MAKING KNOWLEDGE WORK

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INFORMATION TECHNOLOGY MAKES KM POSSIBLE

Much of the literature and discussion of KM has focused on the "human issues", often to the exclusion of technology issues. We acknowledge such popular issues as "knowledge is power and therefore will not be shared" but do not dwell on them. Rather, we believe well-designed KM systems will sufficiently overcome social barriers to achieve great value. It may take some time for KM to be as widely adopted as email, for example. Consider that the Internet was fully operational for 25 years before an easy to understand user interface, the Web browser, and rich multi-media portrayal made the Web a world-wide phenomenon, straightforward to all computer users. Knowledge management, more than the Web or traditional IT, depends upon the inextricable intertwining of human and technical systems. It is the value of this *human-computer symbiosis* that the KM founders really understood.

We assert that good technological tools enable the improvement of human systems in more permanent ways than behavioural intervention alone. There is overwhelming evidence throughout the course of civilization that humans adopt technology if it meets their needs, and then adopt new behaviours to exploit that technology in an ever-continuing cycle. The increased extent to which knowledge workers can more efficiently share knowledge is the practical value of KM. Workers do share now.

A major contribution of KM is to integrate technology into the minute-by-minute, daily knowledge work of people in enterprises, thereby going far beyond current IT in making knowledge work. Certainly this depends on individual and organizational behaviour addressed by the innumerable "methodologies" proffered by consultants. However, if the "water is good, and the horse is thirsty, he will drink".

WHAT TECHNOLOGIES ARE NEEDED?

"Knowledge flows along existing pathways in organisations. If we want to understand how to improve the flow of knowledge, we need to understand those pathways." Larry Prusak.

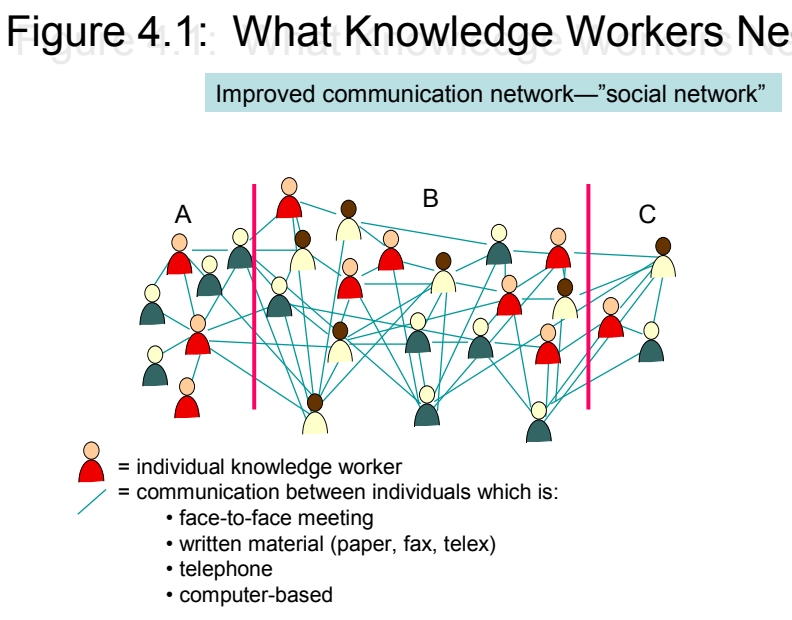
Meeting knowledge worker needs is the best way to make KM successful, but little of the vast amount of knowledge about needs has been applied outside the research setting. Simply put, knowledge workers need technology that improves *human communication*, illustrated in Figure 4.1. It is only through communication that knowledge is shared, whether in instantaneous time or over long periods of time as made possible by written material. There are two major barriers to communication, *time* and *semantics* (referring to the meaning of language). Time, of course, is a barrier in the sense of timeliness – getting the communication to happen in the time frame needed (usually immediately…), and because things change making certain kinds of knowledge and information increasingly irrelevant.
Time is a barrier in several ways including:

- Having knowledge when it is needed
- Having current knowledge
- Not being able to interact with knowledge sources in real time
- The excessive time it takes to find information or knowledgeable people
- Time lost to interruptions

The semantic barrier is basically that the same words mean different things to different people, and different things to the same people in different contexts. Our favourite examples are:

- The word "bond" – is it chemical, a movie star, a connection, an investment instrument, glue, or?
- Understanding Valentine's Day which is not known in most countries of the world, but is supposed to generate romantic behaviour in the US
- Analysing what a person means when they say "I am sick…"
- Understanding the difference between these two sentences:
    - Who has set the table?
    - Who has the set of tables?
    -

Figure 4.1: What Knowledge Workers Need



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Semantics is the most significant hurdle to KM today. KM technology progress focuses on technologies that will enable the increased understanding. This is what overcoming semantic barriers implies. We acknowledge that education, training, organizational development, and so on, can reduce semantic issues without technology. But these have not and will not be sufficient to meet knowledge worker needs in the twenty-first century enterprise. KM builds on the computer-based tools that have been incorporated into enterprise IT over the past 35 years.

The following is an everyday example of the semantic challenges in all languages not just English.

Figure 4.1A –Illustration of the Semantic Barrier

Figure 4.1 A [illustration of semantic barrier]

The UP Side of Semantics

There is a two-letter word that perhaps has more meaning than any other two-letter word, and that is "UP." It's easy to understand UP, meaning toward the sky or at the top of the list, but when we waken in the morning, why do we wake UP?

At a meeting, why does a topic come UP? Why do we speak UP and why are the officers UP for election and why is it UP to the secretary to write UP a report?

We read UP on a story in the paper that we pick UP to find out what is UP in the world & make UP our minds to not give UP hope that something good will turn UP.

We call UP our friends, we use it to brighten UP a room, polish UP the silver, and we warm UP the leftovers and clean UP the kitchen. We lock UP the house and some guys fix UP the old car.

At other times the little word has real special meaning. People stir UP trouble, line UP for tickets, work UP an appetite, and think UP excuses.

To be dressed is one thing but to be dressed UP is special, and this is confusing.

A drain must be opened UP, because it is stopped UP. We open UP a store in the morning but we close it UP at night. We seem to be pretty mixed UP about UP.

To be knowledgeable of the proper uses of UP, look UP the word in the dictionary. In a desk size dictionary, UP takes UP almost 1/4th the page and definitions add UP to about thirty.

If you are UP to it, you might try building UP a list of the many ways UP is used. It will take UP a lot of your time, but if you don't give UP, you may wind UP with UP to a hundred or more.

When it threatens to rain, we say it is clouding UP. When the sun comes out we say it is clearing UP. When it rains, it wets UP the earth. When it doesn't rain for awhile, things dry UP.

One could go on and on, but I'll wrap it UP, for my time is UP & I leave it UP to you to step UP & keep UP the sharing of this list that has been made UP to lift UP your spirit, so put UP or shut UP....I give UP!

By the way--WHAT'S UP??

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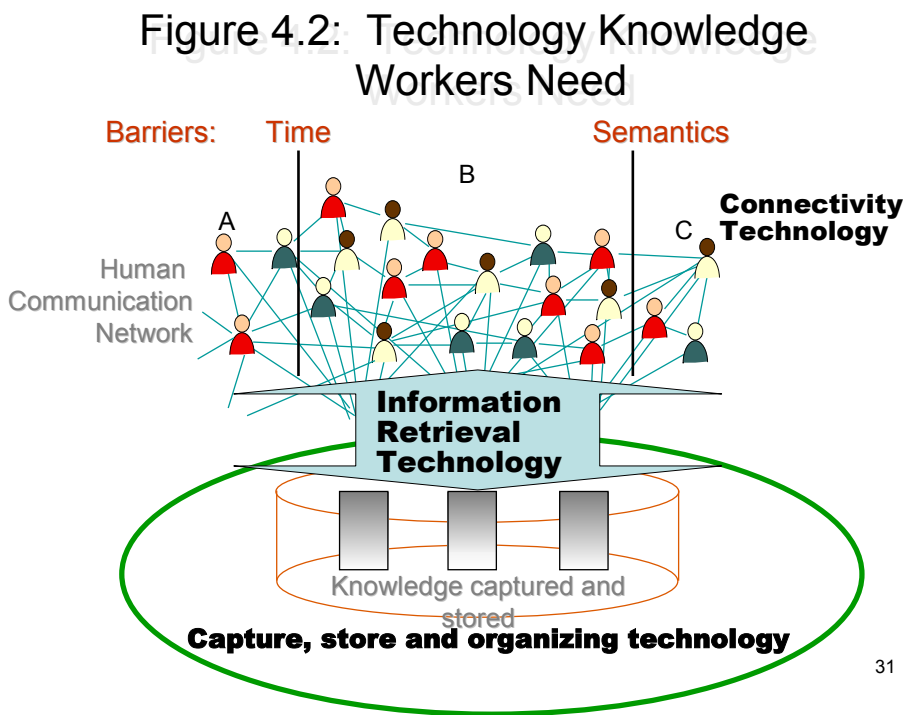
Figure 4.2 illustrates how technology supports the human communication network, by providing new connectivity options that are able to exploit stored “knowledge”, which can be retrieved or interjected into the connectivity media. Technologies to meet these needs fall into three families:

