Re-engineering of the Apprenticeship
Electronic Booklet: Adaptation
to new users requirements

Authors: Lahcen Oubahssi, Pierre Laforcade, Philippe Cottier

Contact email: lahcen.oubahssi@univ-lemans.fr

REDiM Project
(Model Driven Reengineering of Technology Enhanced Learning)
LIUM lab
(Computer Science Laboratory of Le Maine University)
Outline

1. The AEB presentation & new requirements
2. Re-engineering activities
   1. The multi-role management service
   2. The internal editor
   3. The external editor
   4. The communication interface
3. Summary and ongoing work
The Apprenticeship Electronic Booklet (AEB)

- A Web-based Technology Enhanced Learning environment
- Tutors from both training centers and companies
  - can follow apprentices’ progression
  - evaluate apprentices knowledge acquisition
- Apprentices
  - can perceive their progression in the training and regulate it
The Apprenticeship Electronic Booklet (AEB) (2)

- **Origin**
  - Designed from a research project, in a participatory process involving researchers (human science, computer science), practitioners of the trainings (trainers, administrative and employers) and apprentices

- Developed as a configurable artifact
  - Common area of work and communication with others
  - Knowledge-to-acquire tree
  - Global configuration booklet for apprentices within a same training in terms of **terminology**
Zoom on the terminology
Issues and new requirements

End users feedbacks
- AEB difficult to be used in trainings whose general organization scheme does not conform to the initial one
  - Some roles are attached to a same physical person => have to connect/disconnect to change roles / functionalities
  - Some roles / training structures do not exist within some trainings
    - eg. no company structure => no company tutors

New requirements for the design of booklets
- Roles as functionality/components to assign to actors
- Adaptation to various organizational schemes
- Providing opportunities to adapt the booklets on-line or off-line
Re-engineering activities overview

- **Internal re-engineering**
  1. development of the multi-role management service
  2. realization of an internal configuration editor

- **External re-engineering**
  3. development of an external graphical editor following a *Domain-Specific Modeling* approach and tooling
  4. realization of an import / export communication API
The multi-role management service

- Extraction of the multi-role management conceptual model
  - Study and analysis of both functional and conceptual models of the existing database (MySql)
  - Reorganization of the system functions
    - in the form of modules (internal services)
    - identification of the actors, definition of the rules and constraints
    - definition of a new institutional setting, etc.
- Formalization in a metamodel
- Modification of existing code
  - PHP-based
  - Every page must follow a new system architecture
The internal editor

- PHP-based
- Drag&drop

**Functionnalities to assign**

**Roles**

**Global organization scheme**
Domain Specific Modeling (DSM) [Kelly et al., 2008]
- A software engineering methodology for designing and developing systems
- Involves the systematic use of a graphic DSM Language

DSM tools
- Propose meta-modeling techniques
  - Formalizing domain-specific vocabularies (abstract syntaxes)
  - Facilitating definition of notations (concrete syntaxes)
- Generate domain-specific software code
- Generate powerful and user-friendly editors for DSM languages
  - Kind of meta-CASE editors
  - Domain-designers can graphically specify models from their domain
  - Models persistence facilities in a machine-interpreted format
DSM applied

- Tooling: Eclipse Modeling Project
  - Unified set of frameworks: EMF, GMF, ATL...
  - Graphical Modeling Framework (GMF) process
DSM applied

Domain metamodel is at the core of the GMF process, drives the specification of other models.

GMF has a neat set of wizards to help create the various models.
Generation and development of the external editor

- Realized activities
  - development of the editor as a plug-in for Eclipse at first
  - addition of constraints (use of OCL - Object Constraint Language) to add some semantics on the domain meta-model
  - development of a Rich-Client Platform (RCP) version (standalone),
  - addition of support services / guidance (eg. cheat sheets for end-users, splash-screen, etc.)
  - ...

