Extending Social Networks with Service Delivery Capabilities for User-Centric Service Trading

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Abstract - **According to the latest research results, service trading and execution platforms promote automated discovery, composition, contracting and adaptive execution of web services. This vision has not yet arrived in the business sector which is still dominated by manual services listed in person or company profiles in traditional business service directories and social networks. A combination of features from both sides yields powerful, user-centric service trading platforms.**

Keywords - **SOA, Internet of Services, Social Networks, SaaS.**

I. Introduction

Social network sites on the web are popular means to express personal and professional relationships among people and companies [1]. They are especially popular with custom service providers like freelancers and consultants, but less commonly used for traditional service branches such as insurances and room reservation. For those branches, registration with service directories is the preferred means to reach potential customers. Both approaches are separated from registries and brokering platforms for fully automated web services. This separation is unfortunate as it leaves an unused opportunity to achieve a continuous service search and usage process. A combination would bring the ability to offer and deliver a wider range of automatic and hybrid services through a common user interface. We present a concept for the extension of a social networking site with service delivery capabilities and demonstrate its usefulness with an example installation. Our contribution herein is rather non-technical but shall be regarded as fulfilling a precondition for bringing the participative Internet of Services to life through the creation of service communities.

II. Scope of Services and Social Networks

We consider a concept constrained by certain informal models for the roles of the involved people and the types of services to trade.

Three roles can be distinguished: Service providers, service consumers and service platform operators. Any social network user shall have the ability to offer or consume services, while the operator privilege needs to be assigned explicitly by existing trusted operators.

A common classification scheme for services is enclosed by pure real-world services and pure automatic web services. In between, a range of hybrid services with a certain amount of automation exist. For example, a cinema ticket can be sold electronically without user intervention while enjoying the evening in the cinema requires a real-world service in a dedicated location. Depending on the cinema operator, the film playback itself can be performed manually or automatically through online streaming providers. Pure tradeable real-world services consist of only a description and no implementation code.

The traded web services need to be self-contained, but may otherwise vary in terms of implementation technology and self-description. Specifically, services may be described syntactically (e.g. with a Web Service Description Language 1.1 (WSDL) file) or semantically (e.g. by a Web Service Modelling Language 1.0 (WSML) file), and they may ship with fixed or negotiable service level agreement (SLA) definitions (e.g. by a Web Service Agreement (WSAG) file). This concession places a burden on the service platform operator, but brings the necessary flexibility to attract service developers. Consumer actions like ad-hoc service usage and contracting are dynamically offered depending on the availability of declarative service description documents.

Services are either unclassified or belong to certain domains which represent their functionality. High-level domains such as Booking can be divided into more fine-granular domains such as Hotel Booking to increase the accuracy of functional search. In addition, non-functional properties like QoS, pricing schemes, service usage context, legal limitations and subjective ratings and service reputation can be specified. These properties give social network users a tool to select the most suitable service out of many functionally equivalent ones. For some services with real-world effect, the location is an important context attribute which should be honoured during the selection.

Services are deployed as packages, which in turn may be downloaded again to facilitate service sharing. Each service is owned by the provider and can be updated only by this person. The ownership attribute makes it possible to display the list of offered service for each person. Similarly, the list of used services is displayed based on short-term usage and long-term contracting relationships. Thus, each person in the social network may simultaneously act as provider and consumer.

Regarding the scope of social networks and other service brokering options, we consider a functionality commonly found in both business-oriented social networking sites and traditional service directories.

Traditional directories almost always operate on a local or less commonly on a national scale. They only recently embraced online directories. Examples include *Gelbe Seiten* and industry sector books in Germany, *Yellow Pages* in the Anglo-American countries or *Жовті сторінки* in Ukrainian cities. They contain entries for real-world services, sometimes only on a coarse-grained company level without the ability to identify the services themselves. For example, a bakery might or might not offer birthday and wedding party delivery services.

