IBEX: Harvesting Entities from the Web Using Unique Identifiers

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May 31st, 2015

Identifiers on the Web

Samsung I9505

€568.29 (€670.58 inc VAT)

Manufacturer: **Samsung**

GTIN: 8806085560352

Samsung SM S24C770T LED 60,96CM

€671.37 (€792.22 inc VAT)

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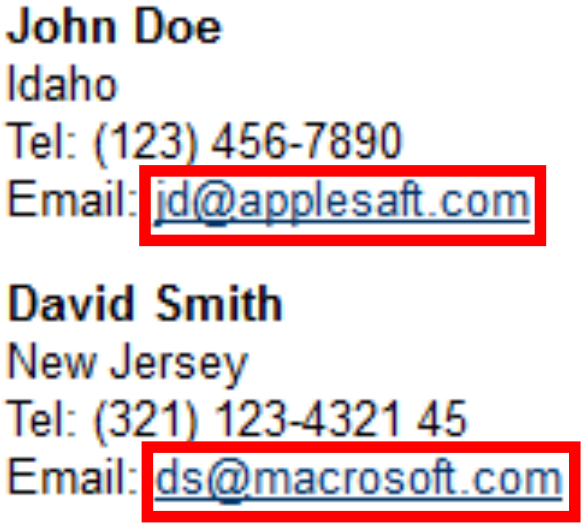

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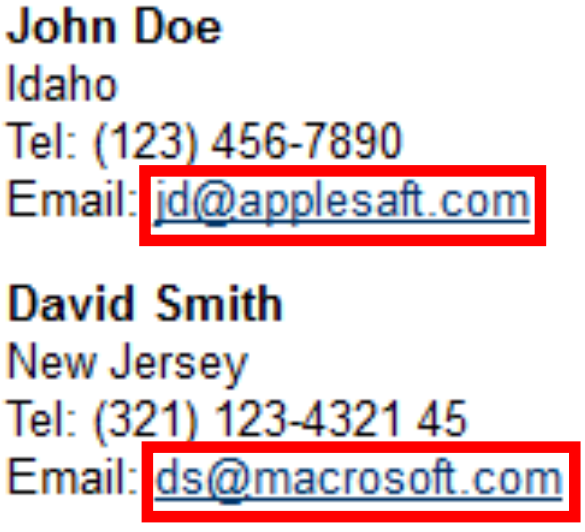
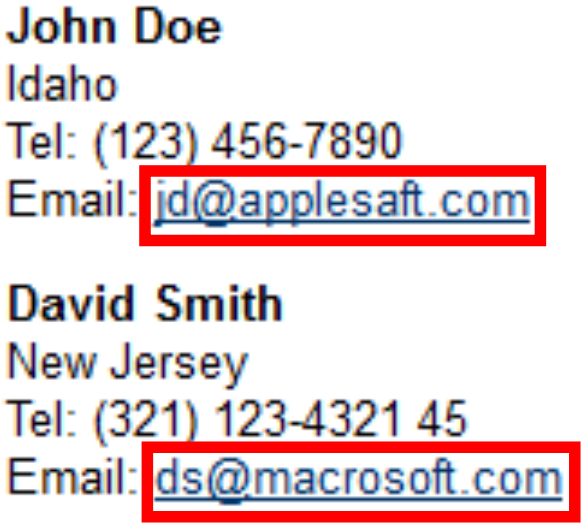


- It is tricky to extract named entities from Web pages
- Some entities have identifiers with recognizable syntax
- We focus on the following id types:
  - → GTINs (products): 8–14 digits
  - → CAS (chemicals): 8 digits
  - → DOIs (documents): numerical prefix, '/'
  - → Email addresses (people)

Names for IDs



- We will extract identifiers from Web pages
- We also want a human-readable name

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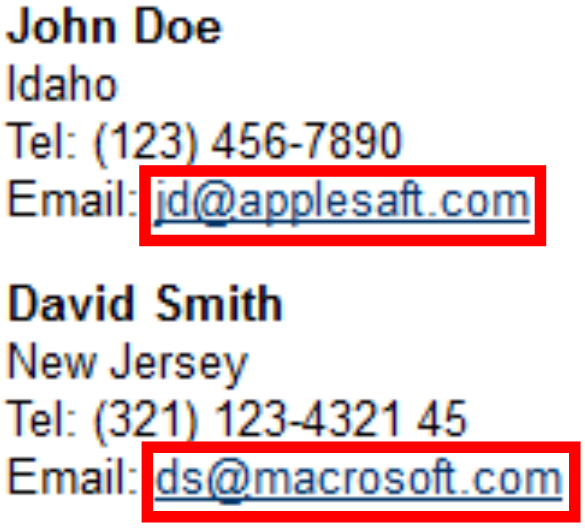

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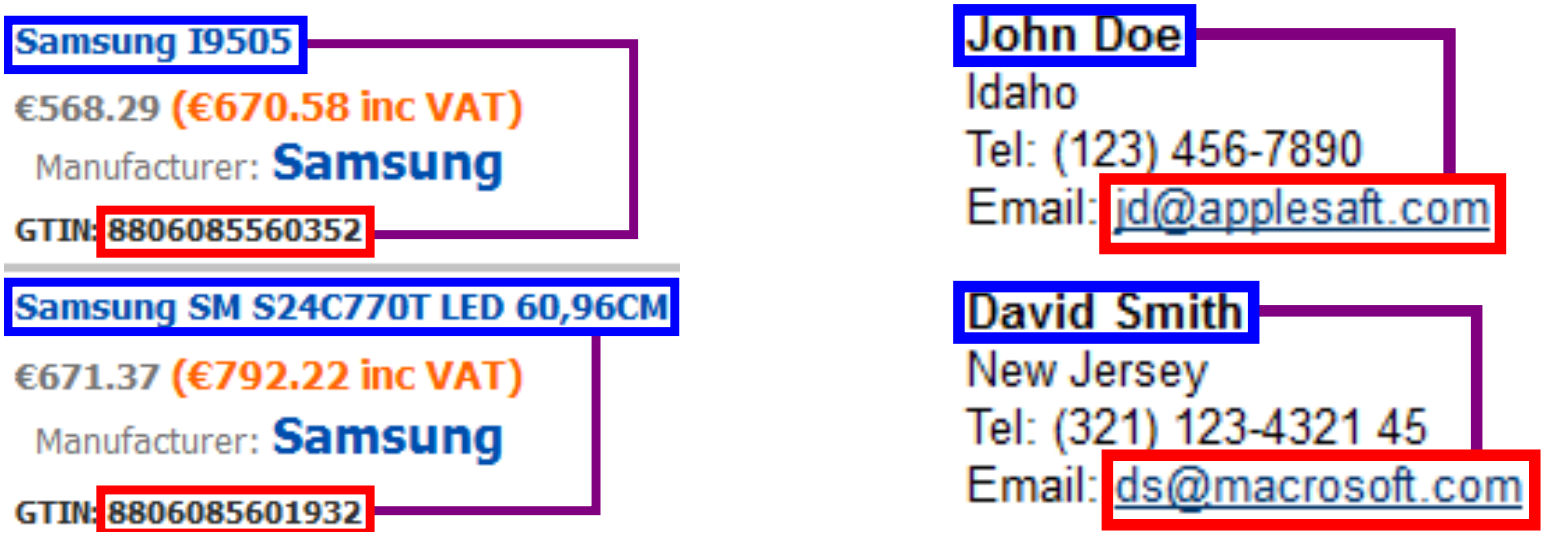

