

Extending the Social Network Interaction Model to Facilitate Collaboration through Service Provision

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Abstract. Social network technology has been established as a prominent way of communication between members of an organization or enterprise. This paper presents an approach extending the typical social network interaction model to promote participant collaboration through service provision within an organization, towards the Enterprise 2.0 vision. The proposed interaction model between enterprise network participants incorporates their actual roles in the organization and enables the definition of custom relation types implementing custom policies and rules. It supports a complex mechanism for refined content propagation according to participant relations and/or roles. Moreover, the collaboration of participants to provide services and complete specific business tasks through Social Business Process Management is facilitated by enabling the execution of specific activities in each participant profile according to his/her actual role. To explore the potential of the proposed interaction model towards Enterprise 2.0, two prototype social networks, developed to serve different communities and needs, are discussed as case studies.

Keywords: Social BPM, Organization 2.0, Enterprise 2.0, Collaborative Communities, Roles and Relations, Social Network Technology, Service Provision and Task Coordination.

1 Introduction

Social networks have emerged as a new model for communication and interaction between individuals, as well as among members of communities or organizations (Acquisti & Gross, 2006). Currently, there are numerous social network platforms, both general-purpose, such as Facebook, and targeted to specific communities, such as MySpace. Social network platforms enable user communication in everyday social life, while they compete with each other in terms of popularity, by continuously offering enhanced functionality, advanced features, external service integration and connection with other social networks (Kossinets & Watts, 2006; Kumar, Novak & Tomkins, 2006; Liu, Maes & Davenport, 2006; Boyd & Ellison, 2007).

The utilization of Web 2.0 technologies, within organizations or enterprises, to promote collaboration between organization members, consists the Organization 2.0 or Enterprise 2.0 vision (Johannesson, Andersson & Wohed, 2008), aiming to explore

how social networks may enhance intra-organization interaction. Corporations and organizations have incorporated social network technology either by using popular public social networks (Thompson & Doherty, 2006) or more often by utilizing private social networks (Geyer et al, 2008), aiming at more effective knowledge dissemination, intra-organization communication and efficient collaboration and service provision between their members (Grasso & Convertino, 2012).

Towards Enterprise 2.0, the potential of collaboration using private social networks has been explored for specific enterprises (DiMicco et al, 2008, Geyer et al, 2008, Motahari-Nezhad et al, 2012) and even for specific communities, such as healthcare/medicine (Boulos & Wheeler, 2007), learning/pedagogical (Hiltz, 1998; McLoughlin & Lee, 2007), and academic (Bermejo et al, 2012). Results are encouraging, as they indicate that novel technological concepts, such as the ones offered through social networks, tend to attract users and facilitate interaction also within the limits of a specific enterprise or community.

Companies encourage their employees to use their private social networks so they can strengthen weak ties with other employees through social interaction. They help organization members interact and contribute to work related issues (DiMicco et al, 2008), while leading to explore new forms of business interaction. At the same time, private social networks tackle emerging security and privacy issues. One of the most well known examples of such a private social network, is the SocialBlue (former Beehive) project (Geyer et al, 2008), created by IBM.

Collaboration within an organization, even utilizing private social networks, currently remains mostly at the informational or communicational level; that is, the social network infrastructure is used only for exchanging information, performing trivial tasks, such as arranging a meeting, or even share and collaboratively edit documents. There are certain efforts that attempt to provide enhanced functionality to assist collaboration, such as file sharing (Shami, Muller & Millen, 2011), targeting the collaborative production of content. Other works, such as (Bruno, 2012), (Hoegg et al, 2006) and (Ploderer, Howard & Thomas, 2010), explore how services offered by existing social networks can be utilized to promote collaboration between their participants. Moreover, the application of business models through social networks is also examined (Richter & Riemer, 2009).

Many current enterprise social network implementations are provided as SaaS platforms, providing services for information sharing among employees, such as activity streams, instant-messaging, file sharing, group creation, real-time document editing etc, and charge on a per-participant basis (Yammer, Zyncro, SocialCast, Jive).

