

# What is this thing called Linked Data?

## Part II - Hands-on session

Manuel Atencia, Jérôme David and Philippe Genoud  
DocEng 2015, September 8, Lausanne, Switzerland

- Part I: From an Excel data file to linked open data
  - you will learn how to
    - create "cool" URIs
    - describe things with RDF
    - make links to other datasets
  - we will use the OpenRefine tool + RDF extension
- Part II: Querying linked data with SPARQL
  - you will learn how to make queries with SPARQL
  - we will use Apache Jena - ARQ command line applications

# Hands-on session

## Introduction Organization and Goals

- Part I: From an Excel data file to linked open data
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Part I: 14:00 - 15:30  
Coffee break: 15:30 - 16:00  
Part II: 16:00 - 17:30

- Artemis owns a bookstore. She has heard of the Linked Data technologies, but she is not fully convinced of the benefits of using these technologies.
- Artemis has provided you with a sample of her data in an Excel file: `artemisBookstoreData.xlsx`
- Let's convince Artemis to join Linked Open Data!

**Artemis  
Bookstore**





# Hands-on session (I)

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# Hands-on session (I)

## Artemis' bookstore data

- Let's have a look at `artemisBookstoreData.xlsx`
- There are two kinds of data: authors and books

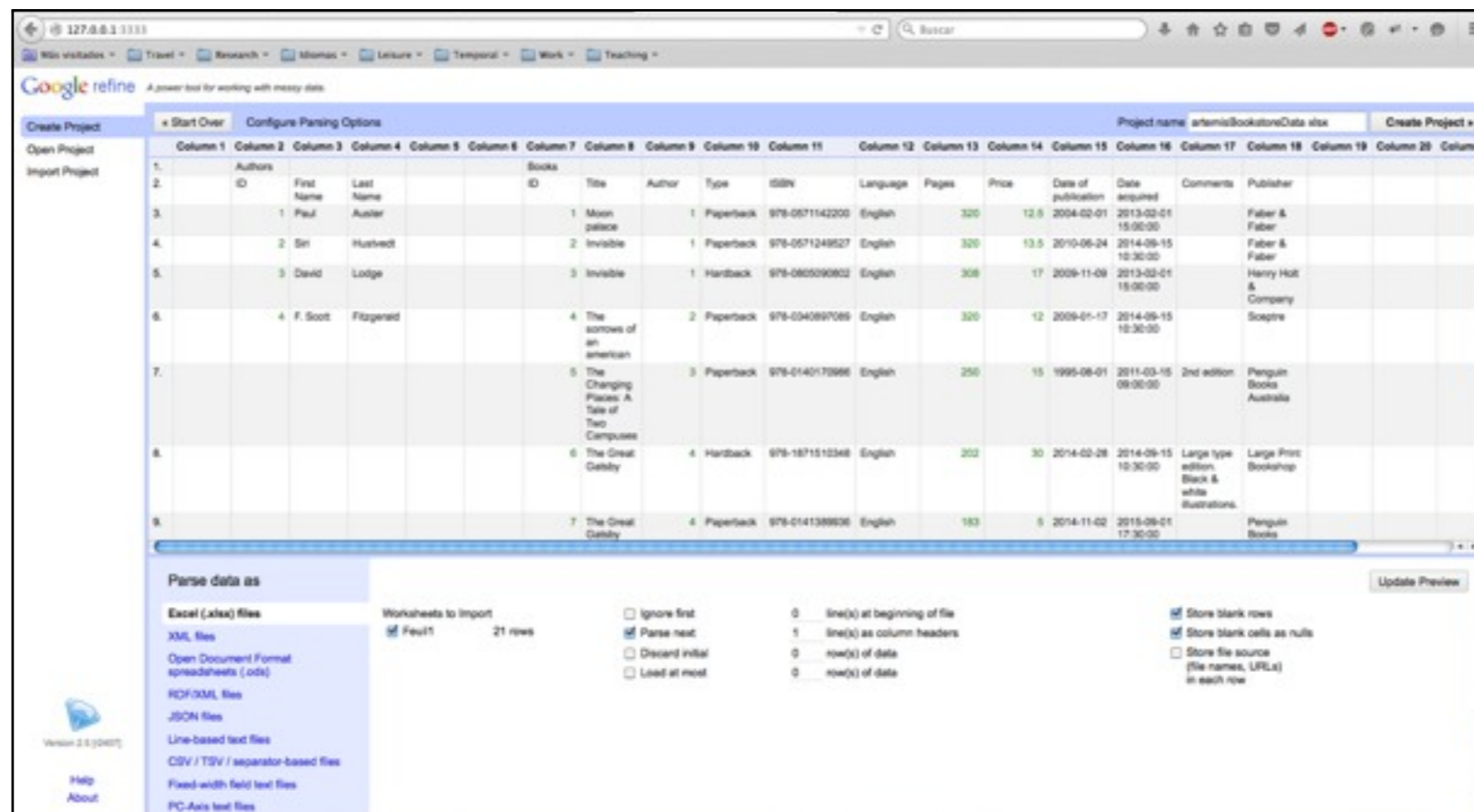
Authors		
ID	First Name	Last Name
1	Paul	Auster
2	Siri	Hustvedt
3	David	Lodge
4	F. Scott	Fitzgerald

Authors have an ID, a first name and a second name. Books have an ID, a title, author(s), a type, an ISBN, a language, pages, a price, a date of publication, a date of acquirement, comments and a publisher

Books											
ID	Title	Author	Type	ISBN	Language	Pages	Price	Date of publication	Date acquired	Comments	Publisher
1	Moon palace	1	Paperback	571142200	English	320	12.5	2004-02-01	2013-02-01 15:00:00		Faber & Faber
2	Invisible	1	Paperback	571249527	English	320	13.5	2010-06-24	2014-09-15 10:30:00		Faber & Faber
3	Invisible	1	Hardback	805090802	English	308	17	2009-11-09	2013-02-01 15:00:00		Henry Holt & Company
4	The sorrows of an american	2	Paperback	340897089	English	320	12	2009-01-17	2014-09-15 10:30:00		Sceptre
5	The Changing Places: A Tale	3	Paperback	140170986	English	250	15	1995-08-01	2011-03-15 09:00:00	2nd edition	Penguin Books Australia
6	The Great Gatsby	4	Hardback	1871510348	English	202	30	2014-02-28	2014-09-15 10:30:00	Large type e	Large Print Bookshop
7	The Great Gatsby	4	Paperback	141389936	English	183	5	2014-11-02	2015-09-01 17:30:00		Penguin Books
8	The Great Gatsby	4	Hardback	1857150193	English	176	15	1991-09-26	2011-03-15 09:00:00		Everyman's library

# Hands-on session (I)

- Our goal is to convert Artemis' raw data into linked open data and for this we will use OpenRefine tool and its RDF extension developed by DERI
- Open OpenRefine and create a new project by uploading artemisBookstoreData.xlsx



The screenshot shows the OpenRefine web interface. The main area displays a table with 20 columns and 9 rows of data. The columns are labeled 'Column 1' through 'Column 20'. The data includes book titles, authors, ISBNs, languages, prices, and dates. The bottom section shows the 'Parse data as' options, with 'Excel (.xlsx) files' selected. The 'Worksheets to Import' section shows 'Feu1' with 21 rows. The 'Update Preview' button is visible.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20
1.	Authors					Books													
2.	ID	First Name	Last Name			ID	Title	Author	Type	ISBN	Language	Pages	Price	Date of publication	Date acquired	Comments	Publisher		
3.	1	Paul	Auster			1	Moon palace	1	Paperback	978-0571142200	English	320	12.5	2004-02-01	2013-02-01 15:00:00		Faber & Faber		
4.	2	Sri	Huxford			2	Invisible	1	Paperback	978-0571249527	English	320	13.5	2010-06-24	2014-09-15 10:30:00		Faber & Faber		
5.	3	David	Lodge			3	Invisible	1	Hardback	978-0805090802	English	308	17	2009-11-09	2013-02-01 15:00:00		Henry Holt & Company		
6.	4	F. Scott	Fitzgerald			4	The sunnys of an american	2	Paperback	978-0340897085	English	320	12	2009-01-17	2014-09-15 10:30:00		Scopre		
7.						5	The Changing Places: A Tale of Two Computers	3	Paperback	978-0140170986	English	250	15	1995-08-01	2011-03-15 09:00:00	2nd edition	Penguin Books Australia		
8.						6	The Great Gatsby	4	Hardback	978-1871510348	English	202	30	2014-02-28	2014-09-15 10:30:00	Large type edition Black & white illustrations.	Large Print Bookshop		
9.						7	The Great Gatsby	4	Paperback	978-0141389936	English	183	5	2014-11-02	2015-09-01 17:30:00		Penguin Books		

you can download OpenRefine at <http://openrefine.org/download.html>

# Hands-on session (I)

# OpenRefine Preprocessing data

- Let's start by doing some preprocessing of the data

The screenshot shows the OpenRefine web interface in a browser window. The address bar shows the URL 127.0.0.1:3333. The page title is "Google Refine" and the subtitle is "A power tool for working with messy data." The main content area displays a table with 17 columns: Column, ID, First Name, Last Name, Column2, Column3, ID2, Title, Author, Type, ISBN, Language, Pages, Price, Date of publication, Date acquired, Comments, and Publisher. The table contains 8 rows of data, including titles like "Moon palace", "Invisible", "The sorrows of an american", "The Changing Places: A Tale of Two Campuses", "The Great Gatsby", and "The Great Gatsby".

Below the table, there is a "Parse data as" section with the following options:

- Excel (.xlsx) files** (selected)
- XML files
- Open Document Format spreadsheets (.ods)
- RDF/XML files
- JSON files
- Line-based text files
- CSV / TSV / separator-based files
- Fixed-width field text files
- PC-Axis text files

Additional options include:

- Worksheets to Import:  Feuil1 (21 rows)
- Ignore first 2 line(s) at beginning of file
- Parse next 1 line(s) as column headers
- Discard initial 0 row(s) of data
- Load at most 0 row(s) of data
- Store blank rows
- Store blank cells as nulls
- Store file source (file names, URLs) in each row

There is an "Update Preview" button on the right side of the parsing options section. The bottom left corner shows the version "Version 2.5 [2407]" and links for "Help" and "About".



# Hands-on session (I)

## OpenRefine Preprocessing data

- Let's start by doing some preprocessing of the data

### 1. Preprocessing the data

1.1. Ignore the first 2 lines (so the data attributes become the column headers)

1.2. Do not store blank rows

1.3. Do not store blank cells as nulls

1.4. Update the preview

1.5. Change, if you want, the name of the project

1.6. Create a project

The screenshot shows the OpenRefine web interface. The top part displays a data preview table with columns: 'Project name', 'Date of publication', 'Date acquired', 'Comments', and 'Publisher'. The project name is 'artemisBookstoreData.xlsx'. The table contains 15 rows of data. The bottom part shows the 'Parse data as' settings panel. The 'Parse data as' section is set to 'Excel (.xlsx) files'. The 'Worksheets to import' section shows 'Feu1' with 21 rows. The 'Ignore first' section is set to 2 line(s) at beginning of file. The 'Parse next' section is set to 1 line(s) as column headers. The 'Discard initial' section is set to 0 row(s) of data. The 'Load at most' section is set to 0 row(s) of data. The 'Update Preview' button is visible. The version number 'Version 2.5 (2407)' is shown in the bottom left corner.

Project name	Date of publication	Date acquired	Comments	Publisher
artemisBookstoreData.xlsx	2004-02-01	2013-02-01 15:00:00		Faber & Faber
	2010-06-24	2014-09-15 10:30:00		Faber & Faber
	2009-11-09	2013-02-01 15:00:00		Henry Holt & Company
	2009-01-17	2014-09-15 10:30:00		Soepte
	1995-08-01	2011-03-15 09:00:00	2nd edition	Penguin Books Australia
	2014-02-28	2014-09-15 10:30:00	Large type edition. Black & white illustrations.	Large Print Bookshop
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	1991-09-26	2011-03-15 09:00:00		Everyman's library

Parse data as

Excel (.xlsx) files

Worksheets to import

Feu1 21 rows

Ignore first 2 line(s) at beginning of file

Parse next 1 line(s) as column headers

Discard initial 0 row(s) of data

Load at most 0 row(s) of data

Store blank rows

Store blank cells as nulls

Store file source (file names, URLs) in each row

Update Preview

Version 2.5 (2407)

Help About

# Hands-on session (I)

## OpenRefine Preprocessing data

- Let's start by doing some preprocessing of the data

The screenshot shows the OpenRefine interface with a data table. The table has columns: All, Author ID, First Name, Last Name, Column3, Book ID, Title, Author, Type, ISBN, Language, Pages, Price, Date of publicati, Date acquired, and Comme. The table contains 8 rows of data. A context menu is open over the 'Column3' header, showing options like 'Split into several columns...', 'Add column based on this column...', 'Add column by fetching UR...', 'Add columns from Freeb...', 'Rename this column', 'Remove this column', 'Move column to beginning', 'Move column to end', 'Move column left', and 'Move column right'. Annotations 1.7 and 1.8 are placed on the interface: 1.7 is on the 'Show as: rows' dropdown, and 1.8 is on the 'Edit column' menu item.

All	Author ID	First Name	Last Name	Column3	Book ID	Title	Author	Type	ISBN	Language	Pages	Price	Date of publicati	Date acquired	Comme
1.	Facet		Auster		1	Moon palace	1	Paperback	978-0571142200	English	320	12.5	2004-02-01	2013-02-01	15:00:00
2.	Text filter		Hustvedt		2	Invisible	1	Paperback	978-0571249527	English	320	13.5	2010-06-24	2014-09-15	10:30:00
3.	Edit cells		Linton		3	Invisible	1	Hardback	978-0805090802	English	308	17	2009-11-09	2013-02-01	15:00:00
4.	Edit column				4	The sorrows of an american	2	Paperback	978-0340897089	English	320	12	2009-01-17	2014-09-15	10:30:00
5.	Transpose				5	The Changing Places: A Tale of Two Campuses	3	Paperback	978-0140170986	English	250	15	1995-08-01	2011-03-15	09:00:00
6.	Sort...				6	The Great Gatsby	4	Hardback	978-1871510348	English	202	30	2014-02-28	2014-09-15	10:30:00
7.	View				7	The Great Gatsby	4	Paperback	978-0141389936	English	183	5	2014-11-02	2015-09-01	17:30:00
8.	Reconcile				8	The Great Gatsby	4	Hardback	978-1857150193	English	176	15	1991-09-26	2011-03-15	09:00:00

1. Preprocessing the data (cont.)
  - 1.7. Remove empty columns
  - 1.8. Change column names if they are not appropriate (e.g. IDs to Author ID and Book ID)

# Hands-on session (I)

## Creating RDF data

# Hands-on session (I)

## Creating RDF data

- Now, let's create RDF data!



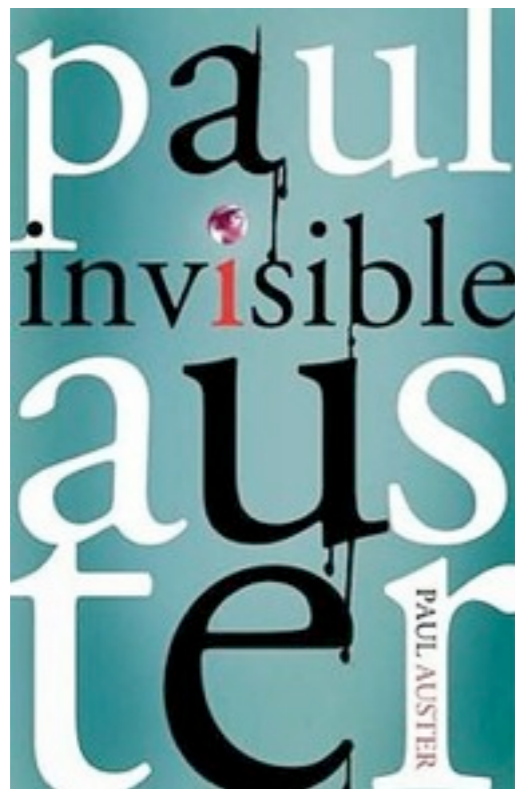
- Now, let's create RDF data!
- But before, let's recall the Linked Data principles:
  1. Use URIs as names for things.
  2. Use HTTP URIs, so that people can look up those names.
  3. When someone looks up a URI, provide useful information using the standards (RDF, SPARQL).
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# Hands-on session (I)

## Creating RDF data Cool URIs

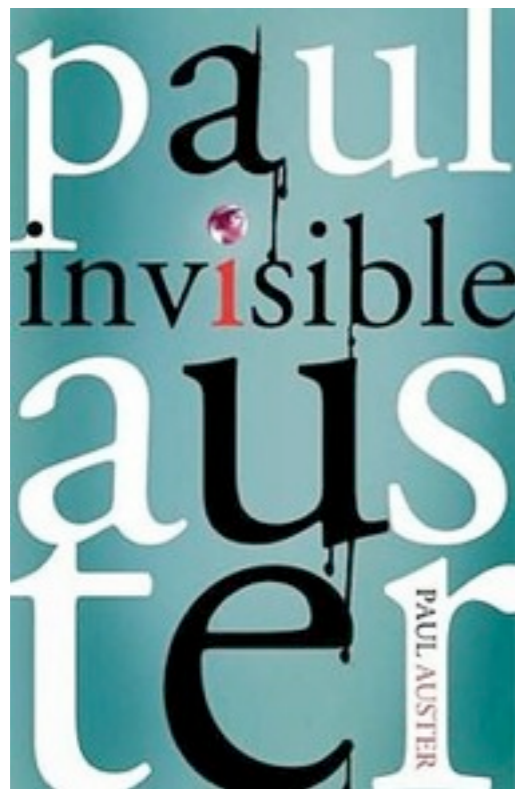
- Let's consider the paperback book "Invisible" written by Paul Auster. Can you find a cool URI for this resource?



