IPDA Planetary Data Access Protocol(PDAP)

An effort to share planetary scientific data

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International Planetary Data Alliance (IPDA)

- The *International Planetary Data Alliance* (IPDA) is an international effort focused on the development and collaboration of standards for data archiving and promotion of interoperability among planetary science data archive systems in order to share scientific results returned from exploration of the solar system.

- Ensuring interoperability promoting standards like PDAP. Work ongoing for other protocols

- Projects defined within IPDA to work on interoperability
- One meeting per year + teleconfs and mailing discussions
- IPDA Technical Experts Group created to deal with technical issues
- Participants from all over the world
- Current IPDA chair: Yasumasa Kasaba (Tohoku Univ., Japan)

Planetary Data Access Protocol

- Interoperability project created and main delivery:
  - **PDAP (Planetary Data Access Protocol)**

- Concept was born at the ESA/PSA and NASA/PDS Technical Interoperability Meeting, held January 10-12, 2006 in Madrid Spain
- Current version v0.4 working draft, under review
- Protocol to access Datasets, products and images
  - Initially prepared by PSA(ESA) and PDS(NASA) technical experts. Now in collaboration with IPDA Technical experts
  - Two servers implementations (PDS and PSA) + two implementations in progress (JAXA)
  - Two client implementations, different flavors
    - PSA Mars Map client: Geometrical searches for PDS/PSA products
    - PDS dataset/product browser: PSA datasets/products access through PDAP

Planetary Data Access Protocol

- PDAP is a two steps protocol:
  - Metadata Access: Software Clients search for available data that match certain criteria. The matching criteria includes specific protocol metadata and PDS keywords
  - Data Retrieval: Software client retrieve through a synchronous HTTP GET/POST request using a reference URL returned from first step

- Any PDAP server service implementation should be registered. Registration allows service discovery and get access to publisher/curation information
  - Interchange default format is VOTable (XML). This format can be easily parsed by a client and displayed in different ways

PDAP input fields

- GET/POST HTTP based protocol (service URL and keyword=value)

- DATA_SET_ID, PRODUCT_ID
- Data Set or Product specific PDS keywords: INSTRUMENT_TYPE, INSTRUMENT_NAME, TARGET_TYPE, TARGET_NAME, MISSION_NAME
- Time Constraints: START_TIME, END_TIME and geometrical constraints using PDS keywords
- Different granularity levels: RESOURCE_CLASS (DATA_SET, PRODUCT, IMAGE)
- Different response output: RETURN_TYPE (VOTABLE, HTML, ASCII)
- Input fields could have different meaning at different granularity levels
- RESOURCE_CLASS=METADATA gives service capabilities

