Chapter 4.5
A Semantic Web–Based Information Integration Approach for an Agent–Based Electronic Market

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ABSTRACT

With the increasing importance of e-commerce across the Internet, the need for software agents to support both customers and suppliers in buying and selling goods/services is growing rapidly. It is becoming increasingly evident that in a few years the Internet will host a large number of interacting software agents. Most of them will be economically motivated, and will negotiate a variety of goods and services. It is therefore important to consider the economic incentives and behaviours of e-commerce software agents, and to use all available means to anticipate their collective interactions. Even more fundamental than these issues, however, is the very nature of the various actors that are involved in e-commerce transactions. This leads to different conceptualizations of the needs and capabilities, giving rise to semantic incompatibilities between them. Ontologies have an important role in Multi-Agent Systems communication and provide a vocabulary to be used in the communication between agents. It is hard to find two agents using precisely the same vocabulary. They usually have a heterogeneous private vocabulary defined in their own private ontology. In order to provide help in the conversation among different agents, we are proposing what we call ontology-services to facilitate agents' interoperability. More specifically, we

propose an ontology-based information integration approach, exploiting the ontology mapping paradigm, by aligning consumer needs and the market capacities, in a semi-automatic mode. We propose a new approach for the combination of the use of agent-based electronic markets based on Semantic Web technology, improved by the application and exploitation of the information and trust relationships captured by the social networks.

CURRENT SITUATION

As the result of technological developments, e-commerce, namely business-to-consumer (B2C), is emerging as the new way of doing business.

In most current (first generation) e-ecommerce applications, the buyers are generally humans who typically browse through a catalogue of well-defined commodities (e.g., flights, books, compact discs, computer components) and make (fixed price) purchases (often by means of a credit card transaction). However, this modus operandi is only scratching the surface of what is possible. By increasing the degree and the sophistication of automation, on both the buyer's and the seller's side, e-commerce becomes much more dynamic, personalized, and context sensitive.

We believe that over the course of the next decade, the global economy and the Internet will merge into a global market with a large amount of autonomous software agents that exchange goods and services with humans and other agents. Agents will represent, and be, consumers, producers, and intermediaries.

When interactions among agents become sufficiently rich, a crucial qualitative change will occur. New classes of agents will be designed specially to serve the needs of the other agents. However, in order to harness the full potential of this new mode of e-commerce, a broad range of social, legal, and technical issues need to be addressed. These issues relate to things such as security, trust, payment mechanisms, advertising, logistics, and back office management. Even more fundamental than these issues, however, is the very nature of the various actors that are involved in e-commerce transactions.

In an efficient agent-mediated electronic market, where all the partners, both sending and receiving messages have to lead to acceptable and meaningful agreements, it is necessary to have common standards, like an interaction protocol to achieve deals, a language for describing the messages' content and ontologies for describing the domain's knowledge.

The need for these standards emerges due to the nature of the goods/services traded in business transactions. The goods/services are described through multiple attributes (e.g. price, features and quality), which imply that negotiation processes and final agreements between seller and buyers must be enhanced with the capability to both understand the terms and conditions of the transaction (e.g. vocabulary semantics, currencies to denote different prices, different units to represent measures or mutual dependencies of products). A critical factor for the efficiency of the future negotiation processes and the success of the potential settlements is an agreement among the negotiating parties about how the issues of a negotiation are represented and what this representation means to each of the negotiating parties. This problem is referred to as the ontology problem of electronic negotiations (Ströbel, 2001). Distributors, manufactures, and service providers may have radically different ontologies that differ significantly in format, structure, and meaning. Given the increasingly complex requirements of applications, the need for rich, consistent and reusable semantics, the growth of semantically interoperable enterprises into knowledge-based communities; and the evolution; and adoption of Semantic Web technologies need to be addressed. Ontologies represent the best answer to the demand for intelligent systems that operate closer to the human conceptual level (Obrst, Liu,

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