

Adaptive Web-based Courseware Development Using Metadata Standards and Ontologies

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The AdaptWeb Project is a consortium of two Universities supported by Brazilian Research Council, CNPq and UFRGS.

Adaptive Courseware

- ◆ **An Adaptive Courseware can:**
 - Adapt the system behavior to the profile of the students

- ◆ **An Adaptive Web based Courseware can also:**
 - Interoperate using Web resources enabling the reuse of educative material created in the system context or in the context of other applications

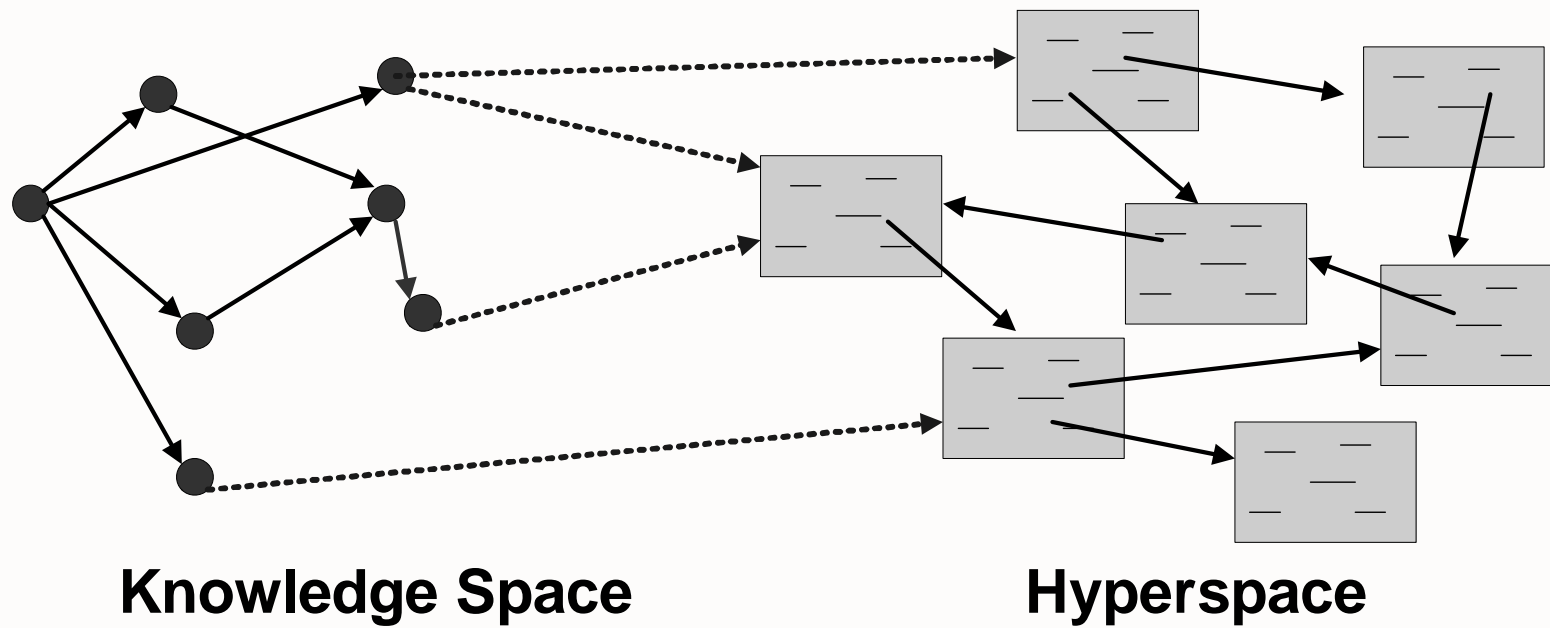
Adaptation tools

- ◆ A model of the Student Profile to conveys the knowledge about the student A model of the knowledge about the educative content based on metadata descriptions to convey:
 - the meaning of each piece of content
 - the correct way to use it (e.g. minimum speed connection)
 - the possible ways to be assembled with others in order to obtain more complex learning object (e.g. courses) based in simple ones (e.g. topics explanations or exercises)

