ISSN 2229-5518

A Study of Finding Similarities in Web Service Using Metrics

D.Chandramohan, Shailesh Khapre, S.Ashokkumar

Abstract— Newest mounting and escalated recognition of services and its equivalent building of significant Web service mature to be a considerable rally. Web service expertise for permitting right to entry for promoting services regardless of locality and execution policies exist already. On the other hand, a huge discrepancy on structural, semantically and technological intensity all along with the emergent number of offered web services formulate their discovery a significant challenge. Our proposal progresses to classify an ultimate approach for identifying web service resemblance with the help of metrics. In particular, we analyzed the intrinsic worth of using metrics based Models, WordNet metrics and semantic similarity metrics for this evaluation purpose.

Index Terms—Web Service, metrics, Web Service Architecture, Simple Object Access Protocol (SOAP), (SOAP) based multicast protocol (SMP). (Web Service Manipulation Language) WSDL, Universal Description, Discovery and Integration (UDDI), XML, Web Ontology Language (OWL) ontology

1 Introduction

Web service allows different application from different sources to communicate with each other without time consuming and custom coding. It is a standardized way of integrating web based applications. It allows organizations and users to communicate data without intimate knowledge of each other and share business logic, data and process through a programmatic interface across a network. It has been employed in a wide range of applications and has become a key technology in developing business operations on the web. In order to leverage on the use of web services, web service discovery and composition need to be fully supported. Several systems have been proposed to meet this need. The search and concepts lets to turn out the useful information retrieval and matching scenarios. Determination of conceptual overlap simplifies phrasing an adequate search concept. These results are ordered by degree of similarity to the searched and compared to the concepts. Delivering a flexible degree of conceptual overlap to a searched concepts gives the similarity measurements and it would additionally deliver the concepts of whose instances are located inside and adjacent to the search result. These concepts are close and identical to the user intended concepts. Identifying the attribute filler or relations for identifying the similarity in WSML (Web Service Manipulation Language) and the service integration scenarios the similarities between the concepts are based on their specification and their chosen representation languages. This proposal leads to develop metrics for identifying the service similarities in web services that can help the clients / users to get serviced by

i) Efficiently finding the web service on web by ranking them according to their category with the help of metrics and proposing their degree of similarity
ii) Implicit and explicit data flow identification in services and computing the service to the best for the requesters.
iii) Eliminating fuzzy decision to identify the web service through improved fuzzy similarity algorithms.

We are proposing an approach enabling the implicit representation of similarities across distinct services which will help the requestors for identifying the exact service in which they are looking for. Similarity between words is becoming a generic problem for many applications of computational linguistics and it explores the determination of similarity by a number of information sources, which consists of structural information and information content from a huge quires.

2 Related Work and Background

Services are provided by logical grouping of operations and its functions, if we consider the relevant service in business process as an activity with specific business goals and new products going to introduces in the near feature, current products to sales and ready for service and fulfilled order and business process consists of service and its operations which are executed in an ordered sequence according to a set of business rules. A service similarity matching algorithm is proposed to address the various degree of similarity in the qualitative matching

- *D.Chandramohan* and Shailesh Khapre are currently pursuing masters in technology program in Computer Science & engineering in Pondicherry Central University,Pondicherry, India, pdchandramohan@gmail.com , shaileshkhaprerkl@gmail.com*
- *S.Ashok kumar is currently pursuing masters in Engineering program in Computer Science and engineering in Veltech DR.RR & DR.SR Technical University,Chennai, India, ashokkumar782@gmail.com*

