Ontological View of Web Services in Network Management

Dr. Vinod Kumar Shukla
Amity Institute of Information Technology
Amity University

Dr. Nitin Pandey
Amity Institute of Information Technology
Amity University

Abstract - We have summarized the information that facilitates the issues of web services implementation on different applications. This paper is an overview of Ontology and web services with OWL-S. The evolution analysis is carried out for web services and we have analyze the changes that took place in the field of Semantic web during the last years, in particular, around the web services, OWL-S of the RDF/S and OWL family and also we have presented the current trends in development of Web services..

Keywords- Semantic web, ontology, RDF, Web Services

I. SEMANTIC WEB

Machine had played a very important role in human life. Since the evolution of computer and internet the information between people and machine can be easily shared. By applying the help the concept of Semantic which we can make a web where the resources are "machine understandable". The information can be used and processed by the users and machine both. The vocabulary, the statements and the structures defined by such a language is defined by "Ontology". Today's structure of web is decentralized for the distributed presentation while the Semantic web is a decentralized platform for the distributed knowledge.

The current web is very large and its user and data are growing exponentially, for the implementation the complete fool proof solution from the point of "Ontology" is not possible. Initially implementing the Ontological solution for the part of the complete set of web with the help of total available information of that subset and using only that part which is relevant by this way we can implement the ontological solution.

When the two parties, widely known as "software agents" are communicating then the use of "Ontologies", which can be understood by each of them can be used for exchanging the information between them. If the "Ontology" which is implemented, if it is giving consistent information then this ontology is logically consistent otherwise we have to revise the implemented "Ontology" to get the consistent result.

Ontologies are planned to catch learning about the world, or some a player in it, so how this information ought to be spoken to. One route is to separate the world up into classes of articles with regular properties, distinguishing a few classes as specializations of others. Furthermore, utilizing the idea of acquiring the majority of the properties of the more broad class and (conceivably) including new properties of their own. This strategy has been considered subsequent to the season of Aristotle, and can be seen in numerous advanced applications, e.g., object situated databases, semantic systems and casing frameworks.

The class and property based methodology of knowledge representation should facilitate its use by software developers as many of them are already familiar with the object oriented paradigm and the use of modeling languages such as EER and UML. However, the extension of these methodologies with logic based semantics and inference mechanisms does increase complexity and may require some adaptation on their part.

So now consider another Web where the genuine substance can be controlled by PCs. For the present, picture it as a web of databases. One "semantic" site distributes a database around a product offering, with items and depictions, while another distributes a database of item surveys. A third site for a retailer distributes a database of items in stock. What norms would make it less demanding to compose an application to work disseminated databases together, so that a PC could utilize the three information sources together to help an end-client settle on better buying choices? How the computer will exactly integrate the information which is laying in WWW. The answer of this question is possible only with the "implementation of Ontology". This is the main objective of the Web ontology language, and it is written in XML. This is mainly designed for the computers.

II. WEB SERVICES AND ONTOLOGY

Gruber [Gru93] defines ontology as "the specification of conceptualizations, used to help programs and Humans share knowledge". The conceptualization is the couching of knowledge about the world in terms of Entities (things, the relationships they hold and the constraints between them). The specification is the representation of this conceptualization in a concrete form.

Guarino [Gua98] defines ontology as "an intentional semantic structure which encodes the implicit rules constraining the structure of a piece of reality." A formal ontology has some underlying logical structure which allows us to reason about the concepts in the ontology.

Ontology is all about things in web if they can be mapped with their description and relationship. For encoding metadata on internet the standard is RDF ("Resource Description Framework"). Meta data is all about the thing like who authored the page, what date a blog entry was updated. RDF is an abstract model, which break down the complete knowledge into discrete pieces with some rules, and while it is widely known as the RDF/XML syntax.

The main beauty of RDF is that it work very well with distributed data, means the data which is posted by the different user across the internet that data can be understood by the RDF and can present the information in the single document which is not given in any single document. The concept used behind is that the metadata of different web pages the keywords are compared and common vocabulary is grouped for a single document presentation.

