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Conceptual, Technological, and Organizational Aspects of Electronic Learning

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eduBITE

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Educating Business and Information Technologies

Abstract:

The development of multimedia learning materials is expensive and very time consuming. In spite of these high production costs most materials are reusable only to a very small extent. Project results are often lost in obscurity. This paper demonstrates a cooperative approach of several Austrian universities and polytechnics to produce, configure and reuse multimedia content in the field of Integrated Business Information Systems. A recently founded association called "AKIT" may be used to distribute this content on a nationwide scale. A courseware configuration tool, eduWeaver, developed within the project will be introduced in detail.

Keywords:

courseware design, multimedia learning material, reusability, integrated business information systems, educational process modeling

Introduction

Knowledge concerning "Integrated Business Information Systems" (IBIS) is a basic element of most computer science studies and spans a variety of topics from the conceptual business process modeling to the implementation details using various Enterprise Resource Planning (ERP) Systems. This knowledge is also currently taught at several universities and polytechnics in Austria focusing on different aspects of IBIS. Learning takes place exclusively in form of face classical classroom teaching, using individual teaching and learning materials (slides, books, scripts, exercises). The efforts needed for the actualisation of these individual materials and the heterogenousness of them did not allow the realisation of a knowledge pool in order to provide case studies and sophisticated multimedia material for the required contents. So teaching IBIS in Austria means having lot of island-solutions with very little or no interconnection to each other.

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In 2001 an association called AKIT (Akademische IT Lehr- und Lernplattform – in english Academic IT Educational Platform) was founded by professors of 12 Austrian universities and polytechnics in order to address this problem. The main objective of AKIT is to benefit from the synergies available within this network in the teaching process. AKIT members discovered that their teaching objectives in the area of IBIS are mostly similar and they aimed to reuse teaching materials and jointly develop virtual courses based on well prepared case studies. This task, however, could not be achieved immediately. Teaching and learning materials as well as case studies were inhomogeneous, too strongly coupled or demonstrated a lack of continuity. Multimedia materials were not available at all, the way towards virtual classrooms was not feasible.

Having this background five AKIT members, among them universities and polytechnics, designed a project called eduBITE (Educating Business and Information Technologies) to overcome these problems and build up a common repository of multimedia IBIS materials as well as an environment for the customizable usage of these materials in different courses. eduBITE started in summer 2002 and has a running time of two years. It is funded by the Austrian Federal Ministry for Education, Science and Culture (bm:bwk).

eduBITE develops multimedia material using business processes as a basis for the business information system, investigating business process properties, their co-operation on various levels and their technological support. Often students are not able to bridge the gap between complex business processes in reality and the abstract information systems supporting them. To solve this problem, eduBITE presents IBIS content through a case-based approach by introducing the demo-enterprise deBITE. This company represents a typical Austrian forest industry plant within a supply chain in order to address all relevant business processes for the usage of an ERP system. Beside the practical aspects particularly abstraction mechanisms should be comprehensible for students. Using the case study enterprise DeBITE, this process of abstraction should become clearer and more comprehensible, while at the same time making much basic background knowledge accessible. The target group for using the multimedia IBIS material in the first stage comprises about 2200 students per annum.

Project focus

eduBITE focuses the development of a multimedial content pool in order to compensate the deficits mentioned above in the following respects:

- *Teaching Materials:*

Topics relating to 'Integrated Business Information Systems' such as conceptual business engineering, enterprise modeling, the support of business processes implementation or the customization of Enterprise Resource Planning (ERP) systems are prepared for multimedia use based on a case study enterprise (deBITE). The produced learning modules focus on computer science students as well as business administration students. They cover a four hour/week conventional course in the field of IBIS and will be evaluated over one semester in at least two courses at two different universities or polytechnics.

- *Instruments:*

Instruments are developed to categorize developed materials according to the IEEE international metadata standard. The meta-indexed learning objects can so be used to construct specific lessons according to special target groups or certain learning processes. Instruments for the configuration of course materials using learning process models are also developed. These guarantee adaptation, enhancement and interoperability of the developed multimedia material. This development will be introduced in detail.

- *Communication Platform:*

The output of the project is aimed to increase the reuse of available multimedia materials in the IBIS context. The AKIT association mentioned above will be the framework to gain access to the multimedia materials and to improve and enhance them. Its members also constitute the market for the sustained use of the project products.

