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IAAA
Grupo de Sistemas de Información Avanzados
Universidad Zaragoza

GeoLab

Planet Data

SEVENTH FRAMEWORK PROGRAMME

Upgrading maps with Linked Data

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The Linked Map project

- **Our vision**
  - Explore new applications of **Linked Data** in **Geographic Information**

- **Our goals**
  - **Semantic upgrade** of OGC WMS (namely LMS)
  - **Semantic integration** of authoritative GI datasets and VGI **with provenance**
  - **Crowdsourcing platform for QA** of semantic integration

The Linked Map project

- **The project was funded by PlanetData**

- **PlanetData (2010-2014)**
  - http://www.planet-data.eu/
  - FP7 Network of Excelence, State-of-art of large-scale public data management
  - **PlanetData Call 2 (2014):** Call for short term projects (1 year)

- **Partners**
  - **IAAA Lab** (Universidad Zaragoza, Spain) http://iaaa.unizar.es/ Research Lab, OGC, INSPIRE, ISO, SDI initiatives
  - **GeoSpatiumLab** (Zaragoza, Spain) http://www.geoslab.com/ SME, focused on GI
  - **CNIG** (Spain) http://www.cnig.es/ National Geographic Institute, data provider

The Linked Map project

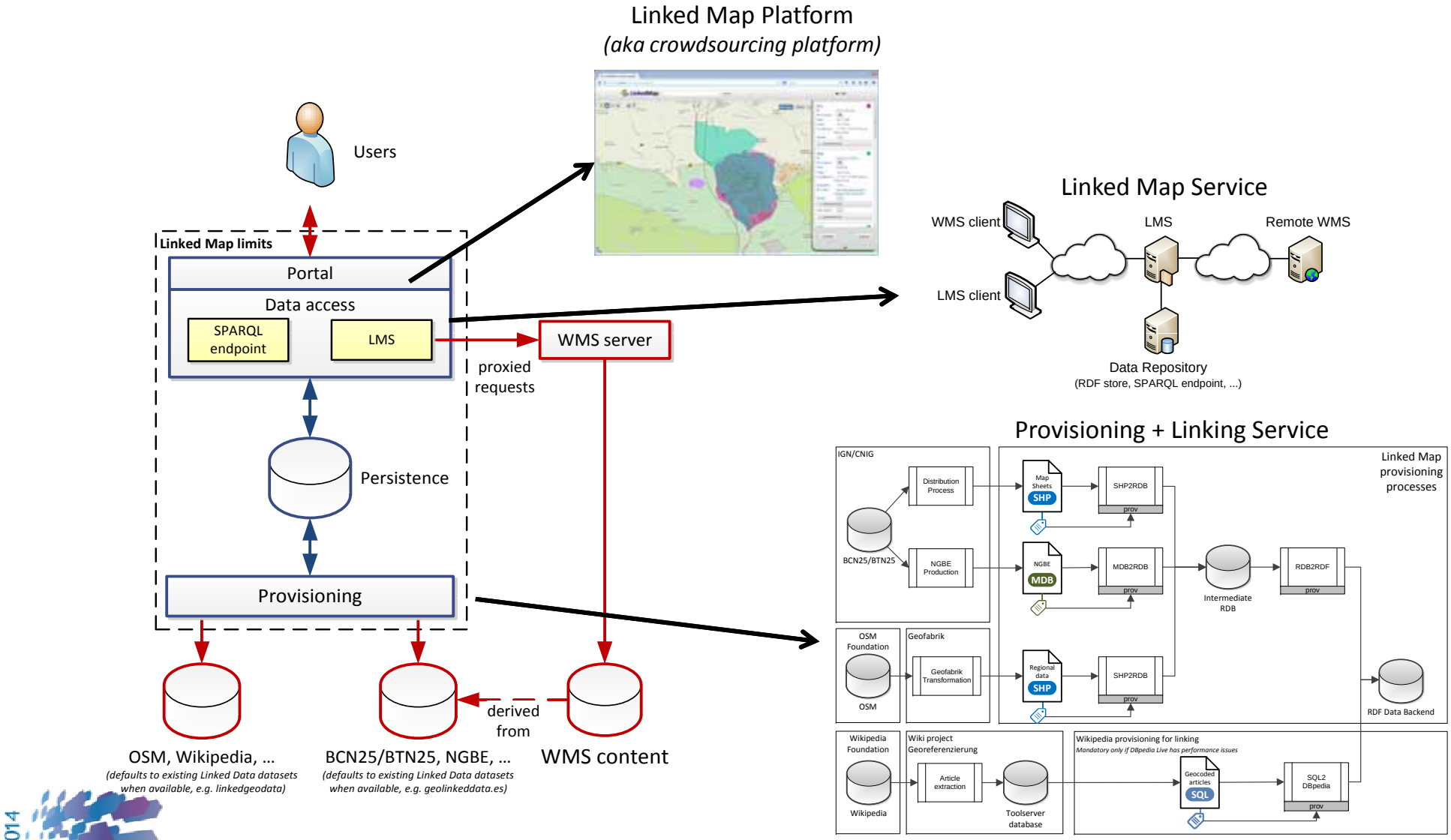
- **The motivating challenge**
  - **VGI and GI integration**
    - "Is VGI data believable for updating official maps?"
    - "Can crowdsourcing be useful for assessing this challenge?"
  - Key point: problem **relevant for GI producers**

