

Plasma Node: Use Case Analysis



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Challenges of IDIS/plasma node: components of the problem

Study types:

- Case studies
- Statistical/systematical studies
- Simulation
- Theory

Fields

- Plasma
- Comparative studies
- Heliophysics studies
- Global (inter-nodes) planetary studies

Type of resources (data, services, tools, ...):

- ▶ Plasmas, E-B fields
- ▶ Neutral (atmosphere, exosphere, other..)
- ▶ Dust, Rings
- ▶ Small bodies
- ▶ Planetary surface, volcanism, ...
- ▶ Solar observations
- ▶ ...
- ▶ Models, simulation codes
- ▶ Data analysis tools
- ▶ Data treatment tools
- ▶ ...

Two levels:

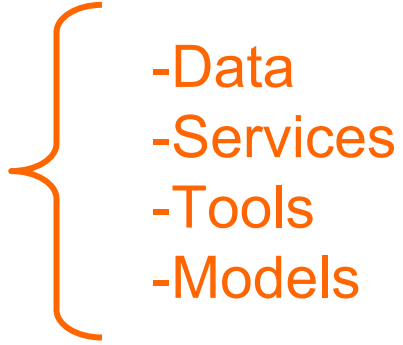
-Intra-node: only dealing with plasma resources, BUT, interacting with other plasma Vos (HELIO, US-VOs)

-Inter-nodes: exchanging resources with nodes of different thematics

⇒ **the Big Challenge...**

⇒ **and a strong justification of a planetary VO**

Goals of the Europlanet/N7 action in FP6?

- (1) Inventory of the resources (until what level?)
 - (2) Science cases: Identifying user requirements and scientific specifications
 - (3) From them, recommending specifications on:
 - Description, exchange, exploitation
 - Data
 - Services
 - Tools
 - Models
- ▶ Final product: reference document, basis for the FP7 proposal
- (4) Build demonstrators/experimentators: to be applied to use cases
- ⇒ **Preparing the FP7 Europlanet project**

We do not start from nothing...

■ SPASE

■ IVOA

■ PDS

For building a VO, the basis of everything is a standard for describing the resources, i.e.,

