Extending Educational Metadata Schemas to describe Adaptive Learning Resources

Owen Conlan

Trinity College, Dublin
E-Mail: Owen.Conlan@cs.tcd.ie

Cord Hockemeyer

University of Graz
E-Mail: CHockemeyer@acm.org

Paul Lefrere

Open University
E-Mail: P.Lefrere@open.ac.uk

Vincent Wade

Trinity College, Dublin
E-Mail: Vincent.Wade@cs.tcd.ie

Dietrich Albert

Hiroshima University
E-Mail: Dalbert@hiroshima-u.ac.jp

ABSTRACT

This paper describes a generic technique for representing Adaptive Learning Resources by extending current metadata schemas. The requirement for the work described here has grown out of the necessity to facilitate accurate discovery and integration of Adaptive Learning Resources, namely Adaptive Hypermedia Services.

KEYWORDS: Adaptive Hypermedia Services, Adaptivity, Metadata Schemas

INTRODUCTION

Current educational metadata schemas, such as IMS Learning Resource Metadata v1.1 and IEEE Learning Object Model v4 [1,2], have been developed to represent static learning objects and courses. Advances in educational content design have lead to content and courses that adapt to a learner's individual requirements (see, e.g., [3]). These advances have not yet been mirrored in the published metadata schemas used to represent learning resources. This paper discusses a mechanism to represent diverse adaptive techniques in a generic sense by extending a current metadata schema.

BACKGROUND AND MOTIVATION

Current metadata schemas (see, e.g. [1,2]) were developed having in mind mainly the reuse of described (learning) objects. One part of this is the search, discovery, and selection of fitting reusable objects. The second step then is to put together objects possibly originating from different sources.

For both steps we need a mechanism to describe adaptivity through standardised metadata. Since there exists a number of different approaches to adaptivity, we propose a generic mechanism open for future developments of adaptvitiy.

Educator Access to Services in the Electronic Landscape (EASEL)

The EASEL project [4] is implementing a search and integration scenario that will allow a tutor to search for static and adaptive content. This content may then be integrated into a newly assembled course comprising both static and adaptive elements. A key problem addressed within EASEL is the effective representation and discovery of Adaptive Hypermedia Services. The Content Inter-working API, such as the ADL SCORM implementation [5] is utilised as the mechanism for communication between the Learning Management System and the AHS. Conlan et al. [6] give further information on how this communication operates.

ADAPTIVE EXTENSIONS TO IMS LEARNING RESOURCE METADATA

Currently, there exist a number of specifications for Learning Resource Metadata, either provided by specific groups (e.g. AICC or ARIADNE project), or by general purpose bodies (e.g. IEEE LTSC or IMS). We have selected the IMS Learning Resource Metadata v1.1 specification [1] because it is the only specification issued by a general body that has already been implemented as an XML specification

Generic Adaptivity Metadata Element

The focus of our work about adaptivity is to create a framework for the reuse of adaptive learning material rather independent of the applied model for adaptivity. As a consequence, we propose a generic metadata element for describing the adaptivity of a learning resource. We propose a new element `adaptivity` as an optional part of the `education` element. This new element may contain an arbitrary number of `adaptivitytype` elements. Each of them contains the information needed for realising a certain type (or aspect) of adaptivity. The `adaptivitytype` element has two attributes, a mandatory `name`, and an optional `ref`. Furthermore, it contains a `langstring`. The `name` attribute denotes the type (or aspect) of adaptivity described by the current `adaptivitype` element The values for the `name` attribute are restricted by recommending a *best practice list*. The `langstring` contains the metadata describing the
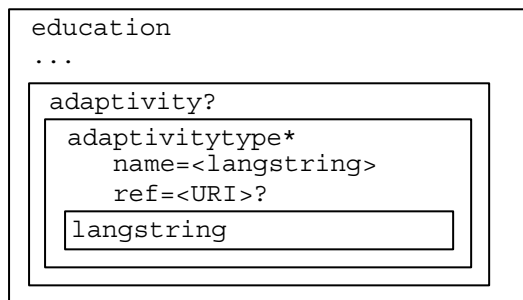
```
education
...

  adaptivity?

    adaptivitytype*
        name=<langstring>
        ref=<URI>?
      langstring
```

Figure 1 : The proposed generic adaptivity metadata element

learning resource with respect to the specified type of adaptivity. The optional `ref` attribute points to a reference document specifying the vocabulary used in this `langstring`. The issues of best practice lists and vocabularies are discussed in more details below.

Examples for the Adaptivity Metadata Element

The proposed adaptivity extension would be a sub-group within the educational group of the metadata. An example, in XML, would look something like this –

```
<adaptivity>
  <adaptivitytype value=
    "competencies.required"
    ref="someURI">
    Database concepts
  </adaptivitytype>
  <adaptivitytype value= "learningstyle"
    ref="some-otherURI">
    auditive
  </adaptivitytype>
</adaptivity>
```

In this example, the `ref` attribute is used as a reference to a best practice guide and vocabulary list possibly including examples and theoretical background for the specific type of adaptivity.

BEST PRACTICE LISTS AND VOCABULARY ADOPTION

Generic formalisms like the one proposed in this paper have the important advantage that they may easily be applied for describing new procedures which were not yet available when developing the formalism. Applying such generic formalisms across heterogeneous user groups, however, includes the risk of using different terminologies. Two mechanisms used for solving this problem are application of best practice lists and specification of vocabularies used.

Best Practice Lists

Best practice list recommendations are a mechanism frequently used in metadata technology (see, e.g. [1,2]). Such a list recommends a number of widely accepted values for the considered entry while allowing for defining own entries if the list does not contain a fitting value.

We propose to use a best practice list for the `name` attribute of the `adaptivitytype` metadata entries. Currently, we are still in the early implementation phase and, therefore, cannot yet provide a comprehensive list but only some examples: `objectives, learningstyle, com-`

`petencies.required`, or `competencies.tes-ted`.

An `objectives` name for `adaptivitytype`, e.g., means that the learning objectives to be achieved with the described resource are specified. The `learningstyle` entry denotes the learning style(s) supported by this resource. A hierarchical structure as in the `competencies` examples denote a common vocabulary for the respective entries.

Vocabulary Adoption

The main body of the adaptivitytype entry may depend strongly on the vocabulary used in the content area of the course or derived from some pedagogical theory. Both cases are definitely beyond the scope of metadata specification. Therefore we propose the use of application-specific vocabularies. Such vocabularies may be based on library classification systems (e.g. [7]), national curricula specifications, or other generally accepted domain-specific or pedagogical publications.

SUMMARY

This paper describes a generic extension for learning object metadata standards which allows to describe the adaptivity of learning objects.

The approach of describing adaptivity through standardised metadata opens a way for reusing not only static but also adaptive learning objects.

ACKNOWLEDGMENTS

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