Social Execution of Business Processes: Concepts and Challenges

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INTRODUCTION

The way that people interact, entertain, communicate and work has drastically changed in the modern world of Information Age. Internet use provides a context where people across the world can exchange messages, share knowledge, and interact with each other regardless of the distance that separates them (Sawyer, 2011). Internet use is now on a daily basis, while, according to (Pew Research Center, 2014), active adult users in the U.S are about 87% of population. A great impact on this ever-growing usage has been accomplished from Web 2.0 applications (Lewis, 2006). There are plenty of applications that are enclosed from the general term Web 2.0, such as Wikis, Blogs, Social Networking Sites (SNS), Video Sharing Sites, etc., which provide the opportunity to users to create web content. The capability of content creation in conjunction with the continuous development of new features for mobile devices resulted a new powerful tool for real time web content propagation, already extensively used (eMarketer 2014).

SNSs have been established as a prominent model for communication and interaction between individuals, as well as among members of communities or organizations. Currently, there are numerous, diverse social network sites, both general-purpose, such as Facebook, and targeted to specific communities, such as LinkedIn focusing on business-oriented communication. Social network platforms enable user communication in everyday social life and they continuously offer enhanced functionality and advanced features including application execution through external service invocation and integration with other social networks (Boyd & Elison, 2007; Kossinets & Watts, 2006; Kumar & Tomkins, 2006).

This entire new age has affected a great number of different domains, such as health, science, business etc., providing new widely accepted tools and options for everyday communication and collaboration among participants. The usage of Web 2.0 applications and technologies in these areas has created new terms, such as Health 2.0 (Boulos & Wheeler, 2007), Education 2.0 (Hiltz, 1998; McLoughlin & Lee, 2007; Bermejo et al, 2012) and Enterprise 2.0 (McAfee, 2006). More specifically, the Enterprise 2.0 vision consists of the utilization of Web 2.0 technologies, within enterprises or organizations,

to promote collaboration between organization members (Johannesson et. al., 2008).

Corporations and organizations have incorporated social network technology either by using popular 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 between their members (Grasso & Convertino, 2012). Owing to the need of real time communication and everyday collaboration using social networks technology within organizations and companies, was the attendance of a new platform, the so-called Enterprise Social Network (ESN). 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). Results are encouraging, as they indicate that novel technological concepts, such as the ones offered through social networks, tend to attract users within the limits of a specific enterprise or community.

Many current ESN 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, e.t.c. (Yammer, Zyncro, SocialCast, Jive). Tibbr, following BPM concepts, supports discrete participant roles. However, they refer to social network administration privileges, not business process task assignment and execution privileges. SoCaM framework, implemented over HP enterprise social network, targets collaborative process execution, by supporting Case Management (Motahari-Nezhadet 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.

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 (Boughzala, 2012). To elevate the impact of enterprise social networks, participants expect some sort of collaborative process execution, eventually leading to Social BPM (Bruno et al, 2011). Thus, a requirement emerges for the adaptation of a new collaboration model and the development of social network platforms supporting Enterprise 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).

MOTIVATION

Business processes have often been roughly classified into two categories depending on their nature: 1) well-defined, easily automated 2) knowledge-intensive, where the content propagation between individuals is extremely important (Swenson et. al, 2011). Communication with others and information sharing are basic characteristics of social networking technology. To this end, we explore the adaptation of social network technology to support

knowledge-intensive processes. Furthermore, we argue that the communication model adopted by SNS may serve as an alternative collaboration model between co-workers and promote business agility within organizations, serving the vision of Enterprise 2.0. Such an effort may be accomplished by providing application execution and interaction capabilities within ESN platforms (Hatzi et. al, 2014a).

