EAGLE

EnhAnced Government LEarning

www.fp7-eagle.eu

FP7-ICT-2013-11

Objective 8.2 Technology-enhanced learning;

Target outcome c): Holistic learning solutions for managing, reaching and engaging learners in the public administrations

Deliverable D5.3

OER Ontology for Local Governments

WP 5 – OER PLATFORM – OER Learning Platform Development
Lead Participant: Fraunhofer

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement N°310806.

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Glossary

FP7	Seventh Framework Programme
EC	European Commission
EAGLE	EnhAnced Government LEarning
EU	European Union
WP	Work Package

1 Software Details

Title of the Software	EAGLE Knowledge Backend System
Version	1.0
Release Date	March 31st 2016
Relevant Licenses	Apache License 2.0 (http://www.apache.org/licenses/LICENSE-2.0)
Programming Languages	Java
Source code	https://git.list.lu/knowledge-space https://git.list.lu/services
Developers	Dietmar Glachs

2 Overview of the Prototype

2.1 High-level System Architecture

This document presents the EAGLE Knowledge Backend System incorporating the *EAGLE Ontology for Local Governments* (EAGLE Knowledge Base). Knowledge management plays a central role in the EAGLE Learning Platform providing a storage backend for the management of metadata related to OER's, the learners as OER users, and their learning competences and skills. In EAGLE, knowledge management is based on Apache Marmotta[1], which is an implementation of the LDP[2] standard.

The development of the EAGLE Ontology follows the requirements of various Liferay Portlets that require access to the knowledge base. Figure 2-1 presents a high-level architecture of the EAGLE Knowledge Backend System: the EAGLE Knowledge Base serves as metadata backend for the distinct EAGLE Portlets. The communication between them is provided through SPARQL queries. Each of the EAGLE Portlets acts as a single client for the EAGLE Knowledge Backend, providing the high-level API for modifying or querying the data. In addition, Figure 2-1 shows the integration of several vocabularies into the EAGLE Knowledge Portal via the basic services of Apache Marmotta. Beside the core functionality for storing triples, Apache Marmotta offers an extended functionality through pluggable modules.

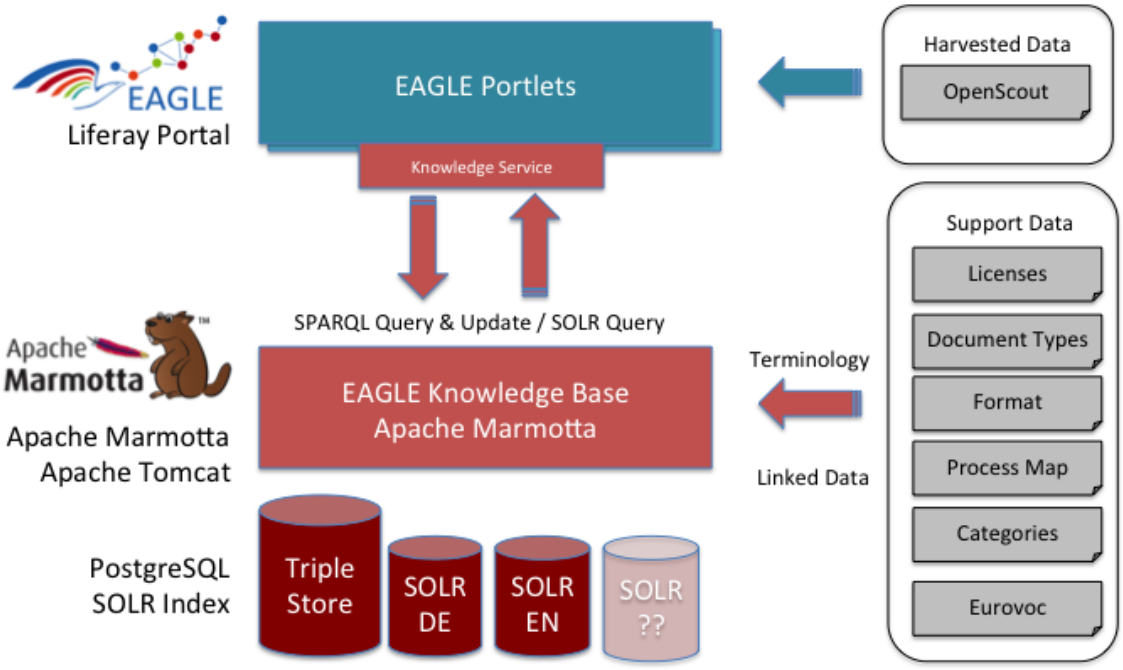

FIGURE 2-1: HIGH-LEVEL ARCHITECTURE OF EAGLE KNOWLEDGE BACKEND

[1] http://marmotta.apache.org
[2] https://www.w3.org/TR/ldp

2.1.1 Knowledge Service

The Knowledge Service connects to the EAGLE Portlets and provides methods requested for their functionality. Each method establishes an HTTP-Connection for writing new information to the storage or for reading information from the storage. Figure 2-2 outlines the list of API methods used to manipulate the data. For example, there are methods for creating new users, storing the last login, publishing new OERs, etc.

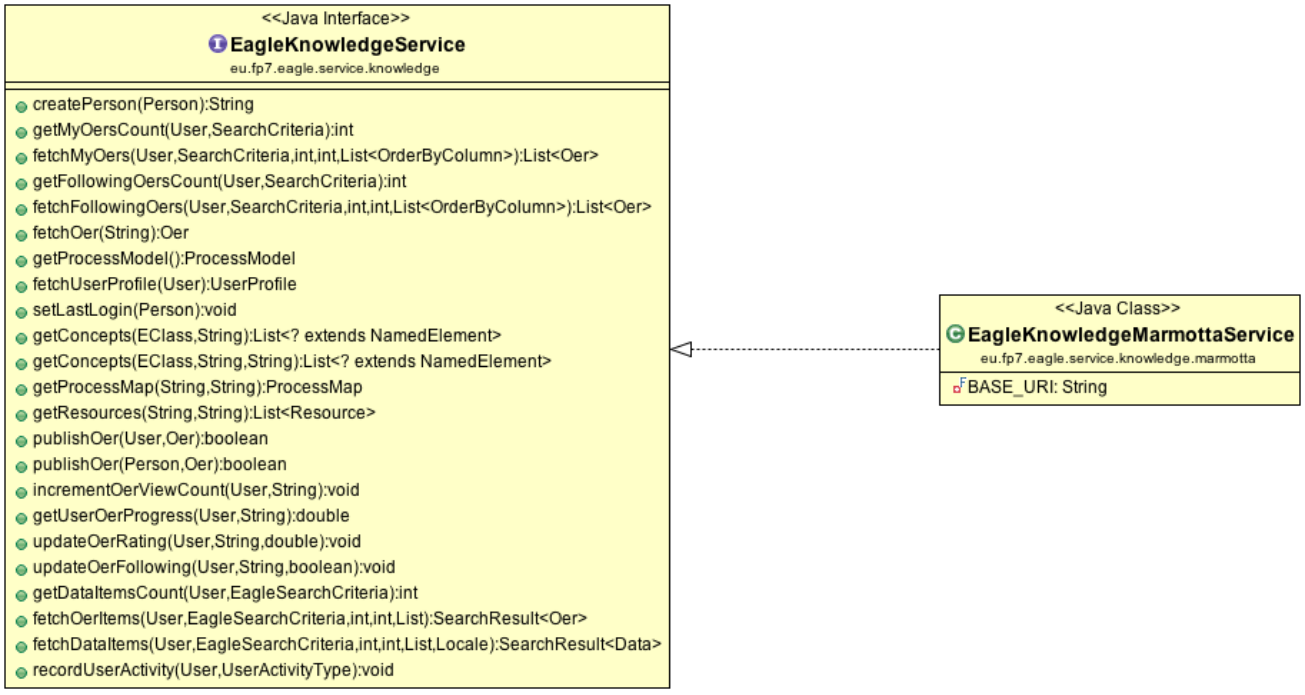

FIGURE 2-2: KNOWLEDGE SERVICE API

As of EAGLE Ontology version 1.0, Knowledge Service API deals with the data as described in the EAGLE Ontology (see Annex – EAGLE Ontology (Version 1.0)).

The EAGLE Ontology is further used to create corresponding Java-Classes, which are then used in the EAGLE Knowledge Service to manipulate the data. As a result, a fine-grained API suitable to modify the Knowledge Base is created. Figure 2-2 provides an excerpt of the created type hierarchy.

