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A Content Modeling Language as Basis for the Support of the Overall Content Creation Process

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Abstract

The conception and production of new e-learning content in a corporate environment is expensive and time-consuming. In this paper we propose a content modeling approach as part of an authoring management platform. This platform aims to make the cooperative process of conception and production of e-learning content faster, easier to manage and equips knowledge domain experts with a tool, which does not demand for media and didactic experience.

1. Introduction and motivation

The conception and production of e-learning content is expensive and time-consuming. This applies especially in a corporate environment where knowledge domain experts, authors, media producers, and project managers participate in the process. The involvement of many participants increases the effort in coordination and communication, especially in the exchange of documents and annotations.

Existing authoring tools in the e-learning area focus on the production of media-based content by supporting media producers or authors with experience in media production only. On the other hand there are solutions for the management and exchange of media objects like content management systems and repositories. These tools have to be combined with editors for the description of concepts and storyboards as well as specialized tools for project management manually. A comprehensive system enabling all participants to cooperate and execute their tasks is still missing.

In the EXPLAIN project [1] a web-based Authoring Management Platform was designed that supports the process of creation of e-learning content on the whole and allows the integration of existing authoring tools.

The content model represents the central element in the overall process. It results from an initial project plan, which describes the learning targets and the content itself, it is created during the conception, it is integral part of the storyboard and the basis for the production phase. The content model can be compared with a bill of materials used in product design and development as well as in production planning and control in an industrial context [2]. Hence, the content model has to meet certain criteria. In the following chapter these criteria will be clarified along with a more detailed description of the Authoring Management Platform. In chapter 3 we will discuss existing modeling languages and point out their shortcomings regarding the proposed platform scenario. In chapter 4 we will introduce our developed modeling language, followed by a conclusion and identification of future work in chapter 5.

2. Authoring Management Platform

The Authoring Management Platform is mainly composed of three processes, which in turn imply different requirements a content modeling language has to meet.

2.1 Process map for content creation

A content creation process has many aspects that have to be taken into account. In addition to the

production of media and their combination into a learning object, it consists of the conception, material and resource management and project management. Our goal is to make this complex cooperative process faster and easier to manage, and to allow knowledge domain experts (called "experts") to take responsibilities for many steps of the process by guidance through the process steps and context sensitive tips. Therefore in the EXPLAIN project an Authoring Management Platform, which handles all these issues, was designed. Figure 1 shows the platform's process-map.

the logical structuring is done – chapter conception, followed by the physical modeling – page conception. The last step includes referencing already available media objects and writing texts or concept descriptions for the modeled pages. If media objects are not available at the point of conception a replacement, called material-notice, that describes the desired media-object is referenced, until the object is available in the proper format. The whole conception process is guided by the Authoring Management Platform in terms of didactical issues. Partly by user-platform dialogues, partly by context sensitive help and partly by textual

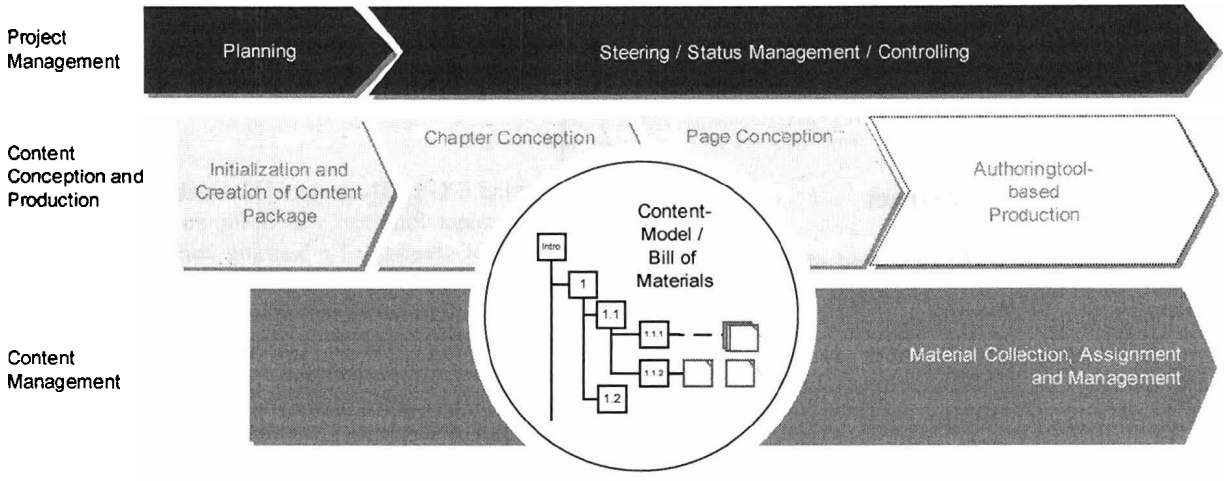

Figure 1: Process map of the platform

The project management encompasses the control of costs and time, administration of milestones for the content-creation process and management of responsibilities. Additionally it handles the collaboration of the users of the plattform. The creation of reports regarding deadline violations, financial overviews or material or personal statistics is included here as well as a notification system sending messages to users automatically, if certain events are triggered. Furthermore, the platform provides a review system, which is part of the project management process, too. Here users can be notified that a review has to be done or is finished. All this is achieved by status management. Every object possesses states like planned and actual costs, responsible individuals and planned and actual timing. This information is enough to derive actions that have to be taken like sending a notification message to a specific person.

