Fighting technical complexity in authoring e-learning material

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Abstract

Technical challenges for non-experts in creating content for e-learning are not trivial. Many more issues raise when that content is required to be universal, usable and accessible. The high-quality of the output, however, seems to be still indissoluble from the high-complexity of the authoring processes. This paper proposes a novel approach to lighten the burden to authors, and to make them produce sophisticated learning objects with little effort. We also describe ISA-WebLob, an authoring platform which takes that approach to implementation.

1. Introduction

E-learning content authors are, by definition, domain experts on the topic they create content about. Unless the topic is, itself, e-learning, chances are that authors have only a vague idea of the technical issues associated to producing good final products off their source content. The production of e-learning packages out of raw sources is then a task that is devolved to a team of expert editors that takes care of all the technical details, or it is dealt with through the aid of specialized software. Assuming, as often happens, that production costs are an issue, good authoring tools become even more relevant as they reduce the need for specialized editorial staff, and reduce the time necessary for the finalization of content.

In this paper we present Isa-WebLOB, an authoring tool for e-learning which provides an easy conversion mechanism that allows users with little or no technical expertise to generate highly sophisticated Learning Objects. This allows all editorial work to be done directly on the source documents, regardless of their data format, and the conversion to happen easily and any time is needed, while maintaining the same technical sophistication in output.

2. Technical complexity in e-learning authoring

Mistaking "e-learning material" and "*high-quality* e-learning material" is very easy. A set of slides on a web repository, a set of inter-linked HTML pages, even a well-organized pool of resources on a web server do not constitute high quality. Several issues should be taken into account:

Portability and reuse: content, besides needing to be pedagogically sound, has to be structured in a standard format to secure the future of this investment. Currently, the best specification to support the reuse, redeployment and portability is represented by the *de-facto* standard SCORM [1].

Universality: content has to be fully displayed on a wide set of user agents, including newest and oldest versions of browsers, uncommon operating systems, and new hardware devices. Compliance to standards such as (X)HTML and CSS is a *condicio sine qua non* to create content that can be universally read.

Usability: content has to be presented in a clear and readable manner. Easy-to-use interfaces should be designed to help users in retrieving information, surfing pages, following pre-defined or customized paths, etc.

Accessibility: finally, content has to be produced in respect of accessibility guidelines[2]. Web accessibility is the capability of providing Web content and services to people using assistive technologies. It is also promoted and sometimes required by national laws[3].

Really few authoring teams can produce by themselves learning objects that can meet *all* these requirements. Most times some such requirements will be neglected or delegated to external experts before the final publications of the material.

The traditional approach to generate e-learning content is based on a two-phase workflow: first, the author produces material in a source format (usually created with personal productivity tools) and then this collection of unrefined materials is processed with *ad-hoc* tools by a staff of experts. Due to their complexity, several activities are performed by the editorial staff: (i) raw material is transformed into a Web-based format, considering all web standards and accessibility guidelines, (ii) transformed content is arranged to structure the final LO, by defining a general didactical model for the SCORM-compliant LO and (iii) metadata are added to the LO and, finally, the content is transformed into a SCORM package.

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Several difficulties can be identified in such a workflow: first, tools do not usually support authors in the provision of all the required information; second, the author could design courses that follows a didactical model unsupported or only partially supported by the delivery platform; third, and more important, content updates have to be performed *directly* on the final LO, by exclusively using the authoring tools included in the platform. Even little modifications require many steps to be performed and intermediate documents to be produced.

3. Related Works

A lot of research projects have designed and developed authoring tools, whether commercial or free, for building e-learning materials such as [4]. These products typically provide authors proprietary interfaces which are very powerful but imply time consumption and a big effort to be learned.

In many cases, authors may prefer to rely on well-known productivity tools. Some products and platforms are designed to exploit Microsoft Word [5]. Their main advantage is that no learning and training phases are needed. Nevertheless these tools provide a strict structure in drawing up content which are already built and they keep authors' stylistic choices invalidating accessibility and usability principles. [5] provides a partial support to accessibility of created content, but, in some cases, generated LOs are not compliant to international guidelines and, in particular, to national laws on Web accessibility. Other academic projects are devoted to face accessible e-learning content production and customization. In [6] researchers put forward a set of basic criteria and rules for learning objects' authoring and learning model templates' generating, and the theories and techniques of customizable distance learning systems.

4. Fighting high complexity

Of course a traditional approach has advantages and will remain advantageous whenever the conditions allow it (for instance, when costs are not a problem or when design and implementation time is plentiful). Unfortunately this is not always the case. The fight of complexity in the authoring of technically sophisticated e-learning material, therefore, requires us to rethink the overall process. The following discussion items provide, in our view, a powerful solution:

Separation of content and presentation: Most of the requirements of section 2 have impact on presentation alone. As such, appropriate templates designed once and for all by professional and competent experts ensure the full support of these technologies with little or no effort from the content provider. The basic task of our tools, in this vision, is to apply templates to plain and simple content. Some smartness in interpreting the source documents allows fundamental characteristics of the original to be maintained and re-flowed into a template-driven usable and accessible output.

