The Planet Project: Collaborative Educational Content Repositories on Structured Peer-to-Peer Grids

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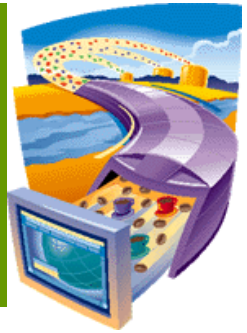
Outline



- Introduction: The Planet Project
- Related Work
- p2p Grid Middleware Layer
  - Dermi and its services
- Content Repositories Layer
  - IMS DRI and the ECL
  - Planet Digital Repository
- Collaboration Layer
- Planet Communities
- Conclusion

Introduction: The Planet Project

- Ubiquity of computing networks is making **distance learning** and **accessibility** to **high quality materials** possible.
- Appearance of different standards for **interoperability** between organizations.
  - Content labelling – **LOM**
  - Packaging and browsing of contents – **SCORM**
  - Remote search and content gathering – **IMS Digital Repositories**
- Main problem is **content accessibility**
  - Need for an open worldwide platform – Global educational content repository
  - **POOL** or **Edutella** are first approaches
    - Missing **directory service** for searching contents hierarchically.

Introduction: The Planet Project (2)

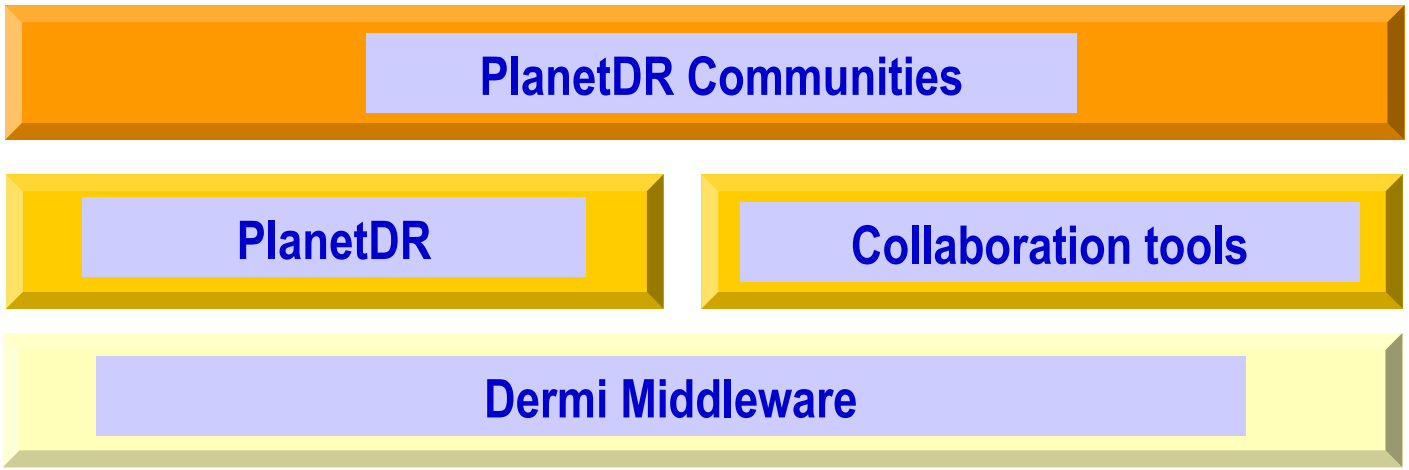
- The **decentralization** pattern is being followed
  - **Content servers** are “fixed elements” in the network
  - **Clients** are “dynamic elements” in the network
- This philosophy matches those of **Peer-to-Peer Grids**
  - Provide services typically found in Grids and p2p networks
- In such context, the **Planet Project** is framed
  - Merge these previously isolated worlds
    - Structured p2p Grids + educational content repositories

Introduction (3): The Planet Project

- Planet Project's objectives
  - Develop a **decoupled and open architecture** based on **Grid/p2p** and federation/replication for educational content **access and distribution**
  - **Integrate collaboration and interaction tools** in content access and interaction
  - **Promote content reusability and interoperability** between multiple platforms by splitting content descriptions from their instantiation
  - And many others, ...

