OWL-LingS Editor
A Tool for Semantic Description of Linguistic Web Services

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Abstract: We propose in this paper a tool called OWL-LingS (stands for OWL for Linguistic Services) Editor providing an augmented semantic description for Linguistic Web Services (LingWS for short). It supports an extension of OWL-S approach for representing non-functional linguistic properties. OWL-LingS uses a linguistic domain ontology in order to semantically annotate the LingWS elements.

1 INTRODUCTION

The development of linguistic systems is very costly. Indeed, it represents a complex task, since it needs many competences. Hence, researchers in linguistic domain have resorted to reuse existing systems. These attempts are essentially based on Web Services (WS for short) such as (Ishida, 2006), (Tufis et al., 2008), (Baklouti et al., 2010), and (Hayashi, 2011).

As the number of Linguistic Web Services (LingWS for short) increases, the issue of selecting desired service(s) becomes a challenging research problem. These services deal with several linguistic applications such as Text Summarization, Translation, and Information Retrieval (Bramantoro, 2011).

The majority of these services are described using WSDL (Web Service Description Language). Nevertheless, the lack of semantic in WSDL prevents the automatic discovery of WS (Papazoglou et al., 2007).

In order to overcome this issue, several semantic approaches have been proposed. They use ontologies for describing WS. We can cite OWL-S (W3C, 2004), WSMO (Group, 2004), and SAWSDL (W3C, 2007). However, they cannot represent some specific properties as well as relationships between them. Indeed, the linguistic domain is characterized by several properties called non-functional linguistic properties such as the processing level, phenomenon, formalism, analysis type, and resources.

Elsewhere in the software engineering domain, some extensions of semantic approaches have been proposed such as (Aier et al., 2007) and (Jean et al., 2010). These extensions have tried to integrate the quality standards of WS.

In this paper, we propose a new tool which is able to semantically describe the LingWS. This tool is based on an extension of OWL-S which is already presented in our previous works (Baklouti et al., 2012a) and (Baklouti et al., 2012b).

The rest of this paper is organized as follows: In section 2, we comment on some works which deal with the LingWS description issues. Thereafter, section 3 provides the proposed approach. The implementation details of OWL-LingS editor and a demonstration are presented respectively by sections 4 and 5. Section 6 concludes the paper.

2 RELATED WORK

For enhancing the semantic description of LingWS, Klein and Potter (Klein and Potter, 2004) have used OWL-S for describing their LingWS. However, this contribution has proposed an annotation of the I/O and ignored non-functional linguistic properties (e.g, processing level, approach, and phenomenon) which are mandatory to know how the LingWS operates.

Toru Ishida (Ishida, 2006) has proposed a wrapper around LingWS that represents the LingWS Profile containing the LingWS name, its type, a textual description, LingWS status, and so on. However, this profile does not contain other relevant properties and mainly their relations which can improve the LingWS discovery.

In (Hayashi, 2011), the author has presented a

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high-level configuration of a linguistic domain ontology, which is integrated into a comprehensive LingWS ontology. They have examined relevant international standards and discussed how these frameworks can be ‘ontologized‘ and incorporated into the comprehensive LingWS ontology. In the developed ontology, authors did not represent the language service I/O which are crucial in the discovery task. For linking service specifications with domain ontology, (Hayashi, 2011) has used the SAWSDL language which is characterized by its simplicity and its interoperability with many ontologies. Nevertheless, it does not offer the possibility to represent precondition, effects, and other details particularly with the richness of the linguistic knowledge.

As a result of the above, we can note that the LingWS description should be augmented with non-functional linguistic properties and their relationships in order to enhance the quality of the discovery task.

3 APPROACH

We present in this section an overview of the OWL-S extension which is already detailed in our previous contributions (Baklouti et al., 2012a) and (Baklouti et al., 2012b). In fact, we start with presenting some non-functional linguistic properties, then we focus on how to integrate these properties within the OWL-S semantic approach.

3.1 Non-functional Linguistic Properties

Different linguistic properties need to be modelled in the LingWS description for enhancing LingWS discovery. We present in Table 1 some examples of non-functional linguistic properties which are further detailed in (Baklouti et al., 2012a) and (Baklouti et al., 2012b).

3.2 OWL-S Extension

The extension is based on the specialization of the *‘ServiceParameter‘* class of OWL-S ontology by one class namely *‘ServiceProcessing_Level‘* (Baklouti et al., 2012a).

