SEMANTIC WEB BASED TO SUPPORT SUPPLY CHAIN MANAGEMENT

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ABSTRACT
Increasing implementation of information technology in the manufacturing environment can be considered in all line of manufacture. Internet introduced heterogeneity of information, such as between supplier and client. The heterogeneity can be data format, representation, and accessing of information. One of starting point in supply chain management is matching process between suppliers and requirement of a manufacture.
Semantic Web and ontology can be considered as an approach to overcome the problem of matching in supply chain management. Discovery and interoperability among parties of information sources in dynamic, open and heterogeneity environment can be improved by the approach. Semantic interoperability in our approach will base on semantic similarity by using label matching enhanced by internal and external structure comparison.

Key Word*: information heterogeneity, information interoperability, ontology, semantic web, supply chain management.*

1. Introduction

Supply chain management can be defined as optimization of the delivery of goods and services, and optimization of information from the supplier to the customer. Integration provides information exchange among parties. Supply chain and network integration means to bring supply chain partners, or network partners in contact with each other. Interoperability system allows to access information from different sources.

Semantic web introduces an approach to handle diversity of information level for interoperability. In advance, a web service fit into the semantic web is in enabling web services to interact with other web services. Web service applications can involve comparison, composition, or orchestration of web services, which require semantic web technologies. These approaches can support supply chain management to interchange the service and data among the community.

This paper will be divided to some sections. State of the art will be described in section 2. Section 3 and 4 explain problem definition and objective or research. Section 5 brings our proposed approach for the problem, and finally section 6 close the paper with summary.

2. State of The Art

Semantic Web exposed to use semantics approach to solve problems of information interoperability. Ontology is an interesting tool and challenge for the approach of semantics. An ontology [3] is to represent formal something that explaining by explicit a specific concept to each other to sharing at

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special domain in computer system. Semantic web is an evolution of WWW to better exploiting meaning of knowledge. There are two vision in development of web forwards, the first vision is to provide good web progressively as media of collaboration, and second view is to give better understanding between machine-machine and machine-human. Berners-Lee [1] stated semantic web need some requirements to achieve the purpose.

A web service is a software system designed to support interoperable machine-to-machine interaction over a network. Web services are software applications that can be *discovered*, *described*, and *accessed* based on XML and standard web protocols over Intranet, Extranet, and the Internet [2].

In this section, we survey some papers, which provide an approach for supply chain management by using semantic web, ontology and web service. Robert Haugen and William E. McCarthy introduce REA [6] that refers to the Resource-Event-Agent business model. As a semantic web, REA can link economic events together across different companies, industries, and nations. The links are activity-to-activity or agent-to-agent or person-to-person, not just company-to-company. IBM provides E2open [4] which not only offers a private, secure registry and data storage repository for capturing and communicating trading partner information and business process definitions, but it also provides the infrastructure that allows for secure publishing and discovery of private and public processes of E2open trading partners. Jung Ung Min & Hans Bjornsson [5] introduces *SCVisualizer (Supply Chain Visualizer)*, an information visualization tool using Web Services and computer agent technology for the rapid and seamless generation of a virtual supply chain in construction.

3. Problem Statement

This research will involve three areas: 1) Information interoperability 2) Semantic web and ontology 3) Business Process and supply chain and industry information. The basic problems of research are : 1) How is supply chain representation from various sources? 2) How to exchange of information based on information source representation? 3) Is the exploiting of semantic web and ontology will improve exchange of information for the supply chain by using web services?

4. Research Objective

Refer to state of the art and problem statement, the objectives of the research are:

- To find an appropriate model to represent the sources of information, this can be used in semantic web and web services.
- How to 'map' among sources base on the representation of concepts based on common ontology to utilize semantic web and web service for supply chain management.
- The approach can be implemented in dynamic and open environment.

5. Approach

5.1. Proposed Approach

The approach of interoperability can be divided into two common approaches: tightly solution (schema integrated globally and integrated ontology globally) and loosely couple (such as: mediation). Our approach considers using hybrid ontology model. The first focus is how to develop relation or agreement between common ontology to ontology of community. The process developing of agreement will based on label matching and structural comparison.

The approach is called MISWHO (Manufacture Interoperability with Semantic Web and Hybrid Ontology). MISWHO based on basic tuple as <ρ1, μ, ρ2>, where ρ1 is common ontology, μ is agreement or mapping between common ontology and local schema/ontology, and ρ2 is local ontology. The MISWHO will utilize semantic similarity
calculation to develop the agreement.