1. *Connectivity* technology enabling communication and collaboration across time and space
2. *Capture, store and organizing technology* to represent knowledge so that it can be reused at different times and different situations
3. *Information Retrieval Technology (IR)* that overcome semantics matching the expressed knowledge needs of the user to the available knowledge stored in “knowledge bases” or resident in other experts

Figure 4.2: Technology Knowledge Workers Need



In the future, needs to manage processes and work flows will be addressed through process control technology or "coordination technology". This integration of dynamic models of how things work is beyond the scope of this report. Exciting research is being done by scientists such as Tom Malone who heads the Center for Coordination Science and technology at MIT. Practically, it is important to review basics such as user needs to provide context and rationale for current KM systems. We have done dozens of in-depth investigations of user needs that have been published but suffer from time and semantic barriers (c.f. Bair, 1983).

TECHNOLOGIES IN THE MARKET

"Make the world as simple as possible but not simpler". Albert Einstein

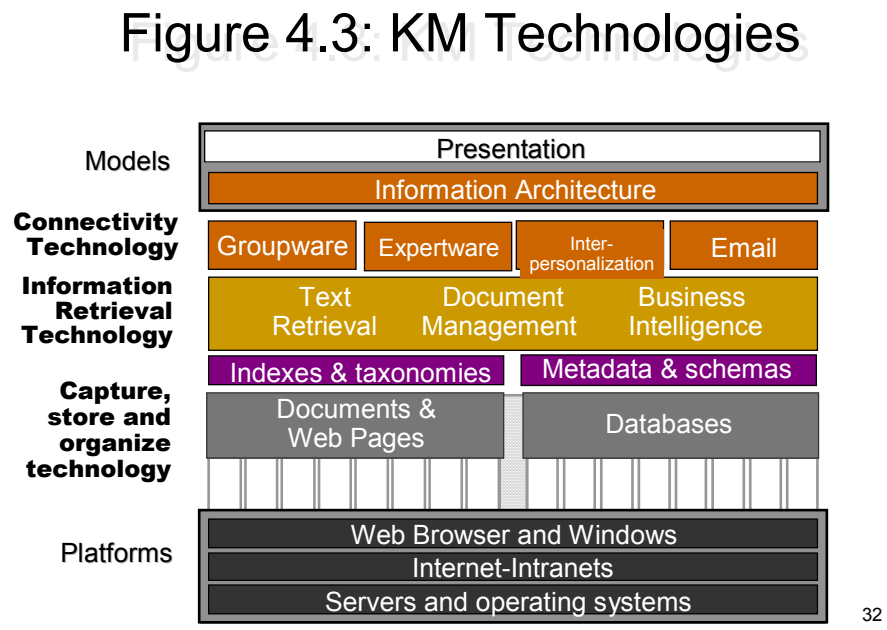
What KM Technology Has Become

Today KM technology (KMT) today is comprised of products and components that exploit readily available platforms and standards. These technologies are designed to overcome the time and semantic barriers, but have a long tradition in much narrower, vertical applications and markets. For example, IR technology comes from a library tradition and is still an independent discipline at major universities such as Syracuse University School of Information Studies. We will allude to the historical imperative in order to explain idiosyncrasies in today's products, but not dwell on the legacy. Note that substantial industries center on applications of products in these families, for example, document management is over a 2 Billion EURO market today that serves needs ranging from regulatory compliance to large manufacturing projects, such as the documentation for the Airbus development and operation.
Figure 4.3 illustrates the technologies in a conceptual architecture, with software types positioned to indicate interdependency. For example, text retrieval depends upon indexes and document entities that can be retrieved as units. Document management adds database functionality to efficiently retrieve documents by fixed attributes such as author, date, type, and so on.

