



Planetary Science Focus Session at 2014 Madrid IVOA Interop. Meeting

Report. June 2014. B. Cecconi.

Introduction

In the frame of the study of the possible collaborations between IPDA and IVOA, a plenary session has been organized during the last IVOA Interop Meeting (Madrid, May 2014). This session is also linked to the *IPDA/IVOA interactions* project of IPDA. B. Cecconi and C. Arviset organized this session. The schedule and presentations are available in the IVOA website :

<http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpMay2014FocusSessions>

This document reports on the session presentations and discussions.

The online document on *IPDA/IVOA Interactions* is available here:

<https://docs.google.com/document/d/1aT-bFvrNDU7PBVivAiex40Chm1N-DhUZje2aEqB02eo/edit#>

Presentations

All presentations were given by invited speakers. All the contributors of the *IPDA/IVOA interactions* online document were contacted but only a few could attend the meeting in Madrid. The series of presentation however covered a large fraction of the topics of interest in planetary sciences, in the frame of the IVOA.

Introduction and presentation of the IPDA/IVOA interaction study. B. Cecconi.

B. Cecconi (Obs. Paris, France) is introducing the focus session on planetary sciences. He presents the main groups and standards in the planetary science community: IPDA, SPASE, PDS, Europlanet, IMPEX... He recalls that during previous Interop meetings, several presentations already showed that the IVOA standards and tools can be used efficiently for planetary sciences studies (TAP [Table Access Protocol], SAMP [Simple Application Messaging Protocol], TOPCAT [Tool for OPeration and CAtalogs and Tables], UCD [Unified Content Descriptors]...). He then presents the *IVOA/IPDA interaction* study, its participants and the 14 identified topics sorting them into 4 themes:

- *Standard Lists and Semantics*: UCDs, List of coordinate systems, of ground based observatories and of space missions
- *Formats and Descriptors*: serialization in other formats, such as NetCDF or CDF, new keywords for FITS, description of the observation geometry.
- *Protocols*: EPN-TAP, SAMP, new MovingConeSearch project.
- *Sharing planetary data from Astronomy repositories*: cross-matching of registries (IVOA/SPASE/PDS), ESO images, Exoplanets...

He shows the links between the IPDA, PDS and IVOA standards for each topic. Finally, he discusses a few points that emerged from the discussions that occurred at the meeting in the previous days, such as:

- SIAv2 (Simple Image Access version 2): usable if adding a reference frame id.



- Implementation of TAP on PSA?
- Use of the QuickViz plugin of Aladin.

A Planetary Science Virtual Observatory prototype. S. Erard.

S. Erard (Obs. Paris, France) recalls the objectives and achievements of the previous Europlanet program (EU-funded, under FP7). One of the objectives was to draft a planetary science virtual observatory, which would allow easy access to archived data, quicklook visualization of data, and external users to include their data. The main constraint was to minimize the developments (building on existing standards and tools). The infrastructure should not be visible to the science user.

The selected architecture is based on IVOA standards (using the Table Access Protocol [TAP], and a set of predefined keywords for planetary sciences: EPN-TAP), and is also capable of querying PDAP services. It is using the IVOA registry to declare data resources. The data is displayed using IVOA tools (TOPCAT, Aladin...)

There is a web-based client called VESPA [Virtual European Solar and Planetary Access], which can search in EPN-TAP and PDAP services.. S. Erard lists the current services reachable in the client. He also shows how the data is displayed in Aladin or TOPCAT. He also presents implementation tests of GIS (Geographic Information System) for lunar mosaicking. The large variety of IVOA standards that has been used for Planetary Sciences shows that IVOA is almost ready to use in this context.

The future Europlanet proposal (EU-Horizon 2020 Research-Infrastructure call in September 2014) will contain a work package dedicated to VO services implementation using EPN-TAP and VESPA. The system can also be used to PI-teams to search into their own data products. Two teams are going to test the infrastructure in such a context. During the next Europlanet, it is also planned to work with IVOA tools developers (TOPCAT, Aladin, CASSIS, DaCHS...) and propose new capabilities, well adapted to planetary sciences.

More information here: <http://voparis-europlanet.obspm.fr>

Accessing Planetary Data with EPN-TAP, Deployment feedback. C. Chauvin.

C. Chauvin (Obs. Paris, France) first recalls that the EPN-TAP web client (now called VESPA, as presented in the previous talk) has already been presented several times at IVOA. He will then concentrate on implementation feedback, rather than a description of the client features. The implementation feedback is presented in three categories:

- *Registry*

The client is using a full searchable registry harvesting all known IVOA registries. The CLIENT-REGISTRY communication is using a REST API, and the EPN-TAP are discriminated with a simple trick (the service short-name shall contain "epn_core"). The main problem here is on the registry side (such as the Euro-VO one in Europe) where it is very difficult to modify a resource once it is registered. A solution would be to use the self-publishing registry capability of DaCHS (the TAP server framework recommended by the VOParis team for implementing EPN-TAP services). Note that the VODANCE framework developed in Italy is also be used

- *TAP*

The requests are handled with ADQL, with COUNT queries to check if resources are present (non zero result) and then SELECT to get the data in a VOTable. ADQL lacks "case conversion" function, especially "to lower case" that would be very useful for planetary target name searches. Another feature that he needs would be the formalization of lists of values (grammar) inside a VOTable cell of a TAP response.



