Introduction to the VO

Hendrik Heinl, Dave Morris, Sara Bertocco

European Data Provider Forum

Heidelberg, March 25 – 27 2026

Everyone invited to develop science use cases

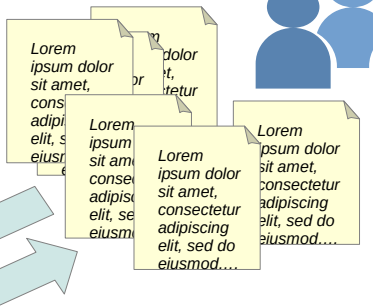
Science based interest groups

Science priorities committee

Scientists from IVOA members and major astronomy projects

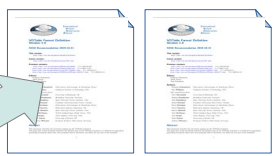
IVOA working groups

Working group discussions



Everyone invited to discuss

Request For Comment (RFC) document



Everyone invited to comment

Anyone can raise issues

IVOA recommendation

GitHub

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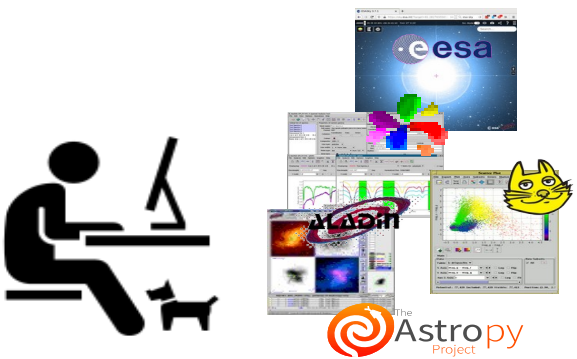
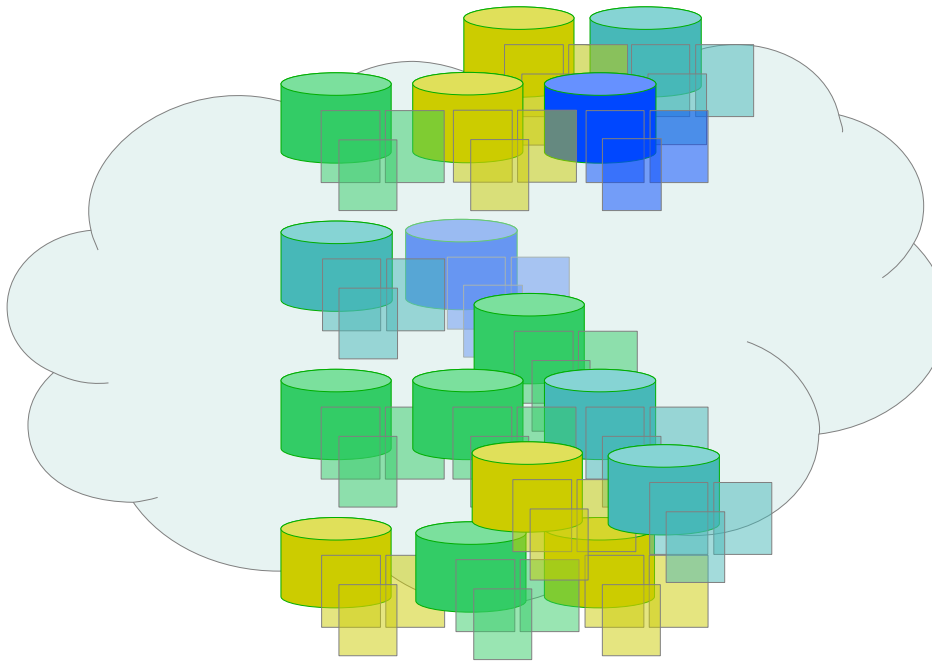
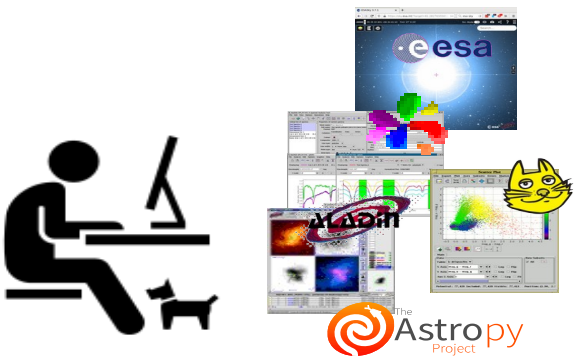
The Astropy Project

