Selecting Web Services "On the Fly" According to Dynamic Social Communities Creation

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Abstract. Service selection is a central challenge not only in the context of a Service Oriented Architecture and SaaS (Software as a Service) but also in social Web. Once functionally sufficient services have been selected, a further selection based on non-functional properties (NFPs) becomes essential in meeting the requirements and preferences expressed by users' communities. Moreover, communities can dynamically be created and services can at run time be associated. This paper aims to propose an overview of research works in (dynamic) services selection and focuses on social Web. Finally, it aims defining an approach for service allocation "on the fly" according to dynamic creation of social Web communities.

1 Introduction

Social networking facilitates communication between peers, experience/content sharing, polling, community creation and profile-based advertisement. Social networking can be considered as one of the main Web2.0 achievements in the Internet; applications such as Facebook[1], Flickr[2] and LinkedIn[3] are successful examples of social networks with hundred millions of users. Social networks can also be helpful in the occasions such as collaborative work, knowledge sharing, learning, etc. Setup of social networks for such events should be fast, spontaneous, with minimum configuration and infrastructure, scalable and customized. Mostly, communities are static but Communities creation has to be dynamic to fit to users' needs and aims which are changing at any time. Moreover, communities are linked to resources such as services available to communities' members.

Service-oriented architecture (SOA) promises the ready creation of applications composed of dynamically selected components. However, service selection also implies an established level of trust between these components: the consumer trusts the service to provide the necessary functionality as well as quality. Current techniques for publishing and finding services (such as the Web Services Description Language

[1] http://www.facebook.com/
[2] http://www.flickr.com/
[3] http://www.linkedin.com/

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(WSDL)[4] and universal description, discovery, and integration (UDDI[5]) rely on static descriptions of service interfaces, forcing consumers to find and bind services at design time. Such techniques don't address runtime service selection based on a dynamic assessment of non-functional attributes, collectively known as quality of service.

In this paper, we propose a state of the art of services selection, and then, we focus on social Web. Even if Web service selection and adaptability is not a new research topic, we believe a new approach has to be defined in the context of social Web. As a first step of our research approach, we aim finding a suitable architecture to support dynamic service selection and adaptation at run time.

The remainder of this paper is organized as follows. Section 2 introduced the concept of Web service. State of the art on Web services selection is given in section 3. Section 4 describes our approach for service allocation "on the fly" according to dynamic creation of social Web communities. Conclusion and future works are given in section 5.

2 Web Service

Web services[6] (WS), like any other middleware technologies, aim to provide mechanisms to bridge heterogeneous platforms, allowing data to flow across various programs [21]. The WS technology looks very similar to what most middleware technologies looks like. Consequently, each WS has an Interface Definition Language, namely WSDL, that is responsible for the message payload, itself described with the equally famous protocol SOAP[7] (Object Access Protocol), while data structures are explained by XML[8] (eXtended Markup Language). Very often, WS are stored in UDDI registry.

3 Service Selection Overview

3.1 Web Service Selection

Web service selection is a complex process, in which the service that best satisfies user preferences is selected from a set of candidate services, usually returned from a service discovery process based on specific user requirements [23]. With the exponential growth of services, the selection based on the functional properties, presents a lack. In fact, the user must choose a service among several similar services (sometimes identical) which offer semantically the same functionalities. The approaches for WSs selection according to non-functional descriptions are numerous and can be classified into three broad categories:

[4] http://www.w3.org/TR/wsdl
[5] http://www.uddi.org/
[6] http://www.w3.org/TR/ws-arch/
[7] http://www.w3.org/TR/soap/
[8] http://www.w3.org/XML/

- Semantic based approaches,
- Graphical and Analytical Modeling Based Approaches,
- Social Based Approaches.

Semantic based approaches are mainly based on WSs semantic description to define the non-functional properties. Initially it was important to specify the non-functional properties ontology of the service and an appropriate vocabulary using a WS ontology model. However, WSMO[9] for example, defines a model of non-functional properties, but to our opinion, not enough flexible. Wang et al. propose in [24] the WSMO-QoS which is a complementary ontology, in order to provide more details on the non-functional aspects of WSs and make the model of non-functional properties extensible. Other approaches are interested in WS registries and propose an extension of the UDDI to allow the expression of non-functional properties. For instance, in [1], the authors propose a WS Quality of Service Manager (WS-QoSMan). This manager presents the model of non-functional properties which allow sending back the measures of WSs non-functional properties.

