Structure of LO's Modeling for eLearning

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What is ‘educational content’?

- Educational material developed to be consumed in computer based learning using on-line web environments
- Educational material has embedded pedagogical & instructional information
- Complex specifications and a variety of description standards
- Complex authoring process and difficult to maintain

Educational Content: Desired properties

- **Interoperability** → Combine different specification in different contexts
- **Maintainability** → Contents must be maintainable and upgradeable
- **Reusability** → Allow 'Cut & Paste' for building new content
- **Durability** → Independence of the delivery technology

Educational Content: Current problems

- **Interoperability** → It is not possible to re-assemble content
- **Maintainability** → Difficulty to update content, authoring not independent from VLE
- **Reusability** → Content embedded in VLE and nor searchable or retrievable
- **Durability** → Do not recover from a deep change in the delivery format or content format

Lack of an abstraction level

Educational Content:
Abstraction Level

Technical issues

HTML tree, *.asp, form, GET/POST, ...

→

Pedagógical/Instructional

Module, Task, Sequence, Prerequisite,
Assignment, Exercise, Simulation, ...

Learning Content Specification

Lack of an appropriate abstraction level

- Provide specifications with associated operational semantic. Not related with delivery formats
- Provide pedagogical design elements
- Authoring tools should not be in VLE's but as standalone applications
- Make LO's interoperable and reusable

Learning Objects

- Interoperable educative content components
- Labeled with Metadata
- Context independent → reusable
- Organized in repositories (distributed) or in conceptual maps (ontology)

Uses of LO's

- Metadata allow search and retrieval
- Aggregation of LO's according to its aggregation level
- Repositories of LO's
  - ARIADNE (1997) → Development of LOM
  - Other projects: OASIS, CELEBRATE (IST E.U.)
- Authoring process based on selection and aggregation

Drawbacks

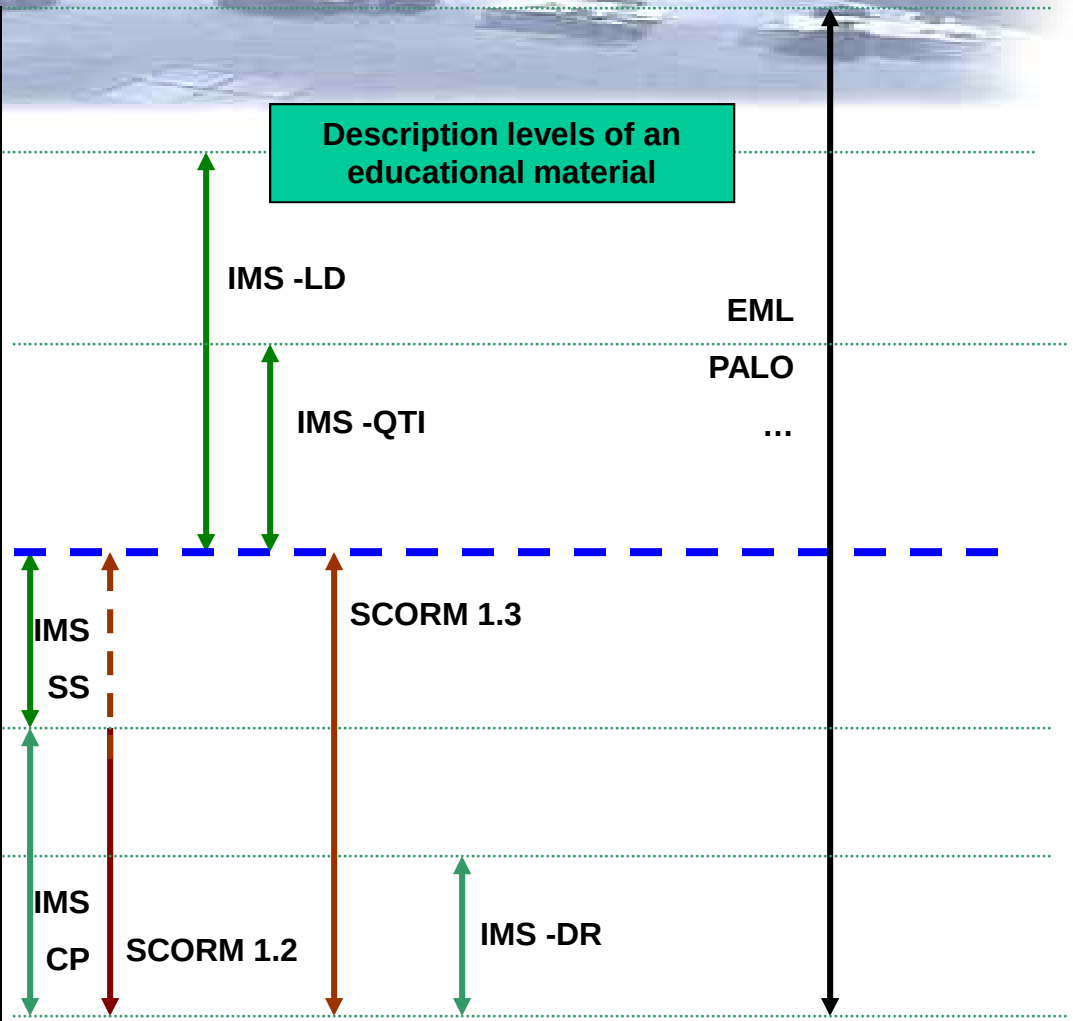
- De-contextualized learning
  - Reusability vs. Aggregation level
  - Context vs. Interchangeability
- Lack of personalization
  - No adaptability to students
- Complex business model
  - Copyright restrictions
  - Known problems of distribution (KaZaA, ...)

Expressivity of contents

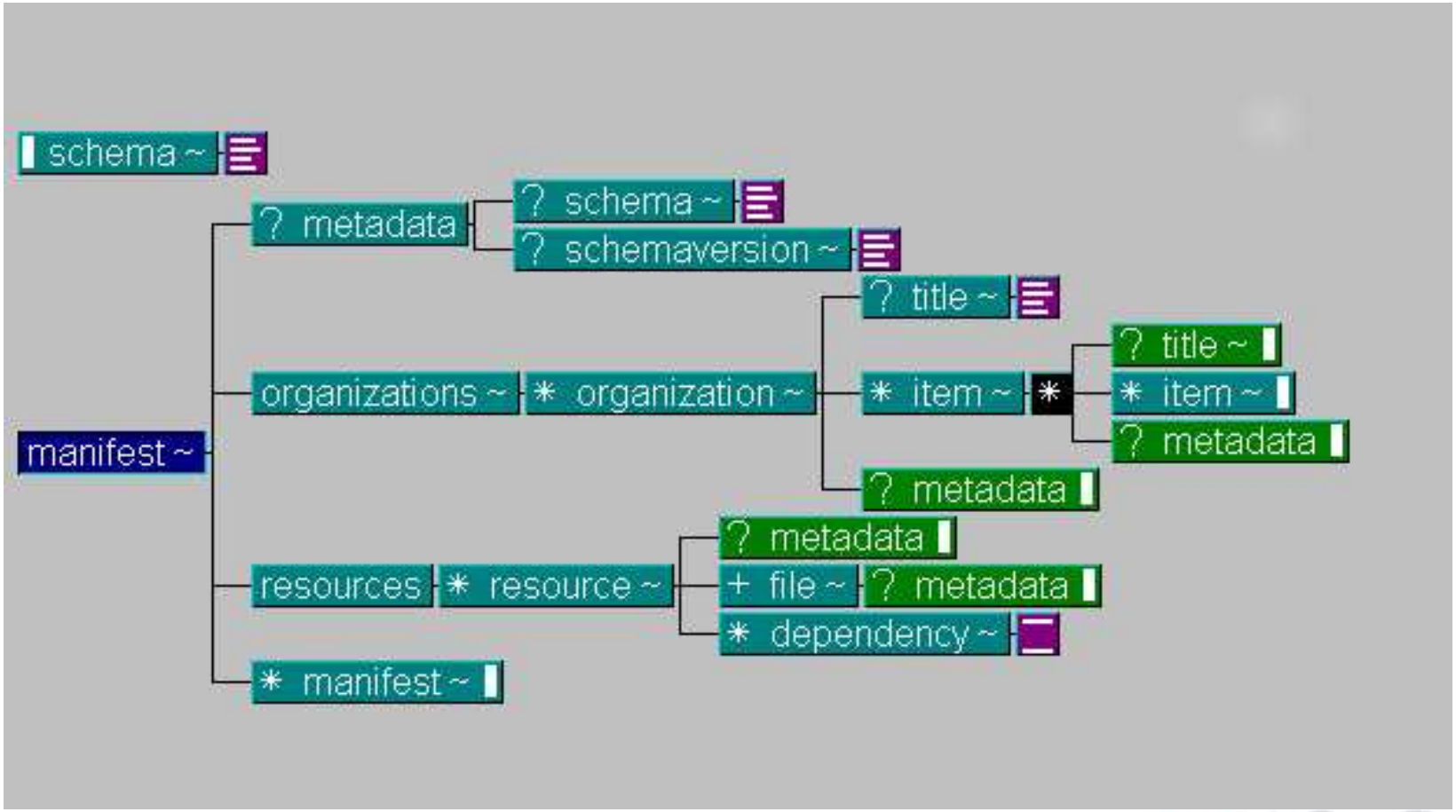
- Need of semantics associated to specifications
- Grouping of elements in semantic layers
- Meaningful elements for rest of layers
- Different specifications in different levels
- Classification of specifications depending on the covered levels