Platforms are common to almost all products in today's market. Although roughly 5% of the desktop is populated by Apple Computer machines, and a few by Linux, the computational environment in today's enterprise is Microsoft at the desktop. Most desktop operating systems are Microsoft as well, but competitors, mostly Unix-based, are also present.
Models are a special layer in KM architecture because of the increased importance of knowing where information and people are in a way that is readily presented to the user. The information architecture at the top level describes what, who, where and relationships that exist between them. It drives the organization of lower levels in the architecture both in document organization and database schemas (schemes define what is in the database). Presentation to the user has become standardized on mass adopted models such as Yahoo Yellow Pages, despite the availability of visualization interfaces such as from Inxight Corp. or The Brain.

Here, we will focus more on what is in general use today rather than the more advanced products.

Figure 4.3: KM Technologies



KM Technology Families

KM technology is the convergence of three families of technologies including information retrieval, connectivity technology, and capture, store and organize technology. In this section, we identify and describe the families which are needed for KM solutions as illustrated in Figure 4.3.

Information Retrieval Technology

The IR business has long focused on retrieving the unstructured, mostly textual content contained in documents, such as email messages and publications. The traditional user for these products has been the individual worker searching through a large data base to retrieve a necessary piece of information. As a result, while the strength of the products has been the ability to accommodate large volumes of text from multiple sources, the weakness as been the re-use of the information thus obtained. Although the individual worker is better off, neither the group nor the organization is able to benefit later on, in another time or place, from this worker's search results.
The leading IR vendors include Oracle, IBM, Microsoft, OpenText, Hummingbird, FAST and Verity. These companies have taken the "low road" and positioned themselves as having KM

products but have avoided calling themselves KM vendors. To that end, they have added functionality that supports KM such as clustering/categorization, taxonomies, thesauri, semantic tools, and content source integration. They also offer enterprise-wide access to all types of digital information, including Web pages, server file systems, and databases. Moving towards a convergence with groupware, the products are also incorporating "people" as a database element with attributes such as expertise.
They are also incorporating *inter-personalization* or "collaborative filtering", which is basically the capability of profiling the interests of others and adding relevance rankings of users with similar profiles to content-based searches. With these additions, the IR family is moving toward a larger, more technologically converged solution to the challenge of knowledge re-use throughout the enterprise.
Newer IR products process documents using more intelligent techniques to "understand" document content. These include natural language understanding, which overcomes ambiguity in language, as per our example above; it could differentiate between uses of the word "bond" as in "chemical bond" or James Bond, as do products from Verity or Convera. Another technique, pattern analysis, uses probability mathematics that can help a system "learn" what a user means by monitoring user feedback, as do products from Autonomy.

Connectivity Technology

Email has become the leading connectivity tool. However, groupware, usually in the form of IBM's Lotus Notes, is used more for KM than other kinds of software. Groupware solutions focus explicitly on the re-use of knowledge that has already been shared at the community level. These solutions go further than IR in terms of enterprise-wide re-use of information, but they have yet to achieve true "corporate memory" functionality. Lotus Notes integrates an IR engine for retrieving entries in the collaboration data base, exemplifying technology family convergence. Other groupware vendors include Microsoft and OpenText.
Groupware has been well known since the advent of Lotus Notes in the late 1980s, and has been thoroughly documented by authors such as Bob Johansen, President of the Institute for the Future. Notes has evolved beyond the basic threaded conversations to embrace everything from document management to instant messaging. The new breed of software adds people searching to content searching. Users can be represented by profiles that match people of common interests or enable users to find experts on particular topics. Intraspect Inc. has pioneered this area.
Connectivity technology includes four functional components:

1. *Groupware* which includes two modalities, synchronous and asynchronous. Asynchronous includes threaded conversations (user's entries into a "conversation" are strung together as an ongoing record of the written discussion), bulletin boards and shared information repositories. Synchronous includes instant messaging, teleconferencing, shared screens, and other real-time means to interact.
2. *Expertware* maintains profiles of individuals describing their expertise, what they have written, projects they have worked on, on so on; it also is called an expert locator.
3. *Inter-personalization* or "collaborative filtering", one of the most advanced tools for collaboration which automatically matches people to like-people and recommends content based on an analysis of similar interests and behaviors (e.g. searches) of users with similar profiles.
4. *Email* has long been a store and forward, written medium that is beginning to be exploited for KM. For example, distribution lists can define communities and through reuse be an efficient means for community management; email analysis can define user's interests and expertise when managed securely, and so on. Voice mail is difficult to exploit because converting from analogue to digital and then recognizing the digitized speech is still immature technology.