level. A multi-level matching frame work for modeling web services are achieved in five different levels syntactic, static semantic, dynamic semantic, qualitative services, dependable services and collaborative design for demonstrating these approaches. The appropriate measuring of distance of different services and their similarity relations between the sequences are based on the non computable notations and shows all its computable similarities globally and this computable similarity measure is similarity metrics as discussed [5], [7], [10], [12], & [15]. The UDDI registry by an approach for web service retrieval based on the evaluation of similarity between web services interfaces are defined with web service description language (WSDL). The higher the similarity and the less are the difference among their interfaces. A semantic oriented variant approach was proposed and discussed in [1], [8], [9], [11], & [13] as a language to annotate a WSDL description. Effective web service retrieval algorithm and to evaluate the similarity degree between two web services by comparing the related WSDL descriptions and the relation between the main elements composing a WSDL description by means of port Type, operation, message, and part Type. The automatic semantic categorization of web services are enabled by categorizing the pre-defined terms to calculate the sum of measure of semantic relatedness, nearest similarity score which are extracted from WSDL of a web service discussed in [2], [14], [17], & [19]. The measures of semantic relatedness are statistical methods for extracting word associations of text from WSDL. Vector based and probability based measure of semantic relatedness to find the point of mutual information and the normalized service distances are easily identifiable. A scalable similarity search for learned metrics and their pair wise similarity was measured using the Mahalanobis distance function enables efficient indexing with learned distances with a very large database as discussed in [3], [16], [18], & [21]. This approach to evaluate the impact on accuracy a learned metric has relative to both standard baseline metrics and state of the art methods and to test how reliably our semi-supervised hash functions preserve the learned metrics in practice when performing sub linear time database searches. Simple Object Access Protocol (SOAP) [1], [2], [4], [20] based multicast protocol (SMP). The SMP reduces the network traffic by aggregating syntactically similar SOAP messages to form a compact SMP message to the service requesters. The similarity of SOAP message is measured in pairs and both based on the message template and on the values of each XML tag in the message as discussed [20], [22], [24]. For measuring the similarity of semantic services and their compatibility by annotated with Web Ontology Language (OWL) ontology. This technique to OWL-S an emerging standard based on the inference as discussed [6] and this ontology based techniques and metrics similarities are under development by the research teams. The approach of UDDI registry for web service retrieval based on the evaluation of similarity between web services interfaces are defined with the WSDL [1] and the clarification by semantically enriching the WSDL specifications in a semantic explanation. The method of enabling the scalable similarity search for learned metrics by finding the Mahalanobis distance function by construction of enabling the hashing construction indexing [23] in retrieved services.

The service categorization and discovery is based on the keywords [2] which are extracted from WSDL and measuring the semantic relatedness of each word with predefined category then finding the nearest similarity score. The similarity based SOAP multicast protocol to address the issue of latency service, the similarity of SOAP message is measured in pairs and is based on the message template [4] and on the value of each XML tag in the message. Finding valuable and attractive web services are becoming difficult due to massive number of web services, mining web service frame work in which the fuzzy logic, fuzzy set theory and fuzzy matching for those services into composite web services [5], [6] and finding the service similarity metrics.

3 Objectives and Research Issues

This proposal states the web service retrieval based on the evaluation of similarity between the services in which the service descriptions are adopted from Web service Description Language (WSDL), Simple Object Access Protocol (SOAP), Universal Description, Discovery and Integration (UDDI) and XML schema.

i. To identify the similarity in services by finding the replica of port type, operations, message, functions, prototypes, in and out parameters, parts etc from SOAP, UDDI, WSDL, and XML schema registries.
ii. Reducing the complexity of evaluating the words and phrases extracted from WSDL by introducing an improved clustering algorithms.
iii. To identify the semantic relatedness of keyword to find the similarity, machine learning techniques can reduce the complexity of extracting from WSDL.
iv. To identify the ontology based service similarity to match the degree of service recommendation by hybrid match making algorithms and techniques in schemas.
v. To identify the web ontology language OWL similarity functions by targeting inference based matching with generic clustering algorithms.
vi. To evaluate the scalable similarity of Mahalanobis distance from very large database by means of introducing the advance hashing algorithm for implicit and explicit parameters existing in service.
vii. To explore a generic similarity service view in automated discovery of mediation by identifying the means of scalability.
viii. A statistical approach for service value decomposition to find the balance point accuracy and ranking of web services based on QOS attributes and cosine values.

ix. Exploiting a linguistic semantics search instead of plain key word based search will make the similarity selection of web service more appropriate.
x. Introducing a retrieval frame work by identify the similarity in service to improve the sophisticated similarity measures in XML service retrieval.
xi. To find the similarity in services an improved fuzzy similarity algorithm can improve the scalability among the services.