Educational Content

Management	**Interoperability parameters with LMS**
Pedagogical/Instructional	**Pedagogical Information**
Activity/Task	**Educative processes y activities. Collaborative tasks and activities**
Secuencing	**Sequencing, prerrequisites, deadlines, dependencies**
Structure	**Navigational model**
Content	**Small LO's, assets and formatted content**



Content Packaging: XML



IMS Content Package (Ex.)

TOC 1	
Lesson 1	lesson1.html
Introduction	intro1.html
Content	content1.htm
Summary	summary1.htm
Lesson 2	…
Introduction	
Content	
Summary	

IMS Manifest (XML)

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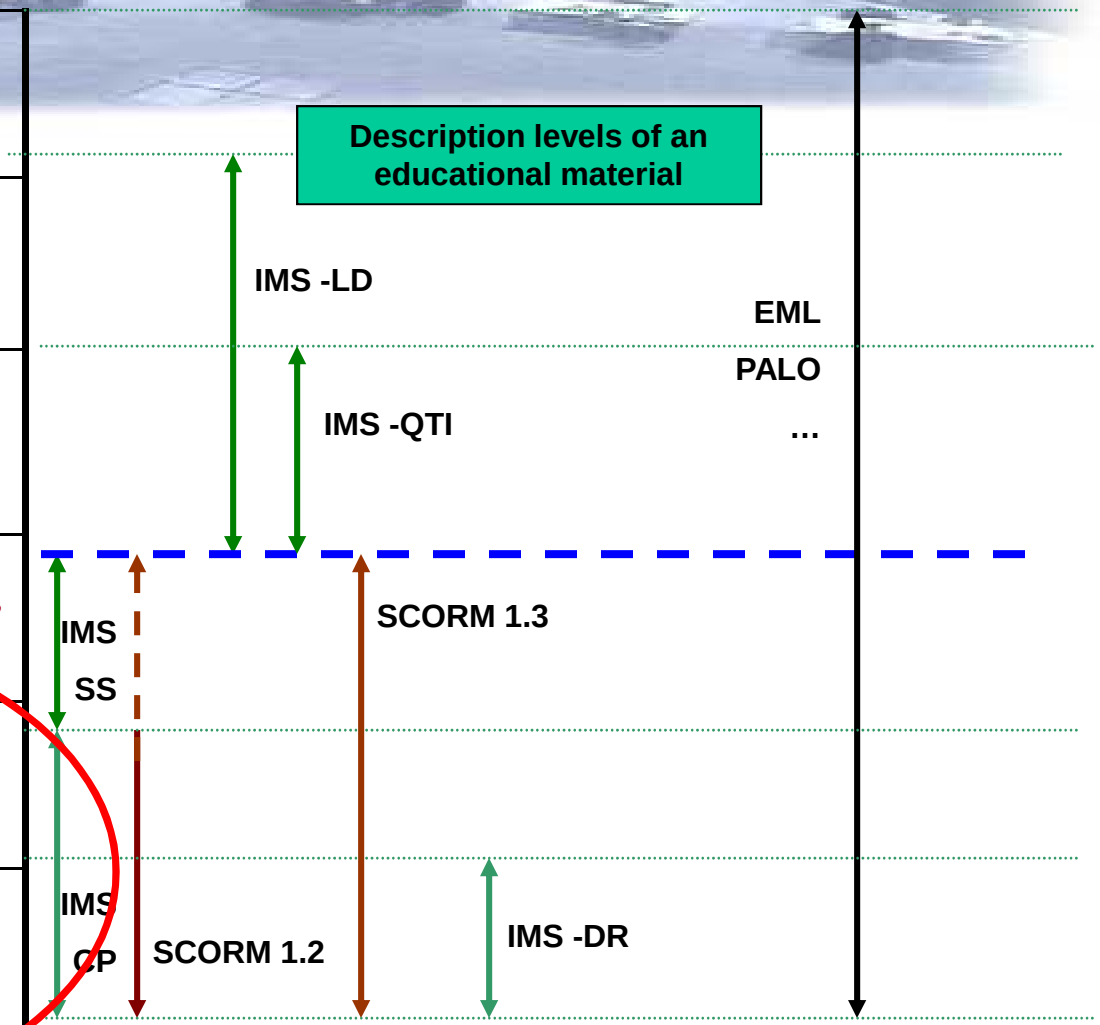


Sequencing Model (IMS)