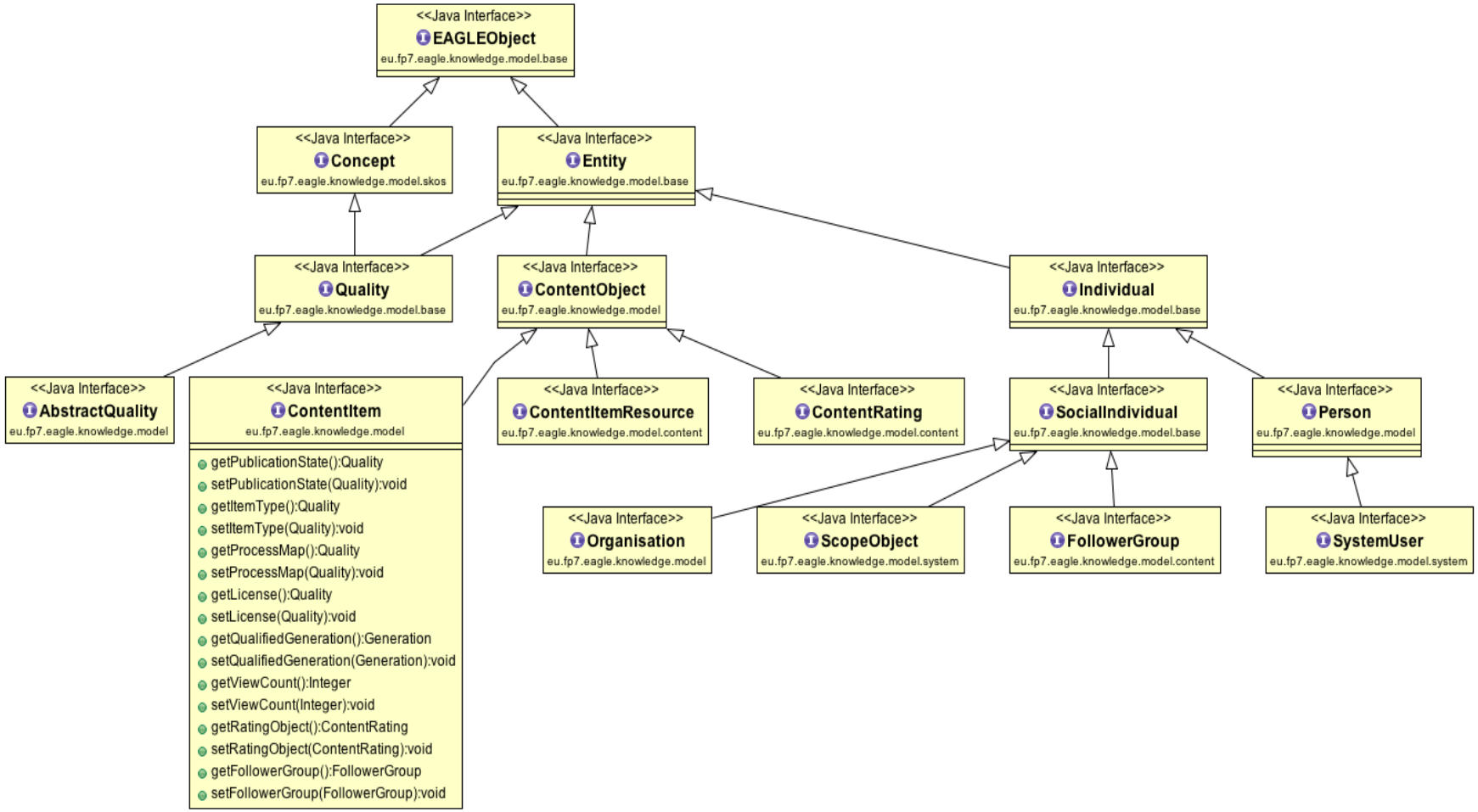

FIGURE 2-3: EAGLE ONTOLOGY CLASSES AND PROPERTIES IN JAVA (AN EXCERPT)

The generated operations representing the ontological properties have been omitted except the `ContentItem` class. Figure 2-3 shows some classes (according to ontological types) and methods (based on specified ontological properties) created, for example, to add a content rating object to the `ContentItem`. This way, the internal structure of the EAGLE ontology is transparent for the developers, and data updates are done automatically via methods implemented as EAGLE Knowledge Services.

2.1.2 EAGLE Knowledge Base

The EAGLE Knowledge Base extends Apache Marmotta by adding new modules for the management of OER metadata and for the management of Learning Outcome Definitions, which could be further combined with QTI-based data. In addition, the EAGLE Knowledge Base interlinks OERs with the **concepts located outside of the Web of Data** that are organized in a form of controlled vocabularies. For example, it interlinks OERs with Process Maps, a knowledge-based system of the German governmental data portal **http://www.govdata.de**. The management of both the OERs and the users of the OERs via the EAGLE Learning Platform are also supported via the EAGLE Knowledge Base.

The EAGLE Knowledge Base provides methods to maintain data in the form of triples. It is easily possible to query the data by means of SPARQL or LDPath queries and also to identify new information by using the built-in rule-based reasoner. The semantic search module allows for the definition of LDPath-based search programmes and is implemented as a part of the EAGLE Search Portlet, further supporting search functionality, semantically enriched indexing and faceted search. An overview of the functionality afforded by Apache Marmotta is given in Figure 2-4.

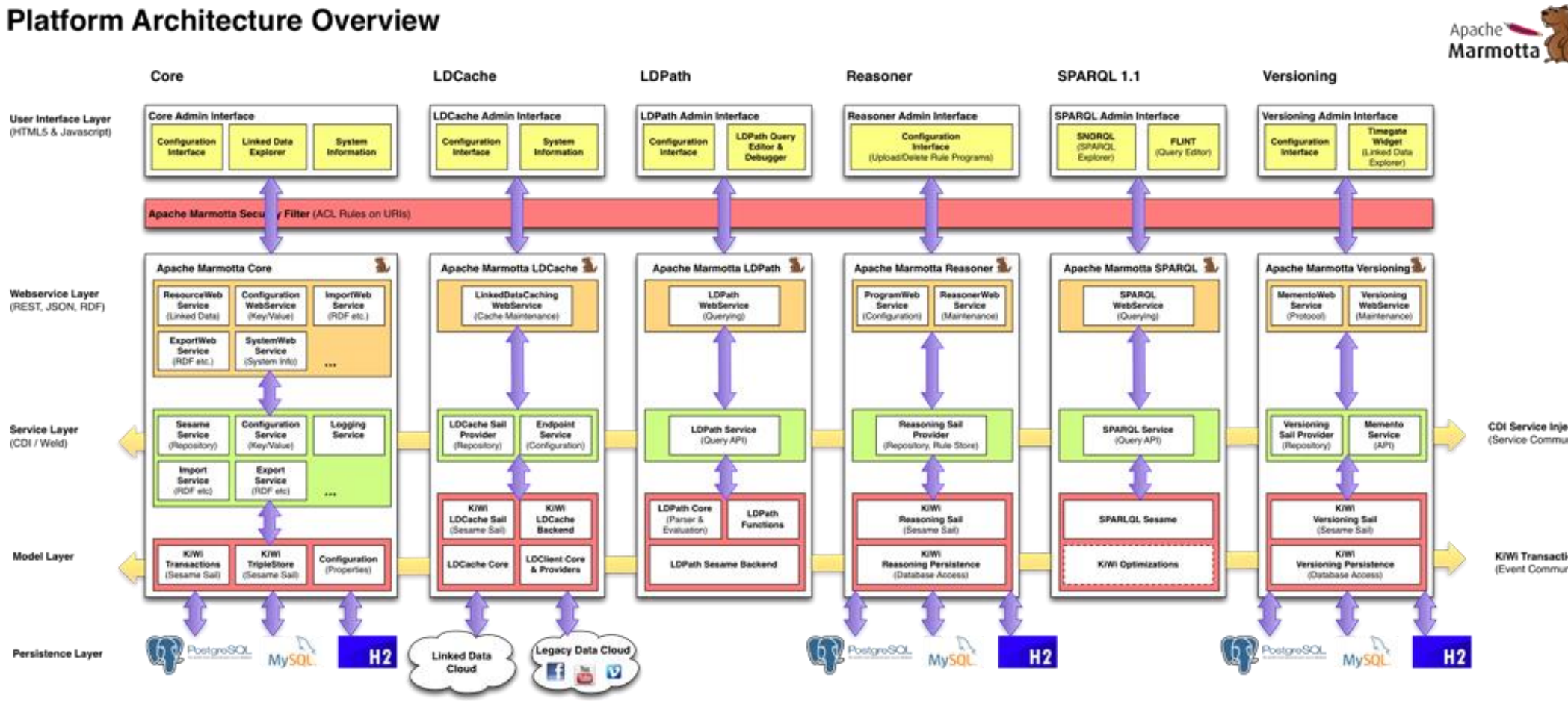

FIGURE 2-4: APACHE MARMOTTA – PLATFORM ARCHITECTURE OVERVIEW

For the EAGLE Knowledge Backend we use the following functionality of Apache Marmotta:

- **SPARQL endpoint**: A SPARQL 1.1 endpoint is provided by Marmotta and can be used for querying and updating metadata. The SPARQL endpoint is accessible in the browser through the Apache Marmotta admin interface, and as webservice conforming to the SPARQL protocol at /marmotta/sparql/select and /marmotta/sparql/update. Using SPARQL is the most powerful method of interacting with content item metadata, but might be too complex for simple cases. SPARQL is described at http://www.w3.org/TR/sparql11-query. Whenever data is stored in the triple-store, it can be verified via the administration interface.
- **Transaction System**: Any data manipulation is secured by a transactional system that ensures data integrity.
- **LDPath**: LDPath is a simple path-based query language, similar to XPath. In combination with the transparent LDCache it is possible to integrate and query data located on remote Linked Data servers.
- **Reasoner**: The reasoning capabilities are use to identify new facts based on existing information. This functionality is used to support the *scaffolding learning approach* on the EAGLE Learning Platform.

The EAGLE Platform uses KiWi as its triple store implementation, which is based on PostgreSQL[3].

2.1.3 Apache Marmotta-based Search Functionality

The Apache Marmotta allows for the definition of search cores by means of LDPath statements. Current definition of the search index is given in Annex - Listing 3.

The search definition consists of several sections:

1. Namespace Definition: The search program requires the distinct namespace definitions in order to have readable search statements.
2. Filter Definition: The filter definition specifies which content type is subject of the search program. As for the current prototype, the search is limited to objects which are of type `eagle:ContentItem`. This ontological class is used as a base class for any of the content types such as OER, Blogs, wiki Pages.
3. Search Field Definition: A search field is a named field in the search index and will finally contain the data retrieved by the LDPath statement. The search field definition follows the structure

   ```
   <fieldname> = <search path> :: <data type>;
   ```

   which is examined for any added or changed resource in the knowledge base which passes the specified filter definition.

Listing 1 outlines the distinct sections of the search program. It specifies both the EAGLE and SKOS namespaces and ensures that only resources with type `eagle:ContentItem` are subject to the search index. The sample search program defines two different search fields that store text out of the EAGLE knowledge base.

[3] http://www.postgresql.org.

```
1: @prefix eagle : <http://knowledge.eagle-learning.eu/base#> ;
2: @prefix skos : <http://www.w3.org/2004/02/skos/core#> ;

3: @filter rdf:type is eagle:ContentItem  ;

4: category  = (eagle:inProcessMap / (skos:broader)* / skos:prefLabel[@en]) ::
xsd:string ;
5: authorLabel      = prov:qualifiedGeneration / prov:agent / rdfs:label ::
xsd:string ;
```

LISTING 1: SEARCH PROGRAM

Whenever a new resource is either added to, or deleted or modified in the EAGLE knowledge base,, the search functionality runs the search program with the changed resource. As an example, upon insertion or modification of the resource outlined in Listing 2, the search program collects the data according to the search program.

```
@prefix context: <http://eagle-dev.salzburgresearch.at/context/> .
@prefix prov: <http://www.w3.org/ns/prov#>.
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix eagle: <http://www.eagle-learning.eu/base#> .

@prefix kb: <http://knowledge.eagle-learning.eu/resource/> .

kb:SampleResource a eagle:ContentObject, eagle:ContentItem, eagle:Entity;

       rdfs:label "Sample Resource explaining search"@en ;
       dcterms:modified "2016-02-25T19:28:33.000+01:00"^^xsd:dateTime ;
       dcterms:language "en"^^xsd:language ;
       eagle:inProcessMap <http://eurovoc.europa.eu/100166> ;
       ...
       prov:qualifiedGeneration kb:GenerationOfSampleResource ;
       .

kb:GenerationOfSampleResource a prov:Generation ;
       prov:entity kb:SampleResource ;
       prov#atTime "2016-02-25T16:56:22.000Z"^^xsd:dateTime ;
       prov#agent <http://knowledge.eagle-germany.de/resource/user/78900> .
```

LISTING 2: SAMPLE CONTENT

The search program checks if the changed resource passes the defined filter, e.g. whether it has the requested `rdf:type` assigned. Furtermore, it traverses the specified path and collects the resources which may be stored locally (`kb:GenerationOfSampleResource`) or may be maintained on remote servers, e.g. the resources such as:

- http://eurovoc.europa.eu/100116
- http://knowledge.eagle-germany.de/resource/user/78900

The remote resources are retrieved and cached. The resulting data, as an example the preferred label of the Eurovoc[4] Vocabulary Entry in the desired language ("*0421 parliament*") is stored in the index field category. This way, the search functionality in EAGLE provides means to collect data according

[4] http://eurovoc.europa.eu/drupal/?q=de/request&mturi=http://eurovoc.europa.eu/100166&language=en&view=mt&ifacelang=en.

to the graph structure defined in the EAGLE ontology. In addition, it may integrate externally stored data in the search, thus benefiting from the existing data throughout the Linked Open Data cloud.

