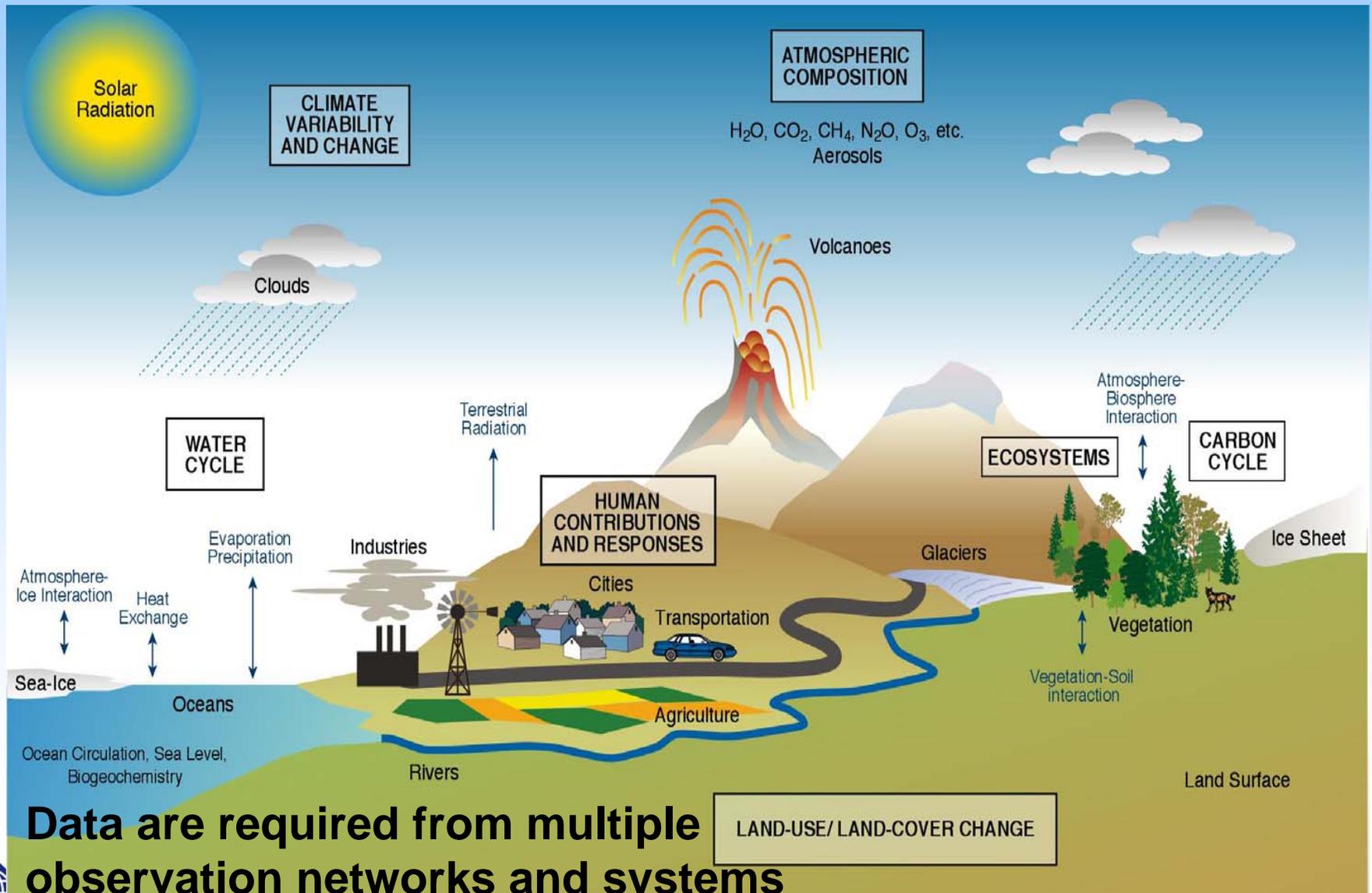


# *The Architecture of GEOSS*

**Dr. Jay Pearlman**

**The IEEE Committee on Earth  
Observation  
July 23, 2006**

# The Earth is a complex system of systems



Data are required from multiple observation networks and systems

# What is a “System of Systems?”

- *Definition:*

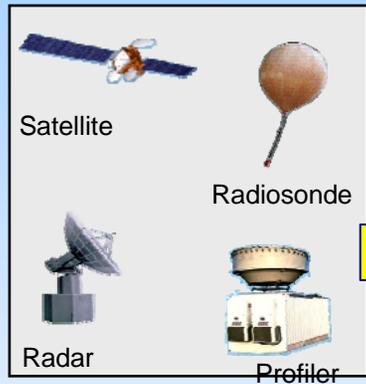
A System-of-Systems (SoS) is a “super-system” comprised of elements that are themselves complex, independent systems which interact to achieve a common goal.

