Hybrid Multi-agent System For Automatic Object Learning Classification

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Content

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1.Introduction

- The learning technology standardization process is one of the key research activities in computer-based education

- The objective is to allow the **reuse** of learning resources and to offer **interoperability** among heterogeneous e-learning systems

  - The prolific fields of the learning technology standardization and the actual context of e-learning

  - How these data models are applied by actual software systems to facilitate the location of learning resources
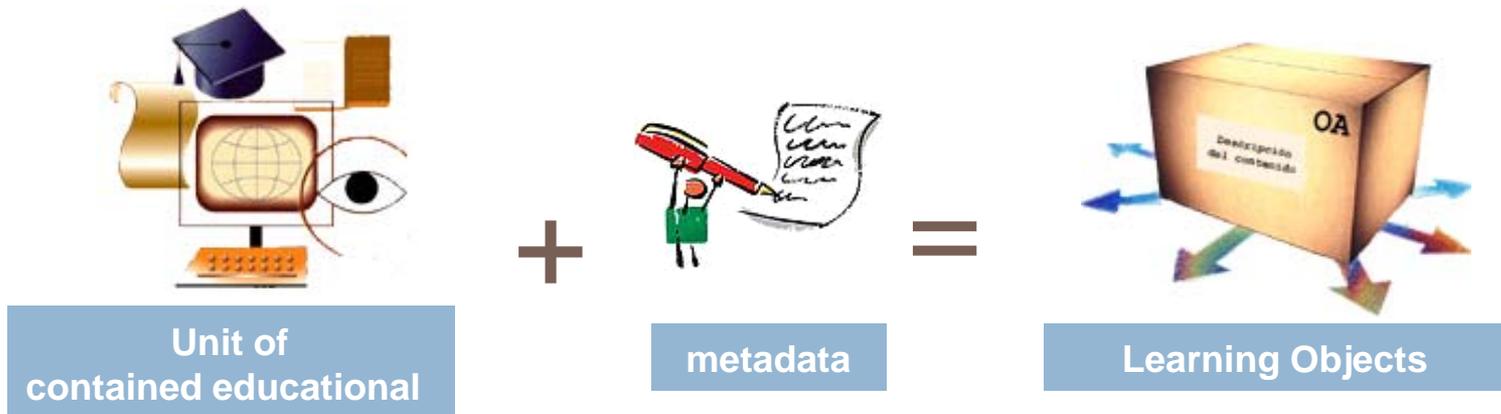
  - Educational brokerage

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1.Introduction. **Learning Objects**

- Standardization applied to learning technologies will enable reuse and interoperation among heterogeneous software systems.

  - Consensus is needed on architectures, services, protocols, data models and open interfaces

  - Learning Technology Standards Committe (LTSC) for the IEEE

- learning object is a digital, self-contained and reusable entity with a clearly instructional content, containing at least

  - Three internal and editable components: content, learning activities, and elements of context.

  - Additionally, learning objects should have an external information structure, the **metadata**, which can facilitate its identification, storage and retrieval.

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1.Introduction. **Learning Objects**

| Unit of contained educational | + | metadata | = | Learning Objects |

□ **Characteristics**:

- ☐ **REUSABILITY** Usable in different learning situations

- ☐ **INTEROPERABILITY** Independent of the platforms

- ☐ **SEMANTIC LABELING** The metadata allow the enhancement of Learning Objects (LO) as educational resources so that they can be automatically managed.

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1.Introduction. **Learning Objects**

- External information structure, metadata, which can facilitate its identification, storage and retrieval.

