

Meta or better data?

The value of user profiling for information services

Stephen Northey
Product Development Manager
Optimus Prime Pty Ltd
stephen@optimus-prime.com

and

Bill Fatouros
Executive Director
Optimus Prime Pty Ltd
bill@optimus-prime.com

Abstract:

The increased use of information technology and 'meta data' standards have resulted in a reduction in the competitive advantage gained from the application of traditional 'meta-data' elements, despite the continued importance of this practice. Without effective user profiling that allows information systems to match information with people, practice and strategy, the content expectations of these systems will inevitably fall short. Application of an extended range of 'meta data' elements can assist information services to differentiate their products and services in the market place, create a knowledge profile for their organisation and better target the delivery of services for competitive advantage. User profiles then become valuable information objects in themselves that allow users to locate expertise within an organisation and allow information services to position information within practice communities and strategic context.

Meta or better data?

The value of user profiling for information services

Consider this ...

How well an organisation does in acquiring and applying knowledge will become a key competitive factor. Peter Drucker (1994)

For information to become knowledge, it must incorporate relationships between ideas. R. Kurzweil (1990)

There can be no knowledge without emotion. We may be aware of a truth, yet until we have felt its force, it is not ours. To the cognition of the brain must be added the experience of the soul. Arnold Bennett (1876-1931)

The aim of knowledge management is for businesses to become more competitive through the capacities of their people to be more flexible and innovative. Marianne Broadbent (1998)

1. Our rationale

The purpose of this paper is to outline the potential benefits for information services in applying an extended meta data set to profile information service clients. There is an increasing need for libraries to identify the needs and expertise of their clients in order to become knowledge agents within their organisations and prosper in a highly competitive knowledge economy. The model proposed in this paper provides opportunities for libraries to shift from a valuable (but disposable) resource to a central organ within the modern organisation.

As system designers, our vision is a more holistic knowledge support technology centred on an information management framework that supports the relationship between recorded knowledge (information), people and the processes used to achieve organisational goals. This requires us to re-think the use of our library management systems in terms of the data we maintain on our clients.

2. What is meta data?

In simplistic terms, meta data is data about data. Meta data allows us to identify meaning, context and validity of data. Meta data provides a set of knowable facts about the structure, organisation and behaviour of a given set of data.

Meta data plays a vital role in data quality processes. The more information (or meta data) you are given about a piece of data, the more value you can derive from the data. When little or no meta data is provided it is difficult to determine the validity of the data - you don't know enough about the data to reliably use it. (Forino, 2000)

The term meta data has different connotations depending on the field of application. From an information management perspective, meta data may refer to the attribute descriptors applied from standards such as Dublin Core or XML schemas. On the other hand, meta data from an

information systems perspective may refer to attributes required for data integration and transfer activities involved in a data warehouse project. This paper uses both understandings of meta data - firstly in advocating for a richer description of information content and context, and secondly, in advocating for organisational standards to enable integration of multiple data sources.

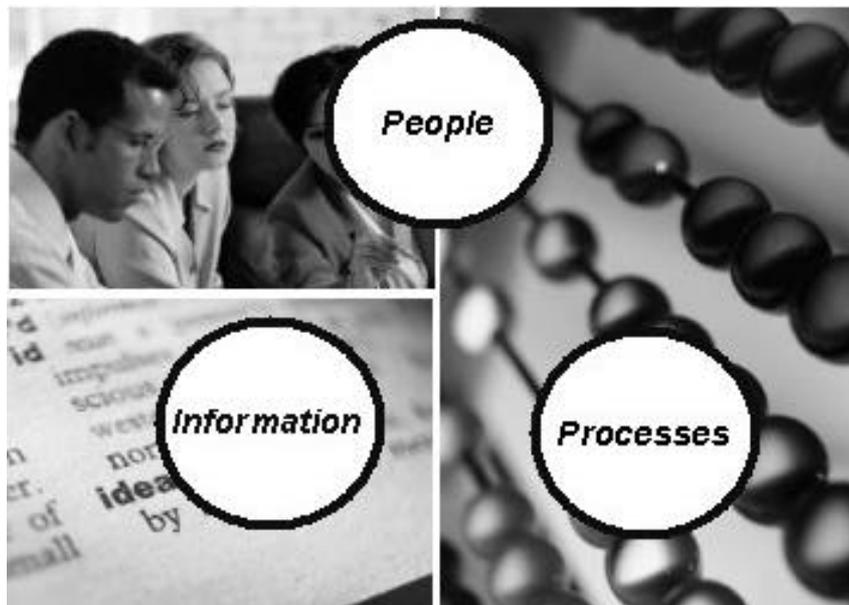
The primary purpose of applying meta-data is to improve access to and interpretation of the information being described. In library terms, meta data elements such as subject headings, keywords and classification codes provide opportunities to place an information object within the subject context of other information objects.

In current library systems, meta data is also used to disseminate information. Selective Dissemination of Information (SDI) uses a meta data match between subject data on a catalogue record and subject data (statement of interests) on a patron record. Meta data is also collected on loan, reservation and route transactions associated with particular patron meta data profiles.

Rules governing business processes are typically encoded into the library system to define the parameters of these transactions, such as the number of days a loan is issued for, and to trigger actions, such as an email alert, based on some criteria, such as a match between subject data on a catalogue record and the statement of interests on a patron record.