Heuristic and complex schema matching algorithms for both functional and non functional semantic distance for finding the web service similarity and the process model search.

4 PROPOSED APPROACH AND WORK PACKAGES

The proposed approach can be identified by means of extracting details from different services of UDDI registry, SOAP, WSDL, and XML schema applies the proposed model and it's easy to identifying the similarity metrics from any service. To realize the strategies mentioned in this proposed project, the following metrics are used in different phase to identify the similarity in web service.

Phase1

The different similarity functions from web services are identified on certain parameters like port type, operation name, input message, data type similarity, information loosed maximization function and similarity functions from the service.

$$\text{MaxSim}(f, Q, P) = \frac{1}{|Q|}.\max \sum_{i \in I}^{j \in J} f(qi, pj).xi,j, \quad (1)$$

$$\sum_{j \in J} x\,i,j \le 1, \qquad \forall i \in I,$$

$$\sum_{i \in I} xi,j \le 1,\ \forall j \in J,\ I = [1..|\,|Q|\,],\ J = [1 \ldots |P|\,]$$

$$P(\boldsymbol{\sigma}_q) = \frac{|\{\sigma i \in \Sigma_{\sigma q} \mid \sigma i \in \Re\sigma q\}|}{|\Sigma_{\sigma q}|}$$

$$R(\boldsymbol{\sigma}_q) = \frac{|\{\sigma i \in \Sigma_{\sigma q} \mid \sigma i \in \Re\sigma q\}|}{|\Sigma_{\sigma q}|}$$

Where σq is the query, $\sum_{\sigma q \text{ is}}$ the returned services after submitting the query, and Rσq is the relevant services for the given query. Precision and recall are measures for the entire result set without considering the ranking order. Thus, R-Precision and AP (Average Precision) parameters are also considered. Both of them depend on the precision at a given cutoff point (P_n). Thus, assuming $\sum_{\sigma q}^{n}$ as the set including the first n returned services

Phase2

Similarity in words in different services are denoted by lexical meaning between two words for example W_1 and W_2 are two words in WSDL document then the SimSet (Set_1, Set2). The set denotes by S_1 and S_2 and their functional similarity value can be calculated as Sim (S_1, S2),

$$Sim(S_1, S_2) = \alpha * SimSet(S_1.T, S_2.T) + B * SimSet(S_1.B, S_2.B) + \Gamma * SimSet(S_1.A, S_2.A)$$

$$Sim(S1, S2) = \frac{\sum_{w \in S1} Sim\ m(w, S2) + \sum_{w \in S2} Sim\ m(w, S1)}{|S1| + |S2|} \quad (2)$$

S, T collection of words in service title information B denotes the service body information, A denotes the service additional information, and T, B and A represents the weights in similarity computation, α, β, γ are coefficients of different parts.

Phase3.

The Web Services are initially categorized under seven different categories Zip Code, Country Information Stock Market, Temperature, Weather, Fax and Currency. The extracted words of a particular Web Service are compared with each category from the WSDL of a web service (pressure, humidity, rainfall etc). The NSS (Normalized Similarity Score) of each word was calculated with category. We use the probability-based MSR – Normalized Similarity Score (NSS). NSS is an MSR that is derived from NGD. To be more precise, the relatedness between two words x and y is derived by NSS(x, y) =1-NGD(x, y)

Where NGD is a formula derived by cilibrasi and derived as

$$NGD(x, y) = \frac{\max\{\log f(x), \log f(y)\} \log f(x,y)}{\log M \min\{\log f(x), \log f(y)\}} \quad (3)$$

Phase4.

Consider two concepts that belong to a same ontology, the similarity between them are calculated by the following equation

$$Sim(C_1, C_2) = e^{-ch}, \frac{e^{\beta h} - e^{-\beta h}}{e^{\beta h} + e^{-\beta h}} \quad (4)$$

Where l stands for the shortest path length between the two concepts in the ontology, and h stands for the depth of the closest common ancestor of the two concepts. The explanation of this measure is apparent. f_1 takes into account the influence of the path length. The similarity between the two concepts decreases at an exponential rate as the path length increases. f_2 reveals the influence of the concepts depth. Deeper a concept in the ontology, more concrete concept that means, a pair of deeper concepts will share more common information comparing with a pair of shallower concepts, when the path lengths of the two pairs are equal.

