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Discovery System Architecture Based on Continues Description Enrichment

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Abstract: The Web Service Discovery is the operation of locating a Web Service which description match with the costumer request. But, the vast majority of accessible OWL-S services do not possess any specification about their preconditions and effects, nor any composite process model yet. Also, it presents only the provider point of view which could be non-objective and incomplete. In other hand, by the time, the semantic and the manner of use of WSs change so their description should change also. Paper at hand presents architecture of a WS Discovery System uses it experiences to improve and enrich published WSs descriptions. After the discovery process, the user feedback and context will be captured and storage. When collected data reaches a temporal term or a defined limen, a data mining process will be executed in order to extract knowledge used to enrich and update WSs Descriptions.

Keywords*:* Semantic Web Service Discovery, Continues Description, Fuzzy Classification, User's feedback mining

I. INTRODUCTION

Web service discovery can be defined as the problem of locating suitable Web services to fulfill a given objective. In the SWS (Semantic Web Service) paradigm, discovery is performed over semantic descriptions of Web services. After a comparative study, [1] decides to follow the Service Profile of OWL-S model instead of the Complex Concept (CC) of WSMO model in the description of SWS to discover. Furthermore, it is difficult to consider CCs in repositories, in contrast to OWL-S Profile instances. The difficulty relies on the fact that a CC does not follow a standard description pattern [2]. [1], [3], [4], [5], [6] are recent works that handle the Web Service Discovery challenge using OWL-S as the description ontology of the candidate services.

Note that the vast majority of accessible OWL-S services do not possess any specification about their preconditions and effects, nor any composite process model yet [7]. Nevertheless, the creation and maintenance of ontologies may be difficult and involve a huge amount of human effort. Could the discovery system accomplish the mission of OWL-S WS description basing on the clients reactions, profiles and context (technological and business context)?

In other hand, by the time, the semantic and the manner of use of WSs change so their description should change also. How could we guarantee the up-to-date of the OWL-S WS description without human invention? The service discovery system could-it uses its experiences to carry out a suitable semantic service description?

The rest of the paper is organised as follow: section 2 presents the proposed discovery system architecture based on fuzzy classification and continues description. The third section presents an overview on the discovery approaches and our choice. Discussions of the propositions and future works are the subject of the last section.

II. DISCOVERY SYSTEM ARCHITECTURE

This section describes a discovery system designed to, not only find WSs, but also to improve the service descriptions. A WS lifecycle begun by its advertisement by a WS provider. Every WS provider should subscribe to the discovery system. Basing on information supplied, the system will classify the provider under adequate classes with a degree of membership to each class (fuzzy classification) then save it in the providers' profiles DB. The profile and the classification will be updated automatically by the time basing on the usage of services he will publish. Subscribed providers could publish their WSs after identification.

Once a WS is delivered to the system, a primitive OWL-S description will be generated (if the published service is non-semantic) and enriched by the provider profile and classification information. Then, a fuzzy classification is applied on the OWL-S WS. It consists of defining the membership degree of the service to each class. Finally, the OWL-S WS description will be added to the service registry.

Until this stage, the OWL-S published WSs descriptions represent only the provider point of view which could be insufficient and lacks objectivity.

Every WS is published in order to be consumed and called. To discover a WS, consumer should be subscribed

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in the discovery system then he will be affected to the suitable classes with a degree of membership to each one.
The discovery process starts by the identification of the user then launching the request. The discovery system will enrich the request by information extracted from the consumer profile. After receiving the discovery results, the user reactions will be captured. This reaction could be positive, negative or fuzzy. The tools of user feedback detection and processing are the subject of many recent research and works [8]. We will use this means in the detection of SWS user's feedbacks.
Users' reactions are stored in a data warehouse then mined in order to extract knowledge that will be used to upgrade and update the user's profile, provider's profile and OWL-S WS's description (in order to be described by consumers points of view in addition to the provider one) and classifications. This updates depend to the user reaction (evaluation of service), the services consumed by the user in the discovery period (before, after and in the same time when using the selected service), the user profile and classes and its reputation degree. To enrich the services' descriptions, only the reactions of users have acceptable reputation degree will be taken into account and treated. This data filtering guarantee the credibility and the reliability of data to process which influence the updates descriptions.

A. *Fuzzy Classification*

The dynamic Web services features raise a serious challenge of locating desired Web services. One possible way is to classify Web services into different categories when they are published in a UDDI registry [9]. The fuzzy classification creates more subtle and smooth distinctions between equivalence classes than crisp and inductive classification [10]. For this reason, we adopt the fuzzy classification of the user, provider and WSs.
In the proposed discovery system, the classification of SWSs is influenced by the provider and consumers categories. The First WS Fuzzy classification is the same of his provider. Then, its classes' membership degrees will be updated according to the consumers' classes ones. By the time and the use, the classes of WS could be completely different from that of his provider.
A consumer or a provider subscribed to the discovery system could mention his membership degree to the proposed classes. If he passes over this step, the system will mention him as "non-classified" and its membership degrees to the classes will be initialised to "0" and update in the future.

