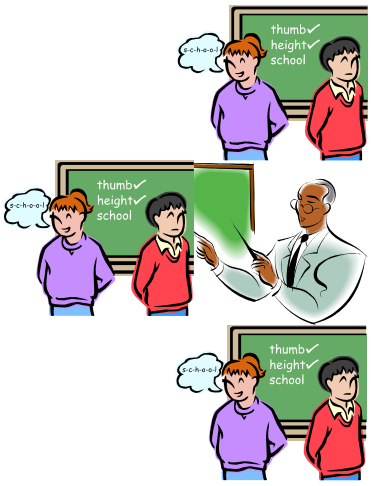
Online Curriculum on the Semantic Web: The CSD-UoC Portal for Peer-to-Peer E-learning

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Instructors and Learners

instructor



learners

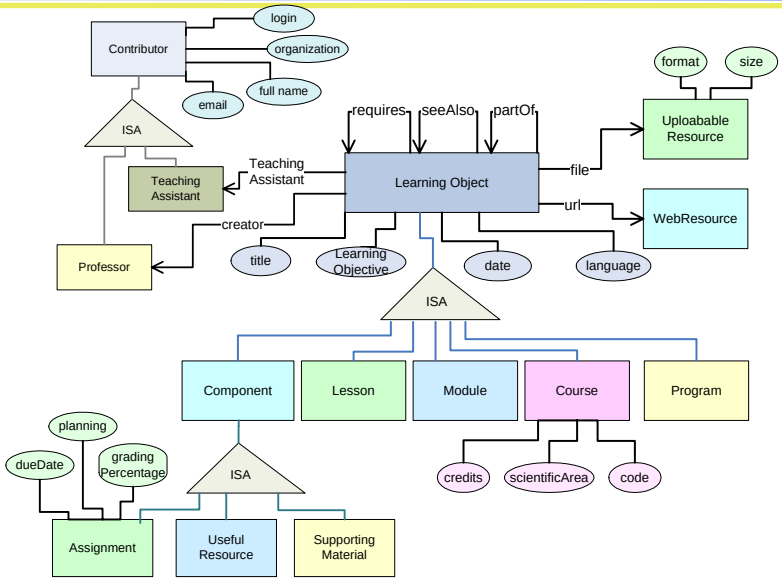


content producers + consumers **content consumers**

Online Curriculum Portals

- Based on Learning Objects (LOs):
  - Any chunk of learning material
  - Encapsulate learning content and metadata
- Online Curriculum Portals:
  - Aggregate LOs at various granularity levels
  - Exploit the pedagogical value of semantic relationships among LOs, which operate in two different spaces:
    - The inner space, which implies the LO structure
    - The outer space, which delivers the learning value of LOs within specific context of use
  - Define Learning Paths that span multiple LOs

