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Semantic based Automated Service Discovery

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Abstract- A vast majority of web services exist without explicit associated semantic descriptions. As a result many services that are relevant to a specific user service request may not be considered during service discovery. In this paper, we address the issue of web service discovery given no explicit service description semantics that match a specific service request. 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. The service request enhancement involves expansion of additional terms (retrieved from ontology) that are deemed relevant for the requested functionality. An efficient matching of the enhanced service request with the retrieved service descriptions is achieved utilizing Latent Semantic Indexing (LSI). Our experimental results validate the effectiveness and feasibility of the proposed approach.

Index Terms- Web Semantic, UDDI, WSDL, Service Discovery

I. Introduction

The need for information technologies which are able to support agile organizations and fast-changing business processes, has led to the wide propagation of Service-oriented Computing (SOC). Today, SOC is a multi-level approach, ranging from the engineering and operation of IT infrastructures to the usage in small Web-based applications called software mashups. One particular application area, which has heavily influenced the computer science research community, as well as the software industry, in recent years, is the Service-oriented Architecture (SOA) paradigm, where services are deployed in order to organize and implement IT architectures and, eventually, realize Business/IT alignment. Independent of the actual application area, SOC is based on services. Services are self-describing encapsulations of functionalities offered by software components. As services are loosely coupled and self-contained, it is possible to dynamically invoke and substitute services, e.g., in a business process, even across the borders of a single company or organization. Hence, one particular application area is the usage of services in workflows, i.e., IT-supported business processes.

One of the primary application areas of SWS is service discovery, which is essentially affected by three steps: (i) The ability of service providers to describe their services, (ii) the ability of requesters to describe their requirements towards services, and (iii) the effectiveness of the service matchmaker, i.e., an algorithm that takes into account a request and finds the best fitting services from a set of service offers. Service matchmaking that considers semantic information is contemplated by a very agile research community, with a large number of different approaches having been proposed in recent years.

A lot of experimentation is conduced concerning the selection of elements from a service description, similarity metrics, and the combination of the resulting similarity values. State-of-the-art matchmakers are mostly quite inflexible towards differing service domains or need to be adapted manually. This is rather inappropriate as single services as well as service domains might differ to a very large degree regarding basic assumptions towards semantic descriptions of distinct service components or even the availability of a semantic-based domain model.

II. Existing System

A majority of the current approaches for web service discovery call for semantic web services that have semantic tagged descriptions through various approaches, e.g., OWL-S, Web Services Description Language (WSDL)-S. However, these approaches have several limitations. First, it is impractical to expect all new services to have semantic tagged descriptions. Second, descriptions of the vast majority of already existing web services are specified using WSDL and do not have associated semantics. Also, from the service requestor's perspective, the requestor may not be aware of all the knowledge that constitutes the domain. Specifically, the service requestor may not be aware of all the terms related to the service request. As a result of which many services relevant to the request may not be considered in the service discovery process.

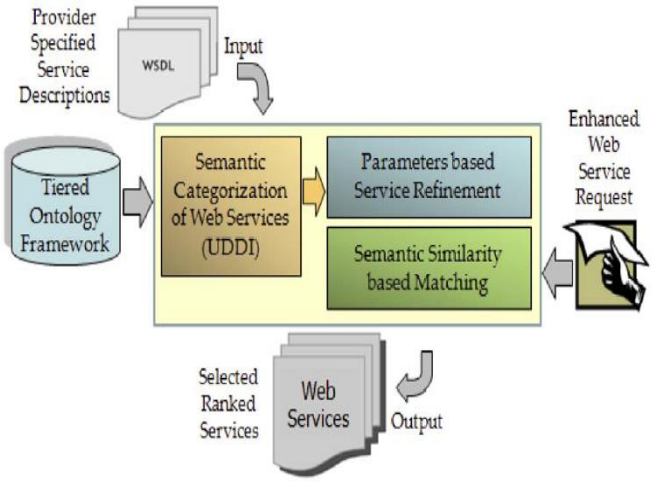
Existing service discovery approaches often adopt keyword-matching technologies to locate the published web services. This syntax-based matchmaking returns discovery results that may not accurately match the given service request. As a result, only a few services that are an exact syntactical match of the service request may be considered for selection. Thus, the discovery process is also constrained by its dependence on human intervention for choosing the appropriate service based on its semantics.