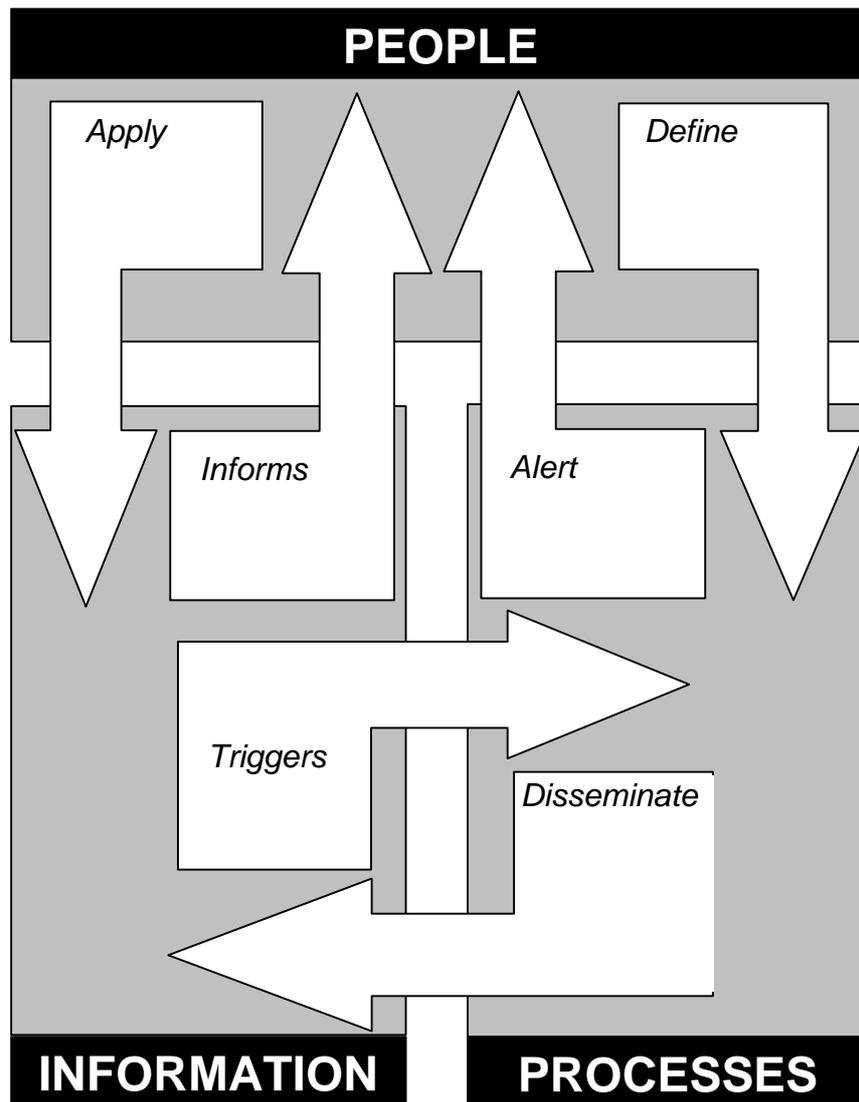
Looking at the relationship between people, information and these matching processes is a useful way of exploring the opportunities for information services to improve the level of service they provide to their clients.

Diagram 1 - The relationship between people, information and processes



The diagram below illustrates the relationship between people, information and processes supported by most current library management systems.

Diagram 2 - A current view library management system support

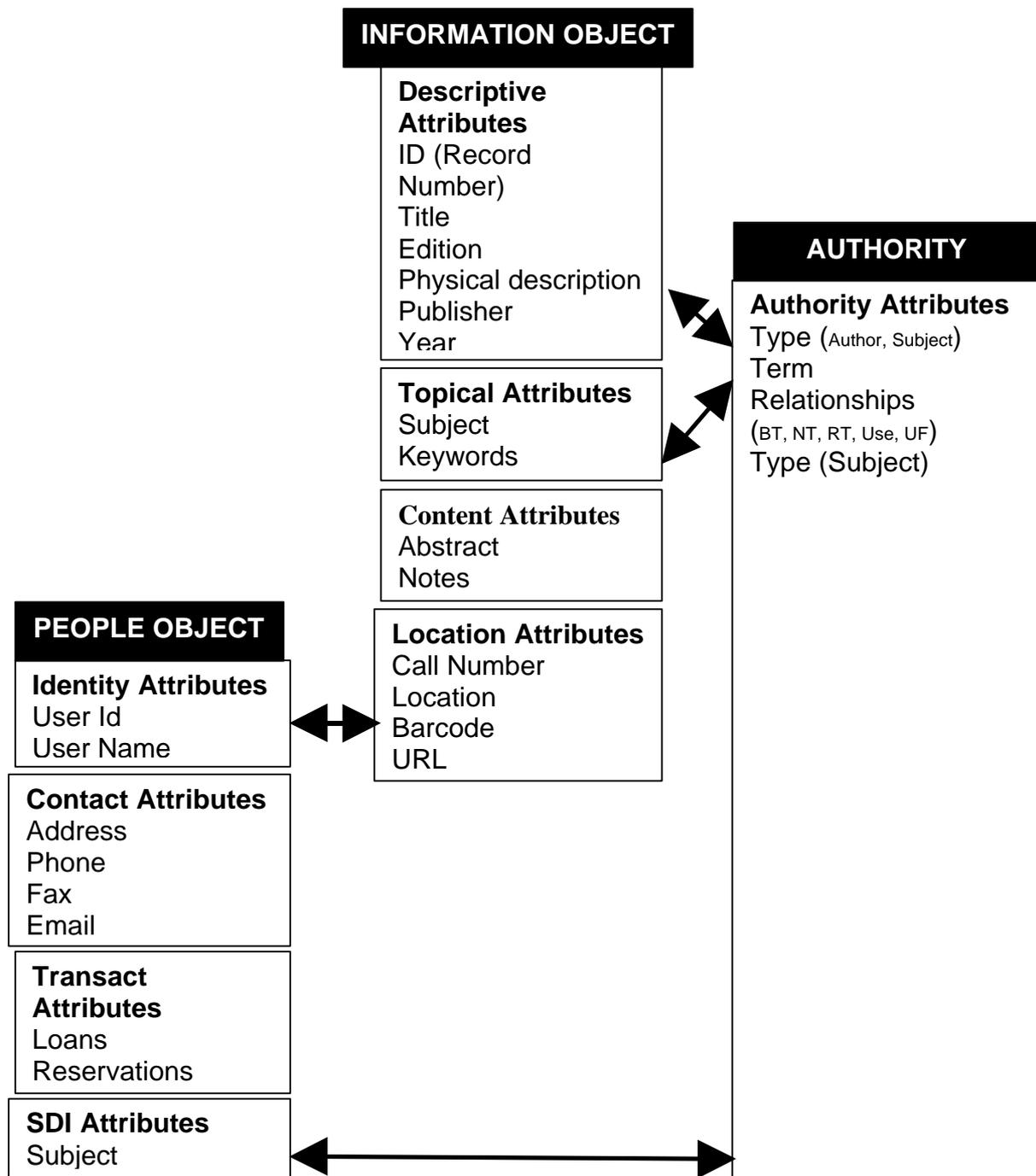


3. Limitations of current library management systems

Information acts as a stimulus to knowledge. People respond differently to any given object of information based on the integration of the information within a pre-existing set of concepts, interpretations and assumed relationships. On one level, knowledge is defined as internalised information. (Meredith and Burstein, 2000)

Current library systems do little to stimulate knowledge. Current systems are 'information-centric'. The following diagram indicates the type of meta data associated with an 'information-centric' system.

Diagram 3 – An ‘information-centric’ approach to meta data



Current library systems provide an excellent tool for storing and organising meta data on information objects. Often they provide efficient search engines for retrieving information based on sophisticated meta data definition. However, current library systems do little to push the right information out to the right users in an effort to stimulate the knowledge acquisition, creation and sharing processes.

