MEDIATING BUYER-SELLER INTERACTIONS: THE ROLE OF AGENTS IN WEB COMMERCE

BY ROBERT D MACREDIE, BRUNEL UNIVERSITY, BRITAIN *

ABSTRACT

Many companies are seeing the potential that electronic commerce offers and, encouraged by internet solution providers, are rushing headlong into establishing a branded web presence to promote their products and investing in web infrastructures to sell their products and/or services.

This paper will question the value in investing in such branding and will suggest that the likely dominant users of web commerce will look for ways of providing the highest return on their time and interaction investment with companies on the web. As such, this paper will consider the role of software agents in mediating interaction between users and web-based companies, present a sample set of agents and highlight key issues in the design of such agents which will be central to their effectiveness.

INTRODUCTION

The increasing importance of electronic commerce and its likely impact on businesses world-wide is well documented, through academic research (such as Benjamin and Wigand 1995, Ives and Javenpaa 1994) and business-focused texts (such as Emery 1995, McEachern and O'Keefe 1998). Many businesses feel under pressure to participate in the electronic commerce arena, often without any real sense of the costs and benefits of doing so. There is an increasing number of internet solution providers who offer their services to such companies and help them establish a presence on the web through which the companies can offer their products and services to the growing globally-networked customer base. In defining and designing their presence, companies may spend large amounts of money on establishing their brand. Yet, how informed are the choices that are being made?

As internet technology, and access mechanisms to it, develop and become widely culturally-accepted, the user base for electronic commerce will not only grow, but will also become more balanced, taking in a wider cross-section of the population. The rate at which this happens will depend on many factors, including equipment and access costs, the means through which commercial sites may be accessed, the possibilities offered by the technology, and the usability of the interface to the technology.

This, however, is not the current position. Instead, the types of users of electronic commerce in the near future (the next five years, say) will, as is currently the case, be people who are competent and proficient with the technology – that is, knowledgeable users who want to use electronic commerce because of the convenience and simplicity that its offers them. It may be that such users are less likely to be interested in the branding of commercial sites than their ease of location, use and the service offered. This suggests that it is important that we invest more heavily in the development of information management techniques to support users of electronic commerce. The particular technique that this paper will look at is the use of software agent technologies.

*Robert D Macredie (Robert.Macredie@brunel.ac.uk) is a Reader in the Department of Information Systems and Computing, Brunel University, UK. His research interests include human-computer interaction, agent technologies, personal information management, and virtual environments.

AGENTS FOR ELECTRONIC COMMERCE

There is growing interest in the use of agents in electronic commerce (for an excellent survey, see Guttman et al. 1998). The term 'agent' is used in many different ways (for a useful discussion, see Nwana, 1997). The common element in these different views is that agent systems can assist users as they work, and that they can be personalised and can undertake tasks autonomously. This can make them extremely useful in managing information, particularly at a personal level where the user can specify and 'control' their behaviour through simple mechanisms (Macredie and Keeble 1997).

There are many agent systems in the electronic commerce area which perform limited functions to support users. Examples include Andersen Consulting's BargainFinder which undertakes price comparison, as does Jango (see Doorenbos et al. 1997), and AuctionBot (see Wurman et al. 1998) and Kasbah (Chavez et al. 1997) – agent systems which support product transactions.

Typically, agent systems for electronic commerce work on local datasets to reduce complexity, with the data being gathered beforehand from commercial sites on the web. Whilst this is useful, an alternative is to develop simple agents which interact directly with the commercial web sites (through established and understood web browsers) and access the information in situ at the commercial site (or at least act conceptually in this way –

the agents will actually copy the required information to the local site for processing as in all web use). In this way, we can develop simple classes of agent to support information management for users of electronic commerce sites. Two important issues are worth considering here: (i) what classes of agent will be useful; and (ii) how will the agents work with the other components of the 'systems' (such as web browsers and remote web sites). We will briefly look at both of these issues in the following sections.

USEFUL TYPES OF AGENTS

The type of agent required to support the users of commerce on the web will obviously depend on the particular set of functions that the user wants. It is important, however, that the agents are kept simple and that the interactions between them are well-understood. This will allow informed users effectively to exploit agent functionality in managing the information arising from their use of commercial sites.

In the rest of this section, we will present an overview of key agent types which are likely to form the basis of an integrated suite of agents to mediate interaction between users and commercial web sites. Suggested agent types are as follows:

(i) 'Page' Agent: this agent processes web pages visited by the user, compiling simple keyword summaries of pages and storing these for later access. In this way a compendium of useful sites can be built up, with information also held on the content and contexts of these sites. The content and context information could be useful, for example, when the user is interested in price comparison.

