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Research Paper

An Enhanced Semantic Web Service Composition Using Ontology Based Automated Service Discovery

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ABSTRACT- *A critical step in the process of reusing existing Web services is the discovery of potentially relevant components. We first analyze the limitations for current Web service standards and point out that semantic description is the basis for automatic service discovery. As a greater number of Web Services are made available today, automatic discovery is recognized as an important task. To promote the automation of service discovery, different semantic languages have been created that allow describing the functionality of services in a machine interpretable form using Semantic Web technologies. The problem is that users do not have intimate knowledge about semantic Web service languages and related toolkits. We propose a discovery framework that enables semantic Web service discovery and composition based on the ontology frame work. We describe a novel approach for automatic discovery of semantic Web services which employs LSI to match a user request, expressed in service discovery language, with a semantic Web service description. Additionally, we present an efficient semantic matching technique to compute the semantic distance between ontological concepts. As well as implementation of service composition is take place in the proposed paper. Our approach to semantic based web service discovery involves semantic-based service categorization and semantic enhancement of the service request. We propose a solution for achieving functional level service categorization based on an ontology framework. Additionally, we utilize clustering for accurately classifying the web services based on service functionality. The semantic-based categorization is performed offline at the universal description discovery and integration (UDDI). The semantic enhancement of the service request achieves a better matching with relevant services.*

Index Terms— *Web Services Publishing, Web Services Discovery, Services Discovery Process and Methodology, Web Service Composition Methodology.*

I. INTRODUCTION

Today, many organizations strive to cope with rapid market changes, such as evolving customer requirements and new business processes. One of the latest challenges is how to work with service-oriented computing (SOC) in a cloud computing environment. These web services offer various functionalities in the areas of communications, data enhancement e-commerce, marketing, utilities among others. Some of the web services are published and invoked in-house by various organizations. A web service is a communication between two electronic devices over the World Wide Web (WWW). The web services describes a way of integrating varies web based languages such as XML, SOAP, WSDL, and UDDI [12]. XML is mainly used to tag the data and SOAP is mainly used to transfer the data. WSDL is used for describing the services are available. It is an XML based description language and it is mainly used for describing the functionality offered by web services. UDDI is mainly used to listing what services are available and used for business to communication with each other. UDDI is a used for Storing information about the web services and web services are described by WSDL.UDDI is mainly used to service registry and similar services may be listed under the different categories. It is difficult to find the service that satisfies the desired functionalities. Service discovery may be used to searching a large number of web services to find the appropriate services so there is need to classifying web services based on their functional semantics and service providers. Semantic services are a component of the semantic web because they can use mark-up and makes the data machine readable.XML standards for interoperation of web services can specify only syntactic interoperability not the semantic meaning

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of messages. WSDL is mainly used to specify the operations are available through a web service and structure of data send and received but can not specify the semantic meaning of the data. Semantic web services [3], [4] are mainly used to interchange of semantic data and make it easy for programmers to combine data from multiple sources and services without loss of meaning. Semantic categorization of web services is mainly used for service discovery and it is not improve the selection and matching process. A Service discovery approach involves keyword matching technology to locate the web services. The syntax based match making provide discovery result but may not accurately match the given service request. Only a few services are matched and considered for selection. Discovery process is mainly used for human intervention for selecting an appropriate services based on the Semantics. Service Discovery may have limitations such as: 1) All new services to have the semantic tagged descriptions; 2) Web services using WSDL and do not have associated semantics. Automated service discovery addressing two major issues: 1) Semantic based categorization of web services and; 2) Selection of services based on the semantic service description. We present a novel approach is mainly used for semantic based automated service discovery. It is focused on the semantic based service categorization and service selection. Semantic categorization is mainly used to classification of web services based on the functional categories. The semantically more related web services are grouped and may be published under different categories within the UDDI.

