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# **X2R Documentation**

***Release 1.0***

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## CONTENTS



## **INTRODUCTION**

X2R is a tool for helping Semantic Web application developers to translate existing data in a variety of formats into linked-data compatible formats, where the X, 2 and R stand for existing data in a variety of formats, to (the homonym of two) and Linked-data compatible formats (i.e., RDF/XML), respectively.

Our vision is to smooth the transition from existing Web to Semantic Web by providing tools, which can dramatically lower the entry barrier of generating Linked-data, to developers. By providing tools, such as X2R, developers can translate existing data incrementally and on-demand.



## USER GUIDE

This part of the guide focuses on setting up your environment for X2R and all its components, including Extractor, Mapper and USS. A quickstart is then presented to give an overview of X2R and its components. Finally, details of each components are presented.

## 2.1 Installation

Installing X2R is simple with `composer`, just use this command:

```
$ php composer.phar install
```

If you did a global install of `composer`, run this instead:

```
$ composer install
```

## 2.2 Quickstart

This page give a a minimal usage scenario for grasping the whole picture of X2R by example. It assumes you already have X2R installed. If you do not, head over to the *Installation* section.

### 2.2.1 A Minimal Usage Scenario

X2R aims to improve the quality of RDF by replacing temporary or invalid URIs with valid and representative URIs.

Before letting X2R do the URIs replacement task for you, you should make sure the configuration file, `X2R.conf`, are consistent with your requirements.

**X2R.conf:**

```
{ "USS": [
    { "endpoints": [
        { "name" : "dbpedia",
          "class" : "endpoints/dbpedia.php"
        },
        { "name" : "linkedgedata",
          "class" : "endpoints/linkedgedata.php"
        }
      ]
    },
    { "refiners": [
```

```
        { "name" : "dbpedia",
          "class" : "endpoints/dbpedia.php"
        },
        { "name" : "linkedgeodata",
          "class" : "endpoints/linkedgeodata.php"
        }
      ]
    },
    { "parser": { "name" : "dbpedia",
                  "class" : "endpoints/dbpedia.php"
                }
    },
    { "selector": { "name" : "dbpedia",
                    "class" : "endpoints/dbpedia.php"
                  }
    },
    { "rankers": [
        { "name" : "dbpedia",
          "class" : "endpoints/dbpedia.php"
        },
        { "name" : "linkedgeodata",
          "class" : "endpoints/linkedgeodata.php"
        }
      ]
    }
  }

],

"Extractor": [ { "tokenizers": [
    { "name" : "CaseBasedTokenizer",
      "class" : "EM/caseBasedTokenizer.class.php"
    },
    { "name" : "DelimitBasedTokenizer",
      "class" : "EM/delimitBasedTokenizer.class.php"
    }
  ]
}

],

"Mapper": [
  { "output_format": "xml/rdf"
  }
],
}
```



## COMPONENTS

### 3.1 Extractor

### 3.2 Mapper

### 3.3 URI Search Service

URI Search Service (USS) 1.0 is monolithic, hard wired with the GUI and not take batch-mode search into consideration. In this revision, we conduct refactoring and introduce some flexibilities through several hooks. In the following paragraphs, the refactored USS is presented with several useful hooks.

#### 3.3.1 Refactored USS kernel

#### 3.3.2 Hooks

In refined USS, seven **atomic hooks** can be replaced and extended, they are:

- **Query Parser**

Query Parser parses the plain text query string into set of query terms, term refinement qualifiers, result set qualifiers and corresponding integration commands.

- **Endpoint Cotainer**

- **Endpoint** (see also: `Endpoint`)

Endpoint wraps the public Endpoint, such as DBpedia, and handles the errors, such as Endpoint service downtime. Endpoint accepts SQARQL query and return the result set in standard format of Endpoint.

- **Term Refiner**

Term Refiner takes one query term as its input and output a refined query term.

- **Result Ranker**

Result Ranker reorders the ranks of result set based on the heuristic that it wants to realize. In addition to heuristic, Result Ranker can also be a crowd sourcing task, which can be delegated to the crowd.

- **Result Filter**

Result Filter filters result set by patterns. The typical usage of Result Filter is to resolve ambiguity.

- **Result Integrator**

Result Integrator takes two or more result sets and integrates them as one ranked result set.

- **Result Selector**

### **Composition of atomic hooks**

The atomic hooks can be composited through method chaining.

## **3.4 X2R**

X2R is designed for both human and machine friendly through a public API. Based on the API, we releases two kinds of user interfaces for human users: a Web-based GUI and a Command Line Interface.

In the following sections a

### **3.4.1 API Usage Examples**

### **3.4.2 User Interface**

User Interface is under construction.

