Chapter XVIII

Electronic Commerce Based on Software Agents

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ABSTRACT

Because electronic commerce provides customers with more convenient and more money-saving services than conventional trading, it has seen explosive growth in recent years and will have a major impact in shaping future markets. Certainly, it will be very advantageous for customers if electronic commerce is capable of being more automated and secure than is currently the case, since the time and energy they spend will be dramatically reduced. This paper focuses on applying software agent technology together with cryptographic technology to automating and securing the information gathering, and payment procedures, which are the principal and most time-consuming steps in electronic commerce, especially on the Internet.

INTRODUCTION

Electronic commerce is emerging as one of the most important applications on the Internet, with the potential to revolutionize the whole structure of retail merchandising and shopping. By providing more complete information to purchasers and cutting transaction costs, it is reducing market friction and making markets more perfect.

With the development of electronic commerce on the Internet, the amount of business information available on the Internet has become so large that it is becoming infeasible for customers and merchants to manually visit each site on the Internet, to analyze the information there, and thus to make sound business decisions regarding the trading of goods or services. In addition, electronic purchase transactions are still largely non-automated. While information about different products and vendors is more easily accessible and orders

and payments can be dealt with electronically, a human buyer is still responsible for collecting and interpreting information about merchants and products, making decisions about them and finally entering the necessary purchase and payment information.

Software agent technology offers a new paradigm for electronic commerce, especially on the Internet. A software agent is a software program that uses agent communication protocols to exchange information for automatic problem solving. Unlike "traditional" software, software agents are personalized (incorporating cooperation, negotiation and conflict resolution), continuously running and semi-autonomous (Maes, 1994). Software agent technologies can be used to automate several of the most time consuming stages of the buying process. A software agent might have service capabilities, autonomous decision making and commitment features. These qualities are conducive to optimizing the whole buying experience and revolutionizing commerce as we know it today (Moukas et al., 1999).

Notwithstanding the fact that software agents are able to simulate the entire person to person trading process, customers are wary about employing them to trade on their behalf, largely because of concerns about unknown risks they may face. The key to alleviating many of these concerns—to mitigating the risk—is the security of agents. In order to run, a mobile agent has to expose its code and data to the host environment that supplies the means for it to execute. Thus the agents are at risk of being tampered with, scanned or even terminated by malicious servers.

In this chapter, software agent technology and cryptographic technology are combined with a view to automating and securing electronic commerce on the Internet. The chapter is organised as follows. Firstly, the fundamental cryptographic technology concepts needed to explain secure electronic commerce systems are introduced. An agent-mediated information-gathering system, in which an agent automatically roams the network and gathers relevant trading information is then proposed. An agent-mediated secure electronic transaction protocol is elaborated and the main security issues for mobile agents are reviewed. The implementation of mobile agent systems is then discussed and some conclusions are drawn at the end.

CRYPTOGRAPHIC TECHNOLOGY

Cryptographic technology is used to ensure the privacy and authentication of data on a network. To implement a mobile agent security policy, we need public key algorithms to provide data confidentiality, digital signature schemes for non-repudiation and to confirm data integrity, and authentication schemes to give assurance of an agent's identity (that is, the identity of the agent's owner). This section will briefly review these cryptographic principles.

Public-Key Cryptosystem

The concept of public-key cryptography was invented by Whitfield Diffie and Martin Hellman, and independently by Ralph Merkle. This contribution was the notion that keys could come in pairs —an encryption key and a decryption key. Since 1976, numerous public-key cryptography algorithms have been proposed. Only a few algorithms are both secure and practical. These algorithms are generally based on some computationally hard problem, such as the problem of factoring large numbers or the problem of calculating discrete logarithms.

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