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Knowledge Management Systems: An Architecture for Active and Passive Knowledge

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Knowledge Management Systems (KMS) offer an environment for organizations to manage their information assets (e.g., documents, databases, etc.). Existing KMS passively employ knowledge by querying a database, showing a document, displaying a Web page, etc. KMS can be extended to incorporate active components, such as expert systems and business rule systems. Currently, business rules reside in application code and database triggers. A KMS with an embedded expert system using business rules from the organization, combined with the connectivity of a server in a client/server architecture, provides an excellent environment for automating business activities at both local and enterprise levels. The segregation of business rules into the Knowledge Tier (KT) should lower the cost of development and maintenance, increase accuracy, and ensure corporation-wide consistency. In addition, knowledge verification tools are now being developed that will allow the computerization of less structured tasks, enabling another round of increased efficiency through computerization.

INTRODUCTION

Corporate rightsizings of the 1980s, combined with the information technology driven productivity gains of the 1990s and the pending retirement of baby boomers has and will result in the continued loss of enterprise and job specific knowledge. The massive loss of intellectual capital resulting from these three events is an unacceptable consequence for most government and private organizations. Consequently, those organizations that can retain knowledge and use it to act upon business situations will have a significant competitive advantage.

Knowledge about an organization or industry is an intellectual asset that, although paid for in part by the employer, is difficult to control and manage. This is because knowledge is fragmented in documents, policies, procedures, and other storage mediums. Managing knowledge also presents a challenge for management to retain the knowledge in a form that is easily retrievable. This is not an easy task, since the enterprise must first identify the location of all needed knowledge, and second, determine the easiest way to retrieve it.

Before proceeding, three related but not interchangeable concepts need to be defined. Data is a set of discrete, objective facts about events. Information is organized data presented in context. Data becomes information when its creator adds meaning or value. Similarly, knowledge is derived from information as information is derived from data. Knowledge can be viewed as information in context, together with an understanding of how to use it. Knowledge can be either explicit (knowledge for which a person is able to make available for inspection) or tacit (knowledge for which a person is unable to make available for inspection) (Davenport and Prussak, 1998; Brooking, 1999).

There are many definitions of knowledge management,

Category	Characteristic	Example
Data	Discrete	Today' s temperature
Information	Organized data	The temperature is 50 degrees
Knowledge	Information in context	If the temperature is below 50, a sweater may be needed to stay warm.

but the Gartner Group's (1999) description seems most appropriate for the perspective expressed in this paper:

"Knowledge management promotes an integrated approach to identifying, capturing, retrieving, sharing, and evaluating an enterprise's information assets. These information assets may include databases, documents, policies and procedures, as well as the uncaptured tacit expertise and experience stored in individual workers' heads."

As the definition implies, information assets are plentiful and are stored in numerous locations throughout an organization. Storage options include books, manuals, documents found in document management systems, groupware processes found in Lotus Notes, and expert or knowledge based systems (Brooking, 1999). Physically, these information assets can be electronically stored on compact disk, laser disk, mechanical hard drives, microfilm, microfiche, and embedded in computer programs.

The management of knowledge in this way is a positive approach to solving the knowledge drain problem. Yet the knowledge stored in this type of KMS is passive. Active knowledge components will increase efficiency, lower costs, automate less-structured domains, and yield a competitive advantage. They can be used as the foundation for the highest level of automation, "lights out" technologies.

The active KMS architecture discussed in this paper provides an integrated approach to creating, verifying, delivering, sharing, and evaluating an enterprise's knowledge assets. This is achieved by using active knowledge components, such as, expert systems and business rules, to support the organizations goals and objectives.

The remainder of this paper develops and justifies a proposed client/server architecture to build a manageable active KMS that uses digital forms of both active and passive knowledge.

THE ARGUMENT FOR A CLIENT/SERVER ARCHITECTURE

In a world of multiple computer languages, database management systems, assorted collaborative and group support software, network technologies, and data storage methods, it can be a difficult and complex problem to locate and retrieve enterprise knowledge. If KMS promotes an integrated approach to identifying, capturing, retrieving, sharing, and evaluating an enterprise's information assets, then the challenge is to get the right information to the right person at the right time.

"An integrated and integrative technology architecture is a key driver for Knowledge Management Systems (KMS) ….knowledge management systems seem to require a variety of technologies: database and database management, communication and messaging, and browsing and retrieval. The need for seamless integration of the various technologies may lead to the dominance of the Internet and Internet-based knowledge management system architectures" (Alavi and Leidner, 1999). Organizational intranets will play a dominant role in the support of internal knowledge management activities due to cost-effective technical capabilities including: access to the legacy systems, platform independence, access to multimedia data formats, a uniform and easy-to-use point-and-click interface, and capability for easy multimedia publication for knowledge sharing (Alavi & Leidner., 1999).

The benefits of these "knowledge enabled intranets" include:

1. Lower communication costs, driven by reducing expenses related to printing, mailing, and processing of documents
2. Improved productivity by making information more widely and quickly accessible
3. Higher team productivity, created through collaborative work environments
4. Rapid implementation as a result of open protocol standards
5. Relatively low costs for hardware and software (O'Dell, Grayson & Essaides, 1998).

We agree in general with the above conclusions and benefits, but believe that focusing only an Internet/intranet architecture greatly limits the capabilities of the KMS. The Internet/Intranet is an excellent delivery vehicle, but imposes many restrictions when considered as the physical repository of knowledge.

We must also express some other cautions. While the common availability of knowledge may enable some tasks (Scholten, 1998), the knowledge must also be maintained. Knowledge evolves (Bartheleme, 1998) and so must be continuously updated. Updates to any source must ripple upward to the KMS. Maintenance is often performed by users, as in the Eureka system developed at Xerox (Wah, 1999). Maintenance may be compromised by new maintenance personnel (Zmud, 1999).

We believe that, except for lower communications costs, the benefits of knowledge management of passive knowledge should also be applicable to active KMS, such as business rules, and that other benefits, such as improved verification, will result in improved business rule performance.

A CLIENT/SERVER ARCHITECTURE FOR ACTIVE KNOWLEDGE MANAGEMENT SYSTEMS

Client/server and specifically n-tier client/server permits the process layer software (written in C, Java, Visual Basic, COBOL, etc.) to interact with multiple data sources simultaneously. Since knowledge is located in so many data sources and housed in many data storage mediums, integrated source data presentation is extremely complex. If the knowledge is located in a departmental procedure, geographic information system, video, and e-mail, the process layer must support the APIs (application program interface) to retrieve these four data sources and present them on a single

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