Semantic Web Service Selection Using Particle Swarm Optimization (Pso)

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***Abstract*— Service selection is a major constraint to discover and deliver services in a user friendly manner. In our system, we are enhancing and evaluating reliability of service discovery by adapting Particle Swarm Optimization (PSO) Algorithm in ontology repository to discover selected services. Our proposed technique is useful for ordinary search as well as semantic search corresponding to the service request using ontology repository. Here, the ontologies are reposited in ontology repository based on some set of concepts related with the domain knowledge. The knowledge provided by ontology repository helps service requestors/users to find semantic service from heterogeneous database and improves interoperatability, reasoning support and user-centricity. Reliability of service selection are evaluated based on the parameters search Time and memory accessing time**

***Keywords*—** *Semantic Web (SW), Ontology Repository (OR), Swarm Partcle Optimization (PSO) Algorithm, World Wide Web (WWW); Web Ontology Language (OWL); Resource Description Framework (RDF)*

I. INTRODUCTION

In World Wide Web [9], the web contains vast amount of information and it is distributed in all kinds of documents including text, hypertext, PDF files, audio, video files and software. Most of the data in the web is weakly structured and largely unorganized. Users use the search engines to search requested service in web pages and most of the web search engines logically organize the web pages into a structured, indexed semantic documents for the queries of information from users. So, web service engineering methodologies use ontology in the development processes. The design of new ontologies during the semantic web development had lack of focusing. Most of the web content not always easy to handle, due to its unstructured and semi structured nature of web pages and designing of web sites. Therefore, here we introduce an idea of semantic web that deals with the construction of understandable semantic results over semantic web and ontology repository.

Current World Wide Web (WWW) is a huge library of interlinked documents that are transferred by computers and presented to people. This also means that the quality of information or even the persistence of documents cannot be generally guaranteed. Current WWW contains a lot of information and knowledge, but machines usually serve only to deliver and present the content of documents describing the knowledge. People have to connect all the sources of relevant information and interpret them themselves. Semantic web is an effort to enhance current web so that computers can process the information presented on WWW, interpret and connect it, to help humans to find required knowledge. In the same way as WWW is a huge distributed hypertext system, semantic web is intended to form a huge distributed knowledge based system.

The Semantic Web as “a web of data that can be processed directly and indirectly by machines”. The term "ontology" can be defined as an explicit specification of conceptualization. Ontologies capture the structure of the domain, i.e. conceptualization. The conceptualization describes knowledge about the domain, not about the particular state of affairs in the domain. Ontology consists of a formal description of classes, relations between them and properties. This formal description is normally written in a logic-based language like RDF or OWL, so that “detailed, accurate, sound, and meaningful distinctions can be made among the classes, properties, and relations”.

Using ontologies can provide applications in reasoning, searching, decision support, natural speech understanding and are useful in domain of knowledge management, intelligent databases. As the major goal of Semantic Web is to extend the current form of Web by employing methods that generate structured knowledge from the existing unstructured contents, it offers a good basis to enrich Web Mining. Semantics can be utilized for Web Mining in many different ways. Web Mining can also be used to facilitate the creation of Semantic Web Prominent examples include ontology learning and population of ontologies. These ontologies encrypt the domain knowledge to facilitate automatic reasoning with the content. Such ontologies are vital for transforming legacy HTML documents into Semantic Web documents. The most important challenge for Semantic Web Mining is gathering knowledge for the creation of semantic annotations, the linking of Web pages to ontologies and creation & interrelation of ontologies for existing and future documents in an automatic or semi-automatic way. The cognition

gathered in such a way in the form of ontologies and other semantic structure can be used to facilitate the improvements in the Web Mining process. The Resource Description Framework (RDF) is a language for representing information on the web RDF can be used for a broad range of information, in particular for the presentation of Meta data about web documents, as author, title or last date of an update. Meta data can be useful for humans, but the main purpose of Meta data is to be processed by applications. Due to its standardized syntax it is even possible to exchange the information between different applications.

The RDF is a metadata specification developed by WWW and the result is a number of metadata communities bringing together their needs to provide a robust and flexible architecture for supporting metadata on the web. The RDF is a framework for describing and interchanging metadata and focuses on web resources. RDF Schema is a semantic extension of RDF. RDF Schema language is used for declaring basic class and types when describing terms used in RDF and are used to determine characteristics of other resources such as domains and the range of properties.