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### REMEMBER!

web document  $\neq$  web resource

Actually, you should find

- A URI for the real object itself.
- A URI for the related information resource that describes the real-world object and has an HTML representation.
- A URI for a related information resource that describes the real-world object and has an RDF/XML representation.

# Hands-on session (I)

Creating RDF data  
Cool URIs

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      - <http://page.artemisbookstore.com/book/0571249527>
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# Hands-on session (I)

Creating RDF data  
Describing things with RDF

# Hands-on session (I)

## Creating RDF data Describing things with RDF

- Which kind of information should we include in the description of the book "Invisible" written by Paul Auster?

# Hands-on session (I)

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  - triples that describe the resource with literals (e.g. title)



- Which kind of information should we include in the description of the book "Invisible" written by Paul Auster?
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  - triples that describe the resource with literals (e.g. title)
  - triples that describe the resource by linking to other resources, or *incoming links* (e.g. author)

- triples that describe resources, or other resources
- triples describing resource's creation
- triples describing a part

and, for writing this description, you can use:

- terms from existing vocabularies
  - Dublin Core (e.g. `dcterms:title`)
  - FOAF (e.g. `foaf:name`)
  - ...
- your own defined terms
- RDFS (`rdfs:comment` and `rdfs:label` for annotations), OWL (`owl:sameAs` for links)

# Hands-on session (I)

## Reusing Existing Terms FOAF vocabulary

- The FOAF ("Friend of a Friend") vocabulary can be used for describing persons, their activities and their relations to other people and objects.
- FOAF = RDF + Social Web
- namespace:

foaf: <<http://xmlns.com/foaf/0.1>>





# Hands-on session (I)

## Reusing Existing Terms FOAF vocabulary

- An example:

```
@base <http://exmo.inrialpes.fr/about> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .

<#j david>
  a foaf:Person ;
  foaf:name "Jérôme David"@fr ;
  foaf:nick "JD" ;
  foaf:mbox <mailto:jerome.david@inria.fr> ;
  foaf:homepage "http://exmo.inrialpes.fr/~j david/" ;
  foaf:depiction <http://exmo.inrialpes.fr/j david_img_small.jpg> ;
  foaf:knows <http://exmo.inrialpes.fr/about#matencia> ,
             <http://www.imag.fr/id/pgenoud> ,
             [ a foaf:Person ;
               foaf:name "Ewan David" ;
               foaf:age "5" ] .
```

# Hands-on session (I)

## Reusing Existing Terms FOAF vocabulary

- An example:

```
@base <http://exmo.inrialpes.fr/about> .
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@prefix foaf: <http://xmlns.com/foaf/0.1/> .

<#jdavid>
  a foaf:Person ;
  foaf:name "Jérôme David"@fr ;
  foaf:nick "JD" ;
  foaf:mbox <mailto:jerome.david@inria.fr> ;
  foaf:homepage "http://exmo.inrialpes.fr/~jdavid/" ;
  foaf:depiction <http://exmo.inrialpes.fr/jdavid_img_small.jpg> ;
  foaf:knows <http://exmo.inrialpes.fr/about#matencia> ,
             <http://www.imag.fr/id/pgenoud> ,
             [ a foaf:Person ;
               foaf:name "Ewan David" ;
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```

# Hands-on session (I)

## Reusing Existing Terms FOAF vocabulary

- An example:

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@base <http://exmo.inrialpes.fr/about#matencia> ;
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```

```
<#jdavid>
  a foaf:Person ;
  foaf:name "Jérôme David"@fr ;
  foaf:nick "JD" ;
  foaf:mbox <mailto:jerome.david@inria.fr> ;
  foaf:homepage "http://exmo.inrialpes.fr/~jdavid/" ;
  foaf:depiction <http://exmo.inrialpes.fr/jdavid_img_small.jpg> ;
  foaf:knows <http://exmo.inrialpes.fr/about#matencia> ,
    <http://www.imag.fr/id/pgenoud> ,
    [ a foaf:Person ;
      foaf:name "Ewan David" ;
      foaf:age "5" ] .
```

*jdavid is a person, with the name of "Jérôme David" and the nickname of "JD", who has an email address of "jerome.david@inria.fr". His homepage is... He is depicted in the image... He knows... He also knows a person whose name is "Ewan David" and who is 5 years old.*

# Hands-on session (I)

## Reusing Existing Terms FOAF vocabulary

- An example:

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@base <http://exmo.inrialpes.fr/about#matencia> ;
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  a foaf:Person ;
  foaf:name "Jérôme David"@fr ;
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  foaf:mbox <mailto:jerome.david@inria.fr> ;
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# Hands-on session (I)

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@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> ;
@prefix foaf: <http://xmlns.com/foaf/spec/#term_> ;
```

```
<#jdavid>
  a foaf:Person ;
  foaf:name "Jérôme David"@fr ;
  foaf:nick "JD" ;
  foaf:mbox <mailto:jerome.david@inria.fr> ;
  foaf:homepage "http://exmo.inrialpes.fr/~jdavid/" ;
  foaf:depiction <http://exmo.inrialpes.fr/jdavid_img_small.jpg> ;
  foaf:knows <http://exmo.inrialpes.fr/about#matencia> ,
```

*jdavid is a person, with the name of "Jérôme David" and the nickname of "JD", who has an email address of "jerome.david@inria.fr". His homepage is... He is depicted in the image... He knows... He also knows a person whose name is "Ewan David" and who is 5 years old.*

### Property: foaf:knows

*knows* - A person known by this person (indicating some level of reciprocated interaction between the parties).

**Status:** stable

**Domain:** having this property implies being a [Person](#)

**Range:** every value of this property is a [Person](#)

The [knows](#) property relates a [Person](#) to another [Person](#) that he or she knows.

from [http://xmlns.com/foaf/spec/#term\\_knows](http://xmlns.com/foaf/spec/#term_knows)

# Hands-on session (I)

## Reusing Existing Terms The Dublin Core Schema

- The Dublin Core Schema is a vocabulary of terms that can be used to describe web resources (videos, images, web pages) and physical resources (books, publications, CDs).
- Dublin Core Metadata Initiative (DCMI)
- two namespaces:
  - Dublin Core Metadata Set version 1.1  
dc: <<http://purl.org/elements/1.1/>>
  - DCMI Metadata Terms  
dcterms: <<http://purl.org/dc/terms/>>



# Hands-on session (I)

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domains and ranges are not specified (e.g. dc:creator may be used with both literal and non-literal values)



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- DCMI Metadata Terms

dcterms: <<http://purl.org/dc/terms/>>

domains and ranges are specified (e.g. the range of dcterms:creator is the class dcterms:Agent)



# Hands-on session (I)

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dcterms:creator is a subproperty of dc:creator

# Hands-on session (I)

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domains and ranges are specified (e.g. the range of dcterms:creator is the class dcterms:Agent)

dcterms:creator is a subproperty of dc:creator

# Hands-on session (I)

## Reusing Existing Terms The Dublin Core Schema

- An example:

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
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@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix ex: <http://www.example.org/> .

ex:myPaper a dcterms:BibliographicResource ;
  dcterms:title "What is this thing called Linked Data?" ;
  dcterms:creator ex:matencia, ex:j david , ex:p genoud ;
  dcterms:subject "Linked Data", "Semantic Web" ;
  dcterms:issued "2015" ;
  dcterms:publisher "ACM Digital Library" ;
  dcterms:bibliographicCitation "Proceedings of the " .

ex:matencia a foaf:Person ;
  foaf:familyName "Atencia" ;
  foaf:givenName "Manuel" .

...
```

# Hands-on session (I)

## Reusing Existing Terms The Dublin Core Schema

- An example:

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@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
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@prefix dcterms: <http://purl.org/dc/terms/> .
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ex:myPaper a dcterms:BibliographicResource ;
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    dcterms:issued "2015" ;
    dcterms:publisher "ACM Digital Library" ;
    dcterms:bibliographicCitation "Proceedings of the " .

ex:matencia a foaf:Person ;
    foaf:familyName "Atencia" ;
    foaf:givenName "Manuel" .

...
```