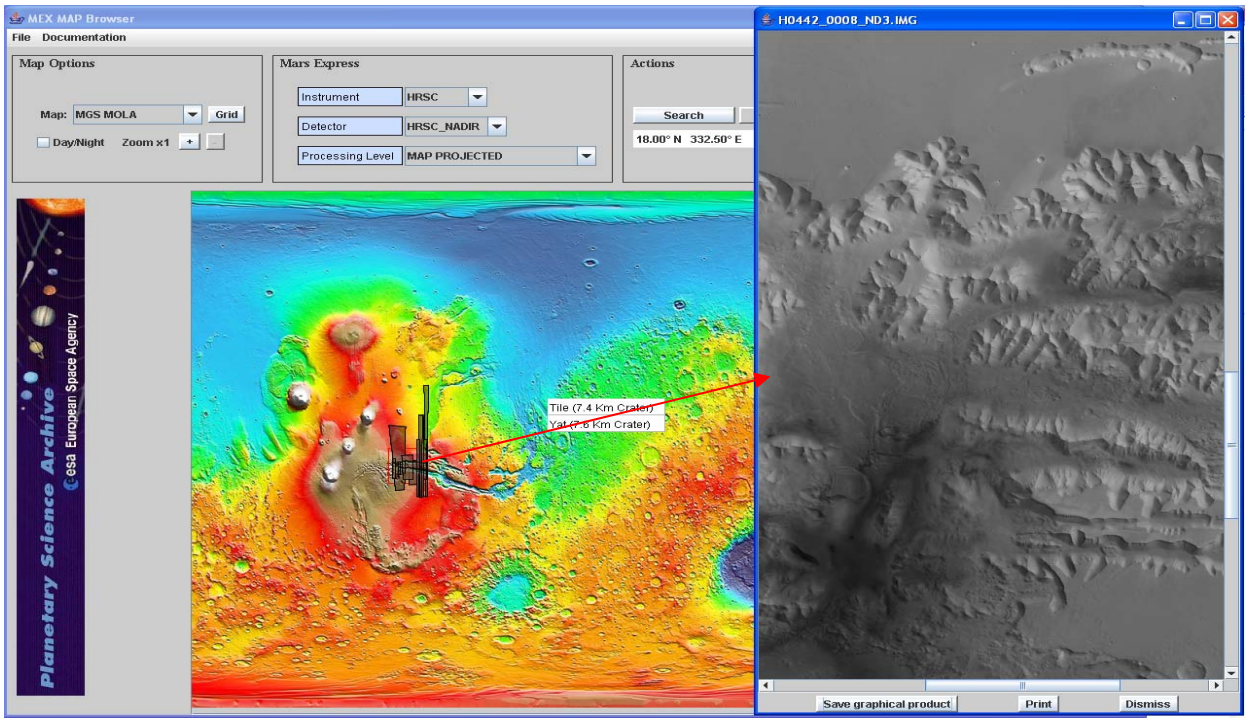
PDAP output fields

- Default output in VOTable format
- General Data Set, Product or Image information. Attribute pointing to the corresponding PDS keyword
- Link to access the data
- Dublin core information (Publisher, Contributor, Publishing date, Rights)
- For Image granularity level, apart from central longitude and latitude, footprint information is added for every record in a simple way
  - POLYGON(LON_1:LAT_1,LON_2:LAT_2,….,LON_n:LAT_n)

IPDA protocols and link to other VOs

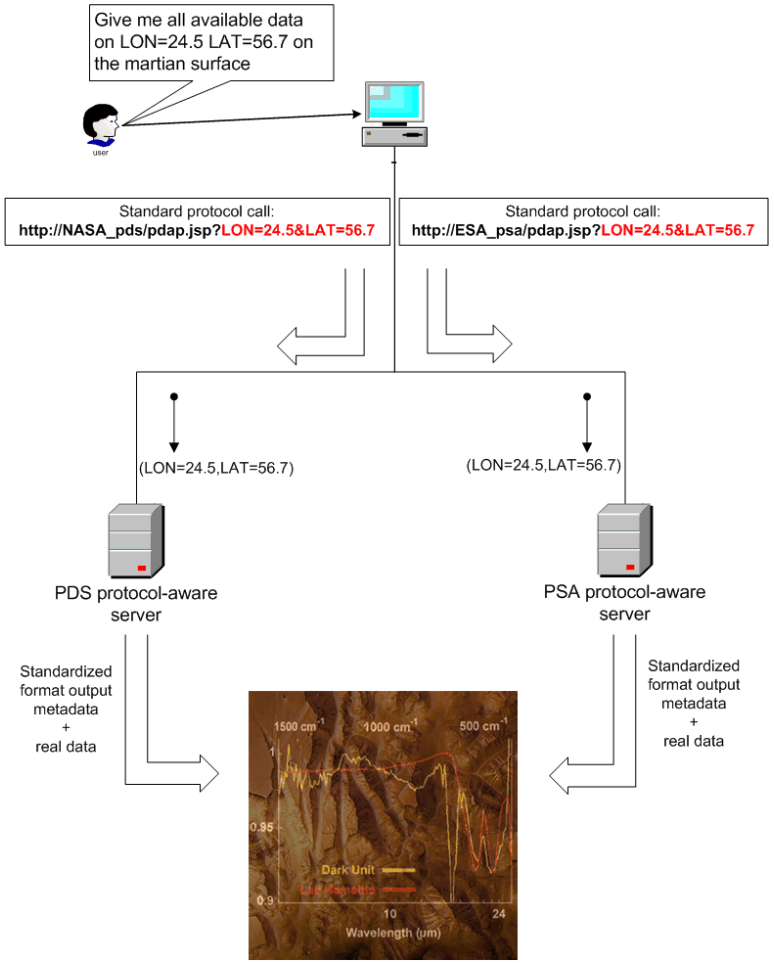
- Protocol is close enough to be interoperable in the future by general clients but they contain specific Planetary characteristics
  - Use of VOTable and Simple protocols concept for PDAP
  - Not need of specific data models or dictionary (semantics) from scratch
  - Use of PDS keywords
- Try to use the best of both worlds:
  - Knowledge of planetary data from planetary community
  - Experience in interoperability from other VOs
- Client applications should be able to consume e.g. IVOA and IPDA resources without major effort and without loosing a good characterization/description of the data