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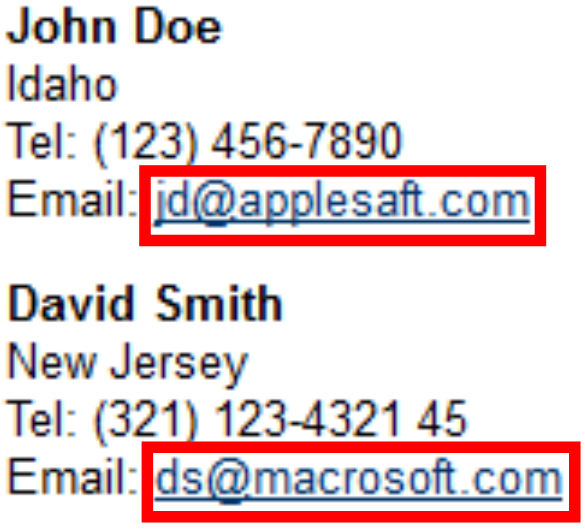

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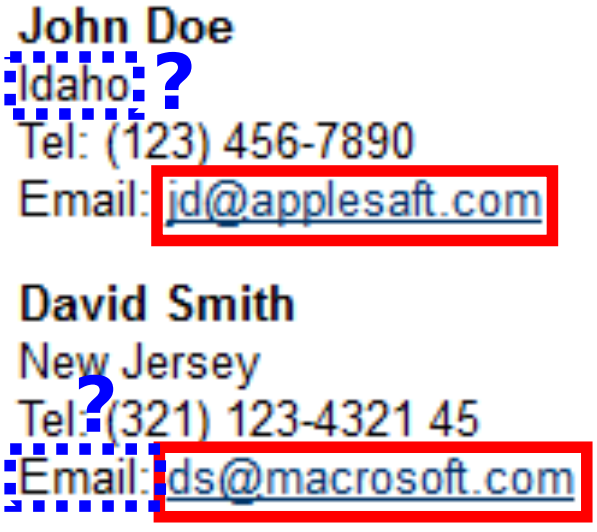

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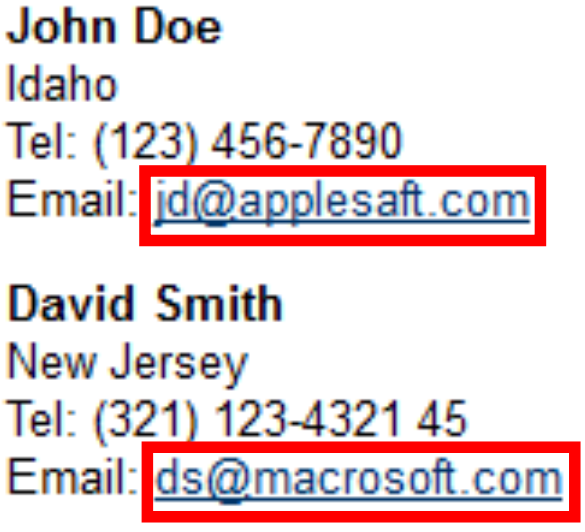

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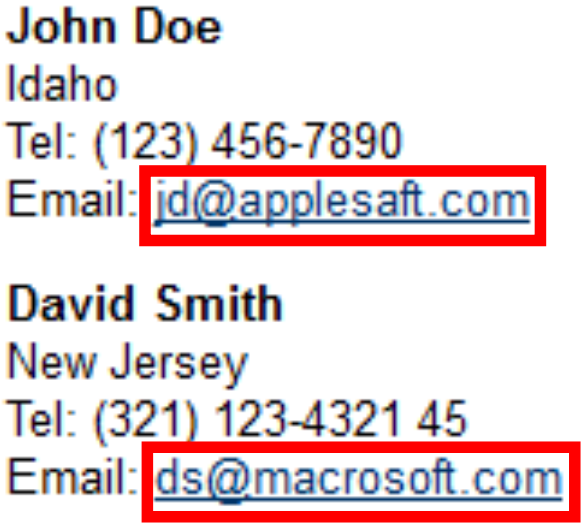

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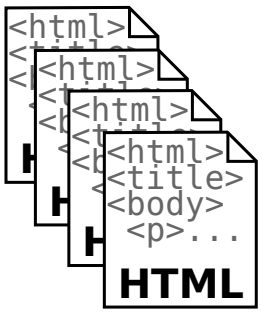

GTIN	CAS	email
nnnnnnnnnnnnn	nnnnn-pp-q	xxx@yyy.zzz

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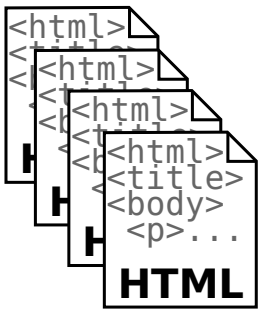

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→ Find out the right name for each of them

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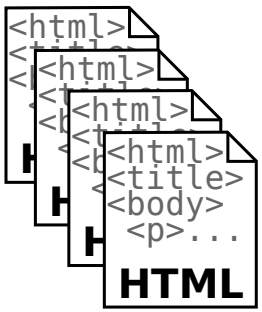

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GTIN	8806085560352	Samsung I9505
GTIN	8806085601932	Samsung SM S24C770T
CAS	10049-04-4	Chlorine dioxide
email	jd@applesaft.com	John Doe
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Related work

Named Entity Recognition. Cannot figure out the ID–name map

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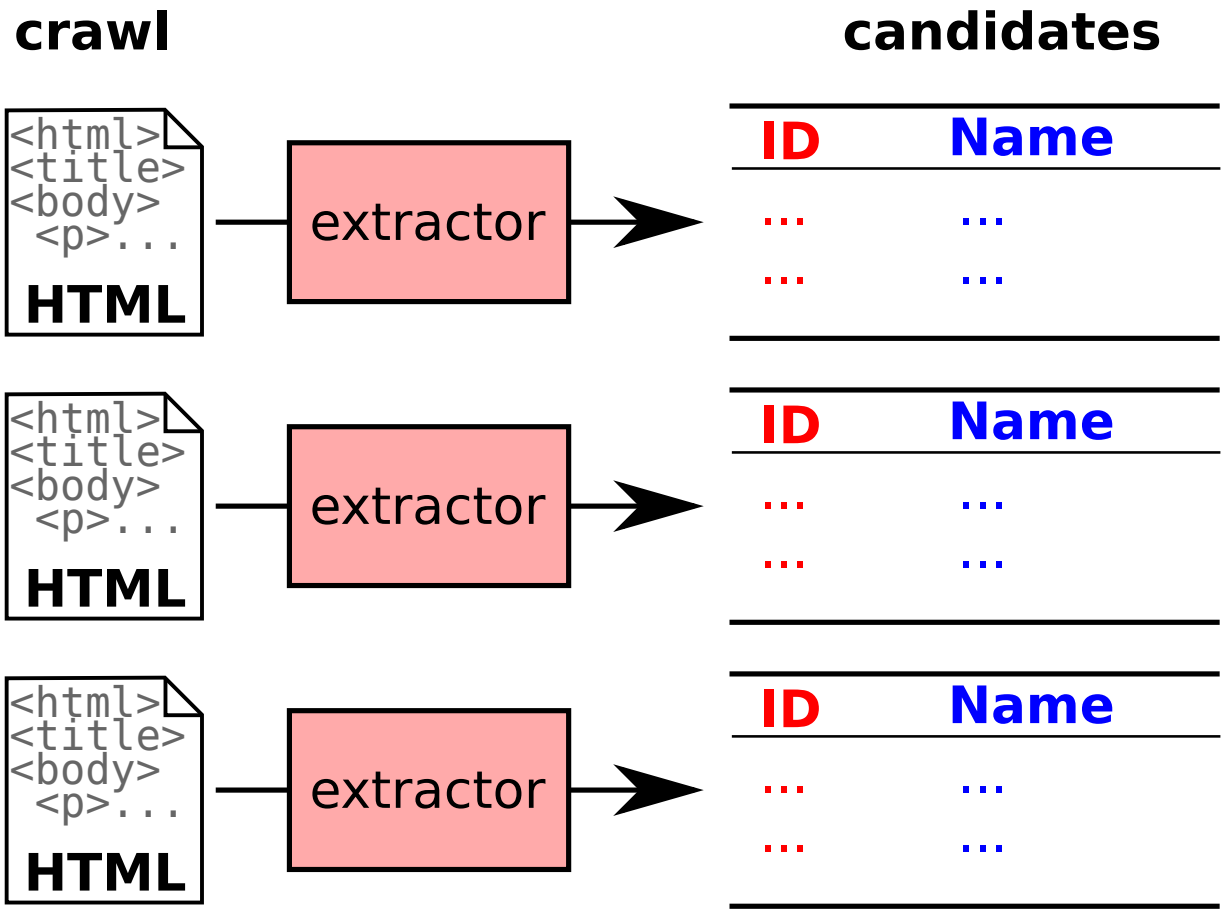
→ Relying on IDs will make our life easier!