Current trends indicate that enterprise social networks, in order to substantially improve the way enterprise members actually work, should not only facilitate information sharing but also help participants cooperate to complete specific business tasks. To elevate the impact of enterprise social networks, participants expect some sort of collaborative process execution, leading to Social BPM (Bruno et al, 2011).

Following BPM concepts, there are examples of social network platforms supporting participant roles. Tibbr enterprise social network, for example, offers discrete participant roles; however, they refer to social network administration privileges, not business process task assignment and execution privileges (Tibbr). SoCaM framework, implemented over HP enterprise social network, targets collaborative process execution, by supporting Case Management (Motahari-Nezhad

et al, 2012). SoCaM represents processes and tasks as first class entities in the social network and assigns participant roles to tasks; however, these roles do not emerge from the actual participant roles present in the organizational structure of the enterprise at hand. Instead, SoCaM offers three specific roles which are the same for each task and depict the obligations of certain participants involved in this task.

What the aforementioned efforts have in common is that they attempt to adapt enterprise collaboration requirements to the existing social network interaction model and infrastructure. In contrast to the popular generic social network interaction model, whose success was based on its simplicity, we argue that in order to accommodate Organization 2.0, network participants should be able to interact and collaborate based on predefined roles, emerging from actual roles in the organization, enterprise or a specific-purpose community, where each participant is expected to contribute accordingly and complete certain tasks assigned to them.

Thus, a requirement emerges for the adaptation of a new collaboration model and the development of social network platforms supporting Organization 2.0, featuring complex interaction/collaboration models, multiple member roles and relations, and collaborative task execution based on discrete, predefined roles (Lewis, 2006; Oreilly, 2007; Vossen & Hagemann, 2007; Bruno et. al, 2011; Grasso & Convertino, 2012).

In order to support a way to execute business process steps using a SN platform, the existence of an extended interaction model is a prerequisite to enable the enforcement of restrictions according to business rules to the human-driven workflow that can be supported in a Social Network environment. In this paper we propose to extend the typical social network interaction model to explore the aforementioned requirements imposed on social network technology in order to promote Organization 2.0. Besides information sharing and collaborative editing, participants should be engaged to perform specific activities according to their role in the organization and current circumstances and cooperate with others based on enterprise policies and rules. This is achieved through collaborative application management and execution, leading to service provision. A social networking platform could support such functionality by ensuring the execution of applications on the participants' profiles, taking into account the participant role in the enterprise. Thus, role management should be integrated within the supported interaction model. Furthermore, relations, specializing the generic relations between participants of a social network, should be supported, in order to reflect the position and responsibilities of each member of the enterprise and facilitate role-based task assignment.

Based on the proposed extended interaction model, a social networking framework was developed for both enterprises and closed communities, facilitating the implementation of social networks that serve collaboration based on participant roles. To demonstrate the potential of the proposed concepts, two different social networks developed are discussed as case studies: a) Unity, an academic social network, aiming at promoting collaboration between the members of an academic institution, currently tested by members of the Department of Informatics and Telematics of Harokopio University of Athens and b) MedWeight SN, aiming at supporting a closed community of volunteers for weight maintenance using professional dietitian advice.

The rest of the paper is organized as follows: Section 2 presents the proposed interaction model to serve Organization 2.0. Section 3 discusses the application of the

proposed model in both case studies. Conclusions and future directions reside in Section 4.

2 Extending Social Network Interaction Model

To effectively serve Organization 2.0 & Enterprise 2.0 a corresponding social network platform should accommodate several requirements. These requirements emerge by identifying elements regarding collaboration through service provision within an organization, which cannot be directly accommodated by existing social network interaction model features. These requirements are include:

- representation of discrete organization member roles
- incorporation of the organization co-operation model based on predefined relations
- information sharing and promotion of collaboration between organization members in a familiar yet intriguing way
- provision of services by specific organization members to others, based on their actual roles and relations, which in practice determine their privileges responsibilities in this specific environment
- coordination of collaborative tasks performed by cooperating organization members
- integration of services offered by external systems through a unified environment

Such a social network could be developed within the limits of a single organization, or it could also be expanded to include multiple organizations on a regional, national or international level, without affecting the underlying collaboration model.

