

ESA Summer School 2012

Week 1: August 3

Cyberinfrastructures in Earth Sciences

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Cyber(e)Infrastructure

- .. Research environment for data acquisition, data storage, data integration, data mining, other computing and processing services, the scope of a single
- Technological and scientific efforts efficiently connecting people with the goal of scientific theories and (Wikipedia)

Earth System
Sciences (ESS)
to address
Global Change
challenges

AuScope Mission Statement

(A national Earth Science Infrastructure Program)

*“Many of these problems can only be solved on a **national, if not global scale**. No single researcher, research institution, discipline or jurisdiction can provide the solutions. We increasingly need to embrace **e-Research techniques** and use the internet not only to access nationally distributed datasets, instruments and compute infrastructure, but also to build online, ‘**virtual**’ communities of **globally dispersed researchers**.“*



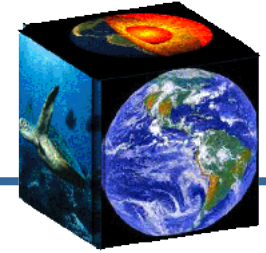
AuScope

An organisation for a national earth science infrastructure program

www.auscope.org.au/



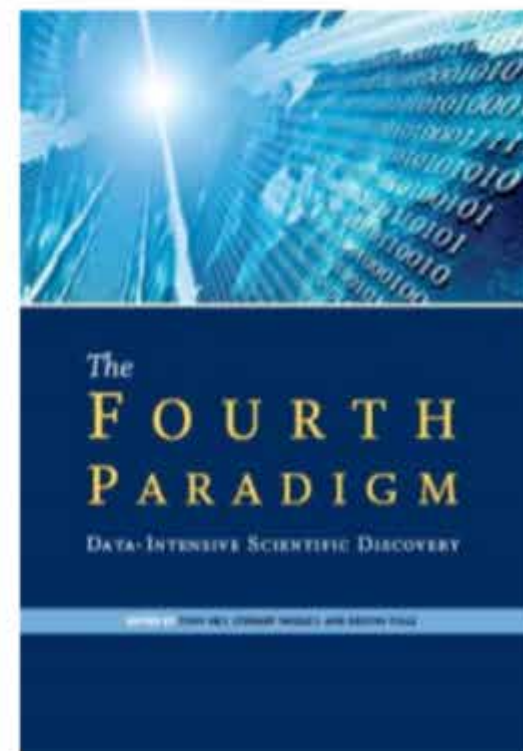
US NSF EarthCube



- ... recognize the multifaceted challenges of modern, data-intensive science and education and envision an environment where low adoption thresholds and new capabilities act together to greatly increase the productivity and capability of researchers and educators working at the frontiers of Earth system science ...

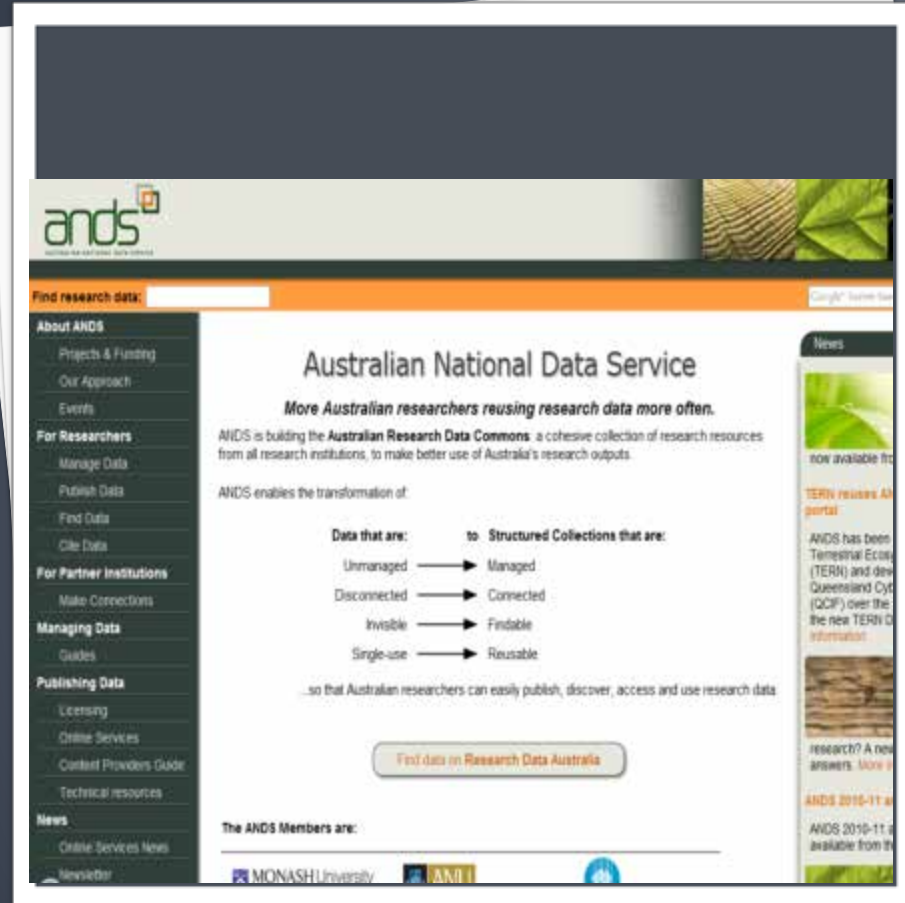
<http://www.nsf.gov/geo/earthcube/>

Dealing with Data



<http://www.sciencemag.org/site/special/data/>

<http://www.economist.com/node/15579717>



AUSTRALIAN NATIONAL DATA SERVICE (ANDS) -

<http://www.ands.org.au/>



AuScope

the organisation for a national earth science infrastructure program

[AuScope](#) [Infrastructure Access](#) [NCRIS](#) [EIF](#) [Communications](#) [Contacts](#) [Gallery](#) [Menu](#)



AUSCOPE -

<http://auscope.org.au>

ONEGEOLOGY

AND

ONEGEOLOGY- EUROPE

<http://www.onegeology.org/>
<http://www.onegeology-europe.eu>

The screenshot shows the OneGeology website homepage. At the top, the OneGeology logo is on the left, and the tagline "Making Geological Map Data for the Earth Accessible" is on the right. Below the tagline, there are links for "Home" and a list of languages: العربية, 中文, English, Français, Português, Español. The main content area is divided into several sections. On the left, there is a sidebar with a list of links: "What is OneGeology", "Participants", "Organisation", "Getting involved", "Technical overview", "Technical detail for participants", "Meetings", "Portal", "OneGeology eXtra", and "Press information". The main content area starts with a "Welcome to OneGeology" section, which includes a globe graphic and text about the initiative's goal of creating a dynamic geological map data of the world. Below this is a "Happy 5th birthday OneGeology!" section, celebrating the 5th anniversary in March 2012. To the right of the welcome section, there is a "Monthly news" section with a small image of a geological map. Below that is a "Geodiversity" section with a world map. Further down, there is an "Accreditation Scheme" section with a row of circular icons. At the bottom, there is a "OneGeology at the 34th International Geological Congress" section, mentioning the event in Brisbane, Australia, from 5 to 10th August 2012. The footer includes social media links for Delicious, Digg, and Facebook, and a "Bookmark with:" section. There are also logos for the 34th International Geological Congress and the OneGeology logo.

What is OneGeology +
Participants +
Organisation +
Getting involved +
Technical overview +
Technical detail for participants +
Meetings +
Portal +
OneGeology eXtra +
Press information

Welcome to OneGeology
OneGeology is an international initiative of the geological surveys of the world. This ground-breaking project was launched in 2007 and contributed to the 'International Year of Planet Earth', becoming one of their flagship projects.
Thanks to the enthusiasm and support of participating nations, the initiative has progressed rapidly towards its target - creating **dynamic geological map data of the world**, available to everyone via the web. We invite you to explore the website and view the maps in the **OneGeology Portal**.
Fill in our **online form** to be kept informed of the OneGeology initiative progress and receive our regular newsletters.
portal.OneGeology.org

Happy 5th birthday OneGeology!
OneGeology celebrated its 5th anniversary in March 2012. The initial start-up workshop was held in Brighton, UK on March 12-16, 2007. Thank you to everyone who has supported the OneGeology initiative over this time.

OneGeology at the 34th International Geological Congress
Brisbane, Australia,
5 - 10th August 2012
OneGeology will be present

Monthly news
OneGeology at the 34th International Geological Congress
Geodiversity
View Geoparks and World Heritage sites linked to geology on a Google map.
Accreditation Scheme
View scheme details and how to apply to be accredited
Blogger twitter



USGIN

United States Geoscience Information Network

[Home](#) [About USGIN](#) [Who Uses USGIN?](#) [Accessing USGIN](#) [USGIN Specifications](#) [Tutorials](#) [Glossary](#) [Administration](#)



Navigation

- [Document Repository](#)
- [Laboratory](#)
- [Metadata Catalog](#)
- [Metadata Wizard](#)
- [What do these links mean?](#)

USGIN OneGeology US Map Services Workshop

USGIN OneGeology US Map Services Workshop - May 3-4, 2012

The goal of this workshop is deploy new GeoSciML portrayal map services as part of a USGIN-sponsored OneGeology-United States collection of services. We invite participants from the State Geological Surveys and US Geological Survey who have geologic map data sets they are ready to publish as web map and feature services. For more information you can [view or download the attached document](#) or click "Read more" to get all the details.

[Read more](#)

Welcome to the United States Geoscience Information Network Portal

This website provides a basic introduction to the United States Geoscience Information Network (USGIN) initiative. USGIN is:

- a conceptual framework for sharing geoscience data
- a distributed data-sharing network
- a collection of [open-source](#) applications, standards, procedures, and [protocols](#) for sharing geoscience

U.S. GEOSCIENCE INFORMATION NETWORK (USGIN) –

<http://usgin.org>



INSPIRE
Infrastructure for Spatial Information in the European Community

European Commission > INSPIRE >

About

- [Home](#)
- [About INSPIRE](#)
- [Legislation](#)
- [History](#)
- [Who's who in INSPIRE](#)
- [INSPIRE library](#)
- [INSPIRE Conferences](#)

Implementation

- [Roadmap](#)
- [Monitoring and Reporting](#)
- [IOC](#)
- [INSPIRE GeoPortal](#)

Adoption

- [Roadmap](#)
- [Implementing Rules](#)
- [Monitoring and Reporting](#)

INSPIRE DIRECTIVE

In Europe a major recent development has been the entering in force of the INSPIRE Directive in May 2007, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.

INSPIRE is based on the infrastructures for spatial information established and operated by the 27 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through implementing rules. This makes INSPIRE a unique example of a legislative "regional" approach.

Legislation

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) was published in the official Journal on the 29th April 2007. The INSPIRE Directive entered into force on the 19th May 2007.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IRs) are adopted in a number of specific areas (Metadata, Data Specification, Network Services, Data and Service Sharing and Monitoring and Reporting). These IRs are adopted as Commission Decisions and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee of representatives of the Member States and chaired by a representative of the Commission (this is known as the Committee of the Regions).

- Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) 14.03.2007
- INSPIRE Metadata Regulation 03.12.2008
- Commission Decision regarding INSPIRE monitoring and reporting 05.06.2009
- Commission Regulation (EC) No 976/2009 of 18 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services 19.10.2009
- Corrigendum to INSPIRE Metadata Regulation 15.12.2009
- Regulation on INSPIRE Data and Service Sharing 29.03.2010

EU INSPIRE -

<http://inspire.jrc.ec.europa.eu/>

[Overview](#)[Services](#)[Projects](#)[Library](#)[Events](#)[News](#)[Newsletters](#)[Links](#)

GMES (Global Monitoring for Environment and Security) is the European Programme for the establishment of a European capacity for Earth Observation.

This website is dedicated to the EU-funded R&D activities that support the implementation of the GMES programme.

The views expressed on this website are those of the authors and do not necessarily represent those of the European Commission or of the European Space Agency. Official information on GMES is available on the GMES institutional portal.

Newsletter Subscription

Your email



WHAT'S NEW

10 Apr 2012
GMES Mobile App
ESA is inviting 20 4
"App Developer" La
June 2012

02 Apr 2012
FP7

2013 FP7 Work Pro
available

13 Mar 2012
GMES Conference
"GMES in Action" 4
June 2012 in Copernicus

09 Mar 2012
Air Quality

cta:Active Marsches
communication idea

FOCUS EVENT

Sentinel-2 Prepa
23 April 2012 - 27
Frascati, Italy

EU GLOBAL MONITORING FOR ENVIRONMENT AND SECURITY: GMES -

<http://www.gmes.info/>

EU SHARED ENVIRONMENTAL INFORMATION SYSTEM: SEIS -

<http://ec.europa.eu/environment/seis/index.htm>

A to Z | About this site | Contact | FAQ | Sitemap | What's new? | Search | U

Sei passato a schermo intero. [Esci da schermo intero \(F11\)](#)

ENVIRONMENT

European Commission

European Commission > Environment > SEIS

Home | Who's who | Policies | Integration | Funding | Law | Resources | News & Developments

SEIS
Good decisions need the right information at the right time

SEIS
Shared environmental information system

Introduction	<h2>Shared Environmental Information System</h2> <p>Experiences of forest fires, floods and droughts show how much timely environmental information is an emergency. Tackling today's environmental challenges such as adapting to climate change, managing natural resources in a sustainable manner, protecting biodiversity, preventing and managing environmental floods, forest fires, and water scarcity depend on the assessment of data from a variety of sectors.</p> <p>This is why it is absolutely vital for the European Union to have an information system based on communication technology (ICT) that will provide decision-makers at all levels (local to European) data, thus allowing them to make immediate and life-saving decisions.</p> <p>As Environment Commissioner Stavros Dimas stated at the launch of the Communication on SEIS:</p>
What is the Shared Environmental Information System?	
Why is SEIS needed?	
What benefits will SEIS bring?	
SEIS and e-Government	
Funding opportunities	
Real life e-Environment examples	
Citizen's right to access environmental information	



[Home](#) • [About GEO & GEOSS](#) • [Communications](#) • [GEO Work Plan](#) • [GEO Community](#) • [Meetings & Events](#) • [Documents](#) • [Contact](#)

What is GEOSS?: The Global Earth Observation System of Systems

GEO new

Announcing the G Office

The European CO₂ GEOCARBON project G&O Carbon Office will support the G&O Observation and Analysis strengthening co-ordinating and engaging more countries to provide information on or to the G&O.

