

MAP-A-PLANET: EXTENDING AND IMPROVING THE CREATION OF CARTOGRAPHIC IMAGE MAPS ON THE WEB. D. L. Soltész, B. A. Peck, T. M. Hare, J. M. Barrett, B. M. Sucharski, P. A. Garcia, J. S. Blue, U.S. Geological Survey, 2255 N. Gemini Dr., Flagstaff, AZ, 86001.

Introduction: In the last decade, the Internet has become the primary source for researchers and the public to access planetary image data, maps, and other geospatial products. Over the years, Internet technologies have evolved and computer performance has improved. Correspondingly, web-based user interfaces have become more sophisticated, web-enabled desktop applications have arisen, and the Internet has become increasingly integrated into our daily lives.

In keeping with the times, we are making enhancements to the USGS Astrogeology Map-a-Planet web site, www.mapaplanet.org, improving the user interface, and adding new capabilities to improve data sharing and access. The Map-a-Planet site serves scientifically accurate planetary global mosaics via a web interface that allows the user to visually navigate planetary imagery and create customized image maps. Map-a-Planet was originally released as a component of the Planetary Data System (PDS) Planetary Image Atlas [1], and was later redesigned and released as an independent website [2].

The Map-a-Planet web site uses an in-house image processing system called MapMaker as the underlying engine to create custom image maps served by the site [1, 2]. MapMaker is capable of reading image data in a variety of formats from numerous file sources. Originally designed to access tiled image data from CD-ROM jukeboxes, the engine can read image data from multiple files, and then scale, mosaic, project, and contrast stretch the data into a single output file to meet the end users' specifications.

Motivation: While the Map-a-Planet web site was incredibly innovative when it was created, the web interface had not changed in several years and was becoming outdated, falling behind community standards for functionality and design. Furthermore, certain aspects of the original design required a great deal of manual setup in order to add new datasets.

Additionally, Map-a-Planet houses several hundred gigabytes of image data, but since the site was designed for the human user, there was no way to easily access the data sets programmatically with other web sites, geographic information systems (GIS), or desktop applications. In order to use Map-a-Planet data, keeping a local copy of the desired data was required, needlessly using excessive file storage space and creating extra work to keep the copy up-to-date.

Approach: The first task we undertook was to provide basic interoperability, providing programmatic

access to the data via Internet protocols. Our primary consumer for this project component was our own web sites, which would benefit from access to the data served by Map-a-Planet for use in online GIS and as base maps for display of vector data sets, such as nomenclature and map extents. We determined that implementing new functionality based on Open Geospatial Consortium (OGC) [3] interoperability standards would provide the greatest flexibility and benefits.

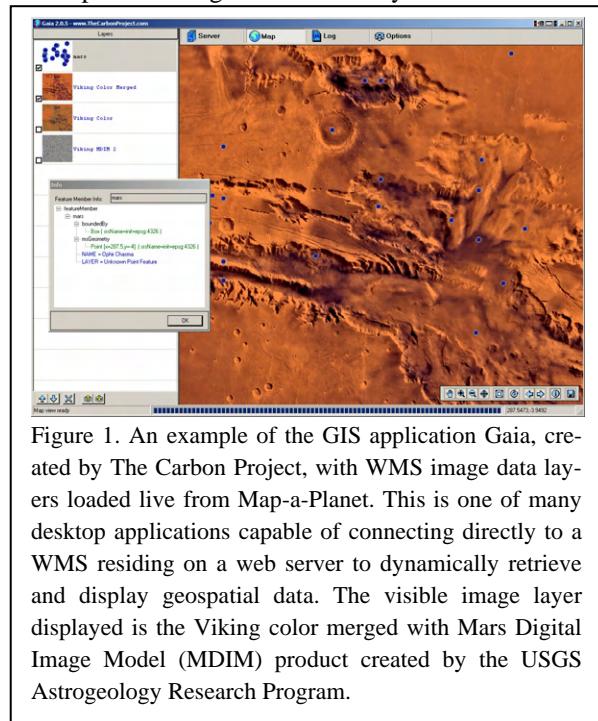


Figure 1. An example of the GIS application Gaia, created by The Carbon Project, with WMS image data layers loaded live from Map-a-Planet. This is one of many desktop applications capable of connecting directly to a WMS residing on a web server to dynamically retrieve and display geospatial data. The visible image layer displayed is the Viking color merged with Mars Digital Image Model (MDIM) product created by the USGS Astrogeology Research Program.

The main strength of implementing OGC web service standards resides in the existence of well-supported collaborative standards that allow independent development of components. Because these standards are well-supported by both the GIS and remote sensing communities, there is a wide range of powerful open source and commercial applications which can be directly used for planetary science and cartography (Fig. 1).