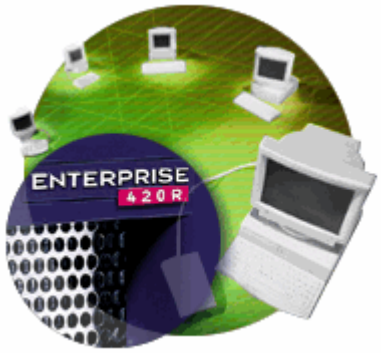
Introduction (4): The Planet Project

- Planet Project's layered architecture

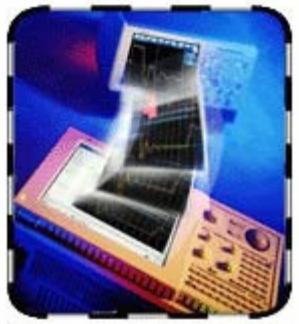


Related Work

- **Wide-Area Middleware Platforms**
  - JxTA
  - OMNIX
  - LaColla



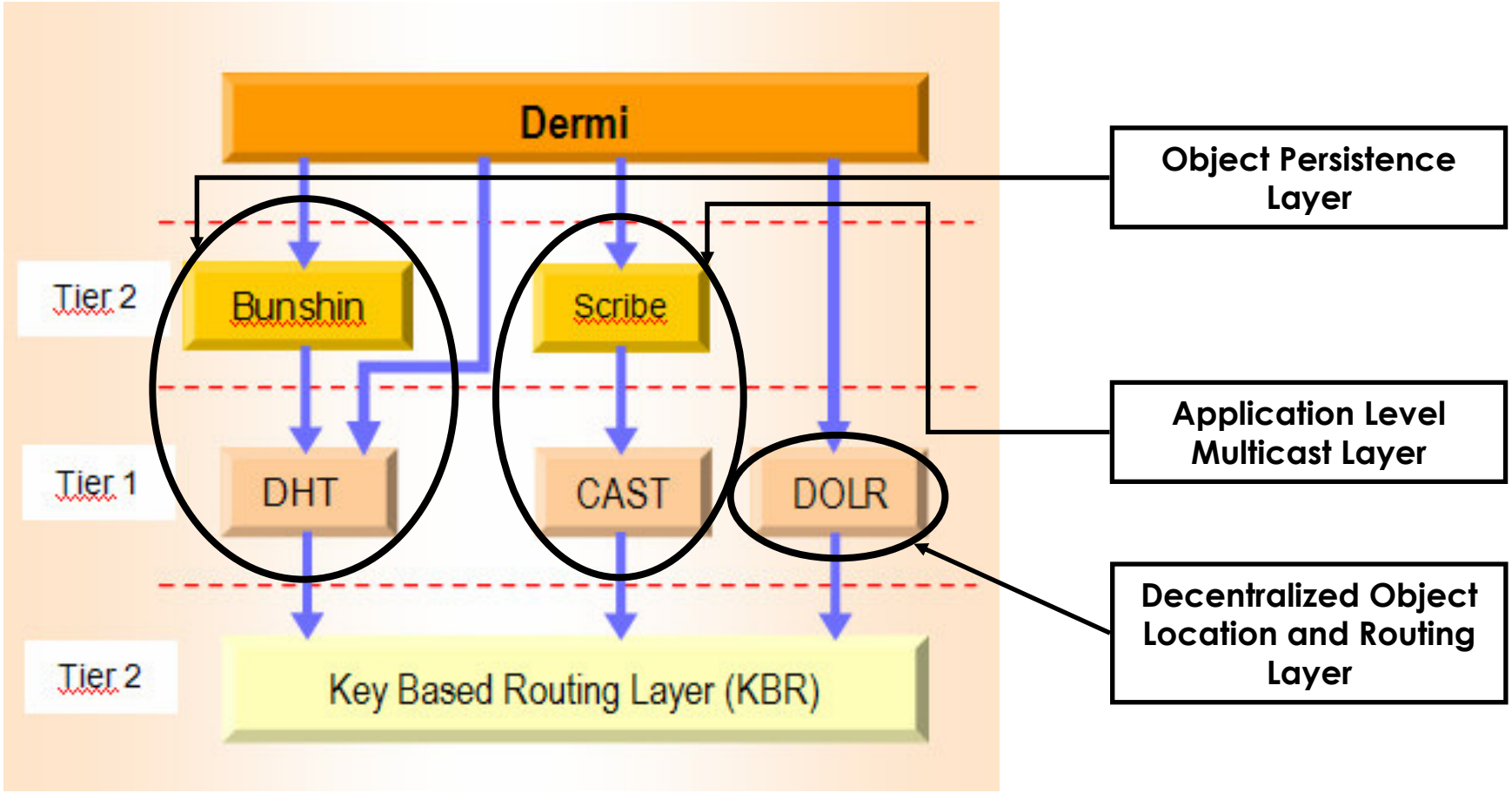
- **Content Repositories Interoperability Standards**
  - IMS Digital Repository Interoperability (DRI)
  - Learning Object Resources Interoperability (LORI)
    - ProLearn



