

PLANETARY OGC INTEROPERABILITY EXPERIMENT. Trent M. Hare¹, Lucian Plesea² and Scott W. Akins¹, ¹U.S. Geological Survey, 2255 North Gemini Drive, Flagstaff, AZ, 86001, ²Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California 91109-8099, thare@usgs.gov.

Introduction: As an ongoing effort to promote Internet protocols for sharing planetary data and resources, a team of planetary facilities will conduct an Open Geospatial Consortium (OGC) Interoperability Experiment (IE) to assess the benefits and limitations of current OGC mapping standards [1-3]. In short, services built using OGC technologies, allow one to stream geospatial raster and vector data sets across the Internet to mapping applications or simple web browsers.

This Planetary IE will strengthen the planetary community on its understanding of various OGC specifications, demonstrate application for planetary science, harden software implementations, and produce a candidate OGC “Best Practices” document that can be used to inform the broader planetary community. To achieve these goals, the Planetary IE will engage the OGC membership to assure that any community recommendations coming from the planetary group will properly leverage the OGC specifications. Potentially, change requests on OGC Specifications will be provided to the OGC Technical Committee to influence the underlying specifications. It is not anticipated that this IE will develop any new specifications.

Review: The most significant difference between extraterrestrial and earth-based GIS systems is the definition of the body to be mapped. Most planetary bodies are defined as simple spheres because of the lack of information regarding the true shape. Even for highly irregular or nearly triaxial bodies like comets and asteroids, a simple sphere is generally fit so that cartographic packages can more easily utilize the data. Because this simple approach has been taken, it opens the door for the community to more easily support common file formats and on-line mapping services [4]. By interfacing with geospatial standards bodies such as the OGC, we may help facilitate better planetary support both in existing and in the next generation of GIS and remote sensing standards.

Interoperability Experiment: The Planetary IE will advance several areas of understanding and application of OGC specifications to web services for planetary science. The IE will apply existing specifications in the context of a planetary domain and will thus only refine and inform specifications, rather than develop new specifications. The team will focus on these areas:

- OGC Web Mapping Service (WMS) and Web Feature Service (WFS) access to planetary data, focusing on planetary coordinate referencing system (CRS) issues.
- Web Registry Service for CRS hand-shaking
- Application of semantic services to Catalog Services for the Web as related to use in an Interoperable Planetary Service
- TiledWMS for optimized tiles access for simple thick and thin clients.

Some of the specific questions we want to answer are:

- How does a user obtain planetary image layers from dispersed, distributed facilities using well-specified web services? (general image case).
- How can a user or application obtain image location (footprint) or nomenclature feature using well-specified web services? (general WFS feature case, potentially KML).
- Is a tiled WMS sufficient for serving an image layer? If it is an optimal serving method, should it be proposed as a WMS extension? Testing will use the Lunar Mapping and Modeling Project team-created “TiledWMS” (not yet proposed as a standard) but has support in many clients (e.g. OpenLayers, WorldWind) [5].
- How are the data defined and described in a consistent and controlled manner for appropriate data use, data sharing, and verification?

Initiator Organizations: The active OGC members that are initiating the planetary Interoperability Experiment are:

- United States Geological Survey (USGS)
- National Aeronautics and Space Administration (NASA)
- National Institute of Advanced Industrial Science and Technology (AIST)

Participating NASA centers include Jet Propulsion Laboratory and may also include Goddard Space Flight Center, Ames Research Center, and Marshall Space Flight Center.

Participant Organizations: The following organizations have expressed interest in participating in the Planetary IE:

- Washington University in St. Louis (WUSTL)
- Freie Universität Berlin
- University of Perugia
- Arizona State University (ASU)
- University of Arizona (UofA)
- U.S. Army Cold Regions Research and Engineering Laboratory (CRREL)

Requirements for Participation: In order to become a participant in this IE, an organization must be willing to make a resource commitment to contribute in one or more of the following areas:

- An OGC service component exposing its resources
- a web client that makes use of semantically enabled service components , OR
- testing of the Services/Clients, OR
- a server to house an IE component, OR
- data to support the IE Demonstration, OR
- compilation of documentation into one or more of the Planetary IE deliverables.

