RESEARCH PAPERS OF THE WROCŁAW UNIVERSITY OF ECONOMICS
No. 25 2008
Knowledge Acquisition and Management

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KNOWLEDGE MANAGEMENT SYSTEM BASED ON KNOWLEDGE GRID IN BUSINESS ORGANIZATION

Abstract: In this paper architecture and problems of knowledge management systems in business organizations are discussed. The objective of this paper is to show that a new architecture of Knowledge Management System based on Knowledge Grid could be a good proposal as a tool for more knowledge effective and efficient management. In this paper, a new model is proposed. This model should show how it could be possible to create and distribute knowledge within Knowledge Grid.

1. Introduction

How important is knowledge in business organization and how difficult it is to manage this capital effectively and efficiently, know not only knowledge management experts. There are a lot of knowledge systems, based on information technologies (IT), which are being continuously developed and improved. People try to find and develop architecture for perfect knowledge management.

The aim of this paper is to show that development of the Grid Knowledge Architecture could be a solution of problems which appear in knowledge management systems, as well as perfect tool for knowledge creation – corn competition of modern institution.

The structure of the paper is as follows. In the next section importance of knowledge creation and construction of knowledge system in business organization will be discussed. In the following section the author will outline problems that exist in knowledge management system in increasingly changing environment. The next section will propose how to overcome these problems. It should be possible by implementing a new structure of knowledge management system, namely, Grid Architecture. First, the meaning of grid system and Knowledge Grid will be explained. Second, the author will present features of Knowledge Grid. It will be the groundwork for further analyzing the framework of Knowledge Management System

based on Knowledge Grid and the model of knowledge creating and distributing proposed by the author, as well as the future of this solution. The conclusions are summarized in the final section.

2. Knowledge systems in business organization

Knowledge and especially creation of a new knowledge in business organization should be regarded as a competitive advantage. The works of scholars from a multitude of disciplines have suggested that access to a rich variety of information stimulates survival and sustainable development of enterprise [Nonaka, Takeuchi 1995]. Crucial role of management is finding possibilities to support the process of organizational knowledge creation. This is the correct way to business' success today, so in the future.

Many business organizations have problems with knowledge management as well as with effectively and efficiently implementation of knowledge management. Additionally, according to Jeffery, theories development directives and empirical studies of knowledge management are still at a nascent stage [Jeffery et al. 2000].

The main components of the knowledge system, after Wang and Ji, include: human being, books, documents, patents and copyrights, computer information systems as well as working solutions, community of practice and webs of relationships. Composite of these elements builds the structure of knowledge system. Different set of networks form one network system. Documents, models, singular human, teams, or even organizations stand as nodes in this network knowledge system and as processes between the singular components stand knowledge flow and workflow [Hengshan, Liqun 2005]. These arts of links connect and coordinate the nodes. Wang and Ji point that very often the nodes are regarded as the only place of knowledge storage and knowledge creation, and in fact, knowledge creation happens also on the links [Hengshan, Liqun 2005]. This point of view affords to meet better the needs of organizations and to build an appropriate architecture of such a network system.

During the building of a new knowledge network system, the five most important aspects of knowledge system in business organization: knowledge gathering, knowledge storage, knowledge transferring, knowledge sharing and knowledge creation should be taken into account.

These aspects can be divided into two knowledge cycles inside the organization. "The first one is knowledge creation cycle, in which there are four processes: creation, codification, storing, and distribution. This cycle addresses a process from idea creation into more structured and reproducible knowledge, or from tacit knowledge to explicit one. The second one is knowledge sharing cycle, in which there are four steps: gathering, sharing, spreading, reusing. This cycle has the focal point on knowledge repository" [Hengshan, Liqun 2005].

3. Knowledge management system in business organization

Currently there are more and more knowledge resources in business organizations, so according to Hubert the traditional architectures of knowledge management systems as well as the network environments could not afford such big knowledge services, especially, knowledge gathering, storing, transferring, sharing and utilization [Hubert 1996].

