Advancing earth observations missions and geospatial interoperability within the Heterogeneous Missions Accessibility project

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The development of geospatial protocols and profiles for Earth Observation - EO performed within the Heterogeneous Missions Accessibility – HMA project relies on two consensus-based forums: one being the Open Geospatial Consortium and the other a HMA Project CEN Workshop Agreement. Here we provide an overall view of the research, technology developments and Service Oriented architecture design from the HMA project.

The three high level requirements which are the basis for the HMA work are the need to:

- Simplify the access to multiple sources of EO data, to fulfill the demand for EO data which increased by a factor of 10 over last decade

- Facilitate the extraction of information from EO data, since during the same time frame most of users passed from the exploitation of a single source (sensor) of data to the use of multiple sources of EO data from different mission operators

- Reduce the barrier for the definition and prototyping of EO Services as it has been evaluated that more than 60% of the efforts of the Value-Adding Services is used for the EO data access.

The European Space Agency's - ESA Oxygen project indicated that EO Services, whether commercial or public, are about the provision of the right information at the

right moment to the proper user. The need to define the interoperability standards to ease the EO data access in Europe is as well a priority since during the initial phase of the joint ESA and European Commission's Global Monitoring for Environment and Security – GMES programme, the Agency shall provide harmonised access to the ESA, national, Eumetsat and other third party Earth Observation Missions for the so-called GMES Fast Track Services, and therefore provide the required capacity to satisfy the GMES spaced-based observation needs. GMES will also offer data from non-European satellite.

In order to deliver the *high-level operational services* which are needed, it is necessary to integrate EO products, space data, with all kinds of other data and information.

The complexity of this next generation of integrated services may also require establishing:

- a distributed digital library of geospatial services, as well as,

- a network of centres able to support the partners who will contribute to the production and delivery of data access and information services.

It is therefore necessary to develop architectures and tools to support the orchestration of data acquisition and handling, transformation of formats, geomatic functions and the required access, processing and value adding chains.

To this end, the identification of a set of common EO related standards and the support of a neutral and open service-enabling architecture becomes mandatory to respond to the need for EO services and "information products" closer to user expectations and processes (easily understandable and ready-to-use).

The HMA project shall allow interoperability across the GMES Contributing Missions (Envisat, Cosmo-Skymed, Radarsat, TerraSAR-X, Pleiades, the meteorological missions from Eumetsat) in a pre-operational manner already by end 2008. The proposed service oriented architecture is designed and described making use of the RM-ODP model (Reference Model of Open Distributed Processing (ISO/IEC 10746-1:1998)).

The following set of EO and geospatial data access services has been defined to specifically support the GMES Programme:

- Collection and service discovery, addressing general EO and a wide range of geospatial collections and services

- Catalogue Service, specifically addressing the EO services, in particular with the definition of a generic metadata product description structure expandable

either horizontally in a mission /sensor dimension (e.g. optical, radar, atmospheric) as well as in a vertical dimension (e.g. optical, high resolution optical, mission specific optical)

- Product Programming and Order in order to cater for the specificity of the user interactions related to the request and acquisition of optical data (i.e. addressing issues related the feasibility analysis performed e.g. on the basis of time series of cloud coverage)

- Online Data Access with a particular attention to the requirements of near real time data access.

- Satellite Multicast Service addressing subscription, emergency and ad-hoc data and service output distribution

- Identity (user) management, which is crucial in order to permit a single sign on as well as ensuring the required traceability, accountability and security of the access and the requests

- Service Orchestration in order to allow scalability and extended cooperation across services and providers.

- Processing Services. In this context extensive tests have been performed as well within the ESA Grid infrastructure with the objective of reducing the burden caused by the transfer of large EO coverages by transferring instead the processing algorithms on the Grid that hosts in its storage element the coverages to be processed.

- Visualization Services. An additional set of geospatial services defined by the Open Geospatial Consortium - OGC will be used for user interaction and/or data access and information visualization: the Web Map Service, the Web Feature Service and the Web Coverage Services