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Proposing an Effective Approach Based on Input-Output, Pre-condition and Requested Service Parameters, for Detecting Semantic Web Services

Mohammad Rostami[1], *Iman Attarzadeh*[2], *Hossein Beigi Harchegani*[3]
Iranian Academic Center for Education, Culture & Research[1,3], Department of Computer Engineering[2]
Ahwaz[1], Dezful[2], Branch Khuzestan[3]
Iran[1,2,3]

mohamad.rostami10@yahoo.com[1], attarzadeh@iaud.ac.ir[2] , hossein_beigi_h@yahoo.com[3]

Abstract: Web service is a comprehensive and autonomous application which can be defined, published, called and established in the network, especially in web. A source can be a software parameter or a machine process. The service is a basic concept in the new generation of internet, that's why it is called internet services in some contexts. The verity of this phenomenon is cloud computing in which, software and super structure is offered in service format. Service technology is one of the modern approaches of internet services in e - commerce that is paid attention by many researchers. After appearing service-oriented architecture, web services gained popularity. Due to existence of web services, finding a web service according to users' demands is a huge challenge. This needs to establish an efficient and reliable process of discovering a web service. Nowadays many researchers design techniques, in order to enhance the accuracy of Web service discovery which will be implemented best services. The results of process for discovering service, is for services to extend the satisfactory of user. Considering of semantic relations among the used words in describing the service, input and output parameters can be detected accurately. In addition to input and output parameters, other parameters services are described, which by using them, it can, enhance the accuracy of web service discovery. These parameters are known effect and post modality. The Proposed method is used for comparing the other methods such as Traditional information retrieval method and it is used for matching input and output. For configuration this approach we used Macro-Average, SWRL and OWL-S software and tools.

***Keywords*:** Autonomous applications, Web services, Internet services, E – commerce, Semantic relations.

1. Introduction

The term "Service" refers to various services in different areas. This word is generally known as Web services in computer science. Web service is a comprehensive and Autonomous application which can be defined, published, called and established in the network, especially in web [1, 10].

With maturity of the Web, Thousands of Web services have been reported in various shapes and complexities of different providers. These services can bias Simple as the Service of Weather forecasting, which can forecast Weather in a particular area and also can be a commercial service. In the meantime, operating users of these services should search through released services to find desired service. In addition growing and maturing needs of users, requires search and discovery service. As much as the complexity of the using services is more, it reduces the speed of services. This paper offers some solutions for providing more complex services and also increasing speed of service [14].

2. Web service

According to definition of World Wide Web Consortium (W3C), web service is a software service which is designed in order to support interaction between operators of two machines [11].

On the other hand, web services are software applications which provide special functions on the web and they can be fined, defined and achieved based on XML and standard protocols [14].Web services are created based on XML and because of the universal popularity of XML, they have functional capability. Messages syntax characterized by the use of XML. And HTTP as the underlying protocol is used to send messages and messages are created in SOAP format. SOAP is one of the most popular standards which is used in the Web service and its aim is to develop a method for sending and receiving XML messages by the web service [1].

Also UDDI is one of the technologies of web services, which allows program to find information about the Web service. Required Information for accessing a web service is created in a WSDL document. WSDL is a standard descriptive language based on XML.

3. Semantic Web

The definition of semantic web is beginning by defining the meaning. Meaning simply means sense or concept. Sense or concept makes it possible for characters to use underlying layer. Often, there is no meaning or purpose in many sources and it requires that users provide it. Simply, semantic web is a web (or network) of data which are described or connected, and are defined the meaning or semantics of the language and rules. Semantic web relevant the meaning through standardize the relations between information [14].

This involves unique tagging and address. Each unique data is connected to the concept or notion of a larger network. Flexibility of web, forms connections to all the necessary information, including the logical rules, directions and words form Vocabulary or ontology. Semantic web uses many anthologies which requires everyone to certain information field [3]. From the perspective of semantic web, ontology is illustration of features from common concepts in a particular domain.

4. Semantic Web Service

Provided Technologies by Semantic Web can work on web which was interpreted by the machine. Nowadays it can be read only by a human user. On the other hand, Web service technologies are working in an environment which organizations can make available some of its capabilities through the Internet. This would be possible with packaging or putting together computational capabilities of the service interface and allowing other organizations for discovering (through UDDI) and interacting it (via WSDL).