Project topics

The following topics are to be dealt with in depth in eduBITE:

- The case study manufacturing enterprise deBITE
- Business Engineering and Enterprise Modeling
- Architecture of Business Information Systems
- The architecture of ERP Systems, including related topics such as customizing and integration
- Sales and Distribution
- Materials Management
- Production Planning
- Financial Management and Controlling

Project Architecture

The architecture of the e-learning environment produced by eduBITE consists of multimedia learning objects, which are organized in a repository. These objects can be configured flexibly using a specific tool, eduWeaver, which enables the configuration of the desired needs. A course can then be published and used in any learning management system understanding IMS standard, i.e. WebCT. It also allows a continuous extension and update of the business process models of deBITE by incorporating case studies from other enterprises as well as by adding further basic knowledge. Through meta description of the learning units the eduWeaver can always pick up and bond the demanded contents to a multimedia course. The use of other learning management systems besides WebCT is also possible as far as learning object standards are supported.

A general overview of the project architecture is shown in figure 1.

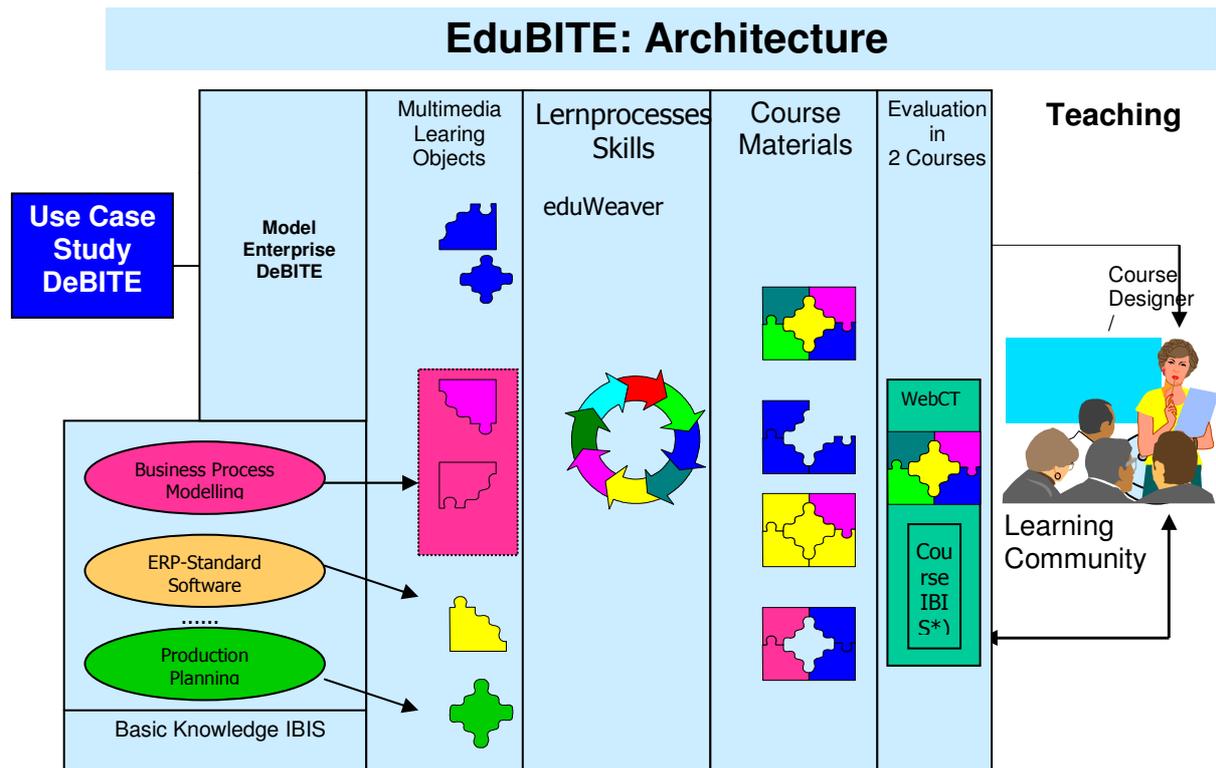


Figure 1 eduBITE Architecture

Courseware can be seen as a special kind of software. To guarantee high quality and re-usability of learning objects the application of an appropriate development process for e-content development is required. For eduBITE we chose to use the process model approach for courseware development of Klein/Stucky (2001) dividing the whole development process in four phases: Analysis, Design, Implementation, Use/Maintenance. Project Management and the development of the courseware design tool eduWeaver accompanied these items. In the following the tool eduWeaver will be introduced in detail.

eduWeaver – the courseware modeling tool

During the design phase of eduBITE learning objects modularizing the content of integrated business information systems, which are analyzed during the analysis phase, have to be modelled as well as learning scenarios describing the whole course structure. These tasks are supported in eduBITE by eduWeaver, a tool developed for this very special purpose supporting also the re-usability of learning objects and course structures in a very high degree.

