Delay-Tolerant Social Networking

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To address privacy concerns in current online social networks, we previously proposed to use a peer-to-peer infrastructure and encryption, thereby recreating the features of online social networks in a distributed, provider-less, community-driven, and privacy-preserving way. Once the functionality is distributed, social networks are no longer dependent on Internet connectivity for every transaction – in contrast to current web-based services. We therefore have the opportunity to take into account locality, both in terms of connectivity by direct exchange between devices, and in terms of content, such as local community interests and events. This way, social networking applications can benefit from local storage, connectivity, and delay-tolerant data transfer via social encounters. The local communities, in turn, can benefit from the social networking applications enabled by such a system, e.g., by finding neighbors with similar interests.

Current online social networking services require the user to be connected to the Internet for every interaction, not only for real-time information but also for older information such as data posted by the user or her friends in the past. Since online social networks are part of the so-called Web 2.0, they run on dedicated web servers.

All information in the online social network is thus stored on logically central servers, even though they may be replicated or cached in different geographic regions using content distribution services. Due to such centralization, there is no distinction between information of global or exclusively local relevance.

Keeping user data centralized or even just distributed but connected allows the service providers of online social networks, third-party application providers and, in cases where there is no deliberate protection, indeed anyone to crawl the network and find out about content or at least about connectivity and access patterns. The information gathered can then be used for data mining, direct advertising, censorship, or other purposes. Moreover, a centralized depository or fully connected network is more susceptible to virus or malware spreading than mostly local social networks that can be partitioned.

We propose to implement online social network functionality in a distributed, delay-tolerant way. Intermittent Internet connectivity can be used to connect with the wider user community, while users can exchange data among each other in direct physical proximity during offline times. The need for constant Internet connectivity, which can be costly, is thus eliminated. When information is of local relevance only, it need not be transferred to a central server that is potentially far away. These needless long-distance transfers can be replaced by local storage.

In addition, it becomes easier to take locality into account logically when keeping local information also local physically.

While portable user devices, such as phones, laptops, an personal digital assistants (PDAs) can be used to exchange data directly, also fixed devices can contribute resources. Schioeberg [5] proposed to use storage on home routers, such as ADSL modems with WLAN capabilities to support peer-to-peer social networks. Many home routers now have unused storage or can at least be extended by USB sticks or external hard drives. Fixed devices that typically are switched on irrespective of user activity not only contribute resources but also increase availability and robustness of a system for delay-tolerant social networks.

Such delay-tolerant, local social networks allow us to build on other proposals and new opportunities. For example, Antoniadis et al. [1] proposed to use local wireless networks to enhance communities such as neighborhoods in towns. Collectively, users would build wireless neighborhood networks by pooling their resources to support the creation and operation of the underlying communication network. They envision user participation and cooperation at several layers, physic, access, network, and application layers. They argue that *the design of communities suitable for this environment will encourage users*

to participate, enable trustworthy network creation, and provide a social layer, which can be exploited in order to design cross-layer incentive mechanisms that will further encourage users to share their resources and cooperate at lower layers. The goal is to bridge the gap between online and offline communities.

The way we envision delay-tolerant social networks can be a vehicle to such fostering of communities. Beyond the features of current social networks that allow users to keep in touch and up-to-date with the friends they already have and, increasingly, the new ones they found thanks to the service itself, delay-tolerant social networks would allow users to benefit from locality. They could find others who live nearby and have similar interests, find or start events in the neighborhood, organize or collaborate for creative of political collective action, found local marketplaces of ideas, goods, or services, edit local information repositories or wikis, to name just a few possibilities.

Another example for potential synergies with existing proposals is broadcasting. Karlsson et al. [4] proposed mechanisms for delay-tolerant broadcast of public channels, for both transmission and reception, as an alternative to the regulated wireless broadcast channel. Their system relies on wireless nodes forwarding data chunks and benefits from user mobility. In addition to such public broadcast channels, nodes could transfer user-created content or social network data from PeerSoN.

Local social networks could also be established to never connect to a wider collection of networks but form islands of social networks, effectively making censorship or data mining prohibitively difficult.

The possibilities of use of delay-tolerant social networks are of course not limited to the examples given above, once the technology is available, users may come up with novel and original applications, as has been the case with online social networks or indeed the advent of the Internet and the World-Wide Web itself. Delay-tolerant social networks can thus be seen as enablers for applications or uses not yet foreseen.

In prior work, we made the case for a peer-to-peer infrastructure for online social networks (combined with encryption) [2], to address concerns over privacy breaches in existing online social networks. To evaluate the feasibility of such an approach, we developed an architecture, protocols and a proof-of-concept implementation in the PeerSoN project [3, 5]. The functionality of online social networks is thus distributed in a peer-to-peer infrastructure instead of the traditional client-server web services. Thanks to this distribution, local and delay-tolerant social networks become feasible by allowing users to exchange data directly between devices via ad-hoc connections in physical proximity. Although the motivating application for PeerSoN arises from privacy concerns in online social networks, the results can be generalized and used for other applications where people communicate and want to protect their privacy.

Taking a wider perspective, we contend that there is a feedback loop between society and technology, and there are interesting dynamics in both directions, raising questions such as the following. How can we develop and use technology to enhance people's lives and society as a whole and how can we take societal phenomena and changes into account to improve technology? Delay-tolerant social networks can serve as an example to allow us to explore these questions directly. First, by experimenting how local user communities can benefit from social networks that do not require Internet connectivity. Second, by analysing how user behavior, such as mobility and use of ubiquitous computing resources, can support distributed social networks.

References

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