Chapter VII
A Recommender Agent to Support Knowledge Sharing in Virtual Enterprises

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ABSTRACT

To remain competitive, virtual enterprises depend on effective knowledge management (KM). On the other hand, KM is deeply affected by the virtualization of modern organizations. As a result, KM systems need to be reshaped to adapt to these new conditions. This chapter presents KARe, a multi-agent recommender system that supports users sharing knowledge in a peer-to-peer environment. In this way, KARe reflects the intrinsically distributed nature of virtual enterprises. Supporting social interaction, the system allows users to share knowledge through questions and answers. This chapter focuses on KARe's recommendation algorithm, presenting its description and evaluation.

INTRODUCTION

The evolvement of information technology inaugurated new ways of structuring the organization and executing work. Many organizations became partially or completely virtual, processes gained a more dynamic and distributed nature and static and hierarchical structures shifted to increasingly adaptable and flexible ones. In this realm, *virtual enterprises* can be defined as "distributed organizations and teams of people that meet and work together online. Group members rely on support systems to help gather, retrieve, and share relevant knowledge" (O'Leary, 1997). From this definition, one immediately concludes that it is paramount for these organizations to invest money and effort in finding effective solutions for collecting and sharing knowledge.

Focusing on these matters is the knowledge management (KM) research area, which deals with the creation, integration and use of knowledge, aiming at improving the performance of individuals and organizations. Advances in this field are mainly motivated by the assumption that organizations should focus on *knowledge assets* (generally maintained by the members of an organization) to remain competitive in the information society's age (Nonaka & Takeuchi, 1995). However, KM practices and systems are also affected by the virtualization of modern organizations. Merali and Davies (2001), for instance, mention three trends that have considerably added to the complexity of KM problems:

- The move towards flexible work practices, resulting in the geographical dispersion of people who would be normally co-located
- The increasing importance of cross-functional and inter-organizational collaborative work practices
- The need to provide quick and innovative organizational responses to changes in the environment

KM systems and practices should consequently be reshaped to adapt to these new conditions. Nevertheless, the current landscape concerning KM systems shows that most initiatives still rely on central repositories and portals, which assume standardized vocabularies, languages and classification schemes (Liao, 2002). Consequently, employees' lack of trust and motivation often lead to dissatisfaction (Merali & Davies, 2001; Pumajera, Bondarouk, & Sikkel, 2003). In other words, workers resist on sharing knowledge, since they do not know who is going to access it and what is going to be done with it.

Workers dissatisfaction many times leads the KM system to be abandoned, while people continue relying on their natural ways of finding knowledge, such as asking for the help of colleagues that are part of their circle of trust. The work described in this chapter aims at improving these natural processes by imitating in a virtual environment, the social processes that are involved in knowledge sharing. Instead of taking a centralized view, we rely on the distributed KM paradigm (Bonifacio & Bouquet, 2002), providing autonomous and locally managed knowledge sources organized in a peer-to-peer community. Peer-to-peer technology supports the horizontal relationship between people, seeing them as both consumers and providers of knowledge (Tiwana, 2003). Each peer controls personal knowledge artifacts and exchanges knowledge with other peers based on, for example, their common interests, roles, expertise and trust.

In this work, we present knowledgeable agent for recommendations (KARe), a socially aware recommender system that recommends artifacts to organizational members based on their natural language questions. KARe (Guizzardi, 2006) is designed and implemented as a multi-agent system, where agents cooperate to organize and search knowledge artifacts on behalf of their users, interacting in a peer-to-peer network. In order to look for the answers to the users' questions, we propose an algorithm based on information retrieval techniques that associate semantic information to the queries and to the artifacts being searched. This semantic information allows us to decrease the computational complexity of the algorithm, at the same time as providing less noisy results.

The remainder of this chapter is organized as follows: section 2 presents some background information on relevant research areas composing the scope of this work and how they relate to the domain of virtual enterprises; section 3 describes the proposed system; section 4 presents the description and evaluation of the recommendation algorithm; section 5 focuses on the developed prototypes of the KARe system; section 6 discusses some related work; and section 7 concludes this chapter.