Status of planetary references frames

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To be leading and comprehensive community of experts making location information:

- Findable
- Accessible
- Interoperable
- Reusable

OGC®

Agenda

- Planetary DWG
- CRS requirements and implementation
- STAC and STAC extension
- Interop between IVOA/OGC
- Future actions (DOI, CRS in formats, checking CRS in WS)
- Conclusion

Planetary DWG (Domain Working Group)

Why a group to OGC ?

- Spatially distributed data
- Thousands of implementations

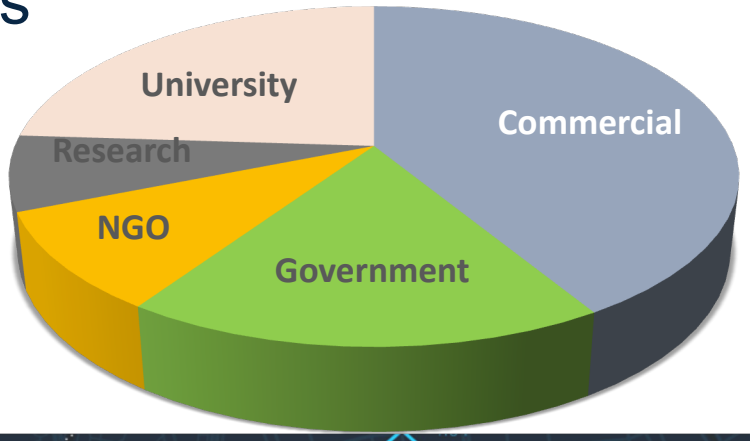
Implementations

Below is information about products that implement OGC Standards. Learn how a "registered product" is different from an "OGC compliant" product. There are also links here to OGC Cookbooks and demonstrations of products that implement OGC Standards.

6000+	1000+	100+
Implementations	Products	Standards

https://www.ogc.org/resources/implementations/

- Many actors



The objective of the Planetary DWG is to identify requirements to revise or extend OGC standards for celestial bodies other than the Earth. These bodies can be planets, satellites, asteroids, Sun and comets.

CRS requirements and implementation

Standards Proposal to Support Planetary Coordinate Reference Systems in Open Geospatial Web Services and Geospatial Applications

January 2006

Authors:

Trent M. Hare **B. A. Archinal**

L. Plesea **E. Dobinson**

D. Curkendall

SRS="IAU2000:49964"

Limitations:

- The namespace IAU2000 is not easy versioned for APIs
- No place to support spherical definitions for ellipsoids
- No triaxial definitions
- Not easily available

CRS requirements and implementation

Standards Proposal for 2021 to Support Planetary Coordinate Reference Systems

December 2021 · Abstracts of the ICA 3:1-1
DOI:10.5194/ica-abs-3-101-2021

Authors:

Trent M. Hare
United States Geological Survey

Jean-Christophe Malapert
Centre National d'Etudes Spatiales

- Updated from 2000 to 2015 IAU definitions
- Updated to support spherical definitions for all bodies and triaxial (when avail)
- Updated to WKT2 for planetocentric reference frame

SRS="IAU:2015:49964"

CRS requirements and implementation

IAU-WGCCRE
Cartographic Coordinates and Rotational Elements publication.
https://astrogeology.usgs.gov/groups/

Manual Process

	Naif_id	Body	IAU2015_Mean	IAU2015_Semimajor	IAU2015_Axisb	IAU2015_Semiminor	rotation	origin_long_name
2	10	Sun	695700000.00	695700000.00	695700000.00	695700000.00	Direct	
3	199	Mercury	2439400.00	2440530.00	2440530.00	2438260.00	Direct	Hun Kal
4	299	Venus	6051800.00	6051800.00	6051800.00	6051800.00	Retrograde	Ariadne
5	399	Earth	6371008.40	6378136.60	6378136.60	6356751.90	Direct	Greenwich
6	301	Moon	1737400.00	1737400.00	1737400.00	1737400.00	Direct	
7	499	Mars	3389500.00	3396190.00	3396190.00	3376200.00	Direct	Viking 1 lander
8	401	Phobos	11080.00	13000.00	11400.00	9100.00	Direct	

