

PERSPECTIVES ON USAGE OF AGENTS IN PERSONAL KNOWLEDGE MANAGEMENT

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Keywords: Intelligent agents, Personal knowledge management, Knowledge worker.

Abstract: It is frequently mentioned that nowadays is the information age. Knowledge becomes the most important asset for individuals and organizations. And more increasingly knowledge has been viewed as an active area of research. Accordingly there is a need for highly qualified knowledge workers. That in turn implies a necessity for on an effective technology based education system, which provides a foundation for obtaining well educated specialists. Thus perspectives of personal knowledge management (PKM) environment are explored in this context. This environment is not just focused on an individual. Rather it is involving also collaboration for knowledge exchange thus forming communities of practice. The central concept of the paper is knowledge worker surrounded by several layers of agents such as personal agents, communication agents and so called “engine room” agents like database and network agents. The next step related to different types of agents would be to consider that all or part of them could be mobile agents. Possible future opportunities for PKM are explored in this respect and potential benefiting parties are identified.

1 INTRODUCTION

In couple last decades one can observe a historic transition from the industrial age to the information age. Some may even argue that we already are in the information age. Creation and consumption of material goods, usage of fixed procedures and following standardized information routines can be named as characteristic elements of industrial age. In opposite to latter mentioned, the information age can be described as creating and consuming information, using ad-hoc approaches and non-standardized information for decision making and reaching solutions. The Web and the Internet have shifted even more focus towards the importance of information. That changes the way information is stored, presented, consumed and shared with others. That in turn provides new options for doing business in different areas - be it accounting, car engineering, or teaching. The development of the Web has been very rapid. So has been with the growth of information amounts people and software systems have to deal with. That is known as information overload. In addition workspace equipment is becoming more sophisticated which requires additional skills and knowledge to handle it. As a result work is becoming increasingly complex

(Wiig, 2004) and more complicated processing systems have to be developed to make sense out of these vast amounts of information. That has led to recognition that knowledge has become the most important asset for organizations and for individuals, which more increasingly has been viewed as an active area of research. This shift from information to knowledge has been a reason for appearance of so called “knowledge work”, which might be seen as a new position within a list of intellectual jobs.

Increased importance and usage of knowledge in business and in everyday life creates a necessity for well educated people. That implies a need for on an effective technology based knowledge management and education system, which would pave the road for a new knowledge-based society and economy, and would allow ambient participation in a social and economic life. This paper reports on one stage of broader research targeted at perspectives of using agents in the environment of personal knowledge management. At this stage of research a personal-knowledge based worker environment supported by number of agents is defined. And next it is viewed in perspective of PKM and possible future opportunities.

2 TOWARD AGENTS

One could assume that over twenty years it is more than enough to get straight with the definition of the basic concepts. This is not the case regarding agents. The concept ‘agent’ has not been defined in a single unified way which could be widely accepted. Thus there are several approaches how to define an agent. The term “agent” itself surfaced for the first time in mid-1950s with John McCarthy (Bradshaw, 1997). The American Heritage Dictionary defines an agent as “one that acts or has the power or authority to act; or one empowered to act for or represent another; or a means by which something is done or caused; instrument” (Pickett, 2000). General software agent definition says that an agent is every program that acts in the name of its user (i.e. human) (Bradshaw, 1997). A more specific definition of a software agent which could be more widely acceptable is given by Shoham: a software entity which functions continuously and autonomously in a particular environment, often inhabited by other agents and processes (Bradshaw, 1997). Also Wooldridge and Jennings point out that first of all an agent is a computer system situated in some environment, and that it is capable of autonomous action in this environment in order to meet its design objectives (Wooldridge and Jennings, 1995). Agents’ autonomy is perceived as equivalent ability to humans’ free will (Vidal and Buhler, et. al. 2001).

Agents may or may not have several characteristics or features. They are: autonomy, social ability, reactivity, pro-activity, mobility, veracity, benevolence, rationality (Wooldridge and Jennings, 1995; Padgham and Winikoff, et. al. 2008). In addition to already mentioned agent features Bradshaw adds: temporal continuity, personality, adaptivity (Bradshaw, 1997).

Agents can be divided in types. Nwana comes up with several of them. He classifies agents as collaborative agents, interface agents, mobile agents, information agents, reactive agents, hybrid agents, heterogeneous agent systems, and smart or intelligent agents (Nwana 1996).