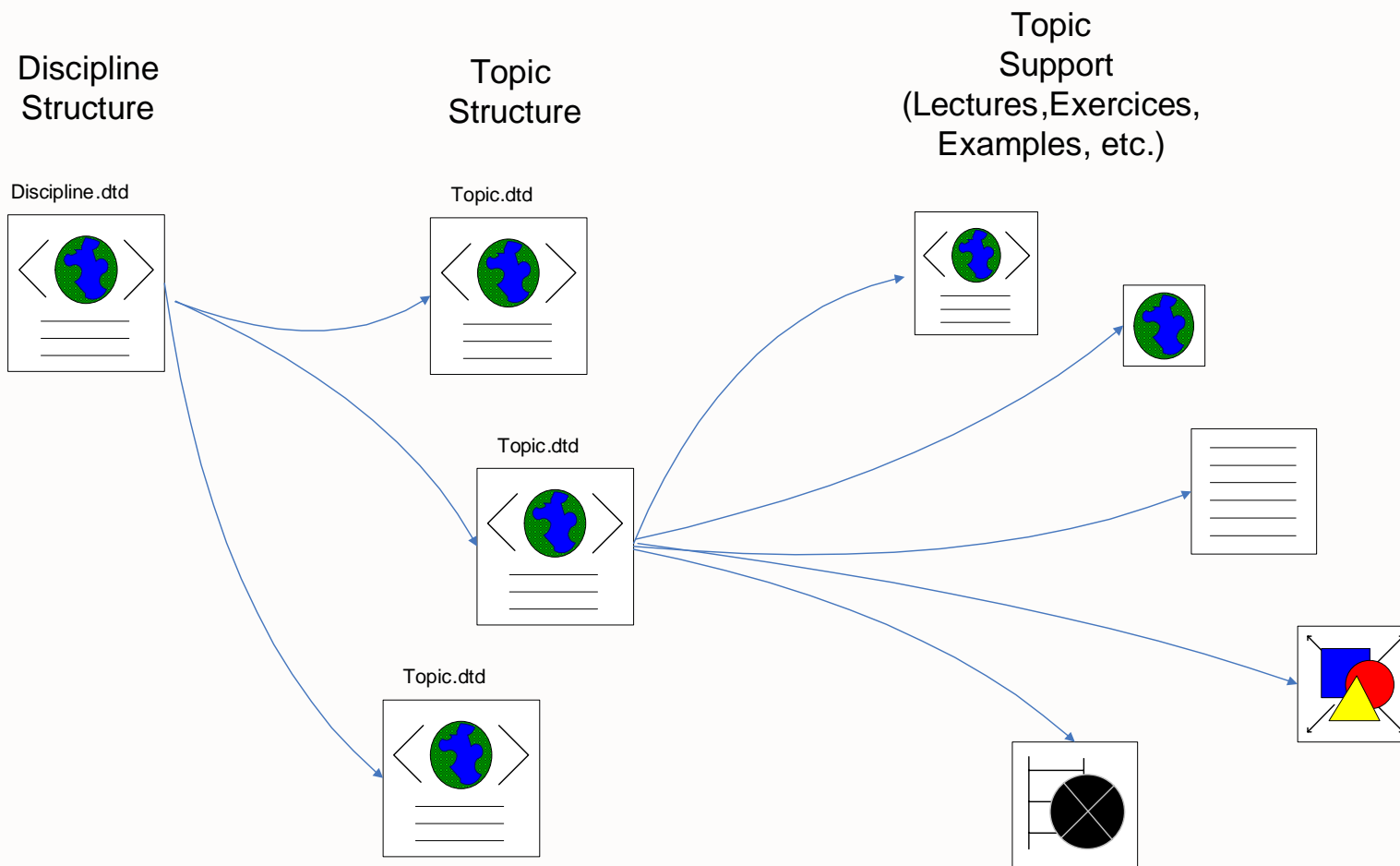
Interoperation tools

- ◆ A Standard Metadata Model envisaged to describe e-learning content in a common language. (e.g. The Learning Object Metadata Model - LOM)
- ◆ A binding to implement the Standard Model on the Web. (e.g. an RDF binding)