The Web Ontology Language (OWL) is another language for defining ontologies and is derived from DAML and OIL. Like RDF and RDF schema it can be used to express the meaning terms and the relations among them. Compared with RDF schema, OWL has several facilities for expressing meanings and semantics. OWL extends the basic statements facilities of RDF and possibilities of how to define classes and properties in RDF schema. Domains are OWL classes and ranges can be either are OWL classes or externally-defined datatypes such as String or Integer. Instances of classes can also be represented in OWL together with the Value of their properties. The most important extension compared to RDF and RDF Schema is the ability to define restrictions for properties or classes. OWL comes in different versions as OWL Lite, OWL DL and OWL Full. In our proposed system, we are enhancing and evaluating reliability of service discovery and selection by adapting PSO in ontology repository to discover selected services based on the request/intention of service consumers [9].

Our proposal has been organized as follows. Related work for ontology techniques has been focused in section II. Our recommended system architecture, algorithm and the explanation are focused in section III, IV, V and the experimental results are discussed in section VI and the final section VII consists of the conclusion and future work of our system.

II. Related Works

Manual approach for the service selection and discovery for each and every service are not suitable for large number of web pages. The number of web services increased vastly in last years. Various providers offering web services with the different functionality, so far web service consumers it is getting more complicated to select the web service, which best fits their requirements., reusability and distributed composition[2]. Further the current representation are lack Most of the hierarchy of context knowledge, it is difficult to infer the knowledge. In domain ontology OWL is used to define context That is why lot of the research efforts point to discover semantic means for describing web services for both functional and non-functional properties. This will give consumers the opportunity to find web services according to their QOS requirements such as availability, reliability, response time etc [1]. Basically ontology extract data from outside environment called context knowledge infer or analyze the data and then respond in real time to environmental situations by providing suitable services to user. As this is done in a context-driven manner, the way context is represented rather important in developing such systems. The issues below are raised in [2].

Context knowledge is usually represented differently in various systems without a proper standard, causing poor interoperatability knowledge the relationship in it and its property. Protégé [3] is used to develop OWL and SWRL. It provides the graphical user interface for easy development and management of ontology. It provides graphical user interface for development and management of ontology. The semantic web service discovery based on ontologies and agents [4] may perform service discovery, selection and ranking based functionalities and QOS. Agents provide service information efficient and dynamic. Use of OWL-S and domain ontologies match services and discovery engine return the relevant services. The problem in [4] is the lack of web service composition and not more practical for real-world applications. The QOS Aware web service recommendation by collaborative filtering [5] achieves better prediction accuracy and predicts past usage experience of service users.

The problem in [5] is reduced effect for web service invocations to the real world and selected only one operation to present performance of web services. The paper [6] explains semantic model checking algorithm which is sound and complete and it is a basic tool for web service selection, validation and composition. The issue behind here in [6] it is efficient only when applied to WSMO abstract state machine rather than STS. The paper [7] explains about composition of web services by two various algorithms: Evolutionary and Non- Evolutionary Algorithms.

The evolutionary algorithms find optimal solution only when the business processes are complex and distribute the service candidates to obtain best results. The non-evolutionary algorithms converge much faster but it produces efficient result under small scale environment and candidates are limited. The paper [8] enables user experience and involvement, simplifies service implementation and optimizes the service lifecycle. But, it doesn't focus on efficient service discovery and selection algorithms and lack of distributed storage mechanisms. So, we are in necessity to enhance interoperatability, reliability, and availability, user centricity by fully automating the search by using ontology repository to reduce human interpretation and to enhance machine interpretations.

III. System Architecture

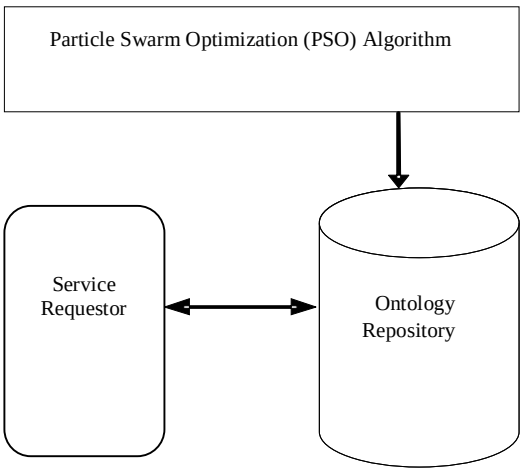

Fig1. Web Service Selection from Ontology Repository

IV. Service Selection From Ontology Repository

The Web service providers are now aware of providing quality of services for the reasons of reliability, interoperability and universality. Consumers need response in a fraction of a second upon their service request. For such a rapid response normal server database cannot be suitable for apt service provision as the service provision from server database takes more time to provide the exact user request. Thus, we use semantic web for rapid service provision. The Semantic Web stack builds on the W3C's Resource Description Framework (RDF). Ontology repository is created using the semantic web. Several ontology repositories provide access to the growing collection of ontologies on the Semantic Web. The data are extracted from multiple data resources is different in their format and order. And lot of data are stored in ontology repository, only provide the data related to queries of service consumers. An existing technique involves checking the similarity between the text and keywords. Our proposed system is a combination of ontology repository and the semantic web. In this approach we use domain ontology according to that classify keywords into different categories. If user is searching for some service, the service provider contacts ontology repository and provide the particular services to the service consumers. In our project, ontology repository is created from the collection of various RDF files. In our ontology repository Figure1, we use PSO Algorithm only to select necessary files are to be identified and those files are added to the ontology repository. Finally the results are evaluated using response time and memory access of the service provision to the client.

