Living Semantic Platform

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ABSTRACT

The Living Semantic Platform (LSP) is a web-based and collaborative development environment for lightweight ontologies based on OWL2 QL. Moreover, it includes an integrated OWL2 QL reasoner which allows for efficient query answering based on SPARQL queries.

Categories and Subject Descriptors

I.2.4 [ARTIFICIAL INTELLIGENCE]: Knowledge Representation Formalisms and Methods – semantic networks

General Terms

Management, Documentation, Design

Keywords

Collaborative ontology development, OWL2 QL, query answering, SPARQL

1. INTRODUCTION

Semantic technologies, especially ontologies, have a broad range of application areas. Topics include but are not limited to knowledge discovery, data integration, enterprise linked data, knowledge visualization and content management. Such applications rely on ontologies to formalize knowledge domains and utilize query answering to satisfy the information needs of domain experts.

However, building such semantic applications nowadays still requires a high level of programming knowledge to weave together the right frameworks, libraries and reasoner for every industrial use case. On top of that, the actual ontology has to be developed and the actual application has to be implemented.

Therefore, we have developed a modular and extensible platform – the Living Semantic Platform (LSP) - to foster the use of ontologies as a formal foundation for business applications. LSP not only includes a fully functional ontology editor but also an OWL2 QL reasoner, which works on the same data backend. Any changes to the ontology are immediately available for query answering. By complying to open standards from W3C we ensure sustainability of the developed applications.

Developers can thus focus on the actual business use case and its representation using ontologies rather than deciding for the correct versions of frameworks and libraries. While LSP provides various means to access and analyze the formalized knowledge, open interfaces allow for querying the ontologies within custom software systems.

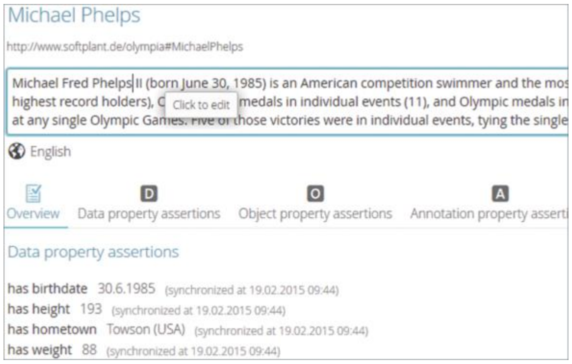
2. SYSTEM ARCHITECTURE

The key idea behind LSP is to utilize the same data backend for query answering as well as ontology management. Ontologies no longer have to be stored in the file systems or specialized RDF storages but are managed within broadly available relational database management systems (RDBMS). The QL profile of OWL2 provides a specific subset of the OWL language features to allow for efficient query answering implemented through rewriting queries, e.g. in SPARQL Protocol And RDF Query Language (SPARQL), to SQL queries that can be posed to RDBMS. Technical details about our implemented rewriting algorithm, the actual database design and its performance can be found in [1].

Based on the data backend required for rewriting we have implemented a web-based application which enables a live ontology editing. All changes modeled in the ontologies are immediately available to the reasoner. Various features extend core ontology editing features so use cases, such as data integration, can be easily covered.

3. FEATURES

3.1 Collaborative Ontology Development



Michael Phelps

http://www.softplant.de/olympia#MichaelPhelps

Michael Fred Phelps II (born June 30, 1985) is an American competition swimmer and the mos
highest record holders), C Click to edit medals in individual events (11), and Olympic medals in
at any single Olympic Games. Five of those victories were in individual events, tying the single

English

Data property assertions

has birthdate 30.6.1985 (synchronized at 19.02.2015 09:44)
has height 193 (synchronized at 19.02.2015 09:44)
has hometown Towson (USA) (synchronized at 19.02.2015 09:44)
has weight 88 (synchronized at 19.02.2015 09:44)