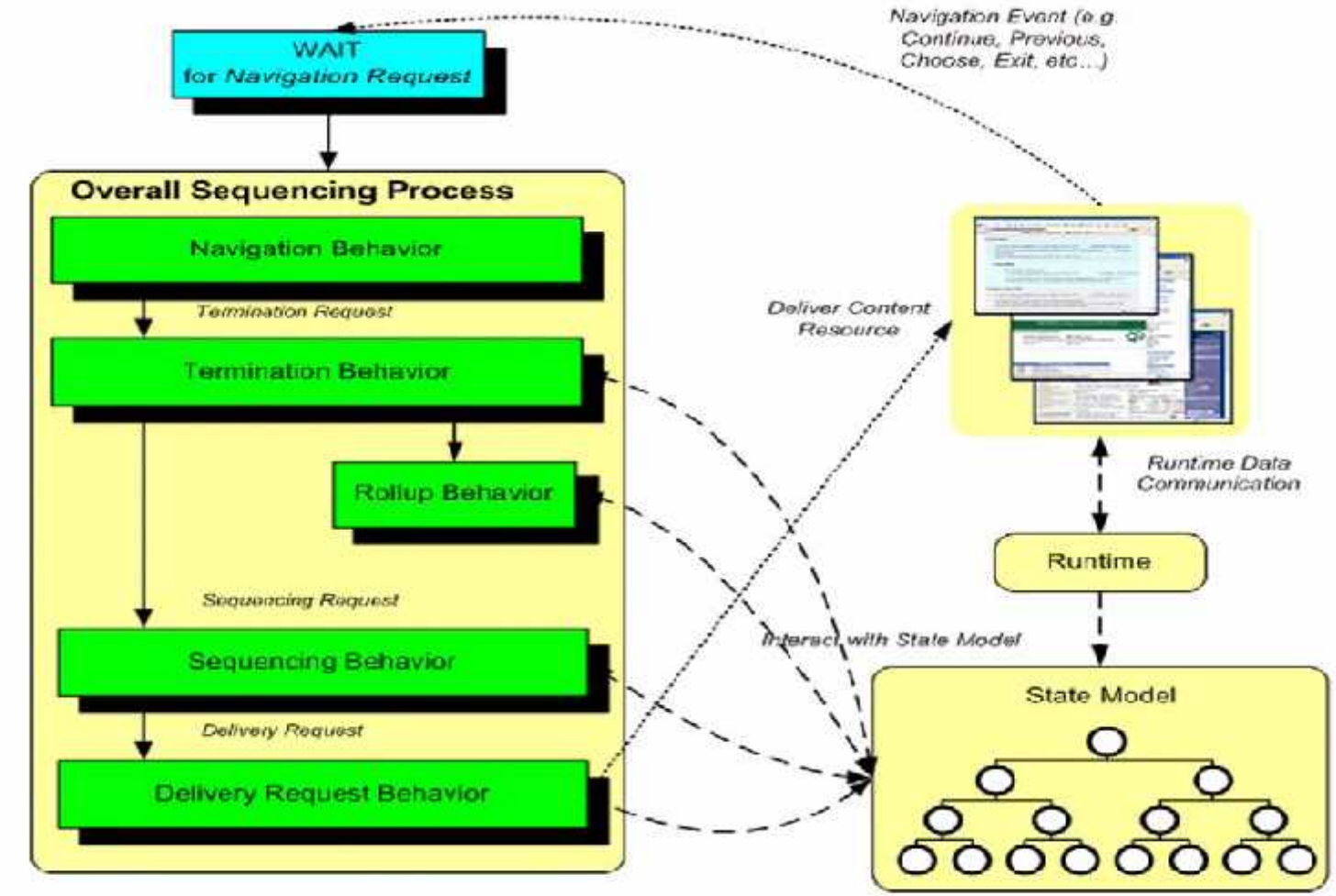
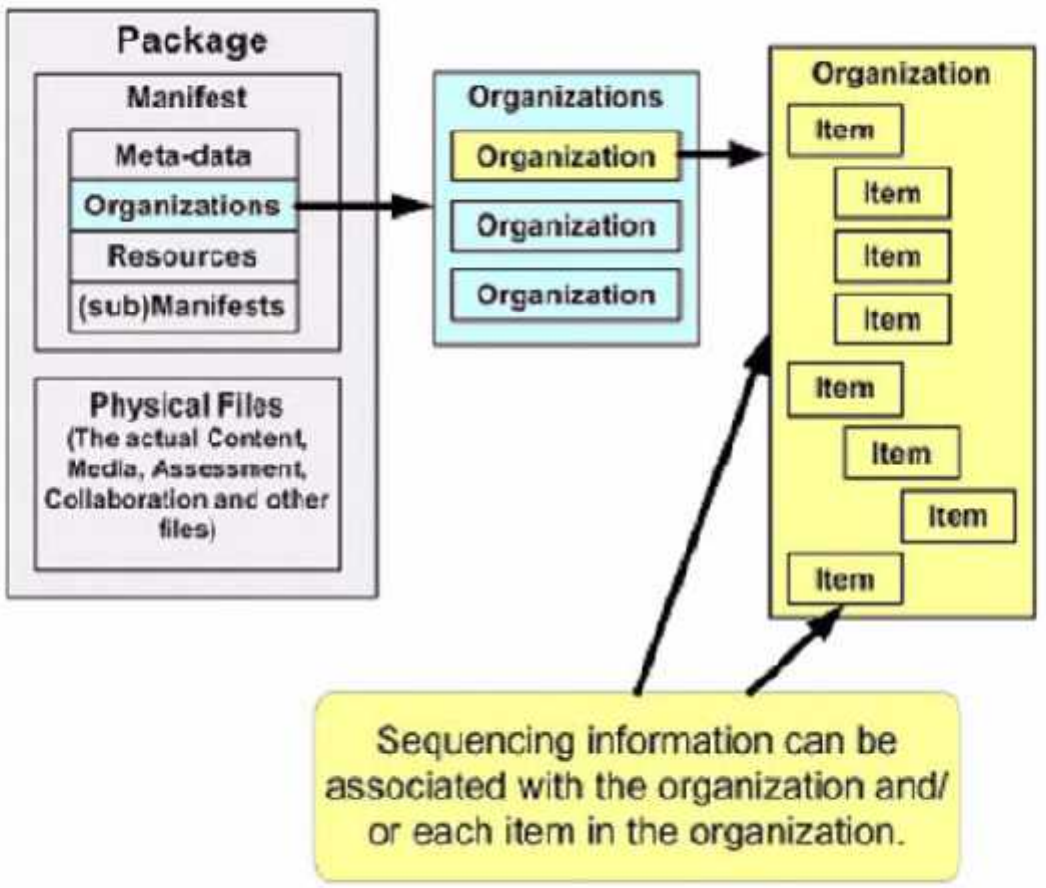


Figure 1.1 - The various steps in the sequencing process.

Map SS and CP



XML

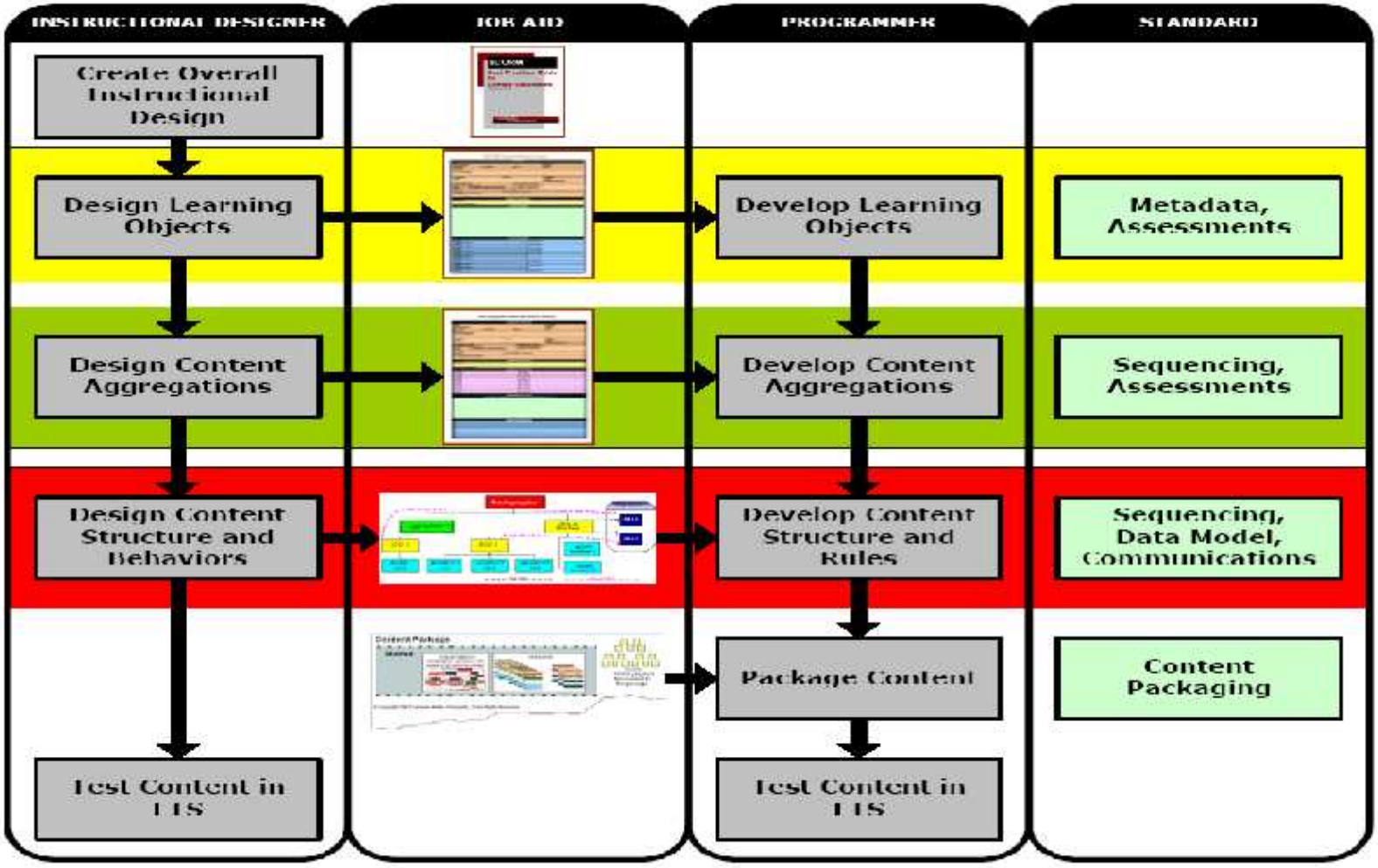
(Extensions)

