

THE GEO STANDARDS AND INTEROPERABILITY FORUM

S.J.S. Khalsa^{a,*}, J. Zhang^b, W. Kresse^c

^aNSIDC, University of Colorado, Boulder, CO, 80309 USA - sjsk@nsidc.org

^bNational Satellite Meteorological Center, China Meteorological Administration, Beijing 100081
China - jszhang@nsmc.cma.gov.cn

^cUniversity of Applied Sciences Neubrandenburg, 17033 Germany - kresse@hs-nb.de

KEY WORDS: Earth Observation, Interoperability, Standards, Decision Support, GEOSS

ABSTRACT:

The intergovernmental Group on Earth Observations (GEO) is leading a worldwide effort to build a Global Earth Observation System of Systems (GEOSS). GEOSS builds upon, and adds value to, functioning Earth observation systems by supporting their interoperability, among other objectives. To help advance these interoperability goals the GEO Architecture and Data Committee (ADC) has established a Standards and Interoperability Forum (SIF) to support GEO organizations offering components and services to GEOSS. The SIF helps GEOSS contributors understand how to work with the GEOSS interoperability guidelines and how to enter their “interoperability arrangements” (standards or other ad hoc arrangements for interoperability) into the GEOSS registries.

In addressing diverse societal needs an activity may require the exchange of data and information between disparate disciplines that do not traditionally interact and therefore lack established common standards necessary for interoperability. For this reason, GEOSS interoperability arrangements must include a process for bridging these gaps and, if necessary for initiating the creation of new standards where the need arises. The Standards and Interoperability Forum exists to facilitate the interchange of information, and make recommendations for standards and interoperability in GEOSS. The SIF is enabling ever greater degrees of interoperability among GEOSS components through facilitation, technical analysis, advocacy and education. Although GEO encourages the use of open international standards, GEOSS must also accommodate the use of non-standard practices. Thus, the GEOSS Standards Registry contains information on these non-standard practices or interoperability “special arrangements.” The process for entering special arrangements into the Standards Registry is handled by the Standards and Interoperability Forum.

We describe the operating principles and current practices of the GEO ADC Standards and Interoperability Forum.

1. INTRODUCTION

1.1 GEOSS

The need for comprehensive and sustained global environmental monitoring has become increasingly apparent as societies are subject to climate change, natural disasters, food and water shortages, resource depletion, pollution and increasingly interdependent economies. In response to this need governments are collaborating through the Group on Earth Observations, GEO, to link together thousands of observing systems that until now have operated in isolation. GEO is creating a Global Earth Observation System of Systems (GEOSS) to bring societal benefits through improved access to, and synergy among, current and future Earth observing systems.

GEO, was established by a series of three ministerial-level summits. It currently includes 72 member countries, the European Commission, and 52 intergovernmental, international, and regional organizations with a mandate in Earth observation or related issues. GEOSS is being built initially from existing systems and initiatives, with an emphasis on the creation of synergies among GEOSS components that provide increased benefits to society. The goal is to leverage existing programs and established standards wherever possible, and to broaden convergence of systems based on interoperability arrangements which have been agreed to by consensus.

1.2 GEOSS Architectural Principles

GEO Members and Participating Organizations are contributing components to GEOSS, which may include observing, processing, modelling and data dissemination capabilities. These systems are built to serve particular needs and will continue to operate according to mandates determined by their owners. However, these systems should also be designed or adapted so their interfaces support interoperability with other systems. The GEOSS architecture principles describe how contributed components fit together to produce an overall system that is capable of providing data and information to meet societal needs better than the individual components operating in isolation. The key to GEOSS’ utility and effectiveness is interoperability of its component data and information systems.

GEOSS architects recognized that it was impractical to build a monolithic data system through which all Earth observation data would be managed. Instead, the GEOSS 10-year Implementation Plan [GEO, 2005a] outlines a Service-Oriented Architecture (SOA) for GEOSS, in which contributed components interact by passing structured messages over network communication services. Such interactions will take place according to agreed-to “interoperability arrangements” which, ideally, are based on non-proprietary, open standards. GEOSS seeks to meet its interoperability objectives through consensus on existing specifications, with preference given to

* Corresponding author.

formal international standards such as ISO, instead of creating new specifications.

1.3 GEOSS Core Components

Fundamental to the operation of GEOSS is access to information about its components. GEOSS uses a “Components Register” and a “Services Register” to store information about components and the services these components offer (Figure 1).

