

An Open-Source Proposal For Educational Web Site Development

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Abstract

In this paper, we propose an open-source and platform-independent solution based on XML (Extensible Markup Language) family for deployment activities of the pedagogical materials available on an educational Web site, giving to all members of the academic institution the possibility of co-operating for this purpose. This proposal refers to a centralized management of a flexible tool able to automatically generate complex and attractive Web presentations, either in SMIL (Synchronized Multimedia Integration Language) or HTML+TIME language, for using as course tutorials or in different student teaching and testing activities. For the design refinement of the Web site, we take into account a solution for building a meta-interface based on XUL (Extensible User-interface Language). As well, the security access system is discussed. By thus, the work of the site manager is easier, any member of the institution could valorize the personal work and ideas, having access to a friendly user-interface, and the aspect of the Web site, still remaining unitary, is permanently enhanced.

1. Introduction

The use of the World Wide Web modern technologies in the teaching process has increase enormous in the last years, becoming a current reality. In 2001, over 98 percents of American and Canadian schools were connected to Internet, and in Romania actually there are many educational programs regarding the Web connected computers endowment. In all kinds of schools, the Internet became an object to study and a bibliographical / imagistic source equally in teaching and in home works preparation. The actual society invests enormous in the IT training of all specialties and kinds of instructors and tutors [9].

Actually, there are many Web educational sites available, having different owners: virtual universities, academic institutions having a

department of distance education, cultural or academic foundations, and different companies. The structure of a Web educational site is very complex [17], involving a public section – with an informative character –, a section destined to students, one for instructors and the possibility of administrative overall control. It is very important the modality of e storing and managing the teaching materials, information about students, results of tests, etc. The teaching stuff suffers permanent changes, every instructor having his personal style in preparing materials and in exposing information. However, the general image of the site must remain unitary. An important particularity which must be considered by the manager of an educational site is the great mobility of the teaching stuff and of the students.

We propose an open-source and platform-independent solution based on XML (Extensible Markup Language) family for *deployment activities of the pedagogical materials* available on an educational Web site. The main goal of our proposal is to facilitate the involving in the site development of all persons who participate to educational process, for creating pedagogical materials, as well as for refining the site design. We also provide a solution for organizing the adjacent and the internal information of the site, taking into account the security access to the information.

Our proposal offers a solution for creating teaching materials conceived as Web presentations and facilitates the implementation of any site design idea, providing a friendly user-interface experience for all actors of the educational process who want to contribute at the site development, without the need of any knowledge of Web programming languages. By thus, it shall be obtained a unitary and attractive profile of the site, the work of the site manager shall be easier, and the communication between students, instructors and administrative stuff shall be notably improved. XHTML, SMIL, HTML+TIME, XUL, XML and free-available script languages (Perl, JavaScript, PHP) could be used for this implementation.

2. Creating Multimedia Web Presentations

2.1 Short presentation of SMIL

SMIL (*Synchronized Multimedia Integration Language*) is an XML-based language [12] developed since 1998 by the Web Consortium in order to facilitate the creation of interactive multimedia presentations. SMIL enables authors to describe the temporal behavior of a multimedia presentation, associate hyperlinks with media objects or describe the layout of the presentation on a screen. A presentation is composed from several components, each including different media types, such as audio, video, image or text, and could be executed sequentially, parallel or in a combined manner. Control buttons such as stop, fast-forward and rewind allow the user to interrupt the presentation and to move forwards or backwards to another point in the presentation.

SMIL 2.0 – the actual version of the language – is defined as a set of reusable markup (annotation) modules. This allows reuse of SMIL syntax and semantics in other XML-based languages, in particular inside those that need to represent timing and synchronization [1]. For example, SMIL 2.0 components are used for integrating timing into XHTML [13] and into SVG [2]. There are special players for SMIL developed by different companies, such as the RealOne of RealNetworks or Oratrix's GRiNS player and editor. The general trend is to incorporate support for SMIL even in the Web browsers: Internet Explorer 5.5 and up plays XHTML+SMIL [10], Apple's QuickTime version 4.1 or later supports SMIL 1.0 and Adobe's SVG Viewer supports SMIL animation in SVG [20].

