OGC CATALOGUE SERVICES FOR PLANETARY DATA PORTALS. T. M. Hare, L. R. Gaddis, and M. B. Bailen, U.S. Geological Survey, Astrogeology Science Center, 2255 North Gemini Drive, Flagstaff, AZ, 86001 (thare@usgs.gov).

Introduction: This abstract presents methods for sharing data and resources using Open Geospatial Consortium (OGC) Catalogue Services for the Web (CSW) to support searches across multiple web sites or data portals. Data portals can catalogue and facilitate access to data, but they can also support the development of tools written by the community. Here, we address the use of data portals for serving high-level geospatial or science-ready cartographic products, not the low-level data products commonly archived in the Planetary Data System (PDS) [1].

At minimum, a valid geospatial data portal should include (1) proper metadata for high-level geospatial products (e.g., science-ready or map-projected image mosaics in formats like PDS or GeoTiff) and/or live maps (e.g., those retrieved from Web Mapping Services [WMS], Web Feature Services [WFS], Web Coverage Services [WCS]); and (2) an application layer or service to catalogue the metadata and support a variety of parameter searches in a standardized way.

Metadata: Metadata is ancillary documentation that describes the rationale, authorship, attribute descriptions, spatial reference, and other pertinent information for data. Although simpler metadata standards exist (e.g., the lean Dublin Core or NASA's older Directory Interchange Format [DIF]), optimal support for a geospatial data portal is provided by the U.S. Federal Geographic Data Committee (FGDC) metadata standards [2] which include International Organization for Standardization guidelines (e.g., ISO 19115). The existing FGDC/ISO metadata standards require only a few minor additions to properly support planetary data [3], with emphasis on data that can be registered to a solid body (exempting for now products that focus on atmospheres, plasma, and rings).

Several planetary projects currently use the FGDC standard. For example, NASA's Cartography Program (formerly of the Planetary Geology and Geophysics Program) supports planetary geologic maps to be formally reviewed and published by the USGS. The USGS requires that all geospatial data include an FGDC metadata record. Data served by the Lunar Mapping and Modeling Project (LMMP) [4] use the FGDC metadata standard to define the required documentation for each data set. Lastly, geospatial data served by the Imaging Node Annex (http://astrogeology.usgs.gov/pds/annex) of the PDS also use metadata records closely tied to FDGC standards [5].

Metadata can be cumbersome to create and only about 30% of the required elements can be readily retrieved from a science-ready product. To facilitate the creation of metadata for groups of similar products, a "template" or base metadata record can be written. This requires focusing on very basic elements of metadata (such as the abstract, purpose, processing steps, heritage), but once the template file is created, applications can then be used to automate retrieval of details for the data product (e.g., cartographic projection, spatial resolution). A Python script in development at the Astrogeology Science Center, called *gdal2metadata.py*, can accomplish this. Sample templates and instructions on how to install and run the application are available on GitHub [6]. Community input for this script is welcome.

Data Portals: One of the latest trends in the geospatial community, including the planetary community, is to provide data portals. These portals assemble data collections for on-line browsing and download. Many Earth-based data portals are built around the use of FGDC/ISO metadata to import, describe, and catalogue data for external users. For planetary data, most portals provide access to a data collection for browsing and retrieval but they often include minimal metadata and thus have limited search capabilities. And even if each product is properly catalogued on the host site, the full listing of products is not easily accessible to outside users (e.g., for searches). Methods defined by the OGC CSW standard will facilitate such outside access, so that users need not build new search tools or application layer interfaces (APIs, see Figure 1). This fundamentally search API doesn't impede existing methods already supported by the community (e.g. RESTful web services provided by the PDS Geoscience Node [7]).

One major benefit of using the OGC CSW standard is that portals can support searches across data catalogues because the standard allows one data portal to index data in other portals. Products served by such mutually indexed portals have standardized metadata, and appropriate credit for and references to the data creators and the original host data portal are assured.

In summary, the benefits for implementing a data portal using the OGC CSW standards include:

- Enabling easy search and discovery of existing geospatial data and services;
- Reduction of redundancy across portals; and
- Authoritative versions are better established.

