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Improving the Response Time of an Isolated Service by using GSSN

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Abstract- A global Web services to support the delivery of service -based economy have had a tremendous impact on the web as a potential silver bullet. However , despite the excellent progress of a web rate has been significantly lower than anticipated at the beginning of their uptake. The isolation of services, the lack of social relationships among related services, inadequate trade-offs between the expressivity and semantics of the service descriptions, and poor scalability, exponentially expanded search time in large search spaces, have been identified as reasons for the poor uptake. In this paper, we propose Connecting the islands as a separate service within the global social service network to improve the services' sociability for service discovery. First, we propose linked social service-specific principles based on linked data principles for publishing services on the open Web as linked social services; then, social link is proposed for linking distributed services according to the quality of social link. Next, we suggest a new platform for assembling the global social service network following linked social service-specific principles based on complex network theories; Finally, experimental results show that our approach can solve the quality of service discovery, recommendation and composition problem, improving both the scalability issue, sociability issue and the success rate by discovering service toservice based on the global social service network.

Keywords: Web services, services, global scale, social link, composition problem, scalability and sociability.

I. INTRODUCTION

Web services were expected to have a tremendous impact on the Web, as a potential solution for supporting a distributed service-based economy on a global scale. However, despite outstanding progress, uptake of the Web has been significantly less than initially anticipated. On the one hand, the number of services available on the Web is far less than expected. For example, one of the largest indexes of publicly available Web services currently provides 28,500 Web services with their corresponding documentation. While there are trillions of Web pages available on the Web, the number of publicly available Web services in one large

composition service system is not greater than 4000, which is very small. Furthermore, other academic inquiries into crawling and indexing Web services on the Web have found far smaller numbers of services.

On the other hand, a large body of research about Web service discovery, recommendation and composition has been devoted to a keyword-, semantic- or QoS based discovery and recommendation to improve the quantity and quality of service matching performance. Nevertheless, from a recent survey, most services published on the Web have not been used, and only a few of the services on the Web have been discovered, composed or invoked. These meager results, handicap the service environment, resulting in a vicious circle of creation, publication, location, and composition of services in the computer industry. From an investigation of several technological perspectives of Web services, the main reasons can be inferred as the 2 following.

In this paper, to address the issues, we propose a methodology to drive an innovation from service islands to a global social service network (GSSN) to support service's social activities. In the global social service network, services described in lightweight ontologism are interlinked to relate services from different sources functionally across the Web and in turn external services may link to them functionally using social link. To connect isolated service islands, linked social service is proposed to connect service islands into the global social service network with social link by following links social service-specific principles. To develop the service's sociability for improving the quality of service discovery, recommendation and composition, the global social service network is constructed considering not only the service's own functional and nonfunctional detail, but also the service's past social interactions and popularity, to provide a network model having properties that reflect the social reality of supporting the service's social activities, such as Link-as-you-go, Workflow-as-a-Service, Recommend-as-you-go. To improve the scalability issue, we preprocess the time-consuming ontology reasoning and other semantic-related computing at the GSSN construction stage and reduce the search dimension by mapping the GSSN into a service cluster network by following social links. Finally, linked social service is described by Service-Of-A-Service (SOAS) model, which is a minimal and common conceptual model used in lightweight ontologism for capturing the semantics of services and reducing overload for expressivity of services.

II. BACKGROUND AND RELATED WORKS

2.1 Functionality and QoS

Web services and Web APIs are service models that consider only the functionality and QoS of service, but not semantic annotations or the service's social activities. On the one hand, the stack of Web service technologies has brought a considerable level of complexity and yet suffers from the fact that descriptions are purely syntactic. As a consequence, discovering, composing, and mediating Web services remain predominantly manual tasks. As well, current discovery techniques are registry-based, such as UDDI; however, UDDI was not adopted widely enough. One of the main reasons for the lack of success of UDDI is the isolation of the services without social relationships among related services in these registries. Services know only about themselves, but not about their peers; the registries do not support expressive queries or guarantee the quality of query results.

2.2 Service Semantics

SWS have long tried to overcome Web service limitations by enriching services with semantic annotations to support their discovery, composition, and execution better. Until now, however, the impact of

SWS on the Web has been minimal, even though they demonstrate the advantages of semantic annotations in discovering services, particularly in terms of accuracy and when dealing with heterogeneous data models.

2.3 Service Sociability

Service's sociability is the skill, tendency or property of being sociable or social, and of interacting well with related services, which is supported by the network models we refer to here as service social networks. The issue with service's sociability is how best to capture the way Web services interact via service social networks, and to know with whom they have worked in the past and with whom 10 they might work in the future.