The process of devising a more valid architecture of knowledge management system, which should equal new requirements, will generate comprehensions for developing better theoretical and practical understanding of implementing knowledge management in business organizations [Hengshan, Liqun 2005].

The implementation of knowledge management system is slowed down by the obstructions of the business network environment. Moreover, there are a lot of problems that most of organizations must accept in increasingly changing environment [Zhuge 2004].

Information overload. In many business organizations, gathering of knowledge resources is increasing at an incredible speed. Precisely the development of IT network resulted in an enormous quantity of knowledge resources. The Web network provides a huge global information resource space. On the other hand, a lot of information, which is available on the Web, is inaccurate, imprecise, incomplete and irrelevant, which only further confuses knowledge workers. This problem is often marginalized or ignored by IT-workers who promote the use of IT in knowledge management-related work [Scott 1998].

Information convergence. Information convergence means that around the world people have increasingly similar abilities to access, analyze and easily communicate information. Information convergence is increasing transparency and is one of the most important conditions to implement an effectively Knowledge Management system. The reality looks not so good. Most of the knowledge management systems are independent also within one business organization. They have their own uniform portal and they are often devoid of channels to communicate with other departments or organizations. Therefore, it is sometimes impossible to share knowledge resources even in the same organization.

Network fragility. Presently utilized knowledge management systems are not suitable for sharing and aggregation of knowledge effectively and efficiently, when business organizations are expanding. Furthermore, these knowledge management systems are not flexible for knowledge communication and reutilization between business organizations considering the network structures' limitations.

Organization and managing of knowledge resources. The knowledge can be got encoded into the Web documents and published onto the Intranet or Internet. The problem consists on suitability of the Web document for this application. Such a document is not a suitable container for knowledge, and the traditional Web server architecture cannot meet requirements of the run time environment for knowledge.

To overcome all these critical problems it is necessary to build up a more robust environment for distributed management and coordinated assemblage, utilization, sharing and creation of knowledge.

4. Knowledge Grid

4.1. Definition

Grid is a settled architecture for distributed computing in Internet and enables extended sharing and coordinated using of resources within network. The global Grid promotes sharing, managing, coordinating, and controlling distributed computing resources, such as machines, networks, data, and any devices. Due to global Grid, compatible devices can be plugged in anywhere on the Grid and the required services are guaranteed [Foster 2000].