p2p Grid Middleware Layer: Dermi

- **Dermi** is a structured p2p Grid object-based middleware
- It provides interesting services on top of a decentralized overlay network:
  - **P2P Invocation Abstractions**
  - **Decentralized Object Location**
  - **Distributed Interception**

p2p Grid Middleware Layer – Dermi Architecture



p2p Grid Middleware Layer – Dermi Services

- p2p Invocation Abstractions
  - **Direct calls** (Sync / Async) — UNICAST
    - A direct call from one object to another (1:1)
  - **Multicalls** (Sync / Async) — MULTICAST
    - A call from one object to many (1:N)
  - **Anycalls** — ANYCAST
    - The call is made to the client's **nearest object**, as dictated by the network's proximity metric
  - **Manycalls** — MANYCAST
    - Similar to *anycall*, but in this case, the call must be satisfied by **several group members**

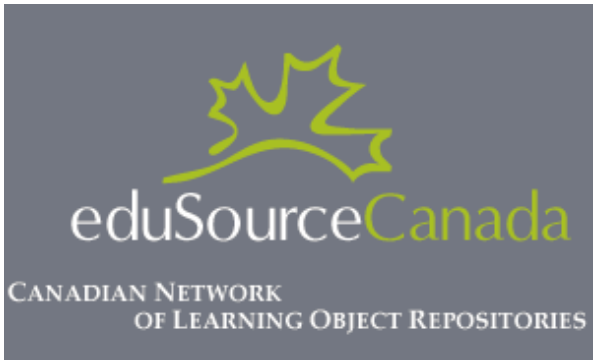
Content Repositories Layer

- We have implemented our own educational content repository: **Planet Digital Repositories (PlanetDR)**
- Interoperability in mind:
  - Implementation of the **ECL protocol** using Web Services
  - It follows the **IMS DRI** interoperability standard

Planet <DR/>

Content Repositories Layer – IMS DRI & ECL

- **IMS DRI** provides recommendations for interoperating between the most common repository functions.
- **ECL** (eduSource Communication Language) is an implementation of IMS DRI
  - Provided by means of an **eduSource connector**
  - It provides a **standard API** to connect an existing repository to the eduSource network.