Organizations that also wish to participate can contact the author.

History: The USGS, Astrogeology Team hosted a small meeting in Flagstaff, AZ on June 18, 2004 to research OGC services for use in the planetary domain. We relied on invited OGC members to describe current services and potential issues in using non-Earth datasets within the OGC services. The main reason this meeting was initiated was in response to the large amount of cartographically-ready datasets being released by the planetary community and a growing number of planetary-capable geospatial applications [4]. Fortunately, the planetary community had already embraced data web services but each facility had generated their own methods to access them. Thus the idea was not an attempt to standardize everyone to a single tool but rather standardize on a minimal set of protocols such that web mapping interfaces could share their derived datasets. The topics that were covered, besides the OGC web protocols, included planetary coordinate reference systems and format support.

Since that first meeting, several NASA-sponsored projects have been and are currently funded to implement planetary OGC services [4, 6]. This includes projects sponsored by all the organizations listed above and more.

About the OGC: The Open Geospatial Consortium was created to help establish and promote a series of formats and Internet protocols for sharing GIS resources (i.e. geospatial data). The OGC is comprised of over three hundred hardware and software companies, universities, and research facilities. Some of the goals are (1) to make geospatial information easy to find, (2) to allow easy access and acquisition of data sets, and (3) to permit data from different sites to be integrated, registered and analyzed.

A key aspect of sharing data sets and/or on-line streamed data sets is the ability to synchronize the different data sets to a single map projection and defined CRS so that data register correctly. Originally,

the OGC, and its various web mapping standards, primarily use the coded CRS definitions and coordinate transformation descriptions as defined by the European Petroleum Survey Group (EPSG) in 2005 [7]. This group also hosts a CRS registry service which maps the codes to a well know projection definition. Presently, there is move toward using a Uniform Resource Name (URN) instead of simple code. And it appears a future direction includes the use of a Uniform Resource Locator (URL) together with multiple Representational State Transfer (REST) CRS definition repositories.

To help resolve this CRS discrepancy, part of the Planetary IE will be to assess these differing methods. Currently there are proposed planetary CRS codes available on the JPL and a couple USGS WMS servers [6, 8]. JPL has also implemented a beta on-line planetary CRS registry catalog for general use.

Conclusion: A desired outcome from the Planetary Interoperability Experiment is to document and test the current and proposed use of OGC specifications by the planetary community. A report on use of OGC specifications by members of the planetary science community will be written and published as an OGC Best Practices document. The report will be proposed as an OGC document for consideration by the OGC Specification Program (i.e., the OGC consensus process).

We also plan to publish a paper in a peer-reviewed technical journal and report our findings to the International Planetary Data Alliance (URL: <http://planetarydata.org/>) and Planetary Data System. Lastly, we hope to report initial findings at the 2011 Lunar and Planetary Conference.

References: [1] Open Geospatial Consortium (OGC), <http://www.opengeospatial.org/>. [2] Erle, S., et. al., (2005). Mapping Hacks. O'Reilly. ISBN 0-596-00703-5. [3] Mitchell, T., (2005). Web Mapping Illustrated. O'Reilly. ISBN 0-596-00865-1. [4] Hare, T.M, et al., (2009), Extraterrestrial GIS chapter, Manual of GIS, ASPRS, ISBN: 1-57083-086-X. [5] Cohen, B.A., et al. (2008), LPS XXXIX, abs. 1640. [6] Hare, T., et. al., (2008), LPS XXXIX, abs. 2536. [7] EPSG, Coordinate Reference System Definition, <http://www.epsg.org/>. [8] Plesea, L., et. al., (2007), ISPRS WG IV/7.