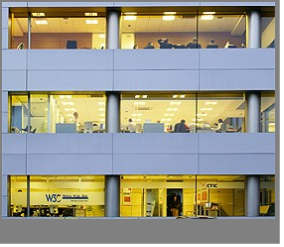
Smushing RDF instances:

are Alice and Bob the same open source developer?

Lian Shi, Diego Berrueta, Sergio Fernández, **Luis Polo** and Silvino Fernández

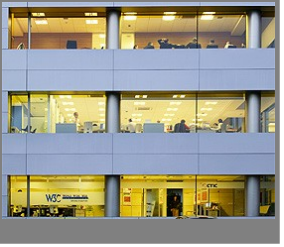
3rd **ExpertFinder** workshop on
Personal Identification and Collaborations: Knowledge Mediation and Extraction (**PICKME 2008**),
co-located with 7th International Semantic Web Conference (**ISWC2008**)

FUNDACIÓN CTIC
(Centro Tecnológico de la Información y la Comunicación)
Parque Científico y Tecnológico de Gijón,
Edificio Centros Tecnológicos
Cabueñes, s/n • 33203 Gijón (Asturias-Spain)
Teléfono: + 34 984 29 12 12
Fax: + 34 984 39 06 12
www.fundacionctic.org



Outline

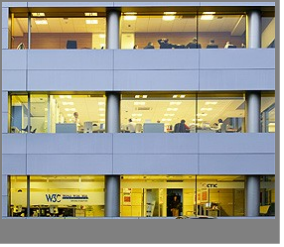
- Introduction
- RDF instances smushing
- Data recollection
- Experimental results
- Conclusions and further directions



Introduction

- Data integration is one of the key points in the ExpertFinder initiative. Expertise evidences have to be gathered from heterogeneous and distributed data sources.

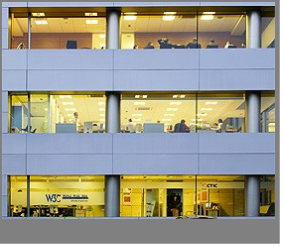
- Identity problem is a complex challenge in data integration processes. There would be a widespread flooding of virtual identifiers for the same individual
  - How can I know that "resource 1" from data source A is the same as "resource 2" from data source B.



What is the identity problem

- The reference and the identity of a person is somehow hidden behind partial descriptions in:
  - Her different participation profiles in the company
  - Her different identities in some communities
  - Her different characterizations ...

- Our hypothesis is based on the idea that "Data smushing" techniques are useful for spotting redundant instances and consolidating datsets
  - We will present an experiment in the context of open sourcee communities

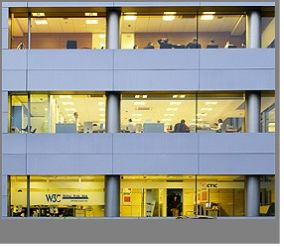


What is *smushing*?

Smushing is the process of normalising an RDF dataset in order to unify *a priori* different RDF resources which actually represent the same thing

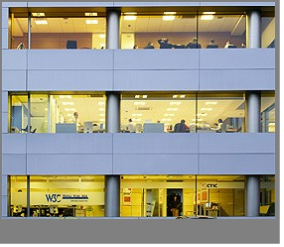
RDF instances smushing

- A smusher is a valuable tool for identifying the co-occurrence of the same person in different online communities
- We have explored two different approaches to implement our smusher
  - Logical approach, based on Inverse Functional Properties
  - Heuristics approach, based on Label similarity
- Pairs of redundant resources spotted by the smusher are automatically related with the property *owl:sameAs*
  - They behave as a single resource for OWL-aware applications



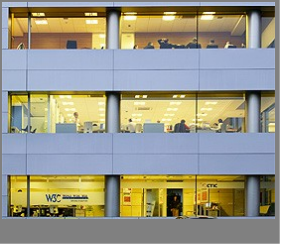
Inverse Functional Properties

- If a property *P* is an *owl:InverseFunctionalProperty* (IFP), then a value *y* can only be the value of *P* for a single instance *x.*
  - If *a priori* two distinct persons *Alice* and *Bob,* such (*Alice*,*y*) and (*Bob*,*y*) are instances of *P*, it should be the case that Alice and Bob are the same person.
- Some FOAF properties can be used as IFPs: mbox, jabberID, openid, etc.
  - These properties are identity criteria for a person
  - We restrict our experiment to the *foaf:mbox_sha1sum* property.



