ELENA: Creating a Smart Space for Learning

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ELENA

Information Society Technologies

Overview

- Motivation, goals
- Architecture, implementation
- Interoperability:
  - Querying resources using TRIPLE views
  - Simple Query Interface
  - Ontology for Learning Services
- Personalization

Motivation

Status quo: Learning resources (e.g. courses, online textbooks, …) are increasingly stored in closed repositories such as Learning Management Systems, Course Databases, Electronic Marketplaces, …

Issue: Lack of transparency of learning resource offerings, no effective search and exchange infrastructures available

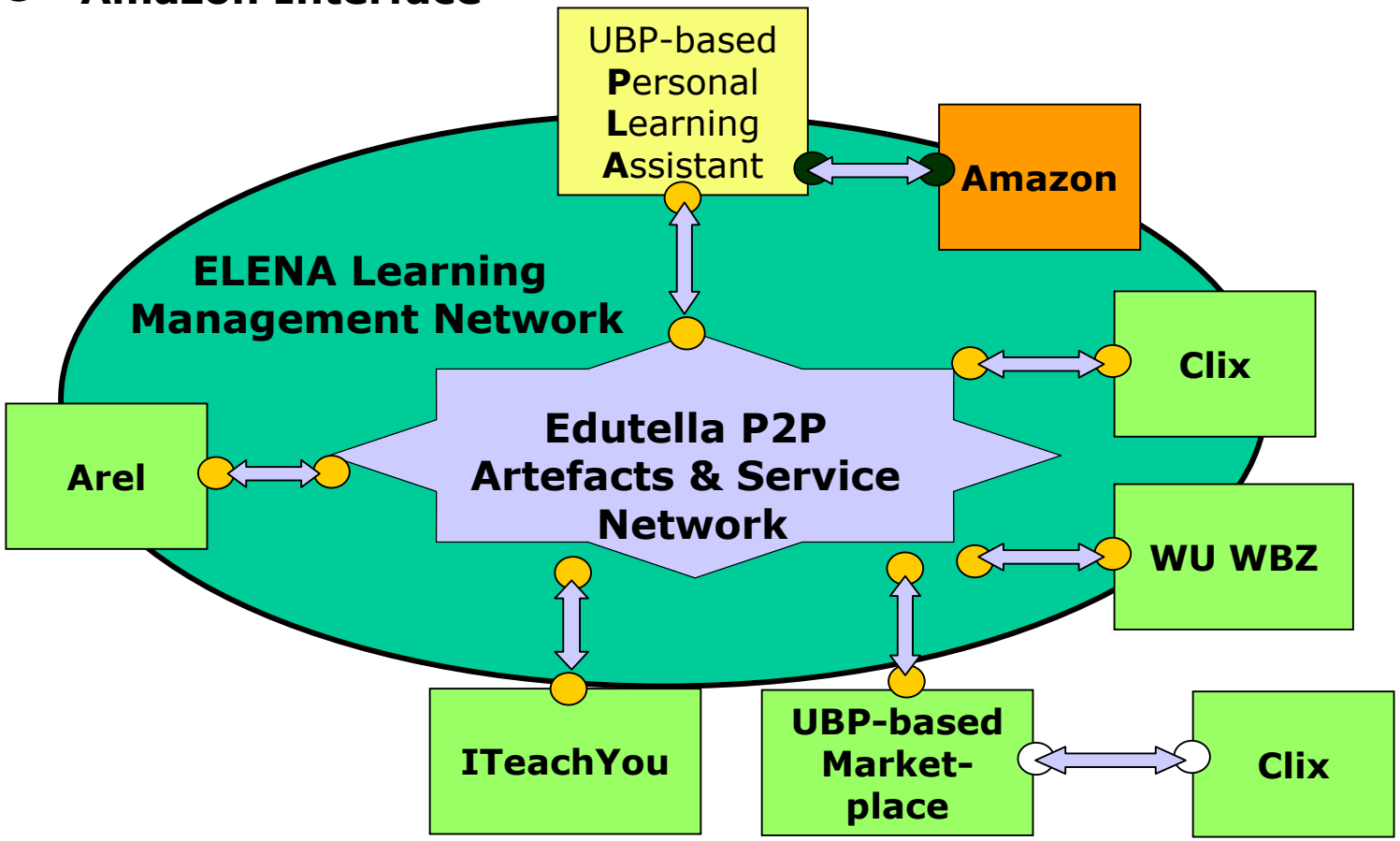
Objective of the ELENA Project: is to create a network of learning resource repositories (educational nodes)

