EXPLORING A SEMANTIC FRAMEWORK FOR INTEGRATING DPM, XBRL AND SDMX DATA

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INTRODUCTION

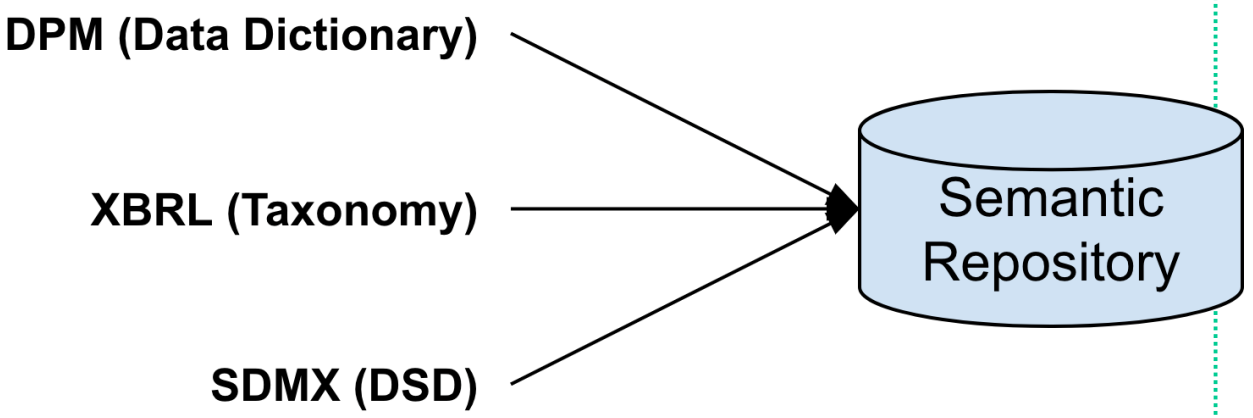
- **Proliferation** financial data and available formats
- Increased need for ways to **integrate** it

- **Semantic Technologies**:
  - facilitate integration by moving effort to the level of meanings
  - instead of trying to deal with syntax subtleties

- Explore this alternative through a practical **experiment**

INTEGRATION SOURCES

- Data sources:
  - XBRL,
  - Data Point Model (DPM)
  - SDMX
- Schema sources:
  - XBRL Taxonomies,
  - DPM Data Dictionaries
  - SMX Data Structure Definitions (DSD)