Example. The SMIL multimedia presentations are easy to be written and do not require sophisticated authoring tools, because there are simply text XML-based files. As an example, a short SMIL document is listed below. The presentation will split the computer screen into two regions, a movie (in the MPEG format) and a text file being displayed in parallel for 40 seconds, each in a specific region, while in the background a sound file is playing:

```
<!DOCTYPE smil PUBLIC
    "-//W3C//DTD SMIL 2.0//EN"
    "http://www.w3.org/TR/REC-smil/SMIL20.dtd">
<smil xmlns=
    "http://www.w3.org/2001/SMIL20/Language">
<head>
<layout type="smil-basic-layout">
    <!-- a region that will display
            the video document -->
    <region id="VideoPlace" top="25" left="125"
            width="875" height="650" />
    <!-- a region that will display
            the text content -->
```

```
        <region id="TextPlace" top="555" left="225"
            width="875" height="200" />
    </layout>
</head>
<body>
    <par>
        <!-- the multimedia content
                will be rendered in parallel -->
        <audio src="presentation1.rm" dur="20s" />
        <video region="VideoPlace"
            src="videos/course1.mpg" dur="10s" />
        <text region="TextPlace"
            src="docs/course.php" dur="40s" />
    </par>
</body>
</smil>
```

2.2 The HTML+TIME alternative

HTML+TIME (*Timed Interactive Multimedia Extensions for HTML*) language was developed by the Microsoft, Compaq and Macromedia companies for facilitating to the authors to add time-based presentation effects to Web pages than using an external, XML-based document. Thus, HTML+TIME extend HTML by adding a set of time-based attributes to its entire existing tag set [15].

For example, an identical set of attributes could be applied to a paragraph, an unordered list and a table, which shall be displayed in parallel each for 5 seconds, but starting at different moments:

```
<!DOCTYPE HTML PUBLIC
    "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<!-- using CSS mechanisms
        to include a temporal behavior -->
<style type="text/css">
    .time { behavior: url(#default#time2); }
</style>
</head>
<body>
<div class="time" repeatCount="5"
    dur="10" timeContainer="par">
    <p class="time" begin="0" dur="5">
        A line of text shall appear first.</p>
    <ul class="time" begin="2" dur="5">
        <li>After 2 seconds, an unordered list</li>
        <li>...having 2 items</li>
    </ul>
    <table class="time" begin="4" dur="5"
        cols="2" rows="1" border="1">
        <tr>
            <td>A table with 2 columns</td>
            <td>appears after 2 more seconds</td>
        </tr>
    </table>
</div>
```

```
</body>
</html>
```

Offering similar capabilities like SMIL, the HTML+TIME language could be used for creating on-line tutorials in the form of Web presentations, which could be linked subsequent to a namely page in the educational site. The XML parentage of SMIL language is an important prerogative which to be taken into account.

Moreover, a SMIL presentation can play only in a region of the site, having no interaction with the rest of the Web page. In contrast, using HTML+TIME, through the HTML DOM (Document Object Model), all the elements in the page can interact with each other, participating in the presentation. For our organizational model, is strongly recommended for the presentations to be independent with the rest of the educational site, so SMIL is the suited solution. Even Dave Raggett, one of the HTML developers, approve that SMIL is great for timing media clips, e.g. presenting an HTML document along with an audio commentary and accompanying images [14].

The main goal of our system's structure is to offer to each member of educational stuff which contributes to the site development the possibility of being the only manager and responsible for all information and multimedia documents inside his/her presentations or other types of Web pages, making changes whenever wants. For this purpose, the materials of each author shall be placed in a special subdirectory in the location destined to a certain course, the author being the single person having modifying rights for that subdirectory.