Semantic Web Service is the combination of two technologies, Semantic Web and Web service, and it provides enabling automatic and dynamic

interactions between Web service technologies and the possibility of describing Interfaces according to a standard procedure.

Semantic Web technology can be used to overcome this deficiency. It can be notation software which is provided by web service intermediate by definition and describes software functions and how it can do this and how they are construable by machine.

Moreover, we can decelerate services to a rich and construable way, by Ontology's which can be able to describe provided services [12].

Combination of these technologies makes most of the new works possible. The services can be prompt on the internet automatically in aspect of Analysis of the protein-selling book, Translation and Run Animation. The company which needs the service can find provider that previously has been unaware of its existence and makes Short-term business combination with it and receive service by paying it. All these steps can be done automatically and quickly. In addition many services can combine with each other and become more complex services. Semantic Web service technology provides a tool for describing service and also infrastructure ability for discovering services and enabling them to provide services to the operation. But it doesn't provide a reason to decide which service provides the best, how we can communicate service parameters and what action should be taken during service. If a service is simple and is used in an easy way, this argument is also easy. However, in some scenarios, would need complex reasoning such as negotiation or dynamic argument. Hence, the semantic Web service alone does not lead to a new world, but it can do this with the combination with other computer science disciplines [3, 11].

Semantic Web services as un-semantic web services have life cycle. To define the life cycle we need to know the concept of Semantic Web services. Service is doing an action or actions by a group for providing value or result for other groups. First group is known as service provider and second group is service requester. Life cycle of semantic Web Services is defined as the relationship between the provider and the service

requester. The cycle consists four steps, which they are modeling, discovering, defining and delivering the services, respectively. In modeling step, requester provides an abstract of requested service and provider provides an abstract of provided service (Recommended Service). In discovering step, the description of abstract requested services suited with proposed service to can find a service which is more suited with needs of requested. The defining step is containing provider service definition and its refinement. Finally, delivering step is done after the final agreement between the requester and provider [17].

Semantic Web Services have two macro and micro architectures. Macro Architecture pays to the main review of semantic Web service According to the three rules, requester, provider and detector. Micro architecture does the messaging between different roles (requester, provider and the detector) [8].

5. The Discovery of Semantic Web Services

Adding semantics to services descriptions increase the accuracy of finding (discovery) related services by using adaptive techniques based on logic. In order to achieve detection for the large-scale real-world scenarios, needs the combination of different techniques, implementation and recovery. Discovery can be done in two steps, the first step is a comparison based on keywords that the services are not team group with service Request would be removed in this step and second step is adjusting based on logic that in this step logical reasoning take place On the ability of describing a set of services that have remained from the previous stage [5].

With considering the quality of service annotations, the templates of discovering requirement will have the ability to determine the described structure. This includes the method of selection with appropriate reasoning models and also choosing what information should be in the descriptions [2], by using methods based on logic in matching description capabilities of requested service and offered service [5].

6. Components of Semantic Web Service Discovery System

✓ **Advertising Services**

Ad Service is not described through WSDL parameters or name of Service Operations, but it is described according specified service annotation ontology. Such ontologies are defined Semantic Web Service models to describe various aspects.

Service Annotation Ontology

Service annotation ontology can be considered as a model to describe service, which its aim is obtaining the meaning of Service functions, Syntactic processing of work flow and call/implementation explicitly details of web service. Such ontology's define a set of service capability features [17].

Domain ontology: semantic service notations as marked by the annotation ontology refer to concepts in the domain ontology. Such ontology's can be described the relationship between the expressions of specific application domains [16].

Request service: Depending on the implementation, request services may have variation of natural text languages to texts that have been described Service ontology annotation.

Matching algorithm: In general, Semantic matching algorithms are more complex and more intelligent algorithms based on syntax. They are designed for applying semantics for describing the function and application of the proposed service.

Repository Service: is a database which records all service information such as name, address, and used service ontology, inputs, outputs, preconditions and effects [8, 9].

7. Grade Match of Substitute

Grade matches of Service requests are four types: Exact, Plug – In, Subsume and Intersect.

