‘Developing an EML authoring and content management environment’

Proceedings of a conference hosted by the OUNL, March 20/22-2002 Valkenburg, the Netherlands

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With special thanks to Scott Wilson
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Summary

This document is a report of a 3-day invited work conference on “developing an EML authoring and content management environment”, March 20-22, 2002 in Valkenburg, the Netherlands. The OUNL facilitated this conference, which brought together recognized R&D institutions in the field of e-learning technologies, users and private sector parties from all over the world (annex I).

The conference addressed two key requirements (annex II):

- Creating, adapting, and previewing content in a user-friendly way while still allowing for the use of advanced instructional design (Personalization, multi-channeling, ....)
- Storing, searching, sharing and reusing content within a defined community

Objectives of the conference were:

1. develop a common framework for EML authoring and content management
2. develop a business model (or more general a model for collaboration)
3. agree on future joint activities in this field

Prior to the conference the invited participants were required to send in a description of their required authoring and content management environment in the form of Domain Diagrams and related Use Cases, using UML1-notation. This "homework" was collected and processed by the OUNL, resulting in an input-document to the conference.(annex III)

In accordance with the conference program, there were plenary sessions and workshops:

The whole group conducted an analysis of the preliminary architecture for an EML design, authoring and content management system, and looked at possible workflows.

Workshops looked at the issues from two different perspectives: an authoring tools perspective, and a business models perspective.

Finally, the two discussions were brought together with brief summaries of each group.

Summing up the conference after three days, the chair of the conference, Rob Koper, felt that a tremendous job in terms of both work and common agreement had been done.

A component based architecture for e-learning had been defined (annex IV) and agreements have been made for joint future activities.

The participants ended the final session by signing the "Valkenburg declaration", in which the intention of all experts to the outside world is expressed (annex V)

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1 Unified Modelling Language, which provides a structured ‘stepping stone’ to the compilation of technical specifications.
1. **Introduction**  
Prof. Wim Jochems, managing director of the Educational Technology Expertise Centre of the OUNL welcomed the delegates. He expected a lot of synergy would be produced in these three days, in view of the conference theme, the 'homework', that has been done and the available expertise.

2. **Program Review**  
Rob Koper, chair of the conference, gave a program review ([annex II](#)), by outlining the problem domain, the problems to be addressed, the objectives and scope of the conference and the boundaries: (EML) tooling and design time  
He pointed out the steps towards a common framework as an output from this Conference.

3. **Presentations and areas of interest**  
Each delegate gave a short presentation on his/her organization and their areas of interest:  
Looking at the overall position of delegates in relation to EML, most are in the experimentation and prototype stages and although using different terminology, participants were facing common issues.

4. **EML introduction**  
Henry Hermans (OUNL) gave an overview of EML ([annex VI](#)); more specifically an overview of the steps to be taken to realise an EML-design (roles, activities, scenario’s, 'manipulation' through conditions etc.).  
Furthermore the state of play between EML and other specifications (IMS and Scorm was discussed

5. **Component based architecture for e-learning**  
With the *input document* as a starting point, the whole group conducted an analysis of the preliminary architecture for an EML design, authoring and content management system, and looked at possible workflows. Subsequently workshops looked at the issues from two different perspectives: an authoring tools perspective, and a business models perspective.  
Finally, the two discussions were brought together with brief summaries of each group.  
These formed the basis for an action plan that was formulated at the end of the conference.

5.1 **Authoring tool perspective**

5.1.1 **Architecture**  
The preliminary architecture from the input document provided a very lively debate, although the overall UML component model was found acceptable to the delegates after modification and resulted in a common defined architecture of an EML authoring and content management environment, i.e. a collection of components with well-defined and language-independent interfaces  
(see [annex IV](#)).  
Main focus was on the EML editor (Learning Design), not Materials Editor or Metadata Editor, which were put out of scope.  
The 'EML Constraint Editor’ was up for consideration, but thought to be filled – at least in the short term – by generic XML tools for editing DTDs.

Some specific issues from the debate:
- Need to separate editors of Materials (such as MPEG, JPEG etc.) from editors of EML documents.
- Requirement for version control, status management in repository subsystems.
- Requirement for repositories to allow or deny search/retrieve of materials and EML documents based on status (so only see finished items, or only draft items)
- Material editors may need to see EML documents in order to author dynamic behaviours, such as showing or changing Dossier values.
- EML Repository stores both EML documents and templates (as they are also EML documents)
- Runtime Simulation system should be more than just a player, but also provide a test environment simulating real use of an EML unit of study for debugging, for example by allowing developer to play all the roles and switch between them.
- Internationalisation (translation) needs to be considered as a fundamental aspect of the system. One EML document with all translations, or one per language?
- Curriculum design is implicit;
- Metadata editor should be able to work with external taxonomies, perhaps from related (but out of scope) taxonomy editor.
- Metadata has to be in the EML document in addition to the “intrinsic metadata” stored with the referenced materials;
- The EML Editor fulfils different needs for different actors; for designing “learning types” (scenarios) and for designing courses.
- Need interfaces for supporting services.

5.1.2 User Interface design
The group produced a prototype design for the user interface of the EML editor:
5.2. Business Models

5.2.1 Markets: remarks in advance
The market for EML-based solutions is by and large not aware yet that it has a problem to be solved. Currently the bulk of elearning customers haven’t come up against the barriers in “traditional” VLEs and e-learning platforms. There is a need to identify benefits from a business and end-user viewpoint. For example cost savings, opportunity cost gains, impact on core business process. Also benefits to end users in terms of their mission, for example benefits to students’ learning. Also it may be worth promoting the benefits provided as a side-effect of using a more disciplined approach. The overall trend will be one of increasing dissatisfaction with current approaches, therefore an increased demand for solutions making use of EML capabilities will arise. What need to be done is to identify key niche markets. Possible candidate markets include government, military, IMS industrial members, the STEP consortium of industry leaders, lifelong and community learning.

Additional niches identified (on Day Three) included organizations of professionals, such as the National Health Service, ACCA, IEEE.

5.2.2 Marketing and business strategy
There is a need for awareness raising through prototypes designed to illustrate benefits. A coherent strategy for presentation is required. A key issue is “crossing the chasm” from an early adopter community into the mass market. One strategy for this is to produce solutions that target a specific vertical or niche market. If niches are identified, then it becomes possible to target solutions (including tools and user interfaces) to totally satisfy customers in those niche markets.

Important is that EML becomes a standard (although this could be via becoming a de-facto industry standard). We need to do things now, however, rather than wait for standardization. By producing a clear picture of the value added, the case for standardization becomes stronger. There is a possibility to promote the design and scenario planning aspects of EML rather than that of the electronic content delivery and provide solutions based around that. It is not enough to provide partial solutions; impact from adoption on business processes need to be considered. There is also the need to provide end-to-end solutions, if necessary by partnering with companies that provide complementary products, services, or content.