Web Ontology Language (OWL) is a markup dialect for distributed and sharing information utilizing ontologies on the Internet. OWL speaks to the implications of terms in vocabularies and the connections between those terms in a way that is suitable for handling by programming.

OWL is based on the highest point of RDF. OWL is expected to be utilized when the data contained as a part of reports should be handled by applications, instead of circumstances where the substance just should be introduced to people. OWL can be utilized to expressly speak to the significance of terms in vocabularies and the connections between those terms.

A set of different axioms which places the constraints on the classes and their relationship, which is also referred as shared vocabulary, known as Ontology. These axioms provide semantics by allowing systems to infer additional information based on the data explicitly provided. OWL is both syntax for describing and exchanging Ontologies, and has a formally defined semantics that gives them meaning.

OWL-S allows the representation of a service as a set of interaction with other services. To represent this interaction, two kinds of process can be distinguished: *Composite process and Atomic process.*

An atomic process receives an input and produces the output message. Thus this type of process can be executed directly. A composite process is the combination of other process. These processes can be represent by the split, join and split, any order, choice, if then else, repeats-while and repeat until.

OWL-S provides constructs to manage the control structures as well as the information flow in composite process. The either of the process mainly have the purpose to change the environment and to represented as precondition and

effects, to process the data represented as process inputs and outputs.

III. ONTOLOGY AND WEB SERVICES IN NETWORK MANAGEMENT

Internet is a collection of different type of network management models. To communicate in the internet various types of network models like CORBA (Common object request broker architecture), DMI (Desktop management Interface), and SNMP (Simple network Management Protocol) exits with the different type of technologies and network management policies. Each of these models works to ensure the cooperation between the managers and its agents. For which each of these models has its own management information definition language.

In this scenario when internet is growing and different type of network models are evolving, there is a need of a mechanism which make the synchronicity between these model so that the managers and agents can communicate in much faster and better manner in the heterogeneous environment. That mechanism can be a framework, which can be implemented from the ontological point of view so that different management information definition languages can be get compared. By this way we can manage the resources which are represented by the each of the network management model in a different way.

A web service provides the maximum decoupling among components and abstraction of the inner complexities with well defined interfaces. Ontologies provide a way to formally describe the management information, avoiding misinterpretations. A set of related web services can be activated to accomplish the task of network management application. OWL-S is a service ontology that describes a set of process, like how and when to activate the web services.

For the utilization of a Web Service, a product operators needs a PC interpretable depiction of the administration and the way to get to this. A critical objective for Semantic Web markup dialects is to build up a structure for making and sharing these depictions. Sites ought to have the capacity to utilize an arrangement of fundamental classes and properties for pronouncing and depicting administrations, and the cosmology organizing systems of OWL gives the suitable structure.

OWL-S is an abnormal state cosmology, at the application level that is intended to answer the what-and why-questions around a Web Service, while the how-inquiries are tended to as a feature of WSDL (Web Services Description Language). WSDL is an archive written in XML. The archive portrays a Web administration. It determines the area of the administration and the operations (or techniques) the administration uncovered. We can express an Ontology as:

Ontology = <taxonomy, inference rules>
And we can express taxonomy as:
Taxonomy = <{classes}, {relations}>

An Ontology for Web Services would make Web Services machine understandable and support automated Web Service composition and interoperability. Therefore, the motivations for creating OWL-S include ontology for Web Services that provides several automated functions like web service discovery, web service execution, web service composition and web service monitoring. In short,

- A program must first be able to automatically find, or discover, an appropriate Web service.
- Software must be able to automatically determine how to invoke or execute the service. A Semantic Web service provides a descriptive list of what an agent needs to be able to do to execute and fulfill the service. This includes what the inputs and outputs of the service are.
- Software must be able to select and combine a number of Web services to complete a certain objective. By this way, agent software can create entirely new solutions.
- Agent software needs to be able to verify and monitor the service properties while in operation.

The ontology of services provides three main types of knowledge about a service, they are ServiceProfile, ServiceModel and ServiceGrounding.

- ServiceProfile give the data around an administration that can be utilized by an operators to watch that either the administration meets the approx needs or fulfills the imperatives, for example, security, region, and quality prerequisites.