- *Common Characteristics:*

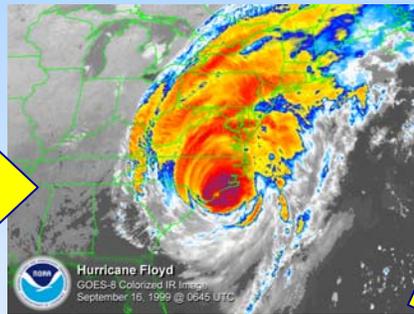
- The component systems can achieve their own intended purposes in their own right even if detached from the overall system
  - The component systems are managed in large part for their own purposes
  - It exhibits behavior, including emergent behavior, not achievable by the component systems acting independently
  - Component systems, functions, and behaviors may be added or removed during its use
- Not just a large, complex system**
- Constructed of Independent systems**
- Value of the synergy**
- Dynamic, open environment**

# SoS Example - Weather Ocean and First Responders Systems

## Measurements & Analysis



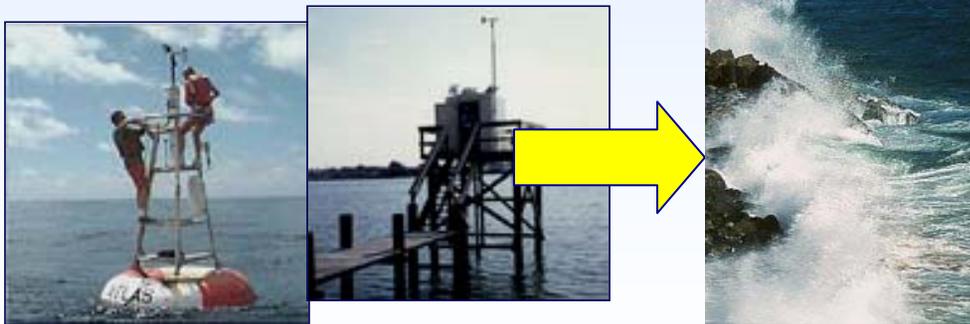
## System Products



## Responders' Information



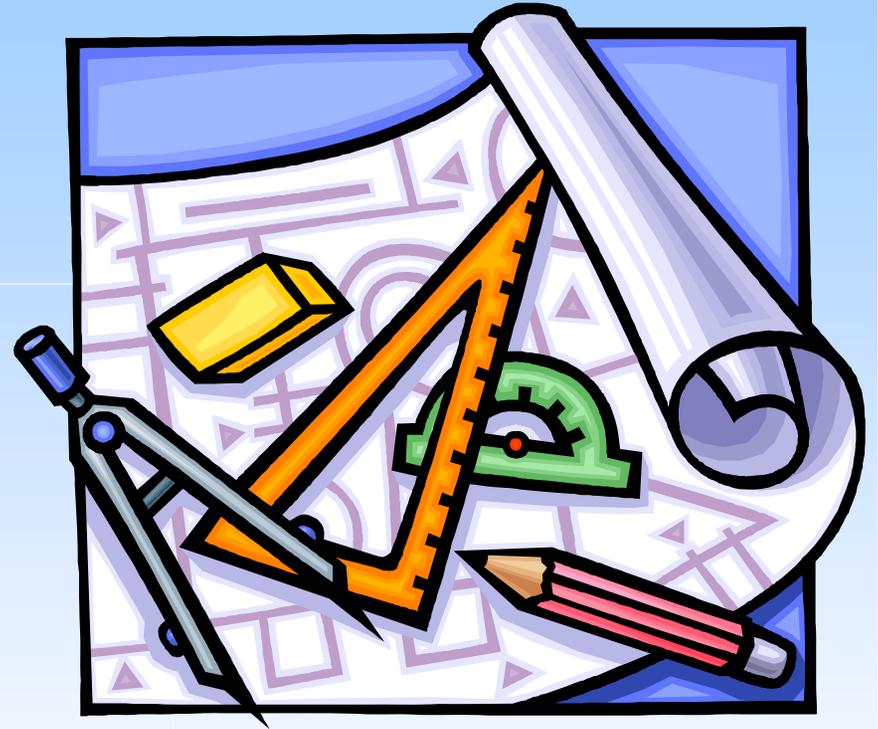
## Weather Systems



## Integrated Storm Impact & Response

# Interoperability Objective

*What few things  
must be the same  
so that everything  
else can be different?*



# **GEOSS Challenges**

- **Interoperability – what is it and how do we address it**
- **Integration of Human factors – broader influence means more impacts**
- **Dynamic participation**
- **End to end integration – what does it mean??**
- **Multiple ownership/prioritization**
- **Understanding system of systems concepts**

# Challenges

## Corporate SoS

### Uniformity of objectives

- Single corporate direction
- Cultural “uniformity”
- Common Technology
- Data standards and quality established
- Process for encouraging or enforcing participation