[Task 21-22 on GEOCARBON website](#)

Prof. Antonio Rumbal

Announcing Earth
Applications Work
NPP

A workshop on the Earth observation science (EOS) (National Partnership) mission 21-22 June 2012 in the DC area. The workshop Earth science communities on EOS applications of data (with an emphasis radiometer known provide an opportu-

INFRASTRUCTURE

 Academia.edu

Figure 1. The effect of the concentration of the solution on the adsorption of the dye. The concentration of the solution was 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 15.0, 20.0, 30.0, 40.0, 50.0, 60.0, 70.0, 80.0, 90.0, 100.0, 150.0, 200.0, 300.0, 400.0, 500.0, 600.0, 700.0, 800.0, 900.0, 1000.0, 1500.0, 2000.0, 3000.0, 4000.0, 5000.0, 6000.0, 7000.0, 8000.0, 9000.0, 10000.0, 15000.0, 20000.0, 30000.0, 40000.0, 50000.0, 60000.0, 70000.0, 80000.0, 90000.0, 100000.0, 150000.0, 200000.0, 300000.0, 400000.0, 500000.0, 600000.0, 700000.0, 800000.0, 900000.0, 1000000.0, 1500000.0, 2000000.0, 3000000.0, 4000000.0, 5000000.0, 6000000.0, 7000000.0, 8000000.0, 9000000.0, 10000000.0, 15000000.0, 20000000.0, 30000000.0, 40000000.0, 50000000.0, 60000000.0, 70000000.0, 80000000.0, 90000000.0, 100000000.0, 150000000.0, 200000000.0, 300000000.0, 400000000.0, 500000000.0, 600000000.0, 700000000.0, 800000000.0, 900000000.0, 1000000000.0, 1500000000.0, 2000000000.0, 3000000000.0, 4000000000.0, 5000000000.0, 6000000000.0, 7000000000.0, 8000000000.0, 9000000000.0, 10000000000.0, 15000000000.0, 20000000000.0, 30000000000.0, 40000000000.0, 50000000000.0, 60000000000.0, 70000000000.0, 80000000000.0, 90000000000.0, 100000000000.0, 150000000000.0, 200000000000.0, 300000000000.0, 400000000000.0, 500000000000.0, 600000000000.0, 700000000000.0, 800000000000.0, 900000000000.0, 1000000000000.0, 1500000000000.0, 2000000000000.0, 3000000000000.0, 4000000000000.0, 5000000000000.0, 6000000000000.0, 7000000000000.0, 8000000000000.0, 9000000000000.0, 10000000000000.0, 15000000000000.0, 20000000000000.0, 30000000000000.0, 40000000000000.0, 50000000000000.0, 60000000000000.0, 70000000000000.0, 80000000000000.0, 90000000000000.0, 100000000000000.0, 150000000000000.0, 200000000000000.0, 300000000000000.0, 400000000000000.0, 500000000000000.0, 600000000000000.0, 700000000000000.0, 800000000000000.0, 900000000000000.0, 1000000000000000.0, 1500000000000000.0, 2000000000000000.0, 3000000000000000.0, 4000000000000000.0, 5000000000000000.0, 6000000000000000.0, 7000000000000000.0, 8000000000000000.0, 9000000000000000.0, 10000000000000000.0, 15000000000000000.0, 20000000000000000.0, 30000000000000000.0, 40000000000000000.0, 50000000000000000.0, 60000000000000000.0, 70000000000000000.0, 80000000000000000.0, 90000000000000000.0, 100000000000000000.0, 150000000000000000.0, 200000000000000000.0, 300000000000000000.0, 400000000000000000.0, 500000000000000000.0, 600000000000000000.0, 700000000000000000.0, 800000000000000000.0, 900000000000000000.0, 1000000000000000000.0, 1500000000000000000.0, 2000000000000000000.0, 3000000000000000000.0, 4000000000000000000.0, 5000000000000000000.0, 6000000000000000000.0, 7000000000000000000.0, 8000000000000000000.0, 9000000000000000000.0, 10000000000000000000.0, 15000000000000000000.0, 20000000000000000000.0, 30000000000000000000.0, 40000000000000000000.0, 50000000000000000000.0, 60000000000000000000.0, 70000000000000000000.0, 80000000000000000000.0, 90000000000000000000.0, 100000000000000000000.0, 150000000000000000000.0, 200000000000000000000.0, 300000000000000000000.0, 400000000000000000000.0, 500000000000000000000.0, 600000000000000000000.0, 700000000000000000000.0, 800000000000000000000.0, 900000000000000000000.0, 1000000000000000000000.0, 1500000000000000000000.0, 2000000000000000000000.0, 3000000000000000000000.0, 4000000000000000000000.0, 5000000000000000000000.0, 6000000000000000000000.0, 7000000000000000000000.0, 8000000000000000000000.0, 9000000000000000000000.0, 10000000000000000000000.0, 15000000000000000000000.0, 20000000000000000000000.0, 30000000000000000000000.0, 40000000000000000000000.0, 50000000000000000000000.0, 60000000000000000000000.0, 70000000000000000000000.0, 80000000000000000000000.0, 90000000000000000000000.0, 100000000000000000000000.0, 150000000000000000000000.0, 200000000000000000000000.0, 300000000000000000000000.0, 400000000000000000000000.0, 500000000000000000000000.0, 600000000000000000000000.0, 700000000000000000000000.0, 800000000000000000000000.0, 900000000000000000000000.0, 10000000

Management

INSTITUTIONS AND DEVELOPMENT

21 Capacity

11. Making

 Science & Technology

400 2000

Engagement

INFORMATION FOR SOCIETY

10

 [Chapters](#) health

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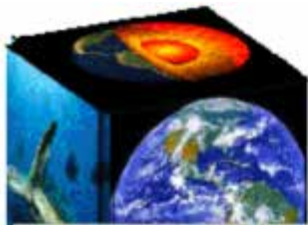
GROUP ON
EARTH OBSERVATIONS

GEOSS COMMON INFRASTRUCTURE -



UNEP-LIVE

<http://www.uneplive.org/uneplive/catalog/maps/home.page>



EarthCube

To transform the conduct of research in geosciences by supporting community-based cyberinfrastructure to integrate data and information for knowledge management across the Geosciences.

EARTHCUBE



<http://earthcube.ning.com/>



EYE ON EARTH

<http://www.eyeonearth.org>



Cyber(e)infrastructure Objectives

- leverage and **share resources**, and developments
- Facilitate **multi** and **cross-disciplinarity** (e.g. ESS)
- **support new applications/tool** development and existing application/tool use
- **enhance knowledge** transfer not only across the community, but into the domain sciences
- **lower existing entry barriers** for users and data producers
- **facilitate and enhance emerging technologies** and methodologies
- **support** the promulgation and institutionalization of agreed-upon **standards, protocols, and practice**

How will CC affect infection rate of dengue fever in Vietnam?



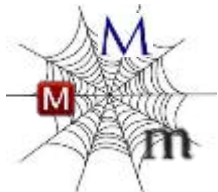
How will CC affect infection rate of dengue fever in Vietnam?

Elements ...

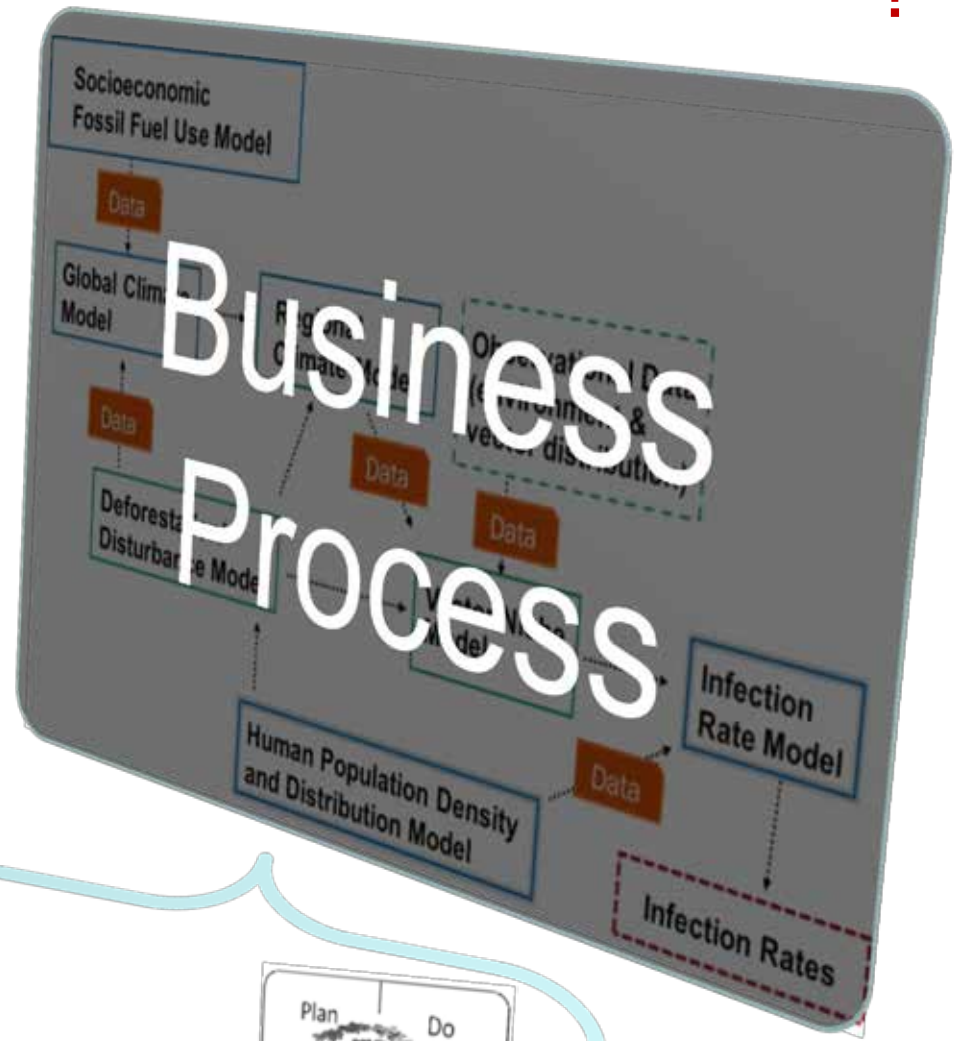
Data

Model

Link/Interface



? How will CC affect infection rate of dengue fever in Vietnam? ?



Vocabularies

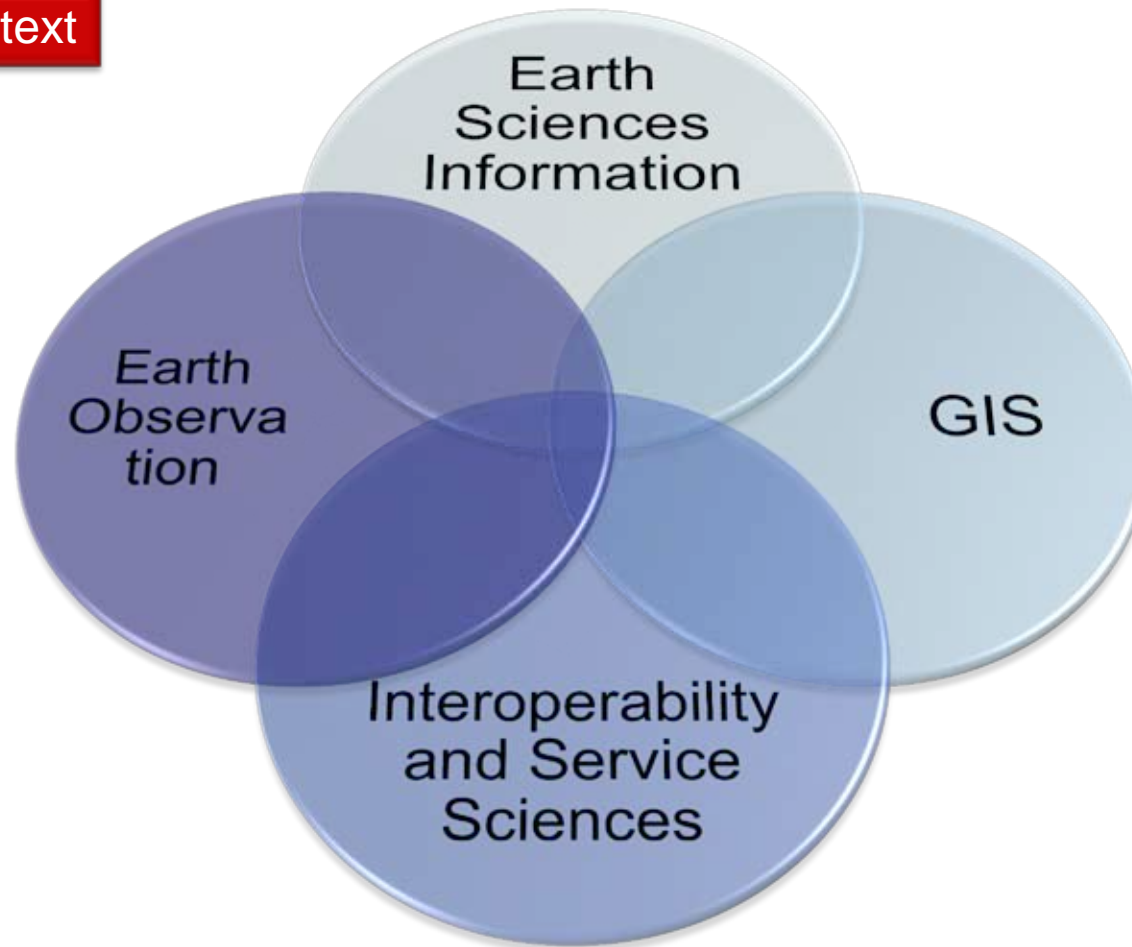


Knowledge Base

Let's go in order ...

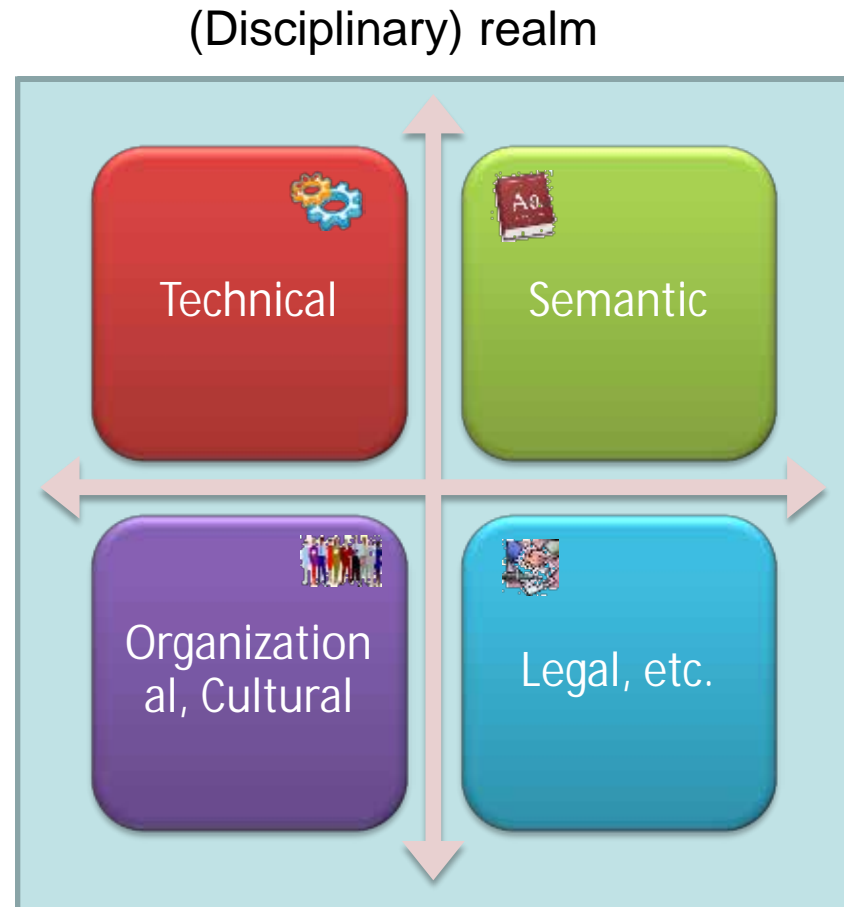
Earth Sciences cyber(e)-Infrastructure

Context



(Disciplinary) Interoperability types

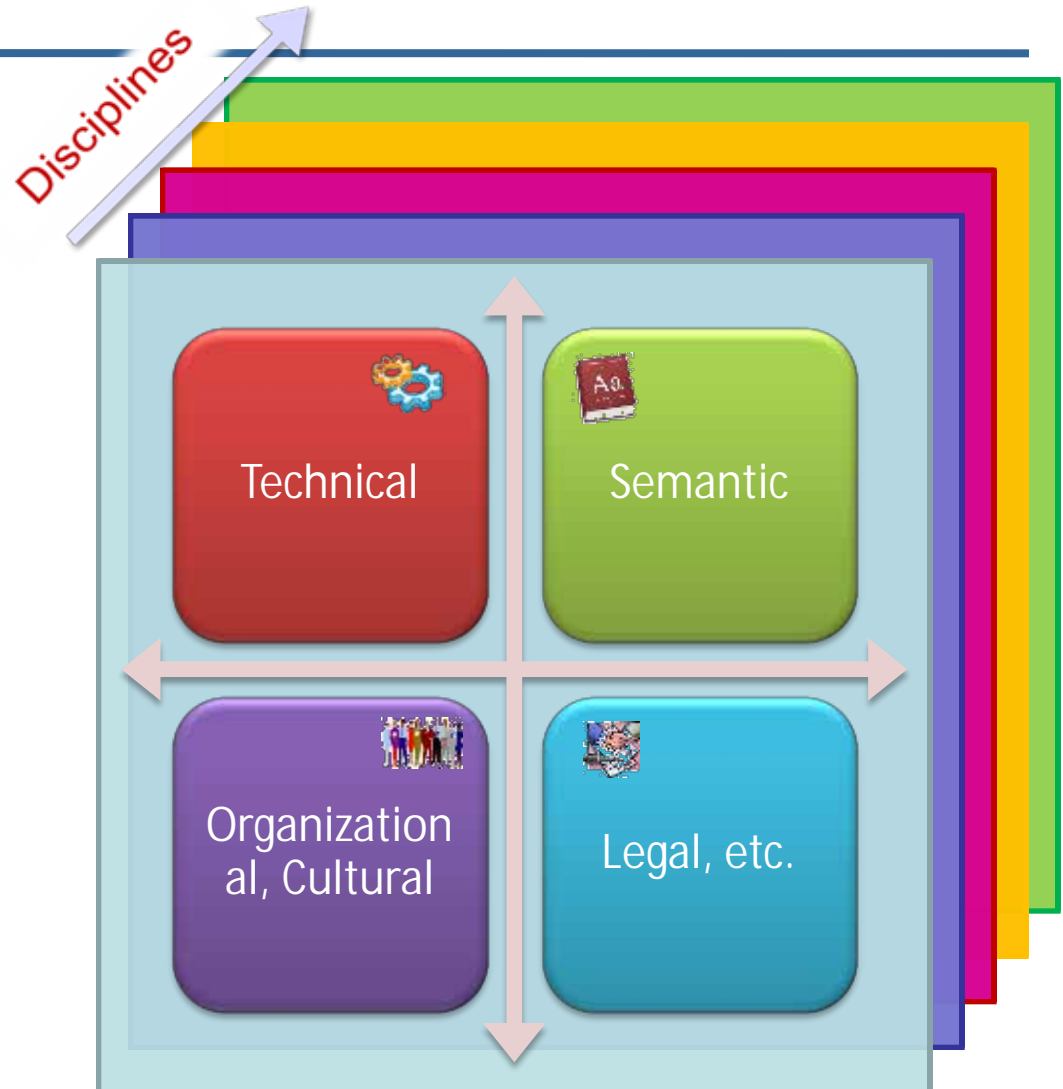
- Cyber(e)-
Infrastructures must
address
Interoperability
 - Technical
 - Semantic
 - Organizational
 - Cultural,
 - Legal,
 - ..



