A High Level Architecture for Personalized Learning in Collaborative Networks

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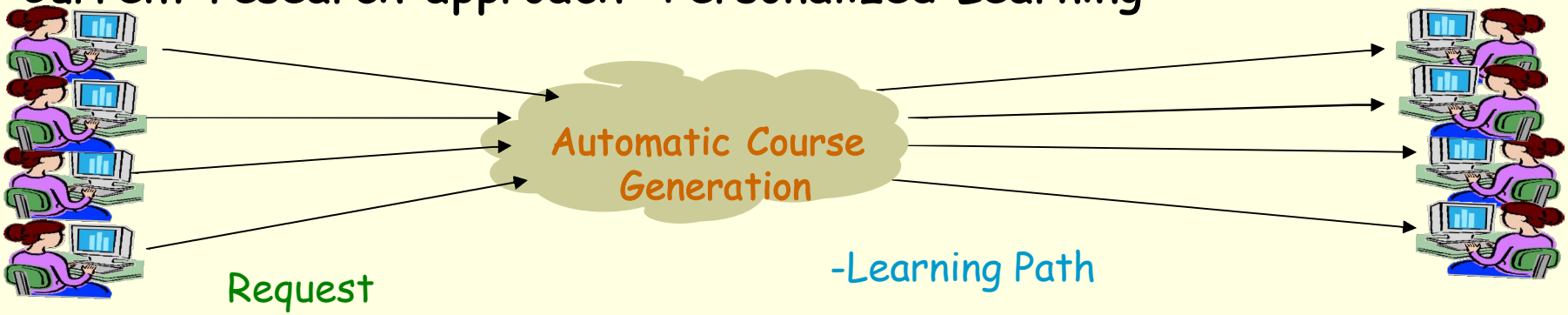
Presentation Outlines

- Introduction
- Related research
- Personalized Learning
- A high level architecture for personalized learning proposed in this paper
- Further challenges in personalized learning
- Conclusion

Introduction

- In traditional learning methods: "one size fits all"
  - fixed syllabus
  - fixed learning path
  - personal decision of teachers on what is "good teaching"
- First E-learning approach: expensive e-content & time consuming
  - Learning Management System (LMS)
  - Learning Content Management System (LCMS)
  - Virtual Class, Education portal, and etc.
- Current research approach: Personalized Learning



Two main categories of approach in personalized Learning

1. Based on reasoning and semantic web
2. Based on optimization methods

Related Research-Personalized Learning Based on 1) Reasoning and Semantic Web

- *Kontopoulos et. al., 2008 (PASER)-* Automatically synthesizing curricula, applying the AI planning and semantic web methods

  - Based on learner's profile, preferences, needs, and abilities dynamically constructing learning path

  - Does not adequately address personalized learning based on the learner's attributes, does not consider the features of LOs,

- *Gaeta et. al., 2009-* methodologies and techniques supporting a community of experts in modeling educational domains through management of educational ontologies

  - Based on user's profile and cognitive state

  - Personalized learning is not sufficiently addressed

- *Chi, 2009-* knowledge-intensive approach to create a general sequencing knowledge base for e-learning.

  - Includes two components: 1) an ontology which is used to represent abstract views of content-sequencing and educational contents,(2) a set of semantic rules are used to represent relationships between individuals.

  - Does not adequately address the learners and LOs attribute.

Related Research – Personlized Learning based on 2) Optimization Methods

- *Chu et. al., 2009-* PC2PSO (personalized e-course composition based on Particle Swarm Optimization) focuses on four specific factors as its objective function

  - Particle Swarm Optimization (PSO) method is used to find the near optimal solution

  - Personalized e-course composition is not sufficiently addressed

- *Wang & Huang, 2008* - an extended approach based on ant colony optimization, rooted in a Meta-heuristic algorithm for discovering on-line learning patterns along an adaptive learning path

  - Emphasizes Relationship between the learners' learning style and the leaning objects, in order to achieve an adaptive learning plan for each learner.

  - Optimization algorithm does not consider learner's cognitive state, and searching the LO is done within static repository

Related Research – Personlized Learning based on Optimization Methods-Continued

- *Lin et. al., 2009* -Automatic course generation system for organizing the existing LOs in a repository.