- **SAMP**

The SAMP library used in VESPA is *jsamp.js*. It is working very well to share data with SAMP-enabled applications and web sites. The “highlight row” capability is very interesting, but is difficult to implement on results of searches, as any a posteriori refinement of the search on the client side, implies to send again the resulting VOTable (in order to keep row indices consistent). It is proposed to think of a row-index column that could be declared for this feature. The main problem is a GUI problem: the security pop-up window that ensure that SAMP connections are not activated without the user’s consent, are displaying the full URL of the caller. In case of URL containing keyword, that URL could be longer than the allowed screen width, depending on the platform, and can be blocking in certain cases. It is propose to abbreviate the URL, when too long.

As a conclusion, C. Chauvin recalls that 11 EPN-TAP services are now running and a few are in preparation. Most of the problems presented here have been already discussed during this meeting and could be solved easily. He thanks the IVOA for the organization of the Interop Meetings that are an excellent and necessary platform for face-to-face technical discussions.

EPN-TAP Registration. P. Le Sidaner.

P. Le Sidaner (Obs. Paris, France) presents his views of the IVOA registration in the frame of the EPN-TAP implementation. EPN-TAP is a full TAP service with a series specific column names (see EPN-TAP documentation), similarly to the IVOA ObsTAP. This service needs to be registered in order to be accessible. The EPN-TAP declaration is made through a regular TAP service declaration together with the table name containing “epn_core”.

The data model in use for the TAP service can be described in the capability entity. However, the recommendation of the registry working-group is to declare a single TAP service for a data provider, and a series of DataCollections. The DataCollection declaration does not allow the data model specification. Thus there will be a problem when a data provider wants to host an EPN-TAP service and an ObsTAP service, because each of those TAP services are using a different data model. A solution would be to declare the services as DataServices instead of DataCollections. This should however be checked to make sure that this solution fits all the needs.

P. Le Sidaner also stress that the Euro-VO registry should have an interface to easily submit updated XML descriptors.

Planetary FITS. C. Marmo.

C. Marmo (Univ. Paris 11, France) could not come in person and S. Erard presents the slides. She proposes to use the FITS standard for planetary data because of it is an open, well-defined and scientific graded standard. There are also a lot of open source tools to manipulate and display FITS files. The presentation is focused on high level imaging (projected surfaces) and surface properties. Spectral cubes and tabular data can also be addressed, but will not in this presentation. The FITS format is compatible with NASA/PDS Archiving (Example with the Hubble Mars images at the Geoscience PDS node).

There is already a lot of literature for handling planetary projections in the FITS standards. The basics of map projections can be found in the USGS report “Map Projections: A Working Manual.” By J.P. Snyder. The FITS standard contains already many projection (Mercator or Tranverse Mercator, Simple Cylindrical and



Equirectangular). It is possible to translate from ISIS (USGS astrogeology software for images and spectra) to FITS.

However, a few peculiarities need to be handled. For elliptical projections, we need to define the planetary RADESYS. For that we need a keyword for datum (surface reference): we could use RADESYS containing the radius. CUNIT should be in meters and degrees, but alternative coordinate systems are already described in FITS. The distortions can be due to topography and not to optics: we cannot provide a polynomial description of the distortion.

IPDA Overview 2014. A. Sarkissian.

A. Sarkissian (LATMOS, France) is the Chair of the IPDA. He presents the activities of the IPDA. The mission of the IPDA is four-fold:

- Facilitate global access to and exchange of, high quality scientific data products
- Support construction of compatible archive
- Support sharing of tools and softwares
- Define data standards within IPDA, including data models and dictionaries, based on the NASA PDS

The IPDA considers that the NASA/PDS is a de-facto standard for all planetary data. The structure of the IPDA is composed of a Steering Committee (SC) and a Technical Expert Group (TEG). The IPDA is a grouping of 14 space agencies from 14 countries. The SC is composed of 28 representatives and the TEG has 20 members (from 8 countries). A general meeting is hosted every year, and several teleconferences are held during the year. The IPDA website is here: <http://planetarydata.org>. Every year a series of projects are activated and are discussed in the regular teleconferences.