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Electronic service directories, on the other hand, only contain registry entries for web services. Examples include UDDI for static SOAP service queries and semantic service discoveries like DIANE for dynamic queries. The service, rather than the entity providing it, is the main object of interest in these directories. This is a major advantage over traditional directories when comparing different service offers. However, such directories are still mostly used inside companies and in limited public installations. More importantly, they lack accessible interfaces and integration into business procurement environments.

Social business networks closely resemble the traditional service directories in that the primary entities in them are companies or persons offering services. While they do not provide the service-centric view which dominates in web service directories, they are popular especially among young entrepreneurs who are already familiar with non-business social networks for school friends or university contacts.

A combination clearly missing from the brokering options as displayed in the simplified matrix below is the offering of tradeable web services through social networks. We intend to close this gap and afterwards be able to offer the entire matrix.

	Social Network	Service Directory
Real-world service	Social business networks	Yellow pages, local directories
Web service	*missing*	Web service registries, e.g. UDDI

Illustration 1: Matrix of service types and service brokering options

III. Implementation

The service delivery functionality has been realised with a custom installation of the TECЛA Service Platform [2]. This modular service-oriented middleware offers platform services for service provisioning, discovery, contracting, execution, monitoring and adaptation. Its main focus is service delivery in open environments such as the Internet of Services with inherently implied heterogeneity of service implementation and description technologies. What is missing from TECЛA is a unified user interface. This is a result from the loose coupling between its platform services, allowing many subsets of those to be combined freely. While most of the platform functionality is properly separated from individual web-based interface services and each such interface can be styled individually through CSS, it will cause a lot of work. Hence, creating an additional consistent user interface on top of the functional platform services increases the usability and raises the acceptance of the service trading concepts.

Among the available frameworks to construct social network sites, Noosfero [3] was chosen to be the most suitable one as it already includes the ability to let registered users create virtual organisations to offer products. This makes is suitable for both business and non-business sites. Noosfero uses Ruby on Rails, a popular web framework adhering to the model/view/controller software development pattern. A number of extensions to Noosfero were required to achieve a seamless integration between the social network software and the service platform. What follows is a brief description of these extensions.

- Service Platform Integration: We have identified integration points between social network users and the service platform and integrated them visually into Noosfero. The two main actions are the provisioning and the selection of services which correspond to specific invocations to the platform parts of Provider Wizard (a service deployment and management application) and ConQo (a semantic service discovery). Each service is represented by a separate page with provider and usage condition information, and can be commented on. The remaining interactive services of TECЛA are not yet integrated, the user will be redirected for e.g. contract creation and monitoring visualisation. We plan to enhance the integration level in the future especially regarding the user-friendly display of service performance data.
- Style: While Noosfero ships with a default style, each instance should have a unique look. We have created custom graphics and modified the CSS to achieve a unique design.
- Internationalisation: Noosfero can be translated into different languages. We have contributed translations into German and Russian in order to increase the global reach of the portal. This still leaves the possibility to set up custom installations for regional or national service brokering. Additional internationalisation aspects such as Unicode-safe URLs affect all Ruby-on-Rails applications and are expected to be solved at some point.
- Georeferencing: Online maps are among the most popular web applications. We have extended the use of maps in Noosfero with Mapstraction, a wrapper around a number of map and geocoding providers. This way, users can select the most suitable map provider for their region. Examples include the Ukrainian city of Kuznetsovsk which is highly detailed in OpenStreetMap but entirely missing from Google Maps, and satellite coverage of varying quality. Using geocoding for service consumers, providers and services, we obtain location context information which can automatically be used as part of the service discovery process.

There are additional integration aspects such as regular provider and consumer notifications about violated SLAs during the service execution. All of the changes can be classified into three categories: Useful for all Noosfero instances, useful for all instances with service trading enhancements, and useful for our sites only. According to the

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category, the changes will be propagated to the upstream developers through a distributed version control system.

The combination of Noosfero and TECЛA is shown in the following figure. The grey boxes correspond to the service delivery platform and the associated extensions to the social networking site. The implementation has achieved a unified user interface for service provisioning and consumption.