It may be useful to build tools for demonstration but not production – instead implementing solution through processes and services. But make use of some prototype tools to demonstrate benefits and get buy-in.

5.2.3 Revenues and business models
The European 6th Framework Program (FP6) could provide a very important source of public funding for prototype development. Therefore we should identify proposals, consortia, strategic economic benefits to enable the “Valkenburg group” to take advantage of FP6 funding. Licensing is also an important issue for cooperation. For example, Open Source code, or restricted-use shared code within a consortium approach. It is necessary to work together to accelerate process, but allow companies to make commercially saleable products.

6. Future activities and the scope for working together
Each of the participating groups provided an outline of planned activities and the scope for partnering with other groups present to produce tools and services. This process identified a number of immediate developments and partnerships.

There was general interest in forming some type of consortium or association to pursue common goals. On basis of what was discussed there was a need to try to define outlines for possible consortia, levels of cooperation and commitment.

Two levels of participation were distinguished:

Level One is the most basic level is to cooperate on common architecture, and anyone involved in this would need to commit to further development of the architecture or to support it in their development efforts.

Level Two is the level of actual EML projects. Not everyone has to participate at this level. The projects may have different licensing agreement and types of relationships between partners; the sole criteria are that the projects have to fit within the architecture. There can also be dissemination projects that raise issues or promote good practice.
6.1 Project requirements
Participants identified several immediately useful projects.
- To produce a ‘proof of concept’ demonstrator that was fully functional along a narrow path through the EML production and delivery process to demonstrate the key benefits of the architecture and the EML standard. Integrating Edubox and Blackboard would be a very compelling demonstrator in this respect.
- A second project may look at the issue of harmonizing material produced at different institutions with different pedagogical approaches, and how the explicit semantics of EML affect this process.
- A shared repository for EML sample materials was considered useful, although a number of participants had some reservations about allowing open access to such a repository as it will be some time before errors (both at design-time and run-time) can be fully addressed. So such a repository would be best suited to “inside” use.

6.2 Timescale for developing the architecture
The group decided a timescale of 60-90 days for architecture development was optimal:
- At this point the architecture will be well articulated with specification of internal interfaces and alignment with other standards activities (including IMS Digital Repositories).
- The architecture will not become ‘fixed’ after this period but will keep on evolving. However, it should provide a solid enough foundation for development.
- The architecture will provide a roadmap that allows the group to define priorities and projects.
- Around the midpoint (40 days) there should be another face-to-face meeting. A number of events were considered, including EdMedia in Germany, IMS in Cambridge, MA in May/June, the National Education Conference in Texas in June.
- A number of other events were considered for PR/political visibility, including Prometeus in September and CEN/ISSS in July.

6.3 Processes and organisation
The group felt there was no need at this stage to produce formal rules, and that at the moment ‘openness is our strength’. However, a joint declaration to use the common architecture would send a strong message.
Some of the participants would attempt to engage the involvement of other important stakeholders, who, for one reason or another, were not present. Examples included the Open Knowledge Initiative and Open Courseware Initiative, commercial authoring system developers (e.g. Macromedia), publishers (e.g. Bertelsmann), infrastructure providers (e.g. Sun), and organisations in the German-speaking countries.

6.4 Sources of funding
- 6th Framework
  Participants considered the European 6th Framework Programme (FP6) in more detail. Participants generally agreed this was an excellent source of medium-term funding for EML projects, as the FP6 approach was very much suited to the ideas for cooperation of those concerned, and some contribution from the Canadian stakeholders is also possible under this programme.
  However, an Expression of Interest must be made very soon (April) if an FP6 bid is to be successful.
- The Dutch-Canadian mission
  initiated by the Dutch government may lead to something useful – both the Dutch and Canadian participants will keep an eye on developments.
- JISC
  In the UK, JISC provides funding along two relevant streams – JISC/NSF and JISC X4L. There are EML-related project proposals either planned or submitted under both funding programmes.

6.5 Testing with Edubox
A number of participants felt it would be extremely beneficial to make the existing Edubox player available so that developers could test EML they generate. Rob Koper agreed to look into the feasibility of doing this.
7. **Who’s doing what?**

- **Tool Repository**: No-one, but this is just a website or CVS repository.
- **Runtime simulation**: Perot - Edubox (Perot, Java), CeLT - Colloquia (Centre For Learning Technology, Java)
- **EML Constraint editor**: OLA (not actually building it, probably use XML spy)
- **Learning design editor**:
  - CeLT - Colloquia (Java)
  - CETIS (Python, Zope)
  - Penn State (WebObjects, Java),
  - Perot (Java on BEA), SA (Java)
  - Intrallect (Java)
  - OpenVES (Java)
  - OLA (Java/Zope)
  - Innsbruck (MS Word templates)
  - Digital University of the Netherlands (Zope)
  - CETIS/X4L/JISC (requirements gathering only)
- **EML repository**:
  - Perot (Java)
  - Intrallect (Java, MySQL, Oracle)
  - OpenVES (Java, Tamino).
- **Material Editor**:
  - Cito-groep (test materials, Xmetal, XMLSpy, .Net)
  - OpenVES (Java)
- **Metadata Editor**:
  - Cito (as above) – includes vocabs
  - Intrallect (as above)
  - CeLT (Java)
- **Material Repository**: same as EML repository
- **Search toolkit**: None
- **Stylesheet Editor**: None

8. **Summing up**

Rob Koper felt that “We’ve done a tremendous job in terms of both work and common agreement”, and this raises the question of “what next?”

7. One immediate action is to set up list server.
8. Another face-to-face event (arranged through list server.) This may provide the “consolidation” necessary for this event.
   - The Expression of Interest for FP6 needs to be worked on.
   - Work on creating the architecture needs to go ahead rapidly, with a timescale of 60 days to completion from the meeting.