Automatic conversion of originals: implies that no custom-made authoring tool needs to be mastered by content authors. The possibility of automatically converting content from commercial off-the-shelf editing applications not only ensures the continuing useful life of legacy content, but allows content authors *to keep on using* such tools, and enjoy the technical sophistication provided by the templating mechanism.

Automatic and semi-automatic metadating: SCORM support requires a fair number of metadata values to be provided with the actual content files. Yet, many of the required metadata really can be deduced (with major or minor degree of accuracy) by careful examination of the operating system's and internal properties of the source documents. Others can be reasonably deduced with some smartness, and proposed to the content author for approval or modification. In fact, the number of necessarily manual metadata elements to be provided is very limited.

Validation: Although most requirements of section 2 impact on presentation alone, a few of them impact content as well, and need to be explicitly tackled and cared for by the author (for instance, the presence of alternative descriptive text for multimedia content). Manually checking that these constraints are met is work intensive on the author, and can be overlooked if (as often happens) the verification is managed by the author itself. On the other hand, providing an automatic validation mechanism can help drive the authors in the fulfilling of such constraints and in the successful management of these requirements. Schema languages such as XML Schema can be used towards this goal.

5. ISA-WebLob

These approaches are concretely applied in the ISA-WebLob system[7]. ISA-WebLob is a chain of applications that let authors use their preferred productivity tools to write content and add metadata, and that *automatically* transforms the content into advanced reusable LOs according to high quality standards. Fig. 1 (in the next page) depicts the overall architecture.

The authors write, modify, update and re-organize content by working only on original sources. Every author's action is performed through MS Word, OpenOffice or HTML editors. The author simply has to create content, indicate the role of each content

fragment (using predefined styles) and supply additional information such as alternative descriptions, acronyms, etc. We also provided users with a set of guidelines and a toolbar that helps them to organize and label content. The toolbar also includes a module to validate the input (validation is optional anyway) and a simplified interface to add SCORM metadata.

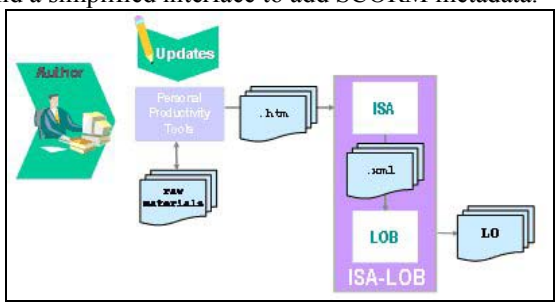

Fig. 1: The overall ISA-WebLob process

The source file is then passed to an application, called ISA, which produces an intermediary XML file of plain content. No limitations and rules are imposed over the editing with MS Word, but ISA is smart enough to separate the meaningful information from non-relevant data. It implements a GIGO (Good Input, Good Output) approach: the more the input is correctly marked-up, the more XML file is meaningful and easy to be processed. However any file can be normalized into XML content, cleaned from presentational aspects.

When (and if) validated, the output of ISA is a set of files that will be *automatically* transformed into LOs, by an appended module called WebLob. Since the conversion performed by WebLob is completely automatic, all changes are always performed on the original MS Word sources, and directly mirrored in the final output. Authors and editors do not need to learn new technologies and tools, but they only need to modify the source files over and over time.

WebLob performs a two-phase process of *composition* and *templating*. First of all XML files are transformed into XHTML valid pages and all the external resources are collected and put together, internal and cross-references are resolved and complex data structures (glossaries or exercises) are built. They all are packaged into a learning object, supplied with a SCORM manifest (created by exploiting automatic and semi-automatic metadata). The final operation is the configuration and application of templates for the delivery platform. Those templates have previously created by professional designers, experts of accessibility, usability and browser-independence. WebLob connects and merges them with the original content, previously extracted by ISA. Fig. 2 shows an example of a MS Word document, and the final result on an e-learning platform.

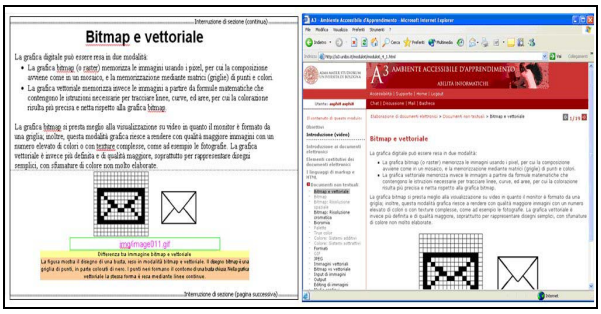

Fig. 2 A page processed by ISA-WebLob

6. Conclusions

ISA-WebLOB is not a prototype: it is a production system, used for more than two years within and outside the University of Bologna. The initial sponsor and originator of the tool has been the *A³ Project* (http://a3.unibo.it/) which was carried out at Department of Computer Science to generate LOs for the teaching of basic IT skills. The original provision of 20 courses, which are still being delivered to more than 2500 students every year, is now accompanied by several courses on all subjects, for a total of 350 LOs. Some of them are targeted for a specific LMS platform (in our case, ATutor [8]) while others are designed to be purely SCORM compliant. Provisions for the specificities of other LMS are foreseen in the near future. Techniques to extract semantic information from content, to automatically annotate sources, and to collaboratively edit content will be studied.

7. References

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