Current enterprise social network implementations focus on providing services for information dissemination among members of an organization, such as instant messaging, file sharing, group creation and real-time document editing. This is an important feature, since co-workers often do now know that two of their colleagues have communicated, or what that communication was about, because it occurs through private channels such as e-mail or the telephone (Cross, Borgatti, & Parker, 2003). ESNs afford the possibility of making visible the communicative activities in which one engages at work, such as the content of one's messages to others, their communication network, and the outputs of their work, which were once invisible to others in the organization (Leonardi et al, 2013).

Besides all this, the penetration of ESN usage in organizations is less that expected. The employees although enjoy using these platforms as another communication tool, they expect them to have a greater impact on their every-day work and business activities. Another disadvantage identified on the usage of ESN is that they fail to reflect the hierarchical structure usually organizations have (van Bavel & Martin, 2012). Also, privacy issues arose, as the involved feel that the use of this kind of services is monitored by the organization so they should be very careful (Wang & Kobsa, 2009).

To further promote the utilization of enterprise social networks in organizations, their contribution in performing every-day activities and complete business goals should be strengthen (Kemsley, 2011). Collaboration to perform a task or complete a goal is usually performed by communicating with others, sharing information or executing applications. The first two, are basic characteristics of social networking technology already supported in enterprise social networks. Although single application execution is a standard feature in a typical social network, application interaction by exchanging or sharing data is not facilitated. To enable application execution to serve a mean for collaboration between participants, application interaction and combination features should also be supported by enterprise social network platforms.

Based on the above, we suggest a new collaboration model targeting the social execution of business processes by entering new features into enterprise social network technology. In order to succeed that, new features such as discrete - predefined roles, member's responsibilities, task execution and business processes design should be integrated within ESN platform. Our basic motivation is to reflect the hierarchy and the organization chart into each organization's social network and to provide the ability of collaboratively task design and execution through social network environment. In terms of accomplishing the aforementioned goals, extensions to the existing social network model are needed.

SOCIAL NETWORK MODEL EXTENSIONS

In order to provide effective collaborative everyday task execution among participants of organizations through social networking technologies, specific functionality should be offered that is not provided by existing implementations of enterprise social networks. The required functionality refers to:

- organization's hierarchical structure reflection
- representation of participants responsibilities
- integration of business processes within the enterprise social network in the form of applications
- applications assignment to users based on participant organization role and responsibilities
- applications communication and data exchange mechanism
- collaborative design and manage of applications

Specific participant Roles and Relations

Representation of organization's hierarchical structure into the enterprise social network is one of the fundamental concepts of our proposed model. We indicate a brand new way to reflect each organization's hierarchical structure within enterprise social network. Realizing that each organization has a particular structure, a dynamic way of hierarchy definition is required. Also, considering that a key feature of social networks is the relation establishment between participants, we set as a demand the flexible specification of social network offered relations.

In order to describe participant's position in the organization, the term role is introduced as a required profile data for each ESN user. In this way we can easily recognize the members of a specific organization's domain (e.g. financial, administrative staff). 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. The determination of supported user roles may vary depending the specific organization, while roles are managed from ESN administrator.

Furthermore, the available relations that would be established between enterprise social network members could be managed through an ESN administrative environment. There are two general types of relations in social networks: mutual (bidirectional) and one-way (unidirectional) (Zhang & Bao, 2012). The proposed model could support the dynamic creation of available ESN relations of both types between participants, based on the predefined user roles. 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.

Responsibilities

Concerning the need of rational hierarchical structure reflection, an extensive approach in order to manage authorities and obligations of users should be supported to map them into the ESN environment. This feature could not

be based on users specific role listed above, as the role is a more general concept and it is not possible to distinguish users with the same role and different authorities. For instance, there are determined tasks for specific participants within the same department.

The notion of responsibility is incorporated into the extended ESN model, to indicate the responsibilities and obligations each user has, within the ESN. In practice, this is reflected to application execution privileges. The assignment of responsibilities can be done either to an existing role or to a specific user. Moreover, one responsibility can be assigned to a group of. An advantage of the proposed extension concerns the cardinality of assignments. The extended model allows for the assignment of multiple responsibilities to an individual; either directly to him or indirectly through their role in the organization.