Major obstacle: Interoperability (and personalization)

We use Semantic Web techniques to realize the Smart Spaces for Learning

Architecture, implementation

- **Provision Interface**
- **Query Interface**
- **Amazon Interface**



Connected systems: Learning Management Systems (Arel, Clix), Educational Brokerage Software (Universal Brokerage Platform) Course Databases (e.g. Continuing Education Centre)

Interoperability problems

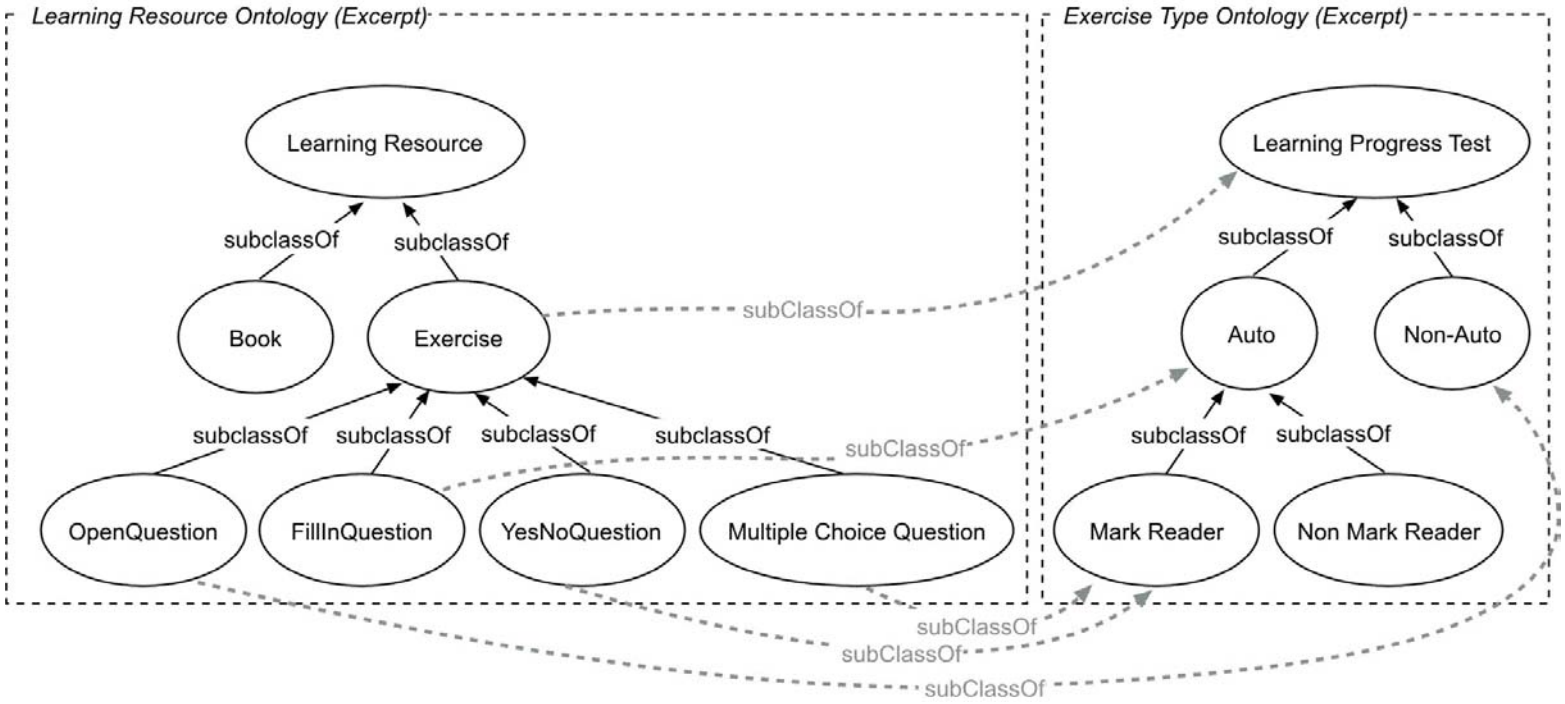
- Metadata repositories use different ontologies
  - Elena solution: We use a common ontology. Views can be defined using the Semantic Web query and transformation language TRIPLE
- How to submit a query to a metadata repository?
  - Elena solution: Unified management of interface calls. Simple Query Interface (SQI). Idea: LMS implement the SQI, which can be seen as a wrapper.
- Heterogeneous repositories (metadata is stored as RDF, relational database, XML)
  - Elena solution: Query language transformation

- Semantic Web: Resources are described with metadata (metadata vocabulary based on an ontology)
- Formulating meaningful queries often requires the knowledge of the ontology
- Ontologies are designed by domain experts, so they might be too complicated for a casual user
- User's view of the domain is usually different from domain expert's

- Goal: allow users (their tools, agents) to formulate queries in terms of a user specific ontology!