- Standards and specifications about learning objects focus on facilitating the search, evaluation, acquisition, and reutilisation
  - Dublin Core
  - MPEG-7
  - Learning Object Metadata, LOM$\rightarrow$ IEEE LOM
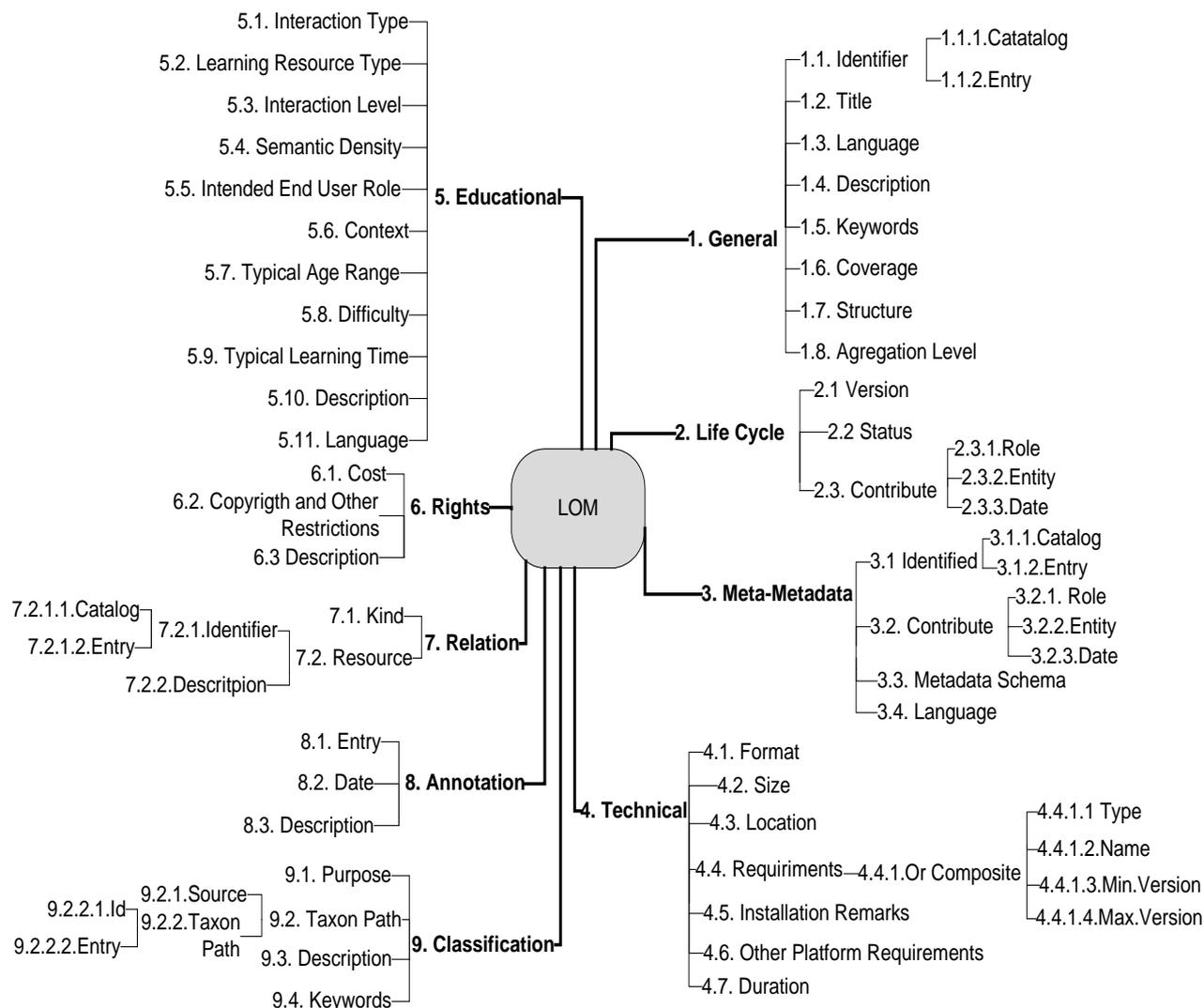
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1.Introduction. **Learning Objects**

- ☐ Since 2002, the IEEE LOM has been the standard for specifying the syntaxis and semantics of learning object metadata
  - ☐ Uses a hierarchical structure
  - ☐ Coded in XML
  - ☐ Includes element names, definitions, data types, taxonomies, vocabularies, and field lengths.

