Awareness-support in Scientific Events with SETapp

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Abstract. The recent rise of social media applications in all fields of our social life has also governed scholarly communications. With the so-called Research 2.0, scholars make use of social media to enhance their work and networking activities. On the other hand, those changes may have negative impact on awareness in Research Networks. Especially in the context of scientific events many information sources are used by the stakeholders to interact with each other. Smart devices, location-based services and recommender systems have been promoted to enhance awareness of people. Recently NFC found it's way into smart devices and is so far mainly used for mobile payment scenarios. In this paper we introduce SETapp, a prototypical application that makes use of NFC to support awareness in the context of scientific events. A first evaluation shows that users like the speed of NFC and prefer to carry out event-related tasks with support of NFC instead of doing them manually.

Keywords: awareness, nfc, android, research networks, scientific events, mobile computing, location-based services

1 Introduction and Motivation

The emergence of ubiquitous computing was enabled by the wide availability of smart mobile devices, high network coverage, affordable data plans and the increasing coverage with wifi. Location-aware applications support the user in gaining awareness about his surrounding; interesting people, recommended cafés, Wikipedia articles for near sights or constellations are only one touch away. So-called Native Mobile Social Networks (NMSN) like Foursquare and Gowalla have been created in which user can check-in to physical locations, share recommendations and pictures of the location. Each check-in is rewarded with points or badges and users heavily engage in contests who checked-in most often into a location. Such location-based services are dependent on the GPS positioning system in order to detect a user's exact position. The mobile applications of Twitter, Google and many other provide the users with location-aware news and search-results resulting in better awareness information for the user.

In the context of scientific events, researchers often feel overwhelmed with the amount of relevant information that is shared in various communication channels

[18]. Often, multiple items of the program run in parallel so it is difficult to stay aware about relevant times, rooms and people. Recently, scientific events faced the introduction of many social media applications, which for some people made it even harder to stay up-to-date. The microblogging tool Twitter[1] is often used for backchannel discussion, facilitating attendees to express their view on a talk or to stay informed about what's going on in parallel sessions. So-called *Twitter walls* are often used in public places at an event to increase the overall perception of the Twitter backchannel. Some users also use the above NMSNs to inform their networks about their current location at an event (e.g. *"I'm now in room A for a session on B"*). As those applications are dependent on GPS data, it is often difficult to use them inside a event venue. The Sociopattern project[2] has created RFID-enabled trackers of social interaction in conferences, exhibitions and fairs. While the tracking with RFID works well and may provide valuable insights in the social dynamics in large communities, the setup requires a huge effort, the equipment is rather expensive and all rooms have to be equipped with RFID readers [2,8].

In this paper we report about the rationale, design, implementation and evaluation of a mobile application to support awareness in scientific events. The Scientific Event Tracker Application (SETapp) makes use of the Near Field Communication (NFC) technology to exchange information between NFC-enabled mobile devices and so-called NFC-tags that can store data. So far, NFC is mainly used for mobile payment solutions. Our goal was to develop a prototypical NFC-enabled application for supporting awareness in scientific events with priority on support for direct physical interactions between attendees, rooms and posters and to compare the performance of NFC with that of QR codes. The paper is structured as follows: in Section 2 we discuss needed awareness support in Research Networks and scientific events. Following, in Section 3, we report about the design and implementation of the Android application and its GAE-based server-backend. In Section 4 we present the results of the SETapp evaluation and give an outlook on prospective applications of the NFC technology in other fields of TEL in Section 5.

2 Awareness Support in Scientific Events

According to Merriam-Webster, being aware of something means "*having knowledge of something [...and...] alertness in drawing inferences from what one experiences*" [10]. The term has been widely used in the context of communication and information system research as well in the domain of Computer Supported Collaborative Work (CSCW). Its definition however has not yet reached consensus within the scientific community. Instead, many composed terms have been used to describe specific forms of awareness such as *'group awareness'*, *'workspace awareness'* or *'social awareness'*. With the rise of mobile devices and ubiquitous computing, interest in location and context awareness has gained momentum. In

[1] http://twitter.com

[2] http://www.sociopatterns.org/

[16,17] we discussed the need for a better understanding of the term *'awareness'* in the context of Learning Networks that is less focussed on providing real-time awareness-support as it has been the case in CSCW research. If the participants in a Learning Network are scholars, we use the term Research Networks to refer to these specific networks. Attending and speaking at scientific events such as conferences and workshops is a core task of most scholars and thus essential part of their daily work. The connections made at such events strengthen one's professional network and are often important triggers for prospective joint research work and subsequent publications.