Semantic Web Modeling of LOs

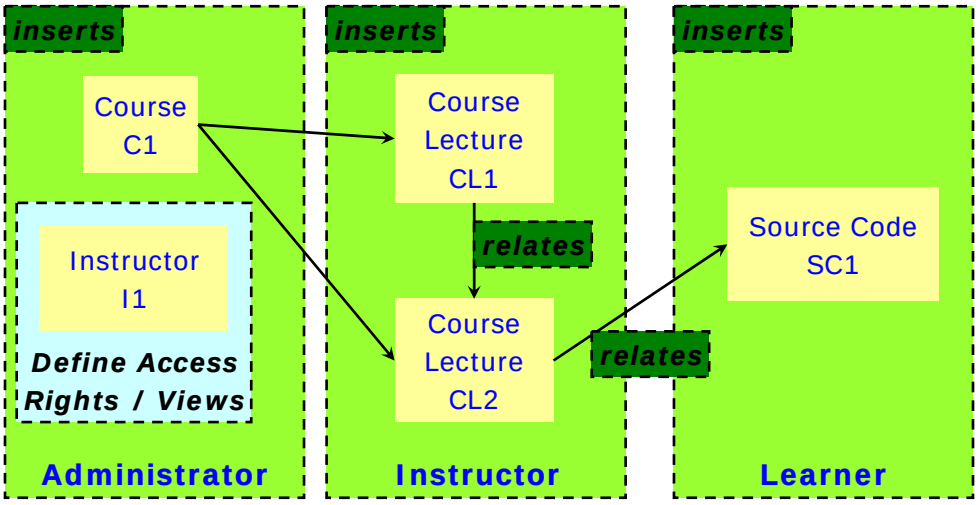


Functionality

- Instructors
  - Insert, delete, modify LOs (Learning content plus Metadata)
  - Customize available views on LOs
  - Define initial learning paths that learners can follow
  - Browse/query through the information space
- Learners
  - Insert LOs
  - Enrich learning paths in a personalized way
  - Browse/query through the information space
- Administrators
  - Define user rights according to user roles
  - Define available views according to user roles
  - Support data management services on curriculum

Correspond to semantic views on the information space

Functionality

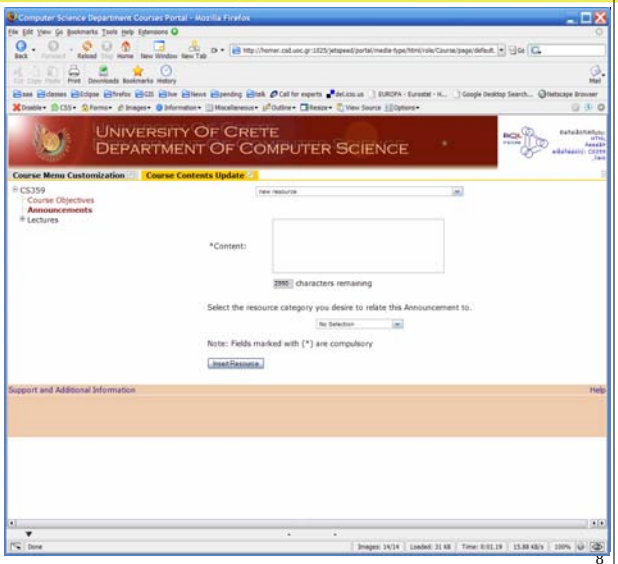


Questions to Address

- How much schema detail do we expose to the content providers and consumers? (information overload)
- How do we keep LOs produced by independent providers semantically related? (consistency)
- How can we support pedagogical metaphors to learners but keep the environment open, i.e. not only predefined paths? (openness)
- What is the development and maintenance cost? (cost-effectiveness)
- How other educational institutions can benefit? (standardization / scaling)

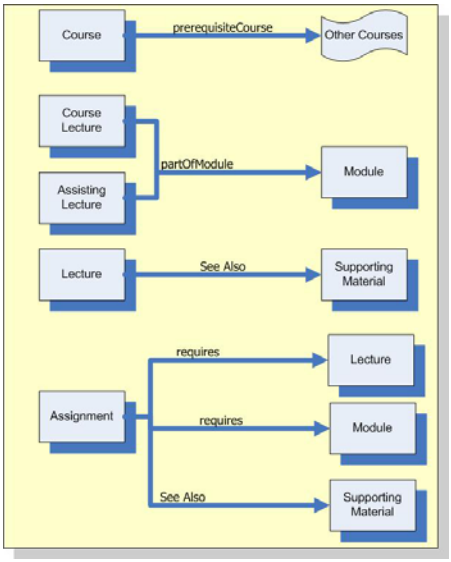
Rich Information Space: Good or Bad?

- Not always desirable …
- Necessity for definition of schema based specific views
  - Allow the instructor to customize the breadth and the depth of the information related to his/her course