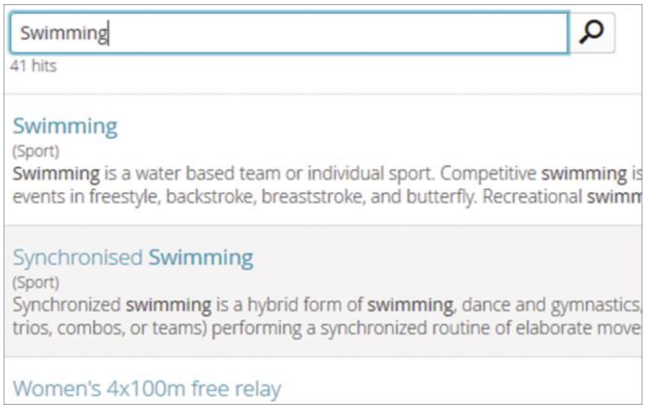
Figure 1. Web-based interface.

SEMANTiCS '15, September 15 - 17, 2015, Vienna, Austria

ACM 978-1-4503-3462-4/15/09…$15.00
DOI: http://dx.doi.org/10.1145/2814864.2814893

LSP implements a web-based and multilingual user interface and allows for team based collaborative ontology development. The user edits all ontology elements directly within the web-based interface (Figure 1).

An integrated search engines provides a full text search within all elements of the stored ontologies (Figure 2).



Swimming

41 hits

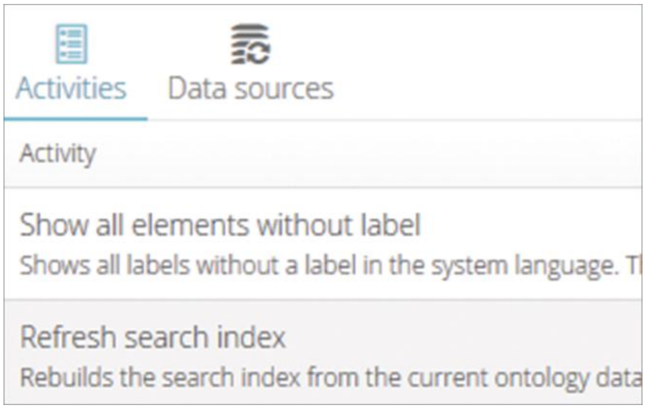
Swimming
(Sport)
Swimming is a water based team or individual sport. Competitive **swimming** is
events in freestyle, backstroke, breaststroke, and butterfly. Recreational swimm

Synchronised **Swimming**
(Sport)
Synchronized **swimming** is a hybrid form of **swimming**, dance and gymnastics,
trios, combos, or teams) performing a synchronized routine of elaborate move

Women's 4x100m free relay

Figure 2. Full text search.

For the quality management of ontologies a dedicated management and gardening area has been realized (Figure 3).



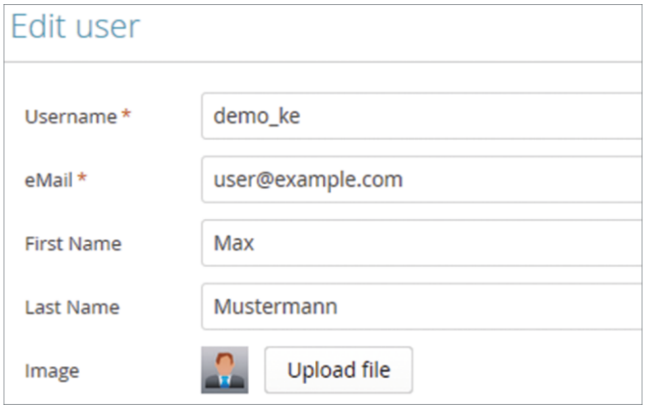
Activity

Show all elements without label
Shows all labels without a label in the system language. T

Refresh search index
Rebuilds the search index from the current ontology data

Figure 3. Management and gardening.

An integrated role-based access control system allows for restricting the access of users to different features and modules (Figure 4).



