In-situ Everywhere: A Qualitative Feedback Infrastructure for Cross Platform Home-IT

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ABSTRACT
The domestic appliance landscape is becoming increasingly interconnected with different options to consume rich media, e.g. on TV, PC or Mobile with manifold options for additional services. From a participatory design oriented perspective, involving users into the design of new applications related to video and TV is a topic with growing importance. However, current options to provide feedback at use-time are limited to a standardized form, e.g. in traditional usability tests. In order to open the design space for long-term and more creative in-situ feedback, we will address this topic by a concept of a cross platform infrastructure that enables users to provide feedback on different devices in the context of the usage. This concept enables users to co-develop and improve a system over time in a continuous manner. Crossing the boundaries of various platforms, feedback can be enriched in a very comfortable way, e.g. by annotating a screenshot of the television screen with the smartphone.

Categories and Subject Descriptors
H5.1. **[Multimedia Information Systems]**: Evaluation/ Methodology

General Terms
Evaluation, Methodology, Human Factors

Keywords
Remote evaluation, in-situ feedback, cross platform infrastructure, community help

1. Introduction
Since many years, research has been putting a strong focus on involving users in the design process of new applications. Including employees in the design of computer systems as they are being developed [3], has its origins in Scandinavia, and participatory design (PD) also became important in domestic contexts. Previous work has put strong focus on real life contexts, with PD variations used for evaluation and exploration. 'Cultural probes' have been used to explore this approach in order to gain new ideas for improvement. Bernhaupt [2] for example created and tested the 'playful probes' – a collection of games and playful material aimed at encouraging user involvement. Other works focus on the question of how to evaluate new prototypes and how to improve usability along design guidelines [1, 5].

In our previous work we gave insight into how users could be involved over longer period of time, in order to collect new ideas and be able to improve functionalities continuously. Our previous experience with community driven development [9] has shown that feedback channels should be integrated directly in the artifact. Instead of only discussing new functionalities in an online forum, additional channels should enable users to provide feedback directly in the context of the usage. Such functionality should go beyond a simple error reporting system and give options to explain desired improvements through visual descriptions, e.g. by annotating a snapshot of the TV interface on the mobile device.

In a running research project we are developing a cross platform framework for the home entertainment domain to support the exchange of audio/visual content between different devices and to enrich this with community functionalities. From an empirical point of view, we have observed different kinds of usage jumps [8] on a single device (e.g. switching between TV and Internet module at the media center system) and between different devices as well (e.g. searching for additional content on the smartphone while watching TV). In order to support such behavior, services need to be adapted for the specific context, e.g. on a public screen or on personal devices. PD oriented work and concepts for remote evaluation may support the design process with adequate services for remote user participation.

Providing feedback on public devices, such as the television set, can be tricky. Normally controlled via remote control, the TV provides only limited options to enter text or highlight certain screen area. While designing for a cross platform infrastructure, we also scaled the feedback-issue on that level. It means that the users should be able to generate in-situ feedbacks on any device and annotate it easily with another one, e.g. capture a screenshot on the mobile device and edit it on the tablet. Options should provide the users with possibilities to enrich screenshots and photos with text, audio or other descriptive elements. The feedbacks then can be made available for the developers and other users as well, e.g. in an online forum. This opportunity would empower users to articulate their needs much easier and much clearer, which in turn makes it possible for the designers to understand the context much better.

2. Context & Motivation
The digitization of the media scene entails far-reaching changes in domestic appliances and information technology. More and more devices such as the television are being equipped with computer

EuroITV'12, July 4–6, 2012, Berlin, Germany.

technology thus offer diverse additional functions because of their network capability. Full-video content is available on demand and in a nonlinear fashion in different contexts. In our research project SocialMedia we will take these developments into account by exploring new integrated techniques and concepts for cross-platform communication and exchange between users. Therefore, we focus on a dynamic home-IT infrastructure, in which the TV or the media center PC is an important component. We are particularly interested in concepts that support social exchange with regard to full-video content.