CSV to WKT
https://github.com/pdssp/csvforwkt

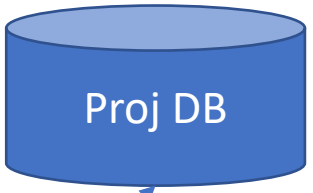
```
GEOGCRS["Mars (2015) / Ographic",
    DATUM["Mars (2015)",
        ELLIPSOID["Mars (2015)", 3396190, 169.8944472236118,
                LENGTHUNIT["metre", 1, ID["EPSG", 9001]]],
                ANCHOR["Viking 1 lander : 47.95137 W"]],
        PRIMEM["Reference Meridian", 0,
            ANGLEUNIT["degree", 0.0174532925199433, ID["EPSG", 9122]]],
        CS[ellipsoidal, 2],
            AXIS["geodetic latitude (Lat)", north,
                ORDER[1],
                ANGLEUNIT["degree", 0.0174532925199433]],
            AXIS["geodetic longitude (Lon)", west,
                ORDER[2],
                ANGLEUNIT["degree", 0.0174532925199433]],
        ID["IAU", 49901, 2015],
        REMARK["Source of IAU Coordinate systems: doi://10.1007/s10569-017-9805-5"]]
```

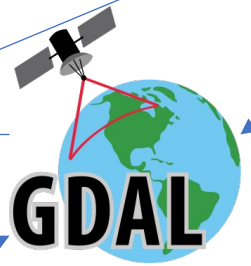
CRS registry app

CSV to Proj
https://github.com/OSGeo/PROJ/blob/master/scripts/build_db_from_iau.py

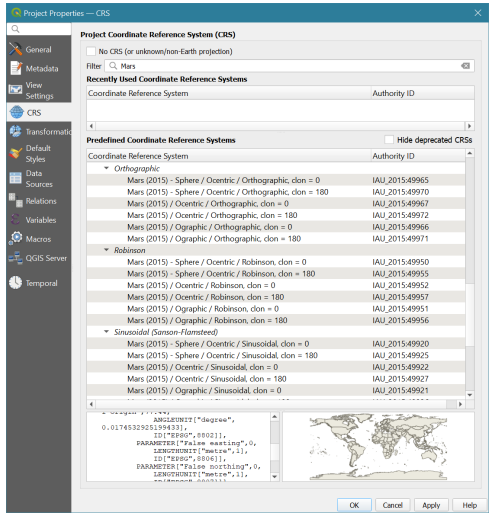
Proj DB

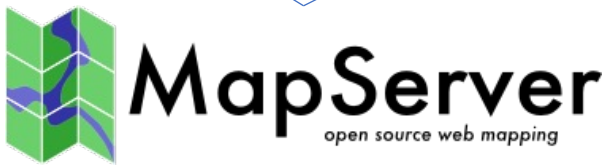
CRS requirements and implementation





gdalsrsinfo urn:ogc:def:crs:IAU::49910
gdalsrsinfo urn:ogc:def:crs:IAU:2015:49910
gdalsrsinfo IAU:49910
gdalsrsinfo IAU:2015:49910





Seems it is not yet compatible with IAU CRS

In the roadmap:
- GeoServer

In discussion:
- OpenPlanetaryMap

Checking/Missing :
- Proj4js, …

CRS requirements and implementation

Open GIS

New OGC standards

Requirement 1	/req/crs/crs-uri
Each CRS supported by a server SHALL be referenceable by a uniform resource identifier (i.e. a URI).	

Recommendation 1	/rec/crs/crs-format-model

Servers that implement this extension SHOULD be able to recognize and generate CRS identifiers with the following format model:

`http://www.opengis.net/def/crs/{authority}/{version}/{code}`

In this format model, the token `{authority}` is a placeholder for a value that designates to authority responsible for the definition of this CRS. Typical values include "EPSG" and "OGC".

