Querying Wikipedia like a database

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Wikipedia

- 5th most popular website (according to Alexa.com)
- Maybe the finest example of truly collaboratively created content (>20M articles, >280 languages, >90,000 contributors)
- Lacks structured representation of content which facilitate querying and search
- Search capabilities are limited to keyword matching

Wikipedia

- Simple questions, hard to answer
  - Which are the companies owned by Sony and located in India?
  - Which universities in India, located in Mumbai, were established before 1975?
  - Who is Shakespeare's child's spouse?

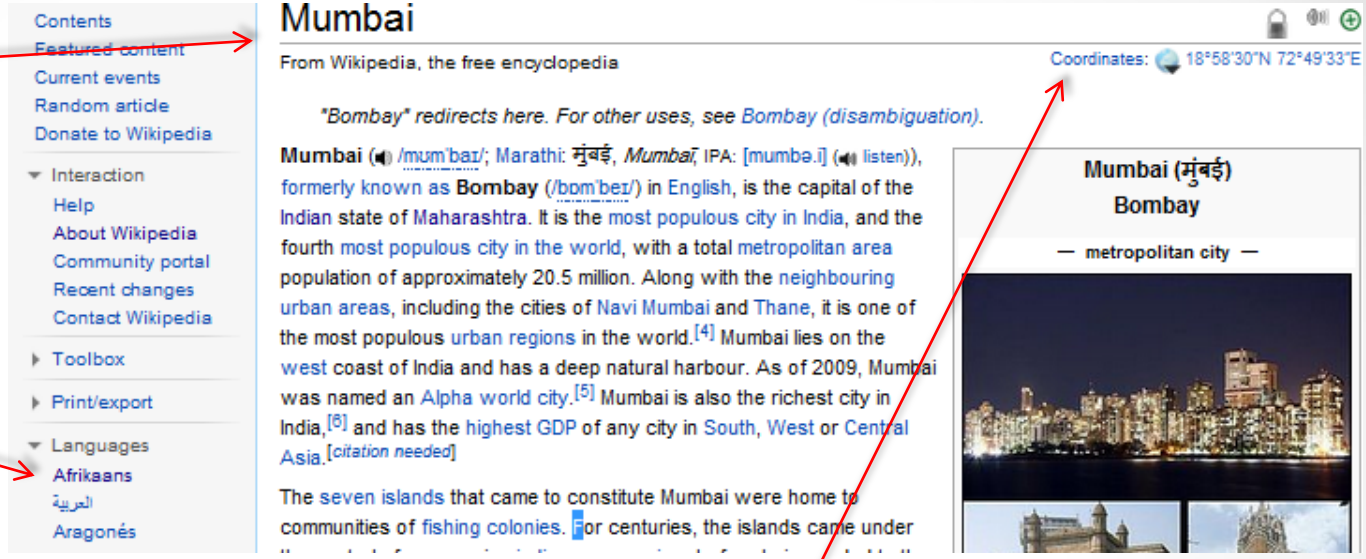
DBpedia

- Tool which facilitates querying Wikipedia
- An effort to extract structured information from Wikipedia and to make this information available on the Web under an open license
- Project undertaken by the **Free University of Berlin** (Germany) and the **University of Leipzig** (Germany), in collaboration with OpenLink Software
- A uniform dataset which can be queried or linked to other data sets on the web

