Chapter VII

Ontology Exchange and Integration via Product-Brokering Agents

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Abstract

Agent-based e-commerce has been booming with the development of the Internet and agent technologies. However, little effort has been devoted to exploring the learning and evolving capabilities of software agents. This chapter addresses the issues of evolving software agents in e-commerce applications. An agent structure with evolutionary features is proposed with a focus on internal hierarchical knowledge. We argue that the knowledge base of an intelligent agent should be the cornerstone for its evolution capabilities, and the agent can enhance its knowledge base by exchanging knowledge with other agents. In this chapter, product ontology is chosen as an instance of knowledge base. We propose a new approach to facilitate ontology exchange among e-commerce agents. The ontology exchange model and its formalities are elaborated. Product-brokering agents have been designed and implemented, which accomplish the ontology exchange process from request to integration.
Introduction

Intelligent agents are already on the Web, freeing us from some drudgework of searching and keeping us up to date automatically. For example, software agents may help users sift through the mass of data and make intelligent decisions. However, applications of software agents in e-commerce are just burgeoning. In the recent decade, agent-based e-commerce (Dignum & Cortés, 2001; Glushko, Tenenbaum, & Meltzer, 1999) has emerged and attracted many efforts in academic and industrial fields. The motivation of introducing software agents into e-commerce is to overcome the arising barricades such as overload of information, difficulty in searching, lack of negotiation infrastructure, and so forth. Software agents have demonstrated tremendous potential in conducting various e-commerce activities such as comparison shopping, negotiation, payment, and auction (Guttman & Maes, 1999; Krishna & Ramesh, 1998). However, these novel e-commerce applications also bring up some new technical challenges to the agent technology such as security, authentication, and privacy. Much research work has concentrated on these issues (Corradi, Montanari, & Stefanelli, 1999; Greenberg, Byington, & Harper, 1998), as they are essential in e-commerce applications.

The academia has not reached a generally accepted definition for software agents. In general, software agents are software entities that carry out some set of operations on behalf of a user or another program with some degree of independence or autonomy. Agents differ from traditional software in that they are personalized and autonomous. They can be personalized to the end users’ preferences. Furthermore, they are adaptive and can learn from past experiences. In addition, in a scenario of multi-agent environments, agents can interact with each other. Therefore, coordination, cooperation, and communication have become the most important external properties for agents. In this chapter, we explore the evolutionary features of software agents based on these basic properties.

Mobility is another exciting feature for agents, especially with the development of the Internet (Yang & Guan, 2000). Mobile agents can move from one machine to another, across different platforms or architectures. Adding mobility to software agents will improve the potential of their applications in e-commerce. With mobility, agents can now move from one e-commerce service provider (ESP) to another and carry on their execution from where they left off in the previous ESP. In this way, mobile agents can not only retrieve information or negotiate prices from one ESP but also they can compare the prices from the other ESPs before deciding for the end user. However, to take advantage of this feature, interoperability of agents across different platforms must be ensured.

When agents are initially created, they have little knowledge and experience. Although agent owners may give some basic knowledge or functionality to these agents, it is advantageous if they have the ability to learn and evolve. Furthermore, the Web
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