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K-SERVICES: From State-of-the-Art Components to Next Generation Distributed KM Systems

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K_SERVICES:
From State-of-the-Art Components to Next Generation Distributed KM Systems

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Abstract: *The information architecture of an organization is the way individuals, groups and the organization itself handle information and hence is a central issue in knowledge management. Knowledge management software assembled in knowledge management systems reflects and influences information architecture in parts or as a whole. Yet insufficient flexibility prevents knowledge management systems to be used effectively as a tool to conduct the ongoing evolution of an organizations information architecture. In this paper we first describe results from the TO_KNOW project regarding the integration of components in current knowledge management systems. These experiences we base on the K_SERVICES project proposing a consequent component-oriented approach to build knowledge management software to enable the support of dynamic strategies in knowledge management.*

Keywords: *knowledge management, knowledge management systems, component-oriented software, sustainable information systems*

1. INTRODUCTION

The term "knowledge management" comprises methods to improve organizational capabilities and rise the efficiency of the implementation of the organizational strategy by the consequent use of knowledge as a resource. Knowledge can be defined in this context as the totality of experience and capabilities which people use for solving a problem ([1], [2] etc.). An important task in this context is to analyze the use and demand of knowledge of the individual members of the organization as well as of the organizational units of different size up to the complete organization by itself - i.e. to grasp the "information architecture" of an organization. ([3])

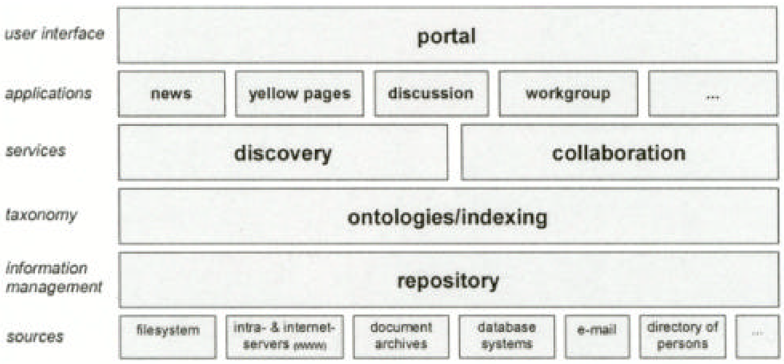

Fig. 1: Architecture of a KM system

Knowledge management systems (KM systems) implement an information architecture hereby delivering direct support to users who have "knowledge-related" problems. For this purpose a wide variety of methods and technologies is integrated into a fully fledged KM system - from database

systems over CSCW tools up to WWW portals with the intention to support „knowledge-intensive“ processes. (e.g. [4], [5], [6]) Figure 1 shows a typical KM system and subdivides the KM specific functional sections and components embedded in a layered architecture.
In the following sections we give an overview about our research in progress regarding component-based KM systems: In the project TO_KNOW ([7]) we study the possibilities to extend typical KM systems using state-of-the-art concepts and technologies. As part of the project a case-based reasoning component is being developed and integrated into an existing KM system. The comprehensive experiences on conceptual and technical aspects lead us to start the project K_SERVICES. Here we investigate into a consequently component-oriented architecture for KM systems: A proper component-oriented design in terms of software-engineering standards is a technical necessity. But far more is needed to make the vision of a KM system combined of knowledge-oriented building blocks become a reality.

