

# Sharing and Reusing Aligned Ontologies with Cupboard\*

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## ABSTRACT

This demo presents the Cupboard online system for sharing and reusing ontologies linked together with alignments, and that are attached to rich metadata and reviews.

### Categories and Subject Descriptors

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

### General Terms

Management, Design, Documentation

More and more ontologies are being created, leading to a pressing need for better support in sharing, finding and reusing ontologies. As ontology developers, we need easy ways to make ontologies available, to deploy them and distribute them. As ontology practitioners, we need easier ways to locate ontologies, to quickly make sense of their content and to assess their quality. As ontology application developers, we need infrastructure components to explore, query and exploit ontologies, preferably without the need for large resources. There have been previous attempts in creating ontology repositories<sup>1</sup> and other systems are currently under development<sup>2</sup>. Cupboard is different from classical ontology repositories as it does not provide one single space where ontologies are exposed. On the contrary, each user can create her own ontology space, containing and relating the ontologies she has selected. In this sense, Cupboard is more of a system to host ontology repositories than an ontology repository. It provides a number of advanced functionalities on top of these

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<sup>1</sup>see e.g. <http://olp.dfki.de/ontoselect/>, <http://www.daml.org/ontologies/>

<sup>2</sup>see e.g. Biportal: <http://biportal.bioontology.org/>

ontology spaces to facilitate the management, sharing and reuse not only of stand-alone ontologies, but also of networks of ontologies connected through alignments.

## 1. MANAGING ALIGNED ONTOLOGIES

In terms of interface, each user's ontology space is presented as a set of ontologies, summarized on a web page (see figure 1). Cupboard makes it easy to add ontologies to one's own space by uploading them from the client's computer or from the Web. Each uploaded ontology is processed in many different ways. First, a new base namespace is suggested to the user that corresponds to the location of the ontology in the Cupboard system. If the user chose to accept this modification, it ensures that the entities contained in the ontology will be accessible directly through their URIs in Cupboard. Second, the content of the ontology is indexed using the engine of the Watson system [1]. Based on these indexes, Cupboard provides advanced search mechanisms, allowing users to find and explore ontologies collected through Cupboard, in general and within specific ontology spaces. In addition, the user is presented with a form to enter rich metadata for the ontology, which is pre-filled with information automatically extracted by the Watson engine (e.g., the formal language of the ontology, its size) These metadata are then registered to the Oyster peer-2-peer system [6] and are managed and shared using the OMV ontology metadata vocabulary [4]. Finally, a visual summary of the ontology is built to be displayed on the ontology space's page, displaying the most important/descriptive concepts of the ontology and an abstract view of their relations (see [7] concerning the extraction of key concepts).

In addition ontologies have to be related with each other to be used jointly in applications. Using the Alignment Server [3] as a core component, Cupboard allows users to populate their ontology spaces not only with ontologies, but also with alignments (mappings). The Alignment server is a middleware component for storing and sharing alignments. It enables applications to share high quality and well referenced alignments featuring metadata annotations. It also provides access to libraries of matchers and alignments, offers retrieval,



Figure 1: An ontology space in Cupboard.

manipulation (through applying threshold or transformations), and export of alignments in the adequate formats. In practice, this means that Cupboard users are offered the possibility to find, upload, automatically create and manipulate alignments between the ontologies spaces in order to create networks of ontologies that can be used jointly in applications.

## 2. THE CUPBOARD APIS

There are three aspects to Cupboard, and three reasons to use it. First, as described above, it allows ontology developers to manage and share their ontologies online. Second, for users it facilitates searching and selecting ontologies and alignments to reuse, including in particular reviews and rating for ontologies. Finally, an important usage is made possible by the set of services and APIs Cupboard provides: for developers to create semantic applications relying on the networks of ontologies in Cupboard's ontology spaces.

These services and APIs combine the various functionalities provided by the different components of Cupboard, in a federated way, transforming each ontology space into a virtual infrastructure for semantic applications. They provide remote, programatic interfaces for:

- creating ontology spaces by uploading ontologies, storing and indexing them;
- attaching metadata to ontologies, retrieving them;
- finding ontologies with advanced search techniques;
- generating summaries of ontologies;

- querying ontologies with SPARQL;
- uploading, retrieving and producing alignments between ontologies, rendering these alignments in various languages (OWL, SWRL, C-OWL, etc.);
- producing alignments using an extensible library of ontology matching techniques;
- retrieving reviews and rating of ontologies, ranking ontologies, possibly in a customized way;

The combination of all these mechanisms provides all the necessary elements for building semantic applications exploiting ontologies and ontology networks, without the need for deploying any local, heavy infrastructure components (e.g., stores, query engines)

## 3. FACILITATING ONTOLOGY REUSE

One of the main goals of Cupboard is to facilitate ontology reuse, in a broad sense. Using the services described above, we developed a plugin for the NeOn Toolkit ontology development environment<sup>3</sup>. Experiments realized with groups of users using the Cupboard plugin have shown that by supporting ontology reuse, Cupboard lowers the cost of building ontologies and facilitates the development of better quality ontologies [5].

**Availability:** Cupboard is an online system accessible at [cupboard.open.ac.uk](http://cupboard.open.ac.uk). It is currently in beta test (user registration will be open soon). One example ontology space is [cupboard.open.ac.uk:8081/cupboard/enrico](http://cupboard.open.ac.uk:8081/cupboard/enrico). The Cupboard REST API is available through HTTP content negotiation at the same URLs as the interface. A Java client API and the Cupboard plugin are currently under development and will be openly in a near future. Finally, we plan to release the software of the Cupboard server to allow organizations to deploy their own ontology sharing environment.

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<sup>3</sup>Based on the Watson plugin [2].