These systems more often than not rely on end users to take responsibility for defining and maintaining their information requirements and knowledge deficits. It is reasonable to

question whether the current practice of information management inherent in the design and application of library systems really has the capacity to support knowledge processes.

If we consider our information/people/process model and the circular relationship between people and information, information and processes, and processes and people, we can see that the eddy created between each relationship is weak.

Even our much-celebrated Selective Dissemination of Information (SDI) technology has limitations. The main problem with SDI is the reliance on users to keep profiles up-to-date. Allowing users to select from group profiles based on the concept of stereotypes is one solution to these problems. (Broadbent and Lofgren, 1993; Rich, 1989)

SDIs are, however, still confined to benefiting the individual user to whom the model/profile belongs. The user profile is used to enrich or tailor that user's interaction with the system but not as an item, which might be of interest to other users. The user is not treated as object of information retrieval. (Harvey, Smith and Lund, 1998) Further, user profiles are rarely used as a way of validating information objects stored in the system.

There are a number of emergent trends in the current business environment that impact significantly on the sustainability of this approach to information management.

4. Five key trends affecting the sustainability of the current approach

4.1 Reduction in competitive advantage achieved from traditional approach

- (a) **Information Technology is increasingly more affordable and accessible:** In the past, information technology and data processing power were expensive. Competitive advantage was gained by investment in technology that supported systems others in the market place could not afford. Today, more and more people have access to networks and personal computers.
- (b) **A plethora of online resources is more affordable and accessible:** As a result of the affordability and accessibility of technology, a plethora of online resources has emerged. Access to these resources is increasingly delivered via the Internet. It was only recently that public users had full access to the entire Encyclopaedia Britannica via the Internet. Simply put, companies everywhere have access to essentially the same information (Buchanan, 1995) thereby obviating competitive advantage.
- (c) **More refined use of meta data has increased access to information:** With the explosive growth in the complexity of information management throughout our society the types of meta data applied to information objects have expanded. Malcolm Chisholm in his article "Is the meta data repository dead?" states that the goal of being able to completely define the meta data for a given database is rapidly receding, although it is very unlikely that we have reached a stage where no new types of meta data will appear. (Chisholm, 2001) The emergence of the Dublin Core Initiative to cope with the explosion of online information resources is further evidence of this trend.

4.2 Information is no longer utilised and managed in a physical library

- (a) **Departments increasingly create, acquire and manage information:** By the end of 20th century, computer-based systems had given individuals access to an enormous network of information. Knowledge was increasingly recognised as the fourth resource in building post-war economies. As a result, concern for husbanding knowledge resources has extended from the traditional library and archive to encompass organisational, institutional and governmental information.
- (b) **Increasing availability of information in electronic format:** IT has functioned in a similar way as the introduction of the printing press in dramatically increasing the publication and distribution of information. The importance of currency in a rapidly changing business environment means more and more information is published and quickly disseminated in electronic format. Production cost is also a factor here.
- (c) **IT driven intranets and portals are replacing libraries as information centres:** With the increase in information stored in electronic format, IT departments have increasingly adopted responsibility for the provision of information services, essentially via intranets. The importance of 'meta-data' has become more apparent as data warehousing and data-mining initiatives have become more widespread. Content on intranets and in data warehouses has exploded and IT departments have begun to face similar challenges to those faced by library science during the 19th century, principally the need to filter and deliver relevant information to end-users. The development of corporate information portals is a technological response to this challenge.

4.3 Knowledge management has changed the notion of the role of information management and the library

- (a) **Value shift from information access to access to the knowledge of people:** In a knowledge-driven society there are two key assets to manage, namely the competitive information an organisation possesses and the individual who increases the value of information by adding experience, knowledge and associations in order to produce other, even more valuable information. (Anderbjörk, 1999) Given organisations everywhere have access to essentially the same information, (Buchanan, 1995) the value of knowledge becomes critical to business success in terms of building competitive advantage.
- (b) **Information requires a more direct relationship with business strategy:** From a business perspective, information only realises its potential value when applied within the context of a situation or problem. People prefer contextual information, synthesised from multiple sources and providing implications and interpretations rather than mere facts. (Davenport, 1997)
- (c) **Information systems need to stimulate knowledge creation and sharing:** Given the importance of information within the context of business strategy, information systems increasingly require functionality that allows people to record their thoughts (cognitive responses), emotions (affective responses) and actions (conative responses) associated with their experience of objects of

information. (Meredith, May and Piorun, 2000; Schauder, 2000) Shared throughout a community, this knowledge or meta-knowledge (Schauder, 2000) stimulates more knowledge and adds value to the overall knowledge assets of an organisation.

4.4 End users increasingly demand more relevant information within context

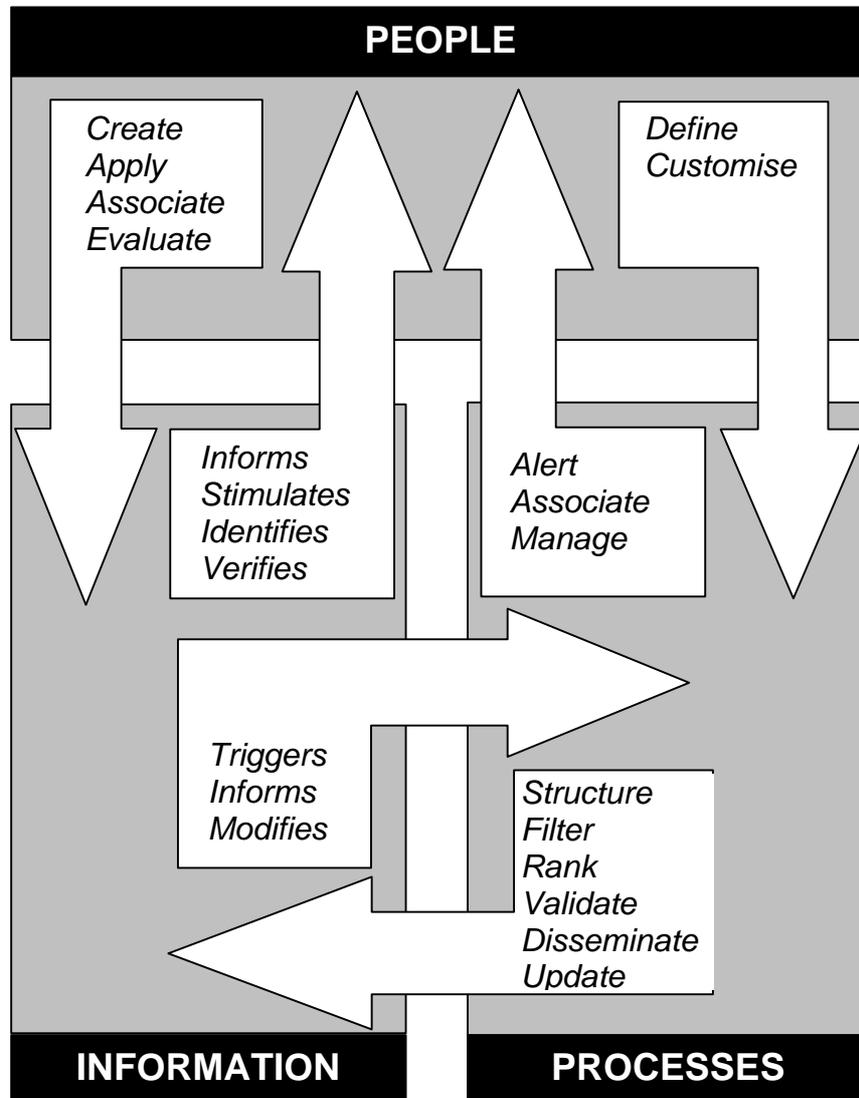
- (a) **Relationships between ideas are required to assist knowledge transfer:** For information to become knowledge, it must incorporate the relationships between ideas or concepts. Transferring this knowledge requires that the attributes used to describe how concepts interact are easily accessible, updated, and manipulated. (Kurzweil, 1990)
- (b) **Data about application of information is increasingly more important:** Learning is critical in a knowledge culture. People learn from personal and social experience. People often seek out other people who may have already applied information in a given situation. This is why ‘word-of-mouth’ and informal ‘coffee-room’ exchanges are emphasised in marketing and knowledge management theory respectively.
- (c) **Information is increasingly relevant to more specialised groups within an organisation:** In his sentinel 1994 article “The Age of social transformation”, Peter Drucker predicted that the central workforce in the knowledge society will consist of highly specialised people and that applied knowledge is effective only when it is specialised. (Drucker, 1994)