Capture, store and organize technology

Document management products capture and add structure to documents in the form of attributes or metadata. The attribute values are stored in an underlying database, for example, the date. Documents may be searched for, retrieved, and managed based on a combination of the metadata fields and full-content indexing. The products manage the "life cycle" of the document, from its creation, to modification, to approval, distribution and storage. Functions include document retrieval, document check-in and check-out, routing, and control. The leading document management vendors, such as Filenet, Documentum and Hummingbird, have integrated documents which include text files, images, embedded sound, and graphics. Consistent with the notion of technology convergence, the document management vendors are also integrating groupware and inter-personalization tools.

Database vendors, particularly IBM, are active in KM, but aside from IBM's Lotus division, they have focused on *business intelligence* including data warehousing and data mining. Although Oracle, Sybase, IBM, and Microsoft are providing store and organizing tools, they have not committed to an overarching KM strategy. IBM and Oracle have developed their own products in each family, while other vendors resell products from Autonomy, Verity and other, mostly smaller vendors. For the foreseeable future, databases will be accessed as one of the more specialized sources of information in enterprise-wide KM. Retrieval will be of records mostly from data warehouses, with increased use of free text fields, and very little data analysis as provided by data mining.

Key functional components of this family are:

1. *Indexes and taxonomies* are two different concepts with similar applications. Indexes essentially refer to a table of all the words in a document collection matched to the word occurrence in each document. This provides the familiar "hit" list of documents in response to an inquiry. Indexes also provide a rich representation of words, word relationships and usage that can contribute to the classification of documents into categories based on similar content. This is a popular means of creating *taxonomies*, especially when they are then placed in an enterprise home page on the intranet. Organization into taxonomies can take different forms such as by type of document or any other attribute ranging from author(s) to publication source. Indexes require little manual, upfront work to create; taxonomy construction can range from relatively automatic to manual assignment of each document to a category.

2. *Metadata & schemas* are the architecture of data bases, defining the fields for the records in the database and the legal values for those fields. They also reflect the larger organization of a data base controlling organization and providing a description of the contents. Although very efficient for structured information, much work has to be done upfront to define all the elements of the data base, which, if left out, can be very difficult to add. Financial data has been most appropriate for data base management because numbers are inherently unambiguous.

3. *Capture* is important to consider separately because the concept is so intrinsic to KM. The capture industry has long focused on scanning paper, images, and the like for storage as database records with manual or automatic assignment of attributes. KM is beginning to expand the notion to include capture of the contents of meetings, phone calls, teleconferences and the like, and converting it to computer usable information. Thus, KM would be supported by having the content of a majority of the human communications available for analysis and reuse. This will be an important enabler of making tacit knowledge explicit.

HYBRIDS OF THE FAMILIES

KM requires technology from all the families simply because users need to collaborate, capture what they collaborate about, store it in reusable form, and then retrieve it to knowledge-enable their work in one consistent environment. In other words, the user should be able to access all needed functionality through a user interface that has the same look and feel for everything. Having a single, overarching environment for users to stay in while performing various tasks is an important predictor of the success of KM. Figure 4.3 illustrates the complete solution containing "all" the technologies. We provide a brief overview of hybridization here starting with IR.

As KM evolves, more implementations will integrate the three IR technologies, text retrieval, document management and business intelligence (BI). Document management already includes text retrieval providing two means of finding relevant documents. Advanced text retrieval features will increase the relevance of retrieved documents by (1) recognizing different words that mean the same thing or the same word with different meanings in different contexts; and (2) enabling the user to quickly see similarity among concepts and relationships among documents. More advanced products will establish relationships between document and data records so that the richness of text can complement the exactness of data. Users should be able to retrieve any relevant information with one inquiry whether in a document or in data base records.