Graphical and Analytical Modeling Based approaches for WS selection use proved algorithms, pulled from operational research or graph theory. For instance, in [4], the proposed approach is based on the utility theory. The authors use a clustering method (K-mean) to partition the candidate services into k clusters. The utility function for a service uses its non-functional attributes and the number of services belonging to the cluster of the studied service.

Jaeger and Muhl [10] propose also an heuristic based approach. Their approach is based on genetic algorithms. They use a model of non-functional properties. This model aims to aggregate the non-functional properties of individual services to define the non-functional property of the composition, by using a workflow manager. Generally, the approaches based on a graphical modeling propose solutions of WSs selection that ensure the overall quality of the composition. The Measures of non-functional properties are offset between services of the composition.

Social Based approach is presented in following section.

3.2 Social Web Service Selection

3.2.1 Social Networks Overview

According to [18], the concept of “the virtual community” had been introduced in Howard Rheingold’s landmark novel by the same name [9], though he would later suggest the term “online social network”. Researchers use quite a number of terms, which are related to social networking sites:

- Internet Social Networking, which can be understood as the phenomenon of Social Networking on the Internet. Hence, the concept subsumes all activities by Internet users with regard to extending or maintaining their social network [17].
- Social Web sites, defined as those Web sites that make it possible for people to form online communities, and share user-created contents [13].
- Social networking services, are online communities that focus on bringing togeth

[9] http://www.wsmo.org/

er people with similar interests or who are interested in exploring the interests and activities of others [15]. Currently most popular definition is one proposed by Boyd and Ellison in [6]. They define Social Network Sites as "web-based services that allow individuals to: (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system.

Moreover, SIOC[10] (Semantically-Interlinked Online Communities) project provides a semantic Web ontology for representing rich data from the social Web in RDF (Resource Description Framework). SIOC is used to describe objects commonly used on social networking sites and their relationship. It reuses the objects defined in other ontologies like FOAF[11] (Friend Of A Friend) for expressing personal profile and social networking information, SKOS[12] (Simple Knowledge Organization System) to describe the content, Dublin Core[13] and RSS (Really Simple Syndication).

3.2.2 Selection

Identifying the set of resources that are expected to receive the majority of requests in the near future is at the basis of most content management strategies of any Web-based service. Social service selection is defined as finding the desired WSs by using information from other users based on their experiences [5]. Social service selection, sometimes referred to as social navigation, is characterized by its personalization, or how people act within a space, and dynamism [7]. According to Singh and Huhns [20], social-based service selection has three main approaches:

- Recommendations based approaches
- Reputation based approaches
- Referral based approaches

Using collaborative-based filtering in WS selection is a new emerging trend; most of WS recommendation approaches use WS ratings based on "subjective opinions" of service consumers [19]. In [16], Metrouh et al. proposed in addition to the collaboration-based associations to build Web services communities, recommendation-based associations to define a Web services discovery process. A collaborative filtering based recommender system can make good quality recommendations when the system has enough required data. But the lack of data generates two problems such as cold-start and data sparseness [2].

Reputation reflects what is generally believed about an entity character or behavior [12]. A reputation system collects, distributes, and aggregates feedback from other members about each member past behavior. Reputation systems have been used to predict the trustworthiness of service providers [11]. With automated ratings likely to be used with WSs, elicitation problems may still exist due to privacy issues [14], or disinterested users.

The referral approach is characterized by an agent A querying about a service to

[10] http://sioc-project.org
[11] http://www.foaf-project.org/
[12] http://www.w3.org/2004/02/skos/
[13] http://dublincore.org/

another agent B among its neighbors. Moreover, each agent maintains expertise and sociability about other agents [20]. Expertise is the ability of an agent to perform a service while the sociability is the ability of an agent to refer other accurate agents. These two factors are updated and based on service ratings [5].

