IVOA Data Access Layer: roadmap as of year 2020

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Abstract. The International Virtual Observatory Alliance (IVOA) produces standards to enable the sharing of astronomical data and services to the global astrophysical community. Within the IVOA, the Data Access Layer (DAL) working group aims to provide standards for querying and accessing data holdings. The standards are primarily implemented by observatories and other data providers, so that the community can use standard tools to interact with the data holdings. Recently, the DAL community has addressed the discovery and exchange of multi-dimensional and multi-messenger data. It has also tackled new topics such as retrieval of observation location and object visibility information. They are now examining further support for the time domain and radio astronomy communities. We present the current DAL status and progress, in order to keep implementors up to date with the DAL landscape. We also discuss upcoming changes to DAL standards. Community contributions and feedback on these standards is needed. We particularly encourage feedback from the data providers and projects that are using VO technologies to address their scientific community’s requirements.

1. Introduction

The International Virtual Observatory Alliance (IVOA) has a mission to facilitate the international coordination and collaboration necessary for the development and deployment of the tools, systems and organisational structures necessary to enable the international utilisation of astronomical archives as an integrated and interoperating virtual observatory. To fulfil its mission the IVOA promotes technological standards, called Recommendations, among which the Data Access Layer Working Group (DAL WG) manages those related to the discovery and access of catalogues and datasets for astrophysical data holdings.

The full set of IVOA Recommendations (and other documents) provides a consistent ecosystem that evolves in time, following astrophysical community requirements and technical landscape updates. This contributions gives a view on the status and near future developments of the subset of this ecosystem that is related to the DAL WG.

1https://www.ivoa.net
2https://wiki.ivoa.net/twiki/bin/view/IVOA/IvoaDAL
3All IVOA published documents are made available at https://www.ivoa.net/documents
activities. To do so, the place in the IVOA architecture taken up by DAL standards is described in Sec. 2, the current roadmap for standardisation activities in Sec. 3 and interrelations among standards in Sec. 4.

Some considerations on the efforts needed in implementing those Recommendations, as well as some new challenges the standards themselves will be facing, are then reported in the summary Sec. 5.

2. Architecture

Figure 1. IVOA Architecture diagram, modified to report the DAL landscape of standards. Blue rectangles identify standards directly managed by DAL, green ones those co-managed with other WGs or on behalf of IGs. A border is applied to standards that are actually IVOA Recommendations with respect to those that are under development; an orange border identifies standards currently under revision.

Each IVOA Recommendation includes a role diagram, derived from the IVOA Architecture (Arviset et al. 2010) Level 2 diagram, to visually describe the role it plays in the VO landscape and how it connects to other standards. Fig. 1 provides a similar diagram, modified from the common IVOA one, to provide a quick-look on the current status of the DAL related standards.

What’s visible from Fig. 1 is an even split between the standards under development or revision and the ones in standby, i.e. awaiting for community feedback. Among those under revision, most are so in response to community implementation feedback (DataLink, ADQL, DALI, VOEvent) while the ConeSearch one is driven both by an attempt to bring it up to compliance with the DALI interface specifications (see also Fig. 3 and Sec. 4) and new requirements from the Time Domain community to allow filtering of catalogues based on a time window of interest. There are also new standards under development (ObsLocTap & ObjVisSAP, ProvTAP & ProvSAP): some are meant to provide a discovery interface leveraging an existing Data Model standard (like the
Provenance one); others try to standardise access to the observation schedules and the visibility of sources in the sky for different ground based or space born facilities.

What’s not visible with the quick-look diagram is the connection to the Time Domain Interest Group (IG) and the (just formed) Radio Astronomy IG. Both are providing or will provide new requirements for the DAL standards. An example of this, as already said, is the ConeSearch specification revision that will include a TIME parameter to accommodate filtering on time alongside the original positional one. Radio astronomy domain, on the other side, as just started works and will possible impact the TAP/ObsCore based discovery scenario.

3. Roadmap

Figure 2. DAL short term roadmap. Recommendations awaiting community feedback are in the STANDBY box on the right. Current status, and expected one by mid 2021, are depicted on the left. Dashed boxes indicate a less certain evolution. There’s no solid background on the +6 MONTHS lane because this is not a fixed release schedule, only the expected outcome given the available efforts.

The development expected for the DAL related standards on the short time scale is depicted in Fig. 2. A few standards are expected to reach or approach the Recommendation status, moving the load from the ongoing development (pre-Working Draft or Working Draft - WD) to final comments and issue of the final standard (Proposed Recommendation - PR -, Request for Comments phase - RFC -, or Recommendation).

On the other side there are many standards that are waiting community feedback from implementation. Here is where data providers and implementors have a major role, identifying missing features, issues and asking new use cases to be taken into account.

4. Dependencies

One more concept to keep in mind, while reading the status and the roadmap for the DAL related standards, is how the various standards are linked together. This is sketched (without pretending to be exhaustive) in Fig. 3. From the diagram it is clear the role played by the DALI Recommendation, that factorises the interface components of DAL access protocols and it could also be seen that some standards haven’t yet been updated to comply with it. The role of TAP also emerges as a support to model driven discovery, solution initially introduced by ObsCore.

DAL standards of course don’t rely only on themselves but have dependencies on many other standards managed by other WGs: VOTable, UCD1+, VOSI, only to cite the more obvious ones.
5. Summary

From the above description a few things can be taken away. Implementing an IVOA discovery or access protocol it’s not a simple matter of reading one specification. Moreover, standards are revised in time and a new version of a standard can potentially lead to revisions in those that depend on it. The overall landscape, however, looks pretty stable and new features, and even standards, can fit in without major disruptions. Some more factorisation can be applied (longer vision) on the non-TAP branch of the protocols, while TAP itself might have to face NoSQL solutions.

In the widened landscape of the IVOA, DAL will have to understand also requirements coming from computational use cases (where SODA and DataLink might need further updates) and will need to work (following Grid & Web Service WG activities) on attaching AAI solution on its protocol interfaces.

Further knowledge on the DAL history and activities can be found in Bonnarel et al. (2017) and Molinaro & Bonnarel (2019).

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