(ii) 'Bookmark' Agent: this agent maintains a collection of bookmarks, providing mechanisms to add, delete, move or group bookmarks. The agent also uses information about the bookmarks' frequency of selection to control rearrangement of the bookmarks. This can be used to provide simple context, through grouping for example, of the relationships of sites which may be useful to other agent classes when searching for product information (i.e. all sites offering particular types of product or service can be grouped together by the user, or groupings may be suggested by the agent).

(iii) 'Interest' Agent: this agent reacts to overlaps between bookmarked pages in terms of keyword content, and cross-references pages according to these overlaps. In addition, the agent generates events which indicate that a potential area of interest has been identified.

(iv) 'Suggestion' Agent: this agent maintains the list of page suggestions, responding to the user accepting or declining suggestions made by the agent, or requests from other agents to modify the site list. The agent also handles requests from other agents for pages to be considered as suggestions. This agent helps the user manage the profile of the site information that is held.

(v) 'Search' Agent: this agent performs background searching for pages of interest: when an area of interest (such as a commercial product or service) has been identified, the agent submits a query to a search engine for processing and passes the results to the suggestion agent so that the user can make a decision on whether or not the site is of interest.

In contrast to many agents for electronic commerce, these agent classes are simple and perform well-defined and easily understandable functions. This is critical, since we expect users to control the agent processes and, as such, they must be conceptually simple. Clearly, this agent list is in no way exhaustive. Agents for price comparison, for example, can be easily added, exploiting features of the other related agents (such as the 'Page' agent). The key issue is to determine a new agent's interaction with the other agents and the information passing that will go on between them.

REFERENCES

Benjamin, R. and Wigand, R. "Electronic markets and virtual value chains on the information superhighway", Sloan Management Review, Winter 1995, pp. 62-72, 1995.

Chavez, A., Dreilinger, D., Guttman, R. and Maes, P. "A real-life experiment in creating and agent marketplace", Proceedings of the Second International Conference on the Practical Application of Agents and Multi-Agent Technology (PAAM '97), London, UK, April, 1997.

Doorenbos, R., Etzioni, O. and Weld, D., "A scalable comparison-shopping agent for the world wide web", Proceedings of the First International Conference on Autonomous Agents, Marina del Rey, CA, February, 1997.

Emery, V. "How to Grow Your Business on the Internet", Scottsdale, AZ, Coriolis Books, 1995.

Guttman, R, H., Moukas, A. G., and Maes, P. "Agent-mediated electronic commerce: a survey", Knowledge Engineering Review, June, 1998. (also available at http://ecommerce.media.mit.edu/papers/ker98.pdf).

Ives, B. and Javenpaa, S. "The global network organisation of the future: information management opportunities and challenges, Journal of Management Information Systems, 10(4), pp. 25-57, 1994.

Keeble, R. J. and Macredie, R. D. (1998a). Assistant Agents for the World Wide Web: Intelligent Interface Design Challenges. Interacting With Computers (forthcoming).