2.1.4 Vocabularies and Terminologies in EAGLE

The EAGLE Knowledge Base uses a variety of existing vocabularies for classifying the content, e.g. the Process Map Vocabulary, Eurovoc[5] or the IPTC Media-Topics[6]. Figure 2-5 shows the built-in SKOS Editor that allows for the management of the Process Map Vocabulary.

[5] http://eurovoc.europa.eu.
[6] https://iptc.org/standards/media-topics.

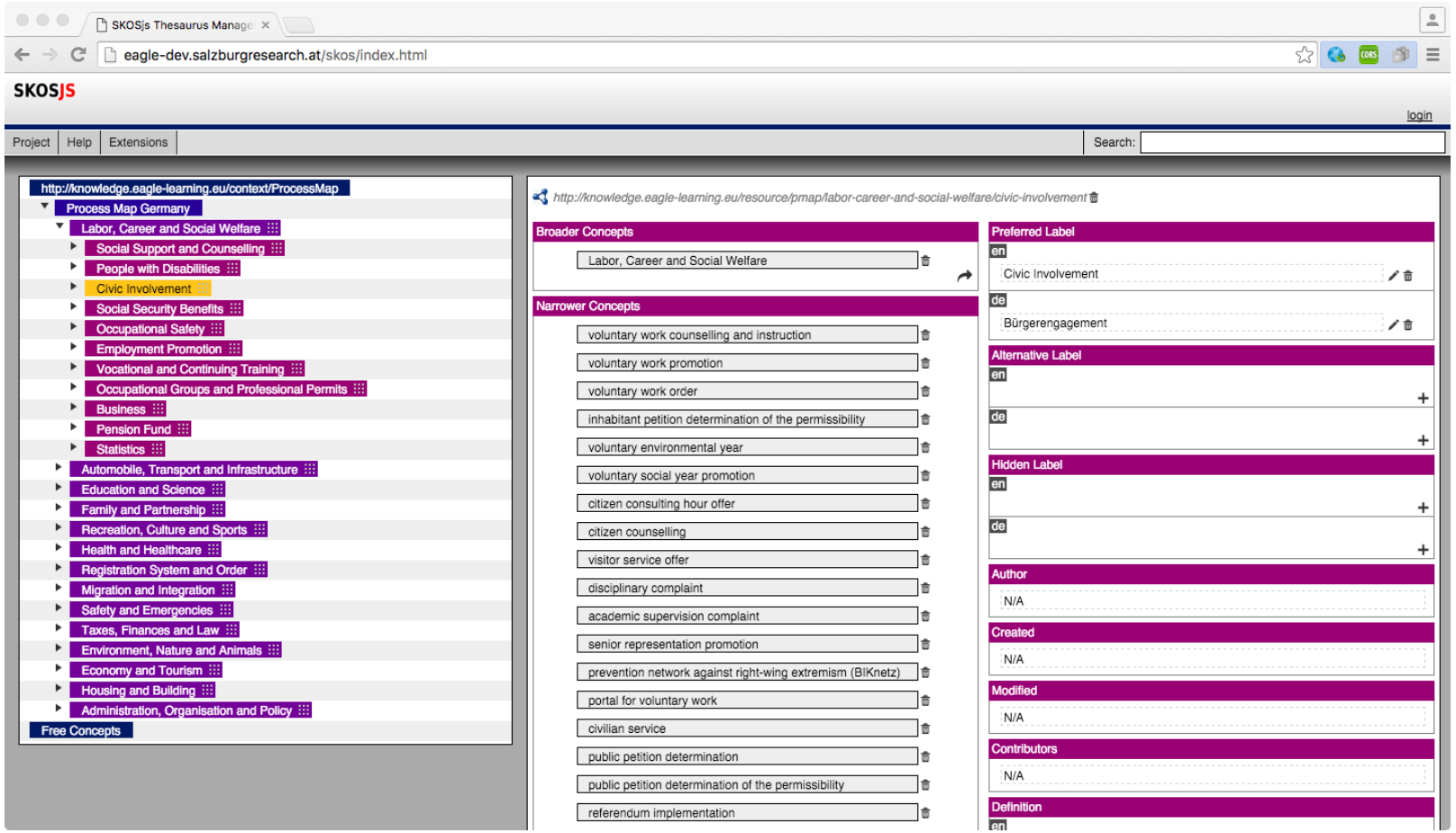

FIGURE 2-5: SKOS EDITOR - PROCESS MAP

2.2 EAGLE Ontology

The EAGLE Ontology incorporates various standard vocabularies and ontologies (see Figure 2-5), such as: *The Dublin Core (DC) ontology* specifies a number of object properties used along with various kinds of resources; *the W3C WGS84 Geo Positioning ontology* specifies the concept of `geo:SpatialThing` which denotes any content with the possibility to be geo-located by defining its position, extent, size, etc.; *the W3C SKOS ontology* provides the foundation for expressing the structure and content of various concept schemes such as thesauri, taxonomies, classification schemes, folksonomies and other controlled vocabularies, as well as the lexical labels for the concepts that are formulated in different languages; *the FOAF ontology* provides means for interlinking people and organisations; a categorisation defined by the Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE) foundational ontology (see: **http://www.loa.istc.cnr.it/old/DOLCE.html**) and its Descriptions and Situations (DNS) ontology; the W3C Organisation ontology; the W3C PROV-O ontology, which aim is to capture "*the information about entities, activities, and people involved in producing a piece of data or thing which can be used to form assessments about its quality, reliability and trustworthiness*." (c.f. **http://www.w3.org/TR/prov-overview/**); the InLOC[7] (Learning Competences and Outcomes) provides means for defining intended learning outcomes, skills and competences; the EUROPASS Standard, which facilitates the description of the users and the exchange of their data.

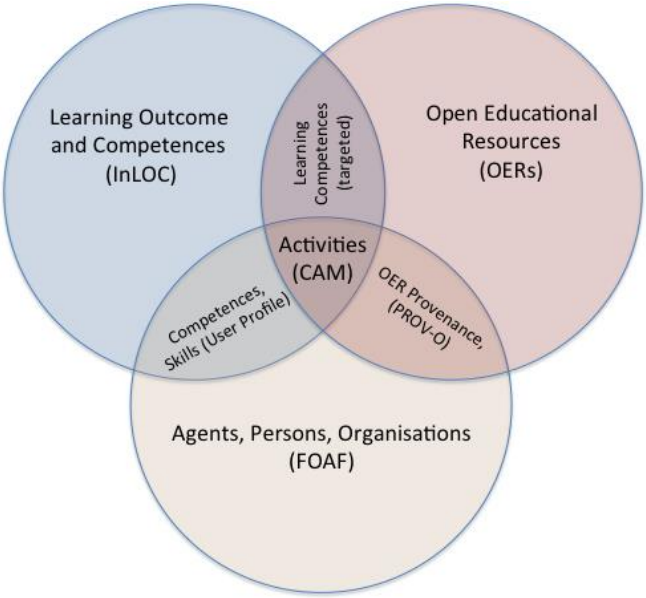

FIGURE 2-6: CONTENT AREAS OF THE EAGLE ONTOLOGY

For example, to provide a proper integration with relevant ontologies such as FOAF, W3C vCard, W3C Organisation, W3C PROV-O, the `Individual` class of the EAGLE Ontology inherits from `vcard:Kind` and `prov:Agent` that is furthermore equivalent to `foaf:Agent`. The EAGLE Ontology provides means to organise users and their organisations and to allow for their interaction. User activities are captured in the knowledge base, thus collecting information of the OERs provenance on

[7] **http://www.cetis.org.uk/inloc**.

one hand and the corresponding learning outcomes on the other hand. When editing OERs, the user plays the role of an author/ contributor, and a learner. It is expected for the interaction between the learner and the learning content to result in improved competences and skills of the learner. Figure 2-7 therefore shows the interaction between the user (Person), OER and Learning Competences and Outcome (InLoc standard), which results in users gaining knowledge and skills when using the platform. Whenever a user interacts with an OER, the system identifies the learner's progress based on the OERs defined learning outcome.

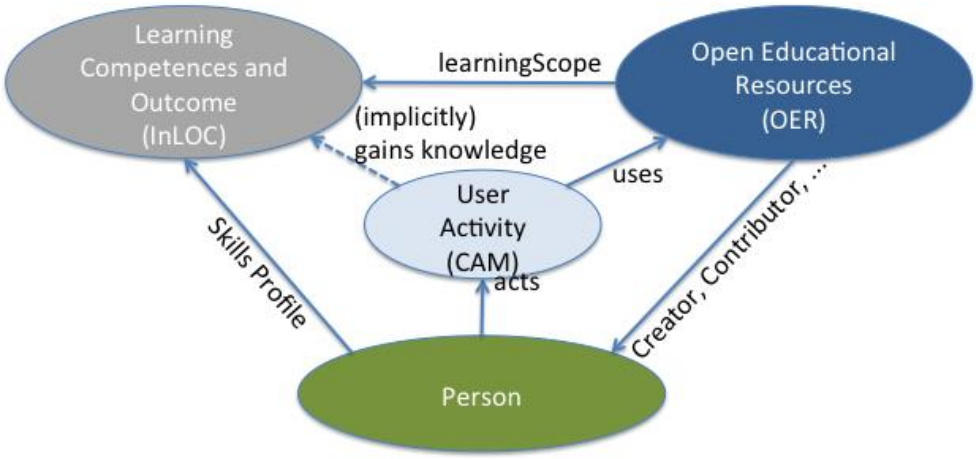

FIGURE 2-7: EAGLE CONTENT AREAS

The EAGLE Ontology itself is expressed as RDF/XML (and/ or Turtle file). The current version of the ontology is presented in Annex - EAGLE Ontology (Version 1.0).