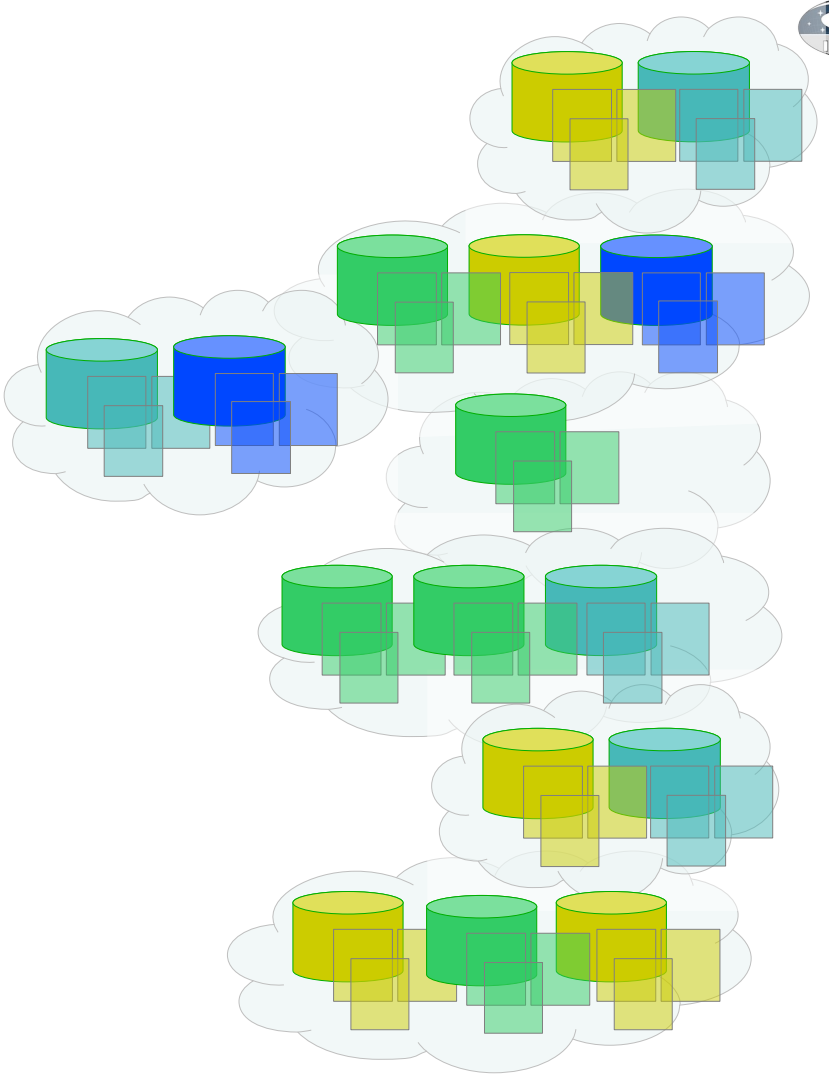




The Virtual Observatory

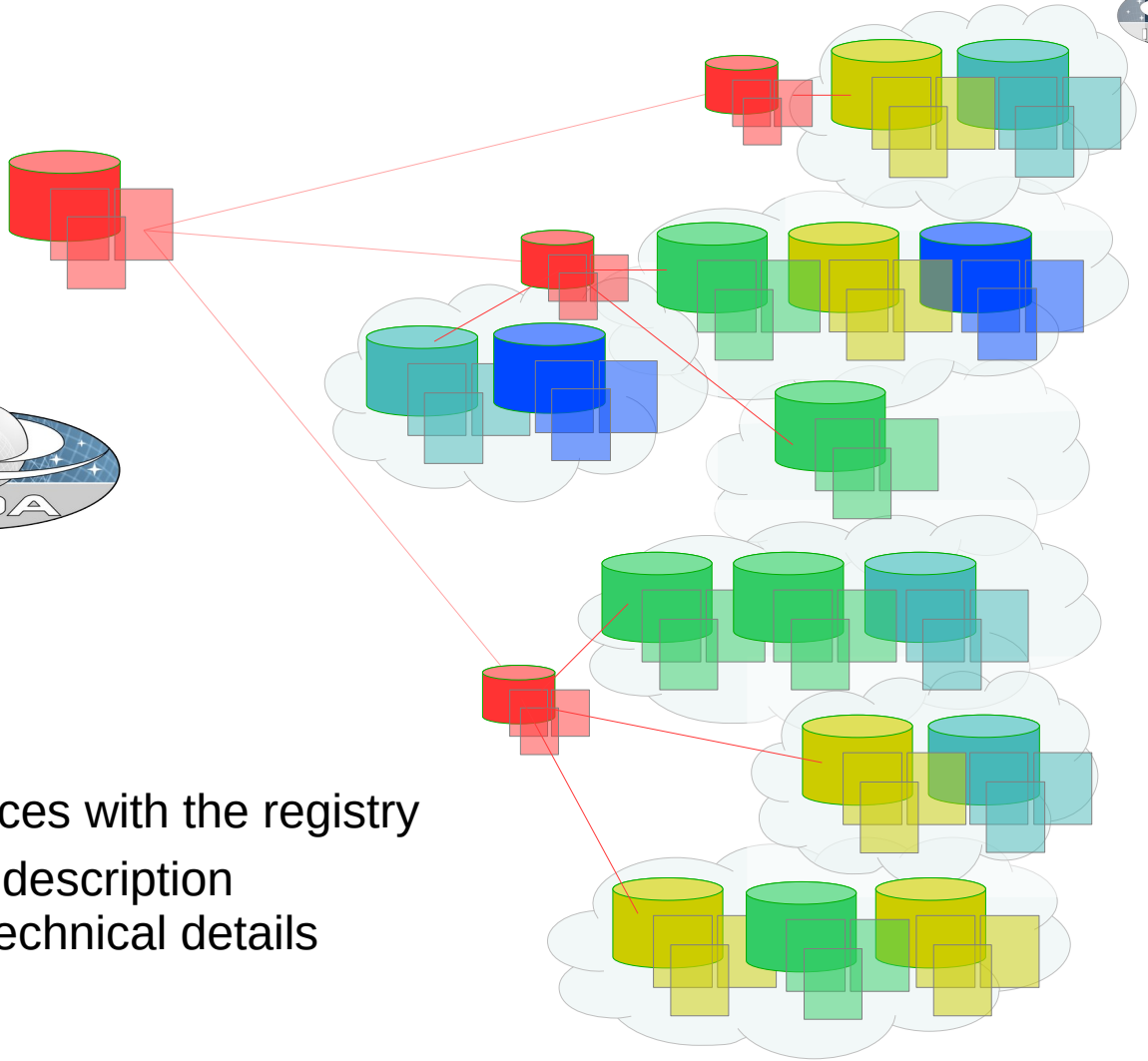