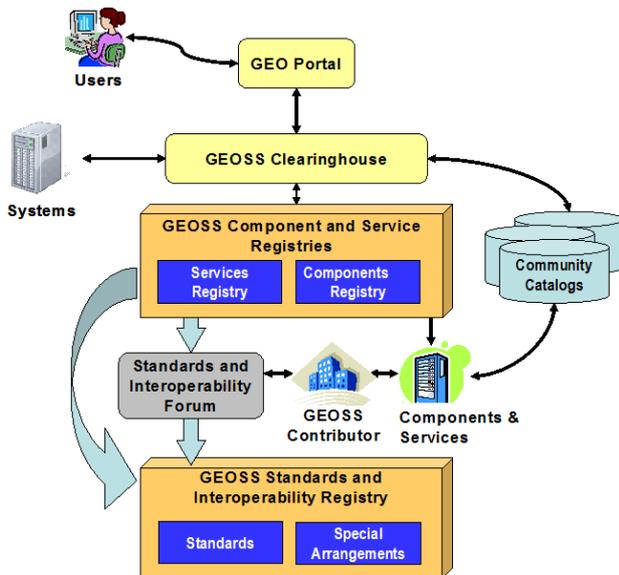


Figure 1. GEOSS Core Components

The interoperability arrangements that are used by GEOSS services are described in the “Standards and Interoperability Register.” All GEOSS registries are interoperable and accessible via the GEOSS Clearinghouse. The GEOSS Standards Register and the web-based interfaces to it are being hosted by the IEEE.

2. THE GEO SIF

To help in the process of reaching consensus on GEOSS interoperability arrangements the GEO Architecture and Data Committee (ADC) established the Standards and Interoperability Forum (SIF). The SIF (Thomas, et al., 2007) helps GEO organizations offering components and services to GEOSS understand how to work with the GEOSS interoperability guidelines and how to enter their “interoperability arrangements” (standards or other ad hoc arrangements for interoperability) into the GEOSS registries.

In addressing diverse societal needs an activity may require the exchange of data and information between disparate disciplines that do not traditionally interact and therefore lack established common standards necessary for interoperability. For this reason, GEOSS interoperability arrangements must include a process for bridging these gaps and, if necessary for initiating the creation of new standards where the need arises. The SIF exists to facilitate the interchange of information, and make recommendations for standards and interoperability in GEOSS.

Although GEO encourages the use of open international standards, GEOSS must also accommodate the use of non-standard practices. Thus, the GEOSS Standards Registry contains information on these non-standard practices or interoperability “special arrangements.” The process for entering special arrangements into the Standards Registry is handled by the Standards and Interoperability Forum.

2.1 Composition, Organization and Reporting

The SIF is composed of experts nominated by GEO Members and Participating Organizations. The SIF also draws on subject matter experts who possess an understanding of the protocols, standard arrangements and other technological practices specific to a particular domain of knowledge, community of practice or other endeavours in support of the GEOSS designated Societal Benefit Areas. The SIF works by consensus of its participants.

2.2 Approach and Functions

Specific SIF activities include:

- Analyzing proposed interoperability special arrangements coming from components offered to GEOSS and overseeing the entry of these special arrangements into the GEOSS Standards and Interoperability Register
- Helping in the identification and promotion of standards required to achieve GEOSS interoperability objectives;
- Monitoring relevant activities within GEO to determine whether there are impediments in the application of interoperability arrangements that are registered to GEOSS
- Identifying organizations and individuals that can play a bridging function among GEOSS components and Societal Benefit Areas (SBAs)
- Facilitating cooperation among the many organizations involved in selecting, developing and using diverse standards applicable to GEOSS
- Facilitating linkages and partnerships between established Standards Development Organizations, users and new groups or organizations interested in collaborating in GEOSS standards efforts.

Furthermore, the SIF seeks to fulfil its mission through:

- Monitoring interoperability challenges, identifying impediments to GEOSS objectives, identifying gaps in current standards, and promoting the creation of standards by appropriate standards organizations to address these issues.
- Working to enhance and broaden the scope of applicability for interoperability arrangements that are registered to GEOSS.
- Demonstrating the benefits of interoperability, showcasing successes of projects and initiatives that use GEOSS registered standards to achieve interoperability.
- Educating component contributors, and, as appropriate, data consumers and integrators, regarding GEOSS registered standards and the resources available to assist in using them.

2.3 Review of Items to be Considered for the Registry

The process for registering a component is depicted in Figure 2. First, a component is registered and details regarding its nature, status and applicability are provided. Next, if the component exposes a service through which the offerings of that component are accessed, then the process of registering those service commences. Details of each service are entered, including the protocols used to access the service and the standards by which information is exchanged across that service interface.