IMS Specifications

- Describe separately different aspects of learning material
- Identify complexity of learning content authoring
- No RTE available for the whole mode (CP+SS+(LD|QTI))

Source: Carnegie Mellon www.lsal.cmu.edu/lsal

Current Authoring model using LO's



Overview of the design and development process and products for specification-based instructional materials.

a Distancia

Celebrate Demo Portal

- Celebrate created a Demo Portal to illustrate Search, retrieval and use of LO's
- More than 1.500 LO's currently available
- Mainly focused on schools, not for higher education
- Currently launching LIFE initiative to continue Celebrate (European School net, EUN)
- http://life.eun.org

Celebrate Demo Portal

LO Examples

- Components of inner ear
- Process of destillation
- Change of State – Water

Instructional Design & LO's

- Research explores definition of activities as part of LO's
- David Merrill (Utah Univ) proposes 4 types of LO's
  - Entities (objects)
  - Properties (attributes of entities)
  - Activities (Actions on objects)
  - Processes (Change attributes triggered by activities)

→ Need to incorporate **learning processes**

Concept of educational modeling language

- Content representation in a variety of levels
- Description of learning tasks: Modelization of activities and instructional processes
- Compatible with LO model
  - Stored in repositories as another LO's
  - Use of ontology and conceptual maps to retrieve "low granularity" LO's

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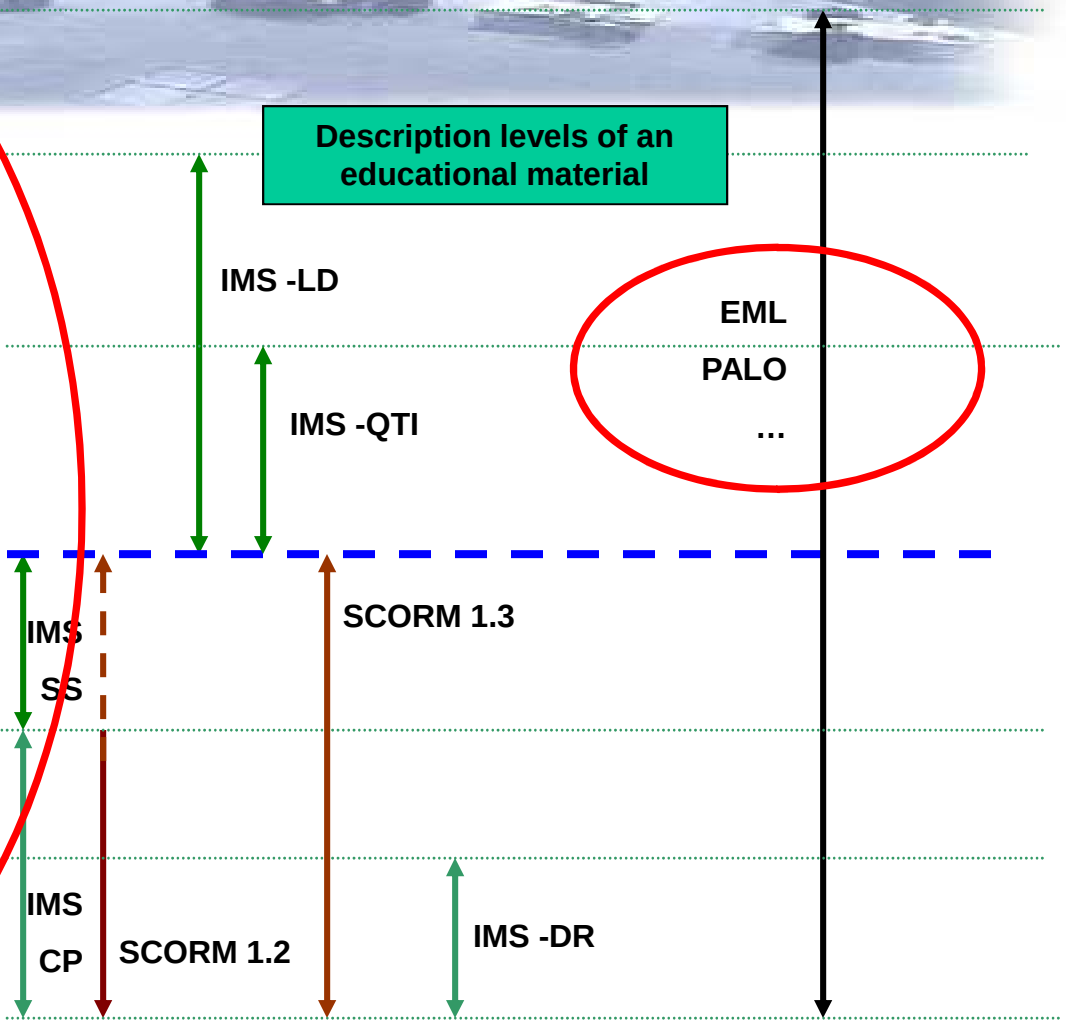


Evolution of Educational Modeling Languages

CEN/ISSS Meeting in Torino (Oct 2001)

→ Introduction of:

- EML (UONL)
- PALO (UNED)
- Targeteam (German Mil. Forces Lab)
- Others

See “Europe Focuses on EML” S. Wilson (CETIS) in http://www.cetis.ac.uk/content/20011015103421

