Interoperability of Learning Object Repositories

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http://www.prolearn-project.org/lori/
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Motivation for Interoperability: Workplace Learning

Tool:
Web Browser
+ Many Proprietary Web Applications

- Publishing House
- Magazines, Journals
- Online Bookstore
- Online Marketplace
- Courses
- Tutorials
- Intranet
- Best Practice Studies
Motivation for Interoperability: Workplace Learning

Tool:
- Web Browser + Personalized Search Client + Educational Semantic Network

Smart Space for Learning™
Why a Network Service?

- Collaboration and interoperation adds more visibility and usage of Learning Resources.
- The global system is more than the individual sum of the parts.
- We want to have a flexible way of interoperation for different systems: no assumptions/constraints on the systems.
- This may help adoption of E-learning systems across Europe: bridge over each country differences.
- May help the acquisition and assimilation of e-learning.
- Service Oriented Architecture is the way to go for actual Information Systems.
Basic Problem

- Query Language, Schema
- Transport
- Results Format

Source

Query?

Target

Results
Architecture of a Solution:
Based on a Simple Query Interface

Query Language, Schema

Result Format, Schema

Learning Repository A (Source)

Transport: SQI

Common Query Language

Results in Common Format

Learning Repository B (Target)

Result Set

Learning Object Meta-Data

Local Query Language

Results in Local Format

Wrapper

Wrapper
Interoperability Stack

Semantic Model
(e.g. Common Query Schema)

Applications
(e.g. Query, Harvesting)

Core Service
(e.g. Session Management)

Messaging Service
(e.g. SOAP, XML RPCs, RMI)

Network Architecture
(e.g. HTTP, SMTP, TCP/IP)
Design Rationales for SQI

- **Overall Objective:**
  - Light-weight design → Easy adoption (like the Web)
- **Flexible:**
  - Synchronous and asynchronous mode
  - Centralized and Peer-to-Peer
  - Stateful - Stateless
- **Open:**
  - Query Language (CQL, QEL, XQuery…)
  - Result Format (Complete records or not)
  - Metadata Schema (LOM, DC, …)
## SQI Methods

<table>
<thead>
<tr>
<th><strong>Session Management</strong></th>
<th><strong>Synchronous Query Interface</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>createSession</td>
<td>setResultsSetSize</td>
</tr>
<tr>
<td>createAnonymousSession</td>
<td>synchronousQuery</td>
</tr>
<tr>
<td>destroySession</td>
<td>getTotalResultsCount</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Query Parameter Configuration</strong></th>
<th><strong>Asynchronous Query Interface</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>setResultsFormat</td>
<td>asynchronousQuery</td>
</tr>
<tr>
<td>setMaxQueryResults</td>
<td>setSourceLocation</td>
</tr>
<tr>
<td>setMaxDuration</td>
<td>queryResultsListener</td>
</tr>
</tbody>
</table>
Uptake of SQI

• Implementation:
  • 15 SQI nodes registered at http://www.prolearn-project.org/lori | SQI Registry

• Standardization:
  • SQI is about to be endorsed as an CEN/ISSS Workshop Agreement (CWA)
  • SQI is part of the IMS Query Service Specification
  • SQI is a candidate of being fast-tracked as an IEEE LTSC standard
  • Preliminary talks with CORDRA (→ SCORM)

• Publications:
  • 5+ papers on SQI and SQI-related issue (in last 6 months)
  • 1st International Workshop on Interoperability of Web-based Educational Systems held in conjunction with WWW2005
ELENA SQI Network

- EduSource, AeShareNet, Edna, HCD Suite, Moodle, Polycllege, Telema, learn @WU, Ariadne
- Amazon Gateway
- EduSource Gateway
- Edutella Gateway
- Universitärer Lehrverbund Informatik (ULI)
- Knowledgebay
- Metzingen Continuing Education Database
- BFI
- CLIX
- EducaNext
- Advanced Learning Solutions