Existing social networking platforms do not discriminate between participants or relations between them. They are based on a simple interaction model: participants interact with others with no restrictions and they may establish between them a single generic kind of relation with specific semantics, for example *friend*. Current generic public social network models feature only the Participant, Profile and Group entities of the UML model presented in Fig. 1. Requirements as the ones discussed previously cannot be covered by existing public social networks, since the generic interaction model offered by them cannot be adapted to reflect participant organization, while there are also security and privacy concerns. To fully accommodate the goals of an organizational / enterprise social network existing social networking technology should provide an interaction model with enriched semantics, as explained in the following and summarized in Fig. 1.

2.1 Basic Interaction Entities

2.1.1 Participant Roles and Relations

The interaction model serving Enterprise 2.0 features discrete roles for participants, corresponding to their actual position and responsibilities in the organization or enterprise. Roles can determine possible relations between participants. The decision about how specific the roles should be is based on whether further specialization affects the emerging relations. Roles also determine additional data stored in the

profile for each participant. Roles can be used to either assign tasks to participants bearing a specific role or indicate the role a participant should have in order to be able to execute specific tasks; combined with relations they direct the flow of information.

Both organization and social relations are supported. Organization relations can be either unidirectional, indicating that an organization member receives services from another member, or bidirectional, indicating that the members cooperate to achieve certain tasks. When a relation exists, the object of the relation receives updates, posts and material published to the corresponding stream of the subject member profile, and benefits from specific services provided by them.

On order not to limit the free interaction and flow of information, as it emerges in a social network context, the social relation fellow is also defined. It is a bidirectional relation denoting that two participants are socially connected and it corresponds to the generic relation offered by existing social networks. This relation may exist between any two participants, regardless of their roles; if the relation exists, each participant receives posts, updates and content published to the social stream of the other. Social relations do not affect workflows and task executions; however, they play an important role in the social network model as they are expected to strengthen ties between participants and encourage cooperation, thus leading to improved interaction.

2.1.2 Streams

The most common operation that a participant performs in a social network is publishing content, which can be of a variety of types, such as links, texts, files, multimedia etc. Published information is propagated in the form of a stream to all participants related to the publishing entity, who receive notifications and updates about the publication, urging them to review it and possibly contribute to it, as dictated by the notion of collaborative content in Web 2.0 (Anderson, 2007).

In an organization, specific streams should be defined based on participant roles and relations. Apart from the intra-organization member relations, the social aspect of the community should not be dismissed; therefore, each member may develop a social relation with any other member of the community, regardless of their roles in it. At the same time, a clear separation between them should be maintained, thus a more complex propagation mechanism is introduced incorporating discrete streams.

Along with streams, the proposed model also defines propagation rules indicating which participants receive the publications directed to each stream. While the publisher maintains a unified stream on the corresponding profile, the propagation of published information does not take place for all publisher's contacts indiscriminately, but is based on the type of their relation with the publisher, determining the stream they receive. The combination of discrete participant roles, multiple streams, extended relations and rules governing the propagation of content successfully achieves the separation between the organizational and social information shared within the organization.

2.1.3 Groups

The combination of roles, relations and streams does not fully facilitate fine-grained content propagation; therefore, a more elaborate mechanism for content delivery is proposed, through groups. Groups are arbitrary sets of contacts that any social network member can create and modify dynamically. Each group has a specific name,

and the member who creates it, as its owner, has control over membership of other participants, which may join or leave the group. All members and only the members of a group can publish content in the group, while the owner maintains control over all posts. Each publication to a certain group belongs to a corresponding custom, ad-hoc group stream and is propagated to all members of this group. Groups are generic enough to serve multiple purposes in a complex organization.

2.2 Collaboration and Task Coordination

Collaboration in a typical social network is performed through exchange of information and notifications in a distributed fashion (Gross & Koch, 2006). In addition to sharing content and notifications through discrete streams and groups, the proposed social network model supports the provision of specific services and enables its participants to complete specific business tasks in collaboration with other participants (Dengler et al, 2010).

Services may be provided by cooperating applications executed in a specific participant profile. Typical social networks enable applications to be executed on the user profile. These applications usually read data from the user profile and may invoke external applications through a web service interface. They also have access to store data in the user profile. In order to ask for services rather than information from another participant, a more sophisticated communication mechanism is required, facilitating information exchange between applications executed on different profiles.