3.3 Dynamic Services Selection and Adaptation

Some research works use Aspects to adapt WSs. Ferraz Tomaz et al. [14] proposed a tool to dynamically weave aspects to WSs. Ben Hmida et al. [3] extended the solution to adapt BPEL on run time.

OSGi[14] (Open Services Gateway initiative) is a Java-Based platform, consisting of three major inseparable components: the Framework, the Life Cycle Model and the Service Registry. OSGi is a famous dynamically adaptable service-oriented architecture which can be viewed as a service based middleware supporting dynamic Web services selection and adaptation. Bundles are packages of functionality that consist the building blocks of OSGi. It can, enclose WSs; it can become part of a bigger SOA with bundles as Web Services. OSGi proposes a specific bundle to support ontologies.

SUPER[15] thus proposes to combine semantic Web services and Business processes in order to create one consolidated technology, termed semantic Business Process Management (SBPM) [25], which would support both agile process implementation and sophisticated process management through knowledge driven queries issued to the business process space in the form of logical expressions. SUPER is based on three levels: business level (strategic and operational), technical level (processes, services and implementation). The proposed architecture is based on Web Service Ontology (WSMO[16]) and Web Service modelling Language (WSML[17]). Web Service Execution environment (WSMX[18]) is considered as a service Broker in Semantically Enabled Service Oriented Architecture (SESA for short) [22].

Moreover, some questions remain unaddressed like: (1) how to dynamically create a user community in a social network. (2) How to dynamically allocate a WS to a user community. (3) How to maintain social networks to reflect changes in Web services. (4) How to capture these changes and (5) how to navigate through these networks to dynamically select the desired WSs.

In this paper, as a first step in our research work, we aim to propose an architecture to support dynamic service selection and adaptation.

4 Proposed Architecture

The new approach architecture (Figure 1) presents several linked platforms such as: the Web semantic based platform and the OSGi platform.

[14] www.osgi.org/
[15] http://www.ip-super.org
[16] http://www.w3.org/Submission/WSMO/
[17] http://www.w3.org/Submission/WSML/
[18] http://www.wsmx.org/

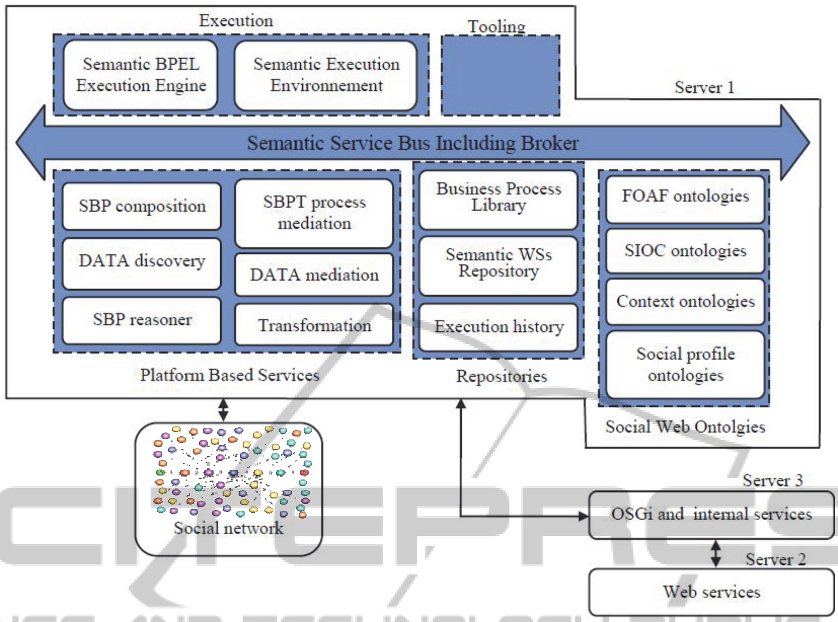

Fig. 1. Architecture for WSs dynamic allocation.