V. Service Selection Using PSO

Particle Swarm Optimization (PSO) technique is categorized into the family of evolutionary computation. It optimizes an objective function by undertaking a population based search [13][15].This novel technique is inspired by social behavior of bird flocking or fish schooling. Unlike genetic algorithms, PSO has no evolution operators such as crossover and mutation. In PSO, the population is initialized randomly and the potential solutions, named particles, freely fly across the multidimensional search space [14]. During flight, each particle updates its own velocity and position by taking benefit from its best experience and the best experience of the entire population. The aim of a PSO algorithm is to minimize an objective function F which depends on a set of unknown variables. At each iteration, the behavior of a given particle is a compromise between three possible choices;

- to follow its own way
- to go toward its best previous position
- to go toward the best neighbor

TABLE I

PSEUDO- CODE OF PARTICLE SWARM OPTIMIZATION (PSO)

```
[x*] = PSO()
P = Particle_Initialization();
For i=1 to it_max
  For each particle p in P do
    fp = f(p);
    If fp is better than f(pBest)
        pBest = p;
    end
  end
  gBest = best p in P;
  For each particle p in P do
     v = v + c1*rand*(pBest – p) + c2*rand*(gBest – p);
     p = p + v;
  end
end
```

VI. Experimental Results

For enhancing reliability of service discovery and selection in ontology repository we have implemented PSO in Ontology Repository. The evaluation of reliability can be calculated through the execution time and memory processing time. The execution time and memory processing time for ontology repository and server can be evaluated by using equations (1) and (2);

Execution Time= Process Start Time (Receiving Request) – Process End Time (Service Provision) (1)

Memory Processing Time= Runtime.TotalMemory-Runtime.FreeMemory (2)

TABLE II

RESULTS OBTAINED USING ONTOLOGY REPOSITORY

Parameters Used	Reliability Evaluation of Ontology Repository and Server	
	Using Ontology Repository	Without Ontology Repository
Memory Accessing Time	Low	High
Search/ Response Time	Quick	Slow

Table II, describes memory access for server which is high when compared with ontology repository is low and also describes Response time for server is high and ontology repository produces quicker service provision for the request of service consumers. Therefore, in our project reliability is enhanced and evaluated by using ontology repository.