User participation in the design and evaluation process has an increasingly important impact on innovative application development [3]. The SocialMedia project has been following the participatory design principle right from the start. A Living-Lab consisting of 27 participants from 16 households has been established in the early stages of the project [10] and design and development has taken advantage of the long-term test studies from the Living-Lab. From the methodological point of view, long-term cooperation with testers requires a specific methodology toolkit that should include standard approaches (e.g. controlled lab studies or media diaries) and customized feedback tools as well. While we used both former methods in certain stages of the project (e.g. creative workshops with groups of participants, usability studies in controlled lab environments), we were also confronted with the need to involve participants in a more continuous way, in-situ at home. This was requested by both the developers and the users. Developers wanted to have feedback channels that were built into the prototypes they developed, in order to receive feedback directly from the actual context of use, so that they could understand the problems better and come up with solutions faster. Users wanted to have easier options to exchange their user experience with other users from the test group in order to help each other in the process of appropriation. Unlike any full automatic bug tracking system, our feedback infrastructure presented in this paper suits the best in a long-term qualitative research methodology. The motivation is to use feedback as a trigger for later discussion between developers and users. The developer will always contact the user and refer to the feedbacks together to help both parties understand the problem better, in this sense the users are able to "co-develop" with the developers.

Within the current development status of the project, we have built an alpha version of a social TV application running on the media center PC which is connected to the television screen, a mobile application running on Android powered gadgets, and a social platform on the web. The motivation of the feedback architecture described in this paper is to provide feedback channels for the interconnected application components during the design phase, so that the developers are able to gather first-hand user needs with preserved context in order to re-design the current (basic) version, as well as gather new ideas for further releases. On the other hand, such tools are important for the users as well to be able to support the appropriation of new applications by providing integrated help channels.

3. PREVIOUS WORK

From the literature there are different methodological approaches to empower the user to report usability and user experience aspects from the real usage context. When studying user interaction with a system imbedded into their real life usage context, in-situ studies are appreciated for its directness of feedback and preservation of the exact context [16]. As shown in the work of Obrist et al. [13], an in-situ field study is best suited for real usage context and actively engaging test sessions. However, it requires the developers to be synchronously and physically beside or next to the users, as direct communication between stakeholders is seen as key in this approach. The session is relatively action-intensive; this makes it difficult to apply this approach to a long-term evaluation.

While users and developers are involved in different Communities of Practice (CoP), there is a gap in the sense of time, space, and culture between both stakeholders [15]. In order to support the appropriation of new functionalities, tools for remote evaluation can also be used for remote participation between participants as well. Members of the community can be empowered to "help themselves" with issues and problems. Another quite important focus of using online technologies in participatory design projects is the definition of new product requirements through members of the community [9]. Online forums, wikis and options to provide feedback in-situ (here implemented as a voting function via TV) enable members of an online community to discuss and decide on their own, which functionalities are important.

Remote evaluation is a well-accepted method to overcome the limitation of distributed locations of users and developers. Different mechanisms can be used to support exchange between users and developers via audio and video. Such remote evaluation (e.g. semi-instrumented remote evaluation which features asynchronous information exchange) is quite interesting for us, although a brief training for the users is necessary to be able to identify and report the critical incidents [6].

Also relevant are previous workings on Technology Probes [12], Mobile Probes [11] and Infrastructure Probes (IPs) [p]. While mobile probes help to explore the mobile context in question for studying people's actions, technology probes are technical artifacts with the aim to evaluate a technology additionally. The aim of the IPs is close to our work and is theoretically informed by research on E-Infrastructures [14]. The IPs specifically aim at documenting 'infrastructure breakdowns' and 'use innovations'.

While services are becoming more and more interconnected with each other, with adequate interfaces on each device, this should be considered for concepts for distributed user participation. Optimally, meta-tools can be used in an open and more creative phase of design exploration and in a more structured feedback phase for evaluation as well. Compared to previous works [9, 11, 12] we have addressed a feedback concept that overcomes limitations of separated solutions. Ideas, improvements and breakdowns should easily be captured in context of use, accessible and annotatable from any other device with the easy options to share.

