Data Integration on Semantic Web

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Introduction

This is just a short example on how the Semantic Web technologies can be used for data integration

The example is, of course, artificial and simplified

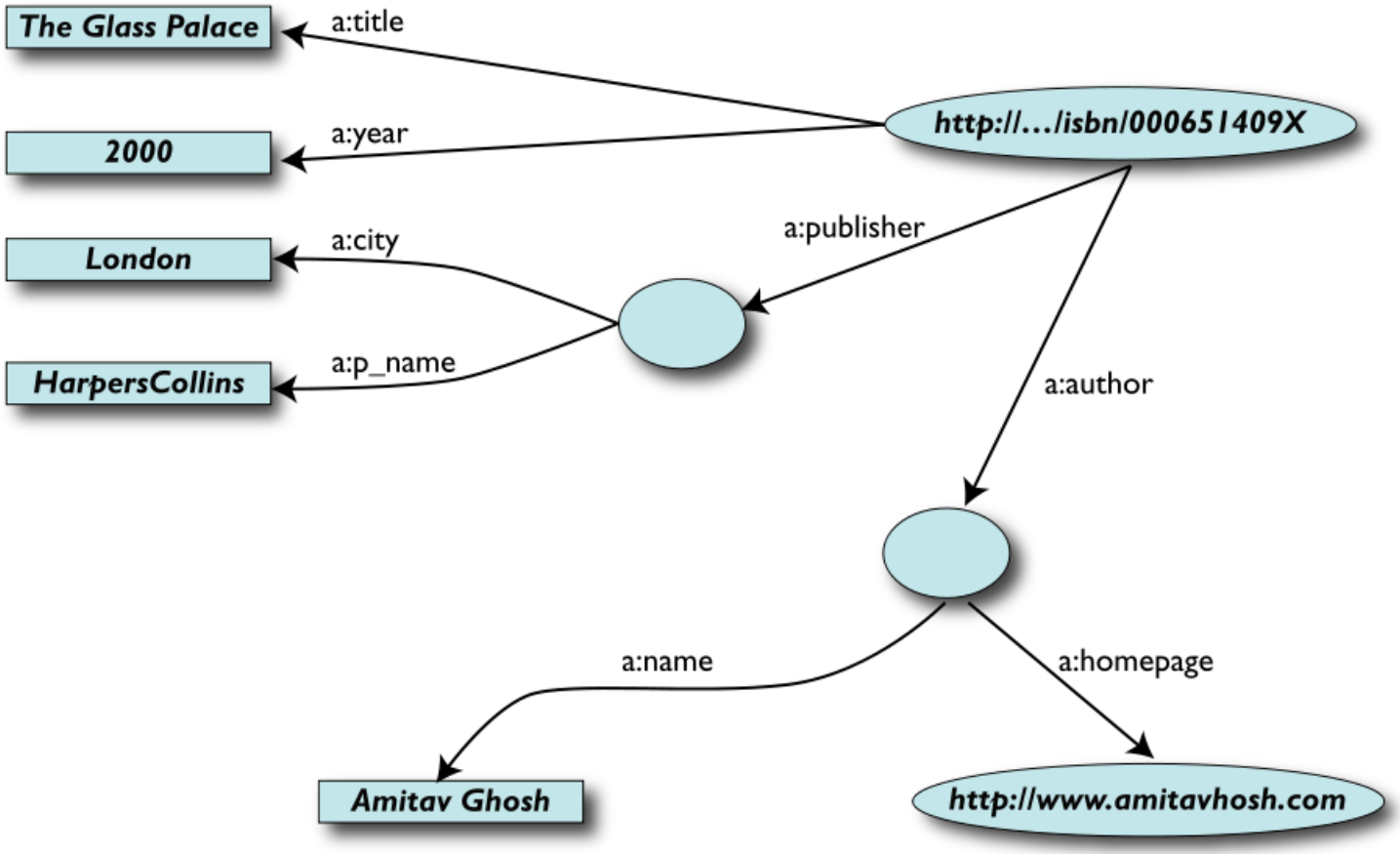
A *simplifed* bookstore data (dataset “A”)

ID	Author	Title	Publisher	Year
ISBN 0-00-651409-X	id_xyz	The Glass Palace	id_qpr	2000

