Achieving Learner Information interoperability

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1 Introduction

Learner Information is likely to be the type of learning related information that has been digitally stored for the longest time. Computer systems have been used since the seventies to store and manage information about employees, pupils and students, as a part of the governmental and/or regional administration. Most of the Learner Information stored in older systems are however of an administrative type for register keeping etcetera. There are however an increasing need to record and store other types of Learner Information that is related pedagogy and life-long learning. The long use of administrative systems means that at least a core of the information needed in the educational system is already digitally available - but often not accessible. There are two main reasons for the inaccessibility of Learner Information: Firstly there is policy. Some of the information about the learner is not permitted to be used outside administrative systems and there are no mechanisms to exchange the information (or parts of it). Secondly the information is often locked into proprietary data formats. Most existing systems pre-date current standards by far. This, in combination with a market with only a few suppliers of administrative system, has a checking effect on the use of standards. The importance of standards is gradually increasing as Learner Information is needed in an increasing number of systems for e-learning. In order to avoid redundancy and corruption of information it is essential to enhance the interoperability and transferability of Learner Information between different systems in order to reuse data in new contexts, in combination with fragments of other types of Learner Information from other sources.

There are a couple of general, established standards for storing, processing and exchanging information about people and users. Some of the most important are the *Lightweight Directory Access Protocol (LDAP)* specifications for catalogues and the *vCard* specifications for digital "business cards". In addition to the general standards initiatives there are a couple of initiatives focusing on e-learning and Learner Information. Some of the most important efforts are the *IMS Learner Information Package (IMS LIP)* and the IEEE-LTSC specifications (formerly called) *Personal and Private Information (PAPI)*[1] (referred to as ex-PAPI further on). IMS LIP and ex-PAPI are similar in many ways and they more or less address the same information domain. There are however some differences: while IMS LIP tends to take on a classical CV-structured approach to Learner Information, ex-PAPI has a stronger focus on performance information and interpersonal relationships [2]. In addition to the differences mentioned above, there are some important technical divergences regarding their respective data models [1] [2]. While IMS LIP is XML-centric, ex-PAPI has a number of different bindings to programming languages APIs, protocols and data representation formats (including XML). Ex-PAPI uses a registry-based approach which means that it becomes less sensitive to changes and a bit more susceptible to additions. Ex-PAPI has a focus of separating different types of Learner Information - such as contact and performance information [1]

1 Ex-PAPI is now incorporated in the work of the ISO/IEC JTC1 SC36 initiative on Learner Information (SC36/WG3). The actual work is however divided and now spread over several SCs and WGs.

[2]. While IMS LIP categories the data into 11 different categories (and ex-PAPI into 6), IMS LIP has no technical mechanisms for separating the data. This might be a weakness when combining information from different sources: such as LDAP data for contact and LMS data for performance or when there is a need to separate different types of information for integrity and security reasons.

Besides IMS LIP and ex-PAPI, there are some limited efforts that address specific parts of the Learner Information. *EduPerson* is an example of a LDAP schema-class for Learner Information. EduPerson can be used in combination with other standards to store catalogue data in an LDAP catalogue. Universal Learning Format (ULF) is another effort. ULF is based on different standards such as vCard and RDF but, in spite of that it is a proprietary format.

2. Current situation

A small study, with the purpose of establishing the current state of interoperability of Learner Information in the Swedish educational system, was carried out for this paper. Informal interviews (or rather conversations) where initiated with representatives for the two largest providers of administrative systems for Swedish schools, two Swedish municipalities and the sole provider of administrative systems for Swedish universities. One assumption that is made is that Sweden, in most respect, doesn't differ much from other European countries in terms of the use standards for Learner Information. The study is therefore likely to be applicable on other European countries as well. This study clearly shows that the level of consciousness about standards and standardization is generally low but, that the will to adopt standards and, especially to meet costumer needs is there. The demand for interoperability in terms of exchanging data between systems is currently increasing in the school sector as well as the university sector.