Some observations on the meeting process itself:
- We achieved a lot more than we expected
- We managed to get started quickly, largely due to the effort put in on the ‘homework’.
- The meeting had an excellent open atmosphere allowing us to collaborate effectively

9. **The Declaration**

The participants ended the final session by signing the “Valkenburg declaration”. This declaration provides a foundation for the FP6 Expression of Interest, and sends out a message of our intentions to the rest of the world.
Annex I  The Valkenburg group

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Annex II  Programme review and expected outcomes

Dia 1

Developing an EML authoring and content management environment

Programme and expected outcomes

Rob Koper

Dia 4

Expectations of e-learning

• Students expect high quality, flexible, personalized content (using the possibilities of ICTs in an effective, efficient and attractive way)
• Tutors expect user friendly, flexible and advanced tools to create content
• Institutions want to implement new technologies for various reasons (e.g. image, cost-effectiveness, attract new student populations, ...). One of the more important issues are the need for interoperability, re-use, sustainability and straightforward implementations of e-learning systems & tools

Dia 2

Content

• Introduction to the problem domain
• Objective of the conference
• Input document: preliminary models
• The programme

Dia 5

In practice

• Students get rather dull web-based sequenced files to learn (with some communications services and test resources around it), based on a rather oversimplified pedagogical view
• Tutors have easy tools to create the dull web sites, but miss the tools to create the flexible and advanced e-learning content they really want
• Institutions see that the content isn’t as interoperable and re-usable as needed

Dia 3

The Problem Domain

Focus on: ‘Content’ for e-learning:
• learning objects (resources)
• service specifications (e.g. chat service)
• activity descriptions (tasks, problems, ...)
• learning designs (e.g. lesson plan)

Note:
Type of content, the content creation process and the actors involved in the creation process are dependent on the pedagogical and organizational view of teaching/learning processes (not only pipeline approaches!)

Dia 6

EML

• EML is a basic learning technology to solve the problems of the quality of e-learning content and the reuse/interoperability problems in principal
• It expects however adequate tooling before the benefits will become clear.
• User friendly (3rd generation) tools for design, creation, management, sharing and interoperability are still missing
We will address two problems

- **Authoring problem**
  Content must be created, adapted and previewed in a user-friendly way, allowing more advanced pedagogical designs (personalization, multi-channeling, …)
- **Content management problem**
  Content must be stored, searched, shared (re-used) within a defined community

**Objective of the conference**

Given:

- the acceptance of EML as a solution for the modeling of e-learning courses
- the struggling of organizations to design, author, and manage high quality content in EML
- the different initiatives worldwide to provide authoring facilities (different projects, initiatives), aiming at different parts of the total puzzle

**Objective of the conference**

Initiative:

- Bring together different parties with authoring problems/plans
- Identify a common framework which could be used as a base for identifying each others' work and as a framework for the interoperability of the different tools and resulting content
- When we agree on such a framework we could collaborate in different fields (R&D projects, tool development, content exchange, services, business, …)

**Objective of the conference**

Objectives:

1. Develop a common framework for EML authoring and content management
2. Develop a business model (or more general a model for collaboration)
3. Agree on future joint activities in this field

**In scope**

Tools for:

- Design of units of learning (e.g. courses)
- Edit learning objects, activity descriptions, test items, …
- Aggregate/disaggregate learning objects, activity descriptions, test items, …
- Content management & workflow

**Boundaries**

1. **Topic is EML tooling** and not EML, standards for e-learning
2. **Business models for the collaboration in co-development of tools** not e-learning business models
3. **Design time** not Run time
Steps towards the common framework

1. Homework: requirements in use cases
2. Analysis and comparison: input document
3. Define joint: domain model, use cases for authoring; use cases for business, reference architecture (components and interfaces) and business model
4. Identify the different efforts on the resulting model
5. Identify collaboration within the framework of the architecture and business model
6. Define future activities

Input document
We created three preliminary models based on input

Preliminary domain model

Preliminary architectural model

Preliminary business model

Business model for co-development of tools:
1. Partners involved in the model
2. Actors/clients involved in the model (e.g. authors, designers, institutes)
3. Activities/roles of partners in the model
4. Revenues for partners (commercial versus consortium versus open source versus …)

Programme
• Day 1: plenary session
  - EML introduction
  - inventory/presentation per participant
  - joint model based on input model
• Day 2:
  - identifying blind spots
  - separate groups: domain model, business model
• Day 3:
  - continued work in separate groups
  - plenary feedback & discussion of outcomes
  - outline action plan/declaration of intent

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Annex III Input document

Input Document

to

the conference

‘Developing an EML authoring and content management environment’

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<th>version</th>
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<th>major revisions</th>
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<td>2</td>
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<td>environment components diagram added detailed classes of educational materials added requirements OpenVES added.</td>
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<tr>
<td>3</td>
<td>March 19</td>
<td>Class diagram educational materials replaced by aggregation model and annex 2 deleted ‘pseudo-UML’ domain model replaced by proper UML models</td>
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Introduction.

This document is prepared as input to the conference “Developing an EML authoring and content management system” and is based on high-level requirements specifications submitted by ten participating organizations. This input document tries to consolidate the shared requirements in the form of common Use Cases and a common Domain Diagram. It is expected that in later versions of this document the requirements from four additional organizations will be added. Based on the outcomes of the conference the document may be further elaborated.
EML structure.

Although the conference-topic is authoring and content management, some additional information about EML may be useful. Especially the question “Should we take EML as it is as the basis for the conference?” has been posed by various participants. To clarify this issue, this section gives an overview of the structural relationships between different types of documents in the EML architecture.

The starting point is EML, as it is presented at http://eml.ou.nl. It consists of a domain model for units of study and its binding in XML. In IMS we work towards a Learning Design specification derived from EML. As it stands it is compatible with the domain model but differs in its binding. In future, when the IMS LD specification is available, the OUNL will provide an automatic converter from EML to IMS LD. In the conference we will take the EML DTD 1.0 as the starting point. The EML DTD is generic and allows for a wide variety of conforming EML-Documents. The EML-DTD might be too generic for the needs of certain educational purposes. It is possible for authors to write educational material in EML in a special restricted way. The resulting EML-document will be valid. Tools can check whether the document conforms to the EML-DTD, but not whether it conforms to the intended restrictions. To support automatic checking of specialized documents, one can define a collection of constraints on the EML-DTD. This results in a specialization of the generic EML-DTD, and tools may check the EML-Documents against this constrained EML-DTD. This is shown in the following figure:

![EML DTD Diagram](image)

Each organization, or even each department in an organisation, can thus develop its own specialised EML-DTD. This allows organisation-specific constraints to be formally defined and enables automatic checking of any EML document against the organization (or department) specific DTD. Every document conforming to the organisation’s specialized DTD will, by definition, also conform to the EML-DTD. This approach allows organisations to tailor the EML-DTD to their specific needs, while staying within the scope of the standardised EML-DTD.
An EML authoring and content management environment.

**System boundaries.**

What is clear from the submitted requirements, is the variety in scope of what is considered authoring and content management. Authoring in its most restricted sense is equalled to editing (written) content, while in its broader sense it may cover documenting an educational vision; creating templates for educational scenario’s; searching and identifying content; creating, editing, (re-)assembling multi-media content; filling EML wire frames/templates; and adding meta. Content management in its restricted sense is limited to functions typically provided by commercial content management software: in a broader sense it includes options to search, identify and check-in valuable educational material for various media; specialised tagging options; provision of (access to) tooling. A special function - in most submissions situated somewhere in-between authoring and content management - is testing, through either a reference runtime system and/or printing.

