Solutions and Challenges for the Development of a Mobile Social Network

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Abstract

In this paper we present SocialCompanion, an approach for connecting virtual and physical social networks. We point out solutions and challenges for the development of a mobile social network, which is intended to provide innovative user-centric and user-assisting services. SocialCompanion is also a learning system, which adapts to the user's needs and interests using contextual information about the user and his environment. Currently, we are implementing a prototype for real-life experiments.

1. Introduction

In January 2011, Facebook, one of the major web-based social networks (SNs), reached 'more than 500 million active users [1]'. More than 200 million users already access Facebook through mobile devices or smartphones (like e.g. the Apple iPhone) while being 'twice as active [...] than non-mobile users [1]'. Figure 1 shows the trend of the Facebook user growth over the last months. In combination with the increasing popularity of smartphones and the expectation that 'by the end of 2011, worldwide smartphone sales will pass world-wide PC sales [2]', mobile access to SNs will be gaining even more importance.

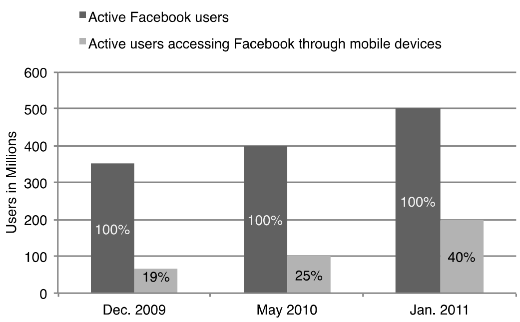

Figure 1. Facebook user statistics [1]

In our opinion, people's growing use of SNs and the increasing number of mobile devices pave the way for mobility in SNs which should not only be limited to bare mobile access to the platform. With millions of people already registered to web-based SNs, data privacy and access control are security aspects, which could benefit from decentralized data storage and ad-hoc peer-to-peer communication. By storing data directly on the users mobile device, concerns towards data collecting monopolies could be dealt with.

Since users tend to carry their mobile device around all the time, this can be utilized to extend the virtual SNs by the user's physical SN including family, friends and colleagues. Contemporary smartphones are equipped with a variety of sensor technologies like for e.g. GPS, microphones, cameras, motion or light sensors which can further be used to gather information about the user's physical context. These sensors can be used to provide innovative and intelligent services, which automatically identify and react on environmental conditions.

2. SocialCompanion

In our approach, we design SocialCompanion, a mobile social network (MSN) that extends a user's virtual social networks with real-life ad-hoc mobile social networking. Mobile devices will not only communicate with SN servers via the Internet, but also directly via peer-to-peer connections with other mobile as well as stationary devices like sensor nodes. SocialCompanion learns about the user and adapts to his interests and needs by taking into account the user's decisions and activities and his physical context.

In the following, we present the resulting challenges, which we have to deal with during the development process and the solutions, which we are implementing at the moment.

2.1. Data Consistency

Today, users often maintain several profiles, hosted on different SN sites for different use cases like e.g. work (LinkedIn) and friends (Facebook). It is an annoying task for the user to take care of the data consistency of all profiles by himself. We decided to develop a system, which can aggregate the data of existing SN profiles and generate a RDF-profile based on ontologies like FOAF [3]. The new profile can then be extended by information that emerges by using the MSN on the go, thus connecting existing virtual networks with the user's physical social network. We aggregate profile data from SNs, which are accessible through the two most widely used SN APIs: the Facebook and OpenSocial API.

2.2. Context Awareness

In our opinion there is a strong need to identify the user's context to be able to develop innovative user-centric and user-assisting services. Hence, we plan to develop a MSN, which will be a personalizing companion to the user. The companion will be able to identify the user's (physical) context as well as make recommendations based on the user's decisions and his profile information. It will not only suggest friendships based on the similarities of users' interests but also those that he often stumbles upon in real-life (e.g. in a club or fitness center).

2.3. Data Privacy

Data access along with trust depends upon a user's role (family, friend, colleague) as well as time, space and topic of a resource. If a user meets a new contact, a trust level (role) to this new acquaintance is assigned within our MSN. There are pre-defined trust levels like 'public', 'family', 'friend', and 'colleague' available to ease the creation of new friendships for the user.

After assigning one of the provided roles to a new contact the user will then be able to create an inherited sub-role. Here, the user is allowed to override the privacy state of each profile field or resource (like e.g. a certain photo-album).

SocialCompanion will automatically recommend roles assigned to new contacts and access restrictions to new resources based on contextual information. The user may agree with the suggestion or set the trust level manually, keeping control of his data while still being assisted and supported by the MSN. E.g. a new contact would be recommended the role 'colleague' if the majority of the mutual contacts shares that role.