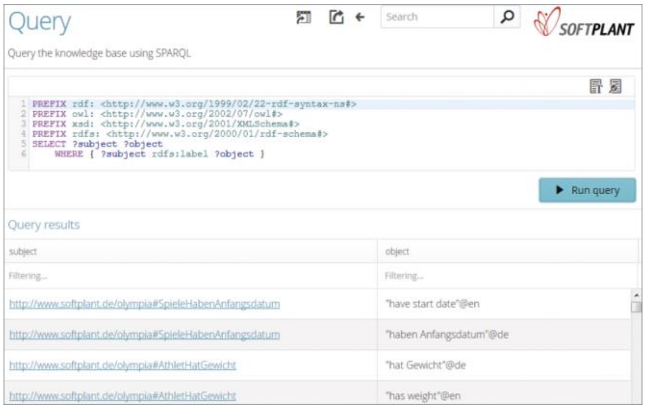
Edit user

Username *	demo_ke
eMail *	user@example.com
First Name	Max
Last Name	Mustermann
Image	Upload file

Figure 4. User Management.

3.2 Integrated Reasoner

An integrated OWL2 QL reasoner enables query answering using SPARQL (Figure 5).



Query

Query the knowledge base using SPARQL

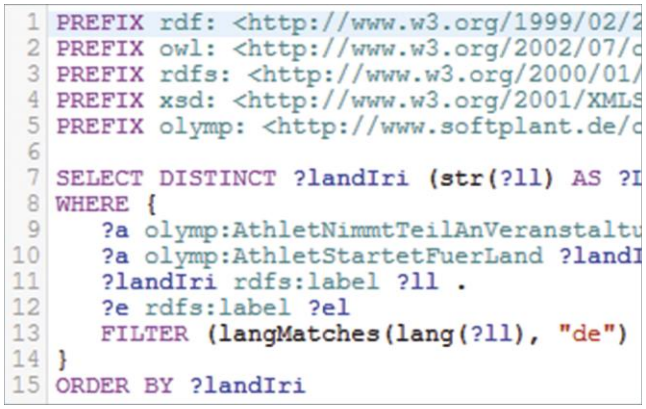
```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
SELECT ?subject ?object
    WHERE { ?subject rdfs:label ?object }
```

Query results

subject	object
Filtering...	Filtering...
http://www.softplant.de/olympia#SpieleHabenAnfangsdatum	"have start date"@en
http://www.softplant.de/olympia#SpieleHabenAnfangsdatum	"haben Anfangsdatum"@de
http://www.softplant.de/olympia#AthletHatGewicht	"hat Gewicht"@de
http://www.softplant.de/olympia#AthletHatGewicht	"has weight"@en

Figure 5. Integrated OWL2 QL reasoner.

Creating queries is supported by a SPARQL editor including keyword highlighting and code completion (Figure 6).

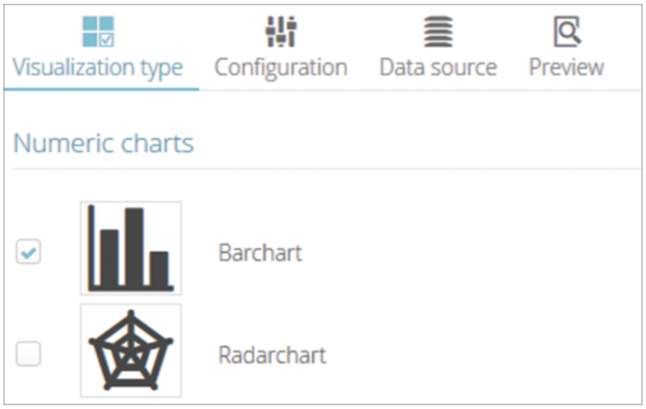


```
PREFIX rdf: <http://www.w3.org/1999/02/2
PREFIX owl: <http://www.w3.org/2002/07/c
PREFIX rdfs: <http://www.w3.org/2000/01/
PREFIX xsd: <http://www.w3.org/2001/XMLS
PREFIX olymp: <http://www.softplant.de/c

SELECT DISTINCT ?landIri (str(?ll) AS ?I
WHERE {
   ?a olymp:AthletNimmtTeilAnVeranstaltu
   ?a olymp:AthletStartetFuerLand ?landI
   ?landIri rdfs:label ?ll .
   ?e rdfs:label ?el
   FILTER (langMatches(lang(?ll), "de")
}
ORDER BY ?landIri
```

Figure 6. SPARQL editor.