## GEOSS

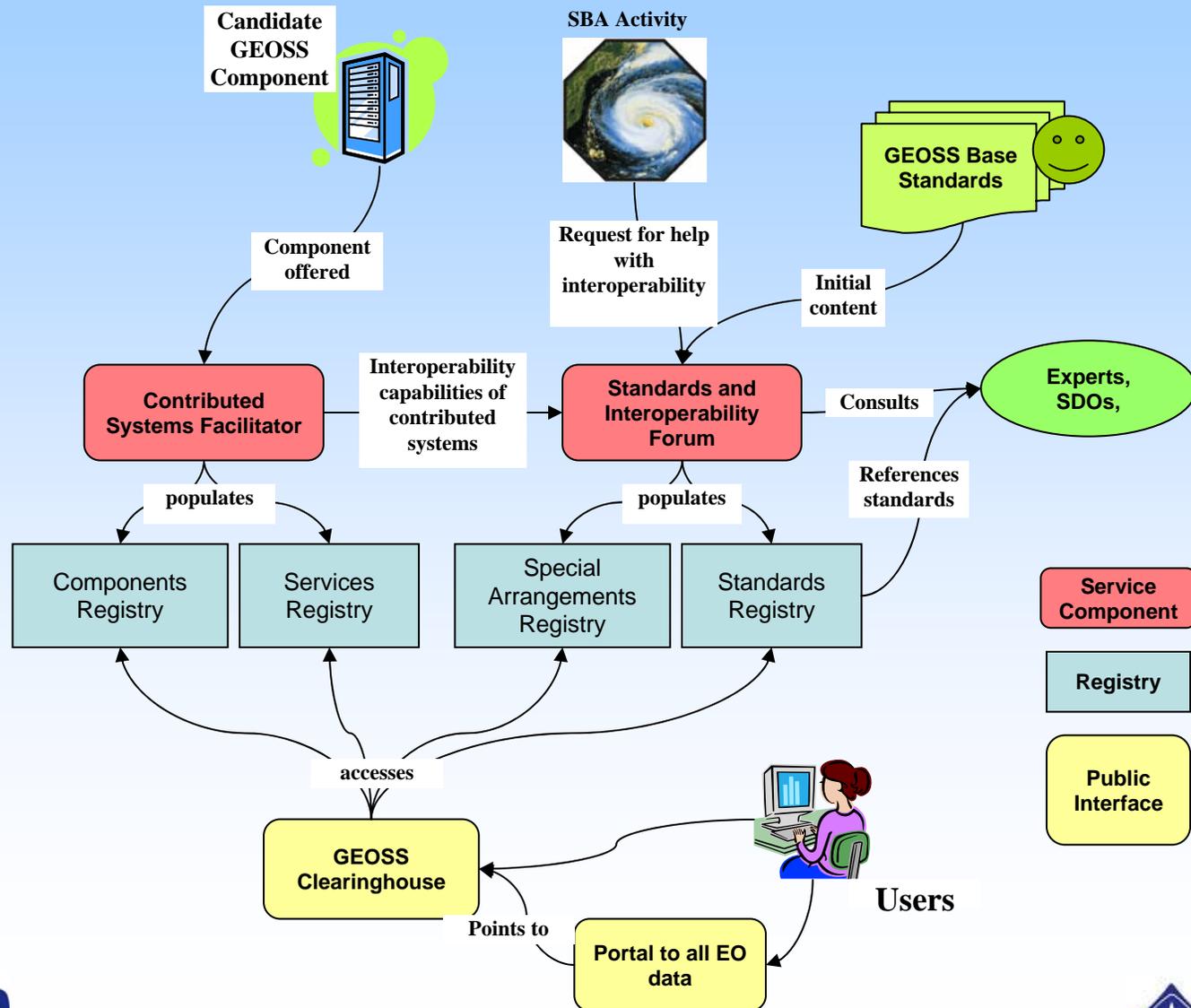
### Disparate motivations

- Competing agendas
- Diverse backgrounds
- Varying technology levels
- Multiple views of data standards and quality

# Architecture and Interoperability Approach

- **Build a flexible architecture and Integration framework on a set of reusable components**
- **Leverage existing external and internal standards, architectures, and models**
- **Capture future capabilities through open architecture**
- **Support wide range of processes and environments**
- **Integrate development through a service oriented architecture (SOA)**

# Core Architecture



# Architecture Implementation Objectives - 2006-7

- **Create an interoperability structure**
- **Implement Registries for Components, Standards**
- **Establish a web portal**
- **Develop a clearinghouse for data and information**
- **Provide for prototype operations**

