

Multimedia Ontology Life Cycle Management with the SALERO Semantic Workbench

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Abstract. Ontologies are gaining increased importance in the area of multimedia retrieval or management as they try to overcome the commonly known drawbacks of existing multimedia metadata standards for the descriptions of the semantics of multimedia content. In order to build and use ontologies, user have to receive appropriate support. This paper presents the *SALERO Semantic Workbench* which offers a set of services to engineer and manage ontologies throughout their life cycle, i.e., from their (semi-) automatic creation through its storage and use in annotation and search.

1 Introduction

The overall goal of the integrated project SALERO¹, as introduced in [1], is to define and develop “intelligent content” with context-aware behavior for self-adaptive use and delivery across different platforms, building on and extending research in media technologies and web semantics to reverse the trend towards ever-increasing cost of creating media. To support the aforementioned aim, semantic technologies have been identified as a viable solution [2]. Ontologies are commonly acknowledged as being a core ingredient of any solution based on semantic technologies as a means to capture the semantics of a domain of discourse and to provide formally represented machine readable models of it. In that sense, one goal of the SALERO project is to create ontologies which support the annotation and semantic search of media resources.

In order to pave the way for the use of ontologies and semantic technologies in media production, SALERO developed a management framework for multimedia ontologies, tools to annotate existing media resources and semantic search facilities to retrieve resources based on semantic annotations. The framework, which offers these functionalities, is introduced in the following.

2 The SALERO Semantic Workbench

The *SALERO Semantic Workbench* supports the creation, management, and use of domain ontologies which includes the following main functionalities (cf. Figure 1):

¹ <http://www.salero.eu>

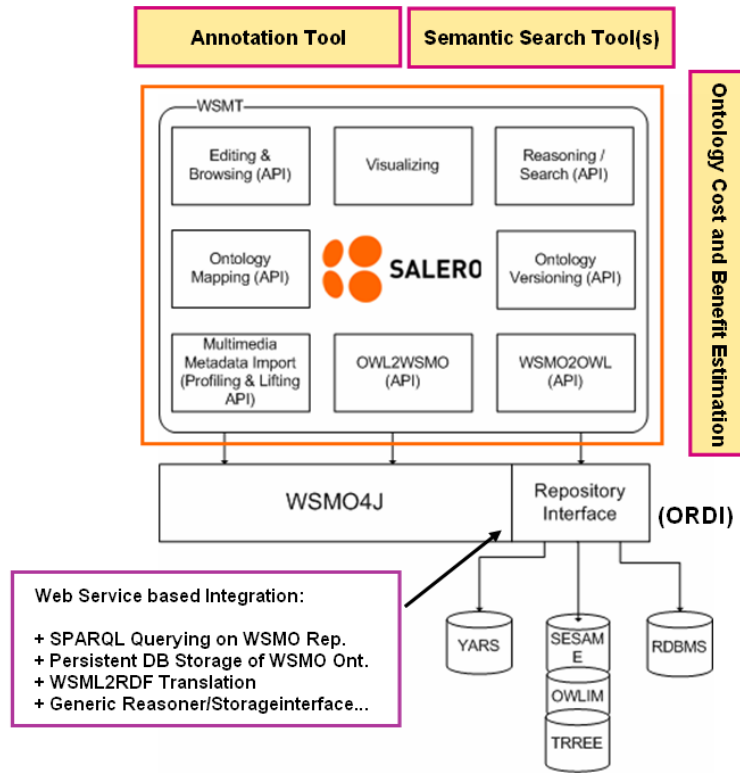


Fig. 1. The SALERO Semantic Workbench – High Level Architecture

1. **Ontology Management** whose central aspects include manual and semi-automatic creation of domain ontologies, alignment of different domain descriptions, translations of ontologies, versioning, or storage of ontologies.
2. **Annotation Support** whose central aspects includes the support for non-technological users with the annotation of media items which is realized in several annotation tools.
3. **Semantic Search Support** which offers advanced retrieval capabilities based on semantic annotations.

To realize this functionality, the workbench not only offers a graphical user interface to engineer ontologies, but also a set of services which provide ontology management functionality to other applications. The workbench acts in the background and its central aspects are thus realized as an API which is designed with the aim to integrate the functionality needed for semantic media annotation and semantic search into plug-ins and interfaces of other applications. This includes most notably storage, querying, or retrieval of annotations.

2.1 Ontology Management

The part of the workbench for the management of ontologies is based on the Web Service Modeling Toolkit (WSMT) that, among others, provides a set of graphical tools for the engineering of WSMO ontologies, for the interaction with external tools such as execution environments and repositories [3].² WSMT is a collection of tools for the engineering of Semantic Web Services and ontologies implemented in the Eclipse framework.³ In SALERO we added the possibility to persistently store and access ontologies in an ontology repository as realized by the *Repository Service* described below.

2.2 Workbench Services

The services offered by the semantic workbench include:

- **The Repository Service** which offers an API for the persistent storage of WSML⁴ ontologies and their elements (e.g., concepts, properties, axioms). It supports management of these elements and the execution of SPARQL queries. The service is realized on top of the *Ontology Representation and Data Integration (ORDI)* – framework, which most notably provides a scalable repository implementation, a WSMO-RDF parser, serializer, and access to query and reasoning facilities.⁵
- **The Annotation Service** is concerned with the management of semantic annotations and provides an API to manage and validate annotations against the ontologies stored in the repository.
- **The Semantic Search Service** offers an API to search for ontology elements and additionally offers keyword-based search for annotations which is expanded into full-text queries on a generated index and SPARQL queries.
- **The Ranking Service** offers functionality to rank media resources based on semantic annotations. This service is used by the semantic search and the recommendation service.
- **The Recommendation Service** offers an API for retrieval of ontology elements which are prominently used for annotation and gives recommendations of related results during search.
- **The Profiling and Lifting Service** can be used to extract structural semantic information from existing MPEG-7⁶ documents and for their semantic enrichment.

2.3 Tool and Annotation Support

Besides tools for ontology management, the workbench is accompanied with a tool set for annotation and semantic search: the *SALERO Intelligent Media*

² <http://sourceforge.net/projects/wsmt/>

³ <http://www.eclipse.org/jdt/>

⁴ <http://www.wsmo.org/wsml/wsml-syntax>

⁵ <http://www.ontotext.com/ordi>

⁶ <http://www.chiariglione.org/mpeg/standards/mpeg-7/mpeg-7.htm>

Annotation & Search (IMAS) system [4]. The IMAS integrates annotation and search into one application and further provides access to content-based search facilities. Both semantic search and content-based search can be accessed via a single interface and the results are being fused.

In order to adequately support non-experienced users in annotation, the workbench offers a methodology to support the users including (i) the selection of adequate ontology elements and (ii) the extension of ontologies during annotation time (cf. [5]).

3 Conclusions

This paper presented the *SALERO Semantic Workbench* which offers functionalities to manage ontologies throughout their life cycle which most notably includes their manual or semi-automatic engineering and use in annotation and search. In SALERO, some services of the workbench have been specialized to be used for media resources, such as the ranking or profiling and lifting service, while other services, and especially the foundational ontology management functionality, can be used with any ontology and any type of resource.

The services of the workbench have been implemented in the course of SALERO and are underlying the previously introduced *SALERO Intelligent Media Annotation & Search* (IMAS) system which is available online.⁷ Preliminary evaluation results of the IMAS annotation functionality are presented in [6].

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⁷ <http://salero.joanneum.at/imas/>