Table of contents

Task description

Extract candidate name–ID pairs from pages in parallel:



HTML parsing

```
<body><h1>Galaxy S6</h1>
  <p>Id:  <b>8806
 <h1>Gear
  <h2>S6 Cable</h2>
  4047              </body>
```

- Custom DOM parser
- Knowledge on tag nestings
- Regoup headers and content

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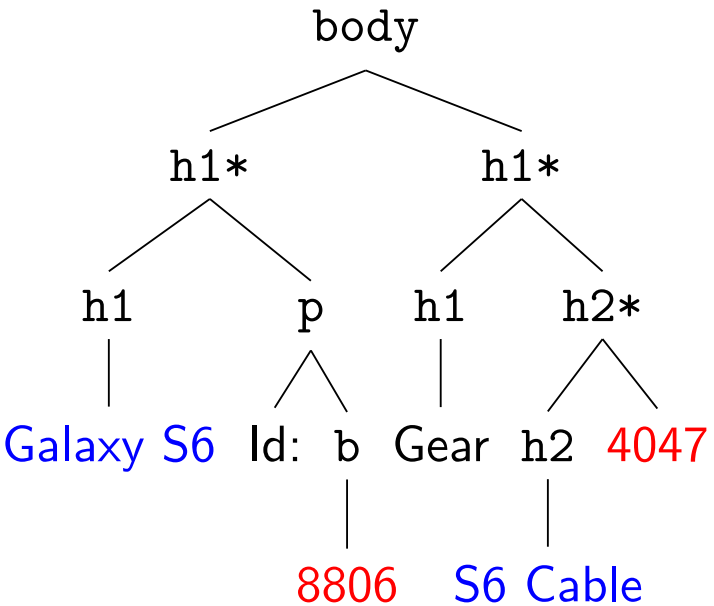

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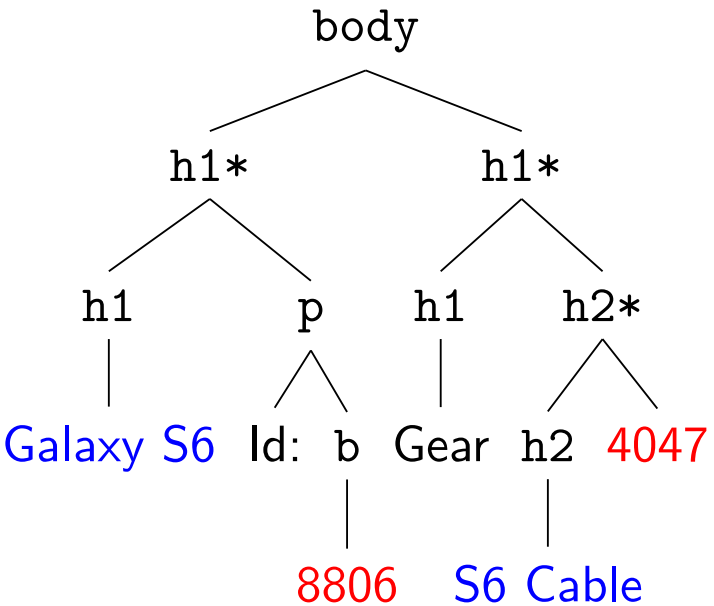


- Custom DOM parser
- Knowledge on tag nestings
- Regoup headers and content

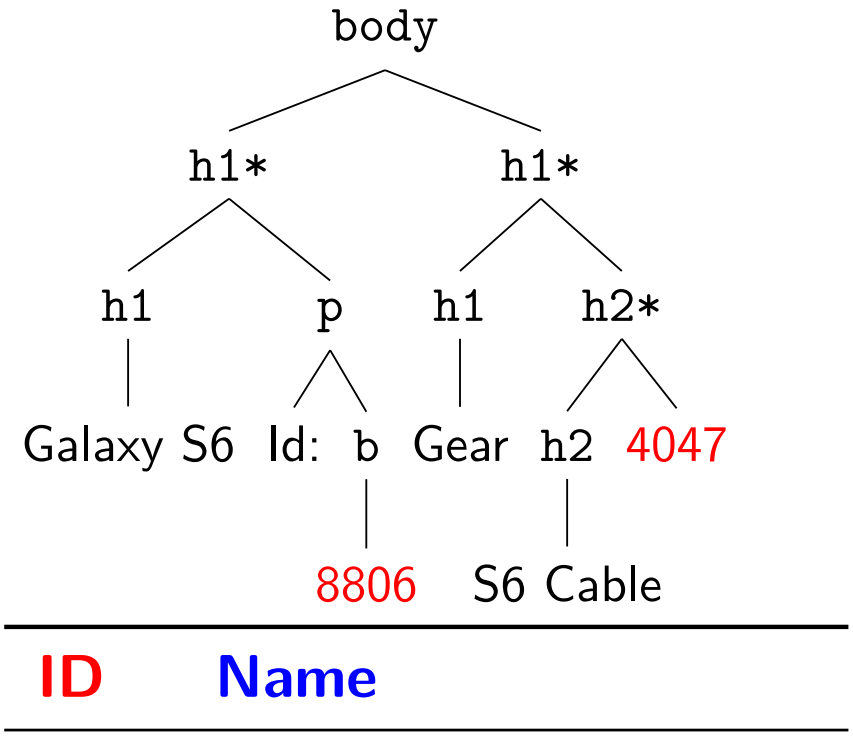
→ Fast (Web-scale)

→ Agnostic (no assumptions)

→ Resilient (real HTML sucks)

→ Simple (clean up later)

Extracting pairs



- Use the pattern to find IDs
- Record: maximal subtree containing only one ID
  - → Detail record (one)
  - → Free record (many)
- Leaves in each record are the name candidates

