

Agent-Facilitated Virtual Marketplace for Airline Ticketing

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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- or m-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 just 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.

The objective of this article is to present a virtual marketplace prototype whereby producers and consumers can meet and conduct e-commerce in cyberspace with the help of software agents.

BACKGROUND

A virtual marketplace is a place whereby producers and consumers can come together, and with the help of software agents, actively participate and conduct e-commerce. 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 (Tsvetovaty & Gini, 1996) and MAGNET (Collins et al., 1998). However, these systems have certain limitations and shortcomings, which make them questionable for e-commerce applications. An example is the Kasbah system architecture, which did not include any form of payment mechanisms. Provision of payment facilities (Guan & Hua, 2003; Guan et al., 2004) is important,

as it makes sure real transactions will happen in online shopping. Another is MAGMA, which is expensive on network bandwidth, and the system performance is heavily reliant on network latencies as it communicates through socket connections.

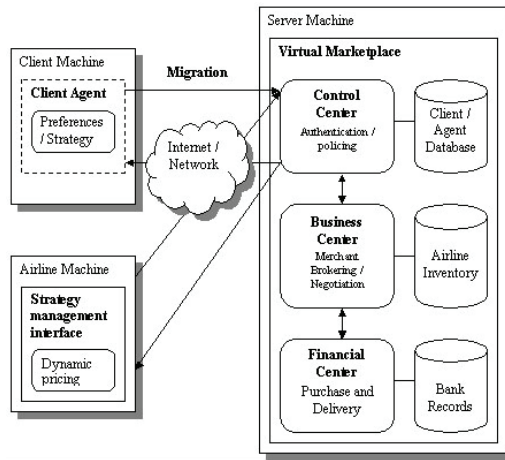
GENERAL MARKETPLACE ARCHITECTURE

A marketplace is a place where buying and selling agents meet to negotiate transactions. It is important, therefore, that the architecture of the virtual marketplace is designed to facilitate interactions between agents by providing a secure and reliable environment for the conduct of electronic commerce. A business-to-consumer model has been adopted for implementation in the virtual marketplace¹. The architecture of the virtual marketplace can be divided into three separate elements. These are the control center, business center and financial center (Figure 1). Specialist agents (Guan et al., 2002) reside in each module and work independently as well as collaboratively with the other agents in the virtual marketplace to achieve their goals and objectives.

Financial Center

If a marketplace is to become anything more than an information source, it needs to provide the necessary banking and financial services that are required by the transacting agents (Tsvetovaty & Gini, 1996). The financial center is aimed at achieving these objectives by housing within it various authorized banks, which are able to provide these services. It is a virtual financial hub that handles all necessary payment activities within the virtual marketplace. The individual banks themselves are represented by their own agents. These agent representatives handle such tasks as verification

Figure 1. Virtual market architecture overview



of legal transactions and assisting in fund transfers from the parties involved in the transaction. They also manage their clients' bank accounts and help carry out the necessary paperwork involved in marketplace transactions. Communication within the financial center, especially those between agent-to-bank or bank-to-bank, needs to be encrypted and secure.

Control Center

The control center role is to act as the administrative center of the virtual marketplace. This is the main gateway that is used by all agents roaming to and from the marketplace. For reasons of security, all potential users of the virtual marketplace will first have to register an account with the control center before its agents are allowed to participate in marketplace activities. Once registered, important user information will then be stored in the market database, and these are later retrieved for various purposes, such as user authentication and user alert notifications. Besides clients, the airlines themselves can also log into the marketplace for purposes of viewing and updating their own customized negotiation strategies. The control center accepts airline connections on a different port to distinguish between client and airline access. To gain access to the server, the airlines will still have to be authenticated.

The control center also keeps a list of all active buyer agents that are currently residing within the virtual marketplace, and it also acts as the policing authority within the virtual marketplace. The agent and transaction monitoring capability is the most important function of

the control center. From the time a buyer agent enters the marketplace till the time it returns home to the client machine, the control center keeps a record of all its activities. Details such as the time the agent entered and left the marketplace, the duration of stay, and the owner of the agent are all noted and recorded into the database. If a successful transaction was completed by the buyer agent, the control center will also keep a record of the exact details of the item in question, in this case, details such as flight times, number and cost of each ticket bought, the time the transaction was completed, and so forth. The control center goes a step further by keeping a log of the entire negotiation process that took place between the negotiating parties, regardless of whether any sale was concluded.

With such a monitoring mechanism in place, it is hoped that fraud and misrepresentation by agents (both buyers and sellers) can be more effectively controlled within the virtual marketplace. This in turn will help increase the level of trust and confidence that users will have in the system.

Business Center

This is the heart of the virtual marketplace, where all buyer and seller agents meet to negotiate deals. Clients are able to send buyer agents into the marketplace to negotiate for items that they would like to purchase. The business center consists of several virtual storefronts belonging to the various airlines. These are controlled by seller agents representing the various airlines. Virtual stores are tied into their own individual inventory databases, and they maintain a permanent presence in the marketplace. The agents controlling the stores are akin to sales personnel, and may adopt different marketing strategies based on preferences set by the individual airlines themselves. After a buyer agent has been authenticated by the control center, it arrives at the business center where it is matched to the relevant seller agents by marketplace merchant brokers. By providing this brokering service, the marketplace frees the agents from having to do this additional work. This is important as incorporating too many functions will inevitably increase the size of the buyer agent, and this will make them more costly to transport through the network. More importantly, it reduces the security risks by not allowing the buyer agent to gain access to the virtual marketplace's database and other system resources. This step can be classified under the merchant brokering

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