ID	Name	Home page
id_xyz	Amitav Ghosh	http://www.amitavghosh.com/

ID	Publisher Name	City
id_qpr	Harper Collins	London

1st step: export your data as a set of relations



Some notes on the data export

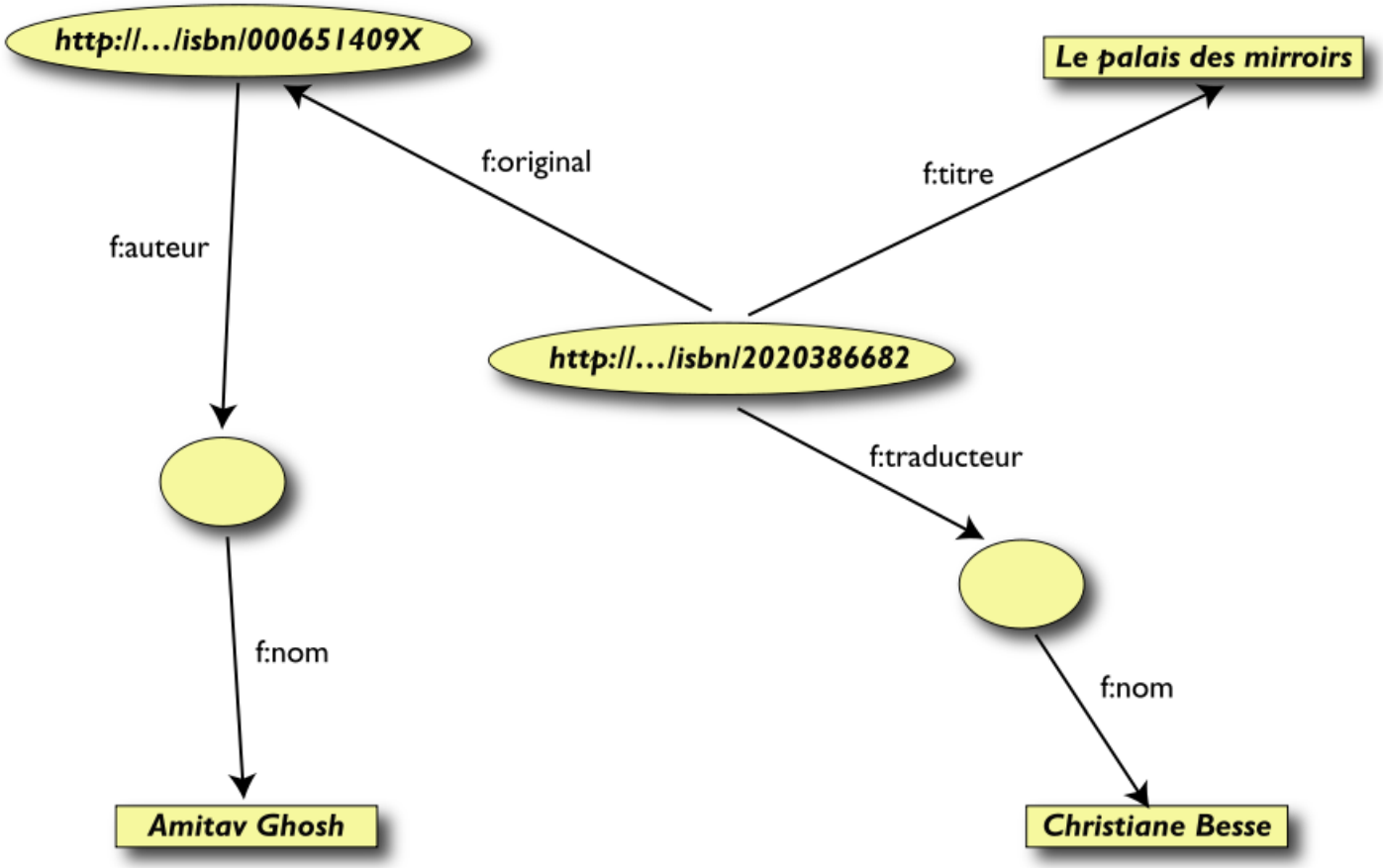
- Data export does not necessarily mean physical conversion of the data
  - *relations can be generated on-the-fly at query time*
    - via SQL “bridges”
    - scraping HTML pages
    - extracting data from Excel sheets
    - etc.
- One can export *part* of the data

Another bookstore data (dataset “F”)