Recurring queries are parametrized and stored within the platform. Furthermore, various visualizations of queries can be configured and saved (Figure 7).



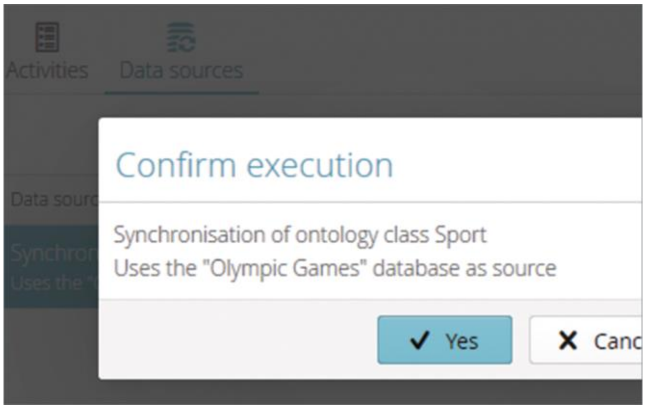
Numeric charts

☑ Barchart

☐ Radarchart

Figure 7. Visualizations.

For business use cases that include the reuse of existing information sources such as SQL databases, Excel, XML or PDF files we have implemented a data integration layer which allows for mapping external data sources to specific ontology elements within the LSP. The information stored in LSP can therefore be synchronized with the actual data source (Figure 8).



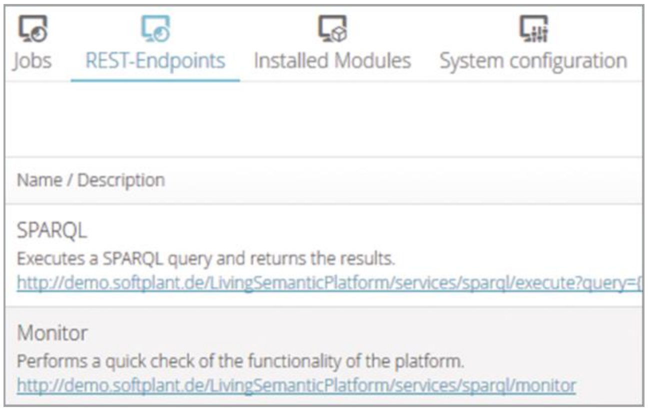
Confirm execution

Synchronisation of ontology class Sport
Uses the "Olympic Games" database as source

Figure 8. Data integration.

3.3 Modular Extendable Platform

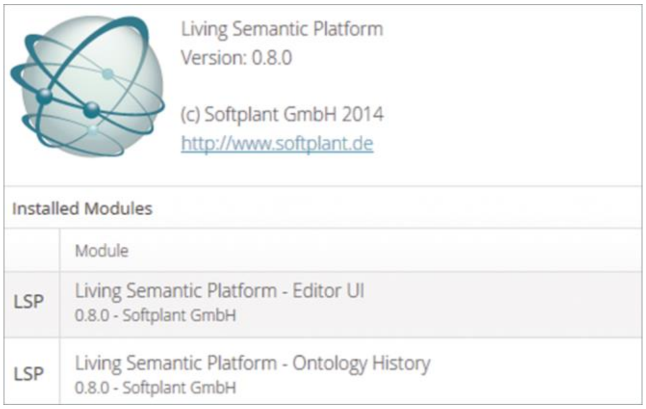
LSP is an open platform. The managed ontologies and the integrated reasoner can be accessed via REST interfaces (Figure 9).



