Multi-disciplinary Interoperability: the EuroGEOSS Operating Capacities

Stefano Nativi (CNR)
Outline

• Rationale
• System of Systems approach and architecture
• Brokering SOA (B-SOA)
• EuroGEOSS Operating Capacities
• Lessons learned and Future development
Rationale

• Contribution to the following Objective
  – Formation and operation of an Earth system science community, based on multidisciplinary knowledge integration
  – Develop advanced digital earth infrastructures: multi-disciplinary cyber(e)-Infrastructure

• Interoperability across disciplines
  – Semantic
  – Technical
  – Organizational
INSPIRE and GEOSS principles

• *Implement a “system of systems”*
  – *Consisting of existing and future information systems*
  – *Supplementing but not supplanting systems mandates and governance arrangements*

• **Build on existing Resources and Interoperability Standards**

• **Register** (existing systems)

• **Mediate** (non-standard capacities)

• **Interconnect** (standard capacities)

• **Domain Communities** should provide:
  – **Metadata** to describe available spatial resources
  – **Network services** to
    • discover, transform, view and download spatial resources
    • invoke advanced processing services to support decision making
System of Systems approach

• Collect task-oriented, autonomous systems that pool their resources together to obtain a new, more complex, 'meta-system'

• Shift from technical interoperability towards conceptual composability –by recognizing and specifying interoperability arrangements

• Deal with holistic solutions to implement service interoperability and metadata sharing among communities and autonomous systems
System of Systems architecture

- Build incrementally on existing infrastructures (information systems) and incorporate heterogeneous resources

- Infrastructure
  - the set of data models, services, and conventions that should not have to be recreated for each application
  - the core of general functionality upon which other systems (e.g. other infrastructures) can be built

- Three main infrastructures
  1. Distributed Computing Infrastructure(s)
     - Distributed Capacity provision functionalities
  2. Geospatial Information Infrastructure
     - Geospatial resources core functionalities
  3. Digital Earth Infrastructure
     - Earth system science core functionalities
System of Systems architecture

• Shift from technical interoperability towards conceptual composability

• Interoperability Arrangements must be able to
  – align (and where necessary to harmonize) the heterogeneous system conceptual models.
  – connect autonomous systems at different infrastructural levels
  – not require tight coupling or strong integrations -only define how system components interface with each other

• Need to raise the level of abstraction and cope with systems complexity
  – Service-Oriented Architectures (SOA) and Model Driven Approach (MDA)
Brokering SOA (B-SOA)

- SOA and MDA must be adapted to avoid tight coupling or strong integrations among SoS components
- Introduce brokering and mediation frameworks for resources
  - Discovery, access, processing and chaining
B-SOA framework

- Extend the traditional SOA approach
- Address SoS complexity
  - Many heterogeneous systems
  - Flexibility to support future systems
  - Avoid tight coupling or strong integration
Operating Capacity: three Interoperability phases

I. Enable thematic interoperability & connections local to global

II. Enable multi-disciplinary interoperability

III. Extend interoperability to other SBAs & systems

WP3: Forestry

WP4: Biodiversity

WP5: Drought

WP6: Cost benefit analysis

WP7: Capacity building

Digital Earth Infrastr.

Geospatial Information Infras.

GolbalSoilMap

AEGOS
The EuroGEOSS Initial Operating Capacity (IOC)

I. Enable thematic interoperability & connections local to global

II. Enable multi-disciplinary interoperability

Multi-disciplinary Common Geospatial Services

EuroGEOSS contribution to the Global EO SoS—Krakow, 24 June 2010
Provided Interfaces & Supported Resource types

EuroGEOSS Brokering Platform
(GeoRSS support)

Service Providers (Resource Servers)
- CSW2.0.2-Core
- CSW2.0.2-ebRIM/CIM0.1.9
- CSW2.0.2-ebRIM/EO0.2.5
- CSW2.0.2-ISO1.0
- Degree2.2
- GBIF
- GDACS
- GeoNetwork2.2.0
- GeoNetwork2.4.1
- GeoRSS2.0
- GI-cat6.x
- GI-cat7.x
- NetCDF-CF1.4
- OAI-PMH2.0
- OAI-PMH2.0
- OpenSearch1.1
- THREDDS1.01-1.0.2
- WCS1.0
- WCS1.1.2
- WFS1.0.0
- WFS1.1.0
- WMS1.1.1
- WMS1.3.0
- WPS1.0.0
- CDI
The EuroGEOSS Advanced Operating Capacity (AOC)

I. Enable thematic interoperability & connections local to global

II. Enable multi-disciplinary interoperability
EuroGEOSS contribution to the Global EO SoS – Krakow, 24 June 2010
Lessons learned and future developments

• S&T Challenges
  • Connect autonomous systems at different infrastructural levels
  • Shift from technical interoperability towards conceptual composability
  • Utilise brokering and mediation service frameworks
  • Develop holistic interdisciplinary approaches & frameworks for Digital Earth applications
  • Provide specific guidance to assist the Earth sciences community in the evolution and/or development of their systems (organizational interop.)
    – Numerous systems, geographically dispersed, and evolving on their own time scales.