Data from all over the world …. in the cloud





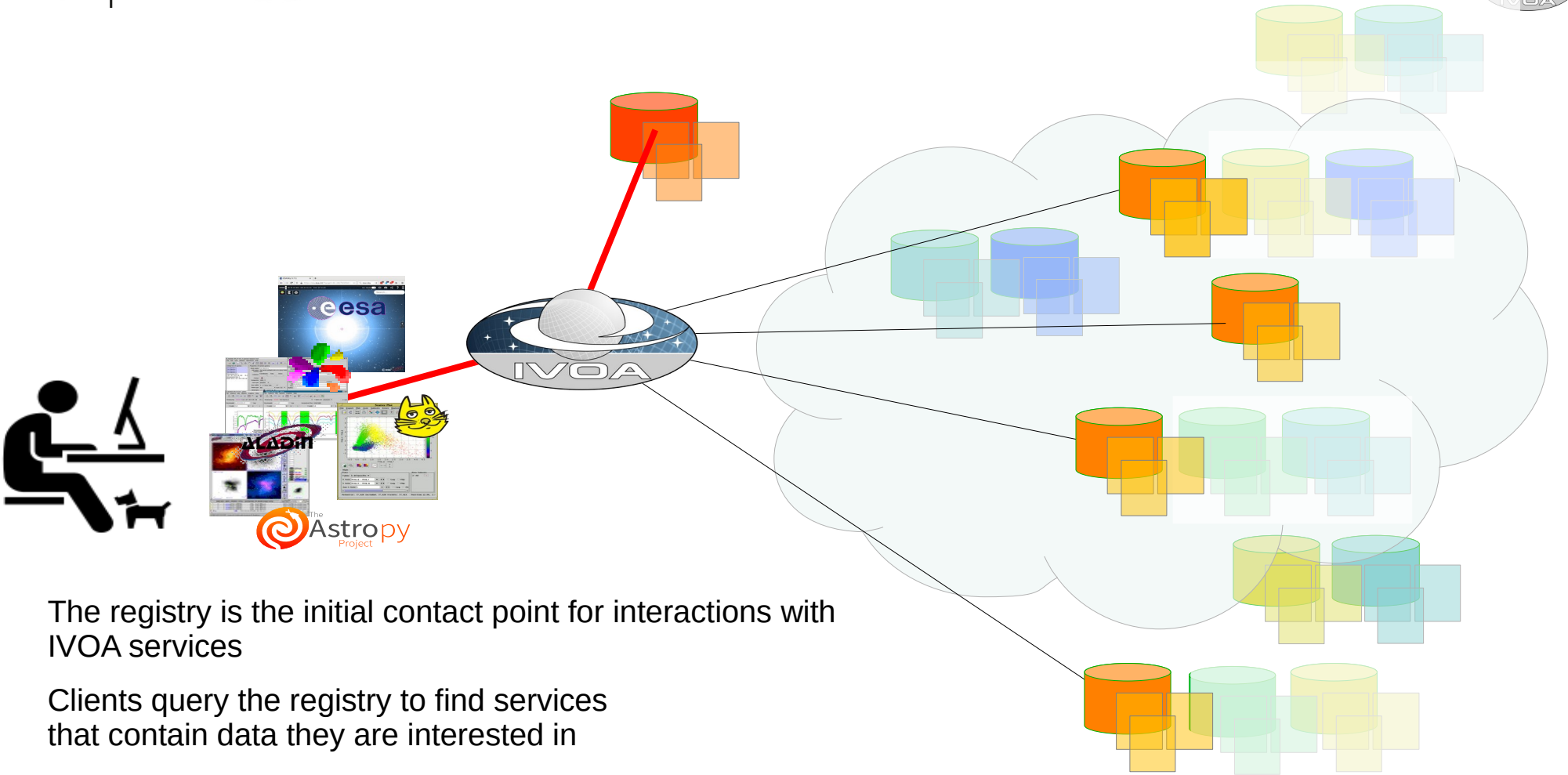
Lots of individual services each playing their part