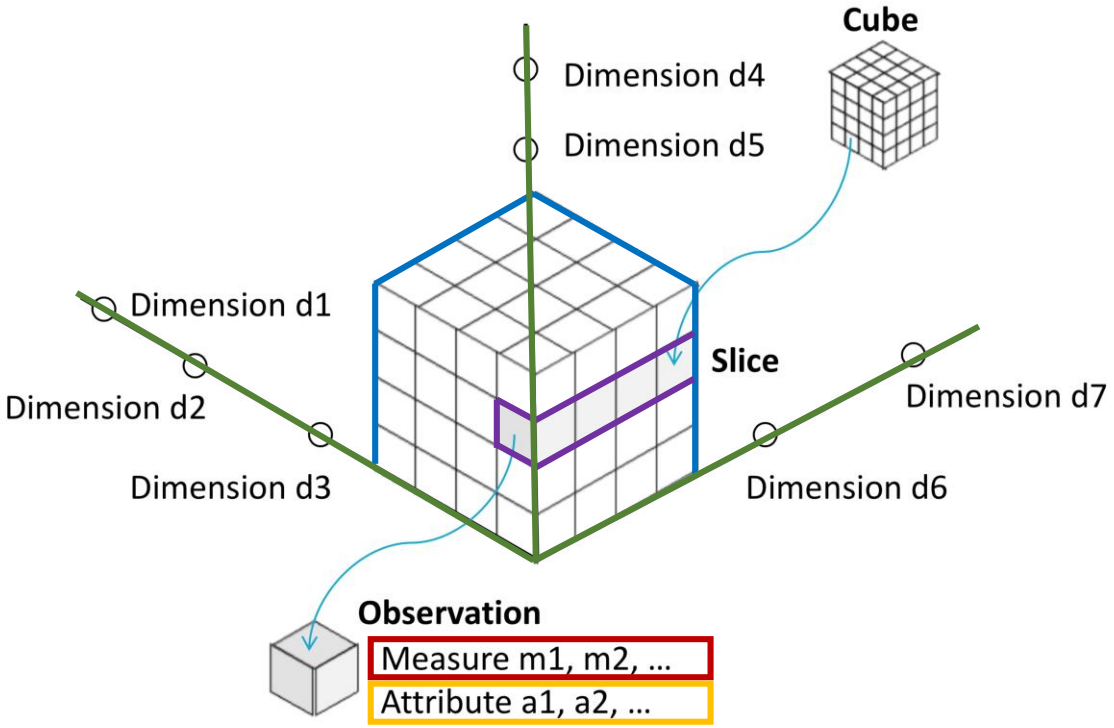


CONCEPTUAL FRAMEWORK

- Consider the **multidimensional** nature of the **data** (e.g. DPM)
  - Far beyond **2D** data available from **spreadsheets**
  - **Avoid** having to encode "**hidden dimensions**" into footnotes, attachments, etc.
  - **Dimensions** might be **hierarchically organised** (like geographical administrative divisions)

- Proposal: **RDF Data Cube Vocabulary** (based on semantic technologies, **RDF** & **Web Ontologies**)
  - Supports **multidimensional** data
  - **Based on SDMX** and the Semantic Web vocabulary for statistical data
  - Web standard (**W3C Recommendation**)
- Approach:
  - **Map DPM and XBRL** to the RDF Data Cube Vocabulary (example next)
    - SDMX trivially becomes RDF based on the Data Cube Vocabulary