Content Repositories Layer – IMS DRI Services

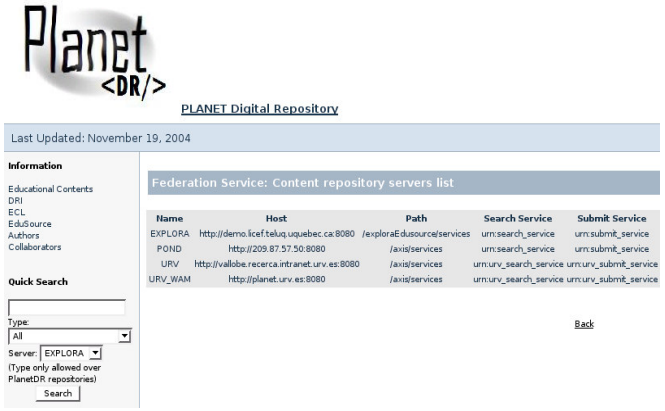
- **IMS DRI Core functions** defined as web services:
  - **Search/Expose**: search contents through their metadata (using the XQuery protocol)
  - **Submit/Store**: how to "upload" contents to an educational content server. Try not to use FTP transport protocol!
  - **Request/Deliver**: access a determinate resource described by its metadata.
  - **Gather/Expose**: defines repository-exposed meta-data requests, and aggregation for use in subsequent searches, or for creating a new meta-data repository.

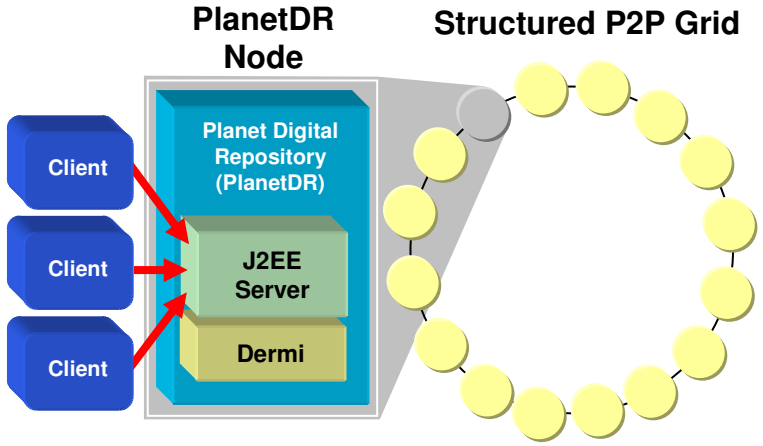
Content Repositories Layer – PlanetDR

- PlanetDR includes the following **services**
  - **Search service**
    - *Quick search*
      - Keyword found in **any** metadata field
    - *Advanced search*
      - *Search by **main meta-data category**:* any LOM meta-data field can be specified.
      - *Accumulated search:* searching for any field, **linking together conditions** of different LOM categories.
    - *Federated search*
      - Results are **gathered from all active content servers** in the eduSource network (it acts as a simulated Gather service).

Content Repositories Layer – PlanetDR (2)

- PlanetDR includes the following **services** (cont'd)
  - **Request Service**
  - **Submit Service**
  - **Federation Mode**
    - Decentralized **management** of PlanetDR compatible servers
    - New PlanetDR active instances in the network are **automatically detected and inserted** into each node's local list of available servers
    - Provides "**awareness**" of which content servers are available on the network.



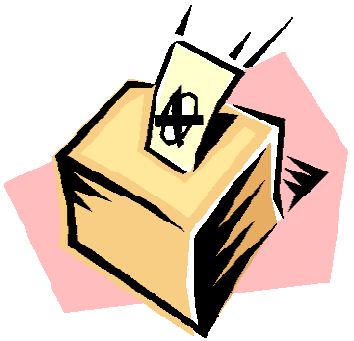


Collaboration Layer

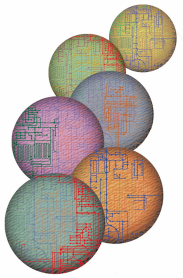
- Development of **wide-area collaborative tools**
  - Developed on top of **p2pCM** (a structured p2p Grid Component Model) or **Dermi**.
  - Programmers **can focus** on interesting aspects of the application (forgetting caching, replication, object location, etc.)
  - The underlying middleware can be used to develop wide-area applications.
  - We focus on **wide-area collaboration** tools and applications.