Scientific events are among the most frequently used means of presenting research results and ongoing research efforts to a larger community of fellow researchers. Following [6,7,13,15], such events can be divided into multiple phases (Figure 1) that make different demands on awareness support features. Moreover, different stakeholders that are involved in the event require different awareness support in the respective phases. In the preparation phase for example, the organization committee might be interested on how frequently the event's web presence is accessed and how the visitors reached the page. Potential attendees of the event on the other hand wish for information about the requested submission format, remaining time for submission as well as which people from their professional network also attend the event.

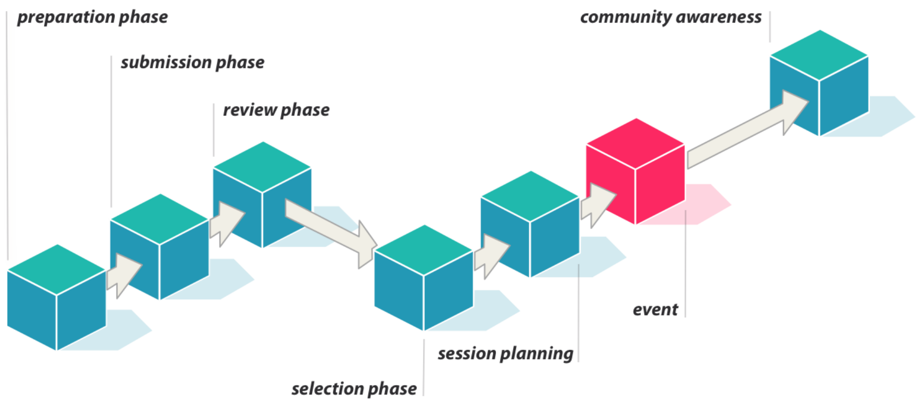


Fig. 1: Generalized phases of a scientific event [15]

Additional to the frequently used conference management systems that are supporting the organizers of an event, many Social Media tools have been used in the context of scientific events as well. Most prominently, Twitter has gained much utilization as backchannel for discussion and sharing of additional material [14] even for people that are not able to attend an event physically. Moreover, there are dedicated platforms like Crowdvine[3] or Lanyrd[4] that aim at building social networks around events. Large social networks for researchers like ResearchGate[5], Mendeley[6] or Academia.edu[7] are creating a focused interaction space for the users that assemble around shared objects of interest. Those social networks and social media tools are enhancing scholarly awareness on a general level but are still detached from the conference management systems that are often a core tool in the management and attendance process. With ginkgo[8] we proposed an integrated Research 2.0 application that brings together the strengths of the separate tools [15]. Ginkgo serves as connector of several otherwise separate information databases with the goal to provide awareness information for all stakeholders in all phases of the event.

While a web-based application is an appropriate mean of communication before, during and after an event, a mobile application can be helpful to remove frictions from the awareness support during an event. The focus on location-based information together with the limited user interface and the often reduced set of features is supportive for staying focused and carrying out one's work effectively. Moreover, a mobile device is much more handily because of its dimensions. Enhanced awareness in the context of scientific events could be achieved using mobile applications that

1. support *attendees* with adaptive news streams depending on the current location and talk,
2. support *attendees* to easily exchange messages with other attendees,
3. support *attendees* to easily understand shared interests (common research fields, similar bibliography or shared event participations) with fellow researchers,
4. support *attendees* to generate their individual event schedule by selecting interesting talks from the overall program,
5. inform *attendees* about recent changes to the event schedule,
6. provide an easy overview for *session chairs*, who of the speakers are already in the room,
7. provide *event organizers* with quantitative and qualitative summaries of social media coverage of the event,
8. provide *event organizers* with an comprehensive list of attendees that have already registered on-site for the event,

It is important to state that applications like ginkgo or SETapp are not intended to replace existing socio-technical solutions but rather to enrich them. For example, for the time being, it is very unlikely for many researchers to switch from Twitter to SETapp for sharing backchannel gossip or from Facebook to

[3] `http://crowdvine.com`
[4] `http://lanyrd.com`
[5] `http://researchgate.net`
[6] `http://mendeley.com`
[7] `http://academia.edu`
[8] `http://ginkgosem.com`

ginkgo to manage their social circles. Instead we see the need for mediating applications that connect various information silos in order to provide the user with more awareness support. In the next section we introduce the general idea, concept and implementation of the Scientific Event Tracker Application (SETapp).