DATA CUBE



Dataset a collection of observations

Dimensions identify an observation
e.g. observation time or a geographic region

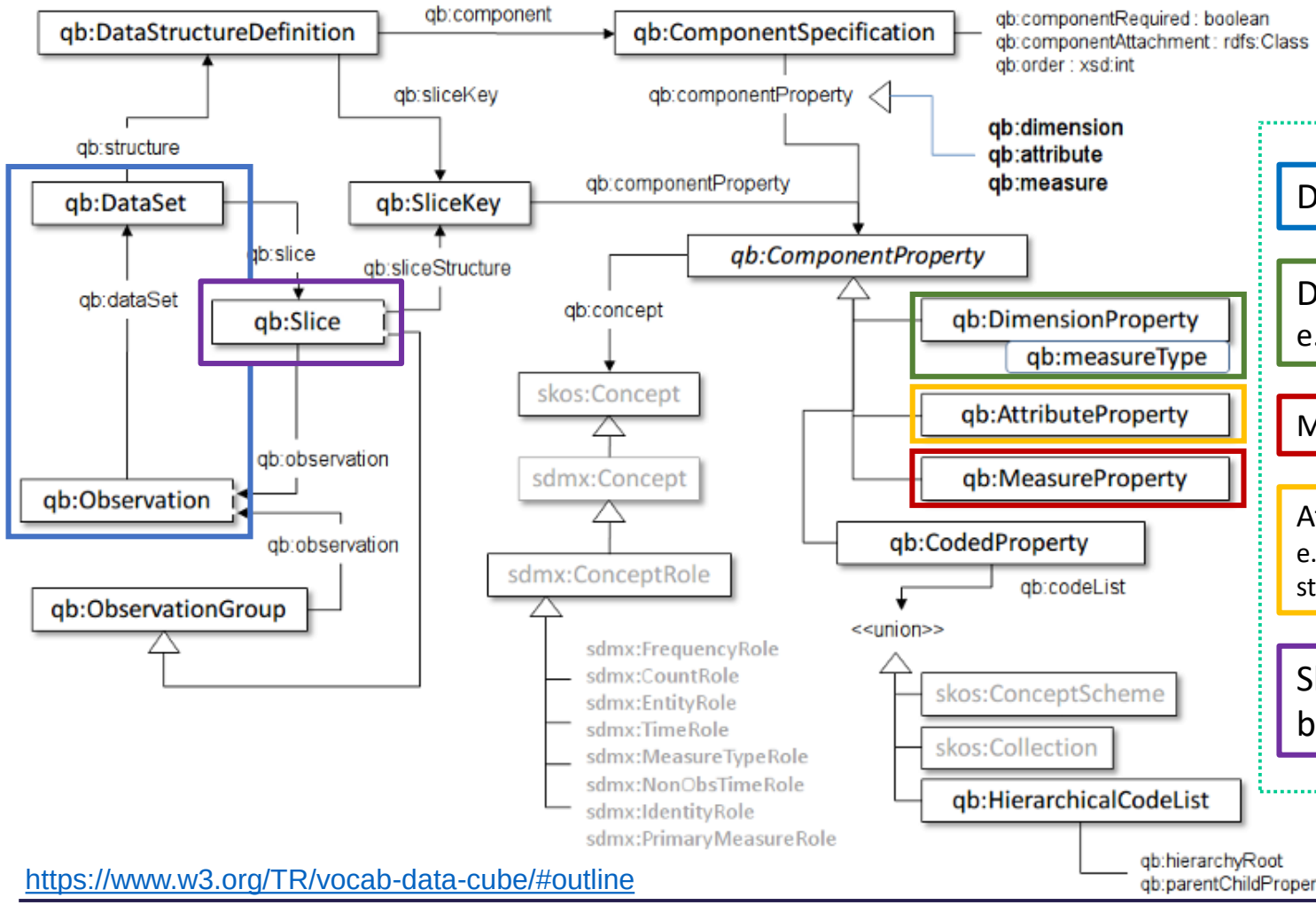
Measures represent observed phenomenon

Attributes qualify / help interpret observations
e.g. units of measure, scaling factors or observation status (estimated, provisional,…)

Slice subsets observations by fixing all but one dimension (or a few)

https://www.slideshare.net/140er/lets-talkaboutstatisticaldatainrdf

RDF DATA CUBE



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https://www.w3.org/TR/vocab-data-cube/#outline

MODELLING EXAMPLE

- **Data Point** example based on the taxonomy "*FINancial REPorting 2016-A Individual (2.1.5)*", authored by EBA using DPM 2.5 and based on table "*Balance Sheet Statement: Assets (F_01.01)*", row "*Total assets*" and column "*Carrying amount*"

  - Metric: **eba_mi53 - Carrying amount** → Value: **1000 EUR**
  - Dimension 1: **BAS – Base** → Dimension 1 Value: **x6 - Assets**
  - Dimension 2: **MCY - Main Category** → Dimension 2 Value: **x25 - All assets**

  - Plus entity with LEI **549300N33JQ7EG2VD447** and time **2017-07-01**

MODELLING EXAMPLE

- XBRL representation of the Data Point

```
<xbrli:context id="c1">
   <xbrli:entity>
      <xbrli:identifier scheme="http://standards.iso.org/iso/17442">
         549300N33JQ7EG2VD447</xbrli:identifier>
   </xbrli:entity>
   <xbrli:period>
      <xbrli:instant>2017-07-01</xbrli:instant>
   </xbrli:period>
   <xbrli:scenario>
      <xbrldi:explicitMember dimension="eba_dim:BAS">eba_BA:x6</xbrldi:explicitMember>
      <xbrldi:explicitMember dimension="eba_dim:MCY">eba_MC:x25</xbrldi:explicitMember>
   </xbrli:scenario>
</xbrli:context>
<eba_met:mi53 unitRef="EUR" decimals="-3" contextRef="c1">1</eba_met:mi53>
```

MODELLING EXAMPLE

- RDF Data Cube Vocabulary representation of the Data Point and XBRL instance

```
ex:dst-1/obs-1 a qb:Observation;
    qb:dataSet  ex:dtst-1 ;
    xbrli:entity lei:549300N33JQ7EG2VD447 ;
    sdmx-dim:refTime "2017-07-01"^^xsd:date ;
    eba_dim:BAS eba_BA:x6 ;
    eba_dim:MCY eba_MC:x25 ;
    eba_met:mi53 "1"^^xsd:int ;
    sdmx-att:decimals "-3"^^xsd:int ;
    sdmx-att:currency currency:EUR .
```

