Future work and applications

RDF Validation tutorial

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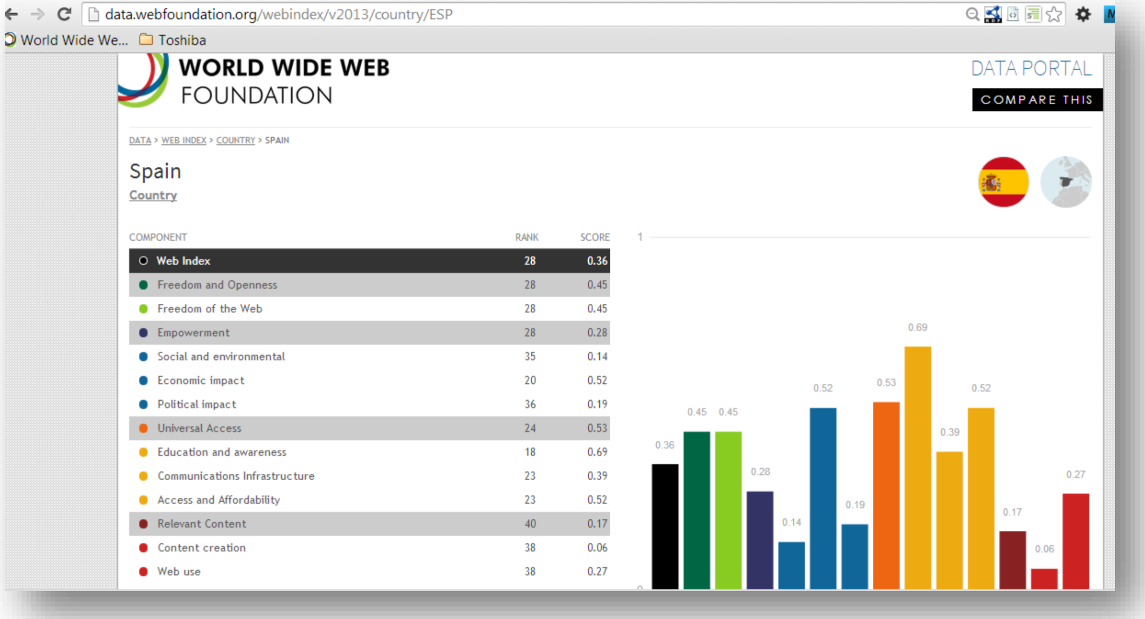
Contents

- Some applications
  - ShEx
    - WebIndex: A linked data portal using ShEx
    - FHIR
  - SHACL
- Future work

Web Index

- Measure WWW's contribution to development and human rights by country
  - Developed by the Web Foundation
  - 81 countries, 116 indicators, 5 years (2007-12)
- Linked data portal
  - http://data.webfoundation.org/webindex/2013



