Proposing a semantic approach to Content Management for Education, Learning and Training

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Abstract

The EFTWeb model results from research efforts concerning the lack of integrated solutions to reuse the contents generated by teachers and students. System functionality is extended in order to make possible content reuse between different disciplines from teachers and considering different educational situations.

EFT*Web* supports Education, Learning and Training, taking advantage of existing Web facilities. The paper focus on the EFTWeb thesaurus and catalogue proposals designed to provide extra mechanisms to turn content classification and content reuse more easy to apply. In particular the paper defends a semantic approach to support content management both to support ongoing classification and support content retrieval.

Keywords: e-learning, web based learning environments, content management.

1 Introduction

The EFTWeb system takes advantage of existent world wide and low cost web facilities. It is based on a client / server architecture where the core content is stored in a database and all the interaction between the system and users is made by a web browser using standard facilities (no plug-ins) [8].

The novelty is on the EFTWeb approach used to create the database structure, whose focus was directed to clients, security and cost supervision. In order to fill these requirements, some integration mechanisms have been developed. In the system core, contents classification based on thesaurus technology is placed along with the contents, allowing great flexibility in the definition of the keywords (terms) to be use for content retrieval. This allows the creation of context description of a given knowledge topic and can be used to inform a textual search engine and thus provide integration with available content in an independent and not previous known way.

The EFTWeb takes advantage of being a web-based system and attempt to address both the requirements of presence and distance education [4]. For presence education, EFTWeb deals with the content management issues of relating contents and support its reuse. In distance education, it extends those facilities to provide the means for synchronous and asynchronous interaction between users (being students or tutors) and allow them to share content and collaborate using a number of available facilities [3]. By providing a semantic description as a strategy for content management (both considering the storage and retrieval) an extra level of flexibility is provided for use within many educational activities as the case of the co-construction of knowledge defined by the development of a given thesaurus or by classifying content, taking advantage of an existent thesaurus.

2 EFTWeb system proposal

2.1 Unit, theme, content and guide

The EFTWeb system follows an innovative approach to education, training and learning processes, through the use of the Web, by presenting a framework that bases teacher and students interaction on the materials and tasks to be accomplish [1, 6]. Content has the same importance than the means for classifying it [7].

The EFTWeb model considers the use of three main concepts for content structuring: unit, theme and content. A unit possesses themes and for them corresponds presential sessions or module units. Each theme has a group of contents that aids information and knowledge transmission. A content is an independent object of a given format, among the many multimedia currently available and supported by the World Wide Web [2].

The organisation scheme for user access (educational content structured as units, themes, and content itself) is given by the notion of a guide. A well-defined sequence of the above elements is associated to structure contents and gives to the user a path to explore and organise information [8].

One of the underlying ideas for EFTWeb is to support with maximum flexibility content access by giving total permission to use available resources and facilities. This is implemented by assigning a particular profile to each user, considering any user as a client. The model allows the necessary flexibility to consider users as potential consumers and producers. This way, the system provides support to organise student's work and integrate them in the content offering by appropriate control of author rights and content's versioning and certification [7]. It also allows teachers to build along with content, new or existing guides based on others work. This can include, in all or partly, already existent guides. The user can also introduce enhancements in the way content is organised. An example of a *guide* is a discipline.

2.2 Distribution, content and structure

The EFTWeb model is implemented with available widespread technology. To support content distribution, World Wide Web becomes the natural solution. It has a lot of information available that needs to be mediated for being trusted. Web access is possible with a personal computer and standard software which turns its cost acceptable.

To support content is used current database technology. This technology eases the storage and retrieval of contents and allows multiple and concurrent accesses to support multimedia and usage logs. It also provides proven means for search and dynamic maintenance of contents and data structures.

To support semantic structures, where relations between content are of importance, thesaurus technology is used. This will provide the necessary flexibility to access content by using a set of ordered concepts that allows to store, with each content, independent semantic and high order relationships.

