

**Agreement Number:** 07HQAG0097

**Final report:** Extending uDig GIS and GeoTools Library for US Framework Data

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**Organization:**

The Open Planning Project

349 W. 12th street, #3

New York, NY 10014

**Project Leader:**

Chris Holmes

212.796.4203

cholmes@opengeo.org

**Collaborating Organizations:**

The Open Planning Project, 349 W. 12 Street #3, New York, NY 10014

Center for International Earth Science Information Network, 61 Route 9W, Palisades, NY 10964

GISCorps, project of URISA, 1460 Renaissance Drive, Suite 305, Park Ridge, IL 60068

**Project Narrative**

The focus of the project was to add Web Feature Server 1.1 and Geography Markup Language 3.1.1 capabilities to uDig in order to support discovery and reading of FGDC Framework Data. The project involved adding complex features support to the core model of GeoTools, writing a WFS 1.1 datastore, GML 3.1.1 reader for complex and nested features, and testing these improvements against the NSDI WFS.

The core feature model of the GeoTools code was successfully improved as evidenced by CSIRO (Commonwealth Scientific and Industrial Research Organisation) launching a multi-million dollar project to bring complex feature support to Geoserver. However, uDig integration has only been partially successful. The addition of WFS 1.1 and GML 3.1.1 to uDig's trunk code base has been slow due to the reduced frequency of additions of branch code into the trunk, uDig's prolonged release cycle for version 1.2, and the extended period of beta releases. The code is currently on an unstable branch for the foreseeable future. The code is available to users at the level of GeoTools and as an uDig plugin. Until, the code is committed to trunk, TOPP has released a distribution available at <http://files.opengeo.org/udig-wfs11/>

TOPP used the distribution in a workshop to test and document the improvements. That workshop was successful and workshop participants were able to install and work with the distribution. As part of the workshop, participants contributed a script for a screencast as well as additional user focused documentation. An online presentation based on the screencast and user notes are planned in the future.

With the increased interest in complex feature support, a more current build of uDig with complex feature support may be needed. There are tentative plans to offer the new build as a download and publicize it through blog posts and supporting educational materials.

*Accomplishments:*

- Addition of working code improvements in the core of GeoTools used in production on a variety of systems to handle complex schemas like those of the NSDI framework data.
- A version of uDig that successfully utilizes to the NSDI WFS node and is also tested against Ionic and MapServer framework deployments.
- A successful workshop with GIS users from Alachua County, Florida who tested the framework data on uDig, using a variety of data sources.

*Collaboration Activities:*

- Code incorporated in to the core of GeoTools and a branch of the uDig open source projects.
- Worked with Refractions and Camp to Camp team members.
- Geoscience Australia (CSIRO) is collaborating on the core code written to add complex feature support to Geoserver.

*Further Challenges*

- While outside the scope of this project, the primary challenge moving forward includes releasing uDig to a full 1.2 stable release in order to distribute it to the uDig user group.

*Strengths and Weaknesses:*

- Primary strength was the contribution of code to open source in order that the code will continue to be available to multiple projects such as uDig and Geoserver
- Primary weakness has been the long release cycles for uDig. As such, there are significant delays in the code release for general use.

**Status of your data access activities**

The following feature types were accessed from the NSDI Framework Web Feature Server (<http://frameworkwfs.usgs.gov/framework/wfs/wfs.cgi>):

- Governmental Unit (County or Equivalent)
- Governmental Unit (Minor Civil Divisions)
- Governmental Unit (State or Territory)
- Hydro Element (Areas - Hi Res)
- Hydro Element (Areas - Med Res)

- Hydro Element (Flow Lines - Hi Res)
- Hydro Element (Flow Lines - Med Res)
- Hydro Element (Lines - Hi Res)
- Hydro Element (Lines - Med Res)
- Hydro Element (Points - Hi Res)
- Hydro Element (Points - Med Res)
- Hydro Element (Water Bodies - Hi Res)
- Hydro Element (Water Bodies - Med Res)
- Area High
- Area Medium
- Flowline High
- Flowline Medium
- Line High
- Line Medium
- Line Event FC
- Point Event FC
- Point High
- Point Medium
- Waterbody High
- Waterbody Medium
- Roads
- Road Segments

The estimated data volume for Framework data is currently unknown and is dependent upon the release of uDig with support for complex features. Until the complex features support is committed to the uDig trunk, the number of users is difficult to estimate. Potentially, the volume could be hundreds of gigabytes (or more) of transportation, hydrography, and governmental units. Framework data from the NSDI WFS and other sources will be accessed via WFS during this project as well as terabytes of orthoimagery, depending on the needs of uDig users. However, it is likely that the average user will access Framework data for local areas, resulting in much lower data volumes.