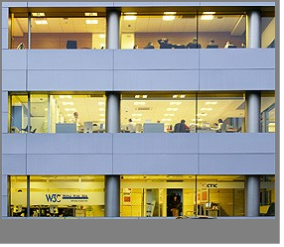
IFP implementation

- We discarded the usage a DL reasoner to smush the instances of the dataset
  - Scalability and performance arguments (when large and OWL-Full datasets)
  - It is not allowed to define datatype properties as *owl:InverseFunctionalProperties*.
- We use light-weight rules to define IFPs
  - Rules can be customized to any kind of properties
  - Datatype properties can be treated as IFPs
  - Rules have been written as SPARQL CONSTRUCT sentences



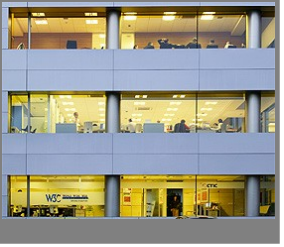
IFP smushing rule

```
CONSTRUCT {
    ?person1 owl:sameAs ?person2
    }
WHERE {
    ?person1 rdf:type foaf:Person .
    ?person2 rdf:type foaf:Person .
    ?person1 foaf:mbox_sha1sum ?email .
    ?person2 foaf:mbox_sha1sum ?email .
    FILTER (?person1 != ?person2)
}
```



Label similarity

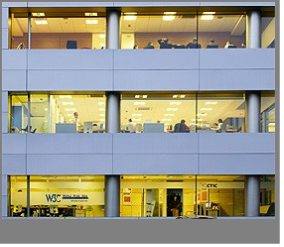
- When smushing people's descriptions, labels refer to personal names (*foaf:name*)
  - Proper names can be used to detect possible redundancies
- Smushing based on label similarity is not a precise operation, i.e., two resources can share the same label with any guarantee that they are the same.
  - "George W. Bush" is not the same person as his father "George Bush"



Label similarity implementation

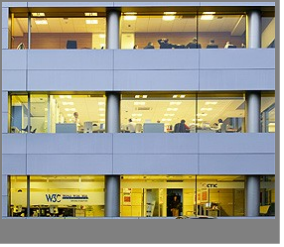
- Previous considerations about personal names
  - Names can be miss-spelled, but the probability is very low if the names are entered by the user.
  - Traditional similarity comparison functions, such as Levenshtein distance, are not really useful

- Our approach just consider strict string equality comparison
  - The label-based smusher has been implemented as a SPARQL CONSTRUCT sentence
  - SPARQL doesn't have rich built-in string comparison functions



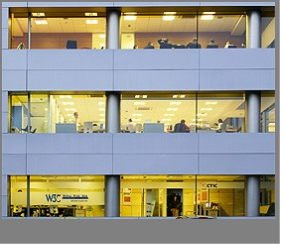
Label smushing rule

```
CONSTRUCT {
    ?person1 owl:sameAs ?person2
    }
WHERE {
    ?person1 rdf:type foaf:Person .
    ?person2 rdf:type foaf:Person .
    ?person1 foaf:name ?name1 .
    ?person2 foaf:name ?name2 .
    FILTER (name1 = name2)
}
```



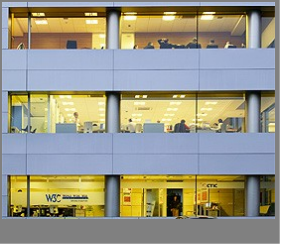
Experiment

- A corpus of RDF data with many *foaf:Person* was assembled from five online communities
  - Two million triples were extracted
  - OpenLink Virtuoso server as back-end
- A smusher prototype was implemented, according to the previous definitions, to consolidate the dataset
  - IFP: *foaf:mbox_sha1sum*
  - String strict equality: *foaf:name*
- The results of the two smushing techniques have been compared and evaluated



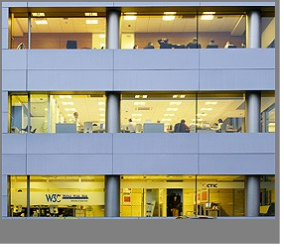
Data recollection

- Advogato Community
  - Exports its data as FOAF files, collected using a RDF crawler
- The RDFohloh project
  - Exposes the information as Linked Data. Data were extracted using Ohloh's API
- GNOME Desktop mailing lists
  - Data exported to RDF using SWAML.
- Debian mailing lists
  - The information was scrapped from the HTML archives (XSLT)
- Debian packages
  - They were extracted from *APT* database