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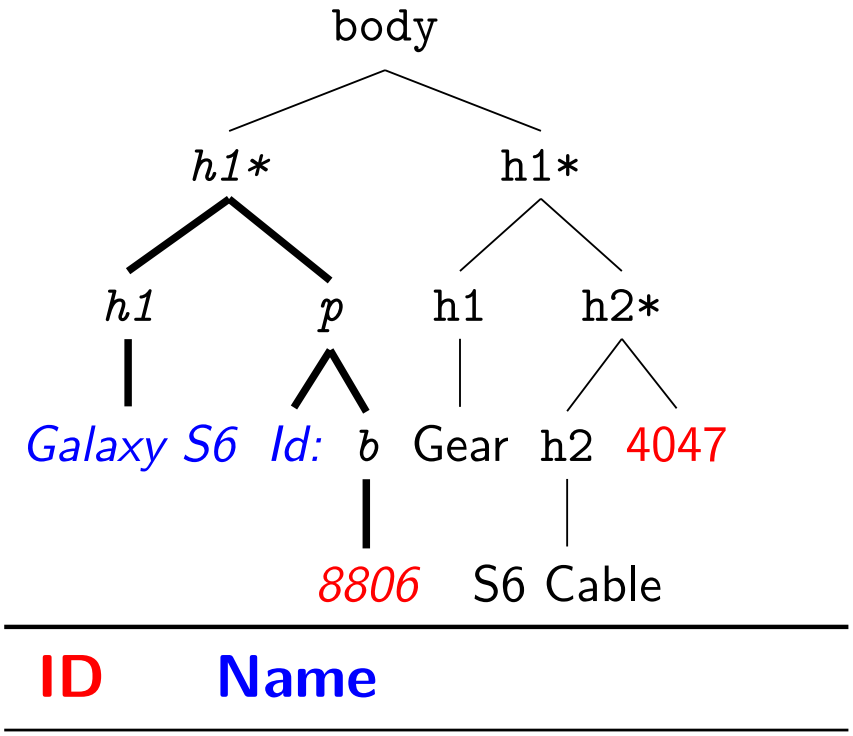

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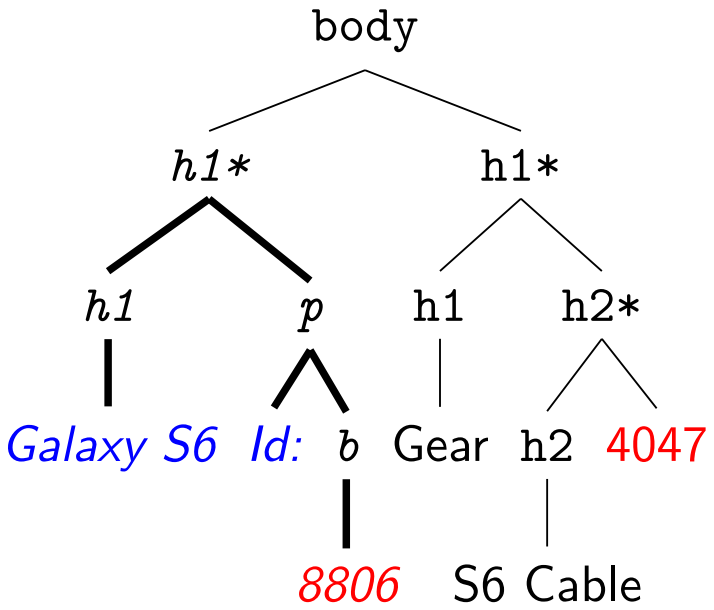

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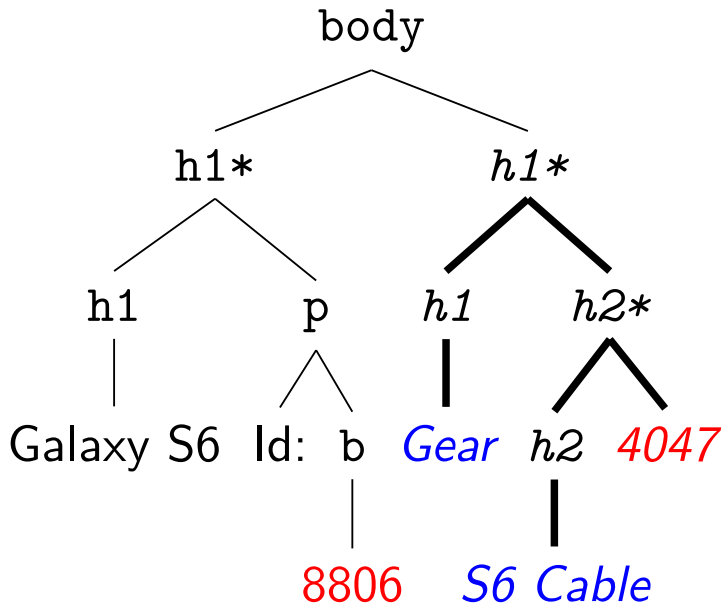

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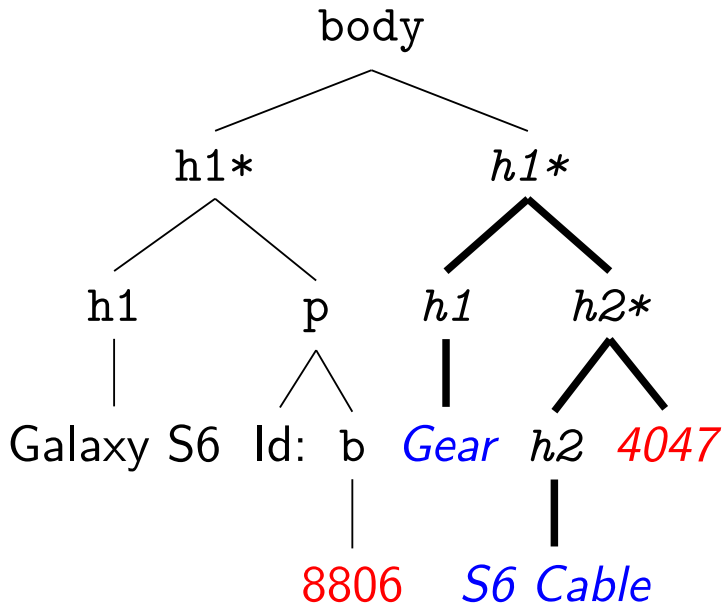

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Clean up the junk in ID–name pairs

Page	ID	Name
page1.html	9780261102361	The Two Towers
page1.html	9780261102361	J. R. R. Tolkien
page1.html	9780261102354	The Fellowship of the Ring
page1.html	9780261102354	J. R. R. Tolkien
page2.html	9780261102354	The Lord of the Rings (Part 1)
page3.html	9780261102354	The Fellowship of the Ring