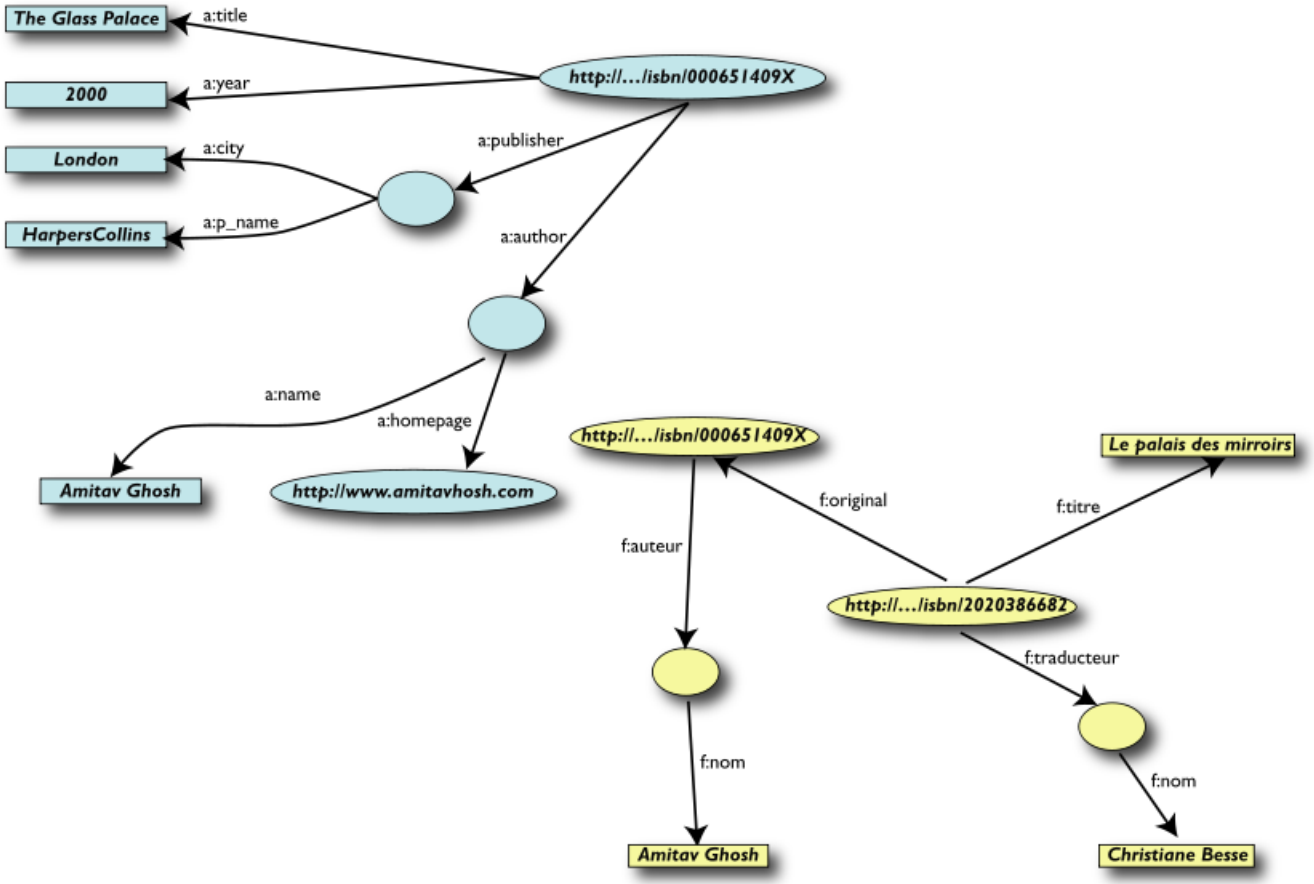
ID	Titre	Auteur	Traducteur	Original
ISBN 2020386682	Le Palais des miroirs	i_abc	i_qrs	ISBN 0-00-651409-X

