

MODELING GEOSS – A DOMAIN MODEL FOR GLOBAL SYSTEMS OF SYSTEMS

-- Abstract --

Author: Michael Burnett, NASA/SGT

1.0 INTRODUCTION

Significant progress has been made in the last several years in building a foundation for a successful Global Earth Observation System of Systems (GEOSS). This foundation has many facets, not the least of which is technical in nature. An initial GEOSS Common Infrastructure (GCI) has been established in order to enable GEOSS members and users to communicate and exchange their resources and experience. The first generation of the GCI has been established and now is being used by the first wave of GEOSS participants. These initial participants are members of contributing systems and scientists highly familiar with GEOSS, and the systems which are being offered to it. A GEO Task (Task DA-09-01b, Data, Metadata and Products Harmonization) has been established to analyze current capabilities and to identify opportunities to improve the utilization and exchange of resources registered with GEOSS. The purpose of this paper is to introduce some reflections on that first generation of the GCI, and to offer some suggestions on evolving it to become even more valuable to current users, and easier for new users to discover, access and exchange Earth Observation resources (data, services, applications and experiences).

2.0 METHODOLOGY

These concepts of the next generation of the GCI have been derived by using two sets of Best Practices in large scale systems. First, we are accounting for the vast experience in developing operational Earth Observation systems based on remote sensors, and the large volumes of data that those systems manage. Secondly, we have used Best Practices of developing enterprise-scale systems. Key Best Practices that have been incorporated to date are: Use Cases and Visual Modeling. A new domain model is at the center of this update, and that domain model has been validated using a fundamental set of Use Cases. In this Use Case modeling exercise, key stakeholders have been defined and a baseline of their fundamental interactions with GEOSS (through the GCI), have been captured.

These efforts have resulted in an updated Domain Model, which is described later in this paper. This domain model has been assessed against the GCI Concept of Operations document, and made as consistent as possible with that document.

3.0 CENTRAL CONCLUSIONS

This effort has produced two sets of conclusions. First there are a set of suggestions, based on an analysis of the first generation of the GCI. Secondly, based on that experience and those suggestions, we have developed a Domain Model of GOESS, and identified how the GCI can interact with that model, in order to more effectively serve the GEOSS community. The following subsections present, at a high level, those conclusions.

3.1 Fundamental Suggestions

There are a set of basic changes and clarifications that need to be made in order to improve the usage of GEOSS resources through the GCI. Those suggestions are:

- 1) Modify the relationship between “system” and “component”.
- 2) Clarify between the management of information about “types” and “instances” or “items” of those types. The delineation between type and item can apply to the three levels of resource represented in the GCI: Data, Service and Standards. Table 1 represents a view of “types” and “items” for GCI information.
- 3) Remote sensing inventories should not be “harvested”
- 4) Authentication should be required before resources are registered
- 5) Portals should be open. The GCI should support portals as the community chooses to establish them. The three current portals could be considered “endorsed” portals, but they should not be the only GCI portals.
- 6) Currently there can be confusion when publishing and discovering resources. There are a series of assertions for resources which may minimize that confusion. Specifically, those assertions are: Events are services; Models are services (or components offering services); Categorization is flexible and ever-changing.

Table 1 - Types and Items in GEOSS

	Data	Services	Standards
Type	DataSet/Collection	Interface	Specification
Item	Granule	Ending	Adherence

3.2 Domain Modeling

This updated Domain Model for GEOSS Package is represented using the UML modeling language. In order to facilitate understanding, the model has been captured in a set of UML Packages. Figure 1 identifies those packages and the two basic GEOSS actors, the GEOSS Provider and the GEOSS User.

The following subsections offer a definition of these packages and a definition of their domain elements.

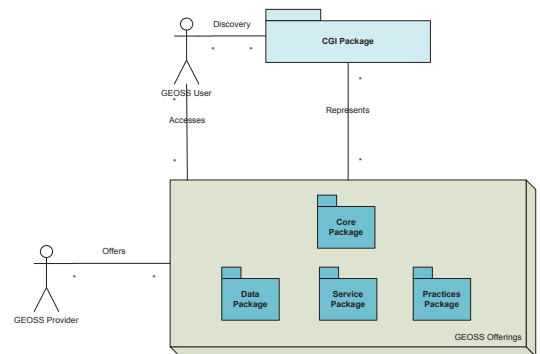


Figure 1 – Domain Model: UML Packages

3.2.1 GCI Package

The GCI package contains the elements that represent the publicly identified pieces of the GEOSS Common Infrastructure. These are the entities that GEOSS Users directly relate to/interact with directly. Figure 2 represents the elements contained within the GCI package and their relationships. The final paper will include definitions for all GCI Package elements.

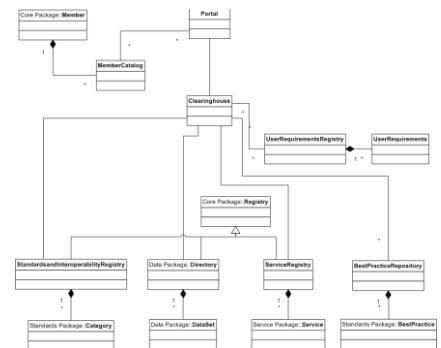


Figure 2 - Domain Model: GCI Package

3.2.2 Core Package

The Core Package includes all the entities and structures that support the functionality of the GCI elements. Figure 3 represents the elements contained within the Core Package and their relationships. The final paper will include definitions for all Core Package Elements.