→ Idea: unlike real names, bad names are not specific to an ID

Filtering names

- Group by name
- Consider the IDs for each name

Name	ID	Page
J. R. R. Tolkien	9780261102361	page1.html
J. R. R. Tolkien	9780261102354	page1.html
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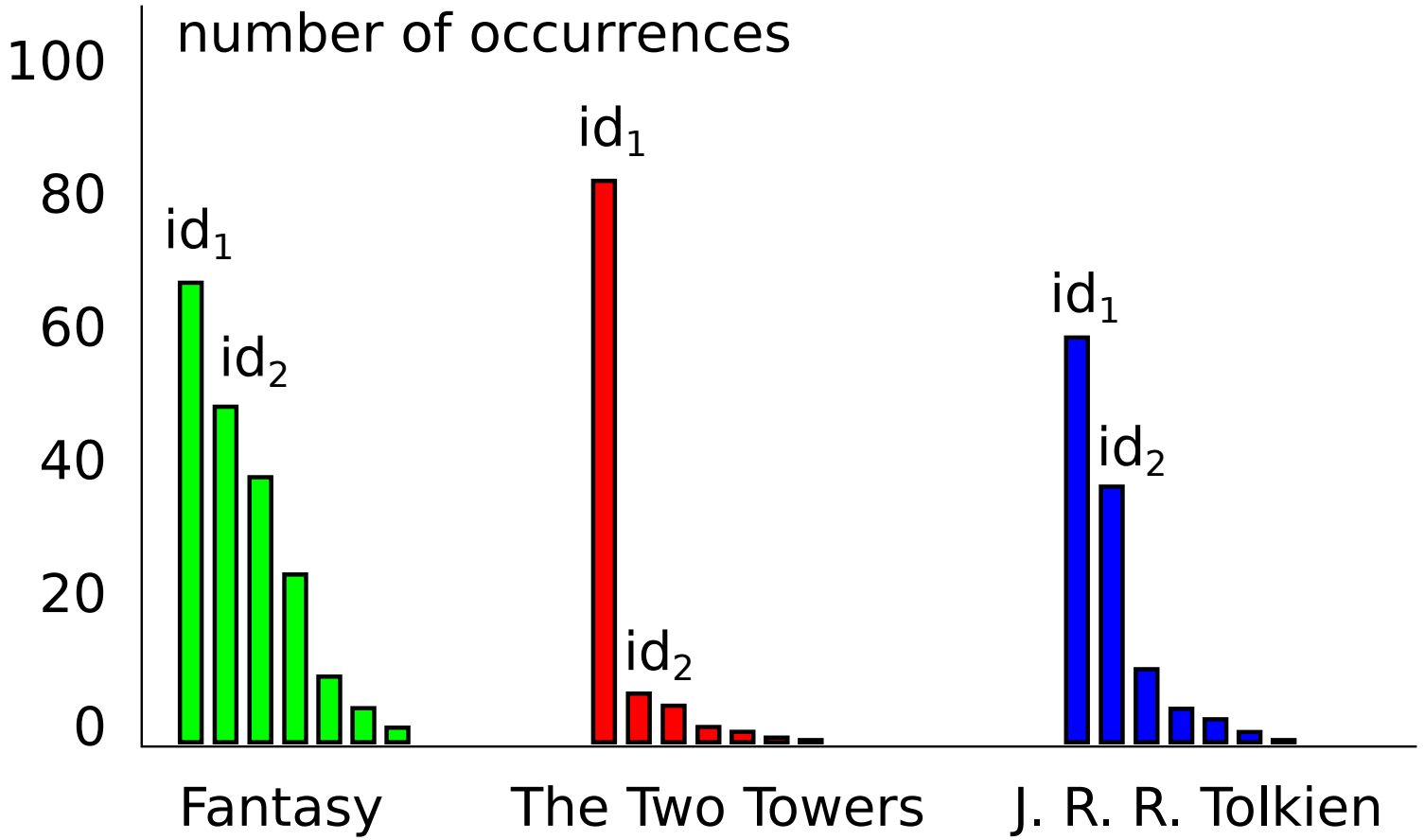
Deciding specificity

For each name, consider the histogram of ID occurrences:



→ most frequent ID id_1 must be much more frequent than id_2

→ id_1 must be sufficiently frequent overall

Putting it together

- We have eliminated unspecific names

Name	ID	Page
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→ We have our final result: IDs and their name

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→ Only 10 hours processing time

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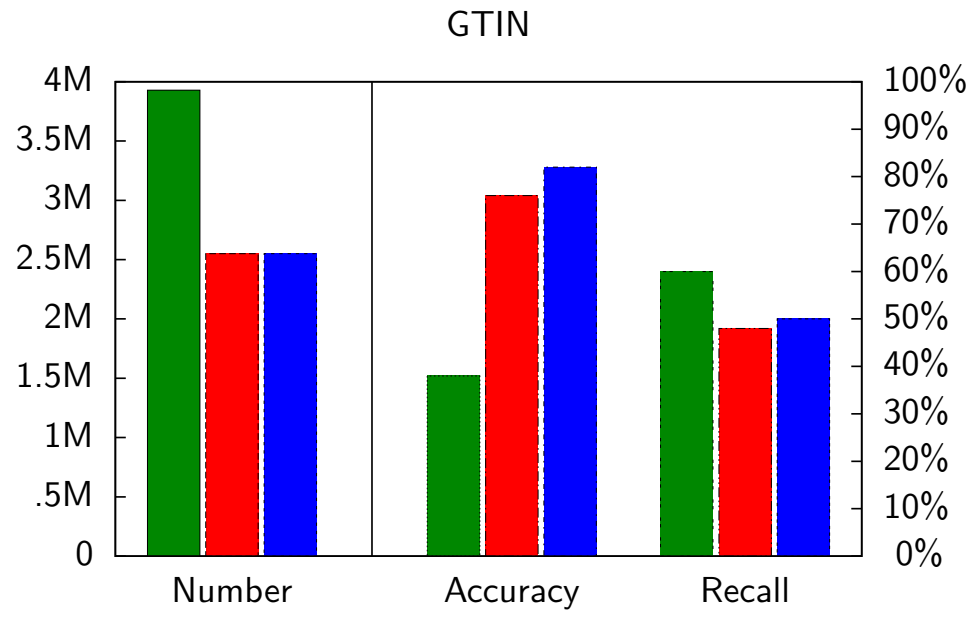
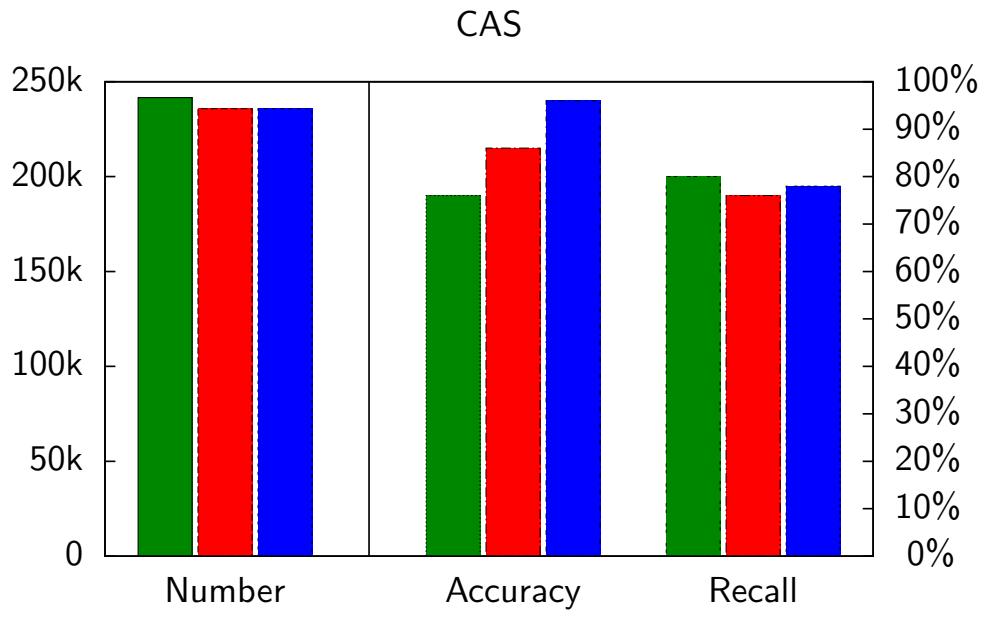
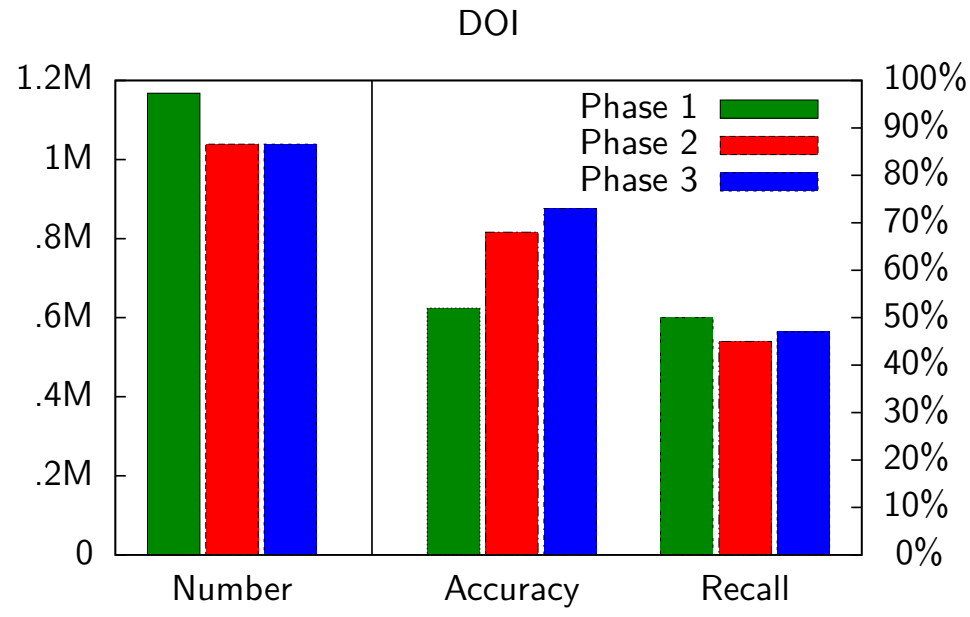
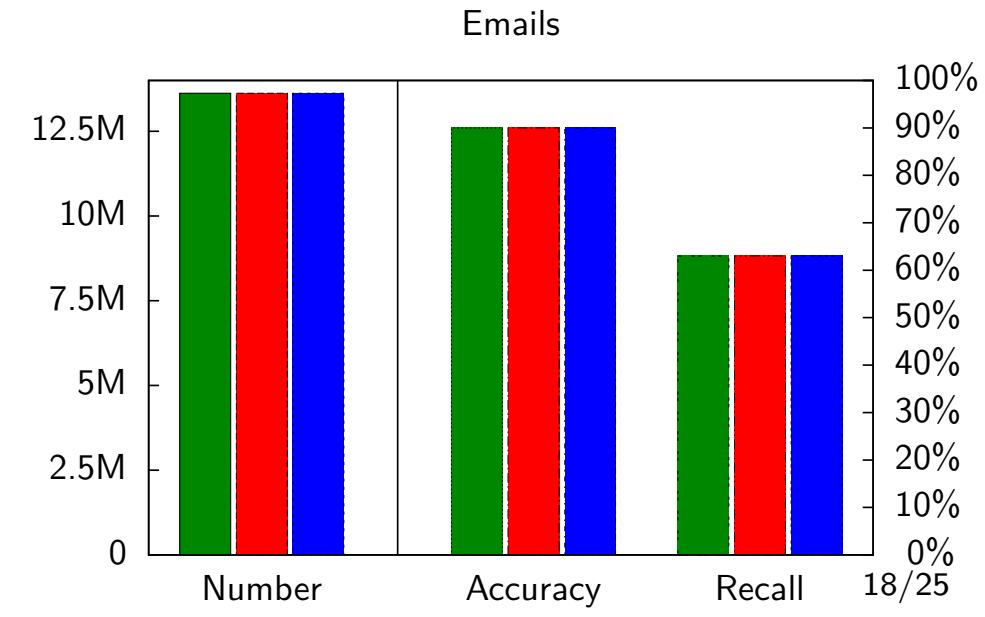
→ In phase 1 and 2, we choose one random name per id

