



ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

The Virtual Observatory

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What is the VO ?

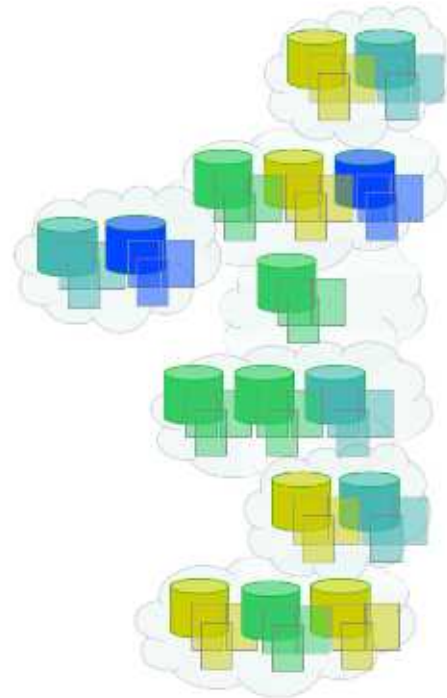
The goal of the Virtual Observatory (VO) is to provide a

**comprehensive set of
data and services
relevant to astronomy
accessible from clients of your choice
regardless of where you are and
preserving products of digital astronomy.**



The Challenge

Divers and distributed Data collections on several servers.



The VO is “FAIR”

There’s tens of thousands of astronomical data collections somewhere online and the number is growing.

To unlock the treasures hidden there, the data has to be

- **Findable**
- **Accesible**
- **Interoperable**
- **Reusable**



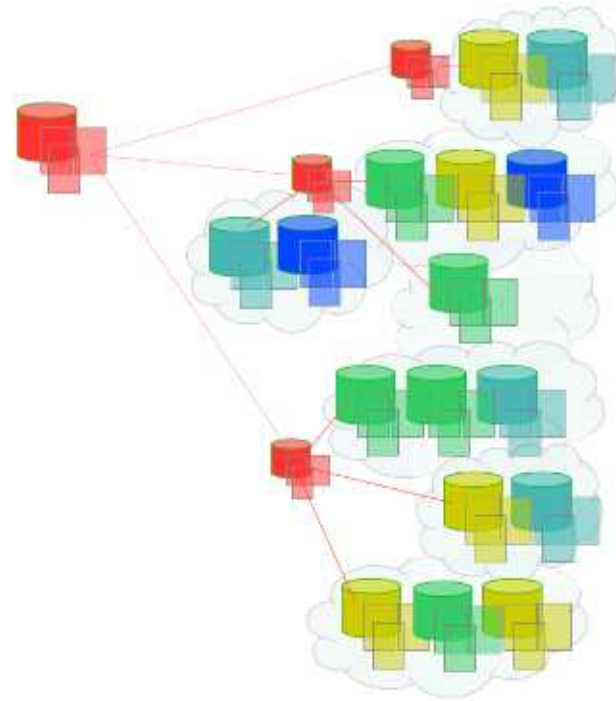
Finding Data: Metadata

To make Data findable it needs to be enriched with metadata, that gives data a meaning. Publishing an astronomical image without a description of the position, or publishing table data without describing the contents of the columns makes the data useless. The VO defines standards for exactly this sort of metadata which a service can publish to the VO-registry, which is the entry point for Data discovery in the VO.



Finding Data: Registry

Services publish metadata to the registry, making the data findable.



Finding Data: Registry

The registry enables users to issue queries like:

- Where are image services specialized on radio?
- What data sets are out there containing x-ray fluxes and proper motions?
- What services are out there dealing with time standards?
- What services expose the data associated to a paper?

Clients: web interfaces, VO Desktop, WIRR, PyVO.registry



Accessing data

Depending on the data access there are many standards and protocols defined within the VO. Defined “typed interface” let one talk to different services with different protocols in similar fashion. The Simple Cones Search Protocol (SCS) was the first protocol and is designed for tables containing positions, the Simple Image Access Protocol (SIAP) for images, and Simple Spectral Access Protocol (SSAP) for accessing spectra.