2. TO_KNOW: A COMPONENT INTEGRATING CBR TECHNOLOGY INTO A KM system

Knowledge oriented methods and technology are well-known from the field of artificial intelligence (AI). Hence various AI methods and technology are part of KM systems, among those case-based reasoning ([8]). Basically cased-based reasoning (CBR) means to solve new problems based on available experiences. These experiences are expressed as “cases” that include a description of a problem and an appropriate solution. If a new problem can be solved by applying and modifying the experiences from the “case base”, the problem and the new solution make up a new case, a new experience. (See [9] for an introduction to CBR.)
Looking at a KM system from a birds eye view there are obvious parallels: The users might not expect the system to solve their problems but they use it as a case-base, learn from the experiences with similar problems they retrieved from it and they add new experiences. Typically a main part of the information involved has the form of documents. These can be looked at as experiences and with his or her initial search query a user just tries to describe his or her current problem. This extends the parallels to information retrieval (IR) (see [10], [11]) that is part (sometimes core) of typical KM systems. (For the combination of CBR and IR see [12], [13].)
As part of the project TO_KNOW a CBR component is designed (and implemented) to fit into a typical KM system (referring to the illustration in fig. 1). This task served as example to develop an architecture-based approach to figure out appropriate interfaces between the KM system and a component to be integrated. As result we found five types of correspondences between the component’s special functionality and the KM system’s general realm, as listed below and illustrated in figure 2.

- *replace:* Do data or tasks play a similar role as well in the component as in the KM system?
- *use:* Can any technical aspect of the KM system be used to implement the component’s functionality?
- *mapping:* Real KM systems can not be expected to be sufficiently open to support every eligible replacement or usage seamlessly or completely. In these cases a loose coupling should be possible, rather than ignoring a possible synergy.
- *add:* How is the exclusive, core part of the component to be integrated into the KM system? (This is the most basic type of correspondence. The concepts of replacement, usage or mapping do not apply here.)
- *feedback:* The component might produce results that are of general interest (in the KM system) even where the special functionality of the component is not needed.

While correspondences of the first three types listed (“replace”, “use”, “mapping”) enable efficient implementation and execution, relationships of the other types (“add”, “feedback”) improve effectiveness (i.e. quality of the provided support for knowledge-oriented tasks).

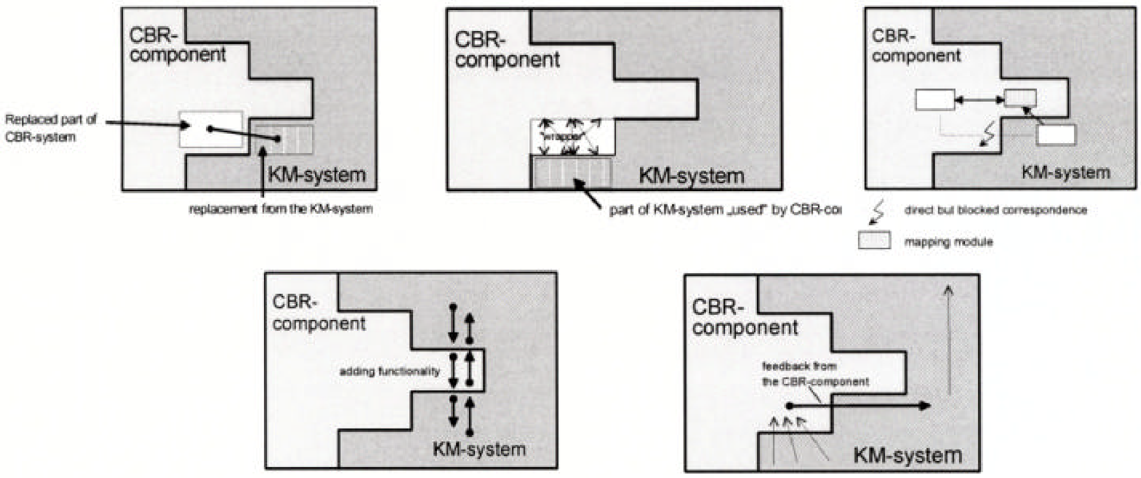

Fig. 2: Five types of correspondences between a KM system and an component

3. K_SERVICES: A COMPONENT-ORIENTED FRAMEWORK FOR KM-SYSTEMS

KM systems have no special qualities that would justify to exclude them from the major trend of building information systems using a component-oriented approach (see [14]) to reduce the cost of development as well as enhance flexibility and hence achieve sustainable architectures resp. long running systems. In fact these issues affect especially KM systems for they are not "primary" systems in two ways: a) KM systems have to integrate, mediate and enrich "basic" information that comes from technically different components, namely from the "standard" information systems of an organization. b) The later include the "first priorty" systems of a company, while KM systems are usually rated rather as "useful" but "necessary" – therefore a KM system's financial requirements should be "moderate" at the latest after deployment.