OFFER

Distribution – Web
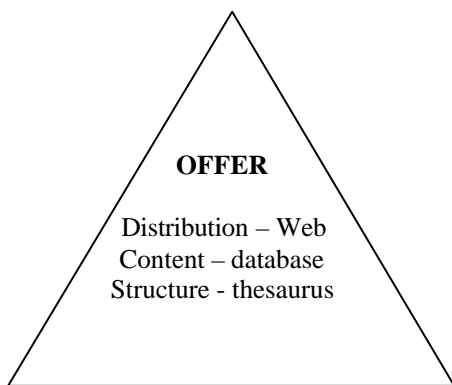Content – database
Structure - thesaurus

Figure 1: The offer concept within the EFTWeb model

The combined use of World Wide Web, databases and thesaurus technologies are designed as the support for the system *offer* (distribution plus content plus structure) and constitutes the system core added value. Figure 1 represents the EFTWeb *offer* concept.

One of the more relevant features of this model is the use of the thesaurus technology to structure content semantic. The thesaurus is used to describe a particular model of knowledge about a given area in terms of keywords and relations between these keywords. The system allows the creation of several different structures in the thesaurus, for different overlapping classification systems to use at the same time – the catalogue - as it will be introduced later on.

From the user perspective, the Web browser integrates system functionality by offering a common and easy to use hypermedia interface. This option allows for the technology integration without increasing user client complexity to configure and use. Its use also allows integration with current Internet and Intranet facilities.

2.3 Client, security and billing

The EFTWeb model considers in its core the support for security and billing issues. The entities represent the interface with external issues like client, security, and billing (figure 2). These three entities were selected in order to provide a clear business orientation for the EFTWeb model:

- *client*: includes teachers and students. The model allows a client to be a consumer and also a producer;
- *security*: deals with the need of protecting client identification and client system use. Also includes user operations allowed, and permissions for what a user can do, modify, comment and add as content and context;
- *billing*: allow the necessary arrangements to use the system in a commercial way, where different types of situations such as paying education, learning and training programs can be applied.
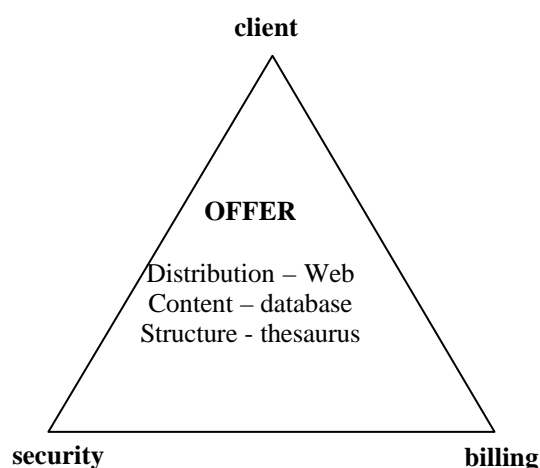

client

OFFER

Distribution – Web
Content – database
Structure - thesaurus

security   billing

Figure: 2. The EFTWeb entities

2.4 Scripts, profiles and credits

EFTWeb needs mechanisms to interface the *offer* and EFTWeb *entities*. Each of these mechanisms receive the information from the corresponding entity and deal with related processes and storage needs in a flexible and independent way.

Each entity has a correspondent mechanism that acts like a system translator between entity requirements and integrates the *offer* (figure 3):

- *scripts*: distribution, content and structure issues are organised and available *offer*. To each client corresponds a particular path that shows a set of selected *offer* customised for its needs;
- *profiles*: corresponds to how each client can interact with the *offer*, by allowing different levels of functionality to take place. These levels are described as use, read, execute, comment, add, certify and evaluate [8];
- *credits*: allows client' interaction with the *offer* in a cost-based approach. A particular content or each kind of interaction can have its own cost or be rewarded with credits. The credits mechanism interacts with billing by allowing an internal unifying cost for tracking usage and allows a commercial independent pricing policy.
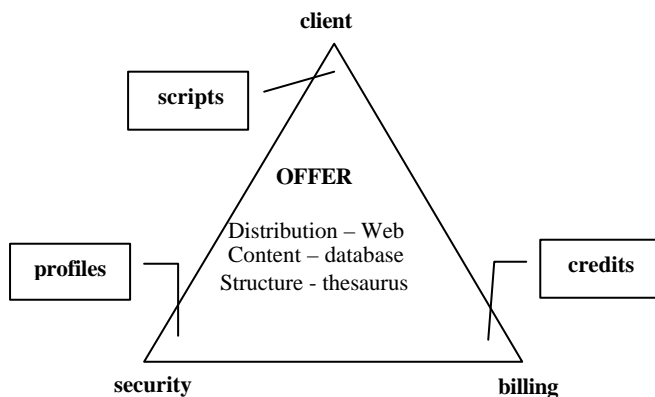