data.webfoundation.org/webindex/v2013/country/ESP

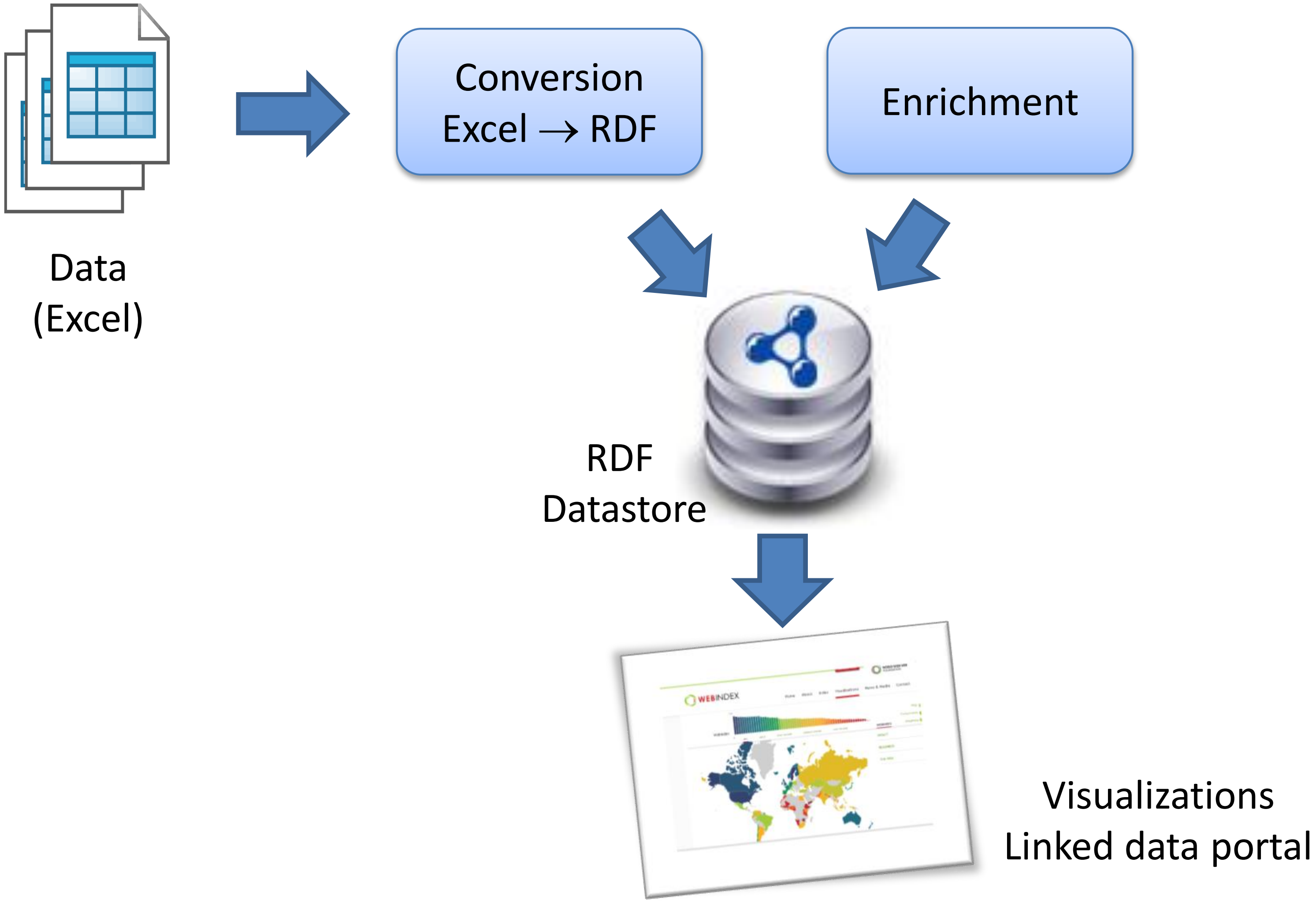
DATA > WEB INDEX > COUNTRY > SPAIN

Spain

Country

COMPONENT	RANK	SCORE
○ Web Index	28	0.36
● Freedom and Openness	28	0.45
● Freedom of the Web	28	0.45
● Empowerment	28	0.28
● Social and environmental	35	0.14
● Economic impact	20	0.52
● Political impact	36	0.19
● Universal Access	24	0.53
● Education and awareness	18	0.69
● Communications Infrastructure	23	0.39
● Access and Affordability	23	0.52
● Relevant Content	40	0.17
● Content creation	38	0.06
● Web use	38	0.27

Webindex workflow



Data
(Excel)

