Taxonomy browsing and ontology evaluation for Wikidata

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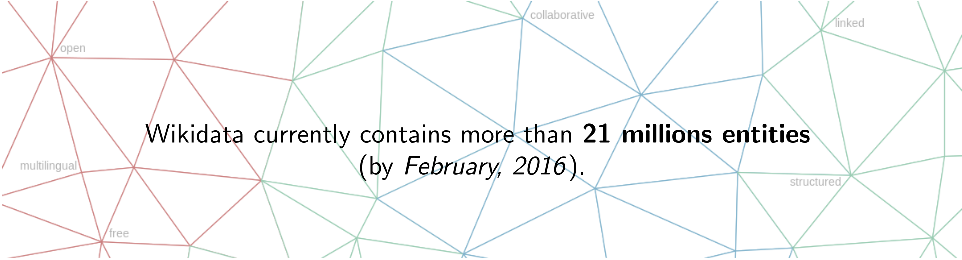
February 12, 2016

Motivation

- How we can **browse the class hierarchy** from Wikidata?
- How can we **improve the quality of ontology** modelling in Wikidata?

Wikidata



Wikidata currently contains more than **21 millions entities** (by *February, 2016*).

- **Free** linked database
- **Collecting structured data**
- **Collaborative**
- **Multilingual**

The Wikidata Entities

a Wikidata page $\Longrightarrow$ an entity

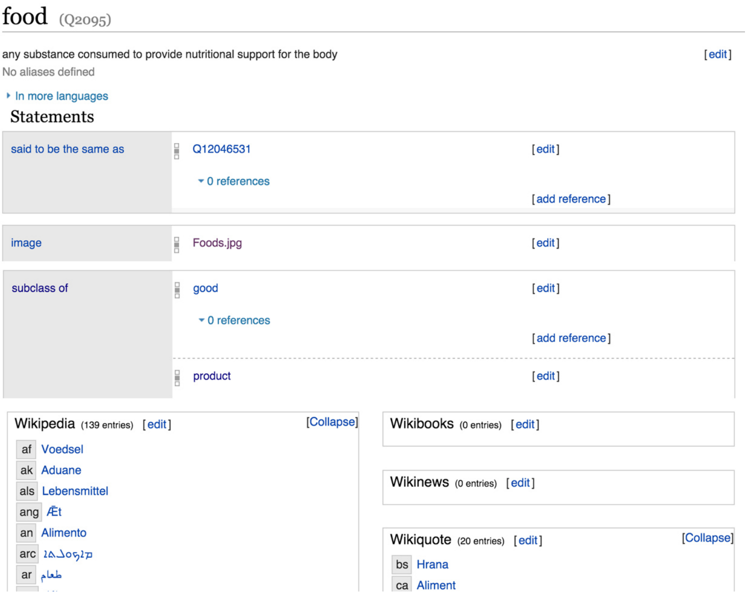
The Wikidata **items**: individuals and classes

- **Unique** – identifiable by a unique ID (with a **Q** prefix)
- **Notable –** usually have a corresponding page to some of the Wikimedia sites (Wikipedia, Wikivoyage, Wikisource etc.)
- **Linked**

The Wikidata **properties**: RDF properties

- Identifiable by a unique ID (with a **P** prefix)
- Have data types that determine the accepted value (string, URL, time, geographic coordinates etc.)

The Wikidata Item: food (Q2095)



food (Q2095)

any substance consumed to provide nutritional support for the body [edit]

No aliases defined

▸ In more languages

Statements

said to be the same as	Q12046531 ▾ 0 references	[edit] [add reference]
image	Foods.jpg	[edit]
subclass of	good ▾ 0 references	[edit] [add reference]
	product	[edit]

Wikipedia (139 entries) [edit] [Collapse]

af	Voedsel
ak	Aduane
als	Lebensmittel
ang	Ǣt
an	Alimento
arc	ܡܐܟܘܠܬܐ
ar	طعام

Wikibooks (0 entries) [edit]

Wikinews (0 entries) [edit]

Wikiquote (20 entries) [edit] [Collapse]

bs	Hrana
ca	Aliment

The Wikidata Class Hierarchy

Entities used:

- **Classes**: type of items which refers to a group of instances
- **Individuals**: individual instances or things or objects

Properties used:

- **subclass of (P279)**: similar to RDF `rdfs:subClassOf`
- **instance of (P31)**: similar to RDF `rdf:type`

Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

1

2

3

4

5

6

Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

1. Cycles detection
2.
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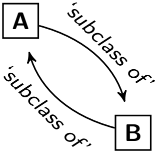
Cycle:



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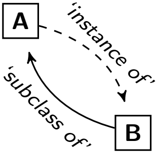

Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

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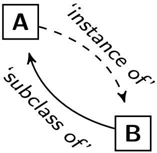
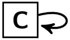


Self-loop:



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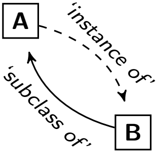
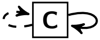


Self-loop:

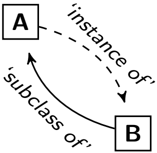


Ontology Evaluation

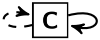
Criteria for the Wikidata ontology evaluation:

1. Cycles detection
2. Self-loops detection
3. Root classes

Cycle:



Self-loop:



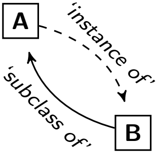
Root classes:

Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

1. Cycles detection
2. Self-loops detection
3. Root classes
4. Finding classes which have more than 100 direct subclasses
5.
6.

Cycle:



Self-loop:

Root classes:

Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

1. Cycles detection
2. Self-loops detection
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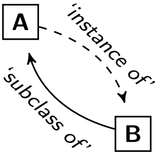
4. Finding classes which have more than 100 direct subclasses
5. Errors of relation properties

Cycle:



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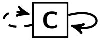

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Ontology Evaluation

Criteria for the Wikidata ontology evaluation:

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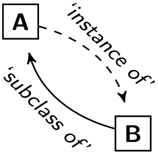
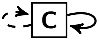
5. Errors of relation properties
6. Redundancies of relation properties

Cycle:

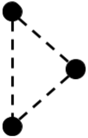


Self-loop:



Root classes:

5. Error Patterns of relation properties



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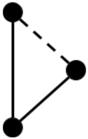

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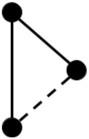

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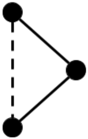

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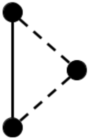
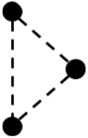
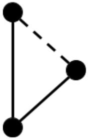


e5

5. Error Patterns of relation properties



e1



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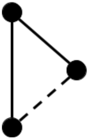

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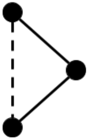

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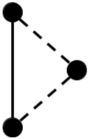
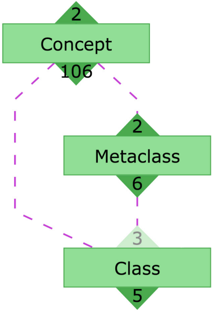


e5



e1

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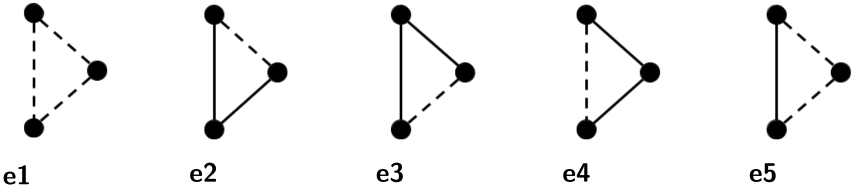

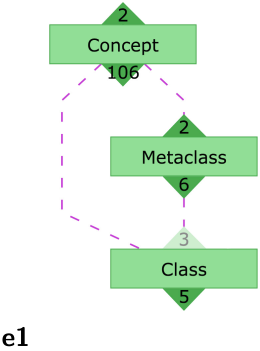

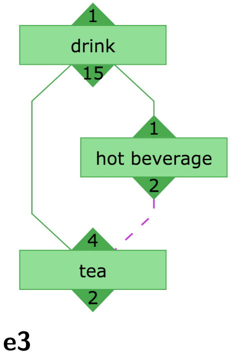

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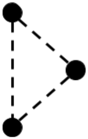