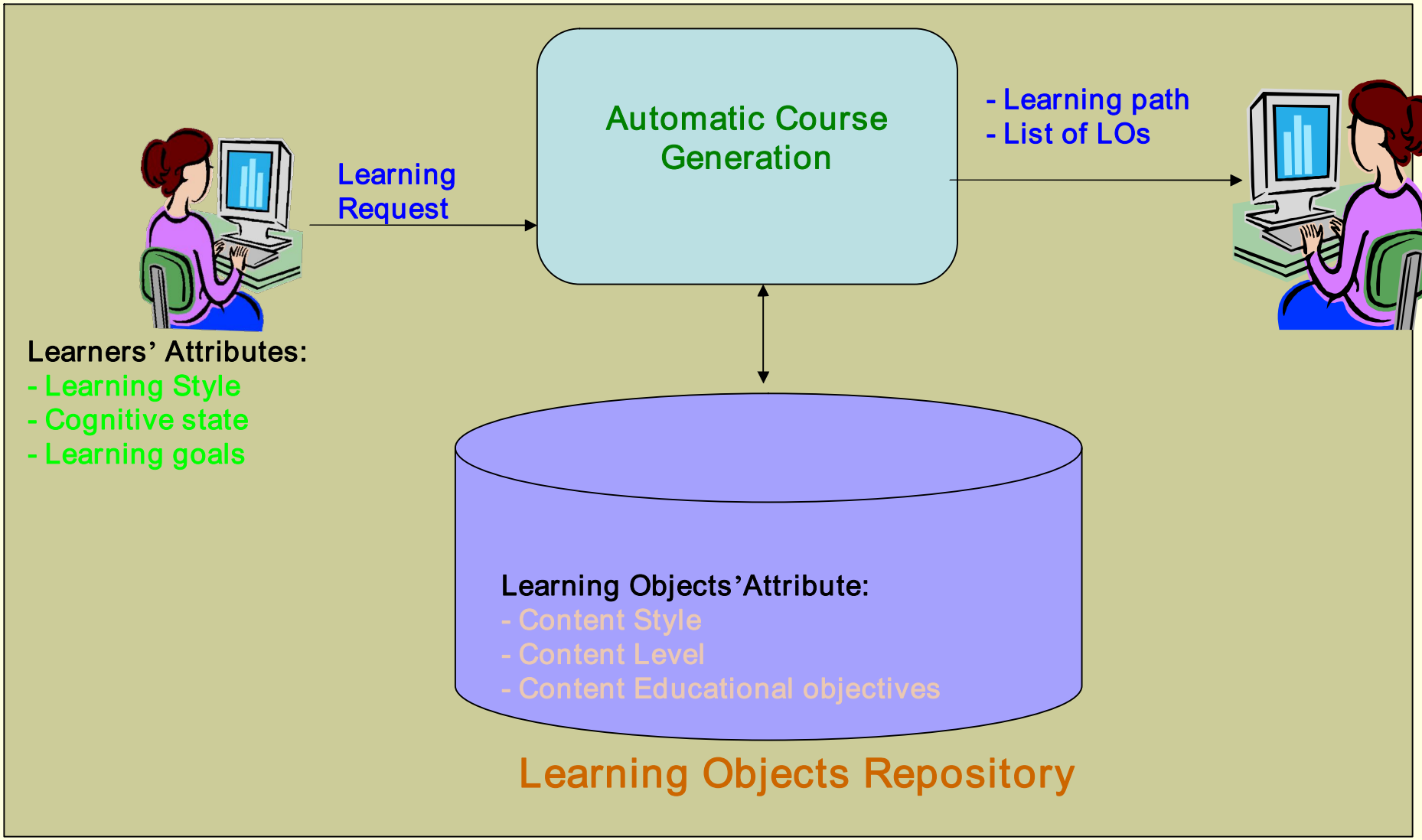
  - Applies a kind of swarm intelligence techniques- Particle Swarm Optimization (PSO).

- *Yang & Wu, 2009*- Attribute-based ant colony system for recommending adaptation of learning objects to learners.

