

# Deploying National Ontology Services: From ONKI to Finto

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**Abstract.** The Finnish Ontology Library Service ONKI was published as a living laboratory prototype for public use in 2008. Its idea is to support content indexers and ontology developers via a browser interface and machine APIs. ONKI has been well-accepted, but being a prototype maintained by the ending research project FinnONTO (2003–2012), a more sustainable service was needed, supported by permanent governmental funding. To achieve this, ONKI was deployed and is being further developed by the National Library of Finland into a new national vocabulary service Finto. We discuss challenges in the deployment of ONKI into Finto and lessons learned during the transition process.

## The Vision: A National Ontology Service

In Finland, a major research initiative FinnONTO [4] was carried out in 2003–2012 with the goal of providing a national level semantic web ontology infrastructure based on centralized ontology services. Since 2008, a prototype of such a system, the ONKI Ontology Service<sup>1</sup> [9,8] has been used in a living laboratory experiment with more than 400 daily human visitors and over 400 registered domains using its web services, including the ONKI mash-up widget for annotating content in legacy systems and semantic query expansion. The FinnONTO infrastructure also includes the notion of creating and maintaining a holistic Linked Open Ontology Cloud KOKO that covers different domains, is maintained in a distributed fashion by expert groups in different domains, and is provided as a national centralized service.

In 2013, the Ministry of Education and Culture and the Ministry of Finance decided to finance the deployment of ONKI and its key ontologies into a sustainable, free, national service Finto<sup>2</sup> (Finnish Thesaurus and Ontology Service), created and maintained by the National Library of Finland. Finto was opened to the public in January 2014, and the API services of ONKI were redirected to Finto in June. This paper summarizes, from a technical standpoint, the major ideas and components underlying Finto and lessons learned during the deployment process. Issues encountered in ontology engineering regarding, e.g., concept analysis and linguistic aspects have been discussed in a separate paper [5].

<sup>1</sup> <http://onki.fi>

<sup>2</sup> <http://finto.fi>

## Deploying Ontology Services

ONKI/Finto supports the publication of ontologies by providing a centralized place for finding, accessing, and utilizing ontologies—the key functions of ontology libraries [2]. Using ontologies and integrating them in applications is made easier because different ontologies can be accessed via the same user interfaces and APIs.

**User groups** ONKI/Finto ontologies are used by both humans and machines. We identified three main human user groups, with slightly different needs in the user interface: full-time annotators (indexers working at, e.g., libraries and museums), users performing annotation as part of their other duties (e.g., journalists publishing articles), and ontology developers. In addition, users looking up information in databases use the service either directly, to look up suitable keywords, or indirectly via APIs used by the search system. The Finto user interface is designed to serve them all. For machine use and application developers, the service provides a variety of APIs with supporting documentation.

**Finto service utilizing Skosmos software** The development of a successor system for ONKI started within the FinnONTO project. The first step was ONKI Light [6], a prototype for an ontology browser on top of a SPARQL endpoint. The software has since evolved into Skosmos<sup>3</sup>, a vocabulary browser using SKOS and SPARQL, developed at the National Library. Skosmos provides a multilingual user interface for browsing and searching, and for visualizing concept hierarchies. The user interface has undergone repeated usability tests. The Finto service is set up as a specific installation of Skosmos, but Skosmos can be used to provide ontology services anywhere. As of September 2014, Finto serves more than 600 human visitors per day, of which 200 are returning users.

Skosmos relies on a SPARQL endpoint (Apache Jena Fuseki with the jena-text index) as its back end and is implemented mainly in PHP. The main benefits of using a SPARQL endpoint is that the data provided by the service is always up to date. This allows fast update cycles in vocabulary development. Vocabularies are pre-processed using Skosify [7] to ensure that they are valid SKOS. The source code is available under the MIT license.