2.2.1 Assessment of Learning Competences and Outcomes

To verify the learning progress, the EAGLE Learning Platform supports self-testing functionality using the TAO tool, which provides: test item authoring and metadata management, registration of the test users, assessments, test scheduling and delivery, and management of the test results. Test items in TAO are based on QTI standard. Therefore, the EAGLE Ontology enables the entry points for the QTI elements, as shown in Figure 2-7. The QTI classes are inherited from `eagle:ContentItem`, which allows for interlinking with InLOC definitions and/or other concepts.

The learner's knowledge is assessed via answering the test items. The learner makes progress in learning, and once she passes a test, the results are stored in the EAGLE Knowledge Base. In addition, InLOC definitions are identified based on the test results, that affects the learner's final skills and knowledge (level to proficiency related to the EAGLE Learning Platform).

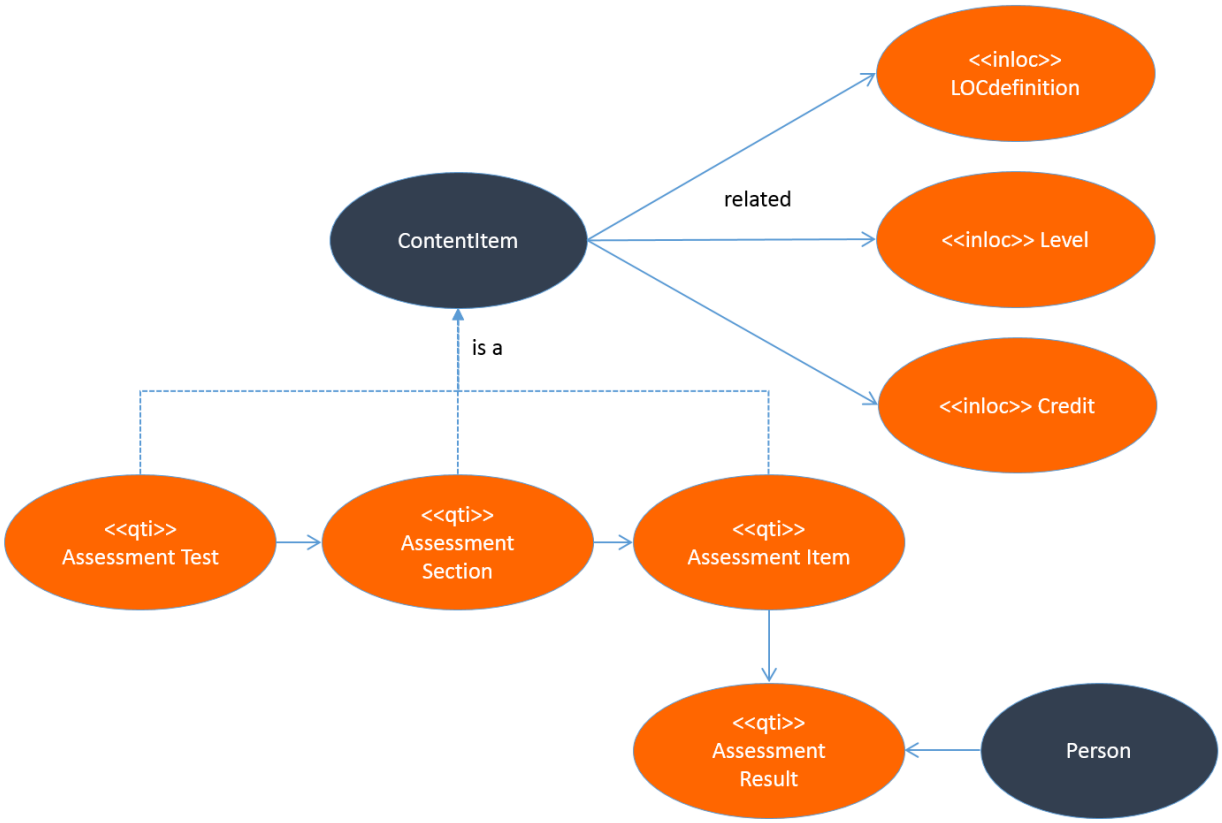

FIGURE 2-8: QTI-BASED TEST RESULTS

3 Installation Guide

The process of installing and running the EAGLE Backend Service can be done in several ways. The entire development of the EAGLE Backend Service is based on *Maven* tool. The service itself builds on the *Java EE stack* and requires an application server (or servlet container) as its runtime environment. The current EAGLE Knowledge Base is provided at http://eagle-dev.salzburgresearch.at. At the moment of writing this report, this is still a development environment that is expected to evolve by the end of the project development phase.

3.1 Installation Prerequisites

The installation prerequisites include the following:

- Java 1.8: Java is the runtime environment;
- Maven 3.x: Maven is used as the build & dependency management tool;
- PostgreSQL is used as the DBMS for the KiWi-Triple-Store.

3.1.2 Java 1.8

Ensure Java is installed on the machine; execute the following commands (on Linux):

```
sudo apt-get update                  // first update the package index
java –version                        // check whether java is already installed, if not then
sudo apt-get install default-jdk     // to install the Java Development Kit
```

3.1.3 Maven 3.x

To install Maven, execute the following commands (on Linux)

```
mvn –version                         // verify whether maven is already installed
sudo apt-get install maven           // install the latest maven package
```

3.1.4 PostgreSQL

To install PostgreSQL, execute the following commands (on Linux)

```
sudo apt-get update                          // refresh the package index
sudo apt-get install postgresql              // install the main and the contrib packages
sudo apt-get install postgresql-contrib      // install the contrib packages
```

Once the database is installed, it will be necessary to create the database for storing the data. During the installation process, a new user account in PostgreSQL will be created.

```
sudo –i –u postgres                  // log into the system as postgres
pgsl                                 // connect to Postgres
createdb  eagle                      // create a new database named eagle
```

3.2 Installation Steps

The EAGLE Backend Service can be installed in various ways. The easiest way is to download the software and execute the following commands in the root directory of the downloaded software:

```
mvn clean install

mvn tomcat7:run
```

3.3 Configuration

Once the service is up and running, it is possible to check the service's administration console by pointing a web browser to http://localhost:8080/marmotta (adjust host and port when required). The console offers access to the built-in functionality including the core services, such as importing or exporting data, gives information of the current system and the actually executed background tasks.

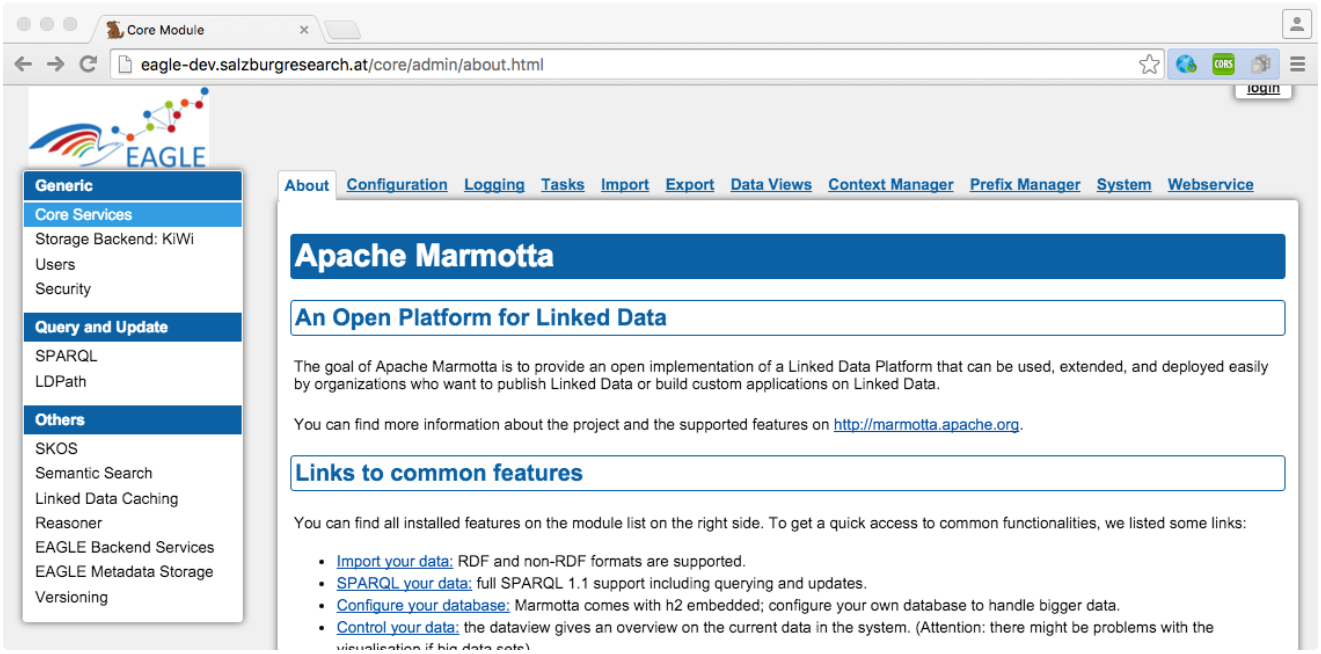

FIGURE 3-1: ADMINISTRATION CONSOLE

The Administration Console of the EAGLE Knowledge Backend Service provides a variety of configuration options.

3.3.1 Database Setup

The most important is the database setup where it is required to specify “postgres” as the database backend and to point to the proper database. The user must have the privileges to create the required database structure (in case it not yet created).