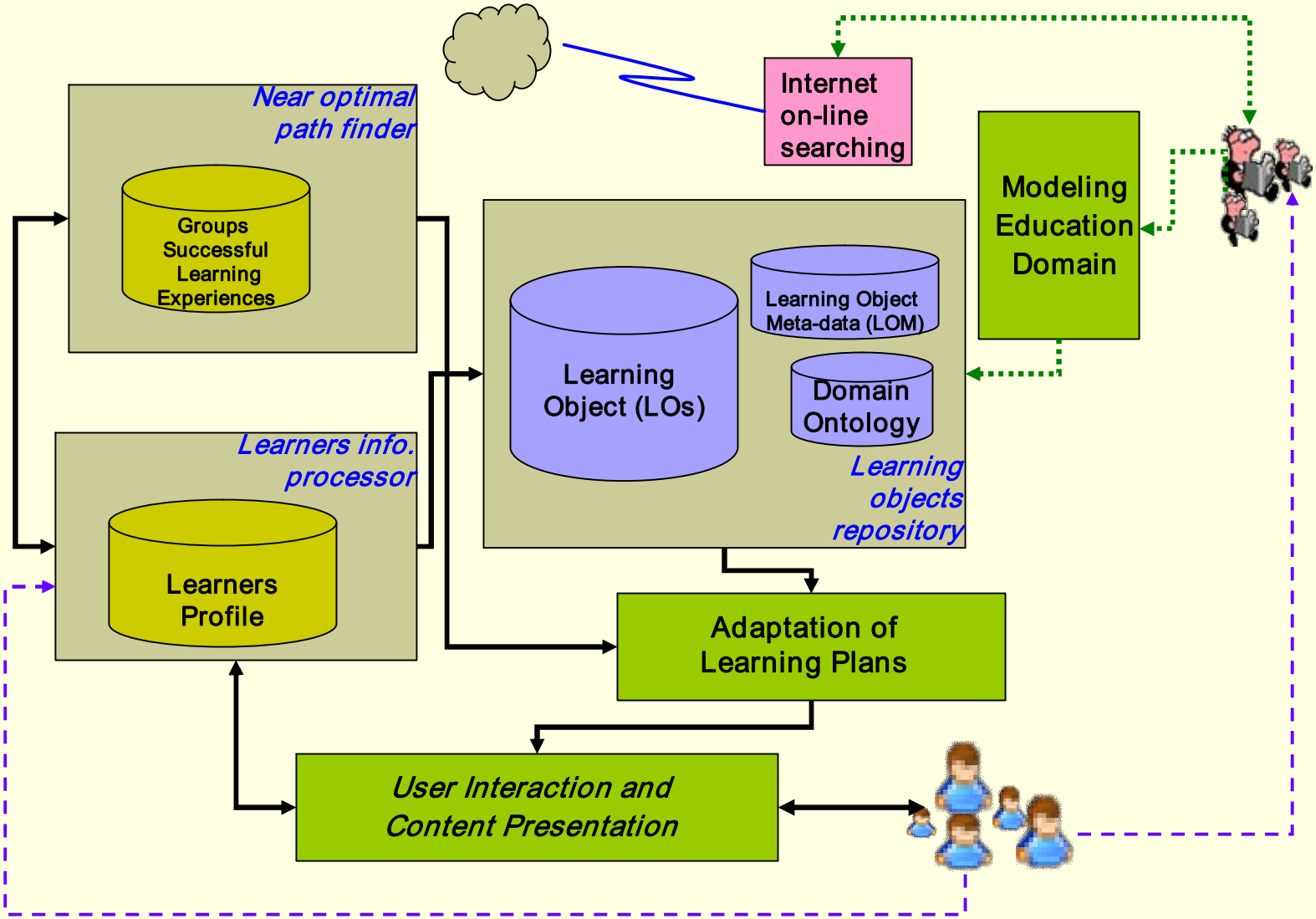
- Introduces an extended ant colony system based on the Kolb's learning style model (Kolb, 1974)

- In some cases requires comprehensive search of all the nodes in search space, which due to time complexity problems is not possible

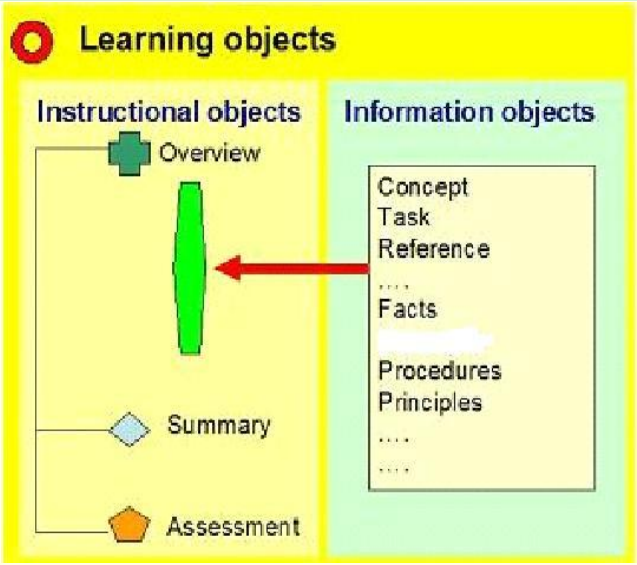
Personalized Learning



A High Level Architecture for Personalized Learning



Learning Object Repository



- **Learning Object (LO)**

  which a resource, usually digital and web-based,

  that can be used and re-used to support learning in

  the environment.

