The Case for a Person/Agent Dublin Core Metadata Element Set

Liddy Nevile
La Trobe University Melbourne Australia
Mail liddy@SunriseResearch.org
Sophie Lissonnet
James Cook University Townsville Australia
Mail slissonnet@netspace.net.au

Abstract: In this paper, the authors revive proposals for the development of a new 'set' of people-centric Dublin Core elements, based on the existing architecture and success of the Dublin Core Metadata Element Set. They argue that the original set was developed for resources, typically digital versions of 'document like objects' (DLOs) and that they included only those elements and terms that suited discovery of such objects.

Keywords: element set; Agent; person; proposal; extension; metadata applications.

1 Introduction

Nowadays, Dublin Core is the core of thousands of metadata application profiles, most of which are secondarily concerned, but many of which are primarily concerned with people, or computer agents as their subject. The terms required to describe people and agents are not the same as those for DLOs although they share some features. Users of DC elements and systems that engage them, particularly, can avoid redundancy in systems and work if they can use DC style metadata across applications but currently there is no standardisation of such metadata. The benefits of DC we have 'come to know and love' are what they now need for people and agents.

2 The Problem

The original Dublin Core Metadata Element Standard was developed with the aim of making digital objects more easily discoverable. It has been a stunning success and has quickly become established in many countries, in many languages, and in many contexts. In fact, it is the success of the original DCMES that has exposed its inadequacy to cover all the situations in which people currently want to use it. This is particularly true as systems start to do more with metadata than mere discovery.

The Web accessibility community, for example, wants to discover not just content of the right topic but often in a form that will be accessible to the immediate user. Recently, they have undertaken new work to make accessible content more discoverable and accessible. Once this meant working on how content could be made more accessible technically, typically the focus of W3C work. The recent work of interest depends upon the provision of metadata about the user in order to enable automated matching of content in suitable modalities, for instance.

But it is not only for accessibility purposes that people descriptions are being considered in this paper.

Many corporations and government organisations have adopted Dublin Core based descriptions for objects within their operations and also have metadata descriptions of the people and roles played within the organisations. Typically though, these descriptions, while both are metadata, are not in the same form: Lightweight Directory Access Protocol

(LDAP), vCards, authority files and others not only have their own formats but they often are associated with applications that do not inter-operate with those using DCMES.

Cultural heritage institutions frequently hold information and artefacts that they want to associate with people or communities. Details about people or communities may include their name, but are likely to have far more interesting information such as their interests, expertise, location. In fact, where an institution has a collection of artefacts associated with a particular person, it may be necessary to refer many times to descriptions of the individual people, or communities, and the attributes of interest may be very different in kind from those that would be of interest when an inert object is being described.

In the field of sensitive information, a decision-support for cancer patients site being developed in Melbourne shows how different people will want different kinds of information at different times and stages of their illness (31).

In addition, there has been a lack of complete satisfaction for some time with some of the DCMES elements. In particular, it is always difficult to know how to associate the various components that describe the identity of a person. It is not always easy to distinguish between values used for the elements of Creator, Contributor, Publisher and Rights. There are problems with the idea of Agents and how they should be described and if they fit into the existing DCMES framework, and there are on-going issues about what to do with library authority files and similar files that are not so rigorously maintained.

At the time of writing, the DCMI Agent Working Group is still engaged with the problem of how to describe what are thought to be 'agents' and has, as part of its charter, to:"Provide input to the DCMI Architecture working group concerning the linking of resource description records to agent description records." {Group, 2002 #3}

This is one of many examples of the need for the DC community to develop closer links between working groups. In this case, between the RDF community who are working on the 'Semantic Web' and the established DCMES community who are still mostly concerned with metadata for discovery of objects. The former community is interested in links between things while the latter has traditionally focused more on descriptions of things. Their work often brings into question the use of the DCMES element 'Relation'.

Finally, looking at the current resource description set shows some of the weaknesses with respect to people and agent:

Identifier: how should this be established uniquely?

Subject: is this not the same as Identifier when it is a person?

Description: can this be considered a unique or static feature of a person when they change constantly? Should it be associated with time? Should it have to be also associated with the author, in an EARL statement?

