



# **What is Interoperability and How Do We Measure It? – Part 2**

## **GEOSS Interoperability Assessment; a mid-term evaluation of GEOSS' interoperability goals**

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# The context

- GEOSS is the Global Earth Observation System of Systems
  - Link existing and planned observing systems around the world
  - Support the development of new systems where gaps currently exist
  - Promote common technical **standards** and **interoperability**
- SIF is the Standards and Interoperability Forum
  - facilitate the interchange of information, and the development of recommendations, for **standards** and **interoperability** in GEOSS.
- GEOSS Interoperability Assessment
  - Study conducted by the SIF to assess interoperability in GEOSS for the GEOSS mid-term evaluation assessment.



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# GEOSS Common Infrastructure at work



## GEOSS Common Infrastructure

Main GEO Web Site

### Registries

Components & Services

Standards and Interoperability

Best Practices Wiki

User Requirements

GEO Web Portals

GEOSS Clearinghouse

## Registered Community Resources

### *Client Tier*

Community Portals

Client Applications

### *Business Process Tier*

Community Catalogues

Workflow Management

Alert Servers

Processing Servers

### *Access Tier*

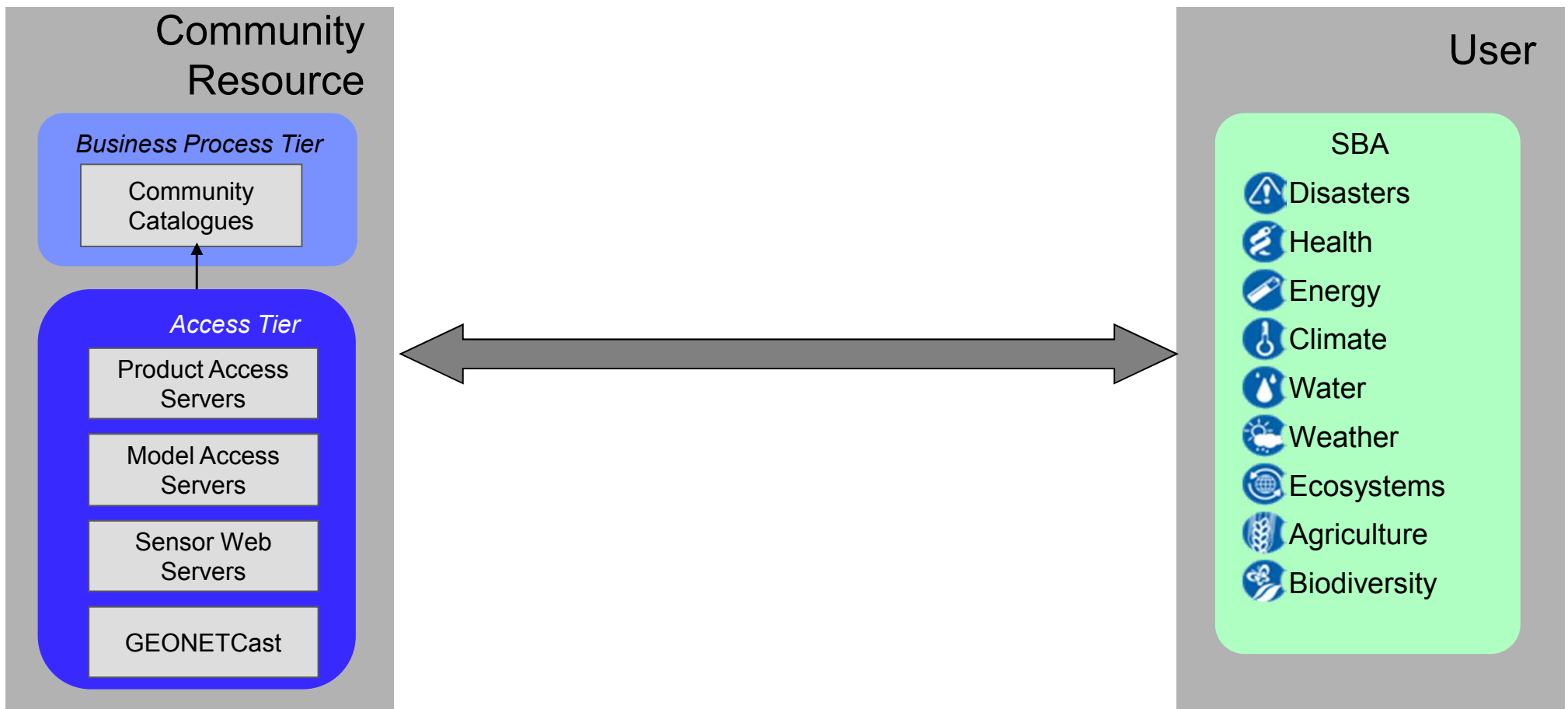
GEONETCast

Product Access Servers

Sensor Web Servers

Model Access Servers

# Before GEOSS



# How GEOSS works today

## Community Resource

### Business Process Tier

Community Catalogues

### Access Tier

Product Access Servers

Model Access Servers

Sensor Web Servers

GEONETCast

## GEOSS Common Infrastructure

Components & Services Registry

Standards and Interoperability Registry

GEOSS Clearinghouse Catalogue

DB

GEO Web Portal

## User

### SBA

-  Disasters
-  Health
-  Energy
-  Climate
-  Water
-  Weather
-  Ecosystems
-  Agriculture
-  Biodiversity