Multi-disciplinary Interoperability

- Address **Heterogeneity across (disciplinary) realms**

- Technical
- Semantic
- Organizational
- Cultural,
- Legal,
- ..



Interoperability for people



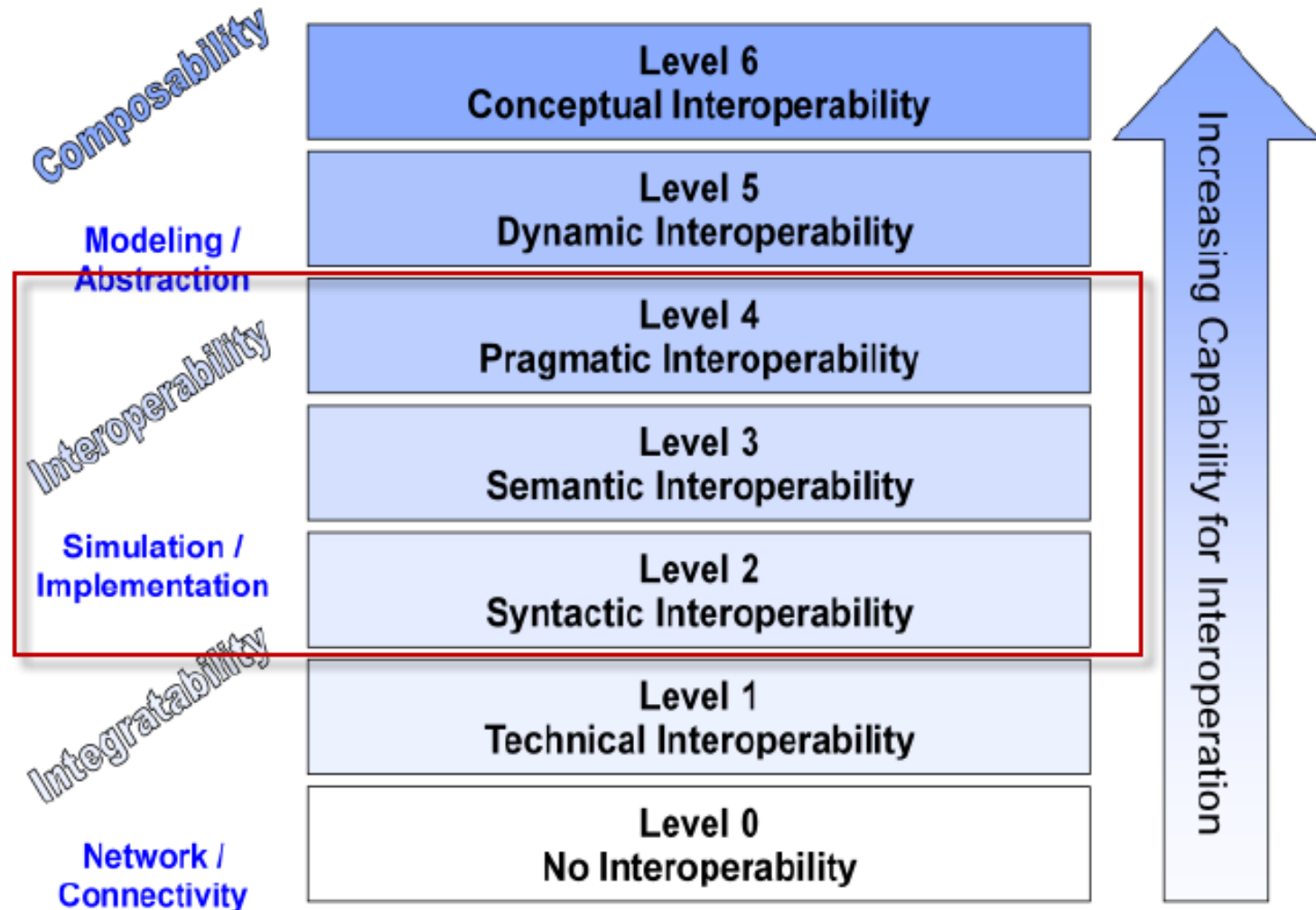
Increased coordination of development activities (technical, organizational, social) among leaders and practitioners in national and international efforts across the geosciences to foster commonalities across disparate networks.

"Before you make the data and systems interoperable you have to make the people interoperable"

[Ian Jackson, OneGeology]



Interoperability levels



[source Ilya Zalavsky, UCSD]

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Earth Sciences

- Fields of science (**disciplines**)
 - **Geology**
 - mineralogy and petrology, geochemistry, geomorphology, paleontology, stratigraphy, structural geology, engineering geology, sedimentology
 - **Physical geography**
 - geomorphology, oceanography
 - **Geophysics and geodesy**
 - **Soil science**
 - edaphology, pedology
 - **Oceanography**
 - physical, chemical, biological
 - **Hydrology**
 - limnology
 - **Glaciology**
 - **Atmospheric sciences**
 - meteorology, climatology, atmospheric chemistry, atmospheric physics.

Disciplinary
Communities

Earth Sciences (geosciences)

- Basic earth science **topics**

Atmosphere

- Atmospheric chemistry
- Climatology
- Meteorology
 - Hydrometeorology
- Paleoclimatology

Biosphere

- Biogeography
- Paleontology
 - Palynology
 - Micropaleontology
- Geomicrobiology
- Geoarchaeology

Hydrosphere

- Hydrology
 - Geohydrology
- Limnology (freshwater science)
- Oceanography (marine science)
 - Chemical oceanography
 - Physical oceanography
 - Biological oceanography (marine biology)
 - Geological oceanography (marine geology)

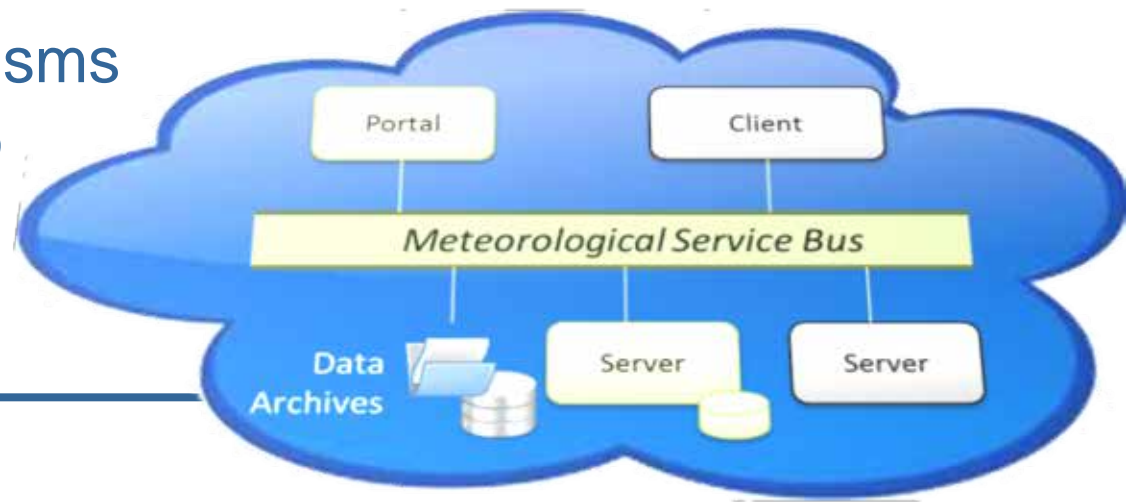
Lithosphere or geosphere

- Geology
 - Economic geology
 - Engineering geology
 - Environmental geology
 - Historical geology
 - Quaternary geology
 - Planetary geology
 - Sedimentology
 - Stratigraphy
 - Structural geology
- Geography
 - Physical geography
- Geochemistry
- Geomorphology
- Geophysics
 - Geochronology
 - Geodynamics (see a)
 - Geomagnetism
 - Gravimetry (also part
 - Seismology
- Glaciology
- Hydrogeology
- Mineralogy
 - Crystallography
 - Gemology
- Petrology
- Speleology
- Volcanology

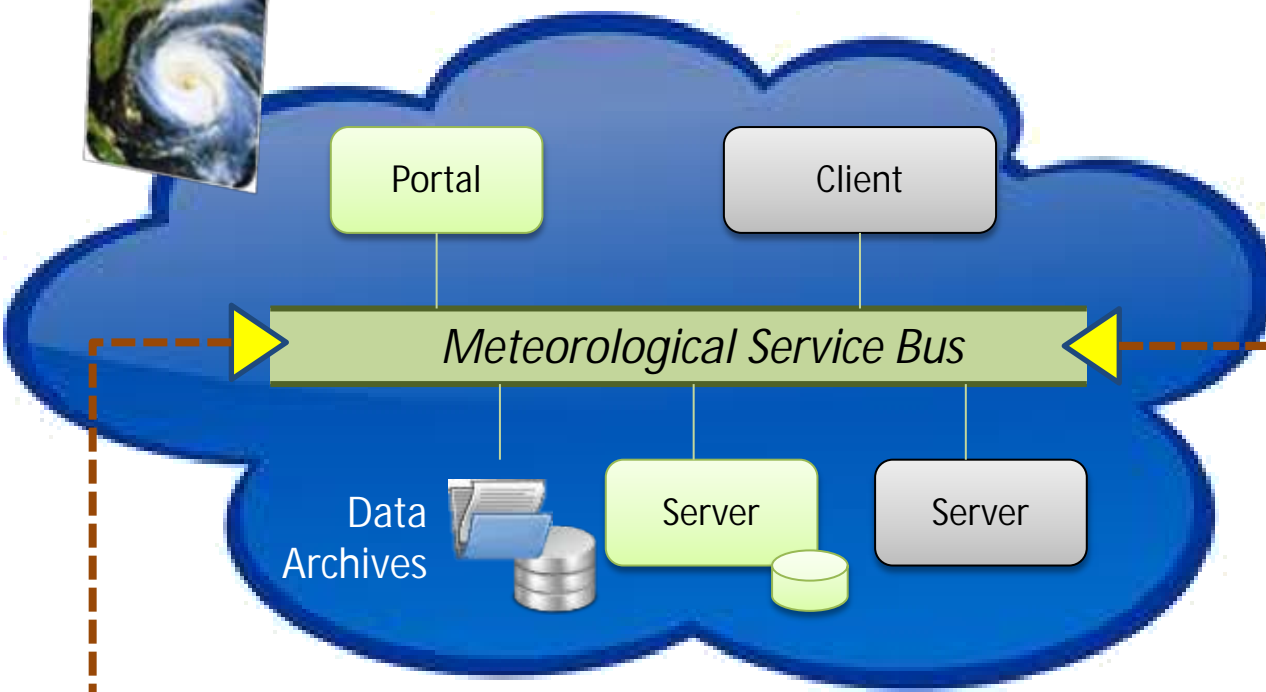
Community of
Practices (CoP)

Disciplinary (CoP) cyber(e)Infrastructures

- Client-Server (C-S) architectures
- Pursue Disciplinary interoperability by pushing standards
 - Open Geospatial Consortium (OGC)
 - ISO specifications
 - Web 2.0
 - Standardized data interchange mechanisms (Community de-facto standards)



Meteorology cyberInfrastructure

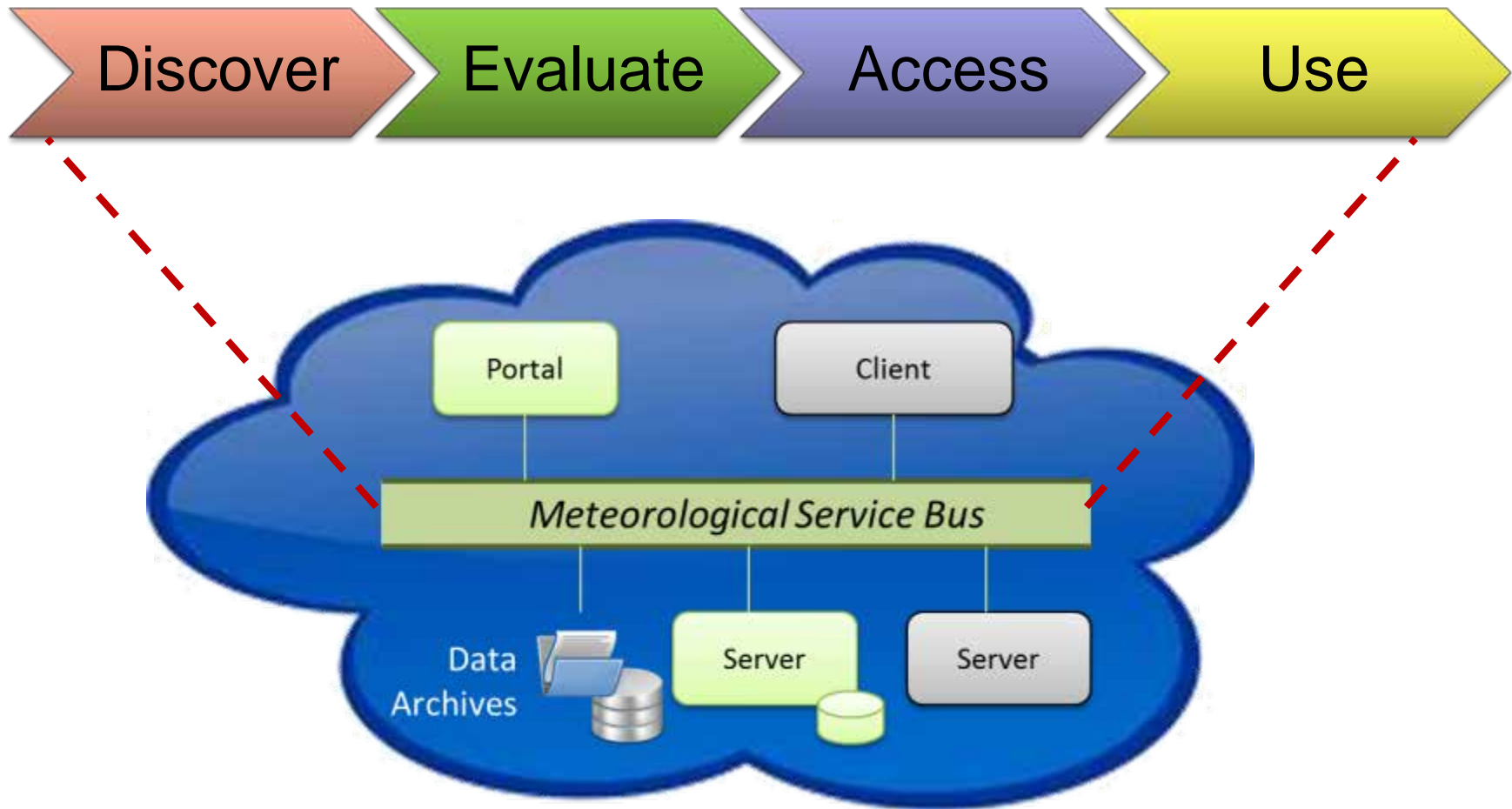


- Best practices
- Data policy
-

- Metadata model(s)
- Data Model(s)
- Encoding Format(s)/Language(s)
- Controlled Vocabulary(ies)
-

- Discovery protocol(s)/interface(s)
- Access protocol(s)/interface(s)
- Visualization protocol(s)/interface(s)
- Semantic protocol(s)/interface(s)
- ...