- ☐ LOM is focused on the minimal set of attributes needed to allow these learning objects to be managed, located and evaluated

- ☐ LOM metadata descriptions support:
  - ☐ Version management and maintenance
  - ☐ Resource storage and recovery (searching, location, instantiation, packaging, editing, etc.)
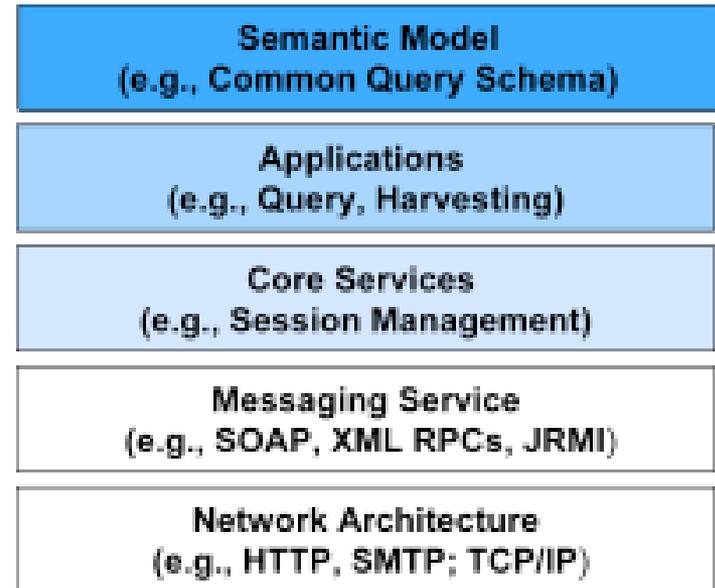 - ☐ and resource sharing.

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5.1. Interaction Type
5.2. Learning Resource Type
5.3. Interaction Level
5.4. Semantic Density
5.5. Intended End User Role
5.6. Context
5.7. Typical Age Range
5.8. Difficulty
5.9. Typical Learning Time
5.10. Description
5.11. Language

5. Educational

1.1. Identifier
 1.1.1.Catatalog
 1.1.2.Entry
1.2. Title
1.3. Language
1.4. Description
1.5. Keywords
1.6. Coverage
1.7. Structure
1.8. Agregation Level

1. General

6.1. Cost
6.2. Copyrigth and Other Restrictions
6.3 Description

6. Rights

LOM

2. Life Cycle
2.1 Version
2.2 Status
2.3. Contribute
 2.3.1.Role
 2.3.2.Entity
 2.3.3.Date

7.2.1.1.Catalog
7.2.1.2.Entry
7.2.1.Identifier
7.2.2.Descritpion
7.1. Kind
7.2. Resource

7. Relation

3. Meta-Metadata
3.1 Identified
 3.1.1.Catalog
 3.1.2.Entry
3.2. Contribute
 3.2.1. Role
 3.2.2.Entity
 3.2.3.Date
3.3. Metadata Schema
3.4. Language

8.1. Entry
8.2. Date
8.3. Description

8. Annotation

4. Technical
4.1. Format
4.2. Size
4.3. Location
4.4. Requirments
 4.4.1.Or Composite
 4.4.1.1 Type
 4.4.1.2.Name
 4.4.1.3.Min.Version
 4.4.1.4.Max.Version
4.5. Installation Remarks
4.6. Other Platform Requirements
4.7. Duration

9.2.2.1.Id
9.2.2.2.Entry
9.2.1.Source
9.2.2.Taxon Path
9.1. Purpose
9.2. Taxon Path
9.3. Description
9.4. Keywords

9. Classification

1.Introduction. **Learning Objects Repositories**

- Learning Objects Repositories (LOR) are software systems in the form of digital catalogues that either store educational resources and their metadata, or only the latter
  - different storage system
  - different access to objects
  - different query methods
- Most LOR belong to educational institutions
  - MERLOT (Multimedia Educational Resource for Learning and Online Teaching)
  - CAREO (Campus Alberta Repository of Education Objects
  - CLOE (Co-operative Learning Object Exchange).
- Highly heterogeneous