System boundaries can even be further extended when including management and support functions required in settings for content creation and content management: project management, workflow management, monitoring and quality assurance, learning management, financial management, etc.

In the conference we will start with the wider system, but (for the time being) exclude the management and support functions. Defining the interfaces to these management and support functions may however also be covered. A further exclusion are the so-called Virtual Learning Environments (VLE) through which learning materials are presented to the learners. Again, the requirements for an interface between the content management system and such VLE’s may be included.

**Use cases.**

The submitted Use Cases of nine organizations have been aggregated into 18 common Use Cases. A detailed comparison between organizations and the Use Case definitions are contained in appendix 1. The 18 Use Cases can be grouped into seven categories as in the below table, each with its specific outcome (product).

<table>
<thead>
<tr>
<th>Process</th>
<th>Use Cases (see appendix 1)</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define EML-DTD</td>
<td>..............................</td>
<td>EML DTD (later IMS LD)</td>
</tr>
<tr>
<td>Define educational vision</td>
<td>1 Define pedagogical approach</td>
<td>Educational vision doc. (txt) translated to specialised (enterprise) EML DTD, which is a compatible subset/specialization of the complete DTD.</td>
</tr>
<tr>
<td>Define learning design for the unit of learning (e.g. a course)</td>
<td>2 Create pedagogical scenario</td>
<td>EML document (excluding any real content)</td>
</tr>
<tr>
<td>Edit material</td>
<td>3 Define requirements 4 Create/edit 5 Assemble/aggregate 6 Disassemble/disaggregate 7 Add meta data 8 Fill scenario</td>
<td>Content in various formats and level of specificity. E.g. XHTML or EML content.</td>
</tr>
<tr>
<td>Manage material</td>
<td>9 Search repository 10 Check in to repository 11 Check in to repository 12 Change status 13 Delete</td>
<td>Repository of learning objects, activities, designs and aggregations .</td>
</tr>
</tbody>
</table>
The last category of 'support processes' is not specific to the production of educational material (project management, workflow management, content management, quality assurance, monitoring, billing, etc.). Their functionality will most likely be found in other — already existing — tools. What is relevant in terms of authoring and content management is to define the relevant interfaces and the configuration specs for these tools to make them fit for supporting authoring and content management.

**Preliminary domain model.**
The products from authoring are stored and managed in a content management system. This contains a so called ‘repository’ of different objects which can be ordered according to certain dimensions:
- re-usable versus not re-usable objects
- smallest unbreakable objects versus container units (aggregates)
- media specific files versus media independent files
- units of learning versus learning designs versus environments containing resource specifications and service specifications
- object identities versus versions of the same object identities

The relationship between the different object is expressed in the domain model below.
A few notes:
In many cases the distinction between the design of a unit of learning and the resources used in the unit of learning is not made.
Also the distinction between resources and services is not made in most cases.
Every object can have metadata associated with it.
Not all details are shown here.
Many other terms are used, but the above are the core or were chosen to express the relationship to EML.
Preliminary architecture of applications and interfaces authoring and content management environment.

This package diagram depicts the components - and the relationships between them – of the authoring and content management environment.

The workflow model – categories somewhat similar to the headings used in the table of Use Cases – can be depicted as follows:
In annex 2 the package diagram and workflow diagram are combined into one.
Expectations.

******
We look forward to helping define an end-to-end solution for single-source publishing of educational content and materials. Furthermore, we feel there is great potential in the formation of a consortium to promote a standard-based, object-oriented set of tools.

We hope that the discussion will give us more insight into our own authoring and content management requirements. We also hope to come away from the conference with a better understanding of OU-EML, and a better sense of ways in which we can ensure the interoperability of OLA’s models with it.

******
Refine JISC X4L system model
Refine development bay functionality
Expand create Unit of Study use cases
Investigate role of EML in implementing the X4L system
Investigate role of EML in creating and implementing tools and development bay”

******
Broaden up the scenario of EML authoring and content management especially to institutions with low budgets and low skilled content producers
Systematical integration of WinWord as one XML-editor for many authors
Clearer picture how to integrate free OpenSource production tools with commercial products
Get more information about possible cooperation/partnerships

******
To consider in much greater detail authoring tools for EML and related mark-up languages
To gain knowledge of EML best practices
Share experiences of practical implementation of EML

******
Hull University is new to EML and so one expectation is to get up to speed in the concepts and interactions in the EML model. We also represent interests in both MLE, authoring and content production tools. We have an MLE, TILE, which we anticipate putting in the public domain as an open-source project. We have spent the last year studying standards in the consideration of our own TILE authoring tool. Because our delivery is dynamic and adaptive, we need a high level conceptual (meta-schema) in order to develop our own schema. We have looked at content packaging standards such as IMS and SCORM but these do not give us the flexibility we need for adaptive delivery based on student and pedagogical models. We hope that EML will provide a standard in this respect.

We need to ensure that this standard is likely to be accepted and that it covers all aspects of our work on adaptive or personalised delivery.

******
I have a number of important expectations I hope to meet at the conference:

To better understand the status and philosophy of the Education Modelling Language and the technology being built using it.

To reconcile the approach we have taken with the EML Tools approach
To work toward a better understanding of the ways the EML approach can add value to our efforts in the states to build a SCORM-like set of reference models for k12 eLearning platform standardization and deployment.

******
Annex 1: Submitted Use Cases compared and consolidated.

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**Define EML DTD:**

**Define educational vision:**

1. Define pedagogical approach | 2 | 2 | 1 | 9,15 | 1

**Define course plan:**

2. Create scenario: design implement | 2 | 2 | 4,5 | 2 | 10,16 | 5,6 | 9

**Edit material:**

3. Define requirements: RO RIO EO RLO UoS activity | 9 | 4 | | | |

4. Create/edit: RO RIO EO RLO UoS activity | 10 | 5 | 1 | 1,5 | 1,6 | 1,6,7 | 3,5,6 | 1,2 | 11,17 | 11,17 | 10 | 11,17 | 11,17 | 15 | 1,3 |
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**Support processes:**