The token `{version}` is a placeholder for the specific version of the CRS definition or `0` for un-versioned CRS definitions.

The token `{code}` is a placeholder for the authority's code for the CRS.

www.opengis.net/def/crs/IAU/2015

Aucune information de style ne semble associée à ce fichier XML. L'arbre du document e

```
−<ns0:identifiers>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1000</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1010</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1015</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1020</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1025</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1030</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1035</ns0:identifier>
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    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1070</ns0:identifier>
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```
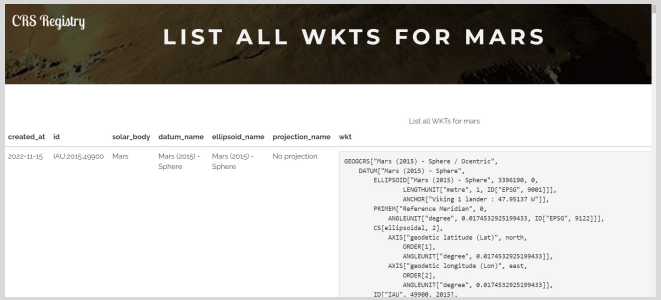

Bridge
OpenGIS to CRS registry

CRS registry



Non sécurisé | voparis-vespa-crs.obspm.fr:8080/ws/IAU/2015

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
▼<ns0:identifiers xmlns:ns0="http://www.opengis.net/crs-nts/1.0" xmlns="http://www.opengis.net/crs-nts/1.0">
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1000</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1010</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1015</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1020</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1025</ns0:identifier>
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    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1055</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1060</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1065</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1070</ns0:identifier>
    <ns0:identifier>http://www.opengis.net/def/crs/IAU/2015/1075</ns0:identifier>
```
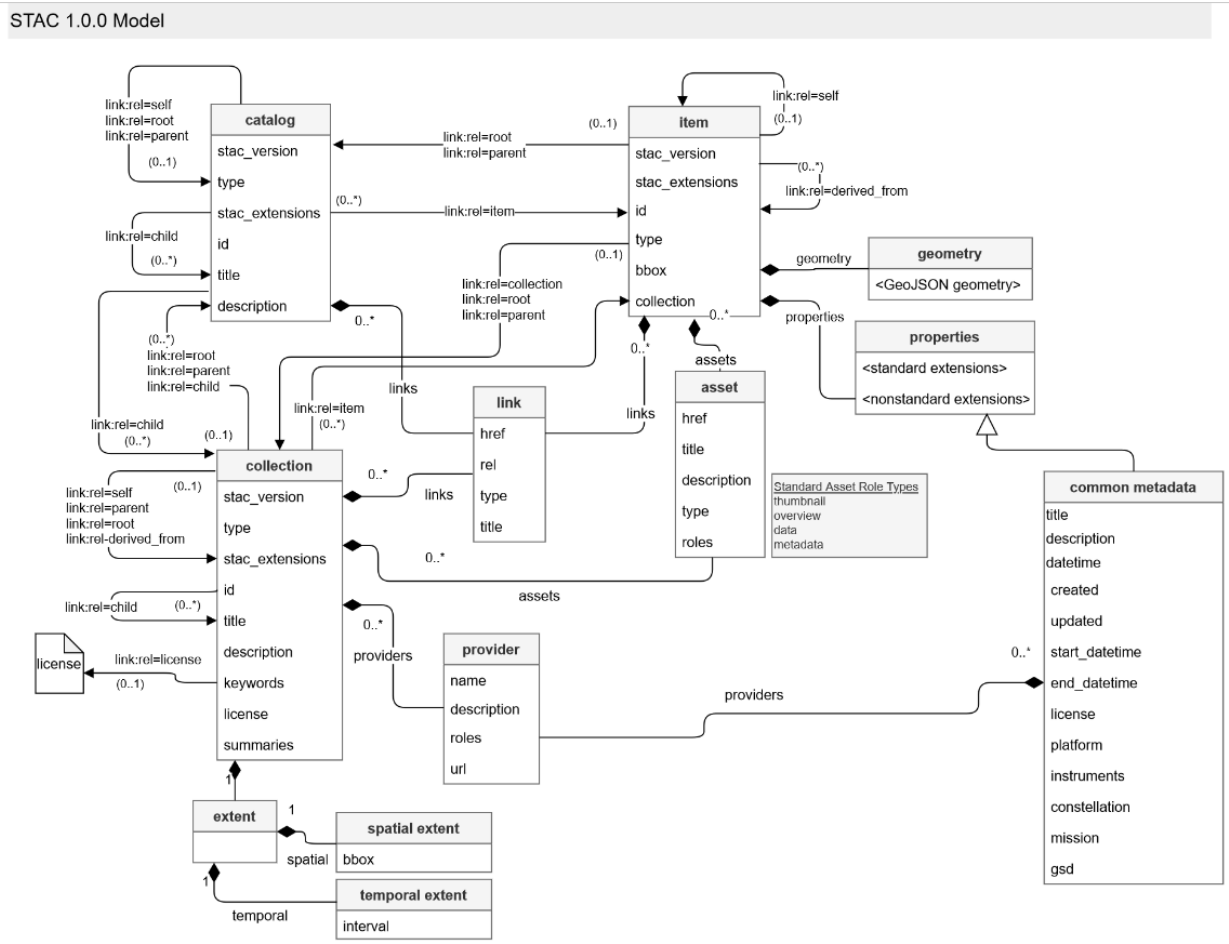

