Enforcing reuse and customization in the development of learning objects: a product line approach

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Goal

The growing demand for content reuse and customization have motivated the development of tools supporting the Creation and Management of the so-called Reusable Learning Objects. Most current Learning Object authoring processes are not driven by Pedagogical criteria; as a consequence, the associated tools use unstructured Content-Models.

Our goal is the development of tools for creating reusable, granular, durable, and interoperable learning objects according to different pedagogical templates, and to compose such objects into meaningful courseware pieces. We explore a new way to reuse and customization following Product Line Engineering principles and tools.

Requirements for Building Learning Objects

Learning Object Content Model

- Instructors create learning materials in their disciplines following the Cisco’s Reusable Information Object strategy.
- A Reusable Information Object (RIO) is a granular, interoperable, reusable piece of information which contains a metadata level.
- RIOs can be combined together to form larger structures called Reusable Learning Objects (RLOs).

Generation Technology (DPL)

- Document Product Lines (DPL) is a methodology to generate documents in domains with high content variability and reuse.
- Documents are the result of assembling document components or InfoElements stored in the product line Repository.
- DPL applies product line engineering principles and their process is composed of two main activities: Domain Engineering and Application Engineering.

Using DPL to Engineer RLOs

1. RLO Document Feature Model
   A family of RLOs is defined in DPL: “Introduction to Programming using Java”

2. Creating - Storing RIO Comp.
   Reusable content assets are stored in the Repository along with their metadata.

3. RLO Configuration
   The Configuration guides the characterization of a RLO: a particular “Introduction to Programming using Java” is defined.

4. RLO Generation
   An automatic process generates the RLO in the format selected.

A Learning Object Authoring Tool (LOAT)

- LOT enforces reuse and customization to increase the efficacy of Learning Object authoring processes.
- Three basic principles have been considered in the design and implementation of LOT:
  1. The cognitive level
  2. Learning object classification
  3. Content-model architecture.
- The LOT architecture is divided into three layers:
  1. The Repository Layer
  2. The Services Layer
  3. The Presentation Layer

Conclusion

- LOT is a tool for creating reusable, granular, durable, and interoperable learning objects.
- A new approach to RIO/RLO development based on product line engineering principles.
- The DPLFW have been used to define families of RIOs and RLOs whose components may be selected dynamically from a set of small pieces.
- This is our first effort towards the design and implementation of LOT.