The main elements of the proposed extension are:

- *ServiceProcessing_Level*: It represents the processing level of the LingWS. Each of them is characterized by its phenomena.
- *LinguisticPhenomenon*: It has the ‘refined_Into‘ relation, since each phenomenon has its sub-Phenomena. The *LinguisticPhenomenon* has also the relations ‘supported_By‘ and ‘treated_By‘ respectively with the *LinguisticFormalism* and *Approach* classes.
- *LinguisticFormalism*: It represents the formalism (e.g., HPSG and LFG for syntactic Grammars). Each *LinguisticFormalism* has an analysis type for resolving a phenomenon.
- *Approach*: It represents the treatment approach of a phenomenon. It has the ‘refined_Into‘ relation. An approach uses a resource to treat a phenomenon. For this reason, we add the ‘use_Resource‘ relation and the *Resource* class.

4 IMPLEMENTATION

In this section, we are presenting the implementation details of the OWL-LingS (stands for OWL for Linguistic Services) Editor. Indeed, we have developed this editor to consolidate the proposed extension of OWL-S(Baklouti et al., 2012a). Figure 1 shows the main basics of this tool, so from a WSDL file it generates an OWL-S description using the *WSDL2OWL-S API*. Then, the Service Provider chooses the required non-functional properties and he/she annotates the LingWS I/O using the developed domain ontology which contains several linguistic resources(Baklouti et al., 2012a). Thus, an **OWL-LingS** description will be generated and published on the service registry.

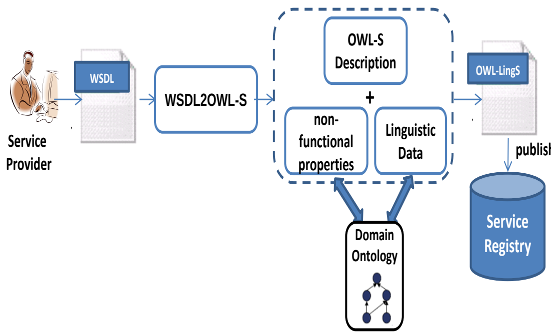

Figure 1: OWL-LingS Editor operation.

To implement the OWL-LingS Editor, we have done an extension of the *OWL-S API* [1]. This extension consists of adding some classes, their attributes, and their relationships (as it is presented in (Baklouti et al., 2012a)). Figure 2 shows the interface of our editor.

The service provider may choose the WSDL file URL (as it is indicated in Figure 2 by (1)), a set of

[1]http://www.mindswap.org/2004/owl-s/api/

Table 1: Examples of Non-Functional Linguistic Properties.

Non-Functional Linguistic Properties	**Examples**
Processing Level	Lexical, Morphological, Syntactic, and Semantic
Phenomenon	Ellipsis, Accord, and Anaphora
Analysis	Structural, Thematic, Syntagmatic, Top-down, Bottom-Up, Profound, and Surfacing or Chunking
Approach	Linguistic, Statistic, and Hybrid
Formalism	Unification Grammar and Resolution Algorithm
Resource	WordNet-LMF and GermaNet

