

DEMO

Project Acronym: EuDML
Grant Agreement number: 250503
Project Title: The European Digital Mathematics Library

D6.4: Web and Service Interface Implementation – Service Interface

Revision: 1.05 as of 25th February 2013

Authors:

Krzyś Wojciechowski ICM - University of Warsaw
Aleksander Nowiński ICM - University of Warsaw

Project co-funded by the European Commission within the ICT Policy Support Programme		
Dissemination Level		
P	Public	✓
C	Confidential, only for members of the consortium and the Commission Services	

Revision History

Revision	Date	Author	Organisation	Description
0.1	14th August 2012	Krzyś Wojciechowski	ICM	Submitted first revision to SVN.
0.2	20th August 2012	Krzyś Wojciechowski	ICM	Added more detailed description of the services.
0.3	1st September 2012	Aleksander Nowiński	ICM	Copy editing.
0.4	26th September 2012	Petr Sojka	MU	Typos correction
1.0	3rd October 2012	Krzyś Wojciechowski	ICM	Final version.
1.01	4th October 2012	Petr Sojka	MU	Final spellchecking.
1.02	12th October 2012	Krzyś Wojciechowski	ICM	Changes in id names
1.03	18th October 2012	Krzyś Wojciechowski	ICM	Changes in Batch Ids service
1.04	6th February 2013	Krzyś Wojciechowski	ICM	Score added to Similar Items service response
1.05	25th February 2013	Krzyś Wojciechowski	ICM	OAI-PMH server and OpenSearch descriptions updated

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

Abstract

Deliverable D6.4 is a demonstrator of the *Service interface* of the EuDML system. This document complements the demonstrator that is available online. The service interface allows the EuDML system to be used by external applications and third party systems. It consists of the following RESTful interfaces: *OAI-PMH server* (still under development), *OpenSearch*, *Batch Ref*, *Reverse Ref*, *Similar Items*, *All Pointers*, *Batch Ids*, *Handled Ids*, *Metadata*. The demonstrators can be found under address <http://project.eudml.org/api-tester/>.

Contents

1	Introduction	2
2	OAI-PMH server	2
3	OpenSearch	2
4	REST services	3
4.1	Batch Ref	3
4.2	Reverse Ref	5
4.3	Similar Items	6
4.4	All Pointers	7
4.5	Batch Ids	9
4.6	Handled Ids	11
4.7	Metadata via REST	12
5	Conclusions	12

1 Introduction

A service interface is an important part of any well designed and implemented system. It allows other applications to connect and interact with the service. The EuDML system allows such an interaction by exposing services described in this document.

2 OAI-PMH server

The server fully supports *OAI-PMH Version 2.0 Specification* (cf. <http://www.openarchives.org/OAI/openarchivesprotocol.html>). It serves public (i.e. no access restricted and stripped of sensitive contents e.g. email addresses, links to PDFs not available for public) EuDML data. The data is served in three formats:

- *EuDML 2.0* (see: <http://eudml.org/schema/2.0/eudml-article-2.0.xsd> and <http://eudml.org/schema/2.0/eudml-book-2.0.xsd>)
- *oai_dc* (Dublin Core Metadata Element Set see: <http://dublincore.org/documents/dces/>)
- *ESE* (Europeana Semantic Elements see: <http://www.europeana.eu/schemas/ese/>) used by *Europeana* project (<http://www.europeana.eu/portal/>)

The service can be enhanced with other formats support in the future.

3 OpenSearch

OpenSearch allows to query EuDML index in a machine way. The query has a form:

```
http://eudml.org/api/search?q={searchQuery}
&startIndex={startIndex?}&count={count?}&format={format}
```

where:

- *searchQuery* - the search query in CQL (details below)
- *startIndex* - the index of the first search result (offset) (optional)
- *count* - number of search results (optional)
- *format* - one of rss, xml, html (required)

The exact form of response can be seen by using the service.