There is other grade match that is called Fail. In fact this grade of matching expresses lack of matching requests with service. Fail means that advertised service doesn't meet any needs of

requests. As the definition of Fail, Its absence does not cause any problems in service discovery. So it seems that if we could adopt Degree of adaptation services that can help to detect better the degree of matching to fail, it would be a considerable help to the efficiency of the algorithm. For example someone has a request as followed: reserving of Hotel in Isfahan from 01.01.91 to 05.01.91 for two people. If there are no services repositories for doing this, and there is a service that allows users to provide accommodation in the camp, Service is replacing forgiven request [15].

8. Input, Output, Preconditions and Effects in the OWL-S

OWL – S profile shows the function which is provided by service. Described functions are divided into two parts: the data transfer is performed by the service and the condition has changed as a result of service.

Inputs and outputs: inputs and outputs of OWL–S described required information and what is generated by the service. Inputs and outputs can be modeled as a parameter. Inputs and outputs and local variable parts of the process in which they participate, are as its domain.

Preconditions and effects: a service may be a Preconditions or effects. If it has preconditions, it would not implement properly as long as they do not satisfy the preconditions. Preconditions are conditions around the world which should be established for the successful implementation of service [13, 14].

9. Previous Approaches:

So many works has been done in Web service discovery so far. These are divided into several categories. One group is compared services based on meaning. Another category uses the information retrieval, which these methods have pay attention to contexts. Other methods to discover Web Services are data mining methods. These methods most consider the service and do not pay attention to how they are being used. Another approach is based on quality of service which considers un-functional services and finally a hybrid approach that is a combination of

techniques based on Semantic methods and retrieved information. There are many researches in the field of semantic web service discovery. We are going to introduce several methods to discover Web services.

Paolucci.et al [1] provided adaptive systems based on the use of UDDI for maintaining service description. When a request is submitted, the algorithm finds an appropriate service first by matching the outputs of the request against the outputs of the published advertisements, and then, if any advertisement is matched after the output phase, the inputs of the request are matched against the inputs of the advertisements during the output phase. One of the best ideas in this research is that the both provider and client use an identical ontology that can have the same semantic values to each service profile. In this approach the task of engine is inference or facilitated deduction. Their matching algorithm is to distinguish between four degrees of matching: Plug in ،Exact ،Subsume،Fail. They only review relationships between ontology classes, parent and child that lead to low recall. Unfortunately some of the main information such as preconditions, effects and categorization of web services in this method are deleted. This led to increase the false negative.

Finally, services that are found by the algorithm do not fully meet the user needs.

Friesen .et al [2] more recent research in the field of Web services has been found to enhance the accuracy of Web service discovery has focused on semantic matching. Semantic service matching process is Implementation of various operations between provided services and requested services.

Friesen has proposed a solution by using the state machine template for service discovery. The proposed template does three actions: finding the function, discovering Semantic Web services and finally selecting the service in the discovery phase, user query is evaluated and user goals are clear. According to meanings of concepts which is used in descriptive service and making certain ontology, this method can find appropriate service by logical reasoning on

service descriptions. Describing of services should reflect their performance.

Chaiyakul .et al [3] has provided a template for templates of automatic discovery of services. In this context, the discovery of web services has been done in three stages.

Review of name, profile matching, comparing and analyzing the meanings of input and output parameters of a Web service preconditions and effects. In this template two knowledge bases are used. One for the base and the other is used to store the OWL Web service descriptions written in OWL-S. In this format, a new concept is offered as provided service plan. Service plan characterizes sequential planning service for responding user needs. To achieve this goal, Tree Services has been created and when calling it, this navigates by Post order method.

Guo et.at [4] proposed semantic matching method which has been benefited of OWL-S. But the ratings have been considered in service for implementing rules easily and this is as a result and it was returned Prevented accurate and appropriate services. The proposed method is used RACERDL deduction and is based on factor. None of these mentioned methods use plan approach for service matching. But there are things that have focused on ranking service.

Lu et al [5] has provided Semantic Web service discovery and ranking based on functional features. Methods have been proposed for implementation of fuzzy logic to abstract the core or basic web service and will be used in the matching process.