# How CSR and SIR record looks like?

## GEOSS Service Instance Details

Service Basic Information	
Component Id:	<a href="#">urn:uuid:6a0fff42-8319-4723-8dfd-d1e62e6b8b2b</a> (Click to see Component details)
Service Id:	urn:uuid:6c97fbc5-b77e-42d1-8e34-e8cd977fc13f
Name:	Digital Climatic Atlas of the Iberian Peninsula WMS Service
Abbreviation:	ACDPI-WMS
Description:	Map Server of the Digital Climatic Atlas of the Iberian Peninsula whether for its display and querying by location.
Information URL:	<a href="http://www.opengis.uab.es/wms/iberia/english/en_cartografia.htm">http://www.opengis.uab.es/wms/iberia/english/en_cartografia.htm</a>
Interface URL:	<a href="http://www.opengis.uab.es/cgi-bin/iberia/MiraMon5_0.cgi?Request=GetCapabilities&amp;Service=WMS">http://www.opengis.uab.es/cgi-bin/iberia/MiraMon5_0.cgi?Request=GetCapabilities&amp;Service=WMS</a>
Service Contact Information	
Contact Name:	Joan Maso
Contact Email:	joan.maso@uab.es
Service Geographic Extent	
Westernmost:	-9.25
Southernmost:	35.78
Easternmost:	3.47
Northernmost:	43.71
Service Time Period of Information Content	
Begin Date:	Indefinite Start
End Date:	2006-01-01
Referenced GEOSS Classification Standard or Special Arrangement	
Classification Information:	Portrayal and Display Service
Standard (click to view details):	<a href="#">OpenGIS Web Map Service (WMS) 1.3 Implementation Specification</a>
Date and Time of Last Update	
2009-09-10T14:30:59Z	
Approval Status	
✓ APPROVED	

IEEE Standards Association PROJECT SEARCH IEEE-SA MEMBER AREA

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GEOSS Standards Registry

HOME SEARCH THE REGISTER

To provide feedback, access the Feedback Forum under User Support >>> Discussion Forum.

VIEW STANDARD

Free-Form Search:  Search [Advanced Search](#)

VIEW STANDARD

Title: [OpenGIS Web Map Service \(WMS\) 1.3 Implementation Specification](#)

Version: 1.3.0

Name:

Uniform Resource Name (URN): urn:ogc:serviceType:WebMapService:1.3:HTTP

Status: PENDING

Type: Standard

Primary Taxonomy Category: Portrayal and Display Service

Secondary Taxonomy Categories:

Author:

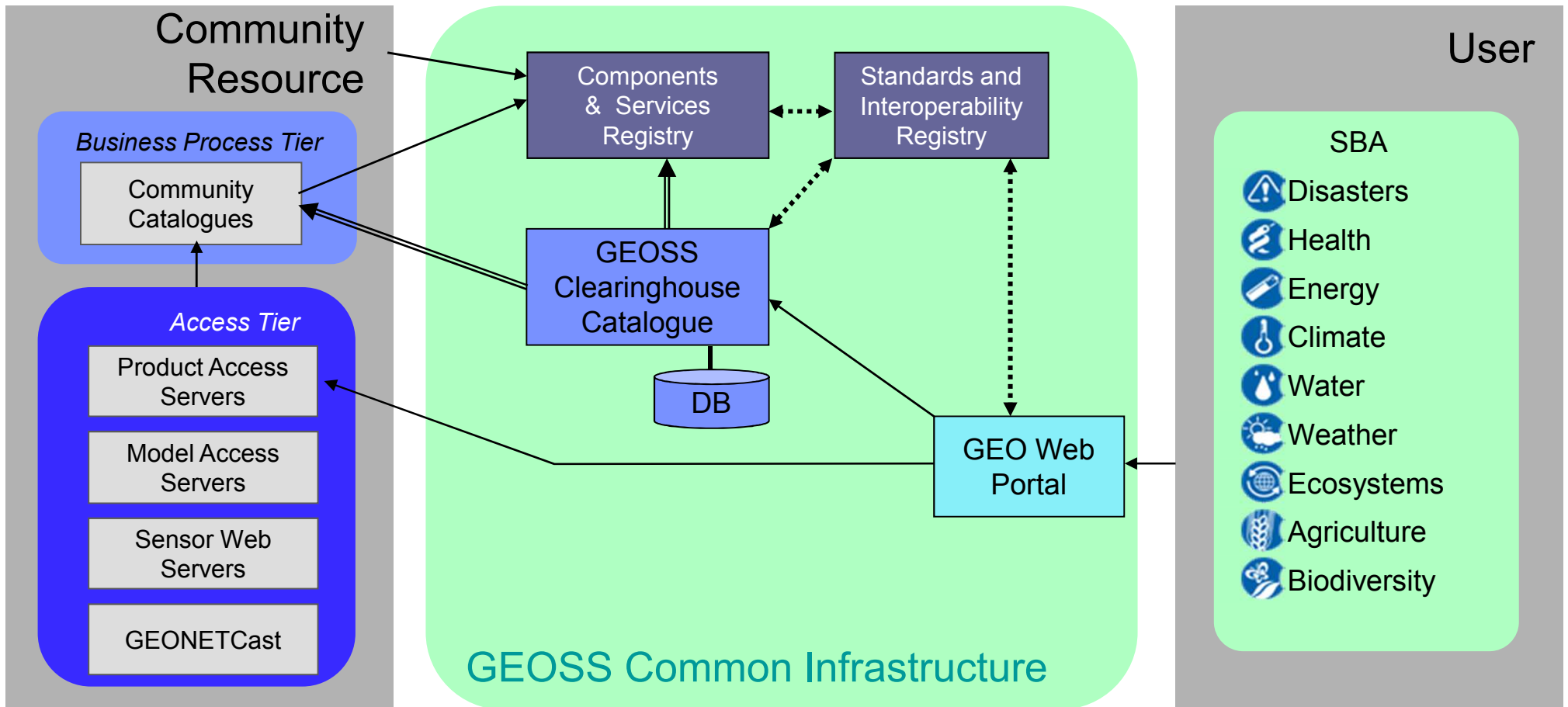
Publisher: OGC

Description:
 

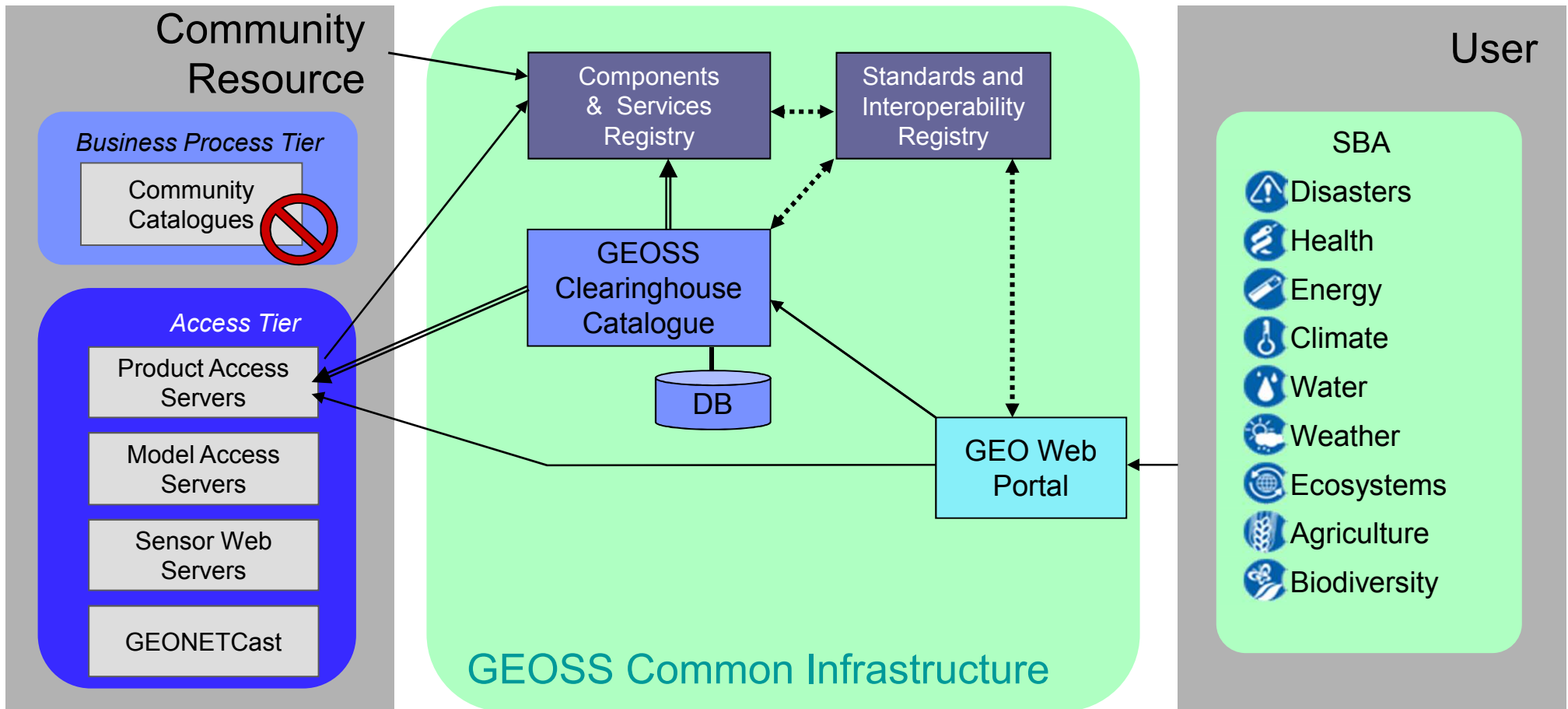
The OpenGIS® Web Map Service (WMS) Implementation Specification provides three operations (GetCapabilities, GetMap, and GetFeatureInfo) in support of the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple remote and heterogeneous sources.