3 Concept and Implementation of SETapp

Near Filed Communication (NFC) is a subset of the well-known Radio Frequency Identification (RFID) technology. NFC is a relatively new technique which was first defined in 2002 by NXP Semiconductors and Sony. NFC is most often promoted as a technology to support cashless payment but NFC can also be used in other contexts. Some companies use NFC tags in their business cards and even modern passports use this technique for the identification of persons. The transmission range for NFC has been specified with maximum 10 centimeters. This limitation results from the requirement that a person should clearly recognizable declare her intention and will to carry out a certain act. So if a person would like to pay via NFC, the NFC-equipped mobile phone must be placed on an appropriate reader as it is the case with a credit card as well.

The first practical use of NFC in Germany was made by Deutsche Bahn with Touch & Travel that is already available at many stations. The system supports the user with easier booking of tickets. The system will soon be available for public transport as well [3]. With Google Wallet, another big NFC-based project was recently presented by Google [5]. Google Wallet offers cashless payments via NFC with certain partners, such as Radio Shack, Subway and Foot Locker. Currently the project will be tested in two major American cities (San Francisco and New York) and even supports NFC-payment with non-NFC phones. So far only a very limited number of devices is equipped with NFC. However, Peter Chou – CEO of HTC – predicts that by 2015 we will see more than 500 million NFC-enabled devices in the market [9]. Thus, a big increase in NFC usage can be expected soon.

SETapp's (Scientific Event Tracker application) primary focus is on awareness-support for attendees during a scientific event. SETapp can be also used prior to an event as well as afterwards but the main field of application is at the event location. Thus, we intended the following main features for the first SETapp prototype:

1. Exchange of professional profiles between SETapp users.
2. Exchange of scientific documents between SETapp users.
3. Exchange of private messages between SETapp users.
4. Check-ins into scientific events and talks.
5. Access additional information for posters.

3.1 NFC tags and tag types used

In order to support the different interactions described above, different type of NFC tags are needed to represent events, talks and posters. The exchange of professional profiles is realized using the built-in NFC functionality of the respective device. The phone has to be NFC-enabled and must run at least Android 2.3.3 (Gingerbread) that supports both reading and writing NFC tags as well as the whole NFC Data Exchange Format (NDEF). To ensure maximum compatibility between Android and the NFC tags, Mifare Classic 1k tags were chosen, which hold a total of 1024 bytes and thus provide enough capacity for extensive records. Other standard sizes available with NFC tags are 64, 96, 152 and 192 bytes. The tags used are in accordance with the specifications of type 1/A of NFC tags [11].

In order to represent the different objects that exist in the context of scientific events, we created different types of NFC tags: such representing 1) events, 2) talks, 3) poster and 4) documents. The NFC-enabled phone itself serves as the container of the fifth tag type: persons. While text records, URI records or smart records only store short strings and their content can be evaluated by all available applications with NFC Permissions, the tags used in our context should only be recognized and processed by SETapp. To ensure this, a separate MIME type was introduced to clearly identify tags to be used with SETapp: `application/x-setapp-share`. If this MIME type is detected in a calling intent of Android, only the SETapp is called. Regular intents would show each application that has the rights to read NDEF definitions within an Android-typical intent-chooser. The distinction between the five possible NFC tag types is realized via the description of the entity in the packet structure. For instance, persons will be identified by `de.upb.messerschmidt.set.entity.Profile`. This information, as well as additional information is then written to the NFC tag. The information on the NFC tag serve as shortcut to a more extensive record that is stored in the server backend (see Section 3.3). Information on poster tags, as opposed to the other tags, are not stored in the server but on the NFC tag itself.