- An administrator must have the web management function (1 Constraint)
- A teacher must have the teaching function (1 Constraint)
- A scholarship chief must have the management function (1 Constraint)
- A tutor must have the tutoring function (1 Constraint)
- .......
- An actor cannot be instantiate twice (8 Constraints)
- A function cannot be added twice for a same actor (13 Constraints)
- A function name cannot be modified (5 Constraints)
The final external editor

The image shows a software interface with various sections labeled as 'Palette', 'Actors', 'Functionnalities', and 'Organi-zational structures'. The interface includes various icons and labels, indicating different functions and roles within an educational or organizational setting. The text at the bottom of the image is not clearly legible.
Example of XML-based configuration file used

- Human-interpretable notation & machine-readable format synchronized by the external editor

Example XML code:

```xml
<Acteur xsi:type="LEAV2:ADMIN" terminologie="Administrateur">
  <Fonction xsi:type="LEAV2:F_ADMIN" droit="admin" nom="Gestion Web"/>
  <Fonction xsi:type="LEAV2:F_SECRETARIAT" droit="rsv" nom="Gestion administrative"/>
  <Fonction xsi:type="LEAV2:F_SR" droit="sr" nom="Conception du suivi"/>
  <Fonction xsi:type="LEAV2:F_SUIVIAPPRENTIS" droit="ma" nom="Tutorat"/>
  <Fonction xsi:type="LEAV2:F_ENSEIGNEMENT" droit="ens" nom="Enseignement"/>
</Acteur>
```

Internal AEB import/export interface
Summary (1)

- The *Apprenticeship Electronic Booklet* re-engineering
  - Techno-centric
  - Internal and external approaches promoting adaptability of architectures and functional models to facilitate their use
  - A preliminary common analysis and design to extract the functional model of the existing system
  - External re-engineering driven by models
    - Domain meta-model at the basis for the development of the external editor
    - Specific *Domain Specific Modeling* tooling experimented: EMF/GMF
Summary (2) and ongoing works

- New need about booklets configuration
  - Internal and external editors realized
  - First end-users feedbacks
    - Both editors useful
    - New need asked for specifying the *know & know-how to acquire* tree with a similar editor (graphical & external)
  - Future experiments and scientific validation required
    - to compare the ownership and usage of these 2 editors
    - to confirm the added-value of the external one
Current research activity

- DSM approach for the AEB re-engineering
  - Opportunistic exploratory activity
  - Real interest about another TEL context:
    
    Helping teachers-designers using existent Learning Management System in specifying learning scenarios and in deploying / operationalizing them...
    ...by following a DSM approach for the specification of a VIDL and an external graphical editor dedicated to the LMS instructional design domain

- Thesis work
  - Started in October 2009
  - Ayman.abedmouleh@univ-lemans.fr
Thank you!

...Any questions?
Current research activity

- DSM approach for the AEB re-engineering
  - Opportunistic exploratory activity
  - Real interest about another TEL context:
    - Helping teachers-designers using existent *Learning Management System*
      - MOODLE as main LMS experimented
    - in specifying learning scenarios
      - with a graphical editor => human-interpretable models
      - dedicated the learning-design domain of the LMS => specific VIDL will be formalized
    - and in deploying / operationalizing them
      - executable scenarios => machine-interpretable models
      - editor outside the LMS
      - API / module added to the LMS for import/export facilities

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Research Context: re-engineering (1)

- **General definition**
  - “The examination and alteration of a subject system to reconstitute it in a new form and the subsequent implementation of the new form” [CHIKOFSKY, 90]

- **Most typical goals**
  - Moving to a new platform = technological shift
  - Rewriting to implement another business logic, add more features...
  - **Combined**: shifting at the same time more than one element: the business logic, the technical base and the algorithmic structure

- **Definition for TEL systems**
  - “Examination of a mediated learning and the modification of the learning in order to reconstitute it in a new form and to put in place a new teaching situation, taking better into account the uses” [CHOQUET & al., 06]

- **Four levels** [TANKELEVICIENNE, 06]
  - **Conceptual** (Re-think): deals with the background for re-engineering
  - **Requirements** (Re-specify) of a module or an organization
  - **Design** (Re-design): deals with learning activities, assessment types, etc.
  - **Implementation** (Re-code): deals with learning resources, activities, etc.
Models for re-engineering

- Allow abstraction & study of the existing system
- Can be used to detect anomalies, to make corrections, to develop automatically regression tests or to generate more complete corrections
- Guide, assist or even drive the changes, fixes or required transformations