with a metal cover and an integrated pen, see Fig. 1. Additionally a few stickers were added to the inside of the metal cover which could be used when taking notes.

Fig. 1. The pocket size (5 x 7 cm) probing kit note book with integrated pen.

The participants were instructed to carry the probing kit as much as possible during the day for a total of three weeks. They were asked to use the probing kit to write down situations, problems, ideas or future activities where they could envision the use of technologies, services or applications which are not available today. They were asked to relate to situations where the use of technologies could help or assist them in improving their everyday working life and secondly also their family and leisure activities.

Taking into consideration the use of the probing kit and the importance of clarifying and making sure that participants understood (were guided in the right direction), small notes or 'bumper stickers' representing different usages scenarios were included in the probing kit as reminders to the participants to think about as they made use of the probing kit. The bumper stickers were meant as a way

of reminding the participants of certain aspects of their daily life involving the use of technology, services and applications that they should record in their probing kit.

The bumper stickers included statements like:

- Virtual work where anything can be done anywhere. Meetings, documents and colleagues, let us communicate and exchange ideas.
- Task-manager or calendar, extremely personal. Who should have permission to look at or make changes? What will I do if I lose it?
- How and when should the personal helper be used?

A brief explanation page was also designed and included as the first page of the probing kit to explain to the participants what they should be doing with the probing kit, should they forget or need reminding.

Throughout the duration of the period where the participants were using the probing kit, a reminder SMS was sent out to them every second days. This SMS was not only a reminder, it also conveyed certain issues that the participants should keep in mind or look out for or maybe have encountered as they were using the probing kit.

Example messages included:

- What information do you need right now?
- Is security something you consider when using technology? Who is able to see what? Who can use the information?
- What are you going to do today? What needs to be planned? What information do you need?
- Can you think of situations today when you could imagine technology assisting you?

The participants received the probing kit at a kick-off workshop that focused on presenting the thoughts behind the probing kit and starting the creative process of idea generation. A second workshop was then held three weeks later, where the participants had carried the probing kit around and used it. Here the aim was that the participants should report their findings, results and possible frustrations over using the probe kit, followed by a group discussion among the participants and their ideas and thoughts. Each workshop was organised over two hours (during afternoons) where the majority of the invited participants were able to participate.

Special emphasis was put on motivating the participants to be creative and to use the probing kit during the three weeks. Therefore, as part of the first workshop, the creativity stimulating tool Visionpool [9] was used. It consists of a large number of small slides (5 cm x 5 cm) showing colours, figures (ambiguous and unambiguous) of all sorts

The idea is that participants in a workshop select a number of slides that they interpret and translate into an idea which is meaningful for them. Taking turns, the participants then explains their interpretation of the slide and their idea.

In this particular situation the methodology was used to stimulate creativity having the participants thinking of ideas and problems linked to the concept of personal networks before they were to use the mobile probing kit themselves.

IV. RESULTS

The eleven nomadic knowledge workers generated a total of 175 notes over a period of three weeks. Typically the notes either appear to have been triggered by a specific situation, described in the note, or were results of thought processes and associations.

When analyzing the notes, about half (86) was concerned with general expectations or requirements to a future system or device; what it should be able to do or which general requirements it should fulfill. Examples of expectations could be that the device or system should ensure fully backup so data never will be lost or that the device should respect privacy and integrity. These notes seem to be developed based on participants' general observations and reasoning on consequences of technology in general.

A group of 40 notes appeared to be triggered by specific situations. In these cases the situation is well-described and often a specific product idea or requirements follows.

The last group of 49 notes could be characterized as "product ideas" describing future products, systems or services. They are more specific than the "expectations" and often linked with an observed or experienced situation.

When analyzing above notes, the "situation notes" seem to have functioned as pivotal points for the "product-" and "expectation" notes even if the triggering situation has been omitted from the note.