# Hands-on session (I)

## Reusing Existing Terms The Dublin Core Schema

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```

# Hands-on session (I)

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ex:myPaper a dcterms:BibliographicResource ;
  dcterms:title "What is this thing called Linked Data?" ;
  dcterms:creator ex:matencia, ex:j david , ex:p genoud ;
```

ex:matencia

...

<b>Term Name:</b>	creator
<b>URI:</b>	<a href="http://purl.org/dc/terms/creator">http://purl.org/dc/terms/creator</a>
<b>Label:</b>	Creator
<b>Definition:</b>	An entity primarily responsible for making the resource.
<b>Comment:</b>	Examples of a Creator include a person, an organization, or a service.
<b>Type of Term:</b>	<a href="#">Property</a>
<b>Refines:</b>	<a href="http://purl.org/dc/elements/1.1/creator">http://purl.org/dc/elements/1.1/creator</a>
<b>Refines:</b>	<a href="http://purl.org/dc/terms/contributor">http://purl.org/dc/terms/contributor</a>
<b>Has Range:</b>	<a href="http://purl.org/dc/terms/Agent">http://purl.org/dc/terms/Agent</a>
<b>Version:</b>	<a href="http://dublincore.org/usage/terms/history/#creatorT-002">http://dublincore.org/usage/terms/history/#creatorT-002</a>
<b>EquivalentProperty:</b>	<a href="http://xmlns.com/foaf/0.1/maker">http://xmlns.com/foaf/0.1/maker</a>

from <http://dublincore.org/documents/2012/06/14/dcmi-terms/?v=terms#creator>

# Hands-on session (I)

## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?



# Hands-on session (I)

## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?

Author ID	First Name	Last Name	Book ID	Title	Author	Type	ISBN
1	Paul	Auster	1	Moon palace	1	Paperback	571142200
2	Siri	Hustvedt	2	Invisible	1	Paperback	571249527

Language	Pages	Price	Date of publicati	Date acquired	Comments	Publisher
English	320	12.5	2004-02-01	2013-02-01 15:00:00		Faber & Faber
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# Hands-on session (I)

## Creating RDF data Reusing existing terms

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foaf vocabulary



Classes: | [Agent](#) | [Document](#) | [Group](#) | [Image](#) | [LabelProperty](#) | [OnlineAccount](#) | [OnlineChatAccount](#) | [OnlineEcommerceAccount](#) | [OnlineGamingAccount](#) | [Organization](#) | [Person](#) | [PersonalProfileDocument](#) | [Project](#) |

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## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?

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# Hands-on session (I)

## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?



Author ID	First Name	Last Name	Book ID	Title	Author	Type	ISBN
1	Paul	Auster	1	Moon palace	1	Paperback	571142200
2	Siri	Hustvedt	2	Invisible	1	Paperback	571249527

Language	Pages	Price	Date of publication	Date acquired	Comments	Publisher
English	320	12.5	2004-02-01	2013-02-01 15:00:00		Faber & Faber
English	320	13.5	2010-06-24	2014-09-15 10:30:00		Faber & Faber

### dublin core vocabulary



Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
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Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>
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# Hands-on session (I)

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dublin core vocabulary



Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
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Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>
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# Hands-on session (I)

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dublin core vocabulary




Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
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Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>
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### dublin core vocabulary




Properties in the <i>/terms/</i> namespace	<p><u>abstract</u> , <u>accessRights</u> , <u>accrualMethod</u> , <u>accrualPeriodicity</u> , <u>accrualPolicy</u> , <u>alternative</u> , <u>audience</u> , <u>available</u> , <u>bibliographicCitation</u> , <u>conformsTo</u> , <u>contributor</u> , <u>coverage</u> , <u>created</u> , <u>creator</u> , <u>date</u> , <u>dateAccepted</u> , <u>dateCopyrighted</u> , <u>dateSubmitted</u> , <u>description</u> , <u>educationLevel</u> , <u>extent</u> , <u>format</u> , <u>hasFormat</u> , <u>hasPart</u> , <u>hasVersion</u> , <u>identifier</u> , <u>instructionalMethod</u> , <u>isFormatOf</u> , <u>isPartOf</u> , <u>isReferencedBy</u> , <u>isReplacedBy</u> , <u>isRequiredBy</u> , <u>issued</u> , <u>isVersionOf</u> , <u>language</u> , <u>license</u> , <u>mediator</u> , <u>medium</u> , <u>modified</u> , <u>provenance</u> , <u>publisher</u> , <u>references</u> , <u>relation</u> , <u>replaces</u> , <u>requires</u> , <u>rights</u> , <u>rightsHolder</u> , <u>source</u> , <u>spatial</u> , <u>subject</u> , <u>tableOfContents</u> , <u>temporal</u> , <u>title</u> , <u>type</u> , <u>valid</u></p>
Classes	<p><u>Agent</u> , <u>AgentClass</u> , <u>BibliographicResource</u> , <u>FileFormat</u> , <u>Frequency</u> , <u>Jurisdiction</u> , <u>LicenseDocument</u> , <u>LinguisticSystem</u> , <u>Location</u> , <u>LocationPeriodOrJurisdiction</u> , <u>MediaType</u> , <u>MediaTypeOrExtent</u> , <u>MethodOfAccrual</u> , <u>MethodOfInstruction</u> , <u>PeriodOfTime</u> , <u>PhysicalMedium</u> , <u>PhysicalResource</u> , <u>Policy</u> , <u>ProvenanceStatement</u> , <u>RightsStatement</u> , <u>SizeOrDuration</u> , <u>Standard</u></p>

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Classes	<p><u>Agent</u> , <u>AgentClass</u> , <u>BibliographicResource</u> , <u>FileFormat</u> , <u>Frequency</u> , <u>Jurisdiction</u> , <u>LicenseDocument</u> , <u>LinguisticSystem</u> , <u>Location</u> , <u>LocationPeriodOrJurisdiction</u> , <u>MediaType</u> , <u>MediaTypeOrExtent</u> , <u>MethodOfAccrual</u> , <u>MethodOfInstruction</u> , <u>PeriodOfTime</u> , <u>PhysicalMedium</u> , <u>PhysicalResource</u> , <u>Policy</u> , <u>ProvenanceStatement</u> , <u>RightsStatement</u> , <u>SizeOrDuration</u> , <u>Standard</u></p>



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English	320	13.5	2010-06-24	2014-09-15 10:30:00		Faber & Faber

### dublin core vocabulary



Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
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Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>
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Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>

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Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>
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### dublin core vocabulary




Properties in the <i>/terms/</i> namespace	<p><u><a href="#">abstract</a></u> , <u><a href="#">accessRights</a></u> , <u><a href="#">accrualMethod</a></u> , <u><a href="#">accrualPeriodicity</a></u> , <u><a href="#">accrualPolicy</a></u> , <u><a href="#">alternative</a></u> , <u><a href="#">audience</a></u> , <u><a href="#">available</a></u> , <u><a href="#">bibliographicCitation</a></u> , <u><a href="#">conformsTo</a></u> , <u><a href="#">contributor</a></u> , <u><a href="#">coverage</a></u> , <u><a href="#">created</a></u> , <u><a href="#">creator</a></u> , <u><a href="#">date</a></u> , <u><a href="#">dateAccepted</a></u> , <u><a href="#">dateCopyrighted</a></u> , <u><a href="#">dateSubmitted</a></u> , <u><a href="#">description</a></u> , <u><a href="#">educationLevel</a></u> , <u><a href="#">extent</a></u> , <u><a href="#">format</a></u> , <u><a href="#">hasFormat</a></u> , <u><a href="#">hasPart</a></u> , <u><a href="#">hasVersion</a></u> , <u><a href="#">identifier</a></u> , <u><a href="#">instructionalMethod</a></u> , <u><a href="#">isFormatOf</a></u> , <u><a href="#">isPartOf</a></u> , <u><a href="#">isReferencedBy</a></u> , <u><a href="#">isReplacedBy</a></u> , <u><a href="#">isRequiredBy</a></u> , <u><a href="#">issued</a></u> , <u><a href="#">isVersionOf</a></u> , <u><a href="#">language</a></u> , <u><a href="#">license</a></u> , <u><a href="#">mediator</a></u> , <u><a href="#">medium</a></u> , <u><a href="#">modified</a></u> , <u><a href="#">provenance</a></u> , <u><a href="#">publisher</a></u> , <u><a href="#">references</a></u> , <u><a href="#">relation</a></u> , <u><a href="#">replaces</a></u> , <u><a href="#">requires</a></u> , <u><a href="#">rights</a></u> , <u><a href="#">rightsHolder</a></u> , <u><a href="#">source</a></u> , <u><a href="#">spatial</a></u> , <u><a href="#">subject</a></u> , <u><a href="#">tableOfContents</a></u> , <u><a href="#">temporal</a></u> , <u><a href="#">title</a></u> , <u><a href="#">type</a></u> , <u><a href="#">valid</a></u></p>
Classes	<p><u><a href="#">Agent</a></u> , <u><a href="#">AgentClass</a></u> , <u><a href="#">BibliographicResource</a></u> , <u><a href="#">FileFormat</a></u> , <u><a href="#">Frequency</a></u> , <u><a href="#">Jurisdiction</a></u> , <u><a href="#">LicenseDocument</a></u> , <u><a href="#">LinguisticSystem</a></u> , <u><a href="#">Location</a></u> , <u><a href="#">LocationPeriodOrJurisdiction</a></u> , <u><a href="#">MediaType</a></u> , <u><a href="#">MediaTypeOrExtent</a></u> , <u><a href="#">MethodOfAccrual</a></u> , <u><a href="#">MethodOfInstruction</a></u> , <u><a href="#">PeriodOfTime</a></u> , <u><a href="#">PhysicalMedium</a></u> , <u><a href="#">PhysicalResource</a></u> , <u><a href="#">Policy</a></u> , <u><a href="#">ProvenanceStatement</a></u> , <u><a href="#">RightsStatement</a></u> , <u><a href="#">SizeOrDuration</a></u> , <u><a href="#">Standard</a></u></p>



# Hands-on session (I)

## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?



Author ID	First Name	Last Name	Book ID	Title	Author	Type	ISBN
1	Paul	Auster	1	Moon palace	1	Paperback	571142200
2	Siri	Hustvedt	2	Invisible	1	Paperback	571249527

Language	Pages	Price	Date of publication	Date acquired	Comments	Publisher
English	320	12.5	2004-02-01	2013-02-01 15:00:00		Faber & Faber
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### dublin core vocabulary




Properties in the <i>/terms/</i> namespace	<a href="#">abstract</a> , <a href="#">accessRights</a> , <a href="#">accrualMethod</a> , <a href="#">accrualPeriodicity</a> , <a href="#">accrualPolicy</a> , <a href="#">alternative</a> , <a href="#">audience</a> , <a href="#">available</a> , <a href="#">bibliographicCitation</a> , <a href="#">conformsTo</a> , <a href="#">contributor</a> , <a href="#">coverage</a> , <a href="#">created</a> , <a href="#">creator</a> , <a href="#">date</a> , <a href="#">dateAccepted</a> , <a href="#">dateCopyrighted</a> , <a href="#">dateSubmitted</a> , <a href="#">description</a> , <a href="#">educationLevel</a> , <a href="#">extent</a> , <a href="#">format</a> , <a href="#">hasFormat</a> , <a href="#">hasPart</a> , <a href="#">hasVersion</a> , <a href="#">identifier</a> , <a href="#">instructionalMethod</a> , <a href="#">isFormatOf</a> , <a href="#">isPartOf</a> , <a href="#">isReferencedBy</a> , <a href="#">isReplacedBy</a> , <a href="#">isRequiredBy</a> , <a href="#">issued</a> , <a href="#">isVersionOf</a> , <a href="#">language</a> , <a href="#">license</a> , <a href="#">mediator</a> , <a href="#">medium</a> , <a href="#">modified</a> , <a href="#">provenance</a> , <a href="#">publisher</a> , <a href="#">references</a> , <a href="#">relation</a> , <a href="#">replaces</a> , <a href="#">requires</a> , <a href="#">rights</a> , <a href="#">rightsHolder</a> , <a href="#">source</a> , <a href="#">spatial</a> , <a href="#">subject</a> , <a href="#">tableOfContents</a> , <a href="#">temporal</a> , <a href="#">title</a> , <a href="#">type</a> , <a href="#">valid</a>
Classes	<a href="#">Agent</a> , <a href="#">AgentClass</a> , <a href="#">BibliographicResource</a> , <a href="#">FileFormat</a> , <a href="#">Frequency</a> , <a href="#">Jurisdiction</a> , <a href="#">LicenseDocument</a> , <a href="#">LinguisticSystem</a> , <a href="#">Location</a> , <a href="#">LocationPeriodOrJurisdiction</a> , <a href="#">MediaType</a> , <a href="#">MediaTypeOrExtent</a> , <a href="#">MethodOfAccrual</a> , <a href="#">MethodOfInstruction</a> , <a href="#">PeriodOfTime</a> , <a href="#">PhysicalMedium</a> , <a href="#">PhysicalResource</a> , <a href="#">Policy</a> , <a href="#">ProvenanceStatement</a> , <a href="#">RightsStatement</a> , <a href="#">SizeOrDuration</a> , <a href="#">Standard</a>

# Hands-on session (I)

## Creating RDF data Reusing existing terms

- Which properties/classes could we use for describing Artemis' bookstore data?



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well... not so optimal

dublin core vocabulary



Properties in the <i>/terms/</i> namespace	<p><u>abstract</u> , <u>accessRights</u> , <u>accrualMethod</u> , <u>accrualPeriodicity</u> , <u>accrualPolicy</u> , <u>alternative</u> , <u>audience</u> , <u>available</u> , <u>bibliographicCitation</u> , <u>conformsTo</u> , <u>contributor</u> , <u>coverage</u> , <u>created</u> , <u>creator</u> , <u>date</u> , <u>dateAccepted</u> , <u>dateCopyrighted</u> , <u>dateSubmitted</u> , <u>description</u> , <u>educationLevel</u> , <u>extent</u> , <u>format</u> , <u>hasFormat</u> , <u>hasPart</u> , <u>hasVersion</u> , <u>identifier</u> , <u>instructionalMethod</u> , <u>isFormatOf</u> , <u>isPartOf</u> , <u>isReferencedBy</u> , <u>isReplacedBy</u> , <u>isRequiredBy</u> , <u>issued</u> , <u>isVersionOf</u> , <u>language</u> , <u>license</u> , <u>mediator</u> , <u>medium</u> , <u>modified</u> , <u>provenance</u> , <u>publisher</u> , <u>references</u> , <u>relation</u> , <u>replaces</u> , <u>requires</u> , <u>rights</u> , <u>rightsHolder</u> , <u>source</u> , <u>spatial</u> , <u>subject</u> , <u>tableOfContents</u> , <u>temporal</u> , <u>title</u> , <u>type</u> , <u>valid</u></p>
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# Hands-on session (I)

## Creating RDF data User-defined vocabularies

- Which properties/classes could we use for describing Artemis' bookstore data?

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# Hands-on session (I)

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your own vocabulary/ontology

```
http://artemisBookstore.com/ontology#author
http://artemisBookstore.com/ontology#type
http://artemisBookstore.com/ontology#isbn
http://artemisBookstore.com/ontology#pages
http://artemisBookstore.com/ontology#price
http://artemisBookstore.com/ontology#datePublication
http://artemisBookstore.com/ontology#dateAcquired
```

# Hands-on session (I)

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your own vocabulary/ontology

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<http://artemisBookstore.com/ontology#type>

<http://artemisBookstore.com/ontology#isbn>

<http://artemisBookstore.com/ontology#pages>

<http://artemisBookstore.com/ontology#price>

<http://artemisBookstore.com/ontology#datePublication>

<http://artemisBookstore.com/ontology#dateAcquired>

use hash URIs for small datasets (e.g. ontologies)

# Hands-on session (I)

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your own vocabulary/ontology

`http://artemisBookstore.com/ontology#author` `rdfs:subPropertyOf` `dcterms:creator`

`http://artemisBookstore.com/ontology#type`

`http://artemisBookstore.com/ontology#isbn`

`http://artemisBookstore.com/ontology#pages`

`http://artemisBookstore.com/ontology#price`

`http://artemisBookstore.com/ontology#datePublication` `rdfs:subPropertyOf` `dcterms:date`

`http://artemisBookstore.com/ontology#dateAcquired` `rdfs:subPropertyOf` `dcterms:date`

**use hash URIs for small datasets (e.g. ontologies)**

# Hands-on session (I)

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# Hands-on session (I)

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rdfs   
rdfs:comment

your own vocabulary/ontology

```
http://artemisBookstore.com/ontology#author rdfs:subPropertyOf dcterms:creator
http://artemisBookstore.com/ontology#type
http://artemisBookstore.com/ontology#isbn
http://artemisBookstore.com/ontology#pages
http://artemisBookstore.com/ontology#price
http://artemisBookstore.com/ontology#datePublication rdfs:subPropertyOf dcterms:date
http://artemisBookstore.com/ontology#dateAcquired rdfs:subPropertyOf dcterms:date
```

use hash URIs for small datasets (e.g. ontologies)

# Hands-on session (I)

## Creating RDF data User-defined vocabularies

- Which properties/classes could we use for describing Artemis' bookstore data?

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your own vocabulary/ontology

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http://artemisBookstore.com/ontology#pages
http://artemisBookstore.com/ontology#price
http://artemisBookstore.com/ontology#datePublication rdfs:subPropertyOf dcterms:date
http://artemisBookstore.com/ontology#dateAcquired rdfs:subPropertyOf dcterms:date
```

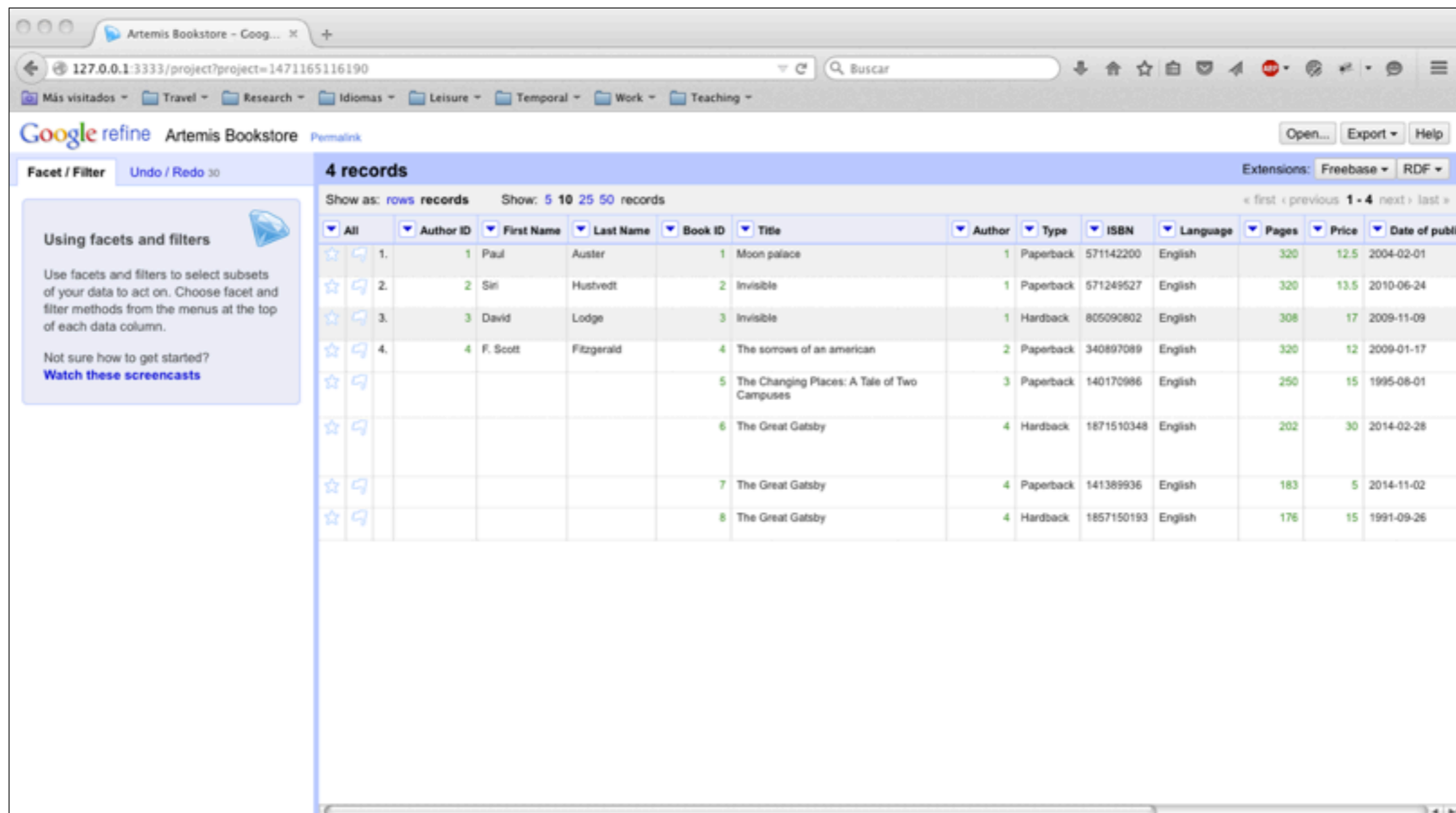
use hash URIs for small datasets (e.g. ontologies)

 protégé out of scope

# Hands-on session (I)

## OpenRefine RDF extension

- Let's create RDF data with OpenRefine + RDF extension (developed at DERI)



The screenshot shows the OpenRefine interface with the 'Artemis Bookstore' project. The main area displays a table of 4 records. The table has columns for All, Author ID, First Name, Last Name, Book ID, Title, Author, Type, ISBN, Language, Pages, Price, and Date of publication. The records are as follows:

