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CUSTOMDP PROJECT
THE FINAL DISSEMINATION EVENT

Athens October 30th and 31st 2003

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Experiences of the CustomDP system and content from content creators', teachers' and learners' point of views

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Abstract

Content creation as small modules authored in XML and combining them into aggregations according to the specific needs of each course and even for single learners are the central ideas in the CustomDP project. It gives new opportunities but it also creates new challenges for content creation and utilisation. The presentation explains how the DTD that is needed for XML authoring was designed, and which opportunities it gives to the content creators to describe the structure of the educational material. The presentation also tells about the feedback that content creators, teachers and learners have given of the system, and how it was taken into consideration in developing the system.

1. Why modular content

The most central idea in the CustomDP project has been to create and support managing content as small modular learning objects. The system makes it possible to use any kind of content as a learning object, but the best support is given to learning objects that have been produced using the DTD (Document Type Definition) that was defined in the project.

A set of rules must be defined when content is to be authored in XML. These rules are expressed as a DTD. The rules tell which elements may be utilised in the document and in which order. In other words, the structure of the document is defined with the help of these elements. For example, a typical text document consists of headings, chapters, and paragraphs. These elements are needed to display the content in a way that makes it convenient to read and use it, and to add the required functionality when electronic publishing is concerned. When we are defining the structure for educational material, we need the possibility to include educational elements in addition to normal structural elements.

Another important feature of XML based publishing is that not all contents of one XML document need to be publish at one time. For example, a DTD may consist of elements that are meant for one publishing channel only or for certain type of users. So, the customisation of content can be made within one document utilising the alternative and optional elements. We did not utilise this feature to a considerable extent in the CustomDP project. In our approach, the main way of customisation is to produce different learning objects for different user groups, and then make the customisation of the content by choosing the relevant learning objects for a certain aggregation.

2. Developing and using the DTD

2.1 The structure of the DTD

The following general requirements were set to the DTD:
- The DTD should be as simple as possible.
- It should be possible to link files in different formats.
- It should be possible to give metadata of the linked files, such as language and copyright information.
- It should be possible to include alternative content for non-printable files. In practice, this alternative content is a printable image and/or text that tells what the non-printable file contains.
- Two image versions should be possible to include – high and low resolution ones.

- Metadata that is to be used for describing the content should be included in the XML file.
- Only such metadata will be included that cannot be created automatically when the learning object is imported into the system.
- Life cycle metadata is created only after the learning object has been imported into the system, and needs not to be included in the DTD.
- All elements must add value from some point of view.
- Mark-up should not have subject related elements.

As the first step in the actual DTD development work, we analysed the material that our project partners used and the structures that could be found in the material. The following elements could be identified:

- paragraphs (+)
- text in marginal (-)
- tables and their captions (+)
- lists (+)
- images and their captions (+)
- institute logo (-)
- emphasised text (+)
- definitions (+)
- code embedded in text and as separate paragraphs (+)
- tasks or exercises (+)
- open questions (+)
- combination tasks(+)
- multiple choice exercises (+)
- examples (+)
- remarks (+)
- abstract (-)
- references to other material (+)
- references within the material (+)

The (+) sign after the element means that our DTD includes these elements, and the (-) sign that they were not included in the DTD.

We also added some elements that were not found in the content samples but that we considered useful. The most important of these new elements are the learning goals of the learning object and the reading guides, of which there may be different ones for the teacher and the learner, if needed.

We ended up choosing a loose and flat structure for the DTD, so the structure resembles HTML. There are very few required elements except in the metadata section. Together with the customisations made into an XML editor, it is quite straightforward to start authoring. The differences to using a normal office software are not that big. The most important difference is the metadata section.

With this loose structure we get the benefit that the learning object may have very varying content. As an extreme example, we can mention that it is possible to include only a link to a file like a PowerPoint presentation, or make a learning object that only consists of some exercises that make it possible to test learner's knowledge of a topic or module. Most of the currently existing learning objects have narrative structure and content, but that need not be the case, and our DTD does not require it.

The metadata and the mark-up within the body section of the document are generic. There are no elements within the body section that are specific to our subject area, digital printing. There are three digital printing specific elements within the metadata section to describe the content with predefined values: subject, module and keywords. (The learning goal element can be used to describe the content with free text.)

All of our content has digital printing as the subject, and if the system is developed to include other subjects, this attribute is needed to indicate which subject the content deals with. The module and keyword element need then be defined in a way that is relevant for the subject. We used the module to describe the predefined subsection of the content, which were assigned for the different content creating partners. The keywords give additional information of the content; there is a list of keywords

from where the relevant ones may be chosen. There is no hierarchy between these two elements, so any of the keywords can be used with any of the modules. This way it is also possible to indicate links between modules.