STAC and STAC extensions

- Provides a set of standardized metadata for describing geospatial data
- STAC metadata includes informations about location, date, format and properties of geospatial data
- STAC facilities discovery, access, and use of geospatial data for several thematics



STAC and STAC extensions

STAC registry (https://stacindex.org/)

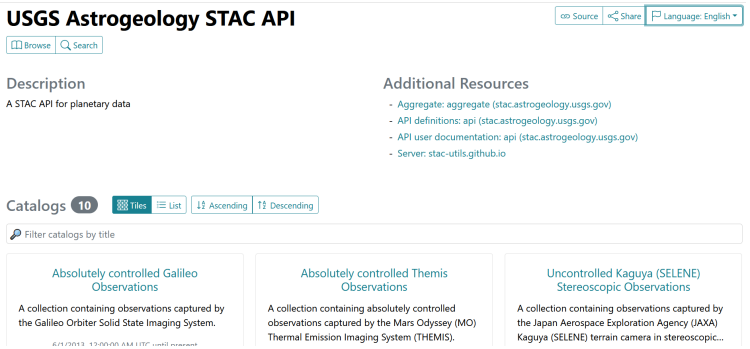
- Find STAC Catalogs, APIs, Learning Resources, Software and Tools

STAC static

- Geospatial cataltal that conforms to the STAC specification
- Provides a simple interface for exploring geospatial data sets and their associated metadata
- Is static

STAC API

- Web API for querying and accessing catalogs of geospatial data that conform to the STAC specification.
- Provides a standardardized interface for searching, browsing, and downloading geospatial data
- Facilitates the integration of geospatial data into data processing and analysis workflows



STAC and STAC extensions

Solar System Extension Specification

- **Title:** Solar System
- **Identifier:** https://raw.githubusercontent.com/thareUSGS/ssys/main/json-schema/schema.json
- **Field Name Prefix:** ssys
- **Scope:** Item, Catalog, Collection
- **Extension [Maturity Classification]:** Proposal
- **Owner:** @thareUSGS

This document explains the fields of the STAC Solar System (SSYS) Extension to a STAC Item, Catalog, or Collection. SSYS covers data sets that represents an individual image, mosaic, or derived raster of a planetary body. Examples of SSYS data include sensors with visible, short-wave and mid-wave IR bands (e.g., the THEMIS instrument on Mars Odyssey), visible images (e.g. Context Camera (CTX) aboard Mars Global Surveyor), or derived data sets like digital elevation models (DEM/DTM).