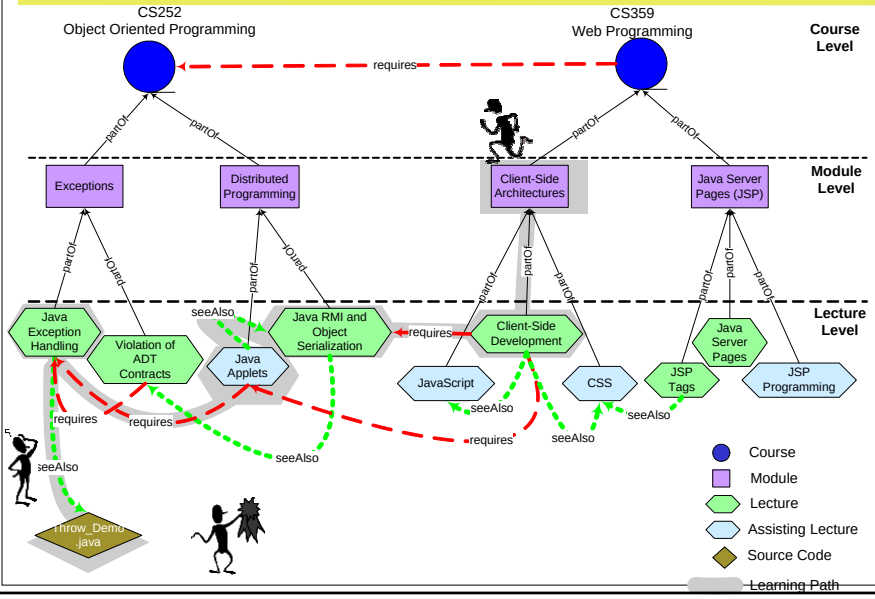
LO Semantic Relationships

- LOs can physically reside outside the portal
- Exploit semantic relationships of LOs classes to facilitate navigation
- Users do not need to navigate back and forth
- More specialized relationships can be defined upon request
- Instructors can determine Learning Paths to be followed
- Learners can enrich these Learning Paths



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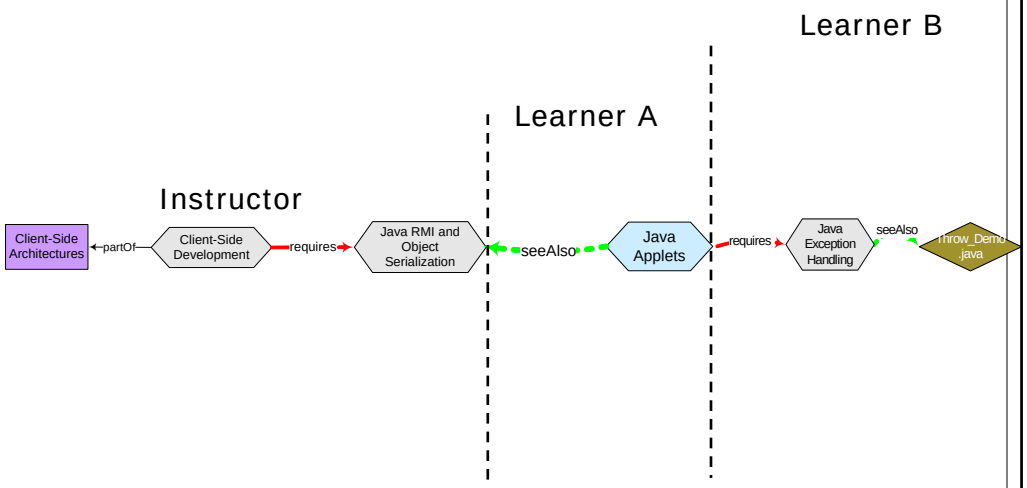
Learning Path Example