Conversion
Excel → RDF

Enrichment

RDF
Datastore

Visualizations
Linked data portal

WebIndex data model

Model based on RDF Data Cube

Main entity = Observation

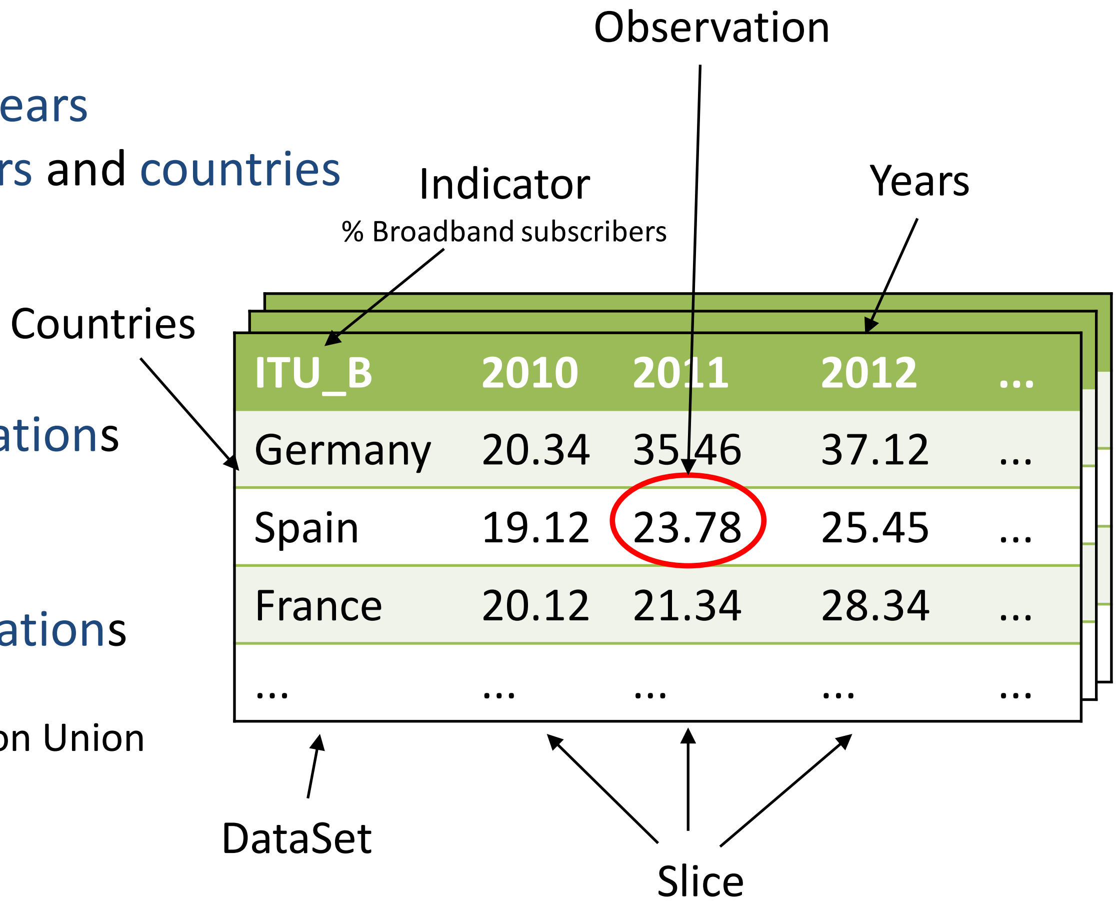
- Observations have values by years
- Observations refer to indicators and countries