Within the content conception process the modeling for the e-learning content to be produced is done. The platform provides an easy to use structuring tool, which allows the modeling of content in distinct steps. First information and checklists, the expert is guided through the modeling of the structure that fulfills the didactical needs of the target group the e-learning content is created for. For the production, the content model is transferred to an external authoring tool, where the learning object can be produced before it is exported to a standardized format like SCORM.

The content management component of the Authoring Management Platform comprehends classical issues of content management. It provides a central data store, where the material can be stored and versioned. Redundancy of data and access conflicts are prevented, which in particular is fundamental for the collaboration to work. In this regard, the Authoring Management Platform also manages the access to the material by assigning different rights to different user-roles. In addition to that the content management component supports the referencing and assignment of materials and handles the metadata and status information of the material.

For all these components of the Authoring Management Platform, the content model is the central

aspect. To harmonize the collaboration of the different components, the content model has to fulfill certain requirements, which will be discussed in the following.

2.2 Requirements

Each of the process components described above implies some requirements, which have to be met by the content modeling language describing the central content model.

Because of the project management being driven almost completely by status, a content modeling language has to support the storing and querying of status information regarding time and financial issues, responsibilities and process status. Furthermore the propagation of such values via the hierarchy of the content model has to be adjustable. Time values, e.g., have to be propagated in a different way than costs.

The chapter and page conception implies a content modeling language that allows hierarchical structuring without generating too much overhead in structure and implementation. The didactical information gained from the user has to be stored with the content model, too.

Regarding the content management, the content modeling language should enable the platform to handle the above-mentioned content management issues. This can be done by providing special status information. Additionally the content modeling language should support the consistent handling of references, especially the handling of material notices which may be of a different format than the objects they describe.

In short, we identify the following requirements for the content modeling language with respect to each of the platform's sub-processes:

1. Storing and querying of project management information along with their propagation over the hierarchy and their adjustment
2. Support for easy to do and easy to understand structuring, especially for the named knowledge domain experts, without generating overhead; storing of information gained from the didactical guidance
3. Support for consistent reference-handling and the possibility of cross format referencing and storing and querying of content management information

3. Related work

Having identified the requirements of a content modeling language for the Authoring Management Platform, we will discuss some existing approaches, which have dependency on our specific needs.

TeachML is a content markup language for the creation of course structures and content representation in XML [3]. However, it was neither designed for educational purposes only, nor to support the full production management of the learning contents. Described by Gunnar Teege as an "author-centric" approach intended to allow content reuse [4], the complete approach reminds of a general content authoring system, without any specific support for content conception, or management of information status during the production of content [3].

LMML (Learning Material Mark-up Language) aims to facilitate the portability and exchange of learning material. LMML is an appropriate XML binding of a meta-model for content structuring called the Passau Teachware Model (PTM). LMML does not fully and consistently support the content creation process. It provides only basic content mark-up and DTDs for web based learning documents and thus is not fulfilling our requirements.

<ML>^{3}, the "Multidimensional Learning Objects and Modular Lectures Markup Language", tries to overcome the problem of content scalability by giving a framework to describe the mapping of content and didactics in three dimensions: the adjustment to the target group, the educational intensity of the material and the varying of output formats [5]. Nonetheless, <ML>^{3} is still only related to a structuring aspect and does not meet the whole of our requirements described above.

Palo and OUNL-EML [3] are two educational modeling languages which basically attempt to model the learning process and not just learning content. This learning process deals with a series of activities and may not involve any content at all. OUNL-EML especially considers that the focus of learning is the activity, not the content [4]. For us, the structuring or generally the production of learning content remains at the core of our approach. Furthermore, both languages are designed to be used mainly by didactic experts and not by a simple user. The use of these modeling languages is generic in the sense that it is not directly related to the creation of multimedia based content. In addition it is difficult to use by domain experts without knowledge in didactics.

So, in taking a closer look to related research works in this area, existing modeling languages seem not to fit in our scenario of use. Two different types of modeling languages can be distinguished: the usage of the first group (TeachML, LMML and <ML>^{3}) is restricted only to modeling and structuring the content without

explicitly and necessarily expressing the whole life cycle of contents, especially in a cooperative scenario. Thus these languages do not provide all the dimensions needed to satisfy the conditions of our approach, particularly regarding easiness of usage, fast structuring and consistent management of the overall content creation process.

The second group (Palo and OUNL-EML), while being abstract, generic and constructivist oriented, does not meet all the requirements of our project.

There are several other modeling languages, but they are either very close related to special use cases or projects, like eLML for the GITTA project [6] or CDF for the ARIADNE project [7], or designed for special knowledge domains like MeML for mathematics or the proposed document model for the eStat-system in statistics [8]. That is why they are not considered in the present paper.