Name / Description
SPARQL Executes a SPARQL query and returns the results. http://demo.softplant.de/LivingSemanticPlatform/services/sparql/execute?query=(
Monitor Performs a quick check of the functionality of the platform. http://demo.softplant.de/LivingSemanticPlatform/services/sparql/monitor

Figure 9. REST endpoints.

Developers can create own extensions for LSP and deploy them into the platform (Figure 10).



Living Semantic Platform
Version: 0.8.0

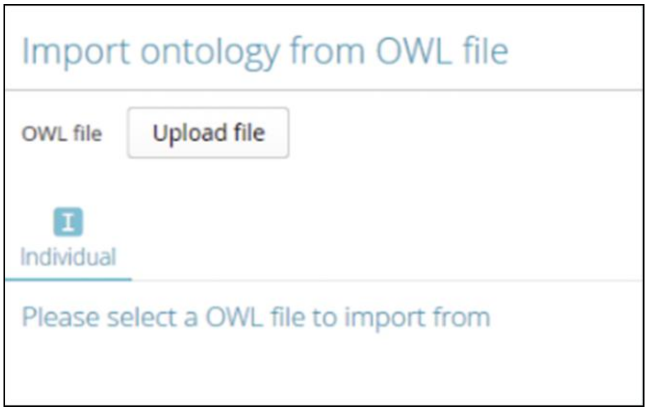
(c) Softplant GmbH 2014
http://www.softplant.de

Installed Modules

	Module
LSP	Living Semantic Platform - Editor UI 0.8.0 - Softplant GmbH
LSP	Living Semantic Platform - Ontology History 0.8.0 - Softplant GmbH

Figure 10. Modular platform.

Importing existing OWL ontologies enables a quick start for using LSP as an ontology development tool (Figure 11).



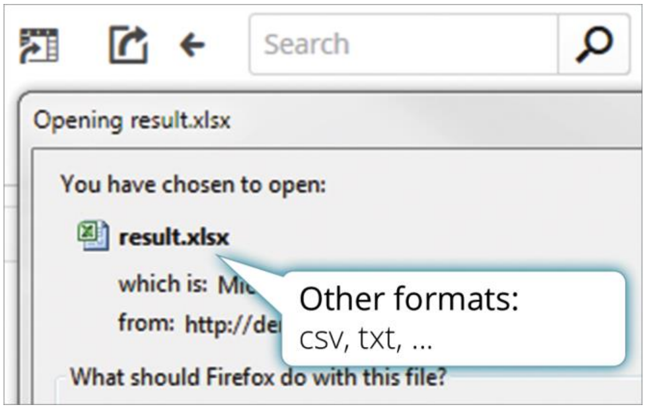
Import ontology from OWL file

OWL file

Please select a OWL file to import from

Figure 11. Import for OWL ontologies.

Query results can be exported using different file formats (Figure 12).



Opening result.xlsx

You have chosen to open:

result.xlsx

which is: Mic

from: http://de

What should Firefox do with this file?

Figure 12. Export to various formats.

4. CONCLUSION

The Living Semantic Platform is a novel commercial platform for building semantic business applications. It seamlessly integrates an ontology editor with a reasoner while utilizing IT infrastructure components that have a wide distribution in today's enterprises. Knowledge engineers are able to focus on developing the required business ontologies with a modern and web-based editor. Software developers can finally access all ontology data by either using a generic SPARQL REST endpoint or build their applications on queries prepared by knowledge engineers and stored within the Living Semantic Platform.

An online demo is accessible at www.living-semantic-platform.de – section Demo and Licensing.

5. REFERENCES

[1] Schönfisch, J. and Ortmann, J. 2013. YARR! Yet Another Rewriting Reasoner. Informal Proceedings of the 2nd International Workshop on OWL Reasoner Evaluation (ORE-2013) co-located with the 26th International Workshop on Description Logics (DL 2013) Ulm, Germany, July 22, 2013, in CEUR-WS vol. 1015, pp.19-25