Service selection contains two step processes such as: 1) Parameter based service refinement and; [15] 2) Semantic similarity based matching. The web service input and output parameters may contain functional knowledge and improving service discovery. Parameter based refinement which contains combining semantics with syntactic characteristic of a WSDL document. The refinement of a document then matched against an enhanced service request based on the semantic similarity based matching. The service request adding an ontology concept and it is mainly used to improve the matching of the service request. Ontology is an explicit specification of a conceptualization

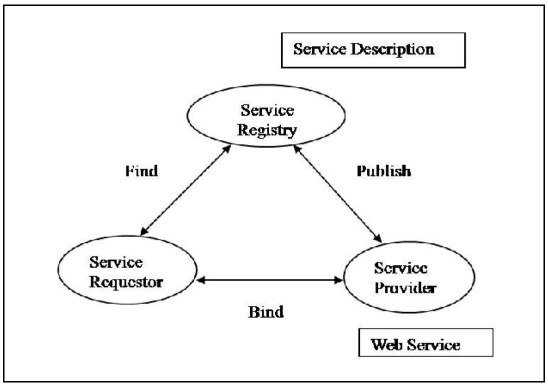

Figure.1.Service Provider Architecture

II. RELATED WORK

M.L.Antonie and O.R.Zaane, describe [5] a Text Document Categorization by Term Association. It is mainly used to categorize large set of text document. A novel approach is mainly used for automatic text categorization. We focus on two major problems; 1) Finding the best term association and; 2) the rules to build a text classifier.

Lu, J., Yu, Y., Roy, D., and Saha, D [9]. Web Service Composition Web service composition framework is high level abstraction without a particular language or algorithm used for composition process. The objective of this framework is to give the similarities and differences of the service composition. The composition system contains service provider and service requester. The service provider is mainly used to providing service to the user. The service requester is mainly used to request to the service provider. The System which contains the following components such as: The translator translates between the external languages used by the user. Internal language used by the process generator. If more than one service found, an evaluator evaluates all services and provided best one for execution. The execution engine executes the service and returns the result to the service provider.

Sajjanhar, A., Hou, J., Zhang, Y. [15].Web service matching is focused on finding an appropriate service provider for a service requester based on the matchmaking. The basic steps are service description, Service publishing, description of user needs, service matchmaking. It is possible to discover individual web service based on the parameter entered into the UDDI registry. UDDI is mainly used to retrieve similar services;

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we extract words from web service descriptions as entered in the UDDI registry. These words are assigned the word weights. These weighted words are used to build a matrix. This matrix contains information about all web service s and description.SVD is applied to the matrices to obtain semantic relationship between web services.

Heb and Kushmerick proposed [14] a service classification and comparing five clustering algorithms. The classification process is mainly focused on the term vectors with relevant words. The hierarchical clustering approach for getting best results.1) including relevant semantic concepts based on the semantic relationship ranking [7] .2) Deletion of non relevant terms. The resulting is reduction of noise and increase in the purity of the cluster.

In Sassen et al described [10] the approach for service discovery based on Ontologies is validated easy to use, complete. Our approach is mainly used to description of an Ontologies framework that includes upper ontologies. Service Discovery is mainly used to initiates service request with concepts and extracted from related domain ontologies.

III. BACKGROUND

3.1 SEMANTIC RELATIONSHIPS

semantic relationship based on the three parameters

Relevance(Rel): The particular concept may be expressed as a high level concept in an upper ontology.

Specificity (sp): The concepts are used to position in the concept hierarchy. The lower level of concepts is termed as specific concepts and higher-level concepts are termed as generic concepts

Span(s): The span of the relationships expressing the semantic association and the linkage among concepts. The span includes the coverage and depth of the concept. The depth of the concept can be represented as either 0 or 1. If the concept within the specified span, the span value equal to 1 otherwise set to 0.

