National Institute of Advanced Industrial Science and Technology (AIST)

Global Earth Observation Grid (GEO Grid)

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JAPAN

Group on Earth Observations

Architecture Implementation Pilot (AIP)

Phase 2 (AIP-2)

GEOSS AIP-2 CFP Response

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GEO Grid Response to the GEOSS AIP-2 CFP

1 Overview

The "GEO Grid, Global Earth Observation Grid" project since 2005 is primarily aiming at providing an E-Science infrastructure for worldwide Earth Sciences community initiated and led by AIST (National Institute of Advanced Industrial Science and Technology, Japan). In the community there are wide varieties of existing data sets including satellite imagery, geological data, and EO data that each data owner insists own licensing policy. For example, satellite imagery data is not always freely available but many of commercial products need to have authorization, authentication and accounting. It is non-trivial to manage such policy diversity across the data sets as well as services including computing resource access. In the GEO Grid project we have developed software package so called “GEO Grid Virtual Organization tools” that intends to integrate all the relevant data and services retaining each provider’s licensing policy enabled by grid technology. Regarding the Social Benefit Area we have proposed GEOSS to develop global road and human settlements map using GEO Grid which contribute to “Biodivesity”. In addition "GSJ: Geological Survey of Japan" in AIST has developed wide variety of geological information that contribute substantially to “Reduction and Prevention of Disasters” area.

As contributions to the AIP phase 2 activities, GEO Grid would propose to provide the software package and associated components that work well with workflows under appropriate authorization.

1.1 Offered Components

GEO Grid Virtual Organization tools

The “Virtual Organization” is the term from the grid computing technology area that allows an “Organizer” to create an organization providing member-only data services, data processing, and other services and resources across multiple service providers with different policies. It also gives a member of a VO a single-sign-on feature without knowing the diversities in the policies and access methods. In addition, by using the tools the service providers are free from managing individual accounts number of which in some cases easily goes beyond 10,000 and more.

1.2 Contribution to SBA

Especially contributes for the development of “2.7 ECOSYSTEMS: EC-09-02: Human Dimension of Ecosystem Utilization and Conservation” and “Reduction and Prevention of Disasters”. Also the above offered components will be beneficial to all the scenarios in Annex B.