4.5 End users have less time to search and process available information

- (a) **Information glut affects performance:** ‘Info glut’, the overwhelming availability of information and data, has begun to measurably affect productivity. Organisations that understand how to navigate the information flood will have a distinct advantage over their competitors. Personalisation features and taxonomies can ease access to relevant information. (Linden and Jacobs, 2001)
- (b) **Experts are the best agents for filtering information for relevancy and utility:** The use of people or experts as an index to information is one way to cope with the information overload phenomenon. (Harvey, Smith and Lund, 1998)
- (c) **Information presentation and peer review decreases information processing time:** Recall and precision (the number and relative quality of items retrieved) are the two key performance measures traditionally used to evaluate information retrieval systems. (Russom, 1999) Information systems usually perform better than people in maximising recall. However, where precision is required, people often consult perceived experts or likely ‘knowledge holders’ in relation to the best information. The information seeker uses the intuition, perceptions and discrimination of the expert to retrieve the required information. (Harvey, Smith and Lund, 1998) However, increased information often leads to negative selection decisions (Thomas, 2000), and therefore reduces precision. Better, faster decisions can provide organisations with a significant advantage in a competitive environment. (Russom, 1999)

Again, looking at the relationship between people, information and processes we can quickly see tremendous opportunities for information services to improve the level of service they provide to their clients. The diagram below illustrates a much richer relationship between people, information and processes.

Diagram 4 – Opportunities for library management system support



Clearly, there is pregnant opportunity to vitalise the relationship, from a system perspective, between people, information and processes. However, a number of trends in the technology and service market should be considered as we contemplate a design for future library/information management systems.

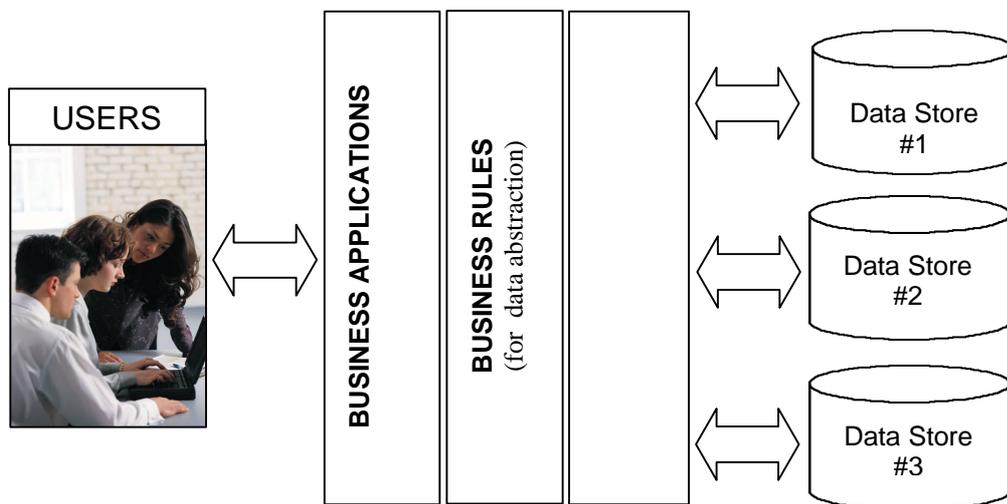
5. Five Key trends affecting the design of future approaches

5.1 Trend away from a single meta data repository towards an integrated model of distributed databases

- (a) **Explosive growth in the complexity of information management:** According to a number of data-warehousing experts, the goal of being able to completely define the meta data for a given database is rapidly receding. (Chisholm, 2001; Dresner, 2001, Hurwitz Group, 1998; Jennings, 2001)
- (b) **Increase in volume of highly specialised data processing needs:** As information becomes a more important corporate resource the demand to manage it increases. As a consequence there is a need for quite disparate kinds of meta data. Meta data is increasingly too diverse to support the notion that there can be one repository to store all meta data. (Chisholm, 2001)
- (c) **Implementation of industry wide meta data standards and data mapping between multiple repositories:** Next generation databases are moving from a large, centralised data warehouse model to one characterised by small, distributed, application-specific databases. A distributed architecture requires databases share common keys and attributes. In other words, meta data consistency is a key issue where multiple repositories are distributed across the enterprise. Currently, the largest cost associated with metadata is that of replication and coordination. (Hulser, 1998)

The diagram below illustrates an integrated meta data repository model.