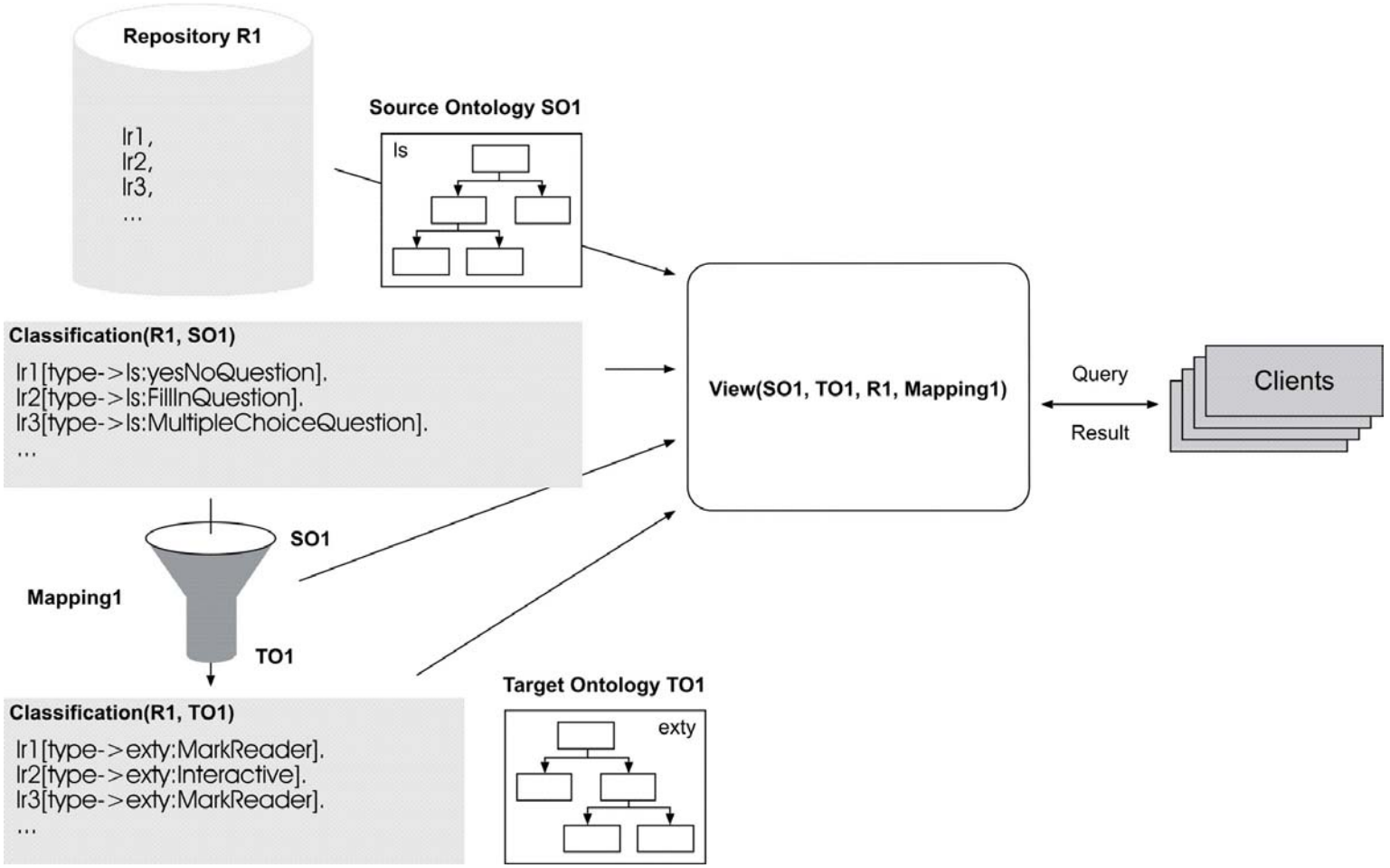
Example: e-Learning

- ***Learning resource ontology:*** designed by experts
- ***Exercise type ontology:*** used by instructors