In the further development of system requirements and use cases for the MAGNET beyond project especially the "expectations" notes played an important role as they pointed at important and general use qualities and user opinions in developing technology.

The preliminary results developed so far have provided valuable information about future users' activities, routines and behavior in their everyday-life, including their working life. Therefore, ethical and emotional aspects have also been brought into focus through the expressed visions and comments. It must be emphasized that the MAGNET Beyond designers' obligation is to view nomadic work activities not as isolated from the other activities of the user, but to take into account the users' different activities, encompassing work, family, shopping, leisure time and home activities. These different activities are interwoven in the design context and the design for the integrated simultaneous nature of these activities has to be made accordingly. Privacy protection is taken for granted by users and is regarded as something being taken care of by the organization or service provider. It has to be assured that MAGNET technologies will not undermine or short circuit privacy or civil rights, e.g. in less privacy concerned contexts, but assure the user full control of which information should be accessible by whom.

V. DISCUSSION

The development and testing of the method within the MAGNET Beyond project provided valuable experience in

terms of both specific and general usage. Overall, the group of knowledge workers using the mobile probing kit received the method well and used the probing kit over the three weeks.

The method of using a probing kit for generating ideas and expectations in relation to future technologies can be evaluated from different levels:

- o How it was perceived and used in the case in comparison to the expectation.
- o What type of results were gathered again in relation to the expectation
- o How generally applicable is this method in relation to other methods which seek to generate user ideas and expectations.

A. The Usage of the Mobile Probing Kit

It was clear from the feedback received that the level of motivation was essential to the extent to which the participants would use the mobile probing kit. Motivation has been identified by many authors [10] to be highly associated with creativity. Research shows that in order to be creative, humans need intrinsic motivation to have fun and to understand the overall need of doing such an exercise. If that is not met, or even a reward is given, the creativity falls significantly. Motivation is therefore seen as a central point in the methodology.

The participants were well motivated in the beginning of the period (the first 4-5 days) where most ideas/expectations were created. Then followed a period of time where most participants got caught up in work, forgot the mobile probing kit to a certain extend or became less motivated to think about ideas and write them down. Around half of the participants then in the end of the period became active again. Two factors for motivation were used in the exercise: the Visionpool element in the first workshop and then later the SMS'. This indicates that one week could be a sufficient period of use.

The participants were all happy with the workshop and the Visionpool exercise. They were eager to discuss ideas and to understand the purpose of the exercise. Also they had a sense of sharing a problem and working with it together. All factors which can motivate the individual for some time [10].

As mentioned already, the SMS messages were intended to motivate and remind the participant of the mobile probing kit and to reflect on their daily life situations and needs in the right moment of receiving the text message. Even though some participants were annoyed and felt pushed to think about something at specific times they did not select themselves, they were reminded of the exercise. Others were happy with the text message to remind them about the exercise. It is clear that in any situation, the messages were useful to remind the participants of the Mobile Probing Kit. However, whether the messages worked as a motivating factor for all participants is probably doubtful. Receiving annoying messages or messages which give a participant bad conscience will most likely have an opposite way of working. It is therefore likely that only the participants who

enjoyed the messages could use this as a motivating factor to produce more ideas and expectations.

B. The results

Originally, the idea was to explore user needs and requirements for the systems developed in the MAGNET Beyond project. However, using the probing kit in the way used in MAGNET Beyond is very open ended. Therefore it produces many ideas and expectations, which are very broad and not necessarily within the type of novelty perspectives that is needed in the particular case. The mobile probing kit created initial ideas and expectations which can be interpreted and used as inspiration for developing user-centered scenarios and use cases and then in a step further developing user requirements. Details on this process can be found in [5].

The fact that the probing kit is used as a pre-indication of items and ideas to be represented in scenarios and use cases and then be translated into user requirements can be a problem in such a project as MAGNET Beyond. Overall, the expectation was that the users would be able to formulate requirements in a quantitative form that would be useful for the system designers. However, the method would never create such detailed and specific requirements, and must be seen as an intermediary approach to establish such requirements. In that respect, it is important to communicate this to others in the project in a way that is sets the expectations straight. Otherwise, there is a risk that the method will be perceived as useless simply because it does not meet expectations.