Diagram 5 – An integrated meta data repository model



5.2 Increasing need to change business rules quickly and cost effectively in a rapidly changing environment

- (a) **Rules governing business process change regularly and rapidly:** The rules governing business processes constantly change. (Johnston, 2001) Addressing these changes is far easier and more cost effective at the meta data level than at the data level.
- (b) **Hard-coded business rules are expensive and time consuming to change:** Systems become increasingly redundant if they lack the flexibility to incorporate changes to business processes quickly and cost-effectively.
- (c) **Business rules are more efficiently managed from the interface:** Staff responsible for service delivery need to alter the parameters of systems from the interface level in order for systems to remain relevant to specific business goals.

5.3 Strong trend towards user authentication to secure and manage access to information products and services

- (a) **Increased ability to access and distribute information invariably means organisations will need to restrict access where commercial-in-confidence or conflict of interest conditions apply.**
- (b) **Privacy issues are associated with providing public access to user data:** Research indicates that individuals need to feel they have control of the content of their profiles to avoid systems being regarded as spying and therefore arousing hostility. (Harvey, Smith and Lund, 1998) Protecting the user's personal information is not just a courtesy: it is a legal obligation. (Rothman, 2000) Privacy of employee details within the organisation may indeed become a major civil liberty issue in the future.
- (c) **Increase in delivery of commercial information products and services:** Organisations who value the knowledge of their people and view their information as a corporate resource are beginning to package these resources as commercial online services.

5.4 Emphasis on profiling users to better match information needs and deliver tailored products and services

- (a) **'Information overload' necessitates information filtering:** The proliferation of available information, coupled with a relative decrease in the amount of free time available to process information, means both specialist and non-specialist demand information services that filter-out information less likely to impact on the decision-making process. Data filtering requires an emphasis on analysing information in the context of an organisation's business environment.
- (b) **People's knowledge, and therefore information needs, are becoming more specialised:** Knowledge has to be highly specialised to be productive. Therefore, people increasingly work in expert teams, groups or communities. (Drucker, 1994) In other words, people are associated with specialist practice areas. The

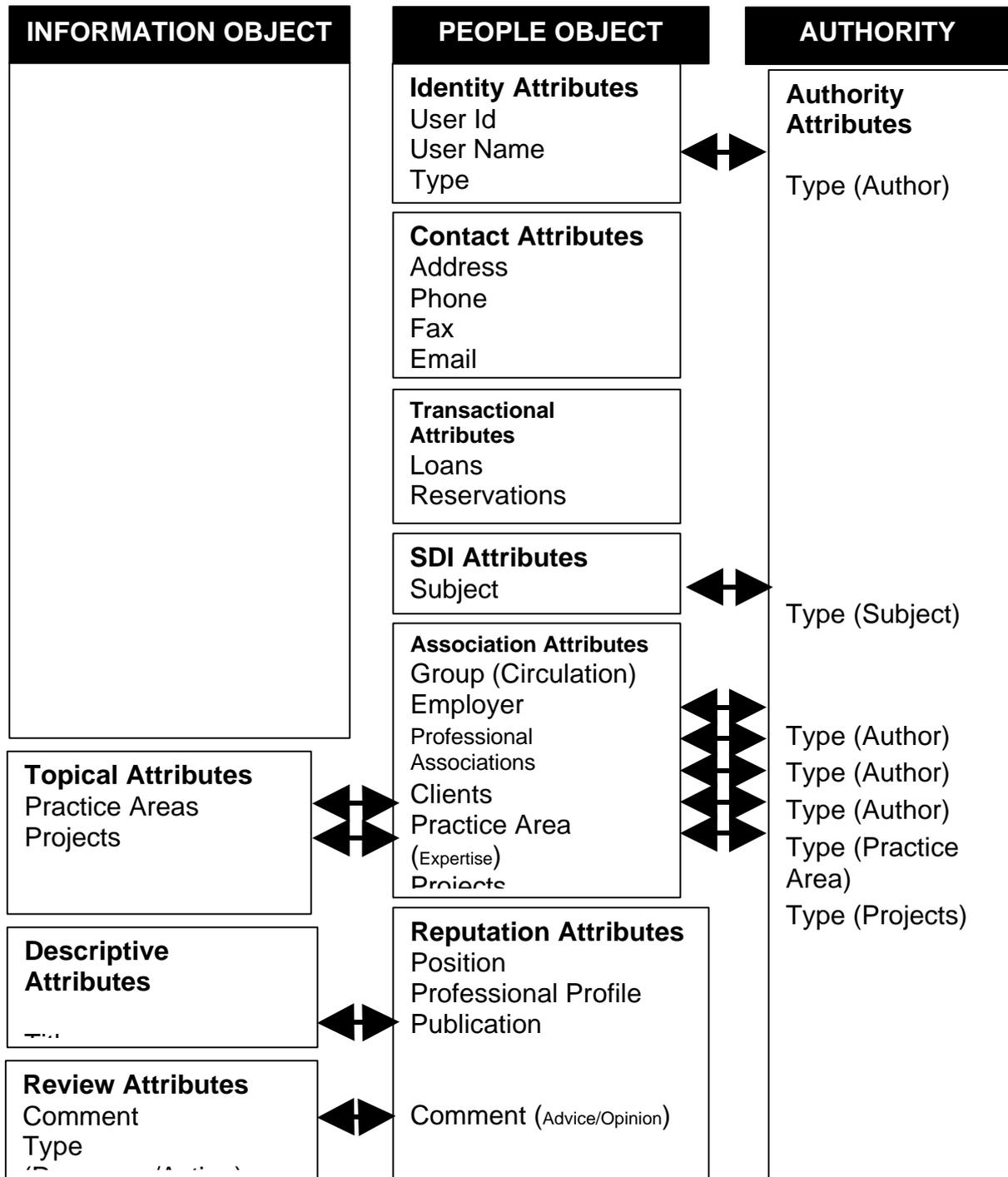
information management challenge in building and managing these ‘intelligent communities’ is to embed relevant business structures or practice areas in information that exists in the form of organised communication or documents. (Anderbjörk, 1999)

5.5 Increasing need to located and verify expertise and peer reviewed information

- (a) **User profiles as an object of information retrieval:** Currently, the user profile is used to enrich or tailor that user’s interaction with the system, but not as an item which might be of interest to other users. The user is not treated as object of information retrieval. (Harvey, Smith and Lund, 1998) User profiles can, however, represent the reputation and expertise of the user it describes.
- (b) **People are excellent agents for filtering, summarising and directing information:** To improve the precision of search results, users require enough data to enable an evaluation of information retrieved. Common factors used to judge relevance include topicality, peer interest, novelty, currency and convenience. (Wang, Hark and Tenopir, 2000)
- (c) **Peer review increases precision in information retrieval:** Typically, the position a person holds in an organisation provides an indication of the relative value assigned to any advice or knowledge contributed by that person. The acceptance of information often depends on who collects and analyses it, and some executives consistently rate the findings of high-priced consultants above those of an underling or colleague. (Buchanan, 1995) Associating information with peer reviews allows users to access and sort critical information vetted by practice area specialist.