The primary data providers for the project are:

- USGS
- CIESIN
- GlobeExplorer
- Microsoft Virtual Earth,
- Yahoo! Maps

- CubeWerx
- The National Map

### **Status of Framework Client Development**

There is a client build currently available at: <http://udig.refractions.net/download/unstable/>

The inclusion of the code is targeted for uDig version 1.2 in Milestone 3 in the uDig development road map. Hopefully, the uDig community will reach 1.2 soon.

The client software will go through uDig's open source process for evaluation and quality assurance. This involves publishing multiple release candidates, receiving bug reports and patches from beta testers, and fixing and patching bugs until the product is stable.

We were able to access the data as expected and it was sufficient for testing the basic premise of retrieving complex features through a Web Feature Service. Internal and external users of the client have requirements for accessing complex features through a WFS. These include subscribers to the uDig user list as well as OGC Web Service implementers that use complex feature types.

The plan for the distribution of the software is to make the current build available until the code is committed to the uDig trunk and released in version 1.2. We will promote the work through our activities in OSGEO, blog posts, and through our work with customers.

### **Project management**

The uDig project will continue to mature and we will continue to maintain the WFS 1.1 code after the uDig 1.2 release. WFS 1.1 capabilities are currently not in widespread usage, but as the complexity of geodata served through the WFS interfaces increases we will continue to promote both the WFS 1.1 code in Geoserver and in uDig. In terms of future work, there will be additional core development needed on uDig.

### **Feedback on Cooperative Agreements Program**

The strength of the CAP Program is that it supplies core funding to build technology that enables the vision of the national spatial data infrastructure. Because no other program does the same, the CAP Program gives organizations a chance to focus on meeting the NSDI use cases. The main weakness of the program, however, is its disconnected structure—each year attempts to build upon past successes, but are unable because last years deliverable are not always fully realized. The goals of the program are ambitious, but with only one year of funding, much of the technology does not achieve the level of completeness requisite of production quality.

The CAP Program makes a difference in pushing the core technology improvements in the direction of NSDI needs before it is of commercial interest. Building SDI initiates a number of chicken and egg problems, and few software providers are able to build technology for requirements that do not have an established user and customer base. Building technology for a SDI

that is not already fully functioning is risky and is rarely funded. The CAP Grant Program solves the chicken and egg problem, by giving software developers an incentive to work on core technology improvements that are not financially justifiable in the short term.

Assistance for interacting with the federal government and running the program was excellent. One criticism related to building more community with the others doing similar grants. While helpful, the monthly phone calls were not always an effective means to learn from the experiences of other grantees — not everyone was always present and conversations focused more on reporting what happened in the past month instead of having dialog between similar projects. Perhaps an email list or a wiki would encourage more peer to peer sharing of ideas and work.

What could make a difference in CAP efficacy is following up on previous year's deliverables, and where possible, continuing to build upon them. We were developing a client to test against multiple NSDI servers that were set up in previous funding years. In practice, however, few were still available, and those that were available were often difficult to locate. In comparison, the follow up and expansion of the Framework WFS (<http://frameworkwfs.usgs.gov/>), the origins of which can be found in CAP work, were great. Without that server we would have had a much harder time testing. In retrospect, it would have been preferable for our year to focus on testing the stability and throughput from previous WFS servers, instead of funding clients that used servers not ready for production.

Developing clients should maintain the same type of follow up of acknowledging their limitations and assisting with next steps. Such assistance should include building upon actual deliverable. For a few years, the GeoConnections program executed this structure by first supporting the low level JTS library, which in turn was used with GeoTools in a GeoServer project. Furthering the chain, the GeoTools and JTS libraries were utilized in helping start uDig. Longer vision projects, in conjunction with iterative smaller pieces, would help to adequately fund this development strategy.

The main problem encountered is that the scope of such a technically difficult project requires more resources than were allocated. Projects focused on basic access—simple features level 0, not even 1—would demonstrate more success. As it is, projects need to rewrite their core technology to merely show the basics. If the focus was level 0 then projects could focus less on the core technology and more on the use cases on top of it. In our case, if less time was spent in the core technology development to read WFS 1.1 and GML 3.1.1, we could have spent significant time on polish and use cases. All software providers have struggled with complex, nested feature support. And the market for such support is still quite small. Programs like CAP certainly make a big difference, but to create a market and push the technology through more demand and incentives are needed, from a variety of sources. Once the core technology is developed and fully integrated in to product lines and production software there still needs to be another round of significant investment demonstrating all the unique use cases and how the new technology meets it better than the old.

There were no program management concerns during the project.

If given another opportunity to work on the project, we would strongly recommend only meeting simple features level 0 and focus more on developing useful functionality on top of the data access – like local caching and syncing for better performance, or particular operations that benefit from a networked service oriented approach.