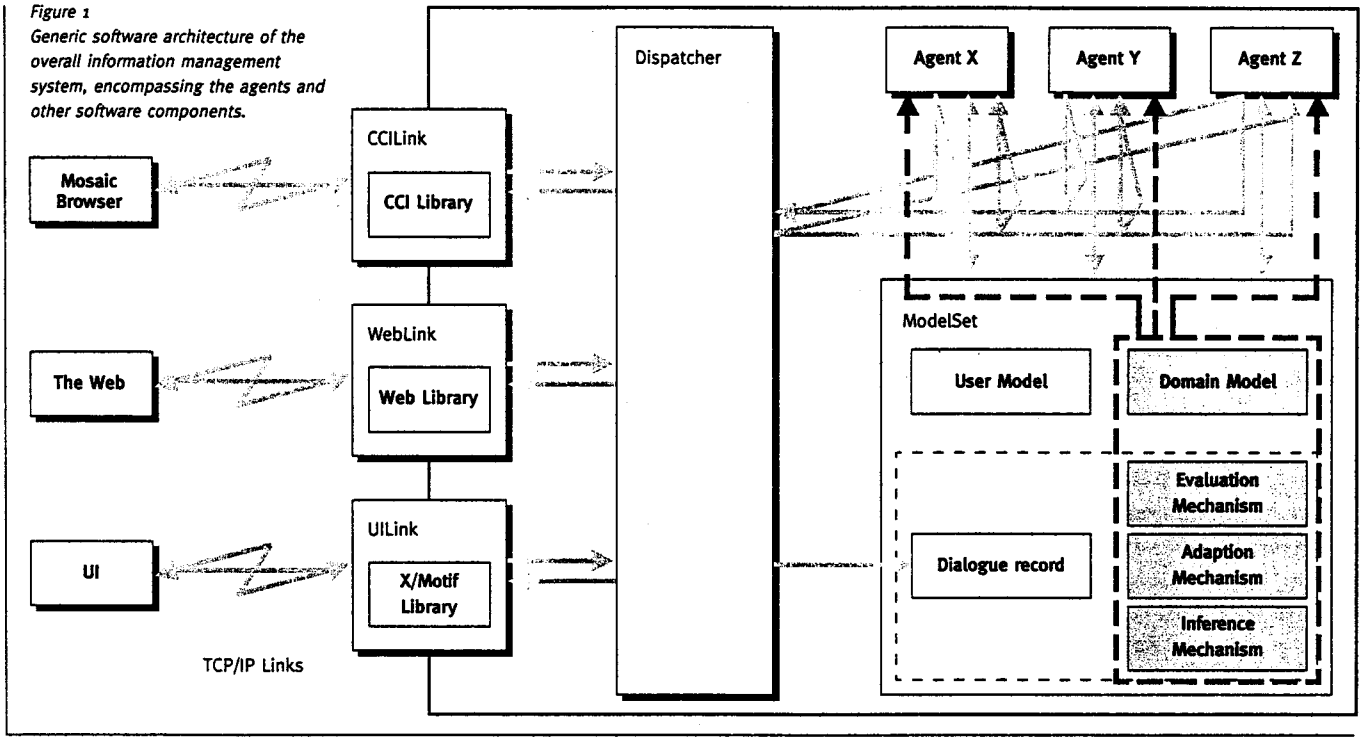


Figure 1
Generic software architecture of the overall information management system, encompassing the agents and other software components.

DEFINING AN ARCHITECTURE FOR WEB AGENTS

To ensure that interaction between agents is well understood and defined, it is important that attention is paid to the architecture of the web agent system. This will include other system components with which the agents interact. A generic architecture is shown in Figure 1.

A technical discussion of this architecture is outside the scope of this paper (see instead, Keeble and Macredie 1998b), but it does show the importance of interaction between the agents and the other parts of the wider system. The 'ModelSet' is of most interest to this paper.

The user model, as its name suggests, encapsulates a model of the user to which the system is intended to adapt. Different types of information about the user are stored in this model, related to details of the user's abilities, preferences and knowledge of the task in hand. The domain model defines the scope of the system, encapsulating information about the system's application area – in this case electronic commerce. It effectively defines the boundaries of the system – what the system can 'know', or at least, make inferences about. (More information on these models and their roles is given in Keeble and Macredie 1998a and 1998b).

With respect to the use of the agents, an important area is the development of an effective and usable user interface to the agents (marked as 'UI' in Figure 1). This is an area of on-going research, but the aim of the interface must be that it is simple and supports the user in their tasks. It is, after all, no good developing agents which remove information location and retrieval burdens from the user if their use creates a time and effort overhead approaching (or even exceeding) the initial information location and retrieval task itself.

CONCLUSIONS

Agents offer users great potential in locating appropriate goods and services offered by commerce web sites. They can mediate between the user and the commercial sites, reducing the vast information location and retrieval overhead that exists on large information networks, such as the internet. As agents become more established in this area, they will have an increasing potential to reduce the impor-

Keeble, R. J. and Macredie, R. D. (1998b). Adaptive interface Agent Development: An Object-Oriented Architecture. Submitted to IEE Proceedings – Software Engineering.

Macredie, R. and Keeble, R. (1997). Software agents and agency: a personal information management perspective. Personal Technologies, 1(2): 88-100.

McEachern, T. and O'Keefe, B. "Rewiring Business: Uniting Management and the Web", John Wiley and Sons, New York, 1998.

Nwana, H. (1997). Software Agents: An Overview. Knowledge Engineering Review, 11(3): 1-40.

Wurman, P., Wellman, M. and Walsh, W. "The Michigan internet AuctionBot: a configurable auction server for human and software agents", Proceedings of the Second International Conference on Autonomous Agents, May, 1998.