III. Proposed System

The limitations of existing approaches, an integrated approach needs to be developed for addressing the two major issues related to automated service discovery: 1) semantic-based

categorization of web services; and 2) selection of services based on semantic service description rather than syntactic keyword matching. Moreover, the approach needs to be generic and should not be tied to a specific description language. Thus, any given web service could be described using WSDL, OWL-S, or through other means. Semantic-based categorization of web services is performed at the UDDI that 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; and 2) semantic similarity-based matching. In order to address the limitations of existing approaches, an integrated approach needs to be developed for addressing the two major issues related to automated service discovery:1) semantic-based categorization of web services; and 2) selection of services based on semantic service description rather than syntactic keyword matching. In this paper, we present a novel approach for semantic based automated service discovery. Specifically, the proposed approach focuses on semantic-based service categorization and selection as depicted in Fig. 1.

IV. METHODOLOGY



User Registration

This module explains the design and implementation of user registration via web based services. This module wills also communication established between client and web based service.

Service Categorization

The semantic categorization of UDDI wherein we combine ontologies with an established hierarchical clustering methodology, following the service description vector building process. 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.

Service Refinement

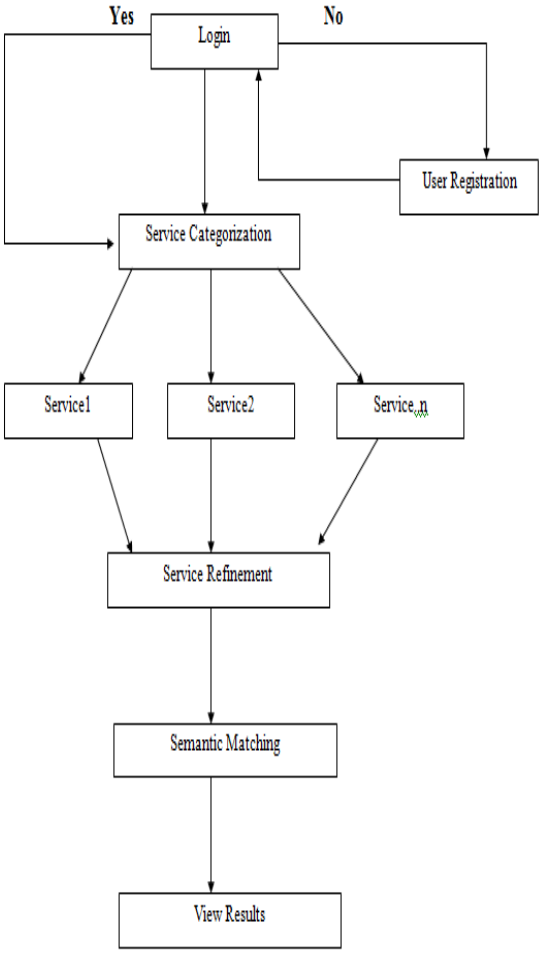
The next step is service selection from the relevant category of services using parameter-based service refinement. Web service parameters, i.e., input, output, and description, aid service refinement through narrowing the set of appropriate services matching the service request.

The 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. To group web service input and output parameters into meaningful associations, we apply a hyper clique pattern discovery. These associations combined with the semantic relevance are then leveraged to discover and rank web services.

Semantic Matching

The parameter-based refined set of web services is then matched against an enhanced service request as part of Semantic Similarity-based Matching. A key part of this process involves enhancing the service request. Our approach for web semantic similarity-based service selection employs ontology-based request enhancement and LSI based service matching. The basic idea of the proposed approach is to enhance the service request with relevant ontology terms and then find the similarity measure of the semantically enhanced service request with the web service description vectors generated in the service refinement phase.

System Flowchart



Algorithm Used

Modify Service Vector Algorithm:

In this algorithm an extra relevant ontology concept is added to the initial service vector. Our approach considers all concepts for enhancing the web service description. The add step extends each service vector by additional Word Net elements [6][14].