The main technological focus within this project is the development of eduWeaver. As described eduWeaver is a metadata based course process modeling tool that allows the configuration of courses based on didactical guidelines and the orientation on reference processes.

Figure 2 shows the basic system architecture of eduWeaver.

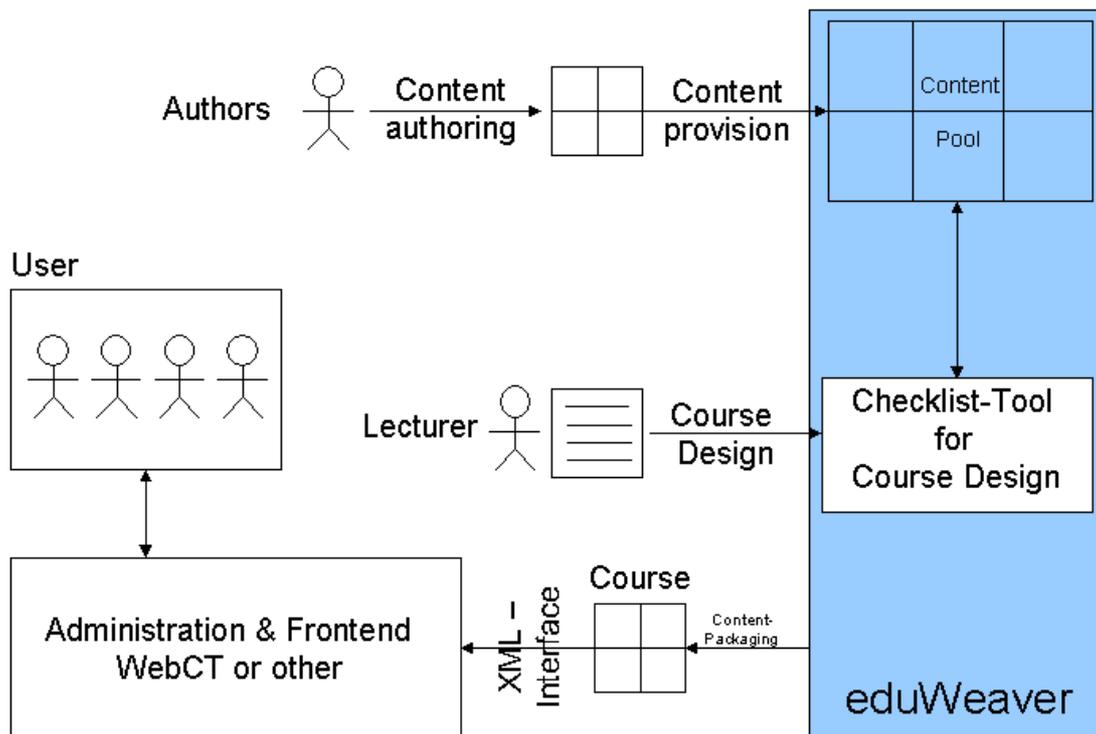


Figure 2 System architecture of eduWeaver

At the beginning contents must be created by professional authors using different authoring systems. In this phase there is almost no limitation using any format that can be published in an LMS or through classical teaching methods. Having created a content pool, courses have to be designed by structuring contents according to didactical arguments. This part is covered by eduWeaver.

eduWeaver is a distributed tool for the creation and the structured administration of learning contents. Therefore eduWeaver meets three requirements in order to create courseware:

- it is a modeling tool for the graphical creation of educational processes based on didactical guidelines and the individual adaptation of these processes,
- it administrates references to learning objects and its didactical arguments, fulfilling requirement to a content management system, and
- it includes an XML-export-interface, which delivers content packages according to IMS standard, that allows to integrate contents and the course structure to any IMS compliant Learning Management System.

The modeling part allows to structure courses on four granularity levels. Level I includes all objects of *courses*, which will be refined in the following levels and provide an overview of possible courses. The detailed process of one course is represented on Level II. Level III shows the *lections* of one phase, which again consists of different *Learning Objects* (Level IV).

These Learning Objects (LOs) represent the most detailed part in our hierarchical structure. The LOs have references to the external documents, that are in the content pool. Through referencing to content and the possibility of multiple references the re-use of Learning Objects is highly supported.

Figure 3 shows an overview of the hierarchical structure of the modeling part of eduWeaver.