Functionalities supported by a Service Bus





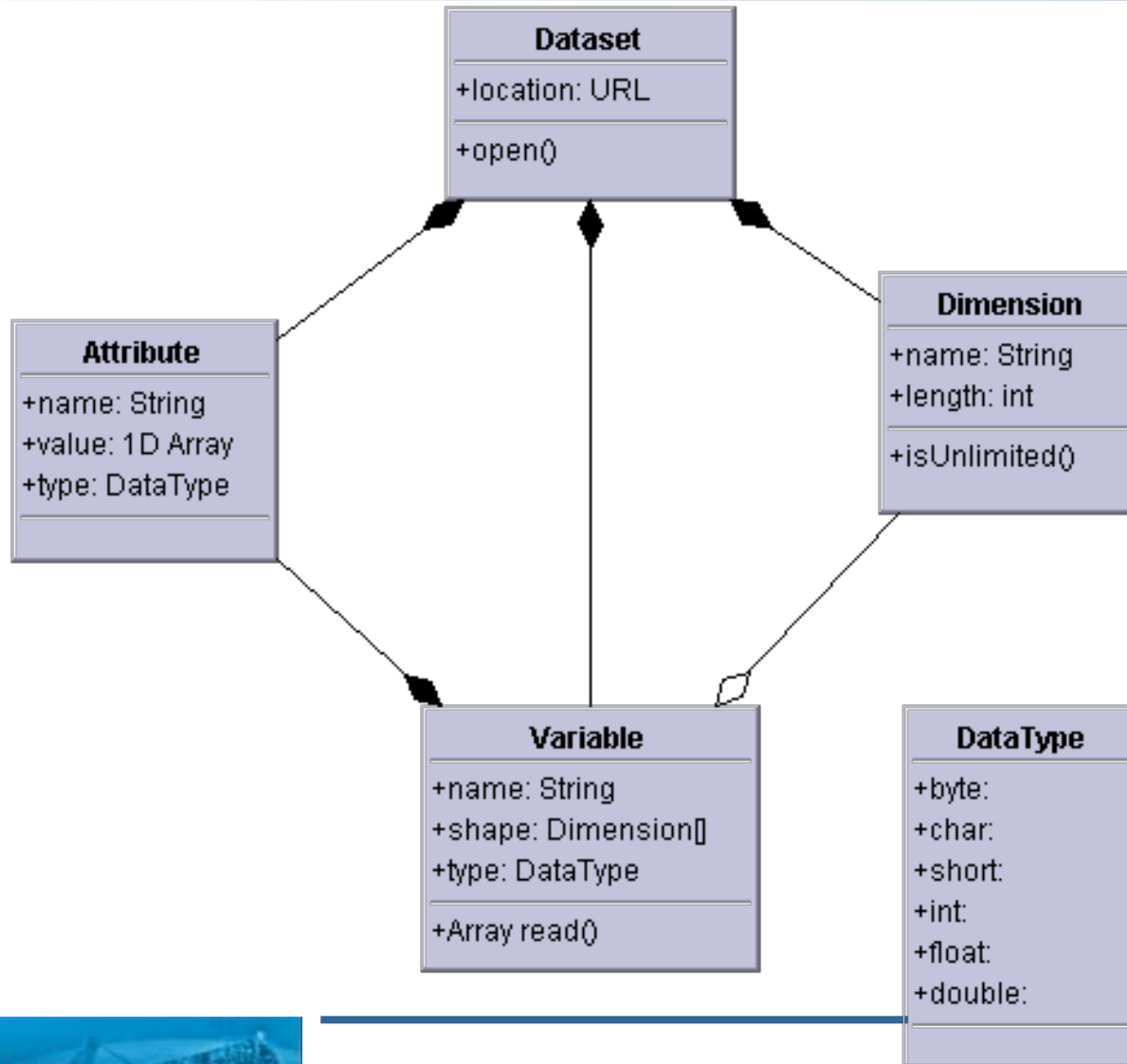
... and what
about the next
technologies?

Atmospheric Science Community



Data model	Array oriented; Profiles; Model outcomes; Sensor outcomes; ...
Metadata model	ISO 19115 profiles; CF; THREDDS; O&M; ...
Web protocols	REST; OGC profiles; OPeNDAP; ...
Encoding languages/Schemas/Formats	netCDF; GRIB; HDF; ncML; XML schemas; BUFR; CDM; CSML;...
Thesauri	CF; UDUNITS; ..
Tools	IDV; GEMPACK; McIDAS; AWIPS II; THREDDS; GI-cat..
Data Systems	WIS; UNIDATA Motherlode; TIGGE; GCMD; ECMWF; ...

NetCDF Core Data Model



[from J. Caron]

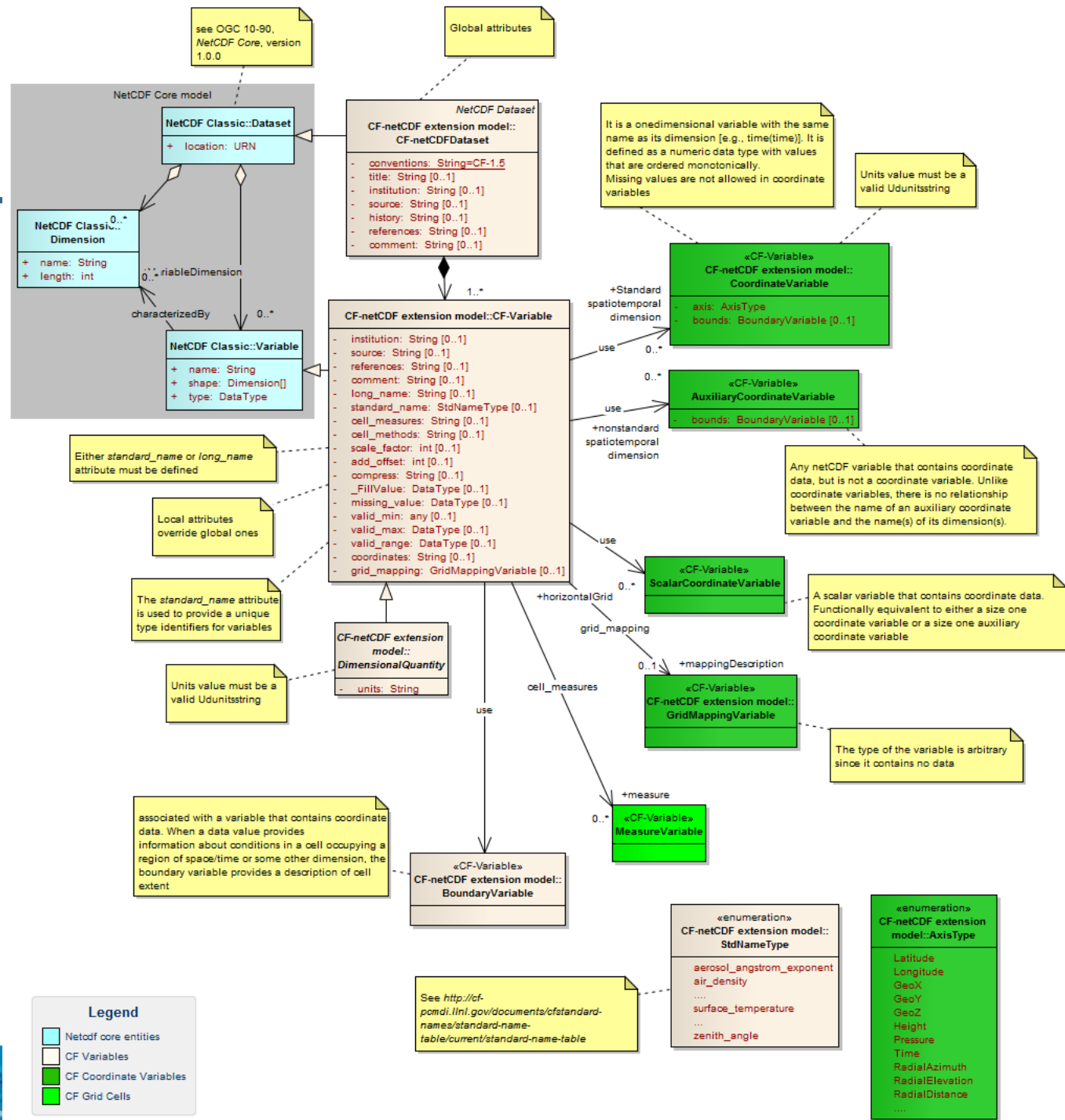
stefano.nativi@cnr.it



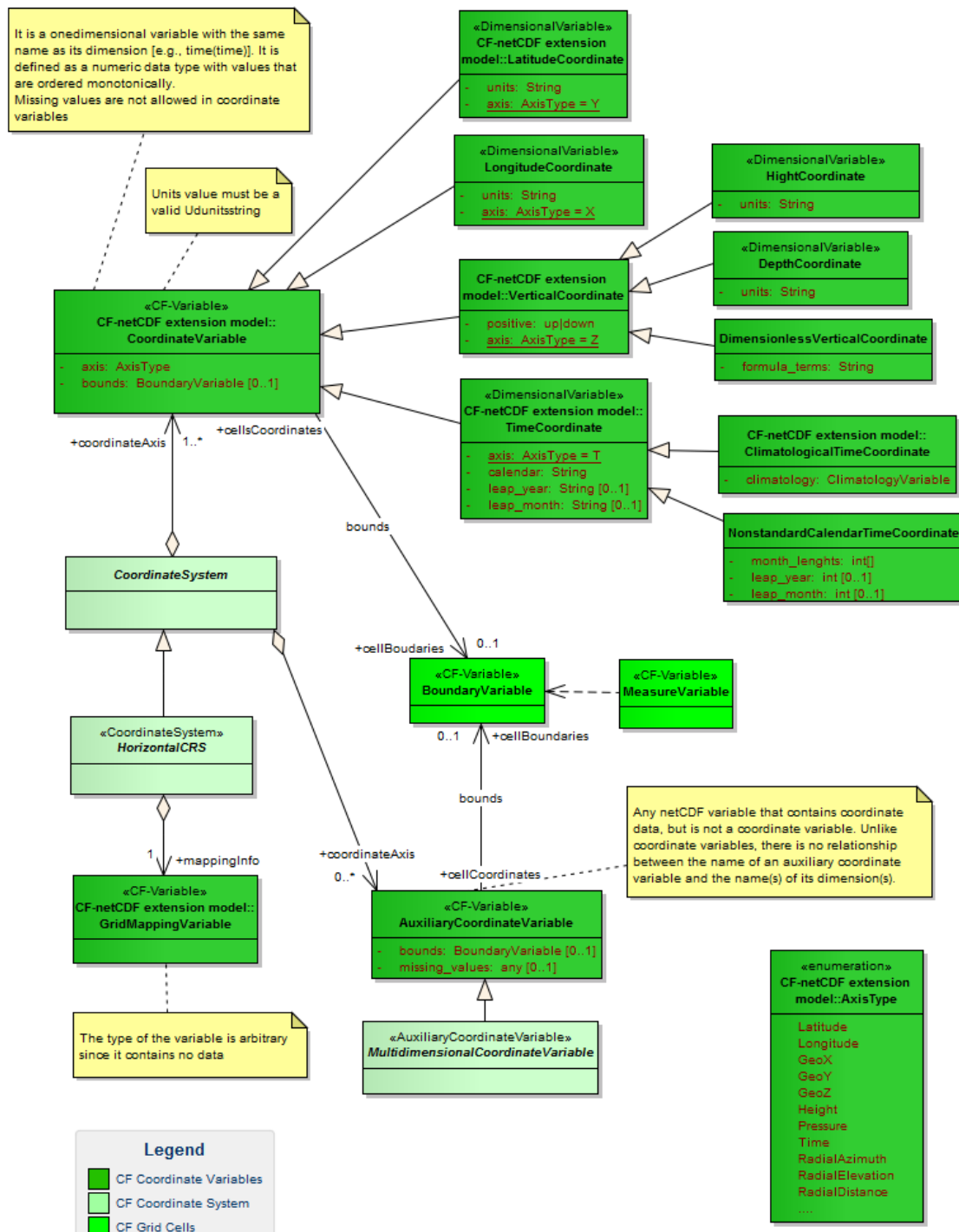
NetCDF data model extensions

- **CF Conventions (Recommended, if applicable)**
- COARDS Conventions (1995 standard that CF Conventions extends and generalizes)
- GDT Conventions (1999 standard that CF Conventions extends and generalizes)
- CDC Conventions (for gridded data, compatible with but more restrictive than COARDS)
- NCAR-RAF Conventions for Aircraft Data
- AMBER Trajectory Conventions for molecular dynamics simulations
- NUWG Conventions (1992-1995 effort to create some observational data conventions)
- PMEL-EPIC Conventions
- GDV Conventions (deprecated)

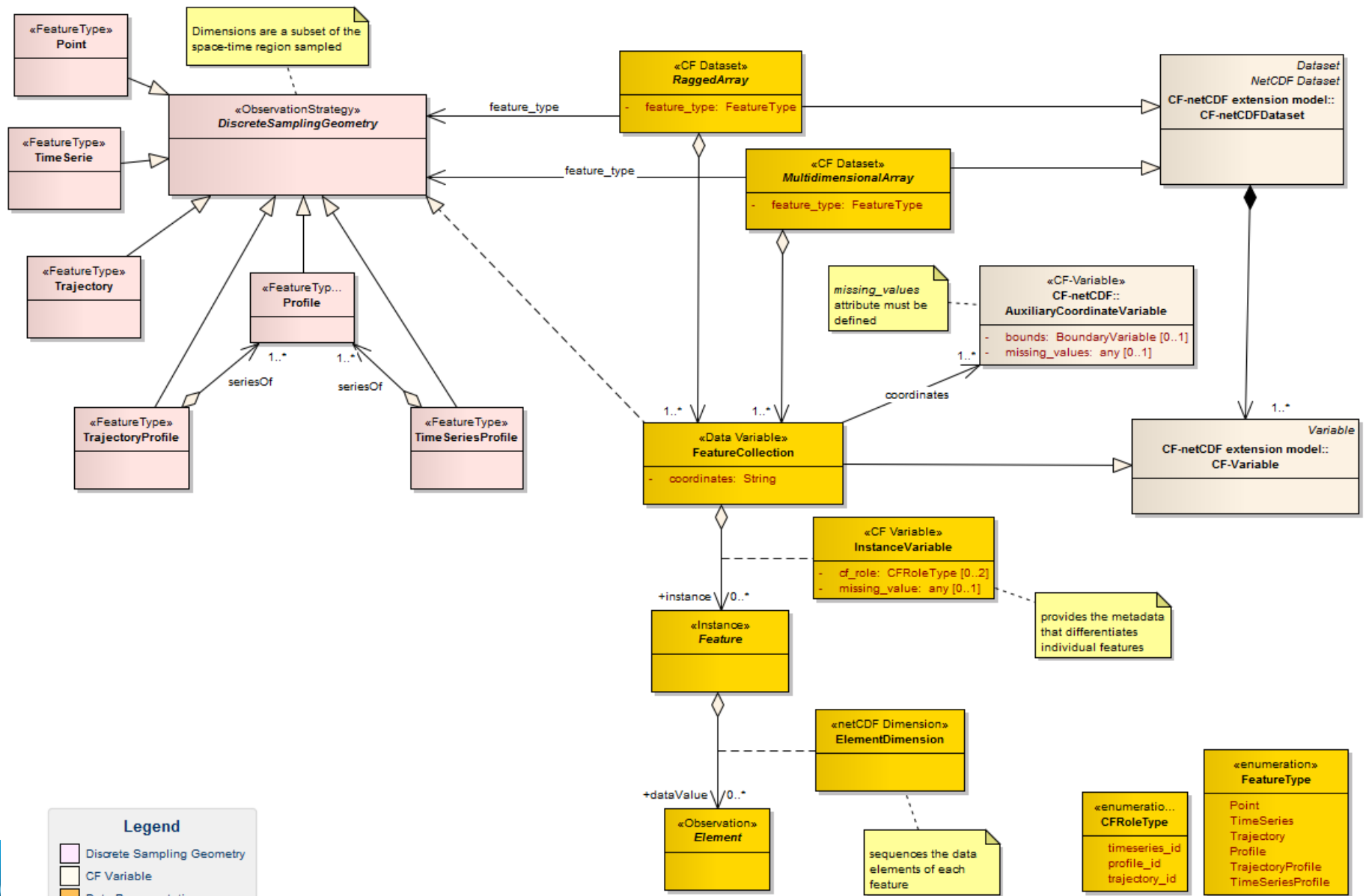
CF-netCDF specification (OGC)



