Using Agent Technology for Company Knowledge Management

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ABSTRACT

Emerging agent-based systems offer a new means of effectively managing knowledge to address complex decision processes, thereby enabling solutions to many real problems that have heretofore appeared intractable. This article presents an overview of expert system and agent technologies, and shows the latter as a powerful extension of artificial intelligence for systems development. To illustrate, a system developed first using an expert system approach and then an agent-based approach is used to identify the strengths and weaknesses of the agent-based approach. Last, the practical implications of a company adoption of agent-based technology for systems development are addressed.

Keywords: artificial intelligence; expert systems; intelligent agents; knowledge management; reverse mortgage, systems development

INTRODUCTION

Expert systems have become the most important artificial intelligence technology since the early 1980s. Today, expert system (ES) applications are found widely in business and government, as ES development techniques and tool kits have multiplied. Many of the techniques applied to expert system development can be directly applied to the newly emerging field of Knowledge Management (KM). ES technology provides powerful tools to manage knowledge/expertise within specific domains. KM is the process of creating value from an organization's intangible assets. It deals with how best to leverage knowledge internally in the organization and externally to the customers and stakeholders. The focus is on how best to share knowledge to create value-added benefits to the organization. Simply put, KM is the process of capturing collective expertise and distributing it in a manner that produces a payoff (Liebowitz, 1999a, 1999b, 2000; Liebowitz & Beckman, 1998). The expert system, which provides a software representation of organizational expertise dealing with specific problems, is a useful mechanism to accomplish the knowledge-

sharing task. However, traditional expert system development techniques have several shortcomings:

i. Expert systems are typically brittle, dealing poorly with situations that "bend" the rules. Further, the components of an expert system are not typically intelligent enough to learn from their many experiences while interacting directly with users. Thus, the rules encoded initially do not evolve on their own, but must be modified directly by developers to reflect changes in the environment.

ii. Expert systems are typically isolated, self-contained software entities. Very little emphasis is placed on tool kits that support interaction with other expert systems or external software components.

iii. As the system develops, functionality increases are accompanied by an ever-growing knowledge base in which inconsistencies and redundancies are difficult to avoid.

iv. Over time, portions of the process that initially required human intervention become well understood and could be totally automated, but there is no mechanism in place to support the transition from human-activated objects to autonomous objects.

These are exactly the types of shortcomings agent technology (AT) was developed to address. Today, as the system developer chooses between tools and techniques in addressing new system requirements, careful consideration must be given to the advantages of using an expert system versus enhancing it with an agent-based approach. The objective of this study is to analyze the added value of using AT, its significant features and characteristics that distinguish them from expert systems, and its strengths and weaknesses in systems development. The concepts are further illustrated through a case study in which the tradeoffs between these techniques are explored.

AGENTS AND WHAT THEY CAN DO FOR YOU

While no standard definition of an agent has yet emerged, most definitions agree that agents are software systems that carry out tasks on behalf of human users. Intelligent agents generally possess three properties: autonomy, sociability, and adaptability.

Autonomy means that an agent operates without the direct intervention of humans and has some control over its own actions and internal state. It is capable of independent action (Wooldridge & Jennings, 1995). An agent does not simply act in response to its environment; it is able to exhibit goal-directed behavior by taking the initiative.

Sociability refers to an agent's ability to cooperate and collaborate with other agents and possibly human users to solve problems. Agents share information, knowledge, and tasks among themselves and cooperate with each other to achieve common goals. The capability of an agent system is not only reflected by the intelligence of individual agents, but also by the emergent behavior of the entire agent community. The infrastructure for cooperation and collaboration includes a common agent communication language like the Knowledge Query Manipulation Language (KQML) (Finin, Labrou, & Mayfield, 1998) or the Foundation for Intelligent Physical Agent (FIPA) Agent Communication Language (FIPA, 2000).

Finally, *adaptability* refers to an agent's ability to modify its own behavior as environmental circumstances change.

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