MODELLING EXAMPLE

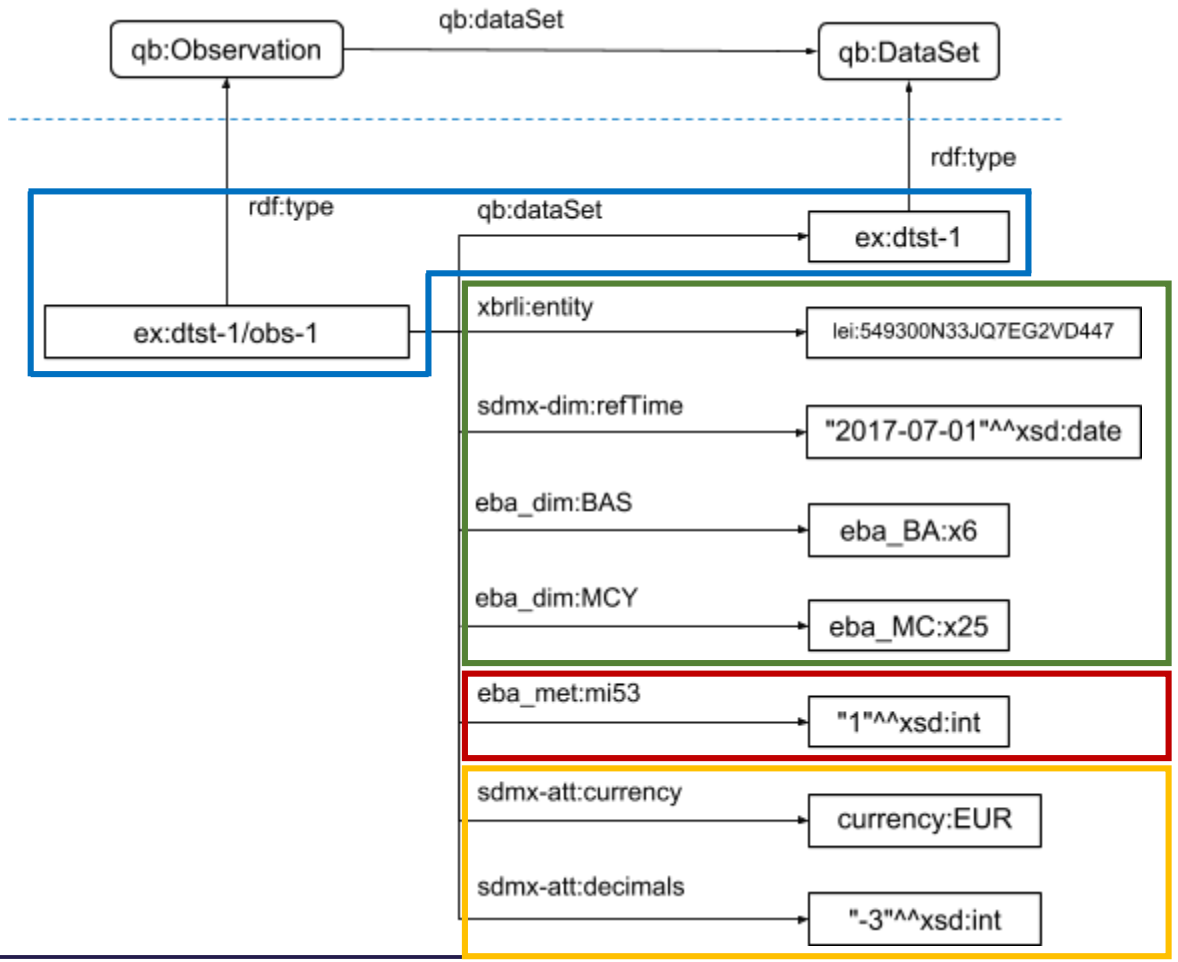
- RDF Data Cube Vocabulary terms to model:

Observations linked to their dataset

Dimensions, including entities and time

Measures, including data type

Attributes, decimals and currency

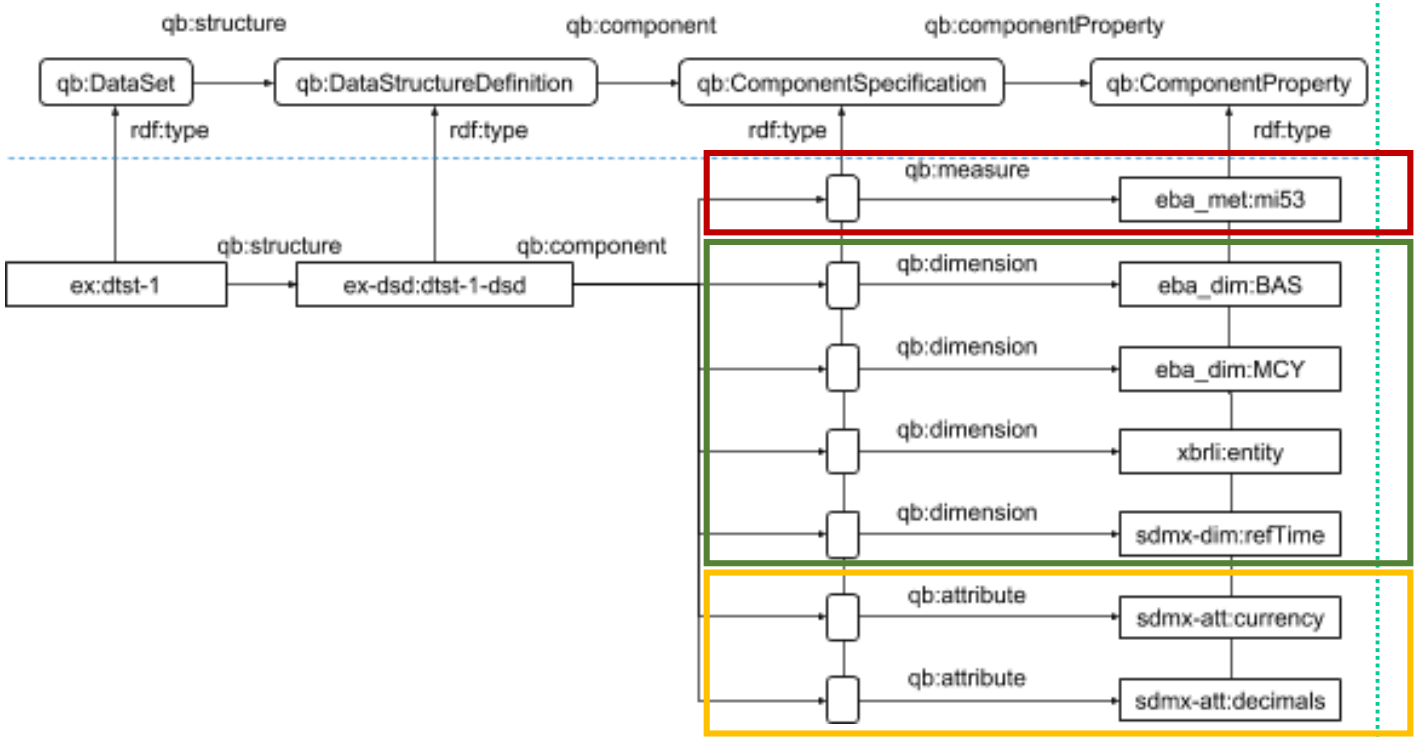


MODELLING FINANCIAL DATA SCHEMAS

- **RDF Data Cube Vocabulary** also to **model** how the **dimensions, metrics and attributes** are structured

