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X2R Documentation

Release 1.0

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CONTENTS

CHAPTER

ONE

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 formats, to (the homonym of two) and Linked-data compatible formats (i.e., RDF/XML), respectively.

Our motivation 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 such tools, i.e., X2R, more and more developers can translate existing data on-demands, and the final vision of Semantic Web can be approached incrementally.

1.1 Roadmap

1.2 Audiences

1.2.1 Semantic Web application developers

1.2.2 API users

1.2.3 Code contributator

1.3 How to Use This Document

The index can be found in *genindex*, and the search page, *search*, can be used to search within this document.

CHAPTER

TWO

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 representive URIs.

CHAPTER

THREE

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.

CHAPTER

FOUR

API USAGE SCENARIOS

Targeted Audience: **API users**

4.1 X2R API Usage Scenarios

4.1.1 Operation Scenarios

Replace Bad URIs

4.1.2 Configuration Scenarios

Set an Extractor

Set a Mapper

Set an USS

4.2 Extractor API Usage Scenarios

4.2.1 Operation Scenarios

Extract URIs from a Given RDF

1. Include the file **"extractor.class.php"** in your program
2. Initialize a **Extractor** instance by passing a **rdfGraph**
3. Call the method **getQueryTerms()**

Tokenize an URI into Query Terms

Extractor can help in tokenizing URI task. To tokenize a given URI, you can use the method **tokenize($str)**, where the $str is the URI that you want to tokenize.

Currently, we implements two representive tokenizers, **DelimitBasedTokenizer** and **CaseBasedTokenizer**, and the **tokenize($str)** applies these two tokenizers on the $str.

4.2.2 Configuration Scenarios

Set a RDF Parser

There are many RDF parsers available. In X2R, we allow developers to set or even introduce new RDF parsers for reasons, such as better performace or wider range of input formats.

Currently, we implement one wrapper, **Easy_Rdf_Adapter**, for EasyRdf. EasyRdf is a popular RDF parser implemented in PHP, and more information can be found in it official site.

To set **Easy_Rdf_Adapter** as the RDF parser.

1. Initialize an instance of **Easy_Rdf_Adapter**
2. Initialize a **Extractor** instance by passing the instance just initialized

Set an URI Filter

If there are some URIs that you want to ignore in the whole URI replacement process, you can use **addFilteredUri($furi)** to incrementally build the URI filter.

You can also use **getFiltedUris()** method to get the current list of URIs that are ignored.

4.3 USS API Usage Scenarios

4.3.1 Operation Scenarios

Search URIs by terms

1. Include the file **"urisearchservice.class.php"** in your program
2. Initialize a **UriSearchService** instance
3. Call the method **uriSearch** with a **query string** as the parameter. After receving all Endpoints' respones, the **result set** is returned

4.3.2 Configuration Scenarios

After initializing a **UriSearchService** instance, the default components are already set. If you want to change the default setting, you can reset the components as the guidences listed below.

The configuration methods can be chained. Here is a code example.

```
include_once (risearchservice.class.php);
$exampleUss = new UriSearchService();
//... Initialize components as $parser, $selector ...etc.
$exampleUss->setFederatedSearch($federatedSearch)
           ->setParser($parser)
           ->setProcessor($rsultProcessor)
           ->setSelector($selector);
```

Set a Parser

1. Initialize a parser
2. Assign the new parser through the method **setParser($parser)**

Set FederatedSearch

1. Initialize a federatedSearch
2. Assign the new federatedSearch through the method **setFederatedSearch($federatedSearch)**

Set a Result Processor (Filter and Ranker)

1. Initialize a rsultProcessor
2. Assign the new rsultProcessor through the method **setProcessor($rsultProcessor)**

Set a Selector

1. Initialize a selector
2. Assign the new selector through the method **setSelector($selector)**

4.4 Mapper API Usage Scenarios

4.4.1 Operation Scenarios

Replace Original URIs with Specified URIs

1. Include the file **"mapper.class.php"** in your program
2. Initialize a **Mapper** instance by passing a **rdfGraph**
3. Call the method **refactoring($refType, $change)**
4. Call the method **serialize($format)**

4.4.2 Configuration Scenarios

Change a Refactor (URI Replacement)

Change different refactors can let Mapper be able to do different refactoring on the given RDF. In order to decouple the **Mapper** from specific **Refactor**, their dependency is injected during runtime through the method **refactoring($refType, $change)**.