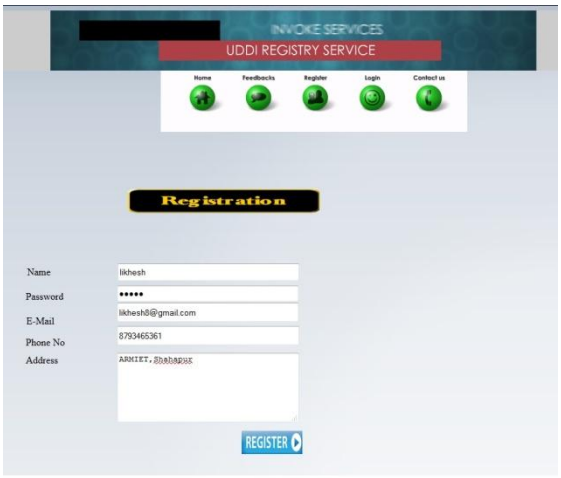
Associate Ontology Cluster Algorithm:

Here the functionally similar services grouped together and a hierarchy structure is created, that is more informative than the unstructured set of clusters. The association of concepts to each cluster facilitates web service discovery by mapping to functional categories. We build a set which contains all concepts that exist in at least one service description and eliminate duplicate concepts [14].

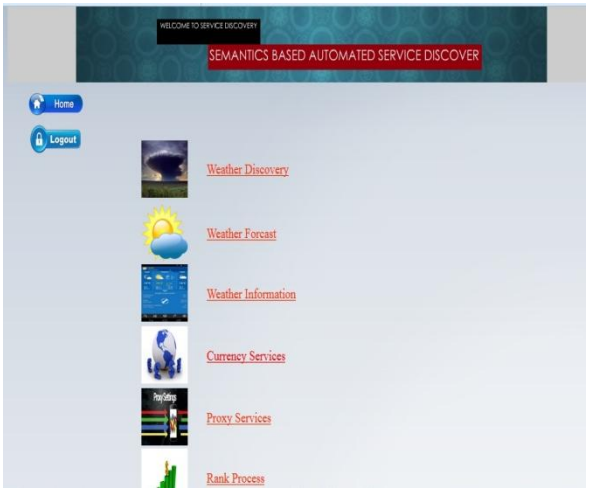
Rank Semantic Associations Algorithm:

This algorithm is used for finding hyper clique patterns is breadth-first. It first checks all the patterns at the first level. If a pattern is not satisfied with the user-specified support and h-confidence thresholds, the whole branch corresponding to this pattern can be pruned without further checking [5].

