

A User Interface for Ontology Repositories

Jouni Tuominen, Mikko Salonoja, Kim Viljanen, and Eero Hyvönen

Semantic Computing Research Group (SeCo)

Aalto University, School of Science and Technology, and University of Helsinki

<http://www.seco.tkk.fi/>, firstname.lastname@tkk.fi

Abstract. Finding ontologies and concepts from a collection of ontologies is a recurring task in many use cases, such as content indexing, searching, and ontology developing. To facilitate this, efficient search and browsing methods are needed. This paper introduces ONKI2, an ontology browser providing a user interface for a repository of ontologies. The system provides a multi-facet search facility for finding an ontology. Finding concepts is supported by autocompletion-based text search that can be refined with additional restrictions. ONKI2 is in use in the Finnish Ontology Library Service ONKI for a collection of 79 ontologies and vocabularies.

1 Introduction

Tools for finding ontologies and concepts are needed in many use cases, such as ontology development, ontology-based content indexing, and searching [1]. When looking for a suitable ontology for a given task in an ontology repository [1–4], methods for filtering the ontologies based on the needs of the user are needed. This can be facilitated using the metadata of the ontologies (e.g. name, description, subject, type) and the contents of the ontologies (i.e. the concepts of the ontology). Also, getting an overview presentation of an ontology is important for understanding the domain, purpose, and structure of the ontology. When browsing an ontology, the concepts should be presented in a clear, meaningful way to the end-user.

This paper introduces ONKI2¹, an ontology browser providing a user interface for a repository of ontologies and vocabularies. The goal of ONKI2 is to provide means for finding and utilizing ontologies for content indexers, information searchers, and ontology developers. The introduced system is in use providing access to a collection of 79 ontologies of various domains. In the following, means for finding ontologies and concepts in ONKI2 are first presented. After this, the system implementation is described. In conclusion, related work is discussed and the contributions of the paper are summarized.

2 Finding Ontologies

Finding a suitable ontology in a repository of ontologies may be laborious without efficient filtering methods. To facilitate the search process of an ontology,

¹ <http://www.yso.fi/onki2/?l=en>

ONKI2 provides a multi-facet search interface integrated with text search. The idea is illustrated in Fig. 1. The available facets are the subject, structure, and publishing status of the ontology. The ontologies are assigned to the facets by utilizing the ontology metadata provided by the ontology developers, allowing filtering ontologies from different perspectives. The autocompletion text search is matched to the names and descriptions of the ontologies. In Fig. 1 the user is searching for a public (publishing status facet) advanced vocabulary (structure facet) in the domain of health or nature (subject facet) with a query string “mes”.

The screenshot shows a search interface with a search bar containing 'mes' and a '2 hits' indicator. The results are organized into three facets: Subject, Structure, and Publishing status. The Subject facet shows 2 results: Health and Nature. The Structure facet shows 2 results: Advanced vocabulary and Project ontology/vocabulary. The Publishing status facet shows 1 result: Public ONKI-ontology. To the right, two ontology descriptions are displayed: 'Medical Subject Headings - MeSH' and 'Ontology of the Birds of the World'.

Facet	Count	Selected
Subject	2	<input checked="" type="checkbox"/>
1 Business		<input type="checkbox"/>
1 Geography		<input type="checkbox"/>
1 Health		<input checked="" type="checkbox"/>
1 Nature		<input checked="" type="checkbox"/>
Structure	1	<input checked="" type="checkbox"/>
1 Class ontology		<input type="checkbox"/>
2 Advanced vocabulary		<input checked="" type="checkbox"/>
Publishing status	1	<input checked="" type="checkbox"/>
2 Public ONKI-ontology		<input checked="" type="checkbox"/>
1 Project ontology/vocabulary		<input type="checkbox"/>

Medical Subject Headings - MeSH
MeSH is the National Library of Medicine's controlled vocabulary thesaurus. It consists of sets of terms naming descriptors in a hierarchical structure that permits searching at various levels of specificity.

Ontology of the Birds of the World
The Ontology of the Birds of the World is based on the list of Finnish Names of the Birds of the World, checked and updated by the BirdLife Finland in the years 2004-2006. The list was initially created by the Finnish Ornithological Society in the years 1981-1992, 1993-1999 and 1999. The ontology contains the names for 194 families, 1227 genera and 9740 species.