In the context of these trends, there is a clear demand for more people-centric rather than information-centric information management practices. The following diagram proposes a range of meta data attributes relevant for a ‘people-centric’ system.

Diagram 6 – A ‘people-centric’ approach to meta data



6. The benefits of a “people-centric” approach

- 6.1 **We can identify our users:** Authenticating users allows an information service to identify the individual user and deliver services and document access privileges that match that users’ profile. Knowing who the user is also allows information services to collect and analyse system usage and information retrieval patterns specific to the user and identified groups of users to assist the information service in targeting training programs, modifying system interfaces, identifying opportunities for new products and services, justifying budget expenditure, identifying redundancies and locating centres of expertise.
- 6.2 **We can locate expertise:** User profiles provide a valuable object of information retrieval when attempting to locate expertise within an organisation. User profiles may be searched directly based on matching meta data defined in a search or retrieved together along with relevant information resources in a topical search.
- 6.3 **We can evaluate claims of expertise:** Users can evaluate an expert’s profile based on the meta data description of that person’s professional profile, position, practice areas, project and client involvements as well as linkages to publications and comments authored by that user.
- 6.4 **We can position information and people within our business structure:** Categorising users and information objects by business specific structures, such as practice areas, allows an information service to build dynamic path finders comprising key information resources and experts in each defined business practice area. This removes the time consuming activity of manually updating static web pages often maintained for this purpose. Categorising users and information objects by practice areas also allows an information service to define automated alerting services to notify users of new material and comments relevant to the practice areas defined on their user profile.
- 6.5 **We can position information and people within our business activity:** Associating users and information objects with projects allows an information service to dynamically manage issues of commercial-in-confidence and conflict of interest as well as build structured webs of organisational experience. Projects can then be reviewed within the context of information resources employed, people involved and reflective comments added by project participants. Again, automated alerting services may be defined to communicate developments to relevant parties.
- 6.6 **We can associate information and people with our customers:** Associating organisational staff with business clients allows staff to identify other people within the organisation who have had dealings with particular clients, and provides those staff with an opportunity to add comments in relation to those dealings and therefore build a dynamic profile of the organisation’s experience with each client.
- 6.7 **We can rank and filter user contributions by ‘standing’ in the business:** Recording the position a person holds in an organisation provides information services with a means of ranking or filtering any comments that a person makes in accordance with the value associated with the contributor’s position. Search results may also be filtered by material reviewed by people in more senior positions.

- 6.8 We can add competitive value to information resources:** The ability to position information within the context of practice areas and projects, and annotate information objects with meta knowledge related to use, experience an/or actions, adds specific organisational value to information objects that is not available to competitors. In other words, user profiling allows an organisation to marry information and knowledge resources.
- 6.9 We can improve the currency and relevance of information resources:** Including users within the author authority file structure allows an information service to manage internally produced documents in the same way as other information objects. This allows a direct linkage from a patron record to authored publications, which can assist the evaluation of expertise. Any comments attached to an authored document by another user can also trigger feedback to the author in relation to inaccuracies, contradictory evidence or emerging developments that may affect content or future usage.
- 6.10 We can personalise the information service desktop:** With the enhanced ability to package information and define more specific business rules based on an extended meta data set, information services can also offer a range of products that can be embedded in corporate portal applications. This allows users to personalise their own information service desktop.

All of these benefits are specific to the business and are therefore defined in business processes. Processes can automate many of the transactions involved in delivering these benefits. The diagram below illustrates some the processes possible in 'people-centric' systems.