DataSets are published by Organizations

- Datasets contain several slices
- Slices group observations

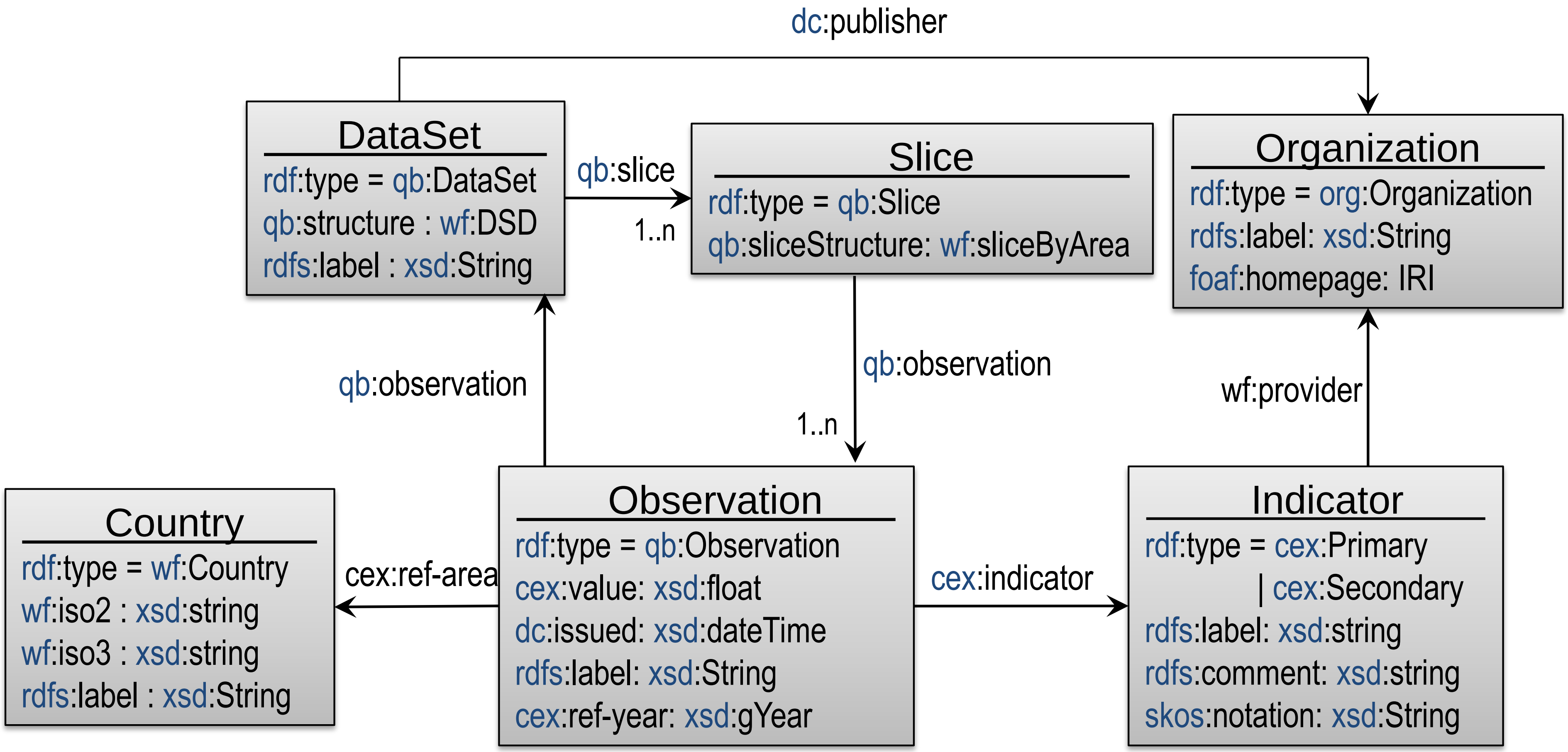
Indicators are provided by Organizations

- Examples
- ITU = International Telecommunication Union
- UN = United Nations
- WB = World bank
- ...



ITU_B	2010	2011	2012	...
Germany	20.34	35.46	37.12	...
Spain	19.12	23.78	25.45	...
France	20.12	21.34	28.34	...
...	...	...	...	...

Main webIndex data model*



DataSet
rdf:type = qb:DataSet
qb:structure : wf:DSD
rdfs:label : xsd:String

Slice
rdf:type = qb:Slice
qb:sliceStructure: wf:sliceByArea

Organization
rdf:type = org:Organization
rdfs:label: xsd:String
foaf:homepage: IRI

