Multi Agent Based Knowledge Management: Issues and Challenges

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---- ABSTRACT ----

Multi-agent Systems (MAS) attracted the interest of researchers far beyond traditional computer science. Knowledge Management, Supply Chain Management was also growing areas for agent research and development, especially where the complex interactions of people in a team as well as with other agents in the same environment make it extremely difficult to understand and thoroughly analyze their behaviors. A new and very interesting research field recently growing is Agent based Knowledge Management (AKM) whose intent is to link the KM theories with the Agent-based models. The basic features of agents (social ability, autonomy, re-usability and proactiveness) can alleviate several drawbacks of the centralized technological approaches for KM. This study is critically reviewed the issues and challenges in managing the knowledge based multi agent system.

Keywords: Agent and Multi Agent System, Knowledge Management System, Multi Agent Based Knowledge Management System and its Issues and Challenges.

1. INTRODUCTION

Since the 21st century, this is era of knowledge economy and knowledge-based competition [4]. Knowledge has been considered one of the important resources and precious property, therefore knowledge management (KM) becomes more important to success of all fields. Knowledge management mainly concerns using, spreading, sharing, representing and storing of knowledge [1].

Developing knowledge management system (KMS) is a difficult task; in fact, there are different approaches towards this. For instance, the process based approach focuses on the use of knowledge by participants in a project or the infrastructure/generic system based approach focuses on building a base system to capture and distribute knowledge for use throughout the organization [2]. With rapid development of the Internet, the original knowledge management systems which are centralized control can not be adaptive to the distributed environment, especially to collaborative environment which brings geographically dispersed teams together, supporting communication, coordination and cooperation. Collaborative environment could not only support the work, but also achieve a seamless knowledge flow among the collaborative team members. In addition, there may be exist more than one knowledge bases including personal knowledge base in the collaborative environment and involve knowledge in each phase of implement process. So the distributed management of knowledge is essential and critical. Currently, to solve the issue of knowledge management in distributed

environment, agent and multi-agent technology use and propose the distributed knowledge architecture for knowledge management based on multi-agent. Multi Agent technology is one of the most exciting fields in the intelligent resource management [3]. This review is the different issues and challenges in multi agent based knowledge management using several emerging technologies to support a Knowledge Engineering approach in order to help professional actors to manage knowledge during their projects.

The purposes of this paper are to (i) introduce knowledge management and multi agent system (ii) present the approach of knowledge management systems based on multi-agent, (iii) identify and discuss different issues and challenges of knowledge sharing based on multi agent system; conclusion and discussion of the future work.

2. MULTI AGENT AND KNOWLEDGE MANAGEMENT SYSTEM

There are many definitions of what is termed an agent. In a nutshell, an agent can be seen as a software and/or hardware component of system capable of acting exactingly in order to accomplish tasks on behalf of its user in some environment. Its characterization includes (1) reactivity; (2) autonomy; (3) knowledgebase. Agent technology is one of the most promising technologies for dealing with distributed collaborative environment and social interaction in now ledge management.

Multi-agent system (MAS) is widely used to deal with some problems in the complex application

environments, especially distributed collaborative environments. MAS are a group of agents that can define their goals and actions, and it integrates these functions to finish a large complex task such as workflow control, knowledge search. Each agent can interact and collaborate with users or other agent through communication for a special problem. MAS offer a new dimension for cooperation and coordination in distributed collaborative environment. It can provide an effective platform for coordination and cooperation to help the members of team to manage knowledge. Agent technology is an appropriate technology to design and develop a distributed system for KM [5].

The term "knowledge" is sometimes used inter-changeably with the term "information". From views held by some in the knowledge management field, knowledge holds an elevated status compared to information [6]. Knowledge management is the name of a concept in which an enterprise consciously and comprehensively gathers, organizes, shares, and analyzes its knowledge in terms of resources, documents, and people skills. Advances in technology and the way we access and share information have changed that; many enterprises now have some kind of knowledge management framework in place[7].
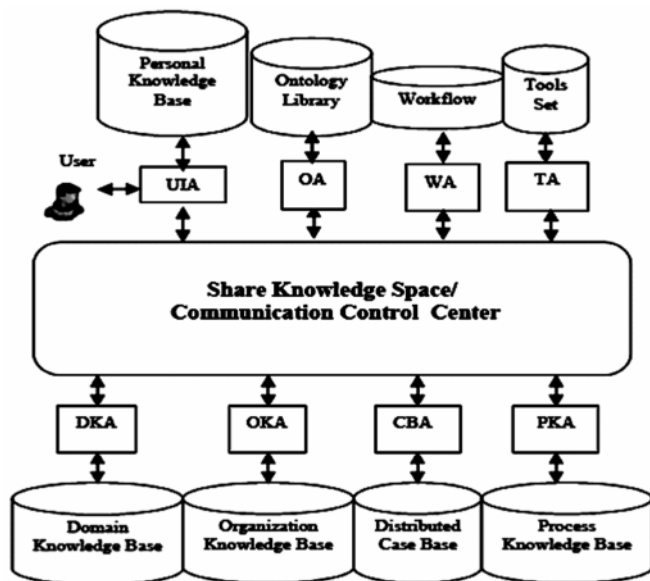