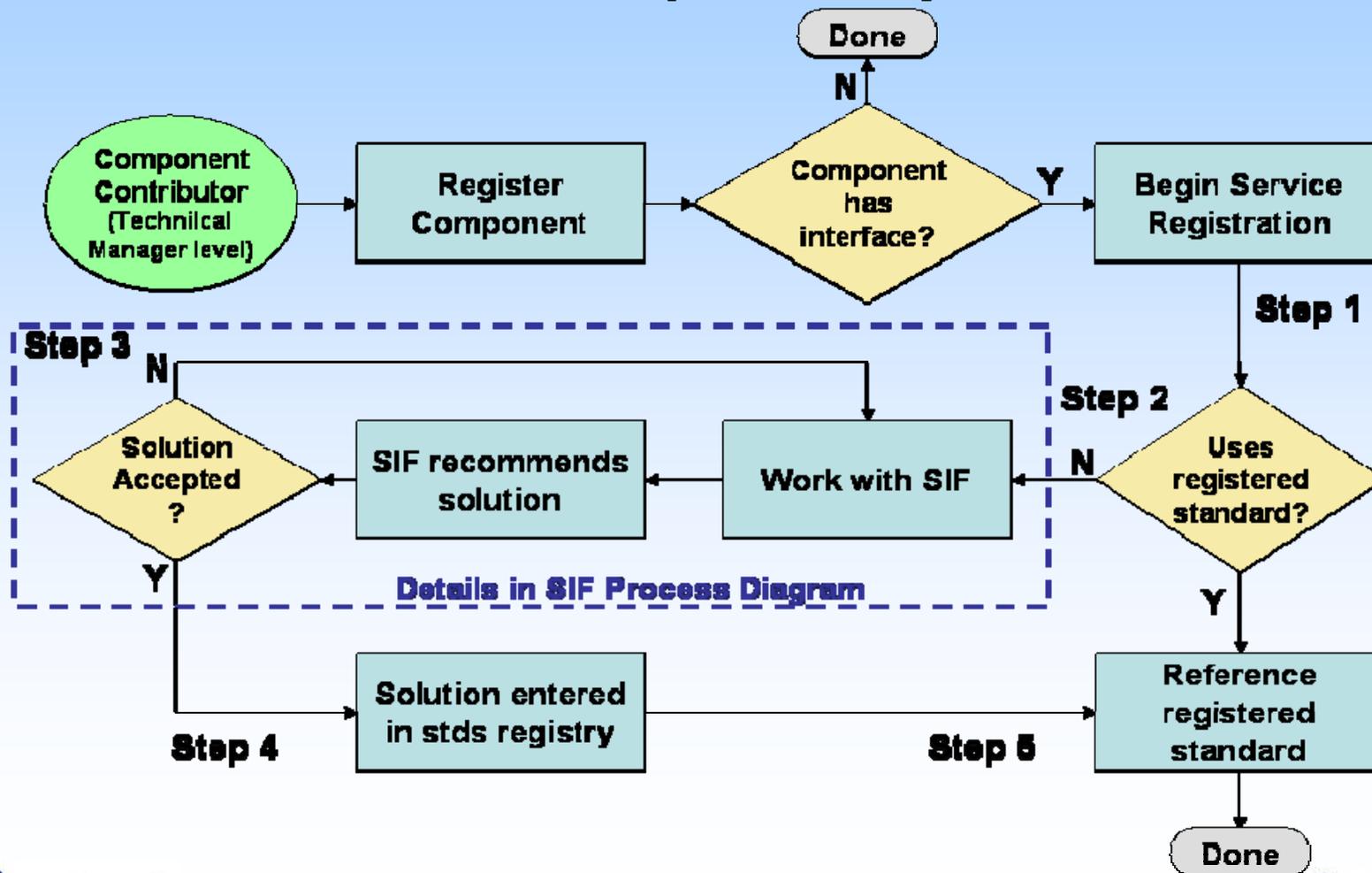


# The Standards and Interoperability Forum

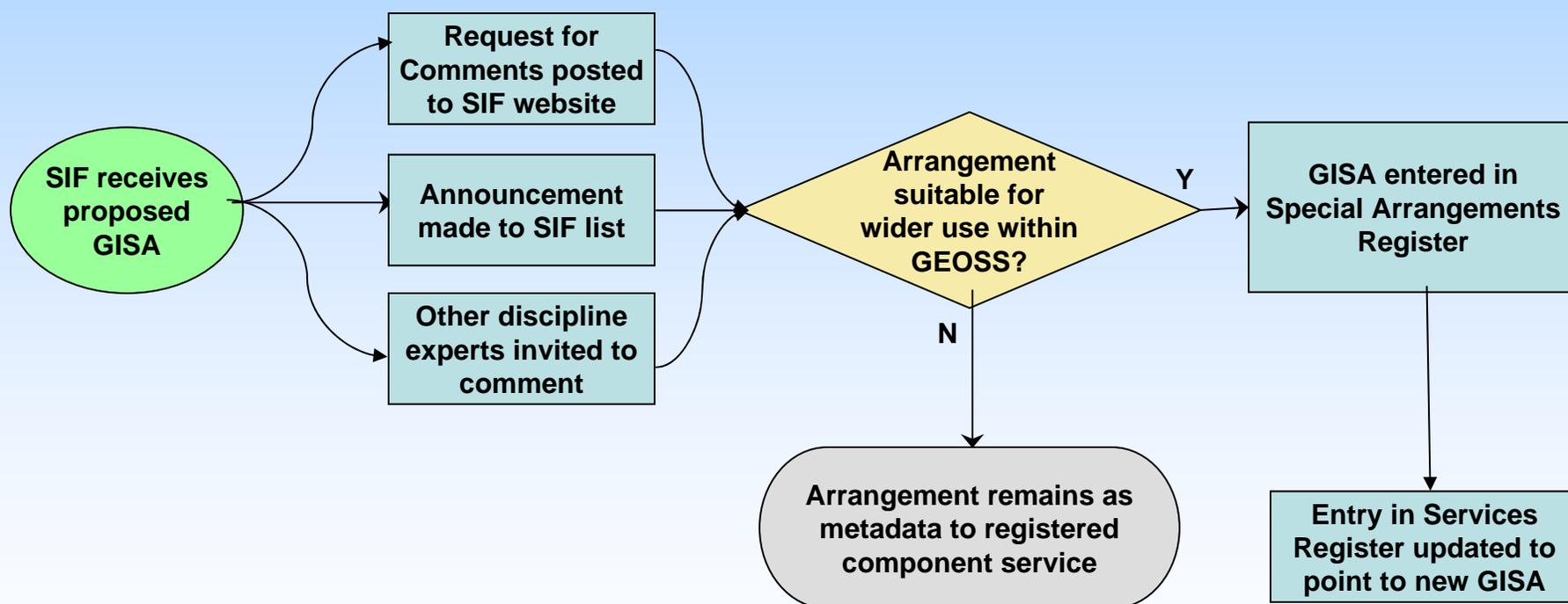
- **Provides advice, expertise and impartial guidance on issues relating to standards and interoperability” for GEOSS.**
- **Its objectives include:**
  - help in the identification and adoption of standards required to achieve GEOSS interoperability objectives
  - facilitate cooperation among the many organizations, and national agencies of member countries, in selecting, developing and using standards applicable to GEOSS
  - support education and outreach for international participants and help increase technical and public awareness