<p>| 17. Project management: | overall project resources outcomes tasks/staff technology users | 21 | 19 | 22 | 4 | 5 | 8 | 7 | 2 | 4 | 8 | 3 |
| 18. Content management: | | | | | | 8,10,12,15 | |
| 19. Workflow management: | | | | | | 5,10,11,12,14 | |
| 20. Quality management: | | | | | | 5,7,9,10,14 | |
| 21. Monitoring use | | | | | | 14 | |
| 22. Documentation: roles | | | | | | 12 | |
| 23. User support: | | | | | | | | | | | | | | | |</p>
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<th><strong>Use Case #: 1</strong></th>
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<td><strong>Use Case name</strong></td>
<td>Define pedagogical approach</td>
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<tr>
<td><strong>Description</strong> (max. 200 char.)</td>
<td>Determine what will be the leading pedagogical approach applied in the learning processes and content.</td>
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<td><strong>Actors</strong> (5 max.)</td>
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<tr>
<td><strong>Prerequisites</strong></td>
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<tr>
<td><strong>Outcome</strong></td>
<td>Prescriptions (at least to some extent) regarding interaction types and their sequencing (between learner and resources), roles, and media.</td>
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<tr>
<td><strong>Main success scenario (optional)</strong></td>
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<td><strong>Exceptions (optional)</strong></td>
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<tr>
<td><strong>Remarks (optional)</strong></td>
<td>The learning process comprises the interactions between learners, staff (tutors, experts, etc.) and other resources (incl. fellow students). This Use Case is sometimes combined with the next one: create a scenario.</td>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case name</strong></td>
<td>Create scenario</td>
</tr>
<tr>
<td><strong>Description</strong> (max. 200 char.)</td>
<td>Implement the pedagogical approach in the form of a (series of) ‘if-then-else’ statements.</td>
</tr>
<tr>
<td><strong>Actors</strong> (5 max.)</td>
<td></td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>The resulting scenario determines a learner’s route through the learning opportunities (specific content still open), based on variables triggered by learner actions and/or by others.</td>
</tr>
<tr>
<td><strong>Main success scenario (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Exceptions (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Remarks (optional)</strong></td>
<td>In EML an implemented scenario is called ‘wire frame’. It can be defined at the level of a single activity up to the level of a complete curriculum (referencing is possible).</td>
</tr>
<tr>
<td>Use Case #: 3</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Use Case name</strong></td>
<td>Define requirements</td>
</tr>
<tr>
<td><strong>Description (max. 200 char.)</strong></td>
<td>Define requirements for a (series of) RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td><strong>Actors (5 max.)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>Definition of (a series of related) RO’s or any of its more specific sub-classes.</td>
</tr>
<tr>
<td><strong>Main success scenario (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Exceptions (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Remarks (optional)</strong></td>
<td>In the case of EML, the RO’s defined here will most likely be needed together with the wire frame (Use Case 2) to create an ‘activity’ or a ‘UoS’ (Use Case 8).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case name</strong></td>
<td>Create/edit</td>
</tr>
<tr>
<td><strong>Description (max. 200 char.)</strong></td>
<td>Create from scratch, or edit existing copy of a RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td><strong>Actors (5 max.)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>A RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td><strong>Main success scenario (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Exceptions (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Remarks (optional)</strong></td>
<td>To be checked into the repository (Use Case 11) after adding meta data (Use Case 7) and/or to be added to a wire frame (Use Case 8).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case name</strong></td>
<td>Assemble/aggregate</td>
</tr>
<tr>
<td>Description (max. 200 char.)</td>
<td>Take an instance of a sub-class to create a (larger) instance of the same sub-class, or to create an instances of a class.</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Larger instance of the same sub-class, or an instance of the class.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>May involve adding additional/new meta data to describe the larger or higher-order product.</td>
</tr>
</tbody>
</table>

**Use Case #: 6**

<table>
<thead>
<tr>
<th>Use Case name</th>
<th>Disassemble/disaggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Break up an instance of a class to create new (smaller) instances of the same class, or instances of its sub-classes.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Smaller instances of the same class, or instances of its sub-class.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>May involve adding additional/new meta data to describe the new instances of the class or the instances of the sub-classes.</td>
</tr>
</tbody>
</table>

**Use Case #: 7**

<table>
<thead>
<tr>
<th>Use Case name</th>
<th>Add meta data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Add meta data to a RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Added value in terms of usability.</td>
</tr>
<tr>
<td>Main success</td>
<td></td>
</tr>
</tbody>
</table>
Reasons for adding metadata may be numerous: to change a RIO into a RLO by adding learning-related meta data; to coin ownership and related rights; to indicate characteristics related to reusability; etc.

### Use Case #: 8
**Use Case name**: Fill scenario
**Description (max. 200 char.)**: Add the resources (RO or any of its more specific sub-classes) to the ‘empty’ scenario. Either through inclusion (‘hard copy’) or through referencing.
**Actors (5 max.)**: A learning activity or a series of learning activities with related resources. A self-contained series of learning activities with an underlying sequence can be defined in EML as a Unit of Study (UoS)
**Main success scenario (optional)**:
**Exceptions (optional)**:
**Remarks (optional)**: The added/referenced resources can be RO’s, RIO’s, and RLO’s (including EML UoS, EML activity, and EML knowledge objects: personal object, tool object, questionnaire object, role object, communication object, announcement object, role information object). The Use Case ‘Fill scenario’ may duplicate the Use Case ‘Create’ and ‘Assemble’ where a UoS is concerned!

### Use Case #: 9
**Use Case name**: Search repository
**Description (max. 200 char.)**: Search for a RO or any of its more specific sub-classes.
**Actors (5 max.)**: Search for a RO or any of its more specific sub-classes.
### Use Case #: 10

**Use Case name** | Check out of repository  
--- | ---  
**Description** (max. 200 char.) | Take out/copy and mark a RO or any of its more specific sub-classes.  
**Actors** (5 max.) |  
**Prerequisites** |  
**Outcome** | Copy of a RO or any of its more specific sub-classes available for editing, assembly, disassembly and/or adding meta data.  
**Main success scenario (optional)** |  
**Exceptions** (optional) |  
**Remarks** (optional) | May be done for editing purposes, for (dis)assembly, adding meta data, or for checking into another repository (e.g. for delivery through a VLE). According to the purpose of checking-out different markers/counters may need to be invoked.  