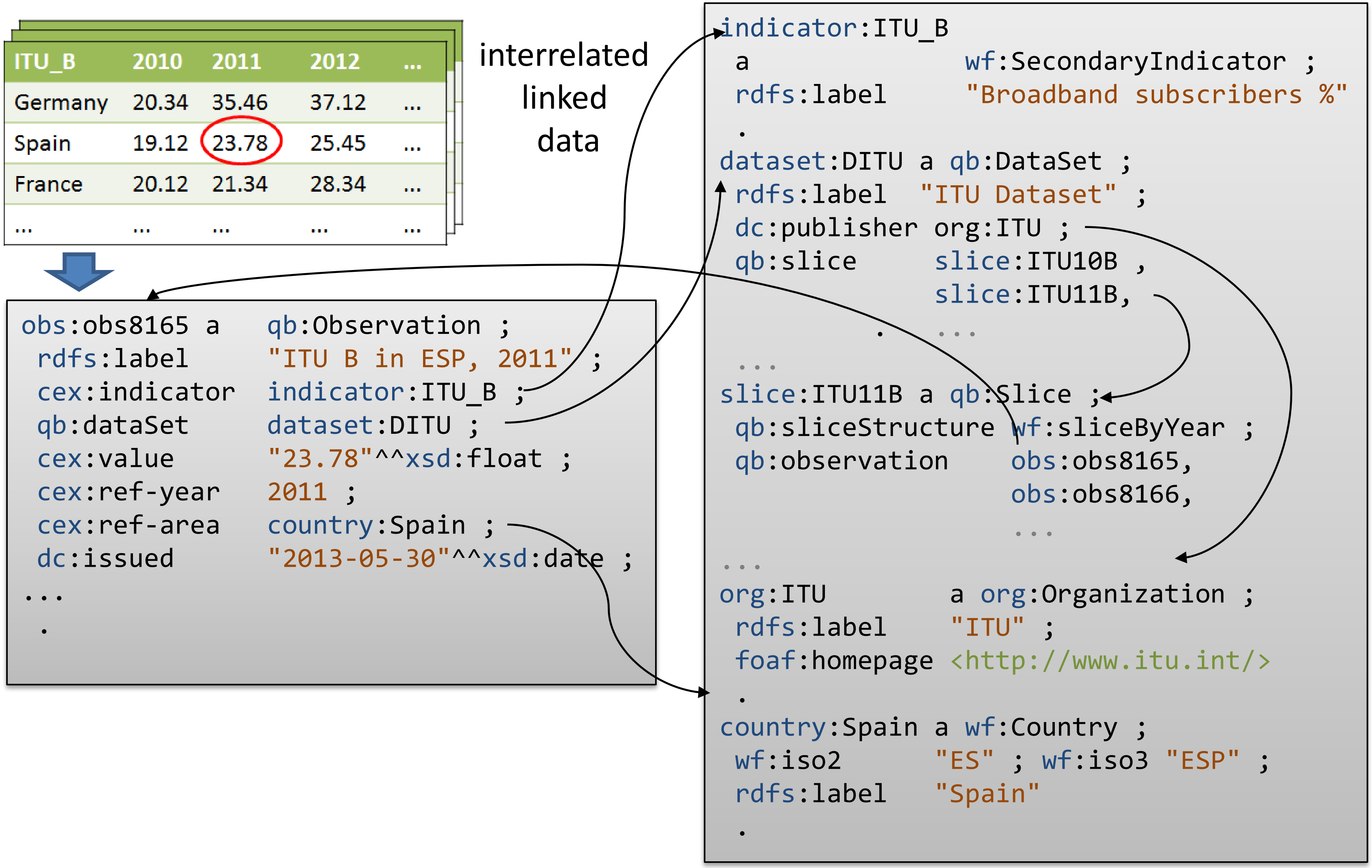
Country
rdf:type = wf:Country
wf:iso2 : xsd:string
wf:iso3 : xsd:string
rdfs:label : xsd:String

Observation
rdf:type = qb:Observation
cex:value: xsd:float
dc:issued: xsd:dateTime
rdfs:label: xsd:String
cex:ref-year: xsd:gYear

Indicator
rdf:type = cex:Primary
| cex:Secondary
rdfs:label: xsd:string
rdfs:comment: xsd:string
skos:notation: xsd:String

*Simplified

Excel → RDF (Turtle)



ITU_B	2010	2011	2012	...
Germany	20.34	35.46	37.12	...
Spain	19.12	23.78	25.45	...
France	20.12	21.34	28.34	...
...	...	...	...	...

interrelated
linked
data

```
obs:obs8165 a   qb:Observation ;
 rdfs:label     "ITU B in ESP, 2011" ;
 cex:indicator  indicator:ITU_B ;
 qb:dataSet     dataset:DITU ;
 cex:value      "23.78"^^xsd:float ;
 cex:ref-year   2011 ;
 cex:ref-area   country:Spain ;
 dc:issued      "2013-05-30"^^xsd:date ;
...
 .
```

```
indicator:ITU_B
 a              wf:SecondaryIndicator ;
 rdfs:label     "Broadband subscribers %"
 .
dataset:DITU a qb:DataSet ;
 rdfs:label  "ITU Dataset" ;
 dc:publisher org:ITU ;
 qb:slice      slice:ITU10B ,
               slice:ITU11B,
         .     ...
 ...
slice:ITU11B a qb:Slice ;
 qb:sliceStructure wf:sliceByYear ;
 qb:observation    obs:obs8165,
                   obs:obs8166,
                   ...
...
org:ITU         a org:Organization ;
 rdfs:label     "ITU" ;
 foaf:homepage <http://www.itu.int/>
 .
country:Spain a wf:Country ;
 wf:iso2       "ES" ; wf:iso3 "ESP" ;
 rdfs:label    "Spain"
 .
```

Description and Validation

Lots of constraints

- *Observations must be linked to some country*
- *Observations have a float value*
- *Observations are related with an indicator, a country and a year*
- *Dataset contains several slices and slices contain several observations*
- ....etc.