2.4 Linked Data: Spawning a new wave of the Services

Linked data technology provides the benefits of machine-understandable data from the Web and improved data discovery by using the links between data items. The semantic annotation is done using a lightweight ontology so that economic and efficient annotation and the deployment of linked data are enabled. The linked data are managed using linked data principles that suggest: 1) using URIs for things; 2) using HTTP URIs when people search for data; 3) using standards (RDF, SPARQL) for looking up a URI; and 4) including links to other URIs for rich discovery.

III. Motivating example for Service Composition

Traditional service composition approaches (e.g., the QoS-based and semantic-based approaches) have considered services as isolated service islands, as shown in Figure 3.1 (a), which leads to several challenging issues, such as poor scalability, exponentially expanded search time in large search spaces, and the lack of services' sociability because of the isolation of services. Note that the Web services {wi} used in Figure 3.1 are illustrated in Table 3.1. In this thesis, to improve the quality of service composition, we aim to study quantitatively the relationship between services and to efficiently construct a GSSN by connecting isolated services, as shown as Figure 3.1 (b). Our objective is to develop a quality-driven service composition approach by exploiting the GSSN for better quality of service composition, as shown in Figure 3.1 (c). The challenges are the following: 1) What are the principles for interlinking distributed services? 2) How can we quantitatively measure the strength of relationships between services? 3) How can we systematically construct the service network model with generic aspects (e.g., growth, adaptation, competitive and preferential attachment) of the GSSN? and 4) How can we exploit the GSSN for better quality of service composition, providing Workflow-as-a-Service? To solve these problems, we first propose to link social service-specific principles based on linked data principles to combine isolated services into a GSSN. To measure the strength of relationships between services quantitatively, we propose the quality of social links, considering not only a service's own functional and nonfunctional detail but also the service's past social interactions and popularity. Based on the quality of social links, we further develop a novel platform for constructing GSSNs to connect isolated service islands, considering four generic aspects of the GSSN. Finally, we propose a novel quality-driven service composition approach to enable exploration of the GSSN for better quality of service composition.

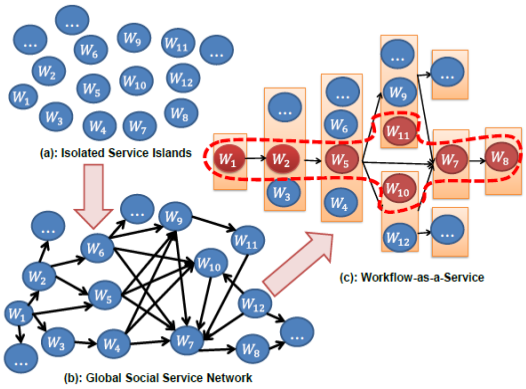

Figure 1: Quality-driven service composition, illustration based on GSSN

IV. Architecture Global Social Service Network

To overcome the limitation of the current service model and the problem of service discovery, recommendation and composition problem, firstly, we propose a methodology to drive an innovation from service islands to a global social service network to support service's social activities. Then based on global social service network, an effective service discovery approach called link-as-you-go has been proposed to enable exploring service-to-service; thirdly, we propose an effective social influence-aware service recommendation approach, which facilitates service-to-service exploration based on a GSSN; Finally, A novel quality-driven workflow-search algorithm was developed based on the GSSN and using quality of social link to effectively improve the quality of service composition. The whole architecture of our proposed approach is shown as Figure 3.3. And details about the motivation and the proposal of these four approaches are described as follows, Table 3.3 shows the major notations used throughout this paper.

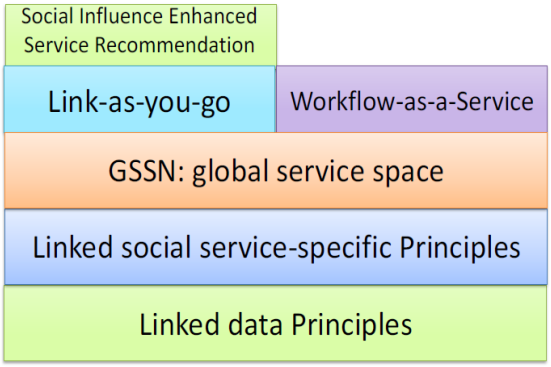

Figure 2: Entire architecture of proposed approach.

In this thesis, to address the scalability and sociability issues, we propose a methodology to drive an innovation from isolated service islands into GSSN to improve the best quality of service composition. To develop the service's sociability, the GSSN is constructed considering not only the service's own functional and nonfunctional detail, but also the service's past social interactions and popularity, to provide a network model with properties that reflect the social reality for enhancing the service's social activities. To improve the scalability issue, our quality-driven service composition approach not only preprocesses the time-consuming ontology reasoning and other semantic-related computing at the GSSN. Construction stage, but also reduces the searching space for QoS optimal by mapping the GSSN into a service cluster network with local optimization of aggregated QoS attributes.