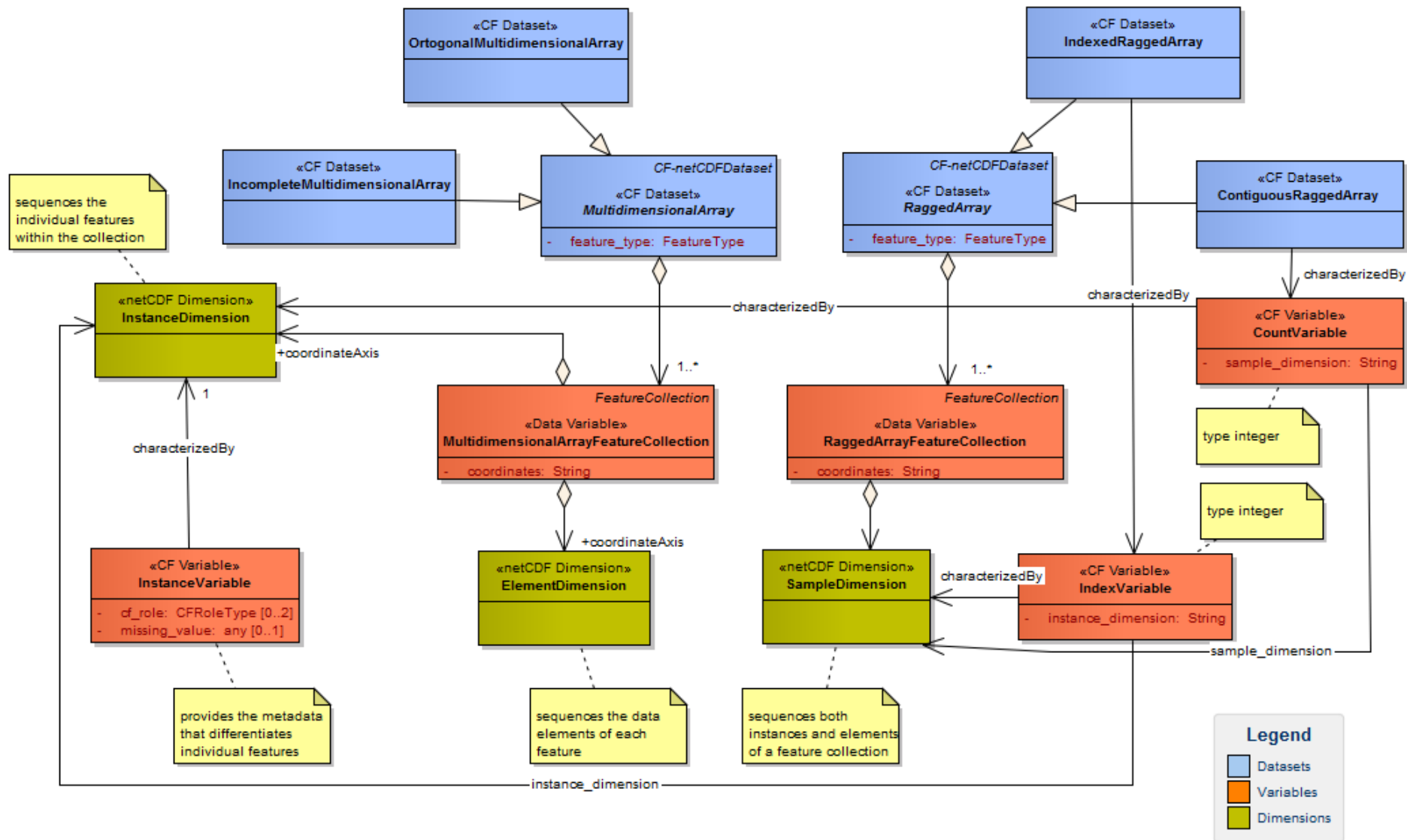
CF-netCDF specification (OGC)



CF-netCDF specification (OGC)



CF-netCDF specification (OGC)



Marine/Oceanography Community



Data model	Array oriented; Profiles; Model outcomes; Sensor outcomes; Ragged array; ..
Metadata model	ISO 19115 profiles (CDI; EDMED) CF; THREDDS; O&M;...
Internet protocols	REST; OGC profiles; OPeNDAP; ..
Encoding languages/Schemas/Formats	netCDF; GRIB; HDF; ncML; XML schemas; BUFR; ...
Thesauri	SeaDataNet Vocabulary; CF; UDUNITs; ..
Tools	ODV; MIKADO; NEMO; THREDDS; GI-cat; DIVA; ...
Data Systems	SeaDataNet; MGDS; UNIDATA Motherlode; MyOcean; GCMD; PANGAEA; ...

Data Model (Coverage/Feature types)

- Multiple coverage and/or Feature types exist
 - mainly, they are related to the Observation&Measurement approach
- The **Common Data Model** will support all these types in netCDF-CF

CDM Feature Type

PointFeature

StationFeature

TrajectoryFeature

StationFeature at fixed time

ProfileFeature

StationProfileFeature at one location and fixed vertical levels

StationProfileFeature at one location

SectionFeature with fixed number of vertical levels

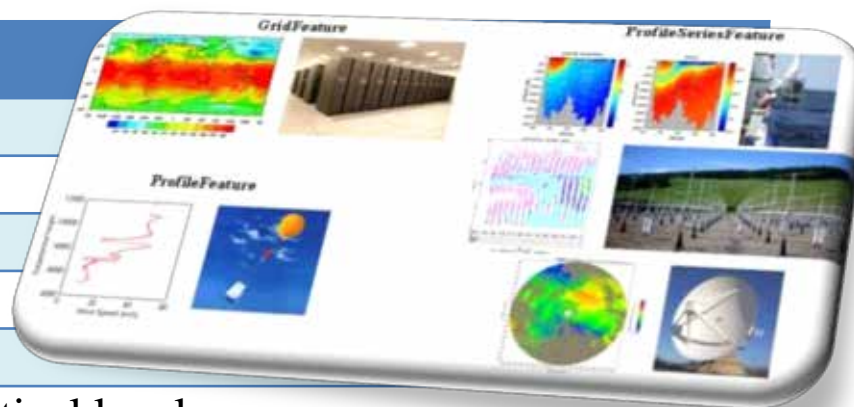
SectionFeature

RadialFeature

GridFeature at a single time

GridFeature

SwathFeature



International Oceanographic Data and Information Exchange (IODE)



- The IODE programme of the "Intergovernmental Oceanographic Commission" (IOC) of UNESCO was established in 1961.
- To enhance marine research by **facilitating the exchange of oceanographic data and information** between participating Member States
- IODE **publishes technical Manuals and Guides**
- Standards
 - In the past decades IODE has made **a number of attempts to agree on data management standards** (e.g. MEDl and mXML for marine metadata).
 - However **these attempts were not successful**, possibly due to insufficient coordination with other similar initiatives.
 - Reasons why now IODE recognizes the opportunity to **achieve success in developing international standards**



GOOS (Global Ocean Observing System)

Pilot Projects



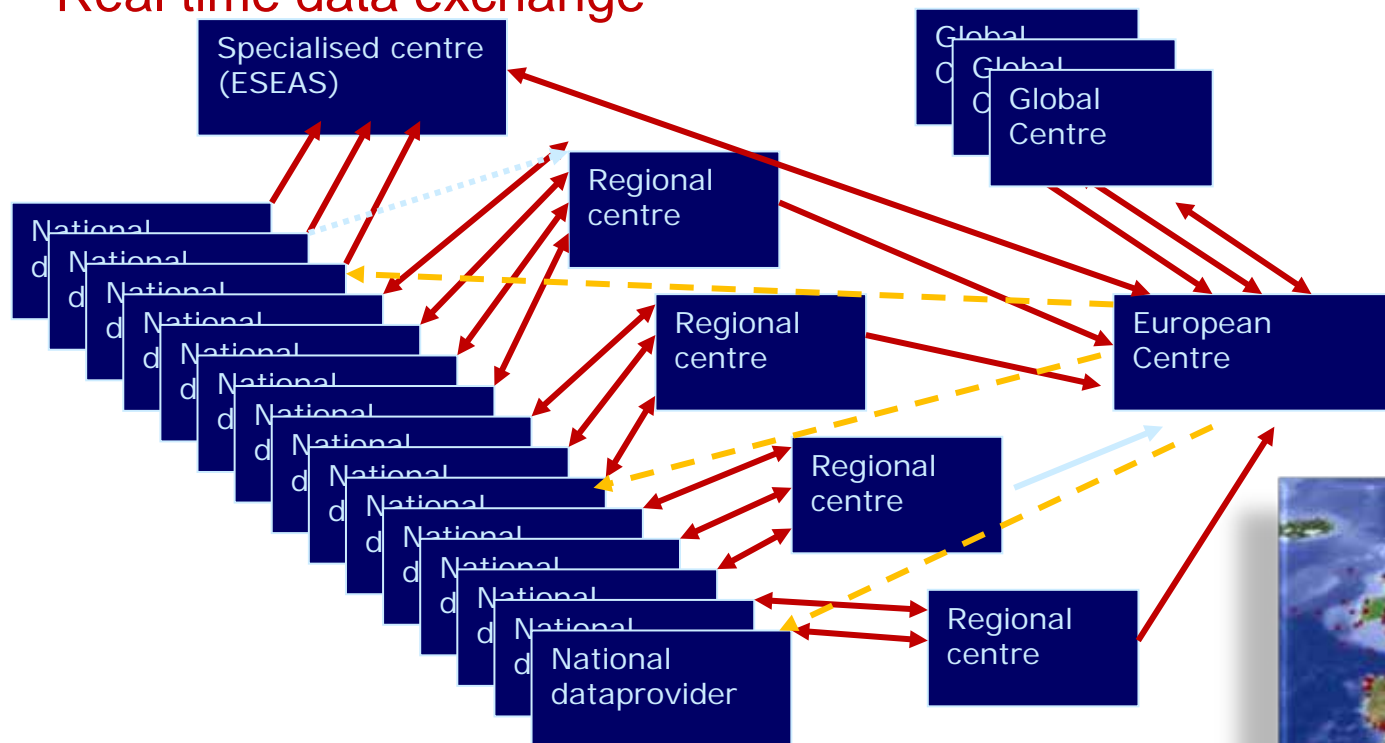
- GOOS is a/the oceanographic component of **GEOSS**
- GOOS provides the ocean component of the Global Climate Observing System (**GCOS**)
- Programmes and Projects which are demonstrating the next generation of **Global Ocean Observation System** technologies, techniques and applications
 - **ChloroGIN** (Chlorophyll Global Integrated Network)
 - Chloro-GIN Africa, ANTARES (ChloroGIN Latin American Regional branch)
 - **Ferry Box**: environmental monitoring systems
 - **GODAE** (Global Ocean Data Assimilation Experiment)
 - **MOON** (Mediterranean Operational Oceanography Network)
 - **Ocean Tracking Network**: track thousands of marine animals around the world
 - **QUIJOTE**: monitor the coastal ocean of Argentina, Uruguay and Brazil
 - **MILAC** (Marine Impacts on Lowland Agriculture and Coastal Resources)



EuroGOOS



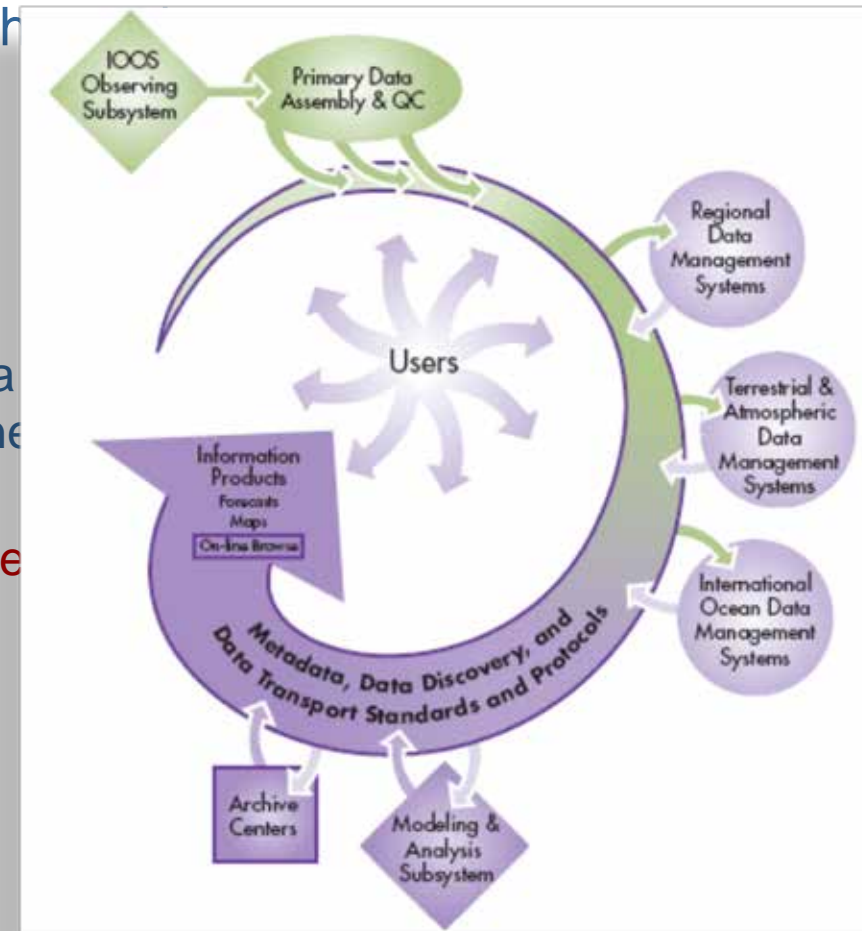
- EuroGOOS is an Association of Agencies to further the goals of GOOS
- Promote Operational Oceanography fostering a sustained production of **services at a Regional scale**
- **Real time data exchange**



[source: Hans Dahlin, EuroGOOS]

U.S. IOOS[®] (Integrated Ocean Observing System)

- IOOS is a federal, regional, and private-sector partnership working to enhance US ability **to collect, deliver, and use ocean information**
- IOOS **helps Decision Makers** taking action to improve safety, enhance the economy, and protect the environment
- DMAC (Data Management and Communications) Team
 - identifies **technologies, formats, and protocols** needed to support the data management and communications needs of IOOS
 - manages a **standards adoption process**



OOI (OCEAN OBSERVATORIES INITIATIVE)



- NSF-funded initiative
 - The OOI is envisioned as a **research-based counterpart** to the U.S. Integrated Ocean Observing System (IOOS)
 - The OOI's **networked sensor grid** will collect ocean and seafloor data at high sampling rates for decades
- OOI Cyberinfrastructure (OOI CI)
 - Start: Oct 2009
 - End: summer 2014



Russian World Ocean Subprogram ESIMO

- “Creating a Unified System of Information on the World Ocean Condition”
 - creation of unified normative and methodological, organizational and **technological basis for developing and maintaining information resources** on the condition of the World Ocean;
 - formation and maintaining the **State data holdings** on condition of the World Ocean;
 - development and **standardization of monitoring technologies of condition and pollution** of the World Ocean and coastal areas;
 - **integration of departmental information systems** and providing an access to overall state information resources on the World Ocean;
 - **organization of exchange of the similar systems** on the World Ocean within the frames of international Cupertino as well as participation in the international programs.