Phase5.

Distance metric for semantic nets and similarity for ontology framework and the semantic similarity was calculated by the similarity of OWL objects a and b is formally defined as

$$Sim(a, b) = \frac{f\ common\ (a,\ b)}{f\ desc\ (a,\ b)}$$

$$0 \le \text{sim} \le 1$$
$$\forall a : sim(a, a) = 1$$
$$\forall a, b : sim(a, b) = sim(b, a)$$
$$f\ common(a, b) = f\ desc(a, b)$$

We have the similarity metric by inference based information value, for any OWL object a and b

$$Sim(a, b) = \frac{\sum_{(x,y) \in com(a,b)} (IBIV(x) + IBIV(y))}{\sum_{s \in code\ sc\ m,n(a,b)} IBIV(s)} \quad (5)$$

fcommon is the common function measuring the information value of the description that is shared between a, b. fdesc is the description function giving the value of the total information content of a and b. The similarity is defined as the ratio of the shared information between the objects to the total information about both objects. From the definition of the similarity function, sim, we can immediately obtain some properties that confirm some of the common intuition regarding similarity.

Phase6.

Metrics learning by similarity search and locality sensitive hashing in web service environments main idea of our approach is to learn a parameterization of a Mahalanobis metric based on provided labels or paired constraints while simultaneously encoding the learned information into randomized hash functions. These functions will guarantee that the more similar inputs are under the learned metric, the more likely they are to collide in a hash table. After constructing hash tables containing the entire database examples, those examples similar to a new instance are found in sub linear time in the size of the database by evaluating the learned metric between the new example and any example with which it shares a hash bucket. Parameterized Mahalanobis Metrics was proposed by means of

$$d_A(x_i, x_j) = (x_i - x_j)^I A (x_i - x_j)$$
$$S_A(x_i, x_j) = x_i^T A x_j$$

By parameter zing the hash functions instead by G (which is computable since A is p.d.), the following relationship express the hash functions by means of described sample inputs

$$P_r\left[h_{r,A}(x_i) = h_{r,A}(x_j)\right] = 1 - \left\{1 - \frac{1}{\pi} \cos^{-1}\left(\frac{x_i^T A x_j}{\sqrt{|Gx_i||Gx_j|}}\right)\right\} \quad (6)$$

Phase7.

Semantic web service mediation as used throughout the remainder of SWS either the description of the web service or the description of service request and it is formally represented with in a particular ontology that complies with a certain SWS reference model and defines the semantic similarity between two service members of a space as a function of the ECD (Euclidean Distance). Euclidean distance between the points representing each of the members, the different distance metrics could be considered based on the nature and purpose of the MS and the definitions of MS given by V, U expressed by vectors $V_0, V_1, \ldots\ldots V_n$ and $U_1, U_2, \ldots\ldots U_n$ within the MS and their distance can be calculated as

$$\text{Dist}(u, v) = \sqrt{\sum_{i=1}^{n} Pi\left(\left(\frac{u_i - \bar{u}}{su}\right) - \left(\frac{v_i - \bar{v}}{sv}\right)\right)_2}$$

A similarity based mediation service can be provided as a general purpose mediator and can be implemented as a particular mediation service in which (MWS_1, MWS_2) are the standard web services and denotes the ontological refinement of SWS_i as a service request description. Consequently mediation services MWS computes a set of x sets of distance Dist (SWS_i) = {Dist (SWS_i, SWS_j), Dist (SWS_i, SWSj)…Dist (SWS_i, SWS_x)}

Where each Dist (SWS_i, SWSj) contains a set of distance {$dist_1$…$dist_n$}

$$\text{Sim}(SWS_i, SWS_j) = \left(\overline{Dist(SWSi, SWS\,j)}\right)^{-1} = \left[\frac{\sum_{k=1}^{n} dist_k)}{n}\right]_{-1} \quad (7)$$

Phase8.