3.2 Android-based mobile application

The Android-based SETapp serves as the front-end for the user to interact with NFC tags and other users of the application. It uses the OAuth authentication method to let users create an account with the software using an already existing account with another software. We chose to allow users to authenticate using their existing Mendeley account (see Figure 2a); this way SETapp does not need to store credentials of the users itself, but rather only an OAuth token that is provided by Mendeley. Moreover, SETapp obtains access to the user profile data stored in Mendeley as well as the list of publications that a user has published there. The main screen of SETapp (see Figure 2b) allows instant access to the main features of the application. The design is based on wide-spread mobile applications as Facebook[9] or Hashable[10]. If the user taps the *'check in via NFC'* button, the device is going into NFC read mode and is able to read information spread by an NFC tag or another NFC-enabled phone. When the

[9] `http://facebook.com`
[10] `http://hashable.com`

user touches a tag with the appropriate MIME type as described above, SETapp opens automatically an activity for the scanned entity and displays the existing information for that record (these are to be loaded from the GAE (Section 3.3) or in the case of a poster directly read from the tag). Thus, the user saves much time navigating manually through the application to the desired record.

Tapping the button *'share your profile'* lets SETapp send the user's profile via NFC. *'Lookup an event'* allows the user to manually screen through the events that would use SETapp for supporting social interactions. For each of those events, the user can express his interest in the event by choosing a status from *'attending'*, *'maybe attending'* and *'not attending'* (Figure 2c). Finally, *'show the events you're attending'* allows the user go through the events that he attended or will attend in the future.

The user profile in SETapp (see Figure 2d) allow access to the list of publications (those that the user published on Mendeley) as well as the straightforward sharing of those using the Android-standard sharing interface. This way, a publication can be shared via email, to Facebook, Dropbox or to another SETapp user. Furthermore, on a user profile you can explore the other connections a user has, the events he is attending as well your own meeting history. The meeting history shows the events two users have in common; either because both of them attended them, planed to attend them or connected their phones at the event. This way, SETapp supports the awareness about a common scientific history.

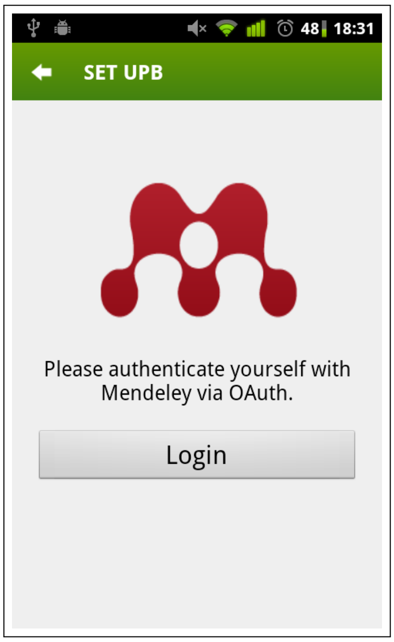
SETapp also features a simple NFC writer application that allows the manual creation of new tags that could be used in our experiments. In a realistic scenario, the NFC tags would be written using a professional writer facility.

3.3 Google App Engine backend

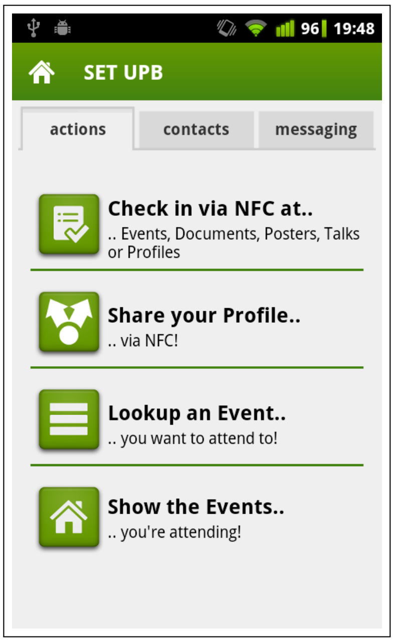
In addition to the Android application, a server backend was needed which enables the necessary data exchange and coordinates communication between participants. Google App Engine (GAE)[11] is a fully scalable and easily implemented platform which was used for the implementation of the Java backend. The technologies used in the implementation can also easily be implemented on alternative server platforms such as Apache HTTP and Apache Tomcat thanks to Java and established standards such as JDO. GAE also supports the automatic deployment of an application via Eclipse as well as a local testing facility, which is operated with a Jetty server. The data storage is managed automatically and requires no local MySQL database.