Calculation of semantic similarity between concept is first step to create approval between content and ontology of provider or whom asking for information. Each concept can represent as hierarchy according to containing label some structural or semantic information. Following three measurement of similarity [7] : (1). **Label Matching,** The process will based on linguistic analysis. There are two common techniques at label matching (Fausto Giunchiglia, et.al, 2003); (2). **Internal Structure,** Similarity between two concept can be obtained compared to 'language' and 'real' attribute and not only from description between their components, but also between structure of graph representing them; (3). **External Structure,** Comparison of external structure is by seeing to set of upper class (Jayant Madhavan, et.al, 2001).

For example, there is a computer assembling company which manufacture some products need special processor to fulfill requirement of customer. When a request of product asked by a customer, the company would search a processor for industrial controller that have ability of middle-speed process, and environment of product above normal condition. The company will deliver a request "requiring special processor for control systems with middle speed". Before sending the query, query rewriting is needed to base on common/reference ontology. Figure 1 depicts the model of concept at company 1 and 2 and reference ontology.

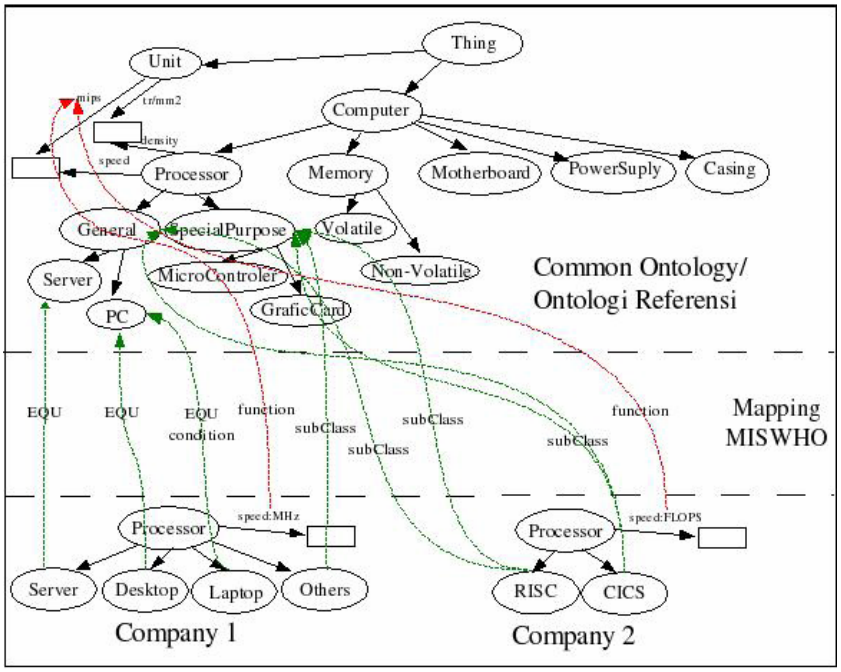

Figure 1. Example case for Ontology Reference, Ontology local and MISWHO

The query is responded by company 1 will consider result of MISWHO (query for Microcontroller will be pointed at *Others*, and value of MIPS will convert to MHz (this is done with table look-up, although in practical is not easy)). Some incomplete or miss information can be occurred in this approach. Because class *Others* is more general concept then class *SpecialPurpose*. For example, *i*n real world, is it possible microcontroller developed by desktop processor. However this approach

provide better result compare to keyword based which used by many search engine in Internet. If we send keyword "Microcontroller AND speed 100-200MIPS", company 1 and 2 will respond with no answer, because keyword is not enough to represent the knowledge of information.

5.2. Prototype and Evaluation Design

Basically, components of architecture based on loosely couple architecture, common ontology and mediation, which consist of:

- Super peer will have function to: (1). providing and looking after common ontology. (2) noting various information source along with metadata of available information, and (3) informing server or other super peer to avoid 'single point failure '.
- Information source will have function to: (1) presenting information or data that able to be utilized by external party, 2) presenting information of scheme or local ontology, (3) making mapping among local ontology and in server/super peer, (4) query response of consumer, and (5) registration mechanism to server/super-peer including to advise active/not condition as well as if existence of data or concept.

Evaluation will base on information retrieval model, such as Precession, Recall, and F-measure. The main problem is to find an appropriate example of domain to evaluate.

6. Summary

The MISWHO approach is based on semantic web by using hybrid ontology model, which gave improvement for information and web service interoperability. The approach has demonstrated to adopt for supply chain management and semantic web to handle diversity of concepts.

For future work, we plan to develop prototype that more deeply on the real world with burden of amount of class and instance. We consider to find tools, which suited for developing our prototype in supporting information interoperability.

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