We propose treating all services, either simple or more complex ones, as tasks consisting of specific steps (e.g. activities) which may be performed by participants of a specific role – a policy that emerges from the actual enterprise organization. Each activity corresponding to a specific task step is handled as an application, which may only be executed in the profile of a participant having the proper role, and may involve the invocation of external services to be completed (Hatzi et al, 2012). Each application, as any other program, needs specific input data to start execution and, when executed, produces output data. The coordination of tasks, e.g. the conditions under which specific activities may be executed, is performed based on the available input data of applications implementing the specific activities. An application implementing a specific activity cannot start its execution until all its input data are available. This data may be part of the user data stored in the profile the application is executed on, or produced as output data of other applications, which may be executed on the same profile, e.g. by the same user, or more frequently on external profiles corresponding to users having the proper role to invoke those applications.

Evidently, in order for collaborative tasks to be supported, inter-application communication executed on different profiles must be enabled. Based on available social network technology, applications may access and store data in a stream specific for this purpose, the Activity Stream, which is private to applications and not visible to participants. While the task is progressing, proper notifications are issued to collaborating participants, urging them to be involved for their part in the task. Obviously, the participants collaborating for a specific task must be properly associated with corresponding relations.

The proposed extended interaction model is presented in Fig. 1 using UML notation. The basic generic social network interaction model features only the participant, profile and groups entities. The proposed extensions concern the assignment of roles to participants, which attach an additional properties container to their profiles, as well as the specialization of the generic relations, to indicate more refined interaction structure. The specialized relations are unidirectional or bidirectional and defined between specific roles. The rest of the entities, i.e. streams, applications and notifications, take into account participant roles and relationships in order to implement organization policies regarding rights and restrictions. These extensions have as a consequence that applications are allowed to be executed only by participants belonging to a specific role – this enables the representation of enterprise tasks assigned to collaborating participants.

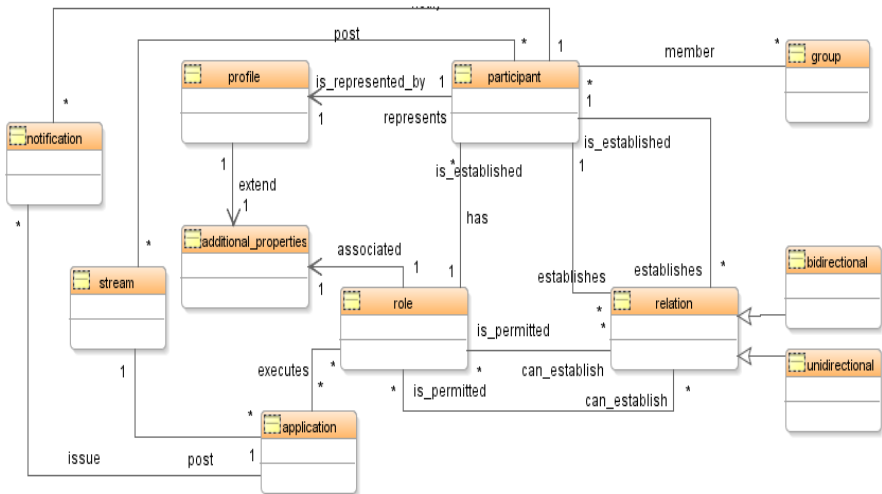


Fig. 1. Enterprise 2.0 extended model

3 Case Studies

3.1 Supporting Organization 2.0 in an Academic Institution

Towards Organization 2.0, the Unity SN was developed to enable collaboration between the members of an academic community. It was based on Google OpenSocial framework and is currently deployed in the Department of Informatics and Telematics of Harokopio University. The case study is briefly presented focusing on task coordination features to demonstrate the impact of the definition of discrete roles and relations, which govern participant responsibilities, to task execution and service provision. Without them task coordination could not be effectively supported.

3.1.1 Interaction Model

Each member of an academic organization has specific responsibilities, may represent specific University services, such as the University Library or the Student Admission Office, and may perform specific tasks to serve other community members.