Instances generation

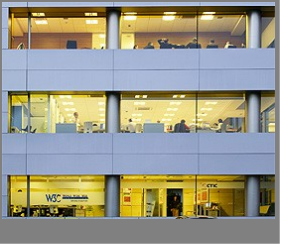
- A single URI was assigned to every generated instance
  - Different namespace for each source
- Some sources directly produce instances of *foaf:Person*
  - Advogato community, Debian Packages and the Ohloh project
- Other sources produce instances of *sioc:User*
  - Gnome and Debian mailing lists
  - Our assumption: for each *sioc:User*, there exists a *foaf:Person* (automatically created by the system when missing)



Experimental results (1)

- Number of smushed instances of *foaf:Person* using *foaf:mbox_sha1sum*

Source	Debian Pkgs	Advogato	Gnome ML	Ohloh	Debian ML
Debian Pkgs	0	81	37	74	762
Advogato		19	270	106	141
Gnome ML			364	112	161
Ohloh				0	115
Debain ML					0



Experimental results (2)

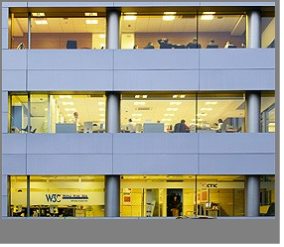
- Number of smushed instances of *foaf:Person* with exactly the same *foaf:name*

Source	Debian Pkgs	Advogato	Gnome ML	Ohloh	Debian ML
Debian Pkgs	98	170	101	58	1319
Advogato		49	592	95	305
Gnome ML			1716	148	432
Ohloh				13	208
Debain ML					2909

Experimental results (3)

- Number of smushed instances of foaf:Person combining both smushing techniques

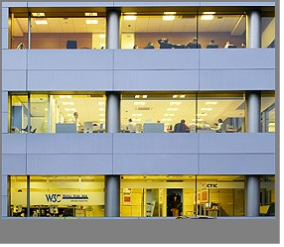
Source	Debian Pkgs	Advogato	Gnome ML	Ohloh	Debian ML
Debian Pkgs	98	188	113	104	1418
Advogato		55	669	167	342
Gnome ML			1765	227	462
Ohloh				13	287
Debain ML					2909



Experimental results (4)

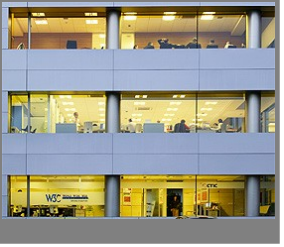
- Details of the top people

Name	Debian Pkgs	Advogato	Gnome ML	Ohloh	Debain ML
Frederic P.	X	X	X	X	X
Dan K.		X	X	X	X
Raphael H.	X		X	X	X
Julien D.	X	X		X	X
Rob B.	X	X		X	X
Daniel R.	X	X		X	X
Federico Di G.	X	X	X		X
Ross B	X	X		X	X
Francis T.	X	X	X	X	
...	...	...	...	...	...



Feedback from the community

- We have contacted the top people from the five online communities to recollect their feedback.
- The aim was to experimentally checked the reliability of our conclusions
  - Measure the precision and recall of the smushing process
- Some important privacy and ethical issues arose, even if the information was publicly available on the Web

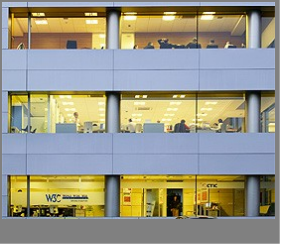


Conclusions

- We have tested smushing techniques in a large dataset
  - More than 36.000 instances of foaf:Person automatically extracted have been smushed.
- The label-based smusher draws more conclusions than the IFP-based one
  - IFP results are largely contained in the results of the label-based smusher
- The differences of the results between both approaches are:

  (a) There are people who have more than one e-mail account

  (b) There are different people with the same name



Further directions

- Enrich the dataset with more detailed descriptions about people
  - We have only used the IFP property *foaf:mbox_sha1sum*
  - There are more personnel properties useful for smushing processes in some controlled environments: homepage, Ids, preferences, etc.
- Explore and evaluate more intelligent string comparison functions
  - Proper names can be written in different ways:

    "J.F.K", "J.F. Kennedy", "John Fitzgerald Kennedy", etc.
  - String similarity techniques can be applied to other datatype properties. For instance, address, nicknames, etc.

thanks

questions?