Q: How can we express those constraints easily?

- Our proposal: Shape expressions

Country

A <Country> has *at least* the following properties:

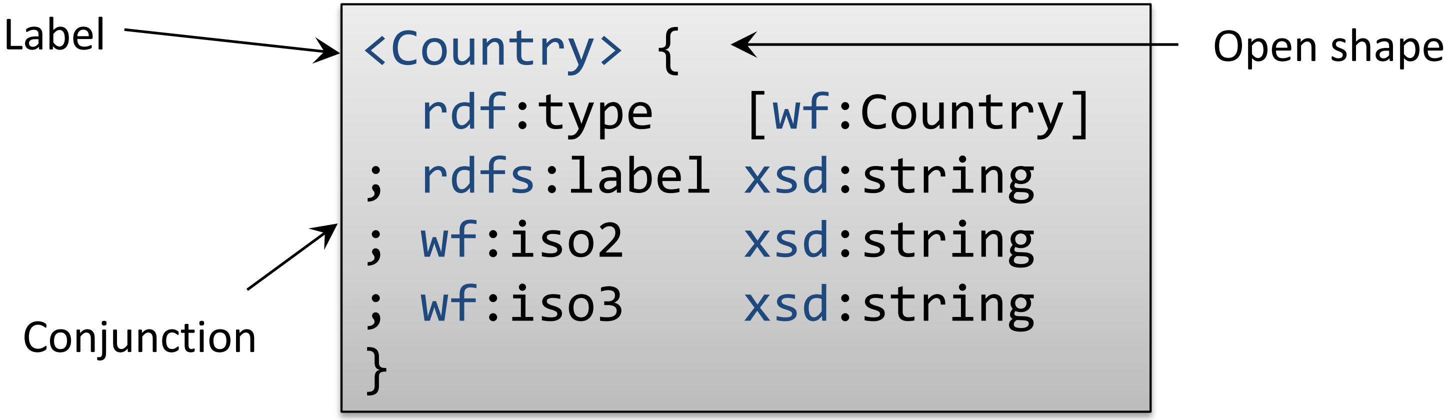
rdf:type with value wf:Country

rdfs:label with value of type xsd:string

wf:iso2 with value of type xsd:string

wf:iso3 with value of type xsd:string

Using shape Expressions:

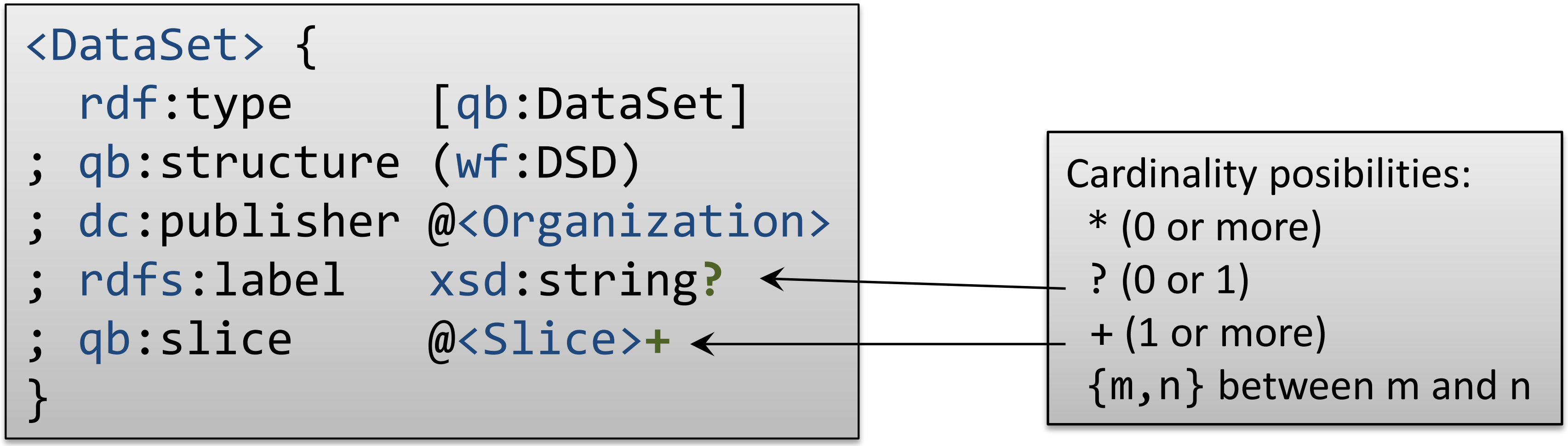


```
<Country> {
  rdf:type   [wf:Country]
; rdfs:label xsd:string
; wf:iso2    xsd:string
; wf:iso3    xsd:string
}
```