Documents Can Look like Data Base Records

Documents themselves are becoming more exact, like data records through the use of technology for data extraction; they are being increasingly represented in standard document structures such as XML. Data or "fact extraction" recognizes the people, places, organizations referenced in text, to determine relationships ("facts") between entities; and entity extraction automatically identifies the people, places and organizations mentioned in text, and then provides a relevance ranking for these. Visualization techniques that usually depend upon crunching numbers in data bases, involving the use of computer graphics, animation, etc., to support BI, will expand to include documents. The sophisticated algorithms that BI uses to mine data will be expanded to include textual data.

Retrieval Based on Collaboration

With greater integration, IR will depend more on the meaning and value given to information through collaborative use rather than dictionaries. Collaborative IR builds on ideas behind groupware, email and workflow but is based on a model of collective value. This functionality can represent the value of documents by tracking their popularity and evaluations by experts and communities of practice. Inter-personalization can define what is likely to interest a user based on what other similar users find significant or trustworthy. For example, collaborative filtering is used for monitoring information flows and alerting users to the addition of relevant documents or of changes to relevant documents. It also classifies information according to usage and enhances the relevance of retrieved documents.

The next stage of KM development is the merging of email with document management, and IR technologies, to leverage email distribution throughout an organization. This merging is vital to the continuing survival and success of these families of technologies. To date, groupware has not completely integrated IR. It relegates document retrieval to searching a single application at a time. The most common type of groupware, threaded conversations, provides a structure to share information by common interest and relevance. But groupware is criticized for being too labor-intensive in capturing and organization a group's ideas as we found at Hewlett-Packard. Also, there are issues of scaling from the group to the enterprise as a whole. At the present time, the merging of the two areas appears to be happening more in the text retrieval area than in groupware.

Use of Advanced Technology

Technologies that are continuing increased use include automatic clustering of concepts and documents; collecting data about collaboration to add meaning to documents—inter-personalization; technologies that can be trained to cluster concepts and documents based on similarity through neural networks (a derivative of AI developments); and semantic networks (models of the weighted relationships among concepts). Research is revealing ways to capture tacit knowledge that unfolds in meetings, phone calls and other synchronous interactions; provide better representation of the meaning of content for discovery and reuse; and processes for improving human cooperation, a fundamental behavior for sharing knowledge.
The next wave of KM products will improve user friendliness and business efficiency. Capabilities will include broader accessibility through enhanced search and query tools for less experienced users, transparent access to multiple data sources, and more efficient access, through data warehousing for example, to multiple data types (e.g., numerical data, text and images). AI tools and technologies are anticipated to be more widely integrated into IR, for example, customizing searches to individual users' cognitive styles. Case-based reasoning, which accesses data bases to find analogous situations to a given problem, supports finding answers to specific questions within predefined areas of interest.

Finally, agents are becoming increasingly important for monitoring information streams and announcing arrival of new documents that meet particular areas of interest. Verity's TopicTree, Convera's Semantic Network, and Hummingbird's agents contain a description of the information a user needs from a variety of ongoing sources. The agents can be used as a filter for incoming information, and/or an activator of delivery software such as e-mail, special file folders, or special Web pages. Products based on neural networks such as those from Autonomy are described as being "artifically intelligent" agents whereas the Verity, Convera and Hummingbird agents are not.

KM involves combining technology families formerly seen as separate; future KM products are envisioned to span not only connectivity and IR but also data processing product areas such as ERP (enterprise resource planning). We anticipate future KM technological developments will reach beyond technology to include linkages with business strategy, human resources, and other key parts of the enterprise as well.