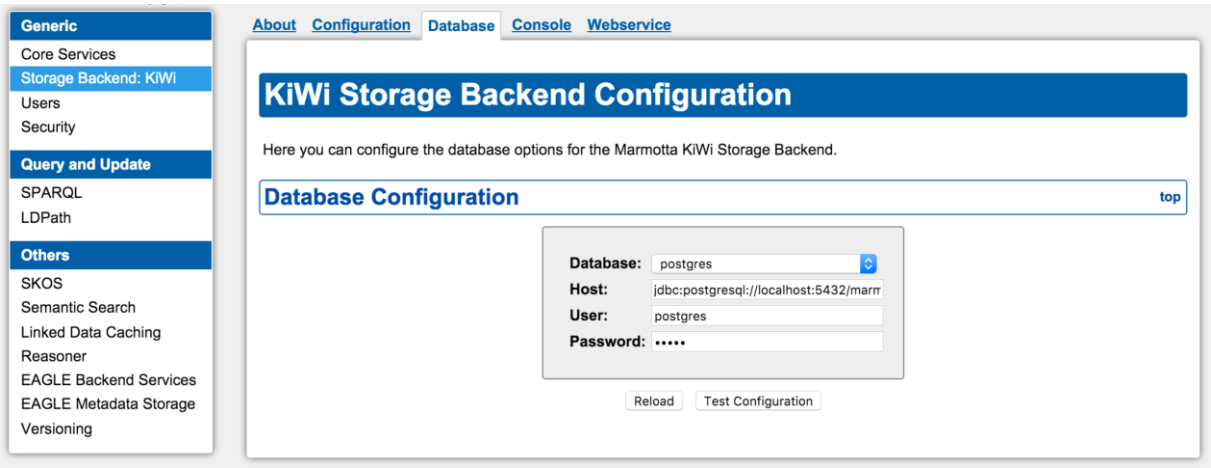

FIGURE 3-2: DATABASE SETUP

3.3.2 Search Indexes

The search indexes used on the EAGLE Learning Platform are called “cores”. Search cores need to be created in either English or German languages (see Figure 3-3). The Knowledge Service Component is currently configured to look for “de_oer” as the search core for German users and for “en_oer” for English users respectively. The search programs are presented in the Annex.

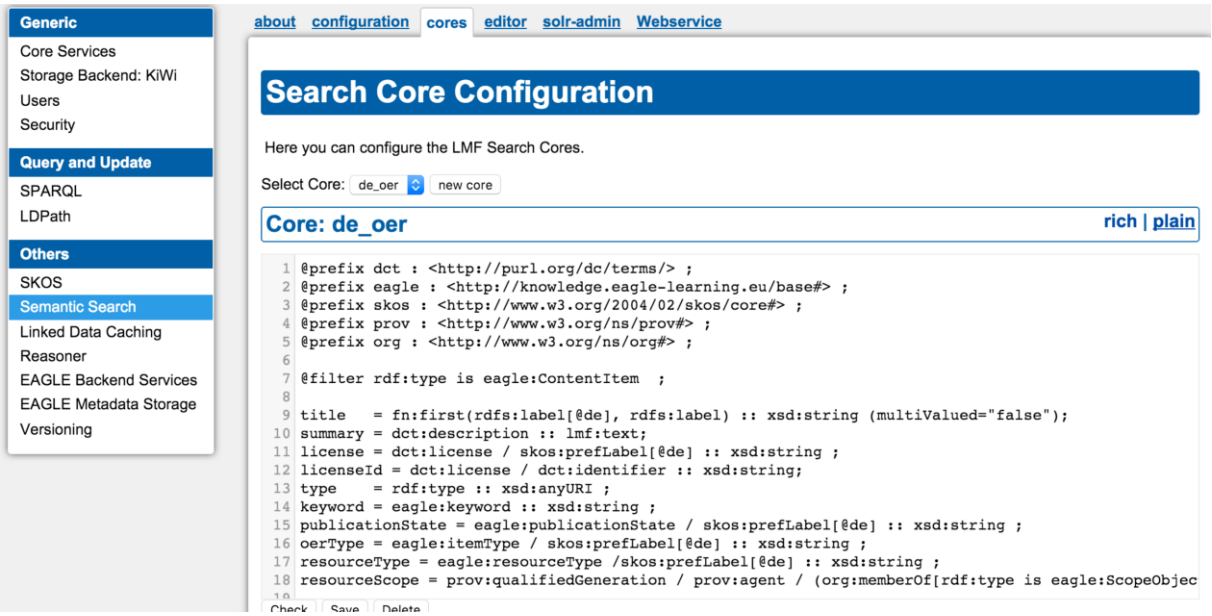

FIGURE 3-3: SEARCH CORES

Annex

Search Program for English-speaking Users

```
@prefix dct : <http://purl.org/dc/terms/> ;
@prefix eagle : <http://knowledge.eagle-learning.eu/base#> ;
@prefix skos : <http://www.w3.org/2004/02/skos/core#> ;
@prefix prov : <http://www.w3.org/ns/prov#> ;
@prefix org : <http://www.w3.org/ns/org#> ;

@filter rdf:type is eagle:ContentItem  ;

title          = fn:first(rdfs:label[@en], rdfs:label) :: xsd:string (multiValued="false");
summary        = dct:description :: lmf:text;
license        = dct:license / skos:prefLabel[@en] :: xsd:string ;
licenseId      = dct:license / dct:identifier :: xsd:string;
type           = rdf:type :: xsd:anyURI ;
keyword        = eagle:keyword :: xsd:string ;
publicationState = eagle:publicationState / skos:prefLabel[@en] :: xsd:string ;
oerType        = eagle:itemType / skos:prefLabel[@en] :: xsd:string ;
resourceType   = eagle:resourceType / skos:prefLabel[@en] :: xsd:string ;
resourceScope  = prov:qualifiedGeneration / prov:agent
               /(org:memberOf[rdf:type is eagle:ScopeObject])+ / rdfs:label :: xsd:string ;
categoryObj    = eagle:inProcessMap / (skos:broader)*
               / fn:eagleConcept(., skos:prefLabel[@en]) :: xsd:string ;
category       = (eagle:inProcessMap / (skos:broader)* / skos:prefLabel[@en]) :: xsd:string ;
categoryUri    = (eagle:inProcessMap) | (eagle:inProcessMap / (skos:broader)*) :: xsd:anyURI ;
processObj     = eagle:inProcessMap / fn:eagleConcept(., skos:prefLabel[@en]) :: xsd:string;
authorLabel    = prov:qualifiedGeneration / prov:agent / rdfs:label :: xsd:string ;
authorUri      = prov:qualifiedGeneration / prov:agent :: xsd:anyURI ;
authorObj      = prov:qualifiedGeneration / prov:agent
               / fn:eagleConcept(., rdfs:label ) :: xsd:string;
organisation   = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:Organisation] / rdfs:label :: xsd:string ;
organisationObj = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:Organisation]
               / fn:eagleConcept(.,rdfs:label) :: xsd:string ;
portal         = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:ScopeObject] / org:memberOf
               / rdfs:label :: xsd:string ;
portalObj      = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:ScopeObject] / org:memberOf
               / fn:eagleConcept(.,rdfs:label) :: xsd:string ;
inProcessMap   = eagle:inProcessMap :: xsd:anyURI ;
dateModified   = dct:modified :: xsd:dateTime ;
dateCreated    = prov:qualifiedGeneration / prov:atTime  :: xsd:dateTime ;
numViews       = eagle:viewCount[^^xsd:int] :: xsd:integer ;
numRatingAvg   = eagle:rating / eagle:ratingAverage[^^xsd:double] :: xsd:double ;
numRatingCount = eagle:rating / eagle:ratingCount[^^xsd:int] :: xsd:integer ;
version        = eagle:version :: xsd:string ;
parts          = dct:hasPart :: xsd:anyURI;
language       = dct:language :: xsd:string ;
tests          = fn:exists(eagle:hasTest) :: xsd:boolean ;
follower       = eagle:followerGroup / org:hasMember / rdfs:label :: xsd:string ;
followsUri     = eagle:followerGroup / org:hasMember :: xsd:anyURI ;
```

LISTING 3: SEARCH CORE FOR ENGLISH USERS

Search Program for German-speaking Users

```
@prefix dct : <http://purl.org/dc/terms/> ;
@prefix eagle : <http://knowledge.eagle-learning.eu/base#> ;
@prefix skos : <http://www.w3.org/2004/02/skos/core#> ;
@prefix prov : <http://www.w3.org/ns/prov#> ;
@prefix org : <http://www.w3.org/ns/org#> ;

@filter rdf:type is eagle:ContentItem  ;

title          = fn:first(rdfs:label[@de], rdfs:label) :: xsd:string (multiValued="false");
summary        = dct:description :: lmf:text;
license        = dct:license / skos:prefLabel[@de] :: xsd:string ;
licenseId      = dct:license / dct:identifier :: xsd:string;
type           = rdf:type :: xsd:anyURI ;
keyword        = eagle:keyword :: xsd:string ;
publicationState = eagle:publicationState / skos:prefLabel[@de] :: xsd:string ;
oerType        = eagle:itemType / skos:prefLabel[@de] :: xsd:string ;
resourceType   = eagle:resourceType / skos:prefLabel[@de] :: xsd:string ;
resourceScope  = prov:qualifiedGeneration / prov:agent
               /(org:memberOf[rdf:type is eagle:ScopeObject])+ / rdfs:label :: xsd:string ;
categoryObj    = eagle:inProcessMap / (skos:broader)*
               / fn:eagleConcept(., skos:prefLabel[@de]) :: xsd:string ;
category       = (eagle:inProcessMap / (skos:broader)* / skos:prefLabel[@de]) :: xsd:string ;
categoryUri    = (eagle:inProcessMap) | (eagle:inProcessMap / (skos:broader)*) :: xsd:anyURI ;
processObj     = eagle:inProcessMap / fn:eagleConcept(., skos:prefLabel[@de]) :: xsd:string;
authorLabel    = prov:qualifiedGeneration / prov:agent / rdfs:label :: xsd:string ;
authorUri      = prov:qualifiedGeneration / prov:agent :: xsd:anyURI ;
authorObj      = prov:qualifiedGeneration / prov:agent
               / fn:eagleConcept(., rdfs:label ) :: xsd:string;
organisation   = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:Organisation] / rdfs:label :: xsd:string ;
organisationObj = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:Organisation]
               / fn:eagleConcept(.,rdfs:label) :: xsd:string ;
portal         = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:ScopeObject] / org:memberOf
               / rdfs:label :: xsd:string ;
portalObj      = prov:qualifiedGeneration / prov:agent
               / org:memberOf[rdf:type is eagle:ScopeObject] / org:memberOf
               / fn:eagleConcept(.,rdfs:label) :: xsd:string ;
inProcessMap   = eagle:inProcessMap :: xsd:anyURI ;
dateModified   = dct:modified :: xsd:dateTime ;
dateCreated    = prov:qualifiedGeneration / prov:atTime  :: xsd:dateTime ;
numViews       = eagle:viewCount[^^xsd:int] :: xsd:integer ;
numRatingAvg   = eagle:rating / eagle:ratingAverage[^^xsd:double] :: xsd:double ;
numRatingCount = eagle:rating / eagle:ratingCount[^^xsd:int] :: xsd:integer ;
version        = eagle:version :: xsd:string ;
parts          = dct:hasPart :: xsd:anyURI;
language       = dct:language :: xsd:string ;
tests          = fn:exists(eagle:hasTest) :: xsd:boolean ;
follower       = eagle:followerGroup / org:hasMember / rdfs:label :: xsd:string ;
followsUri     = eagle:followerGroup / org:hasMember :: xsd:anyURI ;
```