4. CROSS PLATFORM FEEDBACK INFRASTRUCTURE

One major problem when testing early stage prototypes in real world contexts is to identify and report critical incidents during usage. Current approaches only concern themselves with specific use contexts and devices. However, lots of applications are developed for multiple devices and in addition to the mobility of devices such as smartphones, tablets or laptops, users are able to switch their spatial usage context. In our concept, we will focus on a cross platform solution, which enables users to capture their current usage setting on any used device and in any usage context, regardless of e.g. whether they are at home watching TV, on the move at the train station or at work, while surfing the internet.

For an optimal specification of critical incidents, and to avoid forcing users to interrupt their workflow, feedback should be created directly from the main application without the need of leaving the usage context. The effort necessary to create a new report should be as low as possible. To simplify this process, we want to benefit from the devices' multimedia interfaces that allow the user to enrich feedbacks by various multimedia contents. Besides simple text messages it shall be possible to attach different types of images; like screenshots or pictures taken with the internal camera of a smartphone, or sketches. Furthermore, videos and audio recordings are helpful in enriching the feedback with meaningful information. This flexibility of being able to choose between multiple input options also has an advantage in regards to the limitations of input options on some devices. Text input, for instance, can be tedious on the smartphone thus voice recording might be a more comfortable option.

In addition, it would be helpful to be able to create and edit feedback on multiple devices. For instance, when using an application on the television, a screenshot of a critical incident can be captured, but making further text annotations or sketches is not possible on this device due to interface restrictions. Hence, the user should be able to switch to another, more suitable device and complete the report there. To make this possible, reports have to be stored temporarily on a central storage unit, where they can be accessed from any device. Besides, depending on the users' context, creating detailed feedback is not always desired or possible, e.g. due to lack of time. In that case, it is helpful to save a report and then complete it later. When a feedback report has been completed, it will be sent to the feedback pool. A forum manager filters the feedback in the first round, picking out those feedback that could advocate discussion within the test group and posts them in the forum of the community portal. Descriptions of problems, issues and improvements can be forwarded to the developers. The developer, or other representatives from the project team, can also contact the user and discuss the feedback with them together, referring to the feedback as a memory cue. In this sense we motivate the users to "co-develop" with us through the design process.

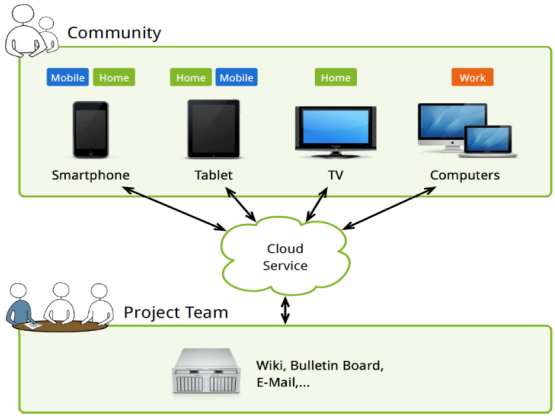

Figure 1. Cross Platform Feedback Infrastructure

Another relevant kind of feedback we are dealing with is the feature request. Due to the strong involvement of users in our design processes, suggestions for additional features will and should be made continuously. These requests can be created in a similar way as a bug report and then submitted to a community portal. This way, the members of the testing community have the opportunity to discuss the submitted feature requests, rate them and even enhance them to participate in the further development.

The overall concept of our cross platform feedback approach is shown in figure 1. Users from a testing community can create bug reports or feature requests on any device they use. To enable a cross platform editing or a subsequent editing, feedbacks are temporarily stored in a central cloud service, where they are accessible from any device at any time. When a report is finished, it will be sent either to a developer platform or a community platform for further discussion. A back channel allows for continuously status request both for the developers or the users.