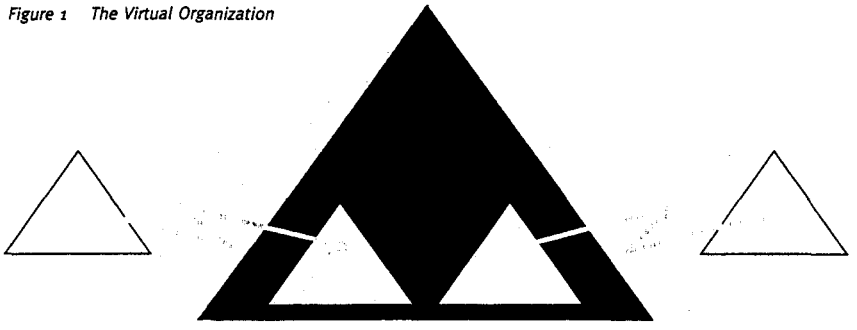
tance of the appearance of the commercial web site. This is because the user will need to have less direct contact with the product/service provider as the agent will take on the role of mediator between the user and the commercial organisation. One implication of this which may have significant impact on electronic commerce is the shift in emphasis that it suggests from the appearance, or form, of web pages to the web page content accessible by the agents. This content is often invisible to user of the sites as it is embedded in the source code for the pages. Some attention is clearly paid to this already as it is this content that simple search engines use to locate sites of interest. As agents become more sophisticated, however, the importance of considering the structure and provision of this information will increase. Yet, it seems that most effort and expenditure in developing web presence for electronic commerce is expended on the obvious appearance of the site. A closer understanding and appreciation of the structure and workings of agent technologies may be a first step for organisations wishing to differentiate themselves and attract the knowledgeable users who currently form the majority of their potential customer-base. It may even be advisable for web service providers to tie together their strategies for encouraging electronic commerce with the development of agents systems for users which are made freely available and are frequently updated. This might satisfy the often disparate goals of supporting users in finding what they want and helping commercial organisations offer their products and services to their target markets.

BUILDING THE VIRTUAL ORGANIZATION WITH ELECTRONIC COMMUNICATION

BY WILLIAM S. REMINGON, RONALD PEDIGO, AND TERRY L. FOX, EMPORIA STATE UNIVERSITY, KANSAS, USA *

Modern electronic communications has made it possible for business organizations to achieve most of the benefits of vertical integration without the significant investment of capital (Palmer, 1996). A "virtual organization" is a collaboration of business partners to achieve some overall objective. Because of electronic communication technologies, multiple business entities can act in concert, as if they were actually parts of a single wholly-owned business organization (Williamson, 1993). This provides many of the advantages of being a smaller firm and a larger firm at the same time. (Byrne, 1993). Use of information technology and electronic communication systems may be the key to developing future competitive advantage (Porter and Millar, 1985). Figure 1 graphically depicts a virtual organization with two "virtual" elements.

Figure 1 The Virtual Organization



CASE EXAMPLES

Virtual organization strategies have already been implemented in a number of successful cases. Nike, for example, has always used Asian sources for the manufacture of athletic shoes. In the 1970's, *without access to proper electronic communications*, Nike had placed their own personnel at each manufacturing location. The purpose of these people was to guarantee proper quality and to serve as a mechanism for coordination and control. By the 1980's, those people were no longer needed. They had been replaced by an integrated CAD/CAM system. Electronic systems that were linked between the Asian and domestic locations provided the coordination and control mechanisms. These systems also monitored quality throughout the various steps of product development (Rosenzweig, 1994).

VF Corporation (VFC) is the maker of Lee jeans. They developed a system to collect point-of-sale information that feeds a flow replenishment system. In this way, VFC takes on the task of maintaining proper inventory levels on the shelves of retailers (Cafasso, 1993).

One of the most successful examples of implementing virtual partnerships is Corning Inc. In 1992, Corning's 19 partnerships accounted for nearly 13% of its revenue (Byrne 1993).

Despite the many examples of successful virtual partnering, not everyone is sold on the virtual concept. In 1993, then Intel Chairman Andrew Grove said, "I think it's a business buzz phrase that's meaningless" (Byrne, 1993)

BUILDING THE VIRTUAL CORPORATION

A virtual organization is developed through two different mechanisms: 1) Strategic Partnerships, and 2) Outsourcing. A Strategic Partnership is formed when two business partners (e.g. supplier and manufacturer) agree to act together as a