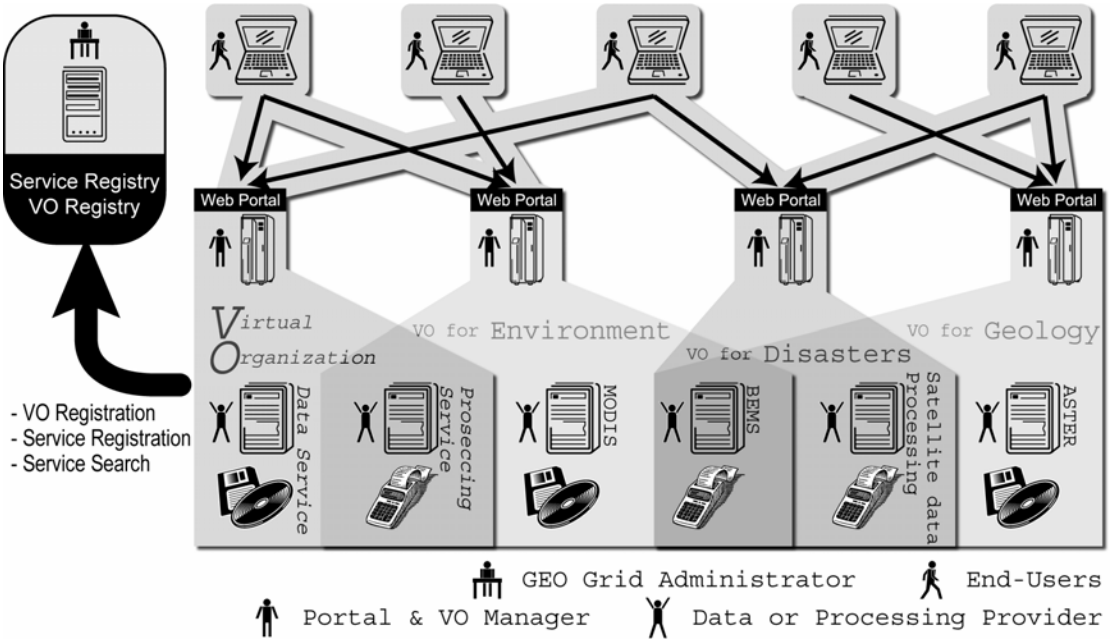
1.3 Current Status

- Feel and look the design and the concept of the VO. Account may be created in the "GEOSS AIP-2 VO" upon request. (Individual contract required)
- WPS-enabled GRASS has been in service for trial use. Each user must bear at least single X.509 certificate or OpenID for authentication and authorization.
- CS-W service for providing ASTER whole data is operational but is limited to the members of authorized VOs.
- Benchmarking WxS with developed tools to get better performance.
- Alpha version of GEO Grid Virtual Organization tools will be available in November, 2008, followed by the beta release by March, 2009. The 1st public release is targeted in 3Q 2009.

Virtual Organization/Security Framework

Many research organizations and/or individuals are providing GIS datasets via WMS simply as images, whereas practical applications often require the original vector/raster data transfer over WFS/WCS, respectively. Most of the data providers, however, are reluctant to employ WFS/WCS because sophisticated data access control mechanisms are not available. For example, it is possible to control access to W*S services represented by a URL using temporal username/password authentication, however, data providers need to configure access control for individual users. This is a troublesome task for the data providers and not scalable for the number of users. In addition, geographically distributed data and computing services are dynamically federated and integrated by users according to their own requirements, and must be accessed under appropriate authentication and authorization by single sign-on and credential delegation. However, the current OGC standards do not provide scalable security mechanisms which implement flexible access control according to the data owner's policies. The current OGC standards are also not appropriate for federating distributed services in multiple security domains. In order to satisfy the requirements described above, the GEO Grid system introduces the concept of a virtual organization (VO), for its design, in which various data and computing resources are provided as services represented by standard protocols. A VO is a dynamic collection of individuals, institutions, and resources, in which sharing of data, computers, software, and other resources are highly controlled, with resource providers and consumers defining clearly and carefully just what is shared, who is allowed to share, and the conditions under which sharing occurs. The following figure illustrates an overview of the GEO Grid system in which data services, processing services, and users each form VOs for their own purposes, such as disaster mitigation, weather prediction, or natural resource exploration. A VO is created dynamically by integrating available services and resources according to the interests and requirements of the VO. In general, a user may be a member of any number of VOs. A VO can categorize users into groups according to their tasks. Authorization plays a key role in the process of gaining access to services in the GEO Grid system. The authorization is established by enforcing agreements between service providers and VOs, where access to the services is controlled by both parties with

different roles. General information regarding the relationship of the user with his VO, such as the groups he belongs to, and roles he is allowed to cover is contained on a server managed by the VO itself. Information regarding what the user is allowed to do is kept and managed at the service provider to control access to the services according to the policy of the service provider. Enabling service providers to control access to the services not for individual users, but for VOs and their groups, this design reduces administrative costs for service providers and realizes a scalable authorization mechanism for any number of users. It should be noted that the credentials of the user are sent to the service provider to implement access control for individual users which can override the permissions granted by the VO.



Overview of the VO component in GEO Grid System

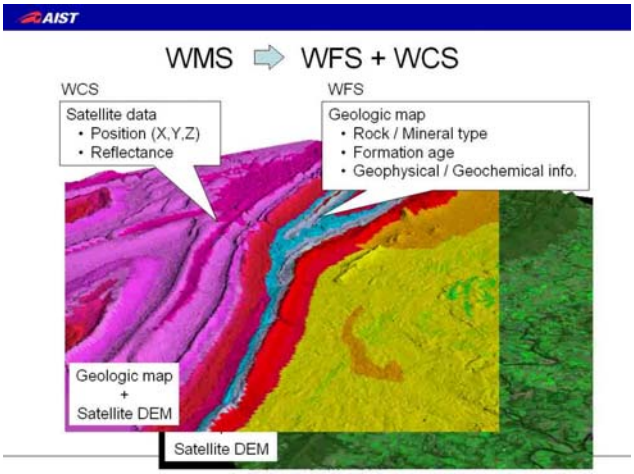
In order to reduce the cost of software development and realize better interoperability with existing systems, the GEO Grid system utilizes standard technologies and protocols, such as Web services and the Grids.

