Metadata standards for the description of portal users: a review

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Version 1.0
14 January 2003

PORTAL Workpackage 6

Acknowledgements

Table of contents

Introduction

One of the key aims of the PORTAL project is to deliver personalised content to users in an effective manner. In order to provide this service, the system needs to gather appropriate personal information from existing corporate systems and store it for use within the portal. A standardised metadata solution is required to support this function.

This document provides a review of metadata standards and specifications for describing people and their interests, particularly in relation to description of portal users. Section 1 presents an overview of selected products, both general and environment-specific (e-Commerce, governmental and educational). Since it was not relevant or practical to examine all these specifications in depth, a more focused approach was required. This was discussed amongst the PORTAL team. It seemed logical to concentrate on standards developed specifically to meet educational needs. Preliminary research also revealed that IMS LIP and eduPerson were the two leading products within higher education and were therefore likely to be the most appropriate for the PORTAL project. For these reasons therefore, Section 2 reviews the IMS Learner Information Package (LIP) and eduPerson in more detail.

Data protection

Data protection is out of scope for this workpackage, but it is nevertheless worth flagging as a key issue for service implementation.

As mentioned below, LIP enables the inclusion of mechanisms for maintaining privacy and protecting the integrity of data. The Centre for Educational Technology Interoperability Standards (CETIS) also recommends that institutions should use some form of encryption and a secure connection for transmitting LIP data.

The eduPerson FAQ acknowledges that many of the attributes contained within the specification raise profound questions about privacy, but suggests this is a local policy issue, rather than an eduPerson issue. However, it is recognised that policy issues will continue to be a prominent feature in ongoing eduPerson development work.

Section 1: Overview of standards and specifications

The overview includes various element sets that are specifically designed to describe people and their interests. It does not include metadata element sets that identify people in a particular role as an attribute of a resource (eg Dublin Core Metadata Element Set, the Encoded Archival Context), name authorities (eg Library of Congress Name Authority File (LCNAF), International Standard Archival Authority Record for Corporate Bodies, Persons and Families (ISAAR(CPF)) or entries from national biographies. Element sets that describe people as part of a larger more generic schema are not covered in this overview. Also omitted is the Semantic Web work on ontologies for describing people, as well as standards and specifications that exist within software and user management systems (for instance, LDAP-based object classes, such as sambaAccount and posixAccount).

Many of these initiatives and standards bodies tend to collaborate and draw upon each other's work, and as shown below 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.

General

Friend of a Friend (FOAF)

The FOAF[1] element set provides a set of properties and classes, focusing initially on people, documents, organisations, images etc. FOAF is a simple vocabulary for describing social networks, people, organisations etc. The FOAFCorp[2] (Corporate Friends of Friends) experiment extends the scope to describe the interconnections and structure of corporate entities. The schema is still under development.

vCARD

vCard is a set of metadata elements defined by the Internet Engineering Task Force (IETF) as a standard for representing information about people and organisations, such as that which is profiled in a common business card.

vCards carry directory information such as name, addresses (business, home, mailing, parcel), telephone numbers (home, business, fax, pager, cellular, ISDN, voice, data, video), email addresses and URLs. vCards can also contain graphics and multimedia (photographs, company logos, audio clips). vCards hold geographic and time zone

information (eg to let others know when to contact). vCards support multiple languages.

According to their overview[3] the vCard specification is 'transport and operating system independent so you can have vCard-ready software on any computer. vCards are Internet friendly, standards based, and have wide industry support'. vCard is used in applications such as Internet mail, voice mail, web browsers, telephony applications, call centres, video conferencing, PIMs (Personal Information Managers), PDAs (Personal Data Assistants), pagers, fax, office equipment, and smartcards.

vCard v.3 is defined in two parts, RFC 2425[4] and RFC 2426[5]. Renato Iannella has written an article on Representing vCard v3.0 in RDF schema[6].

e-Commerce

INDECS (Interoperability of Data in E-Commerce Systems)

INDECS[7] (now completed as a 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. Its basic model has evolved from the copyright societies' CIS (Common Information System) plan, initiated in 1994 and the initiator of the ISO proposals for the International Standard Work Code (ISWC) and International Standard Audiovisual Number (ISAN). The <indecs> metadata framework: principles, model and dictionary is available[8].