Similarly to roles and relations, which are different for each ESN based the proposed model, responsibilities are also not predefined and can be developed on demand, even after the launch of a social network. The creation and assignment of responsibilities to users or roles could be performed by ESN administrator.

Business Activities as Social Network Applications

The integration of business activities within the ESN requires the creation of applications that reflect already designed activities. Business tasks are modeled in a goal-oriented fashion (Whitestein AG, 2010). Each business task may be accomplished by inserting corresponding context in ESN user profiles. Context creation is accomplished by applications executed by ESN users. Each activity corresponding to a specific task step can be implemented handled as an application. In this way, users should incentivize to use the organization's ESN in order to execute their everyday tasks.

Each application can be executed only by participants having the corresponding responsibility assigned to them, directly or indirectly, based on their role or the groups they participate in. Responsibility assignment can be performed either on specific participants or on entire participant roles, in a uniform fashion. It is obvious that one user could execute multiple applications, depending the responsibilities he/she has within organization.

Application Composition

Concerning the need of completing complex business tasks in organizations, this can be served by application composition. Complex tasks are business activities that the involvement of more than one participant is required or the execution of more than one application is needed.

The proposed application composition mechanism is data driven; in the sense that the composition techniques for application matching are based on data exchanged between applications and not on applications themselves. Every single application that would exist in ESN should have already defined the input data that are required for a successful execution and the output data that would produced after execution. Succinctly, each application that exists in the social network is modeled through its inputs and outputs. Inputs and outputs are represented as concepts with a unique identification scheme in the social network database.

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.

Applications Interaction and Data Exchange Mechanism

In order to perform of complex business activities within ESN, a sophisticated mechanism for exchanging information between applications is essential. Each application, as any other program, needs specific input data to start execution and when executed, produces output data. Our proposal recommends a standardized way where applications will store and retrieve the generated information. At the same time, the generated information could be accessed by external systems since some organizations very often interact and collaborate with external parties.

The proposed approach utilize activity streams format (http://activitystrea.ms) to store data that are produced from application's execution. The concept of Application Activity Stream is introduced for application data storage and retrieval. In addition, it includes the ability of applications to cooperate, exchanging data without intervention of the user, which leads to the notion of application composition.

In its simplest form, an activity consists of an actor, a verb, an object and target. This format was extended to cover the requirements of the proposed data model by adding a description and data. The description stores the name of the data, which is produced by an application instance execution, while the data field stores the actual values of the data. When some application, in order to be executed, requires as input data that is provided by another application as output, this application has to perform a search in the description field of application stream to identify if the required data exists.

Collaborative Design and Management of Applications

The integration of business processes within an ESN in the form of applications requires the implementation and management of applications from developers. The additional options that a developer should have as an ESN user pertain to collaborative design and management of applications. Apart from application management features, developers could be able to collaborate with users, in order to communicate and cooperate to the best result in the design of applications. Collaborative management ensures that the applications in the social network will be interoperable, without requiring a strict control over the application implementation and interface.

The developer can register an application, delete and edit his registered applications and examine the already registered application through a straightforward visualization. These extra features in conjunction with the use of ESN in order to collaborate with other application creators provide an effective way to better application design and management.

More specifically, the developer while registering an application indicates that some of its inputs should be provided by other applications as outputs, interactions through the Application Activity Stream, as described in the previous section. If the corresponding applications are already registered in

the social network, a dependency is added between them, indicating that an application receives data from another application; therefore, the execution of the application producing the data is a prerequisite for the execution of the application receiving the data. If the corresponding applications are not already registered, the application at hand can still be registered; however, in this case, its inputs will be annotated as idle. This indicates that the application is not available for immediate execution because one or more of its prerequisite applications are missing; however; as more applications are added to the social network, the proposed framework performs the necessary input-to-output matching in order to suggest possible dependencies which the developers have to confirm or decline. The dependencies discovered among applications result in the development of a graph of potentially interconnected applications, sub graphs of which are all possible compositions at any given time. In order to provide convenience to the user, this graph is visualized in an explorable way within the social network (Hatzi et. al, 2014b).