Semantic Model (e.g., Common Query Schema)
Applications (e.g., Query, Harvesting)
Core Services (e.g., Session Management)
Messaging Service (e.g., SOAP, XML RPCs, JRMI)
Network Architecture (e.g., HTTP, SMTP; TCP/IP)

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1.Introduction. **Presenting The Problem**

- Existence of distributed Learning objects
  - Heterogeneous labelling of educational resources
  - Several standards of interfaces for LORs
- A new economy has appeared in the **management, interchange and creation** of Learning Objects
- The need has arisen for **an intermediation system** that would allow all the data referring to LOs to be
  - Collected and stored by Solving the problem of heterogeneity in the contents
  - To allows inferences to be made about them

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2. Technologies adopted

- To encapsulate the internal logic and facilitate searches LOR

  - Abstraction layer which encapsulates intrinsic characteristics and therefore eases querying by client applications→SQI (*Simple Query Interface*) standard

  - Query language:

    - Very Simple Query Languaje (VSQL)

    - Prolean Query Languaje (PLSQL)

  - The results are returned in LOM standard

  - Federated search for Learning objects in Repositories

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2. Technologies adopted

- SQI (*Simple Query Interface*) standard
    - It was normalized by CEN in 2005
    - Based on Web Services
    - It is defined through tree APIS.
        - Learning Objects Interoperability Framework
        - Authentication and Session Management
        - Simple Query Interface
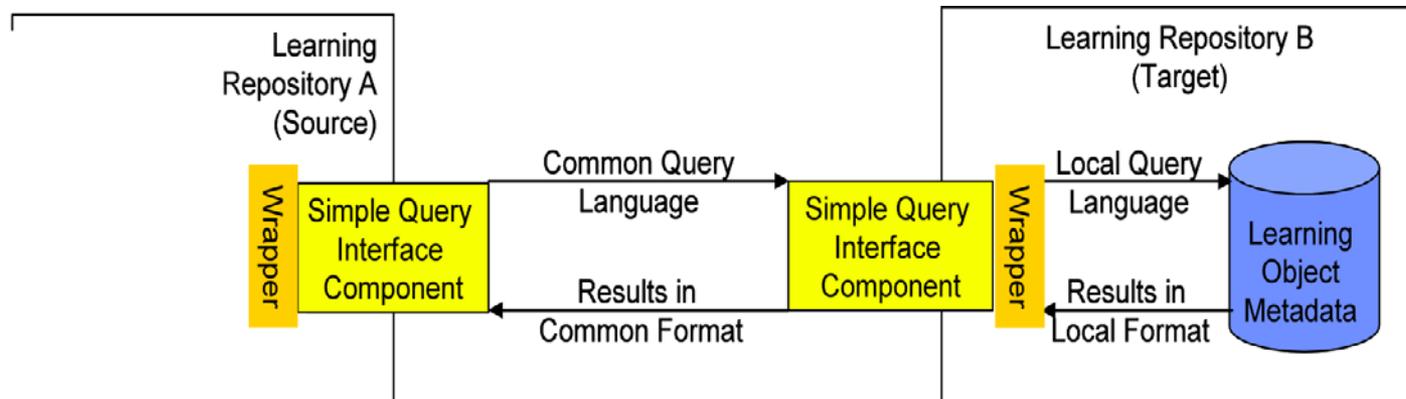
2. Technologies adopted