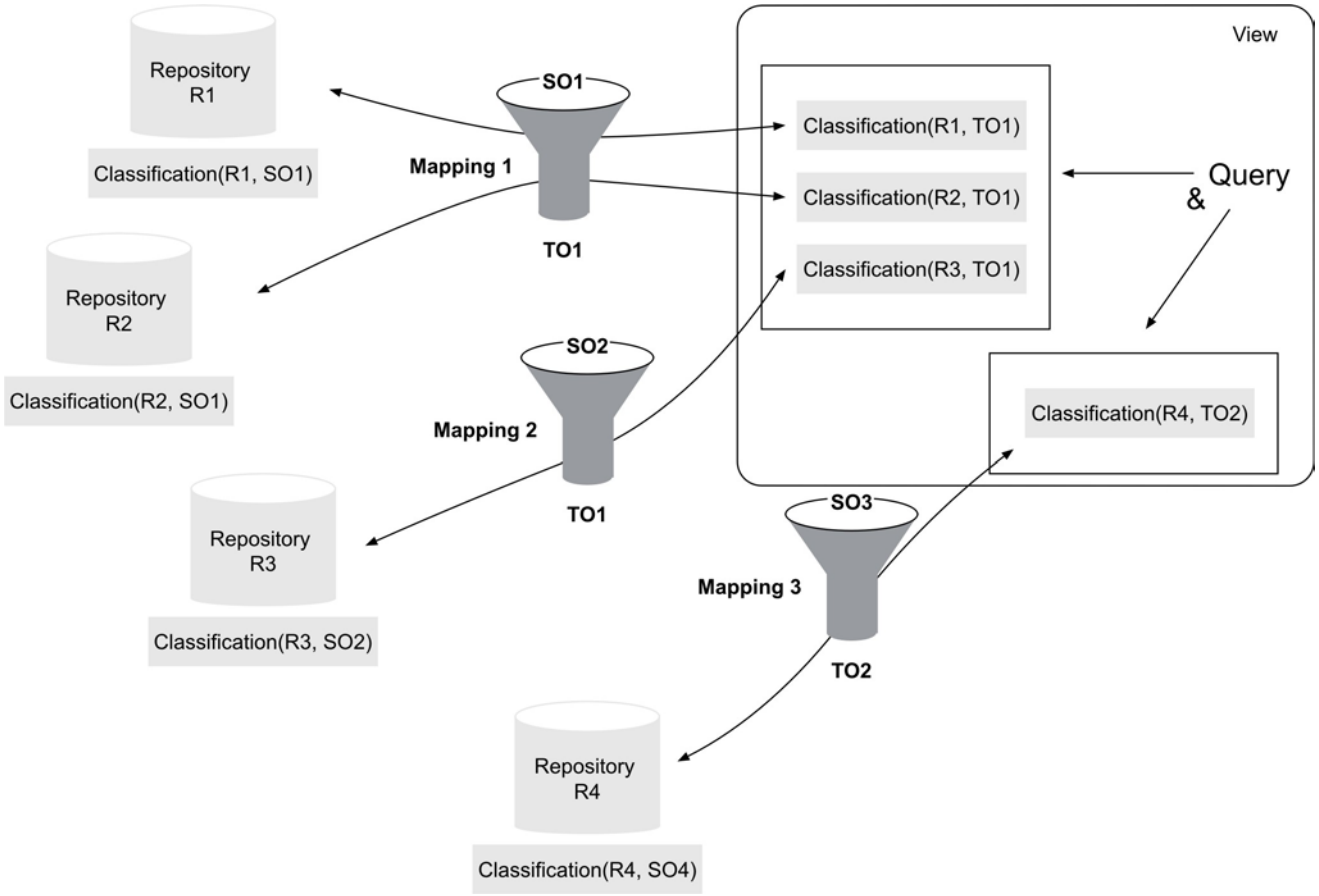
The learning resource ontology (source ontology) describes the resources available on the e-learning platform. The exercise type ontology (target ontology) represents a professor's point of view, who is interested what types of exercises can be used. More powerful mappings are also possible.