3.2HYPER CLIQUE PATTERN DISCOVERY

Hyperclique pattern discovery is mainly focused on the frequent item sets [6].Hyperclique pattern discovery which includes Support and H-Confidence.Support is represented as no less than user specified minimum support Supp(X) and X-> frequent item set. [1]

The confidence X1->X2 can be defined conf(X1->X2)=Supp(X1UX2)/Supp(X1).For example

An Item set P={A,B,C}

Supp({A})=0.2,

Supp({B})=0.2,

Supp({C})=0.1,

Supp({A,B,C})=0.1

Conf({A->BC}) =Supp{A,B,C}/Supp {A}
= 0.1/0.2
= 0.5

Conf ({B->AC}) =Supp {A, B, C}/Supp {B}
= 0.1/0.2
= 0.5

Conf ({C->AB}) = Supp {A, B, C}/Supp{C}
= 0.1/0.1
= 1

H-Confidence = 0.5

H-conf (P) =min {conf (A->BC), Conf (B->AC),
Conf(C->AB)} =0.5

TABLE 1

Item set	Temperature	Wind	Humidity	Play
1	Warm	Calm	Dry	Yes
2	Cold	Calm	Dry	Yes
3	Cold	Windy	Raining	No
4	Cold	Gale	Dry	No
5	Cold	Calm	Raining	No

Example Hyper clique Patterns

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Table 1 Shows hyper clique patterns identified from a real-world web services data set and it includes web service descriptions from varies service categories. Table 1 is mainly used to calculate minimum Support and H-Confidence Value.

1. {Cold, Raining} => No
   Support: 2/5 = 40%
   Confidence: 2/2 = 100%
   => Good
2. {Calm, Dry} => Yes
   Support: 2/5 = 40%
   Confidence: 2/2 = 100%
   => Good
3. {Dry} => No
   Support: 1/5 = 20%
   Confidence: 1/3 = 33.3%
   => Bad
4. {Windy} => No
   Support: 0/5 = 0%
   Confidence: 1/1 = 100%
   =>Bad

TABLE 2
Example of Support and Confidence

Hyper clique Patterns	Support	H-Confidence
{Cold, Raining}	40%	100%
{Calm, Dry}	40%	100%
{Dry}	20%	33.3%
{Windy}	0%	100%

Table 2 which represent the Minimum Support and H-Confidence Value.

3.3 LSI

LSI which stands for Latent Semantic Indexing and it is a statistical approach [15]. It is mainly used to capture term relationships and domain semantics. It is mainly used to find the relationship between web service including service description and parameters. It is mainly used to translate the query into concepts and then matching the documents.LSI is mainly focused on the SVD (Singular Value Decomposition).

SVD is a factorization of a real or complex matrix and it is mainly used to signal processing and statistics. The linear Decomposition set of term to text object association data. Singular Value Decomposition can be represented as following

$M=U\sum V$

IV. NATURE OF WORK

The proposed approach involves semantic categorization of the web services and Selection of Web Services. This step involves two tasks: 1) Refinement of the set of web services based on the input, output, and description parameters. The refinement is used to select a set of services from the service categorization.2)Enhancement of the web` service request with relevant ontology terms, and the matching of this enhanced service request with the set of candidate web services for selecting appropriate service. The approach needs to be generic and should not be tied to a specific description language. The proposed approach focuses on semantic-based service categorization, which involves semantics augmented classification of web services into functional categories. The semantically related web services are grouped together even though they may be published under different categories within the UDDI.Service selection then consists of two key steps;1) parameters-based service Refinement [15] 2) Semantic similarity-based matching. For semantic-based service categorization, it proposes an ontology guided categorization of web services into functional categories for service discovery. This leads to better service discovery by matching the service request with an appropriate service description. For semantic-based service selection, employ ontology linking (semantic web) and LSI thus extending the indexing procedure from solely syntactical information to a semantic level.

