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Comparison of Semantic Web Service Discovery Method

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***Abstract*— The Growth a number of web services increases that raises its own problems, users have difficulty in finding a web service that has been developed and published. A large amount of effort and money has been invested in field of semantic web. An important issue in web service is the discovery of web services. Users have difficulty in finding a web service that has been developed and published. This study aims to comparison several methods that have been done previously associated with the semantic web service discovery. The conclusion of this paper, we have present for semantic web service discovery method such as LSA approach, semantic description approach, OWL-S IDE, using broker creates the user ontology and merges it with general ontology, combines semantic and statistical association metrics. This paper is divided into five sections, the first section is the introduction, the second part contains literature review related to research on the semantic web service, the third part is semantic web service and part four discussion from the comparison of several methods used in service discovery that has been done, and conclusion in section five.**

***Index Terms*—Semantic web, web service, discovery.**

I. INTRODUCTION

Web services enhance the functionality of existing web. The service provided is modular, self-describing, self contained which can be accessed via the Internet using standards such as SOAP, UDDI, and WSDL. Web service has been utilized in several fields such as e-government, e-commerce and e-business. The service provided is able to provide interoperability between machines with machines, even supports different engine platforms. Increasing the number of web service developed and published raises the problem is how to find a web service that fits the needs of users?

An important issue in web service is the discovery of web services. Users have difficulty in finding a web service that has been developed and published. Several research has been done. In this studies, there will be a review of studies that have been done on the approach used to find a web service that has been developed and published.

The remainder of this paper is organized as follow. We briefly present related work in section 2. In section 3, we give fundamental of service discovery. Section 4, we present semantic web service. In section 5, review of research has been done on semantic web service discovery. We present conclusion on section 6.

II. RELATED WORK

Research on the semantic web service discovery has been done, including research conducted by [1][2][3][4][5][6][7][8]. In research conducted by [1] about empirical semantic based web service discovery approach. This research provides an automatic web service discovery mechanism that can locate relevant web services based on concepts rather than keywords. Semantic web discovery requires (1) semantic service searching (2) semantic term suggestion (3) semantic clusters. The author use LSA–based conceptual solution. Other research conducted by [2] Since web service discovery cannot always be based on complete and detailed semantic description, the author propose an approach for offer discovery of semantic web services using OWL-S IDE during discovery process. The research conducted by [3] propose a framework for semantic web service discovery based on semantic web services and FIPA multi agent provides. The main part of this framework is a broker which provides semantic interoperability between semantic web service provider and agents by translating WSDL to DF description for semantic web services and DF description to WSDL for FIPA multi agents. In this research, inconsistencies during the merge occurs. The research conducted [4] using vector space model for calculating the semantic distance, then match web services with ontology hierarchically, and finally match with QoS. Other research conducted by [5] propose three methods to enrich the query by exploiting the semantic relationships given by synonymy and derivatives of the WordNet ontology. It is primarily to allow the user to formulate his request in the least restrictive manner, and secondly, to reformulate the user query using the WordNet ontology to get a better result of semantic web services matching to the query. And finally, to propose a matching between the reformulated query and the semantic web services OWL-S. The research by [6] matching for semantic web service was modeled using bipartite graph of the nodes defined based on the ontology. This research need efficiency of service discovery for further improved by parallelizing some steps. Other research [7] matching web service based on semantic description of the web services which is registered in the Universal Description Discovery and Integration (UDDI).

III. SERVICE DISCOVERY

Service discovery is a process of discovery service that relevant with user needed. Steps performed to make service discoverable [9]

1. Adding interpretable meta-data
2. Use consistent manner of document information about the service.
3. Enable others to search service that store information of service in an efficient manner.

In web service, WSDL and UDDI are used as standards for service discovery. In general, web service model can be seen in Fig 1

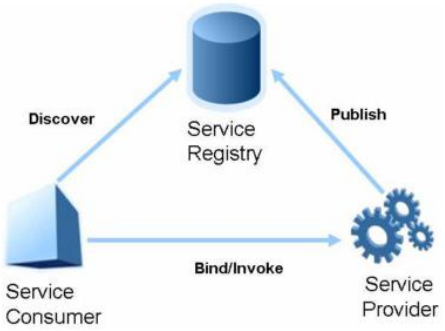

Fig 1. Web service model

In web service model consist of three components.