ID	Nom
i_abc	Amitav Ghosh
i_qrs	Christiane Besse

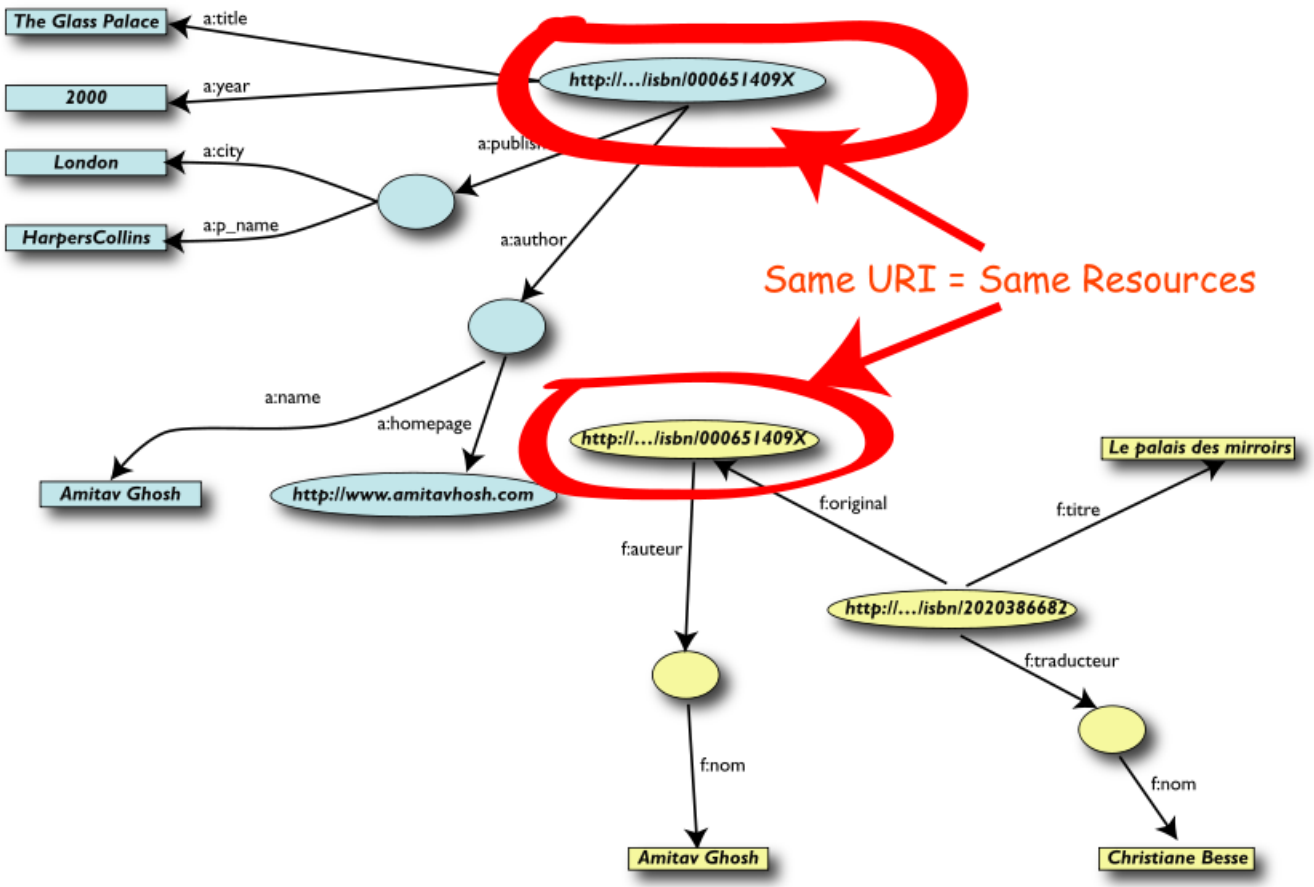
2nd step: export your second data into RDF