All the entities proposed to formulate the extended SN model, to enable application execution within ESNs are summarized in Figure 1. Basic SN model entities are depicted as classes with clear frames and black letter, while proposed extensions are depicted with blue frames and white letters.

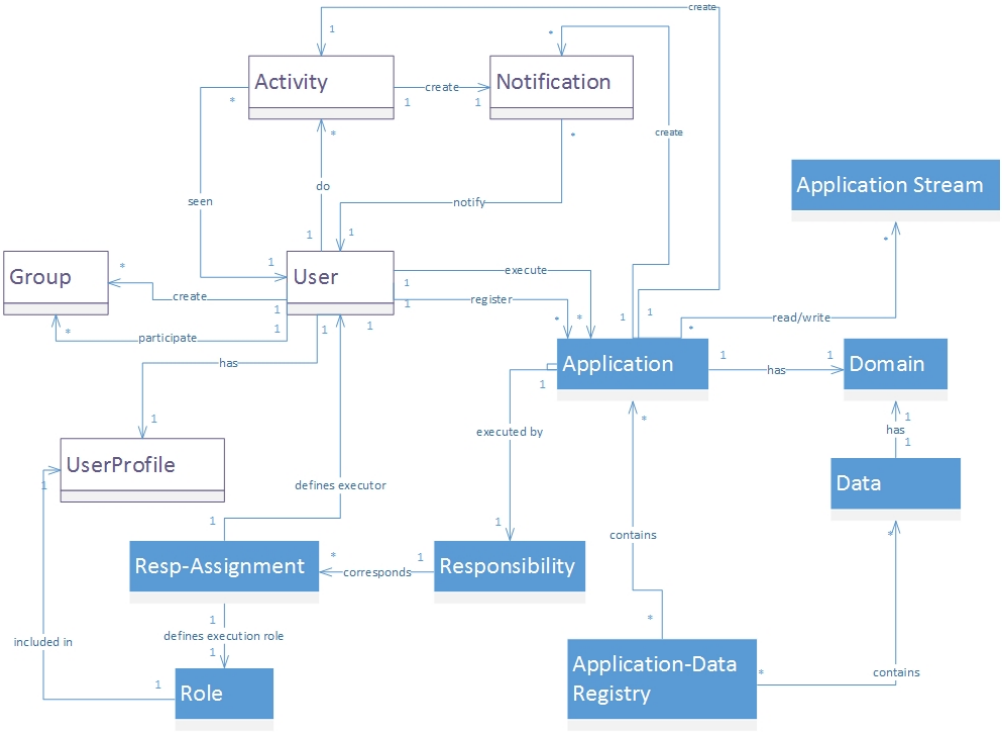

Figure 1 – Extended ESN Model

CASE STUDIES

Based on the suggested model, we have implement an open source ESN development platform called Collato, using Django python framework (https://github.com/meletakis/collato). Using Collato applications, one may

develop ESNs facilitating all the aforementioned features, using the Django python framework. These ESNs support different features, such as role, responsibilities and applications, tailored to the different requirements of each organization. More technical information about Collato can be found in (Hatzi et. al, 2014b). The configuration for each discrete ESN is achieved through a web administration environment in which all available options are provided. To explore the potential of the proposed ESN extensions and the corresponding development framework, two discrete case studies are presented in the following.

The first one is a private academic social network in Harokopio University of Athens, called Unity. Users of this ESN site are all members of the academic community such as students, teaching and administrative staff. The second one refers to MedWeight social network, used from specialized Nutrition researchers and volunteers to study weight maintenance behavior.