PSA: Planetary Science Archive

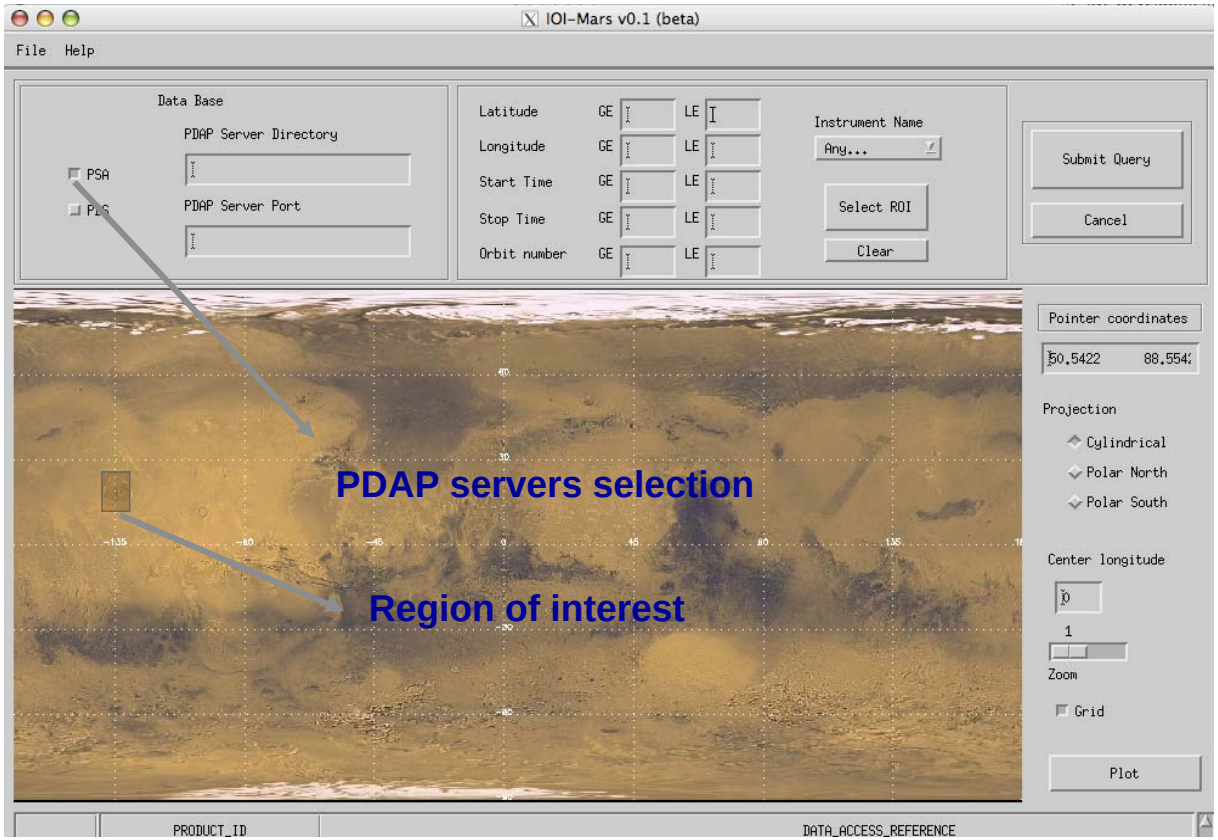


http://www.rssd.esa.int/index.php?project=PSA

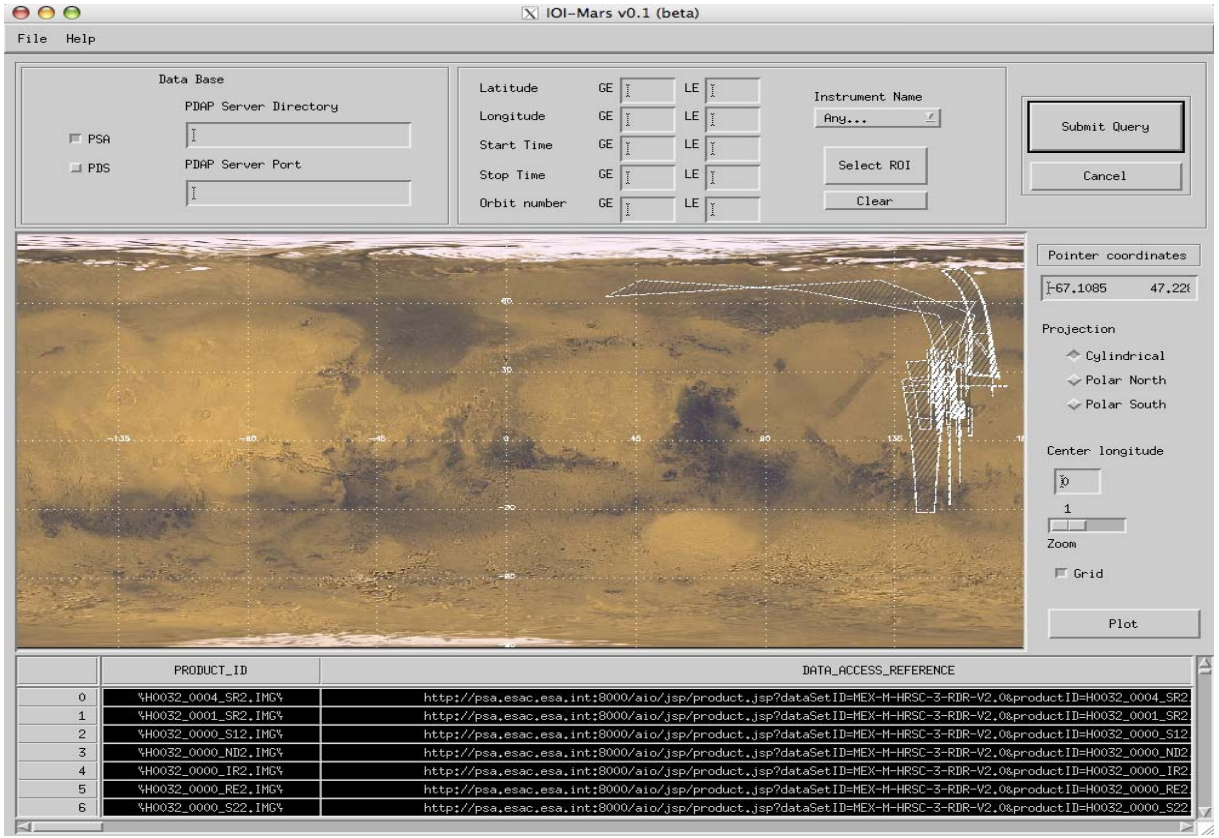