→ Survey of Educational Modeling Languages

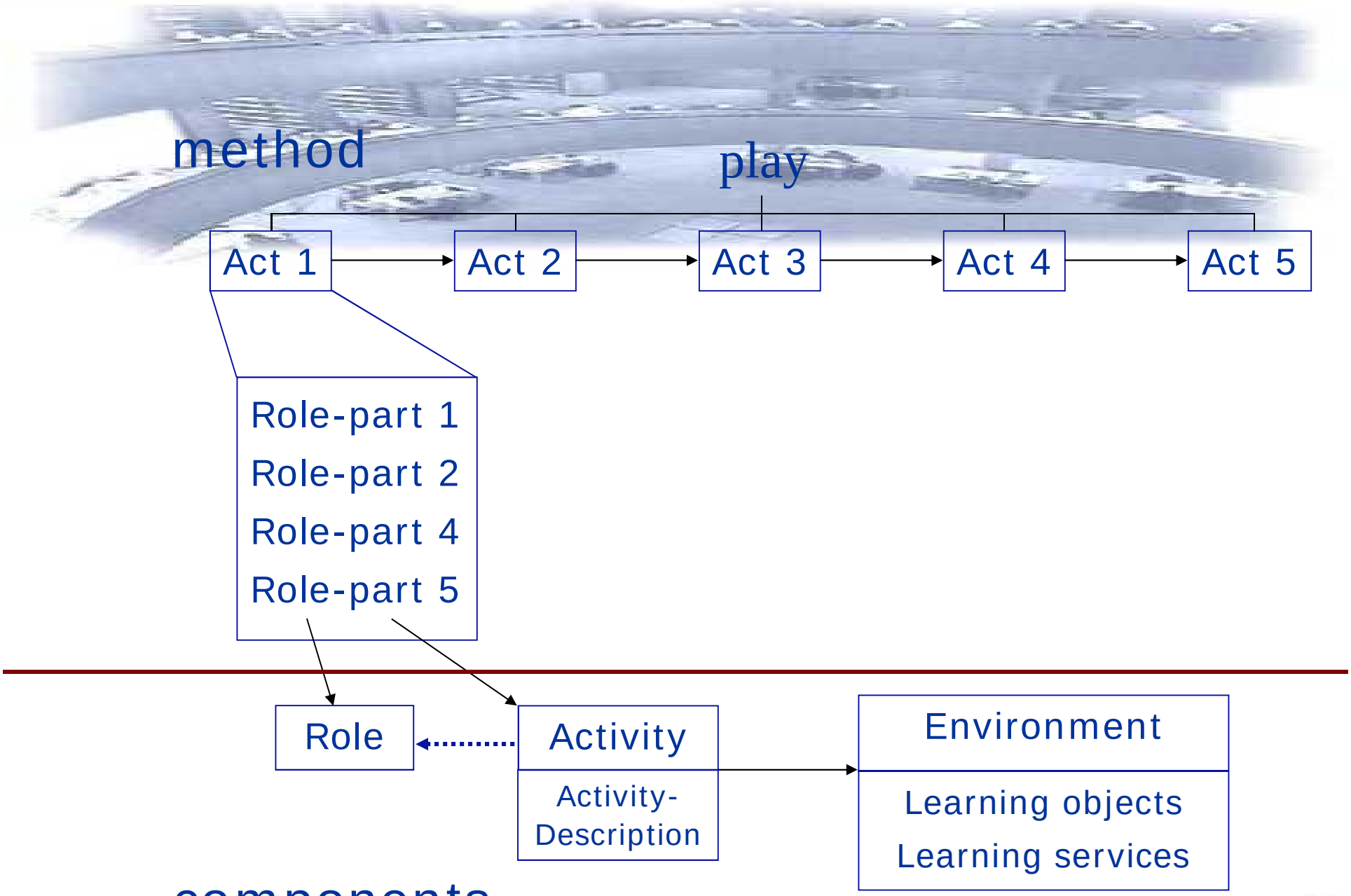
→ Development of **IMS-LD** based on EML (OU of the Nederlands)

IMS-LD

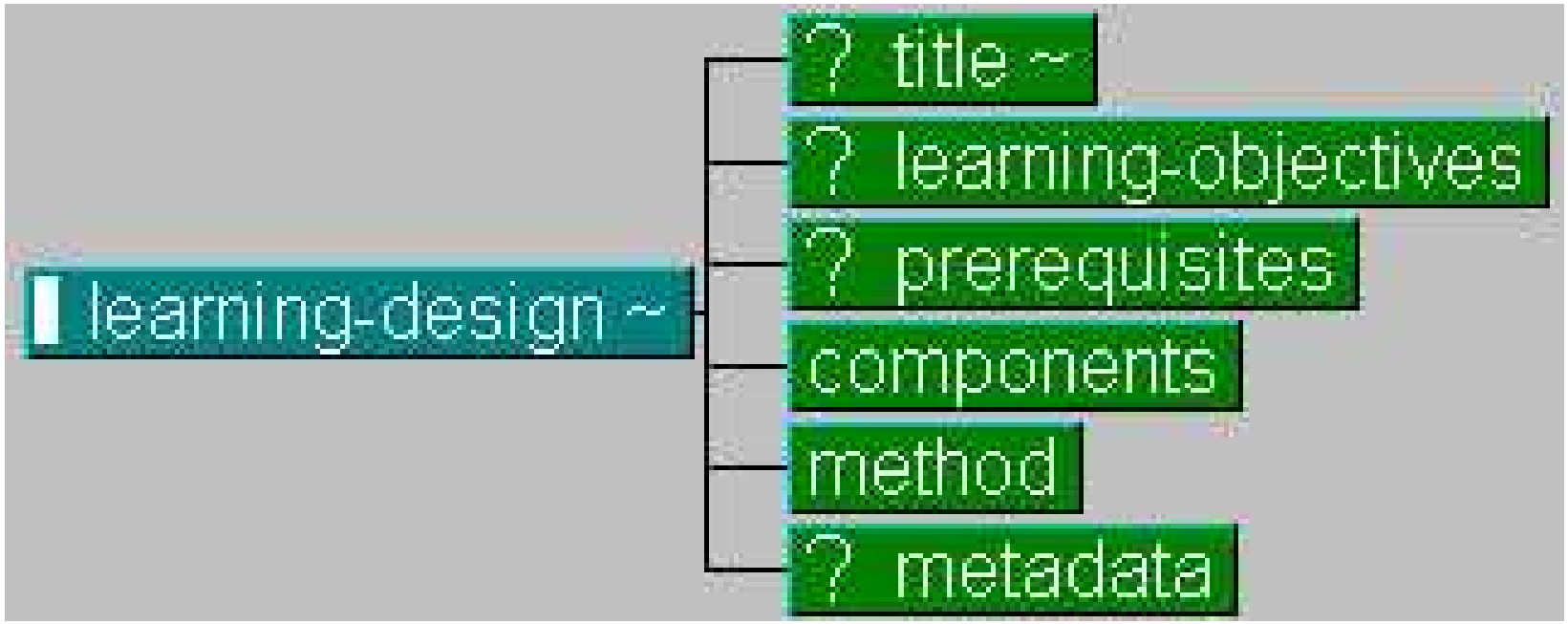
- Based on EML OUNL
- started 1997, research into pedagogies in use
- no description per pedagogy, but
- one meta-language to describe them all: Educational Modelling Language (EML), published in December 2000