# Interoperability

## GEOSS Interoperability Process



# Standards and Interoperability Forum Process



# Standards and Interoperability Forum

**First Meeting - July 27 2007  
Barcelona Spain**

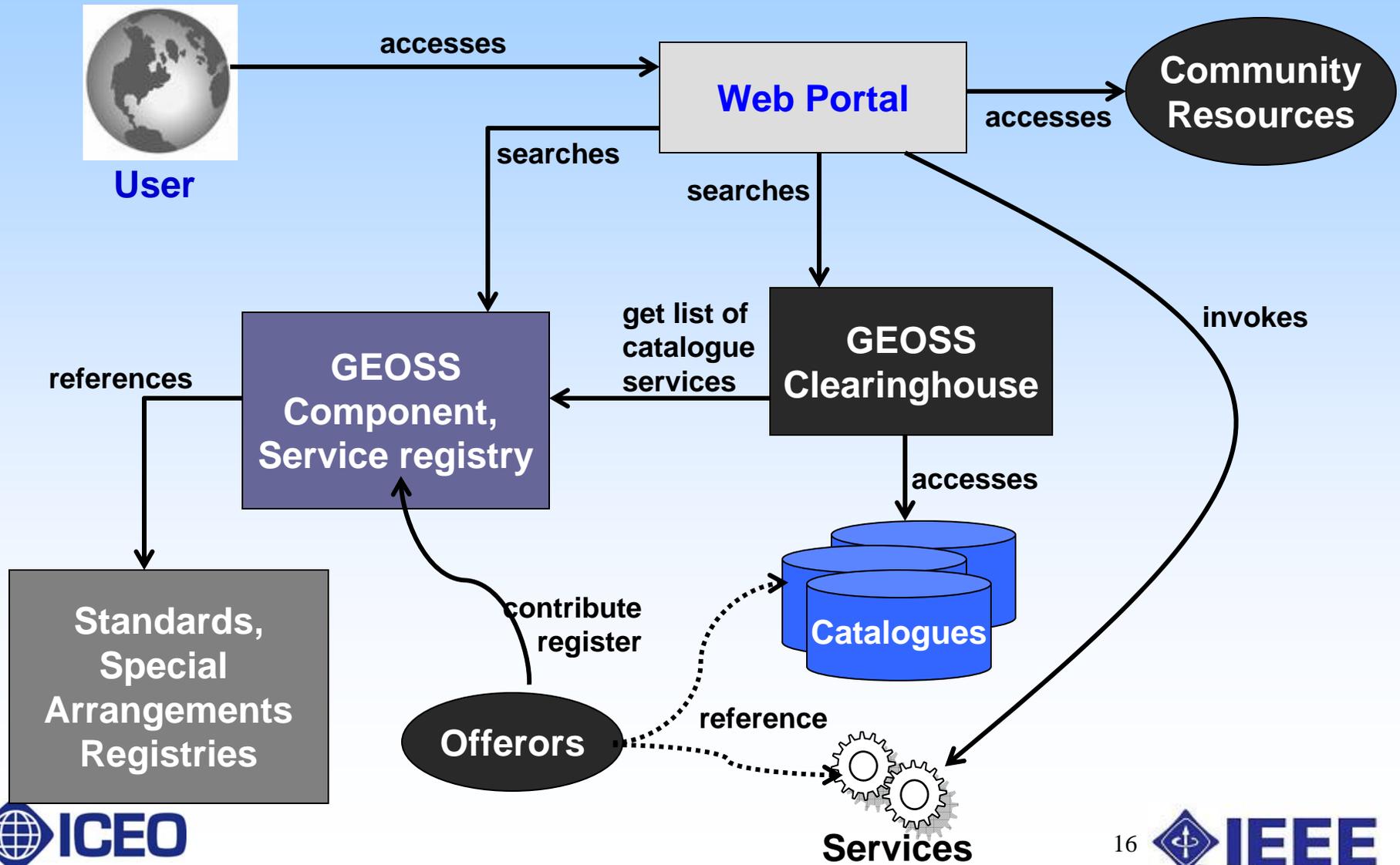
# Architecture Implementation Objectives - 2006-7