Interoperability use case



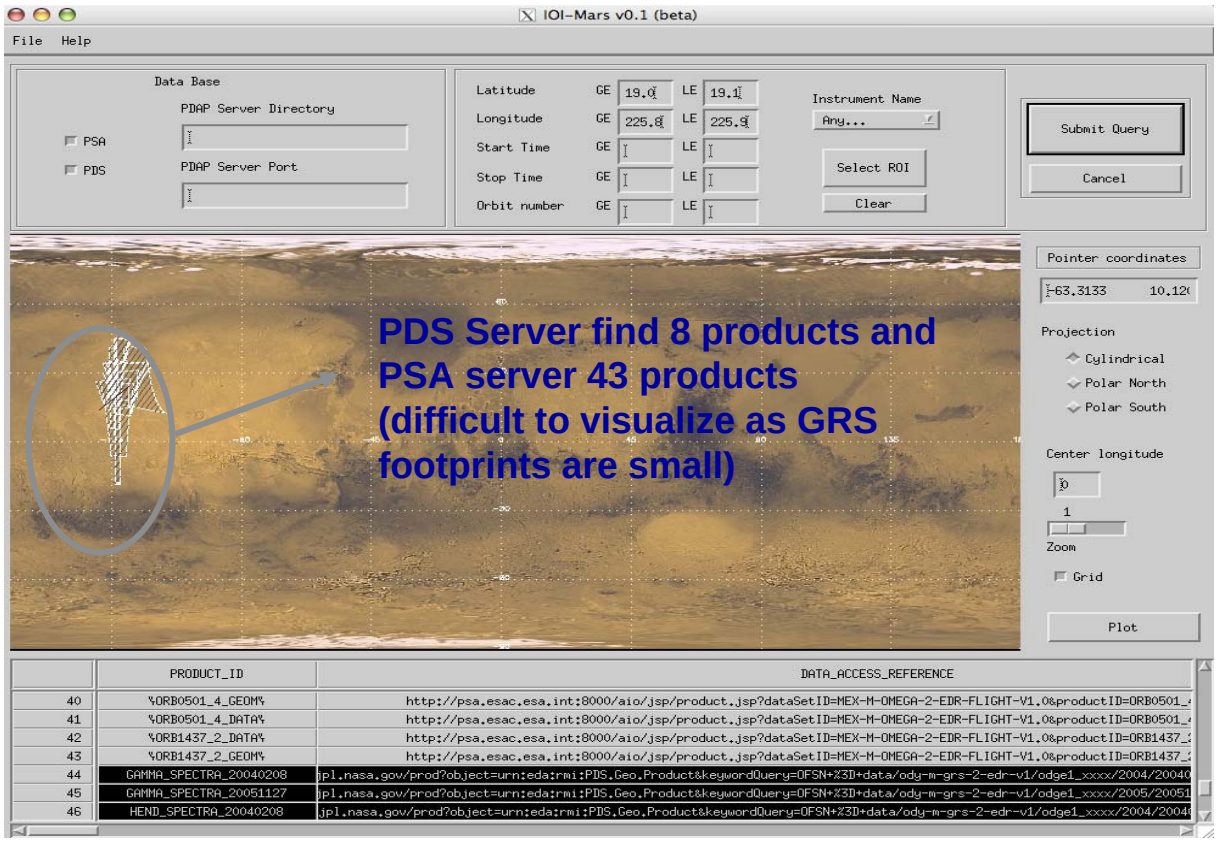
Use Case I: Map based queries



PSA-DH PDAP Map Client



Map based queries (II)