Figure 3: EFTWeb mechanisms

3 Thesaurus and catalogues in practice

The EFTWeb system proposes a number of services including administrative services that allow users to enter the information necessary for system operation such as user information, content and structure information:

- *certifying and authoring*: certifying contents and authoring scripts;
- *version control*: promoting and maintain related content collections;

- *catalogue creation*: complementing the thesaurus with additional information by introducing lists of additional keywords.

Other EFTWeb system user services include a recommender system and the support for co-operative work for tracking document and folder sharing (supporting version management). These facilities along with the more usual electronic mail, news, forum and chat systems provide a set of services integrated with the content database and a thesaurus based content organisation for accessing information. Users can also trade content by using credits to buy and sell contents. Security issues are implemented in the system core in order to certify who and what is doing, for each particular content occurrence [8].

The EFTWeb can be used as broker to assist both teacher and students needs by providing content within specified contexts. Different educational contexts can be envisaged as resulting from learning needs or from different educational settings as presence education, distance education, and training activities.

We can define a thesaurus for a given knowledge area or topic. It can be a broader topic such as *Informatics*, or a more specific one such as *Human Factor in HCI*. As an example, figure 4 presents a partial example of a thesaurus for the *Information Systems* topic.

Information
Technology
System
Enterprise

Figure 4: A partial thesaurus example

A catalogue enhances a thesaurus by considering further detail about a given topic. For example, when considering a thesaurus about *Information Systems (IS)*, several different catalogues can be proposed such as one considering a *IS Management perspective* (figure 5) and other about a *IS Socio-technological perspective* (figure 6). Both catalogues are about the *Information Systems* topic but focusing different issues regarding the same knowledge theme.

Information: value, data, process
Technology: office, production, productivity
System: model
Enterprise: value, added-value, profit

Figure 5: a catalogue example

Information: data, knowledge
Technology: support, learning
System: human, process, ergonomic
Enterprise: work, system

Figure 6: an alternative catalogue example

The use of the proposed "thesaurus and catalogue" solution provides both the possibility to classify content and

characterise a given knowledge topic as a set of keywords (terms) that can be used to inform search and content retrieval. In particular, this approach can be used to use a textual search engine to mine the content database, and to inform the inclusion of more classification keywords to each content occurrence.

An approach to use these facilities is to consider the use of the thesaurus to restrict available keywords and define a context, thus producing a high semantic level description to access content.

Also, the use of the catalogue to define further detail and expand the thesaurus in a number of ways:

- adding more semantics by feeding more keywords for each of the thesaurus entries;

- expand the description level of the thesaurus, using the catalogue as a strategy to search content providing a tuning facility to classify the content itself (adding and deleting keywords associated with each content);

- allow the use of specific keywords to refer existing thesaurus entries. This will provide different perspectives description such as the client that can be a user within an enterprise context, and students within an academic context, or an employee within the implementation of an ERM – *Employee Relationship Management system.*

4   Final remarks

EFTWeb proposes a system that unifies content reuse for education, learning and training activities. The EFTWeb proposes content reuse from and by teachers taking advantage of students work. It provides a structured approach to store educational materials. This will allow content classification as an ongoing activity using EFTWeb and its thesaurus and catalogue facilities.

Content retrieval can be made by taking advantage of both a textual search engine and a combined thesaurus and catalogue search allowing the use of more restrictive conditions to be followed to found relevant content within the available content database.

The use of thesaurus facilities allow for the creation of alternative contexts where same contents can be used and referred within different perspectives produced as additional catalogues to use taking into account a given thesaurus. Traditional ways of content classification offers a limited perspective based on what is the content aim at creation time and focused in content rather than taking into account the content plus context.

If we can, based on learning needs, specify a given knowledge topic using a high abstract level description instead of relying in same previous content classification, a much wider potential use for available content can be expected and thus take a semantic approach to content management.

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