Improving the semantic web services discovery through similarity search in services by means of Metric Space M=<D, d> where domain D is a collection of web services and distance function d is the semantic similarity between requester and web services. A semantic web service modeled in metric space is a triple SWS=<FS, NFS, FW> such that FS is the functional semantics, NFS is the non-functional semantics and FW is the description framework. The functional semantics of SWS is defined as a quadruple of functional features FS=<EX, RE, PR, OU> such that EX describes what a web service expects for enabling it to provide its service, RE describes what a web service returns in response to its input, PR describes conditions over the world state to met before service execution, and OU describes the state of the world after the execution of the service. The non-functional semantics of SWS is defined as a triple of non-functional features NFS = <Q, SP,CP> such that Q is a set of QOS parameters offered by the service, SP is a set of service specific parameters, and CP is context policy Distance measure is defined as semantic similarity based on functional semantics

$$d_M(SWS_R, SWS_A) = \sqrt{\sum_{i=1}^{n} Wi\,(SWS_{Ri} - SWS_{Ai})2} \quad (8)$$

Phase9.

Similarity measures for business process models such as label similarity is one way of measuring the similarity between a pair of process models and relation between elements in one model and elements in other models

$$\frac{\sum_{(n,m) \in A} Sim\ l(n,m)}{|P_1| + |P_2|} \quad (9)$$

Where Siml is a similarity measure between pairs of model elements the similarity between model elements can be computed from their labels using syntactic similarity measures, semantic measures, or a combination of both. Syntactic measures are based on string-edit distance, n-gram, morphological analysis (stemming), and stop-word elimination techniques, whereas semantic techniques are based on synonym and other semantic relations captured. The structural similarity measures are processed as per distance.

Phase10.

Heuristic search and similarity flooding search algorithm A* algorithm was adopted here to find the distance between the services in N-M mapping O (mn) is the worst case in this condition. Fuzzy similarity clustering for the consumer centric for selection of web services, the similarity between WSA_{ai}^{jk} can be obtained via the equation Sim_{ai}^{jk}

$$Sim_{ai}^{jk} = \frac{\int \left(min\{ \tilde{m}\left(wsa_{ai}^{j} \right), \tilde{m}(wsa_{ai}^{k}) \} \right) dx}{\int \left(max\{ \tilde{m}\left(wsa_{ai}^{j} \right), \tilde{m}(wsa_{ai}^{k}) \} \right) dx} \quad (10)$$

We can find the average agreement degree (AAD), denoted as A (WSA_{ai}^{k}) in the form

$$A(wsa_{ai}^{k}) = \frac{1}{n-1} \sum_{\substack{j=1 \\ k \neq j}} Sim\ kj$$

The RAD (Relative Agreement Degree) for each individual opinion uses the RAD equation as given below

$$RAD\,(wsa_{ai}^{k}) = \frac{A(wsa_{ai}^{k})}{\sum_{j=1}^{n} A(wsa_{ai}^{k})}$$

Similarly to obtain the CDC (Consensus Degree Coefficient) for each participant can be obtained by the equation

$$CDC(wsa_{ai}^{k}) = \beta\, x\, w_{k} + (1 - \beta) X\, RAD(wsa_{ai}^{k})$$

The aggregate fuzzy opinions by the CDC can be determined as

$$\tilde{R}_{ai} = \sum_{k=1}^{n} CDC(wsa_{ai}^{k}) . (wsa_{ai}^{k})$$

Thus the AAD, RAD and CDC equations helps to find the similarity in different services.

Phase11.