4. Our approach

Unfortunately, none of the existing approaches seemed to meet the prerequisites proposed by the platform. That is why we decided to design an own content modeling language, which is described in this chapter. We will describe our approach with respect to each of the authoring management platform's processes.

4.1 Content conception and production

The platform's content conception process demands a content model with a concise structure, which can be modeled by an expert easily. The underlying modeling language should support this. We decided to make use of the book paradigm, because it is intuitive and understandable for experts and thus can be modeled easily. Therefore we get a hierarchical structure of lections which represents the logical structure. Lections can be either chapters, if they are part of the highest level in the hierarchy, or sub-chapters otherwise. Lections consist of pages, page groups or more subordinated lections. The recursion of lections is theoretically endless, but should not exceed a reasonable threshold. The pages and page groups represent the physical structure of the e-learning content. That means, while lections do not necessarily possess a physical representation, pages and page groups do. If at time of conception the exact number of pages in a lection is known, a page is used, otherwise a page group is modeled.

Figure 2 shows an instance of the structure model used for our approach.

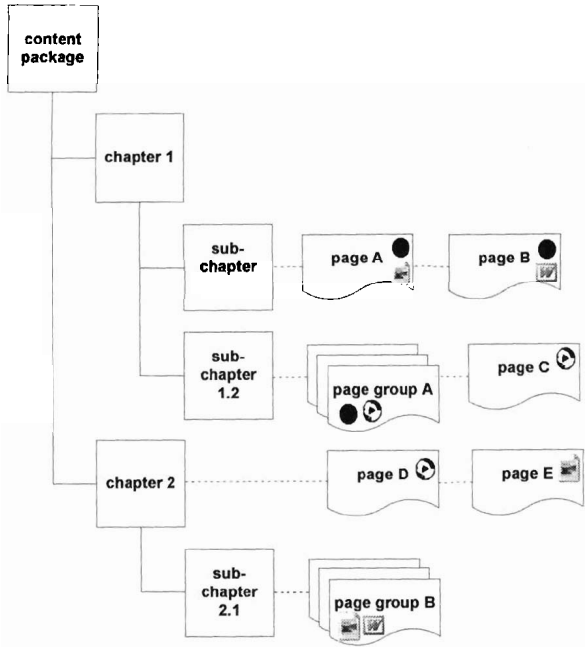

Figure 2: Instance of the proposed content model

4.2 Project management

As shown in chapter 3, most of the existing modeling approaches have shortcomings with respect to the project management support. For our approach we identified the information that needs to be stored to trigger the events that account for the project management. The process status determines the progress of the current process step. Values could be like "in work", "under review" or "review finished". The cost parameters are needed to control the preserving of a given budget and to create financial reports. They include planned and actual costs. Cost parameters are propagated over the content hierarchy additively, i.e. to get the cost of a lection all respective costs of inferior lections, pages, page groups and materials are added. The time parameters are handled similarly. They include deadline as well as start and finish dates of the different process steps. In contrast to the costs, the times are not added. To get the deadline of a superior lection, the earliest time could be taken, for example. The responsibilities determine whom to notify, if special events, like a finished review or a deadline violation occurs. Annotations may be attributes of content objects like lections and pages or references to external documents. Table 1 gives an overview of the project management information.

Table 1: Project management information

Attribute	Description
process status	status of actual process step
cost	cost parameters, additive accumulation
time	deadline, start and finish date of process steps, propagate over hierarchy
responsibilities	individuals responsible for production, review
annotations	review results, didactic information

4.3 Content management

The content management process is manifold and makes high demands on the content model and thus the modeling language used. The main challenge here is, besides the classical content management issues, the referencing and representation of materials. Although a simple reference to the ID of the desired material may be sufficient, the material still has to carry enough information for the platform to handle issues like cross format referencing or versioning. Here the format depicts the actual media format of the actual object, e.g. text for a textual material notice that describes an image that has to be produced. Whereas the typemeans the target type of the material to include, "image" in the given example. Versioning information encompasses references to previous and following versions along with the corresponding identifiers, while the access status can be set to prevent access conflicts, e.g. when one user downloads an object to change it and meanwhile another user wants to change it, too. The following table gives an overview of the information needed for the content management to be stored with the material.

Table 2: Content management information

Attribute	Description
ID	unique identifier for referencing the material object
format	actual format of the material
type	planned type of the media object
access status	flag to prevent access conflicts
versioning information	previous and/or next version, Ids for referencing

5. Conclusion and future work

In this paper we proposed a content modeling approach as basis for an Authoring Management Platform. The proposed language supports the production process of e-learning content on the whole, including project management, content modeling as well as resource and material management. Thus it contributes to a greater effectiveness and efficiency of the production of new e-learning material. The major work in the future will be the implementation of the platform and hence the implementation and application of our content modeling approach. The implementation will also provide the opportunity to give an objective judgment of the quality and capabilities of our approach. The extension of the modeling language by means of didactical issues is another aspect to consider in the future.

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