

# Achieving interoperability of spatial data

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- **GEOSS** (Global Earth Observation System of Systems)
  - Built by the Group on Earth Observations (GEO) on the basis of a 10-Year Implementation Plan running from 2005 to 2015.
  - Seeks to connect together all existing Earth Observations resources and to make it easily accessible with the aim of support better decision making on 9 Societal Benefit Areas
- **INSPIRE Directive**: establishing an Infrastructure for Spatial Information in the European Community (14 May 2007)
  - Legislative instrument that lays down a general framework for a European Spatial Data Infrastructure (SDI) for the purposes of Community environmental policies and policies or activities which may have an impact on the environment. It builds upon National SDIs operated and maintained by European Member States
- **GMES** (Global Monitoring for Environment and Security)
  - GMES is a joint initiative of the European Commission and European Space Agency that consists of 3 components:
    - Space Component that relies on existing or planned European space infrastructure (co-financed by the EU and ESA)
    - In-Situ Component that relies on facilities, instruments and services at national, regional and intergovernmental levels inside and outside the EU.
    - Service component on Marine, Atmosphere, Land, Emergency, Security at pre-operational stage

## Interoperability on European Level?

- Shared commonalities:
  - focus on environmental monitoring,
  - use of geographic information,
  - their Europe- or worldwide dimension,
  - their reliance on international standards and
  - the advanced Spatial Data Infrastructures that are needed for their implementation
- However:
  - different organisational models, different stakeholders, different governance, different funding, different levels of implementation, different approaches for technical development, different timelines
  - *risk of evolving into separate, incompatible services and not profiting from the benefits of an interoperable approach*

## ...an Action in Support to the GEOSS, INSPIRE and GMES

- Coherent and interoperable development of these initiatives
- Concerted adoption of standards, protocols, and open architectures
  - ✓ Recommendations to increase architectural coherence
  - ✓ Strengthened EU contribution to international standardisation
  - ✓ Information Platform for discussion and consensus for the stakeholder communities

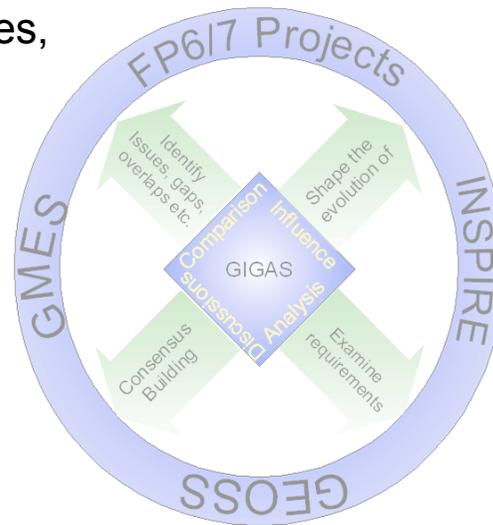
# Iterative and Consensus-driven Approach

## 1. Analysis

Monitor each initiative and selected FP projects (architecture approaches, requirements, consensus processes, and resultant service-oriented interfaces and encodings)

## 2. Comparison + Recommendations

Identification of possible synergies that can be built and further areas of cooperation, to highlight the gaps and overlaps within the initiatives.



**2 iterations**

## 4. Shaping

Suggest modifications to INSPIRE, GEOSS and GMES and be proactive in influencing and shaping their evolution

## 3. Discussion + Consensus

Recommendations will be revised through a broad consultation to achieve as wide a consensus as possible

**Multiple other events and activities of the initiatives / organisations**

**Open Networking Event  
(15<sup>th</sup> April 2010)**

**2<sup>nd</sup> Stakeholder Workshop  
(26<sup>th</sup>/27<sup>th</sup> January 2010)**

# Themes

- Architecture
  - Catalogue & Metadata
  - Data Interoperability
  - Data Access and Processing
  - User Management
- Cross Initiative Scenario
- Interoperability Testbed
  
- In total 40-50 opportunities identified for improving the interoperability across GEOSS, GMES, INSPIRE (and the NSDIs)

## Data Interoperability

- The lack of interoperability on the data level had been identified as a priority item for GIGAS. The data-related interoperability issues can be separated into two levels:
  - interoperability on the semantic level
  - interoperability on the syntactic level
- The approach to data harmonisation / semantic interoperability within INSPIRE, GEOSS and GMES, the standards organisations (OGC, ISO/TC 211 and CEN/TC 287) and, where known and relevant, in FP6/FP7 projects has been analysed with respect to 26 individual aspects, the „data interoperability components“.