Ongoing implementation
The access to the network

http://www.hcd-online.com/networksearch/ and www.hcd-online.com/HCDExp | Network search for personalized search using Lucene
Trial it out!
Send us your comments!
Join us!

bsimon@wu-wien.ac.at
ELENA Network Implementation

Zoltán Miklós
Vienna University of Economics and Business Administration
Content

• Overview of the implementations of connected nodes
• Similarities & differences

• Further information:
  • http://www.prolearn-project.org/lori/
  • Frequently updated, also after the Elena project
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The Semantic Model of the ELENA Network 1/2

- Based on Standards: IEEE LOM, Dublin Core, Open-Q, Vcard
- Mandatory Query Elements:
  - Search Term
  - Learning Resource Language
  - Learning Resource Category
  - Price Flag
  - Restrictions Flag
- Mandatory Result Elements:
  - Identifier
  - Title
  - Additional Information
  - Contributor
  - Description
  - Learning Resource Language
  - Learning Resource Category
  - Price Flag
  - Restrictions Flag
The Semantic Model of the ELENA Network 2/2

• Optional Elements:
  • Organization Name
  • Provider Person
  • Learning Goal
  • Subject
  • Learning Material Type
  • Learning Activity Type
  • Price Amount
  • Price Currency
Implementation of the nodes

• **Common aspects:**
  - Implementation in java
  - Common schema expressed in RDF
  - Query language used for mediation: QEL (edutella)
  - Query management protocol: SQI

• **Differences:**
  - Data integration
  - Individual solutions (with similar/reusable components)

• **Main questions:**
  - Mapping to common schema
  - Answering QEL queries of not RDF data
Gateway: Amazon gateway

QEL query

HCD suite

QEL results

Amazon search

Amazon gateway

Amazon results

QELQueryWrapper

SQL-WebService

AmazonMessageHandler
Gateway

- Gateway
- Nodes: Amazon Gateway (with caching)
- Mapping of Amazon data into Elena common schema
  - Amazon uses proprietary schema
  - Problem: language
- Translation of QEL queries into Amazon specific search format
  - Large fragment of QEL queries can be translated (also logical operations like OR, AND, NOT)
  - Slightly different semantics

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Relational database

- **Nodes:**
  - CLIX
  - WU Executive Academy (formerly WBZ)
  - EducaNext-UPM
  - HCD-suite local repository
  - Ariadne (with QEL)
- **Mapping:** Each system provided a mapping from their local database schema into the Elena common schema
- **Mapping module of Daniel Olmedilla**
- **QEL queries:** Nodes add a new table in their database with all possible RDF triples (in Elena common schema)
RDF and XML files

- **RDF file**
  - Nodes: ULI
  - Answering QEL queries: straightforward (edutella file-base provider)
  - Mapping: mapping module

- **XML file**
  - Nodes: Metzingen
  - Translation of QEL queries into XQuery developed
  - Mapping: QEL- XQuery query translation can handle mappings
XML database
XML database

- Store XML data or metadata from relational databases in an XML database
- Nodes:
  - Relational databases: LASON, Knowledgebay
  - XML data: BFI Vienna
- Answering QEL queries
  - Reuse of QEL – XQuery translation
  - XML schema of the XML database closely related to Elena common schema
- Mappings
  - Expressed in XQuery
- Update
  - Continuous update of the XML database (eXist)
  - Relational database to XML: XQuarkBridge (open source component)
HTTP Proxy

- Nodes: seminarshop.com
- Seminarshop.com implemented a HTTP-based interface + mapping
- Answering QEL: adaptation of QEL- XQuery translation
Integration of edutella
P2P network

- P2P network
- Nodes: Edutella
- Asynchronous SQI interface added to edutella
Work in progress

- Implementation of SQI in script languages
  - Learn@WU: xoTcl
  - Moodle: PHP
- Almost ready implementations:
  - EduSource
  - Polycollege (Vienna)
- Publications (work in progress)
- „How to …“ paper (within PROLEARN, for prospective partners)
- Integration architectures/patterns