Type: does this make any sense? Role might be useful? Or expertise or age or other qualities or attributes?

Format, Rights, Contributor, etc … In some circumstances these are not suitable for descriptions of people.

In addition, there is some information that is really important about people that is often given low priority in descriptions of resources, for instance contact details.

The aim of this paper is to revive interest in the development of a focused set of Dublin Core elements. It should do more than just add to the existing set of elements, as recommended terms do. Instead, it should recognise the value, extent of adoption of, and the inter-operability and multi-lingual ability of the original DCMES. We aim to hear and extend the call for a new activity to undertake a major effort to produce a new element set with a new focus.

We believe that this work deserves to be centre stage. We believe that different people with different skills will need to be involved. It is not about or analogous to cataloguing books. It should engage the business community, for example.

3   History of activity towards an element set for people

Proposals for an Agent element, and discussions about this issue, have been around for a long time: they are documented as early as 1998 when Bearman, Caplan and Dillon drew attention to some possibilities:

"The drafting committee proposes:
- To adopt the element DC.Agent in place of DC.Creator, DC.Publisher and DC.Contributor
- To adopt the USMARC Relator Codes as authorized values of dcq:AgentType for roles of persons and organizations with respect to the resource." (2)

The 'agent' in this case may be a person or a computer agent.

In 2000, Weibel's report in D-Lib of the year's activities of the DCMI contained the following:

"Dublin Core elements describe information resources, but inevitably the value of some of the elements are associated with objects or resources themselves. This is particularly important with respect to Agent elements: Creators, Contributors, and Publishers. People and organizations themselves have potentially complex descriptions, and extensive discussions of these elements suggest that they may merit an element set of their own. This is (not surprisingly) similar to the situation that obtains in conventional cataloging. A creator is generally named within a cataloging record, but the definitive, richer description of the person or organization is retained in an authority record that is maintained independently. Research efforts in the NSF/EU funded Harmony Project, managed by Lagoze, Hunter and Brickley, also suggest that the separation of metadata for resources, agents, and events is a fruitful way to modularize metadata." (3)

This is also a report on work that resulted from the Harmony Project, undertaken by Brickley, Hunter and Lagoze, which proposed what was called "A logical model for metadata interoperability." (4)

A typical solution to the problem of fully identifying a human is shown by the use of what is called a 'cluster' in the ROADS project (5):

"A simple AGENT cluster is defined as:

Attribute	Notes
Template-Type	AGENT
Handle	Assigned automatically
Template-Version	0.2
Name	P e r s o n o r

	organization name
Type	'Person' or 'CorporateBody'
Email	Email address
Identifier	An identifier, for example a URI, for the person or organization.
Destination	

In 2003, the DC Agents Working Group reported on a meeting held in Seattle asking, among other things:

"What is in Scope?

- Three subclasses of agents are likely to be important in metadata: persons, organizations, and instruments.
- Instruments are judged to be out of scope in this effort." {Group, 2002 #3}

Further, the minutes of the meeting report:

"Agents and Rights:

- A successful Agent metadata architecture will support assertions of IP rights
- Link easily to formally managed authority systems such as library authority files or Interested Party file used to manage music rights

Agent Core and Related Authority Activities

- What is the Relationship of the Agent Core to other authority activities
- VIAF (http://www.oclc.org/research/projects/viaf/)
- Interparty (http://www.interparty.org/)
- EduPerson (http://www.educause.edu/eduperson/)

- vCard (http://www.imc.org/pdi/)
- FOAF (http://www.foaf-project.org/)
- Others?" (6)

DCMI's Agents Working Group has been re-chartered to develop a core set of metadata elements for unambiguously describing agents (people or groups) associated with resources. The work plan also includes the development of an identifier scheme to identify unambiguously a specific individual agent. (7)

The draft proposal for people comprises elements such as identifier, name, dates, title, affiliation, location, email, and 'other information'. Such scheme could also be used in the rights area to describe rights holders {, 2003 #6;Group, 2002 #3}.