Governmental

NIH Organisational Person Schema

The US National Institute of Health (NIH) are developing a strategy for a secure, centrally coordinated NIH electronic directory that coordinates directories for email, personnel, parking, etc. NIH has constructed a schema for their associated parties. The schema, Organisational Person Schema[9] (OPS), seeks to create an inter-institutional community object class for higher education. The scope is similar to that of eduPerson (see below).

UKgov - Schema for citizen details

The UK Government is establishing the means for citizens and businesses to be able to transact business with the government electronically. The schema[10] includes elements for passport number, national insurance number etc.

Educational

Short overviews of PAPI and ULF follow below. The remaining two educational specifications (IMS LIP and eduPerson) are reviewed in Section 2.

IEEE PAPI draft standard

PAPI (Personal and Private Information)[11] specifies the syntax and semantics of a 'Learner Model', which will characterise a learner (student or knowledge worker) and his or her knowledge/abilities. This will include elements such as knowledge (from coarse to fine-grained), skills, abilities, learning styles, records, and personal information. The standard will allow these elements to be represented in multiple levels of granularity, from a coarse overview, down to the smallest conceivable sub-element. The standard will allow different views of the Learner Model (learner, teacher, parent, school, employer, etc.) and will substantially address issues of privacy and security.

A key feature of the PAPI Learner Standard is the logical division, separate security, and separate administration of several types of learner information: (1) personal information. eg name, address, social security number; (2) relations information eg cohorts, classmates; (3) security information eg public keys, private keys, credentials; (4) preference information eg useful and unusable I/O devices, learning styles, physical limitations; (5) performance information eg grades, interim reports, log books; (6) portfolio information eg accomplishments and works. These six types of information are also known as 'profile information' and 'learner profiles'.

The PAPI Learner standard may be integrated with other systems, protocols, formats, and technologies.

The standard allows different views of the Learner Model (learner, teacher, parent, school, employer, etc) and substantially addresses issues of privacy and security.

The purpose of this standard is:

- To enable learners (students or knowledge workers) of any age, background, location, means, or school/work situation to create and

build a personal Learner Model, based on standards, which they can utilise throughout their education, learning experiences and work life

- To enable courseware developers to develop materials that will provide more personalised and effective instruction

- To provide educational researchers with a standardised and growing source of data

- To provide a foundation for the development of additional educational standards, and to do so from a student-centred learning focus

- To provide architectural guidance to education system designers.

PAPI Learner was initially developed for learning technology applications but may be easily extended to other types of human-related information such as medical and financial applications.

Universal Learning Format

Universal Learning Format[12] (ULF) draws its learner information from standards such as the Dublin Core Metadata Element Set and vCard. Except for the content description, the ULF consists of a Competency Format for describing skills, knowledge; a Certification Format which is an interchange format for certification-related information (a certification is a group of learning offerings that a learner must complete in order to gain a certification or to be qualified in a particular educational area or field); and a Profile Format that describes learner profile information, name, title roles, competencies, certifications and learning results[13].

Section 2: Review of the leading relevant contenders

Like PAPI and ULF above, IMS LIP and eduPerson were developed specifically for the educational environment.

IMS Learner Information Package

IMS background and development

IMS[14] (originally known as the Instructional Management Systems project) focuses on standards for learning technologies. It defines interoperable specifications for exchanging learning content and information about learners among learning system components. In addition to defining technical specifications, IMS aims to promote their incorporation into products and services worldwide. The IMS Global Learning Consortium, Inc has an international membership and collaborates widely with other standards bodies around the world. In the UK, the Centre for Educational Technology Interoperability Standards (CETIS)[15] is funded by JISC to support use and development of educational technologies.

The IMS Technical Board manages the individual Project Groups which develop the specifications. Functional requirements are gathered from a range of interested parties including end users, content providers and software vendors; feedback is subsequently sought on draft specification documents. A specification typically consists of an information model, an XML binding and a best practice guide. At the time of writing in November 2002, nine specifications have been released: Metadata, Accessibility, Enterprise, Question and Test Interoperability, Content Packaging, Reusable Competency Definitions, Digital Repositories, Simple Sequencing and the Learner Information Package[16].