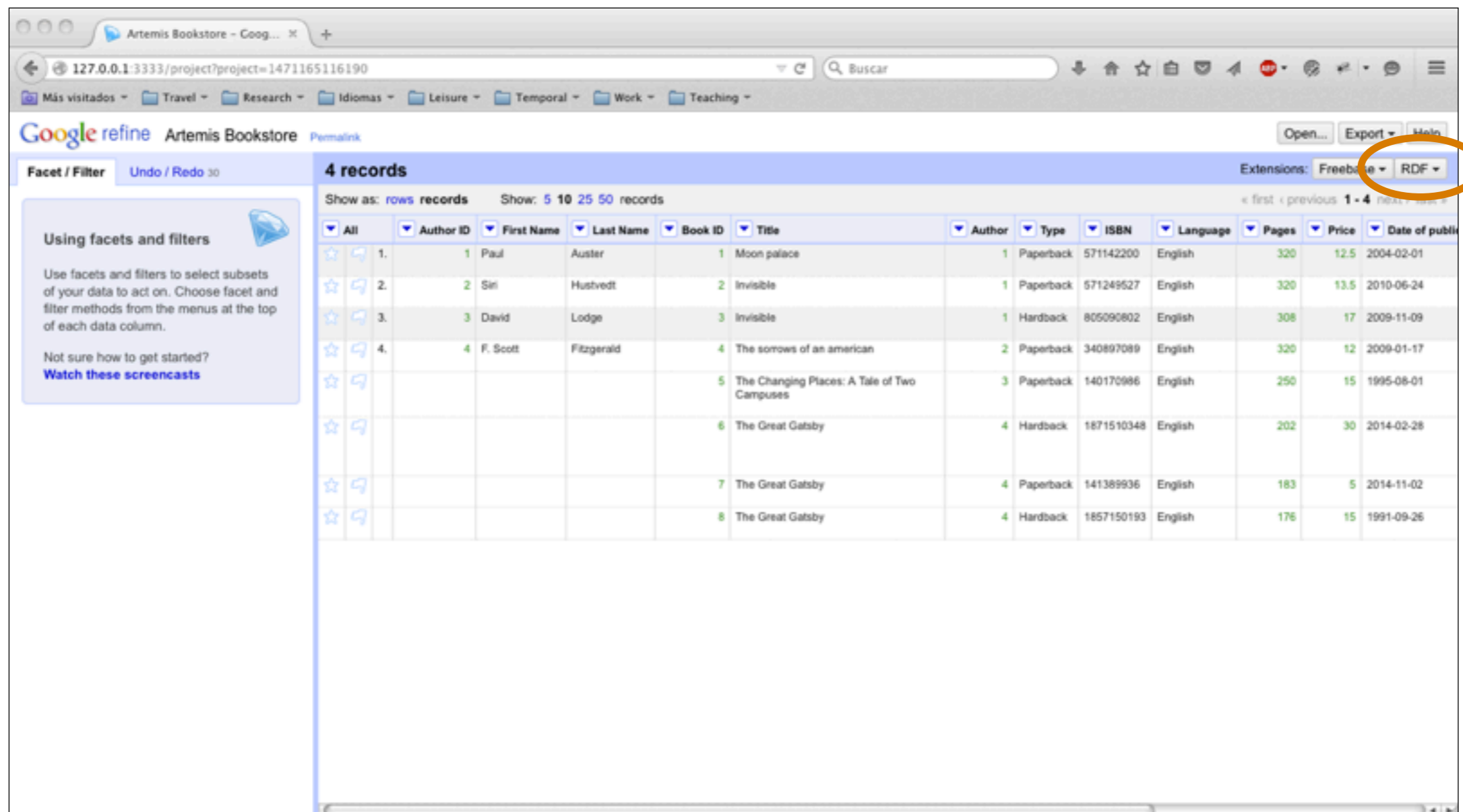
All	Author ID	First Name	Last Name	Book ID	Title	Author	Type	ISBN	Language	Pages	Price	Date of publication
1.	1	Paul	Auster	1	Moon palace	1	Paperback	571142200	English	320	12.5	2004-02-01
2.	2	Siri	Hustvedt	2	Invisible	1	Paperback	571249527	English	320	13.5	2010-06-24
3.	3	David	Lodge	3	Invisible	1	Hardback	805090802	English	308	17	2009-11-09
4.	4	F. Scott	Fitzgerald	4	The sorrows of an american	2	Paperback	340897089	English	320	12	2009-01-17
				5	The Changing Places: A Tale of Two Campuses	3	Paperback	140170986	English	250	15	1995-08-01
				6	The Great Gatsby	4	Hardback	1871510348	English	202	30	2014-02-28
				7	The Great Gatsby	4	Paperback	141389936	English	183	5	2014-11-02
				8	The Great Gatsby	4	Hardback	1857150193	English	176	15	1991-09-26

you can download OpenRefine RDF extension at <http://refine.deri.ie/>

# Hands-on session (I)

## OpenRefine RDF extension

- Let's create RDF data with OpenRefine + RDF extension (developed at DERI)



The screenshot shows the OpenRefine interface with a table of 4 records. The 'Extensions' dropdown menu is highlighted with an orange circle, showing 'Freebase' and 'RDF' options. The table contains the following data:

All	Author ID	First Name	Last Name	Book ID	Title	Author	Type	ISBN	Language	Pages	Price	Date of publication
1.	1	Paul	Auster	1	Moon palace	1	Paperback	571142200	English	320	12.5	2004-02-01
2.	2	Siri	Hustvedt	2	Invisible	1	Paperback	571249527	English	320	13.5	2010-06-24
3.	3	David	Lodge	3	Invisible	1	Hardback	805090802	English	308	17	2009-11-09
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				7	The Great Gatsby	4	Paperback	141389936	English	183	5	2014-11-02
				8	The Great Gatsby	4	Hardback	1857150193	English	176	15	1991-09-26

you can download OpenRefine RDF extension at <http://refine.deri.ie/>

# Hands-on session (I)

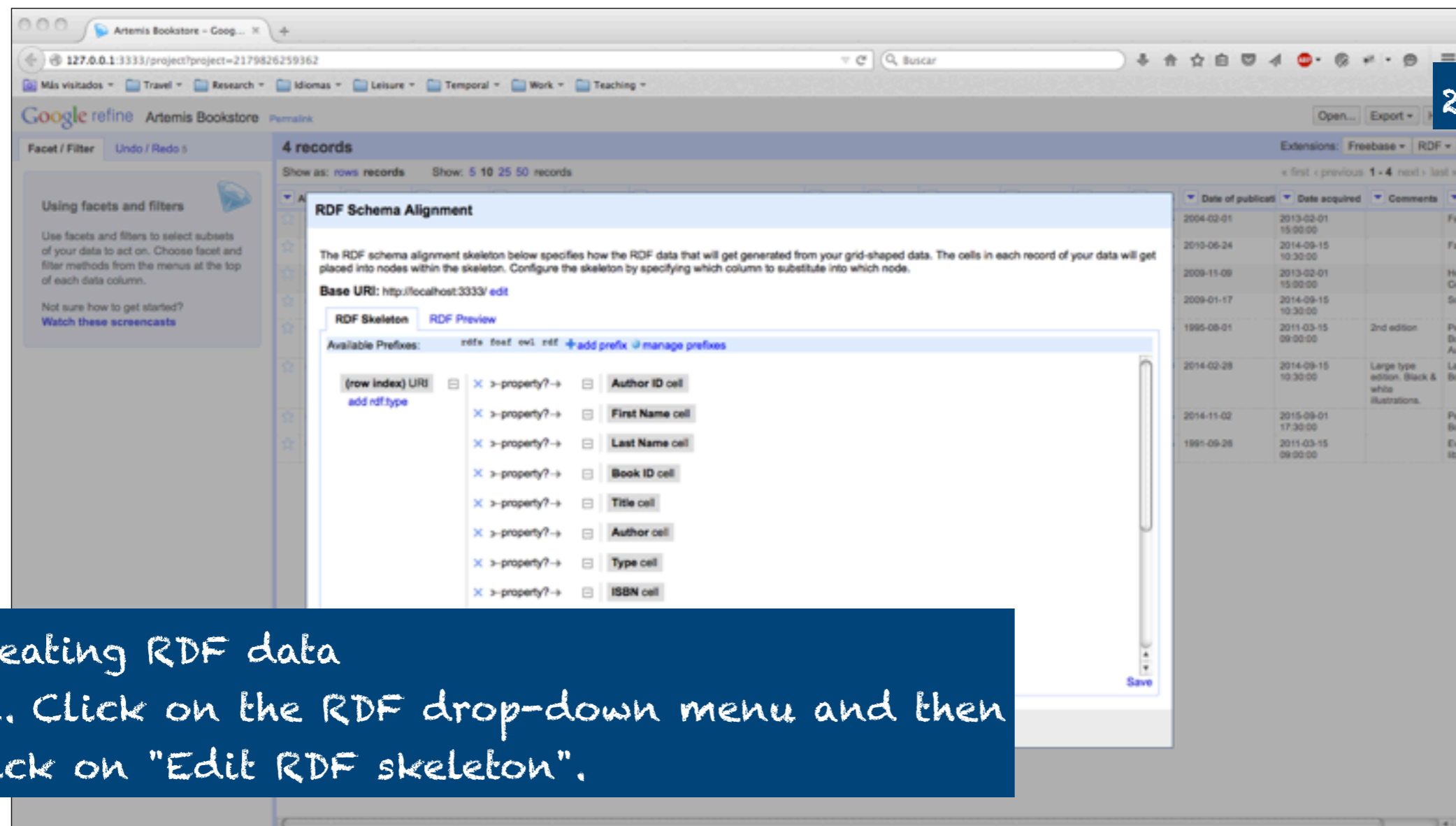
## Creating RDF data

- Let's create RDF data!

# Hands-on session (I)

## Creating RDF data

- Let's create RDF data!



2.1

Using facets and filters

Use facets and filters to select subsets of your data to act on. Choose facet and filter methods from the menus at the top of each data column.

Not sure how to get started?  
Watch these screencasts

4 records

Show as: rows records Show: 5 10 25 50 records

### RDF Schema Alignment

The RDF schema alignment skeleton below specifies how the RDF data that will get generated from your grid-shaped data. The cells in each record of your data will get placed into nodes within the skeleton. Configure the skeleton by specifying which column to substitute into which node.

Base URI: <http://localhost:3333/> [edit](#)

RDF Skeleton RDF Preview

Available Prefixes: [rdf](#) [foaf](#) [owl](#) [rdf](#) [+ add prefix](#) [manage prefixes](#)

(row index) URI	> property? →	
<a href="#">add rdf:type</a>	> property? →	Author ID cell
	> property? →	First Name cell
	> property? →	Last Name cell
	> property? →	Book ID cell
	> property? →	Title cell
	> property? →	Author cell
	> property? →	Type cell
	> property? →	ISBN cell

Date of publication	Date acquired	Comments	
2004-02-01	2013-02-01 15:00:00		Fab
2010-06-24	2014-09-15 10:30:00		Fab
2009-11-09	2013-02-01 15:00:00		Her Com
2009-01-17	2014-09-15 10:30:00		Sci
1995-08-01	2011-03-15 09:00:00	2nd edition	Pen Book Aust
2014-02-28	2014-09-15 10:30:00	Large type edition, Black & white illustrations.	Lang Book
2014-11-02	2015-09-01 17:30:00		Pen Book
1991-09-28	2011-03-15 09:00:00		Ever Libr

2. Creating RDF data

2.1. Click on the RDF drop-down menu and then click on "Edit RDF skeleton".



# Hands-on session (I)

## Creating RDF data

- Let's create RDF data!

**RDF Schema Alignment**

The RDF schema alignment skeleton below specifies how the RDF data that will get generated from your grid-shaped data. The cells in each record of your data will get placed into nodes within the skeleton. Configure the skeleton by specifying which column to substitute into which node.

**Base URI:** <http://artemisBookstore.com/> [edit](#)

**RDF Skeleton** **RDF Preview**

Available Prefixes: `rdfs foaf owl rdf` [+add prefix](#) [manage prefixes](#)

(row index) URI	>-property?->	node
<a href="#">add rdf:type</a>	X	Author ID cell
	X	First Name cell
	X	Last Name cell
	X	Book ID cell
	X	Title cell
	X	Author cell
	X	Type cell
	X	ISBN cell
	X	Language cell
	X	Pages cell

**2.3** [Add another root node](#)

[Save](#)

[OK](#) [Cancel](#)

2. Creating RDF data (cont.)  
2.2. Choose a cool base URI  
2.3. Add another root node (one will be used for books and another one for authors)



# Hands-on session (I)

## Creating RDF data

- Let's create RDF data!

The screenshot shows the 'RDF Schema Alignment' interface. On the left, the 'RDF Skeleton' tab is active, displaying a table with columns for '(row index) URI', 'property?', and 'cell'. The table lists properties like 'Author ID', 'First Name', 'Last Name', 'Book ID', 'Title', and 'Author'. A blue arrow points from the '(row index) URI' column to the 'RDF Node' dialog box on the right.

The 'RDF Node' dialog box has two main sections:

- Use content from cell...:** A list of properties with radio buttons. The '(row index)' option is selected and highlighted with a blue box labeled '2.4'.
- The cell's content is used ...:** A list of data types with radio buttons. The 'as a URI' option is selected and highlighted with a blue box labeled '2.5'.

At the bottom of the dialog, there are 'OK' and 'Cancel' buttons, and a 'Save' button is visible in the background interface.

## 2. Creating RDF data (cont.)

2.4. For each RDF node (root or not), choose the cell content you want it to embody (e.g. Author ID).

2.5. Specify if the content will be used as a URI (e.g. Author ID) or a Literal (e.g. First Name).

# Hands-on session (I)

## Creating RDF data

- Let's create RDF data!

The screenshot shows the 'RDF Schema Alignment' interface. The 'RDF Skeleton' tab is active, showing a table with columns for '(row index) URI' and 'add rdf:type'. The 'RDF Node' dialog is open, with 'Use content from cell...' set to '(row index)'. The 'The cell's content is used ...' section has 'as a URI' selected. The 'Preview URI values' dialog is also open, showing the expression `"/id/author/" + cells["Author ID"].value` and a preview table.

**RDF Node**

Use content from cell...  
 (row index)  
 Author ID  
 First Name  
 Last Name  
 Book ID  
 Title  
 Author  
 Type  
 ISBN  
 Language  
 Pages  
 Price  
 Date of publication  
 Date acquired  
 Comments  
 Publisher

The cell's content is used ...  
 as a URI  
 as text  
 as language-tagged text  
 as integer number  
 as non-integer number  
 as date (YYYY-MM-DD)  
 as dateTime (YYYY-MM-DD HH:MM:SS)  
 as boolean  
 as custom datatype (specify type URI)  
 as a blank node

Use custom expression...  
value  
preview/edit 2.6

**Preview URI values**

Expression: `"/id/author/" + cells["Author ID"].value` Language: Google Refine Expression Language (GREL) No syntax error.

row	value	resolved against the base URI
1.	1	<code>/id/author/1</code> <code>http://artemisBookstore.com/id/author/1</code>
2.	2	<code>/id/author/2</code> <code>http://artemisBookstore.com/id/author/2</code>
3.	3	<code>/id/author/3</code> <code>http://artemisBookstore.com/id/author/3</code>
4.	4	<code>/id/author/4</code> <code>http://artemisBookstore.com/id/author/4</code>
5.		<code>/id/author/</code> <code>http://artemisBookstore.com/id/author/</code>
6.		<code>/id/author/</code> <code>http://artemisBookstore.com/id/author/</code>
7.		<code>/id/author/</code> <code>http://artemisBookstore.com/id/author/</code>

### 2. Creating RDF data (cont.)

2.6. If the cell's content will be used as a URI, find a cool URI. For this, you may need to have a look at GREL - General Refine Expression Language)

# Hands-on session (I)

- General Refine Expression Language (GREL)

The screenshot shows the 'Preview URI values' dialog in OpenRefine. The 'Expression' field contains the GREL expression: `"/id/author/" + cells["Author ID"].value`. The 'Language' dropdown is set to 'Google Refine Expression Language (GREL)'. A message on the right says 'No syntax error.' Below the expression field are tabs for 'Preview', 'History', 'Starred', and 'Help'. The 'Preview' tab is active, showing a table with 7 rows. The first two rows have values, while the last three are empty. A tooltip is open over the `cells` variable in the expression, showing its meaning.

row	value	resolved against the base URI
1.	1	<code>/id/author/1</code> <code>http://artemisBookstore.com/id/author/1</code>
2.	2	<code>/id/author/2</code> <code>http://artemisBookstore.com/id/author/2</code>
3.	3	<code>/id/author/3</code>
4.	4	<code>/id/author/4</code>
5.		<code>/id/author/</code>
6.		<code>/id/author/</code>
7.		<code>/id/author/</code>

variable name	meaning
<code>value</code>	the value of the cell in the base column of the current row; can be <code>null</code>
<code>row</code>	the current row; an object with more fields, with details below
<code>cells</code>	the cells of the current row, with fields that correspond to the column names; more details below

more info at <https://github.com/OpenRefine/OpenRefine/wiki/Variables>

<https://github.com/OpenRefine/OpenRefine/wiki/General-Refine-Expression-Language>



# Hands-on session (I)

## Creating RDF data

- Let's create RDF data!

The screenshot shows the 'RDF Schema Alignment' tool. A 'New Prefix' dialog box is open, with 'dcterms' in the prefix field and 'http://purl.org/dc/terms/' in the URI field. The main interface has several numbered annotations: 2.6 points to the 'Author ID URI' field; 2.7 points to the 'foaf:firstName' property and the 'First Name cell'; 2.8 points to the 'Available Prefixes' list; and 2.9 points to the 'Base URI' field. A table of properties and cells is visible, including 'First Name cell', 'Last Name cell', 'Book ID cell', 'Title cell', 'Author cell', 'Type cell', 'ISBN cell', 'Language cell', 'Pages cell', and 'Price cell'.