Bin_hong .etal [6] introduced a template which has used fuzzy logic in order to abstract and classified that data based on Web service that is used to form phrases and fuzzy rules. It is provided detecting hidden dimensions of web services and it means their data view summary data of Web services is in fuzzy set theory.

Hao .et al [7] has provided an algorithm for detecting of structural and textual information for the service. This algorithm has introduced a new concept called the degree of preference which indicates the priority of a service for user. This is a criterion for rating the service. Also, He introduces two features named Service

Relevance and Service Importance, for calculating the degree of preference.

Dong .et al [8] using data mining techniques to discover Web services can increase the accuracy of Web service discovery. Many of the results of a query satisfied the user. For calculating the similarity between the web services and for grouping that has used the Jaccard coefficient. In order to grouping the similar web services the same classified schema is used.

The idea of this method is that we can use syntax matching for enhanced related results if there is no service with the request of semantic matching.

10. Our Proposed solution

This algorithm is called the FSM initially uses ontology which provides application and then loads the user to receive requests. IOPE extracted the request from it, and then check the Advertising service in reservoirs and IOPE matching the request. With doing the match between IOPE requests and Service candidates is characterized the degree of matching service. The degree of matching service can be one of the degrees named as exact ،Plug – In ،Subsume ، Intersect and Substitute. Service will be scoring after identifying the matching degree of service. The rating service is composed of two criteria, semantic similarity between concepts and the similarities between the concepts of features.

Finally, the degree of matching is considered as a set of services that these rankings are based on their scores.

11. Verification of IOPEs

Here we examine the verification of IOPEs. Input and output of service are formed from one word, but preconditions and effects are content and therefore they are formed as a set of words. So, the comparison between input and output and method of determination from service verification degree are different from the same action in precondition and effect.

Otherwise, because of using comprisal relation to determine similarity amount, there are two different determinations for input/ output and

precondition and effect. The verification is divided into two parts. First part is input and output and second part is precondition and effect.

- **Verification of input and output and candida service**

Verification of input and output and candida service and consideration of comprisal relation between concepts in request and service and its comparison are as follow:

- ✓ At first all the classes are considered as an element. After that input and output class's concepts are extracted from sources, and they are also settled in one element. It should be mentioned that when an element is saving, services in name source and class of concepts are saved in source. Then every element in input and output concept is being compared with all elements in Candida service.

All we said here are about verification degree of Exact, Plug In, Sub-sum, Interest. We present a new algorithm called substitute. It is for service which there is not any high verification degree is looking services that don't remove user's needs but present equivalent them. It means candida service with substitute verification doesn't eliminate user's needs, but it presents the equivalent. For example, assume a request that user requests a reservation for hotel in a certain time. If no one of candida service could not provide this,

There was a service for providing possibility for camping. It selects as supporter service and their verification degree, input/output service and request is examined regarding to complementary of concept.

- ✓ **Verification of precondition and effect of request by candida service:**

Precondition and effect are like a concept, so verification method for input/output is different. We can propose it by SWRL rules. These rules are formed one atom and one interpretation or two atoms and one interpretation. Every interpretation points a concept in ontology. Interpretations are two kinds: one kind of them specifies with class predicate and they are class interpretations, such as atoms, they represent ontology concepts. But second kinds are property predicate which point attributes of

things in ontology. It should be compared concept classes of request and service atoms and request/ service interpretations, for verifying precondition and effect concept. So, there is a need to class predicate and property predict interpretation. Atoms and interpretations should be separated. Then they should be placed into elements. Afterwards, they should be compared equal. Here we should consider a situation of two phrases regarding to others, not word. The situation for this problem is as follow:

- ✓ Each phrase is formed of two or three parts. Therefore, we can say a phrase situation is related to both parts. For example, if we have two phrases which both of them are formed of three parts, and each three parts are in first phrase, it is equal with concept of second phrase, and then first phrase consists of second phrase.

12. Classifying Ads

Here we would determine verification degree of Candida service. By determining the verification degree we could not select an appropriate service.

If there were many services with same verification degree, how could we recognize which of the services are closer to request?!