- **Learning Object Metadata (LOM)**

  A data model, usually encoded in XML and RDF, which is used to describe a learning object and similar digital resources that support learning.

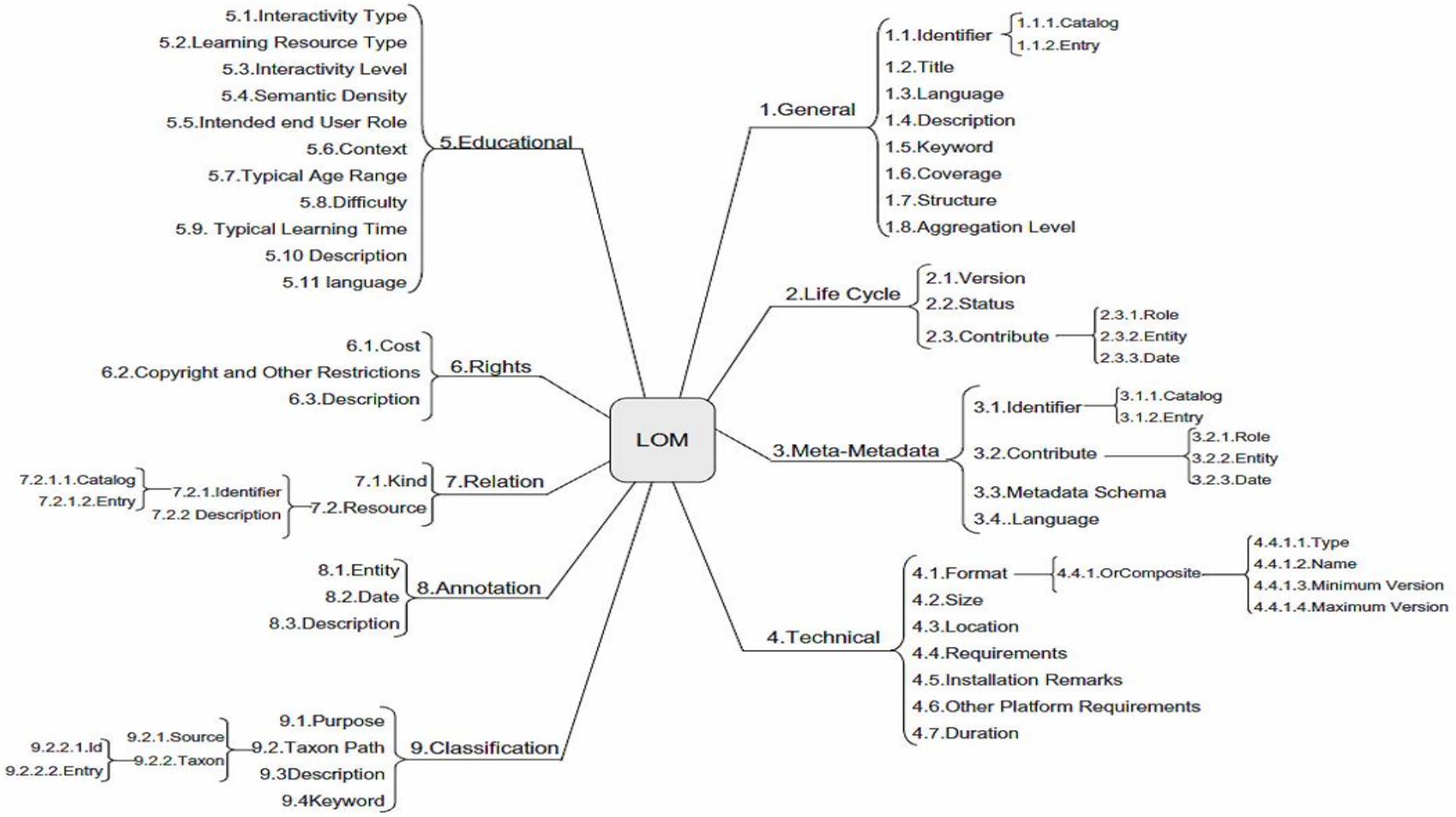
- **Domain Concepts (DC)**

  A concept belonging to the described educational domain. It is explained by more LOs.