Unity

The main goal of Unity is the acceleration of internal business activities, through the use of an ESN to achieve faster settlement of all liabilities. For this purpose, certain university business procedures were selected and provided as services through Unity. 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.

Roles and Relations

Following the proposed model, we have defined the following distinct *roles* in order to succeed the optimal representation of organization's hierarchical structure:

- 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.
- Developer: designers and managers of registered applications in ESN

Based on these roles, the following 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.
- Fellow: a social relation between any two participants.

Figure 2 shows the User Profile of Student. As shown in figure 2, users having different roles in Unity ESN, are described by different properties in their profile. Both social and academic data are included in the profile, while a student may establish different relation with their pears and members of teaching and academic staff.

Supported roles, profiles and relations are defined by Unity administrator, when configuring the ESN through the Web administration panel that is provided by Collato.

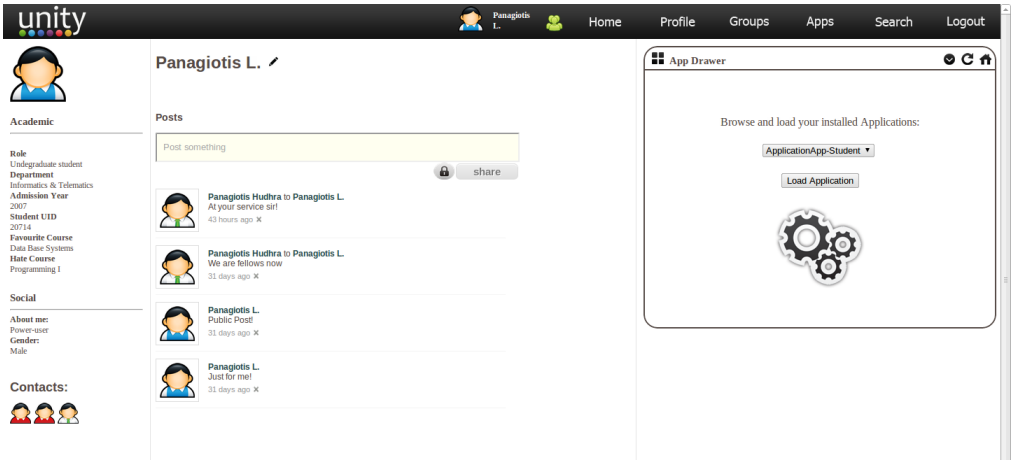

Figure 2 – User Profiles in Unity

Process coordination and Application Composition

As a process coordination example we consider the graduation process. In order for a student to be eligible to apply for graduation, the following requirements should be met for a student to graduate:

- All courses have been successfully completed.
- The degree thesis has been submitted to the University Library.
- All books borrowed from the University Library have been returned.
- The student ID, transportation card and thesis certificate have been returned to the Admission Office.

The applications that reflect the aforementioned activities of the graduation process have been implemented and registered from the users with the Developer role through the Collato collaborative application design and management environment. Figure 3 represents a portion of the Developers view in Collato collaborative application design and management environment, as parameterized for the Developers of Unity ESN.