DataSets

A <DataSet> has the shape:

- rdf:type with value qb:Dataset
- qb:structure with value wf:DSD
- *Optional* rdfs:label with value of type xsd:string
- One or more qb:slice with shape <Slice>



```
<DataSet> {
  rdf:type      [qb:DataSet]
; qb:structure (wf:DSD)
; dc:publisher @<Organization>
; rdfs:label    xsd:string?
; qb:slice      @<Slice>+
}
```

Cardinality posibilities:
- * (0 or more)
- ? (0 or 1)
- + (1 or more)
- {m,n} between m and n

Slices

```
<Slice> {
   rdf:type           [qb:Slice]
 ; qb:sliceStructure (wf:sliceByYear)
 ; qb:observation    @<Observation>+
 ; cex:indicator     @<Indicator>
 }
```

<Slice> has the properties:

rdf:type with value qb:Slice

qb:SliceStructure with value wf:sliceByYear

Several qb:observation with shape <Observation>

cex:indicator with shape <Indicator>

Observations

```
<Observation> {
  rdf:type      [qb:Observation]
; cex:value     xsd:float ?
; dc:issued     xsd:dateTime
; rdfs:label    xsd:string ?
; qb:dataSet    @<DataSet>
; cex:ref-area  @<Country>
; cex:indicator @<Indicator>
; cex:ref-year  xsd:gYear
}
```

...and more

Indicators

```
<Indicator> {
  rdf:type      [wf:PrimaryIndicator wf:SecondaryIndicator]
; rdfs:label    xsd:string
; rdfs:comment  xsd:string ?
; skos:notation xsd:string ?
}
```

Organizations

```
<Organization> {
  rdf:type [org:Organization]
; rdfs:label xsd:string
; foaf:homepage IRI
; org:hasSubOrganization @<Organization>
}
```

Use of shape expressions in WebIndex

1. Documentation of linked data portal

   Human-readable

   Machine processable

   http://weso.github.io/wiDoc

2. Team communication

   Communicate the developers which shapes they had to generate

3. Validation

   For example: check if a value of type `qb:Observation` has shape <Observation>

WebIndex as a benchmarking

We have created a tool to generate synthetic RDF data that conforms (or not) to the WebIndex data model

The tool can be used to benchmark ShEx and SHACL

See: http://labra.github.io/wiGen/

HL7 FHIR

ShEx is currently being used to develop FHIR/RDF

- validate examples (in documentation)
- exchange site-specific restrictions
- enable consumer and producer validation

See: https://www.w3.org/2016/FHIR-tutorial/Constellations

SHACL applications

TopBraid Composer includes support for SHACL

See: http://www.topquadrant.com/technology/shacl/tutorial/

RDFUnit is also planning to include SHACL support

See: https://github.com/AKSW/RDFUnit

OpenPublicData: prototype to list, filter and present open data

See: http://www.openpublicdata.com/

Schema.org converted to SHACL

See:http://datashapes.org/schema

Future work

SHACL Recommendation

- Data Shapes WG chartered until Jul 2017

Other features

- Property paths
- Named graphs
- …

ShEx vs SHACL

- Translate ShEx to SHACL (looks difficult, impossible?)
- Translate SHACL to ShEx (work in progress, see Shaclex)

Future work

SHACL: Data Shapes Working Group:

Mailing list, list of issues,...

https://www.w3.org/2014/data-shapes/

ShEx Community portal http://shex.io

List of issues:

https://github.com/shexSpec/shex/issues