Current status and plan:

- A JQuery-powered GUI is developed in version 1.0, and we are planned to reuse the GUI code to current architecture.
- A Command Line Interface is planned to be included in version 2.0.

## FRAMEWORK WORKFLOW

{diagram}



## **FRAMEWORK HOOKS**

This section focuses on two topics, i.e. **hook templates** and **hook instances**. The term “hook” is used to present the cookbook or guidance for extending X2R in many different aspects. Because some hooks are similar to each other, the hook templates are extracted based on the similarity among existing hooks. Extracted hook templates can be used to instantiate more hook instances to cover more aspects for increasing X2R’s flexibility.



## HOOK TEMPLATES

### 6.1 Template: Add USS Components

#### 6.1.1 Involved Classes

{List of involved classes with links}

#### 6.1.2 Mechanism

1. Based on component's type, create a new class in /USS/{**component\_type**}/
2. Based on the component's type, the new class should extends corresponding parent class
3. Open `ussContainer.class.php`, and add the dependency by adding "include\_once" statement in it
4. Based on component's type, find corresponding method and add the {id, class\_factory} mapping to the method's switch/case block.

#### 6.1.3 Instances

- *Add a new refiner*
- *Add a new filter*
- *Add a new ranker*
- *Add a new selector*
- *hook\_query\_parser*

### 6.2 Template: Add wrapper for new RDF parser

#### 6.2.1 Involved Classes

{List of involved classes with links}

#### 6.2.2 Mechanism

1. todo

### 6.2.3 Instances

- *hook\_easyRdf*

## 6.3 Template: Add new tokenizer

### 6.3.1 Involved Classes

{List of involved classes with links}

### 6.3.2 Mechanism

1. todo

### 6.3.3 Instances

- *hook\_caseBasedTokenizer*
- *hook\_delimitBasedTokenizer*



## HOOK INSTANCES

### 7.1 Add a new Endpoint

### 7.2 Add a new tokenizer

### 7.3 Add a new RDF refactor

### 7.4 Add a new selector

#### 7.4.1 Involved Files

resultselector.class.php, ussContainer.php

#### 7.4.2 Mechanism

1. Create a new class in /USS/selector/
2. The new class should extends ResultSelector, for example 'newSelector.class.php'
3. Open ussContainer.class.php, and add the dependency by adding "include\_once selector/newSelector.class.php;" statement in it
4. Add a case block of the new class into getSelector() method's switch block

#### 7.4.3 Template

*Template: Add new tokenizer*

### 7.5 Add a new ranker

#### 7.5.1 Involved Files

resultranker.class.php, ussContainer.php

## 7.5.2 Mechanism

1. Create a new class in /USS/ranker/
2. The new class should extends ResultRanker, for example 'newRanker.class.php'
3. Open ussContainer.class.php, and add the dependency by adding "include\_once ranker/newRanker.class.php;" statement in it
4. Add a case block of the new class into getRanker() method's switch block

## 7.5.3 Template

*Template: Add new tokenizer*

## 7.6 Add a new refiner

### 7.6.1 Involved Files

queryrefiner.class.php, ussContainer.php

### 7.6.2 Mechanism

1. Create a new class in /USS/refiner/
2. The new class should extends QueryRefiner, for example 'newRefiner.class.php'
3. Open ussContainer.class.php, and add the dependency by adding "include\_once refiner/newRefiner.class.php;" statement in it
4. Add a case block of the new class into getRefiner() method's switch block

### 7.6.3 Template

*Template: Add new tokenizer*

## 7.7 Add a new filter

### 7.7.1 Involved Classes

resultfilter.class.php, ussContainer.php

### 7.7.2 Mechanism

1. Create a new class in /USS/filter/
2. The new class should extends ResultFilter, for example 'newFilter.class.php'
3. Open ussContainer.class.php, and add the dependency by adding "include\_once filter/newFilter.class.php;" statement in it

4. Add a case block of the new class into getFilter() method's switch block

### 7.7.3 Template

*Template: Add new tokenizer*



## API REFERENCE

This part of the documentation dedicates to people who are looking for information on a specific function, class or method.

### 8.1 API

#### 8.1.1 Extractor

**class `Extractor`**

Extractor class is the class for modeling the URI extracting & analyzing process as below.

Step 1. Load the RDF content to a Graph data structure

Step 2. Traverse the Graph to finding all the URIs

Step 3. Transform filtered URIs to search friendly terms, where the filtered URI means the all but those URI listed in the *filtered URI list*

Step 4. Wrap these terms as a JSON output

**`getQueryTerms ()`**

Extract terms from URIs of given RDF, and wrap terms with their contextual information.