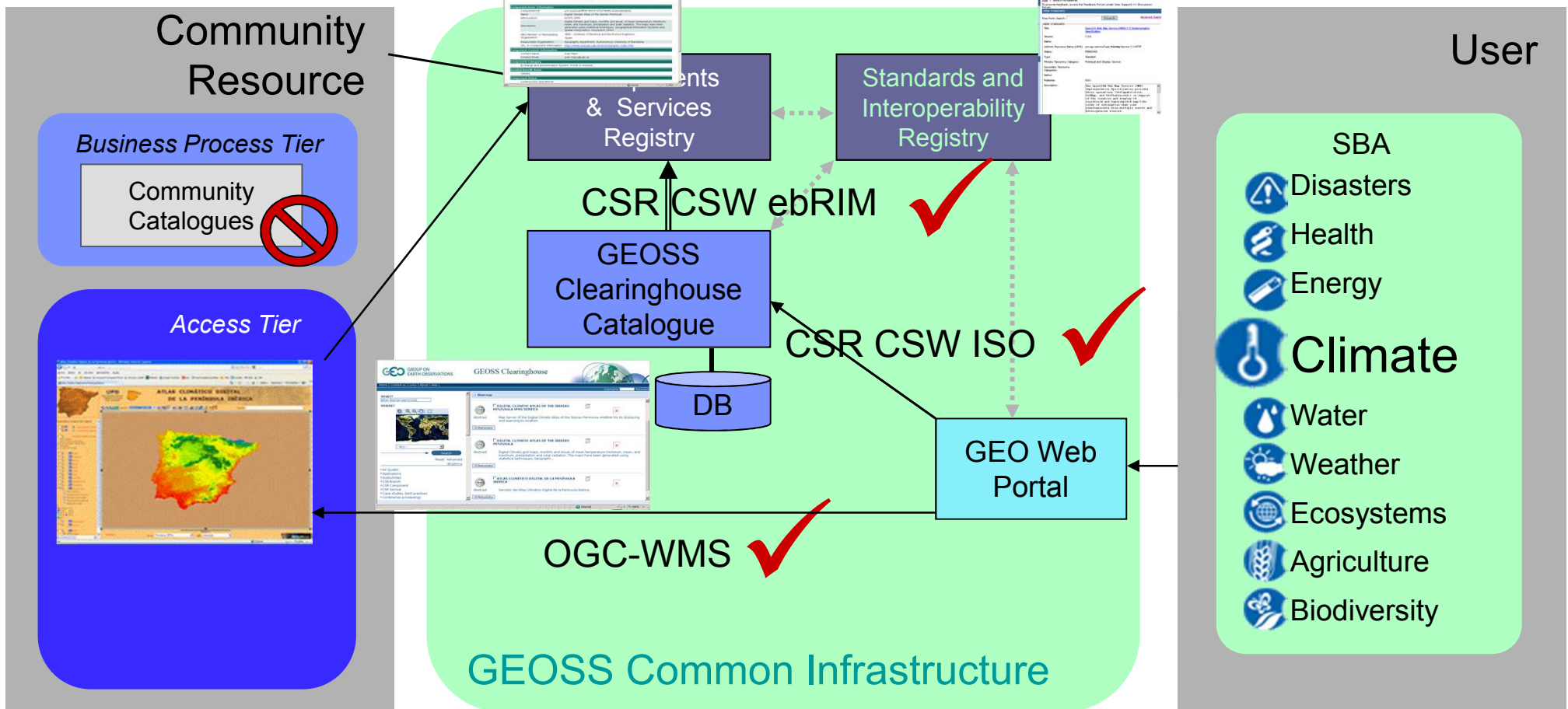
# With Community Catalogue



# Without community catalogue



# Digital Atlas of the Iberian Peninsula Example



# Digital Atlas of the Iberian Peninsula Example

## Components & Services Registry

Component



<http://geossregistries.info:1090/GEOSSCSW202/discovery?SERVICE=CSW&Request=GetRecordByRecordById&Id=2-8319-4723-d1e62e6b8b>