The DC-Agents WG is concerned that privacy laws may forbid the collection (let alone the publication) of such personal information. IN fact this is a tricky issue. For some situations, people metadata should not be identified with individual's identity, as is often the case with metadata that describes people's disabilities. (The idea is that the description should trigger action but the identity should be concealed.) On other occasions, it is critical that the identity of the person described is known and verified. As metadata is used in many ways, for many different purposes, and by different people, this is not something that should be controlled by the DCMI but it is something that should be allowed for. Such problems could be managed in a new element set.

We consider now several domains in which metadata about people is being used, and we look at the development of a case for a new element set that is more specifically tailored to meet the needs of

the community using DC-type metadata in this context.

4 Specific examples

4.1 Accessibility Activities

In the case of work on accessibility of resources for users, including those with disabilities or other temporary sensory deprivations, there is growing support for the profiling of people's needs and preferences. This is driven by the increasing adoption of requirements (and legislation) in most countries that Web resources should be equally accessible to all. This work grew, in a sense, out of the work on portals that introduced the notion of different users having different experiences with the same content. It has increased the level of granularity of choices so that individuals can look forward to having a truly individual experience. It is anticipated that people will have the equivalent of a passport that is available online, or on a smart card, or that in some other way follows them in their travels from one computer access point to another. This passport will contain sufficient information for a suitable system to assess the accessibility of a resource and where necessary, modify it, substitute something more suitable for it, or send it off to a Web service for transformation, without the user having to participate in this process.

The IMS Global Learning Consortium {Group, 2002 #7} has developed the AccessForAll profile {Group, 2002 #8;Group, 2002 #8;Group, 2002 #8} and has coordinated work in which the Dublin Core Accessibility Working Group has participated to develop an application profile for resources that will allow systems to match resources with their user's needs and preferences.

Within the community of people with disabilities, there are many who cannot configure computers and so their ability to use other than a pre-configured computer is limited. Industry Canada solved this problem by creating a smart card that could carry configuration information so that an equipped computer could instantly be configured and then reset to its default settings after use. This saves time, expertise and therefore costs for computer providers, and makes it possible for users to take advantage of the presence and availability of the computers.

The creation of a profile for the purposes of the example above might be by a professional who can assist the person with the disability. Once the original profile is established, the user may wish to add features such as changes that occur for them later in the day, when they are tired, or when they are in a particular location where their needs are different. A learner may have special support when they are learning but be expected to work without it during a test. In this way, a person may develop several profiles and a system somewhat like that which supports cascading style sheets may be necessary. (The Assistive Technology Resource Centre at the University of Toronto is already working on this aspect of the problem).

Establishing a person's profile is often a specialist's work and it is very unlikely that a resource author will know what should be provided for all the potential users. The exception to this is when secondary objects are created specifically for accessibility, such as captions for video content. In general, the profile's author is not likely to be able to predict what content or resources the user will want to access. Thus, the two profiles to

be created and matched come from very different sources. They need to match and hence the need for standardisation.

4.2 Cultural Heritage Work

The proposal currently before the Agents Working Group is focused on the need to describe contemporary (living) agents, with an emphasis on location and contact.

In the cultural heritage and library domains, many of the agents described are historical figures (sometimes only known as "the Athenian potter"), or by their public characteristics. The emphasis of the descriptions moves away from immediate contact details towards date of birth (DOB), place of birth (POB), language, ethnic/cultural group, life roles and other biographical details. Such descriptions are well-established in the museums context (see Getty's Categories for the Description of Works of Arts (10) and also the SPECTRUM schema (11).

The focus of people descriptions in the artistic and scientific works context is related to their history as authors. Accurately determining the providence of artifacts associated with them is usually the motivation for their descriptive records. Such records need to be standardised for convenience and economy.

UKOLN provides a resource headed "Metadata standards and specifications for describing people and their interests" that is "an overview of metadata standards and specifications for describing people and their interests, and particularly in relation to description of portal users. The overview includes various element sets that are specifically designed to describe actors in relation to events in the lifecycle of resources. The overview does not include metadata element sets that identify people in a particular role as an attribute of a resource".