- **Create an interoperability structure**
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# Registries Context



## GEOSS Component Registration

\* Required Fields

### Component Basic Information

Component Name*:	<input type="text" value="U.S. Geospatial One-Stop"/> 
Abbreviation:	<input type="text" value="geodata.gov"/>
Description*:	<input type="text" value="This Component provides comprehensive access to U.S. geospatial data and services. It enables publishing of data sets through the collection or harvest of descriptive metadata and enables search and visualization of geospatial data through certain standards-based services."/> 
GEO Sponsor*:	<input type="text" value="United States"/> 
Responsible Organisation:	<input type="text" value="U.S. Geological Survey"/> 
URL to Component Information:	<input type="text" value="http://geodata.gov"/> 

*Register Information on Component*

### Component Contact Information

Contact Name*:	<input type="text" value="User Support"/> 
Contact Email*:	<input type="text" value="support@geodata.gov"/> 

*Register Information  
on Services (1/2)*

[Feedback for this page](#)

### GEOSS Service Instance Registration

\* Required Fields

#### Service Basic Information

Component ID*:	<input type="text" value="urn:uuid:4509b59b-ce95-4d71-ae1c-a7dc04867606"/>	
Service Instance Name*:	<input type="text" value="Geospatial One Stop Catalog Service (OGC CSW FGDC)"/>	
Abbreviation:	<input type="text" value="gos-csw"/>	
Description*:	<input type="text" value="This interface provides standard access to the Geospatial One Stop national metadata catalog through the Open Geospatial Consortium (OGC) Catalogue Service interface, Version 2.0.1 supporting the FGDC Profile."/>	
Information URL*:	<input type="text" value="http://geodata.gov"/>	
Interface URL* :	<input type="text" value="ta.gov/aimscsw/csw2.0?service=CSW&amp;request=getcapabilities"/>	

The page at <http://uddi.csiss.gmu.edu> says:

 The URL used to invoke the service.

#### Service Contact Information

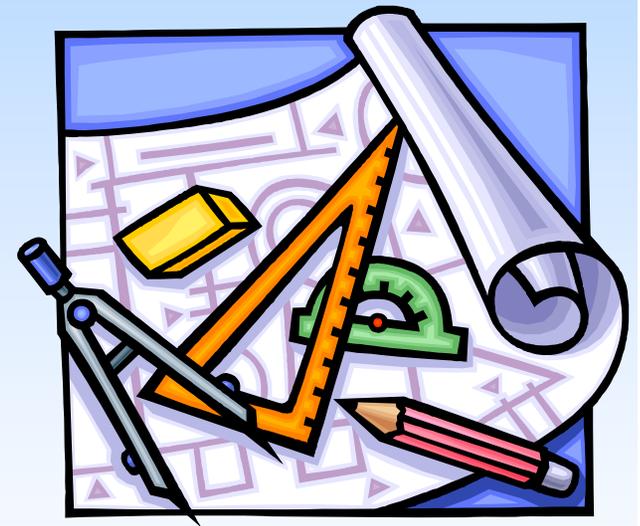
Contact Name*:	<input type="text" value="User Support"/>	
Contact Email*:	<input type="text" value="support@geodata.gov"/>	

