APPLYING SEMANTIC WEB SERVICES

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ABSTRACT

The In Medical Analysis field, patients often must visit a multitude of laboratories related web sites in order to check availability, prices, result duration and find the nearest laboratory. To overcome these limitations the Virtual Laboratory Medical Analysis (VLMA) prototype system proposes applying Semantic Web Services for scheduling outpatient tests in order to discover the suitable Laboratory. The proposal prototype is Web Service Modeling Ontology (WSMO) based.

Keywords : Ontology, Semantic Web Services, web Services, Virtual laboratory Medical Analysis.

I. INTRODUCTION

Web Services are software components that are accessible via the Web. However, their concomitant descriptive languages, Web Services Description Language (WSDL), do not offer sufficient semantic richness that can be machine processable semantics. Human intervention is often needed to interpret the meanings in order to discover, compose, and invoke Web Services. This can be time consuming and error-prone.

The semantic web researchers have proposed to augment Web Services with a semantic description of their functionality in order to facilitate their discovery and integration. This technology, combination of Web Services with Semantic Web technology,
is referred as Semantic Web Services (SWS). SWS(s) have the potentiality to alter the way knowledge and business services are provided and used on the web.

In our work, we are interested in discovery of Semantic Web Services taking into account existing approaches. In our work, we are interested in discovery of Semantic Web Services taking into account existing approaches. Our prototype system proposes applying Semantic Web Services for scheduling outpatient tests (blood tests, urine …etc.) in order to discover the suitable Laboratory. This paper presents a state of the art of current enabling SWS technologies and describes the proposed prototype.

The paper is organized as follows: the reminder of Section 2 summarizes the main approaches related to Semantic Web Services technology. Next, in Section 3, we propose a prototype process according to medical analysis field using the WSMO ontology, the prototype is explained in detail. In section 4; we conclude the paper and outline future work.

II. SEMANTIC WEB SERVICES APPROACHES

Several approaches have already been suggested for adding semantic to Web Services. Semantics can either be added to currently existing syntactic Web Service standards like UDDI or WSDL. Or services can be described using some ontology based description language. The Major initiatives in the area of (SWS)s are documented by W3C member submissions: like OWL-S [1] and WSMO [2] and WSDL-S [3].

OWL-S (Ontology Web Language for Services); a description language that semantically describes Web Services using OWL ontologies. OWL-S services are mapped to WSDL operations, and inputs and outputs of OWL-S are mapped to WSDL messages. WSDL-S is an evolutionary and backwards compatible extension of the existing Web Services standards and descriptions language, which augments the expressivity of WSDL with semantics in an arbitrary semantic representation language.

WSDL-S provides a means to supply semantic information, but actual semantic functionality has to be provided by additional components, which are not part of the WSDL-S initiative. The WSDL-S proposal was superseded by SAWSDL [4], a W3C recommendation, which is a simple and generic mechanism for semantically annotating Web Service descriptions. SAWSDL is a restricted and homogenized version of WSDL-S in which annotations like preconditions and effects have not been explicitly contemplated.

The third approach, the Web Services Modeling Ontology, WSMO (review in detail next), provides ontological specifications for the description of Semantic Web Services. One of the main objectives of WSMO is to give a solution to application integration problems for Web Services by providing a conceptual framework and a formal language for semantically describing all relevant aspects of Web Services. WSMO is the only initiative which has an explicit notion of mediation.

Furthermore, WSMO is the only standard for which there exist several implementation environments which aim to support the complete standard. For these reasons WSMO is used as our Semantic Web Services technology throughout the rest of this paper.
III. THE PROPOSED PROTOTYPE

Motivation

It’s clear that finding out the interested services, without using mechanize methods is very difficult and time consuming. This issue is similar to search in web pages without using browsers. Service consumer can be user, another service or a program. Thus using of automated mechanisms to finding out services is very important.

Semantic Web Services technology can optimize several processes in the domain of e-health, especially in Medical Analysis. These processes are mainly related with human interactions and consequently, with the costs associated to them. Hence the main benefit of applying SWS technology is that it could permit to develop and maintain e-health services with lower costs.

The use of Semantic Web Services technology can optimize this manual process by allowing search in available registries, so that the new Web Services that have been deployed can be discovered.

Fig.1 presents two scenarios that motivated us to develop this prototype. In the first scenario, for an outpatient test (blood test, urine test, etc.), the patient often must visit a multitude of laboratories related web sites in order to check availability, prices, result duration and also to find the nearest laboratory. Using phone directories is also needed if some web site laboratory is not available. The patient should contact each laboratory by phone or email to get the necessary information like, address, distance from home, price, possible results, etc. This method is very difficult and time consuming, especially when the number of laboratories is very important.