Query Construction

- Both servers receive same query and return VOTable responses
- **http://psa.esac.esa.int/aio/jsp/metadata.jsp?**RESOURCE_CLASS=IMAGE&TARGET_NAME=MARS&MINIMUM_LATITUDE>19.0&MAXIMUM_LATITUDE<19.1&MINIMUM_LONGITUDE>225.8&MAXIMUM_LONGITUDE<225.9
- **http://www.planetarydata.org/grs/pdap.jsp?**RESOURCE_CLASS=IMAGE&TARGET_NAME=MARS&MINIMUM_LATITUDE>19.0&MAXIMUM_LATITUDE<19.1&MINIMUM_LONGITUDE>225.8&MAXIMUM_LONGITUDE<225.9

- Client uses "<" ">" operators to constraint the region of interest (note this has been deprecated to prevent the use of these symbols and to define ranges in a more flexible way). Recommended:

http://psa.esac.esa.int/aio/jsp/metadata.jsp? → **Scheme**

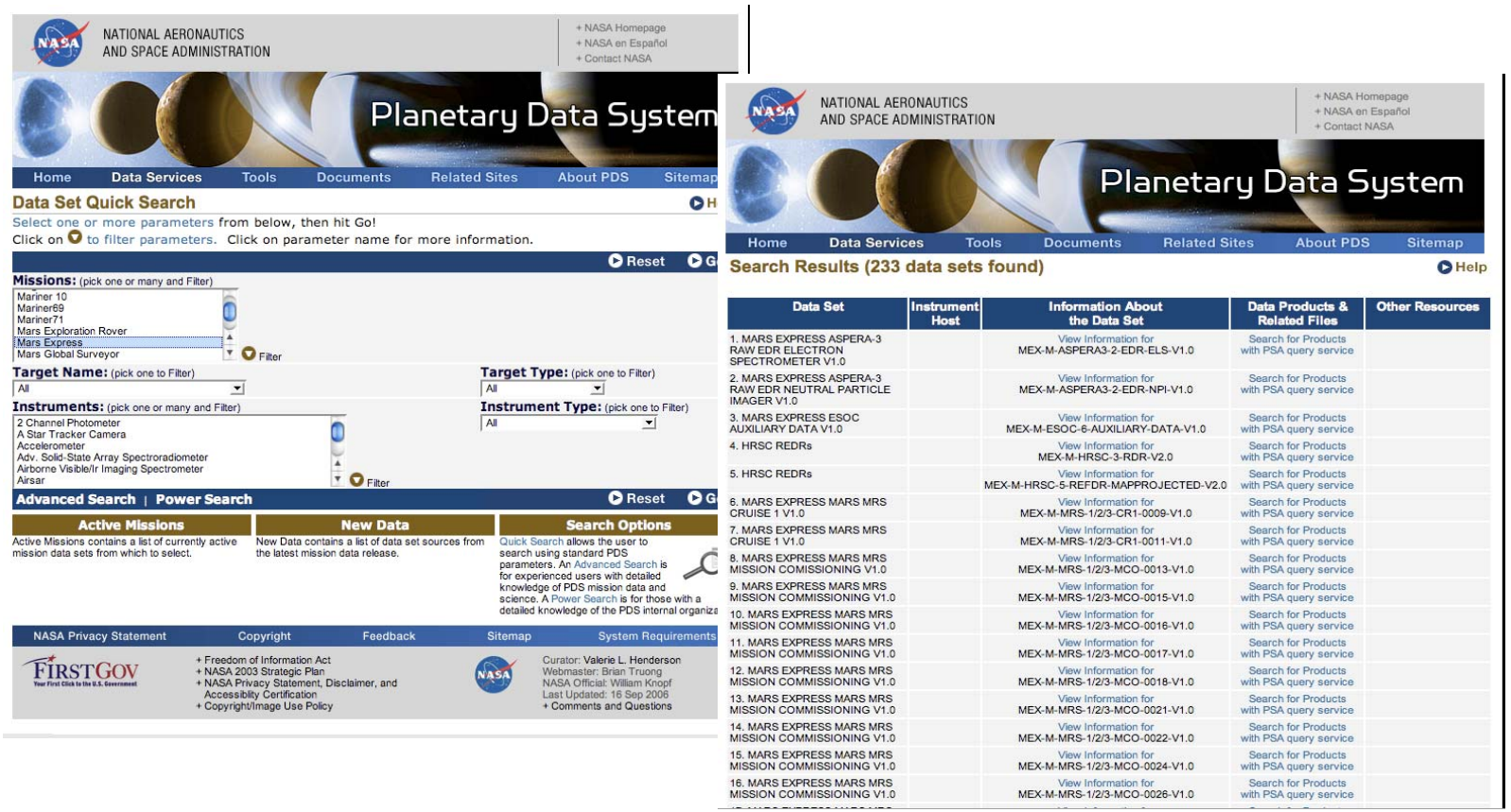
RESOURCE_CLASS=IMAGE& → **Query Type**

RETURN_TYPE=VOTABLE& → **Response return format**

TARGET_NAME=MARS&LATITUDE=19.0/19.1&LONGITUDE=225.8/225.9

And Query!!!