Service discovery and integration of similar service and ranking it Current web service description model fails to provide sufficient information to enable ranking mechanism for service web, but at the same time, due to the fast growth of web services, ranking becomes more and more important for a web user to easily find an appropriate service. Thus, to enrich semantic aspect of a service description for ranking, Anchor Semantic Description Model (ASDM) is proposed to incorporate request semantics and reputation as anchors into a service description. ASDM provides an easy and automatic approach to enhance service descriptions on semantic aspect. It is simpler than the complex OWL-S but can include more information than the document element of WSDL. Selection usage level indicates that the retrieved service operation is selected by the service requestor to view its detailed information. When a service selection action is captured, the use Frequency of s-anchor element of the corresponding service operation will increase 1. Composition usage level indicates that a retrieved service operation is selected and composed into a service application. When a service composition action is captured, the use Frequency of c-anchor element will increase 1 while the use Frequency of s-anchor element will decrease 1 for the corresponding service operation

$$DScore = \cos\left(D_{r}, D_{p}\right) = \frac{\sum_{k=1}^{n} W_{rk}\, X\, W_{pk}}{\sqrt{(\sum_{k=1}^{n} W_{rk}^{2})(\sum_{k=1}^{n} W_{pk}^{2})}} \quad (11)$$

Ranking by means of DScore and to compute the similarity between request description and anchor semantic elements it has a property use frequency and a term list with VSM between request description and anchor semantic elements of a service operation should firstly be represented as a vector.

$$W_{ak} = sr\, X\, T_{s} + cr\, X\, T_{c} + dr\, X\, T_{d} + rr\, X\, T_{r}$$

Where sr, cr, dr, and rr are the reputation values of the four different usage levels; and Ts ,Tc ,Td and Tr are the occurring times of the given term in each anchor semantic element. The AScore ranking also found by using the cos (Dr, Da)

$$AScore = \cos\,(D_{r}, D_{a}) = \frac{\sum_{k=1}^{n} W_{rk}\, X\, W_{ak}}{\sqrt{(\sum_{k=1}^{n} W_{rk}^{2})(\sum_{k=1}^{n} W_{ak}^{2})}} \quad (12)$$

high frequency of service using leads to high quality by RScore in the mean of sr U, F, cr, dr, rr where UFs, UFe, UFd, UFr are the frequency of the four different anchor semantic elements and it is demanded by,

RScore=sr x UFs + cr x UFe + dr x UFd + rr x UFr

Similarity in query retrieval with ranking for XML services and their similarity string and a set of services descriptions

$$Sim = sim\,(Q, D) = \frac{\sum_{j=1}^{t} W_{aj} \cdot W_{id}}{\sqrt{\sum_{j=1}^{t} (W_{aj})2 \cdot \sum_{j=1}^{t} (W_{id})2}} \quad (13)$$

In this equation, wqj is a weighted vector for a word in a query vector, and wid is a weighted vector for a word in a service descriptions. We also use the following method to apply similarity of child entries in the hierarchical structure of service descriptions for measuring upper description similarity. Current Web service discovery mechanisms can be classified into three categories. Registry-based discovery like UDDI, Semantic annotation and discovery, Similarity-based search calculate term frequencies according to their position. By evaluating the different phase (i.e. from phase 1 to Phase 11) and by using equations 1 to 11 the calculation of similarity by means of metrics are described in this work. Identifying the related service and their functionality in these competitive global service providers marked as a robust task in web service

ISSN 2229-5518

world. Fig.1 demonstrates an overview of finding similarity in the web environment.

i. Client request
ii. Query Handler
iii. Query Processor
iv. Request Transporting
v. Registry Handler
vi. Response by XML
vii. Request Execution
viii. Save and Retrieve
ix. Registry Data Storage

Client Request

End-user and customers demand get processed with high demand and priority as per the request.