The UKOLN resource points to the efforts of many organisations in this field and states: "Many of these initiatives and standards bodies tend to collaborate and draw upon each others work, and as will be shown in the overview they have many connections with each other. One example of connections between different efforts is the Internet2/Educause creation of an LDAP-based object class for eduPerson". {Group, 2002 #11}

As well, as UKOLN says: "The INDECS project is concerned with the same resource discovery elements as Dublin Core, but in addition embraces metadata for people (human and legal) and intellectual property agreements and the links between them".{Group, 2002 #12} This has now developed into the International Standard Musical Work Code {Group, 2002 #13} and the International Standard Audiovisual Number. {Group, 2002 #14} The need for people metadata, and the range of vocabularies and contexts for its application/use, is demonstrated by the examples above.

4.3 Business Information Systems

In the corporate context, there are use cases that again appear to lead to a need for a DCMI person element set.

A typical example of the problem as it occurs in the corporate world is that an organisation has structures and roles for people. People gain expertise and knowledge in certain areas over time. As time passes, people change within the roles and structure. They may move to other roles within the organisation, maintaining their contact details or changing them. There may be projects

cutting across roles, and people may move in and out of project teams. Human resource managers might need to know when people join and leave the organisation, and when they have been at work. Frequently, such information is held in a number of different databases and there is no inter-operability. All this information, however, is related to a single identity, the person at the centre of it.

Avoiding duplication has been shown many times to increase accuracy: a single record being updated when a person's circumstances change is far more likely to be accurate and useful than a set that can easily lack synchronisation.

In his call for the use of metadata to streamline business practices, Finkelstein says, "Previously each part of the business maintained its own version of "customer", or "client" or "prospect". They defined processes - and assigned staff - to add new customers, clients or prospects to their own files and databases. When common details about customers, clients or prospects changed, each redundant version of that data also had to be changed. It requires staff to make these changes. Yet these are all redundant processes making the same changes to redundant data versions. This is enormously expensive in time and people. It is also quite unnecessary." He argues that previously effort went into setting standards for information exchange but using metadata makes this much more efficient and economical. (19)

A recent survey of corporations and their use of metadata shows that currently a major use of metadata is to integrate business information systems. Nishikawa et al describe a typical business scenario that also calls for descriptions of people: "Modern multinational corporations realize the need to extend their search worldwide to find the service providers and experts they need to complete complex tasks. Work requires expertise from many fields: a pharmaceutical house would concentrate its efforts in biomedical areas and outsource all others; a telecommunications giant may want to outsource its customer support call centers and information technology help desk services; or a brokerage house may call upon an IT services firm for help with short term E-commerce projects. These service companies become critical to the success of the operations of the larger enterprise. Once expertise is outsourced to a services company, it is a challenge for the enterprise to find the people they need and for the service company to find projects they are best suited for." (20)

Currently organisations and corporations are busy using Dublin Core metadata to unify their enterprise information systems[1], usually including their people information systems. Typically the people data has been kept in separate databases and the Lightweight Directory Access Protocol (LDAP) {Group, 2002 #16} has been used to allow for interoperation of such information. It is being transformed into a special directory services XML

The problem with directory information is that there is not a comprehensive standard way of making structured descriptions of people so that what is exchanged is reliable and useful. This is despite the fact that there is the IETF (17)

---

[1] Joseph Busch, private communications, 2004.

inetOrgPerson standard for how information should be entered into directories and there are such as the eduPerson {Group, 2002 #18} specification for specific cases. A Dublin Core specification for use by LDAP communities would increase the interoperability of the people databases and also allow DC-based developers to use the same technology they use for the other information they are integrating.

4.4 Educational computing

In the case of education, profiles of people are critical. The achievements of a learner may be used to determine the suitability of a learner for new activities, or the choice of courses and materials for a particular learning activity. IEEE LOM specifies descriptions of learning objects so they can be matched to learners. The IMS Global Learning Consortium has developed what is called the Learner Information Package (LIP (21) that is used to match the learner to a learning object. The LIP contains detailed information about the learner, much of which is gained gathered in confidence and must be kept secure. The eduPerson specification is also described above.

