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A model to support design and development of multiple-social-network applications

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ABSTRACT

Online social networks have become so pervasive in people's lives that they can play a crucial role in design and development processes of applications. At moment, a gap exists w.r.t. standard networking programming to support social-network-based programming in large, according to software engineering principles of genericity and polymorphism. This drawback is made evident when applications should be built on top of multiple social networks and the user-centered vision should be kept. Indeed, heterogeneity of social networks does not allow us to produce software with suitable abstraction. In this paper, we cover the above gap by defining and implementing a model aimed at generalizing concepts, actions and relationships of existing social networks. The effectiveness of our approach is shown by two case studies.

1. Introduction

Over the past decade, online social networks have became part of people's live. Nowadays, most people have a profile in one or more online social networks like `Facebook`, `Twitter`, `Linkedin`, `MySpace`, in which they spend a lot of time. This is recognized as an important phenomenon from a social and economic point of view, and, thus, in design and development processes of (Web) applications. Indeed, often applications should be based on behaviors of a community, or take advantage from these, so that modern Web applications should be social by default. In many cases, both personal information and social interactions coming from social network profiles can be part of innovative solutions. Among these, social Web applications are the most significative example, in which both people's identities and contents they produced are involved in the business process and data are mostly owned by users, strongly interlinked and inherently polymorphic [4]. The polymorphic nature of data and functionalities of applications built on top of social networks has different sources. It is related to the dynamics of social-based applications, making the meaning of concepts context and situation dependent. There is a more technical reason related to the need of delaying the binding between abstract concepts and concrete API calls, when applications operate across multiple social networks. On this aspect we focus our attention in this paper. Indeed, despite the conceptual uniformity of the social-network universe in terms of structure, basic mechanisms, main features, etc., each social network has in practice its own terms, resources, actions. This is a strong handicap for the design and implementation of applications enabling internetworking functions among multiple social networks, and, then, for the achievement of the above goal. As a matter of fact, little exists in terms of models and languages to support social-network-based programming in large, according to software engineering principles of genericity and polymorphism.

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On the other hand, the power of the social-network substrate can be fully exploited only if we move from a single-social-network to a multiple-social-network perspective, still keeping the user-centered vision, so that the above issue becomes crucial. The recent literature has highlighted that the aforementioned multiple-social-network perspective opens a lot of new problems in terms of analysis [10,11,13,43] but also new opportunities from the application point of view [8,9,12,32,47,51,65].

Consider, for example, the possibility of building the complete profile of users by merging all the information they spread out over the joined social networks. This could give a considerable added value to market analysis and job recruitment strategies, as membership overlap among social networks is often an expression of different traits of users personality (sometimes almost different identities). Again, consider the field of identity management [17,28,71]: To trust identity of a user or to identify fake profiles a cross check involving different social networks can be used.

From the above observations, it clearly follows that even though each single social network is an extraordinary source of knowledge, the information power of the social-network Web can be considerable increased if we see it as a huge global social network, composed of autonomous components with strong correlation and interaction. Thus, social-network-based programming should work at this abstraction level.

In this paper, we do an important step to cover the gap highlighted above, by defining and implementing a model aimed at generalizing concepts, actions and relationships of existing social networks. We remark that our aim is not just the development of a sort of APIs working over all social networks (as done in [50]), but an approach allowing us to keep the typical semantics structure of a social network in this new multiple social network perspective. From this point of view, the user-centered vision assumes a crucial role because, besides maintaining all entities and relationships of single social networks, allows us to transparently associate with a user the information coming from all the social networks he belongs to.

This paper is organized as follows. The background necessary to understand the topic is presented in Section 2. Section 3 surveys the related work. Section 4 introduces the characteristics of the multiple-social-network scenario that we model. We give a formal definition of the graph-based conceptual model in Section 5. In Section 6, the model is implemented by defining suitable mappings among concepts and social network functionalities. To validate our approach, in Section 7, we show how our model is profitably applied to two very relevant applications in the context of social network analysis. Finally, our conclusions and possible future work are summarized in Section 8.

2. Background

This section provides the background necessary to fully understand the concepts presented in this paper. First, it discusses the main features that differentiate a social network from a regular website, then it lists the social networks we analyze to build our model and, finally, it describes the reference scenario of this paper, which involves social networks altogether.

Online social networks (OSNs) provide powerful technical features to make communication among users easy. Their backbone consists of public profiles, which collect personal information and interests, and an articulated list of friends who are other users of the system. When a user joins a social network, usually he has to fill his own profile with descriptors, such as age, location, interests, photos and multimedia contents. Moreover, an OSN models entities and connections among them. Entities are often individuals who connected to each other by personal relationships, interactions, or information flows. The collection of friends is not simply a list of close profiles. It represents a microcosm inside the social network, where each user can interact with others. Because a friend list is visible to everyone, users can trace friend links. A new participant can find and add a new friend using the friend lists of the other users.

Profiles and friend lists are only two key features of social networks. The third feature allows users to write comments, which are prominently displayed and are visible to anyone accesses the profile of the user who generates it.

The three features (profiles, friends lists and comments) represent the basic structure of a social network. Moreover, all social networks can have a set of basic functionalities which are considered essential to qualify them as a social networking service. These functionalities are:

- the ability to set up and customize a personal profile by simple forms;
- an utility that allows members to reference other users in their posts;
- a feature allowing users to make a granular control of shared information (privacy settings);
- the ability to block an unwanted member in order to exclude him from the friend list;
- a homepage containing personal information, notes and individual picture albums.

Most of the OSNs include also many other proprietary functionalities, such as instantaneous messages, photo tagging tools, notifications, photo and video sharing, the ability to own, form or be member of a group or a community within the network, and to include new “social applications” or gadgets.

In our article, we focus on some specific social sites chosen according to their popularity and specificities. However, most of the other social networks not mentioned here, have functionalities similar to that described below.

`Twitter` is a microblogging and an online social networking service that allows users to exchange short (140-character) messages called *tweets*. We choose it because it currently ranks as one of the leading social networks worldwide based on active users. As of the fourth quarter of 2014, `Twitter` has 288 million monthly active users [59]. The peculiarity of `Twitter` lies in its efficiency to spread out information instantaneously: it allows one person to inform millions of people in seconds, and suddenly to see responses and direct replies.

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