B. *User's Reputation Degree*

The enrichment of the SWS is based on data collected from consumers' feedbacks and opinions after invoking and using it. But, a consumer could be a non-professional or immoral person or a defectives program. In order to make the collected data reliable and useful for true service description, a reputation degree is attributed to Consumer's Profile and to the consumer itself (Fig 2.).
The user's degree of reputation is changeable depending to his profile and the suitability of his feedbacks with those of his community (users have the same profile).

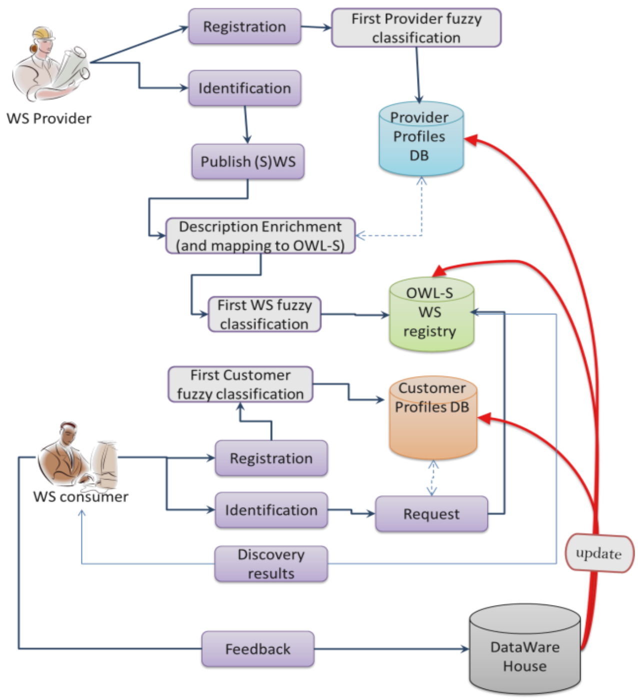

Fig 1. WS Discovery System

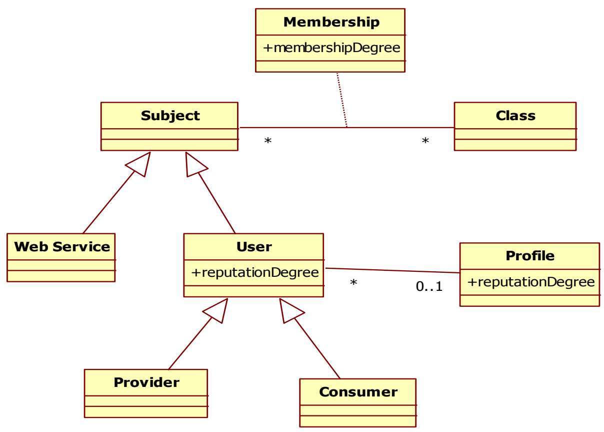

Fig 2. User Storage Model

C. *Users' Feedback mining*

After requesting the discovery system and invoking the service discovered, the system will capture the consumer reactions. Many works had treated the users' point of view capture [8].
Why we will use a data warehouse instead of relational database? The stored data (users' feedbacks and context) are needed in order to be analysed and processed not to be requested (transactional requests). The data warehouse is

optimized for reading operations and it has a high performance for analytical queries. The motivation for using data warehouse was the existing of tools supporting analytical operations for decision support that were not easily provided by the existing database query languages [11].

The Data mining defined by [12] as knowledge discovery from data, extraction of interesting (non-trivial, implicit, previously unknown and potentially useful) patterns or knowledge from huge amount of data. Knowledge discovery (mining) in databases (KDD), knowledge extraction, data/pattern analysis, data archaeology, data dredging, information harvesting, business intelligence, etc…

The users' feedback mining will be the main subject for our future works.

III. CHOICE OF DISCOVERY APPROACH

The proposed system architecture aims to automatically and continuously update and enrich the WSs descriptions basing on the experiences and learning of the discovery system. In this section we will present an overview about WS discovery approaches. Then, decide which one we will use to respond to the user request in order to get his opinion about the discovered service (the raw data for WS description enrichment).