- ◆ If needed, the definition of an Application Profile of the Standard Metadata Model that makes the standard suitable to the particular community without loss of compatibility

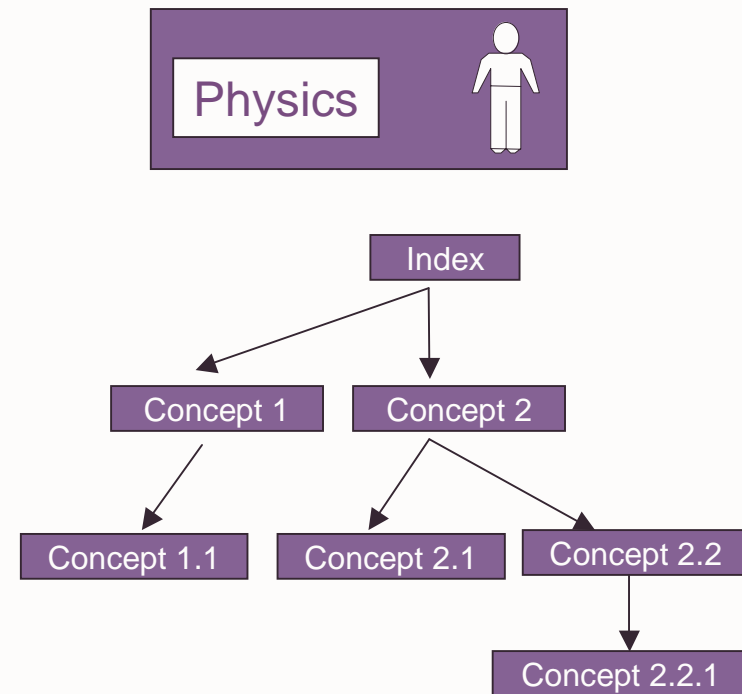
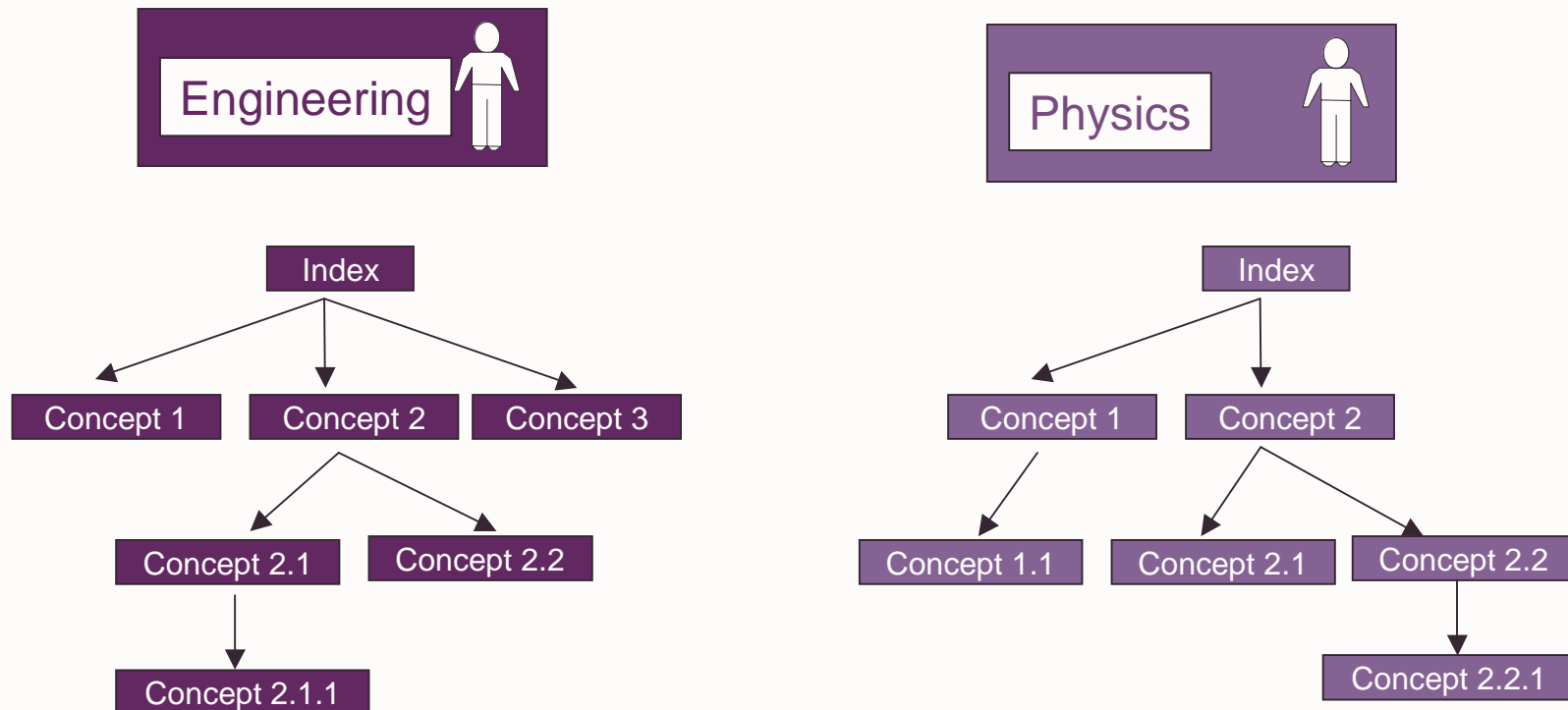
Implementing Adaptation



