Utilizing GOS Map and Data Services for Cross-agency Earth

Science and Geospatial Cyberinfrastructure Communities

Final Project Report

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Final Report Summary Information

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American Association of Geographers (AAG)
Federation of Earth Science Information Partners (ESIP)

Final Report

Executive Summary

This project sought to develop open-source portlets and a standalone client to utilize the Geospatial One Stop (GOS) maps and data services to support the Earth and geography science communities. It was executed through a partnership between George Mason University's Joint Center for Intelligent Spatial Computing (CISC), the Federation of Earth Science Information Partnership (ESIP), and the Cyberinfrastructure Specialty Group (CISG) within the American Association of Geographers (AAG).

The project was accomplished on time, producing an operational UniPortal for searching, querying, visualizing and integrating (Geospatial One-Stop) GOS map resources (http://eie.cos.gmu.edu/WMSUniPortal/cap.jsp). Three supporting documents were developed for users to customize the portal, to deploy the portal on their own server, and operating the portal. The project source code has been released to the public through SourceForge. The compiled project, source code, and related documents can be downloaded from https://sourceforge.net/projects/uniportalcisc/. This portal can be further customized as 1) a portlet to embed in any portal; 2) a standalone client for accessing GOS map resources.

Project Narrative

Activity I: Organize Experiences and Design the System

Relevant experience and insights were gathered through discussion with user communities such as ESIP and CISG, We compiled these insights as requirement and worked out a plan for development in this project. We identified Air Quality, Water Management, and Arctic Spatial CI as project prototype applications useful to the research community.

Activity II: Develop modules based on the expertise and requirements

Uniportal, a testing kernel was developed based on the expertise and requirements of partners. This portal features the following modules:

1) Service Capability Clearinghouse

In order to provide a seamless integration framework for Web Map Service (WMS) services, we have designed and developed a Service Capability Clearing House (SCCH) (Fig. 1) to accelerate WMS integration. The major goal of SCCH is to harvest, and pre-process the WMS capabilities files and to cache the processed information in a database. SCCH works as a centralized service broker to cache service metadata on a centralized server. Therefore, the cached information cannot only be accessed by the user invoking the operation, but also by everyone connected to the SCCH. WMSs are harvested by the SCCH from Catalogue Service for Web (CSW) search results, user input and a service crawler: a) The capabilities file parser is responsible for extracting the layer-based metadata and storing them in the service layer repository; b) while the capabilities updater is running in the background to update the service metadata by reprocessing the capabilities information on a pre-defined frequency (e.g. daily) to keep them consistent with providers. The layer-based performance evaluator is responsible for testing and recording the response time for each layer. APIs are provided for other components to retrieve information from the SCCH.

Figure 1. Architecture and workflow of SCCH

When service metadata is requested, SCCH will search the requested records in its database and respond to the users request immediately if a service is already registered, reducing waiting time. If the requested service is not in the SCCH, the SCCH will automatically harvest this service and return the requested records. In this case it needs a little more time for downloading and interpreting the capability file on-the-fly. SCCH automatically collects services from users' requests, which makes it a self-growing system.

2) Connection to GOS CSW

The Uniportal is connected to the GOS CSW through the OGC Catalogue Services 2.0 specification. To use this service, CSW clients may use the following URL:

http://gos2.geodata.gov/Portal/csw202/discovery as the service interface URL.

The GOS CSW service supports three mandatory CSW requests including: *GetCapabilities, DescribeRecord*, and *GetRecords* It also supports one optional request *GetRecordById*. Both KVP (Key-Value Pair) and POST style requests are supported by the GOS CSW service.

3) Seamless Integration and Visualization

The portal seamlessly integrates catalogue services and available WMS resources with a visual interface for users to access and preview these resources. The feature functions are: search through several catalogue including GOS CSW; directly add WMS resources to SCCH; preview of any WMS resources in 2D/3D viewers; Support time-enabled WMS; and Support Web Map Context File so that composed map can be saved and transmitted.

