Agents and Payment Systems in E-Commerce

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INTRODUCTION

An emerging outcome of the popularization of the Internet are electronic commerce and payment systems, which present great opportunities for businesses, reduce transaction costs, and provide faster transaction times. More research has been conducted with new technologies like mobile Internet used by business models (Baek & Hong, 2003). However, before using the Internet, it is essential to provide security in transferring monetary value over the Internet. A number of protocols have been proposed for these secure payment systems, including NetBill, NetCheque, Open Market, iKP, Millicent, SET (Sherift, 1998), E-Cash (Brands, 1995), NetCash, CAFÉ (Mjolsnes, 1997), EMV cards (Khu-Smith & Mitchell, 2002), etc. These systems are designed to meet diverse requirements, each with particular attributes.

Automation and intelligence is another issue that poses challenges in the development of e-commerce. Agent technology has been incorporated into the area of e-commerce to provide automation and intelligence for the e-trade process. An agent is a software program capable of accomplishing tasks autonomously on behalf of its user. Agents must provide trustworthy consistency and fault tolerance to avoid eavesdropping and fraud. Also, agents should have roaming capability so as to extend their capability well beyond the limitations of owners' computers. To meet these requirements, this chapter will discuss some related components under the SAFER (Secure Agent Fabrication, Evolution, and Roaming) architecture (Zhu & Guan, 2000) and propose an agent-based payment scheme for SAFER.

Different types of electronic payment systems have been developed to meet its diverse requirements, which generally include integrity, authorization, confidentiality, availability, and reliability for security requirements (Asokan, 1997). Payment systems can be classified in a variety of ways according to their characteristics (Dahab & Ferreira, 1998), such as the exchange model (cash-like, check-like, or hybrid), central authority contact (online or offline), hardware requirements (specific or general), payment amounts (micropayment), etc.

Among the available payment schemes in the market, E-Cash is one of the best in terms of security, flexibility, and full anonymity. E-Cash is a cash-like online system that uses electronic coins as tokens. E-Cash has unique advantages, such as flexibility, integrity, and full anonymity that cannot be found in electronic check and credit card based systems. It uses cryptographic techniques to provide full anonymity. The agent-based payment scheme for SAFER adopts some similar principles and concepts of E-Cash.

MAIN THRUST OF THE ARTICLE

This chapter presents a brief overview of agents and payment system attributes used in e-commerce. An agent-based e-payment scheme built for the SAFER e-commerce architecture is proposed, which is aimed at providing a flexible and secure financial infrastructure for Internet commerce.

Software Agents in Electronic Commerce

Attributes of Agent-Based Systems for Electronic Commerce

Agents are bits of software performing routine tasks, typically in the background, on behalf of the user. Gathering, filtering, and presenting information are some of the small and well-defined tasks given to simple agents. An agent distinguishes itself from any other software by its intelligence. Intelligent agents are capable of "thinking" and producing intelligent feedback (Guan & Yang, 1999). Agents are increasing in the degree and sophistication of automation, on both the buyer's and seller's sides, commerce becomes much more dynamic, personalized, and context sensitive. These changes can be beneficial to both buyers and sellers (He, Jennings, & Leung, 2003).

The requirement for continuity and autonomy derives from our desire that an agent be able to carry out activities in a manner that is responsive to changes in the environment without requiring constant human guidance or intervention. According to Bradshaw (1997), agents have the following attributes, as shown in Table 1.

There are several software agent prototypes under development that will be capable of doing even more on behalf of buyers and sellers. One is Kasbah, wherein agents would proactively seek potential sellers and negotiate with them on the buyer's behalf, making the best possible deal, based on a set of constraints specified by the buyer, including the highest acceptable price and a transaction completion date (Chavz, 1996). A disadvantage of this software agent is that it always

Table 1. Attributes of software agents

Attribute	Description
Reactivity	The ability to selectively sense an act
Autonomy	Goal-directness, proactive and self-starting behavior
Collaborative behavior	Can work in concert with other agents to achieve a common goal
Communication ability	The ability to communicate with persons and other agents
Personality	The capability of manifesting the attributes of a believable character, such as emotion
Temporal continuity	Persistence of identity and state over long periods of time
Adaptivity	Being able to learn and improve with experience
Mobility	Being able to migrate in a self-directed way from one host platform to another

accepts the first offer that can meet its asking price, when even better offers might exist. This disadvantage is resolved by AuctionBot, a general-purpose Internet auction server. *AGENTics* is another agent prototype that develops what is referred to as "*online catalog integration for e-commerce*." AGENTics products shield the user from the technicalities of "where" and "how" the information was gathered, while it synthesizes many information pieces into a coherent whole (Mougayar, 1997).

Some agents can select desired items based on preferences, search databases to look for selected pieces of information, and conduct transactions. An example of such an adaptive agent is the SAFER architecture for e-commerce.

SAFER (Secure Agent Fabrication, Evolution, and Roaming) is a Web-based distributed infrastructure to serve agents to query, buy, and sell goods in e-commerce. It establishes necessary mechanisms to transport, manufacture, and evolve all different types of agents. The goal of SAFER is to construct open, dynamic, and evolutionary agent systems for e-commerce (Zhu & Guan, 2000). There will be SAFER-compliant and noncompliant communities coexisting in the e-commerce network. Each SAFER community

Figure 1. Cooperating agents for the SAFER payment scheme