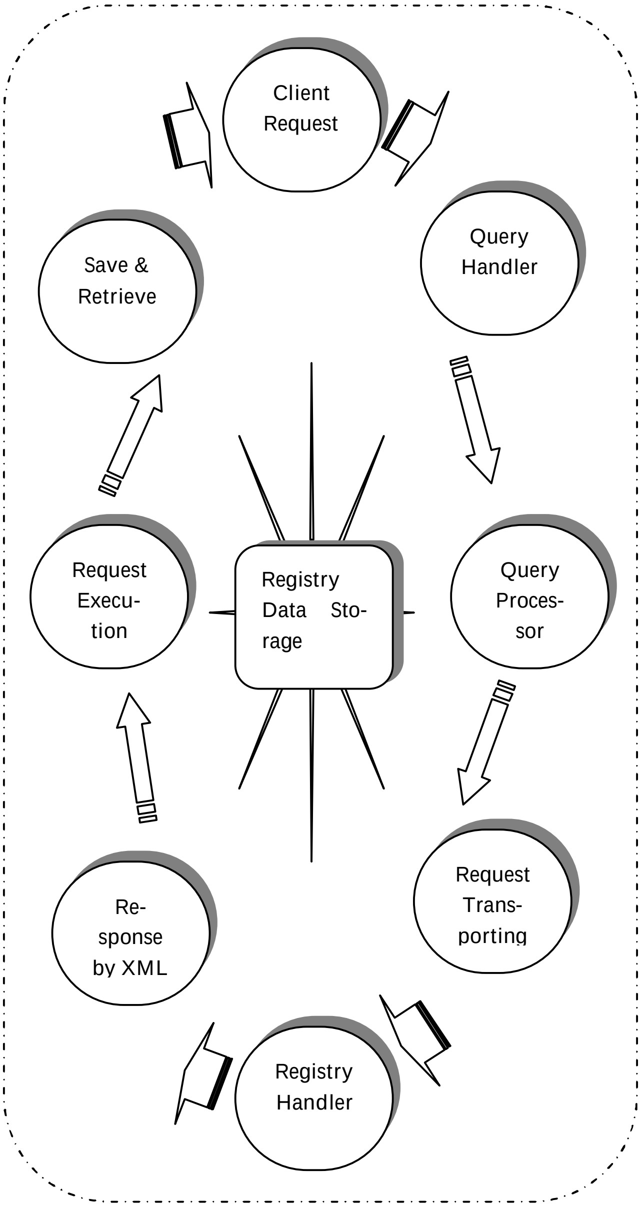

Fig.1. Identifying similarity's in different slice.

Query Handler

The demand and request of different users across globally routed in correct direction with the help of query handler.

Query Processor

As per the request and demand of query handler and end-users, their overall workstation get activated and compared with huge data sets presented in their ware house.

Request Transporting

The communication among various components and elements are by passed with necessary commands and triggers via proper channel and optimized path.

Registry Handler

Maintenance of huge database and ware house of different set of service requests are organized in the form of registry by the help of Registry Handler.

Response by XML

To achieve interoperability as a key feature across the web world the supportive language XML was used to obtain it more consistently.

Request Execution

Client request, Query Handler, Query Processor, Request Transporting, Registry Handler, and Response by XML stands in queue for execution in various environment and critical situations etc.

Save and Retrieve

Requesting services are collected by Registry Handler and processed by request executor in various aspects with respect to its own database registry.

Registry Data Storage

Bulk and huge data set information are collected from various service providers to maintain registry set up as per the conditional requests. All datasets get shuffled periodically based on its updating level.

5 Conclusions

Verdict various related issues in web environment and solving it in a matter of time, our proposed phases pin points stipulated support to web environmental world. A bulky Web services will be offered in the future, which may have the related or the similar utility, situated in unusual places and furnish by different providers across the internet. The optimization of similar service from different web services are grouped and alerted on nonfunctional requirements such as routine, expenditure and confidence etc. The proposed approach can assure the Upcoming research proposals contemplates to find the similarity in different networks with infinite ranking and unusual query retrieval in universal web world.

REFERENCES

[1] Pierluigi Plebani and Barbara Pernici,"URBE: Web Service Retrieval Based on Similarity Evaluation", IEEE Transaction on Knowledge and Data Engineering, Vol.21, No.11, Nov-2009.

[2] Shalini Batra, Seema Bawa, Thapar University, "Web Service Categorization Using Normalized Similarity Score", "International Journal of Computer Theory and Engineering", Vol.2, No.1, Feb-2010.

[3] Brian Kulis, Prateek Jain, and Kristen Grauman, "Fast Similarity Search for Learned Metrics", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.31, No.12, Dec-2009.