Collaboration Layer (2)

- **Getting the best of it** (a collaborative perspective)
  - State propagation (**multicall**)
  - Collaborative components location (**decentralized location service**)
  - State persistence (**stored and replicated in the DHT**, thus providing fault tolerance)
  - Collaborative voting scenario (**manycall**)
- Example: decentralized messenger-like application
  - Contact information stored in the **naming service**
  - Multicall used to disseminate messages 1:N
  - *Offline message delivery system*
    - Messages are **restored from the DHT** once the contact becomes online

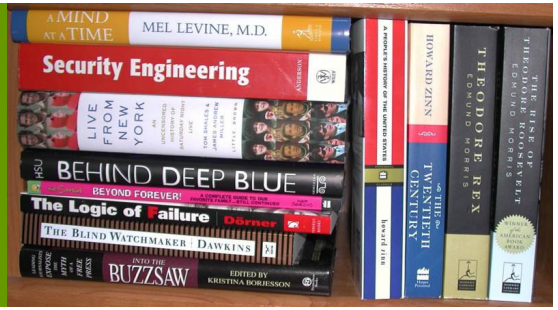


Planet Communities



- **Link** both the **repository** and the **collaborative layers** to create **collaborative communities around educational contents**.
- PlanetDR allows individuals from the same common or other collaborative areas to **make contact** and find each other.
- **PlanetDR's Community Service**
  - Users join the service (@, username, phone number, …)
  - Keyword search: "*p2p dht middleware*"
  - Dermi's naming service extended to support semantic queries.
- This is a **first step** in creating communities around contents in PlanetDR. Future works include:
  - Content evaluation tools
  - Content annotation tools

Conclusions



- We have presented the **Planet Project**
  - Middleware layer
  - Wide-area educational content repository: PlanetDR
  - Collaborative layer
  - PlanetDR communities
- **Federation service** on top of a structured p2p grid
  - **Interconnects** PlanetDR and ECL compatible content repositories
- Fully downloadable source code (LGPL License)
  - http://ants.etse.urv.es/planetdr
- **Interested parties**
  - eduSource Canada
  - UCAM

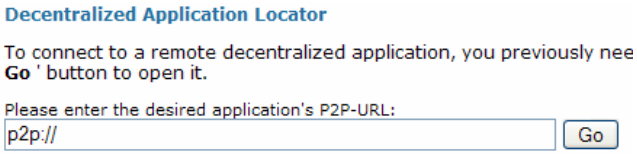
Future Work

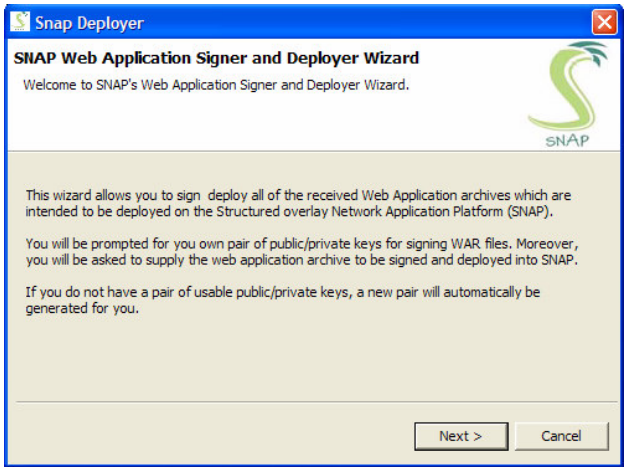
- We have the **technology**, but this kind of platforms maybe lack *quorum*.
- PlanetDR is being utilized in Canada and Mexico, but…

- it is very difficult to **attract users** unless these networks offer some more **added values**.
- We are **seeking new ways** of offering additional services which attract potential users to use our infrastructure…

Future Work (2)

- **Next step** towards wide area application deployment
- **SNAP** (**S**tructured overlay **N**etworks **A**pplication **P**latform)
  - J2EE web application deployment in a **worldwide network**
  - Surely these webapps can be **collaborative** ! ;-)
  - It will offer many services like
    - Security
    - Persistence
    - Load balancing
    - Transparent failover and recovery
- Some enterprises are interested in providing new wide-area applications for Snap.





Thank you very much!

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