From Knowledge Generation To Science-based Innovation

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FROM KNOWLEDGE GENERATION TO SCIENCE-BASED INNOVATION

Raia

Data discovery mechanisms and metadata handling in RAIA Coastal Observatory

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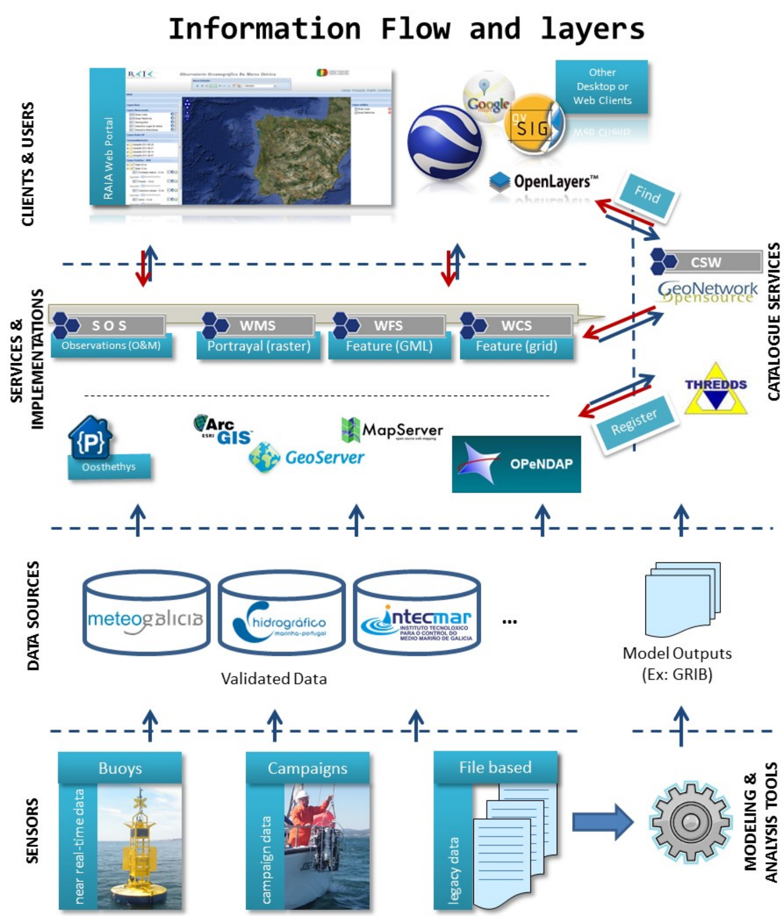
Introduction

- Context: RAIA Coastal Observatory
- Premise #1: Maritime Data and Service Infrastructure, composed of several geographically distributed nodes, which can simultaneously act as data/service providers and consumers.
- Corollary #1: Federated distributed architecture – no central node – each node has the necessary capacity to act as such and remotely invoke services from others to provide value-added services;
- Corollary #2: Adherence to INSPIRE directive, providing compliant remote services;
- Goal: to implement truly interoperable and harmonized services by 2020. How?

Background



Several OGC/INSPIRE compliant services in place from different partners in RAIA:

- WMS: map service for portrayal (raster);
- WFS: features of interest, such as beaches, places for barnacle fishing (attributes and geometry in GML/KML);
- WCS: coverages, maps under the form of grid (forecasts, other multi-dimensional spatiotemporal products);
- SOS: time series API for sensor data.

Challenges

- Describe data and services with consistent metadata;
- Minimize the effort in including metadata in datasets;
- Increase the efficacy of searches, maximizing the chance of the user finding what he is looking for.