For communication between the Android application and the GAE backend, efficient data structures had to be chosen in order to make the data exchange error-resistant and to simplify the data processing on the client. To this end, JSON has been selected as the exchange format. JSON is natively supported by Android and can easily be integrated in the Google App Engine using external libraries. Figure 3 shows an example of how data is requested by the user in SETapp and delivered from the GAE. The implementation of the GAE scales

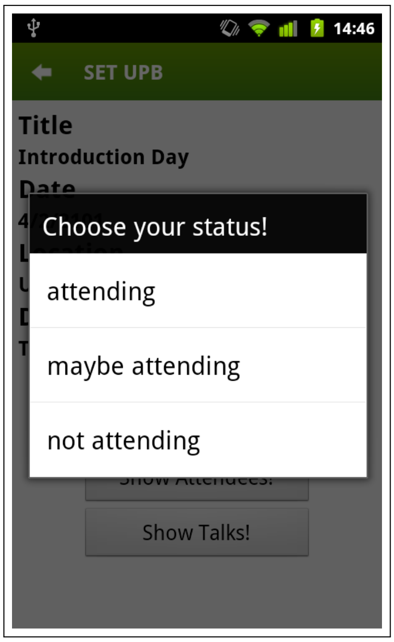
[11] `http://code.google.com/appengine`



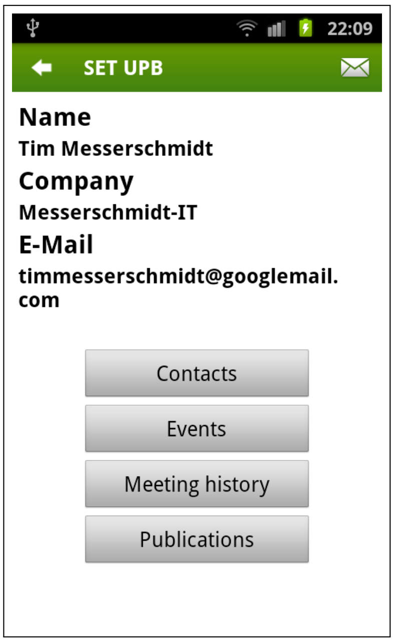
(a) Sign up and Login



(b) Instant access to main features



(c) Choosing an interest in attending



(d) A user profile

Fig. 2: SETapp on Android

with instances that are created for each query and thus should provide an ideal amount of computing power and memory. Especially for long running calculations or many simultaneous accesses to the GAE, this has the advantage the resulting load can be distributed across multiple instances. As soon as the number of queries is declining, the number of running instances is also decreasing until no instance is running anymore. This, in turn, leads to the situation that the next incoming request restarts the whole system. Irregular requests on the GAE therefore lead to the fact that inappropriately long response times occur that can lead to time-outs in the client application. Our evaluation of the GAE's instance model revealed that a request is answered nearly 39 times faster if at least one instance of the GAE is running (69ms) compared to the same request and a required instance start (2666 ms, mean values from 10 independent tests).