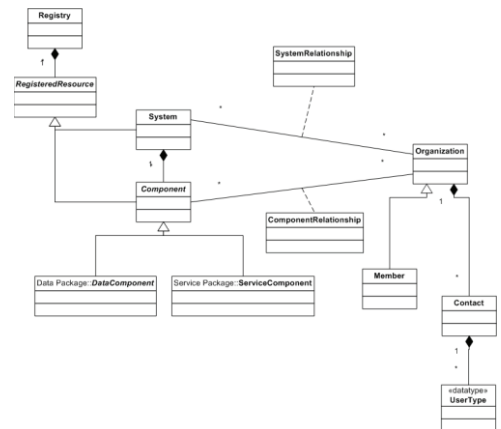


Figure 3 - Domain Model: Core Package

3.2.3 Data Package

The Core Package includes all the entities related to the data resources contributed to GEOSS. Figure 4 represents the elements contained within the Data Package and their relationships. The final paper will include definitions for all Data Package Elements.

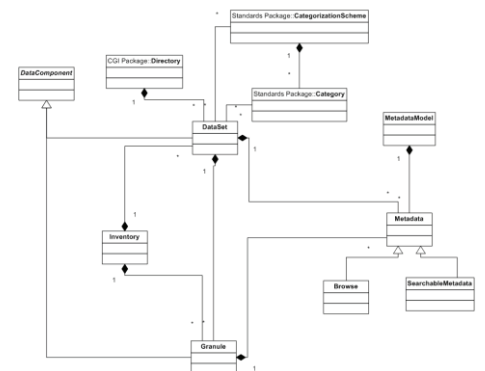


Figure 4 - Domain Model: Data Package

3.2.4 Service Package

The Service Package includes all the entities related to the service resources contributed to GEOSS. Figure 5 represents the elements contained within the Service Package and their relationships. The final paper will include definitions for all Service Package Elements.

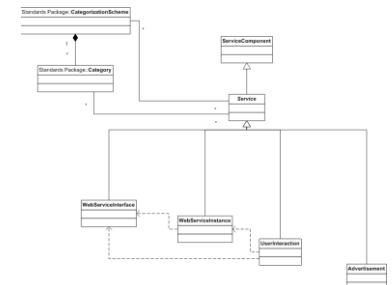


Figure 5 - Domain Model: Service Package

3.2.5 Practices Package

The Practices Package includes all the entities related to the agreements, standards and practices within the GEOSS community. Figure 5 represents the elements contained within the Practices Package and their relationships. The final paper will include definitions for all Practices Package Elements.

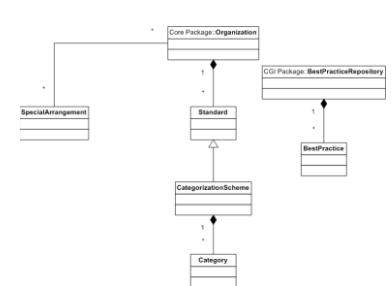


Figure 6 - Domain Model: Practices Package

4.0 SUMMARY

In summary, by using industry proven Best Practices and experience gained from the remote sensing community, the next generation of the GEOSS infrastructure can greatly improve the publication, discovery and access to Earth Observing resources. With this improvement the promise of an alive and dynamic system of systems can be more readily realized.

5.0 BIBLIOGRAPHY

"Concept of Operations Document GEOSS Common Infrastructure."

http://www.earthobservations.org/documents/excom/ec14/09_Concept%20of%20Operations%20Document%20GEOSS%20Common%20Infrastructure.pdf. Group on Earth Observations, 18 Nov. 2008. Web. 5

Dec. 2009. <www.earthobservations.org/documents/committees/adc/200905_10thADC/ADC_DA-09_01b_Slides.pdf>.

Pilone, Dan, and Neil Pitman. UML 2.0 in a Nutshell (In a Nutshell (O'Reilly)). Sebastopol: O'Reilly Media, Inc., 2005. Print.

"WGISS | Interoperable Catalog System (ICS)." Working Group on Information Systems and Services. N.p., n.d. Web. 11 Dec. 2009. <<http://wgiss.ceos.org/ics/>>.

"ECHO Extended Services." ECHO Home. Version 9. NASA/ESDIS, n.d. Web. 6 Dec. 2009. <www.echo.eos.nasa.gov/documents/service_partners/Extended_Services_Client.ppt>.

McDonald, Ken . "Task DA-09-01b Data, Metadata and Products Harmonization." Group on Earth Observations Home. Gropu on Earth Observations, 7 May 2008. Web. 4 Nov. 2009. <http://www.earthobservations.org/documents/committees/adc/200905_10thADC/ADC_DA-09_01b_Slides.pdf>.