2.1 Intelligent Agents

A bit more about intelligent agents - what are they? Wooldridge defines intelligent agents as ones that are forced to work sturdy in rapidly changing, unpredictable, and open environments, where exists a good possibility that actions may fail (Wooldridge, 1999). He adds that an agent is a computer system capable of flexible autonomous action in order to

meet its design objectives. By flexible he means that such system must be responsive, proactive and social. Australian software company JACKTM uses intelligent agents in their commercial applications. There an intelligent agent is being seen as an encapsulated computer system that works within larger systems, or in other environments, and one that can reason. It can perform functions that require higher-level cognitive abilities (AOS Group, 2009).

2.2 Mobile Agents

In turn a mobile agent is an execution unit able to migrate in an autonomic way to another host, transporting along with itself its code and state; and seamlessly resume its execution in this new environment before that installing its own code. (Nwana, 1996; Lange and Oshima, 1999). The term “state” usually means agent parameters’ values, which helps agents to realize from which place to continue to execute interrupted work; “code” in other hand in a sense of object oriented context means class code, used by agent to execute itself (Lange and Oshima, 1999).

3 PERSONAL KNOWLEDGE MANAGEMENT

The term ‘personal knowledge management’ consists of three words – personal, knowledge and management. Obviously personal refers to an individual and to everyday tasks he or she performs or is intending to do. What is knowledge? If to look in a personal – human perspective, then knowledge and its physical location is mainly in the brain and thus it appears as our memories and skills (Apshvalka, 2004). However she also points out that knowledge is rather intangible and that it can not be fully realizable in common with all our human being. Thus considerable role is played by individual’s characteristics such as volition, psychological traits, motivation and his or her intelligence. A broader definition is nailed down by Thomas Davenport, where knowledge is “a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms” (Davenport and

Prusak, 2000). Knowledge management (KM) in its classic way is viewed in business context in organization. Thus KM is defined as such which enables creation, sharing and utilization of knowledge in order to achieve business goals (Quintas 1999). The primary goal of KM in this context is identified as “to facilitate opportunistic application of fragmented knowledge through integration” (Tiwana 2002).

PKM is rather overlooked area within KM even though lately it picks up speed again. “Definitions of PKM revolve around a set of core issues: managing and supporting personal knowledge and information so that it is accessible, meaningful and valuable to the individual; maintaining networks, contacts and communities; making life easier and more enjoyable; and exploiting personal capital” (Higgison 2004). Eric Tsui defines PKM as “a collection of processes that an individual needs to carry out in order to gather, classify, store, search and retrieve knowledge in his/her daily activities”. He adds that “activities are not confined to business/work-related tasks but also include personal interests, hobbies, home, family and leisure activities” (Tsui 2002). More laconic is Steve Barth as he says that PKM is taking responsibility for what you know, who you know, and what they know (Barth 2000). Within essence of this short definition lays the cultural and collaborative aspect of PKM. Meaning that PKM is not focused just on an individual, but it is more concentrating on culture and collaboration between knowledge workers. Thus PKM is fostering a creation of communities of practice (CoPs) which serve as a fertile ground for knowledge sharing and subsequently for knowledge creation. There are already a number of different types of CoPs established online starting from professional, business, everyday practical questions related ones and ending with social network type of CoPs. Users’ comments next to bidder’s history on eBay auction site or customers’ descriptions of bought goods on Epinions.com are examples of CoPs related to everyday practical questions. Instead LinkedIn is both an example of a professional CoP and a social network CoP.

3.1 Knowledge Worker

Thus PKM is also geared toward CoPs, culture and collaboration of knowledge workers. That requests for a closer look at these individuals. Who are they? For the first time the term “knowledge worker” appears in a book by Peter Drucker (Drucker 1959) in the middle of previous century. Since then this

term has been looked at several times. Really in the spot light it started to appear at the end of previous century. A well known author on knowledge and knowledge management Thomas Davenport defines knowledge workers as ones that have high degrees of expertise, education, or experience, and the primary purpose for their jobs involves the creation, distribution, or application of knowledge (Davenport 2005). In short, intellectual job they do is the way of working they do for living. Davenport goes even further – he names categories or areas where knowledge workers would be most probably located. These are: management; business and financial operations; computers and mathematics; architecture and engineering; life, physical and social scientists; legal area; healthcare practitioners; community and social services; education, training and library; and arts, design, entertainment, sports, media (Davenport 2005). He adds, that this forms a respectable almost one third of all the labor force in United States. No doubts that similar situation might be observed in other countries as well.