LISTING 4: SEARCH CORE FOR GERMAN USERS

EAGLE Ontology (Version 1.0)

```
@prefix : <http://knowledge.eagle-learning.eu/base#> .
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#> .
@prefix org: <http://www.w3.org/ns/org#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix pav: <http://purl.org/pav/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix xml: <http://www.w3.org/XML/1998/namespace#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix eagle: <http://www.eagle-learning.eu/base#> .
@prefix inloc: <http://purl.org/net/inloc/> .
@prefix vcard: <http://www.w3.org/2006/vcard/ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@base <http://knowledge.eagle-learning.eu/base#> .

<http://knowledge.eagle-learning.eu/base#> rdf:type owl:Ontology ;
                                           dcterms:creator "Dietmar Glachs" ;
                                           dcterms:description """Term Hierarchy Model for the
EAGLE platform knowledge model including references to

- vCard (http://www.w3.org/2006/vcard/ns)
- SKOS (http://www.w3.org/2004/02/skos/core#)
- Dublin Core (http://protege.stanford.edu/plugins/owl/dc/dubincore.owl)
- W3C Organisation Ontology (http://www.w3.org/ns/org#)

This base ontology adds knowledge model in particular the

- Term Model
- Content Model
- Event Model

which are formally based on the DOLCE foundational ontology."""@en ;
                                           <http://purl.org/vocab/vann/preferredNamespaceUri>
"http://www.eagle-learning.eu/base#" ;
                                           dcterms:contributor "EAGLE Project" .

#################################################################
#
#    Annotation properties
#
#################################################################

###  http://www.w3.org/2004/02/skos/core#editorialNote
skos:editorialNote rdf:type owl:AnnotationProperty .

#################################################################
#
#    Datatypes
#
#################################################################

###  http://www.w3.org/1999/02/22-rdf-syntax-ns#langString
rdf:langString rdf:type rdfs:Datatype .

###  http://www.w3.org/2001/XMLSchema#date
xsd:date rdf:type rdfs:Datatype .

#################################################################
#
#    Object Properties
#
#################################################################

###  http://knowledge.eagle-learning.eu/base#actedOnBehalfOf
:actedOnBehalfOf rdf:type owl:FunctionalProperty ,
```

```
                        owl:ObjectProperty ;
                rdfs:label "act on behalf of" ;
                rdfs:comment "The (social) individual, for whom the activity is
performed!"@en ;
                rdfs:domain :Activity ;
                rdfs:range :Individual .

###  http://knowledge.eagle-learning.eu/base#actor
:actor rdf:type owl:FunctionalProperty ,
               owl:ObjectProperty ;
       rdfs:label "actor" ;
       rdfs:comment "The person who is actively performing an activity!"@en ;
       rdfs:domain :Activity ;
       rdfs:range :Person .

###  http://knowledge.eagle-learning.eu/base#conductedBy
:conductedBy rdf:type owl:ObjectProperty ;
             rdfs:label "was conducted by" ;
             rdfs:comment "This property denotes the acting agent of an activity"@en ;
             rdfs:domain :Activity ;
             rdfs:range :Person ;
             rdfs:subPropertyOf prov:wasAssociatedWith .

###  http://knowledge.eagle-learning.eu/base#contentRating
:contentRating rdf:type owl:FunctionalProperty ,
                        owl:ObjectProperty ;
               rdfs:label "the rating object" ;
               rdfs:comment "The rating object to which a UsageRating contributes " ;
               rdfs:range :ContentRating ;
               rdfs:domain :UsageRating .

###  http://knowledge.eagle-learning.eu/base#currentVersion
:currentVersion rdf:type owl:FunctionalProperty ,
                         owl:ObjectProperty ;
                rdfs:label "current/actual Version" ;
                rdfs:comment "This version is the actual, newest version of the
ContentItem"@en ;
                rdfs:domain :ContentItem ;
                rdfs:range :ContentVersion .

###  http://knowledge.eagle-learning.eu/base#followerGroup
:followerGroup rdf:type owl:FunctionalProperty ,
                        owl:ObjectProperty ;
               rdfs:label "has fowllower group" ;
               rdfs:comment "The group of persons who are following / are interested in a
Content Item " ;
               rdfs:domain :ContentItem ;
               rdfs:range :FollowerGroup .

###  http://knowledge.eagle-learning.eu/base#follows
:follows rdf:type owl:FunctionalProperty ,
                  owl:ObjectProperty ;
         rdfs:label "group follows contentItem" ;
         rdfs:comment "A follower group follows a particular content item" ;
         rdfs:range :ContentItem ;
         rdfs:domain :FollowerGroup .

###  http://knowledge.eagle-learning.eu/base#hasBadge
:hasBadge rdf:type owl:ObjectProperty ;
          rdfs:label "Gained Badges" ;
          rdfs:domain :Person ;
          rdfs:range inloc:LOCdefinition .

###  http://knowledge.eagle-learning.eu/base#hasRating
:hasRating rdf:type owl:ObjectProperty ;
           rdfs:label "has (individual) ratings" ;
           rdfs:comment "The ratings of the distinct users" ;
           rdfs:domain :ContentRating ;
           rdfs:range :UsageRating .

###  http://knowledge.eagle-learning.eu/base#hasVersion
```

```
:hasVersion rdf:type owl:ObjectProperty ;
            rdfs:label "has Version" ;
            rdfs:comment "Retrieve the distinct versions of a ContentResource"@en ;
            rdfs:domain :ContentItem ;
            rdfs:range :ContentVersion ;
            owl:inverseOf :isVersionOf .

###  http://knowledge.eagle-learning.eu/base#isBasedOn
:isBasedOn rdf:type owl:ObjectProperty ,
                    owl:TransitiveProperty ;
           rdfs:comment "A resource/document that was used in the creation of this content
resource"@en ;
           rdfs:domain :ContentItem ;
           rdfs:subPropertyOf skos:semanticRelation ;
           rdfs:range foaf:Document .

###  http://knowledge.eagle-learning.eu/base#isSupervisorOf
:isSupervisorOf rdf:type owl:ObjectProperty ,
                         owl:TransitiveProperty ;
           rdfs:comment "A person who is manager, supervisor of another person, colleague or
employee!"@en ;
           rdfs:domain :Person ;
           rdfs:range :Person ;
           rdfs:subPropertyOf skos:semanticRelation .

###  http://knowledge.eagle-learning.eu/base#isVersionOf
:isVersionOf rdf:type owl:ObjectProperty ;
             rdfs:label "is Version of" ;
             rdfs:comment "The ContentResource where the actual resource is a version of"@en ;
             rdfs:range :ContentItem ;
             rdfs:domain :ContentVersion .

###  http://knowledge.eagle-learning.eu/base#itemType
:itemType rdf:type owl:FunctionalProperty ,
                   owl:ObjectProperty ;
          rdfs:label "internal type of a content item" ;
          rdfs:comment "Denotes the internal type of the content item" ;
          rdfs:domain :ContentItem ;
          rdfs:range :Quality .

###  http://knowledge.eagle-learning.eu/base#keyword
:keyword rdf:type owl:ObjectProperty ;
         rdfs:label "keyword / tag" ;
         rdfs:comment "Keyword or tag associated with a document" ;
         rdfs:domain :ContentItem .

###  http://knowledge.eagle-learning.eu/base#lastLogin
:lastLogin rdf:type owl:FunctionalProperty ,
                    owl:ObjectProperty ;
           rdfs:label "the last login" ;
           rdfs:comment "A date & time of a user's last login" ;
           rdfs:domain :SystemUser .

###  http://knowledge.eagle-learning.eu/base#previousVersion
:previousVersion rdf:type owl:FunctionalProperty ,
                          owl:ObjectProperty ;
                 rdfs:label "Direct predecessor"@en ,
                            "Previous version" ;
                 rdfs:comment "Point to the previous version of the ContentItem"@en ;
                 rdfs:domain :ContentItem ,
                             :ContentVersion ;
                 rdfs:range :ContentVersion .

###  http://knowledge.eagle-learning.eu/base#publicationState
:publicationState rdf:type owl:FunctionalProperty ,
                           owl:ObjectProperty ;
                  rdfs:label "publication state" ;
                  rdfs:comment "The actual publication state of a Content item, either
PUBLISHED, DRAFT or UNDER REVIEW" ;
                  rdfs:domain :ContentItem ;
                  rdfs:range :Quality .
```

```
###  http://knowledge.eagle-learning.eu/base#ratedObject
:ratedObject rdf:type owl:FunctionalProperty ,
                      owl:ObjectProperty ;
             rdfs:label "rated object" ;
             rdfs:comment "The rated content item" ;
             rdfs:range :ContentItem ;
             rdfs:domain :ContentRating .

###  http://knowledge.eagle-learning.eu/base#rating
:rating rdf:type owl:FunctionalProperty ,
                 owl:ObjectProperty ;
        rdfs:label "the rating for an object" ;
        rdfs:comment "The group of persons who are following / are interested in a Content
Item " ;
        rdfs:domain :ContentItem ;
        rdfs:range :ContentRating .

###  http://knowledge.eagle-learning.eu/base#ratingAverage
:ratingAverage rdf:type owl:FunctionalProperty ,
                        owl:ObjectProperty ;
               rdfs:label "average rating" ;
               rdfs:comment "The computed average rating" ;
               rdfs:domain :ContentRating .

###  http://knowledge.eagle-learning.eu/base#ratingCount
:ratingCount rdf:type owl:FunctionalProperty ,
                      owl:ObjectProperty ;

             rdfs:label "number of ratings" ;
             rdfs:comment "The number of all rating" ;
             rdfs:domain :ContentRating .

###  http://knowledge.eagle-learning.eu/base#ratingSum
:ratingSum rdf:type owl:FunctionalProperty ,
                    owl:ObjectProperty ;
           rdfs:label "sum of all ratings" ;
           rdfs:comment "The computed sum of all ratings" ;
           rdfs:domain :ContentRating .

###  http://knowledge.eagle-learning.eu/base#requiredBadge
:requiredBadge rdf:type owl:FunctionalProperty ,