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Learning Path Example



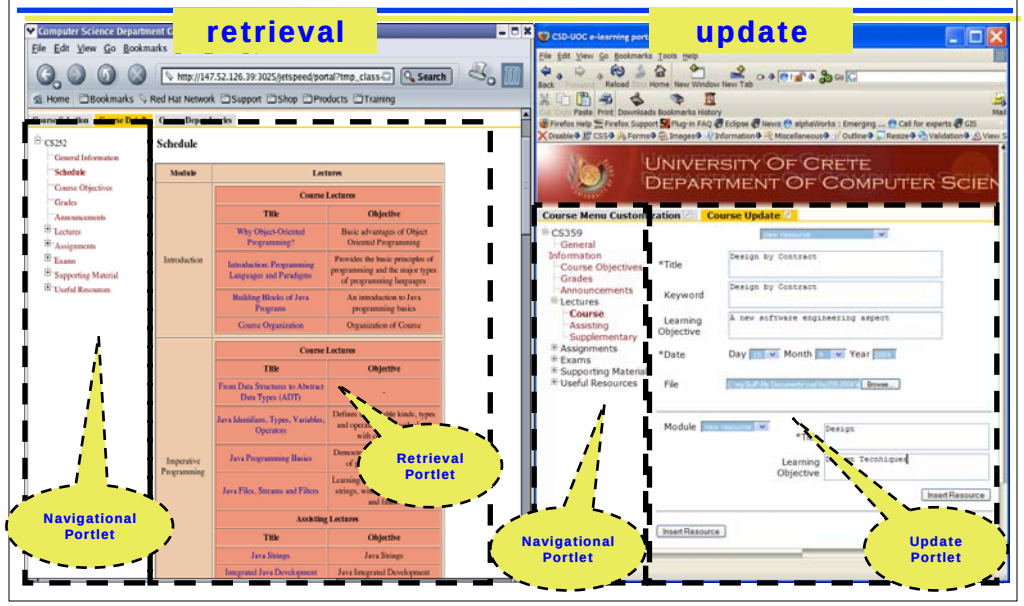
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Querying and Updating

- Provide a unique interface for all actions
- Differentiate by point of entrance in the Portal
- RQL is used in order to translate user navigation to the right questions against the semantically described data stored under the RDF Schema
- Precompute queries for any possible user action
- Use API functions to insert/update LOs
- Preserve consistency by executing actions automatically (i.e. LO deletion results to deletion of all relationships where the LO was either domain or range)