As the move towards whole-of-life learning profiles develops to support people's transition through many institutions and experiences, the need for inter-operability of their profile increases. Currently there is work in Europe to standardise these profiles. {Group, 2002 #22}

The details of interest with respect to a learner may include their right to certain scaffolding during educational and public testing procedures, their achievements and otherwise, and their learning styles and behaviours. Such information will be used by them and against them, as it were: different purposes exist for the information being gathered but it all relates to a single person.

4.5 Mobile Computing

In the mobile computing context, it is important to be able to identify people quickly and bring to them, wherever they are, whatever access devices they are using, their usual interfaces and resources. The information required to do this is specialised but again, it revolves around the person.

Roussopoulos et al describe yet another situation: "Ubiquitous network connectivity for devices does not automatically imply continuous reachability for people. People move from place to place and switch from one network device to another. As a result, phones ring in empty offices, email cannot reach most cell phones, and spam clogs expensive, low-bandwidth links to laptops. Whereas existing mechanisms have addressed host mobility or the mobility of people within one network, few have allowed *people*, the ultimate and most important endpoints of communication, to roam freely, without being constrained to one location, one application, one device, or one network. We have designed the Mobile People Architecture (MPA) to maintain *person-to-person reachability"* (23).

4.6 Ontologies, the Semantic Web and Knowledge Management

Knowledge management systems that include inferencing and other computer processing of information, sometimes known as the Semantic Web (24), require standardisation of the syntax and semantics of information. Being able to use information from one context in

another demands more than simply that there is authority to do this. It is essential that the same kind of information is available in the same way from the two sources.

Particularly for the W3C Semantic Web, based on the Resource Description Framework that grew out of Dublin Core metadata, it is important to retain the Dublin Core architecture at the core. This is so that the vast collection of Dublin Core based metadata is available for use within the Semantic Web without alteration. Alternatively, it is so that the existing Dublin Core metadata can be used to access the Semantic Web without the need for alteration.

"Friends of a Friend" (FOAF) (25) is a playful application that shows the value of this: the few degrees of separation of friends is demonstrated by inference rules being applied to a set of photographs that identify the people in them only by providing their email addresses. Finding people of similar interests, expertise, roles, needs and more could easily be achieved the same way. In fact, it is generally known that the US government is attempting to locate people who are likely to be engaged in terrorist activity by applying similar inference rules that consider who they are, where they have been, and who they associate with.

Although ontologies are emerging that will bridge the gap between information systems, they too will depend upon structured semantics for their success. Again, ontologies can evolve from Dublin Core metadata but they will do so more easily if they are using the same semantic structure and they will also be more interoperable.

Miller muses on the recent experiences with FOAF and suggests that the lessons learned include the benefit of structured metadata and the interoperability problems that will plague ontologies without it. (26)

Seiner describes "Meta Data As A Knowledge Management Enabler". He "briefly describes three types of meta data associated with knowledge: stewardship meta data, business meta data, and artifact meta data". He says, "Someone was (or will be) responsible for keeping the documentation about the process up to date. Someone was responsible for approving the process and giving permission for it to become the standard way of handling customer complaints. All of this information that focuses on the people associated with the knowledge is stewardship meta data – or data about who is accountable for the knowledge." He continues, "Without this information, there is no way to manage accountability, and thus it becomes very difficult to be certain that the knowledge assets are being managed by the correct people." (27)

The Netherlands Biodiversity Information facility wants to manage information about expertise, among other things {Group, 2002 #27;Group, 2002 #27;Group, 2002 #27;Group, 2002 #27}; The Northern Ireland Statistics and Research Agency is working with information about people (29) and many, many more examples exist. In some cases, the same person is being defined by a range of agencies or businesses and yet each time, without an integrating standard, these organisations create new, unlinked profiles that are neither interoperable or easily maintained.

This list of situations in which people metadata is being used is exhausting, if not exhaustive.

4.7 Other issues

The identity of people is always a problem. Names are not sufficient, but even if they were, there are times when they should not be disclosed. In Europe, identity numbers for people are generated from a set of static information, such as the product of the person's birthday multiplied by their mother's age when they were born multiplied by the numeric code for the country in which they were born. These use numbers that are stable and independent of time, place, name, et cetera. Bio-graphics and biometrics are being used to identify people. Although these are not acceptable universally because they discriminate against certain groups (e.g. iris-scans are not appropriate for blind people), they are in use in large numbers.