Mapping Ontologies Using Views



- The instances of repository R1 are accessible in terms of the target ontology TO1 using the view View(SO1, TO1, R1, Mapping1)
- Source and target ontologies can be defined in different ontology languages (RDFS, DAML+OIL, OWL, …)

View With Multiple Ontologies



This approach can also be applied to multiple repositories and several target ontologies.

TRIPLE: Short Introduction

- **`http://triple.semanticweb.org/`**
- Based on Horn-logic and esp. designed to query and transform RDF models
- Syntax:
  - Namespaces: rdf := 'http://www.w3.org/1999/02/22-rdf-syntax.ns#'.
  - Subject[Predicate->Object]. E.g.: Stefan[hasAge->33; isMaried->yes; …].
  - Logical formulae: AND, OR, NOT, FORALL, EXISTS.
  - Models:
    - @facts {

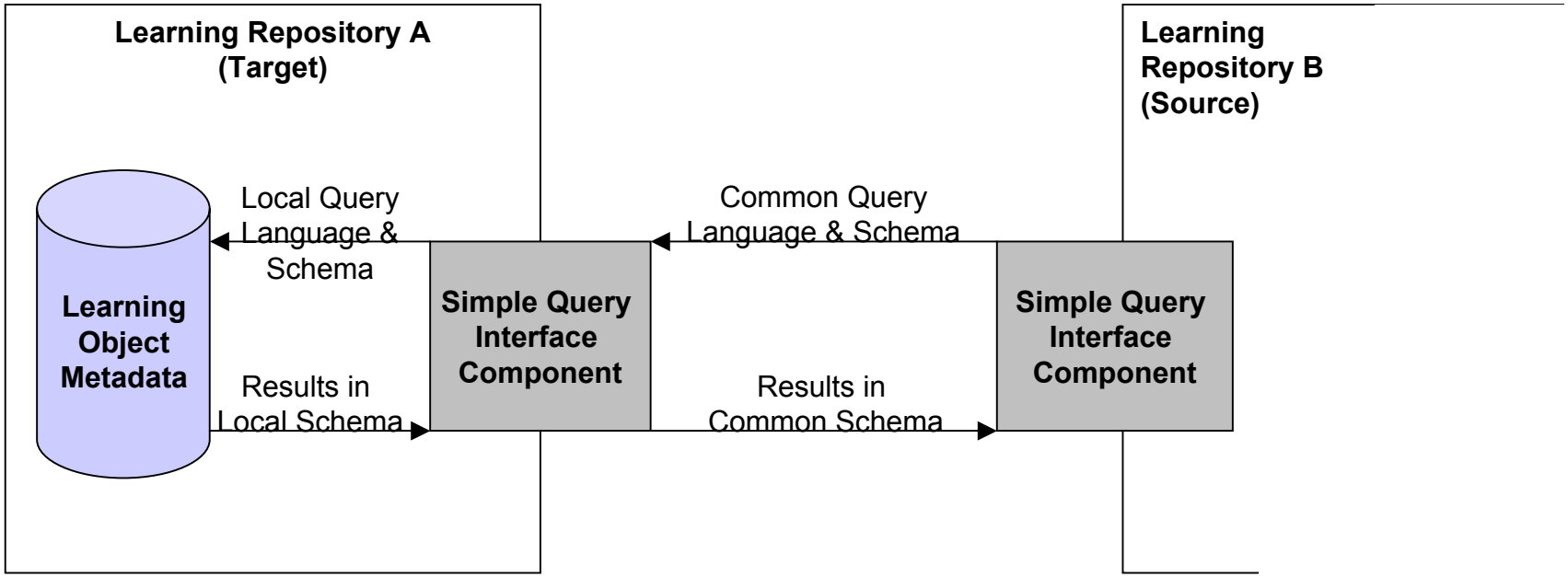
      Michael[hasAge -> 36].

      Stefan[mariedTo -> Birgit].

      }
    - Models can be parameterized:

      FORALL M,N,O @model(M,N,O) { … }
- Semantics of RDFS (and similar RDF-based languages) can be defined with TRIPLE rules directly (as parameterized model)
- Description logic extensions of RDF which cannot be handled with Horn-logic only (DAML+OIL, OWL): interface to external reasoners (e.g., DL classifiers)