- **Ontology of Domain Concepts (DC)**

  Represents and specifies the Domain Concepts (DC) and their relations.

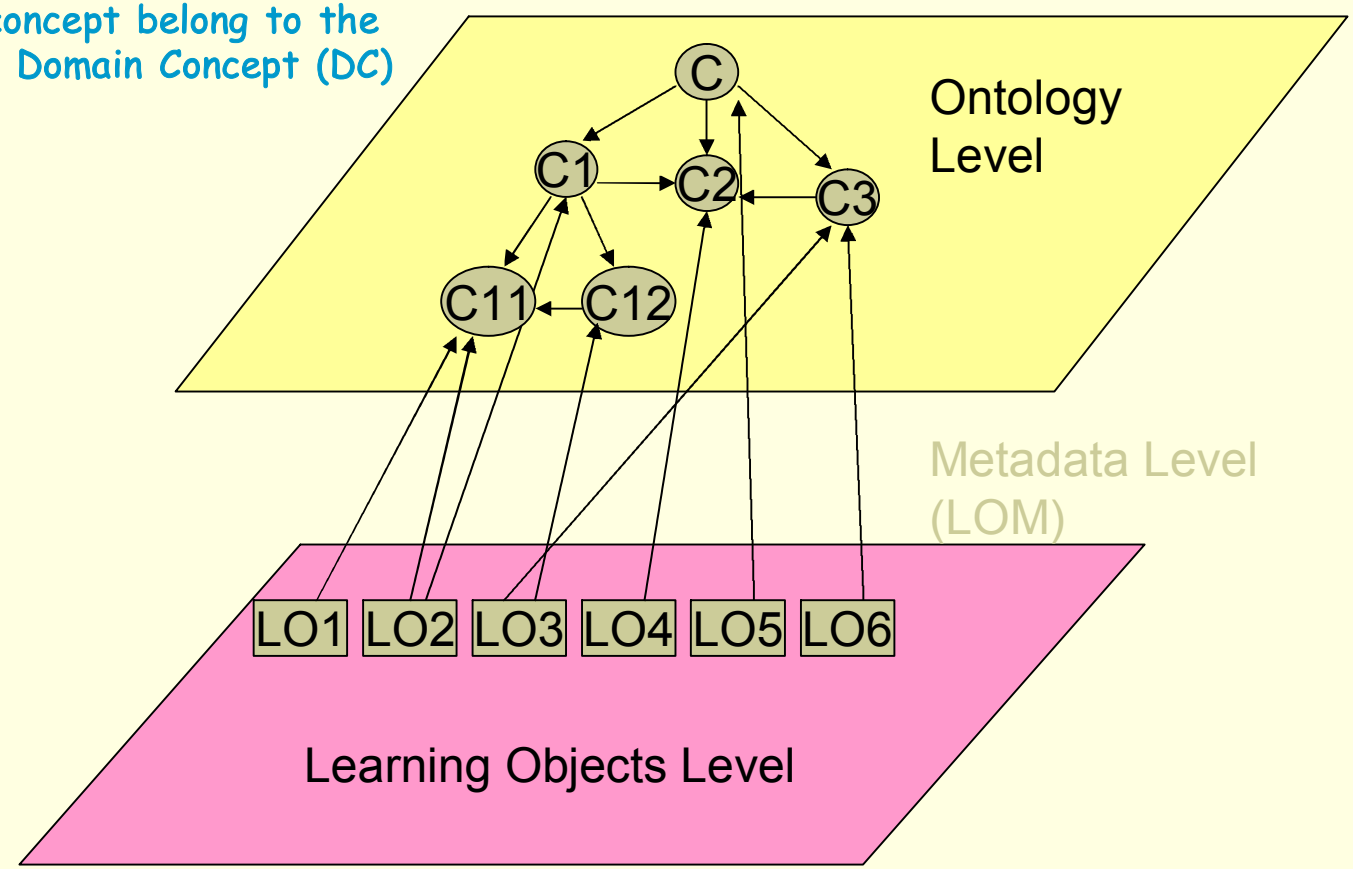
IEEE Meta-data Elements and Structure



http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf

View of the data level of the proposed Architecture

C is a concept belong to the specific Domain Concept (DC)