## **Agreements potentially required on many aspects: The data interoperability components**

1. Requirements
2. Terminology
3. Reference model
4. Architectural support for data interoperability
5. Rules for application schemas and feature catalogues
6. Application schemas
7. Use of ontologies
8. Spatial and temporal aspects
9. Coordinate referencing and units of measurement model
10. Identifier management
11. Object referencing modelling
12. Multi-lingual text and cultural adaptability
13. Data transformation model / guidelines
14. Portrayal
15. Maintenance of information about geographic data
16. Publication of information about geographic data
17. Metadata
18. Maintenance
19. Data & information quality
20. Delivery
21. Consistency between data
22. Multiple representations
23. Data capturing rules
24. Conformance
25. Governance
26. Extension points

## Conclusions – Overview

- Opportunities for improving data interoperability across GEOSS, GMES and INSPIRE were identified based on two relevant scenarios:
  - the reuse of European data in a global context
  - the cross-initiative scenarios where a client accesses data from different initiatives in parallel
- Identified opportunities (= recommendations or issues):
  - Common foundation
  - Coherent thematic view
  - Research agenda and testbeds
  - Infrastructure components
  - Strategy for evolution
  - Technology independence
  - Education, capacity building, training

## Common Foundation

→ INSPIRE, GMES, GEOSS

- For cross-initiative interoperability general agreements on the data interoperability components would be helpful
  - recommendations across the initiatives would be beneficial
    - Iterative approach, focus first on most important data interoperability components
  - recommendations should be standards-based whenever practicable and
    - provide details on how the standards should be used
    - where necessary, efforts should be made to correct, amend or improve standards
  - initiative-specific extensions should be specified in the initiatives
    - for example, the INSPIRE Generic Conceptual Model could be changed to become an extension of a document capturing the cross-initiative recommendations
- Challenging for implementation-oriented communities that so far have no experience with a foundation layer in their information architecture → „Education, Capacity Building, Training“

## Coherent Thematic View

- INSPIRE, GMES, GEOSS, ISO/TC 211, OGC
- Where a theme / domain is relevant for multiple initiatives work on the relevant data specifications should be collaborative - rather than harmonising later on
  - Identify opportunities for collaboration at a very early stage
    - Mechanisms beyond bilateral communication should be available
  - The institutional nature of INSPIRE requires it to be more prescriptive than the other initiatives - this needs to be taken into account
    - An option are modular specifications where not all parts need to be adopted by all
    - Also we need to ensure that there is room for innovation
  - Requires clarification of the evolution of the specifications and standards → „Strategy for Evolution“

## Coherent Thematic View

- The situation is different depending on the data theme; in general, neither of the initiatives has adopted data specifications for a data theme already so there are opportunities that should not be missed
  - For the INSPIRE Annex I themes data specifications are already mature and in the adoption process; other initiatives – including NSDIs – should consider using or extending the INSPIRE specifications before developing new specifications
  - For the INSPIRE Annex II/III themes the process is just starting, so there is the opportunity to coordinate the specification development in particular with GMES, GEOSS and SEIS
  - ISO and OGC have also started to host the development of thematic standards; these should also be considered, particularly if the standard is accepted by the relevant communities

## Example - Observation & Measurements

→ INSPIRE, GMES, GEOSS

- Observation & Measurements (O&M, ISO 19156) is a key component for defining interoperable data models with and across INSPIRE/GMES/GEOSS that should be endorsed
- Stakeholder workshop indicated some concerns about the O&M adoption due to uncertainties about the process of joint OGC-ISO/TC 211-projects; the process and the status of each joint project needs to be more clearly defined and more transparent to those not actively involved

## Research Agenda and Testbeds

→ DG Research, GIGAS

- Currently available operational technologies generally require detailed agreements and harmonised data specifications. Looser approaches e.g. based on ontologies, might simplify the publication and use of data. However, these technologies are not considered mature. It would be helpful to identify which issues need to be resolved to move forward.
  - Ontologies accessing online registries/dictionaries (see below)
  - This is also relevant for the data interoperability component “Terminology”

# Infrastructure Components

→ INSPIRE, GMES, GEOSS

- For a sustainable approach, we need more than documents, i.e. operational components that facilitate the use of common data-related resources
  - Online access to current conceptual schemas in reusable form
  - Online access to encoding schemas, e.g. XML schemas and Schematron schemas
  - Online access to controlled vocabularies / code lists in reusable form
  - Online access to glossaries in reusable form
  - etc.
- The dependencies between these components need to be known and managed
- Someone has to be responsible for the operation of these components and for their governance!