1. **Service provider**, provide services that user can use. WSDL or service profile of semantic Web service is used to carry out this function.
2. **Service consumer**, request the service that provided by service provider.
3. **Service registry**, a broker that provides the search function

Based on research[10] three factors mainly affect the web service discovery process are :

1. Ability of the service providers to describe their services
2. Ability of the service requestors to describe their requirements
3. Intelligence of the service matchmaking algorithm.

IV. Semantic Web Service

Semantic web services are a component of the semantic web because use markup which make data readable by machine[9]. Semantic web services use standard such as OWL-S, WSDL-S, WSMO, OWLS-LR and others.

OWL-S

OWL-S is an ontology language to describe web services; it is the combination of web services and semantic web, mainly to realize using semantic to describe web service. OWL-S including three components: Service Profile, Service Model and Service Grounding. Service Profile: it describes the service features, Service search agent through the Service Profile to realize Service matching, and provides a superclass of every type of high-level description of the service.

WSDL-S

Current WSDL standard operates at the syntactic level and lacks the semantic to represent the requirements and capabilities of Web Services. WSDL-S is a lightweight approach for adding semantics to Web services. In WSDL-S, the semantic models are maintained outside of WSDL documents and are referenced from the WSDL document via WSDL extensibility elements

WSMO

WSMO provides a conceptual framework and a formal language to describe all relevant aspects of Web services to facilitate the automation of service discovery using semantics. The overall structure of WSMO is divided into four main elements.

V. Discussion

Semantic web service discovery using the latent semantic analysis (LSA) [1]. This research focus on LSA indexer, which takes as input the VSM (Vector Space Model) indexes and generates as output the semantic space for service retrieval. Propose architecture can be seen on Fig 2.

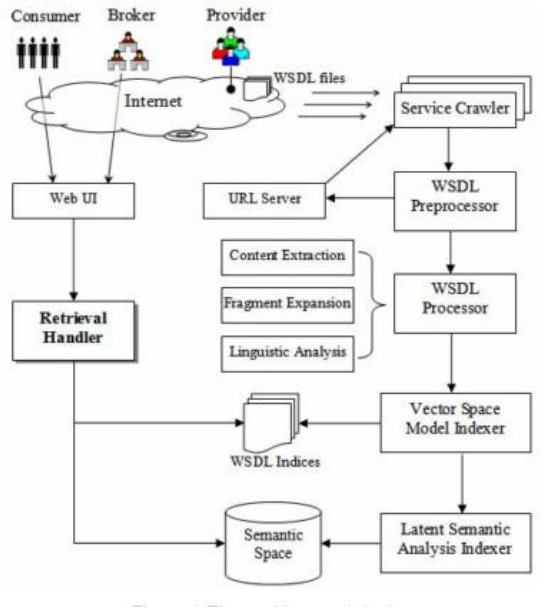

Fig 2. Architectural design

Based on research [1], a five step approach is presented to tackle the detailed technical issues, such as sparse matrix analysis and compression, singular value decomposition, cosine similarity, term space construction, and hierarchical clustering. Semantic web discovery can also be done by using the approach of OWL-S as a web service description mechanism [2]. This research proposes the system architecture that can be seen on Fig 3.

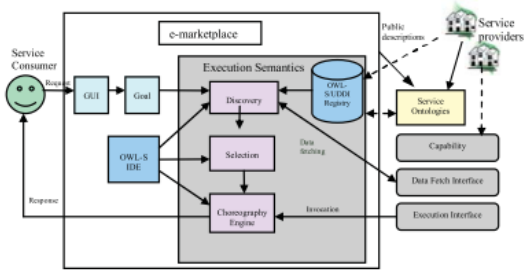

Fig 3. System architecture

Other research [3] propose a framework for semantic Web service discovery that communicates between multi agent system and Web services without changing their existing specifications and implementations by providing a broker. This research propose a framework architecture in Fig 4.