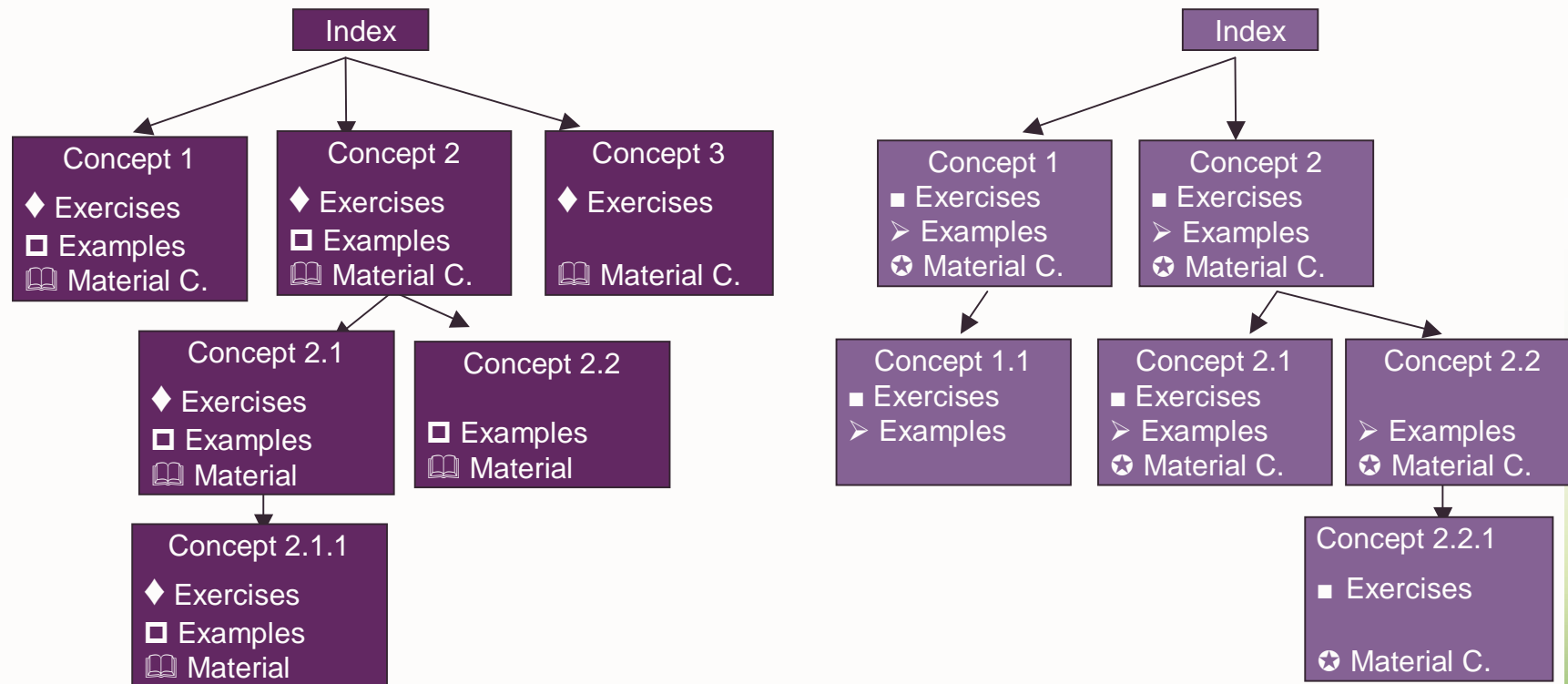
The AdaptWeb Hyperspace



Content Adaptation



Content Adaptation



Ciência da Computação

..: Conceito

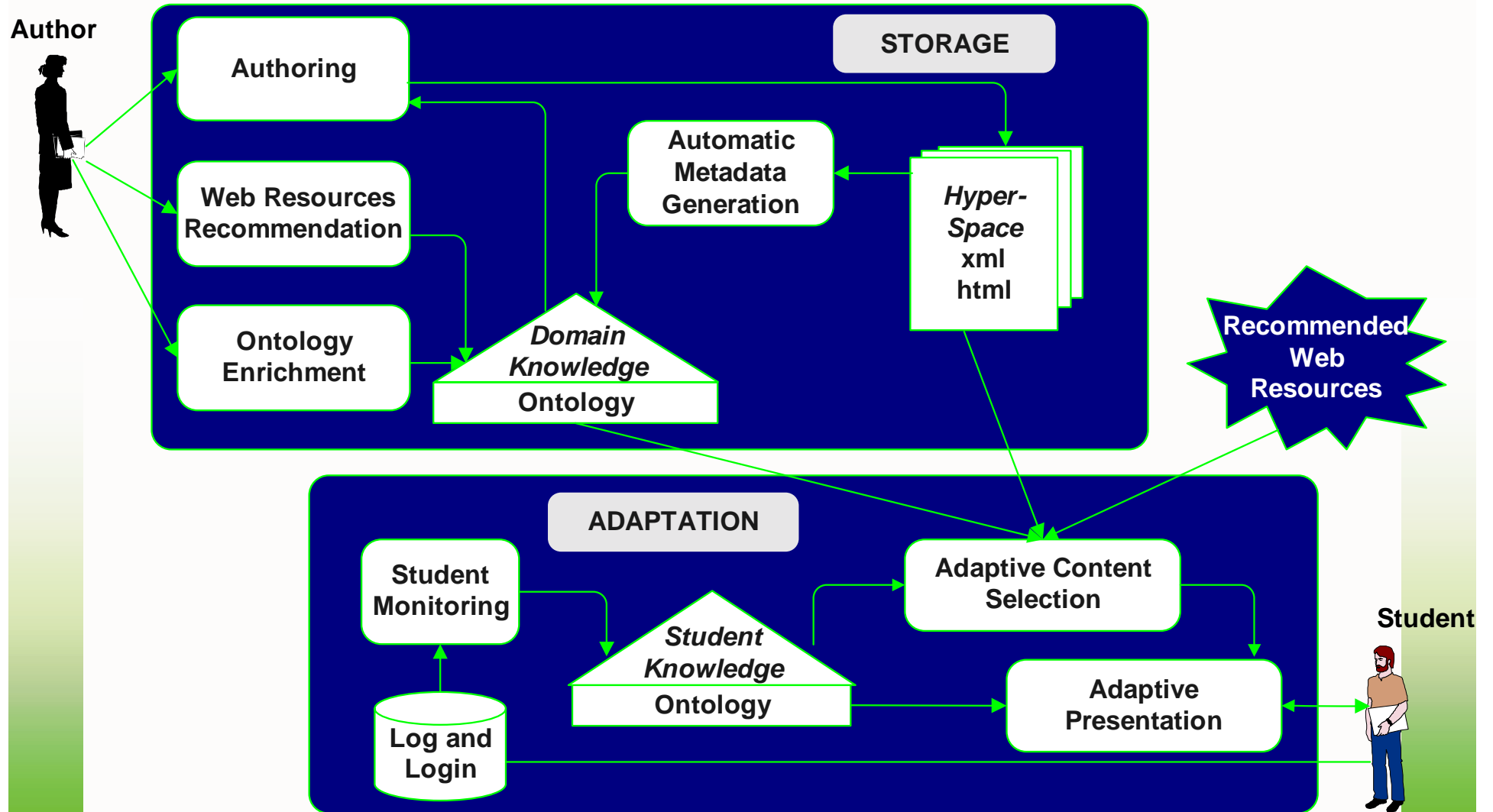
- » Contexto e Objetivos da Computação Algébrica e Numérica
- » Sistemas Lineares de Equações Algébricas
 - » Introdução
 - » Métodos Diretos
 - » Método de Gauss
 - » Algoritmo da Triangularização
 - » Algoritmo da Retrossubstituição
 - » Método de Gauss com Pivotamento
 - » Condicionamento de Matrizes
 - » Método da Decomposição LU
 - » Método de Cholesky
 - » Métodos Iterativos
 - » Método de Jacobi
 - » Método de Gauss-Seidel