Relationship among LOs, LOM, and Ontology

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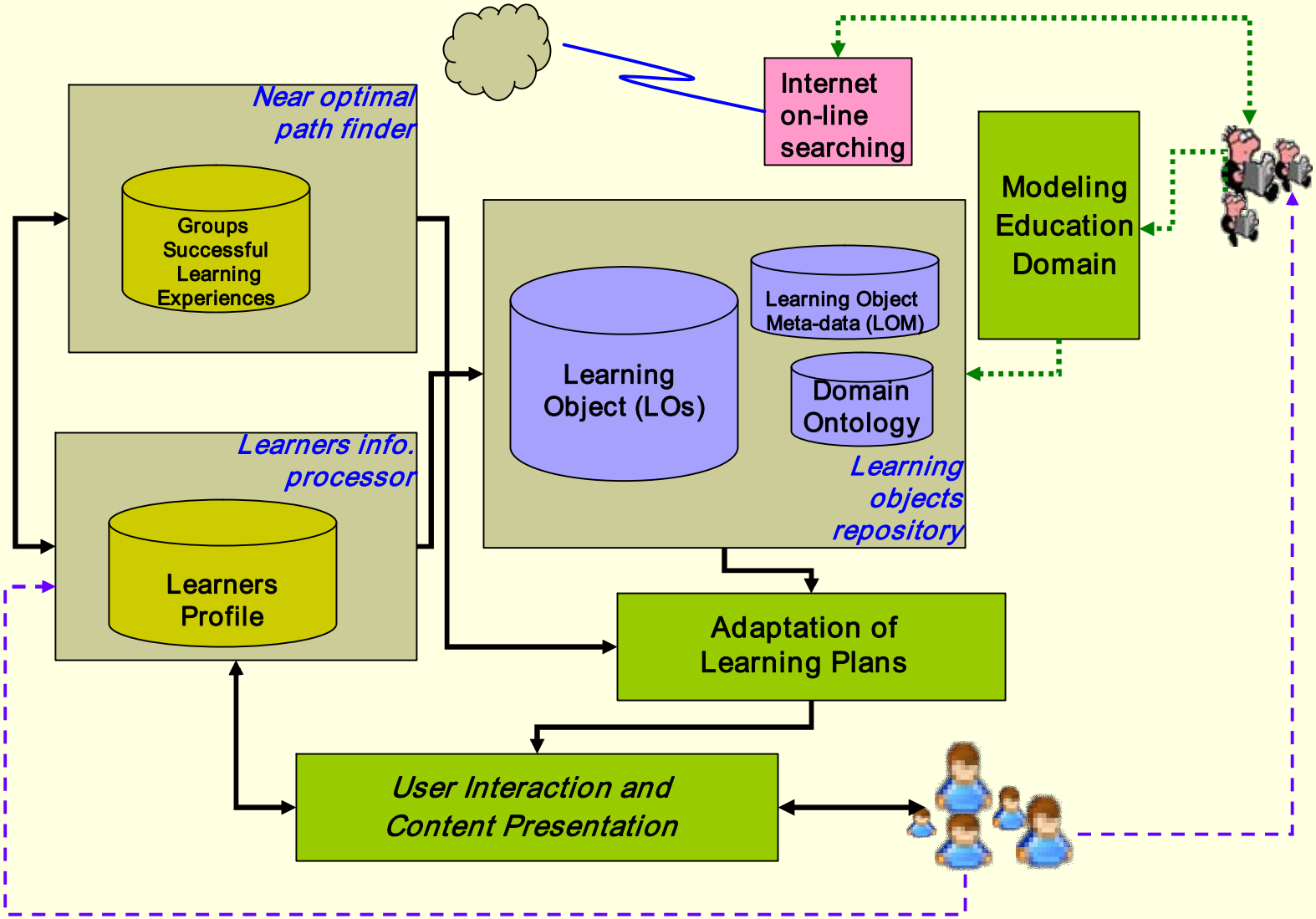

Learner's Information Processor

- The learner model in this system is composed of learner's **Cognitive State**, **Learning style**, and **learning goals**.
- Cognitive state: represents the current knowledge of the learner on the specific topic which he/she tries to learn.
- Each learner also has a preferred method for learning, which is called the learning style.
- Each learner also has his/her learning goals.