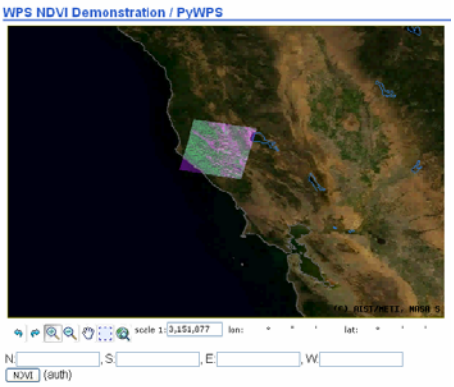
(Source: Sekiguchi, *et al*., Design Principles and IT Overview of the GEO Grid, IEEE Systems Journal, 2008)

Proposed Contributions

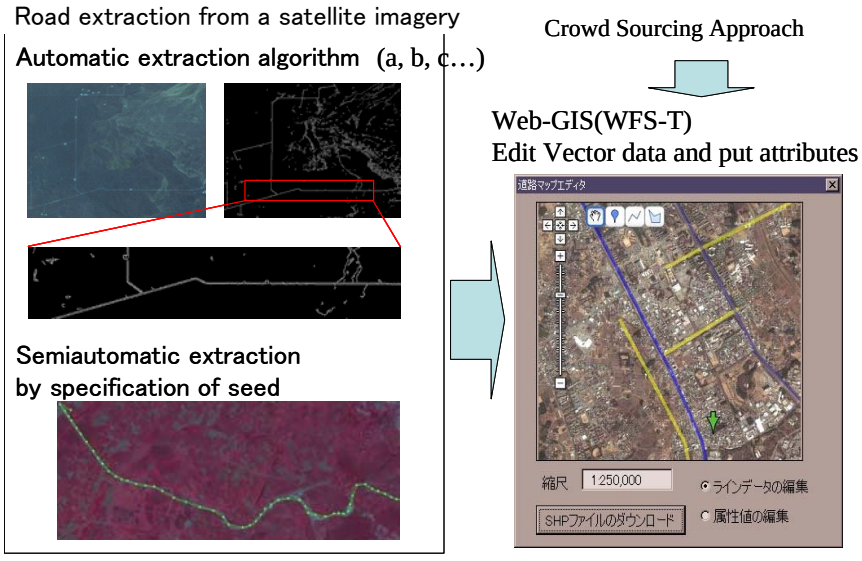
1.4 Societal Benefit Area Alignment and Support

- Geological map may be able to contribute "Disaster Response" scenario. Not only to distribute those maps as WMS, WFS+WCS service would be considered by combining with satellite DEM





- WPS service under the VO would contribute to estimate the post disaster damage.
- Development system for global road and human settlements would directly contribute to the 2.7 ECOSYSTEMS: EC-09-02: Human Dimension of Ecosystem Utilization and Conservation



2 Description of Responding Organization/AIST

AIST

National Institute of Advanced Industrial Science and Technology (AIST), led by President Dr. Yoshikawa, is not a government institution, although funded by Japanese government to a large extend. AIST is a rather new research organization established in 2001, however, AIST and its ancestors have been contributing society through continuous advancement in technologies and supports to Japanese industries since 1876. Headquarters of AIST are located in Tsukuba and Tokyo. AIST has over 50 autonomous research units in various innovative research fields, and the units are located at 9 research bases and several sites (smaller than research bases) of AIST all over Japan. About 2500 research scientists (about 2000 with tenure) and well over 3000 visiting scientists, post doctoral fellows and students are working in AIST. About 700 permanent administrative personnel and many temporary staff supports research works of AIST.

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