2.6. Declare the type of each RDF node

2.7. Add/remove properties specifying the property values (as URIs or literals).

2.8. Add new prefixes and import vocabularies if necessary (e.g. Dublin Core).

2.9. At any time, see the RDF preview to spot possible mistakes

- You should end up with something like this:

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix abo: <http://artemisBookstore.com/ontology#> .
@prefix dcterms: <http://purl.org/dc/terms/> .

<http://artemisBookstore.com/id/author/1> a foaf:Person ;
    foaf:firstName "Paul" ;
    foaf:lastName "Auster" .

<http://artemisBookstore.com/id/book/571142200> a dcterms:BibliographicResource ;
    dcterms:title "Moon palace" ;
    abo:author <http://artemisBookstore.com/id/author/1> ;
    abo:bookType "Paperback" ;
    abo:isbn "571142200" ;
    abo:language "English" ;
    abo:pages "320"^^<http://www.w3.org/2001/XMLSchema#int> ;
    abo:price "12.5"^^<http://www.w3.org/2001/XMLSchema#double> ;
    abo:datePublication "2004-02-01" ;
    abo:dateAcquired "2013-02-01 15:00:00" ;
    dcterms:publisher "Faber & Faber" .

<http://artemisBookstore.com/id/author/2> a foaf:Person ;
    foaf:firstName "Siri" ;
    foaf:lastName "Hustvedt" .
```

# Hands-on session (I)

## Creating links to external datasets

- Now, let's create RDF data! But before
- Let's recall the Linked Data principles:
  1. Use URIs as names for things.
  2. Use HTTP URIs, so that people can look up those names.
  3. When someone looks up a URI, provide useful information using the standards (RDF, SPARQL).
  - 4. Include links to other URIs, so that they can discover more things.**



- Data interlinking
  - Not an easy task
    - a large quantity of data
    - semantic heterogeneity
    - noisy data
  - Performed manually or (semi-)automatically
  - Key-based approaches vs similarity-based approaches
  - Data interlinking tools:
    - Silk - Link Discovery Framework
    - LiMES - Link Discovery Framework for Metric Spaces
    - Link Keys
    - OpenRefine + Reconciliation services

- Data interlinking
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    - Link Keys
    - **OpenRefine + Reconciliation services**

# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints

# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>



# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>



<http://dbpedia.org/resource/??>



# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

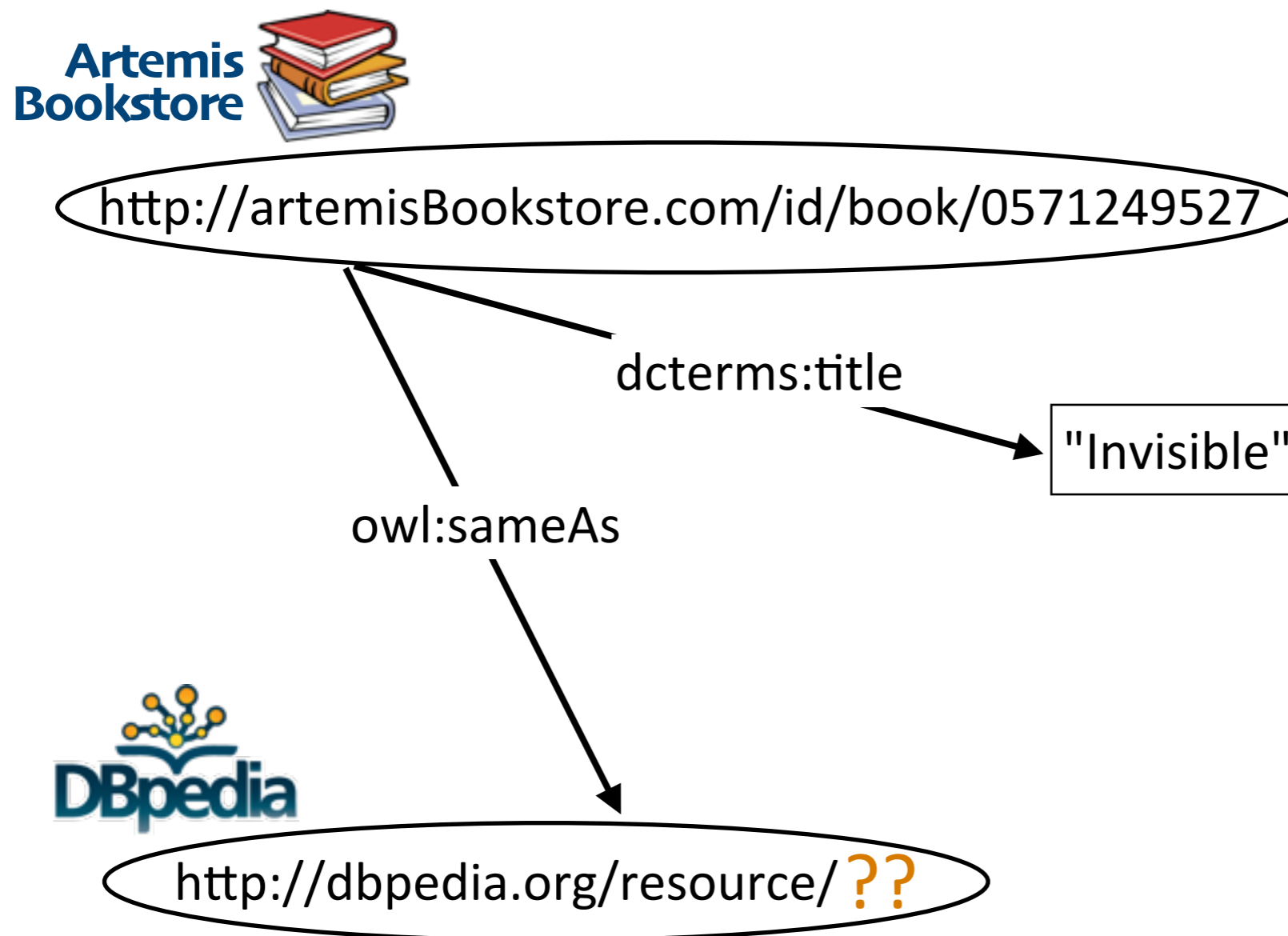
owl:sameAs



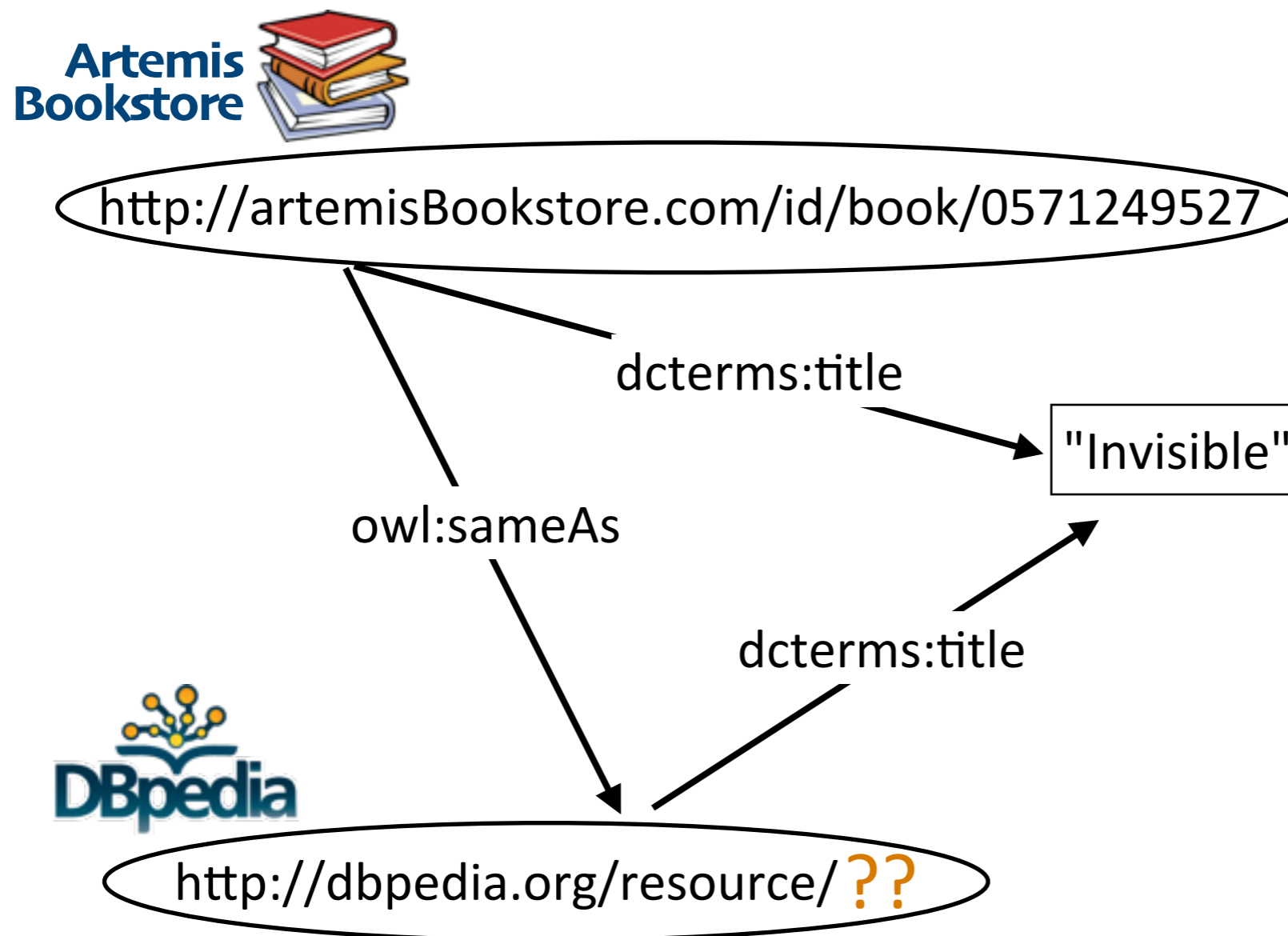
<http://dbpedia.org/resource/??>

# Hands-on session (I)

- Reconciliation services based on SPARQL endpoints



- Reconciliation services based on SPARQL endpoints



- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"

owl:sameAs

dcterms:title



<http://dbpedia.org/resource/??>



- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"

owl:sameAs

dcterms:title



<http://dbpedia.org/resource/??>



find DBpedia resources having "Invisible" as a value for the property dcterms:title

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"

owl:sameAs

dcterms:title



<http://dbpedia.org/resource/??>

we can refine our search:  
-or dc:title, rdfs:label...  
-similar to "Invisible"  
-resources of type dbo:Book



find DBpedia resources having "Invisible" as a value for the property dcterms:title



# Hands-on session (I)

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"



# Hands-on session (I)

## OpenRefine Reconciliation services

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"



[http://dbpedia.org/resource/Invisible\\_\(Auster\\_novel\)](http://dbpedia.org/resource/Invisible_(Auster_novel))

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"

"Invisible (Auster novel)"

rdfs:label



[http://dbpedia.org/resource/Invisible\\_\(Auster\\_novel\)](http://dbpedia.org/resource/Invisible_(Auster_novel))

- Reconciliation services based on SPARQL endpoints



<http://artemisBookstore.com/id/book/0571249527>

dcterms:title

"Invisible"



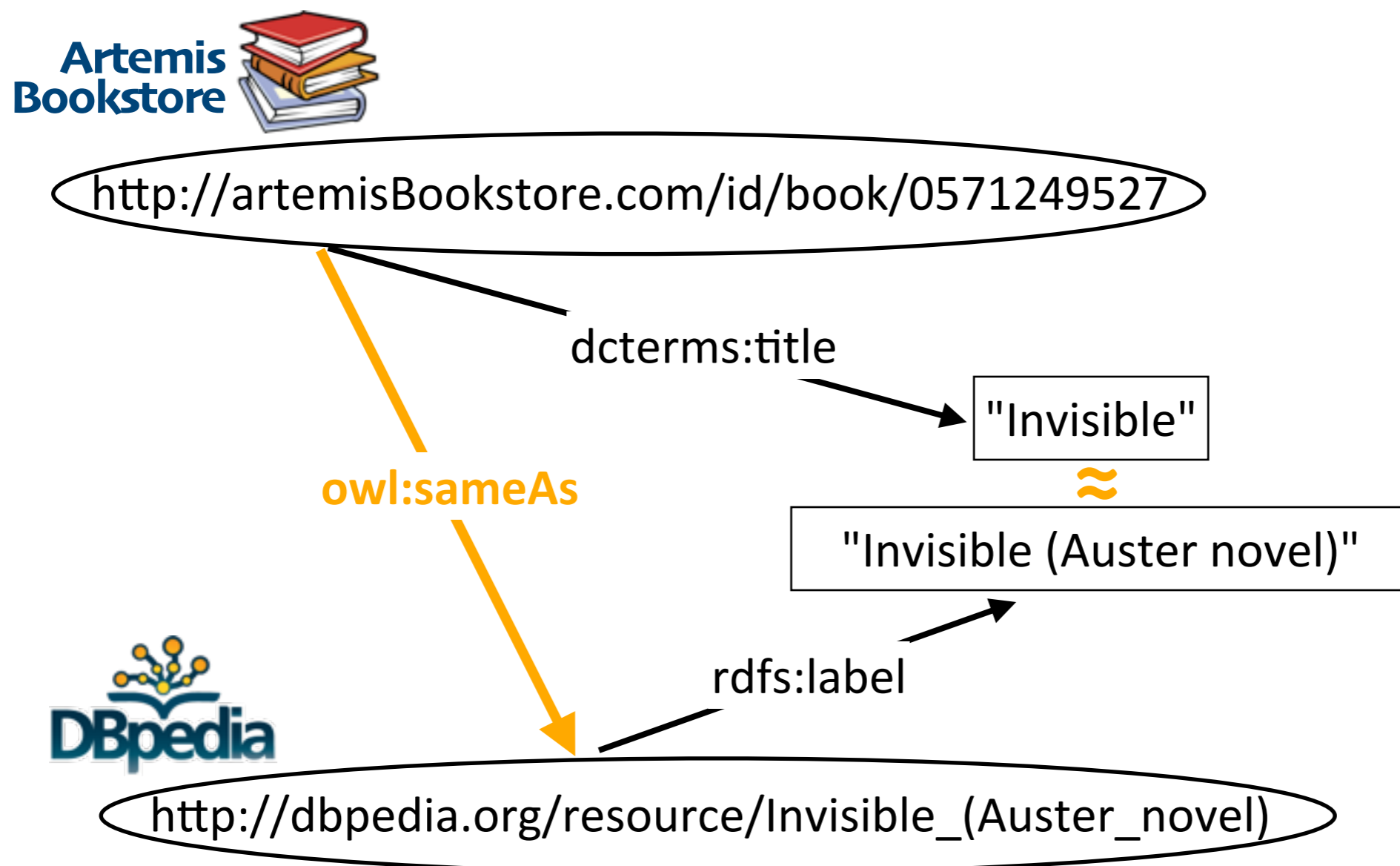
"Invisible (Auster novel)"

rdfs:label



[http://dbpedia.org/resource/Invisible\\_\(Auster\\_novel\)](http://dbpedia.org/resource/Invisible_(Auster_novel))

- Reconciliation services based on SPARQL endpoints



# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

3.1

3.1.1

3.1.2

3.1.3

3.1.3

### 3. Creating links to external datasets

3.1. Add a reconciliation service based on DBpedia SPARQL endpoint.

3.1.1. Choose a name (e.g. DBpedia)

3.1.2. Provide the endpoint URL  
(<http://dbpedia.org/sparql>)

3.1.3. Select the type virtuoso

3.1.4. Select the properties that will be used to match resources (e.g. `rdfs:label`)





# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

3.2

Reconcile column "Title"

3.3

3.4

3.5

Column	Include?	As Property
Author ID	<input type="checkbox"/>	
First Name	<input type="checkbox"/>	
Last Name	<input type="checkbox"/>	
Book ID	<input type="checkbox"/>	
Author	<input type="checkbox"/>	
Type	<input type="checkbox"/>	
ISBN	<input type="checkbox"/>	
Language	<input type="checkbox"/>	
Pages	<input type="checkbox"/>	
Price	<input type="checkbox"/>	

### 3. Creating links to external datasets (cont.)

3.2. Choose the data values you want to use for interlinking (e.g. book titles) and start reconciling

3.3. Specify the type of the resources you want to link your data with

3.4. You also can select other properties, to be used for interlinking

3.5. Start reconciling!

# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

3.6.1

3.6.2

3.6.3

The screenshot shows a vertical list of items in a reconciliation tool. Each item has a 'Title' dropdown, a 'Choose new match' link, and a 'Create new topic' checkbox. The items are: 'Moon Palace', 'Invisible!', 'The Sorrows of an American', 'The Changing Places: A Tale of Two Campuses', and 'The Great Gatsby'. The 'Create new topic' checkbox is checked for 'The Changing Places: A Tale of Two Campuses'.

3.6.3

Search for Match

Search for "The Changing Places: A Tale of Two Campuses"

Match other cells with same content  
 Match this cell only

Match New Topic Don't Reconcile

Changing Places

Select an item from the list:

- Changing Places
- Changing Places
- Changing Places
- Changing places
- Changing Places (album)

[http://dbpedia.org/resource/Changing\\_Places](http://dbpedia.org/resource/Changing_Places)

Changing Places  
This article is about the novel by David Lodge. To read about the thought experiment conceived by Max Velmans, see Changing places. For the album by Tord Gustavsen see Changing Places (album) Changing Places (1975) is the first "campus novel" by British novelist David Lodge. The subtitle is "A Tale of Two Campuses", and thus both the title and subtitle are literary allusions to Charles Dickens' A Tale of Two Cities. A successful sequel, Small World, was published in 1984.

The screenshot shows a 'Search for Match' dialog box. The search term is 'The Changing Places: A Tale of Two Campuses'. There are two radio buttons: 'Match other cells with same content' (selected) and 'Match this cell only'. Below the dialog is a table with columns for ID, Language, Count, Date, and Description. A dropdown menu is open, showing search results for 'Changing Places'. A tooltip is visible over the first result, showing the DBpedia URL and a snippet of text about the novel by David Lodge.

### 3. Creating links to external datasets (cont.)

3.6. Once the reconciliation process is finished

3.6.1. Some links will be correctly found, but

3.6.2. You may need to validate other links, and

3.6.3. You may need to find links manually

# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

The screenshot shows a data table with columns: Title, Author, Type, ISBN, and Language. A context menu is open over the 'Title' column, with the 'Add column based on this column...' option selected. A blue box with the number '3.7' is placed over this menu item. An arrow points from this menu item to a dialog box titled 'Add column based on column Title'. The dialog box has 'New column name' set to 'DBpedia link', 'On error' set to 'set to blank', and 'Expression' set to 'cell.recon.match.id'. A blue box with the number '3.8' is placed over the expression field. Below the dialog box is a preview table showing the results of the GREL expression.

row	value	cell.recon.match.id
1.	Moon palace	<a href="http://dbpedia.org/resource/Moon_Palace">http://dbpedia.org/resource/Moon_Palace</a>
2.	Invisible	<a href="http://dbpedia.org/resource/Invisible!">http://dbpedia.org/resource/Invisible!</a>
3.	Invisible	<a href="http://dbpedia.org/resource/Invisible!">http://dbpedia.org/resource/Invisible!</a>
4.	The sorrows of an american	<a href="http://dbpedia.org/resource/The_Sorrows_of_an_American">http://dbpedia.org/resource/The_Sorrows_of_an_American</a>
5.	The Changing Places: A Tale of Two Campuses	<a href="http://dbpedia.org/resource/Changing_Places">http://dbpedia.org/resource/Changing_Places</a>
6.	The Great Gatsby	<a href="http://dbpedia.org/resource/The_Great_Gatsby">http://dbpedia.org/resource/The_Great_Gatsby</a>

3. Creating links to external datasets (cont.)

3.7. Add a new column based on the column used for interlinking.

3.8. Retrieve the links found using GREL.



# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

The screenshot shows a data table with columns: Title, Author, Type, ISBN, and Language. A context menu is open over the 'Title' column, with the option 'Add column based on this column...' selected. A blue box with the number '3.7' is next to this option. An arrow points from this option to a dialog box titled 'Add column based on column Title'. The dialog shows 'New column name' as 'DBpedia link', 'On error' set to 'set to blank', and 'Expression' as 'cell.recon.match.id'. A blue box with the number '3.8' is next to the expression field. Below the dialog is a preview table showing the resulting DBpedia links for each row.

row	value	cell.recon.match.id
1.	Moon palace	<a href="http://dbpedia.org/resource/Moon_Palace">http://dbpedia.org/resource/Moon_Palace</a>
2.	Invisible	<a href="http://dbpedia.org/resource/Invisible!">http://dbpedia.org/resource/Invisible!</a>
3.	Invisible	<a href="http://dbpedia.org/resource/Invisible!">http://dbpedia.org/resource/Invisible!</a>
4.	The sorrows of an american	<a href="http://dbpedia.org/resource/The_Sorrows_of_an_American">http://dbpedia.org/resource/The_Sorrows_of_an_American</a>
5.	The Changing Places: A Tale of Two Campuses	<a href="http://dbpedia.org/resource/Changing_Places">http://dbpedia.org/resource/Changing_Places</a>
6.	The Great Gatsby	<a href="http://dbpedia.org/resource/The_Great_Gatsby">http://dbpedia.org/resource/The_Great_Gatsby</a>

DBpedia links

3. Creating links to external datasets (cont.)  
3.7. Add a new column based on the column used for interlinking.  
3.8. Retrieve the links found using GREL.

# Hands-on session (I)

- General Refine Expression Language (GREL)

**Add column based on column Title**

New column name: DBpedia link

On error:  set to blank  store error  copy value from original column

Expression: `cell.recon.match.id` Language: Google Refine Expression Language (GREL)

recon: the recon object of a cell returned from a reconciliation service or provider; an object with more fields, with details below

**Recon**  
A recon object has a few fields

field name	meaning	deeper fields
<code>recon.judgment</code>	a string that is one of: "matched", "new", "none"	
<code>recon.matched</code>	a boolean, true iff judgment is "matched"	
<code>recon.match</code>	null, or the recon candidate that has been matched against this cell	<code>.id</code> <code>.name</code> <code>.type</code>

Preview: History Starred Help

row	value	cell.recon.mat
1.	Moon palace	http://dbpedia.o
2.	Invisible	http://dbpedia.o
3.	Invisible	http://dbpedia.o
4.	The sorrows of an american	http://dbpedia.o /The_Sorrows
5.	The Changing Places: A Tale of Two Campuses	http://dbpedia.o
6.	The Great Gatsby	http://dbpedia.o

OK Cancel

more info at <https://github.com/OpenRefine/OpenRefine/wiki/Variables>

<https://github.com/OpenRefine/OpenRefine/wiki/General-Refine-Expression-Language>

# Hands-on session (I)

## Creating links to external datasets

- Let's create links to DBpedia!

Last Name	Author's DBpedia link	Book ID	Title	Book's DBpedia link
Auster, Paul <small>Choose new match</small>	<a href="http://dbpedia.org/resource/Auster,_Paul">http://dbpedia.org/resource/Auster,_Paul</a>	1	Moon Palace <small>Choose new match</small>	<a href="http://dbpedia.org/resource/Moon_Palace">http://dbpedia.org/resource/Moon_Palace</a>
Siri Hustvedt <small>Choose new match</small>	<a href="http://dbpedia.org/resource/Siri_Hustvedt">http://dbpedia.org/resource/Siri_Hustvedt</a>			
David Lodge <small>Choose new match</small>	<a href="http://dbpedia.org/resource/David_Lodge">http://dbpedia.org/resource/David_Lodge</a>			
F. Scott Fitzgerald <small>Choose new match</small>	<a href="http://dbpedia.org/resource/F._Scott_Fitzgerald">http://dbpedia.org/resource/F._Scott_Fitzgerald</a>			

### RDF Schema Alignment

The RDF schema alignment skeleton below specifies how the RDF data that will get generated from your grid-shaped data. The cells in each record of your data will get placed into nodes within the skeleton. Configure the skeleton by specifying which column to substitute into which node.

Base URI: <http://artemisBookstore.com/> [edit](#)

RDF Skeleton [RDF Preview](#)

Available Prefixes: [rdfa](#) [foaf](#) [owl](#) [rdf](#) [abo](#) [dcterms](#) [+ add prefix](#) [manage prefixes](#)

**Author ID URI**  [x foaf:Person](#) [add rdf:type](#)

**Book ID URI**  [x dcterms:BibliographicResource](#) [add rdf:type](#)

**3.9**

**Author ID URI**  [x >-foaf:firstName->](#)  **First Name cell**

**Author ID URI**  [x >-foaf:lastName->](#)  **Last Name cell**

**Author ID URI**  [x >-owl:sameAs->](#)  **Author's DBpedia link URI**  [add rdf:type](#)

**Book ID URI**  [x >-dcterms:title->](#)  **Title cell**

**Book ID URI**  [x >-abo:author->](#)  **Author URI**  [add rdf:type](#)

**Book ID URI**  [x >-abo:bookType->](#)  **Type cell**

**Book ID URI**   **ISBN cell**

[Save](#)

3. Creating links to external datasets (cont.)  
3.9. Now you can update the RDF skeleton with the DBpedia links using owl:sameAs.



# Hands-on session (I)

## Creating links to external datasets

- You should end up with something like this

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix abo: <http://artemisBookstore.com/ontology#> .
@prefix dcterms: <http://purl.org/dc/terms/> .

<http://artemisBookstore.com/id/author/1> a foaf:Person ;
    foaf:firstName "Paul" ;
    foaf:lastName "Auster" ;
    owl:sameAs <http://dbpedia.org/resource/Auster,_Paul> .

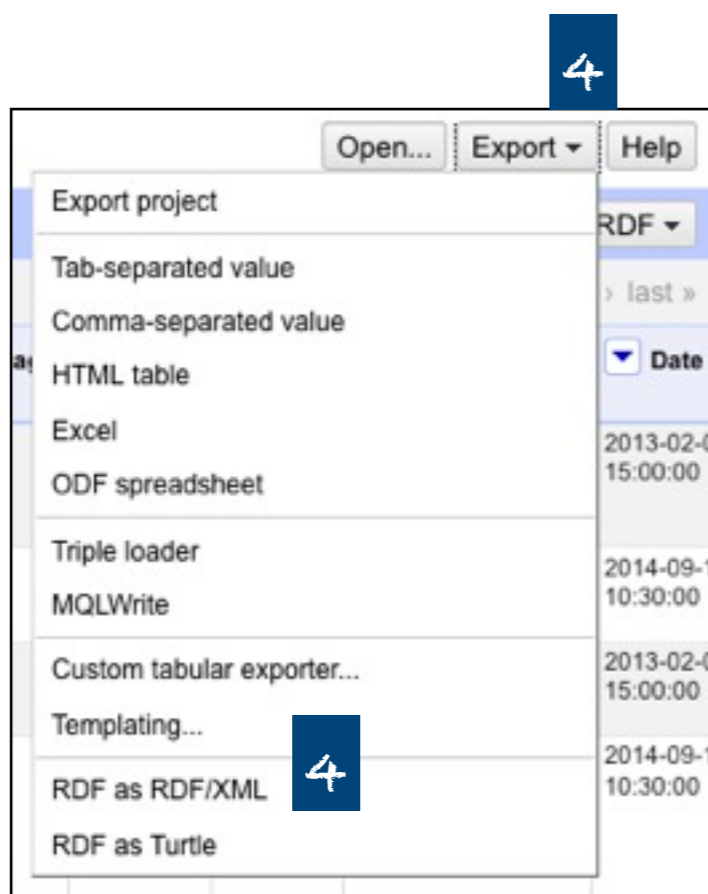
<http://artemisBookstore.com/id/book/571142200> a dcterms:BibliographicResource ;
    dcterms:title "Moon palace" ;
    abo:author <http://artemisBookstore.com/id/author/1> ;
    abo:bookType "Paperback" ;
    abo:isbn "571142200" ;
    abo:language "English" ;
    abo:pages "320"^^<http://www.w3.org/2001/XMLSchema#int> ;
    abo:price "12.5"^^<http://www.w3.org/2001/XMLSchema#double> ;
    abo:datePublication "2004-02-01" ;
    abo:dateAcquired "2013-02-01 15:00:00" ;
    dcterms:publisher "Faber & Faber" ;
    owl:sameAs <http://dbpedia.org/resource/Moon_Palace> .

<http://artemisBookstore.com/id/author/2> a foaf:Person ;
    foaf:firstName "Siri" ;
    foaf:lastName "Hustvedt" ;
    owl:sameAs <http://dbpedia.org/resource/Siri_Hustvedt> .
```