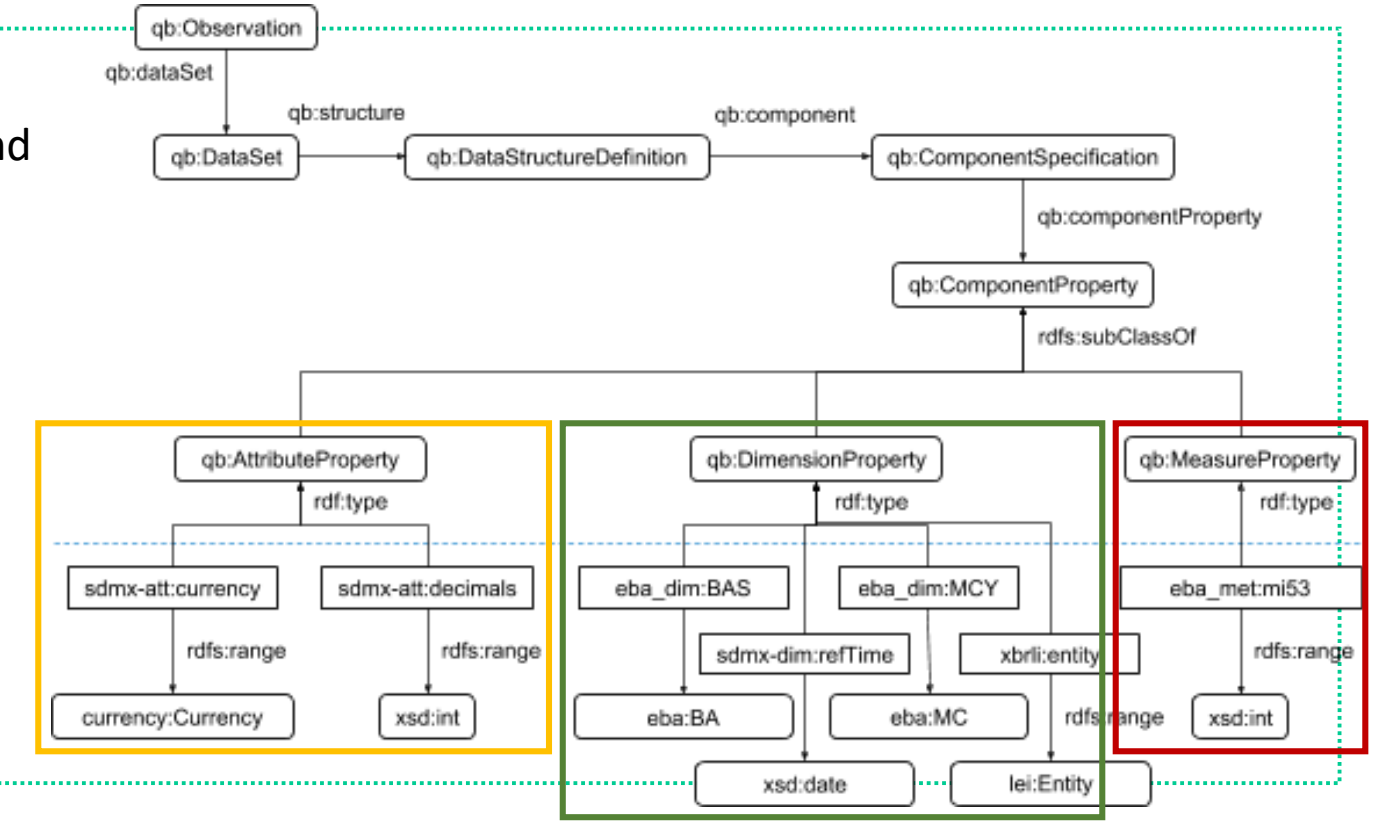
- Capture
  - **DPM Data Dictionaries**
  - **XBRL Taxonomies**

  in a **Data Structure Definition** (DSD) linked to each dataset



MODELLING FINANCIAL DATA SCHEMAS

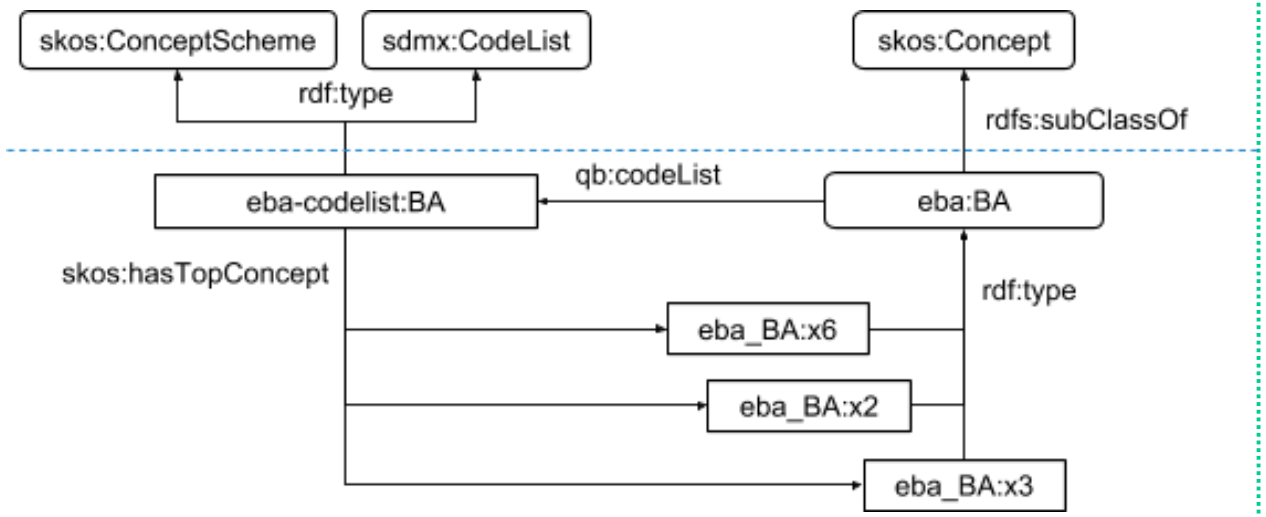
- **DSD** also **defines** the types of the values of measures, dimensions and attributes (their **ranges**):
  - **Data types** (date, integer,…)
  - **Taxonomy terms**