Matemática

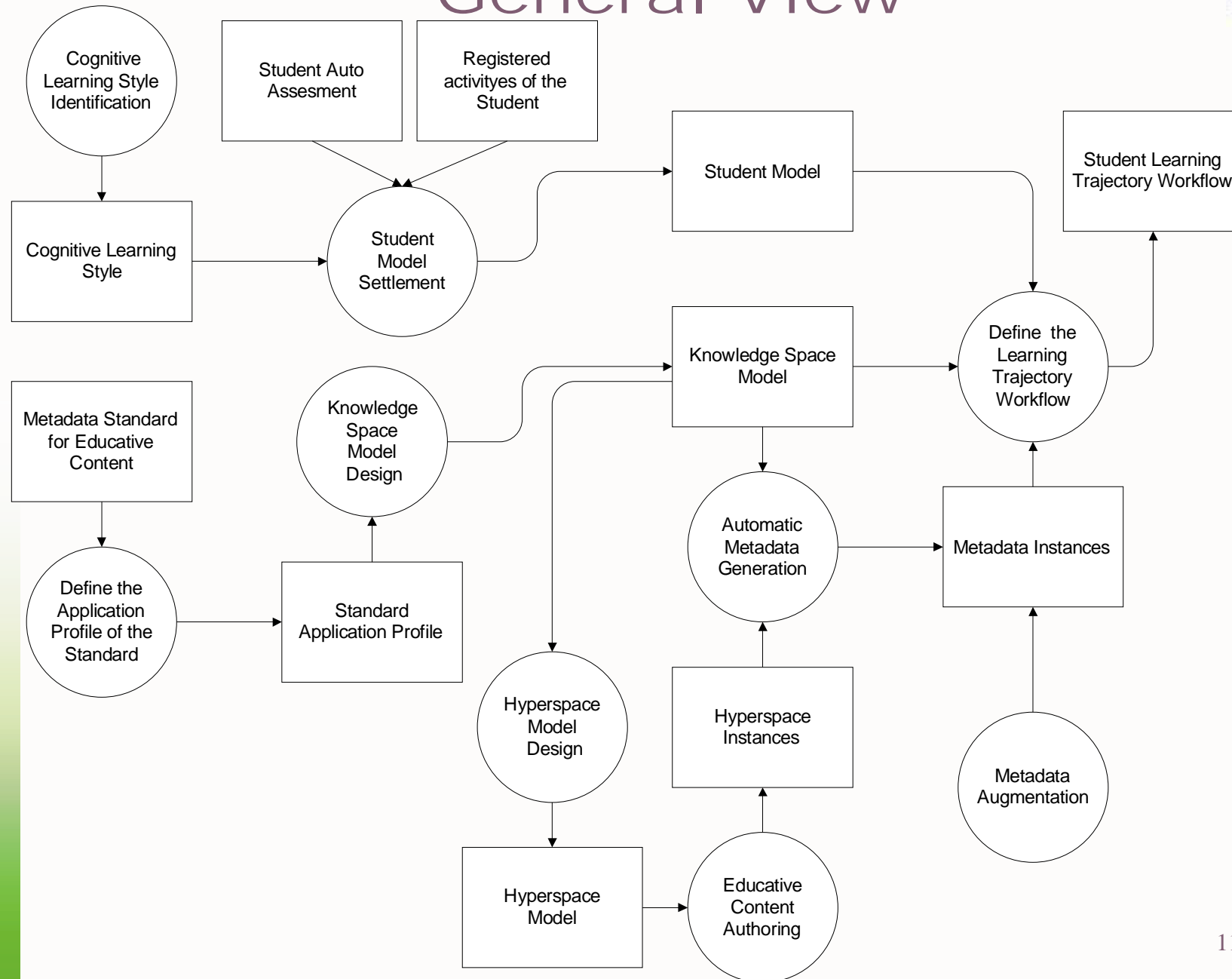
..: Conceito

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AdaptWeb Architecture



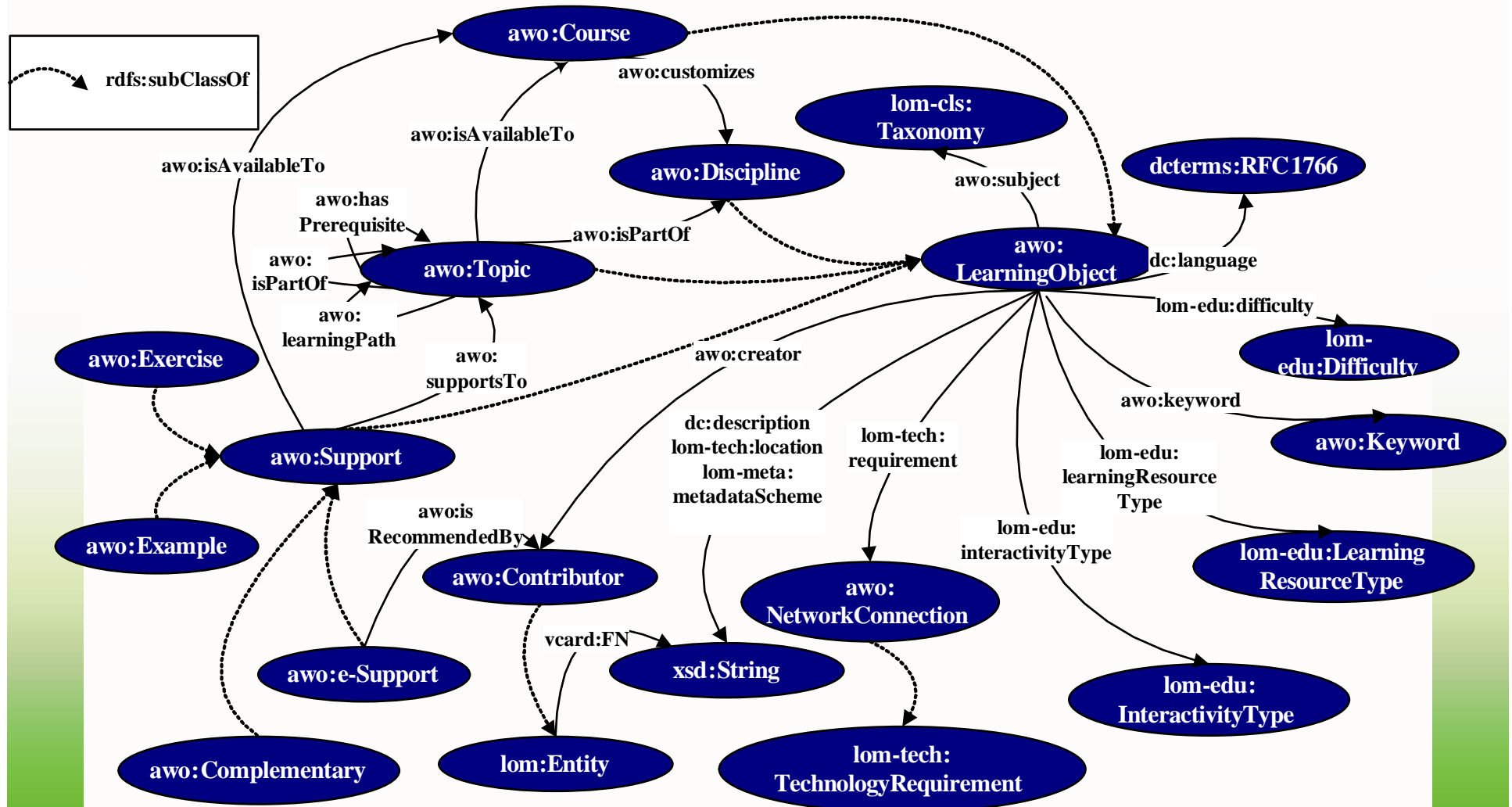
General View



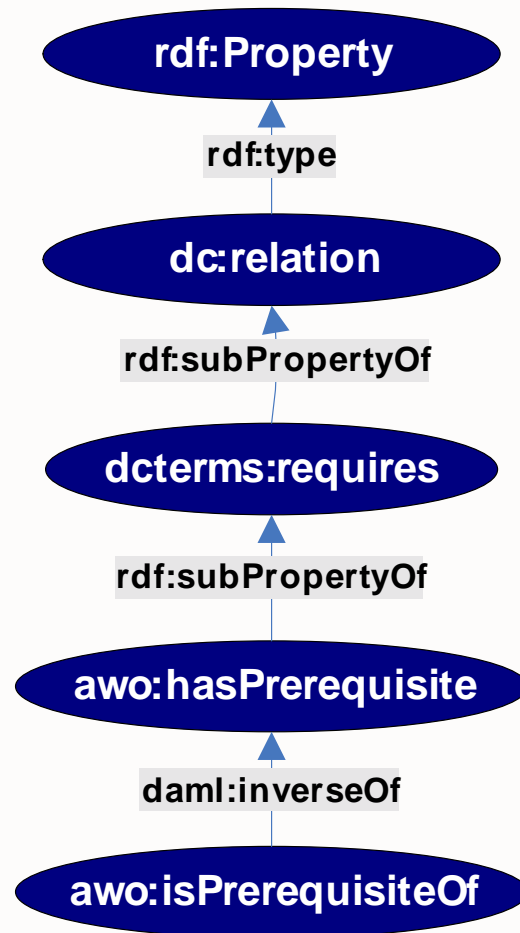
Structuring Metadata

- ◆ A loosely coupled metadata repository supported by a Web Ontology
- ◆ Supports a powerful adaptation mechanism
 - Inference can be used to achieve adaptation (e.g. transitive properties indicating prerequisite conditions can be automatically computed)
- ◆ Supports reusable learning objects
 - Metadata based on standard vocabularies maintained on the Web as reference points for semantics enable the resolution of interoperation at the semantic level