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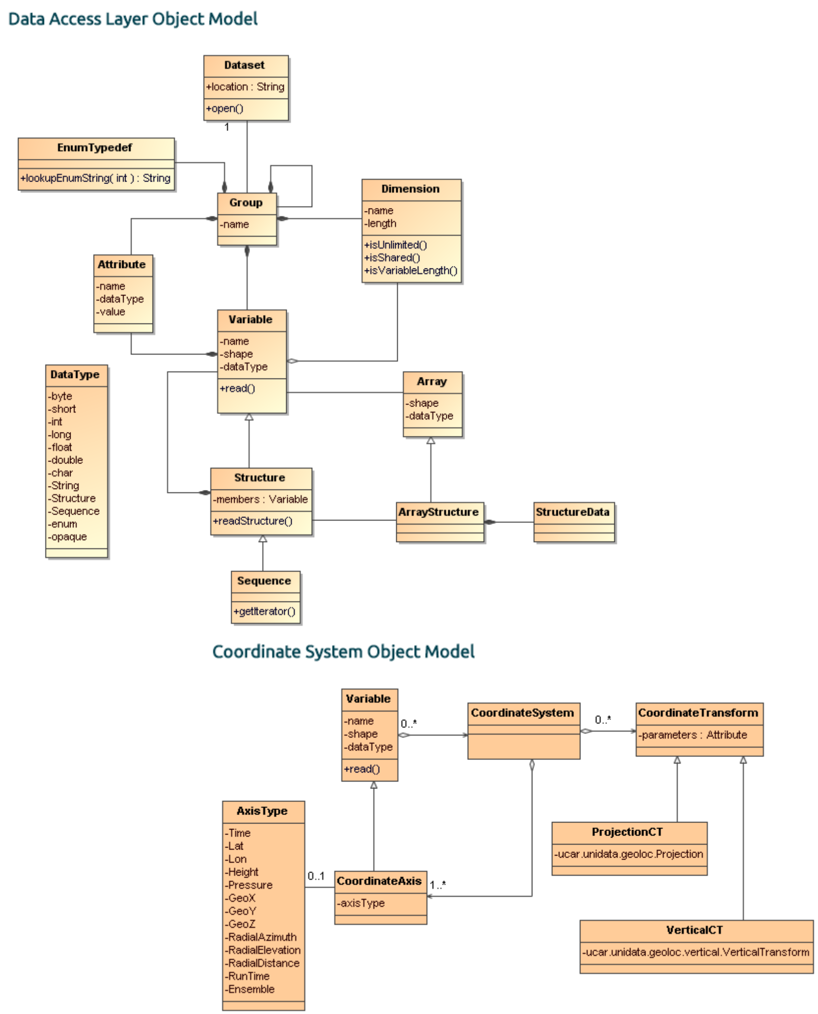
Methods and Implementation

- Service level:
  – Be more thorough at filling "service" metadata;
  – Make use of INSPIRE Code Lists (controlled vocabularies);
- Dataset level:
  – Choose encodings (and the implementations that support them) that ensure the use of a Common Data Model (CDM). Examples:
    - UNIDATA Common Data Model, used in THREDDS
    - INSPIRE Observations & Measurements, used by OGC SOS
  – Adopt common vocabularies to name variables and unit in datasets, such as the Climate and Forecast (CF). Use other domain-specific controlled vocabularies where CF is not suitable.
  – Annotate at the dataset level only the metadata that is different from the service level one.

Implementation Example 1: THREDDS Data Servers

- Used for voluminous file-based data sets (ex: forecasts);
- Uses underlying UNIDATA CDM with intrinsic geospatial traits (CRS);
- Uses CF standard names, which also contain clear rules on how to derive new variable names (1)
- Convention available at:

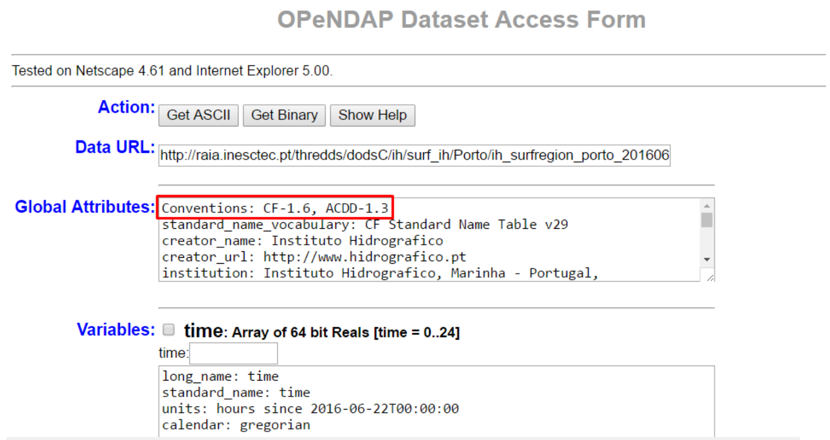
http://cfconventions.org/standard-names.html

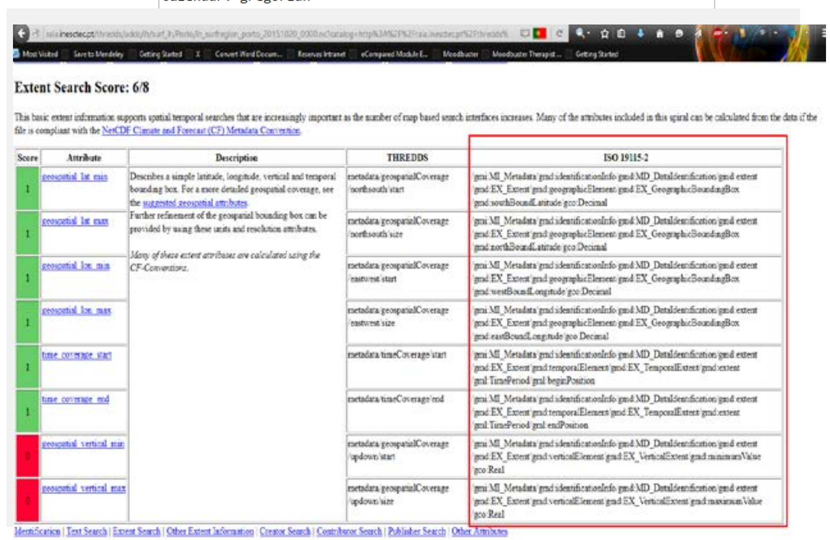


(1) [surface] [component] standard_name [at surface] [in medium] [due to process] [assuming condition]

Implementation Example 1: THREDDS Data Servers

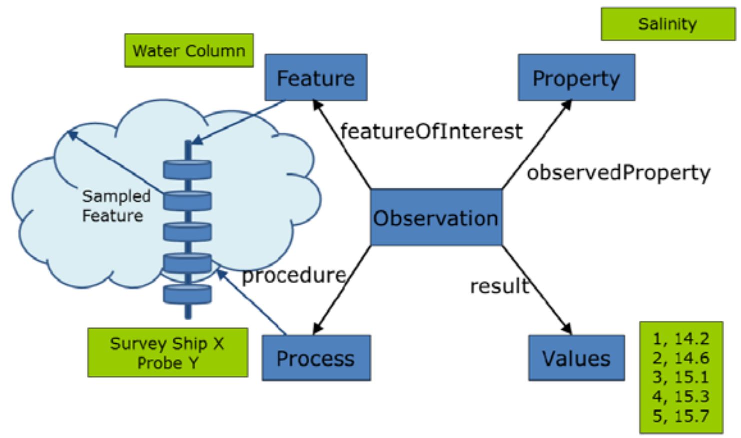
- Partners agreed to use at least CF on version 1.4 (some using CF 1.6)
- THREDDS Data Server implements several standard APIs to access data (WMS, WFS, WCS, etc)
- Metadata accessible according to ISO19115-2
- Simple interface to check completeness of the metadata





