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GI-axe – an ICT Solution for Sensor Data Processing

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In this work, we introduce GI-axe, a distributed, Web-based information system for improved geospatial (including sensor) data processing.

This component is part of a distributed system for generating, publishing, cataloguing, and processing spatial remote-sensing data for sensor-based transport infrastructure monitoring applications, under investigation in the framework of the FP7 ISTIMES project (Integrated System for Transport Infrastructures Surveillance and Monitoring by Electromagnetic Sensing).

The architecture of ISTIMES introduces a four-layered set of services, progressively abstracting the low-level acquisition of data to the production of synthesized meaningful notifications. One of the layers provides peculiar value-added mediation services and includes the processing middleware solution that is the object of this work.

GI-axe is based on a Brokered SOA (Service Oriented Architecture) approach, which extends the traditional SOA introducing a middleware component (the Broker) that provides mediation functionalities between the consumer and provider actors of the SOA archetype.

This decoupling has proven beneficial in a number of use-cases. In particular, sensor data processing very often requires appropriate intermediate steps (e.g. to adapt the format of input data as required by the various algorithms), which may be transparently performed by the broker.

GI-axe implements such Access Proxy functionalities, providing transparent access to normalized data, through the invocation of an appropriate sequence of data pre-processing services, including sub-setting (i.e. trimming, slicing); format conversion; CRS transformation; data interpolation.

GI-axe was designed in order to satisfy the following requirements: i) complement, rather than supplant, the existing access services; ii) support the existing Community of Practices in using their own pre-processing components and services; and iii) comply with INSPIRE transformation services implementing rules.

With special regards to point ii) above, the GI-axe framework is extensible and specifically supports the integration of MATLAB libraries, which are very common in the scientific community, e.g. for data assimilation, correlation, and the like.

In this way, GI-axe effectively enables the implementation of multidisciplinary interoperability, which is one of the main challenges in developing Information and Communication Technology (ICT) systems for effective geospatial resources sharing, namely for transport infrastructure monitoring and surveillance.

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.

In the future, we plan to complement the framework with front-end components implementing standard processing interfaces, such as the OGC WPS, to support the seamless integration of GI-axe in existing Spatial Data Infrastructures (SDIs).

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