Service



<http://geossregistries.info:1090/GEOSSCSW202/discovery?SERVICE=CSW&Request=GetRecordByRecordById&Id=c5-b77e-42d-e8cd977fc13>

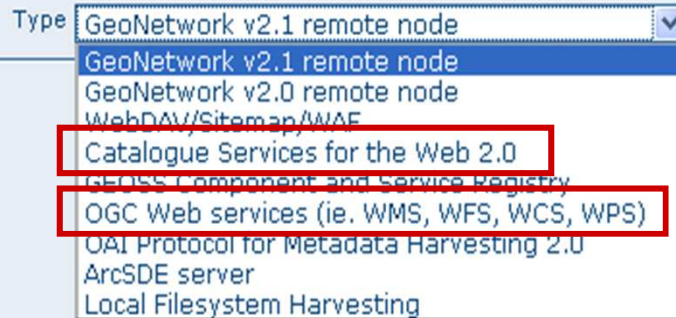
## GEOSS Clearinghouse Catalogue

<http://clearinghouse.cisc.gmu.edu/geonetwork/srv/en/csw?SERVICE=CSW&Request=GetRecordByRecordById&Id=urn:geonetwork.org:component:urn:uuid:6c97f1d-1c211.org/2005/gmd>

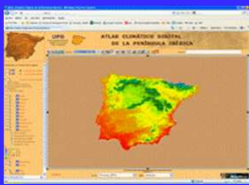
<http://clearinghouse.cisc.gmu.edu/geonetwork/srv/en/csw?SERVICE=CSW&Request=GetRecordByRecordById&Id=urn:geonetwork.org:service:urn:uuid:6c97f1d-1c211.org/2005/gmd>

<http://clearinghouse.cisc.gmu.edu/geonetwork/srv/en/csw?SERVICE=CSW&Request=GetRecordByRecordById&Id=212987ef-7268-4f27-bd85-bfcb0bc49939&ElementSetName=full&outputSchema=http://www.isotc211.org/2005/gmd>

## GCI Harvesting



## Access Tools



[http://www.opengis.uab.es/cgi-bin/iberia/MiraMon5\\_0.cgi?SERVICE=WMS&request=GetCapabilities](http://www.opengis.uab.es/cgi-bin/iberia/MiraMon5_0.cgi?SERVICE=WMS&request=GetCapabilities)

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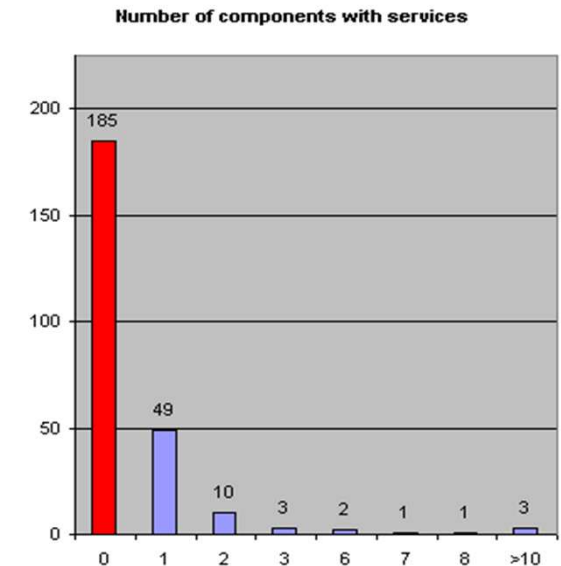
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# GEOSS GCI analysis

at 2010-10-16

# General data from CSR and SIR (1/2)

- Numbers of components, services, and associated standards
  - Approved components in the CSR: 254
  - Approved services in the CSR: 149
  - Standards in the SIR: 171
- Number of catalogs being used compared to all registered services (25/149).
  - OGC catalogs: 20
  - Web access folders: 5
  - Non catalog services: 124
- Number of components (254) and associated services
  - **no services: 185**
  - 1 service: 49
  - 2 services: 10
  - 3 or more services: 7