Content Knowledge Ontology

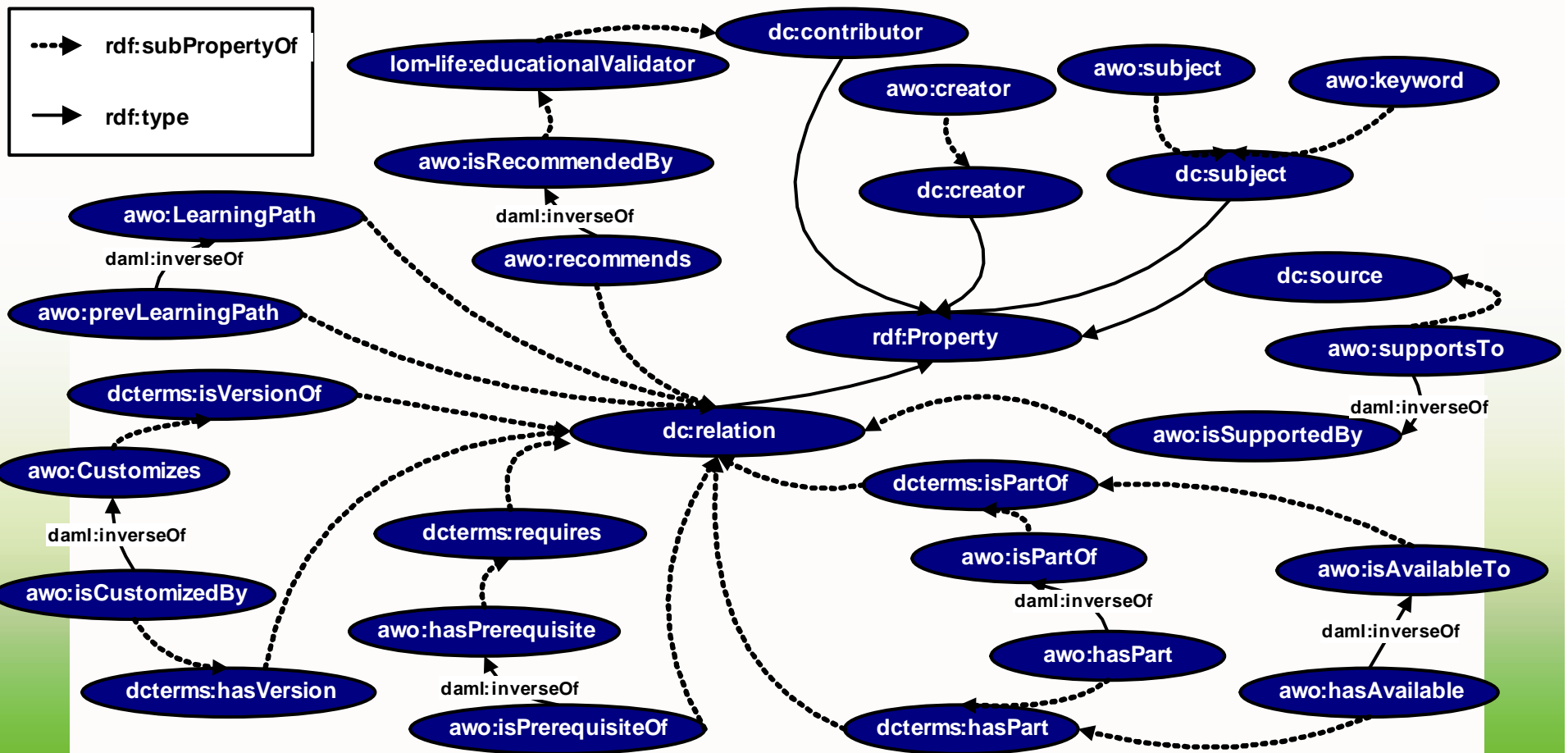


Properties Refinement



- ◆ Inverse and transitive properties are explicitly declared
- ◆ Any Web agent (e.g. an RDF agent) can understand the super-property `dcterms:requires` and to interpret the ontology relation `awo:hasPrerequisite` with the more general semantics of the known property

Properties Refinement



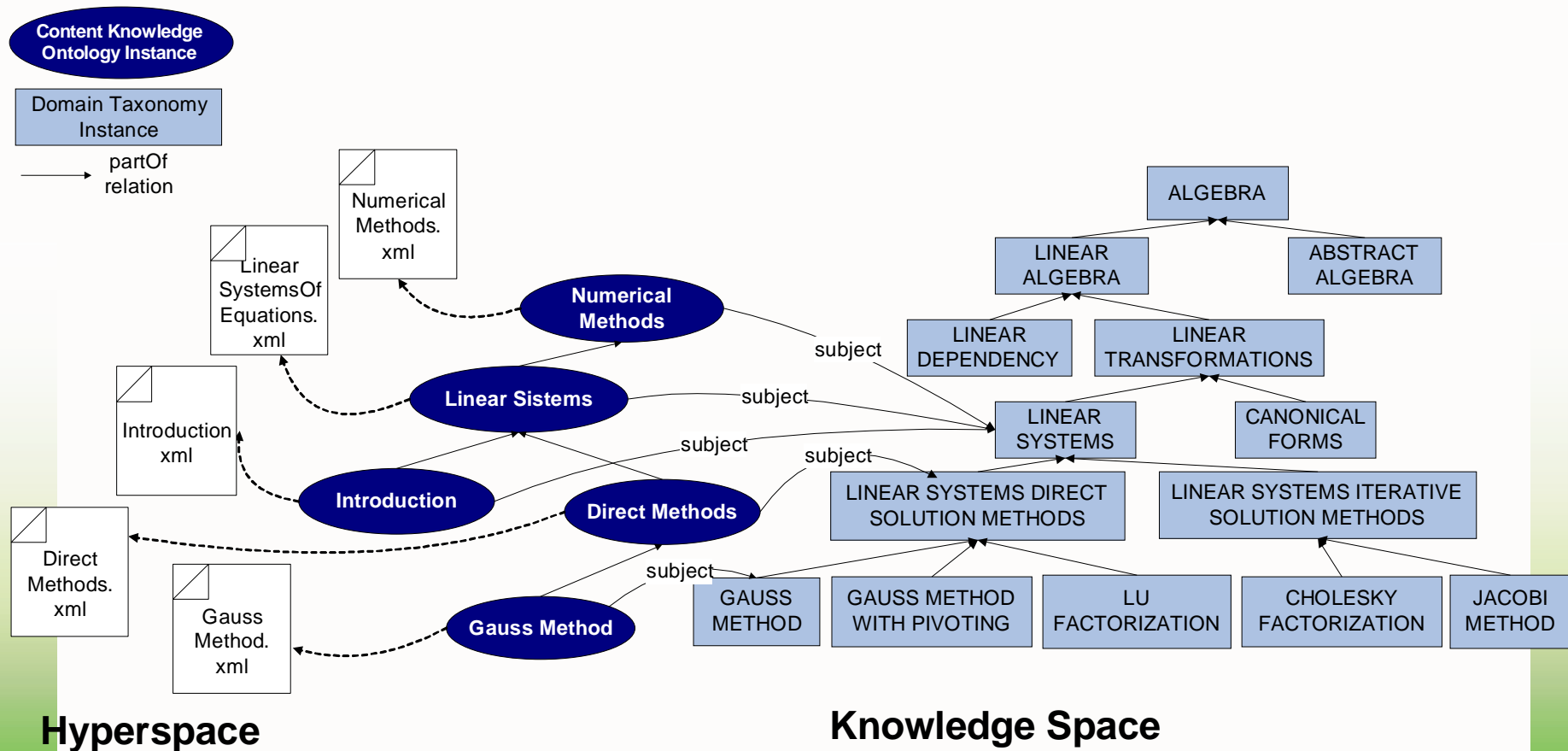
Automatic Metadata Generation

- ◆ Each time new educative content is created into the system context a wrapper, aware of the semantics of the XML tags of the Hyperspace files and the creation context (*e.g. the mother language of the teacher to infer the language of the learning object*), automatically generates RDF statements describing learning objects in the Knowledge Space, such as:
 - ...