Learner Information Package: background

The Learner Information Package (LIP) specification was released in March 2001. Version 1.0 consists of three documents:

- IMS Learner Information Package Information Model

- IMS Learner Information Package XML Binding

- IMS Learner Information Packaging Best Practice & Implementation Guide

Representatives from JISC/CETIS have contributed to the development of the above documents. The LIP Information Model document includes UK Higher Education (Inter-organisational) as a use case. A useful LIP 'primer' is also provided[17]. Version 1.1 is due for release in early 2003.

Learner Information is understood to be a collection of information about a learner (which could be an individual or a group) or a producer of learning content (creators, providers or vendors). The aim of the specification is to define a set of packages that can be used to import data into and extract data from an IMS compliant Learner Information server.

Structure

Segments

Within the LIP, learner information is divided into eleven 'segments' or categories, ranging from the expected identification requirement, to other more 'administrative' information such as security key. The segments are as follows:

- Identification (name, address, email etc)

- Goal (learner's personal goals and aspirations)

- QCL (qualifications, certifications and licenses)

- Accessibility (language information, disability/accessibility information)

- Activity (education/training work; can include digital representations related to the activity, e.g. a digital representation of a work of art)

- Competency (skills acquired, either formal or informal)

- Interest (hobbies and other recreational activities)

- Transcript (a placeholder for emerging standards from other organisations)

- Affiliation (eg professional associations)

- Security Key (passwords etc)

- Relationship (used to store the description of the relationships of data contained in the other segments).

Currently several other groups are working on areas related to Accessibility, Competency and Transcript, so these segments have not yet been fully defined; they are likely to evolve to support the work resulting from these groups.

Elements

Within each segment data elements and structures are defined. The specification includes a huge range of data elements, in order to support the requirements of all the different servers which support learning activities. Most of these are optional; it is expected that most services will only use a small number of the possible elements. However one very complex use case that informed the specification's development, has used almost all the available elements. The developers are keen to stress that the elements eventually included were rigorously checked - any elements that did not directly support online learning were excluded.

LIP also provides facilities for extending the specification to meet local needs, allowing implementors to extend an element to provide greater granularity or definition.

The specification defines and describes the vocabularies and taxonomies that are supported as default by IMS. Vocabularies are held outside the LIP structure, linked by external pointers.

XML schema

LIP is the first IMS specification that uses XML schemas rather than a DTD; one of the reasons for this choice is that XML schemas provide the capability to define element names in the document. However although the XML binding is included, the Information Model document states that it is not meant to exclude other bindings.

Data protection

LIP enables the inclusion of mechanisms for maintaining privacy and protecting the integrity of data. The specification does not, however, specify the form, format or type of these mechanisms or policies for their use. These must be determined by specific implementations in accordance with their requirements.

Related IMS specifications

IMS also produce the closely related Enterprise specification, which is designed to transfer data relating to groups of learners between systems, eg between a student records system and a portal.

Implementations

The IMS web site maintains a useful directory of products and organisations supporting IMS specifications; there is no mention here of any LIP implementations, although it is likely that some organisations in the early stages of development will not yet have contributed details. The CETIS *Standards-compliant products directory*[18] does not list any software products that have implemented the LIP either.

There are however two UK Managed Learning Environment (MLE) projects already using LIP: SHELL[19] (based in South West England) and NIIMLE[20] (based in Northern Ireland). Both projects are using LIP records to allow students to take courses and modules from any of the member institutions (both HE and FE) and receive credits as appropriate.

A factor influencing this takeup was the decision of the JISC MLE Steering Group that participating systems would be required to support IMS specifications[21]. This enables institutions to choose their own software based on individual requirements, but ensures that they are able to move content between services, and therefore not be locked in to a particular vendor.

There are several other UK institutions which are planning to implement LIP; one of these is Staffordshire University which has already implemented the Enterprise specification[22].

Cost

Since IMS specifications are available to implement free of charge, there are no direct costs to the institution. However, there may be considerable indirect cost implications[23]; these could include staff development, the modification of existing metadata to achieve high granularity, and modification to achieve compliance.