Following the proposed model, the following roles can be identified:

- Student: undergraduate students, postgraduate students and PhD candidates
- Teaching staff: faculty members and additional teaching staff
- Administrative staff: University employees that could potentially provide services to community members, i.e. Admission Office employees, Library employees, Erasmus office employees, Computer Center employees, etc.

Based on these roles, the following organizational relations are defined:

- Tutor: a unidirectional relation declaring that a student is being taught / supervised by a member of the teaching staff.
- Facilitator: a unidirectional relation declaring that a Student or Teaching staff member is served by a member of the Administrative Staff.

The social relation fellow is also defined, between any two participants.

In the academic environment, groups may be formed for courses, or any other special interest group, such as the Open Source Community.

The combination of discrete participant roles, multiple streams, extended relations and rules governing the propagation of content successfully achieves the separation between the academic and social aspects of the academic community. For example, a professor may announce his office hours only to participants who are his students and not to all his contacts, while at the same time he may publish information about an upcoming film festival to all his social contacts.

Fig. 2 depicts an example of a participant profile in Unity. The profile shows information concerning the participant, his role in the social network and his contacts, which can also be viewed by relation category. It also contains recent activity, posts and notifications received by the participant. Finally, it features the “App Drawer”, i.e. the application deployment space.

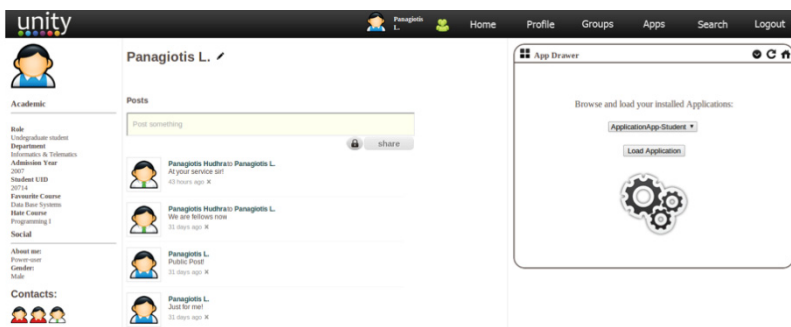


Fig. 2. An example of a Unity Participant profile

The specific participant contacts viewed by relation category are depicted in Fig. 3 (left part), while posts and notifications received by the participant are presented in Fig. 3 (right part).



Fig. 3. Participant contacts (left) and notifications (right)

3.1.2 Collaboration and Task Coordination

As a task coordination example we consider the graduation process. In order to be eligible for graduation, a university student must fulfill the following requirements:

- All necessary courses have been successfully completed.
- The degree thesis has been successfully examined and submitted to the University Library, as indicated by the corresponding certificate.
- All books borrowed from the University Library must have been returned.
- The student ID and transportation card have been submitted to the Department Secretariat.

The student can subsequently fill out a graduation application form and submit it to the Department Secretariat, who confirms that all requirements are valid and notifies the student of the graduation ceremony date.

Such a process could be modeled using a BPMN diagram focusing on the discrete activities performed to accomplish this task, as presented in Fig. 4.