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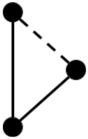

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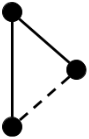

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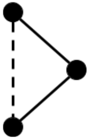

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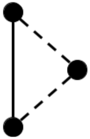

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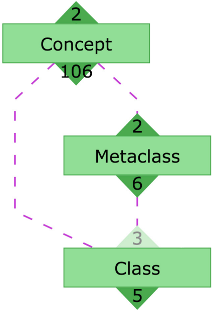

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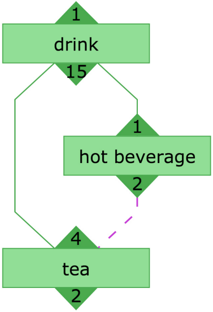

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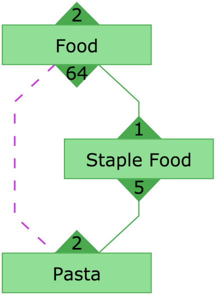
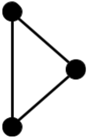
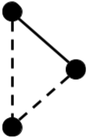


e4

6. Redundancy Patterns of relation properties

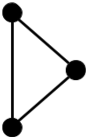


r1

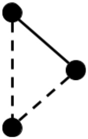


r2

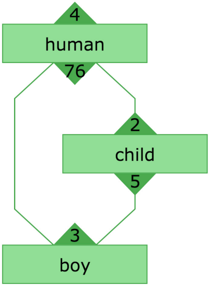
6. Redundancy Patterns of relation properties



r1



r2



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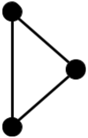

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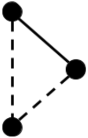

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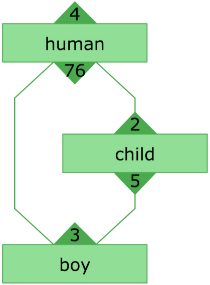

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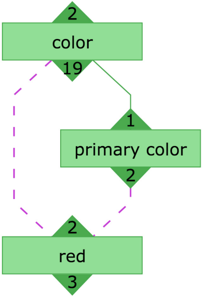
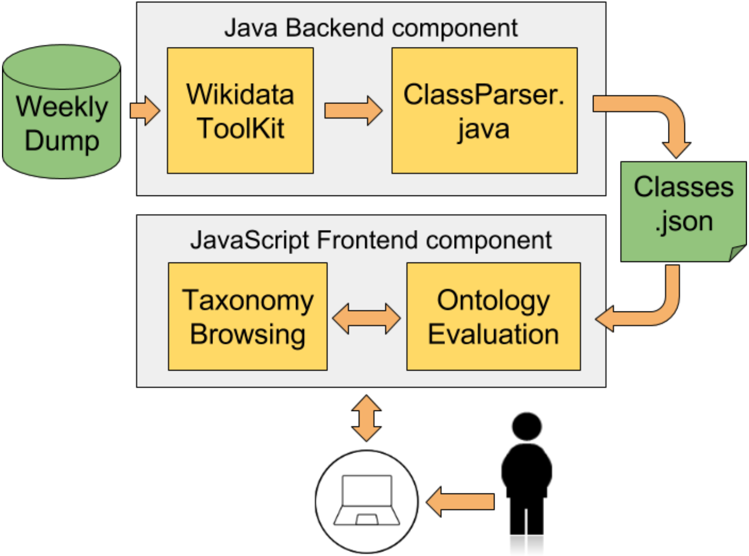


r2

Architecture of the Developed System



Libraries and Tools

JavaScript libraries used in the *Frontend component*:

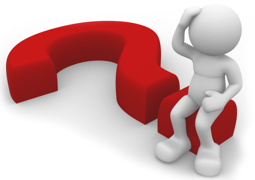
- **Dagre.js (version 0.0.6)** – lay out directed graphs
- **D3.js (version 3.0)** – graph visualization
- **jQuery (version 1.9.0)** – for general implementation
- **jQuery UI (version 1.11)** – user interface