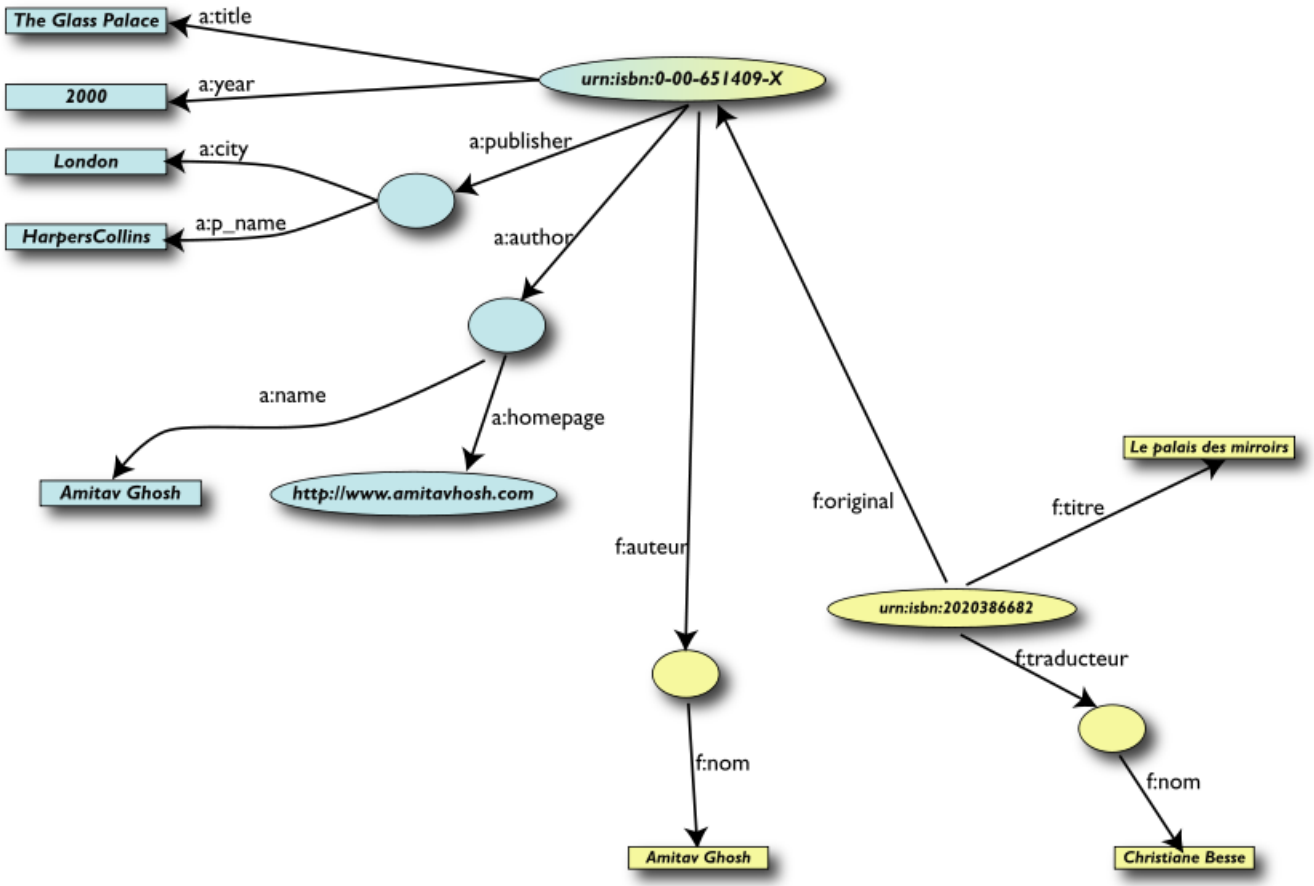
3rd step: start merging your data



3rd step: start merging your data (cont.)



3rd step: merge identical resources



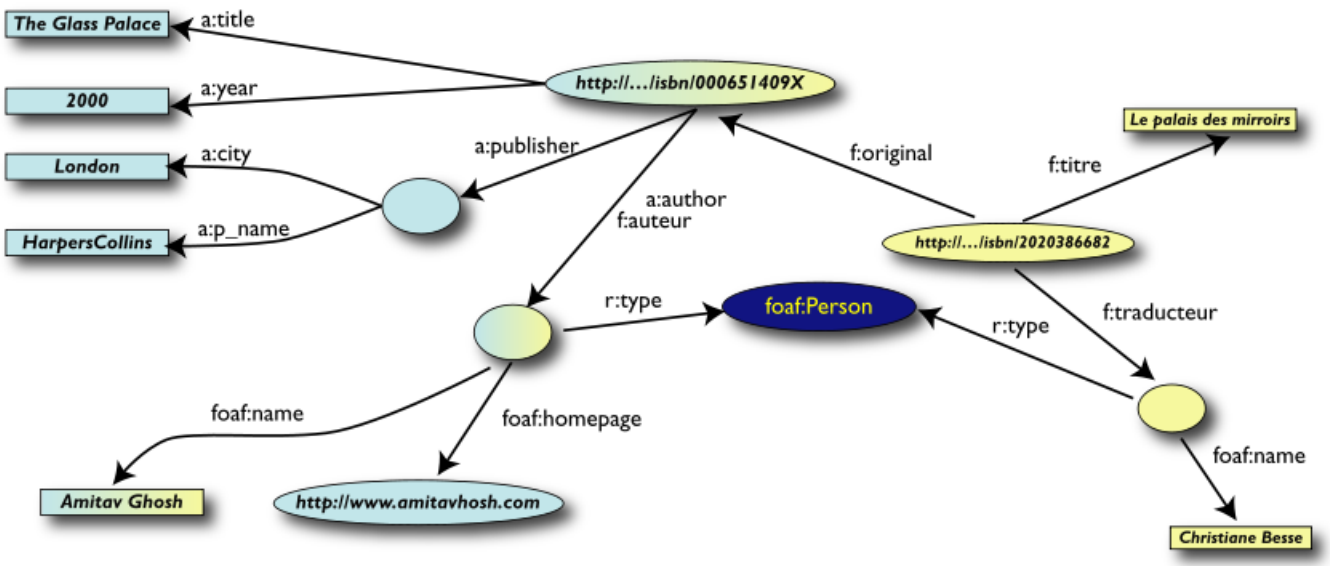
Start making queries…

- User of data “F” can now ask queries like:
  - *« donnes-moi le titre de l’original »*
  - *(ie: “give me the title of the original”)*
- This information is not in the dataset “F”…
- …but can be automatically retrieved by merging with dataset “A”!