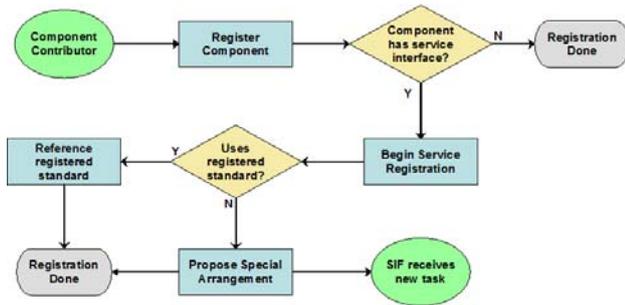


Figure 2. Component and service registration flow.

A list of standards and special arrangements currently registered in the standards registry is presented in pick-lists, organized into broad categories, to associate with a service. If the appropriate standard or special arrangement is not already in the registry the component contributor may submit it to the SIF for consideration. The process that the SIF uses in evaluating such submissions is shown in Figure 3.

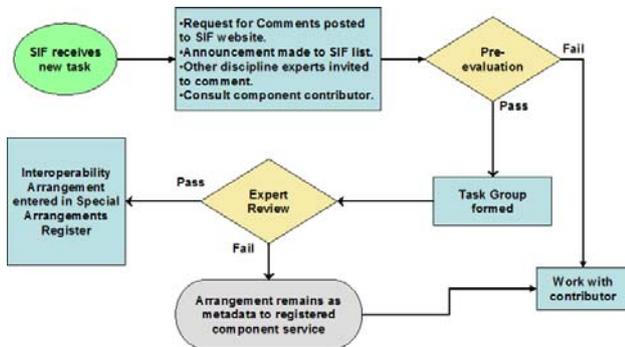


Figure 3. Special Arrangement evaluation flow.

The task groups referred to in Figure 2 will be regionally based. To carry out its work most effectively, the SIF is forming regional teams consisting of subject matter experts representing each (or most) of the societal benefit areas of GEOSS. The lead of each regional team serves as the regional representative on the SIF.

Interoperability arrangements that are submitted to the SIF for consideration are directed to regional teams for review. The regional teams analyze and provide an opinion on the acceptability of this arrangement, based on criteria established by the SIF. These recommendations then go to the SIF leadership team for consideration and disposition with the original submitter.

Discussions within the SIF on proposals for entries into the GEOSS Standards and Interoperability Register continue until the following criteria are satisfied:

1. The proposed Interoperability Arrangement supports the GEOSS architecture principles in effect at the time of the proposal. Currently, these include:
 - a) "must be based on non-proprietary, open standards, and profiles must be specified when standards are not sufficiently specific."
 - b) "interoperability specification states exactly how the service and the data must be described"
2. The proposed Interoperability Arrangement is well-documented (in terms of semantics, syntax, service, security, internationalization)
3. The proposed Interoperability Arrangement has support within at least one user community.
4. The proposer asserts a commitment to maintaining, and making the proposed Interoperability Arrangement more interoperable, e.g. building gateways to other standards and arrangements that are already registered.
5. The proposer asserts a commitment to provide additional information as necessary for implementation of the Interoperability Arrangement within the GEOSS context.
6. The proposed Interoperability Arrangement is suitable for wider use within GEOSS
7. Cross-domain application is desirable

Currently, the SIF is considering standards and special arrangements submitted by a wide variety of organizations encompassing mainly the GEOSS themes of climate, water, weather, and biodiversity. We anticipate in the near future seeing submissions from the remaining GEOSS themes, namely disasters, health, energy, ecosystems and agriculture.

3. CONCLUSIONS

The SIF is enabling ever greater degrees of interoperability among GEOSS components through facilitation, technical analysis, advocacy and education.

REFERENCES

GEO, 2005a. *Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan*, ESA Publications Division, the Netherlands, Bruce Battrick, ed. ISSN No.: 0250-1589, ISBN No.: 92-9092-495-0.

GEO, 2005b. *Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan Reference Document*, ESA Publications Division, the Netherlands, Bruce Battrick, ed. ISSN No.: 0379-6566, ISBN No.: 92-9092-986-3.

Thomas, D, S.J.S. Khalsa, S. Nativi, T. Ahern, R. Shibasaki, 2007: Processes for Achieving Interoperability in GEOSS, Eos Trans. AGU, 88(52), Fall Meet. Suppl., Abstract IN43C-08

ACKNOWLEDGEMENTS

This work is supported by the IEEE Committee on Earth Observation, <http://www.ieee-earth.org/>

