Chapter V
Improving E-Trade Auction Volume by Consortium

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ABSTRACT

In this chapter, we present a two-tier supply chain composed of multiple buyers and multiple suppliers. We have studied the mechanism to match trading parameter, specifically volume in this study, between buyers and suppliers. The chapter discusses the architecture of the agent and the agent community when there is cooperative matching of volume. We present a Dynamic Programming algorithm to describe the agent’s decision process and heuristic algorithms as the practical solution methodology. The results of extensive experiments show the improvement achieved by the cooperation.

INTRODUCTION

Agent-based auction trading plays an important role in the electronic acquisition of products/service for organization or e-procurement, especially for MRO materials. Effective agent-based trading has multiple benefits, such as reducing inventory levels, and a dual impact of centralizing strategic procurement objectives while decentralizing the operational procurement processes (Puschmann and Alt, 2005).
The environment of agent-based auction trading involves online auctions with Web-based buyers and Web-based sellers, typically multiple buyers and multiple suppliers. Therefore how to improve the performance of agent-based auction, specifically match buyers and suppliers, is a challenge for both academia and practitioners. In practice, there are two major parameters of a proposed trade, the price and the volume. This is equally true for a seller’s offer or for a buyer’s bid. Typically, volumes larger than certain lower levels go with lower prices. Thus, a match between a seller’s offer and a buyer’s bid that would lead to a transaction is a combination of matches with volume and price. In this research, we only consider the match of volume, since MRO products usually have a prevailing marketing price, and thus price is automatically matched. Volume is subject to individual agent’s bids and offers in a buyer and seller context, and when a direct match is not possible, a match may still be obtained by cooperation/consortium between buyers and sellers, respectively. The focus of this chapter is on the effectiveness of cooperation in making the match and completing the trade.

In this chapter, we propose a two-tier e-procurement auction agent structure made up of multiple suppliers and multiple buyers. Trading begins with a buyer proposing a trading amount. A seller may match the trading amount, or may propose a different trading amount. The buyer then seeks to match the trading amount with cooperation from other buyers. Alternately, the seller seeks to suit the buyer, or hold the order for a future offer that matches. The purpose of this approach is to provide better matches with offers, while reducing wait periods by means of cooperative trading. Thus, the efficiency of trading is increased.

When agents work together within a community, collaborating to achieve individual goals, it becomes a multi-agent system (MAS), where the interactions between the agents become as important as the decision-oriented actions of the individual agents. At this time, some research has been done on agent cooperation in multi-agent systems. For example, Binbasioglu (1999) proposed an approach to identify problem components, which supports the progress of understanding and structuring for multi-agent cooperative decision making environment. Fox et al. (2000) presented a solution to construct agent-oriented software architecture to manage supply chain at tactical and operational levels. In their framework, they used multiple agents, such as order acquisition agents, logistics agents, transportation agents, scheduling agents, resources agents, etc. One important capability of their agents, related to the present work, is the coordination. The authors developed a generic application-independent language to implement the multi-agent coordination issue. Kosakaya et al. (2001) developed a new cooperation and negotiation algorithm to improve cooperation in a system using multi-agent system. Zhao et al. (2001) developed the agent-based CLOVER platform that can improve system interoperability among agents, and furthermore support dynamic and flexible cooperation. Aknine et al. (2004) proposed two methods of agents’ coalition formation for both cooperative and non-cooperative multi-agent systems, and cooperative agents can exchange information/preferences among them. Based on the virtual enterprise (VE) paradigm and the concept of multi-agent, Roy et al. (2004) proposed a new way to manage supply chains. They defined tiered supply chain architecture, where a virtual enterprise node (VEN) only interacts with an adjacent VEN. The objective is to coordinate the decentralized VEN decisions in real time, and each VEN needs to make a tradeoff between local benefits and global benefits. Anusornsornnitisarn et al. (2005) developed a model of distributed network for distributed resource allocation, and they investigated if multi-agent system, as a whole, can achieve efficient resource allocation in a collaborative environment. Hill et al. (2005) designed a cooperative multi-agent approach for decentralized decision-making environment in free flight, which provides effective results for different scenarios. Zho et al. (2006) applied intelligent multi-agent technology in manufacturing systems, where agents
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