EC FP7 Projects



- Mersea/MyOcean

- Monitors and forecasts the global and regional ocean
- Provides a service for application providers (oil spill monitoring, ship routing, ...) and policy makers
- Information flows are federated through standards back-end services and central facilities (catalogue, viewing portal, system monitoring)

- SeaDataNet

- An network infrastructure for managing the large and diverse data sets collected by the oceanographic fleets and the automatic observation systems.
- Sets up reference services (vocabularies, catalogues, users directory...) before setting up a federating infrastructure for European marine observation data sharing.



Biodiversity/Ecosystems Community



Data model	Feature oriented; Sensor outcomes; Model outcomes; ..
Metadata model	EML; ISO 19115 profiles; GBIF Global Biodiversity Resources Discovery System; NBII; O&M; ...
Internet protocols	REST; OGC profiles; OAI-PMH; TAPIR; DiGiR; UDDI; RSS; ...
Encoding languages/Schemas/Formats	Darwin Core; ABCD; GML; TDWG XML schemas; ...
Thesauri	Life Science Identifiers Vocabularies; ..
Tools	GBIF; DOPA; OpenModeller; BioCatalog; Mercury; ...
Data Systems	OBIS; GBIF; LTER/ILTER, NBII; NASA GCMD; LIFE-WATCH; IUCN; GCMD; ...



OCEAN
BIOGEOGRAPHIC
INFORMATION SYSTEM



GEO-BON



Table 3. Standards for metadata, data exchange and transfer protocols.

<i>Name</i>	<i>Brief Description</i>
ABCD	"ABCD Schema is a common data specification for biological collection units, including living and preserved specimens, along with field observations that did not produce voucher specimens. It is intended to support the exchange and integration of detailed primary collection and observation data." http://www.tdwg.org/activities/abcd
BioCASE	The BioCASE protocol is based on DiGIR but adapted for use with ABCD encoded data. Its main user is the Biological Collection Access Service for Europe (BioCASE - http://search.biocase.org/). http://www.biocase.org/products/protocols
CSDGM	The Content Standard for Digital Geospatial Metadata (CSDGM), (FGDC-STD-001-1998), the US Federal Metadata standard, "provides a common set of terminology and definitions for the documentation of digital geospatial data." http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/base-metadata/index_html
CSDGM - Biological Data Profile	Biological Data Profile of the Content Standard for Digital Geospatial Metadata "broadens the application of the CSDGM so that it is more easily applied to data that are not explicitly geographic (laboratory results, field notes, specimen collections, research reports) but can be associated with a geographic location. The profile changes the conditionality and domains of CSDGM elements, requires the use of a specified taxonomical vocabulary, and adds elements." http://www.fgdc.gov/metadata/geospatial-metadata-standards
CSDGM – Profile for Shoreline Data	Metadata Profile of CSDGM for Shoreline Data "addresses variability in the definition and mapping of shorelines by providing a standardized set of terms and data elements required to support metadata for shoreline and coastal data sets. The profile also includes a glossary and bibliography." http://www.fgdc.gov/metadata/geospatial-metadata-standards

Darwin Core	The Darwin Core is a set of standards including a glossary of terms intended to facilitate the sharing of information about biological diversity. It is based primarily on taxa, their occurrence in nature as documented by observations, specimens, and samples, and related information. http://rs.tdwg.org/dwc/index.htm
DiGIR	Distributed Generic Information Retrieval is a protocol that provides unified access to distributed databases allowing clients to retrieve information from distributed servers. It uses HTTP as transport mechanism with messages and data encoded in XML (Darwin Core). http://digir.sourceforge.net/
Dublin Core	"The Dublin Core metadata standard is a simple yet effective element set for describing a wide range of networked resources. The Dublin Core standard includes two levels: Simple and Qualified. Simple Dublin Core comprises fifteen elements; Qualified Dublin Core includes three additional elements (Audience, Provenance and RightsHolder), as well as a group of element refinements (also called qualifiers) that refine the semantics of the elements in ways that may be useful in resource discovery." (http://dublincore.org/documents/usageguide/). http://dublincore.org/documents/dcmi-terms/
EML	"Ecological Metadata Language (EML) is a metadata specification developed by the ecology discipline and for the ecology discipline. It is based on prior work done by the Ecological Society of America and associated efforts... EML is implemented as a series of XML document types that can be used in a modular and extensible manner to document ecological data. Each EML module is designed to

	describe one logical part of the total metadata that should be included with any ecological dataset." http://knb.ecoinformatics.org/software/eml/
MIENS	MIENS – Minimum Information about an Environmental Sequence, an extension to the minimum information about a genome/meta-genome sequence (MIGS/MIMS) specification of the Genomics Standard Consortium is a proposal for documenting the environmental parameters in the extraction environment associated with a sequence. http://gensc.org/gc_wiki/index.php/MIGS/MIMS/MIENS
Natural Collections Descriptions	Natural Collections Descriptions (NCD) is a standard for facilitating the exchange of information on all kinds of collections of natural history material including specimens, original artwork, photographs, archives, published material. http://www.tdwg.org/activities/ncd/
OAI-PMH	The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) provides a “low-barrier” mechanism for interoperability across distributed metadata repositories. Data providers expose metadata and service providers, in turn, consume the metadata through a client application known as a harvester that issues OAI-PMH service requests over HTTP. http://www.openarchives.org/pmh/
OGC CSW	The Open Geospatial Consortium Catalogue Services for the Web (CSW) specification defines “the interfaces, bindings, and a framework for defining application profiles required to publish and access digital catalogues of metadata for geospatial data, services, and related resource information”. Note that, from an interoperability perspective, this is not a single standard as it encompasses several non-interoperable search technologies. http://www.opengeospatial.org/standards/cat
OGC WCS	The Open Geospatial Consortium Web Coverage Service (WCS) “supports electronic retrieval of geospatial data as “coverages” – that is, digital geospatial information representing space-varying phenomena.” http://www.opengeospatial.org/standards/wcs
OGC WMS	“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.” http://www.opengeospatial.org/standards/wms

OGC WFS	<p>"The OpenGIS® Web Feature Service (WFS) Implementation Specification allows a client to retrieve and update geospatial data encoded in Geography Markup Language (GML) from multiple Web Feature Services. The specification defines interfaces for data access and manipulation operations on geographic features, using HTTP as the distributed computing platform. "</p> <p>http://www.opengeospatial.org/standards/wfs</p>
ISO 19115	<p>"ISO 19115:2003 defines the schema required for describing geographic information and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data."</p> <p>http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=26020 . Countries that are members of ISO are required to provide metadata in a profile of ISO 19115. The INSPIRE initiative in the European Union is recommending use of ISO 19115, and a North American Profile (NAP) for the USA and Canada is under development. The new ANZLIC metadata standard used in Australia and New Zealand complies with ISO 19115.</p>
ISO 19139	<p>"ISO/TS 19139:2007 defines Geographic MetaData XML (GMD) encoding, an XML Schema implementation derived from ISO 19115."</p> <p>http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=32557</p>
TAPIR	<p>Designed as a generic tool that can be applied to domains other than biodiversity and natural science collections data, the TDWG Access Protocol for Information Retrieval (TAPIR) is a specification for accessing structured data on distributed databases using HTTP for transport and XML for encoding messages and data. It combines and extends the features of DiGIR and BioCASE protocols.</p> <p>http://www.tdwg.org/activities/tapir/</p>
Taxon Concept Schema	<p>"The Taxon Concept Schema (TCS) provides a standard for taxon names and taxon concepts in the exchange and integration of biodiversity and natural history data." http://www.tdwg.org/activities/tnc/</p>

BETA

Home | Domains and Actions | Earth System Science and Environmental Management (ESSEM) | Actions | ES1101

- All Actions
- Biomedicine and Molecular Biosciences (BMBS)
- Chemistry and Molecular Sciences and Technologies (CMST)
- Earth System Science and Environmental Management (ESSEM)**
 - In Detail
 - Actions**
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- Food and Agriculture (FA)
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- Individuals, Societies, Cultures and Health (ISCH)
- Information and Communication Technologies (ICT)
- Materials, Physics and Nanosciences (MPNS)
- Transport and Urban Development (TUD)

ESSEM COST Action ES1101

Harmonizing Global Biodiversity Modelling (HarmBio)

Descriptions are provided by the Actions directly via e-COST.

Global biodiversity is declining rapidly, largely as a result of human activities. Effective policy and adaptive management strategies in the face of global change require anticipation of future changes. Mid- to long-term planning will therefore depend, at least in part, on model-based projections. Unlike the well-coordinated climate modelling community, the biodiversity modelling community is currently disparate and largely uncoordinated. Hence, there are no agreed metrics of biodiversity produced as standard output from models, nor are there common datasets used for calibration and validation by modelling efforts. This Action facilitates the harmonization of current models and datasets of terrestrial, freshwater and marine biodiversity to improve the reliability of future projections of biodiversity change. This cross-community initiative aims to accelerate the development of transparent and scientifically robust biodiversity models, through validation, calibration and intercomparison of models and data, and ultimately to enable environmental decision making based on state-of-the-art

Earth System Science and Environmental Management COST Action ES1101

Description

Parties

Management Committee



General Information*

Chair of the Action:
[Dr. Jörn SCHARLEMANN](#) (UK)

Vice Chair of the Action:
[Prof. Paul LEADLEY](#) (FR)

DC Rapporteurs:
[Dr. Emil FULAJTAR](#) (SK)

Science officer of the Action:
[Dr. Basak KISAKUREK](#)

Administrative officer of the Action:
[Chandrasa SJAMSUDIN](#)

Welcome

About

Related Initiatives

Medias

creative-b.eu

Welcome



Toward a Global Virtual Environment for Biodiversity Research

Geology Community



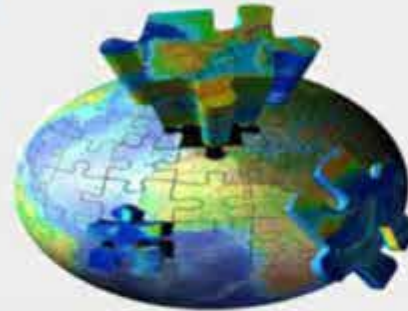
Data model	Feature oriented; Field oriented; Sensor outcomes; Model outcomes; ...
Metadata model	Dataless SEED; ASCII schemas; ISO 19115 profiles; O&M; ...
Internet protocols	REST; OGC profiles; FTP; WAF; ...
Encoding languages/Schemas/Formats	GeoSciML; GML; ESRI Grid; ESRI Grid ASCII; GeoTIFF; XYZ ASCII; netCDF; ESRI File Geodatabase ArcGis 9.3; ESRI shapefile; Mapinfo mif/mid; SEED; miniSEED; Receiver Independent Exchange Format; IRIS StationML and QuakeML;...
Thesauri	EuroGEONames; USGS vocabulary; SWEET;..
Tools	GPlates; GeoMappApp; GoogleEarth; EuroGEONames MatLab; IDV; OPAL; ...
Data Systems	EPOS; OpenTopography; UNAVCO; CHRONOS; GEON; EuroGeographics; IRIS; ...

- [What is OneGeology](#) +
- [Participants](#) +
- [Organisation](#) +
- [Getting involved](#)
- [Technical overview](#) +
- [Technical detail for participants](#) +
- [Meetings](#) +
- [Portal](#)
- [OneGeology eXtra](#) +
- [Press information](#)



Welcome to OneGeology

OneGeology is an international initiative of the geological surveys of the world. This ground-breaking project was launched in 2007 and contributed to the 'International Year of Planet Earth', becoming one of their flagship projects.



Thanks to the enthusiasm and support of participating nations, the initiative has progressed rapidly towards its target - creating dynamic geological map data of the world, available to everyone via the web. We invite you to explore the website and view the maps in the [OneGeology Portal](#).

Fill in our [online form](#) to be kept informed of the OneGeology initiative progress and receive our regular newsletters.

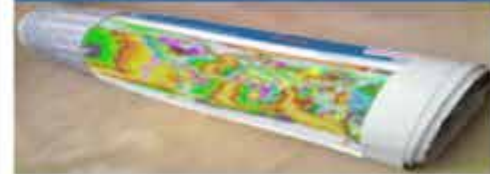
portal.OneGeology.org

Happy 5th birthday OneGeology!

OneGeology celebrated its 5th anniversary in March 2012. The initial start-up workshop was held in Brighton, UK on March 12-16, 2007. Thank you to everyone who has supported the OneGeology initiative over this time.

OneGeology at the 34th International Geological Congress

Monthly news



[ONE OneGeology Newsletter Issue 13](#) is now available

Geodiversity



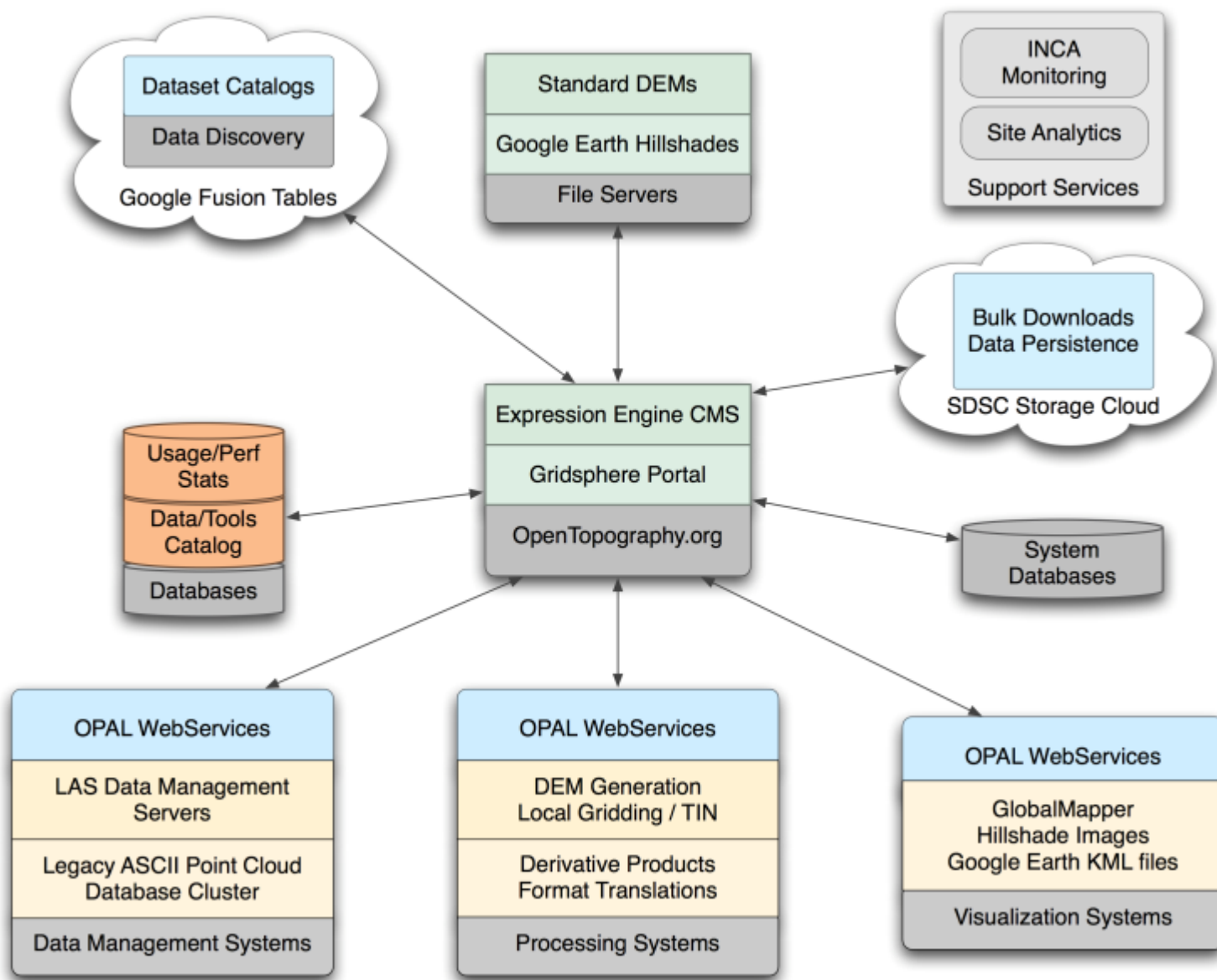
View Geoparks and World Heritage sites linked to geology on a Google map.