To address these issues, we propose a methodology that facilitates the evolution of service islands into a global social service network, thereby enabling the development of social influence-aware service recommendation approaches. A GSSN is constructed to connect isolated service islands, by considering a service's functional and nonfunctional features, as well as the service's past social interactions and popularity, which generates a network model that reflects the social context of a Web recommendation service. To analyze and quantify the social influence and enhance the QoS recommendation, we propose a flexible model of the effective awareness at the criterion level (micro level) of social influence. This model provides a quantitative measure of the strength of influence for different fundamental social factors. We also propose a novel social influence-aware service.

Recommendation approach that explores the GSSN based on a recommend-as-you-go method. Our contributions may be summarized as follows.

1. We propose a flexible model of the effective awareness of social influence, which allows the quantitative measurement of the strength of influence.

2. We propose an effective social influence-aware service recommendation approach, which facilitates service-to-service exploration based on a GSSN.

3. Experiments conducted demonstrated that recommend-as-you-go can improve QoS recommendations and provide rapid query responses, with a low usage threshold and high accuracy, based on user preferences.

V. Revolution: From Service Islands to Linked Social Services

To connect distributed service islands into a service social network, we first propose to link social service-specific principles that provide a basic recipe for publishing and interlinking services into social service networks based on linked data principles. Then we suggest linking social service, which is built on the Web of data using lightweight ontologies, in which services are linked to related services and are being linked by them by following the linked social service-specific principles. Finally, we give a novel service model for linking social service annotation.

5.1 Linked Social Services-specific Principles

Before any significant uptake of services can take place on the Web, proper mechanisms for creating, publishing and discovering services must be in place. In this respect, our previous review of the state of the art shows that:

•Linked data provide best practices for publishing and interlinking structured data on the Web.

•Lightweight ontology's, such as RDF, are the "golden mean" of the expressivity and semantics of the service model.

•Service's sociability is extremely significant for providing a better quality of service discovery and composition.

•Connecting distributed service islands into a single service social network provides a network model for service's social activities.

This review inspires us to construct service social networks based on linked data principles to enhance service's sociability for providing a better quality of service discovery. Here we propose to link social service-specific

principles that include four items to provide a basic recipe for publishing and connecting services into a social network service.

Finally, to develop service's sociability for social activities, the fourth principle advocates considering the service's past social interactions and the service's popularity for interlinking services into a network model to reflect service social reality. If two services worked together frequently in the past, then they are more likely to work together in the future.

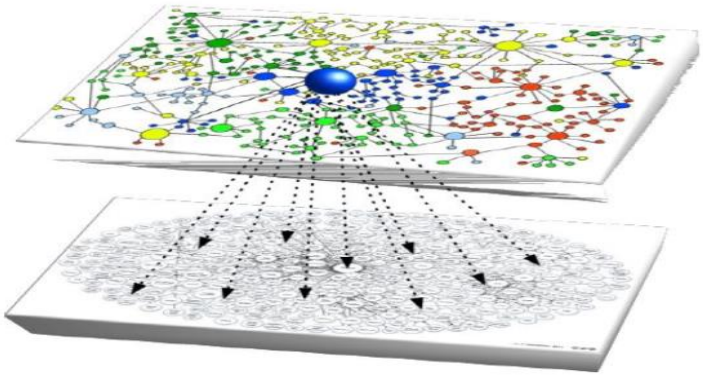

Figure 3: Linked social service built upon the Web of data and linking together to related services with social link

By following linked social service-specific principles, services can be published in the service social network as linked social services, denoted by nodes on the top layer in Figure 3. Linked social services are built upon the Web of data and link to related services and are linked by related services using social links into a service social network for social activities.

5.2 Service-Of-A-Service (SOAS) Model

To publish services on the Web of data to construct a network model for enhancing service's sociability, it is necessary to provide a common vocabulary based on the existing Web standards to be able to describe services in a way that allows machines to automatically locate and filter services according to their functionality, social reality, or the data they handle, and to support their automated invocation appropriately. Here we propose the SOAS model to describe linked social services in a way that is machine readable, where the meaning is explicitly defined, linking to other external related services, and the service can in turn be linked to by external services functionally using social link.