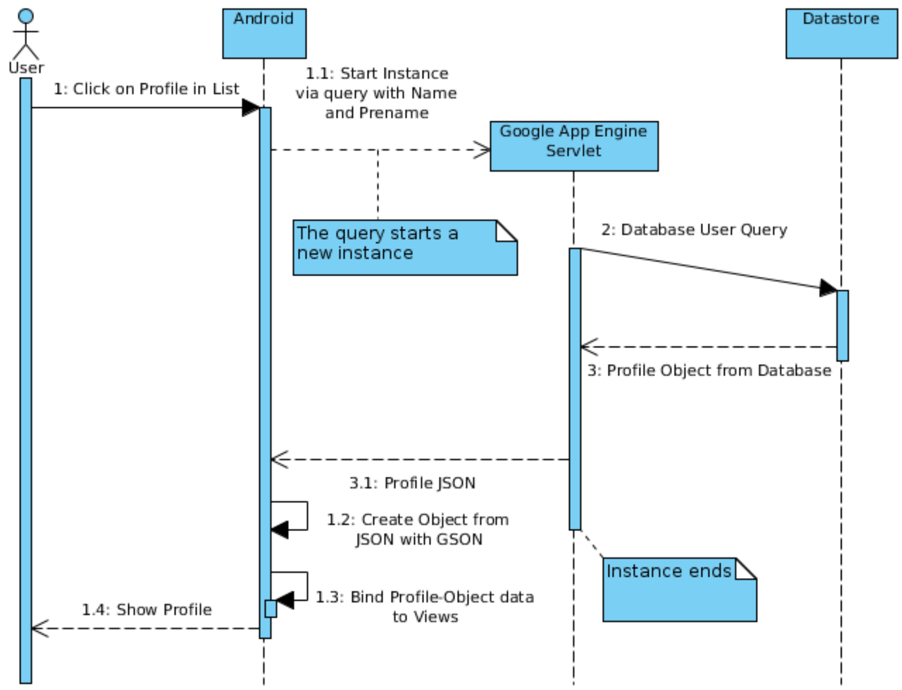


Fig. 3: Interplay of Android, GAE and DataStore: Requesting a user profile

This problem could be overcome with the GAE backend system introduced in version 1.5.0 [4] as this uses no deadline for requests to turn itself off. This kind of instance could be operated during the entire duration of an event to continuously work on important requests.

4 Evaluation of SETapp

SETapp was evaluated twofold: first we compared the scan times of an NFC tag and a QR code holding the same amount of information. Secondly, we evaluated SETapp in an exemplary setting with 11 users that had to carry out real tasks using the application.

In principle it would also have been possible to use QR codes for the purposes of the application described here. To measure the performance of QR codes and NFC tags in a realistic setting, we simulated a poster session in which additional information for the poster was stored on a QR code and also stored on an NFC tag. Both media held the same data and thus the time efficiency could be measured and compared. Table 1 shows the results of six independent measurement runs using the Android application *Barcode Scanner*[12] and SETapp. The actual time was measured from the time of starting the application to the successful display of the information stored on the respective medium.

Table 1: Comparison of scan times QR codes and NFC

Run	QR code	NFC
1	4,730ms	910ms
2	5,300ms	1,920ms
3	5,400ms	2,320ms
4	7,800ms	1,620ms
5	4,710ms	2,260ms
6	5,540ms	2,160ms
Mean	5,580ms	1,865ms

For QR codes, the average scan time is 5,580ms. We have to note that the scans were conducted under optimal light conditions and ideal distance from the printed QR code. External factors such as poor light or slow camera autofocus often found in cheaper phones would significantly deteriorate the measured times. The average time measured for scanning an NFC tag with SETapp was only 1,865ms. This time includes starting the application by intent and showing the tags content on the display. Even under ideal conditions for the use of barcode scanners, NFC is more efficient by almost factor 3 (cf. Table 1). NFC is more efficient not only in terms of time, but also in terms of integration in Android applications. With NFC, functions can directly called from within a custom application and read values can directly processes. To be able to integrate barcode scanners in a custom application, it is necessary to use large external libraries, which implement the detection algorithms for QR codes. In addition, weather

[12] `http://code.google.com/p/zxing/`

resistance and ease of use are other advantages of NFC compared with barcode scanners.

The second evaluation of SETapp involved real users in a constructed application scenario. 11 users in two groups worked with a pre-final version of SETapp installed on Samsung Nexus S smartphones. The users were given a short introduction to the purpose of SETapp, its functionalities and the setup of the user test. The tasks that had to be carried out by the users included:

1. the check-in into an event using NFC and manual check-in,
2. the check-in into a talk at the event using NFC and manual check-in,
3. the exchange of professional profiles using the NFC facilities provided by SETapp,
4. the lookup of publications and event participations of other people,
5. adding other users to their list of followings,
6. the exchange of personal messages with one's followings,
7. the lookup of additional information in a poster session using NFC.

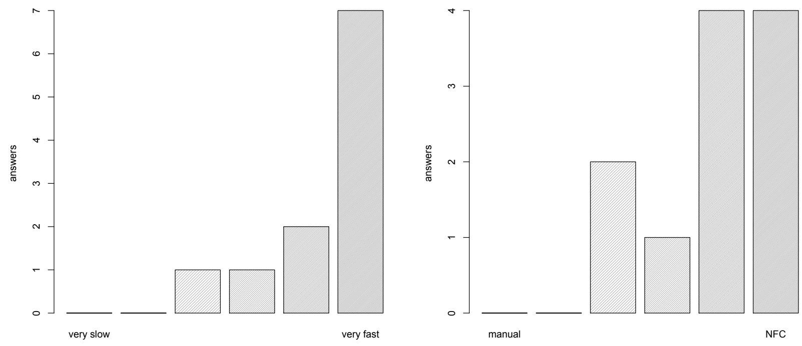
After the user tests all participating users were asked to fill in an online questionnaire dealing with the test. The evaluation questionnaire was partially building on the reworked Nielsen usability heuristics [12] and also covered questions regarding the efficiency of SETapp as well as questions focusing on visual and implementation decisions made. All closed questions were six-stepped Likert scales. In all, 11 people with an average age of 27 took part in the evaluation. We made sure that the participants had no prior knowledge of the application, so we would be able to observe learning effects of the participants. To be able to test the single features of the application, all testers worked with a fresh system, containing no prior interaction data.