However, things are not complete yet…

- We “feel” that `a:author` and `f:auteur` should be the same
- But an automatic merge doest not know that!
- Let us add some extra information to the merged data:
  - `a:author` *same as* `f:auteur`
  - *both identify a “Person”:*
    - a term that a community has already defined
    - a “Person” is uniquely identified by his/her name and, say, homepage
    - it can be used as a “category” for certain type of resources

3rd step revisited: use the extra knowledge



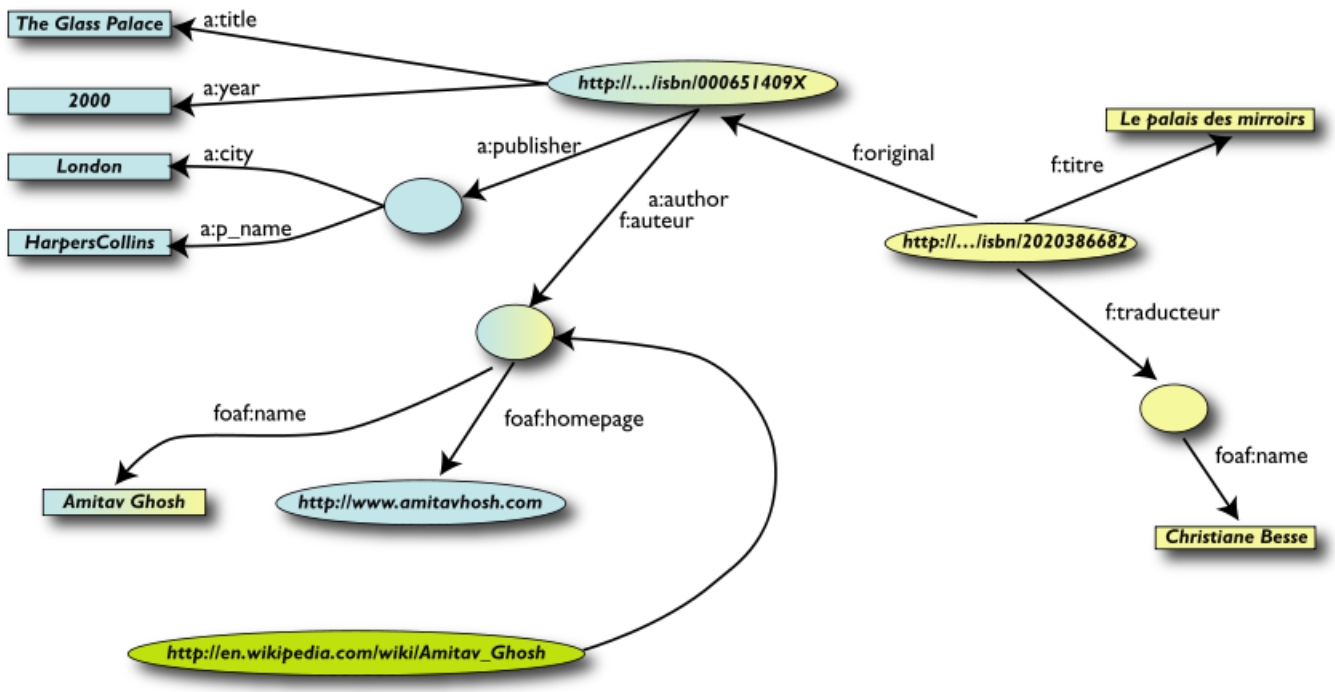
Start making richer queries!