PDS OODT / PDAP Client



VEX Interoperability Project Definition

- PDS Atmospheres Node should have access to VEX Datasets @ PSA
- PDS Atmospheres Node should not need to copy across the data from PSA but data location URLs will point to PSA
- PDS Atmospheres Node should be able to create a uniform display for datasets located at PDS and at PSA

- **First approach:**
  - PDS Atmospheres Node will download the index file every night (or every time the file is updated) from PSA
  - Using a index file parser, a view of the dataset will be displayed at PDS pages
  - Final pointers will be to the ftp mirror located at PSA

PDAP approach for VEX Interoperability Project

- Project lead: PDS Atmos. Node + ESA/PSA
- Include a new granularity level for files in dataset, there is not need for a full download of the data set for review
- Asking for a certain data set, the service will provide a VOTable representation of the dataset, one row per file
- Every row will contain the file name, relative directory to data set top level and a URL to retrieve this single file
- Every row could contain extra metadata per row, as a group id, file type, etc

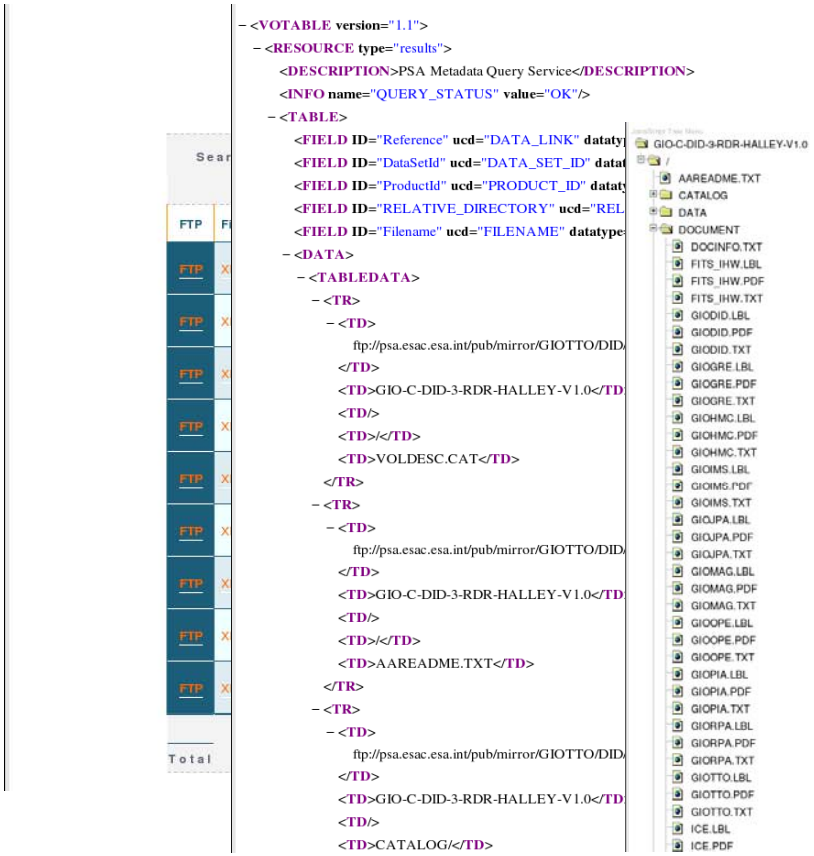
- **PDAP approach to the use case:**
  - PDS Atmospheres Node will query for new data sets at PSA and the corresponding VOTable(s) data set descriptions
  - Using a VOTable parser, a view of the dataset will be displayed at PDS pages
  - URL Pointers are provided, so the server has the freedom to use static or dynamic links

