Self–Modelling Knowledge Networks

Volker Derballa
Augsburg University, Germany

Atonia Albani
Delft University of Technology, The Netherlands

INTRODUCTION

The necessity for managing knowledge is stressed by wide array of recent publications ranging from information science to strategic management substantiating their proposition with the tremendous changes in the context organisations that are operating today. Although knowledge management (KM) literature and research projects are increasingly extending their attention from intra-organisational to inter-organisational aspects (e.g., Seufert, Back, & van Krogh, 2000; Alpar & Kalmring, 2001; Schmaltz & Hagenhof, 2003), the question of how inter-organisational knowledge management can be realised is up to now not sufficiently answered (Carlsson, 2003). That is even more true for virtual enterprises, as the following specific characteristics need to be considered: short-term focus; focus on information and communication technology; decentralised information systems; and distributed ownership. As a solution approach catering for the issues mentioned above, a prototype of a system called "selfmodelling knowledge networks" is introduced. Self-modelling knowledge networks could provide a mechanism that facilitates flexible knowledge retrieval across several nodes in networked and virtual enterprises. Thus, this approach is ideally suited for situations where knowledge resources need to be combined in a flexible way and several levels of the network are comprised.

BACKGROUND

Apparently, technological innovations such as global, Web-based infrastructures, standards, and distributed systems can lead to a substantial reduction in transaction cost. By doing so, this leverages the value creation in the network context. The focus of IT-enabled integration, however, is on the integration of data and information (e.g., price inquiries, delivery time, etc.), whereas the knowledge aspects that are inherent to value creation processes in networked organisations are mostly neglected. A critical point is the fact that in the network context, there is no common knowledge management infrastructure that can be used by all networks participants.

In this area of research, it crucial to answer the following question: How do you to support the identification of scattered knowledge assets, the visualisation and modelling of the network structure in the context of networked organizations? Insights gained from the area of peer-to-peer computing (P2P) can contribute valuable input in this respect. The potential of P2P for knowledge management is emphasised for example by Chillingworth (2002). A P2P-based infrastructure could therefore solve some of the integration problems and thus enable the support of KM in a network context. As a contribution to the area of inter-organisational knowledge management research, the concept of self-modelling knowledge networks is introduced in the following section.

SELF MODELLING KNOWLEDGE NETWORKS

Basis for the concept of self modelling knowledge networks is a value creation process in the context of networked or virtual enterprises. It is assumed that value creation takes place through the combination of internal and external knowledge assets and that not all knowledge required is available within one enterprise. Thus, a network of enterprises or organisational units has to be established, from which or about which knowledge has to be acquired.

Starting point is a request for knowledge—knowledge artefacts or competences—regarding a specific knowledge demand and specified by a knowledge seeking enterprise. The demands can either be fulfilled by the own company or it needs to be sent to existing or potential knowledge suppliers. Doing so, information

about the availability and quality of the knowledge required will be received. Since not only information about the supplier in tier-1 is required by the requesting enterprise in order to strategically develop the knowledge network, the demands are split on each node in sub-demands, which are then forwarded to the next suppliers in the value network. Every node in tier-x receives demands from clients in tier-(x-1) and communicates sub-demands, depending on the demand received, to relevant suppliers in tier-(x+1). Since every node repeats the same procedure, a requestor receives back aggregated information from the whole, dynamically built network based on a specific demand sent at a specific time.

At the core of the concept of self-modelling knowledge networks is the idea that the network nodes can be identified by applying the pull principle. With the pull principle, a network node at the beginning of a (sub-) network can identify potential nodes, that is, knowledge suppliers, in a subsequent tier by performing a knowledge demand specification using standardised ontologies and taxonomies. The mapping of the different ontologies can be achieved employing ontology mapping methods (Canadas et al., 2004; Kalfoglou & Schorlemmer, 2005).

By defining a knowledge demand, primary requirements and dependent requirements can be identified and the respective information can be communicated—sending a *demand*— to the respective network nodes, that is, potential suppliers for dependent requirements, in the subsequent tier, as these suppliers are generally known by the initiating lot. This procedure is repeated by the nodes in the respective tiers until the final tier is reached. Then, the information from the nodes further upstream is aggregated and split-lot transferred to the initiating node. Every node in tier-x receives demands from clients in tier-(x-1) and communicates sub-demands, depending on the demand received, to relevant knowledge suppliers in tier-(x+1). Since every node repeats the same procedure, a knowledge seeker receives back aggregated information from the whole, dynamically built network based on a specific demand sent at a specific time. Having the fact that the seeker-supplier relationship may change over time, new dynamically modelled networks—which may differ from the actual ones—are built whenever sending out new demands to the suppliers in the subsequent tiers. The following example demonstrates the idea.

The concept is illustrated in the following as shown in Figure 1. The figure on the left shows a complete demand driven knowledge network constituted of existing (highlighted nodes) and alternative sub-networks. Existing sub-networks are those the knowledge seeker already uses. Alternative sub-networks are networks, which are built by sending a demand for a specific knowledge artefact to new chosen knowledge suppliers,

Figure 1. Different knowledge networks