Structure in Wikipedia

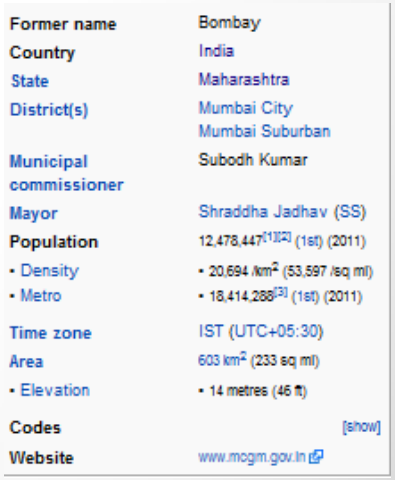
Title

Other language versions



Geo-Coordinates

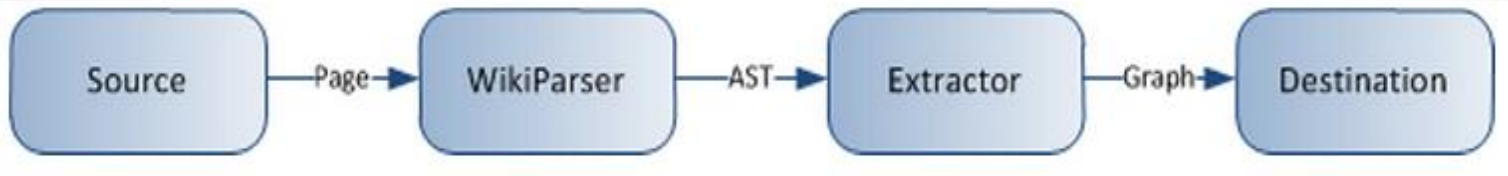
Infoboxes



Categories

DBpedia Extraction Framework

- Identifies structured information in Wikipedia and converts it into to RDF




```
{{Infobox Indian jurisdiction
|former_name = Bombay
|other_name = Bombay
|type = Metropolitan City
|type_2 = Finance Capital
|latd=18 |latm=58 |lats=30
|longd=72 |longm=49 |longs=33
|locator_position = right
|state_name = Maharashtra
|district = [[Mumbai City district|Mumbai City]]
<br />[[Mumbai Suburban District|Mumbai Suburban]]
|language=Marathi language
|leader_title_2 = [[Mayor of Mumbai|Mayor]]
|leader_name_2 = [[Shraddha Jadhav]] ([[Shiv Sena|SS]])
|leader_title = [[Municipal commissioner]]
|leader_name = Subodh Kumar
|altitude = 14
|population_total = 12,478,447
```

dbpedia-owl:areaCode	9122-XXXX XXXX
dbpedia-owl:areaTotal	1561762830.532608 (xsd:double)
dbpedia-owl:country	dbpedia:India
dbpedia-owl:district	dbpedia:Mumbai_Suburban_District dbpedia:Mumbai_City_district
dbpedia-owl:elevation	14.000000 (xsd:double)
dbpedia-owl:leaderTitle	Municipal commissioner
dbpedia-owl:populationDensity	7989.998069 (xsd:double)
dbpedia-owl:populationMetro	21900967 (xsd:integer)
dbpedia-owl:populationTotal	12478447 (xsd:integer)
dbpedia-owl:postalCode	400 xxx
dbpedia-owl:state	dbpedia:Maharashtra
dbpedia-owl:synonym	Bombay

What is RDF?

- **R**esource **D**escription **F**ramework
- Knowledge representation language for describing resources
- DBpedia uses RDF for representing the extracted information
- A typical format of an RDF statement comprises of 3 components
  - **Subject** - Any entity like place, person, book etc.
  - **Predicate** – A characteristic of the subject
  - **Object**– A value for the subject

RDF – Example

- "Mumbai is the birth place of Rajiv Gandhi"

- The corresponding RDF statement would be :

<http://dbpedia.org/resource/Rajiv_Gandhi> → Subject
<http://dbpedia.org/property/birthPlace> → Predicate
<http://dbpedia.org/resource/Mumbai>. → Object

- Subject and Predicate are identified by URIs while the Object can be an URI or a value

- The URIs in the RDF statement can be shortened by using a "prefix"

RDF – Prefixes

- PREFIX dbr: <http://dbpedia.org/resource/>
  PREFIX dbp: <http://dbpedia.org/property/>

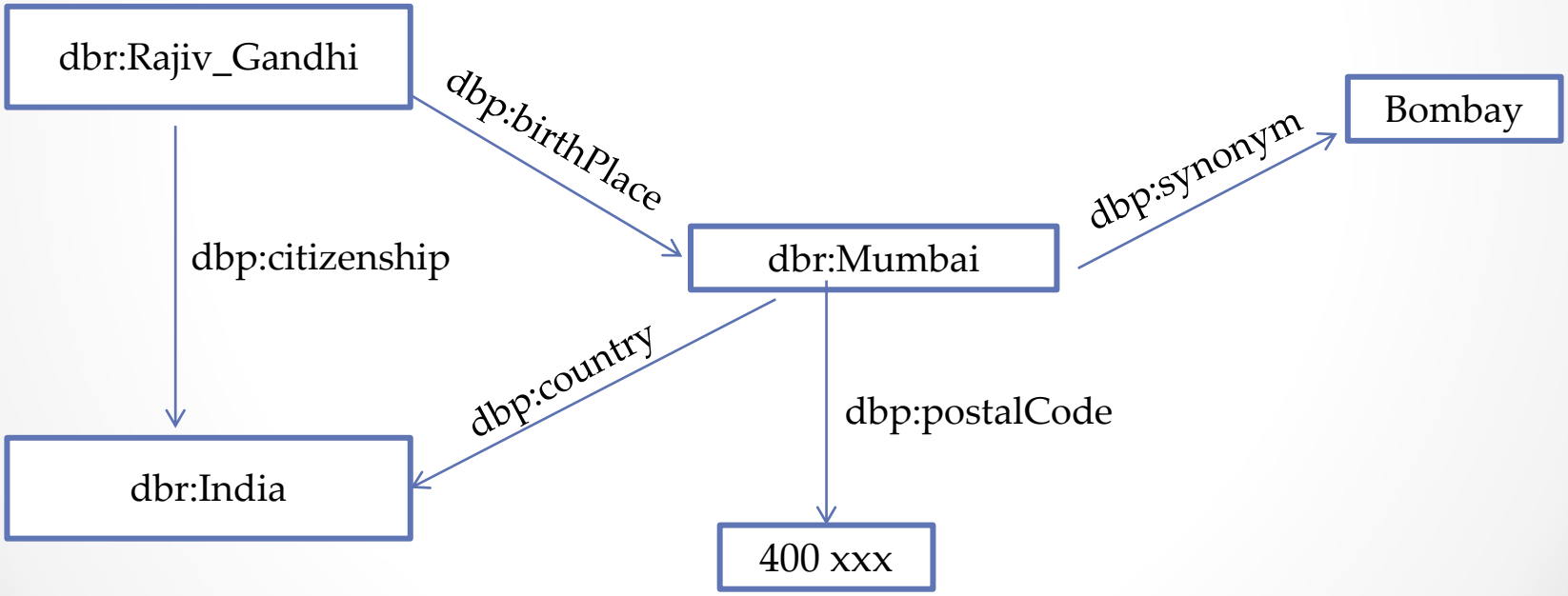
The previous RDF statement can be now represented as