- User of dataset “F” can now query:
  - *« donnes-moi la page d’acceuil de l’auteur de l’original »*
  - *(ie, “give me the home page of the original’s author)*
- The data is not in dataset “F”…
- …but was made available by:
  - *merging datasets “A” and datasets “F”*
  - *adding three simple extra statements as an extra “glue”*
  - *using existing terminologies as part of the “glue”*

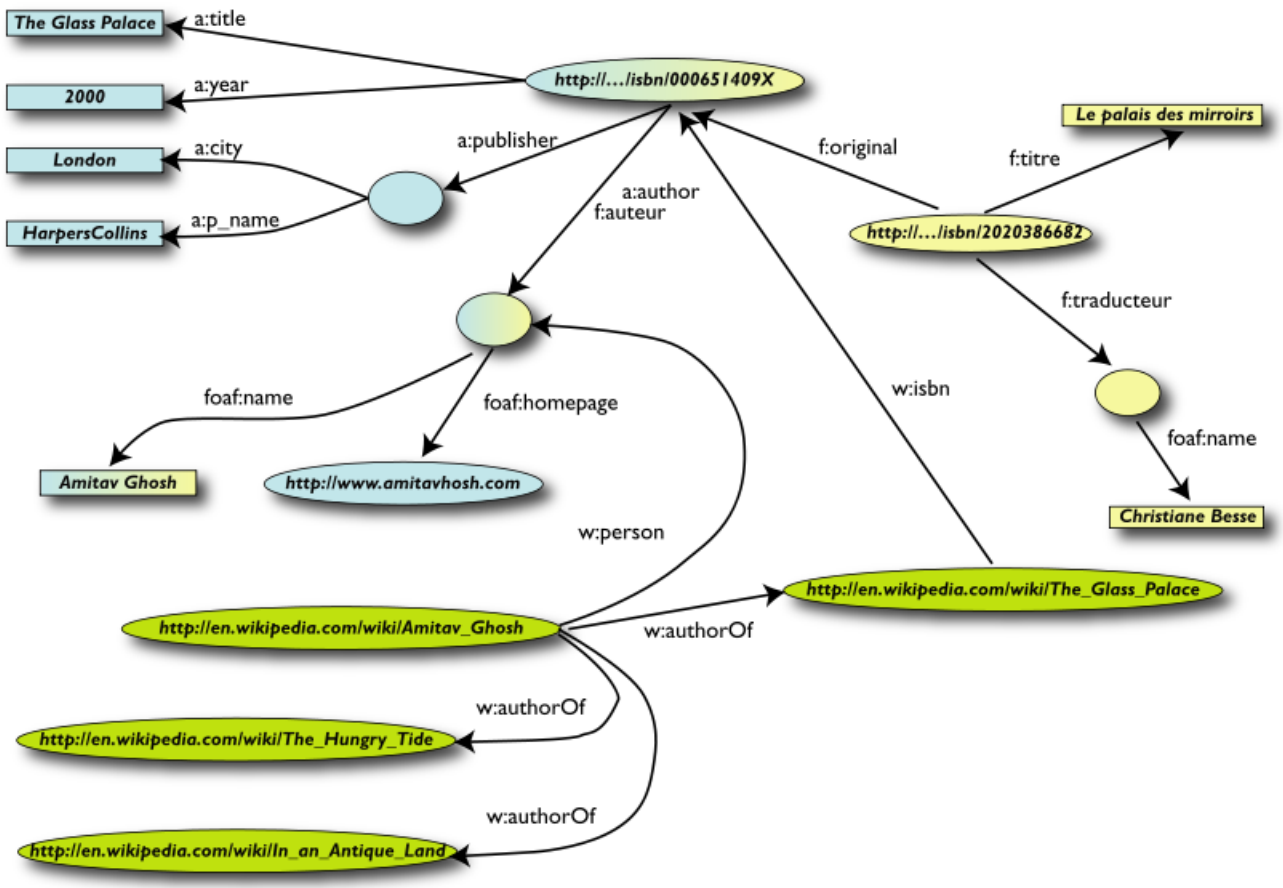
Combine with different datasets

- Using, e.g., the “Person”, the dataset can be combined with other sources
- For example, the data in Wikipedia can be extracted using simple (e.g., XSLT) tools
  - *there is an active development to add some simple semantic “tag” to wikipedia entries*
  - *we tacitly presuppose their existence in our example…*

