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A Semantic Web Service Architecture for Supply Chain Management

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Abstract

In recent years, manufacturing supply chains are inclined to be worldwide business activity due to economic advantage of product development and service deployment in globalized world. This worldwide nature encompasses of complex business interactions and interchange of information between geographically distributed enterprises in different business sectors. Semantic web service can provide appropriate information exchange architectures for global supply chain business operations. This paper describes the main features of an ontology-based Semantic Web Service Architecture (SWSA), for which a prototype system was built for material procurement systems of a manufacturing supply chain. Description Logics (DL) are used to represent the terminological knowledge of SWSA in a structured way. The architecture uses a hybrid knowledge-based system which consists of Structured Case-Based Reasoning (S-CBR), Rule-Based Reasoning (RBR), and a service concept matching algorithm. SWSA includes: (1) a collection of web service descriptions in Ontology Web Language-Based Service (OWL-S), (2) service advertisement using business Complex Concept (CC), and (3) a concept similarity assessment algorithm. Finally, an example of this concept similarity assessment algorithm is presented to demonstrate its functionality.

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Keywords: supply chain; semantic web service; ontology; case-based reasoning; rule-based reasoning; similarity assessment algorithm.

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1. Introduction

All business today understands the value and importance of building an effective Supply Chain (SC), as part of organizational growth and profitability. Supply Chain Management (SCM) has become an important operational strategy for improving organizational competitiveness and responding adaptiveness to changing market conditions. SCM facilitates a SC, composed of geographically distributed enterprises in different business sectors, to efficiently transform raw materials into products and to deliver products and relevant services to customers at the right time and at the right place. The purpose of SCM is to integrate key business processes from end users to original suppliers that provide value-added products, services and information for customers and other stakeholders. Thus, information systems play an important role in SCM.

Recent development in Information Technology (IT) promoted many SCM business solutions, ranging from enterprise resource planning (ERP), best of breed supply chain software, e-business applications to web services. In SCM interacting environment of business needs information systems interoperability, which is of critical importance. Particularly, web service-based business information systems have developed a new paradigm of technology revolution in heterogeneous data source connectivity along supply chain. However, the increasing use of web services has raised new research challenges. One of the important challenges relates to semantic enhancement of web service descriptions to provide smooth information systems integration of distributed business applications. Many methods (e.g. DAML-S, WSDL-S, OWL-S) have been reported to add semantics to web service description to help seamless system integration[8]. Measurement of semantic similarity between web services is an essential aspect for web service discovery, composition and even execution. Semantic web services are usually described using ontologies. The measurement of semantic similarity between web services thus can be reduced to computing semantic similarities between ontologies. This paper describes the functionalities of a hybrid knowledge-based service matchmaking framework, SWSA, which uses Structural Case-Based Reasoning (S-CBR) and Rule-Based Reasoning (RBR). The remainder of the paper is organized as follows. Section 2 outlines the system architecture of SWSA and its concept similarity assessment algorithm. This includes a material management example and related concept similarity assessment algorithm; and its evaluation. Section 3 presents a review of relevant research works. Section 4 ends with concluding remarks.

2. Proposed System Architecture

The computational framework of SWSA is shown in Figure 1. The proposed architecture accepts the service consumer request which consists of the requirements of new service (e.g. input, output, precondition, and so on).

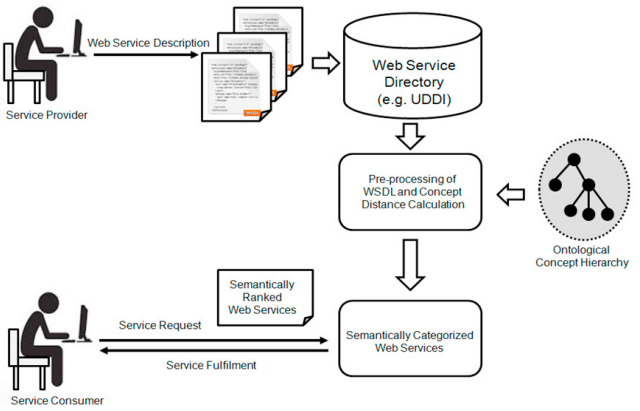

Figure 1. Diagrammatic representation of the SWSA