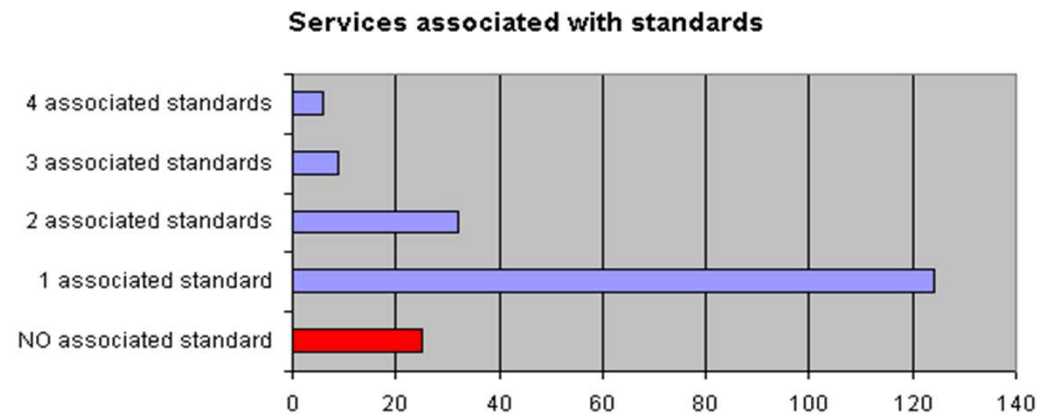


**No services means no standards in the current GCI (no interoperability)**

## General data from CSR and SIR (2/2)

- Number of services (149) and associated standards.
  - **Services with NO associated standard: 25**
  - Services with associated standard: 124
  - Services with 2 associated standards: 32
  - Services with 3 associated standards: 9
  - Services with 4 associated standards: 6

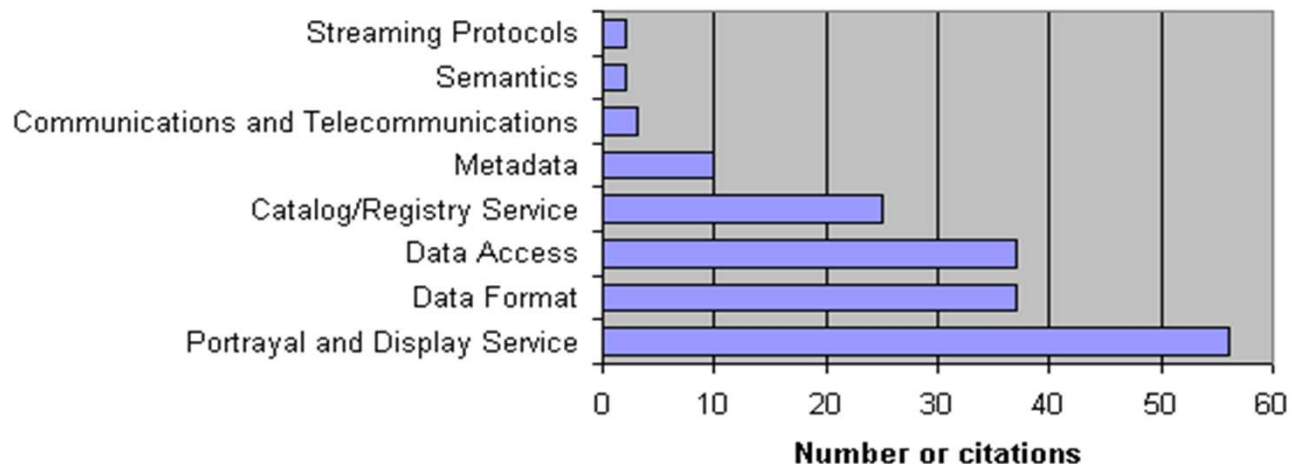
**Services that do not specify the standard they use makes interoperability difficult**



# SIR standards taxonomy

- **Metadata**
- **Data Format**
- **Catalog/Registry Service**
- **Data Access**
- Streaming Protocols
- Modeling, Simulation, or Analytic Processing Service
- Semantics
- **Portrayal and Display Service**
- Data Acquisition
- Engineering Process
- Data Transformation Services
- QA/QC
- Schema
- Archival
- Communications and Telecommunications
- Development Environments and Software Languages
- Technical Documentation