2.2 Experiences of XML authoring

Since the basic features of the DTD are very straightforward to use and the structure is flat, it is quick to start authoring. This may have some drawbacks, since the authors do not necessarily need to study the DTD so carefully, and they only end up using the main features and do not utilise the features that are available to make the content informative and easy to use from the learner's point of view.

Even though we had both separate guides relating to the DTD and using the XML editor, and our customisation files also included some instructions of the meaning and correct values for the different elements, corrections to the files could not be completely avoided at importing. So, even though the structure of the DTD can be regarded as simple, the number of elements turned out to be relatively high.

As the project manager and also based on the feedback we have got from the users, some general guidelines to the authors can be given

- Use simple language. It is easier to read on the screen, and also more user-friendly particularly to people who have to study using a foreign language.

- Utilise elements that help to find the main points like emphasising important words and sections.

- Add information to links, so that the user may decide whether the link is worth visiting.

- Make short and descriptive headings.

- Do not try to tell everything in one learning object. Trust the other authors and learning objects.

- Describe the learning goals in a precise and concrete way, for example, list the important terms and concept that are explained in the learning object.

- Include exercises and tasks that not only test directly what was said in the learning object, but also require applying the information or make the learner to think about the subject more in depth, if possible.

- Spell check the content before submitting into the system.

3. Metadata

The CustomDP system relies on metadata that is used to describe the content and how it should and could be utilised. As we heard in an earlier presentation, metadata includes very versatile information of the learning objects. We took the LOM metadata vocabulary utilised in the SCORM reference model as the starting point, and chose the metadata elements that we regarded as relevant and useful for our material. [IEEE,1998] [ADL, 2001]

There are 13 mandatory pieces of metadata information that must be given at authoring, and another 20 are available. These give a good opportunity to describe the content from many aspects; the bad thing is that someone has to produce the metadata. Some of the metadata can be produced automatically, but manual input cannot be avoided.

In our project, we chose an approach where the metadata is included in the XML file that the content creator produces in order to submit material to the system. The metadata section of our DTD includes all the mandatory and optional metadata information that can be given excluding the ones that are generated automatically at importing or during the life cycle of the learning object.

This solution was partly dictated by the fact that we did the system development and implementation concurrently with the content creation. So, the content creators had to produce quite a lot of content

before they could submit it into the system. This way it was possible to store the SCO metadata together with the actual without the help of the database.

This offline metadata creation has some good features but there are also some limitations. The good thing is that the author can decide which are the most appropriate values and descriptions for the content at his own pace along with the authoring task. The main limitations are that all the value options (so called enumerations) have to be stored in the DTD, which makes their updating more difficult than if the values were chosen directly from the options that the database offers to the users in an on-line connection. Another limitation is that it is not practical to have very long lists of values in the DTD, therefore some required values are to be given as text or numbers, and the author must know the exactly correct value, in other words check the values in the database.

Only the mandatory values need to be given at authoring, and even they may be changed once the learning object is in the database. Also more pieces of metadata information can be given once the learning object is in the system. At importing, the metadata is stored in the database and the actual content, the body section of the original XML document, is stored separately and used for displaying the content.

4. Creating aggregations

The aggregations are created utilising the aggregation editor tool. It was implemented as a Java applet and application. It is possible to create and modify the structure for the course, and it is even possible to view the content within the application. The Java application has a more visual user interface than what had been possible to produce utilising only HTML. The drawback is that the user must be able to install the application in his or her computer.

The user may create a new aggregation out of the smallest available components, i.e. SCOs and referenced content, or utilise existing aggregations as such or by modifying them. This makes aggregation creation really quick if some of the existing aggregations are close to what is needed.

In our test courses, the teachers did not report any difficulties in finding content for their courses, but this was really not to be expected either because the test teachers were members of the project group and they chose for the most part their own learning object. We expect that with the help of model courses and modules, also new teachers can have an easy way to assess the content and to start making their own courses even though they have not been actively participating in content creation.

According to the feedback from KTH, a teacher's main problem is to find teaching material with the right content and to a cost-level that is acceptable to the students. And another problem is to make good presentation materials for the lectures. The CustomDP system could help to solve these tasks.

The important strong point in the EVITech feedback is that a system like CustomDP makes it easy to organise even individual courses, because the contents can be chosen and modified to meet the need and the student can study the content individually.

When content is created by different people at different times, it cannot be avoided that there is variation in style and level. By adding enough metadata it is possible to select content that is of the same level. The style variation cannot be avoided completely without extensive editing, which is not the idea behind the system. Of course, now that we have quite a lot of content available, everyone can look for good examples, and try to use them as a guideline when creating new content, which may reduce the style differences. When assessing the content, we must remember what the real life alternatives might be: the material could be only the slides that the teacher has prepared, or a set of articles and manufacturer brochures, and also there the style and level will vary.