OGC CSW Services: In March of 2015, version 3 of the CSW standard is expected to be approved by the OGC. This standard specifies the abstract interfaces between clients and catalogue services for data portals. It comprehensively details how the requests and responses are sent between clients and servers using HTTP GET and/or POST methods (generally within an XML, web-friendly GeoJSON or a comma delimited container). Each record should also contain a spatial location allowing for spatial searches.

Several existing open source solutions already exist to support creation of a CSW data portal. PyCSW, written in Python, is an open source OGC CSW server implementation which can easily use existing metadata data standards (e.g. ISO 19115) or even custom records [8]. It can be plugged into popular databases or it can help build one. It is mostly used as a simple non-graphical solution and thus is not intrusive for existing web sites. More robust solutions include the OSGeo Foundation project GeoNetwork [9] or Esri's Geoportal Server [10], both of which are open source.

Conclusion: Science-ready data discovery and dissemination continues to be a challenge for the planetary community [11, 12]. By supporting standardized methods for data collections, web sites and data portals can be more easily discovered and accessed by users. Use of proper documentation will also help to guarantee credit for data providers and can help to ensure the optimal retrieval and use of authoritative products.

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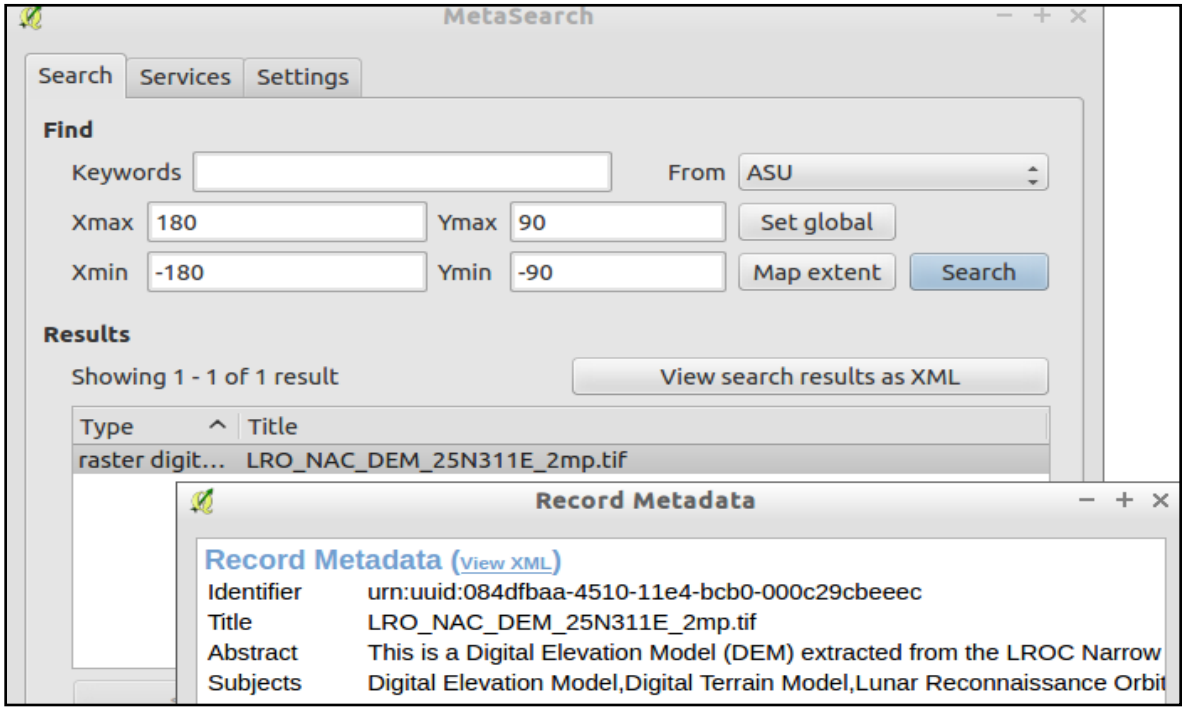

Figure 1. An example CSW search using the Desktop GIS application QGIS with a CSW plug-in. In this case, the CSW server returned a digital elevation model derived from Lunar Reconnaissance Orbiter Camera images.