

## Chapter 2.41

# Knowledge Management Agents

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### APPLYING AGENTS WITHIN KNOWLEDGE MANAGEMENT

The agent has existed as a concept for thousands of years. In the human context, an agent is a person that performs some task on your behalf, for example, a travel agent planning flights and accommodation for your holiday, or a real-estate agent helping you buy or sell a house, or someone arranging marriages. Some Biblical laws specifically refer to agents.

In the much more recent software context, an agent is loosely a program that performs a task on your behalf. Agents have grown in popularity since the introduction of the PC (personal computer) as the target environment for application software has increased in complexity. Software systems must now operate robustly in a networked, global environment comprised of diverse, distributed technologies. Furthermore, the environment is dynamic, and frequent change is inevitable. Having automated help is almost a necessity.

Despite many attempts, there is no universally agreed technical definition of agents. An oft-cited

reference by Franklin and Graeser (1996) gives almost a dozen different definitions. Let us consider a textbook definition given by Wooldridge (2002, p. 15). An agent is “an encapsulated computer system, situated in some environment, and capable of flexible autonomous action in that environment in order to meet its design objectives.”

Essential characteristics of the agent paradigm that can be elicited from this definition are:

- The autonomy of individual agents, or their ability to act for themselves and to achieve goals
- The reactivity of individual agents in response to changes in the environment
- The modularity of individual agents and classes to allow the easy development of complex systems
- The ability of agents to communicate effectively and interact with legacy systems

Optional characteristics of the agent paradigm, which emerge from broader considerations of agents than the above definition, include mobil-

ity in moving around a network and the ability to reason.

This article rests on the metaphoric view of agents as entities performing tasks on one's behalf. Agents are presumed useful for building software to interact with complex environments such as the Internet or within complex organizations such as universities and multinational corporations. Expected of a program being viewed as an agent is an ability to sense and be aware of the environment in which it is situated, an ability to communicate with other agents, and an ability to take action in its situated environment. According to these three expectations, sophisticated e-mail programs such as Microsoft's Outlook and Qualcomm's Eudora can be viewed as agents. They are situated on the Internet and sense various aspects of the Internet, including when Internet connections are live and when new mail arrives. They communicate with other e-mail clients by sending and receiving messages. They take actions such as raising alerts when mail has arrived, sending mail that has been queued once an Internet connection is restored, or filtering messages according to rules.

We now connect with knowledge. Organizations operating in today's software environment need to represent, interact with, and above all, maintain a large collection of knowledge, including, for example, business practices, trade secrets, intellectual property, organizational hierarchies, promotional organizational descriptions, and knowledge of both its own policies and policies of relevant, external regulatory bodies. There is out of necessity great diversity in the form, content, and context of the knowledge. Most of this knowledge is in unstructured or semistructured form. The problem of the representation and maintenance of such knowledge within an organization can be loosely called the knowledge management problem.

For the purposes of this article, there is no need to define the knowledge management problem or knowledge management, for that matter, more precisely. However, we note that the term knowl-

edge management subsumes the term content management. Referring to knowledge rather than content suggests some concern with formalizing knowledge explicitly.

How might agents be applicable to the knowledge management problem? As a running, concrete example, consider knowledge management issues related to the responsibilities of a university lecturer in charge of a subject<sup>1</sup>. She or he must prepare, deliver, and maintain content in a variety of forms, possibly including lecture notes, papers, and media presentations. Let us particularly focus on one component of the task, namely, maintaining a Web site for the subject.

Several possibilities exist for enlisting the help of agents. An obvious first task for agents is to help with the acquisition of knowledge, which is obtaining content and placing it on the Web site.

What type of software agent might be useful for the acquisition of knowledge? It is natural to envisage a custom Web crawler ([http://en.wikipedia.org/wiki/Web\\_crawler](http://en.wikipedia.org/wiki/Web_crawler)), Programs that trawled specified Web sites looking for content were early applications built to exploit the World Wide Web. Building a Web-crawling agent immediately raises important considerations. The agent should be aware of important regulatory issues such as the fact that downloading mp3 files is illegal in some countries without the authorised permission of the copyright holder. The agent should also be aware of conventions such as the robots.txt protocol ([http://en.wikipedia.org/wiki/Robots.txt\\_protocol](http://en.wikipedia.org/wiki/Robots.txt_protocol)) in which guidelines are given about parts of a file hierarchy that should be ignored by well-behaved agents. There are many similar policies of which a knowledge-acquiring agent would need to be aware. These policies demonstrate some of the complexities that need to be taken into account in building agents.

Search engines are based on exhaustive trawls and efficient indexing of files using techniques from information retrieval. Agents can also be constructed using techniques derived from

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