This project did not quite reflect the use scenario that we visioned when we made the proposal, because we had quite a precise plan to create a certain amount of content dealing with digital printing. The vision was based on gradual content development according to the needs of different courses. In practice, however, it is necessary, or at least very beneficial to have this kind of a concentrated effort to create and bring in enough content to start with. In other words, the vision was to create the tools that support collecting and utilising content from different sources and from different content creators to make a content pool, which benefits many kind of learners and learning situations, not to make a tool

for direct editorial co-operation. We have created a starting point from where the material hopefully will live on and be developed further.

There were some complaints about the work needed to define the metadata for aggregations, like a course. The problem with the metadata is that it is not directly beneficial to yourself to define the metadata since you know what the course deals with. And, the system requires that you give at least the mandatory metadata when the course is published, which may be a busy time anyway. Hopefully, when more courses are being created all teachers will mutually benefit from the metadata, and do not regard it as too much of a burden to define it.

5. Viewing courses

The first user tests were made with the first version of the system in winter 2002/2003. The challenge for the users turned out to be the navigation in the course structure. Our first version tried to combine showing the aggregation and learning object metadata along with viewing the content, but this turned out to be too complicated. The first version also required that the user navigated in the structure hierarchy step by step until he or she reached the actual learning objects at the bottom of the hierarchy where the actual content was. At each step, the existing metadata of the aggregation was shown for viewing if the user clicked the aggregation name. And, as we heard in the previous presentation, we also give the users the opportunity to download a PDF version of the content, and this is another option that needs to be shown to the users in a convenient way and integrated into the user interface.

Based on the feedback, we changed the navigation, so that when the user clicks on an aggregation symbol or title in the navigation frame, the content of the first learning object in the aggregation is shown. Also the contents of the aggregation is immediately shown down to the learning object level, and this way the user does not need to spend too much time in navigating. To see the reading guides and learning goals, the user must click on the G&G icon in the navigation frame.

We also made a separate form for selecting the content to be included in the PDF file to be produced. This way the user can quickly access the PDF creation function, and can easily choose whatever content he or she wants to be included in the PDF file. In the first version, the user only had the access to the PDF file of the aggregation or the SCO that was currently being viewed.

The system includes a feedback form for courses, and so far we have had three courses that have tested the system and given the feedback this way (two courses at EVITech and one at KTH). The users rated the content between 3,25 and 3,67 out of 5. The system as a whole got the best points (3,25...4 out of 5) from being easy to use, but the navigation in the content, as explained earlier, got marks below 3. Since then, we have made language improvements in the content, and additional test groups will use the content during the coming months.

The system gives the users the opportunity to comment single learning objects. This feature has not unfortunately been found and used by the users. This feedback would be very useful to authors, teachers and other learners, so hopefully the future learners will be more active on this point in the future.

The PDF feature is convenient for learners, if they for example want to store the course material for future use. It is typical, that the learner only has access to a learning environment only for a limited time, and it may not be at all easy to gather the content into one aggregation. In the user feedback, the usefulness of the PDF was not rated very high (2...2,88 out of 5) even though according to the EVITech teacher the students seemed to be very interested in the opportunity to produce PDFs. The reason for this may be that our PDF implementation was not yet working quite properly at that time, and for example, due to some old image formats, some of the images were rendered as black boxes in the PDF files.

6. Cycles of testing and development

The DTD has only been modified slightly during the project. Initially, the reading guide element was mandatory, but we noticed during the authoring that it is not always very useful or needed at single learning object level, so we changed it to an optional element.

The XML based content gives many opportunities for future development. For example, by adding some more mark up it could be possible to create extracts that help learners to pick the main points. Also utilising images as presentation slides could be made quick and easy. When adding new features the needs and benefits must be weight against the work needed to add the extra mark-up.

Once we decided the metadata elements to be used, no changes have been made there. Most of the optional metadata fields have not been used, which make them rather useless because we cannot conclude that a search made based on these optional metadata fields results in all the content that actually matches the criteria.

When developing a system like this, new needs arise once the system is up and running. And users get new ideas as to how they would like to use the system and content. It is always a good sign that such ideas emerge.

7. Conclusions

This has been a large and long project, which has taught us all many different things. In addition to the mere technical things like XML and metadata, we have learnt more of how to work in an international project, how to make system development, and what a content creation project requires.

The CustomDP system, like the name implies, has produced tools and solutions that make it possible to collect different types of content and combine them according the needs of each course or even a learner. Using XML required the content creators to learn new skills, and hopefully this skill will be more useful also outside the CustomDP system in the future, when XML gains more ground. Authoring the content in XML makes it, however, possible to add new customisation features, and utilise the content in different and flexible ways according to the future needs.

Our final user tests during the coming months hopefully proof that we have developed the system and content into the correct direction, and that they offer an even better user experience and a good basis for further development and utilisation in practical training and education.

8. References

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