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A Brokering Solution for Geospatial Resources Retrieval

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We introduce a distributed, Web-based information system for improved geospatial data access by means of dynamic, configurable pre-processing.

Multidisciplinary interoperability is one of the main challenges in developing Information and Communication Technology (ICT) frameworks for effective geospatial resources sharing. Existing solutions are generally based on the design and implementation of service-oriented frameworks that apply a set of international formal or de-facto standards and interoperability arrangements. These frameworks are known as Spatial Data Infrastructures (SDIs).

A most typical use scenario of an SDI can be decomposed into the following four main stages:
a) Discovery – the user searches for geospatial resources suitable for his/her needs;
b) Evaluate – the discovered resources are evaluated (e.g. previewed) and the user selects the ones which best fit his/her needs;
c) Access – the resources of interest are retrieved;
d) Use – the user exploits the retrieved resources (e.g. ingesting them into a Decision Support System, or into an environmental modeling system).

In order to properly exploit the discovered data, the access stage must provide more features than a simple "dataset download". In fact, in most cases the user needs to pre-process the data in order to satisfy his/her processing requirements. The main required pre-processing functionalities are:
• Sub-setting (i.e. trimming, slicing);
• Format conversion;
• CRS transformation;
• Data Interpolation.

Existing standards for data access services are quite flexible with regards to the above functionalities: that is, such operations are optional. Thus, data providers typically support only a subset of the above functionalities. Moreover, data providers may implement partial support to some of the above functionalities, limiting to a subset of their possible parameters (e.g. a given WCS might support CRS transformation, but only among a limited set of CRS's).

In order to address such issues, we have developed a solution based on a Brokered SOA (Service Oriented Architecture) approach. The Brokered SOA approach extends the traditional SOA introducing a middleware component (the Broker) that provides mediation functionalities between the consumer and provider actors of the SOA archetype.

Implementing the Brokered SOA approach, we have prototyped a flexible Access Broker framework named GI-axe. It provides access to normalized data, making use of existing data pre-processing services, and can be easily extended to accommodate future ones, when available. The system architecture was designed in order to satisfy the following main requirements: i) complement, rather than supplant, the existing access systems/services; ii) support the existing Community of Practices (CoPs) in using their own pre-processing components/services; and iii) be compliant with INSPIRE transformation services implementing rules.

As a practical example of GI-axe use, we can consider the "Common Grid Data Access" use case. Frequently, in order to exploit the data of interest (e.g. to ingest them into a modeling software), these must all be on a common "grid" – that is, all data must have the same format, CRS, and spatial extent/resolution. In heterogeneous environments such as SDIs, discovered data are typically provided on different "grids" and users have to download

the data and pre-process them to fit their needs. GI-axe provides users with access to data on a common grid independently from their specific origin “grids”, moving the task of adapting the data to the common grid from the users to the system.

GI-axe has been developed and is being experimented in the multidisciplinary interoperability framework of the EC-funded EuroGEOSS project, as part of a brokering infrastructure for the Biodiversity, Forestry, and Drought thematic areas.