But … how do you know where everything is ?



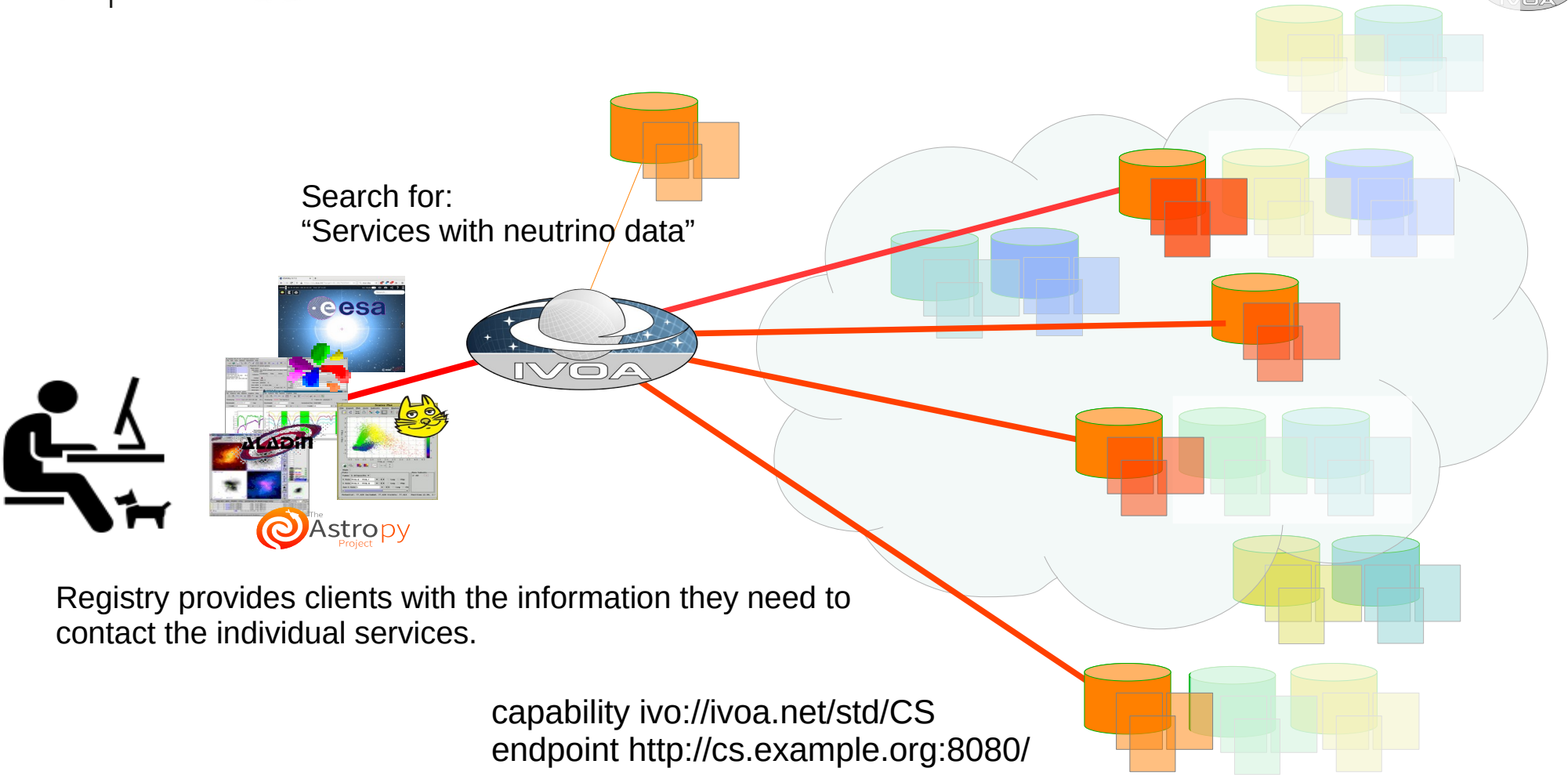
Data providers register their services with the registry