[13] Proposed a Cloud service discovery and selection system that supports OWL-S description with complex constraints, dynamic matching and flexible semantic selection of services. The discovery and selection algorithm is based on service request (input, output) and User Preferences (the lower bound on semantic matching: Exact, Subsume, Invert-subsume, Partial or fail). The authors had adopted a standard logic reasoning approach to match the IO of the request with that of the advertised service (OWLS-MX [7]). This step is followed by SWRL constraint matching after the assumption of suitable domain ontologies. Then, the discovered services will be ranked basing on the score of the matched services. The personalization of the discovery process is limited in the definition of the lower bound of semantic matching. However, it could include the context and profile of the user which improve the relevance of the matchmaking response.

The Discovery process in [14] is constituted of 3 steps: (i) calculate the degree of match between user intention presented in his request and the service intention resented in the description, (ii) calculate the degree of match between user technological context and the service execution context resented in the description and (iii) calculate the service score by adding the intention match degree and the context match degree. This discovery process uses 2 matchmakers which influence the process time.

[15] described a Static and Dynamic Service Discovery Framework that supports both (i) design of service-based systems based on existing available services in service repositories and (ii) adaptation of service-based systems by replacing a participating service by another available service when necessary. More specifically, the framework supports the discovery of services that provide functional and non-functional properties, as well as some extra constraints, of service-based systems. The discovery process is based on similarity analysis and distance measures of service requests against service specifications. The published services were described in service repositories by different facets such as structural, behavioral, quality, or contextual characteristics implemented respectively by WSDL, BPEL, XML & XML files. We can note that this description lacks semantic description aspect so the discovery also will be based only on syntactic representation. Furthermore, the service behavior (BPEL) could be represented using the ServiceProcess Model of the standard OWL-S description specification. Also, the context and the QoS were, in other works like [14] [16] , presented as extensions for OWL-S by adding a property "context" to the ServiceProfile points on an external file or including all context properties to the ServiceProfile Model…

The discovery algorithm presented in [17] is constituted of three steps: Matching, ranking and selection. The Matching is to find services that meet the functional requirements and maintain only the services that respect the non-functional requirements. The Ranking is based on the QoS and reputation score. The Selection is to return the best services according to the services classification (ranking). The published services are described by WSDL, symbolic reputation degree and service cluster. The reputation is represented by the quality of relationships of the service with other services (symbolic reputation based on symbolic description). The authors had used only the syntactic service description WSDL: first, the validity and the availability of the service are verified. Second, information is extracted from the WSDL document as the I/O, endpoint, messages… Finally, this information will be parsed and treated in order to constitute other elements of service representation in the WSDB (baseline representation, Rules based text tagging and symbolic reputation). The UDDI architecture had been extended in order to be adaptable to the new information added to the service description (WSDL) and for enriching it. A degree of reputation of the user whose feedbacks define the service reputation is needed to make confidence to the user feedbacks. Also, the matching is based only on the syntactic aspect of the user request which results a poor user request description [17]. The Web services reputation is generally a numeric quantity computed from user feedback.

[7], [18], [19] and [20] had used a hybrid matching through logical reasoning and non-logic-based information retrieval (IR) techniques for OWL-S service profile signature matching between advertised services and the query. [20] taken into account the effect and preconditions in the semantic matching. According to [21] the ontology

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based discovery approach suffers from performance problems due to the use of ontology reasoners. Furthermore, constructing ontology as a semantic backbone for a large number of distributed web service is really not easy. These are the major setback for ontology based discovery. For this reason, this work present a matching process based only on semantic distance.

To conclude, the discovery process is influenced by the description of WSs, the matchmaker, the user context and profile and the query. A matchmaker could use the ontology reasoning (logic-based matching) or non-logic methods (Information Retrieval techniques) for measuring the semantic distance or similarity degree between user request and service description. In practical application, many approaches may be combined in the discovery process.

The main objective of our work is the automation of OWL-S web service description basing on clients reactions, for this reason, we will reuse an existed discovery system to be the start point of our work. After a study of many research work, OWLS-MX [7] seems to be the most preferment discovery approach except the ignore of the service preconditions and effects in the discovery process.

The hybrid semantic Web service matchmaker OWLS-MX 1.0 utilizes both description logic reasoning, and token based IR similarity measures. It applies different filters to retrieve OWL-S services that are most relevant to a given query [22]. The "X" in OWLS-MX stands for five different instances of the generic hybrid matching scheme depending on the syntactic similarity metric used. OWLS-MX is fully implemented in Java, uses the OWL-DL description logic reasoner Pellet for logic based filtering, and the cosine, loss-of-information, extended Jacquard, and Jensen-Shannon information divergence based similarity metrics for complementary approximate matching [23].

IV. CONCLUSIONS

The usability of a classic WS discovery system was limited in the localisation of the WS satisfying the consumer request. In this paper, we had extended the mission of a discovery system by adding the user feedback detection and the WSs description enrichment which raise the performance of WS discovery, composition and invoking process. In our future works, we will focus and develop the part of users' feedbacks and context storage, the data mining and WS description enrichment.

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