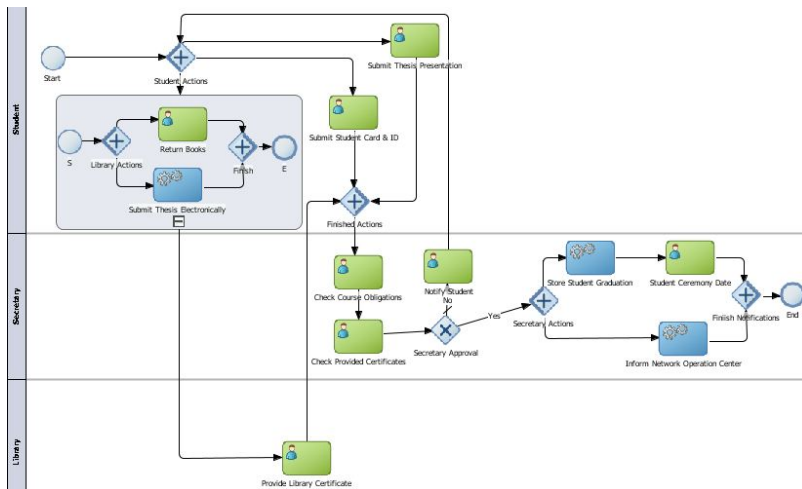


Fig. 4. Graduation Process described in BPMN

However, in the context of the social network, students may view graduation process as a set of certificates they have to gather in their profile before graduating, adopting the Case Management approach as discussed in (Motahari et al, 2012). In such an approach, the student as a Unity participant is not guided to perform specific steps; they are only notified of which data (certificates) are missing from their profile to be eligible for graduation. Some of these certificates cannot be issued by students, thus they need to notify Library and Secretary personnel having the proper authority (and consequently, role) to issue the certificates for them (e.g. are authorized and eligible to serve them since they are their facilitators). Certificates are issued running the corresponding application in the participant profile having the authority to execute the application according to their role in the academic community.

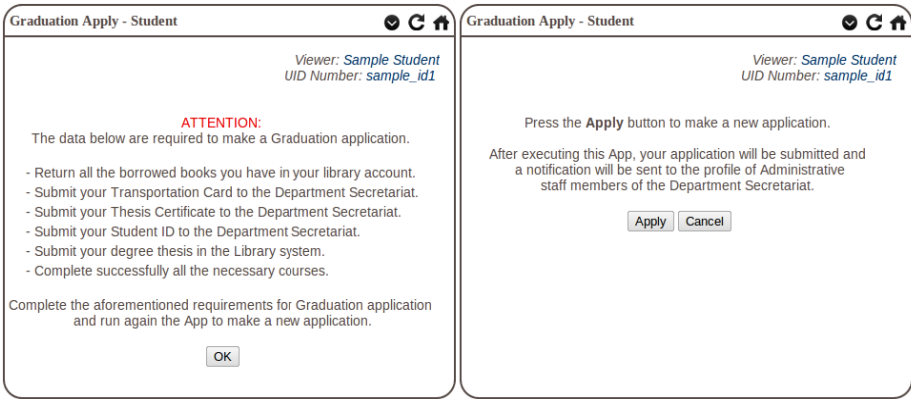


Fig. 5. Graduation Application execution

The student starts the graduation process by installing and executing the Graduation Application. The application checks if all corresponding certificates are available, as shown in Fig. 5. If not, the student should collect them, otherwise the graduation application is submitted to the department secretariat.

An administrative staff member of the Department Secretariat may execute the GraduationCeremony Application, to notify all applicants of the graduation ceremony date, as depicted in Fig. 6. Note that this application is available only to participants with an Administrative Staff role.

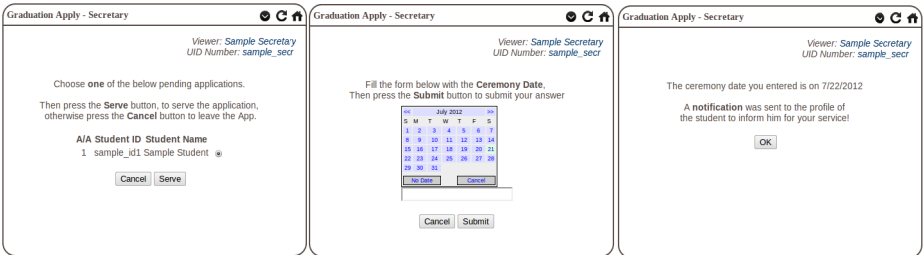


Fig. 6. GraduationCeremony Application execution

What happens when the student may not submit the application? In this case, students should collect all necessary certificates as indicated by the Graduation Application.

For example, in order to confirm that the student has returned all borrowed books to the University Library, the LibraryBookAccountStudent Application must be executed, as depicted in Fig. 7. The application requests the student’s Library Identification Number and issues a notification to the administrative staff of the University Library. This application registers data such as the LibraryIdentificationNumber and the NumberOfBooks to the Activity Stream, in order to be able to communicate with other applications.