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Portal GUI

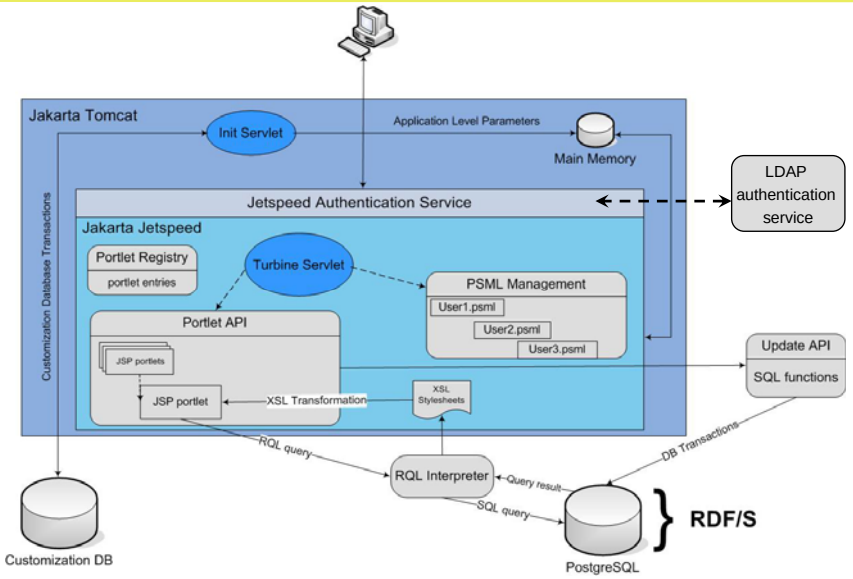


Technologies used

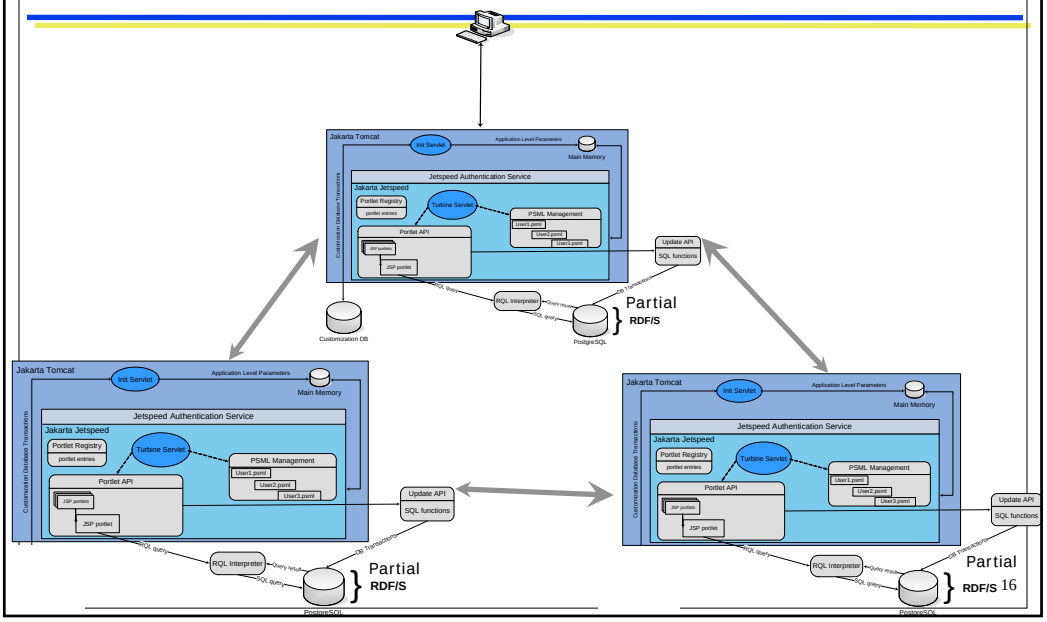
- Database technology for managing and querying RDF/S descriptions and schemata.
  - the ICS-FORTH RDFSuite to support scalability and efficiency when accessing large volumes of LO semantic descriptions in our Portal
  - the declarative RDF/S Query Language (RQL) in order to acquire the necessary expressiveness to support personalized views and dynamic updates specified on learners' demand.
- The Apache Jetspeed framework supporting run-time construction of portlets for generating dynamically the HTML pages of personalized learners' views.

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Portal Architecture



Distributed Portal Architecture



Our Solution: The CSD-UoC Portal

- Relies on a RDF/S binding of e-learning standards (IEEE-LOM)
  - it is the first Portal that exploits the semantic relationships of courses, modules, lectures, etc. in order to support conceptual navigation and retrieval of LOs, taking the form of learning paths
- Supports personalization for both instructors and learners:
  - instructors can specify a subset of the LOs' metadata schema offered by the Portal that are adequate to the needs of their courses
  - learners have the ability to either select a predefined by the instructors learning path or enrich on demand existing ones during their navigation to the Portal's resources
- Offers to both learners and instructors a uniform web based interface for browsing, querying and updating the Portal resources

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Comparison with Existing Technology

- LCMS
  - LO repositories (educational content and metadata) ***but***
  - Mostly support full text queries disconnected from the navigation
- LMS
  - SCORM sequencing rules to specify learning paths of individual LOs ***but*** no semantic relationships of LOs committing to e-learning schemas
  - Association among different LOs takes place only at design time ***not*** allowing for on-demand assembly of LOs
- (Semantic) Portal and brokerage platforms:
  - Build on RDF/S ***but***
  - No semantic personalization facilities are supported for viewing and accessing (i.e. browsing, querying) resources
- Adaptive Hypermedia:
  - Adaptation techniques target frequent access to same e-learning material ***but***
  - Online Curriculum Portals should enable to learn more and new things in different ways from day to day

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Future Work

- Evaluation:
  - Evaluate the Portal in a real-world environment
- Functionality:
  - Extend the Portal to support additional learning activities of the hosting institution (collaboration, student projects' management, etc.)
  - Enrich Portal views with administrative information of curriculum
  - Use conceptual bookmarks in order to find the desired LO without having to traverse the same learning path over again
  - Provide the means for on demand LO assembly
    - authors can query and rank LOs according to various preferences (ongoing)
- System Development:
  - Provide a caching mechanism for portlets so they can be reused
  - Publish portlets as web services so they can be reused by other educational institutions (outside the context of the Portal)

Questions?

Portal: **http://homer.csd.uoc.gr:1025/jetspeed/portal**

Contact: **kotzino@csd.uoc.gr**

Thank you !