Currently, we only implement one type of **Refactor**, called **Rename** (defined in "refaRename.class.php"). Its corresponding change is an associative array, which saves the mapping from original URI to replaced URI. There is one example of **change** that the refactor, **Rename**, accepted.

```
$exampleChange = array('http://original.uri.1' => 'http://replaced.uri.1',
                       'http://original.uri.2' => 'http://replaced.uri.2');
```

Set a RDF Parser

There are many RDF parsers available. In X2R, we allow developers to set or even introduce new RDF parsers for reasons, such as better performace or wider range of input formats.

Currently, we implement one wrapper, **Easy_Rdf_Adapter**, for EasyRdf. EasyRdf is a popular RDF parser implemented in PHP, and more information can be found in it official site.

To set **Easy_Rdf_Adapter** as the RDF parser.

1. Initialize an instance of **Easy_Rdf_Adapter**
2. Initialize a **Mapper** instance by passing the instance just initialized

CHAPTER

FIVE

FRAMEWORK HOOKS

Targeted Audience: **Code contributators**

This section focuses on two topics, i.e. **hook templates** and **hook instances**. The term "hook" is used to present the cookbook or guidence 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 instainate more hook instances to cover more aspects for increasing X2R's flexability.

Hook Templates

5.1 Template: Add USS Components

5.1.1 Involved Classes

{List of involved classes with links}

5.1.2 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 exntends corresponding parent class
3. Open ussContainer.class.php, and add the dependency by adding "incclude_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.

5.1.3 Instances

- *Add a new refiner*
- *Add a new filter*
- *Add a new ranker*
- *Add a new selector*
- *hook_query_parser*

Hook Instances

5.2 Add a new Endpoint

5.3 Add a new RDF refactor

5.3.1 Involved Files

refactor.class.php

5.3.2 Mechanism

1. Create a new class in /EM/
2. The new class should exntends Refactor

5.3.3 Example

- `ReplaceUri`

5.4 Add a new selector

5.4.1 Involved Files

resultselector.class.php, ussContainer.php

5.4.2 Mechanism

1. Create a new class in /USS/selector/
2. The new class should exntends 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

5.4.3 Template

Add a new tokenizer

5.5 Add a new ranker

5.5.1 Involved Files

resultranker.class.php, ussContainer.php

5.5.2 Mechanism

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

5.5.3 Template

Add a new tokenizer

5.6 Add a new refiner

5.6.1 Involved Files

queryrefiner.class.php, ussContainer.php

5.6.2 Mechanism

1. Create a new class in /USS/refiner/
2. The new class should exntends 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

5.6.3 Template

Add a new tokenizer

5.7 Add a new filter

5.7.1 Involved Classes

resultfilter.class.php, ussContainer.php

5.7.2 Mechanism

1. Create a new class in /USS/filter/
2. The new class should exntends 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

5.7.3 Template

Add a new tokenizer

5.8 Add a wrapper for new RDF parser

5.8.1 Involved Classes

rdfGraph.class.php

5.8.2 Mechanism

1. Create a new class in /EM/
2. The new class should exntends rdfGraph'

5.8.3 Example

- `EasyRdfAdapter`

5.9 Add a new tokenizer

5.9.1 Involved Classes

tokenizer.class.php

5.9.2 Mechanism

1. Create a new class in /EM/
2. The new class should exntends Tokenizer

5.9.3 Example

- `CaseBasedTokenizer`
- `DelimitBasedTokenizer`

CHAPTER

SIX

API REFERENCE

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

6.1 API

6.1.1 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 wrapp 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*.

`getFiltedUris`()

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

6.1.2 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.

6.1.3 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 CaseBasedTokenizer

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 DelimitBasedTokenizer

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.

6.1.4 Refactor

class Refactor

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

refactoring(*$change*)

Parameters

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

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 refacroring.

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

6.1.5 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

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

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.

6.1.6 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.

6.1.7 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** (*rdfGraph*) – The RDF, which is holded in the rdfGraph 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

- **$refactorType** (*string*) – The type of rafactor.
- **$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.

6.1.8 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.

6.1.9 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 varity 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.

6.1.10 X2R

class X2R

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

transform(*$rdfGraph*, *$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.

6.1.11 Hot Spots

class `QueryRefiner`

QueryRefiner is an one-to-one adapter, which processes the raw query with the logics defined in it. A varity 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 varity 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.

CHAPTER

SEVEN

ADDITIONAL NOTE

This part of note declares the license of X2R.

7.1 License

GNU GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

7.1.1 Preamble

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Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting

users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

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The precise terms and conditions for copying, distribution and modification follow.

7.1.2 Terms and Conditions

0. Definitions.

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"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

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To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

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An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of

the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

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