An Agent System for Ontology Sharing on WWW

Kotaro Nakayama, Takahiro Hara, Shojiro Nishio
Graduate School of Information Science and Technology, Osaka University, Japan
{nakayama.kotaro, hara, nishio}@ist.osaka-u.ac.jp

ABSTRACT

Semantic Web Services (SWS), a new generation WWW technology, will facilitate the automation of Web service tasks, including automated Web service discovery, execution, composition and mediation by using XML based metadata and ontology. There have been several efforts to build knowledge representation languages for Web Services. However, only few attempts have so far been made to develop applications based on SWS. Especially, front-end agent systems for users are one of the urgent research areas. The purpose of this paper is to introduce our new integrated front-end agent system for ontology management and SWS management.

Categories and Subject Descriptors

H.3.5 [**Information Search and Retrieval**]: Online Information Services—*data sharing, web-based services*; H.4.m [**Information Systems**]: Miscellaneous

General Terms

Management, Design

Keywords

Semantic Web, Web Services, Ontology, Agent Technologies

1. INTRODUCTION

In recent years, the Semantic Web has been the subject of controversy among WWW researchers. The purpose of the Semantic Web is to provide structures and tools that allows data to be shared and reused across applications, enterprises, and communities. It enables users to find target data from a huge amount of documents on WWW, efficiently and quickly. Standardization of structures for metadata, ontology and inference rules have improved [2] in recent years. However, it might be a mistake to assume that the development of metadata has also improved. In fact, the problem of a lack of metadata still remain because of the complicated method to manage metadata. Several research groups have developed modeling tools and user interfaces that allow user to manage metadata and ontologies easily[1, 3].

Let us now look at Web Services, another main topic of WWW technologies. Web Services, Web-accessible programs, are garnering a great deal of interest from industry and researcher, and standards are emerging for low-level descriptions of Web Services. In particular, we must make special mention of activities on enterprise. Native support of Service Oriented Architecture (SOA) on Longhorn is a notable example.

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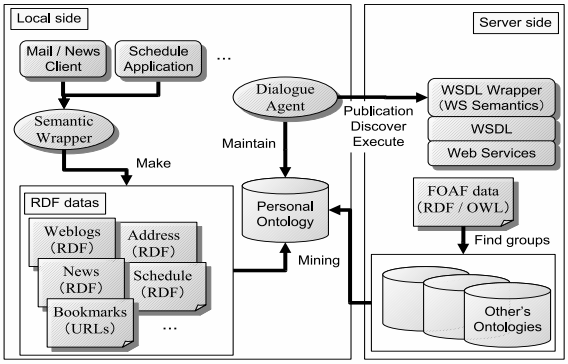

Figure 1: Architecture

Two main topics of the WWW, Semantic Web technology and Web Service technology, established a new research area called Semantic Web Services (SWS). SWS, a new generation web technology, will facilitate the automation of Web Service tasks, including automated Web Service discovery, execution, composition and mediation by using XML based metadata. In the last few years, numerous activities about SWS have been conducted to achieve machine-understandable data structures and architectures for Web Services[4, 5]. However, ontology management and SWS management are completely separated in these research. Users need an integrated system which can provide feedback between modules.

We therefore propose a new integrated agent system for ontology sharing on WWW, which enables users to manage not only ontologies but also SWS.

2. ARCHITECTURE

In this section, we explain our proposed system. Figure 1 shows the system structure. In the following, we examine the system structure in detail.

2.1 Semantic Wrapper

A great deal of effort has made on ontology management. What seems to be lacking, however, is who made ontologies

by such tools for expert. In other words, ontologies have to be managed automatically from every day life by using Personal Information Manager (PIM) agents.

The Semantic Wrapper module creates a semantic data based on the Semantic Web standard RDF from PIM applications such as mail clients, schedulers, and so on. This feature translates PIM data from native data format into RDF. We believe that it will be an approach to solve the lack of metadata on the Semantic Web.

2.2 Personalized Ontology

The Personalized Ontology is a concept dictionary database which is prepared for each user. The hierarchical structure of concept depends on the user's culture, such as company, family, region, and so on, therefore, a concept dictionary should be personalized to each user. We used WordNet 2.0 as an initial ontology database, and the ontology will be personalized while running the agent system by updating the concepts. In addition, we defined Certainty Factor (CF) for each concept and the relation between the concepts to calculate trust for inference. In the view of implementation techniques, all of the XML data is stored in a relational database, and is indexed. This personalized ontology will be used in dialogues with the agent, inference and the vocabulary for the Semantic Wrapper.

2.3 RDF Mining

The RDF Mining module generates ontology by using natural language processing on RDF metadata. This feature uses summary of PIM data, especially RSS, to obtain a user's interest. To begin with it, parses the RSS and get title element and body element. Next, it identifies noun words and unknown words by using NLP tools. Then, it measures word importance from frequency and Co-Occurrence relations, and register the words which are decided as important words. Finally, the registered word will be checked to user via dialogue interface, and will define the relation between other existing words.

2.4 WSDL Wrapper

As we explained, Web Services became a big part of the Semantic Web. However, the problem of the lack of semantics for Web Services still remain because Web Service Description Languages (WSDL) define only syntax. We therefore used OWL-S / DAML-S as an ontology data to make semantics for Web Services because OWL-S is the first well-researched Web Services Ontology, and has numerous users from industry and academe.

This system is based on a semantics wrapper for a PIM data method which integrates personalized ontology management and SWS management into one front-end agent system. We can get a lot of metadata from standard groupware functions such as schedule, CMS, Weblog, and so on. We get action log as a well formed RSS constantly from PIM agent.

WSDL Wrapper is semantic metadata for Web Services which enable agent program to make inferences from Grounding data on personalized ontology. Users can search and execute Web services by using the agent interface. The search function uses this semantics data and personal ontology to infer what Web service user wants to execute from request keyword.

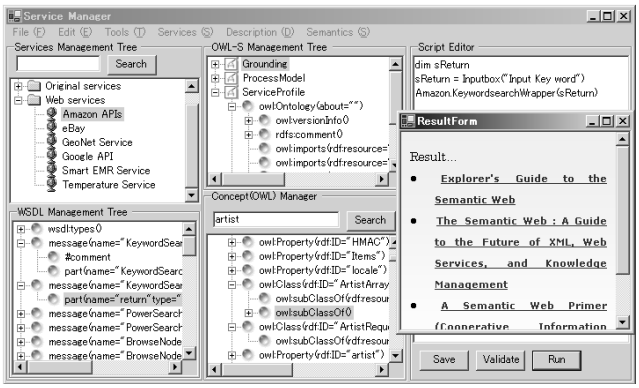

Figure 2: SWS management interface

3. CURRENT STATUS

We are currently implementing the aforementioned architecture in a system. The RSS Mining module and the user interface module have already been developed and experimented with by using user's RDF data, and the result of the experiment was satisfactory. Figure 2 is a screenshot which shows SWS management interface, a partial GUI of this agent system. Users can manage Web Services and the relation between Ontology by using SWS technology. In addition, we can write a VBA script code to execute Web Services via the Script Editor pane. Other interfaces, such as Dialogue agent interface, Ontology management interface, and the PIM interface, cannot be discussed here for want of space.

4. CONCLUSION

We proposed an integrated agent system for ontology management and SWS management. Especially, RSS mining function for making ontologies on our system showed satisfactory result. We believe that an integrated front-end agent system based on Semantic Web Services will be needed in SOA paradigm. In addition, We can now use results of the existing methodologies[4, 5] such as automated composition of Semantic Web Services and Planning for the next step.

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