People may have different types of records: curricula vitae, human resource records, genealogies, photographic collections and more. Thus descriptions of a person should be capable of being qualified in a standard way to show what type of description is being offered.

Clearly the privacy issue is relevant in such a context, but this is not a problem exclusively for people data. Organisations have the need for control of information of all kinds, and having a standardised way of representing that information simply makes it easier to extend the use of their control technologies. It would be possible to include ways for people to verify the information about themselves, for instance with a digital signature, or public key encryption. In this way, they could also determine what is to be published and what is private or confidential in what circumstances. For resources, A-core metadata is usually used to control access to the metadata. In the case of people metadata, this may need to be exposed, as part of the actual metadata.

5 The Size of the Task of Creating a New Element Set

Clearly, there are many standardised, interoperable systems being used so the task of finding functional requirements for a new element set is not one that calls for initiating activities, as did the original DCMES. There is a highly developed architecture for DCMES, a well-developed set of user guidelines, a huge base of DC expertise, thousands of metadata repositories managing both small and large collections of resources, and many other of the pieces required for a standard.

In this paper, we advocate a new activity to make explicit a standard Dublin Core People Metadata Element Set (DCPMES) to support the efforts of those who are already using the established DCMES.

Some years ago, this may have been a substantial task. In the context of recent work, especially work on application profiles, it should be a lot easier. It is especially helpful that there is no longer the major concern about constraining the use of Dublin Core elements. Instead of having the focus so strongly on the 'core' elements, as was considered essential in the early days of Dublin Core, there now appears to be an emphasis on maintaining the DCMES as the core of metadata application profiles.

So what we recommend for the DCPMES is a core for people metadata. That core will be revealed more than developed - it

should be the result of a process of discovering what implementers are doing and a rationalisation and harmonisation of that

Currie et al (30) described the process of developing a shared application profile as one in which application profiles are aggregated, rationalised and then, if necessary, harmonised. Rationalisation involves recognising the similarities and merging them and harmonisation requires choices between different ways of describing the same objects.

The definition of a new element set will, of necessity, involve the task of determining the choice of elements and also of the potential values for those elements. But, asshown, it will not be necessary to initiate definitions of these. They probably already exist in suitable forms, already documented

in namespaces, and so it is very likely that the task will involve more rationalisation and less harmonisation.

6 Conclusion

The survey above of who is doing what suggests, as asserted at the beginning of the paper, that many groups or organisations already working with Dublin Core metadata would find it useful if they could use an extended range of recommended, standardised metadata elements. These should cover people as the original set covered resources. The overlap and difference between the purposes and attributes of people and resources are such that the model of the DCMES would inform the development of a new set but that the process of trying to bend the current set to fit the new purpose is not an effective one.

References

1. *DCMI Agents Working Group*. Retrieved 2004-05, from http://dublincore.org/groups/agents/
2. Bearman, D., Caplan, P., & Dillon, M. (1998). *Proposal to replace DC Elements Creator, Publisher, Contributor with New Element Agent*. Retrieved 2004-13-05, from http://www.archimuse.com/dc.agent.proposal.html
3. Weibel, S., & Koch, T. (2000). The Dublin Core Metadata Initiative: Mission, Current Activities, and Future Directions. *D-Lib Magazine, (6) 12*. Retrieved 2004-05, from http://www.dlib.org/dlib/december00/weibel/12weibel.html
4. Hunter, J., Brickley, D., & Lagoze, C. (1999). *ABC: A Logical Model for Metadata Interoperability*. Retrieved 2004-05, from http://www.ilrt.bris.ac.uk/discovery/harmony/docs/abc/abc_draft.html
5. *Metadata: Storing Dublin Core Metadata in a ROADS database*. (1999). Retrieved 2004-05, from http://www.ukoln.ac.uk/metadata/roads/metadata-mgmt/dcroads.html
6. *Agents Working Group Notes -- DC 2003, Seattle*. (2003). Retrieved 2004-05, from http://dublincore.org/groups/agents/notes-200308.html
7. Wilson, A., & Clayphan, R. (2004). *Functional Requirements for Describing Agents (Working Draft 2)*. Retrieved 2004-05, from http://dublincore.org/groups/agents/agentFRdraft2-2.html
8. *IMS Global Learning Consortium*. Retrieved 2004-05, from http://www.imsglobal.org

