

# Publishing and querying OLAP cubes in the Semantic Web

**Lorena Etcheverry, Universidad de la República, Uruguay**  
lorenae@fing.edu.uy

**Alejandro A. Vaisman**, Instituto Tecnológico de Buenos Aires, Argentina  
avaisman@itba.edu.ar

*5<sup>th</sup> European Business Intelligence summer school, Barcelona, 2015*

**QB4OLAP is a RDF vocabulary that allows to represent OLAP cubes in RDF, and to implement OLAP operators (such as Roll-up, Slice, and Dice) as SPARQL queries directly on this RDF representation.**

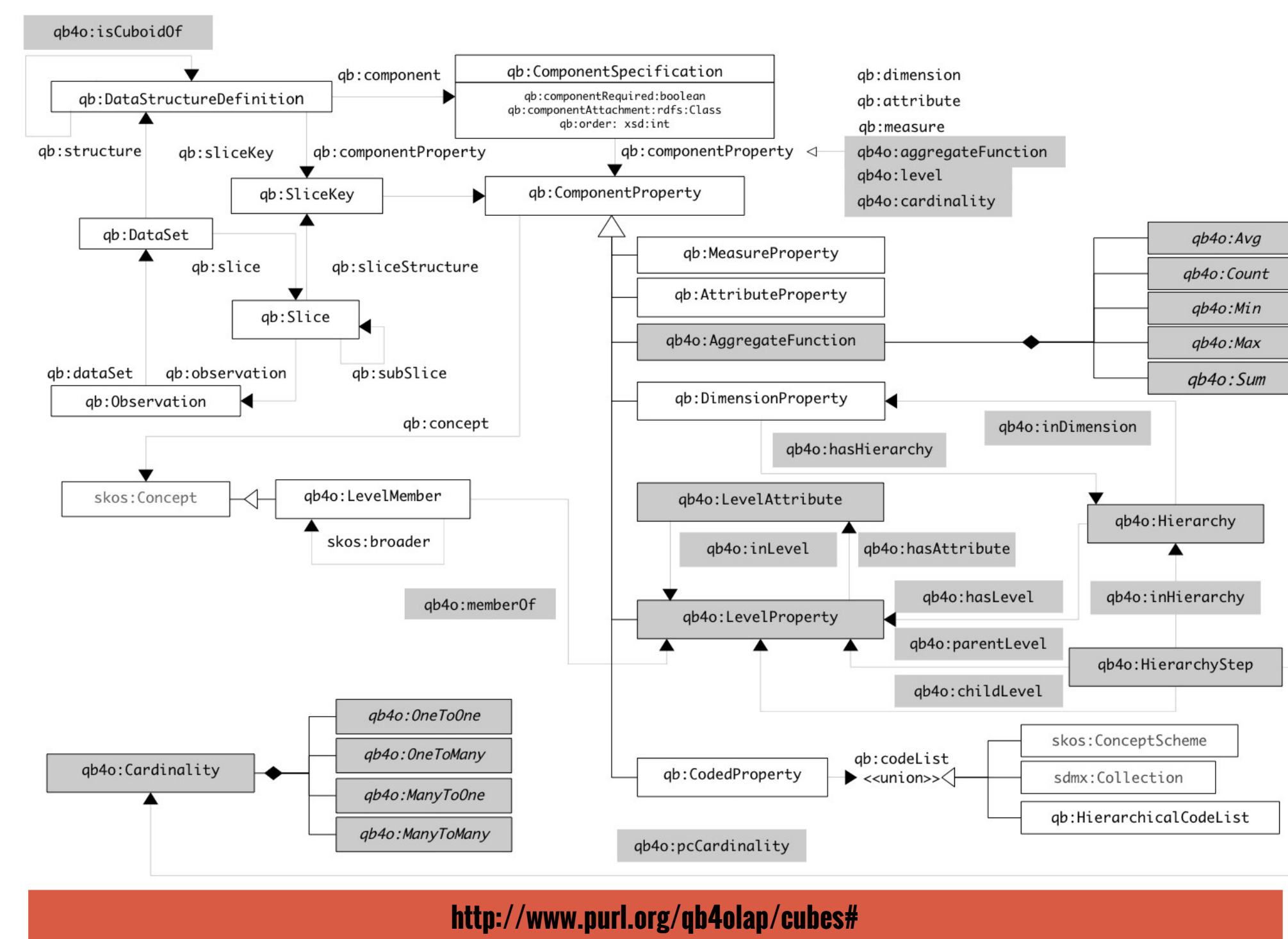
## VOCABULARY DEFINITION

The RDF Data Cube vocabulary (**QB**) is a W3C standard to publish statistical data on the web using a RDF. The **QB4OLAP** vocabulary extends **QB** to support the following concepts, defined in classic multidimensional models for OLAP and not modeled in **QB**:

**Dimension structure:** the structure of a dimension is defined in terms of **levels**, which are hierarchically organized through rollup relations.

**Dimension instances:** level instances are called level members, and there is a relation between level members from different levels.

**Aggregate functions:** aggregate functions are used to compute measure aggregate values when performing OLAP operations (e.g: Roll-Up)



## QUERY PROCESSING PIPELINE



## PROTOTYPE

# PROTOTYPING

QB4QLAP toolkit

Cube Explorer

Query cubes

## Query cubes

Pick a SPARQL endpoint

<http://www.fing.edu.uy/inco/grupos/csi/sparql>

Get cubes

Pick a QB4QLAP cube to explore

### Market capitalization of listed companies (current US dollars)

Schema URI: [http://www.fing.edu.uy/inco/cubes/schemas/world-bank-indicators#QB4O\\_CM\\_MKT\\_LCAP\\_CD](http://www.fing.edu.uy/inco/cubes/schemas/world-bank-indicators#QB4O_CM_MKT_LCAP_CD)

Dataset URI: <http://worldbank.270a.info/dataset/CM.MKT.LCAP.CD>

Schema graph: <http://www.fing.edu.uy/inco/cubes/schemas/wbld>

Instance graph: <http://www.fing.edu.uy/inco/cubes/instances/wbld>

Number of observations: 2904

### Asylum and first time asylum applicants to European countries by citizenship, age

» <http://www.fing.edu.uy/inco/grupos/csi/apps/qb4olap/>

» implemented using Node JS and Opensource Virtuoso.

source code available at <https://github.com/lorenae/qb4olap-tools>

Pick a sample QL query ▼

- Asylum applications by all citizenships (sex, time, age, citizenship, destination, application type)
- Asylum applications by year and continent (sex, time, age, citizenship, destination, application type)
- Asylum applications by year (sex, time, age, destination, application type)
- Asylum applications submitted by African citizens, where destination is France (sex, time, age, citizenship, destination)
- Asylum applications by year submitted by Asian citizens, where applications count > 5000 and destination is France or Germany (sex, time, age, citizenship, destination)

QL editor ▼

SPARQL query ▼

SPARQL Query results ▼

## PUBLICATIONS

- [1] Etcheverry, L., Vaisman, A., Zimanyi, E.: Modeling and Querying Data Warehouses on the Semantic Web using QB4OLAP. DaWak 2014, Munich, Germany (September 2014)
- [2] Bouza, M. Elliot, B. Etcheverry, L., Vaisman, A.: Publishing and querying government multidimensional data using QB4OLAP. In Proc. of 9th Latin American Web Congress (LA-Web) 2014, Ouro Preto, Brazil (October 2014)
- [3] Etcheverry, L., Vaisman, A.: QB4OLAP: A vocabulary for OLAP cubes on the semantic web. Proc. of the Third International Workshop on Consuming Linked Data, COLD2012 Boston, Massachussets, USA (November 2012)
- [4] Etcheverry, L., Vaisman, A.: Enhancing OLAP analysis with web cubes. ESWC2012. Heraklion, Crete, Greece, (May 2012)

## FROM RELATIONAL DWs

- » We have developed tools that automatically translate ROLAP DWs into QB4OLAP [2].
- » NorthwindDW in QB4OLAP

## EXTENDING QB CUBES

- » We are working on the semi-automatical extension of QB cubes.
- » We have manually extended cubes from Eurostat data and World Bank Linked Data

## FROM SCRATCH

**All the examples are available for querying at our SPARQL endpoint**  
<http://www.fing.edu.uy/inco/grupos/csi/sparql>