Overall results









Results: richest sources by type and email domains

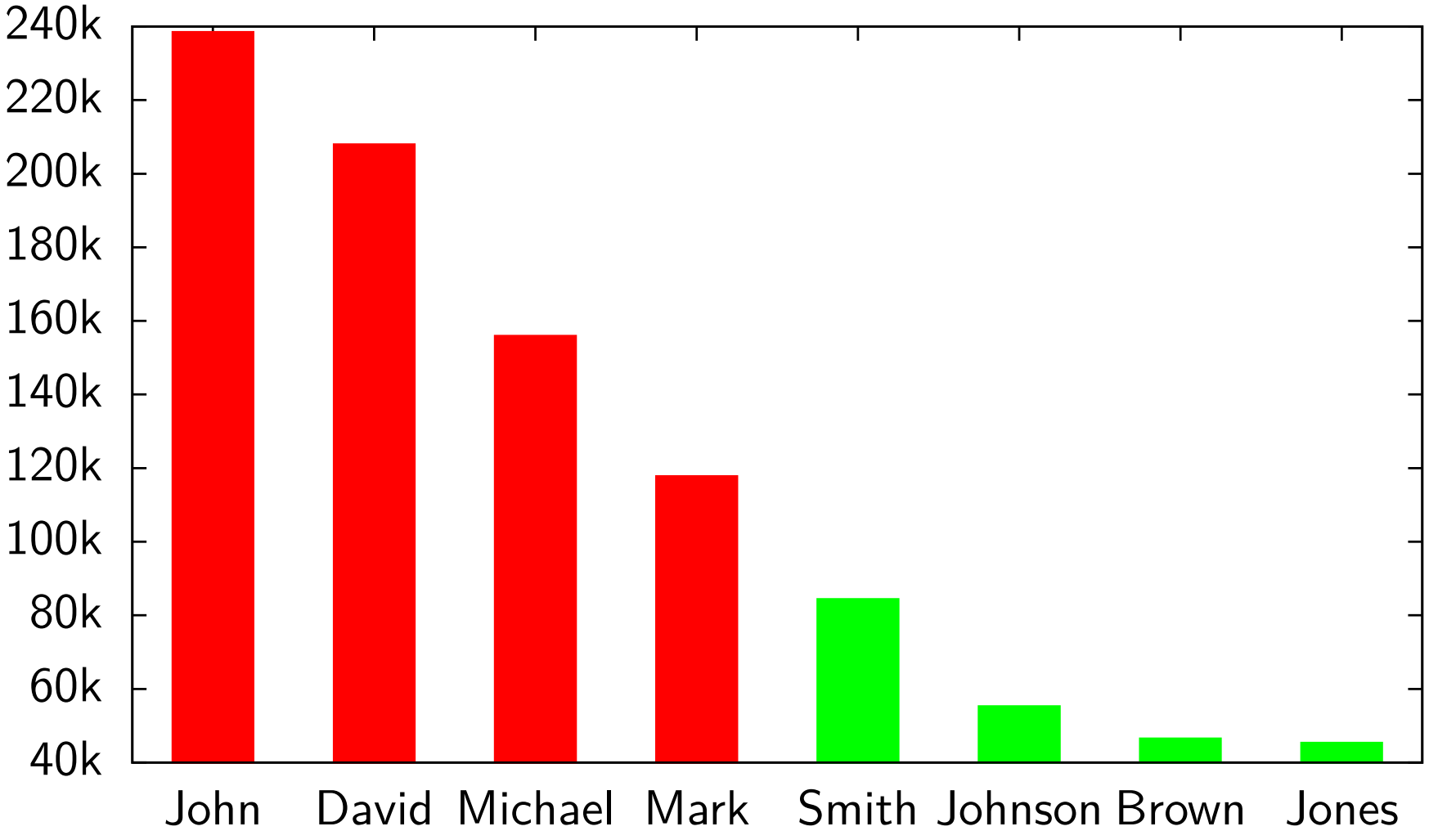
Product sources	Items
www2.loot.co.za	304,431
www.books-by-isbn.com	50,683
gtin13.com	26,834
en.wikipedia.org	21,873
www.buchhandel.de	18,264