## Strategy for Evolution

→ INSPIRE, GMES, GEOSS, OGC, ISO/TC 211

- Maintenance processes and approaches to backwards compatibility need to be analysed across initiatives to identify if/how interoperability can be achieved on a sustainable basis, not only at a specific point in time
  - The use of register procedures is essential (e.g. retire or supersede managed items, do not delete them)
  - The granularity of the managed items in the infrastructure components needs work
  - Work is in progress, but no complete solution exists in either the initiatives or the standards organisations

## Technology Independence

→ INSPIRE, GMES, GEOSS

- The infrastructure should be designed to be able to outlive any particular technology. The specifications should be designed accordingly. Examples:
  - INSPIRE currently foresees GML as the default encoding for the Annex I data, but it explicitly supports the specification of other encoding schemas for appropriate purposes as long as the encoding rules are clearly specified (could be encodings like KML, Shape, GeoJSON, GeoRSS, RDF etc.).
  - Currently the three initiatives are based on a service-oriented architecture. However, this may not be true for all users of the data and it should be ensured that data offerings from the initiatives are ready for usage in non-SOA environments, in particular the general web.
- One has to be aware that this is another layer to manage and implement → „Education, Capacity Building, Training“

## Education, Capacity Building, Training

→ INSPIRE, GMES, GEOSS

- The approach to architectural coherence introduces multiple layers, see in particular “Common Foundation” above; in order to gain acceptance in the various communities and prepare them, capacity building is essential
- General agreement at stakeholder workshop that lack of education/training is the biggest impediment for the uptake of standards
- Inventory and coordination of such activities needed
- Different types of training are required, e.g. to write application schemas, to use data according to an application schema, etc.

## Relevancy of GIGAS results for INSPIRE

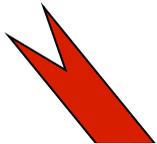
- Establishment of a fundamental and unique cross-initiatives knowledge-base
  - Improved mutual understanding (technical and procedural)
  - Important technical notes and comparative analyses
  - Stakeholders now know where to find this cross-initiative expertise
- Improved communication between stakeholders
  - Link with GMES projects and GEOSS reinforced at technical level
- GIGAS material actively proposed by Consortium as INSPIRE reference material
  - Fed back directly into the appropriate group in INSPIRE for further consideration

## Relevancy of GIGAS results for INSPIRE

- GEOSS-INSPIRE-GMES (“GIGAS”) liaison group established
  - Regular telephone conference scheduled
  - Important for identification of “harmonisation chances”
    - E.g., results of GEOSS user requirements survey to feed into INSPIRE Annex II and III process
  
- GEO SIF European Team hosted by INSPIRE Forum
  - Visibility of GEO activities to INSPIRE Community

## Convergence and Outreach: Input to this process

technology watch methodology  
identified issues and technical  
recommendations



**69 instances in INSPIRE, GEOSS, GMES, and  
standardisation that bear the mark of GIGAS**



Shaping targets = stakeholders

SDI initiatives: GEOSS, INSPIRE,  
GMES

Standardisation organisations (OGC,  
ISO, CEN)

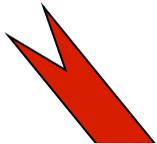
[http://www.thegigasforum.eu/  
workshops.html](http://www.thegigasforum.eu/workshops.html)

## Convergnance and Outreach: Examples of Impacts

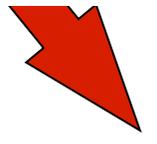
Follow on of OGC WG (OWS-  
Common, Catalogues,  
Metadata)

INSPIRE-GMES joint workshop  
on land cover

Recommendations on  
O&M



**69 instances in INSPIRE, GEOSS, GMES, and  
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GIGAS contribution to  
AIP-3 - Data  
Harmonization

GEOSS SIF - Registration of Data  
Interoperability Standards

GIGAS Methodology  
submitted as OGC best  
practice

Use of GIGAS Technical Notes in  
EO2HEAVEN project

## Links to targeted Initiatives, Organisations and Projects:



European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung



The GIGAS Consortium

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