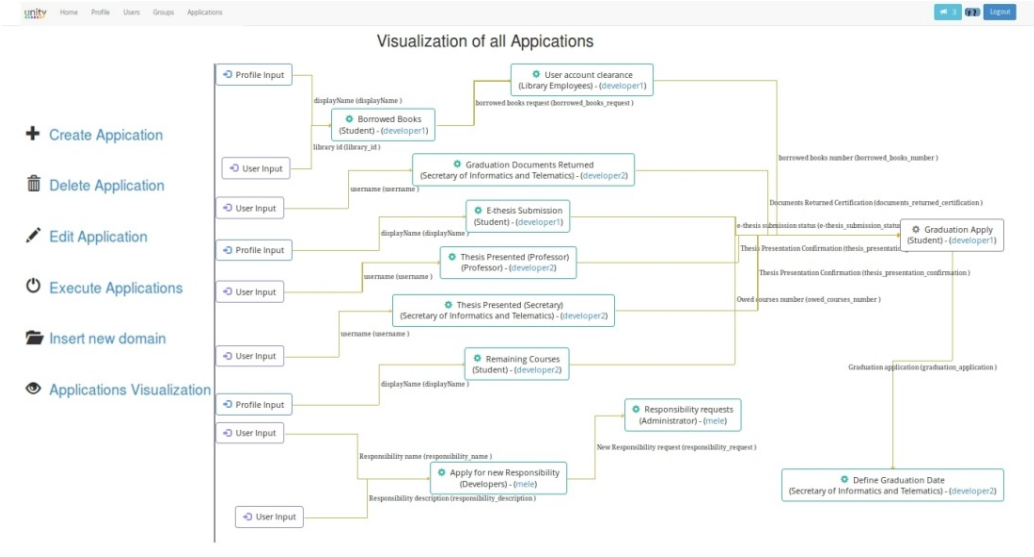

Figure 3 - Unity Developers View / Applications Visualization

A successful completion of graduation process, involves several users such as the graduating student, his/her supervisor, the Library staff, and the Admission Office employees. Therefore, the following *responsibilities* have been defined in order to coordinate the graduation process within Unity:

- Professor: responsibility assigned to Teaching staff role
- Student: responsibility assigned to Student role
- Library employee: responsibility assigned to a specific user who has the Administrative staff role and works in the University Library
- Admission Office employee: responsibility assigned to a specific user who has the Administrative staff role and works in the Admission Office

Figure 3 shows the graph created by the dependencies built by the applications registration procedure, as explained in the previous section. All the essential applications for the graduation process with their input and output data are included in this visualization. The student starts the graduation process by executing the Graduation Application. This application requires data from other applications as shown in visualization (figure 3), accordance with the requirements set by the university. The application checks if all corresponding certificates (data) are available, using the Data Exchange Mechanism. If not, the student is informed that he/she should collect them, by executing other applications as shown in figure 4.

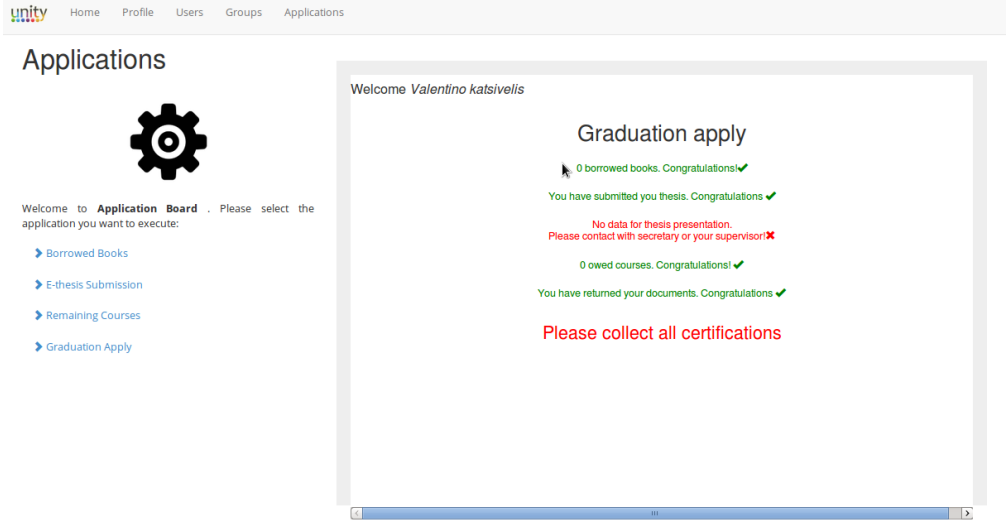

Figure 4 - Application Execution in Unity

For example, in order to confirm that the student has returned all borrowed books to the University Library, the Borrowed Books application must be executed. The application requests the student's Library Identification Number and issues a notification to the administrative staff of the University Library. Subsequently, the Library employee must execute the application User Account Clearance in order to server student's request. This application registers data such as the borrowed_books_number to the Application Activity Stream, in order to be able to communicate with other applications. This data is required to exist and has zero value, alongside with other data in order to have a successful execution of Graduation Apply application.