Chemical sources	Items
www.chembuyersguide.com	129,211
www.chemnet.com	22,061
www.lookchem.com	12,354
www.seekchemicals.com	7,326
www.tradingchem.com	4,769

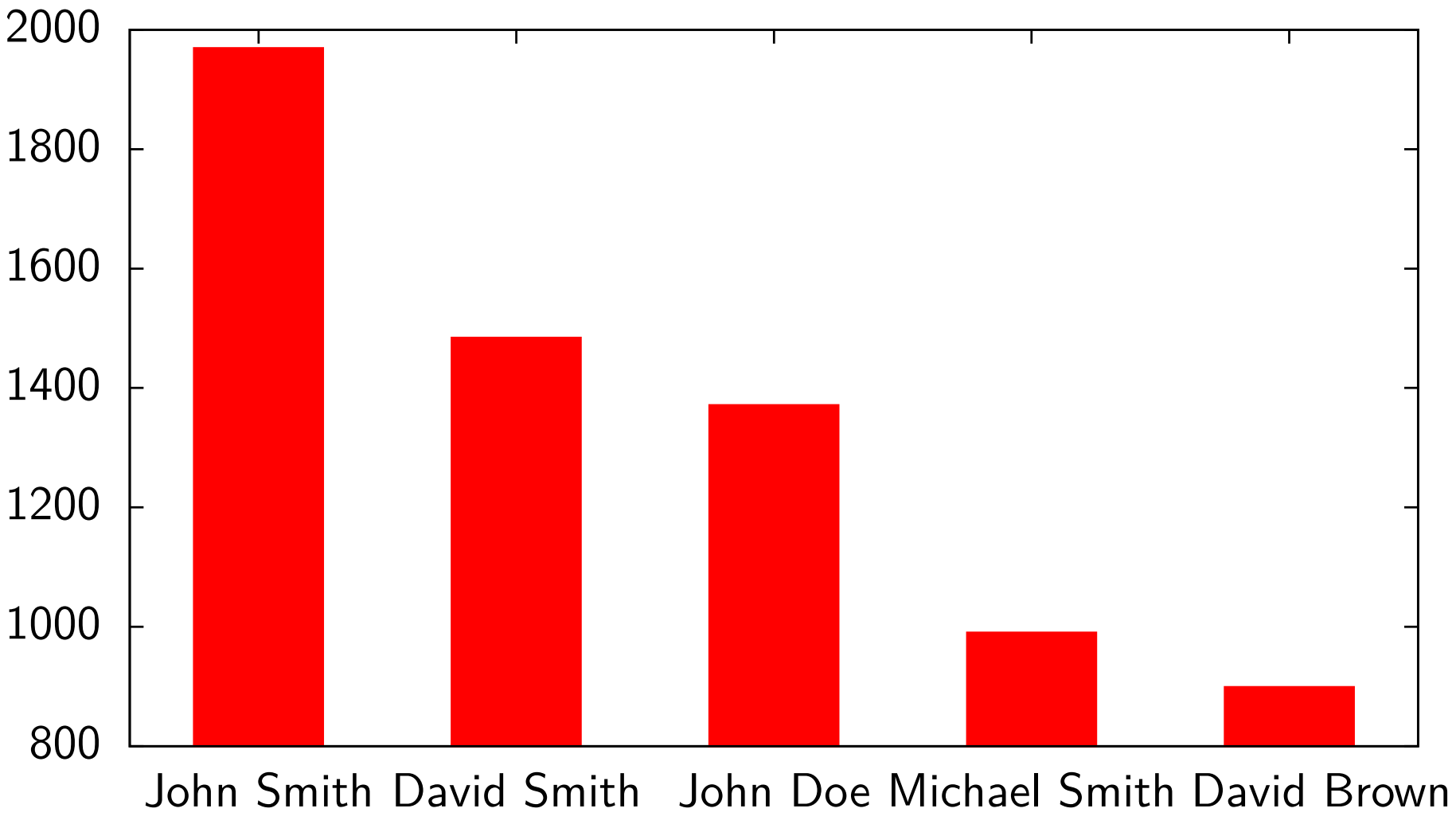
Document sources	Items
wwwtest.soils.org	20,635
www.plosone.org	19,261
www.citeulike.org	13,491
www.astm.org	10,020
bja.oxfordjournals.org	9,030

Domain name	Email addresses
gmail.com	304,236
yahoo.com	290,292
hotmail.com	281,498
aol.com	259,769
comcast.net	95,983