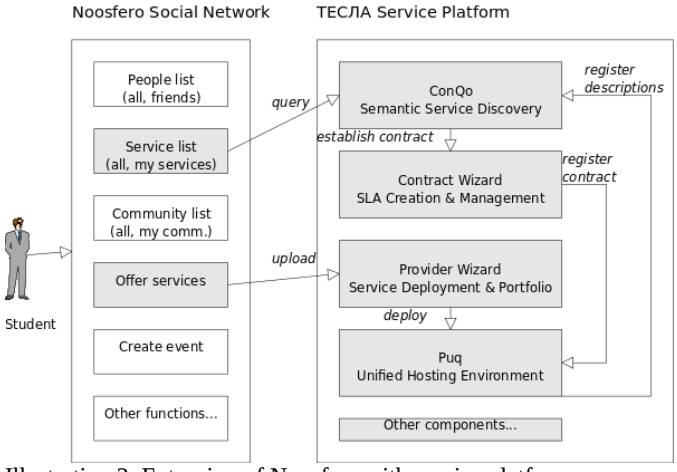

Illustration 2: Extension of Noosfero with service platform components from TECЛA

IV. Evaluation

An instance of the service-enhanced social network is currently used by us in a lecture on service-oriented distributed systems at Technische Universität Dresden. All students are subscribed to the Noosfero instance called Servomat. They can upload and share service packages, and they can query the discovery and negotiate contracts with found services for contract-bound execution. Some further modifications of Noosfero were specifically performed to represent lecture conditions. For example, user signups were disabled and user accounts created based on data retrieved from the web service interface of the faculty course enrolment service. Furthermore, categories such as Atomic Services and Composed Services were created which are useful in an academic context but would not be used in a public installation because users are simply not interested in service implementation details. Finally, the calendar within the social network was filled with lecture and exercise dates, giving students the opportunity to comment on each lecture.

About 18 students and 5 operators are currently using Servomat. We expect to gain 9 atomic SOAP services, 3 composite BPEL processes and 3 RESTful services by the end of the first lecture. While not a business scenario, the processes resemble real-world service trading except for the financial aspect which we intend to accommodate with play money. This small-scale experiment helps us to identify conceptual shortcomings while future medium-scale experiments will focus on acceptance and scalability issues. It also fits into current trends towards Lecture-as-a-Service [4].

We cannot yet at this point report any concrete numbers about the degree of service usage, contracting and contract violation frequencies and long-term service offering quality. Such experiments will be conducted by us in the near future in an open setting in addition to the closed-group lecture setting. This way, we expect to gain insight into the acceptance of the Internet of Services vision as a whole.

A screenshot of Servomat is shown in the following illustration.

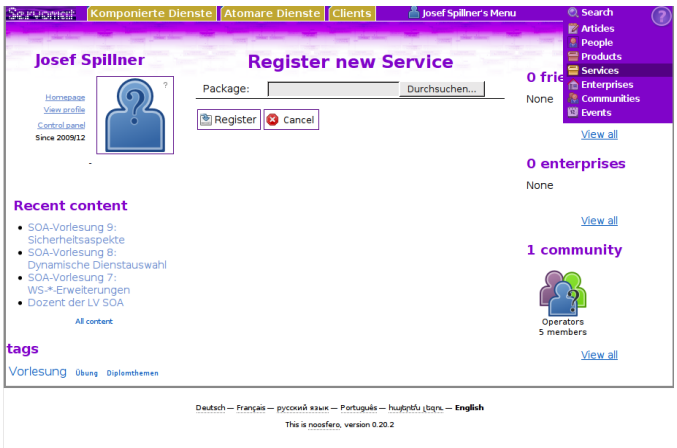

Illustration 3: Screenshot of the service offering page in the social network

V. Conclusion and Future Work

The combination of social networks with service delivery platforms has been proposed, explained and achieved through an integration of two existing software projects. The creation of a service community has thus become possible. Based on this work, we plan to actually launch a service community to evaluate the feasibility of medium-scale service hosting in open environments. We also intend to integrate user interface services and client delivery options in order to increase the attractiveness of the portal.

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