The Web semantic platform is based on ESA framework and SUPER architecture. It can include WSMX broker. The Web semantic platform is divided into several modules:

- Platform based services which includes Semantic Based Process composition, discovery and reasoned, but also, process and data mediation and Transformation.
- Execution module: the use of semantic WSs provides the flexibility required in the execution phase. At runtime goals can be bound to specific semantic WSs selected on the basis of the existing conditions and informed by contextual knowledge, which includes monitoring data.
- Tooling to support modeling and supervision: The Modeling Tool accesses the BPL to store and retrieve process artefacts. The supervision Tool is used at the execution phase, allowing users to manage the lifecycle of components and processes, and in the Analysis phase, where it offers a view into the execution environment.
- Repositories required to manage mediation: several repositories that store information valid with the ontological stack are used: (1) The Business Processes Repository is a shared database of information on business processes. It supports the basic operations on modeling artifacts like addition, update, retrieval and removal. (2) The Execution History Repository captures audit trails and additional information for supporting business process analysis. (3) The Semantic SWs Repository stores descriptions of Semantic WSs.
- Social Web Ontologies including FOAF and SIOC but also a contextual ontology and social profile ontology, which we have to define, are built upon the use of the WSMO, as the core Semantic Web Services conceptualization and WSML as the

family of representation languages supporting the specification of ontologies, goals, Web services and mediators.

The interoperability between SUPER and OSGi allows us connecting the two platforms. So, OSGi can allow dynamic selection and adaptation of services which can be provided from different service providers. We are convinced SUPER can be considered as an OSGi bundle specifically used to manage ontologies.

5 Conclusions and Future Works

This paper aims to propose an overview of research works in (dynamic) services selection and focuses on social Web. We proposed an architecture for service allocation "on the fly" according to dynamic creation of social Web communities. This architecture is based on the interaction between a Web semantic platform and OSGi via remote services hosted on servers on a Cloud mode.

This work is a first architectural proposal. We aim to improve our state of the art about dynamic selection and adaptation on semantic Web services and specifically in social semantic Web services. We have to compare and to test the different studied architectures, and so, to prove our current approach is the suitable one. Then, we have to define what is context and social Web profile ontologies. We shall implement and test the architecture with concrete case study.

References

1. Al-Masri, E., Mahmoud, Q. H.: Discovering the best Web service. In: Proceedings of the 16th international conference on World Wide Web, pp. 1257–1258, Banff, Alberta, Canada (2007)
2. Amatriain, X., Lathia, N., Pujol, J.M., Kwak, H. and Oliver, N.: The wisdom of the few: a collaborative filtering approach based on expert opinions from the web. In: Proceedings of the 32nd international ACM SIGIR conference on Research and development in information retrieval SIGIR '09 ACM, pp. 532-539 (2009)
3. Ben Hmida, M., Tomaz, R. F., Monfort, V.: Applying AOP concepts to increase Web services flexibility. Journal of Digital Information Management (JDIM), vol 4, no. 1, pp. 37–43 (2006)
4. Ben Mabrouk, N., Beauche, S., Kuznetsova, E., Georgantas, N., Issarny, V.: QoS-Aware Service Composition in Dynamic Service Oriented Environments Middleware. In: Proceedings of the International Conference on Middleware, Urbana, IL, USA 2009. LNCS, vol. 5896, pp. 123-142. Springer (2009)
5. Billionniere, E., Greiman, D. and Gosha, K.: A Comparison of Social Service Selection Techniques. Eighth IEEE International Conference on Dependable, Autonomic and Secure Computing (DASC-09), pp. 260 – 265, Chengdu, China (2009)
6. Boyd, d. m., Ellison, N. B.. Social Network Sites: Definition, History and Sholarship. Journal of Computer-Mediated Communication, vol. 13, no 1, pp. 210-230 (2008).
7. Dieberger, A., Dourish, P., Höök, K., Resnick, P. and Wexelblat, A.: Social navigation: techniques for building more usable systems. Interactions, vol. 7, no. 6, pp. 36-45 (2000)
8. Feraz Tomaz, R., Ben Hmida, M., Monfort, V.: Concrete Solutions for Web Services Adaptability Using Policies and Aspects. Int. J. Cooperative Inf. Syst, vol. 15, no. 3, pp.