In the second scenario, to overcome these limitations, the Virtual laboratory Medical Analysis (VLMA) prototype system proposes applying Semantic Web Services for scheduling outpatient tests (blood tests, urine tests, etc.) in order to discover the suitable Laboratory. Our proposal is Web service Modeling Ontology (WSMO) based process.

As shown in the figure, the patient sends a request to the portal with patient preferences. We search suitable Web Services in the WSMX server where all the Web Services are stored. At last, the patient receives one or more Web Services according to his request. We will explain in detail the main architecture of the prototype.

![Motivation Scenario Diagram](image.png)

**Fig. 1 Motivation Scenario**
The WSMO Framework

WSMO is a formal ontology and language and identifies four main top-elements: Ontologies that provide the terminology used by other elements; Goals that state the intentions that should be solved by Web Services; Web Services descriptions which describe various aspects of a service; Mediators: to resolve interoperability problems.

Each of these WSMO Top Level Elements can be described with non-functional properties like creator, creation date, format, language, owner, rights, source, type, etc.

WSMO comes along with a modeling language (WSML) and a reference implementation (WSMX).

WSML (Web Service Modeling Language) is a formalization of the WSMO ontology, providing a language within which the properties of Semantic Web Services can be described.

WSMX (Web Service eXecution Environment) provides an architecture including discovery, mediation, selection, and invocation and has been designed including all required supporting components enabling an exchange of messages between requesters and the providers of services.

Architecture of the Prototype

Fig.2 presents the architecture of the prototype. The patient communicates with the VLMA portal via the HTTPS protocol, which provides a secure communication channel.

The essential functionalities of our prototype process applying to Medial Analysis field handling as shown in Figure 2 are: Provide a friendly interface for patient interaction and discover suitable Web Services according to patient preferences (availability, distance, price, etc.,).

Our prototype consists of three Web services, in which Web service is described by some WSDL file. All the WSDL files are submitted to the REWS tool [5] for wrapping the main Web Service WSMO elements, which are expressed in WSML language and will be stored in the WSMX Server. All semantic descriptions are provided on top of existing
provider's syntactic services, making providers unaware of this semantic layer. No changes are involved in providers' services and native data formats are preserved. The WSMX server is a computer where the WSMX is installed and configured, it acts as a transparent, intermediary layer between interacting parties for mapping and discovery. Patient's desires are expressed via web forms that are mapped to appropriate Goal expressed in WSML language. Once a WSMO Goal with actual values is created, it can be sent to WSMX, where provider matching this Goal is discovered and according to Goal and Web service choreography communication is carried out. At last, one or more Web Services are returned to the patient.

This scenario is very simple, and the use of a Semantic Web Service is needed in this case. The reason for choosing this scenario is to keep the implementation within the scope of the project and because it uses the most important and basic parts of WSMX. To be able to fulfill this scenario, WSMO ontology Elements must be created to provide a shared vocabulary for the different interactions.

**Process Phases**

This section describes in detail the different phases of the process.

- **Creating WSMO Web Services Elements.** Provider's Web Services has to be semantically described, which includes lifting arbitrary XML messages in WSDL document to the semantic level by the ontology conceptualization. In this phase, we use the REWS tool to create WSMO Web Services elements. These elements will be stored on the WSMX server for further using.

- **Creating WSMO Goals.** The requirements and behavior of the client has to express as WSMO Goal. The system allows the expression of patient’s goals using web forms that in turn are mapped to WSMO Goals which allows them to be executed by WSMX. Patient does not have to visit multiple web sites, but can use only the friendly interface provided by the portal that aggregates multiple Medical analysis services and can be extended with new ones. In our prototype, Goals are based on a template approach where the Goal structure is defined but actual input values can be provided during the run-time by the client. The web application provides forms where user can specify his requirements and input values.

- **Matching Web Service to Goal.** The Goal is submitted to WSMX, where provider matching this Goal is discovered and according to Goal and Web service choreography communication is carried out. WSMX takes a semi-automatic approach to this problem.

The human's role is to ensure accuracy of these mappings and to adjust them if necessary.

**IV. CONCLUSION**

Semantic Web Services are a very powerful paradigm to transform the current syntactic Web into a dynamic and semantic to automate the use of the Web Services.

This paper describes a prototype of a Virtual laboratory Medical Analysis application demonstrating how the application of Semantic Web service technology makes it possible for individual patients to find the suitable laboratory for scheduling outpatient tests. In our future work, we try to extend our prototype to taxi transport Web Service.
REFERENCES