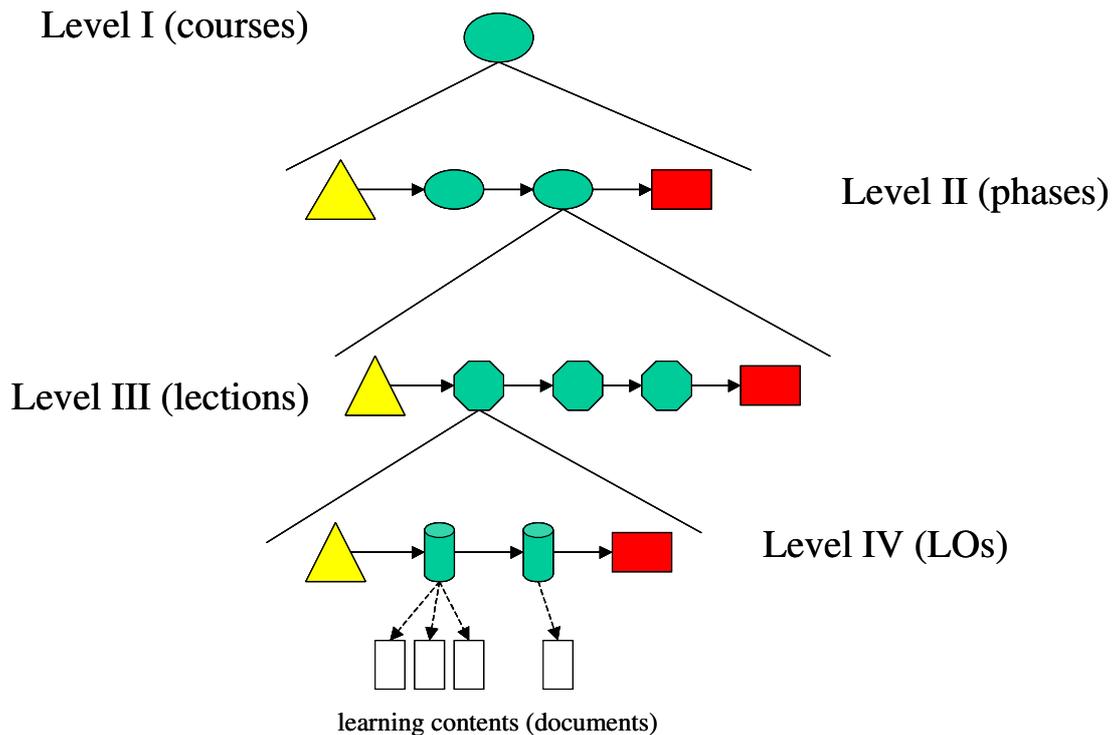


Figure 3 Hierarchical modeling structure

After having constructed the individual course the complete structure including the documents can be exported through an XML-interface into an IMS content package and then imported into any IMS compliant Learning Management System. IMS specification provides the functionality to describe and package learning materials, such as an individual courses or a collection of courses, into interoperable, distributable packages. Content Packaging addresses the description, structure, and location of online learning materials and the definition of some particular content types. Content creators can develop and distribute material knowing that it can be delivered on any compliant system, thereby protecting their investment in rich content development.

Figure 4 describes the understanding of learning objects and course structures in eduBITE in form of a simplified meta-model.