- **Our contributions**
  - "Simple" semantic integration VGI & GI data → **Use of W3C PROV data**
  - Semantic upgrade of WMS → **WMS behaving as a LD server**
  - Crowdsourcing platform for integration QA → **Challenges in the use of LD with maps**
  - Evaluation experiments → **Nichesourcing evaluation**

The Linked Map project

- **Additional scenario details**
  - **Data**
    - GI: BCN/BTN (national map of Spain, provided by CNIG)
    - VGI: OpenStreetMap, Wikipedia
  - **Scope**
    - Spatial: Mainland Spain & Balearic Islands
    - Subject: OSM feature types (roads, buildings, ...)

Approach and implementation: architecture



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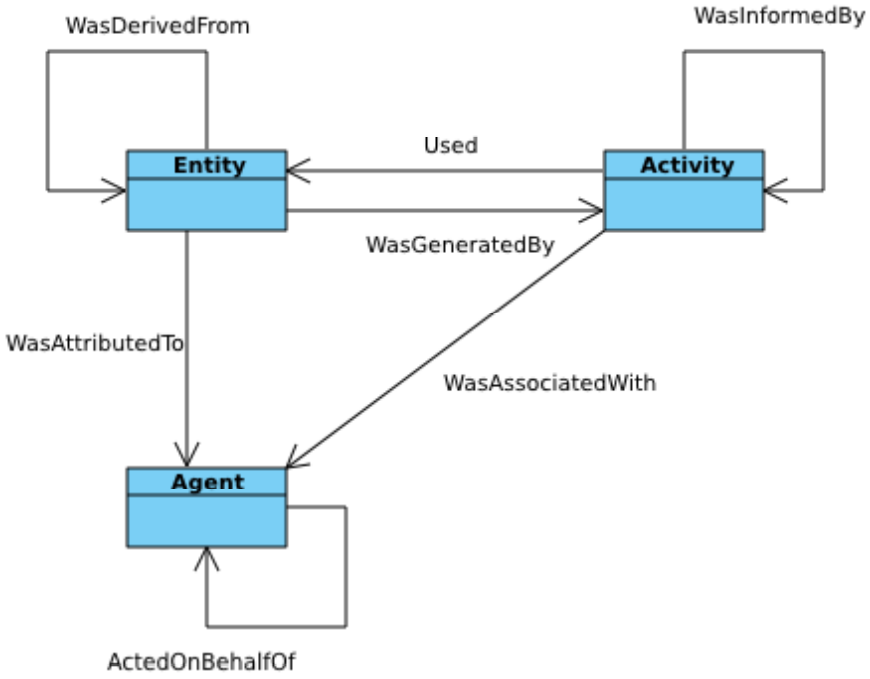
Approach and implementation: semantic integration

- **Tasks**
  - Transform datsets into LD → **GeoKettle** (ETL) + **MorphRDB** (tool)+ **GeoSPARL** (vocabulary)
  - Simple integration (name, type, location) → **Silk**
  - Provenance → Transformation + Integration → **W3C PROV** extended
  - Storage and GeoSPARQL access → **STRABON**

- **Results**
  - BCN/BTN 25: 13M triples, OSM: 35M triples, Enrichment: 3M triples
  - **Provenance tracking at feature level encoded in PROV-XML in RDBMS & RDF**
    - For each feature: File source, row source, transformation script, generation date ....