V. RESULTS

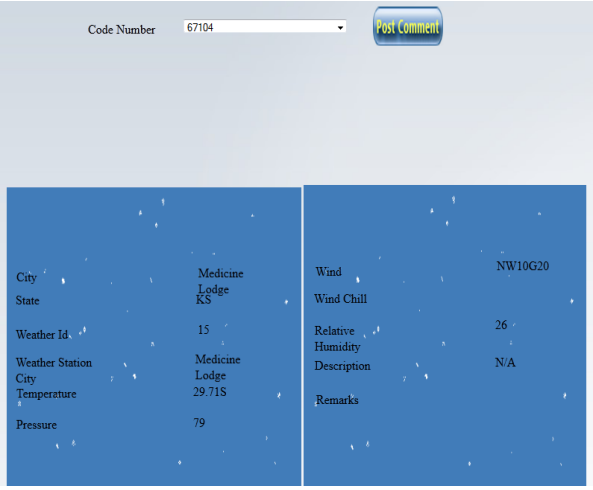


Snapshot No 1:- User Registration

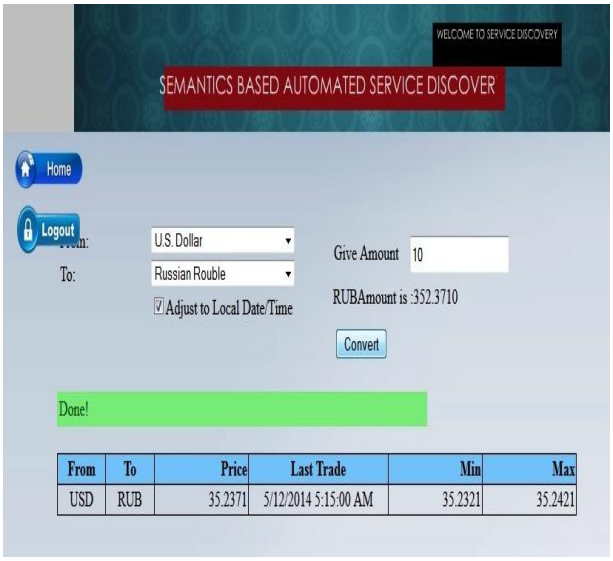


Snapshot No 2:-Home Page

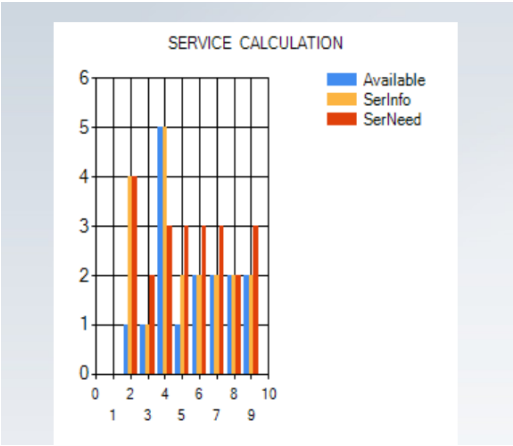
Snapshot No 3:- Weather Forecast



Snapshot No 4:- Weather Information



Snapshot No 5:- Currency Service



Snapshot No 6:- Rank Process

VI. CONCLUSION

In this project, we present an integrated approach for automated service discovery. Specifically, the approach addresses two major aspects related to semantic-based service discovery: semantic-based service categorization and semantic-based service selection. For semantic-based service categorization, we propose 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, we employ ontology linking (semantic web) and LSI thus extending the indexing procedure from solely syntactical information to a semantic level. Our experiments show that this leads to increased precision levels, recall levels, and the relevance scores of the retrieved services.

REFERENCES

[1] J. Adcock, A. Girgensohn, M. Cooper, T. Liu, L. Wilcox, and E. Rie, "FXPAL Experiments for TRECVID," Proc. TRECVID, 2004.

[2] R. Agrawal, T. Imielinski, and A. Swami, "Mining Association Rules Between Sets of Items in Large Databases," Proc. ACMSIGMOD Int'l Conf. Management of Data, 1993.

[3] E. Al-Masri and Q.H. Mahmoud, "Investigating Web Services on the World Wide Web," Proc. 17th Int'l Conf. World Wide Web (WWW '08), Apr. 2008.

[4] M.-L. Antonie and O.R. Zaane, "Text Document Categorization by Term Association," Proc. IEEE Int'l Conf. Data Mining (ICDM '02), 2002.

[5] K. Anyanwu, A. Maduko, and A. Sheth, "SemRank: Ranking Complex Relationship Search Results on the Semantic Web," Proc. 14th Int'l Conf. World Wide Web (WWW '05), 2005.

[6] P. Baldi, P. Frasconi, and P. Smyth, "Modeling the Internet and the Web," Probabilistic Methods and Algorithms, Wiley, 2003.

[7] M. Bruno, G. Canfora, M.D. Penta, and R. Scognamiglio, "An Approach to Support Web Service Classification and Annotation," Proc. IEEE Int'l Conf. E-Technology, E-Commerce and E-Service (EEE '05), 2005.

[8] M.A. Corella and P. Castells, "Semi-Automatic Semantic-Based Web Service Classification," Proc. Int'l Conf. Business Process Management Workshops (BPM '06), 2006.

[9] P.W. Foltz and S.T. Dumais, "Personalized Information Delivery: An Analysis of Information Filtering Methods," Comm. ACM, vol. 35, no. 12, pp. 51-60, 1992.

[10] E. Han, G. Karypis, and V. Kumar, "Scalable Parallel Data Mining for Association Rules," Proc. ACM SIGMOD Int'l Conf. Management of Data (SIGMOD '97), 1997.

[11] A. Heb and N. Kushmerick, "Automatically Attaching Semantic Metadata to Web Services," Proc. IJCAI Workshop Information Integration on the Web, 2003.

[12] http://dit.unitn.it/~kokash/documents/WS_matching-hybrid.pdf, 2012.

[13] http://idcrue.dit.upm.es/biblioteca/mostrar.php?id=2154, 2012.

[14] XMethods, http://www.xmethods.net, 2012.