**Returns** A JSON string of terms derived from extracted URIs of a given RDF file with corresponding metadata,

including *originalURI*, *replacedURI*, *status*, *lineNumbers*.

**`getFilteredUris ()`**

Get current URI filter list.

**Returns** An array of filtered URI.

**`addFilteredUri ($furi)`**

Add the given URI, \$furi, to the URI filter list.

**Parameters**

- **`$furi`** (*string*) – The URI to be filtered

**Returns** Either false on failure, or the true for success.

**`removeFilteredUri ($furi)`**

Remove the given URI, \$furi, from the URI filter list.

**Parameters**

- **`$furi`** (*string*) – The URI to be filtered

**Returns** Either false on failure, or the true for success

### 8.1.2 RdfGraph

#### class **RdfGraph**

RdfGraph class is a standard interface for wrapping or adapting existing RDF parsers into X2R.

**parseRdf** (*\$data*)

**Parameters**

- **\$data** (*string*) – The content of RDF file.

**Returns** Either false on failure, or the true for success.

**serializeRdfAs** (*\$format*)

**Parameters**

- **\$format** (*string*) – The file format of serialized RDF.

**Returns** Either false on failure, or the string representation of serialized RDF in specified format.

### EasyRdfAdapter

#### class **EasyRdfAdapter**

EasyRdfAdapter class is an implemantion of RdfGraph. It is a warpper of an open source RDF parser - EasyRDF.

**parseRdf** (*\$data*)

**Parameters**

- **\$data** (*string*) – The content of RDF file.

**Returns** Either false on failure, or the true for success.

**serializeRdfAs** (*\$format*)

**Parameters**

- **\$format** (*string*) – The file format of serialized RDF.

**Returns** Either false on failure, or the string representation of serialized RDF in specified format.

### 8.1.3 Tokenizer

#### class **Tokenizer**

Tokenizer class is a standard interface for X2R developers to extend X2R with new types of tokenizers. Currently, two tokenizers, i.e. CaseBasedTokenizer and DelimitBasedTokenizer, are implemented and bundled with X2R::Extractor.

**tokenizeString** (*\$str*)

**Parameters**

- **\$str** (*string*) – The string to be tokenized.

**Returns** An array of tokenized strings.

**tokenizeArrayOfStrings** (*\$arr*)

**Parameters**

- **\$arr** (*array*) – The array of strings to be tokenized

**Returns** An array of tokenized strings.

**arrayToString** (*\$arr*)

**Parameters**

- **\$arr** (*array*) – The array of strings to be tokenized

**Returns** A string which is consisted of elements from given array \$arr and is concatenated by whitespace.

**CaseBasedTokenizer**

**class Tokenizer**

CaseBasedTokenizer class

**tokenizeString** (*\$str*)

**Parameters**

- **\$str** (*string*) – The string to be tokenized.

**Returns** An array of tokenized strings.

**tokenizeArrayOfStrings** (*\$arr*)

**Parameters**

- **\$arr** (*array*) – The array of strings to be tokenized

**Returns** An array of tokenized strings.

**DelimitBasedTokenizer**

**class Tokenizer**

DelimitBasedTokenizer class

**tokenizeString** (*\$str*)

**Parameters**

- **\$str** (*string*) – The string to be tokenized.

**Returns** An array of tokenized strings.

**tokenizeArrayOfStrings** (*\$arr*)

**Parameters**

- **\$arr** (*array*) – The array of strings to be tokenized

**Returns** An array of tokenized strings.

**8.1.4 Refactor**

**class Refactor**

Refactor is the class that reserves the flexibility for introducing new kind of RDF refactoring into this RDF analyzing and manipulation framework.

**refactoring** (*\$change*)

**Parameters**

- **\$change** (*int*) – The change spec. for the refactoring.

**Returns** Either false on failure, or the true for success.

## ReplaceUri

**class ReplaceUri**

ReplaceUri is an implemetation of Refactor class. It is the default refactoring used in X2R project. The replaceUri is to replace an existing URI with a new URI.

**refactoring** (*\$change*)

**Parameters**

- **\$change** (*int*) – The change spec. for the refactoring.

**Returns** Either false on failure, or the true for success.

## 8.1.5 MappingEntry

**class MappingEntry**

X2R's components are integrated by standard message passing, where the standard message is the *mapping from original URI, terms and replaced URI*. This MappingEntry is the class used to model one entry of such mapping message.

**MappingEntry** (*\$originalURI, \$replacedURI, \$term, \$lineNumbers*)

**Parameters**

- **\$originalURI** (*string*) – The change spec. for the refactoring.
- **\$replacedURI** (*string*) – The change spec. for the refactoring.
- **\$term** (*string*) – The change spec. for the refactoring.
- **\$lineNumbers** (*string*) – The change spec. for the refactoring.