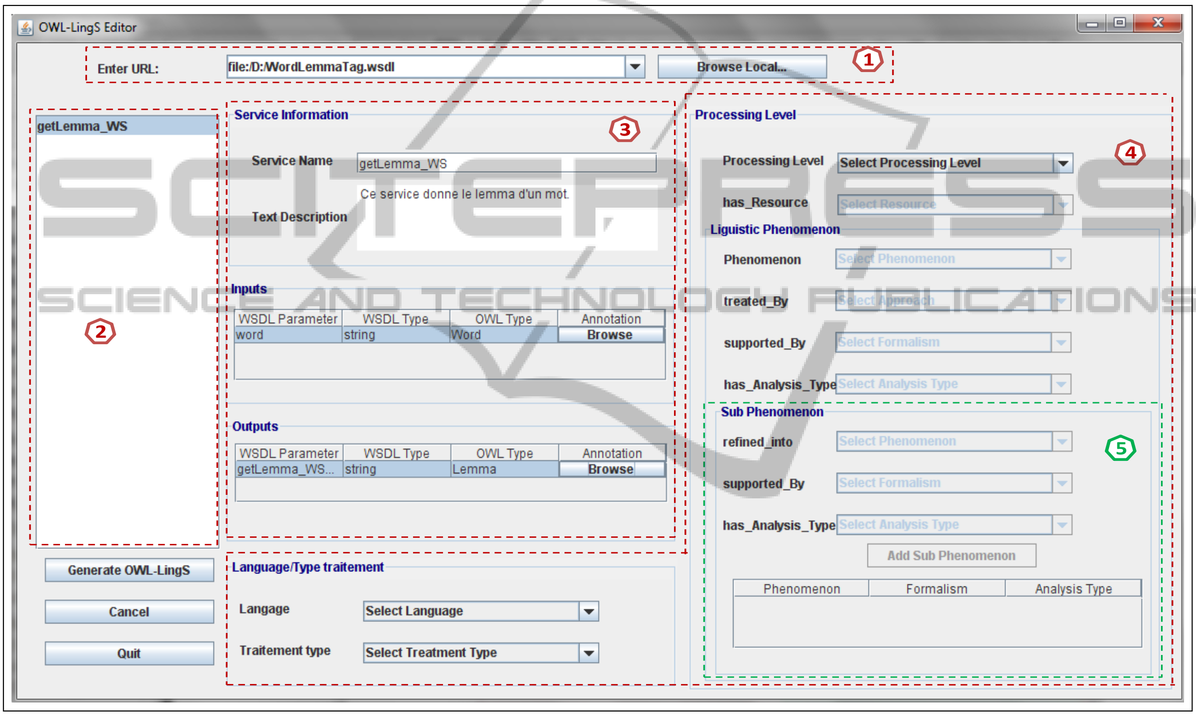

Figure 2: OWL-LingS Editor Interface.

operations will be shown (as it is indicated in Figure 2 by (2)). By selecting one operation, its name, its textual description, and its I/O are shown in area (3). Nevertheless, the I/O types do not reflect the suitable linguistic resources. For this, the service provider has to semantically annotate the I/O by clicking on the 'Browse' button and choose concepts from the domain ontology(Baklouti et al., 2012b). The I/O areas in Figure 2 contain the names of parameters, their types before annotation (as it is indicated by *WSDL Type* column in Figure 2), and their types after annotation (as it is indicated by *OWL Type* column in Figure 2). In addition, the service provider can add some parameters related to the non-functional linguistic properties by choosing a value for each property. There are some relations between properties, for example: the service provider cannot choose the 'Resource' or the 'Linguistic Phenomenon' if he/she does not choose the 'Processing level' (as it is indicated by Figure 2 in area 4). Moreover, if the chosen 'Linguistic Phenomenon' is treated by an approach, one value from the list of approaches will be selected. The same way will be applied for the other non-functional linguistic properties. In area 5, the service provider can choose a value of 'Sub Phenomenon' if the main chosen 'Phenomenon' is refined into a 'Sub-phenomenon'. He/she can also choose a 'Formalism' value if the chosen 'Sub-phenomenon' is supported by a 'Formalism'. Besides, he/she can choose the 'Analysis Type'. After choosing these values, the service provider has to click on the *Add Sub Phenomenon* button, so the chosen properties of 'Sub-phenomenon' are shown in table (see area 5 in Figure2). This process can be repeated as many times as possible refinements of the main 'Phenomenon'. Finally, a semantic description will be generated by clicking on *Generate OWL-LingS* button. The generated file has an *owl-lings* extension.

5 DEMONSTRATION

In order to consolidate our solution, we reuse a service library that is available in our laboratory (Baklouti et al., 2010). It contains many LingWS. Currently, our library contains about forty LingWS which can be expanded by other. The available LingWS cover some languages: Arabic, French, and English. We obtained these LingWS from some open-source tools like OPEN-NLP [2], NLP-LIB, classifier4j, standford [3], extjwnl[4], and JavaRAP[5]. The majority of these tools are used by the known linguistic platforms (e.g, GATE and UIMA). To ensure the description of these services, we use OWL-LingS Editor allowing the generation of the OWL-LingS descriptions. We choose the 'Anaphora_WS' as an example of LingWS for making a practical study. The latter ensures the resolution of the anaphora phenomenon. It treats the *'English'* language and it has *'Analysis'* as a treatment type. In addition, it deals with the *'Anaphora'* phenomenon which is treated by a *'Linguistic'* approach. This approach uses *'WordNet'* as a resource to resolve the anaphora phenomenon. Also, this phenomenon is supported by LFG *(Lexical Functional Grammar)* formalism.

6 CONCLUSIONS AND FUTURE WORK

This paper provides a solution to the problems related to the lack of semantic in the LingWS description. Indeed, we implemented an editor called OWL-LingS that takes into account the proposed extension of OWL-S(Baklouti et al., 2012a).
Currently, we are defining an appropriate matching algorithm allowing the LingWS discovery through its I/O and non-functional linguistic properties.
In the future work, we plan to deploy our editor in the cloud. In fact, the cloud computing provides elastic services, high performance and scalable data storage to a large and everyday increasing number of users.

[2]http://incubator.apache.org/opennlp/
[3]http://nlp.stanford.edu/
[4]http ://extjwnl.sourceforge.net/
[5]https://github.com/WING-NUS/JavaRAP

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