Fig. 1. Multi-facet search view of ontologies.

Once an ontology is found, it can be further examined by accessing the directory view of the ontology. The purpose of the directory is to give an overview of an ontology and act as a starting point for browsing it. Depending on the type of the ontology, the directory is either based on the groups categorizing the concepts, on the topmost concepts of the ontology (in SKOS vocabularies), or on the alphabetical ordering of the concepts. ONKI2 also supports searching ontologies based on their contents. An autocompletion text search is provided, matching to the labels of the concepts in all the ontologies of the collection. Thus, the user can find all the ontologies containing e.g. the concept “cat”. Concept searching is discussed in more details in the following section.

3 Finding Concepts

For finding concepts in a collection of ontologies, ONKI2 provides a user interface with searching and browsing functionalities, as depicted in Fig. 2. Concepts can be searched by using autocompletion text search with a possibility to set additional restrictions. All the ontologies in the collection can be searched simultaneously, or alternatively the search can be limited to a single ontology. In both cases, the search is matched to the labels of the concepts. The search can be restricted to the concept labels in a specific language, to a specific concept type, to the group of concepts, or to the subconcepts of a specific concept.

Ontologies and vocabularies > The United Nations Standard Products and Services Code - UNSPSC > Search

The United Nations Standard Products and Services Code - UNSPSC

Search (info):

Subconcept restriction: Services

Results / page: 20 50 100
 The way property values are displayed: value/row values side by side

Results (7 hits):
[\[expand all\]](#)

[+] Apartment construction

[-] Apiculture

Broader terms: [UNSPSC](#) URI: <http://www.yso.fi/onto/unspsc/C70121610>

- └ [Services](#)
- └ [Farming and Fishing and Forestry and Wildlife Contracting Services](#)
- └ [Livestock services](#)
- └ [Livestock industry](#)

Mehiläishoito (fi)

Coordinate terms: [Animal husbandry](#)
[Bovine production services](#)
[Farm rearing systems](#)
[Livestock breeding](#)

Fig. 2. Concept searching and browsing in the UNSPSC vocabulary.

The search result is presented as a list of concept label links. If there are several concepts with a same label, the concepts are grouped together assuming that they might be equivalent. When the user selects a concept, the properties of the concept are shown below the concept label, eliminating the need for unnecessary navigation between different views of the concepts. The properties are displayed in an ontology-specific meaningful order for the end-user in order to support concept understanding. The order can be specified by the developers of the ontology. Also, possible unnecessary properties can be filtered out from the property view. Moreover, the user can choose how the property values are displayed in the view. The values can either be presented compactly to minimize the used screen space, or more loosely for improved clarity. In the loose presentation mode, the superconcepts of the concept are presented as an indented hierarchy tree. In ontologies containing geographical information, a map user interface component can be used for visualizing the concepts, e.g. by placing geographical regions and points on the map.

All the property values of concepts that are resources (concepts, types, groups) are displayed as links leading to a corresponding concept or concept set, enabling the browsing of ontologies. This means that when selecting a concept from the concept hierarchy or among the related concepts of a concept, the properties of the selected concept are shown. If the selected resource is a concept group, the concepts belonging to the group are displayed as a search result list. Similarly, if a concept type is selected, concepts of that type are displayed. Mapping relations between ontologies can be used for inter-ontology browsing.

In Fig. 2 the user is searching for concepts in the vocabulary United Nations Standard Products and Services Code (UNSPSC)² that are subconcepts of the concept “Services”. The string “ap” was used for querying the concept labels. From the search results, the user has selected the concept “Apiculture” for further investigation.

4 System Implementation

ONKI2 is implemented as a PHP³ application by using the Zend Framework⁴ for providing the Model-View-Controller architecture. The ontology multi-facet search view is generated with the SIMILE Exhibit Publishing Framework⁵. For processing the metadata of the ontologies, the ARC RDF library⁶ is used. The map user interface component is provided by Google Maps⁷.

The ontologies accessed with ONKI2 are represented by using RDFS, OWL, and SKOS. The ontologies are published in ONKI SKOS ontology server [5] instances. The ONKI SKOS servers are accessed by utilizing their HTTP API⁸ for generating the ontology directory views, providing concept search and showing the properties of the concepts.