**Machine access to concepts** The ONKI system offers machine access to ontologies not only by publishing Linked Data, but also custom APIs more suited for integration to e.g. document and collection management systems. ONKI provides three main APIs: a SOAP API, an HTTP API, and a JavaScript widget [8]. These have been integrated into systems used in museums, archives and libraries. For Finto and Skosmos, a new native REST API<sup>4</sup> providing RDF/XML, Turtle or JSON-LD serializations was developed and API wrapper code implemented to support the ONKI APIs. The ONKI system is still available for browsing ontologies, but API calls to ONKI were redirected to Finto in June 2014. The Finto API serves more than 100,000 accesses on a busy day, while the old APIs receive between 10,000 and 15,000 hits.

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<sup>3</sup> <https://github.com/NatLibFi/Skosmos>

<sup>4</sup> <http://api.finto.fi>

## Ontologies in ONKI and Finto

At the heart of ONKI/Finto lies the General Finnish Ontology YSO. The National Library took over the development of YSO in 2013. Since then, special attention has been paid to making YSO intuitive and user-friendly without losing the benefits of machine-readable semantics. The top-level ontology has been reworked, multilingual aspects have been refined, and work is under way to link YSO to the Library of Congress Subject Headings (LCSH). The original OWL representation was changed to SKOS, with some extensions from ISO 25964<sup>5</sup>.

During the FinnONTO project, many YSO-based domain ontologies were created in collaboration with expert organizations. YSO is used as the central hub relating all the domain ontologies to one another while minimizing the number of direct links between them. The aim here is to facilitate the distributed development of the domain ontologies in expert organizations while allowing the domain ontology developers to worry only about links and changes to one other ontology. Their content is aggregated into the unified ontology cloud KOKO [3].

The work on this cloud of interlinked ontologies was begun during FinnONTO and has now been continued at the National Library. The ultimate goal is to use KOKO to relate the annotations in the datasets of the various organizations, facilitating interoperability and breaking down silos. KOKO has been in pilot use as an annotation vocabulary in, e.g., various museums and at the National Broadcasting Company YLE – in organizations that potentially manage material from all possible domains.

In addition to YSO, KOKO and the YSO-based domain ontologies, a number of thesauri, classifications and other controlled vocabularies have been published in Finto, including Medical Subject Headings<sup>6</sup>, Iconclass<sup>7</sup>, and Lexvo<sup>8</sup> language codes, so they can be used via the same user interface and APIs. Currently 27 vocabularies are available and more are being prepared for publishing.

## Experiences during Deployment

The process of transitioning users from ONKI to Finto has generally been smooth. The ONKI name had been used for several related but distinct initiatives, so the name Finto was chosen to avoid confusion. The Finto user interface has undergone multiple rounds of usability testing and is already well-liked by users, but the implementation could be further improved in terms of speed and scalability. The bottleneck is often the SPARQL endpoint.

During usability testing, the System Usability Score (SUS) [1] was calculated for the Finto system. The average score from 8 user tests was 80 points (out of 100), with individual scores ranging from 68 to 88 points. In earlier usability tests on the ONKI system, the average score from 14 user tests was 48 points.

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<sup>5</sup> <http://www.niso.org/schemas/iso25964/>

<sup>6</sup> <http://www.nlm.nih.gov/mesh/>

<sup>7</sup> <http://iconclass.org>

<sup>8</sup> <http://lexvo.org>

The transition from ONKI APIs to Finto was managed by testing the new wrapper implementations both internally and among major user organizations well in advance of their deployment. Nevertheless, some problems had to be resolved after the transition, e.g., caching and SSL/TLS issues. Users were simultaneously introduced to new versions of ontologies including YSO and KOKO, which caused compatibility issues. However, those issues were generally resolved in a matter of days. We expect to encounter similar migration issues as ontologies evolve, but the changes are likely to be incremental in nature.

It remains a challenge to convert existing systems, processes and users to the ontology-based environment. Many databases that use thesauri in a traditional fashion (i.e., store terms only) are still in use, both within the library sector and beyond. There are generally few resources to convert legacy systems to make use of ontologies, URIs and APIs. The most significant competitor to Finto remains the VESA online thesaurus search service<sup>9</sup>, which is well-liked by indexers despite being 15 years old. In the future, we expect major growth in the usage of the Finto service, as well as more systems integrated to use the API services. We also expect organizations to deploy their own Skosmos instances to set up their own vocabulary services.

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<sup>9</sup> <http://vesa.lib.helsinki.fi>