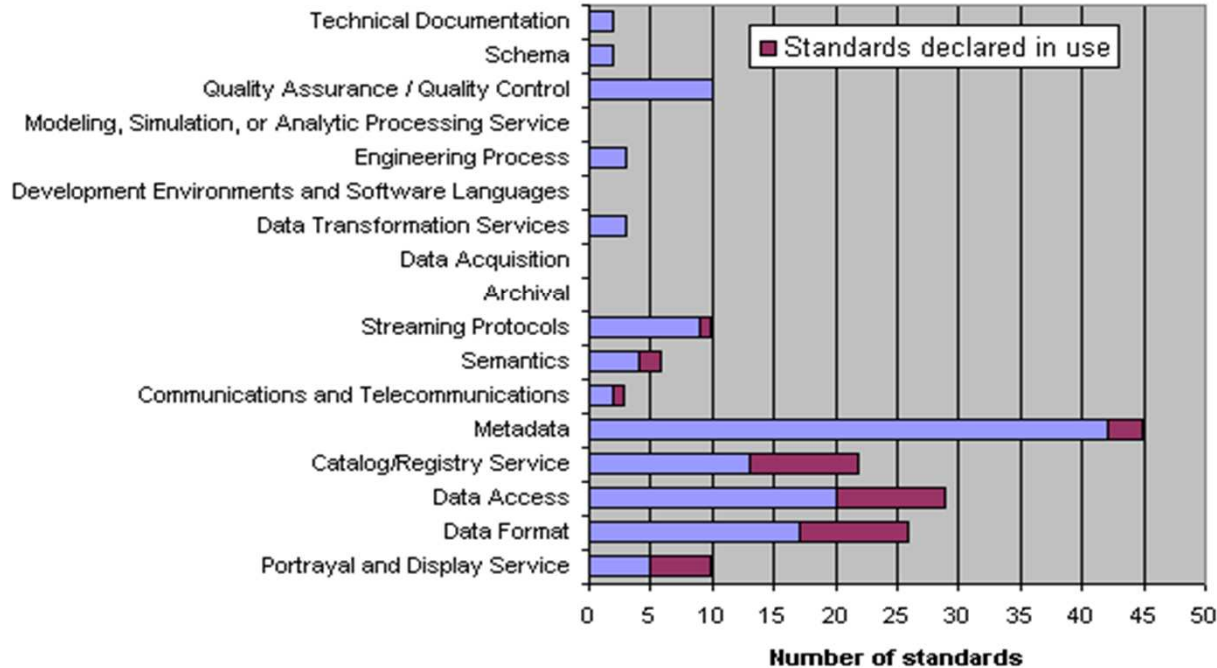
**Number of citations of standards**





# Standards currently in use by taxonomy

Standards in the SIR and declared in CSR



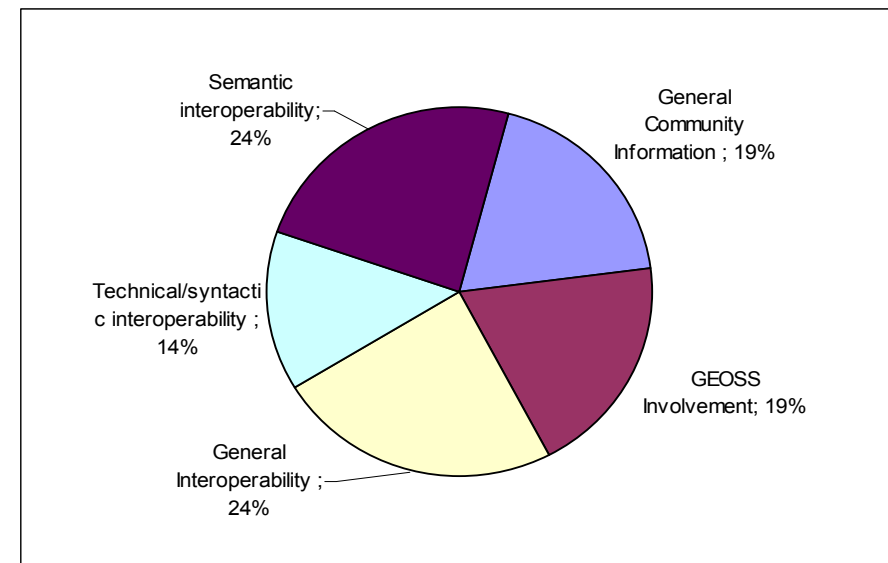
- Complete bars (blue+red) represent the number of the services in the SIR
- The red part represents the ones used
- **Only a few of the registered standards in the SIR are really declared by services in the CSR.**

# Reasons for no service-no standard

- Some contributors do not register their services when the register components
  - 18 *components* contain the word "service" and are obvious *services* that could use *standards*. E.g. Air Quality Community Catalog (CSW)
- Som components use standards by themselves even if do not register standards.
  - At least 45 components are datasets.
    - These datasets exist or are distributed in a particular format but they do not declare *standards* because there are no *services* associated
      - E.g: "IPCC Climate Change Model Maps (KML)"
  - At least 38 components are CLIENTS and PORTALS
    - they use *standards* but since they do not have any "service" associated
      - E.g. "OGC OpenLS Location Utility Service v1.1 Client"
  - At least 18 components are TOOLS that can use *standards* but since they are not "services" they can not declare standards.
    - E.g "OPeNDAP HDF5 Handler"
- There is a need for allowing associating component directly to components
- Standards in the SIR could be classified in 4 categories to allow that:
  - component standards (e.g: . semantic, quality)
  - service standards (e.g: portrayal and data access)
  - both (e.g: data format, schemas)
  - none

# Survey to measuring interoperability

- 65 questions
  - Contact Information
  - General Community Information
  - GEOSS Involvement
  - General Interoperability
  - Technical/syntactic interoperability
  - Semantic interoperability
- We collected the responses and we are analyzing them.