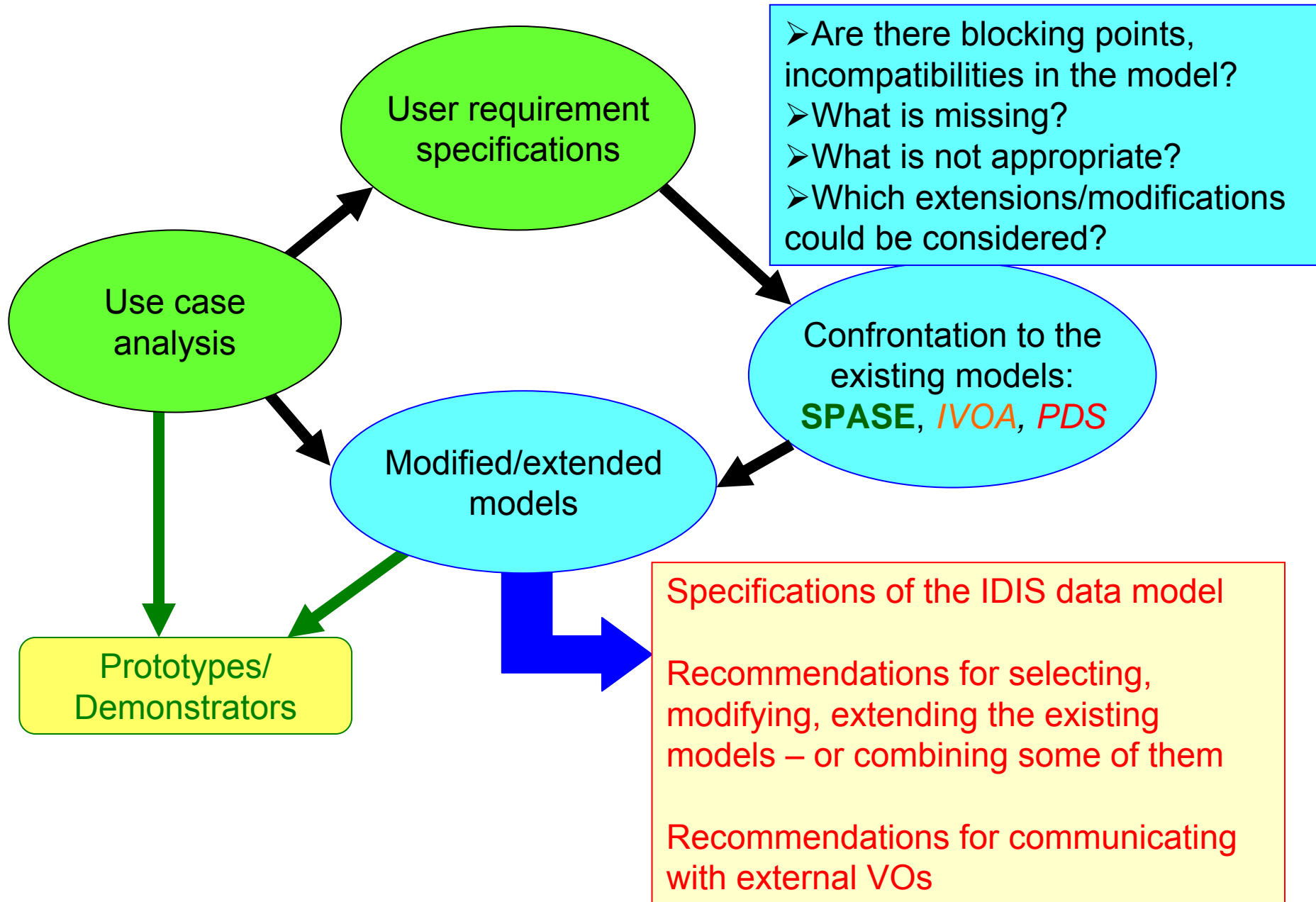
- a data (resource) model + a dictionary
- or a model + several dictionaries
- or several [model+dictionary(ies)] + translation tools

Defining the specifications on the data model(s) of the future planetology VO is one of the main goal of FP6/N7

In practice, in regards of the user requirements :

- (i) Are SPASE, IVOA or PDS good basis?
- (ii) Which one – or combination - is the most adapted?
- (iii) Recommendations for FP7 project?

Plasma node: the adopted method for science case analysis



Application: science case “Solar wind / saturn magnetosphere interaction and auroras” (1)

Needed resources

➤ In situ data

- CASSINI B-field, plasma, particles

- Heliospheric (ACE, WIND, ULYSSES, MEX) B-field, plasma, particles

➤ Remote data

- Solar observations

- CASSINI, ULYSSES radio

- CASSINI aurora images

- HST, FUSE saturn aurora images

➤ Services

- Integrated analysis tools

- Solar wind propagation simulation

- Interplanetary disturbance (CME) propagation simulation

In red, resources coming from IDIS

In blue, resources coming from external VOs

Application: science case “Solar wind / saturn magnetosphere interaction and auroras” (2)

Needed resources

➤ In situ data

- CASSINI B-field, plasma, particles ⇒ **extended-SPASE, (PDS?)**
- Heliospheric (ACE, WIND, ULYSSES, MEX) B-field, plasma, particles
⇒ **SPASE**

➤ Remote data

- Solar observations ⇒ **SPASE, IVOA**
- CASSINI, ULYSSES radio ⇒ **extended-SPASE, (PDS?)**
- HST, FUSE saturn aurora images ⇒ **IVOA**

➤ Services

- integrated analysis tools ⇒ **None**
- Solar wind propagation simulation ⇒ **in development in SPASE**
- Interplanetary disturbance (CME) propagation simulation ⇒ **in development in SPASE**

Needed extensions on SPASE

- Spacecraft attitude does not exist in SPASE (yet)
- Instrument attitude does not exist in SPASE (yet)
- Field of view of instrument does not exist in SPASE (yet)
⇒ But it is possible to implement extensions.