PDAP approach advantages

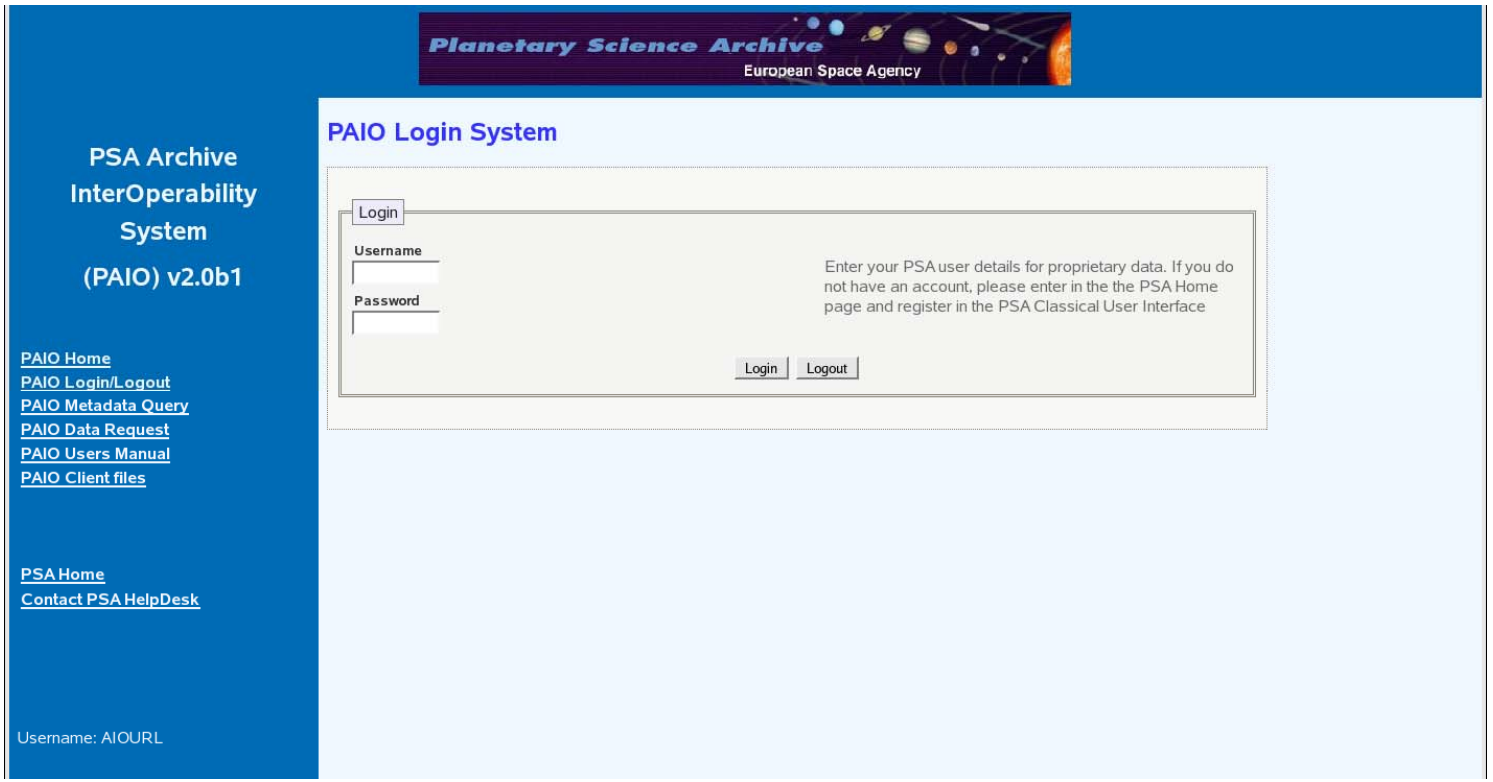
- All the files inside the data set will be present in the VOTable response. No files lost
- URLs are provided in the response. More freedom and extensible for other data providers. No need of creation of mirrors with a specific directory structure
- Extra metadata could be added to allow better searches of files (like files for a specific product)
- It could be used in combination of other PDAP queries
- Extensible for proprietary data using dynamic links that could check proprietary rights
- Extensible to google-ize searches to file level by extending PDAP

PAIO (PSA Archive InterOperability) (I)

PAIO (PSA Archive InterOperability) (II)



PAIO (PSA Archive InterOperability) (III)