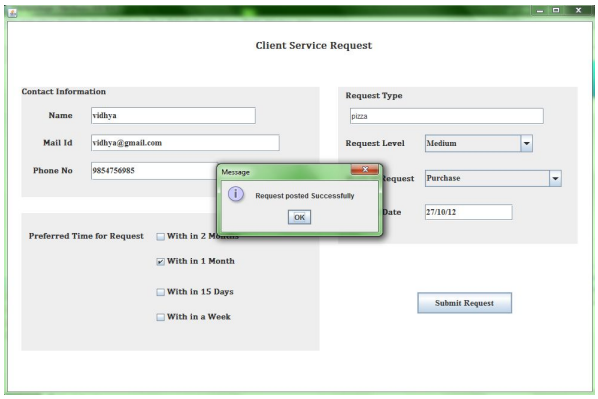

Fig2. Consumers Requesting Services

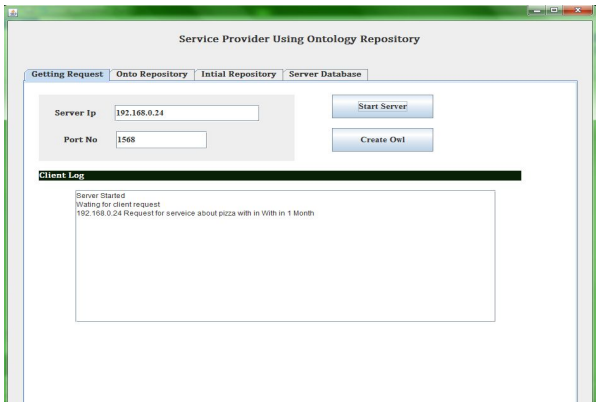

Fig3. Service Provider Receiving Requests from Consumers

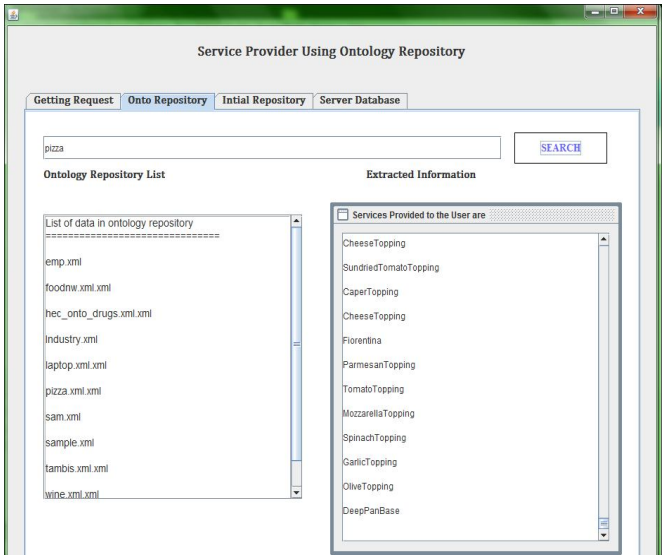

Fig 4. Retrieved Information from OR by Matching Consumer Requests

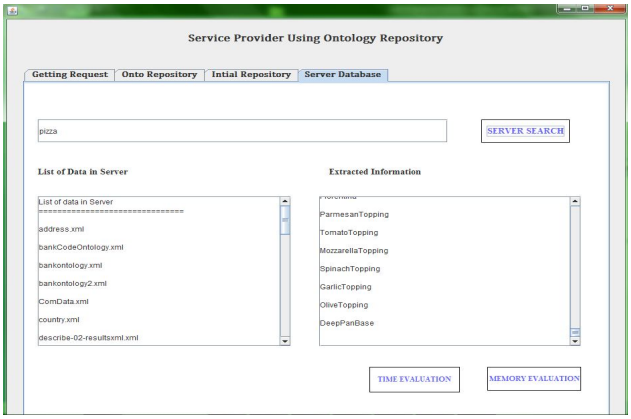

Fig 5. Retrieved Information from Server by Matching Consumer Requests

Fig 6. Reliability Evaluation based on Response Time

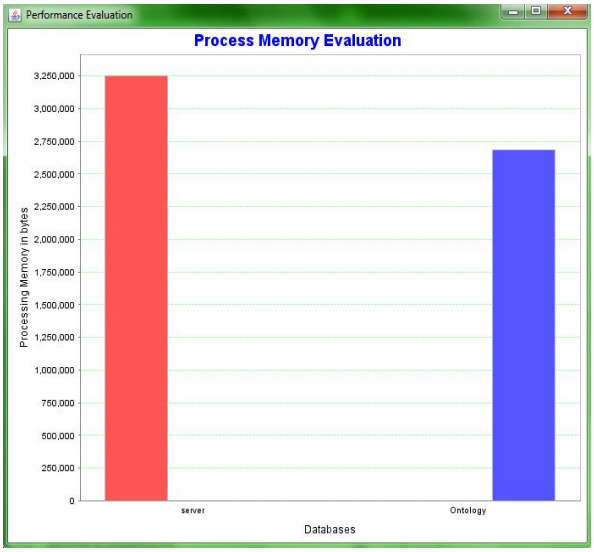

Fig 7. Reliability Evaluation based on Memory Access Time

Fig 2 describes the service requested by the Service Consumers. Fig 3 describes the requests received by Service Providers. Fig 4 describes the Extraction of Similar Services from ontology Repository in accordance to the request of Service Consumers. Fig 5 describes the extraction of Semantic service from the database server in accordance to the request of Service Consumers. Fig 6 and 7 explains about the evaluation of reliability by considering two various performance measures like Search Time and Memory Accessing Time.

VII. CONCLUSION

Ontology repository conceptually a large interlinked database and the contents are formally defined and its utilization is maximum and reasoning capability. Semantic Web is very easy and efficient for information search, access, extraction, and interpretation. Semantic web has more accuracy and less semantic heterogeneity and consists of contents, formal description of semantics and presentations. In ontology repository, adapted PSO an evolutionary algorithm in Ontology Repository to optimize the service lifecycle when complexity occurs and the reliability of service discovery and selection are enhanced and evaluation of reliability achieved by comparing the table based on response time and memory accessing for server and ontology repository. Thus, the service lifecycle gets optimized and the user centricity gets improved. Further work will be focused on ranking more number of ontology repositories based on Skill- Matching Algorithm and the ratio of success and failure of services and by considering error rate as one number of Ontology Repository doesn't satisfy various requests from service consumers.

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