 Spase[Rq]

 Version[Rq]

 Catalog[* of A]

 Display Data[* of A]

 Numerical Data[* of A]

 Granule[* of A]

 Instrument[* of A] 

 Observatory[* of A] 

 Person[* of A]

 Registry[* of A]

 Repository[* of A]

 Service[* of A]

 Extension[* of A]

Extensions in observatory description

Observatory (* nbsp;of nbsp;A)

has elements

Resource ID (1)

Resource Header (1)

Observatory Group (0)

Location (1)

Extension (*)

has elements

Resource Name (1)

Alternate Name (*)

Release Date (1)

PIROR ID (*)

has elements

Observatory Region (+)

Coordinate System Name (0)

Latitude (0)

Longitude (0)

Elevation (0)



Extensions in instrument description

Instrument (* of A)

has elements

Resource ID (1)

Resource Header (1)

has elements

Resource Name (1)

Alternate Name (*)

Release Date (1)

Expiration Date (0)

Description (1)

Acknowledgement (0)

Contact (+)

Information URL (*)

Association ID (*)

Prior ID (*)

Instrument Type (+)

Investigation Name (1)

Observatory ID (1)

Caveats (0)

Extension (*)



Prototypes.demonstrators

Registry demonstrator: (Demo if extra time)


- Description SPASE of several planetary plasma data (MAPSKP, VEX, MEX)
- Building a registry
- Building a search engine
- Goals: demonstration and experimentation (standard versus user requirements, SPASE extensions, ...)

Science demonstrator: (Demo if extra time)

- Based on AMDA
- Using distant data (MAPSKP, VEX-MAG, HST) and local data
- High level tools and functionalities
- Goals: demonstration and experimentation

An example of registry for space physics: VSPO

<http://vspo.gsfc.nasa.gov/websearch/dispatcher>

**GODDARD SPACE FLIGHT CENTER**
Space Physics Data Facility

[+ Goddard Home](#)
[+ Visit NASA.gov](#)

SEARCH NASA

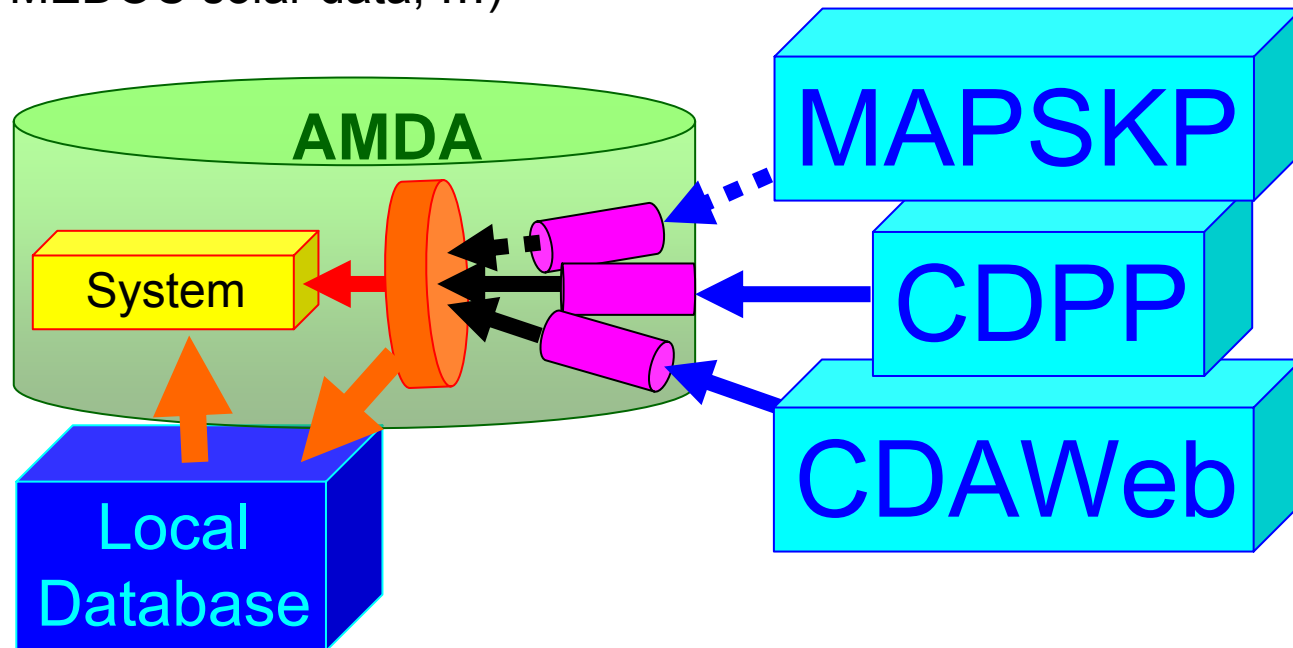
Virtual Space Physics Observatory **SPASE**
inside