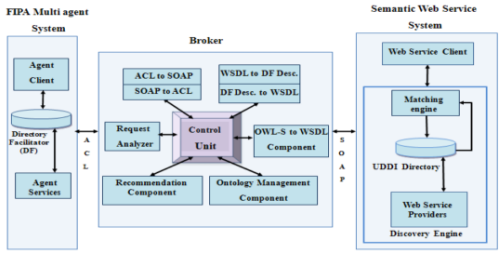

Fig 4. Framework architecture for semantic web service [3]

Different with research conducted by [1] and [2] on research [3] broker creates the user ontology and merges it with general ontology and and recommends the created WSDL based on generalized ontology to selected Web service provider to increase their retrieval probability in the related queries. Research conducted [4] matching web service with three step, there are matching with vector space model, matching with hierarchical ontology and with QoS. The semantic web service discovery prototype developed in combination of matching algorithm. Other research [5] present a query reformulation for searching semantic web service. Propose three methods to enrich the query.

The research conducted by [6] propose a new semantic Web Service discovery scheme using bipartite graph and improved Hungarian algorithm to achieve the goal. The matching for semantic web service was modeled using bipartite graph of the nodes defined based on the ontology. This research presented a maximum matching algorithm for service discovery using bipartite graph modeled based on semantic similarity. Computer simulation demonstrated that the proposed algorithm is substantially faster than matching with the original Hungarian algorithm. The scalability is also much higher. Computer simulation reveals that the proposed scheme allows much higher quality service discovery compared with the UDDI-based discovery.

The research [7] propose discovery web service based on semantic description. The semantic information is extracted from service description document which registered in UDDI. The research conducted by [8] propose a service discovery algorithm. This research propose three steps, (1) classify the web service by category, (2) calculate the semantic similarity (3) propose a simplify search method after classifying the web service, this research associate the corresponding domain ontology with web services are classified according to the category. Survey about semantic web service conducted [10], Classified semantic web service discovery method in six class, there are context aware, publish subscribe, keyword clustering, layer based semantic web discovery, SAM and agent based.

Other research conducted by [11] propose approach for semantic web service discovery with combines semantic and statistical association metrics. Semantic metrics based on semantics aspect of ontology. Statistical association metrics are based on the association aspects of web services instances, specifically their inputs and outputs. approach exploits

semantic relationship ranking for establishing semantic relevance, and a hyper clique pattern discovery method for grouping web service parameters into meaningful associations. These associations combined by the semantic relevance are then leveraged to discover and rank web services. In the last, comparison of several methods that have been proposed can be seen on table 1.

Table 1. Comparison of semantic web service discovery method advantages and disadvantages

No	Web service discovery method	Advantages	Disadvantages
1	An Empirical Approach	This method provide automatic web service discovery mechanism that can locate web service on concept. Can traced back to earlier component retrieval research.	The architecture of system are complex
2	OWL-S approach	Support discovery in both server and client process. Can discovery web service during discovery process.	Time consuming for building ontology
3	Broker approach	Can discovery web service between multi agent and web services without changing their existing specifications and implementations	The architecture of system are complex
4	VSM	Can retrieve the most similar services according to their WSDL service description specified	Can't provide discovery based on concept, but VSM just find document by similarity
5	Query Reformulation	Offer to the user the possibility to express freely his request, after that query reformulation provide query with relevant in web service description	Don't provide concept
6	Bipartite graph	Reducing the service discovery time and increasing the	Need parallelizing some step for improve the

		quality of discovery	efficiency service discovery
7	Semantic description	Provide semantic description which is extracted from service description document.	Need to build ontology for description service document.
8	Combines semantic and statistical association metrics	Effective to retrieval relevant web services	Need to provide generic ontology.

VI. Conclusion

In this paper we discussed about comparison of methods for semantic web service discovery. We have been reviewed several methods for semantic web service discovery such as using keyword for search web service, LSA approach, semantic description approach, OWL-S IDE, using broker creates the user ontology and merges it with general ontology, combines semantic and statistical association metrics. Different approaches for semantic web services discovery and their advantages and disadvantages have discussed semantic web services discovery approaches reduces cost and time, enhances precision and recall.

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