                        owl:ObjectProperty ;
               rdfs:label "Required InLOC level"@en ;
               rdfs:domain :Plan ;
               rdfs:range inloc:LOCdefinition .

###  http://knowledge.eagle-learning.eu/base#requiredType
:requiredType rdf:type owl:FunctionalProperty ,
                       owl:ObjectProperty ;
              rdfs:label "Required (Class) type"@en ;
              rdfs:domain :Plan .

###  http://knowledge.eagle-learning.eu/base#resourceType
:resourceType rdf:type owl:FunctionalProperty ,
                       owl:ObjectProperty ;
              rdfs:label "internal resource type of a content item" ;
              rdfs:comment "Denotes the internal resource type of the content item" ;
              rdfs:domain :ContentItem ;
              rdfs:range :Quality .

###  http://knowledge.eagle-learning.eu/base#resultBadge
:resultBadge rdf:type owl:FunctionalProperty ,
                      owl:ObjectProperty ;
             rdfs:label "Result InLOC level"@en ;
             rdfs:domain :Plan ;
             rdfs:range inloc:LOCdefinition .

###  http://knowledge.eagle-learning.eu/base#resultType
:resultType rdf:type owl:FunctionalProperty ,
                     owl:ObjectProperty ;
```

```
            rdfs:label "Resulting (Class) type"@en ;
            rdfs:domain :Plan .

###  http://knowledge.eagle-learning.eu/base#viewCount
:viewCount rdf:type owl:FunctionalProperty ,
                    owl:ObjectProperty ;
           rdfs:label "number of views" ;
           rdfs:comment "The number of tracked views" ;
           rdfs:domain :ContentItem .

###  http://purl.org/pav/authoredBy
pav:authoredBy rdf:type owl:ObjectProperty ;
               rdfs:domain :ContentItem ;
               rdfs:range :Individual .

###  http://purl.org/pav/createdBy
pav:createdBy rdf:type owl:ObjectProperty ;
              rdfs:domain :ContentItem ;
              rdfs:range :Individual .

###  http://purl.org/pav/curatedBy
pav:curatedBy rdf:type owl:ObjectProperty ;
              rdfs:domain :ContentItem ;
              rdfs:range :Individual .

###  http://www.w3.org/2003/01/geo/wgs84_pos#alt
geo:alt rdf:type owl:FunctionalProperty ,
                 owl:ObjectProperty ;
        rdfs:domain geo:SpatialThing .

###  http://www.w3.org/2003/01/geo/wgs84_pos#lat
geo:lat rdf:type owl:FunctionalProperty ,
                 owl:ObjectProperty ;
        rdfs:domain geo:SpatialThing .

###  http://www.w3.org/2003/01/geo/wgs84_pos#long
geo:long rdf:type owl:FunctionalProperty ,
                  owl:ObjectProperty ;
         rdfs:domain geo:SpatialThing .

###  http://www.w3.org/2004/02/skos/core#altLabel
skos:altLabel rdf:type owl:ObjectProperty ;
              rdfs:domain skos:Concept ;
              rdfs:range rdf:langString .

###  http://www.w3.org/2004/02/skos/core#hiddenLabel
skos:hiddenLabel rdf:type owl:ObjectProperty ;
                 rdfs:range rdf:langString ;
                 rdfs:domain skos:Concept .

###  http://www.w3.org/2004/02/skos/core#inScheme
skos:inScheme rdf:type owl:FunctionalProperty ,
                       owl:ObjectProperty ;
              rdfs:domain skos:Concept ;
              rdfs:range skos:ConceptScheme .

###  http://www.w3.org/2004/02/skos/core#prefLabel
skos:prefLabel rdf:type owl:ObjectProperty ;
               rdfs:range rdf:langString ;
               rdfs:domain skos:Concept .

###  http://www.w3.org/2004/02/skos/core#related
skos:related rdf:type owl:ObjectProperty .

###  http://www.w3.org/2004/02/skos/core#semanticRelation
skos:semanticRelation rdf:type owl:ObjectProperty .

###  http://www.w3.org/ns/prov#wasAssociatedWith
prov:wasAssociatedWith rdf:type owl:ObjectProperty .

#################################################################
```

```
#
#    Data properties
#
#################################################################

###  http://knowledge.eagle-learning.eu/base#keyword
:keyword rdf:type owl:DatatypeProperty ;
         rdfs:label "keyword / tag" ;
         rdfs:comment "Keyword or tag associated with a document" ;
         rdfs:range xsd:string .

###  http://knowledge.eagle-learning.eu/base#lastLogin
:lastLogin rdf:type owl:DatatypeProperty ,
                    owl:FunctionalProperty ;
           rdfs:label "the last login" ;
           rdfs:comment "A date & time of a user's last login" ;
           rdfs:range xsd:dateTime .

###  http://knowledge.eagle-learning.eu/base#ratingAverage
:ratingAverage rdf:type owl:DatatypeProperty ,
                        owl:FunctionalProperty ;
               rdfs:label "average rating" ;
               rdfs:comment "The computed average rating" ;
               rdfs:range xsd:double .

###  http://knowledge.eagle-learning.eu/base#ratingCount
:ratingCount rdf:type owl:DatatypeProperty ,
                      owl:FunctionalProperty ;
             rdfs:label "number of ratings" ;
             rdfs:comment "The number of all rating" ;
             rdfs:range xsd:int .

###  http://knowledge.eagle-learning.eu/base#ratingSum
:ratingSum rdf:type owl:DatatypeProperty ,
                    owl:FunctionalProperty ;
           rdfs:label "sum of all ratings" ;
           rdfs:comment "The computed sum of all ratings" ;
           rdfs:range xsd:double .

###  http://knowledge.eagle-learning.eu/base#requiredType
:requiredType rdf:type owl:DatatypeProperty ,
                       owl:FunctionalProperty ;
              rdfs:label "Required (Class) type"@en ;
              rdfs:range xsd:anyURI .

###  http://knowledge.eagle-learning.eu/base#resultType
:resultType rdf:type owl:DatatypeProperty ,
                     owl:FunctionalProperty ;
            rdfs:label "Resulting (Class) type"@en ;
            rdfs:range xsd:anyURI .

###  http://knowledge.eagle-learning.eu/base#version
:version rdf:type owl:DatatypeProperty ;
         rdfs:label "Version"@en ;
         rdfs:comment "The version number of a resource. This is a freetext string, typical
values are \"1.5\" or \"21\". The URI identifying the previous version can be provided using
prov:previousVersion."^^xsd:string ;
         rdfs:seeAlso :previousVersion ;
         rdfs:range xsd:string .

###  http://knowledge.eagle-learning.eu/base#viewCount
:viewCount rdf:type owl:DatatypeProperty ,
                    owl:FunctionalProperty ;
           rdfs:label "number of views" ;
           rdfs:comment "The number of tracked views" ;
           rdfs:range xsd:integer .

###  http://purl.org/dc/terms/created
dcterms:created rdf:type owl:DatatypeProperty ,
                         owl:FunctionalProperty ;
                rdfs:comment "The date of the creation"@en ;
```

```
                rdfs:domain :Resource ;
                rdfs:range xsd:date .

###  http://purl.org/dc/terms/title
dcterms:title rdf:type owl:DatatypeProperty ,
                       owl:FunctionalProperty ;

              rdfs:comment "Denotes a title for the resource"@en ;
              rdfs:domain :Resource ;
              rdfs:range xsd:string .

###  http://purl.org/pav/authoredOn
pav:authoredOn rdf:type owl:DatatypeProperty ,
                        owl:FunctionalProperty ;
               rdfs:domain :ContentItem ;
               rdfs:range xsd:dateTime .

###  http://www.w3.org/2003/01/geo/wgs84_pos#alt
geo:alt rdf:type owl:DatatypeProperty ,
                 owl:FunctionalProperty ;
        rdfs:range xsd:double .

###  http://www.w3.org/2003/01/geo/wgs84_pos#lat
geo:lat rdf:type owl:DatatypeProperty ,
                 owl:FunctionalProperty ;
        rdfs:range xsd:double .

###  http://www.w3.org/2003/01/geo/wgs84_pos#long
geo:long rdf:type owl:DatatypeProperty ,
                  owl:FunctionalProperty ;
         rdfs:range xsd:double .

###  http://www.w3.org/ns/prov#endedAtTime
prov:endedAtTime rdf:type owl:DatatypeProperty ,
                          owl:FunctionalProperty ;
                 rdfs:range xsd:dateTime .

###  http://www.w3.org/ns/prov#startedAtTime
prov:startedAtTime rdf:type owl:DatatypeProperty ,
                            owl:FunctionalProperty ;
                   rdfs:range xsd:dateTime .

#################################################################
#
#    Classes
#
#################################################################

###  http://knowledge.eagle-learning.eu/base#AbstractQuality
:AbstractQuality rdf:type owl:Class ;
                 rdfs:subClassOf :Quality ;
                 rdfs:comment "Something which has a name, which is referenceable"@en .

###  http://knowledge.eagle-learning.eu/base#Activity
:Activity rdf:type owl:Class ;
          rdfs:subClassOf prov:Activity ;
          rdfs:comment "A action performed by an agent, taking place at some time and
(optionally) on some place." ,
                       "An activity is something that occurs over a period of time and acts
upon or with entities; it may include consuming, processing, transforming, modifying,
relocating, using, or generating entities."@en .

###  http://knowledge.eagle-learning.eu/base#Community
:Community rdf:type owl:Class ;
           rdfs:subClassOf :SocialIndividual ,
                           foaf:Group ;
           rdfs:comment "A community of people." .

###  http://knowledge.eagle-learning.eu/base#CompetenceDefinition
:CompetenceDefinition rdf:type owl:Class ;
                      rdfs:subClassOf :ContentObject ,
```

```
                                    inloc:LOCdefinition ;
                        rdfs:comment "EAGLE Competence Definition" .

###  http://knowledge.eagle-learning.eu/base#CompetenceStructure
:CompetenceStructure rdf:type owl:Class ;
                     rdfs:subClassOf :Vocabulary ,
                                     inloc:LOCstructure ;
                     rdfs:comment "EAGLE Learning Outcome Structure" .

###  http://knowledge.eagle-learning.eu/base#Conception
:Conception rdf:type owl:Class ;
            rdfs:subClassOf :Term ;
            rdfs:comment "This term-type covers all kind of conceptualizations like roles,
course and tasks"@en .

###  http://knowledge.eagle-learning.eu/base#ContentItem
:ContentItem rdf:type owl:Class ;
             rdfs:subClassOf :ContentObject ;
             rdfs:comment "A resource holding educational content used for learning"@en .

###  http://knowledge.eagle-learning.eu/base#ContentObject
:ContentObject rdf:type owl:Class ;