# Hands-on session (I)

## Artemis' RDF data

- Artemis' data is now available in RDF. Well done!



```
- <rdf:RDF>
- <rdf:Description rdf:about="http://artemisBookstore.com/id/author/1">
  <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/Person"/>
  <foaf:firstName>Paul</foaf:firstName>
  <foaf:lastName>Auster</foaf:lastName>
  <owl:sameAs rdf:resource="http://dbpedia.org/resource/Auster,_Paul"/>
</rdf:Description>
- <rdf:Description rdf:about="http://artemisBookstore.com/id/book/571142200">
  <rdf:type rdf:resource="http://purl.org/dc/terms/BibliographicResource"/>
  <dcterms:title>Moon palace</dcterms:title>
  <abo:author rdf:resource="http://artemisBookstore.com/id/author/1"/>
  <abo:bookType>Paperback</abo:bookType>
  <abo:isbn>571142200</abo:isbn>
  <abo:language>English</abo:language>
  <abo:pages r...>320</abo:pages r...>
  <abo:price r...>12.5</abo:price r...>
  <abo:datePubl...>2004-02-01</abo:datePubl...>
  <abo:dateAcq...>2013-02-01 15:00:00</abo:dateAcq...>
  <dcterms:pul...>Faber & Faber</dcterms:pul...>
  <owl:sameAs...>http://dbpedia.org/resource/Moon_Palace</owl:sameAs...>
</rdf:Description>
- <rdf:Description...>
  <foaf:firstName>Siri</foaf:firstName>
  <foaf:lastName>Hustvedt</foaf:lastName>
  <owl:sameAs...>http://dbpedia.org/resource/Siri_Hustvedt</owl:sameAs...>
</rdf:Description>
```

```
<http://artemisBookstore.com/id/author/1> a foaf:Person ;
  foaf:firstName "Paul" ;
  foaf:lastName "Auster" ;
  owl:sameAs <http://dbpedia.org/resource/Auster,_Paul> .

<http://artemisBookstore.com/id/book/571142200> a dcterms:BibliographicResource ;
  dcterms:title "Moon palace" ;
  abo:author <http://artemisBookstore.com/id/author/1> ;
  abo:bookType "Paperback" ;
  abo:isbn "571142200" ;
  abo:language "English" ;
  abo:pages "320"^^<http://www.w3.org/2001/XMLSchema#int> ;
  abo:price "12.5"^^<http://www.w3.org/2001/XMLSchema#double> ;
  abo:datePublication "2004-02-01" ;
  abo:dateAcquired "2013-02-01 15:00:00" ;
  dcterms:publisher "Faber & Faber" ;
  owl:sameAs <http://dbpedia.org/resource/Moon_Palace> .

<http://artemisBookstore.com/id/author/2> a foaf:Person ;
  foaf:firstName "Siri" ;
  foaf:lastName "Hustvedt" ;
  owl:sameAs <http://dbpedia.org/resource/Siri_Hustvedt> .
```

4. You can export Artemis' RDF data as RDF/XML or Turtle.

- Part I: From an Excel data file to linked open data
  - you will learn how to
    - create "cool" URIs
    - describe things with RDF
    - make links to other datasets
  - we will use the OpenRefine + RDF extension
- Part II: Querying linked data with SPARQL
  - you will learn how to make queries with SPARQL
  - we will use Apache Jena - ARQ command line applications

- Now that her data is written in RDF, Artemis can benefit from the Linked Data technologies.
- She has a great idea: for next Valentine's day, she will offer a special discount for pairs of books written by married couples who are living writers, like Paul Auster and Siri Hustvedt, two of her favourite writers.
- Although "being married with" or "being alive" is not information Artemis can find in her local data, she could find it in the Linked Open Data cloud. Let's see how.
- We will start by running some SPARQL queries at DBpedia SPARQL endpoint, and then we will query local and remote data with Apache Jena - ARQ.