SearchQuery is accepted in CQL (<http://www.loc.gov/standards/sru/specs/cql.html>) language. Most of this language syntax is supported. General format of the search-Query is "*fieldName operator term(s)*", where:

- *fieldName* can be one of:
 - *all* - search within all data
 - *defName* - search within titles
 - *defDescription* - search within titles
 - *authorCoauthorName* - search within authors' names
 - *language* - search within languages (ISO 639-1 code)
 - *journalName* - search within journal names
 - *published* - search within dates of publication
 - *id* - search by identifiers

- *operator* can be one of:
 - *STANDARD OPERATORS*
 - * "=" ("==") - phrase query
EXAMPLE: defName = "Riemann–Stieltjes integral"
 - * "=/exact" - phrase query matching only whole values
EXAMPLE: defName =/exact "the proof book 1"
 - * "any" - search for any of given terms (like boolean OR)
EXAMPLE: defDescription any "integral ring"
 - * "all" - search for all of given terms (like boolean AND)
EXAMPLE: defDescription all "integral ring"
 - * "within" - search for terms within given bounds (inclusive)
EXAMPLE: published within "2001 2004"
 - * "=/ID" - Special id query
EXAMPLE: id =/id "urn:eudml:doc:10345"
 - *NUMERIC OPERATORS*
 - * ">" (">=") - greater then (greater or equals)
EXAMPLE: published >= 2002
 - * "<" ("<=") - less than (less or equals)
EXAMPLE: published < 2002
 - * "<>" - less or greater
EXAMPLE: published <> 2002

Search clauses can be combined into boolean queries using "and", "or", "not" connectives.

EXAMPLE: (defName = integral or defName all "physics nuclear") and published > 2002 not defDescription any "weak short"

Search results can be ordered.

- *SORTING OPERATOR*
 - "sortBy" - accepts multiple sort fieldNames, placed at the end of the query
EXAMPLE: defName=mathematics sortBy published defName
- *SORTING MODIFIERS*
 - "sort.descending" - descending order, "sort.ascending" - ascending order
EXAMPLE: defName=mathematics sortBy published/sort.ascending defName/-sort.descending

4 REST services

Several REST services are provided by EuDML system. They are all described in the following sections.

The services are implemented in a way that restricts the rate of requests to all REST services to 50 per second in order to prevent *flooding* and similar (D)DoS attacks.

4.1 Batch Ref

The service allows matching reference strings against EuDML collection and finding EuDML identifiers of given references.

It is available under <http://eudml.org/api/rest/batchref> address. The service requires POST request with header "Content-Type: application/xml" and responses with XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/batchRef> address. An example of a request is presented in the listing 1, an example of response in the listing 2.

Listing 1: Batch Ref request example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ref-batch-request>
  <ref-item>
    <inref>
      McNeal, Jeffery D., Varolin, Dror, Analytic inversion
      of adjunction: L2 extension theorems with gain,
      Ann. Inst. Fourier (Grenoble) 57 (2007), 703-718
    </inref>
    <myid>ID0</myid>
  </ref-item>
  <ref-item>
    <inref>
      M. Van den Bergh, A relation between Hochschild homology
      and cohomology for Gorenstein rings,
      Proc. Am. Math. Soc 126 (1998), 1345-1348
    </inref>
    <myid>ID1</myid>
  </ref-item>
</ref-batch-request>
```

Listing 2: Batch Ref response example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ref-batch-response>
  <ref-item>
    <inref>
      McNeal, Jeffery D., Varolin, Dror, Analytic inversion
      of adjunction: L2 extension theorems with gain,
      Ann. Inst. Fourier (Grenoble) 57 (2007), 703-718
    </inref>
    <myid>ID0</myid>
    <eudml-id>urn:eudml:doc:10238</eudml-id>
    <matches>1</matches>
  </ref-item>
  <ref-item>
    <inref>
      M. Van den Bergh, A relation between Hochschild homology
      and cohomology for Gorenstein rings,
      Proc. Am. Math. Soc 126 (1998), 1345-1348
    </inref>
```

```

    <myid>ID1</myid>
    <eudml-id><eudml-id/>
    <matches>0</matches>
  </ref-item>
</ref-batch-response>

```

4.2 Reverse Ref

The service allows finding EuDML documents that cite a given EuDML document.

The service is available under <http://eudml.org/api/rest/reverseref> address. Service requires POST request with header "Content-Type: application/xml" and responses with XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/reverseRef> address. An example of a request is presented in the listing 3, an example of response in the listing 4.