[15] http://reliant.teknowledge.com/DAML/SUMO.owl, 2008.

[16] http://www.uddi.org/specification.html, 2012.

[17] http://www.few.vu.nl/~andreas/projects/annotator/ws2003.html, 2012.

[18] H.L. Johnson, K.B. Cohen, W.A. Baumgartner Jr., Z. Lu, M. Bada, T. Kester, H. Kim, and L. Hunter, "Evaluation of Lexical Methods for Detecting Relationships Between Concepts from Multiple Ontologies," Proc. Pacific Symp. Biocomputing, 2006.

[19] M. Kher, D. Brahmi, and D. Ziou, "Combining Visual Features with Semantics for a More Efficient Image Retrieval," Proc. 17th Int'l Conf. Pattern Recognition (ICPR '04), 2004.

[20] M. Klusch and X. Zhing, "Deployed Semantic Services for the Common User of the Web: A Reality Check," Proc. IEEE Int'l Conf. Semantic Computing (ICSC), 2008.

[21] J. Lu, Y. Yu, D. Roy, and D. Saha, "Web Service Composition: A Reality Check," Proc. Eighth Int'l Conf. Web Information Systems Eng. (WISE '07) Dec. 2007.

[22] D. Martin, M. Paolucci, S. McIlraith, M. Burstein, D. McDermott, D. McGunneess, B. Barsia, T. Payne, M. Sabou, M. Solanki, N. Srinivasan, and K. Sycara, "Bringing Semantics to Web Services: The OWL-S Approach," Proc. First Int'l Workshop Semantic Web Services and Web Process Composition, July 2004.

[23] S. McIlraith, T. Son, and H. Zeng, "Semantic Web Services," IEEE Intelligent Systems, vol. 16, no. 2, pp. 46-53, Mar. 2001.

[24] S. McIlraith and D. Martin, "Bringing Semantics to Web Services," IEEE Intelligent Systems, vol. 18, no. 1, pp. 90-93, Jan. 2003.

[25] I. Niles and A. Pease, "Linking Lexicons and Ontologies: Mapping WordNet to the Suggested Upper Merged Ontology," Proc. IEEE Int'l Conf. Information and Knowledge Eng. (IKE '03), 2003.

[26] N. Oldham, C. Thomas, A. Sheth, and K. Verma, "METEOR-S Web Service Annotation Framework with Machine Learning Classification," Semantic Web Services and Web Process Composition, vol. 3387, pp. 137-146, Jan. 2005.

[27] A.V. Paliwal, N. Adam, and C. Bornhoevd, "Adding Semantics through Service Request Expansion and Latent Semantic Indexing," Proc. IEEE Int'l Conf. Services Computing (SCC), July 2007.

[28] A.V. Paliwal, N. Adam, H. Xiong, and C. Bornhoevd, "Web Service Discovery via Semantic Association Ranking and Hyperclique Pattern Discovery," Proc. IEEE/WIC/ACM Int'l Conf. Web Intelligence, 2006.

[29] A. Sajjanhar, J. Hou, and Y. Zhang, "Algorithm for Web Services Matching," Proc. Asia-Pacific Web Conference (APWeb), pp. 665-670, 2004.

[30] G. Salton and C. Buckley, "Improving Retrieval Performance by Relevance Feedback," J. Am. Soc. for Information Science, vol. 41, no. 4, pp. 288-297, 1990.

[31] G. Salton, A. Wong, and C.S. Yang, "A Vector Space Model for Automatic Indexing," Comm. ACM, vol. 18, pp. 613-620, Nov. 1975.

[32] K. Verma, K. Sivashanmugam, A. Sheth, A. Patil, S. Oundhakar, and J. Miller, "METEOR-S WSDI: A Scalable P2P Infrastructure of Registries for Semantic Publication and Discovery of Web Services," Information Technology and Management J., vol. 6, pp 17-39, 2005.

[33] http://www.musclenoe.org/research/sci_deliv_pub/D5.1_WP5_SoA_RevisedVersion_sept05.pdf, 2012.

[34] H. Xiong, P. Tan, and V. Kumar, "Mining Strong Affinity Association Patterns in Data Sets with Skewed Support Distribution," Proc. IEEE Third Int'l Conf. Data Mining (ICDM), 2003.

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