Chapter VII

Open Multi-Agent Systems for Collaborative Web-Based Learning

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Abstract

Web-based learning plays an important role in modern teaching environment. Many Web based tools are becoming available on this huge marketplace. Agent technology contributes substantially to this achievement. One of the fundamental problems facing both students and education services providers is how to locate and integrate these valuable services in such a dynamic environment. In this chapter, I present mediator-based architecture to build open multi-agent applications for e-learning. An agent services description language is presented to enable services advertising and collaboration. The language exploits ontology of service domain, and provides the flexibility for developers to plug in any suitable constraint languages. Multiple matchmaking strategies based on agent

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service ontology are given to help agents finding appropriate service providers. The series of strategies consider various features of service providers, the nature of requirements, and more importantly the relationships among services.

Introduction

The World Wide Web has the largest collection of knowledge ever in man kind history. It is one of the most important resources in modern education. With the success of search engines, such as Google, and the vast acceptance of online learning systems, such as WebCT, students and teachers can search text and images efficiently. These tools are changing our learning process in schools and universities all over the world everyday. However, the Web has not reached its full potential. At its early stage, the Web is solely a huge collection of digital information. Nowadays, it is evolving into a huge growing marketplace for information providers and consumers. Agent technology makes a substantial contribution to this achievement.

However, how to find information providers and how to integrate information agents in such an open environment are new challenges. Information agents, such as Ahoy (Shakes, Langheinrich, & Etzioni, 1997), ShopBot (Doorenbos, Etzioni, & Weld, 1997), and SportsFinder (Lu, Sterling, & Wyatt, 1999) are programs that assist people to find specific information from the Web. They are information service providers, which have the capabilities to find information for users, for example locating a person's homepage, finding the cheapest available prices for music CDs, or finding sports results of a team or a player. For a novice user, a challenge is how to find these services; for an information agent, the challenges are how to locate the service providers, and how to communicate with them to solve its tasks cooperatively. This is one of the basic problems facing designers of open, multi-agent systems for the Internet is the connection problem — finding the other agents who might have the information or other capabilities that you need (Decker, Sycara, & Williamson, 1996).

In Genesereth and Ketchpel (1994), two basic approaches to this connection problem are distinguished: direct communication, in which agents handle their own coordination and assisted coordination, in which agents rely on special system programs to achieve coordination. However, in the Web application domain, where new agents might come into existence or existing agents might disappear at any time, only the latter approach promises the adaptability required to cope with the dynamic changes in the environment.

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