- PRODUCT FINDER + ABOUT + HELP + ACCESSING VSPO + SERVICES + FEEDBACK

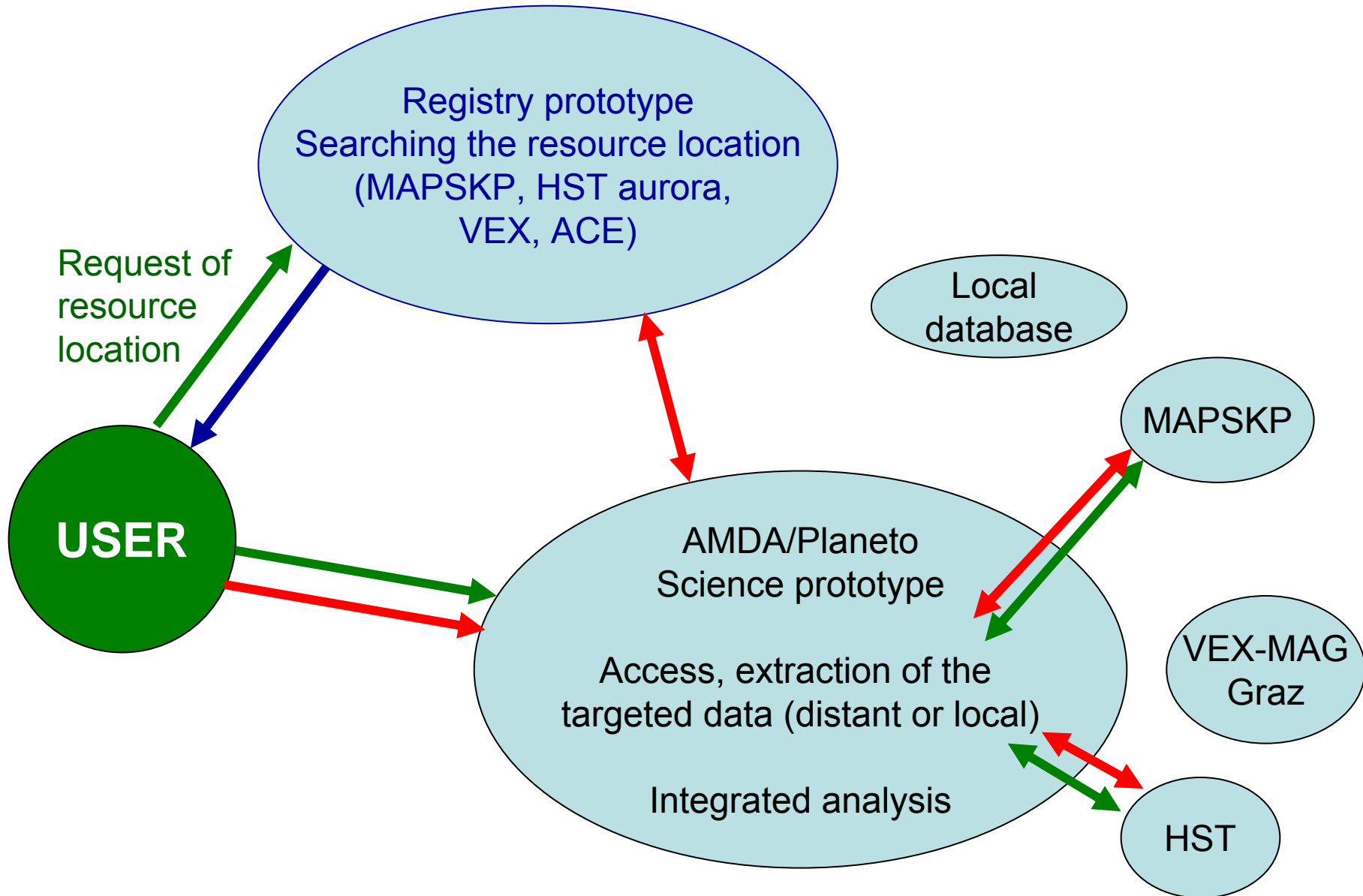
Text Restriction <input type="text"/> <input type="button" value="Add"/>	Current Product Restrictions No restrictions are currently set.																								
Time Span Restriction ⓘ YYYY-MM-dd or YYYY-DDD from: <input type="text"/> to: <input type="text"/> <input type="button" value="Add"/>	<table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>#</th><th>Product Name</th><th>Access Links</th></tr></thead><tbody><tr><td>1</td><td>ACE 27-day Survey Plots</td><td><ul style="list-style-type: none">· Polar-Wind-Geotail 'gif-walk' site</td></tr><tr><td>2</td><td>ACE CRIS 1-hr Z=3-28 flux data</td><td><ul style="list-style-type: none">· ACE Science Center· ACE/SIS L2 data in HDF via ftp</td></tr><tr><td>3</td><td>ACE Daily Survey Plots</td><td><ul style="list-style-type: none">· Polar-Wind-Geotail 'gif-walk' site· ACE Science Center (ASC)· in HDF via ftp from ASC</td></tr><tr><td>4</td><td>ACE EPAM 1-hour particle flux data</td><td><ul style="list-style-type: none">· CDAWeb <input type="button" value="get data"/>· in CDF via ftp from CDAWeb· in ASCII via ftp from NSSDC</td></tr><tr><td>5</td><td>ACE EPAM 5-min particle flux data</td><td><ul style="list-style-type: none">· ACE Science Center (ASC)· in HDF via ftp from ASC</td></tr><tr><td>6</td><td>ACE GSE 12-min Position Data</td><td><ul style="list-style-type: none">· in CDF via ftp from CDAWeb· Satellite Situation Center· CDAWeb <input type="button" value="get data"/></td></tr><tr><td>7</td><td>ACE