Listing 3: Reverse Ref request example

```

<?xml version="1.0" encoding="UTF-8"?>
<referencing-ids-request>
  <ids-batch>
    <id-item>
      <eudml-id>urn:eudml:doc:10238</eudml-id>
    </id-item>
    <id-item>
      <eudml-id>urn:eudml:doc:183686</eudml-id>
    </id-item>
    <id-item>
      <eudml-id>urn:eudml:doc:10064</eudml-id>
    </id-item>
  </ids-batch>
</referencing-ids-request>

```

Listing 4: Reverse Ref response example

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<referencing-ids-response>
  <ids-batch>
    <id-item>
      <eudml-id>urn:eudml:doc:10238</eudml-id>
      <referencing-ids>
        <eudml-id>urn:eudml:doc:116309</eudml-id>
      </referencing-ids>
    </id-item>
    <id-item>
      <eudml-id>urn:eudml:doc:183686</eudml-id>
      <referencing-ids/>
    </id-item>
    <id-item>

```

```

    <eudml-id>urn:eudml:doc:10064</eudml-id>
    <referencing-ids/>
  </id-item>
</ids-batch>
</referencing-ids-response>

```

4.3 Similar Items

Returns items similar to a given EuDML document within a EuDML collection.

The service is available under <http://eudml.org/api/rest/similarItems> address. The service requires POST request with header "Content-Type: application/xml" and responses with XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/similarItems> address. An example of a request is presented in the listing 5, an example of a response in the listing 6.

Listing 5: SimilarItems request example

```

<?xml version="1.0" encoding="UTF-8"?>
<ids-batch-request>
  <id-item>
    <eudml-id>urn:eudml:doc:10007</eudml-id>
  </id-item>
  <id-item>
    <eudml-id>aaa</eudml-id>
  </id-item>
</ids-batch-request>

```

Listing 6: SimilarItems response example

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ids-batch-response>
  <id-item>
    <eudml-id>urn:eudml:doc:10007</eudml-id>
    <similar-items>
      <similar-item>
        <eudml-id>urn:eudml:doc:10288</eudml-id>
        <score>0.5482559</score>
      </similar-item>
      <similar-item>
        <eudml-id>urn:eudml:doc:116206</eudml-id>
        <score>0.49623075</score>
      </similar-item>
    </similar-items>
  </id-item>
  <id-item>
    <eudml-id>aaa</eudml-id>
    <similar-items/>
  </id-item>

```



```
</ids-batch-response>
```

4.4 All Pointers

The service allows converting one type of EuDML pointer used within the system ("eudml-id", "eudml-url" or "eudml-rest-url") to any other pointer.

The service is available under <http://eudml.org/api/rest/allPointers> address. It requires POST request with header "Content-Type: application/xml" and responses with XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/allPointers> address. An example of a request is presented in the listing 7, an example of response in the listing 8.