415-438 (2006)
9. Howard, R.: The virtual community - Homesteading on the Electronic Frontier, Addison-Wesley (1993)
10. Jaeger, M. C., Muhl, G.: QoS-based Selection of Services: The Implementation of a Genetic Algorithm. In: Proceeding of KiVS (Kommunikation in Verteilten Systemen) in Workshop: Service-Oriented Architectures und Service Oriented Computing, pp 359-370, Bern, Switzerland (2007)
11. Jøsang, A.: Online reputation systems for the health sector. Electronic Journal of Health Informatics, vol. 3, no. 1. (2008)
12. Jøsang, A., Ismail, R. and Boyd, C.: A survey of trust and reputation systems for online service provision. Decision Support Systems, vol. 43, no. 2, pp. 618-644 (2007)
13. Kim, W., Jeong, O.-R., Lee, S.-W.: On social Web sites. Information Systems, vol. 35, no 2, pp. 215-236 (2010)
14. Lin, K.J., Lu, H., Yu, T. and Tai, C.: A reputation and trust management broker framework for web applications. In: Proceedings of the 2005 IEEE International Conference on e-Technology, e-Commerce and e-Service (EEE '05), Published by the IEEE Computer Society, pp. 262-269 (2005)
15 Marcus, A., Krishnamurthi, N.: Cross-Cultural Analysis of Social Network Services in Japan, Korea, and the USA Internationalization, Design and Global Development. Proceedings Vol. 5623, pp. 59-68 (2009)
16. Metrouh, A., Seridi-Bouchelaghem, H., Mokhati, F.: Web Services Discovery - A Novel Social Networks Approach based on Communities. In: Procedings of the 14th International Conference of the Entreprise Information Systems (ICEIS 2012), vol. 2, pp. 316-319, Wroclaw, Poland (2012)
17. Richter, D., Riemer, K., vom Brocke, J., & Große Böckmann, S.. Internet Social Networking - Distinguishing the Phenomenin from its Manifestations in Web Sites. 17th European Conference on Information Systems (2009)
18. Ryan, J. A.: The Virtual Campfire: An Ethnography of Online Social Networking. Wesleyan University (2008).
19. Sherchan, W., Loke, S.W. and Krishnaswamy, S.: A fuzzy model for reasoning about reputation in web services. In: Proceedings of the 2006 ACM symposium on Applied computing SAC'06, ACM, pp. 1886-1892 (2006)
20. Singh, M.P. and Huhns, M.N., Service-Oriented Computing: Semantics, Processes, Agents, John Wiley & Sons, Ltd, Chichester, West Sussex PO19 8SQ, England (2005)
21. Staab, S., van der Aalst W., and Benjamins, V. R.: Web services: been there, done that?. IEEE Intelligent Systems [see also IEEE Intelligent Systems and Their Applications], vol. 18, no 1, pp.72–85 (2003)
22. Vitvar, T., Zaremba, M., Moran, M., Zaremba, M., Fensel, D.: SESA: Emerging Technology for Service-Centric Environments. IEEE Software, vol. 24, no 6, pp. 56-67 (2007)
23. Vitvar, T., Mocan, A., Kerrigan, M., Zaremba, M., Moran, M., Cimpian, E.,Haselwanter, T. and Fensel, D., 'Semantically-enabled service oriented architecture: concepts, technology and application'. Service Oriented Computing Applications, vol. 1, no. 2, pp. 129-154 (2007)
24. Wang, X., Vitvar, T., Kerrigan, M., Toma, I.: A QoS-aware selection model for semantic Web services. In: Proceedings of the 4th International Conference on Service Oriented Computing (ICSOC 2006), Springer-Verlag LNCS series, pp. 390-401, Chicago, USA (2006)
25. Wetzstein, B.; Ma, Z.; Filipowska, A.; Kaczmarek, M.; Bhiri, S.; Losada, S.; Lopez-Cob, J.M.; Cicurel, L.: Semantic Business Process Management - A Lifecycle Based Requirements Analysis. In: Proceedings of the Workshop on Semantic Business Process and Product Lifecycle Management (SBPM-2007), Vol. 251, CEUR-WS (2007)