- □ Topology of Learning Objects search systems
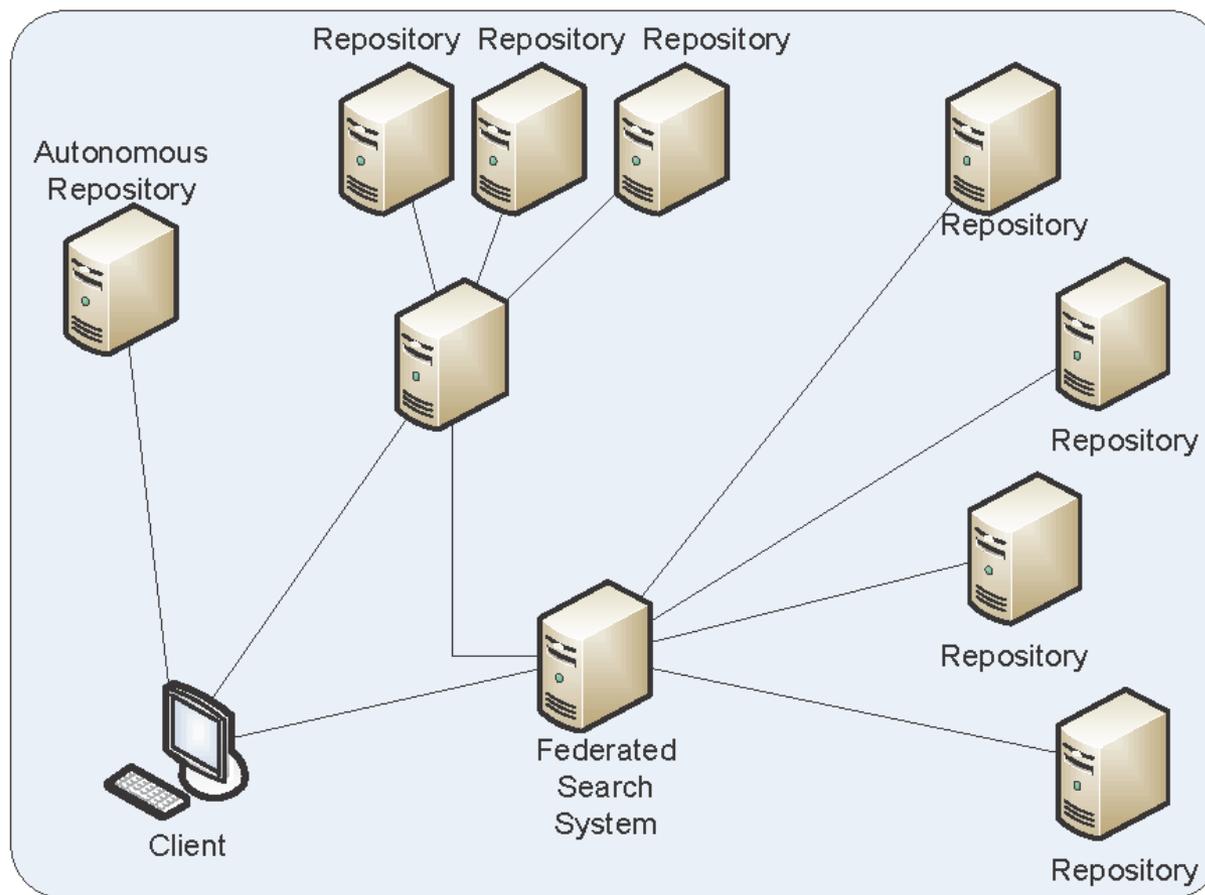
3. Hybrid Multiagent-system for automatic Classification

An agent-based architecture has been designed and developed which is especially focused on resolving the problem of the **federated search**

1. **Query Transformation.** Query Transformation in natural language and VSQL.