2.1 The School sector

The situation in the school sector is quite complex. Event though there are only two large suppliers of schools administrative systems, there are a multitude of small (sometimes) home-brew systems generating, recording and storing Learner Information of different kinds. In addition to schools administrative systems there are a multitude of systems that constitutes parts of the Virtual Learning Environment (VLE). Many of the systems connected to the VLE are recording, generating and storing different kinds of Learner Information as well. The situation gets even more complicated by the decentralized nature of the Swedish school system, where each municipality is responsible for managing the local systems and there are no national guidelines, regarding standards and interoperability at all. Sometimes the systems are even implemented and run at school-level. The effect of this is that most Learner information is stored in proprietary and closed data formats. Data is sometimes transferred between systems by “hands-on” transformation via export to another proprietary system (and format). This is only done in special situation where there is a very high and clear return of investment, mainly because of the huge overhead of such practise.

This complex situation creates enormous information redundancy- and consistency problems. One way to address those problems would be through common standards for Learner Information.

2.2 The University sector

The situation within the university sector is only slightly less complicated. Since there is only one provider of administrative systems it is easier to control the information. On the other hand, most universities, faculties and faculty department's runs there own systems for parts of the student administration as well as for VLE and additional Learner Information resides in those systems. As in the school sector, the flora of systems spans over commercial (proprietary) systems, home-brew systems and Open Source Software systems (OSS). The use of VLEs are however much more common at universities and the degree of ripeness is much higher. One of the consequences of this is that the amount of recorded and stored Learner Information related to students performance [2] and learners objectives is higher at universities. Schools are however moving in the same direction.

3. Conclusions, key issues and recommendations

The current situation, with a complex web of systems, all dealing with Learner Information in one way or another clearly shows the need for using interoperability standards for Learner Information. Due to the complex situation it is important that the standards and specifications to be used allow Learner Information to be stored in a distributed fashion and that the information can be combined into contextualized Learner Profiles on demand as well as exchanged between systems. The contact with system provides and users indicate that a situation where all the Learner Information is stored in one place according to one common data model is a utopia – at least in a foreseeable future. Mechanisms for combining different data models need to be supported by the recommended standards.

There is a necessity to combine different data models into Learning Profiles in a fashion similar to how Application Profiles are used for combining different models for metadata [8]. In such way data models - including data models from standard specifications such as IMS LIP and ex-PAPI - can be supported. A consequence of such use would be that the strength of both specifications can be utilized, while their respective weaknesses can be avoided. In [2], [3] and [4] Dolog et al. suggests how this can be accomplished through the use of Learner Ontologies and RDF [9] [10]. In [4] Dolog et al. gives an example of how three different Learner Information data models are used to describe an Ontology-based, exchangeable Learner Profile, focusing on learner performance. A similar approach is proposed by Magoulas and Dimakopoulos in [11]. They emphasises the problems when dealing with multiple data models for Learner Information in the scope of Service Oriented Architectures, where different services are masters for different parts of the Learner Model and the Learner Information. The focus in [11] is on personalization and preferences - which is another aspect of Learner Information that is becoming increasingly important. Such considerations will further increase the need to combine different data models as well as the requirement to map proprietary data models to existing (and future) standards and specifications. As Magoulas and Dimakopoulos put it [11 (page 69)]:

> *"...it is unlikely that all the information required by any particular personalised information space can be captured in the elements of a specific data models."*

And further on:

> *"Encoding user profiles in RDF provides flexibility to include elements from multiple schemata, to enrich them with additional elements, when necessary, and to maintain interoperability with other systems."*

Recommendations

In the short-term perspective there is a need to:

- Increase the knowledge about standards and interoperability among system owners and system providers
- Support system suppliers and system owners that want to adapt their systems to existing standards for Learner Information
- Promote and support the adoption of recommendations and best practise at European and national levels.

In the long-term perspective there is a need to:

- Favour research and development of Learner Information standards and interoperability, focusing on Learner Profiles and the combined use of several data models.
- Research and develop Semantic Web technology for interoperability of Learner Information.

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