MedWeight Social Network

The main objective of MedWeight SN is to support a closed community, participating in weight maintenance study. The volunteers participating in MedWeight community for a period of 3 years, hope that the community will assist them to maintain their weight. This assistance is achieved through the interaction and communication between volunteers and the scientific instructions of specialized Nutrition personnel. The prospect of user's mutual support for health issues through direct communication, is the main motivation of MedWeight's implementation.

Colatto ESN development platform was also used to build Medweight SN. Based on requirement analysis, the following distinct roles were defined for MedWeight SN:

- 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
- Developer: a user who register and manage the applications in ESN.

Also, two relations has been defined based on aforementioned roles:

- Instructor: a unidirectional relationship from a volunteer to a dietitian
- Fellow: a bidirectional social relationship, which can be defined between any volunteers

MedWeight specific roles and relations are defined using Colatto web administration environment, as shown in figure 5.

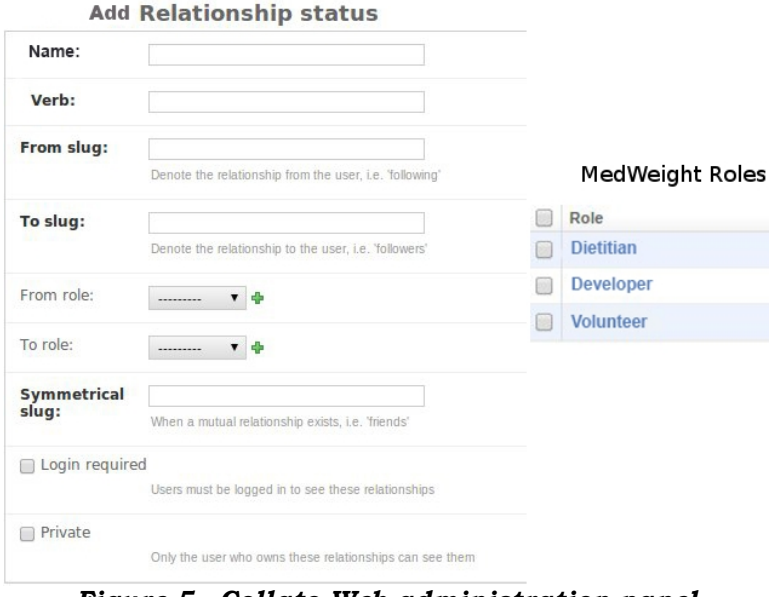

Figure 5 - Collato Web administration panel

The interaction between users in Medweight is mainly performed by publishing content, either in user's profile or in interest groups that can be created. The content that is published by a Dietitian, is shown to all the volunteers "instructed" by him/her, while all the content published by a volunteer is visible for all of his/her fellows that meet certain conditions (for example be-

longing in the same group. In order to succeed the optimal dissemination of information, there are several given options to users related to "visibility" of the publication such as private, public, visible to a specific user, visible to all users with one specific relation established.

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.

CONCLUSIONS

The suggested extensions to the typical social network model aim to facilitate Social BPM features through the completion of everyday business activities using social networking characteristics. These extensions achieve the representation of organization's hierarchical structure including the responsibilities, authorities and obligations of participants within ESN. Also, transform business activities to ESN applications enabling collaborative application execution and management. As a result, participants are engaged to perform specific activities by executing the corresponding applications, according to their role in the organization and current circumstances, and collaborate with others based on business policies and rules in order to complete their business tasks.

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INDEX