5 Discussion

The previously developed Ontology Library Service ONKI [1] supports publishing a collection of ontologies in different ontology servers, such as ONKI SKOS [5]. However, the ontologies are displayed only as a simple listing, and searching for concepts from all the ontologies simultaneously is not supported. Browsing between ontologies is possible if the ontologies contain mapping relations. BioPortal [2] is an ontology repository for accessing and sharing ontologies in the biomedical domain. The system is also used in the Open Ontology Repository Initiative [4]. It supports searching for concepts from all the ontologies and browsing between ontologies. Ontologies can be filtered based on their categories and groups.

Another ontology repository supporting concept searching and browsing of a collection of ontologies is Cupboard [3]. It provides an overview for an ontology by generating a graph of the key concepts of the ontology. It also supports collaboration by introducing commenting and reviewing options and shared spaces for publishing and grouping ontologies. Also semantic web search engines such as Watson [6], Swoogle [7], and Sindice⁹ provide means for locating ontologies

² <http://www.unspsc.org>

³ <http://www.php.net>

⁴ <http://framework.zend.com>

⁵ <http://www.simile-widgets.org/exhibit/>

⁶ <http://arc.semsol.org>

⁷ <http://maps.google.com>

⁸ <http://www.yso.fi/onkirest/>

⁹ <http://sindice.com>

and concepts on the web. However, as general RDF search engines, their support for understanding and browsing ontologies is rather limited due to the lack of visualization methods suited for ontologies.

ONKI2 is a general-purpose ontology browser for a collection of ontologies, supporting finding ontologies and concepts from the collection. The ontologies and their concepts are displayed in a meaningful, intuitive way for facilitating their understanding and usage as ready to use ontology web services [1, 5]. Furthermore, ONKI2 provides access to a network of distributed ontology repositories conforming to the Linked Open Ontology Services (LOOS) architecture [8].

Acknowledgements This work is part of the National Semantic Web Ontology project in Finland¹⁰ (FinnONTO, 2003–2012), funded mainly by the National Technology and Innovation Agency (Tekes) and a consortium of 38 organizations.

References

1. Viljanen, K., Tuominen, J., Hyvönen, E.: Ontology libraries for production use: The Finnish ontology library service ONKI. In: Proceedings of the European Semantic Web Conference ESWC 2009, Heraklion, Greece, Springer-Verlag (2009)
2. Noy, N.F., Shah, N.H., Whetzel, P.L., Dai, B., Dorf, M., Griffith, N., Jonquet, C., Rubin, D.L., Storey, M.A., Chute, C.G., Musen, M.A.: BioPortal: ontologies and integrated data resources at the click of a mouse. *Nucleic Acids Research* **37**(Web Server issue) (2009)
3. d’Aquin, M., Lewen, H.: Cupboard - a place to expose your ontologies to applications and the community. In: Proceedings of the European Semantic Web Conference ESWC 2009, Heraklion, Greece, Springer-Verlag (2009)
4. Baclawski, K., Schneider, T.: The open ontology repository initiative: Requirements and research challenges. In: Proceedings of Workshop on Collaborative Construction, Management and Linking of Structured Knowledge at the ISWC 2009, Washington DC., USA (2009)
5. Tuominen, J., Frosterus, M., Viljanen, K., Hyvönen, E.: ONKI SKOS server for publishing and utilizing SKOS vocabularies and ontologies as services. In: Proceedings of the European Semantic Web Conference ESWC 2009, Heraklion, Greece, Springer-Verlag (2009)
6. d’Aquin, M., Baldassarre, C., Gridinoc, L., Sabou, M., Angeletou, S., Motta, E.: Watson: Supporting next generation semantic web applications. In: Proceedings of IADIS International Conference on WWW/Internet, Vila Real, Portugal (2007)
7. Ding, L., Finin, T., Joshi, A., Pan, R., Cost, R.S., Peng, Y., Reddivari, P., Doshi, V., Sachs, J.: Swoogle: a search and metadata engine for the semantic web. In: Proceedings of the ACM International Conference on Information and Knowledge Management, New York, NY, USA, ACM (2004)
8. Viljanen, K., Tuominen, J., Salonoja, M., Hyvönen, E.: Linked open ontology services. In: Proceedings of the Workshop on Ontology Repositories and Editors for the Semantic Web (ORES 2010), the Extended Semantic Web Conference ESWC 2010, Heraklion, Greece (2010)

¹⁰ <http://www.seco.tkk.fi/projects/finnonto/>