Accreditation Scheme



View scheme details and how

OpenTopography

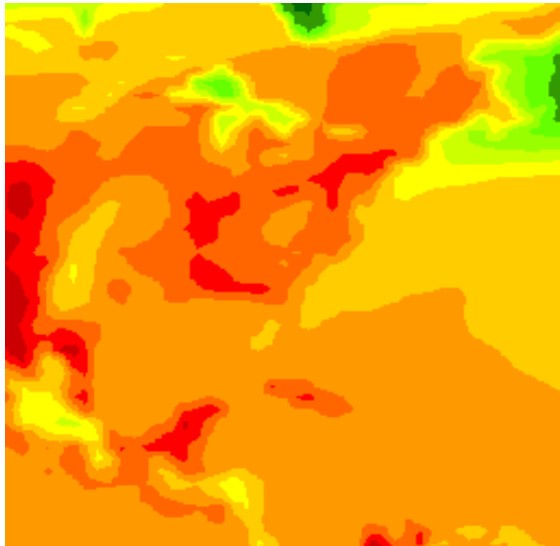


Hydrology Community



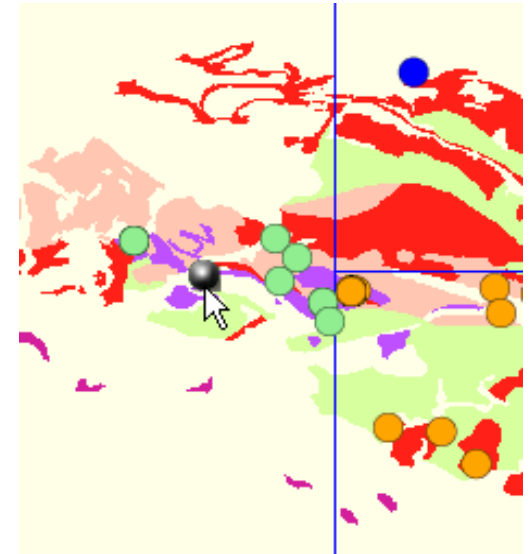
Data model	Feature oriented; Sensor outcomes; Model outcomes; Ragged array; ..
Metadata model	ISO 19115 profiles; O&M; ...
Internet protocols	REST; OGC profiles; ...
Encoding languages/Schemas/Formats	GML; WaterML; ...
Thesauri	CUAHSI vocabulary; CF; UDUNITs; ..
Tools	ArcHydro; HydroServer; HydroDesktop; HIS central; ...
Data Systems	HIS;

Summary: Different Data Models



classic earth-observations:
“field” or “coverage”

Fields
vs.
Objects
vs.
Specimens



classic geology:
“feature”

Specimen	Au (ppm)	Cu-a (%)	Cu-b (%)	As (ppm)	Sb (ppm)
ABC-123	1.23	3.45	4.23	0.5	0.34

- A **Cell** reflects the result of a single observation

[source: S. Cox]

Summary: Different Metadata Model

- Mostly **ISO 19115 profiles**
 - **part 2** is important, as well
- **Dublin Core** Metadata Initiative
- **Extensions** are introduced by specific CoP
 - Satellite Remote Sensing community
 - **ebRIM; EO;**
 - Biodiversity/ecosystems
 - **Taxonomies**
 - Modelers
 - **Uncertainty** (propagation)
 -

Summary: Different Web protocols

- OGC Web protocols are well used
 - Discovery and access
- Internet protocols are well used
 - HTTP-based protocols;
- Community de-facto standards
 - OPeNDAP; IDD; TAPIR; ...
- Content agnostic protocols
 - FTP; WAF; ...
- Web 2.0 protocols are gaining popularity
 - OpenSearch; RSS; SKOS; ...

Summary: Different Encoding languages/Schemas/Formats

- Plethora of technologies
 - OGC languages
 - Community de-facto standards
 - Internet MIME types
 - Legacy products
 - Web 2.0 languages
- Different types
 - Binary; ASCII; XML; Video; Imagery; Streams;
 -

Summary: Different Thesauri

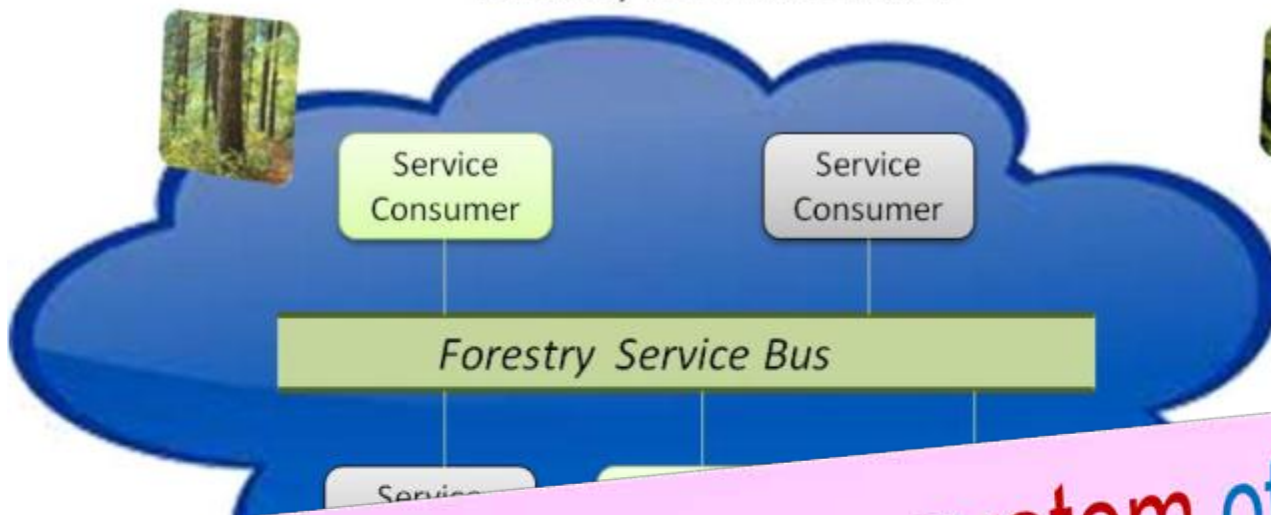
- **Controlled vocabularies exists** for most of the Disciplines
 - Many are accessible and re-usable (e.g. SKOS, RDF, etc.)
- Interconnection and **alignment is still a challenge**

Summary: Different Tools and Data Systems

- Many different portals
 - Almost a portal for each significant application
- Often such portals do not allow to access data with one/few clicks

What about
multidisciplinarity
interoperability?

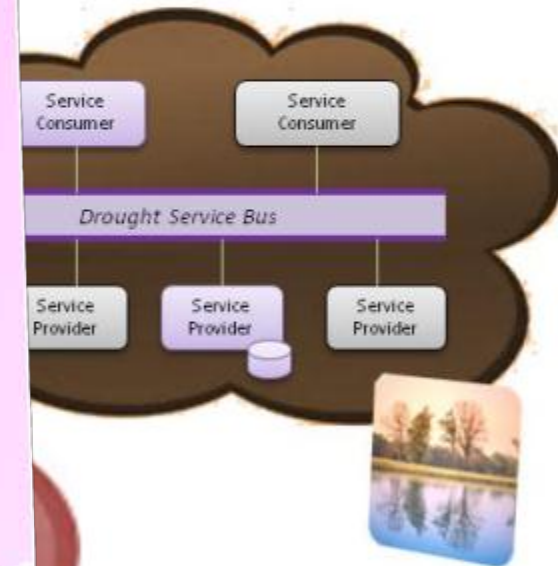
Forestry e-Infrastructure



Meteo-Ocean e-Infrastructure



Drought e-Infrastructure



Biodiversity e-Infrastructure

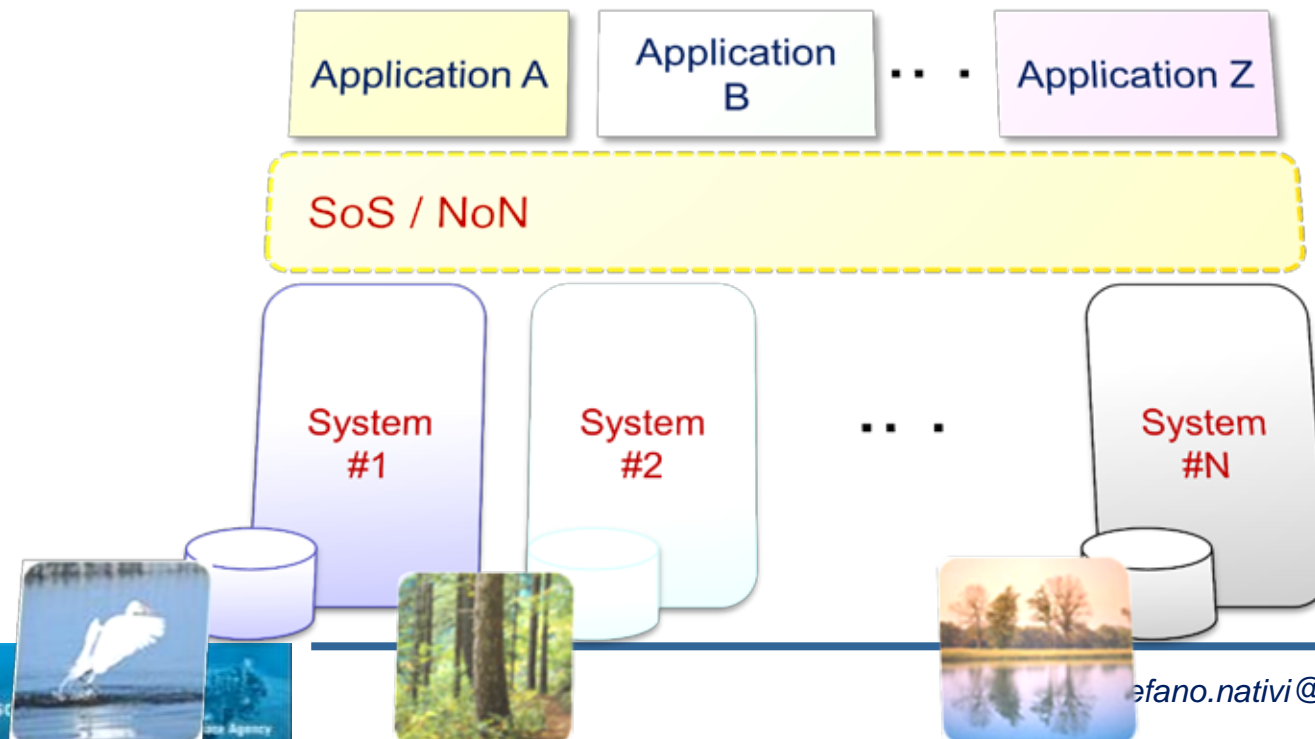
... an ecosystem of
Community
Infrastructures
(i.e. Service Buses)

ESS Cyberinfrastructure Challenges

- un-controlled (technological) environment
 - global dimension
 - multi-disciplinary
 - multi-organizational
 - based on voluntary contributions
 - fast-growing
 - etc.
- almost impossible to “impose” and “preserve” specific technological solutions (e.g. standard interfaces)
- apply System of Systems (SoS) or Network of Networks (NoN) principles to build interoperability cyberinfrastructures

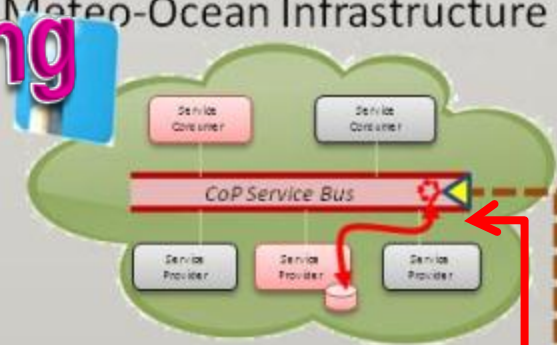
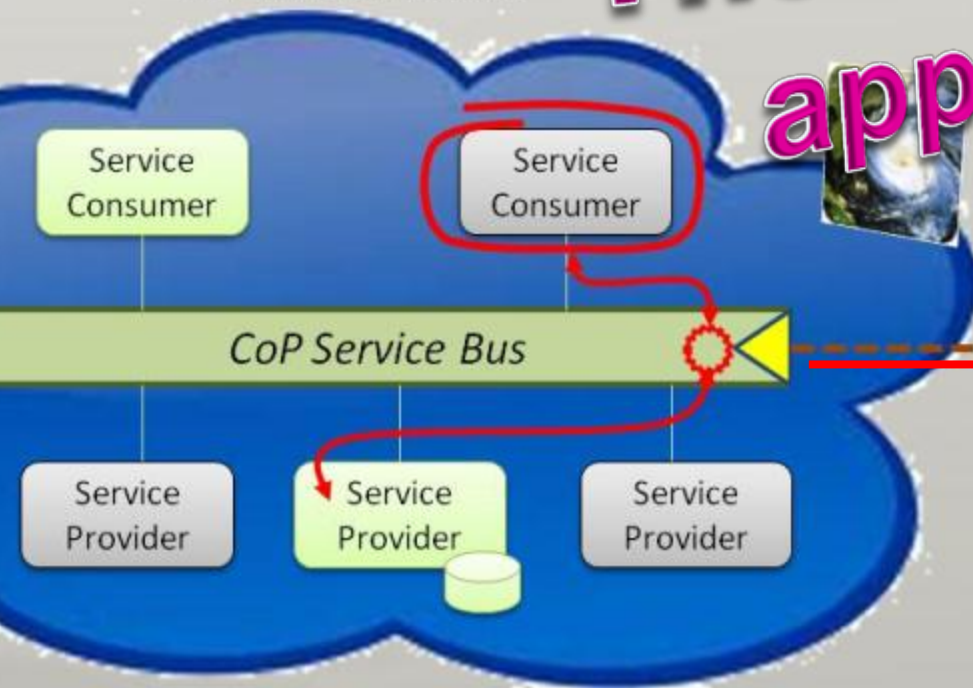
System of Systems / Network of Networks principles

- **Build** on existing (community) system/network infrastructures
- **Supplement** but **not supplant** system/network mandates and governance arrangements
- Address heterogeneity to **lower** User/Data Provider **entry barriers** avoiding to impose a federal approach

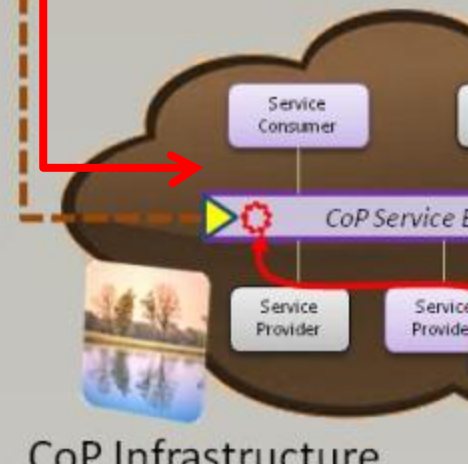
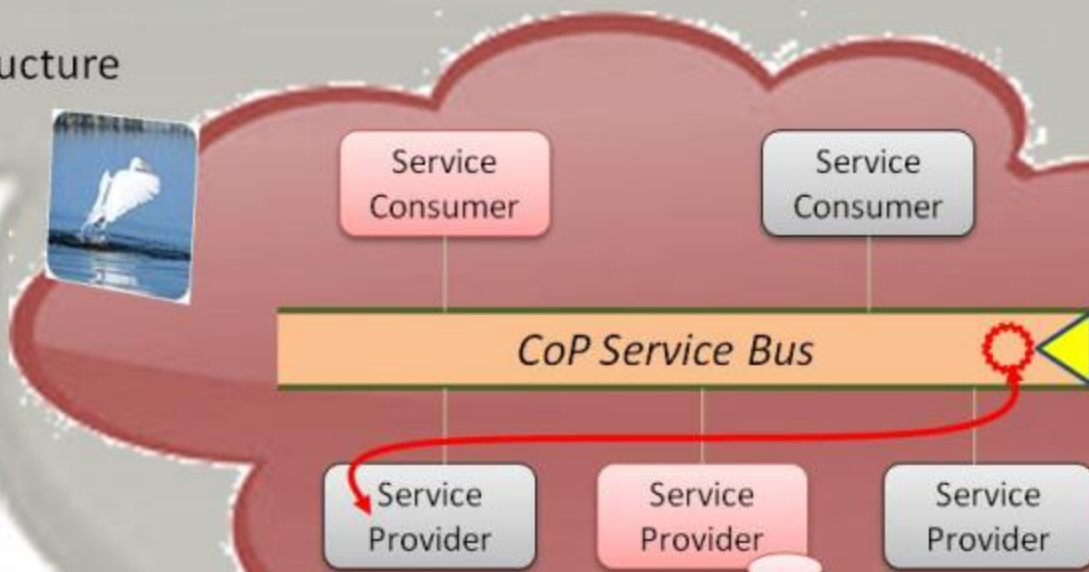


The Brokering approach

CoP Infrastructure



structure



CoP Infrastructure

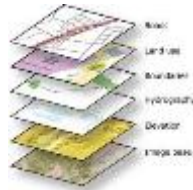
Brokering benefits



- **Lowers barriers** to participation in distributed systems for both users and resource providers
 - minimal burden or cost impact on existing systems;
- **Accelerates interconnection** of disparate systems;
- **Facilitates sustainability, reusability, extensibility, and flexibility** of the infrastructure
- **Enhances multi-disciplinary interoperability** via introduction of new capabilities across multiple domains;
- **Removes need to impose common** (e.g. federal, “top-down”) **specifications** and software components enabling a more adaptive “bottom-up” evolution of the infrastructure

Broker types

- Discovery Broker
- Access Broker
- Semantic Broker
- Service composition Broker
- Quality Broker
- Policy Brokers
- ...