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the properties of Paul Auster in DBpedia?



- Which are the properties of Paul Auster in DBpedia?

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop ?obj .
}
```



# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the properties of Paul Auster in DBpedia?

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop ?obj .
}
```

prop
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>
<a href="http://www.w3.org/2002/07/owl#sameAs">http://www.w3.org/2002/07/owl#sameAs</a>
<a href="http://www.w3.org/2000/01/rdf-schema#label">http://www.w3.org/2000/01/rdf-schema#label</a>
<a href="http://www.w3.org/2000/01/rdf-schema#comment">http://www.w3.org/2000/01/rdf-schema#comment</a>
<a href="http://xmlns.com/foaf/0.1/name">http://xmlns.com/foaf/0.1/name</a>
<a href="http://dbpedia.org/property/name">http://dbpedia.org/property/name</a>
<a href="http://xmlns.com/foaf/0.1/depiction">http://xmlns.com/foaf/0.1/depiction</a>
<a href="http://purl.org/dc/elements/1.1/description">http://purl.org/dc/elements/1.1/description</a>
<a href="http://xmlns.com/foaf/0.1/givenName">http://xmlns.com/foaf/0.1/givenName</a>

and more...

# Hands-on session (II)

## Querying Linked Data with SPARQL

- We also can order the results.

# Hands-on session (II)

## Querying Linked Data with SPARQL

- We also can order the results.

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop ?obj .
}
ORDER BY ?prop
```

# Hands-on session (II)

## Querying Linked Data with SPARQL

- We also can order the results.

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop ?obj .
}
ORDER BY ?prop
```

prop
<a href="http://dbpedia.org/ontology/abstract">http://dbpedia.org/ontology/abstract</a>
<a href="http://dbpedia.org/ontology/activeYearsStartYear">http://dbpedia.org/ontology/activeYearsStartYear</a>
<a href="http://dbpedia.org/ontology/alias">http://dbpedia.org/ontology/alias</a>
<a href="http://dbpedia.org/ontology/birthDate">http://dbpedia.org/ontology/birthDate</a>
<a href="http://dbpedia.org/ontology/birthName">http://dbpedia.org/ontology/birthName</a>
<a href="http://dbpedia.org/ontology/birthPlace">http://dbpedia.org/ontology/birthPlace</a>
<a href="http://dbpedia.org/ontology/birthYear">http://dbpedia.org/ontology/birthYear</a>
<a href="http://dbpedia.org/ontology/genre">http://dbpedia.org/ontology/genre</a>
<a href="http://dbpedia.org/ontology/influenced">http://dbpedia.org/ontology/influenced</a>
<a href="http://dbpedia.org/ontology/influencedBy">http://dbpedia.org/ontology/influencedBy</a>

and more...

# Hands-on session (II)

## Querying Linked Data with SPARQL

- We also can order the results.

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop ?obj .
}
ORDER BY ?prop
```

prop
<a href="http://dbpedia.org/ontology/abstract">http://dbpedia.org/ontology/abstract</a>
<a href="http://dbpedia.org/ontology/activeYearsStartYear">http://dbpedia.org/ontology/activeYearsStartYear</a>
<a href="http://dbpedia.org/ontology/alias">http://dbpedia.org/ontology/alias</a>
<a href="http://dbpedia.org/ontology/birthDate">http://dbpedia.org/ontology/birthDate</a>
<a href="http://dbpedia.org/ontology/birthName">http://dbpedia.org/ontology/birthName</a>
<a href="http://dbpedia.org/ontology/birthPlace">http://dbpedia.org/ontology/birthPlace</a>
<a href="http://dbpedia.org/ontology/birthYear">http://dbpedia.org/ontology/birthYear</a>
<a href="http://dbpedia.org/ontology/genre">http://dbpedia.org/ontology/genre</a>
<a href="http://dbpedia.org/ontology/influenced">http://dbpedia.org/ontology/influenced</a>
<a href="http://dbpedia.org/ontology/influencedBy">http://dbpedia.org/ontology/influencedBy</a>

and more...

Uhhh... so DBpedia knows  
when and where Paul Auster was born

# Hands-on session (II)

## Querying Linked Data with SPARQL

- When and where was Paul Auster born?



- When and where was Paul Auster born?

```
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT DISTINCT ?date ?place
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> dbo:birthDate ?date ;
  dbo:birthPlace ?place .
}
```

# Hands-on session (II)

## Querying Linked Data with SPARQL

- When and where was Paul Auster born?

```
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT DISTINCT ?date ?place
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> dbo:birthDate ?date ;
  dbo:birthPlace ?place .
}
```

date	place
1947-02-03	<a href="http://dbpedia.org/resource/Newark,_New_Jersey">http://dbpedia.org/resource/Newark, New Jersey</a>
1947-02-03	<a href="http://dbpedia.org/resource/New_Jersey">http://dbpedia.org/resource/New Jersey</a>

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Is Paul Auster dead?

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Is Paul Auster dead?

```
PREFIX dbo: <http://dbpedia.org/ontology/>

ASK {
  <http://dbpedia.org/resource/Paul_Auster> dbo:deathDate ?date .
}
```

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Is Paul Auster dead?

```
PREFIX dbo: <http://dbpedia.org/ontology/>

ASK {
  <http://dbpedia.org/resource/Paul_Auster> dbo:deathDate ?date .
}
```

false

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the classes Paul Auster is an instance of?



- Which are the classes Paul Auster is an instance of?

```
SELECT DISTINCT ?class
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> a ?class .
}
```

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the classes Paul Auster is an instance of?

```
SELECT DISTINCT ?class
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> a ?class .
}
```

class
<a href="http://www.w3.org/2002/07/owl#Thing">http://www.w3.org/2002/07/owl#Thing</a>
<a href="http://xmlns.com/foaf/0.1/Person">http://xmlns.com/foaf/0.1/Person</a>
<a href="http://dbpedia.org/ontology/Person">http://dbpedia.org/ontology/Person</a>
<a href="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Agent">http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Agent</a>
<a href="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#NaturalPerson">http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#NaturalPerson</a>
<a href="http://www.wikidata.org/entity/Q215627">http://www.wikidata.org/entity/Q215627</a>
<a href="http://www.wikidata.org/entity/Q36180">http://www.wikidata.org/entity/Q36180</a>
<a href="http://www.wikidata.org/entity/Q483501">http://www.wikidata.org/entity/Q483501</a>
<a href="http://www.wikidata.org/entity/Q5">http://www.wikidata.org/entity/Q5</a>
<a href="http://dbpedia.org/ontology/Agent">http://dbpedia.org/ontology/Agent</a>
<a href="http://dbpedia.org/ontology/Artist">http://dbpedia.org/ontology/Artist</a>
<a href="http://dbpedia.org/ontology/Writer">http://dbpedia.org/ontology/Writer</a>

and more...

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the classes Paul Auster is an instance of?

```
SELECT DISTINCT ?class
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> a ?class .
}
```

class
<a href="http://www.w3.org/2002/07/owl#Thing">http://www.w3.org/2002/07/owl#Thing</a>
<a href="http://xmlns.com/foaf/0.1/Person">http://xmlns.com/foaf/0.1/Person</a>
<a href="http://dbpedia.org/ontology/Person">http://dbpedia.org/ontology/Person</a>
<a href="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Agent">http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Agent</a>
<a href="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#NaturalPerson">http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#NaturalPerson</a>
<a href="http://www.wikidata.org/entity/Q215627">http://www.wikidata.org/entity/Q215627</a>
<a href="http://www.wikidata.org/entity/Q36180">http://www.wikidata.org/entity/Q36180</a>
<a href="http://www.wikidata.org/entity/Q483501">http://www.wikidata.org/entity/Q483501</a>
<a href="http://www.wikidata.org/entity/Q5">http://www.wikidata.org/entity/Q5</a>
<a href="http://dbpedia.org/ontology/Agent">http://dbpedia.org/ontology/Agent</a>
<a href="http://dbpedia.org/ontology/Artist">http://dbpedia.org/ontology/Artist</a>
<a href="http://dbpedia.org/ontology/Writer">http://dbpedia.org/ontology/Writer</a>

and more...

OK, so Paul Auster is a Writer  
(an instance of the class dbo:Writer)

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the relations (if there is any) between Paul Auster and Siri Hustvedt?

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the relations (if there is any) between Paul Auster and Siri Hustvedt?

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop
  <http://dbpedia.org/resource/Siri_Hustvedt> .
}
```

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Which are the relations (if there is any) between Paul Auster and Siri Hustvedt?

```
SELECT DISTINCT ?prop
WHERE {
  <http://dbpedia.org/resource/Paul_Auster> ?prop
  <http://dbpedia.org/resource/Siri_Hustvedt> .
}
```

<b>prop</b>
<a href="http://dbpedia.org/ontology/spouse">http://dbpedia.org/ontology/spouse</a>
<a href="http://dbpedia.org/property/spouse">http://dbpedia.org/property/spouse</a>



# Hands-on session (II)

## Querying Linked Data with SPARQL

- Let's find married couples who are writers.

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Let's find married couples who are writers.

```
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT DISTINCT ?w1 ?w2
WHERE {
  ?w1 a dbo:Writer ;
      dbo:spouse ?w2 .
  ?w2 a dbo:Writer .
}
ORDER BY ?w1
```

# Hands-on session (II)

# Querying Linked Data with SPARQL

- Let's find married couples who are writers.

w1	w2
<a href="http://dbpedia.org/resource/A._E._van_Vogt">http://dbpedia.org/resource/A. E. van Vogt</a>	<a href="http://dbpedia.org/resource/Edna_Mayne_Hull">http://dbpedia.org/resource/Edna Mayne Hull</a>
<a href="http://dbpedia.org/resource/Aaron_Elkins">http://dbpedia.org/resource/Aaron Elkins</a>	<a href="http://dbpedia.org/resource/Charlotte_Elkins">http://dbpedia.org/resource/Charlotte Elkins</a>
<a href="http://dbpedia.org/resource/Akiko_Yosano">http://dbpedia.org/resource/Akiko Yosano</a>	<a href="http://dbpedia.org/resource/Tekkan_Yosano">http://dbpedia.org/resource/Tekkan Yosano</a>
<a href="http://dbpedia.org/resource/Alan_Sillitoe">http://dbpedia.org/resource/Alan Sillitoe</a>	<a href="http://dbpedia.org/resource/Ruth_Fainlight">http://dbpedia.org/resource/Ruth Fainlight</a>
<a href="http://dbpedia.org/resource/Alissa_York">http://dbpedia.org/resource/Alissa York</a>	<a href="http://dbpedia.org/resource/Clive_Holden">http://dbpedia.org/resource/Clive Holden</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Fleur_Adcock">http://dbpedia.org/resource/Fleur Adcock</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Meg_Campbell">http://dbpedia.org/resource/Meg Campbell</a>
<a href="http://dbpedia.org/resource/Andrew_Grant_(writer)">http://dbpedia.org/resource/Andrew Grant (writer)</a>	<a href="http://dbpedia.org/resource/Tasha_Alexander">http://dbpedia.org/resource/Tasha Alexander</a>
<a href="http://dbpedia.org/resource/Andrew_Sarris">http://dbpedia.org/resource/Andrew Sarris</a>	<a href="http://dbpedia.org/resource/Molly_Haskell">http://dbpedia.org/resource/Molly Haskell</a>
<a href="http://dbpedia.org/resource/Anita_Lobel">http://dbpedia.org/resource/Anita Lobel</a>	<a href="http://dbpedia.org/resource/Arnold_Lobel">http://dbpedia.org/resource/Arnold Lobel</a>
<a href="http://dbpedia.org/resource/Ann-Marie_MacDonald">http://dbpedia.org/resource/Ann-Marie MacDonald</a>	<a href="http://dbpedia.org/resource/Alisa_Palmer">http://dbpedia.org/resource/Alisa Palmer</a>
<a href="http://dbpedia.org/resource/Anne_Fine">http://dbpedia.org/resource/Anne Fine</a>	<a href="http://dbpedia.org/resource/Kit_Fine">http://dbpedia.org/resource/Kit Fine</a>
<a href="http://dbpedia.org/resource/Anne_Henderson">http://dbpedia.org/resource/Anne Henderson</a>	<a href="http://dbpedia.org/resource/Gerard_Henderson">http://dbpedia.org/resource/Gerard Henderson</a>
<a href="http://dbpedia.org/resource/Anne_Rice">http://dbpedia.org/resource/Anne Rice</a>	<a href="http://dbpedia.org/resource/Stan_Rice">http://dbpedia.org/resource/Stan Rice</a>
<a href="http://dbpedia.org/resource/Anne_Strieber">http://dbpedia.org/resource/Anne Strieber</a>	<a href="http://dbpedia.org/resource/Whitley_Strieber">http://dbpedia.org/resource/Whitley Strieber</a>
<a href="http://dbpedia.org/resource/Anne_Wagner">http://dbpedia.org/resource/Anne Wagner</a>	<a href="http://dbpedia.org/resource/T._J._Clark_(art_historian)">http://dbpedia.org/resource/T. J. Clark (art historian)</a>
<a href="http://dbpedia.org/resource/Annie_Hall_Cudlip">http://dbpedia.org/resource/Annie Hall Cudlip</a>	<a href="http://dbpedia.org/resource/Pender_Hodge_Cudlip">http://dbpedia.org/resource/Pender Hodge Cudlip</a>
<a href="http://dbpedia.org/resource/Antonia_Fraser">http://dbpedia.org/resource/Antonia Fraser</a>	<a href="http://dbpedia.org/resource/Harold_Pinter">http://dbpedia.org/resource/Harold Pinter</a>
<a href="http://dbpedia.org/resource/Antony_Beevor">http://dbpedia.org/resource/Antony Beevor</a>	<a href="http://dbpedia.org/resource/Artemis_Cooper">http://dbpedia.org/resource/Artemis Cooper</a>
<a href="http://dbpedia.org/resource/Arnold_Lobel">http://dbpedia.org/resource/Arnold Lobel</a>	<a href="http://dbpedia.org/resource/Anita_Lobel">http://dbpedia.org/resource/Anita Lobel</a>

and more...



