Chapter 2.12
Multi–Agent Architecture for Developing Cooperative E–Business Applications

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ABSTRACT

This article describes a multi-agent approach that provides solutions to the problems raised during the development of cooperative e-business applications. This approach is organized in the form of cooperative application groups representing the different parts of a company. Agent coordinators orchestrate the cooperative work of these groups. The most requested functionalities inside the company and those offered to the external world can be exported as Web Services. These Web Services are described with DAML-based Web Service ontology (OWL-S) and managed with an intermediate agent called Web Service Finder Agent. The proposed solution provides a new vision of the cooperation context where the companies and their partners share knowledge and offer functionalities as agents and Web Services.

INTRODUCTION

The fast evolution of the World Wide Web and the changes made in the economic world motivate companies to invest more and more in the e-business. In its simplest form, the e-business can be defined as the conduct of businesses on the Internet. It is a more generic term than e-

commerce because it refers not only to buying and selling but also to servicing customers and collaborating with business partners. Companies use the Web to buy parts and supplies from other companies, to collaborate on sales promotions, and to do joint researches.

Since e-business became an economic cooperation activity, we can say that it has changed the rules of the market and the role of information technology (IT). The rapid growth of the technical and organizational needs creates several intelligent solutions for the e-business domain (Khubaib & Mansoor-uz-Zafar, 2008). The main perceived obstacle to e-business is the fewest number of methodologies that exist for the development of complete e-business projects. In order to ensure the effective establishment of e-business applications in a company, it must be developed and implemented from the business requirements and not from the technological viewpoint. Although, initial expectations of e-business growth were often overly optimistic, there is no doubt that commercial applications of Internet, Intranet, and related technologies have rapidly assumed an important position in the global economy. Although technology can play a very important role, it is a tool for obtaining results but never an aim in itself (Gregorio, Kassicieh, & De Gouvea Neto, 2005). The demands of e-business for rapid response and agile adaptation to the market-place require sharing knowledge among not only the intra-organizational staff but also among the partners and customers in new and more efficient ways. Furthermore, the cooperation between the business actors is more than necessary. Being confronted with the needs related specifically to the concepts of knowledge management and cooperation, the agent metaphor seems to be an adequate solution (Minhong, Jiming, Huaiqing, William, & Xiaofeng, 2008). It can be viewed as an encapsulated problem solving entity which exhibits the properties of autonomy, social ability, responsiveness and proactiveness (Wooldridge, 2002). In spite of these advantages, the kind of

cooperation brought by the agent technology and notably in the e-business context is not sufficient with the emergence of Web Services, which are a new breed of Web applications. They are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web.

Most organizations and companies want to exploit this new technology with standards such as the UDDI repository Universal Description Discovery and Integration (http://www.uddi.org/pubs/uddi_v3.htm) in their various tasks. For them, a Web Service can be defined as an application available on the Internet by a supplier and accessible to customers. Several works tried the combination of the agent paradigm with the Web Services. This combination is made for using agents as proxies that assist during the selection of Web Services according to some criteria (Maximilien & Singht, 2004) or even in the reasoning about the semantic description, the composition and the use of Web Services (Richards, Van Splunter, Brazier, & Sabou, 2003).

For us, our new vision is that Web Services promise universal support for cooperative systems. Exploring these features allows an agent-based application to be more open in their cooperation mode. In this article, we propose an approach for designing and developing cooperative e-business applications, this approach can be used in particular to support enterprise information systems, e-commerce applications or to supply chain management. This approach imposes the mixture of agent technology and Web Services. The core solution is based on agents organized into clusters (groups) of agents that accomplish some tasks. These clusters of agents are delegated by their agent coordinators under the FIPA contract net protocol (FIPA, 2002a) using the FIPA-ACL language (FIPA, 2002b). Furthermore, the most requested functionalities inside the company and those offered for the external world can be defined as Web Services specified in the Ontology Web Language Service OWL-S based on

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