

# A search tool for the digital biodiversity resources of *KeyToNature*

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**Abstract** — The European *KeyToNature* project has created a framework to gather large amounts of biodiversity-related digital data and metadata from cooperating providers and to make them publicly available via an advanced search engine tool. The novelty of the solution consists in the creation of specific queries for the search web service in the *KeyToNature* digital repository, in the implementation of a communication protocol between the client application and the repository server, and in other original solutions for metadata presentation.

**Index Terms** — online digital repository, metadata search engine, Rich Internet Application.



## 1 INTRODUCTION

*KeyToNature* ([www.keytonature.eu](http://www.keytonature.eu)) is an EU-funded project focusing on interactive educational tools for the identification of organisms. It aims at enhancing the knowledge of biodiversity at all educational levels across Europe. Some project partners are data providers for an online repository for metadata of media resources which can be used in the creation of interactive, computer-aided identification keys. These digital objects should become online searchable and accessible. The solution was to create an online digital object repository that stores only the metadata associated with the digital resources. The associated search tools, based on the assessment of user needs, are described here.

The repository is now searchable via web services, it can interact with other web services which support the management and access of the digital repository [1]. The most important web service is GSearch, which indexes the Fedora

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digital repository FOXML objects (Fedora Object eXtended Markup Language) and of supports searching this index.

## 2 DATA MANAGEMENT AND STRUCTURE

A metadata exchange agreement has been created within *KeyToNature*, so that all metadata in the repository have standardized semantics and support a range of syntactical options for data transfer. The metadata for each resource include information on, e. g., title, creators, keywords, taxa, geographic location, copyright, license, format, access type (printed, offline, online, free, login), URIs, etc. [2]. The actual aggregation of these biodiversity metadata occurs by a “metadata harvesting” process, implemented using specialized tools and methods [3].

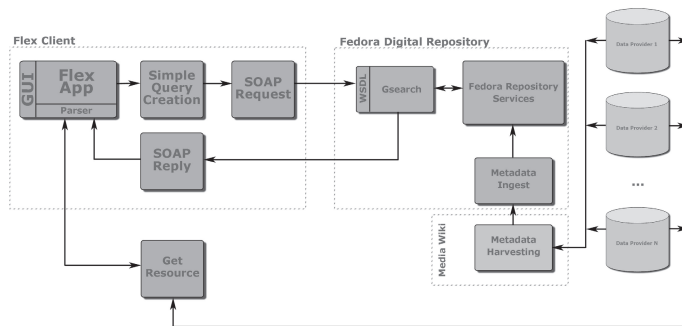


Fig. 1 – The communication between the search client and the digital biodiversity repository of *KeyToNature*.

## 3 APPLICATION DESIGN

The chosen framework of Fedora Commons [1] and GSearch is a backend framework (Fig. 1). Although generic search interfaces exists, these are primarily geared towards developers and totally unsuitable for end-users. Furthermore, a goal of the project was to allow search endpoints in various web presences, from the *KeyToNature* portal to various eLearning environments.

The search application was implemented in Adobe Flex [4, 5], which is embeddable in a large variety of web environments. After defining and implementing the communication between the Flex-based client and the Fedora-based digital repository (Fig. 1), the most important step was the creation of the user interface. The interface exposes the methods and mechanisms that the search tool will use in order to transmit the user input (the request or query) to the repository and to present the result for various types of users (beginner to advanced).

### 3.1 SIMPLE SEARCH

The simple search interface (Fig. 2) consists of a single text input control and additional drop-down menus. The menus allows users to add additional search criteria for narrowing or filtering results. Examples are selections according to the resource type they wish to find (images, identification keys, etc.) or according to availability (online, free, printed-only, etc.).

The exhaustive search for organism names uses a thesaurus of synonyms. This is a complex mechanism that helps users find more resources by extending their search criteria with added synonyms, scientific names and common names. Despite the underlying complexity, the feature is implemented and communicated in the simplest possible way. When the results come back from the repository, users are informed about the extra search terms that were extracted from the thesaurus reply and used in the query.

The simple search interface automatically chooses the best display mode (tabular or matrix image gallery) based on the resource type of the media retrieved.

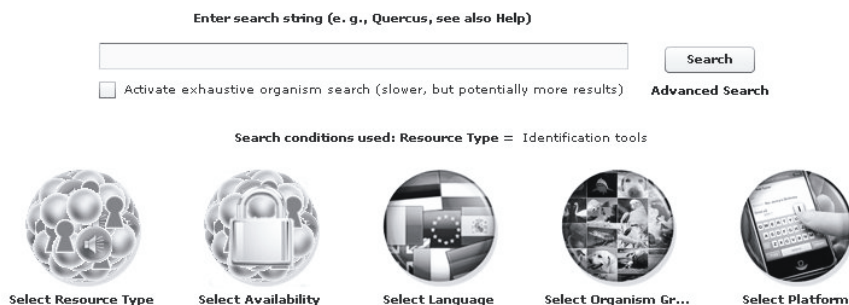


Fig. 2 – The main user interface for simple search.