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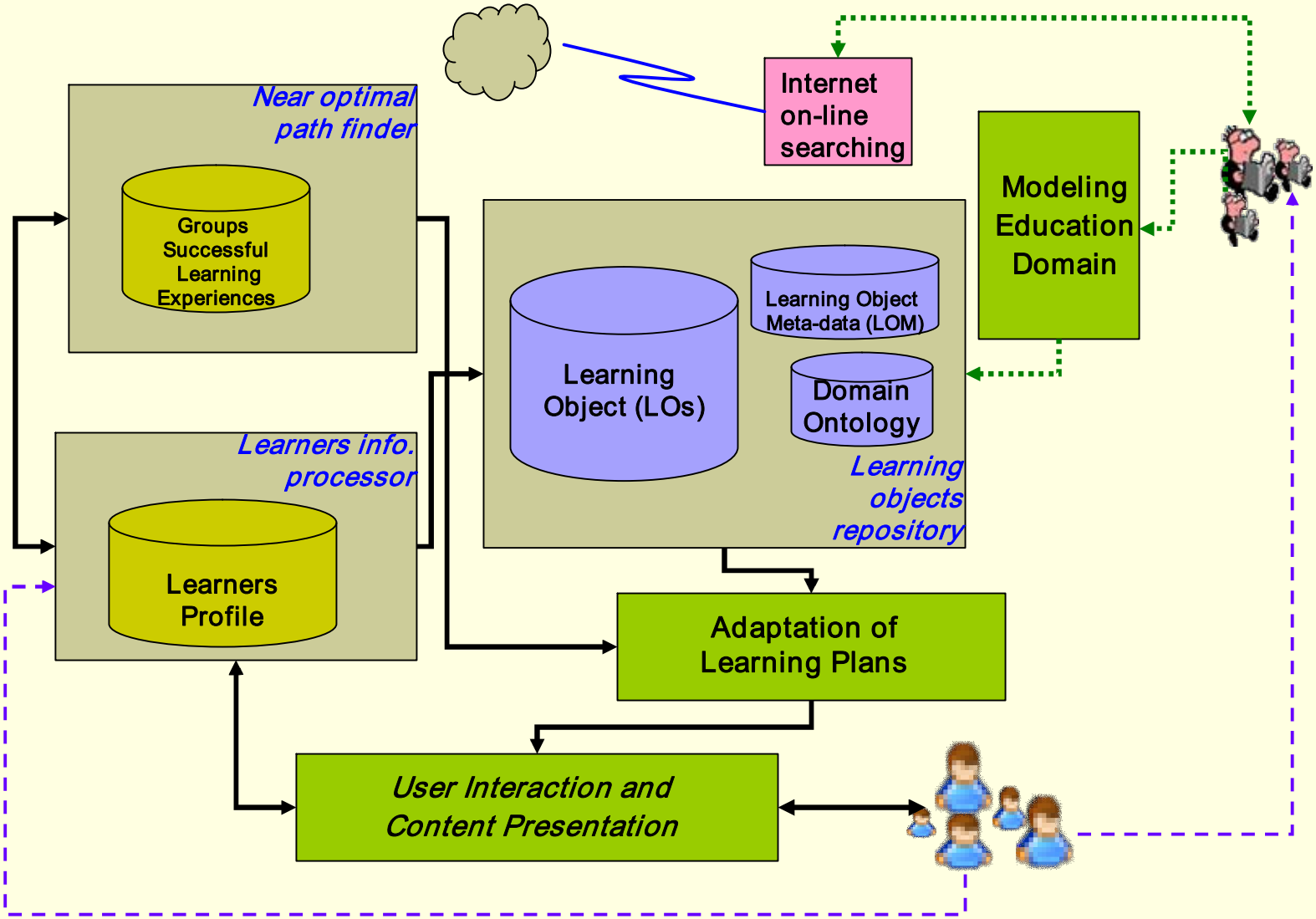

Others Modules of the Architecture

- Modeling of Educational domain
  - Is a module in the architecture to assist the instructors and content providers to set up the learning domain for the CNs.
- Near Optimal path finder
  - Tries to find for each subject learned in each group, the successful learning path followed by the most number of learners who passed the test on that subject.
- Adaptation of learning Plans
  - Try to find the best learning path for the learner from a group in the CN who tries to learn a subject.