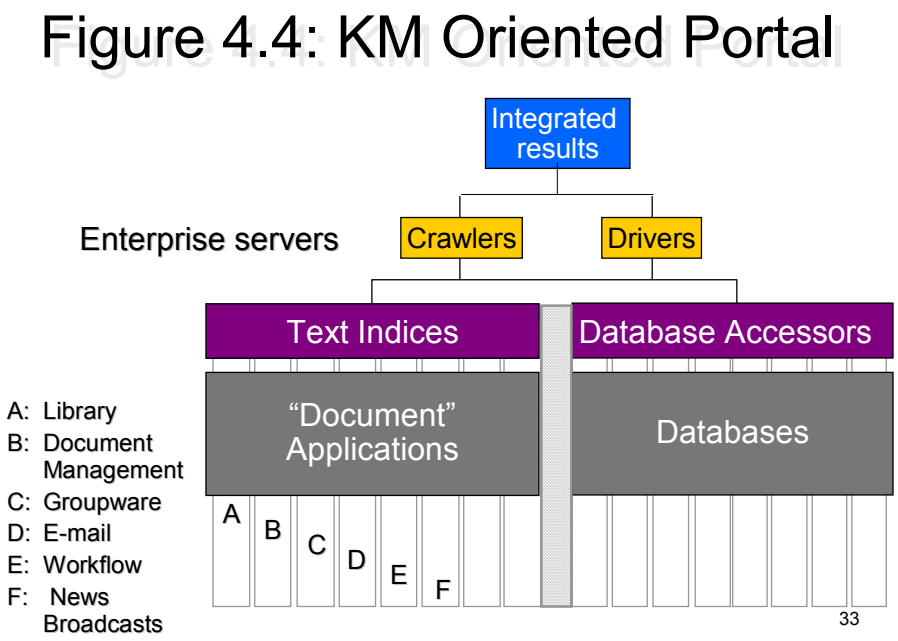
RELATED TECHNOLOGY: NOT REALLY KM

Portal software

Portals are a market focused information retrieval product that brings Internet functions such as crawlers/spiders into the enterprise intranet. It has had a very high profile over the last few years, particularly during the dot.com boom. The market has now stabilized substantially from the heady days of the late 1990s. Virtually every independent portal vendor has gone out or business of been acquired, one exception being Plumtree. The large vendors like Microsoft, Oracle and IBM, and second tier vendors such as SAP, OpenText and Hummingbird have all produced highly functional portals.

As well as this stabilization, another trend is emerging –the 'Yahoo!' Web-based portal which simply delivers a friendly user interface and relatively little functionality is disappearing. If the definition of a portal remains unchanged from that commonly used in the late 1990s then the portal as a market niche may disappear.
A KM oriented portal as illustrated in Figure 4.4 is much more valuable, providing access to text documents and databases through a single query. This requires database drivers that speak the language of data bases, i.e., SQL, to operate in parallel to the text query processor. Results from both types of information stores are merged into a single result list for the user, at least in the ideal situation. Textual content in different application types is also integrated into a single result. Hummingbird has acquired pioneering products to do this through the integration of SQL into both retrieval engines.

Figure 4.4: KM Oriented Portal



Portals are evolving into fully functional collections of software tools or suites. All the leading portal products offer a significant emphasis in either managing structured content, through BI tools, or managing unstructured content through content management tools. This change marks not so much the death of the portal as its re-incarnation. We believe the most useful portal is one that is an integral part of KM thus exploiting the human disciplines of KM as well as the broader families of technology.

E-learning

Many applications have spun off of from KM per se, retaining the technology underpinnings, but focusing on specialized uses and markets. E-learning is a spin-off with an important difference: it is the fourth part of the knowledge cycle and represents the transformation of explicit knowledge back into tacit. But since e-learning systems have not included the discipline of knowledge capture and sharing, we consider the area tangential.

A great deal of the vendor push for e-learning has come form IBM, which has announced the availability of a set of fully integrated, e-learning modules form IBM Mindspan Solutions. This program is committed to a market that IBM defines as worth over $2 Billion U.S., emphasizing enterprise training programs. Smaller vendors such as Saba have focused on the "virtual classroom" designed to enable formal and informal learning across as many as 2,500 concurrent learners worldwide. Another vendor focus has been providing the integration of e-learning services with enterprise business applications, for example, training in the manning of CRM (customer relationship management) systems. Productivity cost savings can come from the automation of administrative activities such as student management and content assignment, and provides services for remote student authentication.

The production of "courseware", as it has been called for the past thirty years, is a major opportunity in the e-learning area, leading to libraries of learning modules. At least one vendor has built a portal add-on that enables users to find tutorials on any subject in a database of over a million tutorial sites categorized by more than 2000 subjects. The network of information allows users to find tutorials by subjects and keyword searches.
Groove Networks, which pioneered peer-to-peer computing, offers the Groove U program. Peer-to-peer is an appealing platform for e-learning by avoiding the need for large, centralized server-based operations. The Groove Workspace is an example of e-learning functions with a

persistent, virtual class environment that supports secure, two-way professor-to-student and student-to-student interaction and collaboration. Features include live, instructor-led training; multi-media meetings with document sharing; prescriptive and personalized learning; configuration options to eliminate the need for customization; pre-tested content solutions; and so on.