Support

As mentioned above, CETIS represents UK Higher and Further Education on international educational standards initiatives including IMS. The CETIS web site provides briefing papers and links to articles and information on IMS specifications. The JISC report comments that 'current provision for the support of stakeholders is limited mainly to literature'[24]. However, although CETIS can only offer limited personal support, indirect support is provided more specifically by the LIP Special Interest Group (SIG)[25]. This has over 20 UK members. LIP SIG have produced a useful introduction to

the LIP, which provides a UK perspective to the work[26]. LIP SIG also promotes the development and take-up of the related IMS Enterprise specification

The Centre for Recording Achievement and CETIS have mapped the UK HE Transcript to LIP 1.0[27], setting out a common means by which Higher Education Institutions can exchange information about a learner whatever software they operate. It is intended to support pilots that will be undertaken in 2003 which will cover the exchange of information between further and higher education.

The FEFC ISR (Individualised Student Record) has also been mapped to LIP.

Relation between IMS LIP and other standards

The IMS LIP and PAPI

The IMS LIP has been derived in part from PAPI (versions 5.0, 6.0 and 7.0). PAPI Learner is a data interchange specification, ie supporting communication among cooperating systems. The data is exchanged: (1) via external specification, ie only PAPI Learner coding bindings are used while some other data communication method is mutually agreed upon by data exchange participants; (2) via control transfer mechanism to facilitate data interchange, eg PAPI Learner API bindings; (3) via data and control transfer mechanisms, eg PAPI Learner protocol bindings.

IMS LIP and vCard

The vCard specification allows the open exchange of Personal Data Interchange (PDI) information typically found on traditional paper business cards. The specification defines a format for an electronic business card, or vCard. The vCard specification is suitable as an interchange format between applications or systems. An XML binding of the vCard specification has produced a DTD and this has been used to inform the development of the IMS Enterprise Person structure. The LIP *Best Practice & Implementation Guide*[28] states that LIP is fully compatible with the IETF vCard specification, ie all of the vCard fields can be contained by an LIP-XML instance.

eduPerson

eduPerson: background

eduPerson[29] was designed to facilitate communication between higher education institutions. The EDUCAUSE/Internet2 eduPerson task force saw its mission as:

> Defining an LDAP object class that includes widely-used person attributes in higher education. The group will draw on the work of educational standards bodies in selecting definitions of these directory attributes.

eduPerson Object class version 1.6 was released in October 2002. (Version 1.0 dates from January 2001.) The working group was composed of a number of US universities including the University of Wisconsin, Georgetown University, University of Washington and MIT.

Structure

eduPerson consists of a set data elements about individuals within higher education, together with recommendations on the syntax and semantics of the data that may be assigned to those attributes. Information is organised into object classes and attributes. Each named attribute holds a specific data element such as phone number, address etc. An object class is a defined set of attributes relating to a particular type of directory entry.

Attributes

Many of the eduPerson attributes are intended to support applications such as controlled access to web pages or licensed resources. Most are related to instructional and research use rather than to internal institutional operations. For example, a set of web pages developed for a particular course at one institution could be authorised and made securely available to a student group enrolled on a similar course at another institution.

There are 42 attributes in total listed in eduPerson version 1.6. These are divided into two types:

- General attributes already contained within higher level or 'parent' object classes in commercial directory server products (eg name, email address, security settings etc).

- Eight 'new' attributes, created by the working group to facilitate collaboration between institutions (there were six originally; two were added in version 1.6).

The eight new attributes are as follows:

- eduPersonAffiliation: specifies the person's relationship(s) to the institution in broad categories eg student, faculty, alumni etc

- eduPersonEntitlement: URI that indicates a set of rights to specific resources (added in version 1.6)

- eduPersonNickname: informal name

- eduPersonOrgDN: distinguished name of the directory entry representing the institution with which the person is associated

- eduPersonOrgUnitDN: distinguished name(s) of the directory entries representing the person's organisational unit(s)

- eduPersonPrimaryAffiliation: specifies the person's *primary* relationship to the institution in broad categories eg student, faculty, alumni etc

- eduPersonPrimaryOrgUnitDN: distinguished name of the directory entries representing the person's *primary* organisational unit (added in version 1.6)

- eduPersonPrincipalName: 'netID' of the person for the purposes of inter-institutional authentication.

