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Chapter 20

Virtual Marketplace for Agent-Based Electronic Commerce

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ABSTRACT

This chapter proposes the architecture for a mobile agent-based virtual marketplace. As the Internet grows, the potential for conducting electronic commerce grows as well. However, given the explosion of online shopping, searching for particular products amongst the sea of commercial content could become a fundamental obstacle for Internet electronic commerce. Hence, an agent-based virtual marketplace is seen as the solution. The agents in the marketplace are autonomous, and so there is no need for user intervention once the agents have been deployed with the assigned task. The architecture of the marketplace has been specifically designed to facilitate agent negotiations by providing a trusted and secure environment. A novel dynamic pricing mechanism has also been implemented in the context of the airline ticketing industry and found to be rather successful.

INTRODUCTION

With the ever-increasing amount of available online resources in general, information overload has become a very real problem. One possible solution is the application of software agents in e-commerce. Intelligent agents are already on the Web, freeing us from some of the drudgework of searching and automatically keeping us up to date. There are now many examples of software agents currently available on the Web. Shopping agents like BargainBot, Excite's Jango, and Andersen Consulting's BargainFinder are but a few. However, they have their shortcomings, such as lack of purchasing capability and limited range of product selection. Furthermore, the current Web front end to an online storefront is not conducive to autonomous browsing by search agents.

A more comprehensive solution would, therefore, be to build a virtual marketplace whereby producers and consumers can come together and, with the help of software agents, actively participate and conduct e-commerce. Software agents have already been in

development since the mid 1990s, but with recent advances in software agent technologies, their potential and capabilities have been greatly enhanced.

There are currently several agent-based marketplace systems that have been developed for purposes of electronic commerce, and these include Kasbah (Chavez & Maes, 1996), MAGMA (Tsvetovatyy & Gini, 1996) and MAGNET (Collins, Youngdahl, Jamison, Mobasher, & Gini, 1998). Kasbah was developed in 1996 by the Software Agents Group of the MIT Media Lab as an agent-based consumer-to-consumer marketplace where users can create autonomous agents that help buy and sell goods on their behalf. Once these agents are created and released into the marketplace, it negotiates and makes decisions on its own without the need for user intervention. In preliminary experiments on Kasbah, users preferred simple, predictable agents with predetermined negotiation strategies over "smarter" agents that continuously adapted their behavior according to their analysis of the marketplace. A strength of the Kasbah system is the straightforwardness of its negotiation strategies, as this simplicity made it easy for users to understand the workings of their agents and subsequently they were able to trust their agents to perform the necessary transactions on their behalf. However, one weakness of the Kasbah system architecture was that it did not include any form of payment mechanisms, and this hampered users from effectively concluding transactions after a deal had been struck.

The University of Minnesota's Multi-Agent Negotiation Testbed (MAGNET) is a generalized market architecture that was designed to provide support for a variety of types of transactions, from simple buying and selling of goods and services to complex multi-agent contract negotiations. The MAGNET architecture is organized around three basic components: the Exchange, the Market, and the Session. An important fundamental concept in the MAGNET architecture is its market Session. Because the session is contained within the market, and because it maintains, independently of the initiator and any clients, a persistent record of the activities encompassed by the session, it is able to discourage value-based counter-speculation by acting as a trusted auctioneer. More importantly, however, it can record commitments made by all parties and, within the limits of its enforcement powers, ensure performance against those commitments.

The MAGMA architecture is an earlier prototype of a virtual marketplace designed by the team that developed MAGNET. This virtual marketplace architecture was designed to exhibit many of the properties attributed to physical marketplaces. It therefore includes several elements simulating a real market. These elements include a communication infrastructure, a mechanism for the storage and transfer of goods, advertising and a banking system. The MAGMA system consists of a relay server written in Allegro Common Lisp and a set of agents written in Java that work over the World Wide Web. The current implementation of MAGMA includes multiple trader agents, an advertising server, and a bank. The advertising server provides a classified service that includes search and retrieval ads by category. The banking system is able to provide a basic set of banking services including checking accounts and lines of credit. However, a shortcoming of the architecture is the fact that all agents within the system communicate to one another through socket connections. In order to facilitate communications between agents, a relay server maintains all socket connections and routes messages between the agents based on unique agent names. This architecture is felt to be rather expensive on network bandwidth and the system performance is heavily reliant on network latencies. Moreover, the scalability of this approach is also questionable.

The objective of our research work is to build a new virtual marketplace prototype whereby producers and consumers can meet and conduct e-commerce in cyberspace with