Based on the current results we suggest the following recommendations for the development of a conceptual structure and services: The user experience of moving and sharing data between devices has to be easier and faster than today's user actions of moving/sharing data between devices. User actions of moving/sharing data have to be very intuitive with high cognitive transparency and high degree of user feedback on performed actions. The conceptual structure of users, identities and roles has to be flexible to accommodate both official and pragmatic user needs. E.g. in some cases enabling access (although officially forbidden) to specific personal files, or granting temporary rights to a trusted other person. Personalized context aware push services aimed at knowledge workers should primarily offer solutions for trivial tasks. Personalized context aware pull services can be much further developed, and is what users seem to prefer Instant data upload/mirroring of e.g. recordings through a High Data Rate (HDR) connection to (media) server would revolutionize e.g. media production. Viewing work life and private life as interwoven parallel activities in time/space and thus facilitate services for easy swap between roles and identities is important.

C. General Application

It is central for evaluation of the mobile probing kit to discuss the participants in the exercise. The participants were all knowledge workers with a generally good understanding and experience using technologies and with a large level of self determination and planning of own work.

This could mean something in relation to how well, the participants would be able to identify and express experiences and ideas. Whether that is a relevant parameter needs to be proven by testing the method with other groups or participants.

The probing kit was in this method used differently than cultural probes [6] in general. Here it was aimed at getting insight to the participants' expectations and ideas as they would come to mind (or are met) in their everyday life – at work and in private life – and at the same time to catch flair of the future and wishful thinking. It is seen to be very important to gather the ideas/expectations in the environment and situations where the users live their lives.

An alternative method for getting a somewhat different understanding of the participants' daily life would be to use observation and contextual interviewing techniques [2]. Using the observation method, the advantage is that it records actual behavior and not what participants say they do or believe they do. On the contrary this method does not give any insight into what the participant thinks or wants (unless the person is asked), and also there is a risk that the observed person actually changes behavior and feels uncomfortable with the situation. In interviews, persons can express needs, thoughts and expectations, but they can seldom be creative and envision problematic situations or new ways of using technology.

CONCLUSION

The findings from the workshops emphasized the MAGNET designers' obligation not to view nomadic work activities as isolated from the other activities of the user, but to take the whole of the users activities where work, family, shopping, leisure time and home activities are interwoven as the design context and accordingly design for the integrated simultaneous nature of these activities.

Context-aware pull-systems were generally requested. Examples of these services could be a look-up for a certain type of restaurant within a geographical area or information regarding an empty meeting room in an office environment, or the physical position of small shared devices e.g. a video camera. If the context-aware services enabled the user to create content or configure the systems, the services would be much appreciated.

Privacy protection is taken for granted – and regarded as something being taken care of by the organisation or service. When privacy is a critical issue (in terms of protecting for example a journalist's sources) no communication equipment or service (mobile phone, email etc) is used in order to blur the identity and location.

The mobile probing kit methodology aims to obtain inspiration and insights into user needs, requirements and visions in a user centered design process. The aim is to situate the actual creation of ideas and identification of needs. We have positive initial indications on the applicability of the method from the IST MAGNET Beyond project with eleven nomadic knowledge workers. In the project the method was useful in terms of generating specific product ideas and it also gave insights into user expectations and usage situations. The method was applied with nomadic knowledge workers that are used to formulate needs, thus it is unclear if the method would be suitable outside that user domain. It was found that there is a limit to how long the participants are willing to use the mobile probing kit. The three week duration of use appeared to be too long for most of the participants. Nevertheless, the probing method was useful as a conversation tool in terms of obtaining inspiration, initial user ideas and information needed in the process of capturing user requirements, which can help shape future applications and services.

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