- Examples:
- Catalog Example (Europa Galileo SSI Image)
- Collection Example (Europa Galileo SSI Image)
- Item Example (Europa Galileo SSI Image)
- SSYS JSON Schema
- Changelog

Item Properties

Field Name	Type	Description
ssys:targets	[string]	Array to hold list of target bodies (e.g. Mars, Moon, Earth)

Additional Field Information

ssys:targets

the field `ssys:targets` allows to have one or more targets listed within an array of strings. This can happen, for example, if several moons are in the same view. As an example, this scene has both of Ganymede and Jupiter in the same image as taken by the NASA mission Cassini PIA02862.

https://github.com/stac-extensions/ssys

Adds support for IAU codes. #12

Open **jlaura** wants to merge 9 commits into `stac-extensions:main` from `jlaura:iau`

Conversation 41 · Commits 9 · Checks 1 · Files changed 4

jlaura commented on Oct 17, 2022 • edited

Fixes #8.

This PR includes changes necessary to support IAU codes in the proj extension. To support non-EPSG codes, it is necessary to split the authority and the code into two separate fields. The PR adds `proj:authority` with a default of `epsg` and `proj:code`. The PR maintains the `proj:epsg` field for backwards compatibility.

I ticked the version of the extension to 2.0.0 since this should likely be a breaking change where `proj:epsg` is simply deprecated, but I am not 100% how the maintainers prefer to version the extension spec.

Happy to update, make changes, etc.

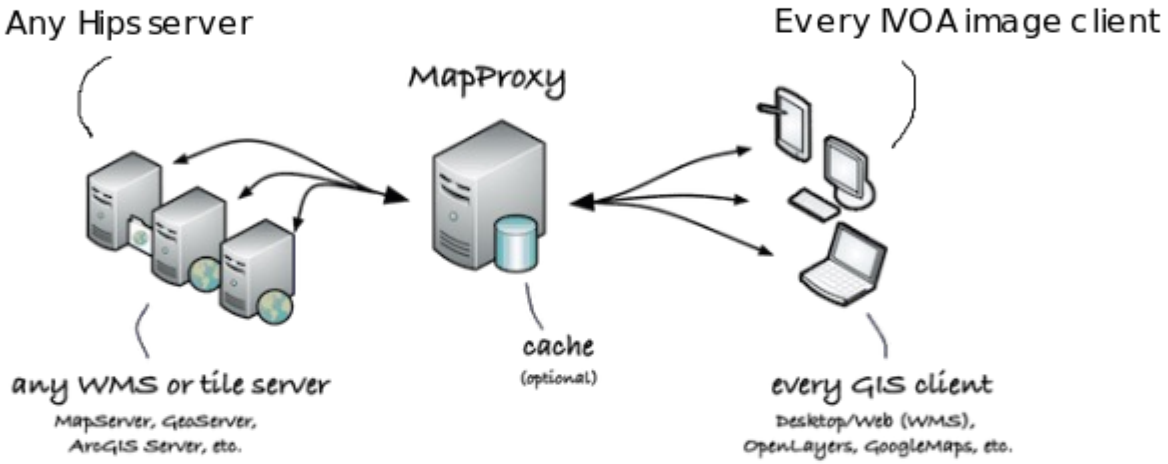
The follow on to this PR are PRs across the STAC ecosystem to update reading projections in the form `authority:code` instead of assuming EPSG.

