EDUTELLA

A P2P Networking Infrastructure Based on RDF

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Overview

Edutella: Project Context and Motivation

Edutella: Enabling Technologies
- Peer-to-Peer (P2P)
- Resource Description Framework (RDF)
- RDF Query Exchange Language Format RDF-QEL-i

Edutella: Working Scenario & Current Status

Edutella: Current and Future Work
Edutella: Project Context

Submodule of PADLR Project (Personalized Access to Distributed Learning Repositories) (www.learninglab.de/english/projects/padlr.html)
PADLR: Basic Assumptions

Assumption 1/2: lots of learning resource repositories, which typically employ various back-ends, various meta-data schemas, and various architectures, etc., have already existed in many institutions. (troubles: isolate information islands, lack of interoperability between each other)

Assumption 2/2: Many institutions are reluctant to give up their control over learning resources, which is currently troubling many central-server based approaches to learning resource sharing, e.g., eLearning „portals“. (troubles: „portals“ are costly but unprofitable)

Solutions:

- **P2P**: enable institutions to actively participate in a global sharing network without losing the control over their learning resources
- **RDF**: describe heterogeneous material and collections in distributed learning resource repositories to provide basic interoperability
Edutella: Using a Peer-to-Peer Approach

Peer-to-peer computing is the sharing of computer resources and services by direct exchange between systems.

Edutella connects highly heterogenous peers (heterogenous in uptime, performance, storage size, functionality, number of users...)

Goal: making distributed nature of Edutella services (e.g. repository storage) completely transparent to Edutella clients

Means to get there: specification and implementation of a set of Edutella services
Edutella: Enabling Technology 1/2 (JXTA)

- Project JXTA (www.jxta.org)
  - An open source programming platform to enable P2P services and applications
  - Interoperability, Platform independence, Ubiquity
  - Layered approach

Source: Li Gong, Project JXTA: A Technology Overview
Edutella: JXTA Layers

JXTA-enabled Edutella Services

- Edutella Query Service: query Edutella provider peers and retrieve query results
- Edutella Annotation Service: annotate meta-data stored in repositories
- Edutella Update and Replication Service: update and replicate (meta-) data
- other services (mediation, mapping, etc.)

JXTA-enabled Edutella Applications

- "Provider" Applications: Edutella Provider, Edutella Hub
- "Client" Applications: Conzilla (Query GUI, KTH, Stockholm), Edutella Shell (Query GUI, L3S, Hannover), Ontomat (Annotation tool, AIFB, Karlsruhe), etc.

JXTA Core

- Security, pipe-based communication, Rendezvous-based discovery mechanism
Edutella: Enabling Technology 2/2 (RDF)

Resource Description Framework

- Key representation language in the Semantic Web
- URI-based identifying mechanism to describe distributed resources, and state relationships between these resources
- RDF graph model makes it easy to integrate a number of other formats for recording information, e.g. tables/tuples in RDB, simple assertions in formal logic, etc.,
- RDFS offers a mechanism to define specific RDF vocabularies, enabling schema / ontology level meta-data mapping.

RDF strength in eLearning area and P2P environment

- Availability of RDF-binding to most learning resource specifications (DC, IEEE LOM/IMS, ADL SCORM (ongoing)).
- As „distributed XML“, RDF perfectly fits into decentralized P2P environments, enabling distributed queries spanning various repositories.
Edutella: Goal and Approach

Specify and implement a RDF-based meta-data infrastructure for P2P networks

Developed as part of the open source peer-to-peer project JXTA edutella.jxta.org

Contributors from various institutions
### Project JXTA

**Project Info**
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- Login
- Mailing lists
- Report bugs

**Documentation**
- Project JXTA docs
- Protocol Spec
- License
- Governance

**Weekly Stats**
**March, 2005**
- Members: 9,595
- Posts: 127
- CVS Commits: 629

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**Download Project JXTA Demos Now!**

*myJXTA Demo App and Latest Shell*

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<th>Role(s)</th>
<th>Assigned Issues</th>
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RDF/RDFS: What is missing?

RDF/RDFS: describe distributed resources on the Web and to describe the vocabulary (properties) and constraints (classes, domain/range) for these descriptions

How do I query these distributed sources ???

- How do my queries reach their destination?
- How do I ensure they are understood at their destination?
RDF-QEL: RDF Query Exchange Language

RDF-based Query Exchange Language (RDF-QEL)

- RDF QEL1: conjunctive query
- RDF QEL2: RDF QEL1 + disjunctive query
- RDF QEL3: RDF QEL2 + negation (SQL92)
- RDF QEL4: RDF QEL3 + transitive closure (SQL3)
- RDF QEL5: RDF QEL4 + general recursion

- Datalog is used as the internal data model (ECDM: Edutella Common Data Model) and provided as a set of Java classes
- RDF is used to represent the queries transmitted between the peers
- Wrappers for other RDF query languages (RQL, TRIPLE, etc.) and XML query languages (like Xpath)
Edutella: Query Service Architecture

- JXTA Service
- Query Exchange Language Parser
- Query Class Model
- RDBMS Adapter
- RDF File Adapter
- dbXML Adapter
- ...
Edutella: Query Class Model (ECDM)
Edutella: Working Scenario

Edutella Consumer

Edutella Hub

Edutella Provider

Edutella Provider

Edutella Network

Mediation, meta-data mapping

Web browser

Registration:
Replication:
Query:
Annotation:
Edutella: Current Status

4 Edutella provider peers have been implemented, permanent peers have been running since March 7

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<th>OLR (Open Learning Repository)</th>
<th>ConceptBase</th>
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<td>Back-end: Oracle 8i</td>
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<td>Meta-data: RDF</td>
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<td>Local query : SQL</td>
<td>Local query : O-Telos</td>
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<tr>
<td>Meta-data: RDF</td>
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<tr>
<td>Local query : Jena RDQL</td>
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<td>Implementer: L3S, Hannover</td>
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**Edutella: Current Status**

3 Edutella provider peers are under development

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Edutella: Current Status

4 Edutella Consumers have been implemented

Conzilla (Query GUI)
Implementer: KTH, Stockholm

Ontology Query (Query GUI)
Implementer: Stanford
Edutella: Current Status

4 Edutella Consumers have been implemented

Edutella shell (Query GUI)
Implementer: L3S, Hannover

Ontomat (Annotation tool)
Implementer: AIFB, Karlsruhe
3.2 Architecture

The Edutella annotation service is composed of the Edutella peer structure and the KAON\(^3\) framework incorporating the Ont-O-Mat\(^4\) plugin for annotation (cf. Figure 4).

Figure 4: Ont-O-Mat as Edutella Peer
Edutella: Current & Future Work

RDF-based Edutella Modification Exchange Language (RDF-MEL)
- Transmit requests concerning update and replication within the Edutella network (see ISWC Paper)

Implement more powerful Edutella Discovery
- Super-peer based indices, efficient peer-only broadcast topologies (see HyperCuP Paper) plus ontology indices

Integrate other peers into the Edutella network
- UNIVERSAL www.ist-universal.org

Implement low-end Edutella consumer peers
- PDA (Zaurus, iPAQ)

Edutella P2P network as building block to provide ambient intelligence in a smart learning space
- European IST project ELENA

Iron out bugs and improve ease of configuration and use
Links

- All source code downloadable from the Edutella Homepage under [edutella.jxta.org](http://edutella.jxta.org)
- PADLR Project Homepage: [www.learninglab.de/english/projects/padlr.html](http://www.learninglab.de/english/projects/padlr.html)

New Edutella contributors are welcome!