Social Networks on the Web

Social networks are emerging as a product category on the Web, as opposed to an analytical tool for KM in the enterprise. There is a fairly obvious opportunity for these Web offerings in an enterprise KM system, but it is still nascent. They enable users to create searchable networks of friends and co-workers. Social-networking ventures that are focused on business usage, such as Spoke Software, LinkedIn and Ryze, let Web users create networks of co-workers. Users create profiles that list past and current jobs. They can then search for others with similar backgrounds. For example, a salesman at a big tech manufacturer might discover that a co-worker two floors down is married to the brother of the information-technology chief at a potential customer. The salesman could ask his co-worker for an introduction — leading to a possible sale. One network had 62,000 contacts in the system and 5,000 companies after only three months in operation.

Value comes from connecting users to new business opportunities through their online relationships. Prior online systems that have attempted to provide value around relationships have ended up in the throws of a dilemma – shortchange personal privacy around contact and relationship information, and risk adoption by only the most extroverted net-workers--or restrict access to and information about individuals thus failing to provide enough quality information for value. Earlier products have required manual self-profiling and one-to-one online declaration of relationships. Despite gaining hundreds of thousands of users, these first-wave services ultimately required too much user maintenance to motivate habitual use. What has been missing is software that supports qualifying and managing the vast numbers of people we interact with through the Web with tools for maintaining and improving the number of correspondence relationships that professionals have to manage in their daily work.

Newer tools automate the process of collecting, analyzing, managing, and enhancing users' relationship network in email, while protecting ownership and the privacy of your personal information. Securely mapping known relationships on behalf of tens of thousands of users makes available a social network of professionals online, governed by privacy policies configured by users, with connection or invisibility at their discretion. Users can search for user-specific relationships with relevance ranking. The goal of social network tools is manage extended sets of relationships that make up personal and professional networks, without revealing a user's private information, and without exposing the user to direct, unqualified approaches from people unknown to the user.

Identity Management

Identity management is a platform function that is fundamental to both KM and enterprise wide IT. Internally it embraces user provisioning, single-sign-on, and management of user identities across the enterprise.
Externally it enables user authentication in inter-enterprise applications. It is crucial for the success of Web services, transactional web applications, and other inter-enterprise business applications such as EFT (electronic funds transfer).
The failure of earlier attempts to establish PKI (public key encryption) environments has left a hole in the security underpinnings of the KM platform. There is now competition between centralized attempts to provide suitable services (such as Microsoft Passport) and more federated approaches (such as that of the Liberty Alliance). Beneath this layer, the PKI vendors are seeking a role for their earlier technologies but the lack of interoperability standards is still a problem.

Businesses will come together to meet this need by looking at how PKI is being adopted for use in this more application-specific domain and at the other business issues surrounding both internal and external use of digital identity management systems.

KEY POINTS

This brief overview presents the families of technology that will meet user needs. Anything less than the integrated availability of the functionality in each family greatly increases the risk of failure. The difference between KM and the knowledge sharing of pre-computer days is the intervention of tools that create permanent change.

- Technology is necessary for KM to work, otherwise it is impossible to leverage knowledge across time and space, especially on a global level.
- Sharing knowledge is tantamount to human communication which can be enabled by a rich network of synchronous and asynchronous media.
- Users need to overcome the time barrier to sharing knowledge, and the semantic barrier to understanding the language that knowledge is captured in.
- There are three families of technology that will meet knowledge worker needs, information retrieval (documents and data), connectivity, and capture-store-organize.
- Hybrids of the KM technology families have emerged in the marketplace, combining the different components of the families into products. For example, documents that are managed like data base records using automatic concept extraction.
- Some technologies are related to KM, but have taken of life of their own leaving out key pieces of KM; these include e-learning, social networks, and identity management.
- KM success is largely dependent upon the availability of a product offering a consistent interface to all three technology families. Enterprises must avoid products that are actually different products merely bolted together to have market appeal, but are not truly integrated.