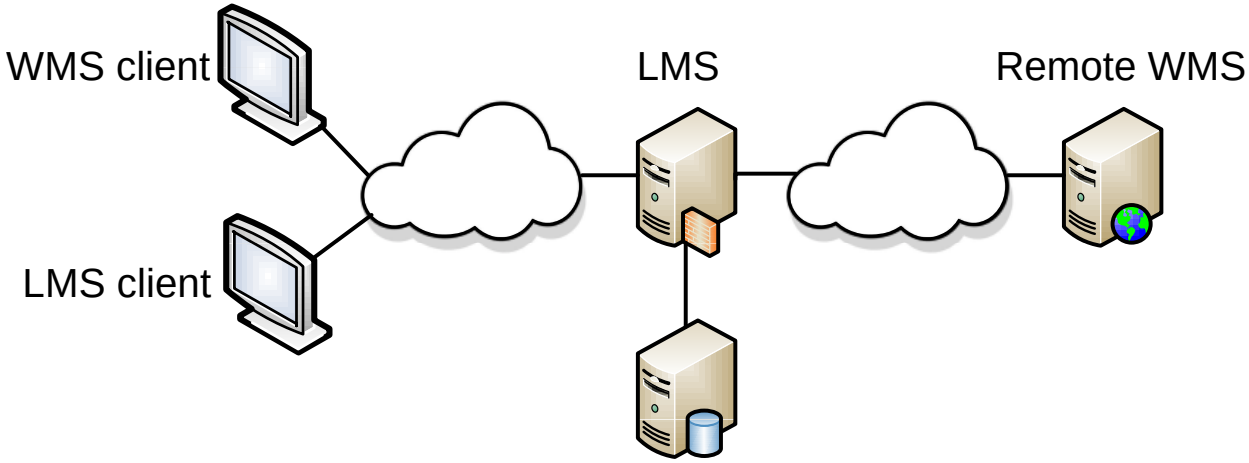
Approach and implementation: semantic integration

- **Track provenance at feature level with PROV**
  - Family of W3C Recommendations and Notes
    - http://www.w3.org/TR/prov-overview/
  - Goal: enable publication and interchange of provenance on the Web
    - Emerging standard (2013)
    - Available in RDF and XML
  - Compatible with ISO 19115 lineage model
    - All ISO 19115 lineage models can be represented
    - ISO metadata record = PROV bundle + explicit primarty topic
    - "scope" (in the sense of view/selector) is not part of PROV but can be added



Approach and implementation: semantic upgrade

- **Transparent enablement WMS (Linked Map Service - LMS)**
  - WMS 1.3.0 **reverse proxy**
  - Semantic upgrade of WMS requests by **content negotiation**
    - e.g. GetMap: return RDF resources spatially related to the map
  - **Web links headers** (RFC 5899) link both WMS and semantic responses