# Hands-on session (II)

# Querying Linked Data with SPARQL

- Let's find married couples who are writers.

w1	w2
<a href="http://dbpedia.org/resource/A._E._van_Vogt">http://dbpedia.org/resource/A. E. van Vogt</a>	<a href="http://dbpedia.org/resource/Edna_Mayne_Hull">http://dbpedia.org/resource/Edna Mayne Hull</a>
<a href="http://dbpedia.org/resource/Aaron_Elkins">http://dbpedia.org/resource/Aaron Elkins</a>	<a href="http://dbpedia.org/resource/Charlotte_Elkins">http://dbpedia.org/resource/Charlotte Elkins</a>
<a href="http://dbpedia.org/resource/Akiko_Yosano">http://dbpedia.org/resource/Akiko Yosano</a>	<a href="http://dbpedia.org/resource/Tekkan_Yosano">http://dbpedia.org/resource/Tekkan Yosano</a>
<a href="http://dbpedia.org/resource/Alan_Sillitoe">http://dbpedia.org/resource/Alan Sillitoe</a>	<a href="http://dbpedia.org/resource/Ruth_Fainlight">http://dbpedia.org/resource/Ruth Fainlight</a>
<a href="http://dbpedia.org/resource/Alissa_York">http://dbpedia.org/resource/Alissa York</a>	<a href="http://dbpedia.org/resource/Clive_Holden">http://dbpedia.org/resource/Clive Holden</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Fleur_Adcock">http://dbpedia.org/resource/Fleur Adcock</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Meg_Campbell">http://dbpedia.org/resource/Meg Campbell</a>
<a href="http://dbpedia.org/resource/Andrew_Grant_(writer)">http://dbpedia.org/resource/Andrew Grant (writer)</a>	<a href="http://dbpedia.org/resource/Tasha_Alexander">http://dbpedia.org/resource/Tasha Alexander</a>
<a href="http://dbpedia.org/resource/Andrew_Sarris">http://dbpedia.org/resource/Andrew Sarris</a>	<a href="http://dbpedia.org/resource/Molly_Haskell">http://dbpedia.org/resource/Molly Haskell</a>
<a href="http://dbpedia.org/resource/Anita_Lobel">http://dbpedia.org/resource/Anita Lobel</a>	<a href="http://dbpedia.org/resource/Arnold_Lobel">http://dbpedia.org/resource/Arnold Lobel</a>
<a href="http://dbpedia.org/resource/Ann-Marie_MacDonald">http://dbpedia.org/resource/Ann-Marie MacDonald</a>	<a href="http://dbpedia.org/resource/Alisa_Palmer">http://dbpedia.org/resource/Alisa Palmer</a>
<a href="http://dbpedia.org/resource/Anne_Fine">http://dbpedia.org/resource/Anne Fine</a>	<a href="http://dbpedia.org/resource/Kit_Fine">http://dbpedia.org/resource/Kit Fine</a>
<a href="http://dbpedia.org/resource/Anne_Henderson">http://dbpedia.org/resource/Anne Henderson</a>	<a href="http://dbpedia.org/resource/Gerard_Henderson">http://dbpedia.org/resource/Gerard Henderson</a>
<a href="http://dbpedia.org/resource/Anne_Rice">http://dbpedia.org/resource/Anne Rice</a>	<a href="http://dbpedia.org/resource/Stan_Rice">http://dbpedia.org/resource/Stan Rice</a>
<a href="http://dbpedia.org/resource/Anne_Strieber">http://dbpedia.org/resource/Anne Strieber</a>	<a href="http://dbpedia.org/resource/Whitley_Strieber">http://dbpedia.org/resource/Whitley Strieber</a>
<a href="http://dbpedia.org/resource/Anne_Wagner">http://dbpedia.org/resource/Anne Wagner</a>	<a href="http://dbpedia.org/resource/T._J._Clark_(art_historian)">http://dbpedia.org/resource/T. J. Clark (art historian)</a>
<a href="http://dbpedia.org/resource/Annie_Hall_Cudlip">http://dbpedia.org/resource/Annie Hall Cudlip</a>	<a href="http://dbpedia.org/resource/Pender_Hodge_Cudlip">http://dbpedia.org/resource/Pender Hodge Cudlip</a>
<a href="http://dbpedia.org/resource/Antonia_Fraser">http://dbpedia.org/resource/Antonia Fraser</a>	<a href="http://dbpedia.org/resource/Harold_Pinter">http://dbpedia.org/resource/Harold Pinter</a>
<a href="http://dbpedia.org/resource/Antony_Beevor">http://dbpedia.org/resource/Antony Beevor</a>	<a href="http://dbpedia.org/resource/Artemis_Cooper">http://dbpedia.org/resource/Artemis Cooper</a>
<a href="http://dbpedia.org/resource/Arnold_Lobel">http://dbpedia.org/resource/Arnold Lobel</a>	<a href="http://dbpedia.org/resource/Anita_Lobel">http://dbpedia.org/resource/Anita Lobel</a>

they are duplicated!

and more...

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Let's remove duplicates.

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Let's remove duplicates.

```
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT DISTINCT ?w1 ?w2
WHERE {
  ?w1 a dbo:Writer ;
      dbo:spouse ?w2 .
  ?w2 a dbo:Writer .
  FILTER ( str(?w1) <= str(?w2) )
}

ORDER BY ?w1
```



# Hands-on session (II)

# Querying Linked Data with SPARQL

- Let's remove duplicates.

w1	w2
<a href="http://dbpedia.org/resource/A._E._van_Vogt">http://dbpedia.org/resource/A. E. van Vogt</a>	<a href="http://dbpedia.org/resource/Edna_Mayne_Hull">http://dbpedia.org/resource/Edna Mayne Hull</a>
<a href="http://dbpedia.org/resource/Aaron_Elkins">http://dbpedia.org/resource/Aaron Elkins</a>	<a href="http://dbpedia.org/resource/Charlotte_Elkins">http://dbpedia.org/resource/Charlotte Elkins</a>
<a href="http://dbpedia.org/resource/Akiko_Yosano">http://dbpedia.org/resource/Akiko Yosano</a>	<a href="http://dbpedia.org/resource/Tekkan_Yosano">http://dbpedia.org/resource/Tekkan Yosano</a>
<a href="http://dbpedia.org/resource/Alan_Sillitoe">http://dbpedia.org/resource/Alan Sillitoe</a>	<a href="http://dbpedia.org/resource/Ruth_Fainlight">http://dbpedia.org/resource/Ruth Fainlight</a>
<a href="http://dbpedia.org/resource/Alissa_York">http://dbpedia.org/resource/Alissa York</a>	<a href="http://dbpedia.org/resource/Clive_Holden">http://dbpedia.org/resource/Clive Holden</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Fleur_Adcock">http://dbpedia.org/resource/Fleur Adcock</a>
<a href="http://dbpedia.org/resource/Alistair_Campbell_(poet)">http://dbpedia.org/resource/Alistair Campbell (poet)</a>	<a href="http://dbpedia.org/resource/Meg_Campbell">http://dbpedia.org/resource/Meg Campbell</a>
<a href="http://dbpedia.org/resource/Andrew_Grant_(writer)">http://dbpedia.org/resource/Andrew Grant (writer)</a>	<a href="http://dbpedia.org/resource/Tasha_Alexander">http://dbpedia.org/resource/Tasha Alexander</a>
<a href="http://dbpedia.org/resource/Andrew_Sarris">http://dbpedia.org/resource/Andrew Sarris</a>	<a href="http://dbpedia.org/resource/Molly_Haskell">http://dbpedia.org/resource/Molly Haskell</a>
<a href="http://dbpedia.org/resource/Anita_Lobel">http://dbpedia.org/resource/Anita Lobel</a>	<a href="http://dbpedia.org/resource/Arnold_Lobel">http://dbpedia.org/resource/Arnold Lobel</a>
<a href="http://dbpedia.org/resource/Anne_Fine">http://dbpedia.org/resource/Anne Fine</a>	<a href="http://dbpedia.org/resource/Kit_Fine">http://dbpedia.org/resource/Kit Fine</a>
<a href="http://dbpedia.org/resource/Anne_Henderson">http://dbpedia.org/resource/Anne Henderson</a>	<a href="http://dbpedia.org/resource/Gerard_Henderson">http://dbpedia.org/resource/Gerard Henderson</a>
<a href="http://dbpedia.org/resource/Anne_Rice">http://dbpedia.org/resource/Anne Rice</a>	<a href="http://dbpedia.org/resource/Stan_Rice">http://dbpedia.org/resource/Stan Rice</a>
<a href="http://dbpedia.org/resource/Anne_Strieber">http://dbpedia.org/resource/Anne Strieber</a>	<a href="http://dbpedia.org/resource/Whitley_Strieber">http://dbpedia.org/resource/Whitley Strieber</a>
<a href="http://dbpedia.org/resource/Anne_Wagner">http://dbpedia.org/resource/Anne Wagner</a>	<a href="http://dbpedia.org/resource/T._J._Clark_(art_historian)">http://dbpedia.org/resource/T. J. Clark (art historian)</a>
<a href="http://dbpedia.org/resource/Annie_Hall_Cudlip">http://dbpedia.org/resource/Annie Hall Cudlip</a>	<a href="http://dbpedia.org/resource/Pender_Hodge_Cudlip">http://dbpedia.org/resource/Pender Hodge Cudlip</a>
<a href="http://dbpedia.org/resource/Antonia_Fraser">http://dbpedia.org/resource/Antonia Fraser</a>	<a href="http://dbpedia.org/resource/Harold_Pinter">http://dbpedia.org/resource/Harold Pinter</a>
<a href="http://dbpedia.org/resource/Antony_Beevor">http://dbpedia.org/resource/Antony Beevor</a>	<a href="http://dbpedia.org/resource/Artemis_Cooper">http://dbpedia.org/resource/Artemis Cooper</a>
<a href="http://dbpedia.org/resource/Arthur_F._H._Mills">http://dbpedia.org/resource/Arthur F. H. Mills</a>	<a href="http://dbpedia.org/resource/Lady_Dorothy_Mills">http://dbpedia.org/resource/Lady Dorothy Mills</a>

and more...

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Now, let's find married couples who are living writers.

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Now, let's find married couples who are living writers.

```
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT DISTINCT ?w1 ?w2
WHERE {
  ?w1 a dbo:Writer ;
      dbo:spouse ?w2 .
  ?w2 a dbo:Writer .
  FILTER ( NOT EXISTS {?w1 dbo:deathDate ?date1} &&
           NOT EXISTS {?w2 dbo:deathDate ?date2} &&
           str(?w1) <= str(?w2) )
}

ORDER BY ?w1
```



# Hands-on session (II)

# Querying Linked Data with SPARQL

- Now, let's find married couples who are living writers.

w1	w2
<a href="http://dbpedia.org/resource/Aaron_Elkins">http://dbpedia.org/resource/Aaron_Elkins</a>	<a href="http://dbpedia.org/resource/Charlotte_Elkins">http://dbpedia.org/resource/Charlotte_Elkins</a>
<a href="http://dbpedia.org/resource/Alissa_York">http://dbpedia.org/resource/Alissa_York</a>	<a href="http://dbpedia.org/resource/Clive_Holden">http://dbpedia.org/resource/Clive_Holden</a>
<a href="http://dbpedia.org/resource/Andrew_Grant_(writer)">http://dbpedia.org/resource/Andrew_Grant_(writer)</a>	<a href="http://dbpedia.org/resource/Tasha_Alexander">http://dbpedia.org/resource/Tasha_Alexander</a>
<a href="http://dbpedia.org/resource/Anne_Fine">http://dbpedia.org/resource/Anne_Fine</a>	<a href="http://dbpedia.org/resource/Kit_Fine">http://dbpedia.org/resource/Kit_Fine</a>
<a href="http://dbpedia.org/resource/Anne_Henderson">http://dbpedia.org/resource/Anne_Henderson</a>	<a href="http://dbpedia.org/resource/Gerard_Henderson">http://dbpedia.org/resource/Gerard_Henderson</a>
<a href="http://dbpedia.org/resource/Anne_Strieber">http://dbpedia.org/resource/Anne_Strieber</a>	<a href="http://dbpedia.org/resource/Whitley_Strieber">http://dbpedia.org/resource/Whitley_Strieber</a>
<a href="http://dbpedia.org/resource/Anne_Wagner">http://dbpedia.org/resource/Anne_Wagner</a>	<a href="http://dbpedia.org/resource/T._J._Clark_(art_historian)">http://dbpedia.org/resource/T._J._Clark_(art_historian)</a>
<a href="http://dbpedia.org/resource/Antony_Beevor">http://dbpedia.org/resource/Antony_Beevor</a>	<a href="http://dbpedia.org/resource/Artemis_Cooper">http://dbpedia.org/resource/Artemis_Cooper</a>
<a href="http://dbpedia.org/resource/Ayelet_Waldman">http://dbpedia.org/resource/Ayelet_Waldman</a>	<a href="http://dbpedia.org/resource/Michael_Chabon">http://dbpedia.org/resource/Michael_Chabon</a>
<a href="http://dbpedia.org/resource/B._M._Suhara">http://dbpedia.org/resource/B._M._Suhara</a>	<a href="http://dbpedia.org/resource/M._M._Basheer">http://dbpedia.org/resource/M._M._Basheer</a>
<a href="http://dbpedia.org/resource/Barb_Hendee">http://dbpedia.org/resource/Barb_Hendee</a>	<a href="http://dbpedia.org/resource/J._C._Hendee">http://dbpedia.org/resource/J._C._Hendee</a>
<a href="http://dbpedia.org/resource/Beth_Gyls">http://dbpedia.org/resource/Beth_Gyls</a>	<a href="http://dbpedia.org/resource/Thomas_Forsthofel">http://dbpedia.org/resource/Thomas_Forsthofel</a>
<a href="http://dbpedia.org/resource/Betsy_Lewin">http://dbpedia.org/resource/Betsy_Lewin</a>	<a href="http://dbpedia.org/resource/Ted_Lewin">http://dbpedia.org/resource/Ted_Lewin</a>
<a href="http://dbpedia.org/resource/Bill_Pronzini">http://dbpedia.org/resource/Bill_Pronzini</a>	<a href="http://dbpedia.org/resource/Marcia_Muller">http://dbpedia.org/resource/Marcia_Muller</a>
<a href="http://dbpedia.org/resource/Birgit_Zotz">http://dbpedia.org/resource/Birgit_Zotz</a>	<a href="http://dbpedia.org/resource/Volker_Zotz">http://dbpedia.org/resource/Volker_Zotz</a>
<a href="http://dbpedia.org/resource/Boaz_Keysar">http://dbpedia.org/resource/Boaz_Keysar</a>	<a href="http://dbpedia.org/resource/Linda_E._Ginzler">http://dbpedia.org/resource/Linda_E._Ginzler</a>
<a href="http://dbpedia.org/resource/Brenda_Webster">http://dbpedia.org/resource/Brenda_Webster</a>	<a href="http://dbpedia.org/resource/Ira_M._Lapidus">http://dbpedia.org/resource/Ira_M._Lapidus</a>
<a href="http://dbpedia.org/resource/Brian_Lindstrom">http://dbpedia.org/resource/Brian_Lindstrom</a>	<a href="http://dbpedia.org/resource/Cheryl_Strayed">http://dbpedia.org/resource/Cheryl_Strayed</a>
<a href="http://dbpedia.org/resource/Carol_Gorman">http://dbpedia.org/resource/Carol_Gorman</a>	<a href="http://dbpedia.org/resource/Edward_Gorman">http://dbpedia.org/resource/Edward_Gorman</a>
<a href="http://dbpedia.org/resource/Carol_Weston">http://dbpedia.org/resource/Carol_Weston</a>	<a href="http://dbpedia.org/resource/Rob_Ackerman">http://dbpedia.org/resource/Rob_Ackerman</a>

and more...

- Jena is a free and open source Java framework for building Semantic Web and Linked Data applications.
- an apache project: <http://jena.apache.org/index.html>
- Jena APIs:
  - RDF: RDF API, ARQ (SPARQL)
  - Triple Store: TDB, Fuseki
  - OWL: Ontology API, Inference API
- ARQ Command Line Applications
  - `arq --data=mydataset.nt --query=myquery.rq`
  - `arq --data=mydataset.nt --query=myquery.rq --results=xml`

more info at <https://jena.apache.org/documentation/query/cmds.html>

# Hands-on session (II)

## Querying Linked Data with SPARQL

- Finally, let's find in Artemis' bookstore data pairs of books written by married couples who are living writers.

```
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX abo: <http://artemisBookstore.com/ontology#>

SELECT DISTINCT ?v1 ?b1 ?v2 ?b2
WHERE {
  ?b1 abo:author ?v1 .
  ?b2 abo:author ?v2 .
  ?v1 owl:sameAs ?w1 .
  ?v2 owl:sameAs ?w2 .
  SERVICE <http://dbpedia.org/sparql> {
    SELECT DISTINCT ?w1 ?w2
    WHERE {
      ?w1 a dbo:Writer ;
        dbo:spouse ?w2 .
      ?w2 a dbo:Writer .
      FILTER ( NOT EXISTS {?w1 dbo:deathDate ?date1} &&
              NOT EXISTS {?w2 dbo:deathDate ?date2} )
    }
  }
}
ORDER BY ?v1 ?v2
```



# Hands-on session (II)

## Querying Linked Data with SPARQL

- Finally, let's find in Artemis' bookstore data pairs of books written by married couples who are living writers.

```
PREFIX foaf: <http://xmlns.com/foaf/0.1>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX abo: <http://artemisBookstore.com/ontology#>

SELECT DISTINCT ?fn1 ?ln1 ?t1 ?fn2 ?ln2 ?t2
WHERE {
  ?b1 dcterms:title ?t1 ; abo:author ?v1 .
  ?b2 dcterms:title ?t2 ; abo:author ?v2 .
  ?v1 foaf:firstName ?fn1 ; foaf:lastName ?ln1 ; owl:sameAs ?w1 .
  ?v2 foaf:firstName ?fn2 ; foaf:lastName ?ln2 ; owl:sameAs ?w2 .
  SERVICE <http://dbpedia.org/sparql> {
    SELECT DISTINCT ?w1 ?w2
    WHERE {
      ?w1 a dbo:Writer ;
        dbo:spouse ?w2 .
      ?w2 a dbo:Writer .
      FILTER ( NOT EXISTS {?w1 dbo:deathDate ?date1} &&
              NOT EXISTS {?w2 dbo:deathDate ?date2} )
    }
  }
}
ORDER BY ?ln1 ?ln2
```