#### Service Geographic Extent (Click in the box to enter value in decimal format, e.g. 37.234)

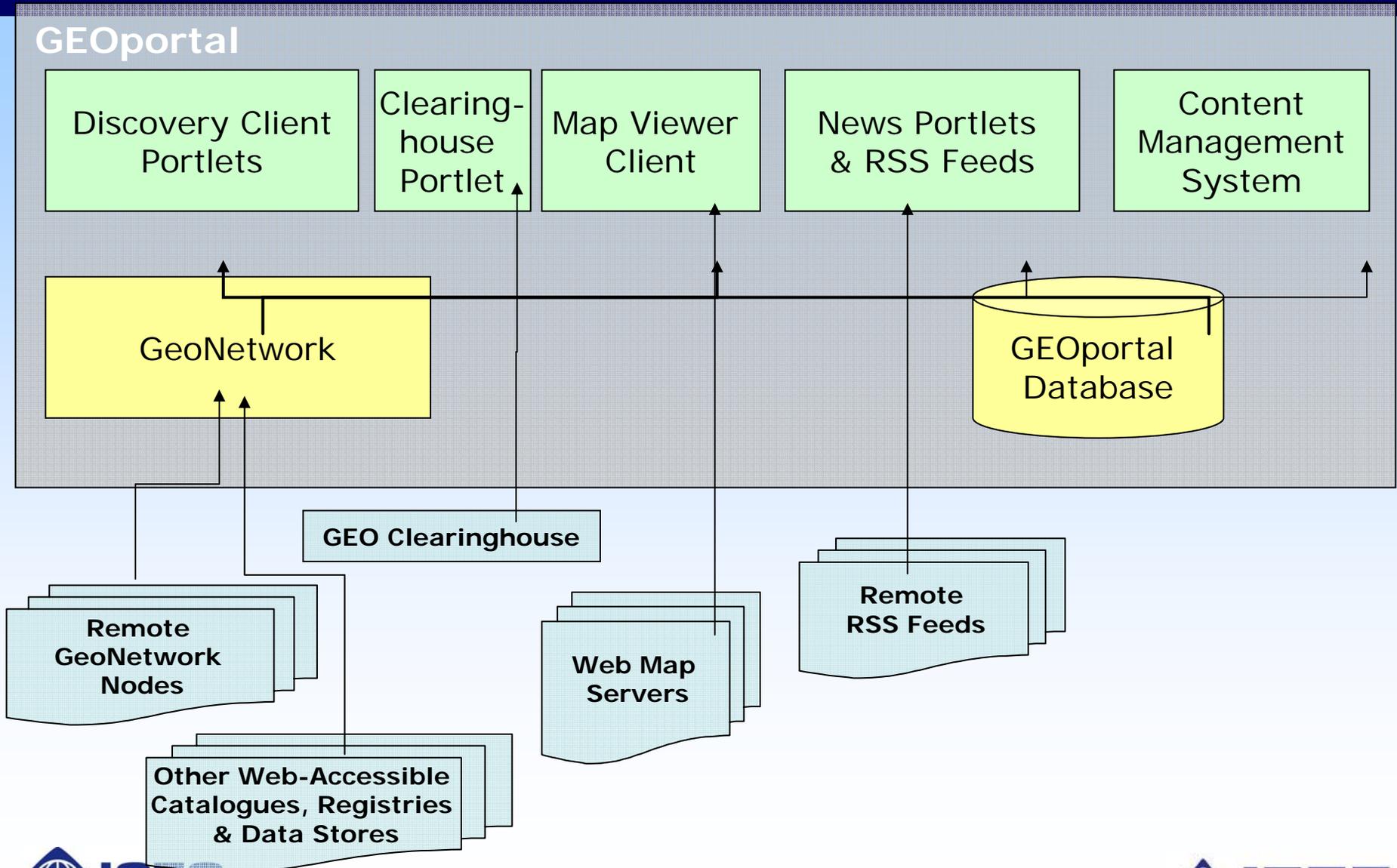
- Service Geographic Extent is specified in EPSG:4326

# Architecture Implementation Objectives - 2006-7

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# GEOportal Architecture



**Browse Resources by Societal Benefit Areas**

- DISASTERS
- HEALTH
- ENERGY
- CLIMATE
- WATER
- WEATHER
- ECOSYSTEMS
- AGRICULTURE
- BIODIVERSITY

**GEO Clearinghouse**

**Browse Resources by Location**



**FOCUS ON**

**IGARSS, 23-27 July 2007, Barcelona, Spain**

The 27th International Geoscience And Remote Sensing Symposium (IGARSS) will be held this year in Barcelona, Spain. IGARSS has become an international focus for remote sensing theory, programs, applications and state of the

**SHOWCASE**

The Elbe region in Saxony was affected by heavy flooding following strong rainfall in conjunction with snowmelt in the Krkonose Mountains (Czech Republic). The Elbe river rose to a level of 7.45 meters. In the city of Dresden, areas near the river had to be evacuated. Along the Elbe, whole districts of several towns were flooded. A state of emergency was declared in

**Breaking News**

Widespread flooding, the worse since 1954, over 24 Chinese provinces caused over 500 deaths and 3 million evacuations, with enormous damage to dams, roads, buildings and crops. In Mengwa, near Chongin in the Fujian basin, about 150,000 people were stranded on high ground when the Wangjia dam was opened to evacuate floodwaters. In Chongqing Municipality about 29,500 houses collapsed between 17 and 18 July.

[more...](#)

**Welcome to GEOportal**

The GEOportal provides an entry point to access remote sensing, geospatial static and in-situ data, information and services. The site is currently under construction. **Please take a few minutes to browse through the GEOportal and let us what you think.**

[more...](#)

**MY GEO**

**TUTORIALS**

# Architecture Implementation Objectives - 2006-7

- ✓ • **Create an interoperability structure**
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# GEOSS Architecture

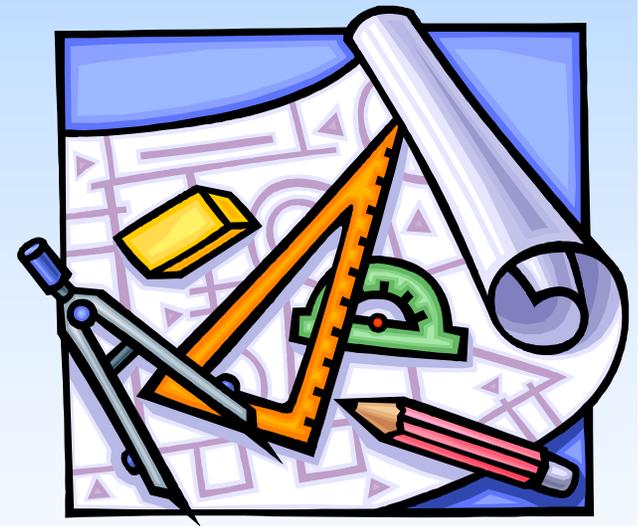


The following table details the major events associated with this CFP:

CFP Issued	13 April 2007
CFP Responses Due	11 May 2007
Kickoff Meeting at ESA-ESRIN, Frascati, Italy	5-6 June 2007
Demonstration, Washington DC, USA	September 2007
EO Summit and GEO Plenary, Cape Town, South Africa	November 2007

# Architecture Implementation Objectives - 2006-7

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# Documentation for contributors



## Contributing to and Benefiting from GEOSS, the Global Earth Observations System of Systems

### Strategic Guidance for current and potential contributors

**Purpose of this Document:** This document answers strategic questions for current or potential contributors of GEOSS systems, from the perspective of high-level systems architecture and data management. A companion 'Tactical Guidance' document provides more technical information for managers and implementors of systems, data centres, etc. For additional information about GEO and GEOSS, see <http://earthobservations.org>

#### What is the Global Earth Observations System of Systems (GEOSS)?

As a "system of systems", GEOSS is composed of contributed Earth Observation systems, ranging from primary data collection systems to systems concerned with the creation and distribution of information products. Although all GEOSS systems continue to operate within their own mandates, GEOSS systems can leverage each other so that the overall GEOSS becomes much more than the sum of its component systems. This synergy develops as each contributor supports common arrangements designed to make shared observations and products more accessible, comparable, and understandable.

#### How is GEOSS managed by the Group on Earth Observations (GEO)?

GEOSS is overseen by the Group on Earth Observations (GEO), an intergovernmental organization at the ministerial level. The GEO vision is to realize a future wherein decisions and actions for the benefit of humankind are informed via

DRAFT

## Contributing to and Benefiting from GEOSS, the Global Earth Observations System of Systems

*Tactical Guidance for current and potential contributors*

**Purpose of this Document:** This short document is for technical managers (eg of information systems or data centres) seeking to contribute to and benefit from the GEOSS - explains the 'interoperability process' to be followed to ensure that systems are compatible suitably interfaced to the GEOSS. A companion 'Strategic Guidance' document provides high-level advice on systems architecture and data management. For additional information about GEO and GEOSS see <http://earthobservations.org>

#### Introduction

Overall GEOSS is a federated system that grows ever more useful over time as constituent GEO Members and Participating Organizations link their contributed S components together. More details may be found in the "Strategic Guidance" document.

GEOSS Components and Services need to be registered respectively in the Component Registry and the Service Registry. This registration process for the new components & services provided by the GEO Members and Participating Organizations is described further down in the present document. Following the registration, the components & services need to be linked to the existing GEOSS components (they are not linked to systems as much as they are accessible from a centralized or distributed portal/clearinghouse through interoperability arrangements) respecting some constraints like the interoperability standards or the

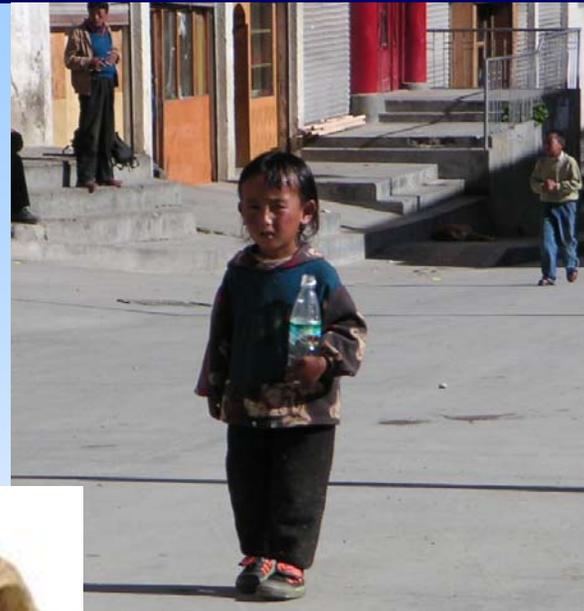
# Potential Plans 2008-9 more details (1)

- **Operations**
  - Institute Operational Capability – Phases 1,2  
Portal, Clearinghouse, SIF, Registries
  - Maintain Reference Cases – IP3, ...
- **Interoperability**
  - Metadata, data harmonization
  - Quality Assurance approach and processes
  - Data Sharing Principles

## Potential Plans 2008-9 more details (2)

- **Horizontal Development**
  - Observations – sensor web, virtual constellations, imaging spectrometry
  - Advanced Data Management Approaches
  - Best Practices (Populate Registry)
- **Capability Maintenance**
  - Radio Frequency Protection
  - Global Geodetic Ref Frames

# What we do in this generation will determine the destiny of our children's children



Courtesy of  
Rick Anthes