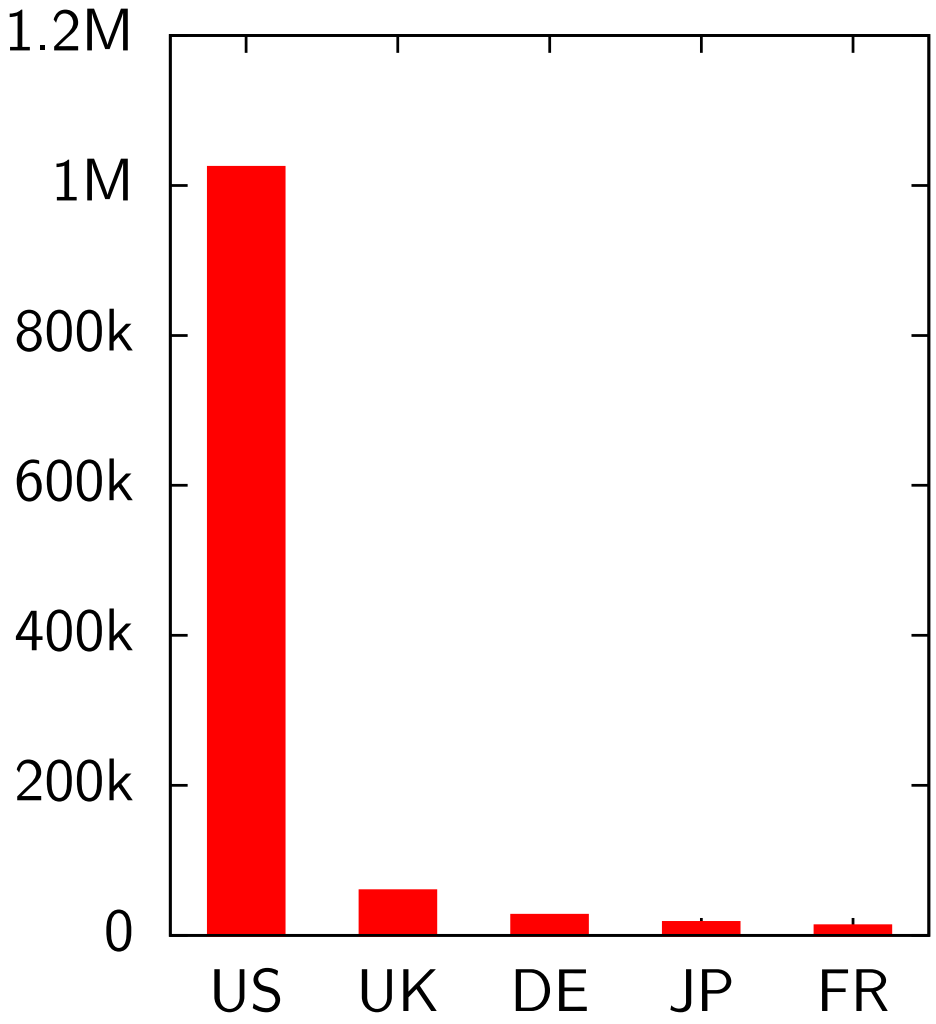
Results: first and last names

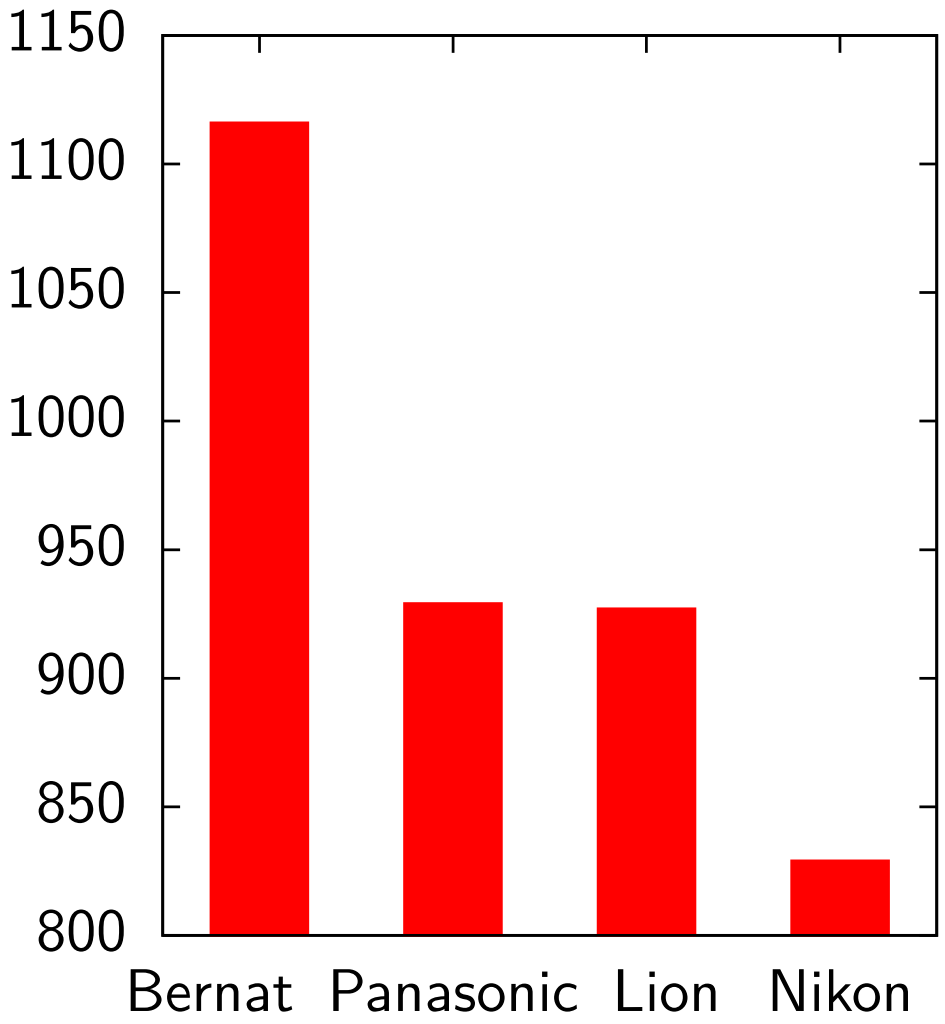


Results: full names



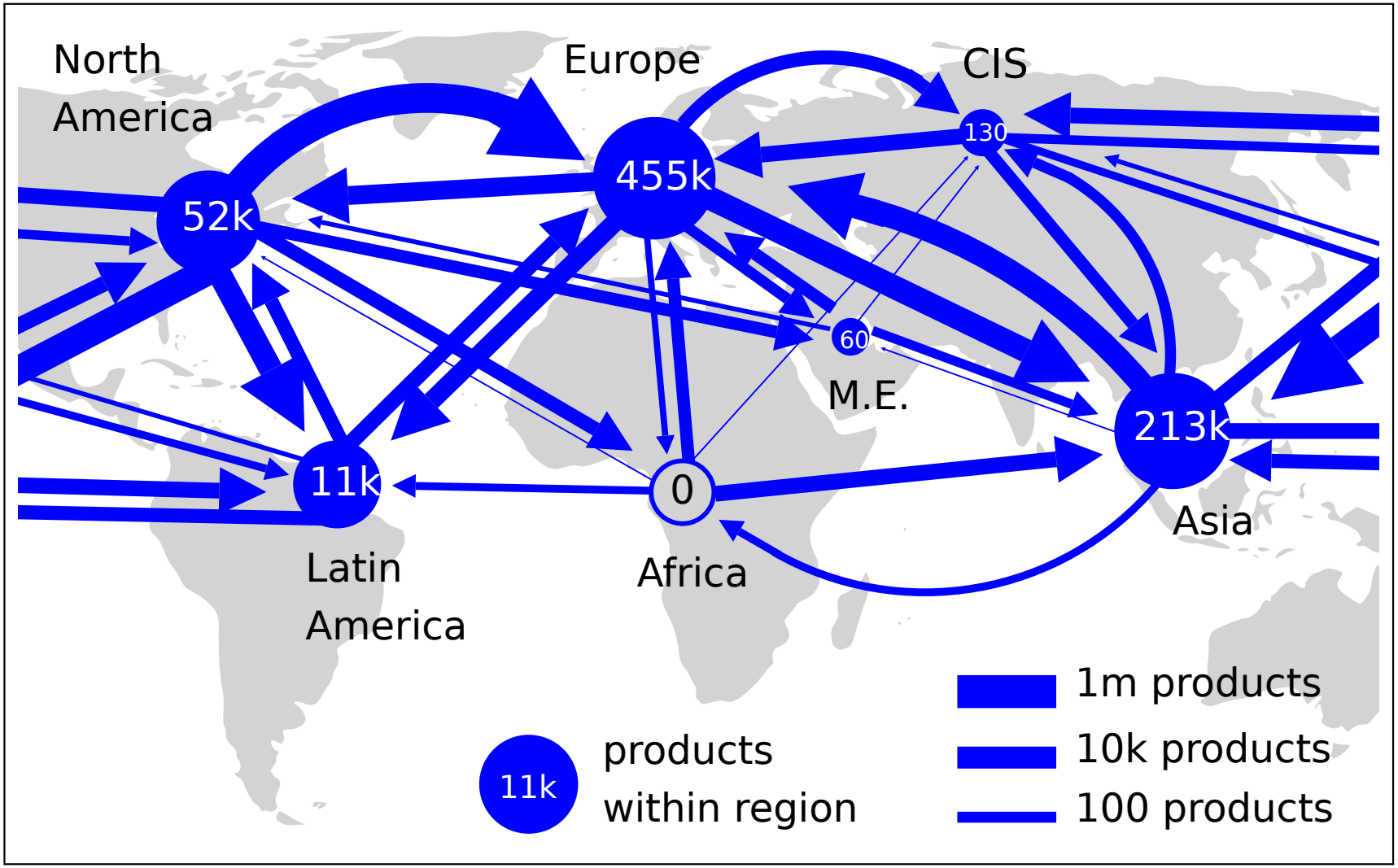
Number of products by country, by company





Analyses: world trade

Products produced somewhere (GTIN) but sold elsewhere (URL).



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  - 1M documents
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Thanks for your attention!

These slides are inspired from an earlier presentation by Aliaksandr Talaika.