3. Using XUL to Build a Web Meta-Interface

It is possible that many members of the academic institution to be familiarized or attracted by the facilities of a visual interface editor. Their abilities could be used in the context of our open-source and platform-independent proposal through the mediation of XUL (*Extensible User-interface Language*), an XML-based language defined as a part of the Mozilla project [11; 8].

XUL provides various types of widgets used to build complex graphical interfaces that can be a valuable advantage in designing and implementing an e-learning Web environment. These widgets are very similar with the current approaches used in graphical user interface development environments such as *Borland Delphi* or *Kylix*, *Glade*, *Qt Designer* or *Microsoft Visual Studio .NET*. Any member familiarized with such visual environment could use a XUL meta-interface both to provide certain functionality or a design extension for each multimedia presentation, and to create a new type of pedagogical material.

Because XUL is a platform-neutral language, the Web graphical user interfaces designed in XUL shall have the same look and behavior on different operating systems or graphical architectures (for example, standard *Motif* architecture from *XWindow System*).

A short example of an XUL interface follows [6]:

```
<?xml version="1.0" ?>
<!-- a window with a tabbed dialog -->
<window title="XUL – Simple Example"
  xmlns=
    "http://www.mozilla.org/keymaster/
  gatekeeper/there.is.only.xul">
  <tabcontrol>
    <tabbox value="Documents" />
    <tabbox value="Images" />
    <tabbox value="Videos" />
  </tabcontrol>
</window>
```

The XUL documents have no reference or direction as to how it should be displayed. In Mozilla/Netscape browser, this is the task of the Gecko internal engine, which takes XUL constructs and adds a “skin” to the XUL skeleton to proper display the elements’ interface in a platform-independent way. By using *XSL (Extensible Stylesheet Language)* stylesheets [21; 8], it is straightforward to transform XUL elements into XHTML or SMIL pages, according to the Web designer needs. This property shall take into account by our proposal in order to adopt a flexible solution to easily build effective educational Web sites, using exclusively open-source technologies.

4. Developing The Educational Web Site

The process of developing and maintaining an educational Web site is a very complex one, not only requesting the appropriate hardware and software support, but implying a great number of specialists: *project manager*, *system architect*, *creative lead*, *security architect*, *database developer*, *component developer*, *UI (user interface) developer*, *graphic artists*, *HCI (Human-Computer Interaction) engineer*, and even others [7]. In a past article [3], we proposed a model for the management of the information resources inside an academic institution, especially a faculty of computer science, that use and develop in the same time different related educational projects, taking into account two aspects of the organization approach: the outlook of the data formalism for the information system and the pursuit of a set of directions for facilitating and stimulating the collaborative communication between all project teams members.

4.1. The Information Organization System

Inside the intranet of the academic institution, the person(s) who has/have an overall information control is the network administrator(s). His role is to manage distributed information about both users (accounts, rights etc.) and information resources of the institution's computer systems – physical resources (e.g. storage systems, printers etc.) and logical resources (i.e. databases, processes of the operating systems, applications and others). These resources need to be allocated to different users by using various permissions policies: *individual access*, *group access*, *access for the intranet's domain*, or *public access*.

The organization of all information regarding the Web site of the academic institution is the task of the site manager. Our suggestion made in another past article [4] is to organize on the site server different directories for each academic year, having corresponding subdirectories for every module, sub module, discipline, instructor etc., in these being stored all the materials about the courses and students. For each atomic organizational unit shall be create a group of users having different rights. Every student shall obtain from the network(s) administrator a user name and a password in the moment of admission, which shall be removed at the end of the studies. As well, the instructors and the administrative staff of academic institution detain such accounts. In order to control the information access, the site manager could appeal to the modules described in the first mentioned article [3]. Hereby, a student shall be authenticated by the WebIdent module, while WebRights module shall assigned the rights for having access to all materials adjacent to the followed courses, by enrolling the respective student in the proper groups of users.