Fig. 1: Multi Agent Architecture for Knowledge Management

Developing KMS is a difficult task; in fact, there are different approaches towards this. For instance, the process/task based approach focuses on the use of knowledge by participants in a project or the infrastructure/generic system based approach focuses on building a base system to capture and distribute knowledge for use throughout the organization [10]. On the other hand, before developing this kind of system it is advisable to study and understand how the transfer of knowledge is carried out by people in real life.

However, when developing KMS developers often focus on the technology without taking into account the fundamental knowledge problems that KMS are likely to support [11].

Figure.1 shows the overall architecture of the distributed knowledge management system which is constituted of a set of agents and mainly function modules [12]. These agents are identified by their active roles: serving users, or cooperating work and etc. Each agent is specialized according to its intended roles in the supply chain [12].

Each agent is autonomous in making decisions on behalf of each function. That is, each agent autonomously collects and processes knowledge information, and cooperative work between these agents according to the practical needs. Share Knowledge Space and Communication Control Center are the main area of knowledge exchange and interaction during the development project. In this knowledge architecture, some agents are very important for project teams to cooperative design and develop. These agents are named as: Domain Knowledge Agent (DKA), Organization Knowledge Agent (OKA), Process Knowledge Agent (PKA), Distributed Case Base Agent (CBA), Ontology Agent (OA), User Interface Agent (UIA), Workflow Agent (WA) and Toolset Agent (TA).

3. ISSUES AND CHALLENGES

Today multi-agent technology has been widely used in the development of knowledge management system. The intelligent agents are able to tackle specialist problem and can interact with each other within a distributed environment. So the use of agents and multi-agent technologies in knowledge management systems is necessary and effective. It follows from this section that research in multi agent based knowledge management is diverse. As multi agent can provide several benefits to knowledge management, with these benefits there is a challenge for the research community to suggest an integrated approach to the study and practice of knowledge management based on multi agent.

It follows from the previous existing research and empirical efforts in agent based knowledge management are currently focused on one of two broad categories: technical or human and organizational. These two categories are viewed as the main issue and challenges in multi agent system and knowledge management as well. It is argued, however, that the most critical challenge for effective knowledge management or multi agent system as well as, for research in both areas is the integration of these 'hard' and 'soft' aspects. In order to provide a structure that could make it more practical to define or explain the two categories of issues, we performed a factor analysis (a statistical procedure for

organizing categories into factors, or groupings, based on similarities). The figure.2 outlines the two resulting factors incorporating the various issues and challenges.
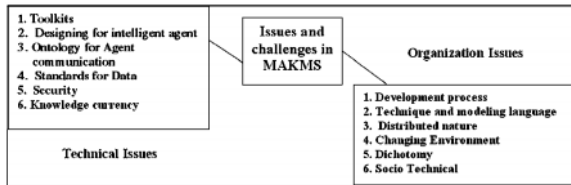

Fig.2: Issues and Challenges in Multi Agent Based Knowledge Management

Technical Issues

Current research on knowledge management tools it is evident that there are several challenging technical issues that need to be resolved for multi agent based knowledge management to become more effective. It is important to identify the key technical challenges that are yet to be overcome to allow most effective implementation of multi-agent systems within the power engineering community. These include the following.

- *Platforms:* A number of multi-agent system platforms exist. However, judicious selection is required to ensure long-term compatibility and the required robustness for Knowledge management. There are necessities to develop agents that can interact with each other, irrespective of the platform they run on, knowledge management is used by different types of user for different purpose through different platforms. So it necessary to develop flexible, extensible, open architectures. For this reason, platform choice for standards-adherence is extremely important.

- *Toolkits:* Based on the increasing amount of agent research within the knowledge management community, there is the opportunity to reuse agent designs and functionality for the benefit of the whole community. Therefore, there is a requirement for toolkits which allow the reuse of existing agent behaviors and capabilities. There is the requirement of tools that can support knowledge sharing, knowledge distribution knowledge capture and codification and support knowledge creation

- *Designing for Intelligent Agent:* New researchers in knowledge management implementers need guidance on how exactly an agent should be designed or, at very least, knowledge of the available options [13]. What is not readily understood is how flexible autonomy varies across these implementation strategies and their suitability for different knowledge management applications.

- *Ontology for Agent Communication:* Agent communication language defines how agents exchange information, communicate, and negotiate. Within them are protocols and content languages which allow meaningful Knowledge or information to be composed and interpreted. These protocols do not support all platforms and tools. A key aspect of using multi agent-based knowledge management technology should support all agents within organization cooperates and interoperates, and this should be independent of the individual developer.