Listing 7: AllPointers request example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<all-pointers-request>
<desc-batch>
  <desc-item>
    <eudml-url>http://eudml.org/doc/10001</eudml-url>
  </desc-item>
  <desc-item>
    <eudml-id>urn:eudml:doc:10002</eudml-id>
  </desc-item>
  <desc-item>
    <eudml-short-id>10003</eudml-short-id>
  </desc-item>
  <desc-item>
    <eudml-rest-url type="oai_dc">
      http://eudml.org/api/rest/urn:eudml:doc:10004?format=oai_dc
    </eudml-rest-url>
  </desc-item>
  <desc-item>
    <eudml-rest-url type="eudml-nlm">
      http://eudml.org/api/rest/urn:eudml:doc:10005?format=eudml-nlm
    </eudml-rest-url>
  </desc-item>
</desc-batch>
</all-pointers-request>
```

Listing 8: AllPointers response example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<all-pointers-response>
<desc-batch>
<desc-item>
  <eudml-url>http://eudml.org/doc/10001</eudml-url>
  <eudml-id>urn:eudml:doc:10001</eudml-id>
  <eudml-short-id>10001</eudml-short-id>
```

```

<eudml-rest-url type="eudml-nlm">
  http://eudml.org/api/rest/urn:eudml:doc:10001?format=eudml-nlm
</eudml-rest-url>
<eudml-rest-url type="oai_dc">
  http://eudml.org/api/rest/urn:eudml:doc:10001?format=oai_dc
</eudml-rest-url>
</desc-item>
<desc-item>
  <eudml-url>http://eudml.org/doc/urn:eudml:doc:10002</eudml-url>
  <eudml-id>urn:eudml:doc:10002</eudml-id>
  <eudml-short-id>10002</eudml-short-id>
  <eudml-rest-url type="eudml-nlm">
    http://eudml.org/api/rest/urn:eudml:doc:10002?format=eudml-nlm
  </eudml-rest-url>
  <eudml-rest-url type="oai_dc">
    http://eudml.org/api/rest/urn:eudml:doc:10002?format=oai_dc
  </eudml-rest-url>
</desc-item>
<desc-item>
  <eudml-url>http://eudml.org/doc/10003</eudml-url>
  <eudml-id>urn:eudml:doc:10003</eudml-id>
  <eudml-short-id>10003</eudml-short-id>
  <eudml-rest-url type="eudml-nlm">
    http://eudml.org/api/rest/urn:eudml:doc:10003?format=eudml-nlm
  </eudml-rest-url>
  <eudml-rest-url type="oai_dc">
    http://eudml.org/api/rest/10003?format=oai_dc
  </eudml-rest-url>
</desc-item>
<desc-item>
  <eudml-url>http://eudml.org/doc/10004</eudml-url>
  <eudml-id>urn:eudml:doc:10004</eudml-id>
  <eudml-short-id>10004</eudml-short-id>
  <eudml-rest-url type="eudml-nlm">
    http://eudml.org/api/rest/urn:eudml:doc:10004?format=eudml-nlm
  </eudml-rest-url>
  <eudml-rest-url type="oai_dc">
    http://eudml.org/api/rest/10004?format=oai_dc
  </eudml-rest-url>
</desc-item>
<desc-item>
  <eudml-url>http://eudml.org/doc/10005</eudml-url>
  <eudml-id>urn:eudml:doc:10005</eudml-id>
  <eudml-short-id>10005</eudml-short-id>
  <eudml-rest-url type="eudml-nlm">
    http://eudml.org/api/rest/urn:eudml:doc:10005?format=eudml-nlm
  </eudml-rest-url>

```

```

    <eudml-rest-url type="oai_dc">
      http://eudml.org/api/rest/urn:eudml:doc:10005?format=oai_dc
    </eudml-rest-url>
  </desc-item>
</desc-batch>
</all-pointers-response>

```

4.5 Batch Ids

The service allows to check external or internal identifiers against EuDML collection and, if identifiers are found, response with all identifiers known by the system. All the types handled can be determined with Handled Ids service.

The service is available under <http://eudml.org/api/rest/batchIds> address. It requires POST request with header "Content-Type: application/xml" and responses with XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/batchIds> address. An example of a request is presented in the listing 9, and an example of a response in the listing 10.

Listing 9: BatchIds request example

```

<?xml version="1.0" encoding="UTF-8"?>
<batch-ids-request>
  <id type="zbl-item-id">1087.47061</id>
  <id type="mr-item-id">1881582</id>
  <id type="cedram-id">AIF_2006__56_7_2249_0</id>
  <id type="buldml-id">1232</id>
  <id type="eudml-id">urn:eudml:doc:11111</id>
  <id type="eudml-id">urn:eudml:doc:999999</id>
  <id type="eudml-xxxid">urn:eudml:journal:10004</id>
</batch-ids-request>

```

Listing 10: BatchIds response example

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<batch-ids-response>
  <ids>
    <id type="zbl-item-id">1087.47061</id>
    <matches>2</matches>
    <match>
      <id type="eudml-id">urn:eudml:doc:10513</id>
      <id type="mr-item-id">2126449</id>
      <id type="zbl-item-id">1087.47061</id>
      <id type="cedram-id">AMBP_2005__12_1_205_0</id>
    </match>
    <match>
      <id type="eudml-id">urn:eudml:doc:10528</id>
      <id type="mr-item-id">2233015</id>
      <id type="zbl-item-id">1087.47061</id>
    </match>
  </ids>

```