For the 2011-2015 period of time, he presents a selection of the projects: development and coordination of the PDS4 (next generation); development of PDAP; development of an internal registry for tools and services; standards related to geometry and navigation. For the year 2013-2014, the selected projects were: PDS4 implementation, Registrations and Search, international MoU template, ESA Registry implementation, tools registration, PDAP/PDS4 Integration, Geometry, IVOA/IPDA collaboration, CDF/PDS4 compatibility... He also present the list of standards and their respective release status. IPDA also has an outreach activity towards the community at international conferences. Finally, A. Sarkissian presents the open action items: addition of new countries (Poland, Sweden, Brazil...), Search services, PDAP applications, PDS4 release.

PSA report and PSA-UG Activities. D. Heather.

D. Heather (PSA, ESAC, Madrid, Spain) reports on PSA (Planetary Science Archive) activities. The PSA is available since March 2004 at <http://archives.esac.esa.int/psa>. It is still in active development and continuously receives data from PI teams. All datasets are independently peer-reviewed and internally validated before ingestion into the PSA. The whole database contains ~20TB of data. There are 4 possible access services: Advanced search interface, Map based interface (Mars Express datasets), FTP access and Machine interface (PAIO). The PSA archive contains all its missions (Huygens, Rosetta, Giotto, Mars-Express, Venus-Express, Smart-1) in a single database, and in PDS format. The Bepi-Colombo datasets are currently being prepared, as well as certain instruments on Chandrayaan-1. Some ground based observations of comets are also archived. The involvement of PSA into the IPDA is strong. ESA is a founding member. PSA has a leading role in the TEG. D. Heather presents the link between the Venus-Express datasets archived at PSA and the PDS-atmosphere node. This interoperable link allows



the scientist to access PSA Venus-Express datasets directly from the PDS. During this year, the PSA participated to the preparation of the international MoU template, the registry implementation, the PDS4 implementation, the Chandrayaan-1 interoperability, PDAP extensions and the IPDA/IVOA interaction study (this meeting!)

The PSA-User-Group (PSA-UG) is chaired by A. Pio Rossi (Jacobs Univ., Bremen, Germany) and is composed of 6 members from various planetary science fields. This group advises ESA for future developments of the PSA content, interfaces, documentation and compatibility with other planetary science archives and tools. The PSA-UG web site is here: <http://archives.esac.esa.int/psa/psa-ug>. The group meets twice a year and is promoting the PSA activities at conferences. The recent activities were focused on a questionnaire aiming at gather the inputs from the community: <http://surveymonkey.com/s/psaug>. The first responses are showing a strong interest for interoperable access.

General Discussion

The floor is then open to discussion.

- Do the users know that all the developments comes mainly from IVOA ?
Answer: It is always advertised during the presentations and workshops where we do the demos. It should be present on the tools and websites too.
- Questions about the “Moving Cone Search” concept. It is suggested that all images could be processed with a service checking the location of solar system bodies in the field of view. SSODNet (Solar System Open Database Network) from IMCCE (Paris) provides a service that computes the coordinates of solar system bodies for a given field of view. A similar service exist at CADC.
- Questions about ObsTAP and EPN-TAP:
 - Is it difficult to setup an EPN-TAP service when an ObsTAP service is present (or the reverse)?
Reponse: it should be easy, and it is a very interesting test setup. This will be studied between CADC and VOParis.
 - Why not use ObsTAP for planetary sciences ?
Response: Both protocols are complementary. ObsTAP is focused on astronomical coordinates and targets, while EPN-TAP deals with planetary targets and planetary coordinate systems. Planetary scientists can use both protocols: EPN-TAP for searching for planetary resources, ObsTAP for background sources (that are used for calibration).
- The addition of a time keyword for SIA (Simple Image Access) is not only useful for planetary sciences, but also for astronomy (transients, exoplanets...)

Other discussions

- **Registry group:** At the moment, TAP services are declared as simple VOResources. It is proposed that EPN-TAP and ObsTAP can be declared as « CatalogService » (a type of VOResource). The Registry Group is also interested in comparing the IPDA/PDS4 registry system and content descriptions to the that of the IVOA and to study possible links between the two.
- **Semantic:** list of UCDs (Unified Content Descriptors) additions proposed for planetary sciences is now under review by the Semantics group of IVOA.
- **Workflows:** The new version of Taverna (Workflow manager with a graphical user interface) is 2.5.0. There is a version for astronomy with a series of specific



services and tools included, such as displaying VOTables or sending results with SAMP.

- **Discussion with CADC:** VOParis and CADC will work together to test the ObsTAP/EPN-TAP complementarity and compatibility.
- **QuickViz:** The QuickViz plugin of Aladin (developed under the MUSE project) will be upgraded to work with the new version of Aladin and for planetary spectral cubes.

Conclusion

The session was obviously successful. The astronomy community is willing to share the planetary science data, which are already in their repositories, using the IVOA standards. They also agree on adapting their standards and tools to planetary sciences when necessary.

Another planetary science session will be proposed at the next IVOA Interop meeting, in Calgary, Canada (Oct. 2014).