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D6.4: Web and Service Interface Implementation – Service Interface
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| C | Confidential, only for members of the consortium and the Commission Services |  |
## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
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<th>Organisation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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</tr>
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</tr>
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<td>ICM</td>
<td>Copy editing.</td>
</tr>
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</tr>
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</tr>
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</tr>
<tr>
<td>1.02</td>
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<td>Changes in id names</td>
</tr>
<tr>
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<td>ICM</td>
<td>Changes in Batch Ids service</td>
</tr>
<tr>
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<td>OAI-PMH server and OpenSearch descriptions updated</td>
</tr>
</tbody>
</table>

### 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This deliverable contains original unpublished work except where clearly indicated otherwise.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/](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
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ref-batch-request>
  <ref-item>
    <inref>
    </inref>
    <myid>ID0</myid>
  </ref-item>
  <ref-item>
    <inref>
    </inref>
    <myid>ID1</myid>
  </ref-item>
</ref-batch-request>
```

Listing 2: Batch Ref response example

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ref-batch-response>
  <ref-item>
    <inref>
    </inref>
    <myid>ID0</myid>
    <eudml-id>urn:eudml:doc:10238</eudml-id>
    <matches>1</matches>
  </ref-item>
  <ref-item>
    <inref>
    </inref>
  </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](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](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
<?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
<?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>
    </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](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](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
<?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
<?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. 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](http://project.eudml.org/api-tester/allPointers) address. An example of a request is presented in the listing 7,

Listing 7: AllPointers request example

```xml
<?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">
    </eudml-rest-url>
  </desc-item>
  <desc-item>
    <eudml-rest-url type="eudml-nlm">    
    </eudml-rest-url>
  </desc-item>
</desc-batch>
</all-pointers-request>
```

Listing 8: AllPointers response example

```xml
<?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>
  </desc-item>
</desc-batch>
</all-pointers-response>
```
8

D6.4: Web and Service Interface Implementation – Service Interface, revision 1.05 as of 25th February 2013
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 Handle Ids service.

The service is available under [http://eudml.org/api/rest/batchIds](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](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
<?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
<?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>
</batch-ids-response>
```
<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>
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/handledIds](http://eudml.org/api/rest/handledIds) address. It requires an empty request and responds with an XML file. The demonstrator can be found under [http://project.eudml.org/api-tester/handledIds](http://project.eudml.org/api-tester/handledIds) address. An example of a response is presented in the listing 11.

Listing 11: HandledIds response example

```xml
<?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>
</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.