2.4. Offline Availability

We will provide our MSN with several technical communication techniques as it is demonstrated in Figure 2. In our opinion, even though most smartphones will be permanently connected to the Internet over Wi-Fi or 2G/3G networks, in the near future, the network coverage of providers may still not be guaranteed in isolated places. To provide offline-functionality, we will provide the possibility to establish direct Wi-Fi and Bluetooth connections between mobile devices when people meet each other physically. As soon as a connection to the Internet is available again, the profile data on the mobile device and remote server will be synchronized automatically.

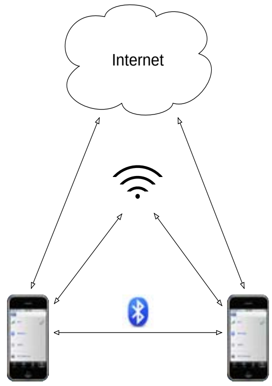

Figure 2. Available network communication techniques in SocialCompanion

3. Prototype

Our first SocialCompanion prototype is currently in the stage of implementation. For a start, it is going to be developed for the iPhone. It is planned to port SocialCompanion to the Android platform later on to create a heterogeneous network of mobile devices and that way address a larger community.

3.1. Appointment Planning Service

With the aim of expanding the user-assisting functionalities of SocialCompanion, an appointment planning service has been developed and added to the application [4]. It is able to automatically identify an appropriate time slot for a group of at least two persons that wants to schedule a new meeting.

For that purpose every user can set up his own preferences to be considered during the automated search process by the appointment planning service inside his own SocialCompanion application. Afterwards, one person of the user group initiates the computation. This initiator specifies the parameters like the desired duration of the appointment and the overall time period, which should be considered for the following search process.

If the appointment planner has been started, it first looks up each of the users' existing schedules stored in the local calendars provided by their smartphones and computes the available dates in a decentralized mode. This part of the computation is executed locally on each of the users' smartphones to save computing time on the one hand and to respect the data privacy of each participant on the other hand.

In a next step the available time slots of each participant are sent to the device of the initiator. A centralized algorithm then searches for shared slots that are suitable for every user. Depending on the choice of the initiator, the algorithm's results will be presented either only to the initiator, who then will decide about the final date by himself, or to the whole group for a voting comparable to Doodle [5]. The new appointment will finally be written to the smartphone calendar of each participant.

In the first version of the appointment planning service the participants' smartphone companions must be present in direct Bluetooth communication range. Both, SocialCompanion and the appointment planning service are based on peer-to-peer communication between the smartphone devices. Providing the option of using Internet instead of Bluetooth peer-to-peer communication between the users' devices is also planned for a next version of the appointment planning service.

3.2. Environmental Context

In addition to the above-mentioned approaches of gaining information about the user's context, we also work on SocialCompanion to access environmental data measured by sensor nodes. By taking advantage of the sensor data we want to provide the users with more services that are based on their individual environmental context. To reach our goal we first have to enable the users' smartphones and the sensor nodes to communicate with each other. Continuative, we work on the analysis and interpretation of raw sensor data, which we finally want to use for SocialCompanion's context-aware services.

3.3. Opportunistic Message and Data Delivery Protocol

To leverage the offline-availability of SocialCompanion, we work on the extension of our prototype with an opportunistic message and data delivery protocol, which e.g. uses trust information of a user's friendship list. The protocol will allow users to communicate with people who are not in direct communication range and without the need for an Internet connection by preferably using peer-to-peer Bluetooth communication links for the message and data delivery, which can be trusted most. This protocol will be designed and analyzed regarding the effect of security issues such as data privacy.

4. Related Work

MobiClique [6] is a middleware for mobile social networks, which can import profiles from Facebook. Its focus is set to provide direct peer-to-peer and opportunistic communication between mobile devices using Bluetooth. In SocialNets [7], an EU-funded project, researchers from various disciplines work on solutions for adaptive mobile social networks and their benefit from insights into human behavior. The Personal Smart Space (PSS) [8] is a theoretical paradigm that describes a logical space belonging to an owner. It is a learning and self-improving companion that adapts to a user or thing and interacts with other PSSs. Recent developments in the field of distributed social networks include the decentralized Diaspora [9] network in which users may either join one of several public diaspora servers or host their own server and become part of the network.

5. Conclusion

In this paper we presented SocialCompanion, an approach that connects the virtual and physical social networks. SocialCompanion uses contextual information about the user and his environment to provide innovative user-centric and user-assisting services. We described the appointment planning service, which assists a group of people with the intention of finding appropriate time slots for scheduling new meetings. SocialCompanion is a learning system, which adapts to the users needs and interests. Currently, we are implementing a prototype of SocialCompanion for real-life experiments.

6. References

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