The same list of 'permissable values' (if controlled language is required) is provided for eduPersonAffiliation and eduPersonPrimaryAffiliation. The notes acknowledge that this list is incomplete, but the view is that additional values should result from discussions with stakeholder communities.

The documentation states that for the general attributes, eduPerson has focused on developing HE-appropriate recommendations on syntax, semantics and use, in order to reduce ambiguity. However, semantics have not been included for all the attributes. The notes recommend avoiding use of several of the attributes listed.

Each attribute has an associated 'application utility class' which is intended to suggest the class of applications for which this attribute is appropriate. The three classes are as follows:

- Core: the minimum attributes (cn: common name; sn: surname; and eduPersonOrgDN: the distinguished name of another entry in the directory that represents the person's home institution)

- Standard: an expanded list of attributes that are adequate to support a full-featured white pages and directory of directories

- Extended: the rest of the defined attributes, supporting a larger class of potential applications.

The only mandatory attributes are the two listed as mandatory by the X.521(1993) person object class: common name and surname. The local institution decides whether or not to populate the other attributes.

It is anticipated that institutions will develop local object classes to capture local attributes which eduPerson does not aim to provide.

In addition, the eduPerson specification includes recommendations on search and indexing characteristics and other technical issues.

Implementations

The FAQ (dated February 2001) states that many institutions had agreed to implement the eduPerson object class including University of Wisconsin, Georgetown University, Johns Hopkins University, University of Memphis, University of Michigan etc. There is no updated implementation information on the website.

The person specification provided within uPortal[30] (the portal software already implemented by the University of Hull) is based on eduPerson. uPortal is being developed by the Java in Administration Special Interest Group (JA-SIG)[31], mainly composed of HE institutions. As well as Hull, a number of other UK institutions are actively developing, or evaluating, use of uPortal.

Development

It is anticipated that the eduPerson object class will evolve rapidly over the next few years as more experience is gained in inter-institutional sharing, directory operation etc. However 'the firm commitment is to avoid altering or tinkering with existing features and definitions to the maximum possible extent.' Despite this, the letter to implementers of eduPerson v 1.0[32] warns that implementers should be aware of its planned evolution and exercise caution when setting up services, with the implication that some work may have to be repeated.

Interestingly, the eduPerson FAQ[33] points out that approaches such as the Grid[34] are building advanced scientific computing environments that layer, in part, on top of eduPerson.

IMS LIP and eduPerson: alignment?

It is not immediately clear whether the IMS LIP and eduPerson specifications are complementary or competing. The eduPerson FAQ states the following:

The IMS Learner Information Packaging (LIP) Specification defines application-independent structured data models for representing a rich panoply of learner information. The eduPerson object class defines how some subset of the same person information might be represented in an enterprise directory. We are in communication with senior IMS staff and will align our ongoing efforts as appropriate. In version 1.0 of IMS LIP, an XML binding for the core data model is provided. That XML binding might well be the most logical point of integration and mapping between the two efforts.

Despite the eduPerson object class being described as a subset of LIP, in structural terms, it is not in fact a direct subset. The LIP data structure is a lot more detailed, eg the eduPerson givenName attribute is broken down in LIP into partname (first/last), typename (from a vocabulary), and text (the name itself); there is also formname (detailed formatted name), which appears to be equivalent to commonName in eduPerson.

The LIP *Best Practice & Implementation Guide*[35] states that:

the eduPerson specification is an object class for LDAP services whereas LIP is a set of data objects for the exchange of learner information and not just directory-related information.

An example of how to use the IMS LIP to exchange eduPerson information is given in the above *Guide*. A table maps EduPerson Object Definitions to the LIP Data Structure. However it only includes the 'new' eduPerson attributes, and is also based on version 1.0, which means that just six of the eight current eduPerson attributes are mapped (from a possible total of 42).

Data elements currently stored by the University of Hull portal

uPortal[36] has been implemented at the University of Hull in order to provide portal services to users. The data elements provided as standard within uPortal for storing information about people are based on the EduPerson specification. Just 12 data elements are currently stored in Hull's implementation. These are as follows:

- Given name (first name)

- Surname

- Email address

- Username

- Faculty name

- Faculty code

- Department name

- Department code

- Hull ID (student or staff ID)

- Affiliation (used to store campus location ie Hull/Scarborough)

- Type (ie staff/student)

- Programme of study course code for students

However it is likely that more data elements will be added as more functionality is added, since different applications will require the presence of different elements. One additional requirement is to store some information on the role of staff, based on their negotiating body.

