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Eldon Y. Li

Eric Wei

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A MOBILE AGENT-BASED ELECTRONIC MARKETPLACE

Timon C. Du[1], Eldon Y. Li[2] and Eric Wei[3]

[1] Department of Decision Sciences and Managerial Economics,

The Chinese University of Hong Kong, Hong Kong

[2] Orfalea College of Business, California Polytechnic State University, USA

[3] Department of Industrial Engineering, Chung Yuan Christian University, Taiwan

Abstract

The electronic marketplace is a new medium for exchanging information, goods, services, and payments. The marketplace houses infrastructure, facilitates transactions, and matches buyers with sellers. An agent-based marketplace allows corporate data to be maintained by local buyers and sellers and transferred to the marketplace only when orders are matched. This provides participating companies with autonomy and independence. This study proposes a framework of using the mobile agent to demonstrate autonomous behavior in the electronic marketplace.

INTRODUCTION

Electronic commerce (EC) sites are developed on the same infrastructure as network architectures, communication protocols, Web standards, and security systems. Through the infrastructure, electronic commerce transfers products, services, money, and information. The applications of EC include supply chain management, on-line banking, procurement and purchasing, on-line marketing and advertising, home shopping, video-on-demand, on-line publishing, electronic malls, travel, and so forth [4]. An electronic marketplace has three main functions: matching buyers and sellers, facilitating transactions, and providing institutional infrastructure [1]. The first function determines product features, aggregates products, determines prices, and matches buyers with sellers. The other two functions relate to the infrastructure of transactions such as logistics, settlements, legal matters, and regulations. This study will focus on the function of matching buyers and sellers.

Mobile Agents

Agents are autonomous objects, created for dynamical and distributed applications. The agents are responsible for executing designated tasks. Agents can be identified as either strong or weak. Strong agents have the capabilities of (1) mentalist notions, (2) rationality, (3) veracity, and (4) adaptability and learning. These capabilities come mainly from the technology of artificial intelligence. Weak agents, on the other hand, can complete tasks autonomously, interact with external objects, and be reactive and proactive toward environmental change based on a pre-planed scheme.

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This study presents an electronic marketplace framework using mobile agents by referring to the models in MAgNET [2], TESTBED [5], and BROKERAGE [3]. The marketplace aggregates the demands of buyers and matches the demands with suppliers. Figure 1 presents the mobile agent-based electronic marketplace framework with the major components of the main system, an intermediary database, a two-stage matching procedure, and an agent manager.