An instructor should access by a unique user name and the right password the materials from all modules he was involved in teaching activities, having modifying rights only at the materials managed by him. A person from administrative staff shall access for modifying only the general information from the site. The casual visitors should access for reading only the public section of the site.

4.2. The Web Presentations Management System

The proper persons to create and manage the courses tutorials, tests and other teaching materials placed on the educational site are even the authors of their content. Because the diversity of this persons specialties, we exposed in [5] a solution to facilitate the automatically generation of the teaching materials as Web presentations.

The site manager could conceive – in XHTML [13], for example, – a Web form by which to ask for all information necessary to build a course tutorial in

the form of a SMIL presentation: text, audio, video, graphic streams of data, associating with the action of this form a CGI script which to generate the desired SMIL presentation file. For example, a course tutorial could be progressive presented in some slides by: its theme, summary, the principal goal, a general description of the each main subject, and a detailed presentation of each topic, an example in the closing section of every sub-chapter, some conclusions and bibliographical recommendations in the end. The CGI script have to take over the content of each field of the form in a variable, creating a file with each textual information, and then to generate the markups (tags) of the SMIL file, specifying the names of all existing files as values for animation and temporization attributes. Accessing such a form, any member of the educational staff could easy build a SMIL presentation, storing it temporary on the computer from his/her office.

In order to integrate the presentation into the educational site, the respective member could use another Web form – provided by the site manager, too – where to fill in the complete information about the course: academic year, module, discipline, group of instructors etc. This information is transformed by the script into an XML document. This file is being automatically sent to the site manager, who could affiliate this file to the general site of the company, by associating a hyperlink in the site with the SMIL file. Also, the script has to realize the upload action for storing the SMIL presentation in the proper subdirectory, corresponding to the respective academic year, module, discipline, etc. We choose XML because this document type could be processed regarding formal rules defined by a Document Type Definition (DTD) or an XML schema [21]. By this way, on the server, in the special location of the general site files shall be stored only the corresponding XML document, not entire the presentation, which shall be definitively stored in its correspondent subdirectory. The structure of the XML document could be, for example:

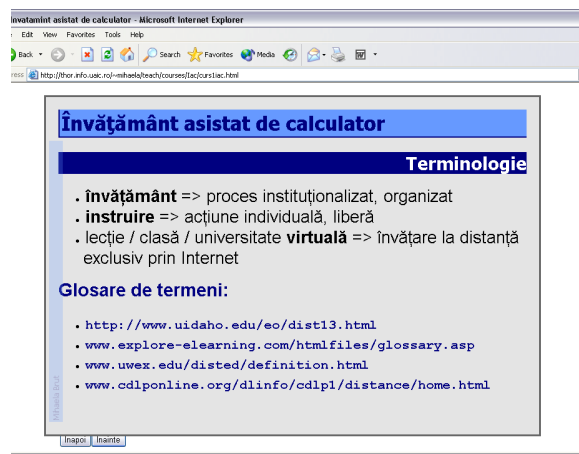
```
<presentation type="tutorial">
  <!-- tutorial stored in /test/exercise -->
  <item type="text/smil">
    <name>JavaLesson1</name>
    <description>
      Swing details ...
    </description>
    <desc href="demo1.smil"> ... </desc>
    <!-- the location shall be automatically
    completed by the script-->
  </item>
</presentation>
```

Because a SMIL presentation constitute an attractive manner for presenting a personal idea or the results of the work, a set of similar Web forms

could be put at the disposal of all academic institution members to facilitate the professional communication between them. By this way, SMIL presentations could become a familiar dialect for different specialty persons, without being necessary the knowledge of SMIL language or others programming matters.

Also, the site manager could conceive Web forms for generating other types of teaching material: tests, exercises, etc. For each type, the educational stuff could give ideas relative to different kinds of such material, to be taken into account by the site manager. For example, the generated tests could be one/multiple answer, with equal/different score assigned with each question, etc. The scripts which process the corresponding Web form shall manage the manner of storage the answers given by the students, etc.