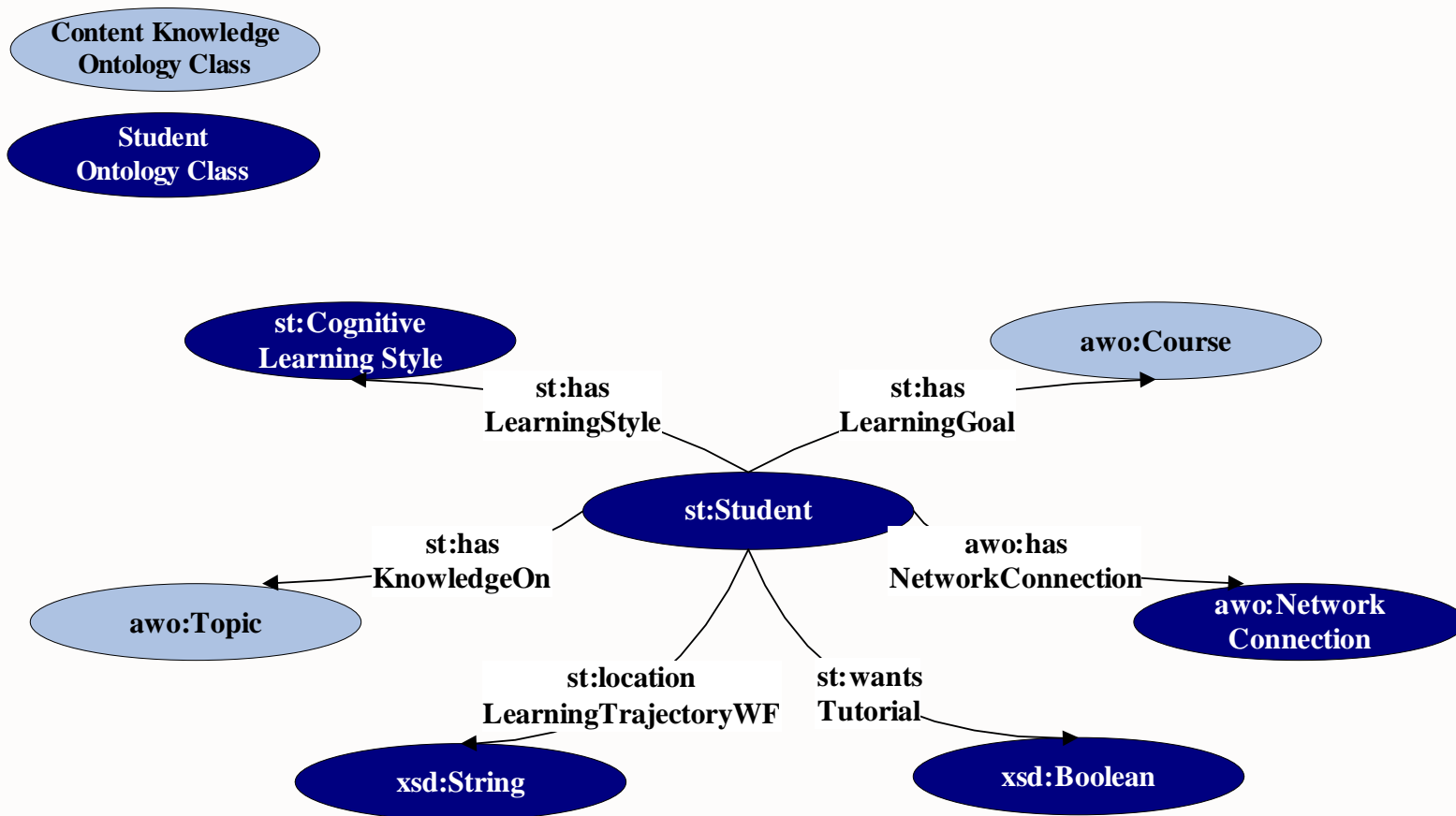
Automatic Metadata Generation

- ◆ ...
 - 1) Disciplines and Courses plus the information of which courses customize which disciplines
 - 2) Topics explanations, exercises, examples and other kind of complementary material plus the information of which material support which topic explanation and the other relations
- ◆ The correct sequence of topics into a discipline and the isPartOf relation among them are inferred from the XML sequencing and nested position of elements

Automatic Metadata Generation



Student Ontology



Final remarks

- ◆ This paper describes an in progress project for adaptive content automatic computation of Web-based courses, according to selected programs and student's profile
- ◆ A new application profile of the Standard LOM based in a RDF binding is defined and implemented in order to give the system the capacity of share learning objects across the Web
- ◆ A formal Web ontology supports metadata descriptions based in the constructed application profile. Such a ontology sets the stage to use inference in the computation of adaptability

Final remarks

- ◆ A simple taxonomy models the learned domain. Links relating each learning object with elements in the taxonomy indicates to which topic in the domain the learning object is associated
- ◆ Authoring software is provided for syllabus generation, supported by XML standard files (i.e. The Hyperspace)
- ◆ A wrapper automatically generates the metadata instances (i.e. The Knowledge Space). The automation is based on the XML structure of the Hyperspace and the knowledge available about the context creation of the educative content
- ◆ The learner's profile is modeled by a Web Ontology that support adaptation tasks