In other hand, which services are more appropriate for user's needs? So, the classifying for services is important. There is need to appoint classification to service for classifying service. There are different criteria for classifying services. Some of them are: reply time of service, service quality, and amount of similarity for service elements to each other. These are three important criteria for classifying service. Similarity for service elements is an appropriate criterion for classifying the service. So, for the presented algorithm about classification and ranking it we used similarity criteria for elements. It is divided into two parts: one part is amount of similarity for concepts which service profile elements point them. Another part is the amount of similarity for concept attributes. Each of both has a role in determination the classifying of service.

✓ **Classification method**

To services base on similarity between concepts:

✓ **Verification algorithm**

Consists of recalling the function of similarity measurement, that is calculated the amount of concept similarity of two elements. The measurement function is based on hierarchical tree. It consists of comparable concepts and it is a number between zero and one, that shows the similarity degree and returns it as a result. This function uses some classified tree needs which concepts are placed in it. 'r' is considered as tree root of hierarchical concept. 'a', 'b' are two concepts. 'd' is a minimum interval between concepts, La , Lb are depth of common point of two concepts. They aren't negative and all of them are positive.

For example, if a=c10 , b=c5 , so, d=3 , La=3 , Lb=2 , ma=2 , mb=10.

There are some attribute for calculating similarity and classification amounts in the following:

- Concept similarity between a, b would decrease by increasing d linely.
- Concept similarity between a, b would increase by increasing (La+Lb).
- Concept similarity between a, b would increase by decreasing (La+Lb)
- Concept similarity between a, b would increase by decreasing (ma+mb)
- Concept similarity between a, b would increase by decreasing / ma- mb/

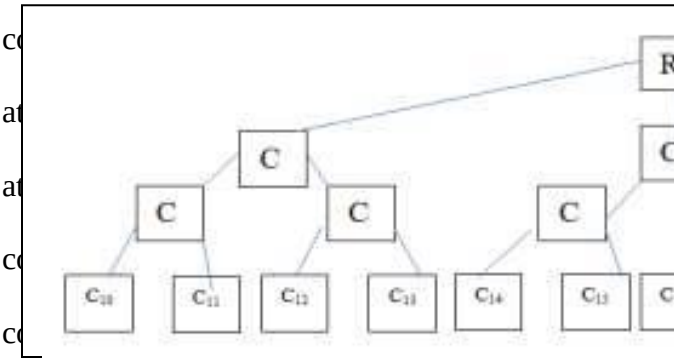
If we use S(a, b) for showing function, function should have following attribute:

1. O S(a , b) 1

2. a: S (a , b) = 1

3. a, b : S(a , b) = S(b, a)

First attribute determines range of function. Concept similarity between two concepts that are not related to each other is zero, and two similar concepts have



simultaneity attribute.

Figure1. *An example of ontology classification tree*

Now, we can introduce function equation according to upper attribute. B is regulating parameter.

As we see, this function is parametrical. If it is zero, it means both concepts are equal. So, the amount of similarity is 1.

If it is not zero, it means concepts are not equal and the amount of similarity should be calculated according to presented formula.

- Method for determining the amount of similarity of attribute concepts:

As mentioned before, there are some methods for examining the attribute between concepts.

Comprisal relation can discover the relationship between concepts. But the answer for interpreting on hierarchical tree of ontology is true or false. Therefore, it does not help to understand exact concept between two concepts. So, it feels like a need for comparing between two concepts for discovering web services.

For comparing concepts first we should consider an element for each concept which is inserted their attributes. Then they would compare with each other. This is not like meaning but they are like words. After comparison, amount of request concept attribute with Candida service and same attribute is divided to total attribute of both concepts, then would specify classification on concept attributes. The classification of concept attribute similarity can be calculated by equation:

Where, att-sim is the same classification for attributes.

- ✓ **Method for calculating the classification for each service profile element**

In this section we would describe methods for calculating input – output – precondition and effect. We use concept sim and att-sim.