2. **Session Management.** Obtaining the session identifier

3. **Query.** Carrying out the query though Web services

4. **Metadata Extraction.** Extraction of information contained in the metadata

5. **Sort Results.** Once the learning objects are available, an organisation of the results is carried out
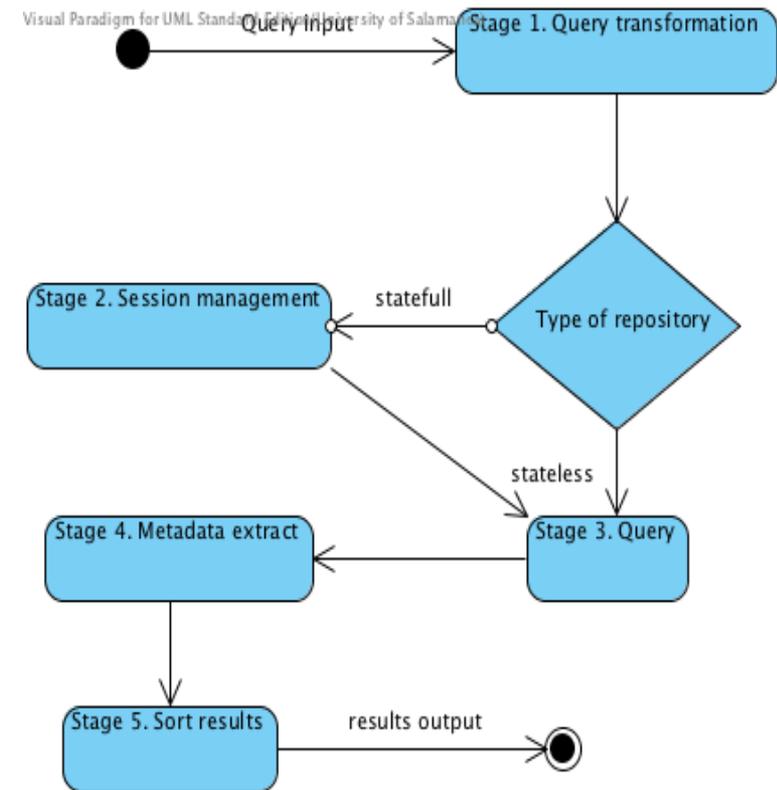
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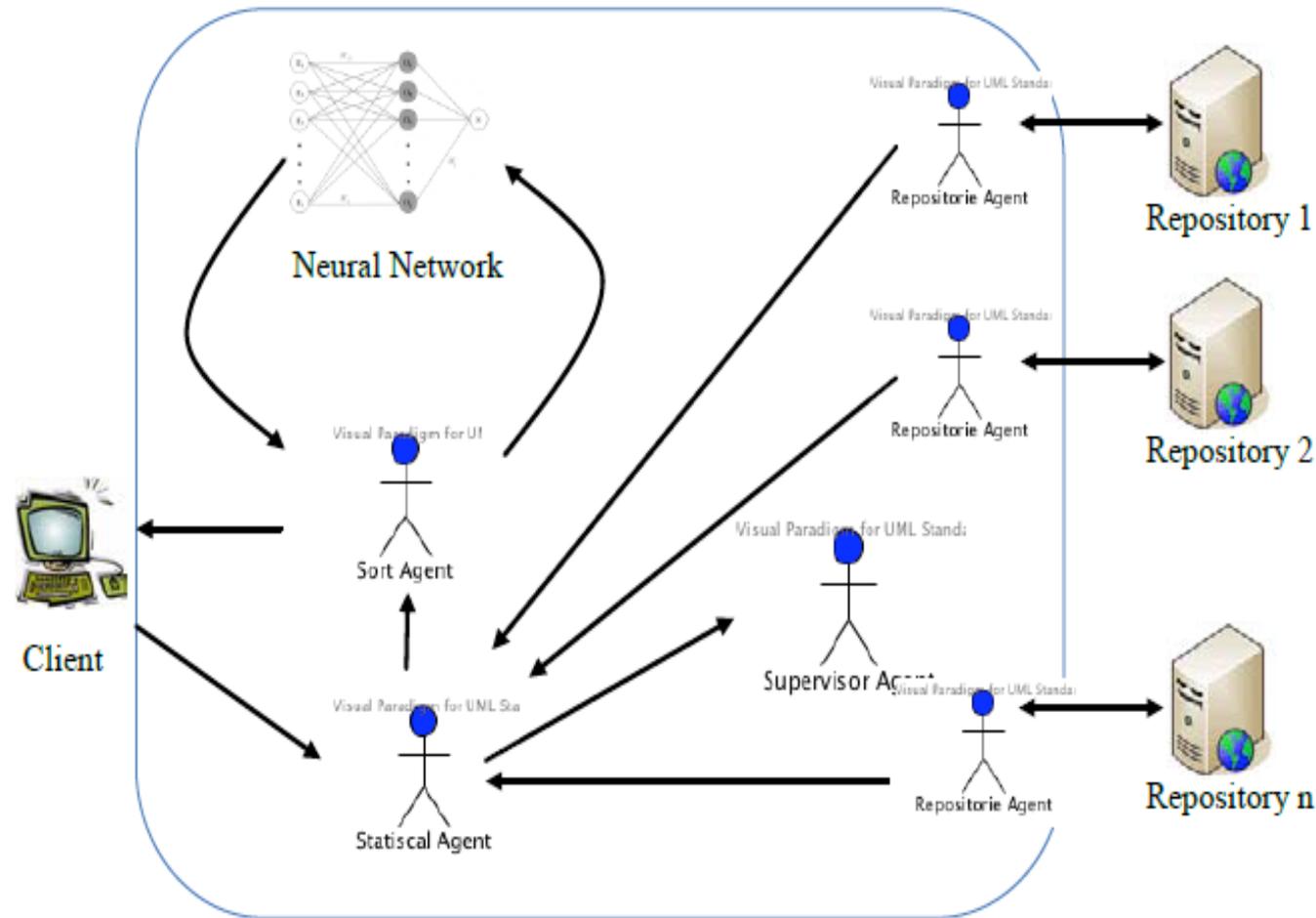
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- ☐ **Repository agent.**