We give below the image capture of one slide of a Web presentation built in HTML+TIME.



4.3. Refining the Design with XUL

For the institution members familiarized with the facilities of an visual interface editor, the site manager could conceive an XUL meta-interface: an Web interface built in XUL which put at the user disposal the entire set of widgets under a graphical form. Each widget could be included inside a XUL document by associating the proper action to the “drag and drop” or/and to the “double click” event(s). By this way, any user could easy build graphical interfaces for the teaching materials who want to include into the site. For the purpose of an unitary site style, each new XUL document create with this meta-interface could already contains some identification elements, such as the institution coat of arms, the current university year, etc.

Using this XUL meta-interface, the users could conceive themselves the structure of the teaching material, not having to follow the presentation route imposed by the Web form discussed in the previous section. Following the opportunities provided by a

PowerPoint-like application, the XUL meta-interface could give the possibility to insert a new “slide” in the XUL document, as well as the resulted XUL document being in fact a Web presentation.

Moreover, for each slide of the generated XUL presentation, the site manager could put at the user disposal – by the XUL meta-interface menu – a set of slide design layouts, similar to those from PowerPoint, containing text, bulleted lists, tables, images, graphics, etc. By thus, a Web presentation shall have a professional aspect, the variation of design eliminating the possibility of a boring or ineffective interface.

Because presently only a few clients (*i.e.* Mozilla or Netscape browsers) may directly support XUL, we do not intend to post on the site the XUL presentation. The site manager could conceive different “proxy” programs in order to automatically transform XUL documents into SMIL or XHTML+TIME multimedia presentations. In fact, XUL documents can act as containers [6] for multimedia-rich synchronized elements annotated in other XML dialects such as SMIL, XHTML+TIME or SVG languages.

By this way, the user can build a personalized Web presentation in XUL, using a XUL meta-interface, but he/she obtain as result the corresponding SMIL or XHTML+TIME multimedia presentations, which shall be managed as was mentioned above. If the structure and the design of new teaching material is new and could be helpful to the others members of the academic institution, its layout could be saved through the XUL Web meta-interface.

The XUL meta-interface could give to the user the possibility of “opening” a SMIL or XHTML+TIME document, that it means it shall be generated a new XUL document which to incorporate the native SMIL / XHTML+TIME tags. By this way, a user could modify the content or the design of an existing SMIL presentation through a friendlier graphical user interface. The bidirectional transformations in or from XUL documents could be processed inside the XUL meta-interface by the means of *XSL (Extensible Stylesheet Language)* stylesheets.

5. Conclusions and Further Work

Our proposal for developing the educational web sites tries to cover many problems that we consider important: the platform-independence and the open-source character of the solution, the discharging the work of the site manager, the automatically updating of the site, and – not in the last – the participation of all members of the academic institution to the site development. Having complete rights to the personal created teaching materials, any member is the single responsible for these. A Web XUL meta-interface can give him/her the possibility

of modifying them from anywhere and anytime, as well as the opportunity of creating new materials and layouts, within a friendlier graphical user-interface experience. The teaching materials are created as XUL documents and generated as SMIL Web presentations.

We are considering SMIL as the appropriate language for the synchronization and integration of Web-based multimedia sources, making the development and management of multimedia Web pages a more streamlined, efficient process [14]. The XML-based property of SMIL language is one important prerogative, beyond its capacity of making the message in the transmission clearer or more attractive.

A future direction in our research shall regard the possibilities for the academic institution members to modify their presentations from any place on the globe including via WAP, and to store the educational resources files on multiple computers, in a complex distributed manner. Also, taking into account the great amplitude and the permanent development of the distance education phenomenon [19], we shall try to design a set of Web agents which to gather useful information from similar educational Web sites or from reference bibliographical resources.

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