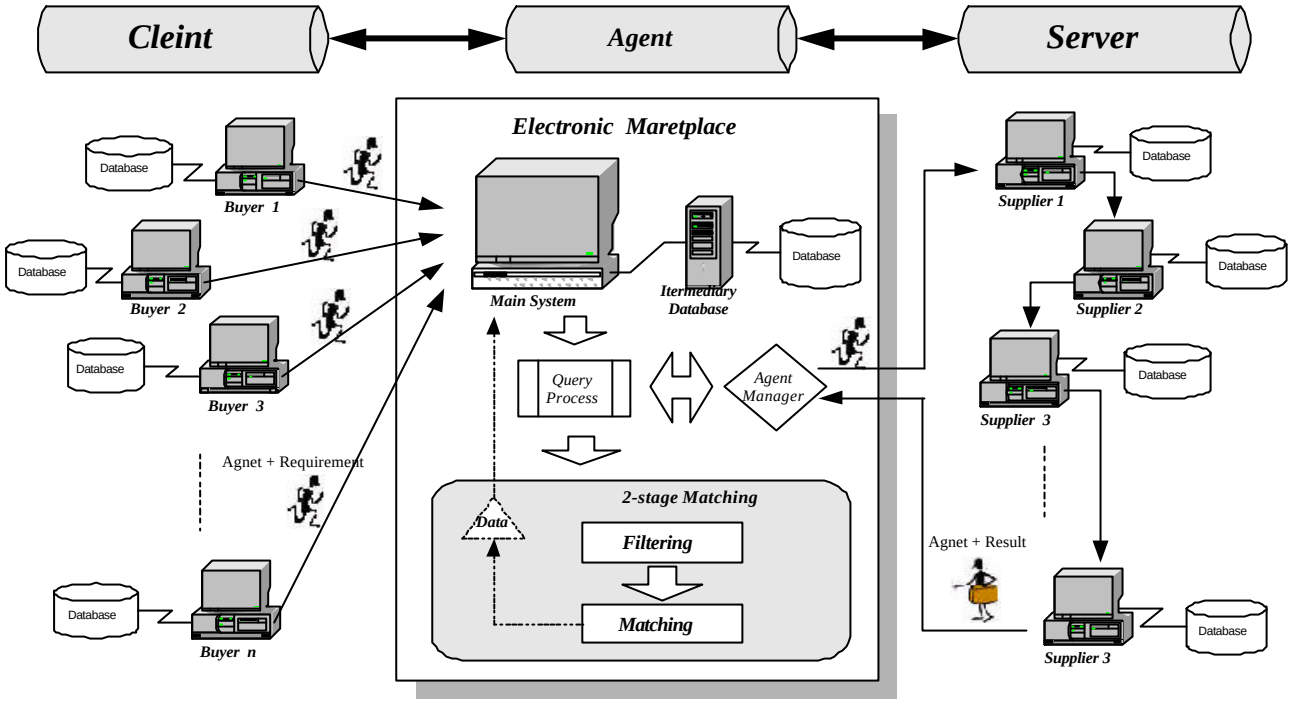

Figure 1. The Framework of Agent-Based Electronic Marketplaces

Main System. The main system coordinates the operations of three sources: the buyers on the client side, the suppliers on the server side, and the intermediary. The intermediary uses a 2-stage matching procedure (which will be discussed later) to match the buyers and suppliers.

Agent Manager. The mobile agent is the key component in the framework. The intermediary marketplace uses Agent Name Service (ANS) to interact with Local Agents. In the Marketplace, Message Generator is responsible for generating communication information, Message Queue is the input queue, Message Router outputs the information to Local Agent, and Message Interpreter analyzes the contents of received information. Matching Process refers to the 2-stage matching procedure that implements filtering and matching operations on the acquired estimates by referring to the transactions history in Record Database.

Two-Stage Matching Procedure. A two-stage order matching procedure is adopted to search for the best combination of suppliers. The intermediary triggers the two-stage matching procedure, the filtering stage and the matching stage, after receiving *bid_spec* from suppliers.

Order Aggregation. The buyers and sellers can have one-to-one, one-to-many, many-to-one, and many-to-many relationships. One-to-one relationships are the simplest: the mobile agent is sent between one buyer and one supplier to negotiate the contract. Similarly, one-to-many and many-to-one relationships can also involve sending the mobile agents between designated buyers and sellers. In a many-to-many relationship, a buyer can purchase products from many suppliers and a supplier can sell products to many buyers. That is where a marketplace is needed: to provide an intermediary to match both sides.

Two types of product assignment policies to find the best combination of suppliers.

1. *Lowest price first*. This policy means that the

buyers choose the suppliers with the lowest price. To implement the policy, the algorithm (1) sorts suppliers in ascending order based on the averaged price at the quantity; (2) adds the first supplier into the selection list; (3) deducts the supplying quantity from the total order quantity; (4) includes the next supplier in the list if ordering quantity remains; and (5) stops when the order is fully met.

2. *Largest quantity first*. This policy means that the buyers purchase the products from the suppliers who can provide the largest volume at a time. The algorithm (1) sorts suppliers in descending order by the quantity; (2) includes the first supplier in the combination; (3) deducts the supplying quantity from the ordering quantity; (4) assigns the next supplier into the combination if ordering quantity remains; and (5) stops when the order is fully met.

Both policies generate a set of suppliers in different combinations and prices. In general, the lowest-price-first assignment can obtain a lower averaged price with a complicated combination of suppliers. In contrast, the largest-quantity-first policy generates a higher averaged price with fewer suppliers in combination. However, both policies should produce a lower averaged price than the individual order can acquire. Notice that both policies have residual quantities because the remaining order amount is less than the supplying amount of the last chosen supplier. In this case, the residual cannot have the discount rate designated for larger order volumes, which is obtained by the mobile agent in advance. Two methods can be used to resolve this problem: (1) the intermediary can refer to the historical transaction record to adjust the price; and (2) a new mobile agent can be sent to the supplier directly to query the new price for the residual.

CONCLUSION

The electronic marketplace finds product features, aggregates orders, and determines prices to match buyers and sellers. This study proposes a mobile agent-based marketplace that matches transactions while allowing data to be maintained in local buyers and sellers. The framework provides the advantages of autonomy and independence to companies and is suitable for the distributed architecture of electronic commerce. In addition, a mobile agent-based electronic marketplace has the following advantages:

(1) The marketplace allows mobile agents to operate independently and asynchronously. Therefore, it is suitable for a heterogeneous environment.

(2) The two-phase matching process involving the lowest-price-first policy and the largest-quantity-first policy can match up buyers and sellers effectively.

(3) The object-oriented programming language can be used in cross-platform applications.

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