               rdfs:subClassOf :Entity ,
                               foaf:Document ;
               rdfs:comment "A content object holding information relevant to users /
learners"@en .

###  http://knowledge.eagle-learning.eu/base#ContentPart
:ContentPart rdf:type owl:Class ;
             rdfs:subClassOf :ContentObject ;
             rdfs:comment "A resource holding parts of the content item, such as metadata,
analysis results" .

###  http://knowledge.eagle-learning.eu/base#ContentRating
:ContentRating rdf:type owl:Class ;
               rdfs:subClassOf :ContentRating ;
               rdfs:comment "The object for computing the average rating of a content object"
.

###  http://knowledge.eagle-learning.eu/base#ContentVersion
:ContentVersion rdf:type owl:Class ;
                rdfs:subClassOf :ContentObject ;
                rdfs:comment "An expression of a content resource"@en .

###  http://knowledge.eagle-learning.eu/base#Credit
:Credit rdf:type owl:Class ;
        rdfs:subClassOf :AbstractQuality ,
                        inloc:LOCdefinition ,
                        inloc:Numberable ;
        rdfs:comment "EAGLE Credit" .

###  http://knowledge.eagle-learning.eu/base#Descriptive
:Descriptive rdf:type owl:Class ;
             rdfs:subClassOf :Term ;
             rdfs:comment "Predefined settings of some kind"@en .

###  http://knowledge.eagle-learning.eu/base#Entity
:Entity rdf:type owl:Class ;
        rdfs:subClassOf :Term ,
                        prov:Entity ;
        rdfs:comment "An Entity is everything which exists, is referenceable, has a name (or
title)" .

###  http://knowledge.eagle-learning.eu/base#FollowerGroup
:FollowerGroup rdf:type owl:Class ;
               rdfs:subClassOf :SocialIndividual ;
               rdfs:comment "A group of persons wich together are following (are interested
in) a particular eagle:ContentItem" .

###  http://knowledge.eagle-learning.eu/base#Individual
```

```
:Individual rdf:type owl:Class ;
            rdfs:subClassOf :Term ,
                            prov:Agent ,
                            foaf:Agent ;
            skos:editorialNote """Any Individual within EAGLE is an ontological subclass of
foaf:Agent: to allow all foaf-attributes such as foaf:account, foaf:knows
prov:Agent: to participate in Activities
vcard:Kind to allow all the VCard Attributes
:Term: to be organizable in controlled vocabularies"""@en ;
            rdfs:comment "Individual covers natural persons, virtual persons like avatars and
characters in literature, movies, animals with an known identity as well as al kinds of
socially constructed individuals like organizations, communities and teams."@en .

###  http://knowledge.eagle-learning.eu/base#Level
:Level rdf:type owl:Class ;
       rdfs:subClassOf :AbstractQuality ,
                       inloc:LOCdefinition ,
                       inloc:Numberable ;
       rdfs:comment "EAGLE Competence Level" .

###  http://knowledge.eagle-learning.eu/base#Organisation
:Organisation rdf:type owl:Class ;
              rdfs:subClassOf :SocialIndividual ,
                              org:FormalOrganization ;
              rdfs:comment "A company with name, employees etc." .

###  http://knowledge.eagle-learning.eu/base#Person
:Person rdf:type owl:Class ;
        rdfs:subClassOf :Individual ,
                        foaf:Person ;
        rdfs:comment "A human person" .

###  http://knowledge.eagle-learning.eu/base#Plan
:Plan rdf:type owl:Class ;
      rdfs:subClassOf :Descriptive ,
                      prov:Plan ;
      rdfs:comment "A plan holds information of intended actions.." .

###  http://knowledge.eagle-learning.eu/base#Quality
:Quality rdf:type owl:Class ;
         rdfs:subClassOf :Term ;
         rdfs:comment "Something which has a name, which is referenceable"@en .

###  http://knowledge.eagle-learning.eu/base#Resource
:Resource rdf:type owl:Class ;
          rdfs:comment "Base class for all EAGLE Resources"@en .

###  http://knowledge.eagle-learning.eu/base#Role
:Role rdf:type owl:Class ;
      rdfs:subClassOf :Conception ,
                      prov:Role ;
      rdfs:comment "A role is the function of an entity or agent with respect to an activity,
in the context of a usage, generation, invalidation, association, start, and end."@en .

###  http://knowledge.eagle-learning.eu/base#ScopeObject
:ScopeObject rdf:type owl:Class ;
             rdfs:subClassOf :SocialIndividual ;
             rdfs:comment "Organisational unit defining a scope within the portal" .

###  http://knowledge.eagle-learning.eu/base#ScopeOrganisation
:ScopeOrganisation rdf:type owl:Class ;
                   rdfs:subClassOf :ScopeObject ;
                   rdfs:comment "Organisational unit definig a scope within the portal" .

###  http://knowledge.eagle-learning.eu/base#ScopePortal
:ScopePortal rdf:type owl:Class ;
             rdfs:subClassOf :ScopeObject ;
             rdfs:comment "Organisational unit definig a scope within the portal" .

###  http://knowledge.eagle-learning.eu/base#SocialIndividual
:SocialIndividual rdf:type owl:Class ;
```

```
                rdfs:subClassOf :Individual ,
                                org:Organization ;
                rdfs:comment "Any acting individual which is not a person" .

###  http://knowledge.eagle-learning.eu/base#SpatialQuality
:SpatialQuality rdf:type owl:Class ;
                rdfs:subClassOf :Quality ,
                                geo:SpatialThing ,
                                prov:Location ;
                rdfs:comment "Something which has a name, may be organised in vocabularies,
which is referenceable & has a spatial extension"@en .

###  http://knowledge.eagle-learning.eu/base#SystemUser
:SystemUser rdf:type owl:Class ;
            rdfs:subClassOf :Person ;
            rdfs:comment "A person with system login" .

###  http://knowledge.eagle-learning.eu/base#Team
:Team rdf:type owl:Class ;
      rdfs:subClassOf :SocialIndividual ;
      rdfs:comment "A group of persons working together" .

###  http://knowledge.eagle-learning.eu/base#TemporalQuality
:TemporalQuality rdf:type owl:Class ;
                 rdfs:subClassOf :Quality ;
                 rdfs:comment "Something which has a name, which is referenceable & has a
timed extension"@en .

###  http://knowledge.eagle-learning.eu/base#Term
:Term rdf:type owl:Class ;
      rdfs:subClassOf :Resource ,
                      skos:Concept ;
      rdfs:comment "A Term defined as skos:Concept represents some element which is part of a
controlled vocabulary. It provides an URI, labels and descriptions (in multiple languages).
Any skos:Concept may have semantic relationships specified by SKOS such as skos:broader,
skos:narrower. Specific subtypes of terms may hold additional information & relationships."@en
.

###  http://knowledge.eagle-learning.eu/base#UsageFollows
:UsageFollows rdf:type owl:Class ;
              rdfs:subClassOf prov:Usage ;
              rdfs:comment "A person follows a particular resource." .

###  http://knowledge.eagle-learning.eu/base#UsageRating
:UsageRating rdf:type owl:Class ;
             rdfs:subClassOf prov:Usage ;
             rdfs:comment "A person rates a particular resource." .

###  http://knowledge.eagle-learning.eu/base#Vocabulary

:Vocabulary rdf:type owl:Class ;
            rdfs:subClassOf :Resource ,
                            skos:ConceptScheme ;
            rdfs:comment "A vocabulary is a management unit for terms. Each term is organized
in exactly one Vocabulary! However, terms may be related to other terms in different
vocabularies (semantic relationship)"@en .

###  http://purl.org/net/inloc/LOCdefinition
inloc:LOCdefinition rdf:type owl:Class .

###  http://purl.org/net/inloc/LOCstructure
inloc:LOCstructure rdf:type owl:Class .

###  http://purl.org/net/inloc/Numberable
inloc:Numberable rdf:type owl:Class .

###  http://www.w3.org/1999/02/22-rdf-syntax-ns#langString
rdf:langString rdf:type owl:Class ;
               rdfs:subClassOf rdfs:Literal .

###  http://www.w3.org/2000/01/rdf-schema#Literal
```

```
rdfs:Literal rdf:type owl:Class .

###  http://www.w3.org/2003/01/geo/wgs84_pos#SpatialThing
geo:SpatialThing rdf:type owl:Class .

###  http://www.w3.org/2004/02/skos/core#Concept
skos:Concept rdf:type owl:Class .

###  http://www.w3.org/2004/02/skos/core#ConceptScheme
skos:ConceptScheme rdf:type owl:Class .

###  http://www.w3.org/2006/vcard/ns#Kind
vcard:Kind rdf:type owl:Class .

###  http://www.w3.org/ns/org#FormalOrganization
org:FormalOrganization rdf:type owl:Class .

###  http://www.w3.org/ns/org#Organization
org:Organization rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Activity
prov:Activity rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Agent
prov:Agent rdf:type owl:Class ;
                    owl:equivalentClass foaf:Agent .

###  http://www.w3.org/ns/prov#Entity
prov:Entity rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Location
prov:Location rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Plan
prov:Plan rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Role
prov:Role rdf:type owl:Class .

###  http://www.w3.org/ns/prov#Usage
prov:Usage rdf:type owl:Class .

###  http://xmlns.com/foaf/0.1/Agent
foaf:Agent rdf:type owl:Class .

###  http://xmlns.com/foaf/0.1/Document
foaf:Document rdf:type owl:Class .

###  http://xmlns.com/foaf/0.1/Group
foaf:Group rdf:type owl:Class .

###  http://xmlns.com/foaf/0.1/Person
foaf:Person rdf:type owl:Class ;
            rdfs:subClassOf foaf:Agent .

#################################################################
#
#    Individuals
#
#################################################################

###  http://knowledge.eagle-learning.eu/base#Term

:Term rdf:type owl:NamedIndividual ,
               [ rdf:type owl:Restriction ;
                 owl:onProperty skos:inScheme ;
                 owl:someValuesFrom :Vocabulary
               ] ,
               [ rdf:type owl:Restriction ;
                 owl:onProperty skos:inScheme ;
                 owl:allValuesFrom :Vocabulary
```

```
                ] .

###  http://www.eagle-learning.eu/base#
eagle: rdf:type owl:NamedIndividual ;
       dcterms:title "EAGLE Base Term Ontology"@en .
```

LISTING 5: EAGLE ONTOLOGY (VERSION 1.0)