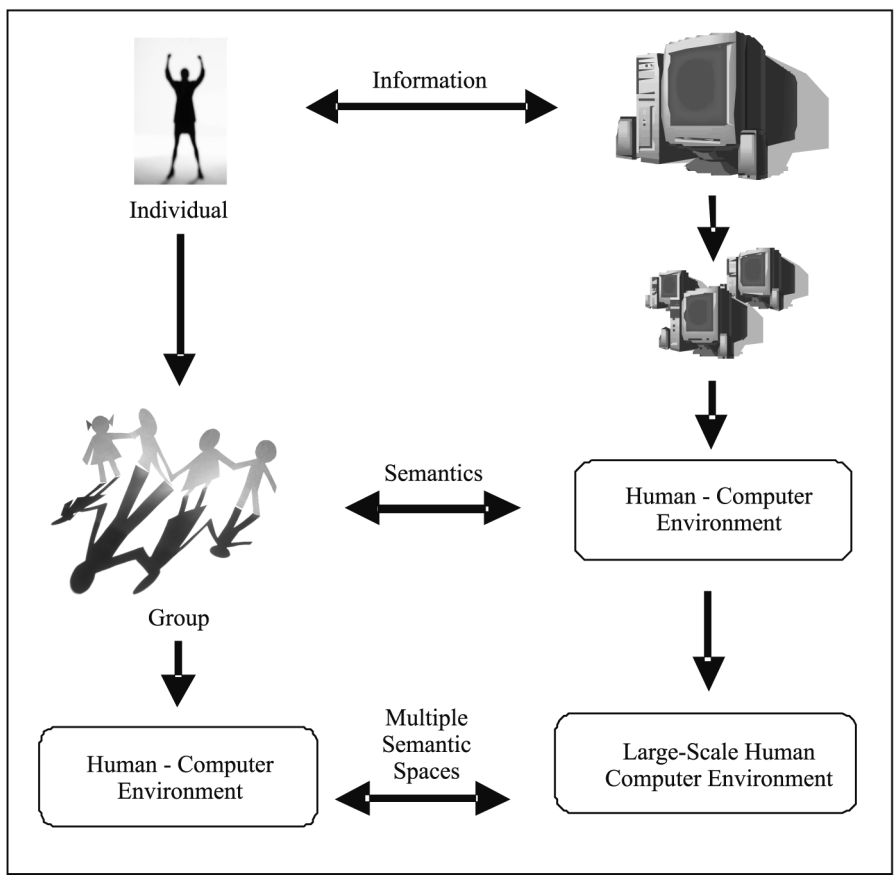

Fig. 1. The evolution of the computing environment

Source: [Zhuge 2004].

According to Fran Berman, Knowledge Grid will be a mechanism that can synthesize knowledge from data through mining and reference methods and enable search engines to make references, answer questions, and draw conclusions from masses of data [Berman 2001].

The Knowledge Grid, in accordance with Zhuge, is an intelligent and sustainable Internet application environment that enables people or virtual roles to effectively capture, coordinate, publish, understand, share and manage knowledge resources. Grid should provide on-demand and robust services to support innovation, cooperative teamwork, problem solving and decision making in a distributed environment, which varies in scale and stability [Zhuge 2004].

Knowledge Grid is planned to be over traditional and improved information procurement, filtering, and mining and responding to question techniques. It will also utilize the new Web environment, using it to build a more efficient and effective intelligent application platform. The computing environment evolves very fast, to meet the needs the Knowledge Grid will be a platform constructed to support the large scale human-computer environment.

4.2. Extraordinary characteristics of the Knowledge Grid

According to Zhuge, Knowledge Grid as a knowledge platform has its own features [Zhuge 2004]. They are admittedly discussed by other scholars, but they give a perspective to look in the future with optimism.

Single semantic entry point access to worldwide knowledge. People from all over the world could access the Knowledge Grid and it is not necessary to know where exactly the required knowledge is. The connection with the Grid environment is possible from a single semantic access.

Intelligently clustered, fused and distributed knowledge. Related knowledge, which is distributed around the world, could intelligently cluster together and integrate to supply suitable on-demand knowledge services. Knowledge providers should include knowledge, how to use knowledge, and could use a kind of uniform resource model to encase the supplied knowledge and meta-knowledge to realize active and clustered knowledge services.

Single semantic image. Within the Knowledge Grid environment people could share knowledge and enjoy deduction and rationalization services in a single semantic space. In this kind of space, there would be no barriers to mutual understanding and widespread knowledge sharing.

Worldwide complete knowledge service. The knowledge from all regions of the world could be gathered in the Knowledge Grid and provide compact and complete data, suitable to the solution of particular problems.

Dynamic evolution of knowledge. In the Knowledge Grid environment, knowledge would not be just statically but also dynamically stored. The knowledge in such a system could evolve and be created.

By the time, there is no other architecture which has exactly these advantages. Based on these features, it is possible to build a theoretical model how the knowledge in such a model is distributed and created.