### Use Case #: 11

**Use Case name** | Check into repository  
--- | ---  
**Description** (max. 200 char.) | Store a RO or any of its more specific sub-classes in the repository.  
**Actors** (5 max.) |  
**Prerequisites** |  
**Outcome** |  
**Main success scenario (optional)** |  
**Exceptions** (optional) |  
**Remarks** (optional) |  

Search can be carried out in a closed repository (content management system; CMT) or world-wide; possibly these two instances should be split into two distinct Use Cases! In the case of an identified RO’s outside the repository, disassembly and adding of meta data may be part of the checking-in process.)
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Stored RO or any of its more specific sub-classes in the repository in such a way that it is easily retrievable (through meta data) and of certified quality (indicated by status).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>Will usually be preceded by some sort of quality assurance procedure, of which the outcome is indicated by a status (see below, Use Case 12).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 12</th>
<th>Change status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Change the marker of a RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Status of any RO or any of its more specific sub-classes in the repository known at all times.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>E.g. to indicate the RO was checked out for editing, has been certified, was checked out for delivery, is a parent version, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 13</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Delete RO or any of its more specific sub-classes from the repository.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>Will hardly ever happen as material will have all sorts of trails: changing the status (Use Case 12) into ‘inactive’ may be more appropriate.</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 14</th>
<th>Use Case name</th>
<th>Develop style sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Case name</td>
<td>Develop style sheet</td>
<td>Develop lay-out for delivery.</td>
</tr>
<tr>
<td>Description</td>
<td>Develop style sheet</td>
<td>Develop lay-out for delivery.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exceptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Case #: 15</th>
<th>Use Case name</th>
<th>Reference run</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Case name</td>
<td>Reference run</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Reference run</td>
<td>Allows for testing a RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td>Tested RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exceptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td></td>
<td>Should have similar (but less sophisticated) functionality as a VLE and have demo-options (fast play-back, play forward, simulate roles and responses, etc.).</td>
</tr>
</tbody>
</table>
### Use Case #: 16

<table>
<thead>
<tr>
<th>Use Case name</th>
<th>(reference) print</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Print RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Printed version of RO or any of its more specific sub-classes.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>In the case of EML this requires printing both the actual content and some sort of representation of the pedagogical scenario, and the dynamism between them!</td>
</tr>
</tbody>
</table>

### Use Case #: 17

<table>
<thead>
<tr>
<th>Use Case name</th>
<th>Project management and support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>Ranges from managing overall educational (content development) projects to specific technology planning and implementation.</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>objectives, role specifications, time plans, etc.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>More subcategories can be identified. Some management-support functionality may be incorporated into the tooling environment, but defining interfaces to existing support/productivity tools is probably more productive.</td>
</tr>
</tbody>
</table>

### Use Case #: 18

<table>
<thead>
<tr>
<th>Use Case name</th>
<th>Content management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (max. 200 char.)</td>
<td>The functions as performed by a regular content management system: version control; sharing and locking files; assigning and managing user rights; keeping track of history (audit trail); etc.</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Actors (5 max.)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Information on object history and technical status.</td>
</tr>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>Some of the status aspects (Use Case 12) may be configured in the content management system.</td>
</tr>
</tbody>
</table>

| Use Case #: 19             |                                                                                                                                                                                                 |
| Use Case name              | Workflow management                                                                                                                                                                                                                                        |
| Description (max. 200 char.) | Planning and monitoring tasks, procedures, and delivered products.                                                                                                                                                                                            |
| Actors (5 max.)            |                                                                                                                                                                                                 |
| Prerequisites              |                                                                                                                                                                                                 |
| Outcome                    | Efficient and effective processes (manual and automated).                                                                                                                                                                                                     |
| Main success scenario (optional) |                                                                                                                                                                                                 |
| Exceptions (optional)      |                                                                                                                                                                                                 |
| Remarks (optional)         | When the core process is centered around educational materials, there may be overlap with material status (Use Case 12), content management (Use Case 18), quality management (Use Case 20) and monitoring (Use Case 21). |

<p>| Use Case #: 20             |                                                                                                                                                                                                 |
| Use Case name              | Quality management                                                                                                                                                                                                                                        |
| Description (max. 200 char.) | Secure quality of the produced materials.                                                                                                                                                                                                                 |
| Actors (5 max.)            |                                                                                                                                                                                                 |</p>
<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>Outcome</th>
<th>Educational materials which are fit for delivery to users.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main success scenario (optional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exceptions (optional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks (optional)</td>
<td>Quality usually indicated by status variable.</td>
<td></td>
</tr>
</tbody>
</table>

Use Case #: 21

Use Case name: Monitoring usage

Description (max. 200 char.): Monitor the application (checking out) of material by users.

Actors (5 max.): |

Prerequisites: |

Outcome: Overview of material usage.

Main success scenario (optional): |

Exceptions (optional): |

Remarks (optional): To keep track of use, e.g. for billing purposes.

Use Case #: 22

Use Case name: Document

Description (max. 200 char.): Create documentation.

Actors (5 max.): |

Prerequisites: |

Outcome: Documentation.

Main success scenario (optional): |

Exceptions (optional): |
| Remarks (optional) | Can in principle extend to all products, processes and related procedures; from the perspective of development, operation and maintenance. |

| Use Case #: | 23 |
| Use Case name | User support |
| Description (max. 200 char.) | Provide support to the users of (checked out) educational materials. |
| Actors (5 max.) | |
| Prerequisites | |
| Outcome | Support services (various) |
| Main success scenario (optional) | |
| Exceptions (optional) | |
| Remarks (optional) | |
Annex 2: Authoring and content management components and workflow.
Annex IV Component based architecture for e-learning

This document describes the reference component based architecture for e-learning as defined during the EML work conference on March 20-22 in Valkenburg, the Netherlands.

Overall architecture

The overall architecture is defined as a collection of components, with well-defined interfaces. The following components and their interfaces have been identified.

Figure 1: Reference architecture for EML environment
Each lollypop ( o---- ) is an interface through which the component can be accessed. A dashed arrow from one component to the interface of another component indicates that the component a usage relationship. (NB. Note that data flows in the direction opposite to the dashed arrow)

The role of each of these components in the reference architecture is summarized below. Additionally an indication is given whether the component may be implemented using existing tools, or whether it may need customized development for EML.

**Tool Repository**
The Tool Repository is the place where the various components of the EML environment are kept. Users (usually system administrators) can download tools from this repository and install them on their computer.
Tools: a simple solution might be a website where tools can be downloaded. In any case this type of tool is not EML specific and existing tools should be used.

**Runtime Simulation System**
The Runtime Simulation System can play units of learning or partial units of learning. It is used to get an active view on a unit of learning.
Potential uses are:
- Authors to check learning material during development
- Teachers, to preview selected units of study
- Reviewers, to review material against quality guidelines
- ...

The Runtime Simulation System should be more than just a player, but also provide a test environment simulating real use of an EML unit of study for debugging, for example by allowing developer to play all the roles and switch between them, or by playing faster or slower than real time.
The Runtime Simulation System is not intended for production use in teaching.
Tools: the Runtime Simulation System needs to be developed specifically for EML. The Edubox system from the OU is such a system.

**EML Constraint Editor**
The EML Constraint Editor allows users to define constraints on the EML Schema. This leads to specialized EML schemas.
Tools: this component can be an existing tool for editing generic XML Schemas.