7. Using processes to match people with information

Diagram 7A – Processes matching people with information

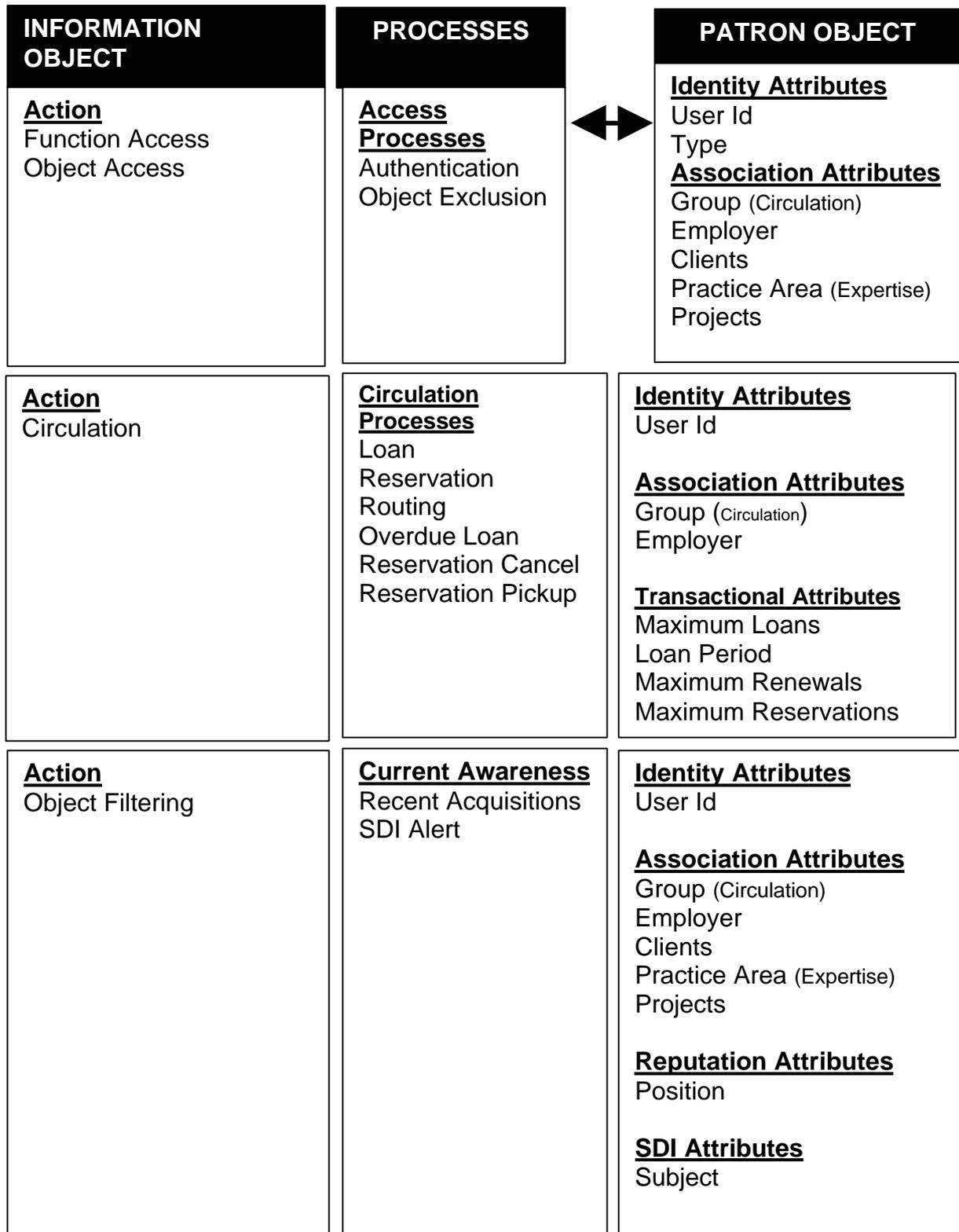


Diagram 7B – Processes matching people with information

INFORMATION OBJECT	PROCESSES	PATRON OBJECT
<p><u>Action</u> Function Access Object Access Object Filtering</p>	<p><u>Structural Processes</u> Relationship Reporting</p>	<p><u>Identity Attributes</u> Type</p> <p><u>Association Attributes</u> Practice Area (Expertise) Projects</p>
<p><u>Action</u> Object Filtering</p>	<p><u>Topical Processes</u> Relationship</p>	<p><u>Association Attributes</u> Practice Area (Expertise)</p> <p><u>SDI Attributes</u> Subject</p>
<p><u>Action</u> Object Update</p>	<p><u>Update Processes</u> Update Alert</p>	<p><u>Transactional Attributes</u> Date Modified</p>
<p><u>Action</u> Object Filtering Object Sorting Object Linkage</p>	<p><u>Validation Process</u> Relevancy Expertise Contribution</p>	<p><u>Association Attributes</u> Professional Associations Practice Area (Expertise) Projects</p> <p><u>Reputation Attributes</u> Position Publication Comment (Advice/Opinion)</p>
<p><u>Action</u> Usage Statistics</p>	<p><u>Learning Processes</u> Profiling Pattern Matching</p>	<p><u>Transactional Attributes</u> Searches Object Access Downloads Date/Time</p>
<p><u>Action</u> Object Update</p>	<p><u>Feedback Processes</u> Comment Alerts Verification Peer Review</p>	<p><u>Identity Attributes</u> User Id User Name Type</p> <p><u>Reputation Attributes</u> Position Comment (Advice/Opinion)</p>

8. Conclusions

This paper has outlined the benefits of applying an extended meta data set in order to profile users. These meta data attributes provide a deeper description of the people who collectively comprise the knowledge asset of an organisation.

Better data on this asset allows us to match, filter, categorise, evaluate, package and disseminate information with the specific business requirements of individual people and groups of people.

The model proposed in this paper provides opportunities for libraries to use their information management systems to stimulate knowledge processing and become more central to the strategic direction of the organisations they seek to support.

In summary, this paper concludes:

- 8.1** The ability for libraries to survive and prosper will depend on their ability to better match information with people.
- 8.2** User profiling provides a means for libraries to deliver dynamic information products and services that match the known and potential requirements of individual users and groups.
- 8.3** The information needs of people are increasingly aligned with activities directed towards achieving specific organisational or community goals.
- 8.4** User profiling provides a means of associating information and expertise (people) with specific organisational strategies.
- 8.5** The capacity of people to acquire and apply knowledge, to be more flexible and innovative, is a key competitive factor.
- 8.6** User profiling provides a means of associating and sharing experience and locating knowledge with an organisation.

In short, we need to consider the application of better meta data to meet future data processing requirements and service expectations. Importantly, better application of meta data can significantly increase the competitive advantage derived from an organisation's knowledge resources.

REFERENCES

- Anderbjörk, Gabriel, October (1999). *Intelligent communities: managing people and information in the 21st century*. Comintell. [Downloaded from www.comintell.com]
- Bates, M. J. (1986). 'Subject access in online catalogs: a design model' in *Journal of the American Society for Information Science* 37: pp 357-76.
- Bishop, Ann Peterson. (1998). 'Logins and Bailouts: Measuring Access, Use, and Success in Digital Libraries' in *The Journal of Electronic Publishing* 4 (2). [Available from <http://www.press.umich.edu/jep/04-02/index.html>]
- Broadbent, M. (1998). 'The phenomenon of knowledge management: What does it mean to the information profession?' in *Information Outlook* 2 (5): pp 23-36.
- Broadbent, M. and Lofgren, H. (1993). 'Information delivery: identifying priorities, performance, and value' in *Information Processing and Management*. 29 (6): pp.683-701.
- Buchanan, Leigh. (1995). 'Scavenger Hunt' in *CIO Magazine* July 1, 1995. [Downloaded from www.cio.com/archive/070195_info_content.html on 31/5/2001]
- Chisholm, Malcolm (2001). 'Is the meta data repository dead?' in *DM Review Online* May 2001. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=3335 on 31/5/2001]
- Davenport, Thomas H. (1998). 'Industry insight: from data to knowledge' in *Oracle Magazine* May 1998. [Downloaded from www.oracle.com/oramag/oracle/98-May/ind2.html on 31/5/2001]
- _____. (1997). 'Processing process information' in *CIO Magazine* March 15, 1997. [Downloaded from www.cio.com/archive/031597_think_content.html on 31/5/2001]
- Dresner, H. (2001). 'The Data warehouse: dead or alive'. Research Note 2 May 2001. Gartner. [[Download from www.gartner.com on 17/7/2001]
- Drucker, Peter F. (1994). 'The Age of social transformation' in *The Atlantic Monthly* 274 (5) November 1994: pp 53-80. [Downloaded from www.theatlantic.com/politics/ecbig/soctrans.htm on 31/5/2001]
- Eifrig, Janice and Roberts, Carol. (1998). 'Creating an online client information database'. Special Libraries Association, Washington D.C. [Downloaded from www.sla.org/pubs/serial/io/1998/jul98/roberts.html on 31/5/2001]
- Estabrook, Leigh S. Encyclopedia Britannica Article. Britannica.com. [Downloaded from <http://www.britannica.com/eb/article?eu=109616> on 23/07/2001]