- ServiceModel empowers an operators to perform a top to bottom examination of whether the administration addresses its issues, to create administration portrayal from numerous administrations to perform a particular assignment, to facilitate the exercises of various specialists and to screen the execution of the administration.

- ServiceGrounding determines the subtle elements of how to get to the administration, for example, convention and message positions, serialization, transport, and tending to.

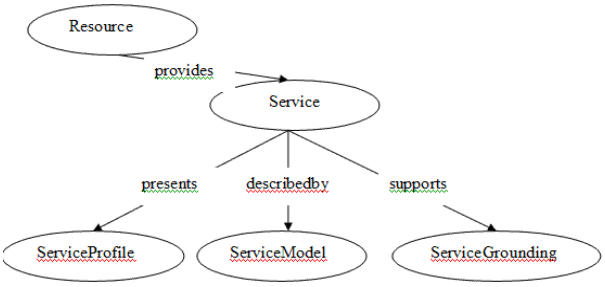

Fig.1: Upper ontology services

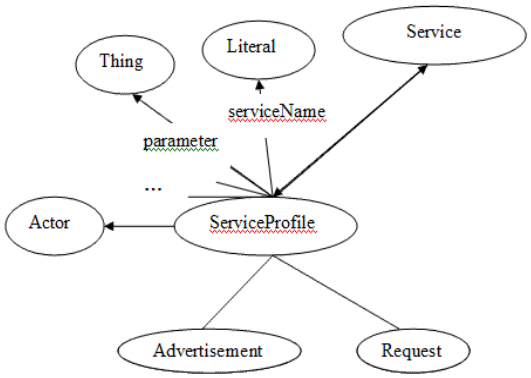

Fig.2: ServiceProfile Realtionship

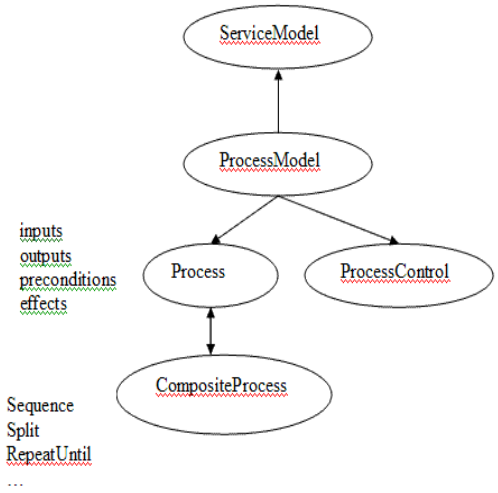

Fig.3: Service Model

The following listing illustrates a Process.

```
<owl:Class rdf:ID=Process>
<rdfs:comment> The most general class of processes</rdfs:comment>
<owl:disjointUnionOf rdf:parseType= owl:collection>
<owl:Class rdf:about="#AtomicProcess"/>
<owl:Class rdf:about="#SimpleProcess"/>
<owl:Class rdf:about="#CompositeProcess"/>
</owl:disjointUnionOf>
</owl:Class>
```

The atomic processes can be invoked directly and are executed in a single step. For each atomic process, there is a grounding that enables a service requester to construct messages. Listing 2 identifies an AtomicProcess as a subclass of a Process.

The following listing illustrates the Atomic Process.

```
<owl:Class rdf:ID="AtomicProcess">
<owl:subClassOf rdf:resource="#Process"/>
</owl:Class>
```

The concepts of the Network Management interface can be deployed on the network resources easily with the help of web services technology. These services are usually combined to perform a management task, but WSDL (Web Services Description Language) specifications only provide the information related to each interface. To address this problem, services ontologies, such as OWL-S are useful to define the relation among different web services in a management process. This definition can be interpreted by a manager, which calls the services following a sequence with control structures.

OWL-S precondition and effects are represented in logic formulas. OWL-S does not define a default language to represent such logic formulas. However, it recommends and provides some facilities to work with the semantic web rule language (SWRL) and provides the mechanism to represent those formulas in other language.

IV. CONCLUSION

With these concepts it is possible to achieve the motive of creating a complex and interoperable description, to represent a composite process, which is useful in network management. One of the most promising technologies in

this scope is the one related to the web services given that they are based on well-known technologies and used broadly by the developers. There is lot of work to be done as it is the beginning of implementation of ontological concept.