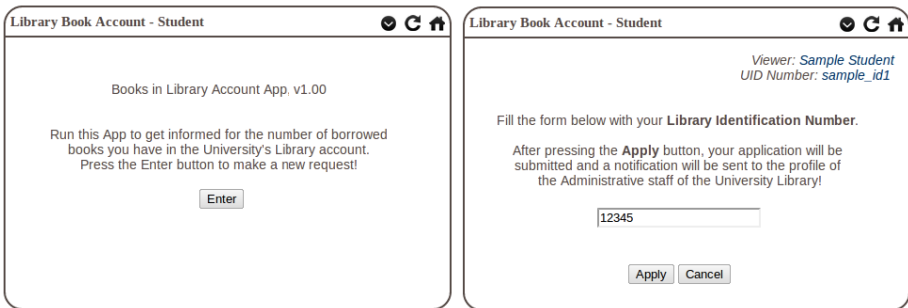


Fig. 7. LibraryBookAccountStudent Application execution

A member of the Library administrative staff, which is connected by the facilitator relation with this specific student, must then execute the collaborating BookAccountLibrary Application, which shows all pending requests. This application requests a username/password for the Library Information System by the member of the Library administrative staff, invokes the appropriate API to obtain the number of books that the student has borrowed, updates the ActivityStream and issues a notification to the student. The process is depicted in Fig. 8.

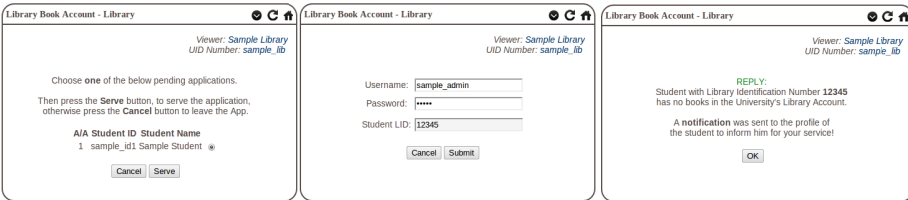


Fig. 8. BookAccountLibrary Application execution

The definition of discrete roles in the interaction model, based on actual organization member roles, enables application execution based on the role and responsibilities of each academic community member, while relations define the circumstances under which a specific member of the academic community may serve another and help them collaborate to complete a task.

3.2 Organization 2.0 Features Useful in a Collaborative Community

MedWeight Social Network aims at supporting volunteers to maintain their weight and eat healthy for a period of three years. The network aims to build ties between volunteers participating the network, to help each other maintain their weight and exchange healthy eating habits and recipes. Furthermore, advice and guidance from dietitians may be provided without treating the volunteers as “clients”. It is a research project from the Department of Nutrition and Dietetics Science of Harokopio University of Athens, which is involved in the study. It is currently deployed in its prototype phase using Python and Django technology. The user interface is currently in Greek. Although this is a private social network targeting a closed community, it still features the basic characteristics of content dissemination and service provision based on predefined, discrete participant roles and relations.

More specifically, the following roles were identified:

- Volunteer: a person who takes part in the study and wants to benefit but has no expert knowledge concerning diets and nutrition
- Dietitian: an expert scientist that provides services and feedback to users of the role Volunteer

Based on these roles, the following relations were defined:

- Instructor, which is a unidirectional relationship from a volunteer to a dietitian
- Fellow, which is a bidirectional social relationship and can be defined between any two members of the community

A screenshot of a participant profile is depicted in Fig. 9

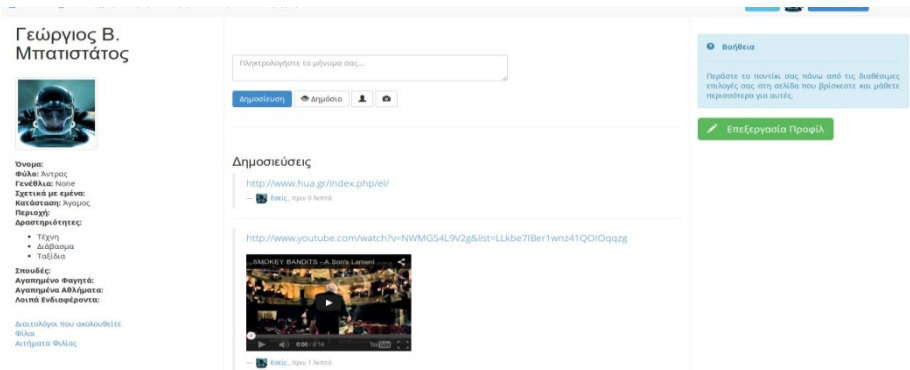


Fig. 9. MedWeight social network participant profile

As before, roles and relations are used for content propagation, as well as for application execution, leading to task completion. In such closed communities, role-based content propagation is important, as certain participants belong to roles indicating “expertise” or “authority”, enabling other participants to establish trust to the integrity of the content they post and act accordingly.