  - ◻ Performs searches with the various repositories,

  - ◻ Extracts metadata

  - ◻ Quality control for the LO received, and optimizing the search system

  - ◻ One agent for each of the LOR → multiple searches can be performed simultaneously

- ☐ **Sort agent**

  - ◻ Responsible for verifying, controlling and coordinating the results from the neural network

  - ◻ Classify and catalogue the results

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Statistical agent.

- Responsible for gathering the statistical data from the repositories and the interaction between the users and the search tool

- Provides the supervisor agent with the appropriate statistical data needed to effectively coordinate the tasks.

Supervisor agent.

- Responsible for supervising the other agents, and for coordinating tasks.

- It obtains data from the statistical agent and adapts the tasks to the system according to different variables

  - such as the state of communication

  - the system load, etc.

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3. Hybrid Multiagent-system for automatic Classification. **Overview**

□ A prototype of a federated search system has been constructed called BRENHET

□ Main Characteristics:

    □ Web Application

    □ Learning Objects Search

        ■ SQI Client Implementation.

        ■ Carrying out queries through VSQL.

        ■ Object extraction in LOM standard and packaging through SCORM.

    □ Cataloguing (Filtering) of Learning Objects

    □ Management of Users

    □ Search History

    □ Statistical System

    □ Advanced management of repositories

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4.Conclusions and Work in Progress

- We have presented an architecture currently being worked on that is based on a multiagent system for LO retrieval from repositories distributed around the Internet and their cataloguing to satisfy user needs

- BRENHET **an intermediation system** that allow all the data referring to LOs to be

  - Collected and stored by Solving the problem of heterogeneity in the contents
    - Evaluate Quality LO
    - Evaluate LOR query results, query duration, etc
  - To allows inferences to be made about them
  - Reduce the response time for final results
  - N-top method for LO recommendation

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4.Conclusions and Work in Progress

□ Taking into account the results obtained from the construction of the BRENHET application, it is possible to conclude that agent-based architecture is ideal for resolving the problem of federated searches in heterogeneous repositories

□ We also outline the particular point our work is currently focused on:

   ▫ the design and implementation of an more intelligent LO recommendation system that can be integrated into that architecture

      ■ Implementing Social recommendation

      ■ By adding web usage mining and web content mining

      ■ Etc.

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Thanks!

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23-25th June, 2010 San Sebastián, Spain