MAG 1-hr Key Parameter (recent) data</td><td><ul style="list-style-type: none">· in CDF via ftp from CDAWeb· CDAWeb <input type="button" value="get data"/>· ACE Science Center (ASC)· in HDF via ftp from ASC</td></tr></tbody></table>	#	Product Name	Access Links	1	ACE 27-day Survey Plots	<ul style="list-style-type: none">· Polar-Wind-Geotail 'gif-walk' site	2	ACE CRIS 1-hr Z=3-28 flux data	<ul style="list-style-type: none">· ACE Science Center· ACE/SIS L2 data in HDF via ftp	3	ACE Daily Survey Plots	<ul style="list-style-type: none">· Polar-Wind-Geotail 'gif-walk' site· ACE Science Center (ASC)· in HDF via ftp from ASC	4	ACE EPAM 1-hour particle flux data	<ul style="list-style-type: none">· CDAWeb <input type="button" value="get data"/>· in CDF via ftp from CDAWeb· in ASCII via ftp from NSSDC	5	ACE EPAM 5-min particle flux data	<ul style="list-style-type: none">· ACE Science Center (ASC)· in HDF via ftp from ASC	6	ACE GSE 12-min Position Data	<ul style="list-style-type: none">· in CDF via ftp from CDAWeb· Satellite Situation Center· CDAWeb <input type="button" value="get data"/>	7	ACE MAG 1-hr Key Parameter (recent) data	<ul style="list-style-type: none">· in CDF via ftp from CDAWeb· CDAWeb <input type="button" value="get data"/>· ACE Science Center (ASC)· in HDF via ftp from ASC
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Element Restriction ⓘ Resource type ⓘ Measurement type ⓘ Observatory Group ⓘ Observatory ⓘ Instrument ⓘ Observed region ⓘ Instrument region ⓘ Spectral range ⓘ Cadence ⓘ Repository Name ⓘ Access rights ⓘ Format ⓘ																									