EML: simple yet powerful

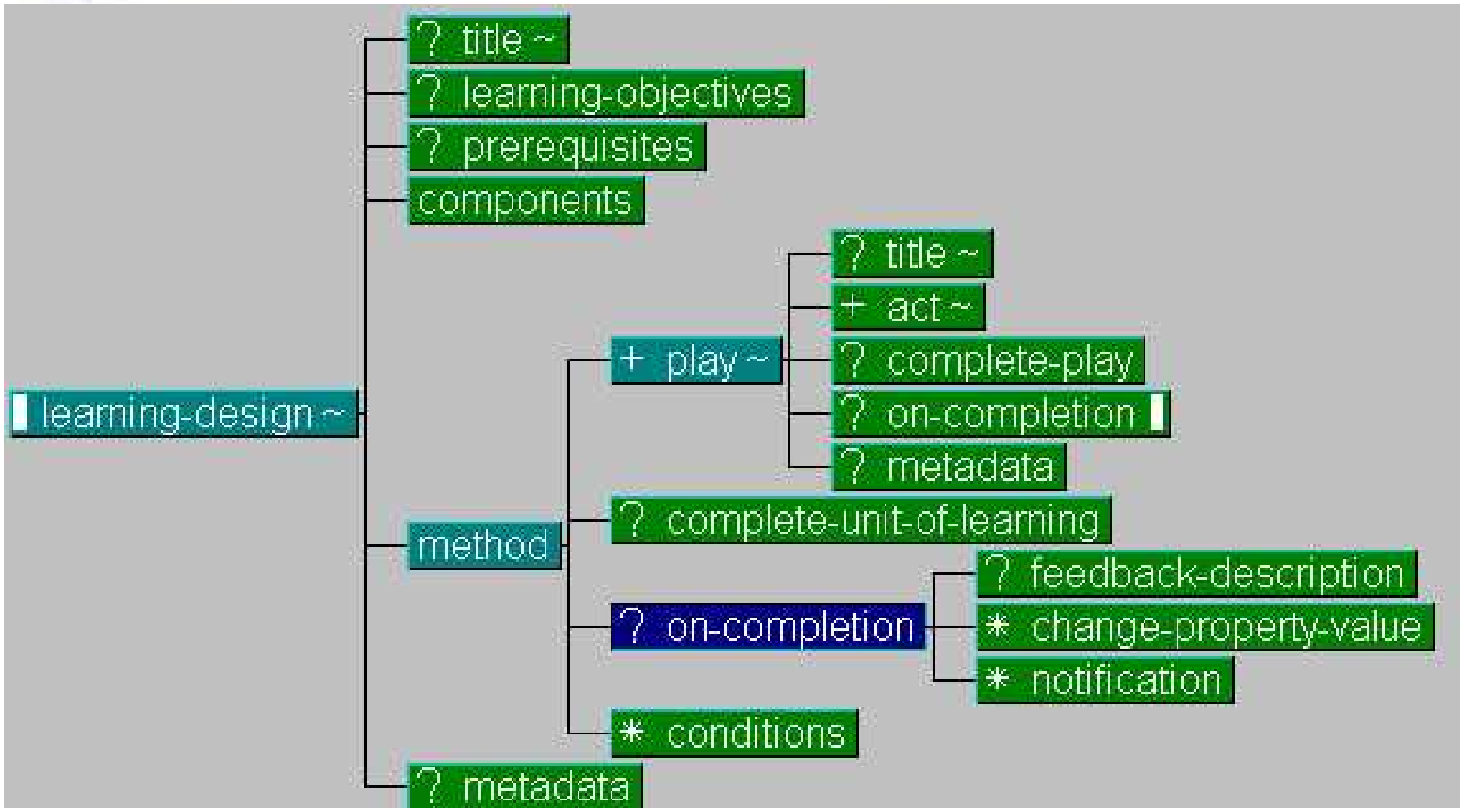
- People engage in Activities, for which they use Resources
  - People: one or many, learner or staff roles
  - Activities: description, structured
  - Resources: learning objects & services (chat, etc.)
- Many roles, activities and resources need co-ordination in a workflow: learning flow
- An instructional design/pedagogy/learning design essentially is a learning flow.


method
play
Act 1
Act 2
Act 3
Act 4
Act 5
Role-part 1
Role-part 2
Role-part 4
Role-part 5
Role
Activity
Activity-Description
Environment
Learning objects
Learning services
components

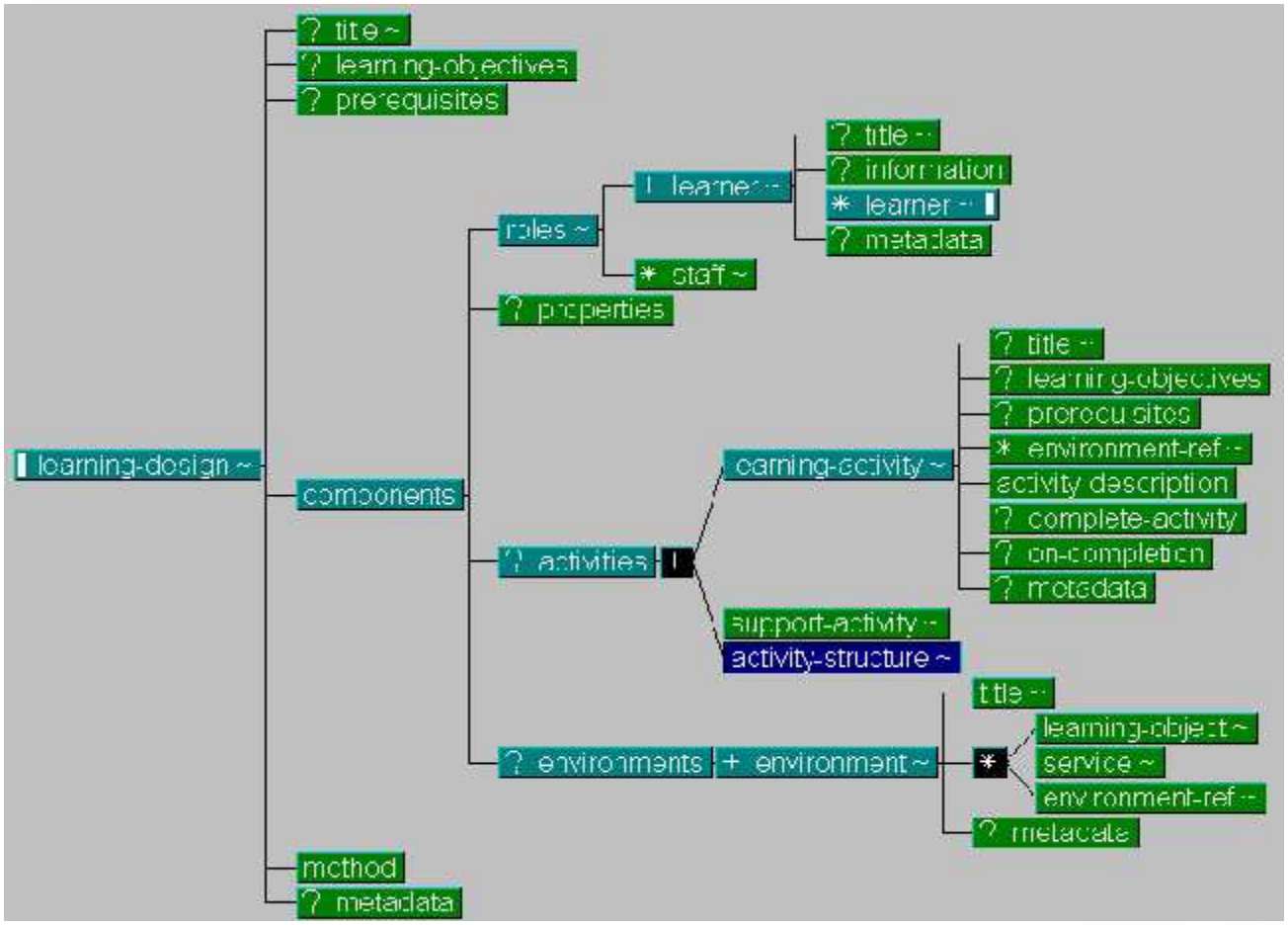
LD: XML - top level



LD: XML - method



LD: XML - components



Example: Course creation in EML

1. **Roles**: Definition of roles (ex. Student, staff member) and definition of the workspaces of each one of the roles, and also types of outcome
2. **Activities:** Definition of content by mean of ona or more activities
3. **Methods**: Definition of sequences of activities defining
   - **Activity structure**
   - **Play per role**
   - **Conditions**

XML File (Example)

- **Components:** tools

Activity structure

AS-boeing-simplified

- AS-introduction
  - LA-fuel-valve-lesson-intro
  - LA-fuel-valve-theory
- AS-lessons-and-procedure + E-interactive-electronic-training-manual
  - AS-fuel-valve-lessons
    - LA-lesson-hazards OR
    - LA-lesson-components
  - AS-fuel-valve-removal-procedure
- AS-tests + E-interactive-electronic-training-manual
  - LA-knowledge-test-hazards
  - LA-knowledge-test-components
  - LA-performance-test

Authoring process and use

- Requires a RTE to play the course (Edubox, Coppercore, etc.)
- Manage activities independently from LO's and other static resources
- Manage static resources independently from activities defined in the course
- **Reuse ALL: Resources, Activities, Course templates** → !!This is it!!