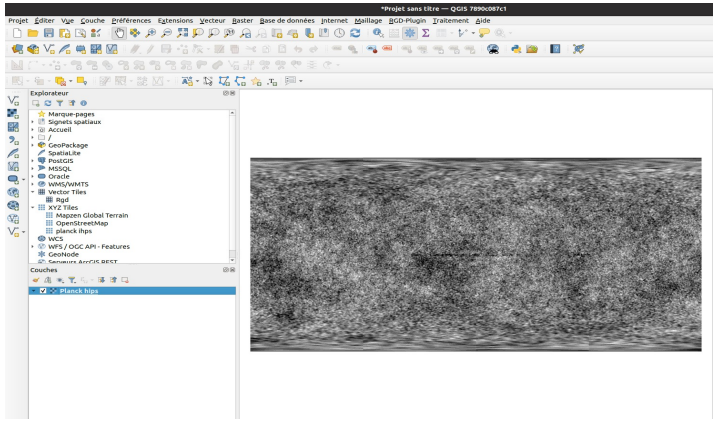
1

m-mohr requested review from **matthewhanson** and **m-mohr** 7 months ago

https://github.com/stac-extensions/projection/pull/12

Interop between IVOA/OGC



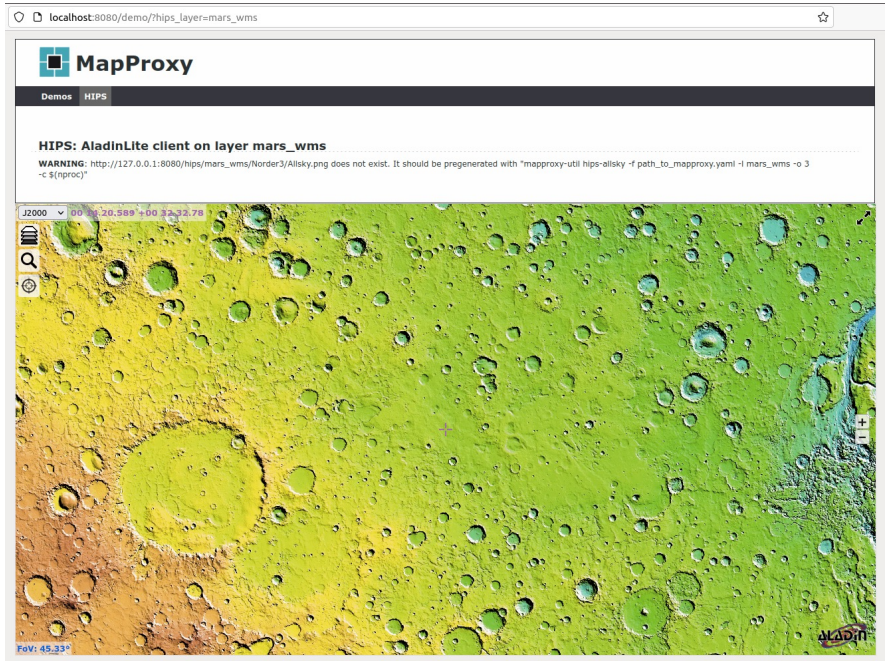


https://pypi.org/project/mapproxy-hips/

- Interoperability Hips < -- > WMS/WMTS
- Do not need to change the implementation of tools

To configure it, look at the examples :

https://github.com/rouault/mapproxy_hips/tree/master/hips_examples



Future actions

- Checking the use of IAU CRS in OGC API (Features, Process, Common, Tiles)
- Fostering the connection between OGC/OSGeo (e.g. GDAL, PROJ, QGIS, Mapserver,...)
- Cartography of the OGC standards and dependencies about IAU CRS and the check that this standard covers the IAU registry (Discussion Paper on Planetary CRS). Make sure that the CRS definition in the OGC API standards continue to meet our needs.
- SPICE
- Add IAU CRS and ssys extension in DOI
- Wiki of the Planetary group on the OGC github repository (under construction)
  - Collection use case of the planetary community
  - Develop a list of tools where IAU CRS are implemented
  - Governance of IAU CRS registry

OGC

Thank You!

More info about the Planetary Group

Charter :
https://portal.ogc.org/files/?artifact_id=99970
Mailing list :
https://lists.ogc.org/mailman/listinfo/Planetary.DWG
Github (empty for the moment):
https://github.com/opengeospatial/Planetary-DWG

Contact info@ogc.org to schedule a meeting for an in-depth discussion with OGC staff and join our community today!