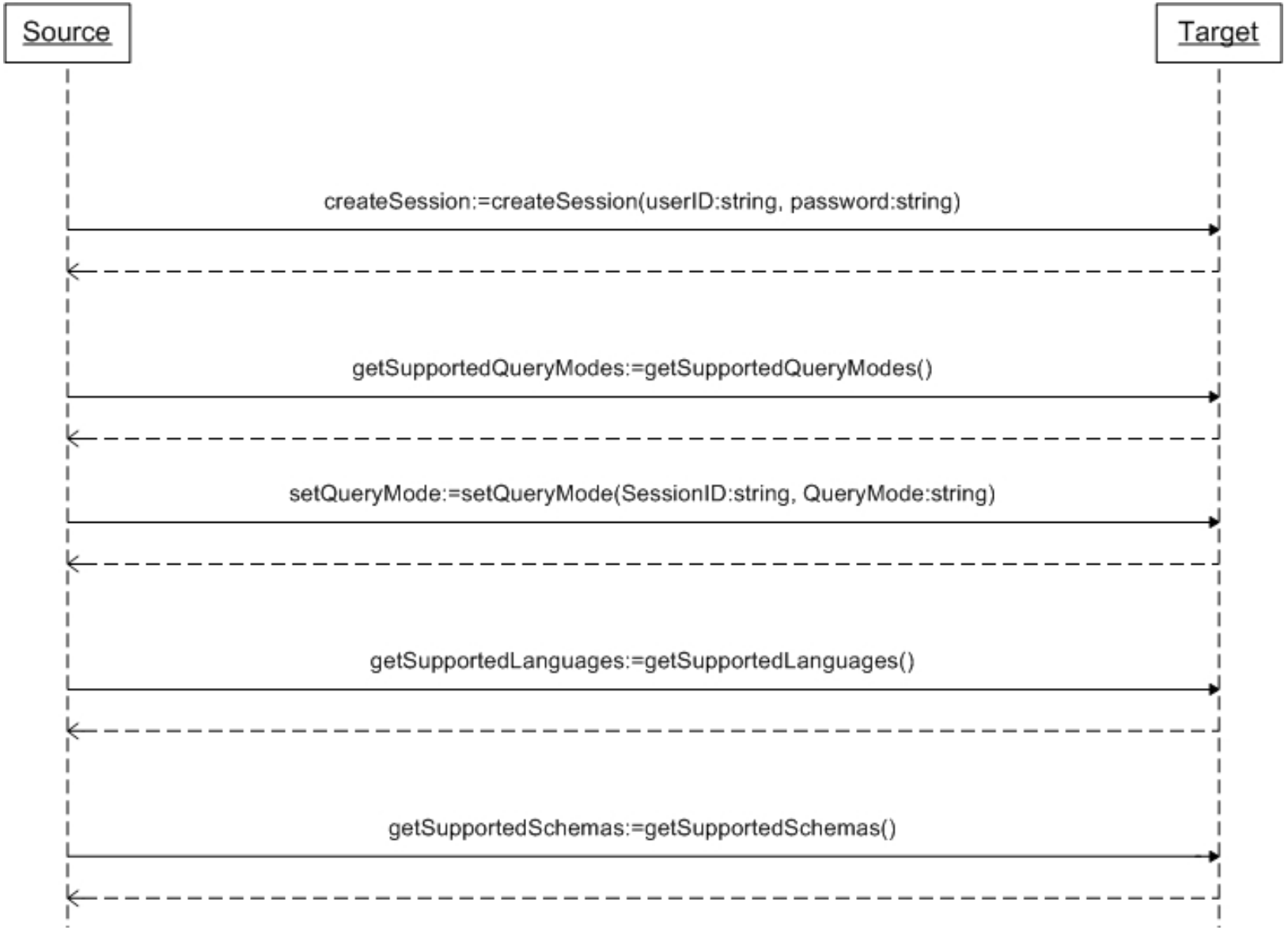
Simple Query Interface



Simple Query Interface: Does not assume a specific schema or query language. Communication is based on SOAP. It does not assume a specific network architecture. Combined with schema mappings.

http://nm.wu-wien.ac.at/e-learning/inter/sqi/sqi.pdf

Overall Workflow (1/2)



Overall Workflow (2/2)

Personalization

- Personalized view: matching learners profile (metadata about learners) with metadata about learning services and resources.
- Learner Profile is based on existing standards: IEEE Personal and Private Information (PAPI) (learning performance) and IMS Learner Information Package (LIP)
- The description of learning services and resources: Elena learning services ontology
- Personalization:
  - Transforming the user queries based on the content of learning profiles
  - Filtering the query results (privacy)

Thank you for your attention!

http://www.elena-project.org