AMDA, Automated Multi-Dataset Analysis (<http://cdpp-amda.cesr.fr>)

- Multi-spacecraft and multi-instrument data
 - Visualisation
 - user defined parameter computation
 - Standard model computation
 - Data and computed parameter extraction
 - Event list production and management
- Automated and semi-automated (visual) search on the content of the data
- Access to external databases (now: CDAWeb, CDPP, next: MAPSKP, VEX-MAG, HST images, MEDOC solar data, ...)



Prototype application on use cases



IDIS external connections

IDIS requests to outside:

- Astronomy (IVOA), HST, XMM, Ground radio-astronomy (Nancay, LOFAR)
- Plasma solar system (heliophysics): Heliophysics VO (ULYSSES Jupiter flyby), HELIO, EGSO, Radio-planetology (ULYSSES)
- Spectroscopy database

Outside resource requests to IDIS:

- Earth magnetosphere studies: ROSETTA, CASSINI or GALILEO earth fly-by
- Heliophysics Vos: Planetary probes used as solar wind monitors

Conclusion

What can be done shortly (2 months):

- User requirement reference document for plasma field
- Analysis of existing standards et sub-sequent recommendations for FP7 but need help for IVOA (CDS, ASOV) and PDS
- SPASE based registry demonstrator for **some** planetary plasma resources
- Specification of communication with external VOs (for the plasma field)

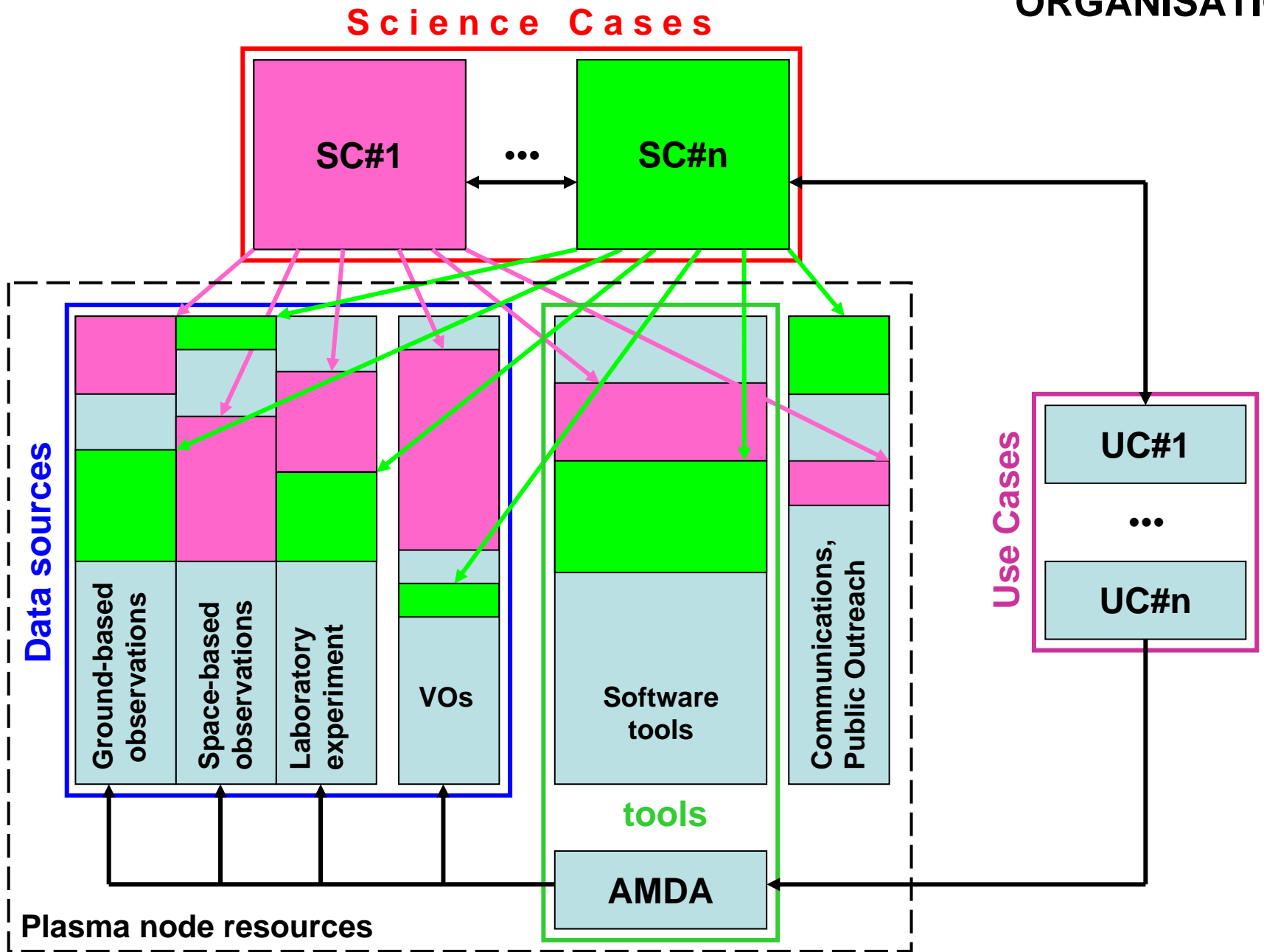
And for February 15, 2008:

- User requirement reference document for inter-thematic (inter-node) fields, i.e., more science cases to be analysed
- Requirements on the inter-node data model, recommendation for the future IDIS
- Science demonstrator, V1.0, (MAPSKP, HST, VEX, MEX)

Plasma Node organization: Science Case vs. Use Case

**Plasma Node teams:
IWF-Graz, CDPP-Toulouse**

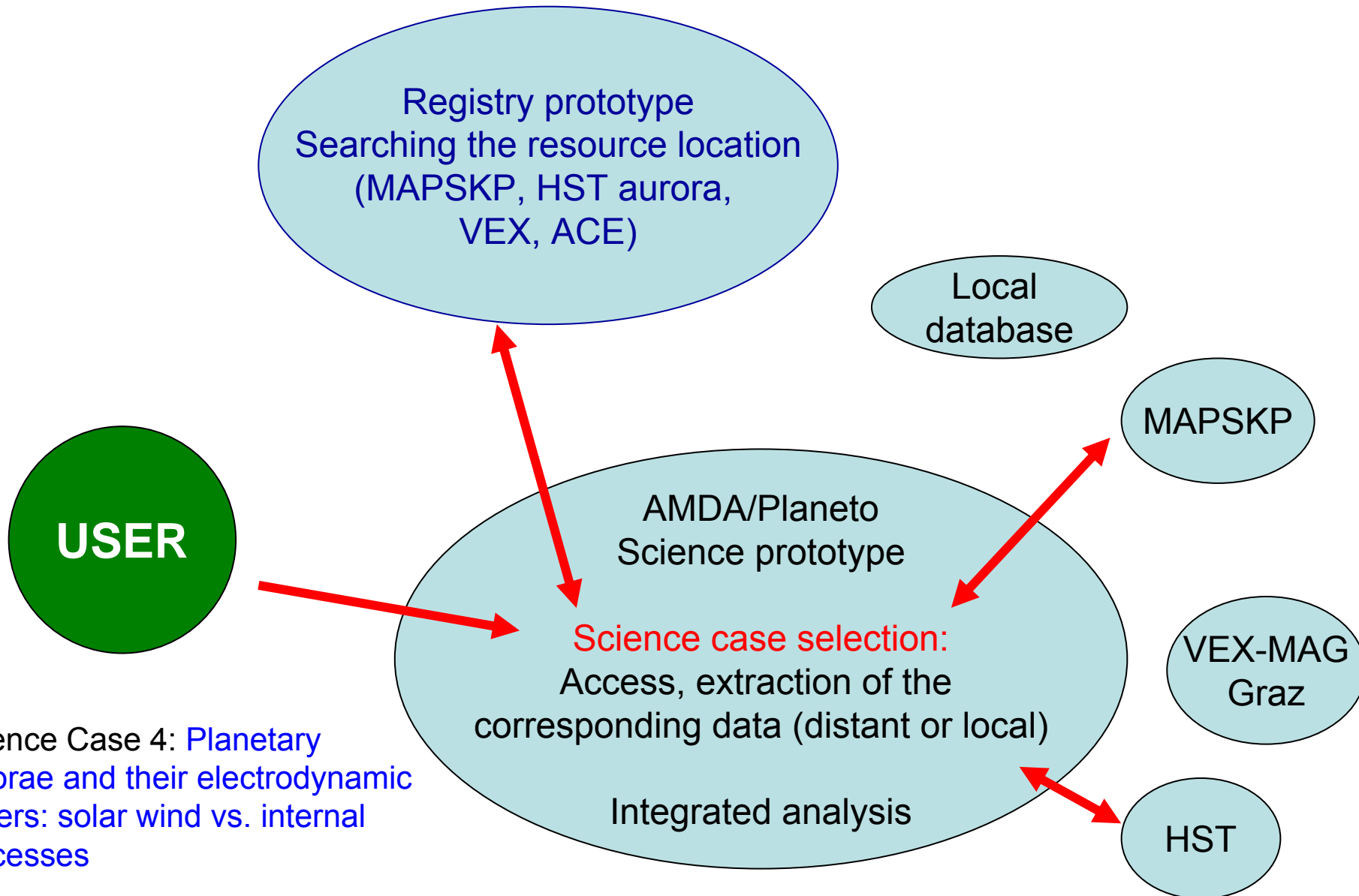
PLASMA NODE ORGANISATION



General Principles of the Science Case category

- **Science case** = working demonstrator (prototype) of the Resource Inventory within a *given topic*
- **Science case** = „one click“ selection of resources from the whole Plasma Node Resource Inventory
- Architecture of **Science Cases** repeats the architecture of the Node Resource Inventory (it covers not only data, but also software and communications)
- **Science Cases** are closely connected to **Use Cases**:
 - **Science Case** is a topic
 - **Use Case** is a topic-related particular operation, applied to data resources in the Node Resource Inventory

Prototype application on science cases



Science Case 4: Planetary aurorae and their electrodynamic drivers: solar wind vs. internal processes

Science Case 4: Planetary aurorae and their electrodynamic drivers: solar wind vs. internal processes

- **Space Missions:** Cassini, Ulysses, Voyager
- **Ground- & geo- based facilities:** IRTF, UTR-2, HST
- **Data catalogues / VOs:** Data archive in IWF, elsewhere
- **Software tools:** e.g.: SWF-WV algorithm; Linear filtering technique; Linear prediction theory (LPT) software
(Links to expert teams and on-line resources)
- **Conferences, Public events:** Scientific meetings; Lecture courses
IHY-events; topical e-books & reviews

Technical realization of the SC#4 ... #n selection -- by application of a system of markers provided to resources (links) during their implementation

Science Case 4: Planetary aurorae and their electrodynamic drivers: solar wind vs. internal processes

Future developments:

Creation of plasma physics topical „filters“:

- ◆ Classification of phenomena according
 - plasma beta
 - physical phenomenon (shocks; current sheets)
 - wave-particle interactions
 - etc.
- ◆ User self-created / “individual filtering” option (i.e. selection of particular parameters)
- ◆ Virtual Plasma Laboratory (VPL) – continuation in FP7