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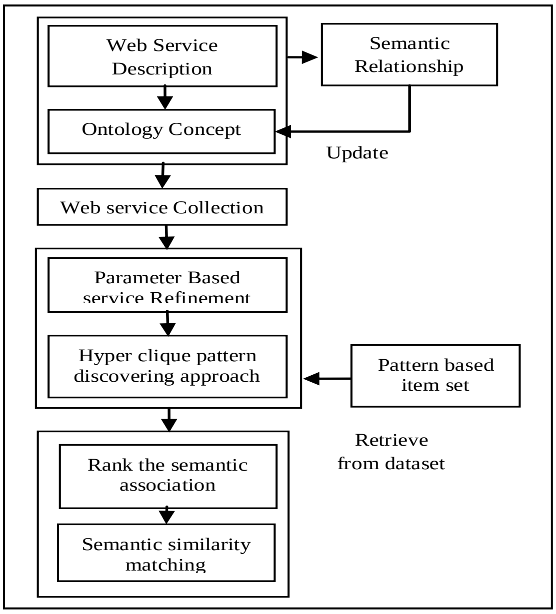

Figure.2. Service Description Architecture

Figure.2.The Service Categorization is processed offline and independent of the service request. Service Selection is performed at online and it is based on the request basis

1. Service initialization

The first module is creating web services with the corresponding description and tags. The service initialization implements different kind of services with set of labels and tags. The authentication for the service initialization also considered in this module, it provides the security from the unauthorized user. Every user must need to register and can access their accounts. It is secure the user information from the unauthorized person.

2. Service request processing

The query processing for the service is the second module of the project. The query processing process locates the information sources by executing conventional search engines. The implementation of the query processing is based on the search mechanism. If the number of searched results is fewer than that specified by a user, An Ontology-enhanced Cloud Service Discovery System generates new alternate queries to have more results.

3. Ontology Concept

Ontology can provide Meta information which describes data semantics [10].It provides a shared understanding of a domain of interest to support communication among human and computer agents. Ontology contains a set of concepts and relationship between concepts, and can be applied into information retrieval to deal with user queries. An aggregated similarity (i.e., Service Utility) is used to determine the rating as shown in algorithm 1.A web-page which has the highest service utility would be selected as the best service for the user.

4. Semantic categorization of web services

Semantic categorization of web services will facilitate service discovery by organizing similar services together. For each term in the service description vector, a corresponding concept is located in the relevant ontology. If there is a match, the concept is added to the description vector. Additional concepts are added and irrelevant terms are deleted based on semantic relationships between the concepts. The resulting set of service descriptions is clustered based on the relationship between the ontology concepts and service description terms. Finally, the relevant semantic information is added to the UDDI for effective service categorization. In the semantic categorization associate Ontology Cluster Algorithm has been saved.

5. Service selection

The next step is service selection from the relevant category of services using parameter-based service refinement. Web service parameters, i.e., input, output, and description, aid service refinement through

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narrowing the set of appropriate services matching the service request. His relationship between web service input and output parameters may be represented as statistical associations. These associations relay information about the operation parameters that are frequently associated with each other.

$$\text{Best Service} = \text{Max} \sum_{i=1}^{n} q_i \{d(t)\} \leq \sum_{i,j=1}^{n} WS_i\{d_j(t_i)\}$$

$$\text{Best Service} = \text{Max} \sum_{i=1}^{n} q_i \{d(t)\} = \sum_{i,j=1}^{n} WS_i\{d_j(t_i)\}$$

q_i ->Query Input
d(t) ->Document Term
WS_i->Web Services

6. Semantic similarity module

Semantic similarity module helps to calculate similarity between two concepts by counting common reachable concepts [6]. The similarity of concepts represents the degree of commonality between the services. We compute semantic similarity based on the method which is proposed in this module.