If to bring focus back on the individual himself or herself, then ideally, knowledge workers should possess not just technical know-how, but also sure sense of the cultural, political, and personal aspects of knowledge (Davenport 2000). That means that personality characteristics of knowledge workers most probably play an important role in how he or she is at finding, understanding, and making use of organizational knowledge (Dalkir 2005). This is true not just in case of organizational knowledge. It is true also in managing and enhancing knowledge worker’s own knowledge as well. John Brown says that innovation takes place at all levels of the company – not just in the research department (Drucker and Garvin, et. al. 1998). This can be derived even further by saying that innovation and new ideas in knowledge worker’s level happen at all places and times within his or her daily routine – not just at work or school. Thus it is important that knowledge worker has at hand a PKM system (PKMS). It is a complex system and includes psychological, social and technological aspects (Apsvalka and Grundspenkis, 2005). The performance of PKMS is conditioned with knowledge workers emotions, perceptions, believes, objectives, surrounding society and environment. Also technologies play an important role. Such system can serve as a support for performing simple information management tasks as well as a support for much more intellectual activities, for example, such as collaborative learning of a new language while commuting by train.

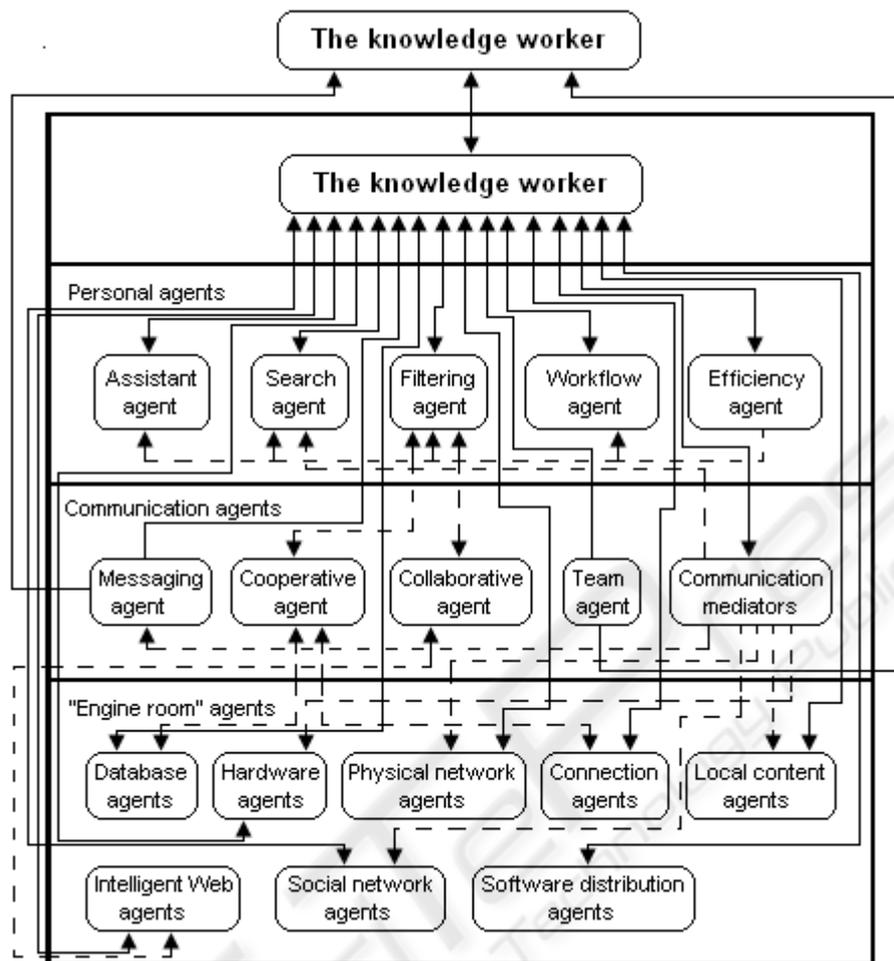


Figure 1: Knowledge worker's agent environment.

4 AGENT BASED PKM SYSTEM

If to look in more details one can easily see that an individual might be involved in a number of very different activities that requires knowledge and skills. He or she might be studying at university a new subject, looking for a new or better job, setting up a meeting with peers to get help on chemistry homework, booking a plain ticket for attending an international conference and so on. Many times in these activities a searching is involved for information, communication, scheduling or messaging just to mention a few of them. In PKMS all these activities require an intelligent support, which may be implemented in the form of communities of intelligent agents. There can be distinguished three groups of agents (see Figure 1) that could form a basis for knowledge worker's agent environment.