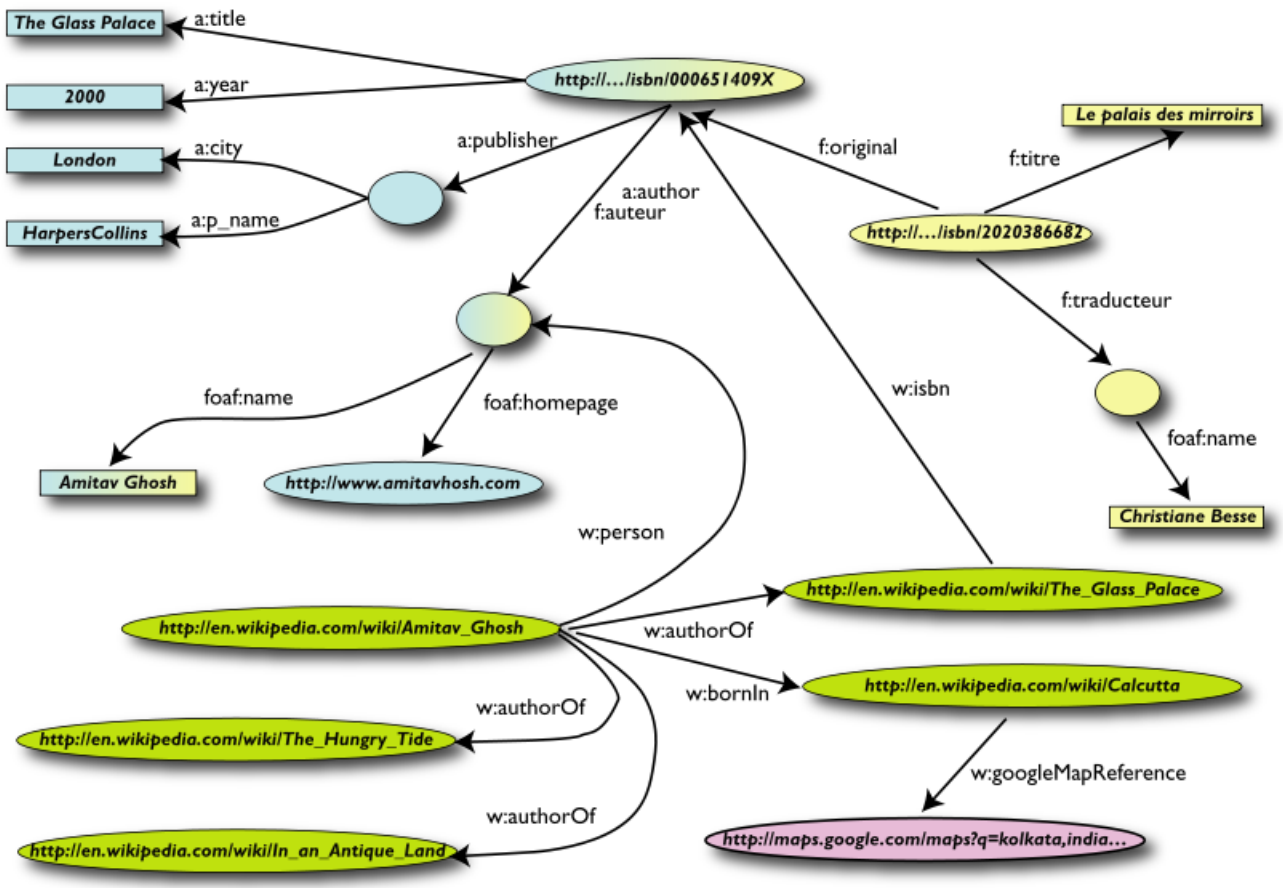
Merge with Wikipedia data



Merge with Wikipedia data



Merge with Wikipedia data



Is that surprising?

- Maybe but, in fact, no…
- What happened via automatic means is done all the time, every day by the users of the Web!
- The difference: a bit of extra rigor (e.g., *naming* the relationships) is necessary so that machines could do this, too

What did we do?

- We combined different datasets
  - *all may be of different origin somewhere on the web*
  - *all may have different formats (mysql, excel sheet, XHTML, etc)*
  - *all may have different names for relations (e.g., multilingual)*
- We could combine the data because some URI-s were identical (the ISBN-s in this case)
- We could add some simple additional information (the “glue”), also using common terminologies that a community has produced
- As a result, new relations could be found and retrieved

So where is the Semantic Web?

- The Semantic Web provides the technologies to make such integration possible!
  For example:
  - *an abstract model for the relational graphs: RDF*
  - *means to extract RDF information from, eg, XHTML pages: GRDDL*
  - *a query language adapted for the relational graphs: SPARQL*
  - *various technologies to characterize the relationships, categorize resources: RDFS (RDF Schemas), OWL (Web Ontology Language), SKOS*
    - depending on the complexity required, applications may choose among the different technologies
  - *reuse of existing "ontologies" that others have produced (FOAF in our case)*

A real life example: Antibodies Demo

- Scenario: find the known antibodies for a protein in a specific species
- Combine four different data sources
- Use SPARQL as an integration tool