- Fenn, J and Linden, A. (2001). 'Hottest of the hot: discontinuities of the next decade'. Research Note, 20 April 2001. Gartner. [Download from www.gartner.com on 17/7/2001]
- Field, Tom. (1997). 'Getting in touch with your inner web' in *CIO Magazine* 15 January 1997. [Downloaded from www.cio.com/archive/011597_intranet_content.html on 31/5/2001]
- Forino, Ronald. (2000). 'Data e.Quality: the meta data supply chain' in *DM Review Online* November 2000. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=2522]
- Hallet, Peter. (2001). 'Web-based visualization' in *DM Review Online* June 2001. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=3486]
- Harman, D. (1992). 'User friendly systems instead of user friendly front ends' in *Journal of the American Society of Information Science* 43: pp 164-74.
- Harvey, Clare F, Smith, Peter and Lund, Peter. (1998) 'Providing a networked future for interpersonal information retrieval: InfoVine and user modeling' in *Interacting with Computers* 10 1998: pp 195-212.
- Hert, C. A. and Marchionini, G. (1998). 'Information seeking behavior on statistical Web sites: theoretical and design implications' in *Information access in the global economy: proceedings of the 61st annual meeting of the American society for Information Science* October 25-29, 1998. Pittsburg, PA: pp. 303-314.
- Hodge, Gail (2000). *Systems of knowledge organisation for digital libraries: beyond traditional authority files*. The Digital Library Federation, Council on Library and Information Resources: Washington, D.C., April 2000.
- Hulser, Richard P. (2001). 'Integrating technology into strategic planning'. Special Libraries Association, Washington D.C. [Downloaded from www.sla.org/pubs/serial/io/1998/feb98/hulser.html on 31/5/2001]
- Hurwitz Group. (1998). *Enterprise Metadata Management*. Hurwitz Group: Framingham, MA, December 1998.
- Jennings, Mike. (2001). 'The Generic meta data repository' in *DM Review Online* January 2001. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=2954 on 31/5/2001]
- Johnston, Tom. (2001). 'Business rules, meta data and late binding, part 2' in *DM Review Online* February 2001. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=3066 on 31/5/2001].
- _____. (2001). 'Business rules, meta data and late binding, part 3' in *DM Review Online*, February 2001. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=3108 on 31/5/2001]

- Kennedy, J., and Schauder, C. (1998). *Records Management: A Guide To Corporate Record Keeping*. Addison Wesley Longman: Sydney.
- Kurzweil, R. (1990). *The Age of Intelligent Machines*. MIT Press: Cambridge.
- Larson, R. R. (1991). 'Between Scylla and Charybdis: subject searching on the online catalog' in *Advances in Librarianship* 15: pp 175-236.
- _____. (1991). 'The Decline of subject searching: long term trends and patterns of index use in an online catalog' in *Journal of the American Society of Information Science* 42: pp 197-215.
- Lesk, Michael. (1997). *Practical Digital Libraries: Books, Bytes, and Bucks*. San Francisco: Morgan Kaufmann Publishers.
- Linden, A. and Jacobs, J. (2001). 'How to swim, not sink, in the information flood'. Research Note, 25 May 2001. Gartner. [Downloaded from <http://www.gartner.com> on 17/7/2001]
- Luther, Judy. (2001). *White Paper on Electronic Journal Usage Statistics*, Second edition. Council on Library and Information Resources: Washington, D.C. [Downloaded from <http://www.clir.org/pubs/abstract/pub94abst.html> on 23/06/2001]
- Marchionini, G. (1992). 'Interfaces for end user information seeking' in *Journal of the American Society of Information Science* 43: pp 156-63.
- Marco, David, 2001. 'Meta data and data administration: implementing data quality through meta data, part 1' in *DM Review Online* November 2000. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=2525 on 17/7/2001]
- Meredith, R., and Burstein, F. V., (2000). 'Getting the Message Across with Communicative Knowledge Management'. Paper presented at the Australian Conference on Knowledge Management & Intelligent Decision Support, November 2000, Melbourne, Australia.
- Meredith, R., May, D. and Piorun, J. (2000). Looking at Knowledge in Three Dimensions: An Holistic Approach to DSS Through Knowledge Management. Paper presented at the IFIP TC8/WG8.3 International Conference on Decision Support through Knowledge Management, 9-11 July, Stockholm, Sweden: pp 241-254.
- Rich, E. (1989). 'Stereotypes and user models' in *User models in dialogue systems*. Eds. A. Kobsa and W. Wahlerster : Springer-Verlag: pp 35-51.
- Rothman, Joel B. (2000). 'Establish an Effective Privacy Policy' in *e-Business Advisor* (March): 34.
- Rowley, J. (1994). 'Revolution in current awareness services' in *Journal of Librarianship and Information Science* 26 (1) 1994: pp 7-14.
- Russom, Philip. (1999). 'New directions for knowledge management software' in *DM Review Online* October 1999. [Downloaded from www.dmreview.com/editorial/dmreview/print_action.cfm?EdID=1454 on 17/7/2001]

- Salton, G. (1992). 'The state of retrieval systems evaluation' in *Information Processing and Management* 28 (4) 1992: pp 441-449.
- Schauder, D. (2000): Postscript. In K. Williams (Ed.): *Research Methods for Students and Professionals: Information Management and Systems*, Centre for Information Studies, Charles Sturt University: Wagga Wagga.
- Sistla, Mala and Todd, James. (1998). 'Warning: a killer mistake in business – don't let technology define your requirements'. Special Libraries Association, Washington D.C. [Downloaded from www.sla.org/pubs/serial/io/1998/jun98/sistla.html on 31/5/2001]
- Smiraglia, R. P. (1992). 'Authority control and the extent of derivative relationships'. PhD. diss., University of Chicago.
- St. Lifer, Evan and Older, Norman . (2001). 'What public libraries must do to survive' in *Library Journal* April 1, 2001. [Downloaded from http://www.britannica.com/magazine/printcontent_id=218587 on 23/07/2001]
- Stricker, Ulla de. (1998). 'Marketing with a capital s : strategic planning for knowledge based services'. Special Libraries Association, Washington D.C. [Downloaded from www.sla.org/pubs/serial/io/1998/feb98/stricker.html on 31/5/2001]
- Thomas, David H. (2000). 'The Effect of interface design on item selection in an online catalog' in *LRTS*, 45 (1) 2000: pp 20-46.
- Townley, Charles and Murray, Leigh. (1999). 'Use-Based Criteria for Selecting and Retaining Electronic Information: A Case Study' in *Information Technology and Libraries* 18 (1): pp 32-9.
- Wang, Peiling, Hark, William B. and Tenopir, Carol. (2000). 'User's interaction with World Wide Web resources: an exploratory study using a holistic approach' in *Information Processing and Management*. 36 2000: pp 229-251
- Zipperer, Lorri (1998) 'Librarians in evolving corporate roles'. Special Libraries Association, Washington D.C. [Downloaded from www.sla.org.pubs.serial/io/1998/jun98/zipperer.html on 31/5/2001]