# General Interoperability

- What level of interoperability is your community using within the community?
- What level of interoperability is your community using with GEOSS?
- Please review the following aspects of interoperability and indicate the importance of each in attaining interoperability:
  - Technical/Syntactic interoperability: Common file formats, Common data structures, Agreed-to-exchange protocols, Other
  - Semantic interoperability: Controlled vocabularies to describe data elements, Metadata usage, Ontologies to enable reasoning, Others
  - Legal interoperability: Common and agreed to data access and licensing restrictions Others
- What is your community's state of success, and rate of evolution, with regards to interoperability compared to your community's original requirements/objectives?
- What is your community's state of success, and rate of evolution, with regards to interoperability compared to that of GEOSS?
- What types of data are you not able to share and why?
- Are your current systems using web services to share data?
- Does your community use its own registries for interoperability within your community? If so, please describe.

# Technical/syntactic interoperability

- Have you achieved technical/syntactic interoperability within your community?
- How have you measured technical/syntactic interoperability success or failure?
- What is the extent of technical/syntactic interoperability achieved in your community?
- Did you exploit GEOSS to achieve technical/syntactic interoperability?
- What do you consider the biggest challenge in reaching technical/syntactic interoperability?
- Has your community achieved the capability to integrate data from various systems within the community?
- Has your community achieved the capability to integrate data from various systems outside the community?
- Is sharing data between systems outside of your community difficult?
- Has the community experienced any impediments in achieving community technical/syntactic interoperability?
- What are the main factors for impeding community interoperability ?
- Has the community experienced any impediments in achieving GEOSS technical/syntactic interoperability?
- What are the main factors for impeding GEOSS interoperability?

# Semantic interoperability

- Have you achieved semantic interoperability within your community?
- How have you measured semantic interoperability success or failure?
- What is the extent of semantic interoperability?
- Did you exploit GEOSS to achieve semantic interoperability?
- What do you consider the biggest challenge in reaching semantic interoperability?
- Does the community use any common lexicons, taxonomies, or ontologies?
- Does the community maintain the lexicons, taxonomies, or ontologies used?
- Are any IT standards being used to achieve semantic interoperability? If so, can you list them (RDF, OWL, SPARQL, GML, other W3C Semantic Web standards, etc.)?
- Does your community achieve semantic interoperability by using well-known data types from community-based data models?
- In terms of catalogue services, what metadata fields do you make queryable/searchable?

# Conclusions

- Sorry but I do not have results from the survey yet. It will be quite interesting.
- Some interoperability problems derive from an incorrect use of the CSR.
  - Most of the components do not have services associated with them
    - The critical ones are those that actually have services which have not been registered
  - CSR is incomplete in some aspects.
    - Catalog services do not declare the corresponding metadata standards used
    - Web Feature Services are not associated with GML
    - Many Web Coverage Services are not associated with data format standards
    - Many services support more than one version of the same standard but people only declare one.
- Some interoperability problems derive from the design of the CSR/SIR database.
  - Apart from Portrayal, data format, data access and catalog/metadata standards other categories are rarely used.
    - Standards to access the real data are rarely cited. This is not a good situation because GEOSS users are looking for real data.
    - Need to utilize other categories, such as semantics, to improve interoperability.

# Suggestions to mitigate the problems shown.

- Define standard dependencies in the SIR. If a service is declared as WFS, GML will be automatically associated.
  - This is more of a CSR issue to help registration and mitigate interoperability issues.
  - The SIF/ISWG should gather these relationships and provide to the CSR.
- Allow components to be associated with service independent standards (semantic, schema and quality control can be considered intrinsic to the component and common to services)
- Autodetection of standards during the CSR registrations process (if somebody is registering a service called, "My data web map service", it is obvious that is a WMS or some sort. if somebody is providing a URL that says "http://myserver.com/mydata?service=WCS, it is obvious that is a WCS) or directly by testing the URL capabilities.
- Define generic standards (for example, version independent) that might be used when the person registering the service do not know exactly the version.
- Reduce the list of the SIR by reconsidering the standards that are never used.
- Provide a way of finding in the CSR the most used standards



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Thank you!

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