Clients: Topcat, Aladin, SplatVO, PyVO



TAP/ADQL

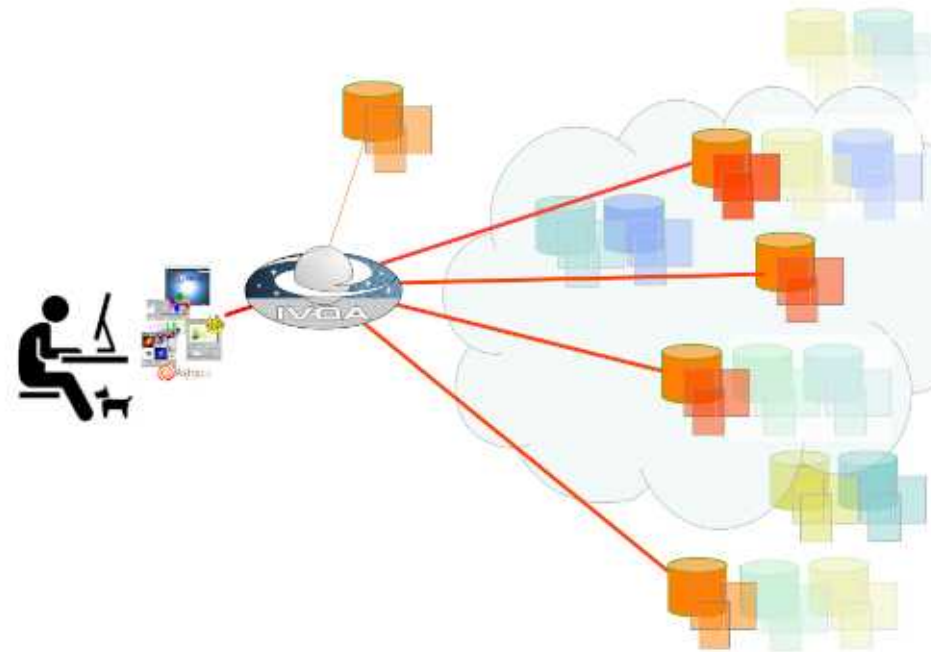
The Table access protocol (TAP) and the Astronomical Data Query Language (ADQL) always come as a pair. They enable to make a selection on table data based on algebraic expression. It's a feasible way to deal with huge catalogues like SDSS, 2MASS, WISE or Gaia.

Clients: Topcat, Aladin, PyVO.



Accessing Data: Clientsoftware

Client software can access data through VO protocols



Interoperable data

To exchange data across different machines demands agreed on structure of the data, or agreed on ways to annotate the data ("Column X contains a position in ra"). The VO is about the latter. Keeping the description of the data close to it (best: in the same file) helps understanding the data and enables automated access to the data. Standards here are VOTable, SAMP, UCD and more.

Clients: Topcat, Aladin, SplatVO, PyVO



Reusing data

Reusing data is about describing data in a way that somebody in the future will be able to understand the meaning of the data and use it. In some way all VO standards are about reusing data, but the provenance related protocols ProvTAP and the data model ProvDM and take it a step further.



Demonstration

See a short introduction on how this works for real.



IVOA

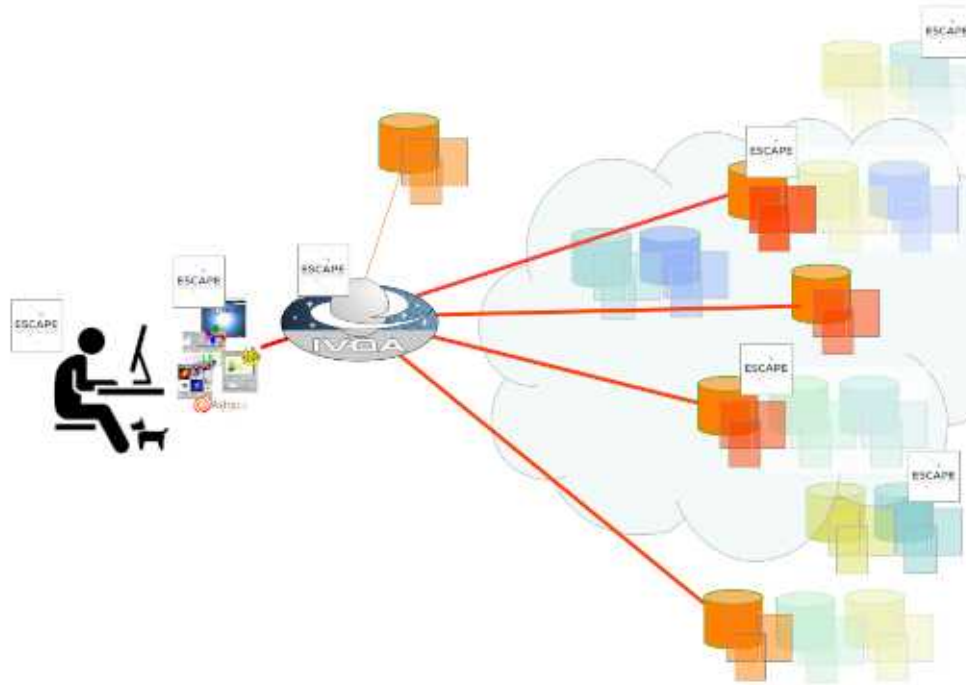
All these standards and protocols are defined by the International Virtual Observatory Alliance in biyearly interoperability meetings. You can find the VO standards and protocols as well as more information about the process of developing these on the web page of the IVOA:

<https://ivoa.net/>



ESCAPE in the VO

ESCAPE partners are involved in every level: data publishers, software developers, scientific users and also standard development.



Thank you...

... for your attention!