MODELLING FINANCIAL DATA SCHEMAS

- **Example**: the range of the property *eba_dim:BAS* is *eba:BA*
- *eba:BA is* defined as a **SDMX Code List** (and a semantic SKOS Concept Scheme) with members:
  - *eba_BA:x6*
  - *eba_BA:x2*
  - *eba_BA:x3*

  (members can be hierarchically organised)

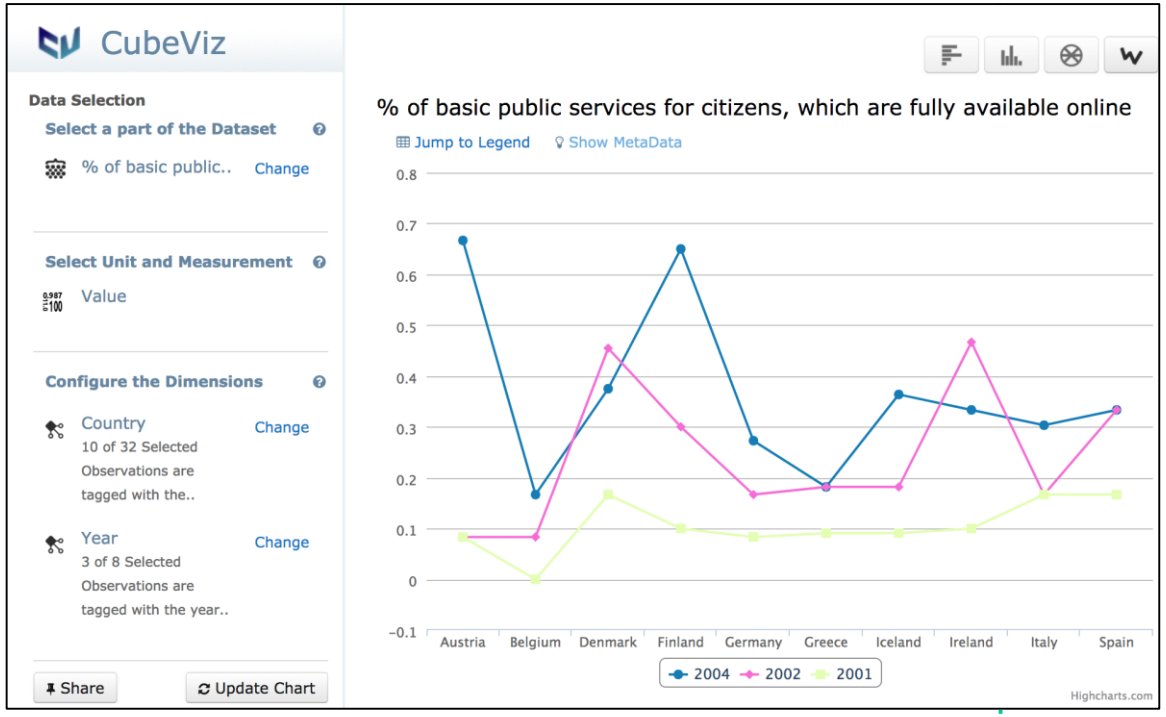


CONCLUSIONS

- Possible to use the RDF Data Cube Vocabulary to **semantically model and integrate**:
  - **Data Point / XBRL Instance**
  - **Data Dictionary / XBRL Taxonomy**
- Per design, also **SDMX / DSD**

- Semantic technologies **facilitate the integration** by operating at the level of dictionaries and taxonomies

- Facilitates **multidimensional data management** and multiple views on the same data



FUTURE WORK

- More **systematic analysis** of how the different constructs in the **DPM Dictionaries and XBRL Taxonomies** can be **mapped** to the **RDF Data Cube DSDs** (automation?)

- **Formalisation** of the **semantic relationships** among the concepts and relationships defined in the **DPM Dictionaries, XBRL Taxonomies and SDMX DSDs**
  - For instance, formalise the equivalence between the concepts related to currency values in all them so they can be queried transparently using semantic requests

- Additionally, possible to **benefit from existing efforts to unify these dictionaries and taxonomies**
  - **ECB Single Data Dictionary** (SDD) can also be formalised using semantic technologies and become the **hub for integration using semantic relationships**

THANK YOU