**Learning Design Editor**
The Learning Design Editor allows users to edit educational material. Although the editor reads and writes EML, the user may get a more sophisticated and personalized view. The Learning Design Editor is described in more detail in the following section.
The Learning Design Editor fulfils different needs for different actors; for designing “learning types” (scenarios) and for designing courses.
Tools: as this is the most important tool for teachers and instructional designers, generic XML tools will not be able to support the envisioned users. Therefore this component needs to be developed specifically for the design of educational material.

**EML Repository**
The EML Repository is the place where all learning material is managed in the form of EML documents. Both complete EML documents and templates are stored in this repository. It should also be possible to store EML “fragments” which are simply reusable chunks of EML in this repository.

All non-EML material is kept in the Materials Repository, while the EML repository keeps references to this material only.

As a repository of shared information this component needs to support the typical repository functions:

- Version control, status management
- Access control, search facilities
- Allow or deny search/retrieve based on status (so only see finished items, or only draft items)
- Etc.

Tools: existing database packages with XML support provide the basic functionality for an EML repository. It might be necessary / useful to develop an EML-aware layer on top of this to make the interface to the repository easier to use in an EML environment.

Materials Repository

The Materials Repository is the place where plain educational material (resources, Knowledge Projects, etc.) is stored and managed. To be useful in an educational environment the raw material needs to be associated with metadata, which is stored with the raw material in the Materials Repository.

Preferably there are no references from the Materials Repository to the EML Repository. If such a link exists, the material will not be reusable, which is one of the major goals of the EML initiative. TBD

As a repository of shared information this component needs to support the typical repository functions as mentioned with EML Repository.

Tools: existing database packages (with XML support) might be used for this purpose.

Style sheet Editor

The Style sheet Editor allows the user to create and edit style sheets that can be used to specify the presentation of educational material.

Tools: existing XSSL (or other) editors might be used for this purpose.

Materials Editor(s)

The Materials Editors allow users to edit raw materials.

Tools: all currently available tools for editing pictures (JPG, GIF, etc), video (MPEG, QuickTime, ...), text, (X)HTML, etc. etc. fall in this category.

Metadata Editor

The metadata editor allows the user to tag raw material with metadata. The editor does not need to be able to edit and create metadata taxonomies, but it should have import facilities to import external metadata classifications or taxonomies.

Although a taxonomy editor might be useful, it is out of scope for the EML environment.

Tools: not decided yet.

Search Toolkit
The Search Toolkit is a toolkit that supports the user to search for educational material anywhere on the world. It may help to find raw materials, but can also find material in existing EML repositories. Tools: search engines on the web, like Google and others.

Implementation considerations
EML is a platform independent technology and does not restrict the platform on which it can be used. For the components above their implementation platform (programming language, Operating System, etc.) is completely free. Each of the components may be build on a different platform.
However, the communication between the components must be [platform independent. This means that the interfaces should use technologies like SOAP, Corba, or even EML document transfer through plain files.

The Learning Design Editor

The Learning Design Editor (formerly called EML editor) is the main component for developing educational material. In the editor it is possible to develop:

The EML Design part, which consists of activities, roles, conditions etc.

- The EML Environment part, consisting of resources and services.

From the initial collection of use cases found in the input document of the conference, this editor will support the following two use cases:

- Create pedagogical scenario
- Fill scenario

The original proposal divided the Learning Design Editor into two separate editors, one for each use case. As both of these use cases are editing the same object (i.e. an EML document) and because the pedagogical scenario might be changed during the Fill Scenario use case it is more logical to group these together into one tool.

As a consequence the Learning Design Editor has different actors (types of users). It is necessary to be able to personalize the editor to support these actors. This leads to a third use case Customize Editor. The actors that were identified are:

- Educational Specialist (Template developer or Learning (instructional) designer)
- Teacher (although perhaps using a simplified interface)
- Tool manager

To allow for as much freedom as possible for the users of the editor the use cases above are split up into a number of smaller use cases, each of which can be performed by an actor at any moment in time. The use case model of the Learning Design Editor including the smaller grained use case is shown in the following model:
The editor allows a large number of small tasks to be performed in any order. This allows maximum freedom / flexibility for the users.

Educational specialist

Learning Design Editor(s)

crud roles
create timeline
crud activities
assign roles to activities
align activities on timeline
assign environment to activity
crud environment
attach objects to environment
customize editor

Teacher
tool manager

CRUD = Create Read Update Delete

Figure 2: Small-grained use cases in Learning Design Editor
Note that the actors are roles, which means that one person might possibly play multiple roles in a situation within an organisation. The might be different for each organisation.

The following model shows the larger grained use cases and the relationship with the fine-grained use cases. Such a large grain use case might be implement as a kind of wizard that guides the user through the small-grained use cases in a certain predefined order.

Figure 3: Course-grained use cases in Learning Design Editor
The use cases, especially the fine-grained one, might not be fully complete yet. If more fine-grained use cases are found, they should be added to the use case models.

**Architecture of the Learning Design Editor**

The Learning Design Editor is a large component and it is hard to build it completely in one project. Therefore the need exists to create a framework in which the various projects can develop their own plugins. This will support a collaborative way of working between various institutes.

The main structure of the framework is shown in figure 4.

The Common EML Layer and the Tool Layer form the framework of the Learning Design Editor. The Plugins can be developed separately and use the framework.

<table>
<thead>
<tr>
<th>Common EML Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Common EML Layer holds the internal representation of the EML document(s) that are being edited. It provides an interface to the plugins that enables them to find, read and change the various EML elements inside the EML document(s). Each plugin therefore has access to the complete EML document(s). A notification mechanism is needed to ensure that plugins can be notified of changes in the EML document(s) performed by other plugins.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tool Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Tool Layer will show the main window for the Learning design Editor. It will provide standard functionality. More important it allows a plugin to insert new menu-items in the menu bar and/or new tool buttons on the tool-bar. To the user of the editor there should be no noticeable difference between standard and plugin provided options.</td>
</tr>
</tbody>
</table>

**Tools**

An example of an open source framework that supports this is the Eclipse project ([www.eclipse.org](http://www.eclipse.org)). The Netbeans ([www.netbeans.org](http://www.netbeans.org)) open source project has similar functionality. These frameworks were developed with a programming IDE in mind, but might be useable for the Learning Design Editor.
The common EM L Layer of the Learning Design editor allows plugins to read/write EM L documents or individual EM L elements that are loaded in the editor.

The Tool Layer allows plugins to install new menu-items, etc within the Learning Design Editor.