More approaches to LO creation

- PALO Educational Modeling Language
  - Developed at UNED University
  - Presented in CEN/ISSS EML Workshop in Torino (2001)

Features

  - Uses of **domain ontologies** rather than metadata labeled LO's
  - Simple tasks (no roles) and sequencing

Cognitive Design Process

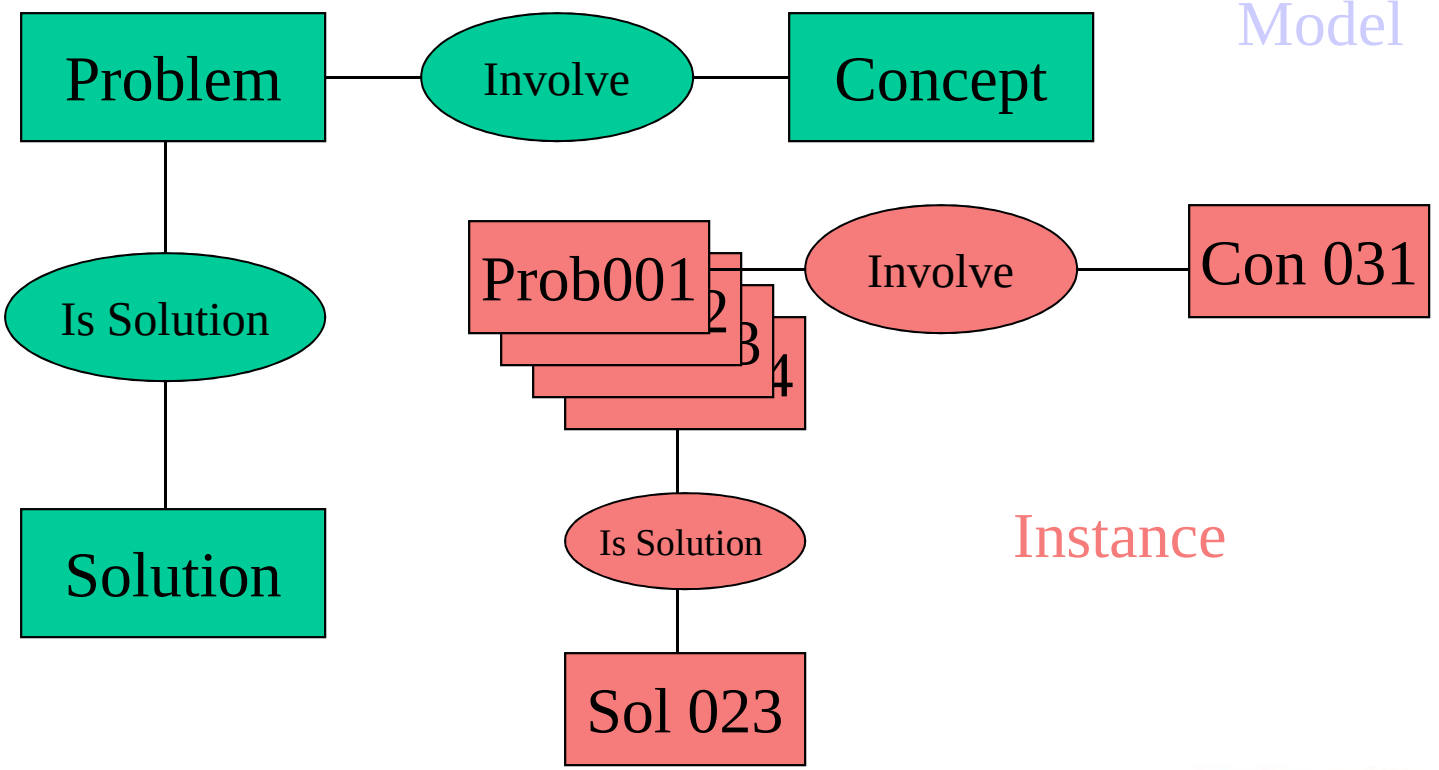
Conceptualisation Phase

Creation of a **generic domain** to describe content matter = ONTOLOGY

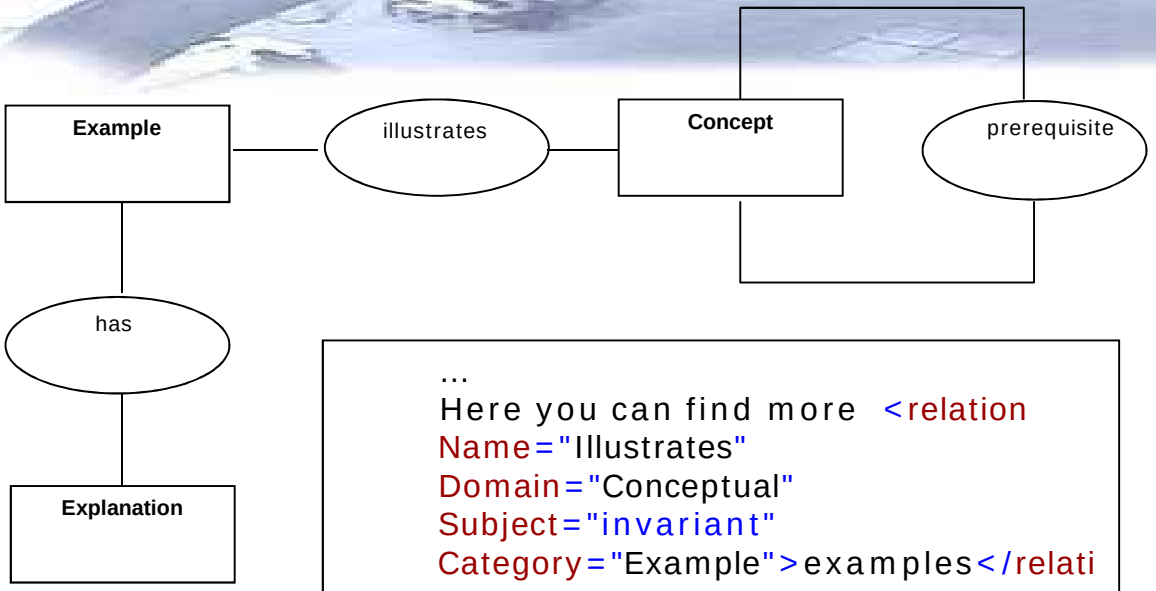
Instantiation Phase

Creation of one or more **instances** for a particular domain matter

An example: Models and Meta-Models

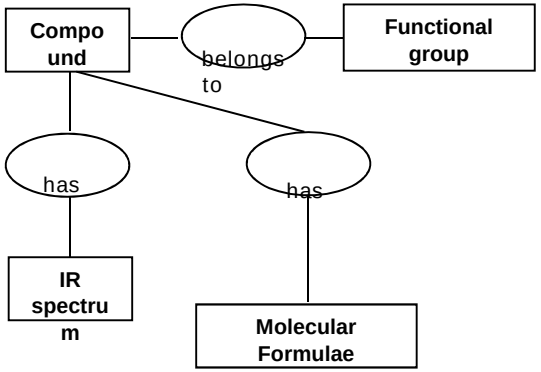


Use of ontologies of LO's



XML Example

```
...
Here you can find more  <relation
Name="Illustrates"
Domain="Conceptual"
Subject="invariant"
Category="Example">examples</relati
on>
of the concept  invariant.
...
```