- *Standards for Data:* The knowledge management expended significant effort in defining data standards for various application areas. One example is the Common Information Model (CIM) for data exchange between multi agents Systems and related applications [14] Another is the IEC 61850 Communication Networks and Systems in Substations standard for data exchange between intelligent electronic devices (IEDs) [15] These standards cannot be directly applied for agent communication, as the conversational abilities of agents require a richer language than a data-passing standard.

- *Security:* Due to the peer-to-peer nature of agent systems, security can be a key concern. If agents are to seamlessly join an agent community, there must be measures in place to determine the level of trust between agents and the security of messaging. The communication between two agents is open to attacks such as sender spoofing, knowledge modification (a information is changed while traveling between agents, particularly in negotiation situations).

- *Knowledge Currency:* Knowledge does not have the same structure and characteristics as data. It is interpreted and evaluated information, but interpretations change over time. How can an organization ensure that knowledge stays current? Knowledge management based on multi agent system, where different agents currently use and support the system need total concurrency control over the process of the system.

Beyond technical and implementation issues described above, the lack of experience in the use of multi-agent system technology in industry is an obvious concern of both utilities and manufacturers considering MAS solutions. Furthermore, there is also a requirement for clear communication of results from industrial trials of MAS technology, highlighting failures and problems as well as successes.

Organization Management

Organization management in multi agent systems (OMAS) have been usefully employed as a paradigm for developing agent systems [17]. One of the advantages of organization development is that systems are modeled with a high level of abstraction, so the conceptual gap between real world and models is reduced [18]. Organization Management Multi agent system development implies new requirements on traditional Multi agent system models and technology [19]. Therefore, traditional MAS software engineering is not enough to develop OMAS.

Development issues we have made a detailed study of the state of the art methods and tools for OMAS. These issues are classified as: (i) Development methodology (ii)Technique and modeling language; (ii) OMAS tool; and (iii) software designing (iv) platform. Following, those categories are deeply discussed.

- *Development Process:* The methodology and the modeling language which support multi agent knowledge management should be able to extract the organizational requirements; and model the organizational concepts and structure, and also the individual behaviors and objectives of agents. An analysis whether they cover the whole development process is needed. Most approaches, such as AGR, Roadmap and Tropos, only cover the analysis and the design stages.

- *Technique and Modeling Language:* The gap between the concepts of the methodology and the modeling language should be as little as possible, so a complete organizational modeling language is needed. The modeling language can be formal or informal. The organizational management multi agent system methodologies should offer an informal modeling language that cover completely the concepts and the relationships studied in the methodology.

- *The Distributed Nature of Knowledge:* May — from a technical point of view raise special challenges, but for an organization and its individuals it is the only way to cope with the complexity of knowledge and should therefore be seen as an imperative and not as a nuisance. Agents have to be capable in natural to represent that knowledge which is created and used by various actors with diverse objectives. Socially enabled agents should help to tackle derived questions like accountability, trust, etc.

- The Continuously Changing Environments are not entirely an intrinsic KM characteristic, but nevertheless any IT support for KM has to deal with this given factor. Agent approaches should

allow for extensibility and openness in situations where it is impossible to know at design time exactly which components and uses the system will have.

- Dichotomy between business processes and KM processes leads to the fact that knowledge workers typically do not adopt KM goals with a high priority. Proactive agents may be able to stand in for (or at least remind the knowledge worker) when KM tasks fall behind.

- *Socio–technical:* How can the teamwork of human knowledge workers and artificial agents (that might act "on behalf of" people) be balanced? Questions from human computer interaction arise here, but also questions of trust, responsibility, etc.

4. FUTURE WORK AND SUMMARY

To address above given issues, there is a need for a theoretical framework for developing approaches for eliciting, organizing and managing architecture knowledge and providing suitable tool support. Such a framework can exploit the theoretical concepts and practical guidelines from the knowledge management and experience factory paradigms to provide an integrated infrastructure for managing architecture knowledge in multi agent environment. Apart from the technical challenges, knowledge management in multi agent architecture process also suffers from non-technical resources and lackluster sponsorship by management. Hence it is equally important to design and develop effective strategies to deal with these issues. In future this research work will carry over towards the development of a framework which will provide solution to some of the major issues discussed above.

The goal of this paper was two fold, i) to clarify the relationship between typical characteristics of Knowledge Management environments and core features of multi agent system as a basic technology to support KM, and ii) to discuss major issues and challenges related to agent–based KM systems.

This paper contributes to the stream of research on knowledge management systems based on multi agent by describing different issues on multi agent based knowledge management. This paper provides a means to explore issues related to KMS and unifying dimensions underlying multi agent system. This paper provides a window into work in a number of reference disciplines that would enrich the utility of Knowledge management based on Multi agent system and also open up fruitful areas for future research.

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