Dependency on Internet connection The current implementation of SETapp is designed to rely on a reliable connection between client and server. Only the access to the data stored on poster tags is currently feasible without having Internet connection. This, in turn, would require the event organizers to provide stable wifi connections throughout the event, if the attendees shall be relieved from paying roaming costs or suchlike. Especially for very large events this could be an issue.

Usability and user interface design While text color, text size and background color of SETapp were perceived pleasantly, the arrangement and design of icons were partly rated adversely. Some of those rating can be explained with the rather large percentage of iOS-only users (45%, 5 persons[13]). 64% of all users (7 persons) had experience with Android before the test, 27% (3 persons) had also experience with Windows Mobile or Symbian.

The overall interface design was perceived as being deeply minimalistic (73%, 8 persons), which is amongst others attributable to the sharp distinction between different functionalities and the utilization of the ActionBar design pattern. Some

[13] The participants could select all mobile OS they had hands-on user experience with.



(a) Users' perception of NFC speed (b) Users' preference of NFC functionality over manual processing

Fig. 4: Users' perception of NFC features (N=11)

of the uses design patterns however seem to be confusing for persons very familiar with iOS, as they are not in line with Apple's User Interface Guidelines for mobile devices [1]. The implementation of the ActionBar was consistently rated positive with some participants suggesting a better differentiation between background and buttons would be helpful. The introduction of separation lines between the single buttons in the ActionBar would certainly achieve a higher usability of SETapp.

Despite a high satisfaction with SETapp's usability, the evaluation also showed that some of its functionalities need to be made more prominently. For example, the testers suggested that adding a person to one's contacts after having exchanged profiles with each other should be made easier and more eye-catching.

NFC technology The results of the evaluation have shown that using NFC for check-ins can effect significant efficiency enhancements over manual check-ins. 64% of the testers (7 persons) perceived this equally and rated the NFC features as being *very fast*; 82% (9 persons) rated it *fast* or *very fast* (see Figure 4a). Even after only short usage of SETapp and the NFC technology, a steep learning curve could be identified. While the first check-in using SETapp (into the event) took 1m12s for 3 persons (24s / person), the second check-in (into a talk) only took 41s (14s / person).

As Figure 4b shows, 82% of the participants (9 persons) prefer using NFC-enabled functions over performing the same task manually (e.g. the registration for an event at a desk reception). The other 18% said that they did not like the way the exchange of user profiles was implemented in SETapp. Their critique is mainly caused by the missing duplex feature of the NFC component found in the tester Samsung Nexus S. Currently people will need to start one activity where they receive data from other phones and another one, where they send their own profile. Allowing full duplex in future versions of NFC would overcome this point of critique.

The users found the possibility to read data from NFC tags without having to open SETapp especially appealing. This allows a very easy handling of NFC tags in the context of scientific events and significantly reduces the time needed to check-in. Moreover, the users found the large capacity of poster tags very interesting as reading information from those tags worked even faster and without access to the GAE (and potential issues with wifi etc.). Additional to the currently available functions of the poster activity (showing title, abstract, authors and URL with additional information), users wished to be able to reach the user profiles of the authors to get to know more about them or contact them via direct message. Moreover, the users wanted to have a history feature for scanned (poster) tags implemented, which would support them in post-event reflections and prevent repeated scanning of tags.