Algorithm : Similarity Ranking
Input : Service Request
Output : Semantic Results
Step 1: Begin
Step 2: Give the input to the Web Server
Step 3: For all filtered results {Ft (1), Ft (2), Ft (3),…, Ft (N)}
Step 4: Calculate similarity q (1) in user queries {q (1), q (2)… q (N)} with term t(1) in The Ft (N) {t(1), t(2), …, t(N)}.
Step 5: Calculate Similarity Ranking.
Step 6: Display Semantic Results
Step 7: End.

V. WEB SERVICE COMPOSITION

Web Service composition is the process to find a new services S which consists of set of component web services $\{S_1, S_2 .... S_n\}$.Each component web service is mapped to a set of real web services [9].

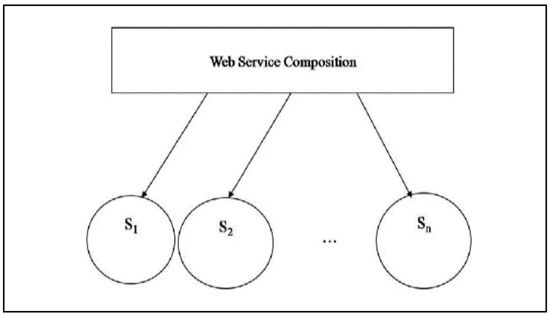

Figure.3. Service Composition

1. Semantic Web Service Composition

In this module, we review semantic web service composition by focusing on its main components as follows:

1) Semantic Web Services (we will assume without loss of generality that each service refers to a single operation),

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2) Their Semantic Links (also known as Causal Links) as a Formal way of representing their semantic connections, and
3) A way to model a composition through its constituent Semantic links.

Query by Semantics

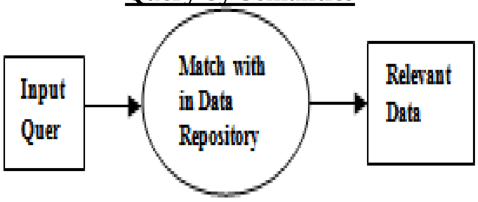

Figure.4.Semantic Query

2. Calculating Description Rate

In this module the description of the link that is mentioned in the web service can be analyzed to find the description rate. This is done in order to find the effective description for the particular link.

Algorithm: Web Service Composition
Input **:** Service .Request
Output: Service Description and Related Terms
Step 1: Begin
Step 2: Read the Service Request D_a for Service 1
Step 3: Read the Service Request D_b for Service 2
Step 4: Combined set of services $D_{(a+b)}$
Step 5: Mapped the Service Request and Associate WSDL file
Step 6:Display the Service Description and Related terms
Step 7: End

3. Link Quality calculation

This module is to find the Matching Quality of a Link. The link quality can be calculated 'y' the semantic method by analyzing the features of the link. The quality of the link can be calculated by means of the execution price and the response time. That is the expected time between the request time and the response time.

4. Report Generation

The report will be produced after comparing multiple services based on their service providing and the quality. The best service will be proposed for the better optimization.

VI. EXPERIMENTAL EVALUTION

The effectiveness of our approach which contains three experiments such as 1) Semantic Categorization of the web services in the UDDI. The results are evaluated by using F-measure. F-measure is mainly focused on the Precision and Recall. It is mainly used to Statistical classifications. Precision is the fraction of retrieved instances that are relevant which recall is the fraction of relevant instances that are retrieved. Both Precision and Recall based on understanding and measure of relevance 2) Semantic Similarity based matching. It is mainly used to discover services for an average of service request. The first discover process is based on the small number of WSDL files focused on Precision and larger number files of WSDL files focused on the Recall. 3)Performance of the service description which includes; i) Predefined categories ii) Semantic categorization iii) Set of uncategorized services above all the process observed the time calculated.