REFERENCES

[1] http://www.rdfabout.com/intro/#Blank Nodes and Literal Values
[2] http://www.aifb.uni-karlsruhe.de/~sst/is/WebOntologyLanguage/horrocks.htm
[3] http://www.sti-innsbruck.at/fileadmin/documents/deliverables/Ontoweb/D4.0.pdf
[4] http://www.webservicessummit.com/Excerpts/BuildingSemanticWS.htm
[5] J. Schönwälder, A. Pras, J.P. Martin-Flatin: On the Future of Internet Management Technologies. IEEE Communications Magazine, Vol. 41, Issue 10 (2003) 90-97.
[6] H. Haas, A. Brown: Web Services Glossary. W3C Working Group Note (11 February 2004)
[7] T. Berners-Lee, J. Hendler, O. Lassila: The Semantic Web. Scientific American, Vol. 284, No. 5 (2001) 34–43
[8] T. R. Gruber: A Translation Approach to Portable Ontology Specifications. Knowledge Acquisition, Vol. 5, No. 2 (1993) 199-220.
[9] M. Burstein, C. Bussler, T. Finin, M.N. Huhns, M. Paolucci, A.P. Sheth, S. Williams, M. Zaremba: A semantic Web services architecture. IEEE Internet Computing, Vol. 9, Issue 5 (2005) 72-81.
[10] J.E. López de Vergara, V. A. Villagrá, J. Berrocal: Application of OWL-S to define management interfaces based on Web Services. MMNS'2005, Lecture Notes in Computer Science, Vol. 3754, Springer Verlag (2005) 242-253. 7. J. Keeney, K. Carey, D. Lewis, D. O'Sullivan, V. Wade: Ontology-based Semantics for Composable Autonomic Elements. In Proc. Workshop on AI in Autonomic Communications at the 19th International Joint Conference on Artificial ntelligence (IJCAI), Edinburgh, Scotland. (July 2005)
[11] D. Martin, M. Burstein, J. Hobbs, O. Lassila, D. McDermott, S. McIlraith, S. Narayanan, M. Paolucci, B. Parsia, T. Payne, E. Sirin, N. Srinivasan, K. Sycara: OWL-S: Semantic Markup for Web Services. W3C Member Submission (November 2004)
[12] I. Horrocks, P.F. Patel-Schneider, H. Boley, S. Tabet, B. Grosof, M. Dean: SWRL: A Semantic Web Rule Language Combining OWL and RuleML. W3C Member Submission (May 2004)
[13] Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair, In- tegrated Management of Networked Systems, Morgan Kaufmann,1999.
[14] Jorge E. López de Vergara, Victor A. Villagrá, and Julio Berrocal, "Semantic Management: advantages of using an ontology-based management information meta-model," Proceedings of the HP Openview University Association Ninth Plenary Workshop (HP-OVUA'2002), Boblingen, Germany, 11-13 June 2002.
[15] R. Studer, V.R. Benjamins, and D. Fensel, "Knowledge Engineering: Principles and Methods," Data & Knowledge Engineering. 25: 161-197. 1998.
[16] Oscar Corcho and Asunción Gómez-Pérez, "A Roadmap to Ontology Specification Languages," Proceedings of the Twelfth International Conference on Knowledge Engineering and Knowledge Manage- ment (EKAW'2000), Juan-les-Pins, France, October 2000.
[17] H. Wache, T. Vgele, U. Visser, H. Stuckenschmidt, G. Schuster, H.Neumann, and S. HÜbner, "Ontology-based integration of informa-tion - a survey of existing approaches," Proceedings of the Work- shop Ontologies and Information Sharing, IJCAI 2001, Seattle, Washington, U.S.A., August 2001.
[18] O. Festor, P. Festor, Laurent Andrey, and N. Ben Youssef, "Integra- tion of WBEM-based Management Agents in the OSI Framework," Proceedings of the Sixth IFIP/IEEE International Symposium on Integrated Network Management (IM'99), Boston, Massachusetts, U.S.A., May 1999.