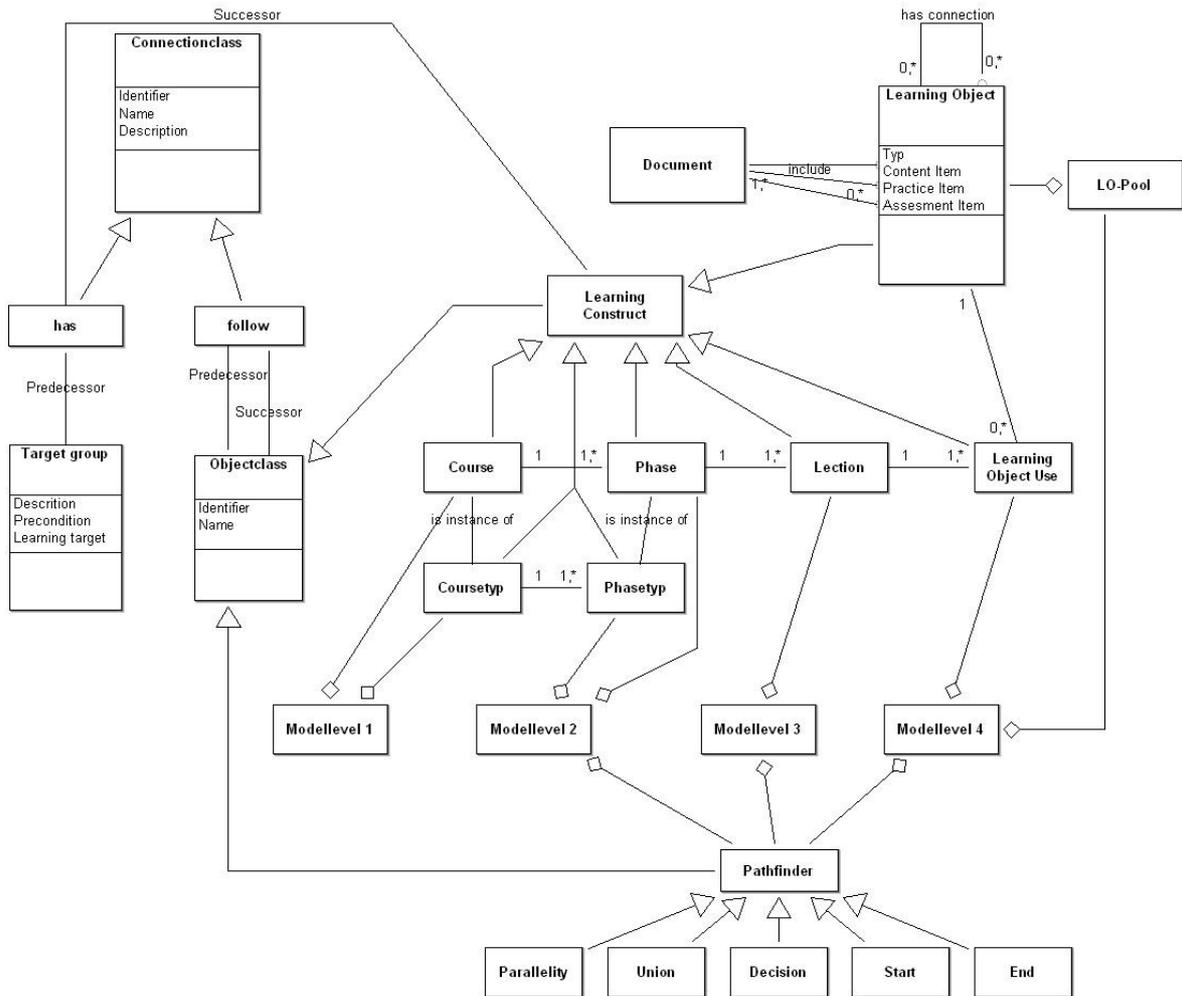


Figure 4 eduBITE courseware meta-model

Learning objects are aggregates of documents describing contents, showing their applicability and testing the learner (content items, practice items, assessment items).

Learning objects are supposed to have high integration and to be loosely linked. Learning objects have objectives producing competences for the learner. So, they also can be structured to lessons (for an example see figure 5) and lessons are aggregated to phases. A whole course is built out of various phases. The structure of best practice courses can be re-used in form of course types predefining special course patterns.

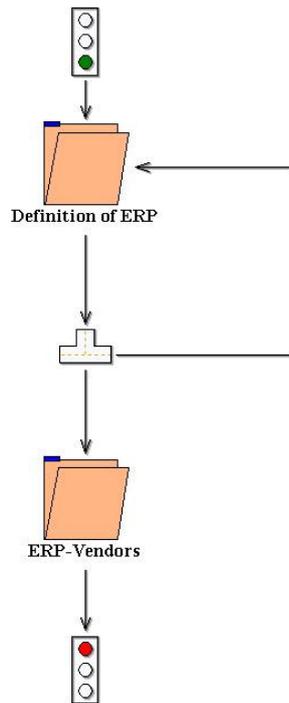


Figure 5 Learning Objects are grouped to a lesson

Project outlook

eduBITE is an attempt to produce highly reusable learning objects to be used in different integrated business information system learning scenarios. To do this an e-content development process framework is supported by a computer aided courseware engineering tool, the eduWeaver, in order to evaluate the outputs professionally and to rollout the experiences and products in Austria. The project started in autumn 2002 and has a runtime of 2 years.

Until now analysis phase was completed and documented in a content specification handbook. Design of learning objects has been started. A prototype of eduWeaver is available to support design work. Design of learning objects is supposed to be finished in June 2003. Implementation of the specified documents is planned for summer 2003. The first learning scenario that will be designed based on these learning objects will be to support a face-to-face course that will be evaluated in spring 2004. Experiences of this evaluation process will result in learning object enhancements being evaluated again in a blended learning scenario in autumn 2004. These experiences will also be rolled out together with the developed learning objectives and learning scenarios in form of a central eduWeaver repository as a project result in autumn 2004.

As future work in this area we plan to do investigations of analysis and simulation potentials of course scenarios in dependence of learner skills and knowledge based automatic configuration of course scenarios.

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