Teaching the Virtual Observatory

Markus Demleitner

Herbsttagung der Astronmischen Gesellschaft 2025, Görlitz

Teaching the VO

The Virtual Observatory is useful and usable.

And yet, most astronomers still fiddle around with astroquery or even CSVs from web pages.

Why? – They don't know about the VO.

How do we fix this?

History

GAVO has been running "VO Days" since the early 2010s. Quite a bit of material was developed for them (see VOTT), but a long-runner was the ∼ 6-hour
GAVO ADQL course.

(blessed through a link from within TOPCAT)

Later, we made an experiment with a course on pyVO.

That was a lot less successful: There is just too much to tell and people's python skills are too different to make it work within an afternoon.

Course Structure

We have merged and extended the ADQL and pyVO courses and embedded them into a course frame designed for a whole semester (∼ 14 lectures). We tried it in the summer semster 2024.

The material is split into

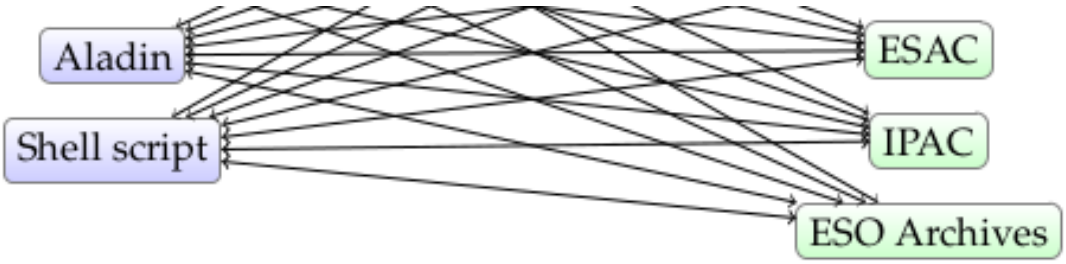
- the main track, intended to be held sequentially
- side tracks, intended to be covered as convenient (or possibly not at all or in an accompanying seminar)

The Main Track

- Introduction, philosophy, a fairly complex demo
- Simple protocols (SCS, SIAP, SSAP…) and their clients
- SQL basics with a focus on joins
- A deeper dive into ADQL, TAP uploads
- Interlude: HEALPix, MOC, HIPS
- pyVO with focus topics on TAP, async
- Registry, Datalink, SAMP in more depth using pyVO
- Odds and ends, in particular on scaling matters up.

Side Tracks

- VO Architecture
- Standards: Why and which?
- UCDs
- Vocabularies
- VOTable
- IVOA Identifiers



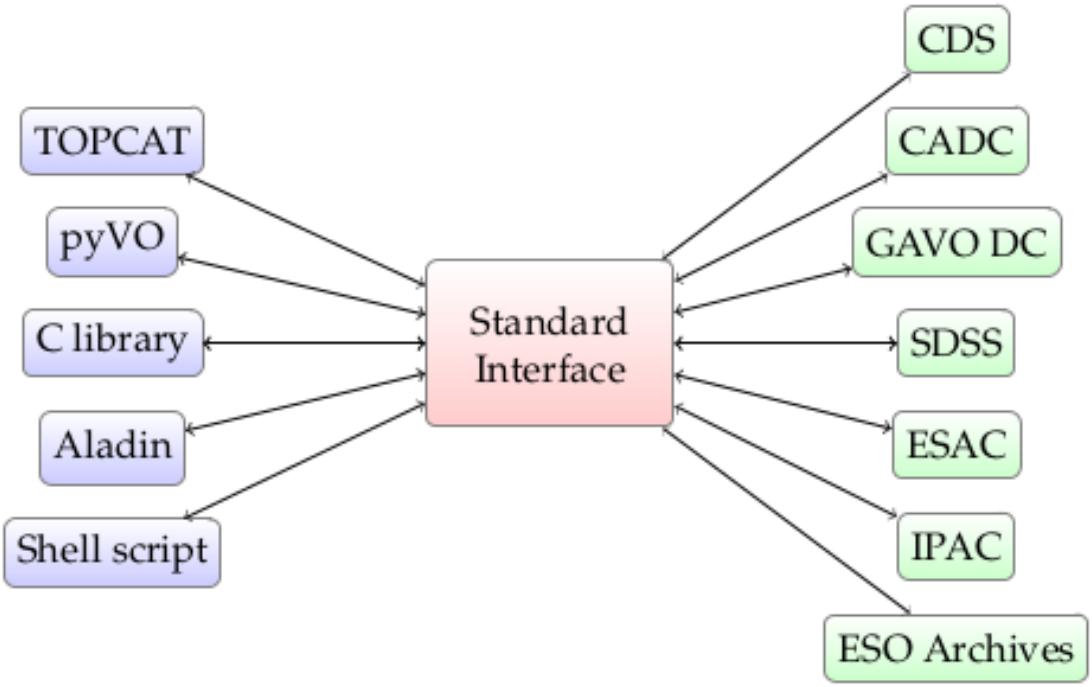
Note that *M*, the number of servers, is potentially pretty large.

```
SELECT DISTINCT gavo_getauthority(access_url)
FROM rr.interface
```

on the GAVO DC TAP server; for me, that's more than 200 di
With a few clients in the mix, you'd quickly be up to hundreds c
would have to be maintained.

Data Access With Standards

With a standards there's just one thing to get right for each
sources of brokenness):



Exercises

The course comes with ~ 50 exercises. Solutions are (mostly) included.

In the 2024 test run, we had 90 minutes of lab work per week (in addition to 90 minutes of lecture time). That roughly worked out.

Exercise 44

The SSAP service at http://d
houses theoretical spectra mo

See if you can retrieve three s
4.5 and 5.5, an effective temp
Kelvin, and a Nitrogen mass f
+Inf for "no upper limit").

Send the spectra retrieved to

Hints: Use `viewparams.py`, star
`dal.ssa.SSAService`, and p
retrieving spectra in both FIT

Exercise 45

Add full Gaia records from ivo
to some records from the hdg
centre. This does not need ar
actually need for matching; fo
example should be helpful.

Hint: for our simple table.join
name in both tables), it is pro
hdgaia at the ADQL level.

Exercise 46

For the lab work, a special slide set with only the exercises is built

Copy Us

The material is available in three git repos at codeberg. The base repo is at
https://codeberg.org/msdemlei/vo-course.

The ADQL and the pyVO parts are still buildable separately.

Why don't you offer a VO course at your university? Or online? I'm happy to help!

And no worries with The Law: It's all CC-0.

Learn It Yourself

We hope the course works reasonably well for self-study. Try it and file bugs on codeberg if it fails in that.

- Using the Virtual Observatory doi:10.21938/avVAxDlGOiu0Byv7NOZCsQ
- A short course on ADQL doi:10.21938/uH0_xl5a6F7tKkXBSPnZxg
- A short course on pyVO doi:10.21938/08rzo4ylRPmnS8iXYPO:rg