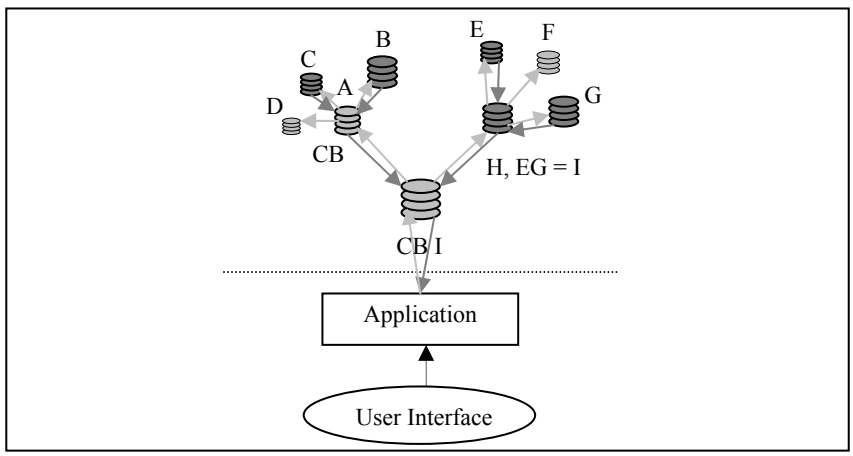

Fig. 2. Theoretical model of distributing and creating knowledge in Knowledge Grid

Source: own elaboration.

In the interface layer of this model user can ask about information. After that his question is going to application, where is transformed to the Knowledge Grid application language. Transformation proceeds in application layer.

Next two layers (function and storage) are connected. In these layers the knowledge is gathered and distributed. This exemplary system is segmented in two micro Knowledge Grids with main nodes A and H.

The required knowledge is recognized in storages as following pieces of information: C, B, H, E, G. Information C and B are transported to the storage A. There proceeds the control, if recognized information not disqualifies each other and if they are non-redundant. In this case all the transformed knowledge is accepted.

The same process proceeds in the storage H (verification and comparing of information E, G, H). As a result of this process, based on deduction, proceeds new information I (from E and G) and information H becomes accepted.

After that pieces of information: CB, I and H, are transported to the next node. They are controlled again and it turns out that information CB includes information H. Information H as redundant must be rejected. Finally, only pieces of information CB and I are transformed through application to the user-interface as required knowledge.

This model allows system to return only required non-redundant knowledge, as well as to create new knowledge during the process of distributing and sharing. System can be freely developed and expanded.

4.3. Knowledge Management system based on Knowledge Grid architecture

There are partly successful attempts to develop a new knowledge management system based on Knowledge Grid architecture. The system should have the same characteristic like the Knowledge Grid and should be designed especially for pervasive gathering, sharing, managing and coordinated utilization of knowledge resources. Such a system should provide more intelligent Web services, which will build up solid theoretical and technological fundaments to realize the next step in Knowledge Management in business organization [Hengshan, Liqun 2005].

The architecture of the new Knowledge Management system based on Knowledge Grid is sketched out in Fig. 3.