9. *AccessForAll*. Retrieved 2004-05, from
http://www.imsglobal.org/accessibility/index.cfm#version1pd

10. Baca, M., & Harpring, P. (2000). *Categories for the Description of Works of Art (CDWA)*. Retrieved 2004-05, from
http://www.getty.edu/research/conducting_research/standards/cdwa/

11. *SPECTRUM: The UK Museum Documentation Standard*. (2002). Retrieved 2004-05, from
http://www.mda.org.uk/spectrum.htm

12. *Metadata Resources: Metadata standards and specifications for describing people and their interests*. Retrieved 2004-05, from
http://www.ukoln.ac.uk/metadata/resources/people/

13. *<indecs>™ Framework Ltd*. Retrieved 2004-05, from
http://www.indecs.org/

14. *ISWC International Agency*. 2004-05, from
http://www.iswc.org/iswc/en/html/home.html

15. *International Standard Audiovisual Number (ISAN)*. 2004-05, from
http://www.isan.org/

16. *OpenLDAP*. Retrieved 2004-05, from http://www.openldap.org/

17. Smith, M. (2000). *RFC 2798: Definition of the inetOrgPerson LDAP Object Class*. Retrieved 2004-05, from
http://www.openldap.org/

18. *eduPerson Object Class*. Retrieved 2004-05, from
http://www.educause.edu/eduperson/

19. Finkelstein, C. (2001, January). Meta data and XML for business. *The Data Administration Newsletter, 15.0*. Retrieved 2004-05, from
http://www.tdan.com/i009fe03.htm

20. Nishikawa, M., & Schlumberger, K. (2003). *A metadata network for bridging people and places*. Retrieved 2004-05, from
http://www.mulberrytech.com/Extreme/Proceedings/html/2003/Nishikawa01/EML2003Nishikawa01.html

21. *IMS Learning Information Package (LIP) Specification*. (1999). Retrieved 2004-05, from
http://www.imsglobal.org/profiles/index.cfm

22. *Europortfolio*. Retrieved 2004-05, from
http://www.qwiki.info/projects/Europortfolio

23. Roussopoulos, M., Maniatis, P., Swierk, E., Lai, K., Appenzeller, G., & Baker, M. (1999). *Person-level Routing in the Mobile People Architecture*. Retrieved 2004-05, from
http://mosquitonet.stanford.edu/publications/USITS1999/USITS1999.html

24. *Semantic Web Activity*. (2004). Retrieved 2004-05, from
http://www.w3.org/2001/sw/

25. *The friend of a friend (foaf) project*. (2004). Retrieved 2004-05, from
http://www.foaf-project.org/

26. Miller, L. (2000-11-30). *Ontologies and Metadata*. Retrieved 2004-05, from
http://www.ilrt.bris.ac.uk/discovery/2000/11/lux/

27. Seiner, R. (2001, January). Meta data as a knowledge management enabler. *The Data Administration Newsletter, 15.0*. Retrieved 2004-05, from
http://www.tdan.com/i009fe03.htm

28. *NLBIF Metadata Search*. Retrieved 2004-05, from
http://145.18.162.30/metadata/searchpersons.php

29. *Census 2001 - Metadata*. (2002, December). Retrieved 2004-05, from

http://www.nisra.gov.uk/census/metad
ata/glossary.html

30. Currie, M., Geilesky, M., Nevile,
L., & Woodman, R. (2002).
*Visualising interoperability: ARH,
aggregation, rationalisation,
harmonisation*, 2004-05, from
http://www.bncf.net/dc2002/program/f
t/paper21.pdf

31. Enterprise Information Research
Group (2002). *EIRG Breast Cancer
Knowledge Online*, 2004, from
http://www.sims.monash.edu.au/resear
ch/eirg/bcko.html