**Returns** Either false on failure, or the true for success.

**getOriginalURI** ()

**Returns** Either false on failure, or the *Original URI* for success.

**getReplacedURI** ()

**Returns** Either false on failure, or the *Replaced URI* for success.

**getQueryTerm** ()

**Returns** Either false on failure, or the *Query Term* for success.

**getLineNumbers** ()

**Returns** Either false on failure, or the *Line Numbers* for success.



## 8.1.6 MappingCollection

### class MappingCollection

The MappingCollection is a collection of MappingEntry. The MappingCollection object can be serialized as JSON, and serves as the integration glue among X2R's components.

**addMappingEntry** (*\$mappingentry*)

#### Parameters

- **\$mappingentry** (*MappingEntryint*) – An entry of mapping.

**Returns** Either false on failure, or the true for success.

**toJson** ()

**Returns** Serialize the collection of mappings in Json format.

## 8.1.7 Mapper

### class Mapper

Mapper is the class for modeling the RDF transformation (refactoring) process.

Currently, the Mapper only support one kind of transformation (refactoring) - replaceURI.

The replaceURI is to replace an existing URI with a new URI..

**Mapper** (*\$graph*)

#### Parameters

- **\$graph** (*rdGraph*) – The RDF, which is holded in the rdGraph data structure, to be refactored.

**refactoring** (*\$refactorType*, *\$change*)

Based on the type of refactoring (*\$refactorType*) and the desired change (*\$change*) to conduct the refactoring on target RDF.

#### Parameters

- **\$refactorType** (*string*) – The type of refactor.
- **\$change** (*array*) – The month.

**Returns** Either false on failure, or the datetime object for method chaining.

```
//This is an example of $change
array('http://127.0.0.1/sport_center' => 'http://openisdm.iis.sinica.edu.tw/sport_center',
      'http://127.0.0.1/park' => 'http://openisdm.iis.sinica.edu.tw/park');
```

---

**Note:** Currently, only one type refactor is supported, that is, *replaceUri*. More refactors can be implemented and integrated into Mapper.

---

**serialize** (*\$format*)

Return the RDF content in the format specified by \$format.

#### Parameters

- **\$format** (*string*) – The format of output file.

**Returns** Either false on failure, or the string of refactored RDF's content in the specified format.

### 8.1.8 WebUtilities

#### **GetParameter** (*\$para*)

Get the value of HTTP GET request by parameter's name

##### **Parameters**

- **\$para** (*string*) – The parameter's name.

**Returns** The value of given parameter's name.

### 8.1.9 USS

#### **class Endpoint**

Endpoint is the class for modeling the public Endpoint, such as DBpedia. (refer to *URI Search Service*)

#### **issueSparqlQuery** (*\$sparqlQuery*, *\$resultFormat*)

##### **Parameters**

- **\$sparqlQuery** (*string*) – The SPARQL query.
- **\$resultFormat** (*string*) – The format of returned result.

**Returns** The string of result in the specified format.

#### **class SparqlQueryComposer**

SparqlQueryComposer is a class to aggregate a variety of SPARQL composition methods. Currently, only plain text terms are supported.

#### **term2Sparql** (*\$term*)

Turn plain text terms to SPARQL query.

##### **Parameters**

- **\$term** (*string*) – The desired query term..

**Returns** The SPARQL query string.

### 8.1.10 X2R

#### **class X2R**

X2R models the process of translating an imperfect RDF, especially for those with invalid URIs, to RDF with relatively higher quality.

#### **transformation** (*\$rdfGraph*, *\$configuration*)

##### **Parameters**

- **\$graph** (*rdfGraph*) – The RDF, which is holded in the rdfGraph data structure, to be refactored.
- **configuration** – to be defined.

**Returns** The refactored RDF.

### 8.1.11 Hot Spots

#### **class QueryRefiner**

QueryRefiner is an one-to-one adapter, which processes the raw query with the logics defined in it. A variety of refinement heuristics or methods can be introduced into X2R through extending this class.

**refine** (*\$query*)

##### **Parameters**

- **\$query** (*string*) – The query that is directly extracted and tokenized from original URI.

**Returns** The refined query.

#### **class SearchResultSelector**

SearchResultSelector is a many-to-one selector, which selects one fittest result from a given result set. A variety of fitness function can be introduced into X2R through extending this class.

**select** (*\$resultSet*)

##### **Parameters**

- **\$resultSet** (*array*) – A given result set.

**Returns** The fittest result.



## INDICES AND TABLES

- *genindex*
- *modindex*
- *search*



## ADDITIONAL NOTE

This part of note declares the license of X2R.

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- c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.
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```
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