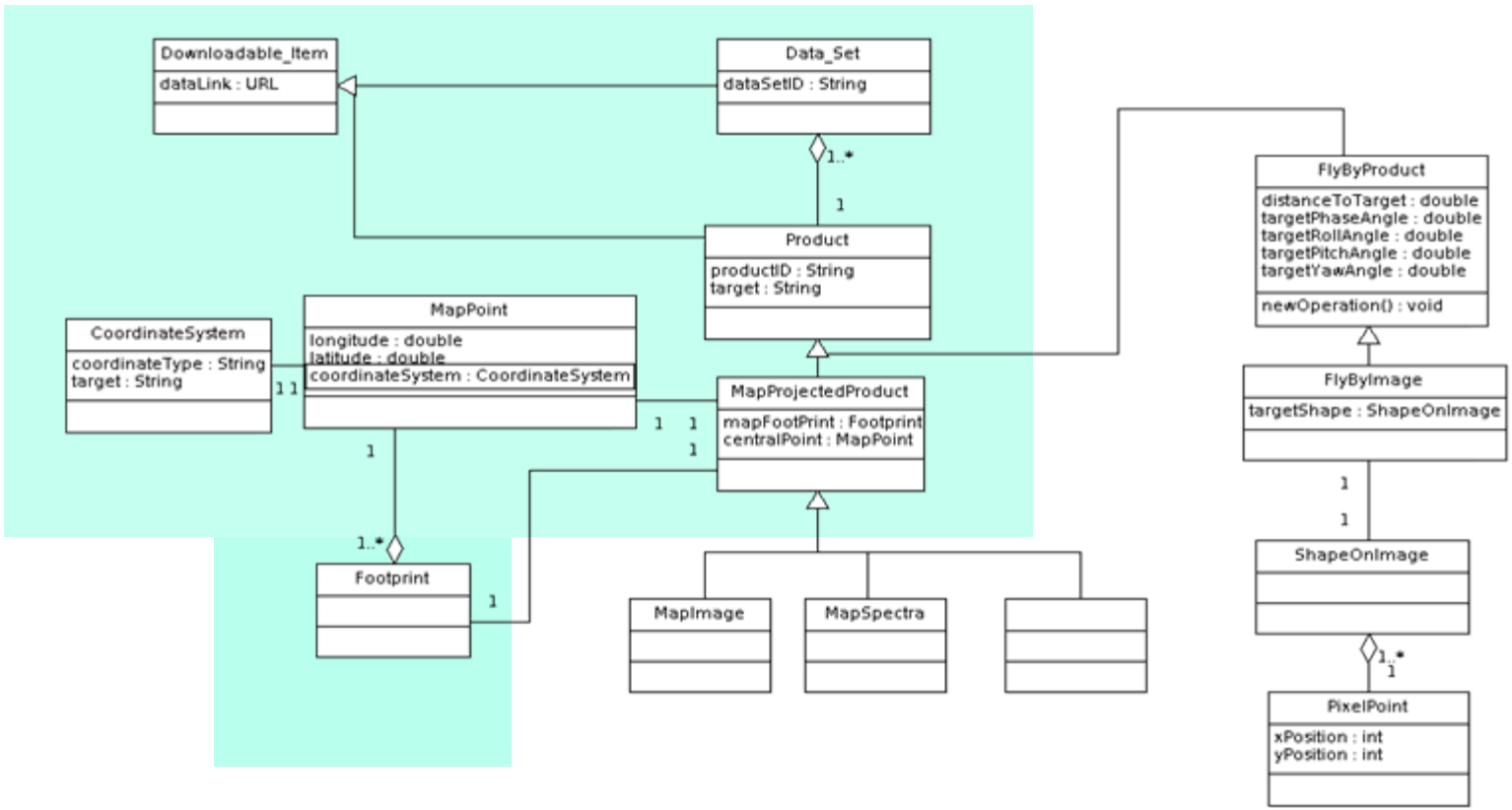


Hayabusa/Selene PDAP implementation project (JAXA) (I)

- The Hayabusa spacecraft, formerly known as **MUSES-C** for Mu Space Engineering Spacecraft C, was launched on 9 May 2003 and rendezvoused with Itokawa in mid-September 2005. After arriving at Itokawa, *Hayabusa* studied the asteroid's shape, spin, topography, colour, composition, density, and history
- **SELENE** (**Sel**enological and **En**gineering **E**xplorer), better known in Japan by its nickname **Kaguya** (かぐや**?**), was the second Japanese lunar orbiter spacecraft.[1] Produced by the Institute of Space and Astronautical Science and NASDA (both now part of the Japan Aerospace Exploration Agency, JAXA), the spacecraft was launched September 14, 2007. After successfully orbiting the moon for 1 year and 8 months, the main orbiter was intentionally crashed onto the lunar surface near Gill lunar crater at 18:25 UTC on June 10, 2009.

- IPDA project lead by JAXA
- Flyby products in the case of Hayabusa
  - Extension to non-map-projected data
  - Creation of simple UML diagram
- Proprietary data
- Pagination
- Link to OpenGIS
- Full PDAP review
- Prototypes created for both projects

Hayabusa/Selene PDAP implementation project (JAXA) (II)



Conclusions

- IPDA is an effort to define/implement data archiving standards and interoperability for planetary data
- PDAP is the first interoperability protocol defined in the IPDA context
- IPDA main members plan to expose their data through PDAP and adapt archives to consume it so community can access datasets from different IPDA members in a transparent way
- Extensions of PDAP for new data and new use cases are expected

THANK YOU

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