In figure 5, an example of the editor is shown with several concrete plugins. The Raw EML editor plugin is a standard plugin that allows direct editing of EML code. It is useful to have such a plugin available, because it ensures that a user has complete access to all EML details if he wishes to. A plugin that allows reading and writing of EML documents from and to file is also provided.
Note that the above two plugins are considered to be standard functionality, but can be developed as a plugin as well. This allows them to reuse all plugin functionality (like turning a plugin on/off). They also provide a good test case for the framework. A potential plugin is a SCORM import/export plugin that will read and write SCORM format. More sophisticated, we can also define a SCORM Editor plugin. This plugin can provide an interface to the user [purely in terms of SCORM, and use the Common EML Layer to store this in the form of EML elements. If all the other plugins are turned off, the Learning design Editor will look like a SCORM editor to the end-user.

The strength of this approach is that various plugins can be developed independently and any user organisation can configure its own Learning design Editor, as it is best applicable to the organisations needs. Still the underlying structure for all organisations will be EML.
Figure 5: Some example plugins for the Learning Design Editor

Might use DOM / SAX, but need to handle invalid/incomplete elements and multiple root elements.
Another series of plugins could consist of specialized editors for specific parts of EML. E.g. a graphical activity editor plugin might enable editing of activity structures, while another Environment plugin might enable setting up environments.

To enable a fast first version of the Learning Design Editor that can be used by teachers, one might develop a plugin (or a set of plugins) that provides a straightforward form-based interface to the underlying EML structure. In time the simple forms can be replaced by more sophisticated plugins.
Annex V  Declaration of intent

During the work conference from 20-22 March at Valkenburg, which was organized by the Open University of the Netherlands, the outlines of an EML authoring and content management system have been explored. The contributing experts of the organizations mentioned below have reached a consensus on the requirements that can form a common starting point for further cooperation. The experts share the opinion that the present results will need a follow up by the organizations they represent. The OUNL will take the lead in this by proposing the outlines of such a cooperation framework at most three months after the conference. The decision makers of the organizations involved, will be requested to react formally within four weeks on receipt of the proposal.

In the meantime the communication between the signatory experts will be facilitated by a list server hosted by the OUNL. Anticipating this proposal the present experts will act as contact person within their organizations for the subject. They will also propagate the results of the conference in order to create a basis for the decision makers.

Publication or use otherwise of the input or output of the conference by the participants, respectively their organizations, is allowed only by giving chapter and verse.

The signatories / experts:

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Cito groep

Ignace Latour,  
Cito groep

Rob Koper,  
OUNL
Annex VI  EML introduction

Dia 1

**EML 1.0**

Henry J.H. Hermans
Open University of the Netherlands

Dia 2

**EML Educational Modeling Language**

- Pedagogically neutral language for modeling (e)learning environments
- Elaborated within XML (as a DTD)
- Designed at the Open University of the Netherlands

Dia 3

**EML: specify...**

... who plays a role in your instructional design
- students(groups)
- staff (tutor, instructor, teacher, ...)

```xml
<Roles>
  <Learner Id = "Student" Link-name = "student">
    <Role Id = "Chair" Link-name = "chair"/>
  </Learner>
  <Staff Id = "Tutor" Link-name = "tutor"/>
</Roles>
```

Dia 4

Problem based learning example

- Tutor
- Student group
- Chair

Dia 5

Role declaration in EML

```xml
<Roles>
  <Learner Id = "Student" Link-name = "student">
    <Role Id = "Chair" Link-name = "chair"/>
  </Learner>
  <Staff Id = "Tutor" Link-name = "tutor"/>
</Roles>
```
EML: specify…

... what persons in these roles should do

- students: analyse problems, formulate learning objectives, find literature, discuss, assess peer students, take tests, et cetera
- staff: tutor, assess, provide feedback, monitor, make time-table, answer questions, et cetera

<Activities>

Activity-description in EML

Activítty Link-name = "the conflict" Id = "a-conflict"

<Metadata>
  <Title>Identifying an intercultural conflict on the workplace.</Title>
</Metadata>

<Activity-description>
  <What>
    <P>In order to have sufficient and realistic material to analyse, you will first need to...</P>
  </What>
  <How>
    <P>Describe the conflict at surface level, i.e...</P>
  </How>
</Activity-description>

<Completed><User-choice/></Completed>

<Activity>

Learning objectives in EML

<Learning-objectives>
  <Learning-objective Id = "LO-1">
    <Objective-description>
      <P>At the end of this course you are able to describe and analyse a conflict situation.</P>
    </Objective-description>
    <Objective-type><Skill></Objective-type>
  </Learning-objective>
</Learning-objectives>
EML: specify...

... how the performance of the activities is supported

- content (books, articles, cases, references, et cetera)
- tools and services (search engines, glossary, portfolio, notes, e-mail, conferences, et cetera)

<Environment>

Environment specification in EML

<Environment Link-name = “support environment”>
  <Environment-ref Id-ref = “env-curriculum-guide”>
    <Knowledge-object Link-name = “about this module”/>
    <Knowledge-object Link-name = “method”/>
    <Knowledge-object Link-name = “timetable”/>
  </Environment-ref>
  <Environment Link-name = “communication”>
    <Communication-object Link-name = “FirstClass”/>
  </Environment>
  <Environment Link-name = “dossier”>
    <Role-information-object Link-name = “progress”/>
  </Environment>
</Environment>

Environment example in Edubox

EML: specify...

what the learning path looks like and how it can be influenced

<Method>
EML method: specify…

… how activities are related

<Activity-sequence>

and

<Activity-selection>
EML Play example

```xml
<Method>
  <Play Id = "Default-play">
    <Role-ref Id-ref = "Student"/>
    <Activity-structure-ref Id-ref = "AS-student"/>
    <Role-ref Id-ref = "Teacher"/>
    <Activity-structure-ref Id-ref = "AS-teacher"/>
  </Play>
</Method>
```

Play example in Edubox

Student view Teacher view

EML method: specify...

...how (parts of) the learning path can be manipulated and can be adapted (personalized) to students’ characteristics (properties)

```xml
<Conditions>
</Conditions>
```

EML conditions example

```xml
<Method>
  <Conditions Id = "Chair-conditions">
    <If>
      <Is><Role-ref Id-ref = "Chair"/></Is>
    </If>
    <Then>
      <Show><Content-type Type = "only-for-chair"/>
      <Activity-structure-ref Id-ref="AS-chair"/></Show>
    </Then>
    <Else>
      <Hide><Content-type Type = "only-for-chair"/>
      <Activity-structure-ref Id-ref="AS-chair"/></Hide>
    </Else>
  </Conditions>
</Method>
```

Put in another way...
EML: application of XML

- Medium neutral; publish to several media from 1 source
- Easy to search through
- Software independent
- Better connection possibilities

Medium neutral:
Search: define very specific queries
Software: resistant against ever changing software systems; not propriatary formats
Connection to financial systems, administrative systems, billing systems, tracking and tracing system

Thank you for your attention!