First, agents that can serve as the hard work performers – a driving force for so called “engine-room”, which basically is an integrated set of hardware, software and technologies to assure knowledge acquisition, processing, storage and representation as it is stated for organizations in (Grundspenkis, 2003). Here we try to use this concept for PKM. Secondly, they are agents that enable communications. And finally, these are personal agents that are most closely tied with knowledge workers.

The idea behind “engine room” agents is that nowadays there are plenty things to-do related with rather technical tasks that knowledge worker has to embrace in order to streamline his or her daily activities. Such agents, for example, could provide a helpful hand in monitoring and collecting information from data streams. They could appropriately react on changes in combined “engine

room” environment, which could consist from LAN, WAN, the Internet, hardware used by knowledge worker, etc. Such environment for most people is increasingly difficult and time consuming to handle. As “engine room” agents can be mentioned database agents – for storing knowledge elements and information, hardware agents – for performing system adjustments to particular user’s hardware, physical network agents – for supporting PKMS on a network level, connection agents – for establishing connections and determining appropriate protocols, local content agents – for taking care of different knowledge elements stored on user’s device, intelligent Web agents – for performing advanced knowledge elements’ acquiring and processing activities on the Web, and social network agents – for supporting low level activities in relation with social networks. Also there can be mentioned other agents that provide means to support technologies for fundamental functions of knowledge work, for example, software distribution agents, which main goal is to take care of timely software updates and software installation package deliveries.

Other group of intelligent agents is communication agents. As their name says by itself, these agents are in charge of communications. For individual situated in multi-agent environment communications is very important point of focus in order to have effective knowledge creation, acquisition, sharing and distribution in the PKMS. These agents include messaging agents (Knapik and Johnson, 1998), cooperative agents that are geared towards communication with other agents and collaborative agents that focus on performing tasks in collaboration with other agents. Thus these agents support the collaboration, communication and culture characteristics of PKM. Also team agents (Ellis and Wainer, 2002) that support groupware technologies can be mentioned as part of communication agents.

Personal agents are ones that are directly influenced by the individual, support interaction with particular hardware device, and provide help in knowledge work. These agents include assistant agents, search agents, filtering agents and workflow agents (Knapik and Johnson, 1998). Assistant agents can provide help with automated hotel or flight booking, scheduling meetings by taking into account available time frames and locations, or they could handle individual’s e-mail system by sorting incoming e-mails and reminding to reply. Search agents are most well know and widely used ones, for example, one can think about Paper-clip agent in MS Office. Such agents can be geared towards different

type of searches like keywords in scientific articles or database indexes, or yellow page directories on corporate network. Filtering agents can be used for monitoring information on the Web or for suspicious pattern recognition in home video surveillance system. Workflow agents can be helpful in scheduling daily tasks. This list of agents could be expanded by adding efficiency agents that help to coordinate, prioritize and schedule other personal agents work in order to achieve higher performance results. That is especially important in perspective of mobile devices used as the basic hardware platform for PKMS as they have limited resources and connection time with the Internet or with other type of network.

The era of intelligent agents approaches quite fast even though still are being used rather simple agents. However despite usage of these relatively simple agents there are quite good options to develop an agent-supported environment for knowledge worker in the PKMS. In Figure 1 is depicted proposed knowledge worker’s agent environment. Solid directed lines denote data, information and knowledge flows. Dotted directed lines denote possible connections between involved agents.

5 CONCLUSIONS AND FUTURE PERSPECTIVES

Nowadays are being done first movements towards online community where intelligent agents will support individuals in their knowledge work by helping to get a better grasp on knowledge and resources located out there on the Web. In particular the Semantic Web is considered to be the way to go as the regular Web is missing common uniform data and information encoding language and common ontology to represent knowledge. Thus it is understandable to humans, but not to agents. On contrary the Semantic Web is the right environment for intelligent agents, which enables them to help individuals in better management of their personal knowledge. Agents will team up in groups to achieve better performance by working as one whole unit thus outperforming single intelligent agents.

Another future perspective lays in the idea that part of agents in the proposed knowledge worker’s environment could be mobile agents. That would be especially beneficial in case of using mobile devices. They have limited memory and processing resources as well as connections to network are unstable,

which is very true in remote areas. Thus individual, for example, could dispatch agent with a task and reconnect back to network just after a week to find out the status.

In either way proposed knowledge worker's agent-based environment is being seen as a source for potential direction of creating more enhanced PKMS. It is also believed to serve as a foundation for researchers to perform investigation in different domains like mobile learning, personal business or healthcare where proposed environment in context of personal knowledge management approach could be beneficial to apply.

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