Activity III: Demonstration and Applications

Based on the core module, we developed several applications. These applications are:

○ Air quality(http://eie.cos.gmu.edu/WMSUniPortal/)

○ Arctic SDI(http://eie.cos.gmu.edu/WMSUniPortal/arctic.jsp):

○ Water portal(http://water.cisc.gmu.edu/):

• NASA   Spatial Web Portal (http://wms.gmu.edu/SWPBing/)

- Microsoft/CISC Virtual Earth Observation
  (http://eie.cos.gmu.edu/BingEO/)

Activity IV: Outreach

During the development, we have maintained a close relationship with the Federation of Earth Science Information Partnership (ESIP), and the Cyberinfrastructure Specialty Group (CISG) within the American Association of Geographers (AAG).

1) Open source

We set up a project in SourceForge (http://sourceforge.net/projects/uniportalcisc/) Our Source codes as well as supporting documents are uploaded to this site for free use. Currently, we have 28 downloads a month.

2) We incorporate the model with the graduate courses in GMU

We used this portal in our graduate course, the "2009 summer training program" at George Mason University.

3) Conference Sessions

1. Service Oriented Computing and Architecture, technical session in AAG 2010 Annual Meeting, Friday, 4/16/10, from 12:40 PM - 2:20 PM in Tyler, Marriott Mezzanine, Organized by Huayi Wu and Xuan Shi through the CISG AAG.
2. What are the Grand Challenges of Geographic Information Science? Panel discussion in AAG 2010 Annual Meeting, Saturday, 4/17/10, from 12:40 PM - 2:20 PM in Virginia Suite B, Marriott Lobby Level, Organized by Chaowei Yang through CISG, AAG
3. Geospatial Web Services in Government, Panel discussion in AAG 2010 Annual Meeting, Organized by Chaowei Yang and Douglas Nebert through CISG, AAG

4) Conference presentations

1. Huayi Wu, Zhenlong Li, Chaowei Yang, Quality-supported architecture for Geospatial Information Service, AAG 2010, Washington DC, 14-18 April, 2010-4-15(ORAL)
2. Zhenlong Li, Huayi Wu, Chaowei Yang, Application Composition based on WMS Layers for Supporting Spatial Data Infrastructure, ESIP (Federation of Earth Science Information Partnership) 2009 Winter Meeting, Washington DC, 5-7 Jan., 2010 (ORAL)
3. Zhenlong LI, Huayi Wu, Chaowei Yang, Application Composition based on WMS Layers for Supporting Spatial Data Infrastructure, American Geophysical Union, Fall Meeting 2009, abstract #IN12A-06, San Francisco, CA, Dec 14-18, 2009-12-3(ORAL)
4. Huayi Wu, Zhenlong Li, Chaowei Yang , Real-time Monitoring of WMS Quality for Optimized Map Composition with Distributed WMS Layers, AGU 2009 Fall Meeting, San Francisco, CA, Dec 14-18, 2009-12-30 (ORAL)

5) Publications

1. Wu H., Li Z., Zhang H., Yang C., Shen S., 2010, Monitoring and Evaluating Web Map Service Resources for Optimizing Map Composition over the Internet to Support Decision Making, *Computer and Geoscience.* DOI: 10.1016/j.cageo.2010.05.026
2. Li Z., Yang C., Wu H., Li W., Miao L., 2010, An optimized framework for OGC web service seamlessly integration to support Geospatial Sciences, *International Journal of Geographic Information Science*, DOI: 10.1080/13658816.2010.484811.
3. Li W., Yang C., Nebert D., Raskin R., Houser P., Wu H., Li Z., 2010, Semantic-enabled Service Discovery and Chaining for Building a Virtual Arctic Spatial Data Infrastructure, *Computer & Geoscience*, (in press).
4. Yang C., Wu H., Huang Q., Li Z., Li J., 2010. Spatial Computing for Supporting Geographic Science, *PNAS.* (in review)

Next Steps:

We plan to keep the portal in operation online for end users and to maintain the open source codes and documents to benefit the field long term. We also plan to extend this portal to support not only WMS, but also WFS, WCS and WPS to contributive to a geospatial cloud computing platform. We are also working to link the portal to other commercial web mapping platforms such as Google map, Bing map.

Feedback for Cooperative Agreements Program

We found through this project that the CAP program is a very effective way to develop components for spatial data infrastructure and solve SDI problems with a team effort between ourselves and other grantees and FGDC experts. We would like to continue to be involved in NSDI development in the future through both CAP projects and other projects that can contribute to NSDI evolution and advancement.