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VESPA: Developing the Planetary Science Virtual Observatory in H2020

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Introduction

The Europlanet H2020 programme will develop a research infrastructure in Horizon 2020. The programme includes a follow-on to the FP7 activity aimed at developing the Planetary Science Virtual Observatory (VO). This activity is called VESPA, which stands for Virtual European Solar and Planetary Access. Building on the IDIS activity of Europlanet FP7, VESPA will distribute more data, will improve the connected tools and infrastructure, and will help developing a community of both users and data providers.

One goal of the Europlanet FP7 programme was to set the basis for a European Virtual Observatory in Planetary Science. A prototype has been set up during FP7, most of the activity being dedicated to the definition of standards to handle data in this field. The aim was to facilitate searches in big archives as well as sparse databases, to make on-line data access and visualization possible, and to allow small data providers to make their data available in an interoperable environment with minimum effort. This system makes intensive use of studies and developments led in Astronomy (IVOA), Solar Science (HELIO), plasma physics (SPASE), and space archive services (IPDA). It remains consistent with extensions of IVOA standards.

1. Infrastructure

The system is based on a new access protocol, a specific client to query the available services, and intensive recycling of tools developed for the Astronomy VO [1]. The architecture consists in connecting existing data services with IVOA protocols (Cone Search, TAP…) or with the IPDA protocol (PDAP) whenever relevant (Fig. 1). However, a more general standard has been devised to handle the specific complexity of Planetary Science, e.g. in terms of measurement types and coordinate frames. This protocol, named EPN-TAP, is based on TAP and includes precise requirements to describe the contents of a data service [2]. Services are declared in standard IVOA registries and are expected to provide answers formatted as VOtables.

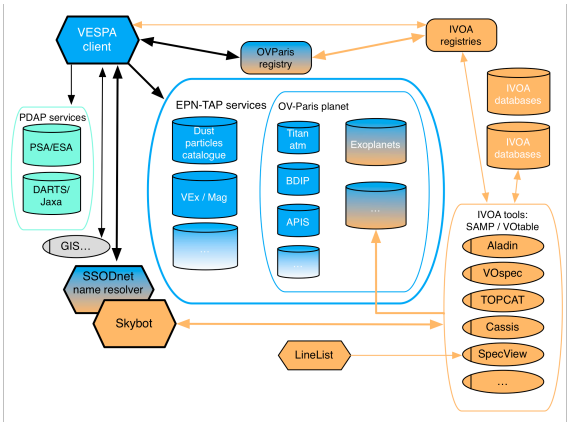

Fig 1: Data access and visualization services (in orange: IVOA, blue: Europlanet, cyan: IPDA, gray: OGC)

A full client, also called VESPA, has been developed at VO-Paris (Fig. 2). It is able to use all the mandatory parameters from EPN-TAP, plus extra

parameters from individual services. The results can be sent to VO visualization tools such as TOPCAT, SpecView, or Aladin though the SAMP protocol. A resolver for target names and an ephemeris service are also available. The H2020 activity will focus on improving the user's experience, will connect extra tools such as GIS or mosaics builders, and will make it possible to read and visualize PDS3 data files on-line. Future developments include implementations of workflows to support on line data processing. A special task related to VO standards will be in charge of formalizing the Europlanet standards and have them validated by higher-level consortia (IVOA, IPDA, IAU…). This will ensure the sustainability of the Planetary Science VO after the end of the H2020 programme.

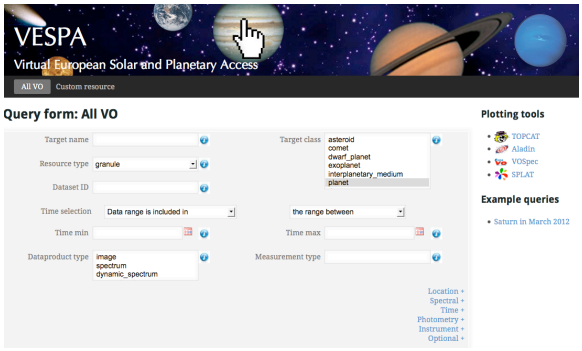

Fig 2: The VESPA user interface: http://vespa.obspm.fr

2. New services

Some new data services were produced in the Europlanet-RI framework, and some older data services were provided VO access through EPN-TAP. This system will be extended to all fields of Planetary Science in the frame of the H2020, and open to external data providers.

The activity will be organized around 5 science themes (surfaces, atmospheres, small bodies, magnetospheres, spectroscopy). The science themes will setup new, selected data services, and will work on improving interfaces between domains. Of particular importance is the study of an interoperable link between the VO and Geographic Information Systems now commonly used for planetary surfaces; SSHADE is a network of 20 European spectroscopy laboratories that will distribute their data in a consistent service accessible to observers in support of data interpretation; projection of high-resolution data on shape models of small bodies will be made possible; several large data services related to atmospheres and plasma environments will be also become interoperable [3].

An important part of the programme will consist in annual calls for new data services open to the community. The selected teams will get dedicated support to set up EPN-TAP services from their data, typically corresponding to published works. The benefit for the teams will be in terms of visibility of their science work, and VO techniques knowledge transfer. We expect to be able to implement 15 such services during the programme lifetime. In addition, a few significant amateur services will be considered for implementation in the same system, and links with major data archives (ESA, ESO…) will be studied.

3. Community building

In addition to providing support to selected providers during the program lifetime, VESPA will seek to spread the EPN-TAP system among other research teams. A light framework (DaCHS/GAVO) and a procedure have been identified to install topical data services easily, and several hands-on sessions aimed at potential data providers have been organized in the past three years. The immediate benefit will be to provide search functions to data archives.

Training of potential users is also a crucial part of the programme, and will be centred on tutorials and hands-on sessions during conferences in Europe (EGU and EPSC).

[1] Erard et al (2014) Planetary Science Virtual Observatory architecture. *A&C* **7-8**, 71-80 http://arxiv.org/abs/1407.4886
[2] Erard et al (2014) The EPN-TAP protocol for the Planetary Science Virtual Observatory. *A&C* **7-8**, 52-61. http://arxiv.org/abs/1407.5738
[3] Génot et al (2014) Joining the yellow hub: uses of the Simple Application Messaging Protocol in Space Physics analysis tools. *A&C* **7-8**, 62-70.

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