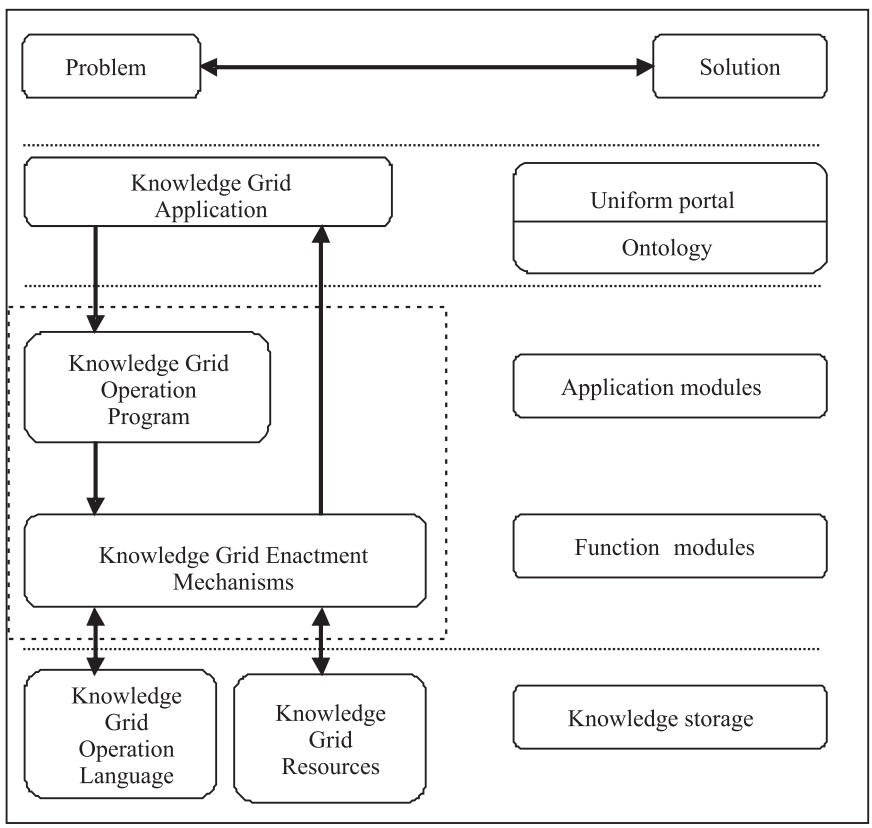

Fig. 3. Knowledge Grid architecture

Source: [Hengshan, Liqun, 2005].

Knowledge Management System based on the Knowledge Grid architecture consists of 3-layer model [Hengshan, Liqun 2005]:

– knowledge storage layer at the bottom,
– knowledge services layer in the middle,
– Knowledge Grid application with interface for the end-user on the top.

The knowledge storage layer corresponds almost exactly to the knowledge bases. The knowledge is stored there and can be recovered from the base, when necessary. This layer has function to provide secure access to expanded data and knowledge resources for knowledge workers. Its function involves syntactic analysis, searching, inquiring and extending of knowledge bases. It supports the Knowledge Discovery service with distributed resources. The most important tasks for the Knowledge Grid support of knowledge management would be purchasing of knowledge units and optimization of the storage, navigation and distribution of entities of knowledge in databases.

The knowledge services layer consists of two components [Hengshan, Liqun 2005]:

– Knowledge Grid operation program, which contains application modules, such as knowledge indexing;
– Knowledge Grid enactment mechanisms, which realize function modules, and the controlling mechanisms.

This layer supplies homogeneous view over heterogeneous knowledge sources and software systems, together with suitable software for knowledge discovery and reduction-statistics.

The hypotheses or theories held in this layer should calibrate and control the instrumentation from the bottom layer, in this way, they allow smarter knowledge gathering. What is more, knowledge is used in this layer to improve query precision and to explain results to the end-user [Hengshan, Liqun 2005].

4.4. The future

A worldwide Knowledge Grid is a long-term aim. A trial of developing of a medium-sized Knowledge Grid based on an Intranet (in any institution) would be a huge step towards the target. Knowledge Grid could support effectively knowledge management within institutions, also in business organization. Medium-sized Knowledge Grids could become components of the worldwide Knowledge Grid.

A Micro Knowledge Grid could be the basic component of a medium-sized Knowledge Grid and in that way the basic component of the worldwide Knowledge Grid.

It would be useful in helping individual knowledge management. However, according to synergy principle, a worldwide Knowledge Grid should be more powerful than the sum of its components.

According to Zhuge, Knowledge Grid should support more semantic spaces than just one text space. Knowledge sharing in a Knowledge Grid should depend on a correct understanding of the semantics of its resources. Semantics should be diffe-

rent from traditional formal semantic. They should be more like informal computable semantics, which supports computing, reasoning, abstraction, integration and transformation between semantic spaces. Postulate is that the semantics of the Knowledge Grid should be easily understood by humans and readily processed by machines.

Moreover, the Knowledge Grid should combine the approach of symbolic systems with the approach of non-symbolic systems.

5. Conclusion

This paper analyzes the situation of knowledge and knowledge management systems in business organizations. There are a lot of problems to solve and a lot of questions to answer. Generally individuals as well as institutions, in face of information overload and other limitations, need a new system architecture which would allow them to capture, store, distribute and create knowledge in more efficient and effective way. Then this paper proposes a solution, namely, architecture of Knowledge Management System based on Knowledge Grid. Extraordinary features of this system serve knowledge management's needs. The model proposed in this paper seems not to have limitations as far as the necessity of further improvement is concerned. This model allows to look forward with optimism.

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