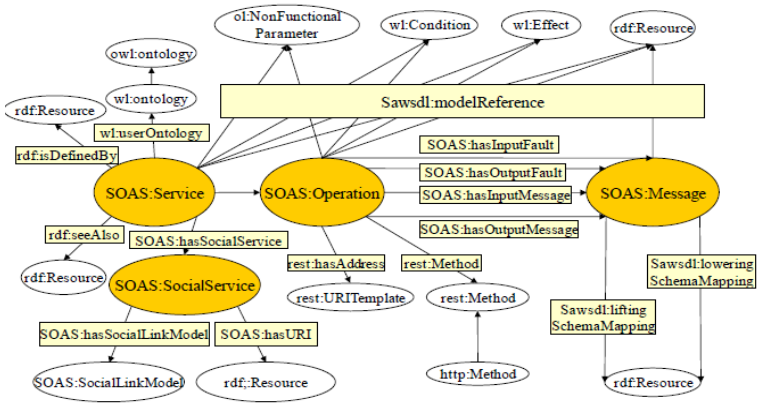

Figure 4: Model of SOAS

VI. GSSN: Global Social Service Network

Linked social service was proposed to overcome the current service model by using lightweight ontology's and interlinking isolated service islands into a global social service network to develop the service's sociability for more effective service discovery and composition. In this Chapter, we will suggest a new framework for constructing a global social service network following links social service-specific principles.

Definition 6.1 (Global Social Service Network)

A global social service network is a service social network for service's social activities; its structure is a directed graph G = <V, E> on the Web, where:

- *V represents a set of nodes, with each node being a linked social service; and*
- *E represents a set of direct edges, with each edge corresponding to social link.*

A global social service network connects cross-domain distributed services together by social link. On the one hand, just as RDF links in the Web of data connect distributed data into a single global data space, linked social service enables social links to be formed between services in different service sources, and therefore connect these services into the global social service network on the Web; this enhances the service's sociability and collaboration for service discovery and composition. On the other hand, the global social service network describes service societies' features such as social relations and social status, and provides a basis for

VII. Implementation

SOAS is a platform to construct global social service networks following linked social service-specific principles; it enables the exploitation of the global social service network, providing LSSaaS. SOAS uses the SOAS model as its core conceptual model, which provides a minimal and common conceptual model in lightweight ontologies and uses social links to connect service islands into a global social service network using the quality of social link.

To show how SOAS supports construction of a global social service network and to show the exploitation of the global social service network, here we briefly overview the SOAS architecture. It has four main modules:

• First, the Translator module receives isolated services based on service descriptions such as those of OWL-S, WSMO or WSDL, and translates them into RDF descriptions based on the SOAS model. DBpedia, a common vocabulary on the Web of data, provides lightweight ontologies for service semantic annotation.

• Second, the recommender module recommends social services for isolated services using the recommendation algorithm 1 based on the quality of social link.

• Third, the GSSN module adds services into the global social service network with social links using the construction procedure, it is used as an RDF repository for storage, inferencing and querying of services.

• Finally, application module offers service consumers approach to enable exploitation of the global social service network simply by following the social links, providing link-as-you-go, Workflow-as-a-Service and Recommend-as-you-go.

VIII. Conclusion and Future work

A global Web services to support the delivery of service -based economy have had a tremendous impact on the web as a potential silver bullet. The isolation of services, the lack of social relationships among related services, inadequate trade-offs between the clarity and semantics of the service descriptions, and poor scalability, exponentially expanded search time in large search spaces, have been identified as reasons for the poor uptake. In this , we propose connecting the isolated service islands into a global service network. Which improve the services' sociability.

Firstly, to improve the quality of service discovery, we have proposed a methodology to drive an innovation from isolated service islands to Linked social service. Thus, services can link to and be linked by related services functionally on the Web to a global social service network, allowing exploration from service to service. Our approach can solve the quality of the service discovery problem, improving not only the service discovering time, but also the success-rate by discovering service-to-service based on the global social service network.

Secondly, to solve the problems of isolated islands of services and to enhance services' sociability for improving the quality of service composition, we have proposed a methodology that progresses from isolated service islands to a GSSN that allows us to provide workflow as a service. To improve the scalability of service composition, our approach preprocesses the time-consuming ontology reasoning and other semantic-related computing at the GSSN construction stage and reduces the search dimension by mapping the GSSN into a service cluster network by following social links. Success rate of service composition is improved by a quality-driven workflow-search method it considers not only a service's own functional and nonfunctional detail, but also the services' earlier social interactions.

Thirdly, we developed a method for connecting isolated services into a GSSN to facilitate social influence-aware service recommendation. In a GSSN, Web services concentrate on their own functional and nonfunctional details all over their service life cycles.

This approach provides more prority for the secured services hence it is resulted in effective output for the intendent search.

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