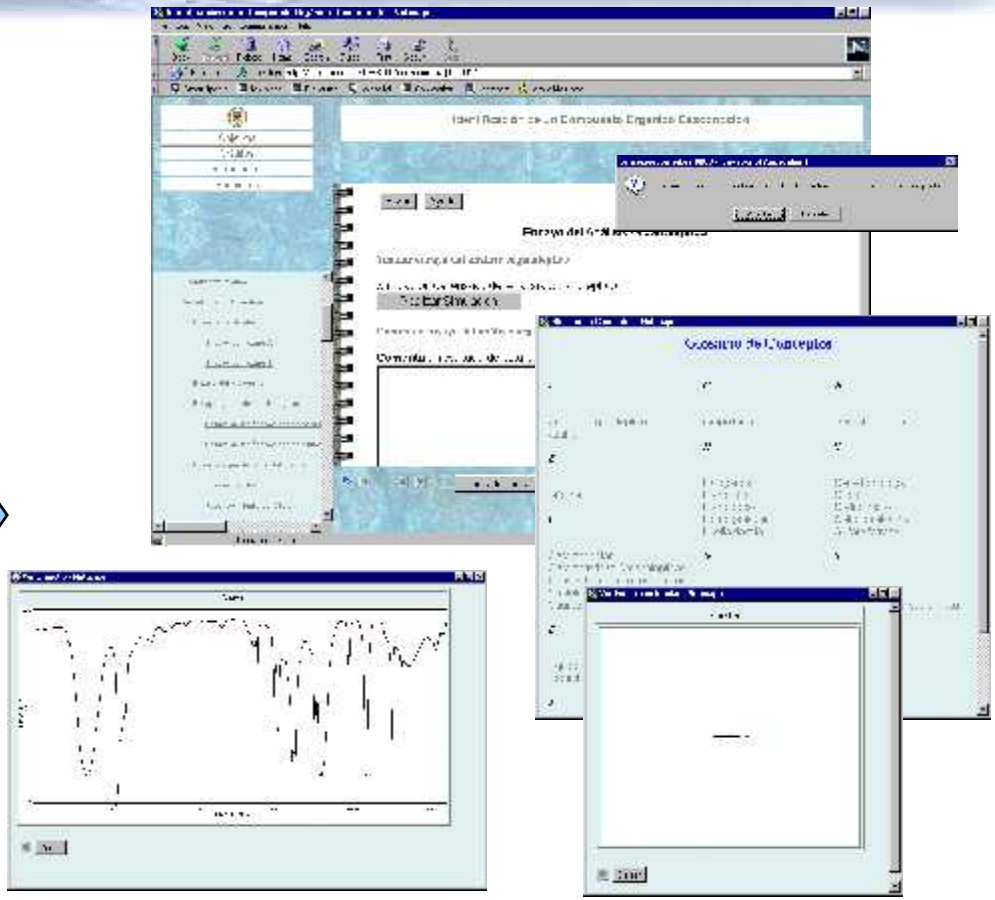
PALO production cycle

PALO Template (DTD)

PALO File (XML)

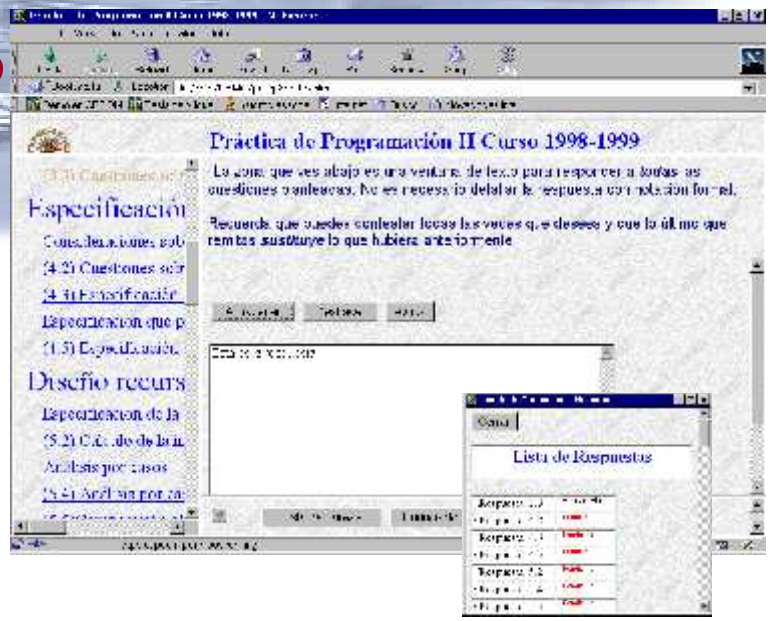
PARSER

Domain Knowledge Base

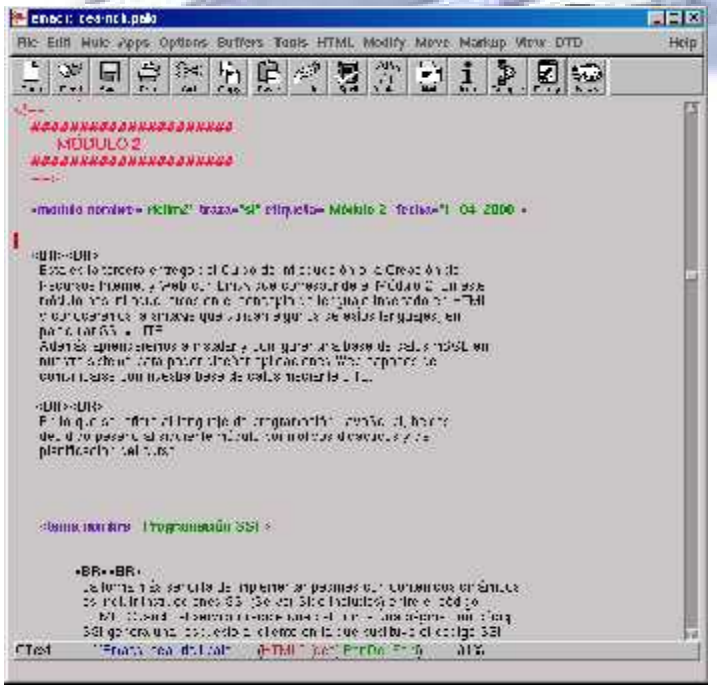


Editing Proces

Student Scenario

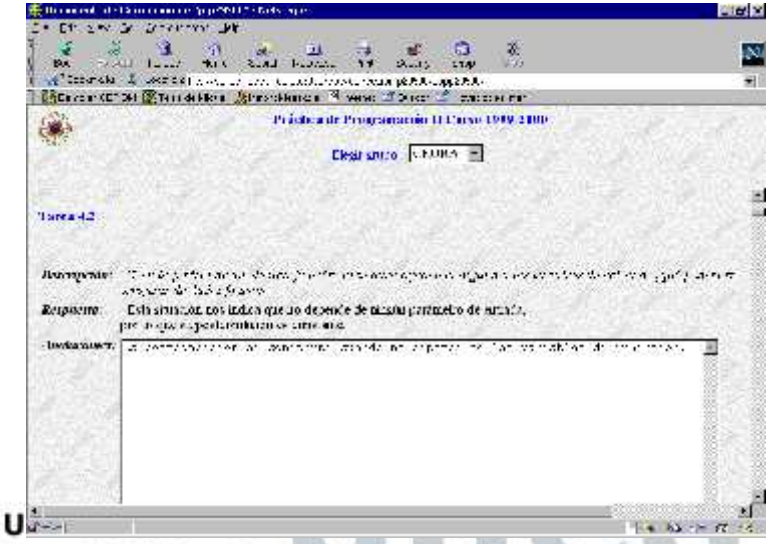


PALO Document

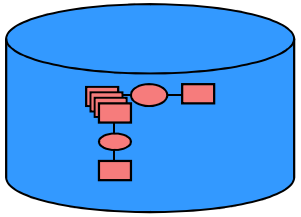


PALO Compiler

Tutor Scenario



Domain Model



CBUC -- Barcelona, Junio 2004

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