Section 3: Summary and recommendation for the PORTAL project

Arguments in favour of using IMS LIP

- IMS as a whole has a longer history (although the IMS LIP and eduPerson were released at almost exactly the same time, at the beginning of 2001)

- IMS LIP could be a more stable product than eduPerson (cf the warnings in eduPerson documentation to exercise prudence when implementing, because of planned changes to come)

- IMS LIP probably has more users than eduPerson (although this is difficult to gauge precisely, given the lack of up-to-date information on the web)

- There has been UK involvement in the development of IMS (primarily via CETIS, also via commercial software developers), but not in eduPerson

- CETIS provides a focus for IMS in the UK and more specifically, the LIP Special Interest Group provides UK support for the LIP

- There are already several LIP users in the UK

- If IMS becomes widely used in the UK, it would be simple to integrate the LIP with other IMS specifications eventually used by institutions

- Given its huge range of attributes LIP is more likely than eduPerson to cover PORTAL attributes added later

- IMS LIP has a much broader remit (the exchange of all types of learner information and not just directory-related information), and is therefore more likely to contain facilities to manage functionality required by the portal in the future.

Arguments in favour of using eduPerson

- It may be an advantage that eduPerson is developed by a group of universities themselves (unlike IMS, where development is largely driven by software companies)

- There is a huge number of attributes in LIP that will never be required by the portal service

- The person specification provided within uPortal (the portal software already implemented by the University of Hull) is based directly on eduPerson

- Provided that eduPerson supports all the functionality required, it is preferable to select the simpler option, with potentially lower overheads (in terms of implementation effort).

Discussion

Both IMS LIP and eduPerson appear to support the attributes required by the project. Not all the current attributes are directly provided (eduPerson does not include eg faculty code or course code), but it is intended that local attributes should be created. LIP also provides extension facilities.

Both initiatives make their specifications available free of charge. There is therefore no direct financial cost involved in selecting either option.

The above arguments in favour of using IMS LIP appear to outweigh, in number at least, those of using eduPerson. However this does not automatically mean that LIP should be selected. Some arguments carry more weight than others. The final listed argument in favour of eduPerson (that of selecting the simpler option that supports current functionality, without incurring unnecessary overheads), is a strong one, and probably outweighs the others.

Despite this, given the speed of development of portal type services, it is tempting to try to 'future-proof' the University of Hull portal as far as possible. This is especially important since it is not a 'proof of concept' project, but providing a university service, which is already in use. However, if IMS is required for wider institutional use in the future, eduPerson attributes could be mapped to IMS LIP. As described above, a basic mapping is provided within the LIP documentation.

The fact that eduPerson has been designed by HE for HE is another strong element in its favour; it has also been used as the basis for person specification by international HE developments such as uPortal.

IMS LIP appears to be more appropriate for institutional or inter-institutional extended profiling needs, whereas eduPerson provides adequate facilities for current portal requirements.

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Appendix A

Comparison of attributes

University of Hull portal	eduPerson	IMS LIP
givenName	givenName	identification.partname; typename; text
sn	sn	identification.partname; typename; text
mail	mail	identification.email
uid	uid	identification.uid
faculty ou	ou	-
faculty code	-	-
dept ou	ou	-
dept code	-	-
hull_id	-	-
localityName	localityName	-
eduPersonAffiliation	eduPersonAffiliation	affiliation.classification
pos_crse_cd	-	-

Explanatory notes:
givenName = first name
sn = surname
mail = email address
uid = user id
ou = organisational unit (with which the named object is affiliated)
hull_id = student or staff ID
localityName = campus location ie Hull/Scarborough
type = staff/student
pos_crse_cd = programme of study course code for students

The eight new eduPerson attributes created by the working group, are prefaced with eduPerson, eg eduPersonAffiliation.

commonName (eduPerson attribute no.10) = full name
eduPersonPrincipalName = for inter-institutional authentication