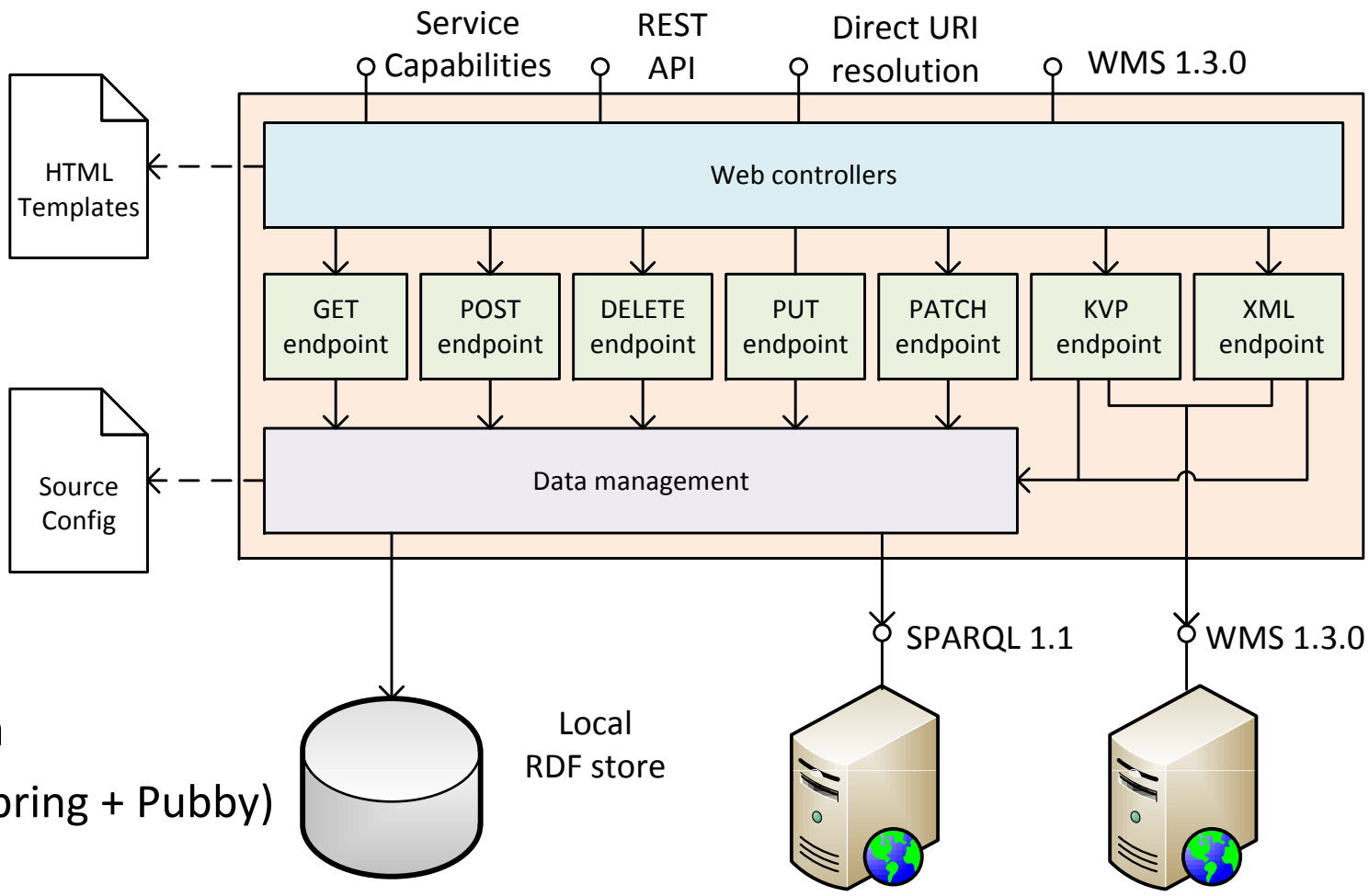
Approach and implementation: semantic upgrade

- **LMS is from the point of view of a WMS client**
  - A **WMS server**
  - WMS response headers contain **Web links** to alternate representations of capabilities, map images, etc;
    - A PNG map contains links to a JPEG map (WMS request) or RDF (machine processable representation)

- **LMS is from the point of view of a generic REST client**
  - A **Linked Data endpoint that contains as resources map tiles and data**
    - Each possible GetMap, GetFeatureInfo or GetCapabilities request denotes a resource
    - Resource **representations contain links to equivalent KVP WMS requests**
  - Response headers contain **Web links** to alternate representations, including KVP WMS requests

Approach and implementation: semantic upgrade

- **Architecture**



- **Implementation**
  - Java based (Spring + Pubby)