dbr:Rajiv_Gandhi dbp:birthPlace dbr:Mumbai.

Subject Predicate Object

Why RDF?

- Structured knowledge base
- Relations between Resources can be formed by combining multiple RDF statements resulting in a "graph"



How to query this RDF graph?

- **S**imple **P**rotocol **A**nd **R**DF **Q**uery **L**anguage (SPARQL)

- **Format**

  Select <variable(s)> → Denoted by ? mark

  Where <condition(s) . > → RDF statement (s)

- **Example**

```
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX dbp: <http://dbpedia.org/property/>
SELECT ?capital
WHERE  {
dbr:India    dbp:capital     ?capital .
}
```

How to query DBpedia?

- The DBpedia dataset consists of over 1 billion pieces of RDF triples from Wikipedia

- The dataset can be accessed via
    1. SPARQL query endpoint -http://dbpedia.org/snorql/
    2. SPARQL Linked Data Interface
        Example - http://dbpedia.org/page/India
    3. Download the DBpedia dataset

Example

- **Universities in India, located in Mumbai, which were established before 1975:**

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?institutes
WHERE  {
            ?institutes dbp:country dbr:India .
            ?institutes dbp:city dbr:Mumbai .
            ?institutes rdf:type dbo:University .
            ?institutes dbp:established ?date.
            FILTER(?date < 1975)
}
```

Example

- **List of Hindi movies having run time greater than 3 hours and starring Anil Kapoor**

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?movie, ?runtime
WHERE  {
            ?movie rdf:type dbo:Film.
            ?movie dbo:runtime ?runtime.
            ?movie dbo:language dbr:Standard_Hindi.
            ?movie dbo:starring dbr:Anil_Kapoor.
            FILTER (?runtime > 10800)
}
```

Example

- **Information about Germany in German language**

```
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?abstract
WHERE {
dbr:Germany dbo:abstract ?abstract .
FILTER langMatches( lang(?abstract), 'de')
}
```

DBpedia – Use Cases

1. Improving Wikipedia Search
2. DBpedia data for your web pages
3. Mobile and Geographic Applications
   - Example - DBpedia Mobile
4. Document Enhancement
   - DBpedia Spotlight (Annotation)
   - Zemanta (Blogging)
5. Support Wikipedia Authors
6. Other Applications
   - RelFinder

DBpedia - Improvements

- Synchronization with Wikipedia data
  - http://live.dbpedia.org/LiveStats/

Entity Statistics

Description	Total
Number of instances updated within last minute	83
Number of instances updated within last 5 minutes	76
Number of instances updated within last hour	4131
Number of instances updated within last day	132826
Number of instances since the start of the database	11762481

20 Most Recently Updated Entities

#	Time	Title	DBpedia	Wikipedia
1	19 seconds ago	The Judas Kiss	DBpedia	Wikipedia
2	20 seconds ago	Rebirth of the Temple	DBpedia	Wikipedia
3	20 seconds ago	'Abd al-Ilah	DBpedia	Wikipedia
4	21 seconds ago	Muddy Waters	DBpedia	Wikipedia
5	22 seconds ago	Jean-Claude Van Damme	DBpedia	Wikipedia
6	23 seconds ago	Sufism in Sindh	DBpedia	Wikipedia
7	23 seconds ago	Dashboard/Requested moves	DBpedia	Wikipedia
8	25 seconds ago	List of Diary of a Wimpy Kid characters	DBpedia	Wikipedia
9	25 seconds ago	Alfonso XIII of Spain	DBpedia	Wikipedia
10	26 seconds ago	Donald Bren School of Information and Computer Sciences	DBpedia	Wikipedia
11	27 seconds ago	Atticus Finch	DBpedia	Wikipedia
12	28 seconds ago	Duffy Conroy	DBpedia	Wikipedia
13	28 seconds ago	Hadise	DBpedia	Wikipedia

- Data Cleansing required
  - Properties like PlaceOfBirth and BirthPlace

Thank you!