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Service Selection

$$\text{Best Service} = \text{Max} \sum_{i=1}^{n} Q_i \,\{d\,(t)\} \leq \sum_{i,j=1}^{n} WS_i\{d_j(t_i)\}$$

$$\text{Best Service} = \text{Max} \sum_{i=1}^{n} Q_i \,\{d\,(t)\} = \sum_{i,j=1}^{n} WS_i\{d_j(t_i)\}$$

$$\text{Best Service} = \text{Max} \sum_{i,j=1}^{n} Q_i \,\{d\,(t)\}\; WS_i\{d_j(t_i)\}=1$$

Q_i ->Query Input
d(t) ->Document Term
WS_i->Web Services

For Example,

No. of Web Services

$WS_1 \rightarrow \{a_1, a_2, a_3 \ldots\ldots a_n\}$
$WS_2 \rightarrow \{b_1, b_2, b_3 \ldots\ldots b_n\}$
$WS_3 \rightarrow \{c_1, c_2, c_3 \ldots\ldots c_n\}$

No. of Queries

$Q_1 \rightarrow \{c_1, a_2, b_3 \ldots\ldots\}$
$Q_2 \rightarrow \{b_4, b_6, b_7 \ldots\ldots\}$
$Q_3 \rightarrow \{c_1, a_6, c_7 \ldots\ldots\}$

BS=> $(Q_1 = = WS_1) = (c_1 = = a_1) = 0$
BS=> $(Q_1 = = WS_2) = (a_2 = = a_2) = 1$
BS=> $(Q_1 = = WS_3) = (a_3 = = b_3) = 0$
BS=> $(Q_2 = = WS_1) = (b_1 = = b_4) = 0$
BS=> $(Q_2 = = WS_2) = (b_2 = = b_6) = 0$
BS=> $(Q_2 = = WS_3) = (b_3 = = b_7) = 0$
BS=> $(Q_3 = = WS_1) = (c_1 = = c_4) = 0$
BS=> $(Q_3 = = WS_2) = (c_2 = = c_2) = 1$
BS=> $(Q_3 = = WS_3) = (c_3 = = c_8) = 0$

$$BS = \begin{array}{c c} & \begin{array}{ccc} WS_1 & WS_2 & WS_3 \end{array} \\ \begin{array}{c} Q_1 \\ Q_2 \\ Q_3 \end{array} & \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \end{array}$$

BS $\rightarrow$Best Services
Consider the above matrix; Integer 1 represents the best Services.

VII. RESULTS

The results obtained for implementation are shown below. Discovery home pages and it Contains,
Discover Service: It is mainly used to discover the information from the Web Server.
Retrieve Service: It is mainly used to retrieve information from the Web Server.
Service Description: Service Description is used to provide the description about the typed keyword.

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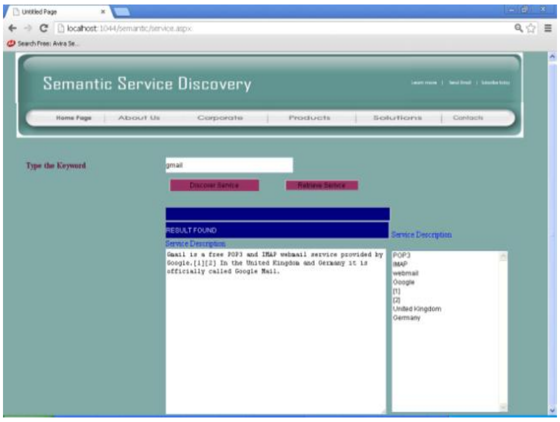

Figure .4. Service Home Page

The Above Service is mainly used to providing a Service Description. The user types any keyword. The web server providing Service Description and important key terms about the key word.

VIII. CONCLUSION

A novel approach is described for automatic discovery of semantic web services to match a user request with a semantic web service description. This approach involves two steps such as Semantic-based service categorization and Semantic Enhancement of the service request where the categorization is performed offline at the Universal Description Discovery and Integration (UDDI) and the enhancement of the service request achieves a better matching with relevant services. A solution for functional level service categorization based on an ontology framework is also proposed.

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