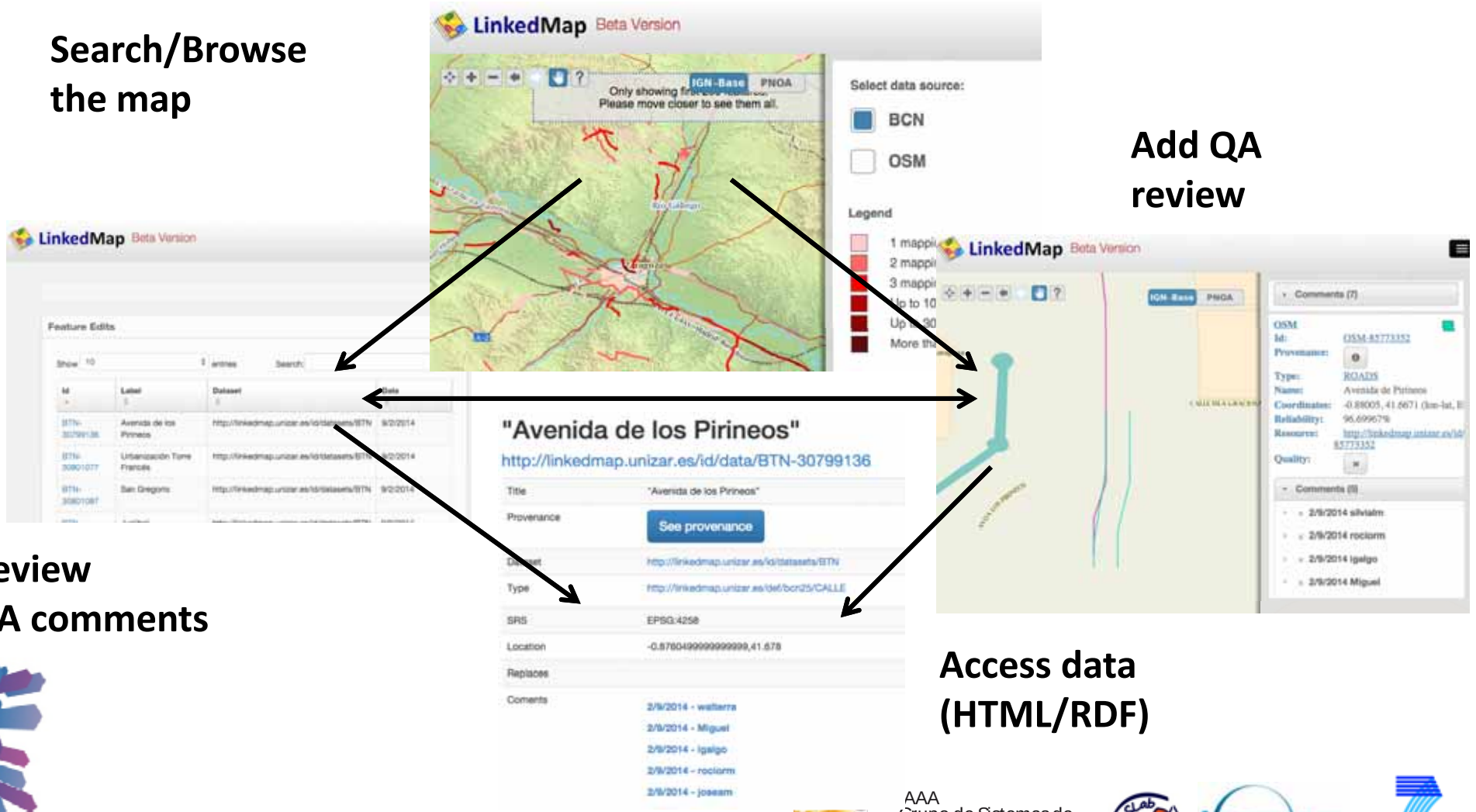
Approach and implementation: crodwourcing platform

- **Frontend**
  - Map client
  - Layer of linked features
  - User can add, review QA of links & features, browse data
- **Backend**
  - LMS + GeoSPARQL endpoint
- **Evaluation experiments**
  - **Open**
    - Can the platform (and the task) engage a big community? → Failled to create a critical mass
  - **Focused**
    - **Nichesourcing**: Can be used by **a small engaged but professional community** for QA of data and links? → Yes, but be careful with authority bias

The platform is available at ...

- http://linkedmap.unizar.es/crowdsourcing-platform/

Search/Browse the map



Add QA review

Review QA comments

Access data (HTML/RDF)

Lessons learned

- **W3C PROV**
  - It is possible to track ETL geo workflows with PROV
  - ISO 19115 compatible, can be stored in RDF as XML literal (as Geo)
- **Semantic upgrade of geoservices**
  - Services can be upgraded transparently using (carefully) existing IETF/W3C standards and best practices
  - Unexpected opportunities: RFC 5899 can increase discoverability of OGC web services in search engines
- **Use of LD with maps**
  - Flexible and rich data model
  - Experiments do not take full advantage of semantics (e.g. Inference)

Concluding remarks

- Years ago the **OGC** standards **were ahead of its time**
- Can we afirm this today? Yes, no? Are OGC standadization programs slow?
- I think that we **can upgrade** them without breaking by using wisely W3C/IETF standards
- Do you agree? What do you **think**?

If you whish know more:

http://linkedmap.unizar.es/

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