Organizing standardisation of astronomical data access: the DAL WG current experience

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Abstract: ***The tremendous amount of data available in astronomy at all wavelengths allow astronomers to make new science and to correlate an extremely wide range of phenomena. It is also a challenge for digital data management distribution and processing. Interoperable Data access protocols as designed by the IVOA take a major place in this challenge. This contribution reviews the current trends of IVOA efforts in this context.***

Introduction

Astronomy has nowadays transformed in a multi-approach, multi wavelength discipline where full understanding of the astronomical objects requires cross correlating data obtained by exploring all data dimensions. In addition the amount of available data is tremendously increasing reaching now several petabytes. Designing standard protocols for accessing all these data in an interoperable way is critical. This has been the task of the IVOA DAL WG since 2002. The outcome is a complex set of specifications, with already a lot of services built along the guidelines offered by these standards. Bonnarel et al. [1] presented the historical development of this landscape. The current paper aims at providing a clear view of who is doing what in this field and how it can evolve in the future.

DAL protocol properties

DAL protocols can be considered under several aspects or "properties" :

- Types of the data they are dealing with, such as catalogues for tables, 1-D data: spectra and light curves, images and cubes, various low level data, spectral lines, theory data
- Functionalities they are performing on the data: cone search-type discovery, multi-D discovery, description, simple data access, advanced data access, resource linking
- Software design of the protocol : synchronous, asynchronous, ADQL or PARAMETER based interface (hereafter “PBL”), DALI compliance or not.

Protocol classification

DALI [2] gathers common definitions to all protocols. ADQL [3] is a generic language which may be used by other protocols. VTP [4] deals with real time distribution of information. They are outside the classification.

Table 1 provides a classification of all others DAL protocols used in IVOA services.

The table shows clearly that some protocol are rather isolated and specific in the landscape :

- SLA, DataLink and SimDAL.
- TAP is fully adapted to catalogues but is also the base for ObsTAP services dedicated to discovery of all types of data .
- Older protocols are generally PBL and not DALI compliant

Future evolution

- Enhancing the Time dimension (for LSST, etc…)
- Progressive fine tuning of data discovery and access on spatial axis (using HiPS - [5]) and further in all dimensions
- Full datasets metadata availability
- Advanced access functionalities, integration of custom services, pushing code to the data
- Language evolution: extension of 3 factor semantics, non relational TAP services, complex parameter query language based on Parameter Description Language, relationship language model

	Design	Functionalities					
Data type		ConeSearch-Discovery	Multi-dimensional Discovery	Description (NB: SIA1 is very different from others)	Simple-Access	Access-processing	Link
Catalogues/ tables	Sync	TAP,CS,ObsTAP	TAP,ObsTAP		TAP,CS		DataLink
	Async	TAP,ObsTAP	TAP,ObsTAP		TAP		
	ADQL	TAP,OBsTAP	TAP,ObsTAP		TAP		
	PBL	CS			CS		DataLink
	DALI	TAP,ObsTAP	TAP, ObsTAP		TAP		DataLink
	No-DALI	CS			CS		
Spectra / timeseries	Sync	SSA,ObsTAP	SSA,ObsTAP	SSA,ObsTAP	SSA	SSA	DataLink
	Async	ObsTAP	ObsTAP	ObsTAP			
	ADQL	ObsTAP	ObsTAP	ObsTAP			
	PBL	SSA	SSA	SSA	SSA	SSA	DataLink
	DALI	ObsTAP	ObsTAP	ObsTAP			
	No-DALI	SSA	SSA	SSA	SSA	SSA	DataLink
Images/ cubes	Sync	SIA1,SIA2,ObsTAP	SIA2,ObsTAP	SIA1,SIA2,ObsTAP	SIA1,SODA1.0	SIA1,SODA1.1	DataLink
	Async	SIA2,ObsTAP	SIA2,ObsTAP	SIA2,ObsTAP	SODA1.0	SODA1.1	
	ADQL	ObsTAP	ObsTAP	ObsTAP			
	PBL	SIA1,SIA2	SIA2	SIA1,SIA2	SIA1,SODA1.0	SIA1,SODA1.1	DataLink
	DALI	SIA2,ObsTAP	SIA2,ObsTAP	SIA2,ObsTAP	SODA1.0	SODA1.1	DataLink
	No-DALI	SIA1		SIA1	SIA1	SIA1	
Raw data/ Event list/ Visibility	sync	ObsTAP	ObsTAP	ObsTAP			DataLink
	async	ObsTAP	ObsTAP	ObsTAP			
	ADQL	ObsTAP	ObsTAP	ObsTAP			
	PBL						DataLink
	DALI	ObsTAP	ObsTAP	ObsTAP			
	No-DALI						
Spectral Lines	sync	SLA	SLA	SLA			
	async						
	ADQL						
	PBL	SLA	SLA	SLA			
	DALI						
	No-DALI	SLA	SLA	SLA			
Theory data	sync		SimDAL	SimDAL	SimDAL	SimDAL	SimDAL
	async						
	ADQL						
	PBL						
	DALI						
	No-DALI		SimDAL	SimDAL	SimDAL	SimDAL	SimDAL

Table 1: DAL protocol properties

Conclusions

DAL efforts have permitted an interoperable backbone of services for all kind of data. It allows easy access to these data with VO tools. The upcoming data avalanche is a big challenge for the evolution of this DAL backbone.

References:

1) Bonnarel et al. “IVOA Data Access Layer: Goals, Achievements and Current Trends”, ADASS XXV Proceedings
2) Dowler et al. “Data Access Layer Interface Version 1.0”, IVOA Recommendation 11/2013
3) Osuna et al. “IVOA Astronomical Data Query Language Version 2.00” , IVOA Recommendation 10/2008
4) Swimbank et al. “VOEvent Transport Protocol Version 2.0”, IVOA Proposed Recommendation (2016)
5) Fernique at al. “HiPS - Hierarchical Progressive Survey Version 1.0”, IVOA Working Draft (2016)

IVOA Documents can be found at http://ivoa.net/documents

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