Implement
Discovery
Interoperability
Arrangements

Evaluate



Discovery Broker



«CatalogInterface»
Published Interfaces

- + CSW2.0.2-ebRIM/CIM0.1.9
- + CSW2.0.2-ebRIM/EO0.2.5
- + CSW2.0.2-ISO1.0
- + GI-cat Extended interface 7.x
- + OAI-PMH2.0
- + OpenSearch-GENESI-DR
- + OpenSearch1.1

Users

Implements
Multi-disciplinary
Interoperability
Arrangements

Authoritative Data Providers

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
- + Deegree2.2
- + GBIF
- + GDACS
- + GeoNetwork2.2.0
- + GeoNetwork2.4.1
- + GeoRSS2.0
- + GI-cat6.x
- + GI-cat7.x
- + NetCDF-CF1.4
- + 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



Discover

Evaluate

Non-authoritative Data Providers

What about Citizen Science ?

Implements
Web 2.0
Interoperability
Arrangements

Discovery Broker

Web 2.0 mediator

Implements
Web 2.0 discovery
Interfaces

«CatalogInterface»
Published Interfaces

- + CSW2.0.2-ebRIM/CIM0.1.9
- + CSW2.0.2-ebRIM/EO0.2.5
- + CSW2.0.2-ISO1.0
- + GI-cat Extended interface 7.x
- + OAI-PMH2.0
- + OpenSearch-GENESI-DR
- + OpenSearch1.1

Users

Web 2.0



What about
Semantic discovery
?

Discover

Evaluate

Data Providers

Service Providers (Resource Servers)

- + CSW 2.0.2-Core
- + CSW 2.0.2-ebRIM/CIM 0.1.9
- + CSW 2.0.2-ebRIM/EO 0.2.5
- + CSW 2.0.2-ISO 1.0
- + Deegree 2.2
- + GBIF
- + GDACS
- + GeoNetwork 2.2.0
- + GeoNetwork 2.4.1
- + GeoRSS 2.0
- + GI-cat6.x
- + GI-cat7.x
- + NetCDF-CF 1.4
- + OAI-PMH 2.0
- + OpenSearch 1.1
- + THREDDS 1.01-1.0.2
- + WCS 1.0
- + WCS 1.1.2
- + WFS 1.0.0
- + WFS 1.1.0
- + WMS 1.1.1
- + WMS 1.3.0
- + VPS 1.0.0
- + CDI

Discovery Broker

Web 2.0 mediator

Implements
Semantic

Augments the
Discovery Broker
capacities

Users

Connects and
Mediates
heterogeneous
Semantic resources

Semantic Broker

Semantic
engines

Thesauri/
Gazetteers

W3C SKOS



stefano.nativi@cnr.it



Access

Use

Implement
Subsetting &
Transformation
services

Data Providers

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
- + Deegree2.2
- + GBIF
- + GDACS
- + GeoNetwork2.2.0
- + GeoNetwork2.4.1
- + GeoRSS2.0
- + GI-cat6.x
- + GI-cat7.x
- + NetCDF-CF1.4
- + OAI-PMH2.0
- + OpenSearch1.1
- + THREDDS1.01-1.0.2
- + WCS1.0
- + WCS1.1.2
- + VFS1.0.0
- + VFS1.1.0
- + VMS1.1.1
- + VMS1.3.0
- + VPS1.0.0
- + CDI

Discovery Broker

Web 2.0 mediator

Implements
Subsetting &
Transformation
services

Users

Underpins
a Common
Environment

Access Broker

What about interoperability with my preferred client(s) ?

Access

Use

Data Providers

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
- + Deegree2.2
- + GBIF
- + GDACS
- + GeoNetwork2.2.0
- + GeoNetwork2.4.1
- + GeoRSS2.0
- + GI-cat6.x
- + GI-cat7.x
- + NetCDF-CF1.4
- + OAI-PMH2.0
- + OpenSearch1.1
- + THREDDS1.01-1.0.2
- + WCS1.0
- + WCS1.1.2
- + VFS1.0.0
- + VFS1.1.0
- + VMS1.1.1
- + VMS1.3.0
- + VPS1.0.0
- + CDI

Discovery Broker

Web 2.0 mediator

Users

Access Broker

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GEO GROUP ON
EARTH OBSERVATION

Google

GI go

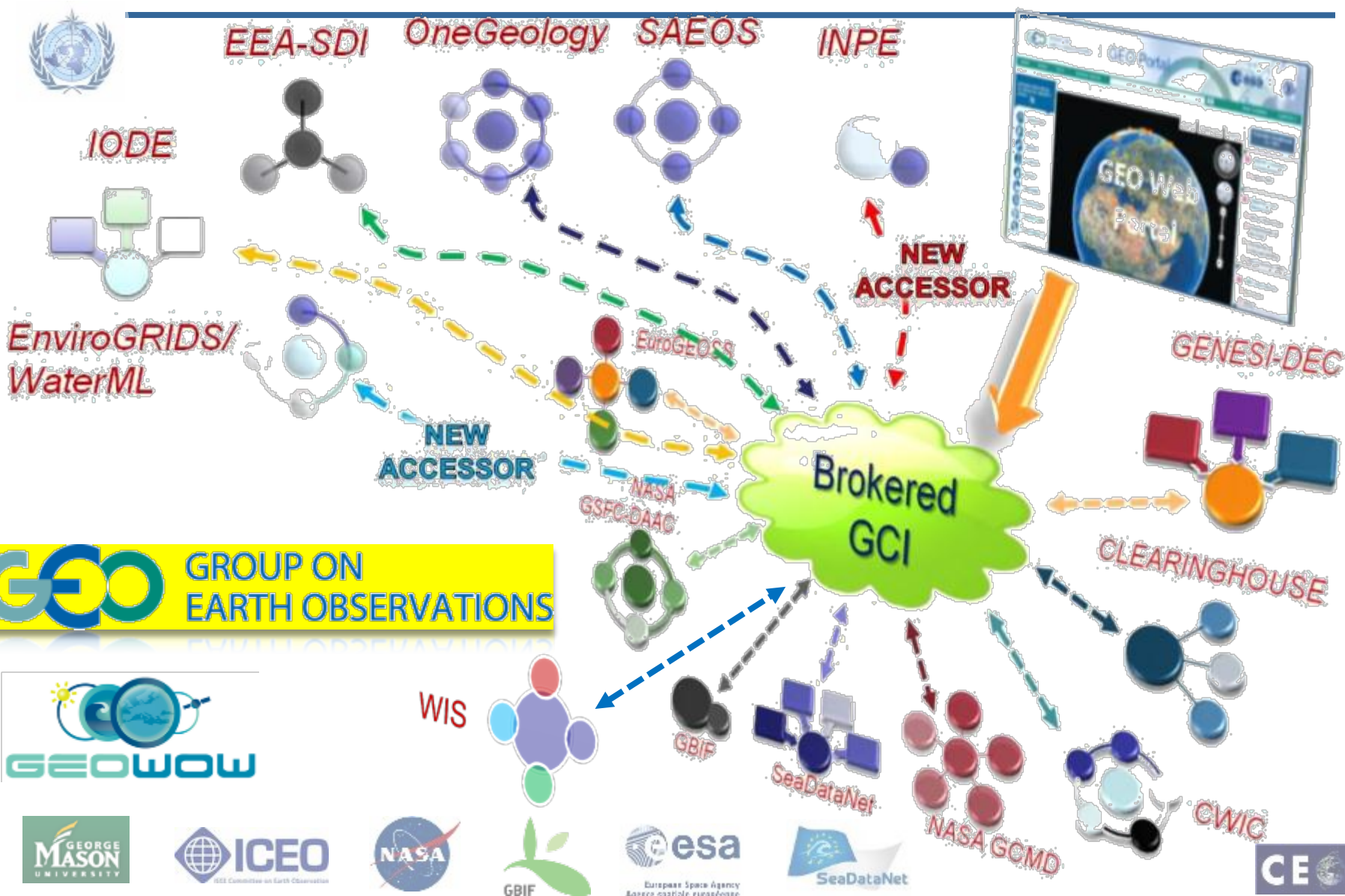
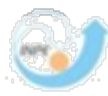
GeoNetwork
OpenSource



GI dac



The GEO Discovery & Access Broker

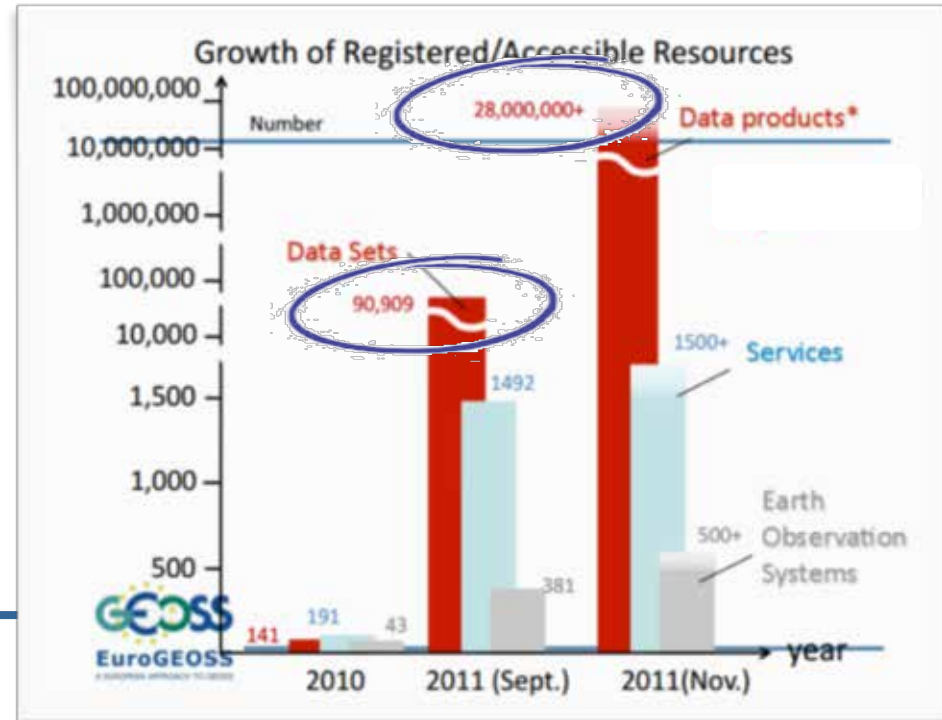


Contributing to make accessible the GEOSS Data CORE

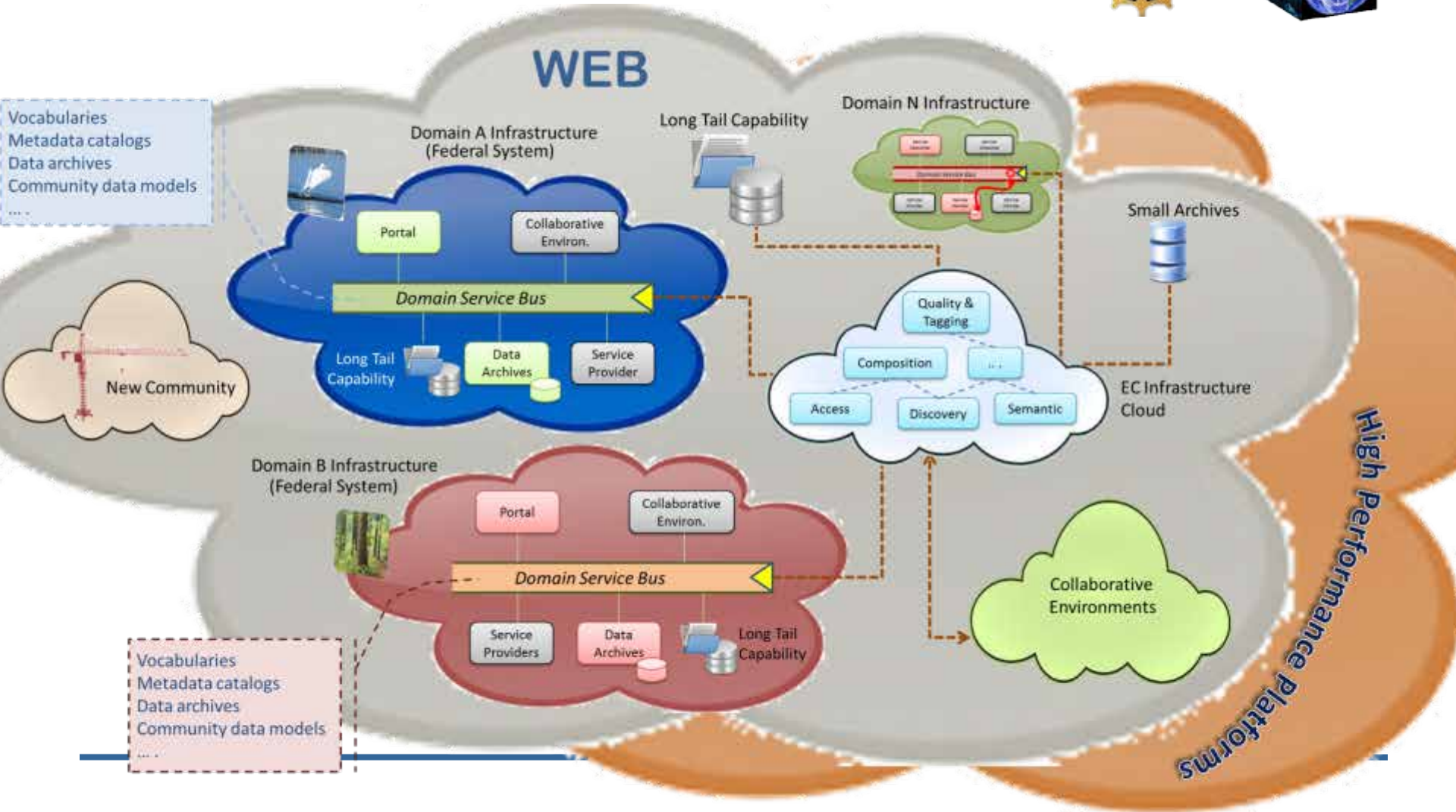
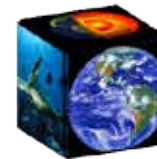


Growth of Accessible resources

[source: 2012 GEO plenary, Istanbul]



NSF Earth Cube Initiatives



Service bus intermediation



Thank you !

Questions ?