Java libraries/tools used in the *Backend component*:

- **Java SE Development Kit (version 8u66)** – for developing
- **Wikidata Toolkit (version 0.4.0)** – access to the Wikidata repository and ontology dump files parsing

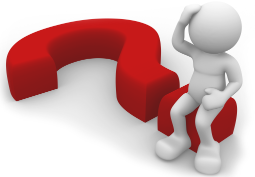
Technical Problems and Solutions

- Problem: *very slow response time* for data processing



Technical Problems and Solutions

- Problem: *very slow response time* for data processing
- Solution: modified the JavaScript libraries (**Dagre.js** and **D3.js**)



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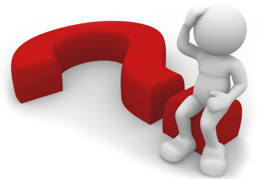

Technical Problems and Solutions

- Problem: *very slow response time* for data processing
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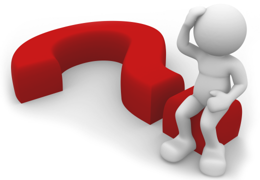
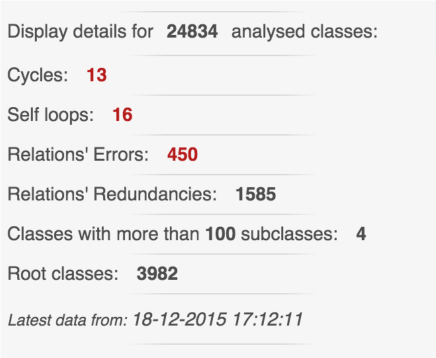
- Problem: *running out of virtual memory* for data extraction
- Solution: convert extracted data fields



What we have learned about the Wikidata ontology

We found:



Display details for **24834** analysed classes:

Cycles: **13**

Self loops: **16**

Relations' Errors: **450**

Relations' Redundancies: **1585**

Classes with more than **100** subclasses: **4**

Root classes: **3982**

Latest data from: 18-12-2015 17:12:11

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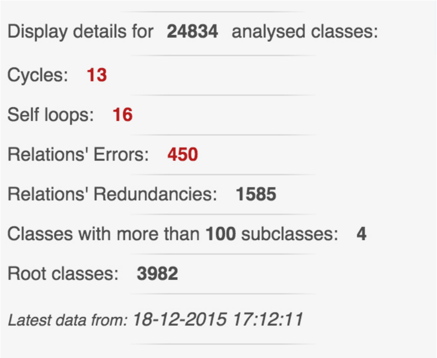

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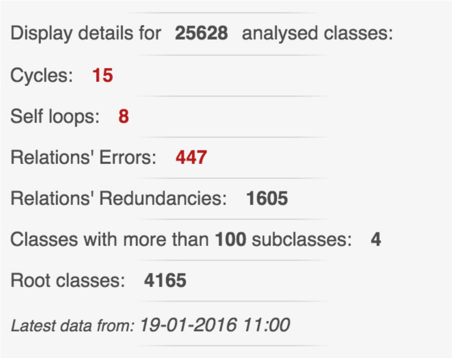

Display details for **25628** analysed classes:

Cycles: **15**

Self loops: **8**

Relations' Errors: **447**

Relations' Redundancies: **1605**

Classes with more than **100** subclasses: **4**

Root classes: **4165**

Latest data from: 19-01-2016 11:00

Demo Presentation

Official launch – *October, 2015*

Users Feedback:

- *"Great tool! The error detection is precious!"*
- *"This is fantastic. :)"*
- *"Nice work! Thanks for sharing"*

`http://sergestratan.bitbucket.org`

All the information about the developed system, can be found on:
`https://bitbucket.org/sergestratan/sergestratan.bitbucket.org`

Conclusions & Future Work

Conclusions:

- Implemented a system for browsing the Wikidata taxonomy
- Provided some methods for the Wikidata ontology evaluation
- Applied different approaches to design and develop the system

Extensions:

- the Wikidata API integration
- extend ontology evaluation for additional quality criteria
- increase the amount of analyzed data

Thank You