

Effectiveness of Web Services: Mobile Agents Approach in E-Commerce System



Kamel Karoui

University of Manouba, Tunisia

Fakher Ben Ftima

University of Manouba, Tunisia

INTRODUCTION

With the development of the Internet, the number of people buying, selling, and performing transactions is expected to increase at a phenomenal rate. The emergence of e-commerce applications has resulted in new net-centric business models. This has created a need for new ways of structuring applications to provide cost-effective and scalable models.

Mobile Agents (MA) systems are seen as a promising paradigm for the design and implementation of distributed applications, including e-commerce. MA are also useful in applications requiring distributed information retrieval because they move the location of execution closer to the data to be processed. While MA have generated considerable excitement among the research community, they have not been applied into a significant number of real applications.

Web services (WS) are emerging as a dominant paradigm for constructing distributed business applications and enabling enterprise-wide interoperability. A critical factor to the overall utility of WS is a scalable, flexible and robust discovery mechanism; an application can be built by integrating multiple services together to make a more efficient service. WS represent a major development in the e-commerce sector. They enable companies to capitalize on their existing architecture by making their application services accessible via the Internet.

The application of MA and WS technologies to e-commerce will provide a new way to conduct business-to-business (B2B), business-to-consumer (B2C), and consumer-to-consumer transactions (C2C) and facilitate the communication between heterogeneous environments.

In this article, we first focus on these two technologies of actuality and show their integration in an e-commerce system. Second, we present different kinds of interaction between MA and WS and study their effect on application performance. We also study an example that illustrates an e-commerce system including three categories of transactions:

- Shopping transactions: a customer delegates one MA for research and purchase of articles online. The MA will interact with available WS to find the article and its best price.

- Salesman transactions: to valorize their products, WS will invoke MA to make publicity for the customers.

- Auction transactions: for this type of transaction, a MA (respectively a WS) can sell and buy a product from/to others MA (WS) by auction.

Finally, we conclude with a discussion on our inferences and their implications.

This work is structured as follows:

Section “background” reviews the notions of e-commerce system, WS and MA paradigms. Section “Web services and mobile agents’ technologies on e-commerce system” presents the integration of these two paradigms on the e-commerce system. In section “performance evaluation,” we evaluate the performances of our approach and we study an illustrated example in the section “a case study.” The section “future trends” presents our future perspectives and we end this work with the “conclusion” in the last section.

BACKGROUND

E-Commerce

E-commerce can be viewed as a set of processes that support commercial activities within an information network (Chaves, Martins, Monteiro, & Boavida, 2002). These activities produce information about products, events, services, suppliers, consumers, publicists, transactions, advanced search algorithms, transactional security, authentication, and so forth. In brief, e-commerce entails the development of a business vision, supported by information technology with the goal of enhancing efficiency within the process of trade (Adam, Dogramaci, Gangopadhyay, & Yesha, 1999). The fact that this technology is so fast, transactions require less human interaction and a greater reliance on autonomous software agents (Chaves, Simões, & Monteiro, 2003).

Web Services

WS are a new kind of Web application. They are self-contained, self-describing and modular applications that can be published, located, and invoked across the Web. WS perform functions, which can be anything from simple requests to complicated business processes. Once a WS is

deployed, other applications (and other WS) can discover and invoke the deployed service (Lemahieu, 2001). WS can significantly increase the Web architecture's potential, by providing a way of automated program communication, discovery of services, and so forth. Therefore, they are the focus of much interest from various software development companies (WSAP, 2000).

Mobiles Agents

MA are software programs that can travel autonomously from host to host to perform one or more tasks on behalf of a user. They can communicate (and even negotiate) with other agents and hosts. The MA paradigm proposes a new approach for designing applications in open and heterogeneous distributed environments (Nwana, Rosenschein, Sandholm, Sierra, Maes, & Guttman, 1998). Several application areas can benefit from the adoption of the MA technology: It can support electronic commerce transactions and help in information gathering, filtering, and negotiation. MA solutions provide mobility, autonomy and easy personalisation (Guttman, Moukas, & Maes, 1998).

WEB SERVICES AND MOBILE AGENTS TECHNOLOGIES ON E-COMMERCE SYSTEM

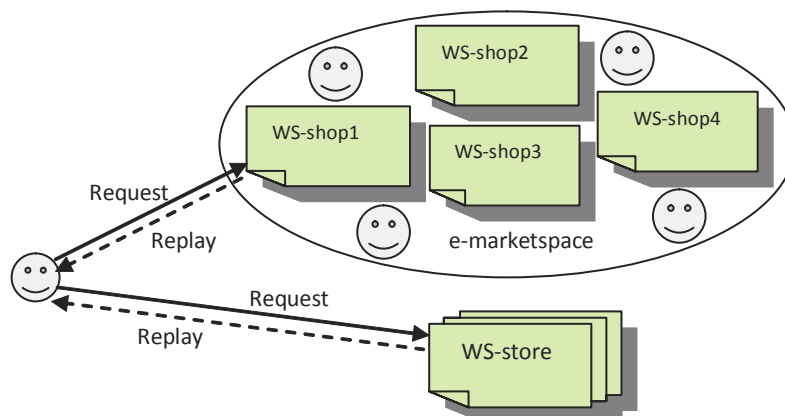
E-commerce covers any form of business or administrative transaction or information exchange that is executed using any information and communication technology. It refers especially to the commercial activities conducted on the Internet. E-commerce systems not only provide commercial information, such as product price and features, but also fa-

cilitate various commercial actions, such as buying, selling, and negotiation. The popularity of software agents, in the execution of tasks related to information filtering, mapping of people with similar interests and automation of repetitive behaviours is well known (Maes, Guttman, & Moukas, 1999). It is thus without surprise that agent-based technology is seen as the one that will revolutionize e-commerce in the way it is seen today, promising a new and innovative approach in the way transactions are processed, whether they are business-to-business, business-to-consumer or even consumer-to-consumer. Using MA represents an important leap in the development of first generation (static) agent systems (El Falou & Bourdon, 2004). The possibility of working off-line, thus saving network resources, is one of the main advantages. There is no need to keep a connection active while a transaction is processed.

To achieve a result, a program tasked (e.g., a MA) can use Web services as support for its computation or processing. The program can discover Web services and invoke them fully automated. Hence, it becomes a service requester. If the Web services have a cost attached, the program knows when to search for a cheaper service and knows all the possible payment methods. Furthermore, the program might be able to mediate any differences between its specific needs and a Web service that almost fits (Bernard, 2000).

In e-commerce, this translates into automatic cooperation between enterprises (Shaw, 2000). Any enterprise requiring a business interaction with another enterprise can automatically discover and select the appropriate optimal Web services relying on selection policies. They can be invoked automatically and payment processes can be initiated. Any necessary mediation applied is based on data and process ontologies and the automatic translation of their concepts into each other (Papaioannou & Edwards, 1998; Sandholm, 1999).

Figure 1. Shopping transaction



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