5. Feedback App

The implementation of the feedback system is highly modular and extensible. The feedback component on each platform can be developed independently and then easily integrated into the whole infrastructure. Starting out, we discussed several options and decided that a feedback tool on a mobile platform should be the first step to the whole system. A feedback tool on a mobile platform can be used in a very flexible way to cover the other platforms when their native feedback counterparts are still in their early design phases. Using the built-in camera of the mobile phone, the user can easily take pictures of the interfaces of the project prototypes on other platforms, e.g. from the sofa and capturing the TV interface. In this way, cross-platform feedback composing can be achieved in a temporarily compromised way. The second reason is due to the different progress of the prototypes development in the SocialMedia project. The mobile application in the project has been the lead in the development compared with the TV client and web client, a feedback tool on the mobile platform to keep pace with the prototype development was then part of our consideration.

In the stage we are currently in, we have developed a feedback tool for the Android platform, which will be delivered together with the project mobile app for user evaluation. Figure 2 shows the user interface and an example feedback report. There are 3 ways to launch the feedback application. It can be started just like any other Android applications and this is meant for casual feedback composing, editing, or browsing. The user is also able to take a screenshot directly in the project mobile app by pressing a key combination of "Menu" and "Search". The feedback app will then automatically open and generates a new feedback report using the screenshot. This method is mostly used to capture use context directly from inside the mobile app. The 3rd method starts with a normal camera capture, the user can then send the photo to a list of applications that is shown to him when he opens the picture from the device's photo gallery. When the user selects the feedback app to receive the photo, the app will be launched and a new feedback report will be generated using the photo. This method is mainly designed for capturing photos of the other platforms.

The example feedback report in Figure 2 consists of a screenshot directly taken from within the project mobile app (in its remote control module) and a photo of the TV client. It was a complaint where, when the user pressed the info button on the mobile app, nothing happened on the TV client. The user was expecting the additional information panel to automatically pop up, so he manually opened the information panel and took a photo of it with the mobile phone to show the effect he would like to have. Each feedback is a combination of text comments, photos, or audio recordings. The 4 icons on the top right corner provide the user with the ability to attach this content to the feedback report. By choosing the send button, the current report is saved on the

server's side. The designer can access the feedback and react, e.g. with adaptations of the software or by discussing the feedback in the online forum.

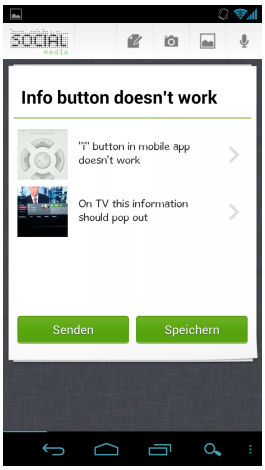

Figure 2. UI of the feedback tool on the mobile platform

6. TOWARDS META-DESIGN VARIATIONS

While infrastructure breakdowns and user innovations become especially visible during usage [14], our work is motivated by the need to involve users more in the design of their usage contexts and within development process. In order to support meta-design as proposed by Fischer [4], with tools that empowers users to continuously 'design' during use, we present the concept of a cross platform feedback infrastructure. It is designed to empower users to provide feedback directly from within the context of use, regardless of specific platform's limitations. The feedback can be sent to the developers for professional support, as well as to other users from the community, to take advantage of the collective wisdom.

For our further work we are planning to use the mobile feedback tool in combination with the project application bundle (the social TV application, the mobile application and the social network). We are aware of the current limitations, but we are able to support the feedback process at the current state. The concept of the cross platform feedback infrastructure can be used in various domains. Even though our current implementation is focused on functionalities that support the design process (e.g. reporting bugs or providing improvement suggestions), the concept can be further utilized for empirical studies, to explore the context in general (e.g. digitalized media diary). In our future work we are also thinking about adding more playful traits to the concept to better motivate users to participate, e.g. by earning badges or providing a 'tamagotchi' like interface.

7. ACKNOWLEDGMENTS

The project *SocialMedia* is funded by the Ministry for Innovation, Science, Research and Technology of the country of North Rhine-Westphalia, Germany with resources from the European Union and European funds for regional developments (Ziel 2) (280411902). Additionally we thank Martin Radvak and Benjamin Sprengart for their assistance in the coding.

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