

Intelligent-Agent-Supported Enterprise Information Portal

Zaiyong Tang

Louisiana Tech University, USA

Kallol Bagchi

University of Texas at El Paso, USA

INTRODUCTION

Enterprises in today's highly competitive environment must cope with mountainous information. At the same time, they must act quickly to make timely business decisions. Providing the right information at the right time has been a challenge for information technology professionals. Wells, Sheina, and Harris-Jones (2000) found that in the average company in the United States, 80% of information is kept on individual personal computers, and less than five percent of employee knowledge is captured and made available in enterprise systems. Various systems, such as management information systems, enterprise resource planning, and knowledge management systems have been used to support the information needs of organizations. In recent years, enterprise information portal (EIP) have been developed to provides an effective platform for knowledge workers in organizations to find, manage, use, and share previous disparate information. An EIP gives the user a single point of access to data, information, and knowledge across the entire enterprise, thus holding the promise of increasing the competitiveness of the organization (Mitchell, 2005; Schroeder, 2000).

Aneja et al. (2000) proposed a generic framework for an enterprise portal that aimed at taming content chaos on corporate intranets. Raol, Koong, Liu, and Yu (2002) developed a simplified model that is used for classifying enterprise portal features and functions. In most EIPs, the key functions and features include interface, content management, search, collaboration, personalization, security, network, administrative tools, and extensibility. Typically, EIPs offer a familiar and easy-to-use Web interface to the users. However, a traditional Web interface lacks the breadth and flexibility desired by end users. Artificial intelligent agents have recently become capable enough to be integrated with enterprise information portals. Those agents can be used to facilitate the effective use of many of the features and functions in EIPs. Various types of intelligent agents, such as interface agents, personal assistant agents, information foraging and filtering agents, collaborative filtering agents, decision support agents, and bargaining and negotiation agents can work separately or

collectively to make EIPs more accessible and user friendly. However, there are many theoretic as well as practical issues that must be addressed before intelligent agents should be widely deployed. We must understand the inherent limitations of intelligent agents and be able to assess the benefits and risks associated with using intelligent agents in EIPs.

A report published by KPMG in March, 2000, found that 70% of the firms surveyed indicated that they experienced information overload even when enterprise information portals/intranets were used. Apparently, making vast information available is not enough in creating effective enterprise portals. We need to provide a set of intelligent functions to improve the effectiveness of EIPs. Traditional EIP functions from major EIP software packages are discussed in Raol et al. (2002). We attempt to bridge the research in enterprise portals and intelligent agents by identifying and characterize the role of intelligent agents may play in EIPs. Previous research has shown that intelligent agents can be used in various applications that have similar characteristics to EIP functions. For instance, intelligent agents are used in locating expertise in computer networks (Vivacqua, 1999) and in risk monitoring (Wang, Mylopoulos, & Liao, 2002). As intelligent agent technology becomes more mature, the application of intelligent agents has become more wide spread (Kontolemakis et al., 2004; Xu & Wang, 2005). However, there is little research on systematic integration of intelligent agents and enterprise information portals.

INTELLIGENT AGENTS

Intelligent agents are small autonomous software programs that mimic the behavior of humans. A widely cited definition given by Franklin and Graesser (1996) delineates several essential characteristics of intelligent agents: "An autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future." This definition is broad enough to include most intelligent agents, while allowing further restrictions in more specific types of agents. Research on intelligent agents has

spread over a wide spectrum of disciplines, from computer science, to psychology, management, economics, information systems, and social science. The phrase “intelligent agents” gained popularity in both the research community and the general public in 1994, when a number of important articles on agents were published in the first of several special issues of *Communications of the ACM*. In an influential paper, “Agents that reduce work and information overload,” Pattie Maes, of MIT, explored the potentials of personal and information agents (Maes, Guttman, & Moukas, 1994). The excitement over intelligent agents research was evidenced in many publications as agent-based computing and was hailed as “the new revolution in software” (Ovum, 1994).

Characteristics of Intelligent Agents

Although the functions and capabilities of intelligent agents vary in different applications, intelligent agents are designed with the ability to model the goals and preferences of their masters. All intelligent agents share certain human-like characteristics. For example, they are autonomous, context sensitive, capable of learning and adapting, goal driven, possessing specialized knowledge, and communicating with people or other agents. It is not necessary, however, for all intelligent agents to have all of these characteristics:

- **Autonomous:** Being able to accomplish tasks without intervention from a human user or other agents.
- **Adaptive/Learning:** Being able to learn and adapt to their external environment through interaction with information, objects, or other agents (includes humans).
- **Social Interaction:** Being able to communicate, bargain, collaborate, and compete with other agents on behalf of their masters (users).
- **Mobile:** Being able to migrate themselves from one machine/system to another in a network, such as the Internet.
- **Goal-Oriented:** Being able to act and react in accordance with built-in goals.
- **Continuous:** Being able to monitor their environment and update their knowledge base continuously.
- **Communicative:** Being able to communicate with people or other agents through protocols such as agent communication language (ACL).
- **Impersonal:** Being able to show/emulate feelings, emotions, subjectivity, or biases that are typical in human agents.
- **Intelligent:** Being able to exhibit intelligent behavior such as reasoning, generalization, learning, environment awareness, dealing with uncertainty, using heuristics, and natural language processing.

Intelligent Agent Applications

In recent years, with the improvement of agent technologies, intelligent agents have found various applications in solving real-world problems. The following is a sample of current applications of intelligent agents (Maes et al., 1999; Moukas, Zacharia, Guttman, & Maes, 2000; Proffitt, 2001):

- **Interface Agents:** Intelligent agents that monitor user behavior over a length of time and then customize the application interface that is tailored to the user’s needs.
- **Foraging and Filtering Agents:** Intelligent agents are widely used in automated searching and retrieval of information based on users’ queries. They help users to classify, sort, organize, and locate information from various sources such as the Internet, online databases, and government/corporate data warehouses.
- **Collaborative Filtering Agents:** Collaborative filtering agents provide the user with information based on his/her profile and those of other users who share similar interests or activity patterns.
- **Planning and Scheduling Agents:** Intelligent agents that support communications and collaborations among team members.
- **Procurement Agents:** Intelligent agents that support the cooperation between buyers and suppliers, and build a virtual market place to carry out electronic searching, negotiation, ordering and invoicing.
- **Shopping Agents:** Shopping agents, known as shopbots, are designed to help the user to find the best bargain with minimum effort.
- **E-Commerce Agents:** While shopping agents are servants to buyers of the online markets, e-commerce agents are deployed to help the sellers or facilitate the transactions.
- **Decision Support Agents:** Intelligent agents that have access to databases and analytical tools and provide decision support. Various artificial intelligence techniques can be implemented, including but not limited to: statistical analysis, rule-based expert systems, case-based reasoning, heuristic search, fuzzy logic, neural networks, and evolutionary computing.
- **Personal Assistant Agents:** Intelligent agents that provide individual, custom-tailored services, typically aimed at individual information organization and personal productivity.
- **Network Management Agents:** Intelligent agents that automatically monitor, allocate, coordinate, and manage network services over an intranet and/or the Internet. They can assist in network administration tasks like routing, access and service provisions.

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