```

        <id type="cedram-id">AMBP_2006__13_1_207_0</id>
    </match>
</ids>
<ids>
    <id type="mr-item-id">1881582</id>
    <matches>1</matches>
    <match>
        <id type="eudml-id">urn:eudml:doc:115979</id>
        <id type="mr-item-id">1881582</id>
        <id type="zbl-item-id">1020.11044</id>
        <id type="cedram-id">AIF_2002__52_1_303_0</id>
    </match>
</ids>
<ids>
    <id type="cedram-id">AIF_2006__56_7_2249_0</id>
    <matches>1</matches>
    <match>
        <id type="eudml-id">urn:eudml:doc:10203</id>
        <id type="mr-item-id">2290780</id>
        <id type="zbl-item-id">1138.68045</id>
        <id type="cedram-id">AIF_2006__56_7_2249_0</id>
    </match>
</ids>
<ids>
    <id type="buldml-id">1232</id>
    <matches>1</matches>
    <match>
        <id type="eudml-id">urn:eudml:doc:11253</id>
        <id type="buldml-id">1232</id>
    </match>
</ids>
<ids>
    <id type="eudml-id">urn:eudml:doc:11111</id>
    <matches>1</matches>
    <match>
        <id type="eudml-id">urn:eudml:doc:11111</id>
        <id type="mr-item-id">2182065</id>
        <id type="cedram-id">SEDP_2004-2005___A21_0</id>
    </match>
</ids>
<ids>
    <id type="eudml-id">urn:eudml:doc:999999</id>
    <matches>0</matches>
</ids>
<ids>
    <id type="eudml-xxxid">urn:eudml:journal:10004</id>
    <matches>0</matches>

```

```
</ids>
</batch-ids-response>
```

4.6 Handled Ids

The service gives a list of id types that are handled by Batch Ids service.

The service is available under <http://eudml.org/api/rest/handleIds> address. It requires an empty request and responds with an XML file. The demonstrator can be found under <http://project.eudml.org/api-tester/handleIds> address. An example of a response is presented in the listing 11.

Listing 11: HandleIds response example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<handled-ids-response>
  <id>
    <type>numdam-id</type>
    <description>
      Identifiers used by NUMDAM library (http://numdam.org/).
    </description>
  </id>
  <id>
    <type>cedram-id</type>
    <description>
      Identifiers used by CEDRAM library (http://cedram.org/).
    </description>
  </id>
  <id>
    <type>dmle-id</type>
    <description>
      Identifiers used by Spanish Digital Mathematics Library.
    </description>
  </id>
  <id>
    <type>dmlcz-id</type>
    <description>
      Identifiers used by Czech Digital Mathematics Library
      (http://dml.cz/).
    </description>
  </id>
  <id>
    <type>pii</type>
    <description>
      Publisher Item Identifier
      (http://en.wikipedia.org/wiki/Publisher\_Item\_Identifier).
    </description>
  </id>
  <id>
```

```

    <type>doi</type>
    <description>
      Identifiers used by 'The DOI System' (http://doi.org/).
    </description>
  </id>
  <id>
    <type>eudml-id</type>
    <description>
      Identifiers used by European Digital Mathematics Library
      (http://eudml.org/).
    </description>
  </id>
</handled-ids-response>

```

4.7 Metadata via REST

The service returns metadata of EuDML documents in `eudml-nlm` or `oai_dc` formats.

It is available under `http://eudml.org/api/rest/[eudml-id]?format=[metadata-format]` address, where *metadata-format* can be `eudml-nlm` or `oai_dc`. The service requires GET request with *eudml-id* and responds with metadata in the requested format. The demonstrator and examples of response can be found under `http://project.eudml.org/api-tester/restNlm` and `http://project.eudml.org/api-tester/restDc` addresses.

5 Conclusions

The EuDML Service interface is a functional set of services to allow external systems to use information from the EuDML, making it interoperable, comprising of:

- *OAI-PMH server*: service to give access to sets of bibliographic records (all the records in just one data set or in different data sets according to their original data provider).
- *OpenSearch*: interface for external services to query in real-time the general EuDML index and get list of records as result.
- *Batch Ref*: service allowing matching reference strings against EuDML collection, returning the identifiers of the found references.
- *Reverse Ref*: service returning the identifiers of the EuDML documents that cite a given EuDML document.
- *Similar Items*: service that returns items similar to a given EuDML document within a EuDML collection (according to the similarity rules of the system).
- *All Pointers*: This service converts EuDML identifiers among their different syntaxes ("eudml-id", "eudml-url" or "eudml-rest-url").
- *Batch Ids*: Given a list of identifiers, this service returns those known by EuDML.
- *Handled Ids*: The service gives a list of types of identifiers that are handled by the Batch Ids service.
- *Metadata via REST*: The service returns the metadata records of EuDML documents in `eudml-nlm` or `oai_dc` formats.