Implementation Example 2: SOS

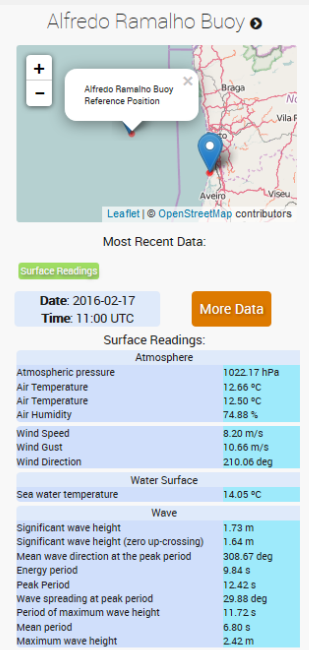
- Standard to provide access to time series from sensors and sensor systems;
- Goal is to be able to query data from sensors independently of which sensor is providing it;
- Facilitate data tailoring and fusion for (real-time) observations, enabling cross-domain analysis.

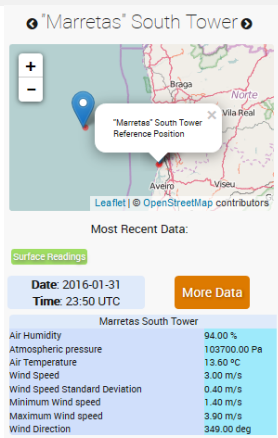


- Advantages:
  - Richer API
  - Includes reference to Feature of Interest and Process (Sensor, Lab Process, …)
- Disadvantage:
  - Not so efficient for bulkier data (ex: forecasts)

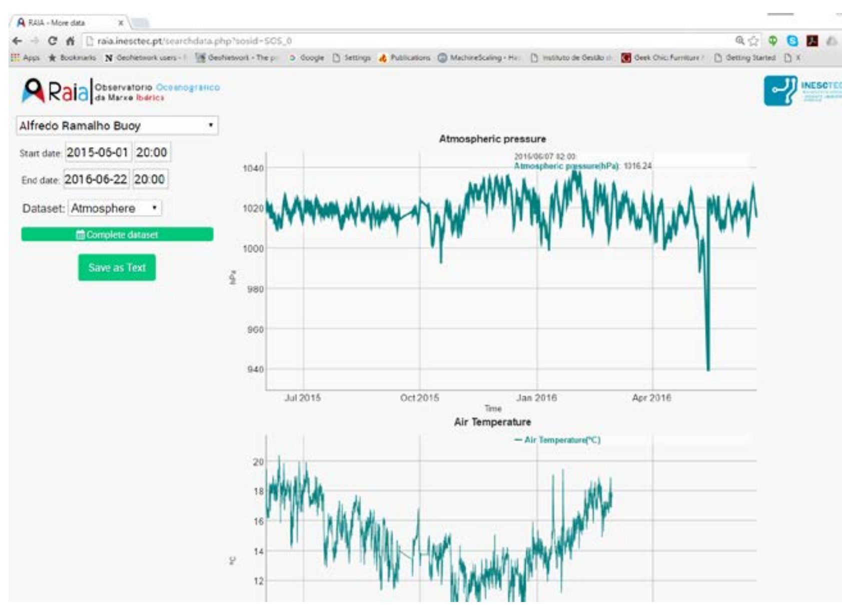
Implementation Example 2: SOS

- Used in RAIA for Buoys and Wind Towers alike.
- Example containing last observation:

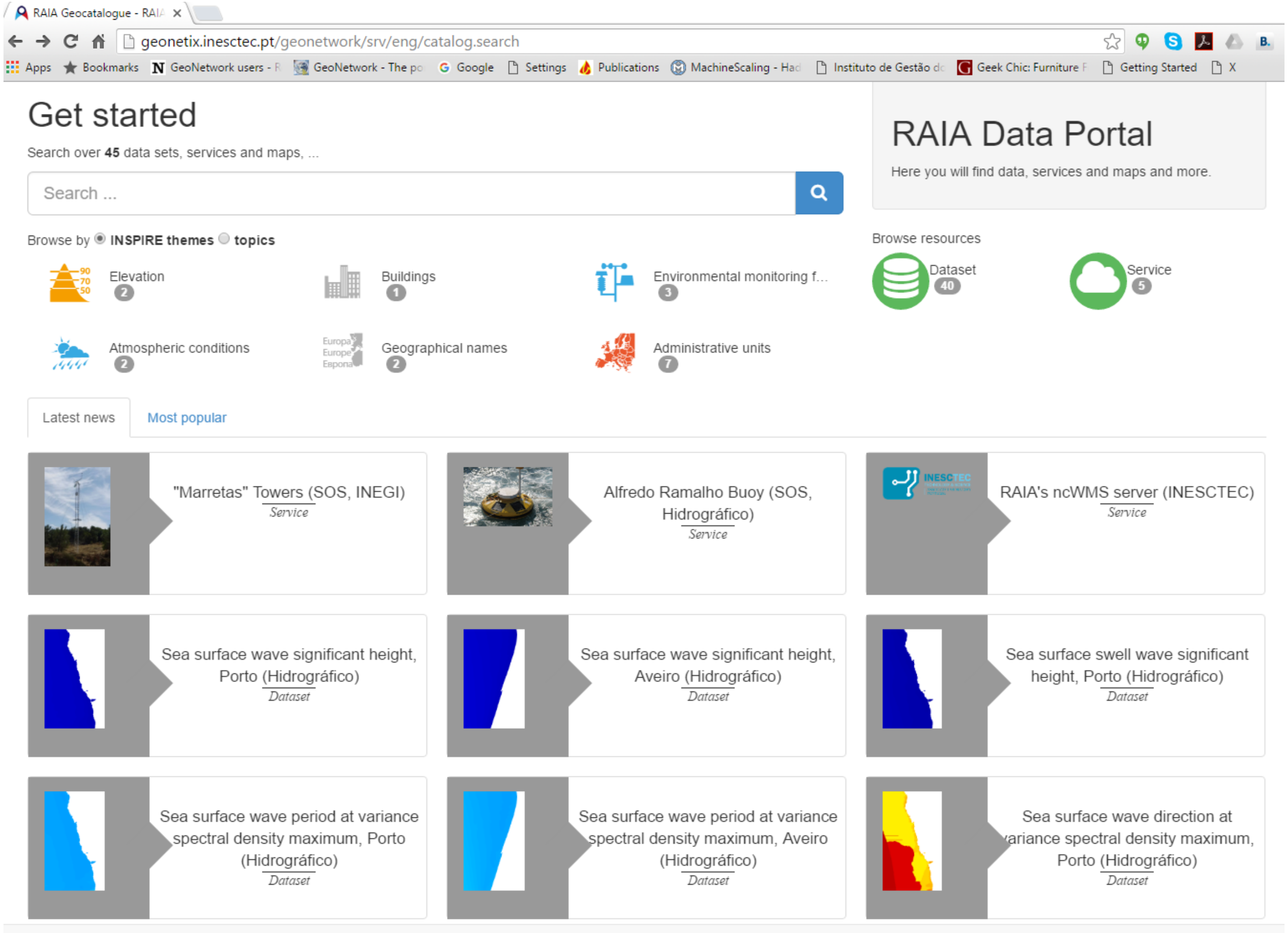




- Example for a more thorough exploration of a sensor time series:



Example of automatic harvesting of service metadata



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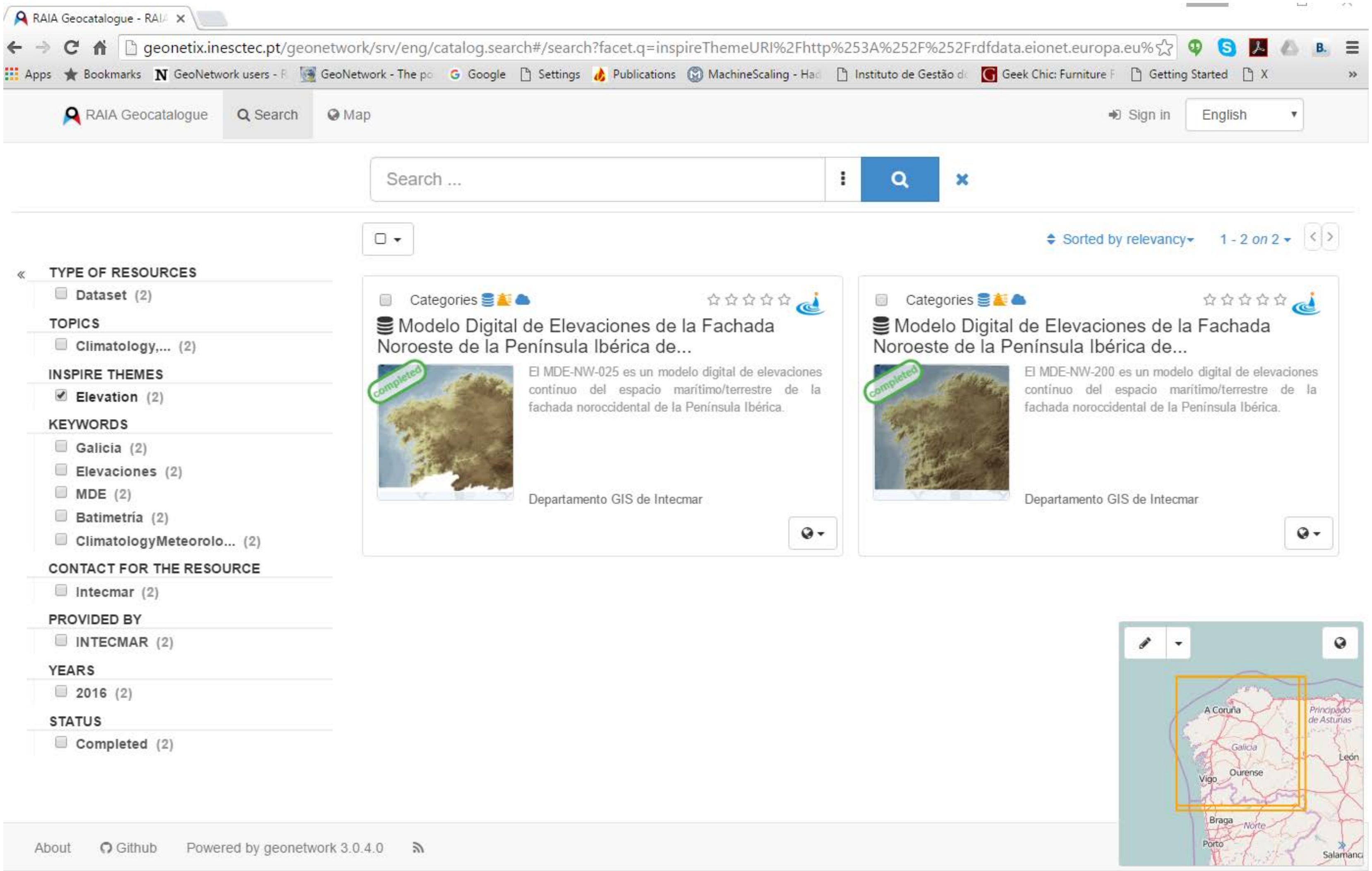
Example of automatic harvesting of dataset metadata



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Conclusions and Future Work

- Implementation of services according to standards has made possible the automatic harvesting of metadata from services and datasets that they contain, thus reducing the effort in annotating datasets;
- Catalogue services can index each other's contents;
- Harmonization requires use of standard code lists and controlled vocabularies;
- A continued effort is needed to promote the implementation of more interoperable services and catalogues, as well as better interoperation between catalogue service and newer services such as SOS;
- More advanced user interfaces need to be developed to facilitate the finding and usage of data by specific user communities.

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