For calculating classification, each couple that compared before is calculated classification. This couple consists of one concept of request and one concept of candida service. Because of semantic relations in ontology hierarchical, they are comparing with each other. They are the same on the perspective of hyper-concept and sub-concept. It should be say every element of request is compared with all matched elements in Candida service and output is considered as maximum score for calculating the score. Score of each element for input/output/ precondition and effect calculates from following equation:

Sub score = W_1 * concept – sim + W_2 * att-sim

Where, W_1 , W_2 are two weights for concept similarity and concept attribute similarity, respectively. It should be considered that W_1 + W_2 = 1.

After calculating the score of every couple (sub score), score of service would be calculated. Indeed, service is the average of all couple that was compared with each other. The reason for considering average is more severity for discovering the service. This means that if there were some couples between compared couples which had lower score, it would increase the score. Score of total service is calculated as follow:

After calculating the score of service (total score), every degree of comparison is considered as one collection (ontology). Services should be arranged according to that.

13.FSM Algorithm

Proposed Algorithm is called the FSM is as follows:

Input: Proposed services, application services, ontology, concepts of weight, weight feature.

Output: set of services sorted by degree of match and points.

Step 1: Extract the input, output, precondition, and effect of the proposed service and the requested service.

Step 2: If the input number of inputs of the proposed service is requested to step 11, otherwise go to Step 3.

Step 3: If the number of requests output is greater than the service offered to step 11, otherwise go to Step 4.

Step 4: If the number of the application preconditions service is offered to step 11, otherwise go to Step 5.

Step 5: If the number of parameters of service requests is proposed to Step 11, otherwise go to Step 6.

Step 6: Calculating comparison degree between request and proposed service:

- ✓ If all concept classes of input, output, precondition and effect are same, so comparison degree of proposed service is Exact.
- ✓ If concept classes of input, output, precondition and effect are all concept classes of input, output, precondition and effect are same, so proposed service consists of classes of request service concepts and degree of comparison is Plug In.
- ✓ If all same, so request service is consist of classes of proposed concepts, degree of comparison for proposed service is Sub-sum.
- ✓ If some classes of request service concepts were similar to proposed service or consisted of them, proposed degree is Intersect.
- ✓ If concept class for one of the inputs or outputs of proposed service had a complement of relation with the same of than in request service, the degree of comparison for service is substitute.

Step 7: If the matching degrees Substitute go to step 10, otherwise go to Step 8.

Step 8: Sub score calculated for each element of the input, output, precondition and effect.

- ✓ calculating concept-sim according
- ✓ Calculating att- sim according
- ✓ calculating concept-sim according

Step 9: Calculate Total score proposed service.

Step 10: Add the matching degree of service is proposed and rating Total score answer set.

Step 11: Finish.

14. Evaluation of Algorithm

The criteria of results from the assessment are Recall / Precision, F1 and the average response time to requests. FSM algorithm with three other algorithms is used traditional methods for retrieving the information. Another by matching input and output and the other by Matching IOPE Word Net module to detect similarities between concepts.FSM algorithm because of Recall / Precision and F1 are two algorithms for comparing. It means FSM Algorithm will be performed better in terms of accuracy of service discovery than other algorithms. We can use other algorithms that have less accurate but more speed than the FSM algorithms.

15. Conclusion

Web service discovery is still highly regarded. Many solutions have been proposed in this field, which are briefly syntactic and semantic. However, there are ways in which patterns are used to discover Web services but they are less. The semantic method has higher accuracy between them. Most methods for service discovery have been referred to the service profile. In most methods for discovering semantic Web services are considered only input and output.

The proposed algorithm in this paper, can consider input, output, effect, preconditions. The proposed algorithm in this paper with combining the comparing between concept and their characterization improve the discovery process and also offering a new class called Alternative Matching and increase accuracy in service discovery.

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Authors Profile:

Mohammad Rostami, has done his B.Tech in Ahvaz University and currently he is M.Tech student in Tehran Azad University. His research areas are artificial intelligence, Software engineering, Computing network, web services, semantic web and Relational Database Relationship in expert systems for treatment of ears illness and etc. He published total 94 papers including 7 Papers in various international conferences or 75 papers in national conferences and 3 Papers in ISI and ISC journals.

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Samaneh Dezhdar, have done her B.Tech in Saveh university. Currently she is M.tech student in software engineering in Azad saveh University and her M.Tech. final project is related to grid computing. Her research areas are: Network security, Web services, service management, relational database and etc.