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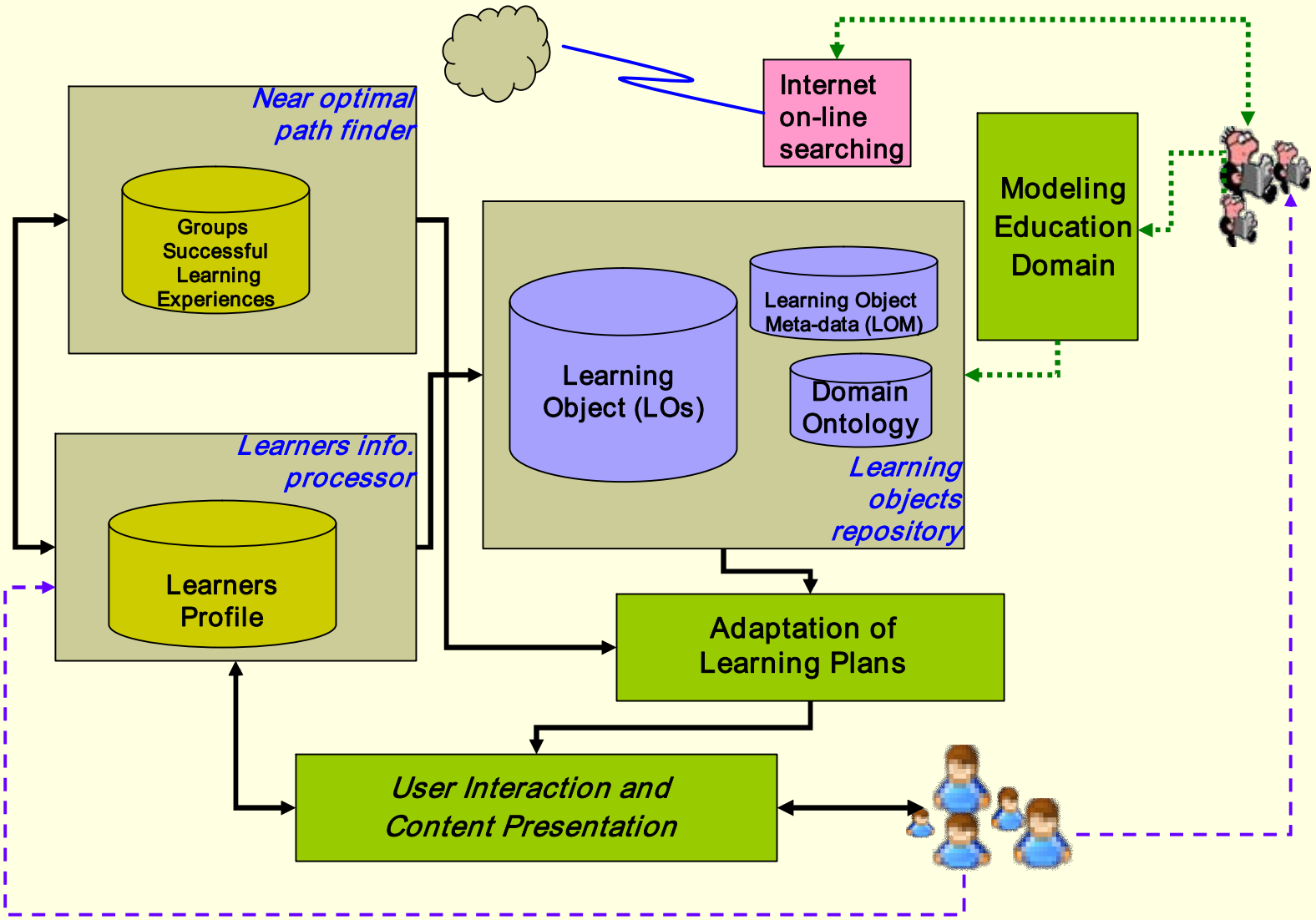

Further challenges in personalized learning

- Recognizing the current knowledge level of the learner in relation to the domain/subject which he/she tries to learn.
- Identify the list of learning objects that best match the learners' requirements.
- Identifying the set of criteria to be used for searching/mining new suitable LOs on the Internet, and primarily based on the learner's profile (on line searching & mining related LOs) .
- Finding suitable optimization methods to fit both learner's and LOs' attributes together.

Conclusion

- Some related works tend to serve reasoning and semantic web in personalized Learning.
- Others, try to serve the optimization Methods for finding optimal Learning path and suitable LOs list.
- Our approach tries to apply both of these approaches furthermore the group learning.
- Three attributes for LOs and Learners are also considered in our approach
  - For the learner: cognitive state, preference, and learning goals
  - For the LOs: Style, level, and educational objectives.

Thanks for your attention