5 General Discussion and Outlook

In this paper we discussed the impact of social media applications on the awareness in scientific events. Building on our research on future scientific event management systems [15], we presented a generalized set of phases of a scientific event that can be supported with web-based and mobile applications. We discussed how a mobile application could be enhancing the awareness of attendees at such events and discussed exemplary awareness-support areas in Section 2. Moreover, we introduced the concept and the prototypical implementation of the Android-based SETapp together with its GAE-enabled server backend and introduced the way to interact with NFC tags. Our evaluation shows that scanning NFC tags is at least 3 times faster that scanning QR codes with the same amount of information. Moreover, the integration of NFC facilities in custom applications is a far easier task than integrating good barcode scanners in an application. Scanning and recognizing QR codes is heavily influenced by external factors such as weather, light and the speed of the autofocus of the built-in camera, whereas NFC is independent from all these factors. The evaluation of SETapp with users also showed that they prefer the usage of NFC over the manual pendant and that they perceive NFC as working at great pace.

Also, we showed how a new technology that is so far mainly used to support mobile payment solutions could be adapted to the domain of scientific event management. While our specific focus was on supporting researchers, SETapp could also be used in regular events and fairs easily. We also see potential use of the NFC technology in the domain of Technology Enhanced Learning and describe possible use cases hereinafter.

5.1 Application of NFC to support other TEL fields

For one thing, the NFC technology could be also applied in the context of client-support in career guidance as relevant within the MATURE project[14]. Personal advisors (PAs) have to visit students at schools and support them in terms of future planning, overview of labour market information and job opportunities. Supporting knowledge maturing in this context can be two-fold if the NFC technology is available on both sides: On the one hand PAs can be provided with context-specific information about the students. Information about strengths and weaknesses, personal data and information about grades and graduation could be available from a central information system that would be accessed via NFC tags. On the other hand, students do not necessarily need an appointment to the PA for getting information about the labour market, individually matching her/his personal information if NFC tags are provided publicly. The student could simply place her NFC-enabled mobile phone at a NFC tag placed in a public place. The mobile application would then access available labour market information, match it against the profile of the student and present her with a list of recommended job opportunities. That way, the overall process of career guidance could be much more focused on the needs of the clients and could be improved in terms of efficiency, added value and sustainability.

For another thing, the NFC could be used for recommending courses or (open) educational resources to learners. Given that some mobile application had access to the institutional repository of courses and education resources it could recommend them after learner scanned a book for example. A recommender system would take into account the learner's profile, the objects scanned and the institutional offerings to present the learner with possible learning options.

5.2 Outlook

Retrospectively, the decision to use Google's App Engine as server backend was not optimal. Caused by the issues of the current instance model, the mobile application often faced timeouts that hindered the usage of SETapp. The new instance model introduced in version 1.5.0 of GAE could relieve this issue, but other problems with the platform would remain. Also, choosing Mendeley as OAuth provider caused serious problem in the development process. Until June 2011, the provided API did not even provided access to data stored in the user profile, access to user-stored publications was not given and so on. With the call for Mendeley's binary battle[15] the API was undergoing constant changes and improvements, leading to an API that provides access to most data stored in Mendeley today. Due to the novelty of the API it still comprises some errors and instabilities. To overcome those limitations and problems, we plan to integrate additional OAuth provider like Twitter and Facebook, which also would allow to get in contact with people that are friends/followers in those platforms.

[14] `http://mature-ip.eu/`
[15] `http://dev.mendeley.com/api-binary-battle`

Moreover, it would be interesting to analyze the meeting histories of the SETapp users, resulting in a network of physical meetings combined with the information about the context (event, location, date or even talks). Finally, we plan to integrate the preliminary insights in how users perceive and use a mobile application for awareness-support in scientific events into a mobile application for our scientific event management system ginkgo[16] [15] in the future.

Despite the very satisfactory evaluation results of SETapp, the evaluation also made clear that we need evaluation frameworks for mobile applications that are able to differentiate between the users' prior knowledge of mobile OS. If an application to be evaluated uses design patterns that are common standard in Android OS, it will receive high agreement from people that are familiar with this OS. Users that are unfamiliar with Android and its design principles (e.g. users of iOS or Blackberry OS) however will find it difficult to identify those patterns and thus will be more confused with the application. We see the need for comparative studies that research how well users familiar with different mobile OS are able to work with applications from different mobile OS. The research should also take into consideration how the results differ, if the application design sticks closely to the design guides for the respective OS. Moreover, this research should investigate how well Nielsens usability heuristics are also valid for the evaluation of mobile applications' usability.

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