Because the information served by Map-a-Planet consists of global raster image mosaics, we felt the most appropriate standard for delivering image data products via a web service was Web Map Service (WMS), the most widely supported of OGC's web service standards. At this time, WMS does not natively support planetary coordinate reference systems, so we

followed the standards for planetary coordinate reference system codes proposed by Hare, et. al. [4].

The WMS was built as an interface using the MapMaker engine, leveraging on the existing image processing capabilities already in place on the server. Once implemented, we tested the Map-a-Planet WMS using a variety of open source and commercial applications. We initially deployed the WMS for use with WorldKit [5] to provide interactive, illustrative maps for our Gazetteer of Planetary Nomenclature [6] and Index of Maps of the Planets and Satellites [7] web sites. Minor modifications to MapMaker will be required to provide compatibility with our planetary GIS map server, PIGWAD [8], and similar map servers that drive our sites. We discovered some map servers request image data outside valid geographic boundaries, expecting the invalid regions to be rendered with blank space, which MapMaker is currently unable to generate.

WMS clients typically obtain coverage for a geographic extent by making several requests for smaller subareas, automatically tiling the retrieved subareas into the complete image coverage. Currently, MapMaker performs regional contrast stretches based on the request, thus each tile in the region a WMS client is making requests for will have a different contrast stretch and the tiles will not visually match. For this reason, the current implementation of our WMS server does not generate images with a contrast stretch. In order to handle these types of requests, MapMaker will require modifications to allow it to perform stretches based on global instead of regional image statistics. With these modifications in place, the WMS client will be able to request the image processing using any of the stretch methods available in MapMaker.

Once the basic WMS capabilities were in place, we turned our attention to redesigning the Map-a-Planet web site, primarily to improve the usability of and add new functionality to the Map-a-Planet Explorer image browser interface. First, we added additional parameters to the initialization files that provide the basic information about the data sets and implemented parsing of the new information in the scripts that drive interactive mapping on the web site. This allowed us to simplify scripts that previously had this information hard-coded, eliminating several scripts as well as the future need to modify scripts when adding new data sets to the site, thus reducing the amount of manual set up required to add new data sets.

Several new navigation tools were added to the Explorer interface (Fig. 2), including a dynamic zoom

tool, diagonal pan tools, readout of the geographic coordinates beneath the mouse cursor, feature name search, and cross-reference links to search for nomenclature and planetary maps in the region of interest. Other improvements were made to provide easier access to advanced options to set projection, image size, resolution, and other parameters.

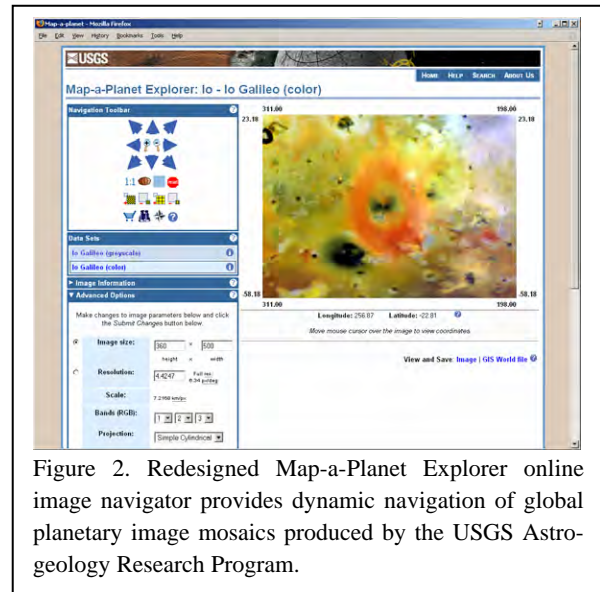


Figure 2. Redesigned Map-a-Planet Explorer online image navigator provides dynamic navigation of global planetary image mosaics produced by the USGS Astrogeology Research Program.

Conclusion: The Internet continues to become increasingly integrated into our daily routines, both personal and professional, through web-enabled desktop applications and devices. As a result, we are responding to increased demand and expectation for both utility and applicability of online planetary data servers in order to provide quick and easy access through either standard web browsers or web-enabled desktop applications. Map-a-Planet is an important tool for the dissemination of ready-made global image data. We will continue to improve and enhance this resource to meet the needs of the planetary research and education communities.

References: [1] Garcia, P. A., et. al. (1998) *LPS XXIX*, 1907. [2] Garcia, P. A., et. al. (2001) *LPS XXXII*, 2046. [3] OGC, www.opengeospatial.org. [4] Hare, T., et. al. (2006) *LPS XXXVII*, 1931. [5] WorldKit, worldkit.org. [6] Gazetteer of Planetary Nomenclature, planetarynames.wr.usgs.gov. [7] Index of Maps of the Planets and Satellites, astrogeology.usgs.gov/Projects/MapBook. [8] Hare T.M. and K.L. Tanaka, (2004) *LPS XXXV*, 1765.