The TO_KNOW approach discussed in the last section provides a roadmap to design efficient and effective components for integration into typical KM systems. But the results also show that there is need for a more detailed "domain specification" for knowledge management software support: Developing a component for a KM system still rises too many questions regarding entities that should be easily recognized as common business objects or vertical facilities with clearly understood positions in a typical components framework for knowledge management systems.

As part of the project K-SERVICES such a framework is developed by abstracting from correspondences found by applying the TO_KNOW approach to different component candidates. Elaboration of the framework covers two main aspects:

- Interfaces for a KM systems information sources, services and applications: What are the basic and extended mechanisms that these types of components offer or need and that should and can reasonably be unified?
- Core components of a KM system: Some features are necessary to run a KM system that integrates a variety of components and changes over time (e.g. user profiles). Others are candidates for "common knowledge facilities" because of their high potential to increase the overall quality delivered by many components (e.g. metadata and internal association services). Of course a complete KM framework includes such functionalities. But it is conceptually crucial that the core system provides unified and logically centralized access points to these facilities, while the implementation might reside in external components as well.

To fully exploit the advantages of the component-oriented approach KM systems have to operate distributedly. A KM system should be able to integrate components externally provided by using the emerging web-services technology ([15]) and it should be able to cooperate with other KM systems. The option to integrate a variety of external knowledge-oriented services like ontologies, analysis-tools or community support with reasonable effort facilitates the vision of an evolving KM system:

Not only the accessible information sources but the complete functionality of the KM system can adopt to changes in the information architecture of an organization. This is of specific interest in knowledge management, because KM systems implement knowledge management strategies and thus are expected to influence the way individuals, organizational units and an organization as a whole handle information. (In most standard information systems flexibility is mainly needed to adopt to externally caused "drift effects" in user or technical requirements but change is not inherent to their purpose.)

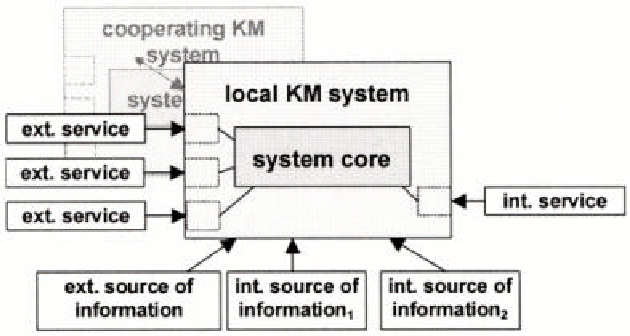

Fig. 3: Outline of the K_SERVICES architecture for KM systems

This vision imposes a bunch of problems to be coped with from different fields, e.g.:

- Technical problems: Which additional web-services standards (like [16], [17]) are useful and which are still inadequate or missing?
- Application barriers: Some external components of a KM system might need extensive access to sensitive data. Both appropriate business models and feasible tools to grant just the access needed are required.
- KM specific aspects of distribution: In case of an external component dropping out a KM specific rules can enable more tolerant reactions compared to standard information systems.

With extended (and affordably priced) flexibility a local setup and maintenance of KM systems becomes a more common scenario, e.g. local KM systems in departments that have very special and important knowledge intensive tasks in a company. To prevent counterproductive "knowledge islands" to emerge, in the design of the core KM system resp. the "common knowledge facilities" there has to be a major focus not only on integration but on cooperation as well.

4. CONCLUSIONS & FUTURE WORK

Developing a state-of-the-art component and integrating it into an existing KM system lead us to the vision of a consequently component-oriented approach addressing the shortcomings we experienced working with current knowledge management software. Starting to design a suitable framework in the K-SERVICES project we came to a first intermediary result: It is not sufficient just to define appropriate business objects and implement these using a current component software standard. The design of the K_SERVICES framework will additionally include knowledge management specific issues regarding integration and cooperation into the design of a framework for KM systems. As we outlined above this can significantly improve a KM systems suitability to evolve interactively and dynamically with an organizations information architecture.

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