[4] Khoi Anh Phan, Zahir Tari, Peter Bertok, "Similarity-Based SOAP Multicast Protocol to reduce Bandwidth and latency in Web Services", "IEEE Transaction on Services Computing", Vol.1, No.2, Jun-2008

[5] Ming Li, Xin Chen, Xin Li, Bin Ma, Paul M.B.vitanyi, "The Similarity Metric", "IEEE Transaction on Information Theory", Vol.50, No.12, Dec-2004

[6] Khurram Shehzad, Muhammad Younus Javed, "Multithreaded Fuzzy Logic Based Web Services Mining Framework", "European Journal of Scientific Research", Vol.41, No.4, 633-645, 2010.

[7] Jeffrey Hau, William Lee, John Darlington, "A Semantic Similarity Measure for Semantic Web Services", "IEEE Conference", May-2005

[8] Min Liu, Weiming Shen, Qi Hao, Junwei Yan, "A Multilevel Match Making Frame Work for Semantic Web Service in Collaborative Design", "International Conference on Computer Supported Cooperative Work in Design", April 2008, pp. 392-398

[9] Xianyang Qu, Hailong Sun, Xiang LI, Xudong, Wei Lin, "A WordNet-Based Web Service Similarity Mining Mechanism", IEEE-Conference-JAN-2009.

[10] Shalini Batra, Seema Bawa, "Web Service Categorization Using Normalized Similarity Score", International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010 1793-8201.

[11] Haoxiang Xia, Taketoshi Yoshida, "Web Service Recommendation with Ontology-based Similarity Measure", IEEE Conference-2009.

[12] Jeffrey Hau, William Lee, John Darlington, "A Semantic Similarity Measure for Semantic Web Services", IEEE-Conference-2007.

[13] Ricardo Mendoza Gonzalez, "Web Service-Security Specification based on Usability Criteria and Pattern Approach", Journal of Computers, Vol. 4, No. 8, AUGUST 2009.

[14] Stefan Dietze, Alessio Gugliotta, John Domingue, "Exploiting Metrics for Similarity-Based Semantic Web Service Discovery", ICWS, pp.327-334, IEEE International Conference on Web Services, 2009.

[15] Minghui Wu, Fanwei Zhu, Jia Lv, Tao Jiang, Jing Ying, tase, "Improve Semantic Web Services Discovery through Similarity Search in Metric Space", Third IEEE International Symposium on Theoretical Aspects of Software Engineering, pp.297-298, 2009.

[16] Marlon Dumas, Luciano Garcia-Ba nuelos, Remco Dijkman, "Similarity Search of Business Process Models", IEEE Conference -2009

[17] Wei-Li Lin, Chi-Chun Lo, Kuo-Ming Chao, Nick Godwin, "Fuzzy Similarity Clustering for Consumer-Centric QOS-aware Selection of Web Services", International Conference on Complex, Intelligent and Software Intensive Systems-2009.

[18] Jing Luo, Ying Li, "Anchor Semantics Enabled Ranking Method for Service Discovery and Integration", 2008 IEEE International Conference on Web Services.

[19] Shirin Sohrabi and Sheila A. McIlraith, ISWC 2009, LNCS 5823, "Optimizing Web Service Composition While Enforcing Regulations", pp. 601–617, 2009, Springer

[20] Kyong-Ha Lee, Mi-young Lee, Yun-Young Hwang, Kyu-Chul Lee, "A Framework for XML Web Services Retrieval with Ranking", 2007 International Conference on Multimedia and Ubiquitous Engineering IEEE.

[21] Jing Luo, Ying Li, "Anchor Semantics Enabled Ranking Method for Service Discovery and Integration", 2008 IEEE International Conference on Web Services.

[22] Shrabani Mallick, D. S Kushwaha, "An Efficient Web Service Discovery Architecture", International Journal of Computer Applications Vol.3 – No.12, July 2010.

[23] Hoi Chan, Trieu Chieu and Thomas Kwok, "Autonomic Ranking and Selection of Web Services by Using Single Value Decomposition Technique", 2008 IEEE International Conference on Web Services.

[24] Manish Godse, Rajendra Sonar, "The Analytical Hierarchy Process Approach for Prioritizing Features in the Selection of Web Service", Indian Institute of Technology Bombay, India, Shrikant Mulik, L& T Infotech Mumbai, India.