As a task example, the weight maintenance application is briefly presented. Volunteers may daily register measurements of their weight, running such an application in their profile. With each measurement, the application calculates certain

dietetic factors, such as Body Mass Indicator. If any of these factors have exceeded a certain limit, a notification is issued to dietitians chosen by the volunteers as their instructors. Consequently, the dietitian can provide personalized feedback and expert advice to the volunteer, properly directing the proper content to him/her. A screenshot of this application is depicted in Fig. 10.

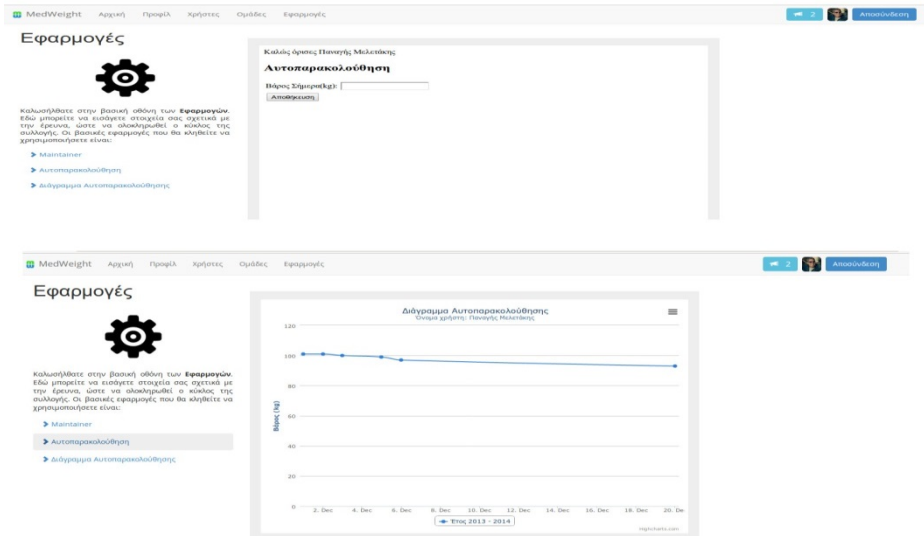


Fig. 10. Weight maintenance application – weight insertion & report

The extension of the original interaction model with roles, in the case of communities, enables to impose restrictions on application execution. For example, in this particular case, a volunteer in the social network will receive feedback on their weight maintenance only from expert dietitians and not other volunteers, as non-expert advice might be anywhere between misleading and dangerous.

4 Conclusions

Current social network technology and corresponding interaction mechanisms cannot effectively serve the Organization 2.0 & Enterprise 2.0 vision, since business task coordination based on predefined organization roles is not a supported feature. To this end, the typical social network interaction model was extended and a corresponding social network platform supporting it was developed.

The support of a single, simple relation offered by typical social networks is not adequate to model restrictions on the interaction between enterprise members collaborating to perform a task. The definition of discrete roles and relations enhances the description of workflows corresponding to specific business tasks, which are completed by collaborating participants. Taking into account different roles and relations, multiple content streams may be defined, facilitating improved control over the propagation of content to participants.

Future work concerns a more elaborate mechanism for defining applications in the proposed social network model that will be able to handle semantics through ontologies or folksonomies. Such an extension would encourage the development and integration of applications by third parties, permitting the proposed model to be used effectively for e-administration or e-government, involving multiple organizations, as well as for inter-enterprise collaboration. Application and experimentation with the proposed collaboration model in other collaborative communities and enterprises featuring discrete roles and relations, following the concept of Enterprise 2.0, will also be explored.

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