### 3.2 ADVANCED SEARCH

The advanced search interface (Fig. 3) allows users to interactively create complex queries, including logical operators. The interface has three sections: 1) Search Conditions: select the group of searched metadata fields; 2) Sorting Mode: ascending/descending by multiple user-selectable fields; 3) Display mode: a) gallery mode (Fig. 4) with metadata details accessible via the icons situated on the upper right side of the thumbnail image (Fig. 5), or b) table mode.

[Back to simple search](#)

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**I. Search Conditions**

1. Pick Field Groups  
 Primary fields  Additional fields  Internal fields

2. Select Fields  
 Please select... ▾

3. Edit Selected Fields:

Resource Type: Images ▾ OR Identification tools ▾ + -

AND ▾ Scientific Names: melandrium album + -

AND ▾ Metadata Creator: Stefano Martellos + -

AND ▾ Availability: Online (Creative Commons) ▾ OR Online (free) ▾ + -

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**II. Sorting**

Sort by: Resource Type ▾  Descending

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**III. View**

Gallery Results per page: 35

Table

Search Reset

Fig. 3 – The user interface for advanced search.

Enter search string (e. g., Quercus, see also Help)

malandrium album

Activate exhaustive organism search (faster, but potentially more results)

Search conditions used: Resource Type = Images  
 [ Options: New Query, Revise Query – Switch to Table View ]

Results 1–20 of 250 Page 1 2 3 4 5 6 ... >> of 13

Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album

Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album Lamium album L. subsp. album

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Fig. 4 – The search results of digital objects displayed in the “gallery” view mode.

The advanced user interface is based on XML (eXtensible Markup Language) storing the user’s selections and inputs [6], [7]. After a search has been performed, the created query may be easily revised by the user, without having to re-compose a query. When browsing through the displayed results, users have access to three options which are available for both simple and advanced search modes: “New Query”, “Revise Query” and “Switch gallery/table mode”.

### 3.3 PARAMETERS

The *KeyToNature* search tool currently has several external parameters by means of which it can be preconfigured when embedded into a web interface: 1) language selection (nine languages are presently supported), 2) preset to search identification keys only, 3) preset for searching freely available online

resources only, 5) preset for searching only online resources which are under a “Creative Commons” license.

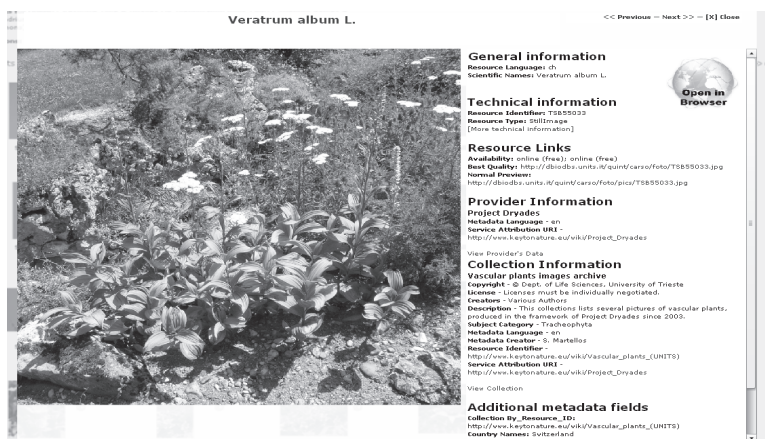


Fig. 5 – Metadata details on a biodiversity-related digital object (in this case, a picture).

### 3.4 MULTILINGUAL INTERFACES

The *KeyToNature* metadata search engine is currently available in nine languages (Bulgarian, Dutch, English, Estonian, German, Italian, Romanian, Slovenian, Spanish), based on two XML external configuration files, which are easily customizable and extendable to additional languages.

### 3.5 TESTING

The search tool has been carefully tested by project partners as well as experts in software usability. Dedicated wiki [8] pages were created in the *KeyToNature* portal for bug-reporting and suggestions. The reported problems are fixed and suggestions are being analyzed and implemented in an ongoing process.

## 4 CONCLUSION

The search tool presented in this paper was implemented as a client application in Adobe Flex. It communicates via specific web services and protocols with the *KeyToNature* online repository of biodiversity-related digital resources. The selection of Adobe Flex has proved a successful decision for implementing the user interface for search. It is an excellent tool for processing the large amount of XML returned by the digital repository. The search application is largely platform-independent, due to the wide availability and distribution of the Flash player. The *KeyToNature* search engine proved to be a robust, fast application, which can be easily integrated into various portals. It could be a model for implementing similar applications interacting with online digital repositories.

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