Registration metadata includes a description of the data they provide and the technical details of how to connect



The registry is the initial contact point for interactions with IVOA services

Clients query the registry to find services that contain data they are interested in



Registry provides clients with the information they need to contact the individual services.

capability ivo://ivoa.net/std/CS
endpoint http://cs.example.org:8080/

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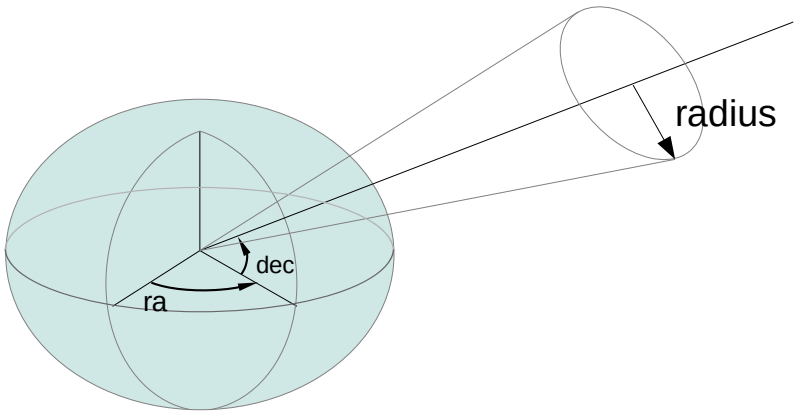
Simple Cone Search

One of the earliest services defined by the IVOA

Version 1.0 adopted as an IVOA recommendation in 2006

RA = 170° (deg)
DEC = 25° (deg)
SR = 30° (deg)



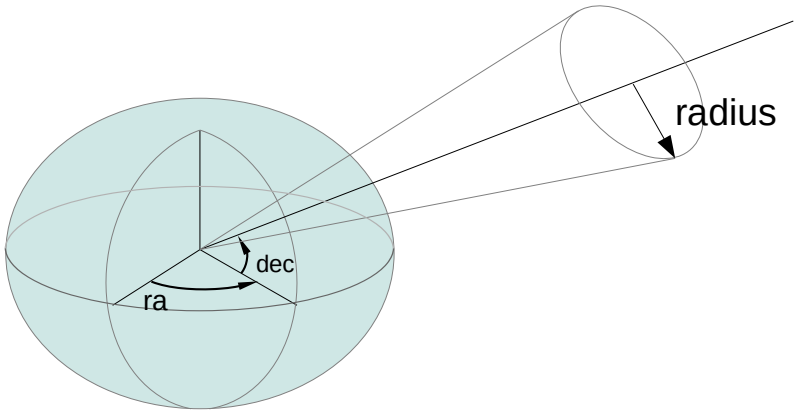
https://ivoa.net/documents/latest/ConeSearch.html

Simple Cone Search

Simple HTTP GET request

https://ivoa.example.net/cone?RA=170&DEC=25&SR=30

RA = 170° (deg)
DEC = 25° (deg)
SR = 30° (deg)



https://ivoa.net/documents/latest/ConeSearch.html

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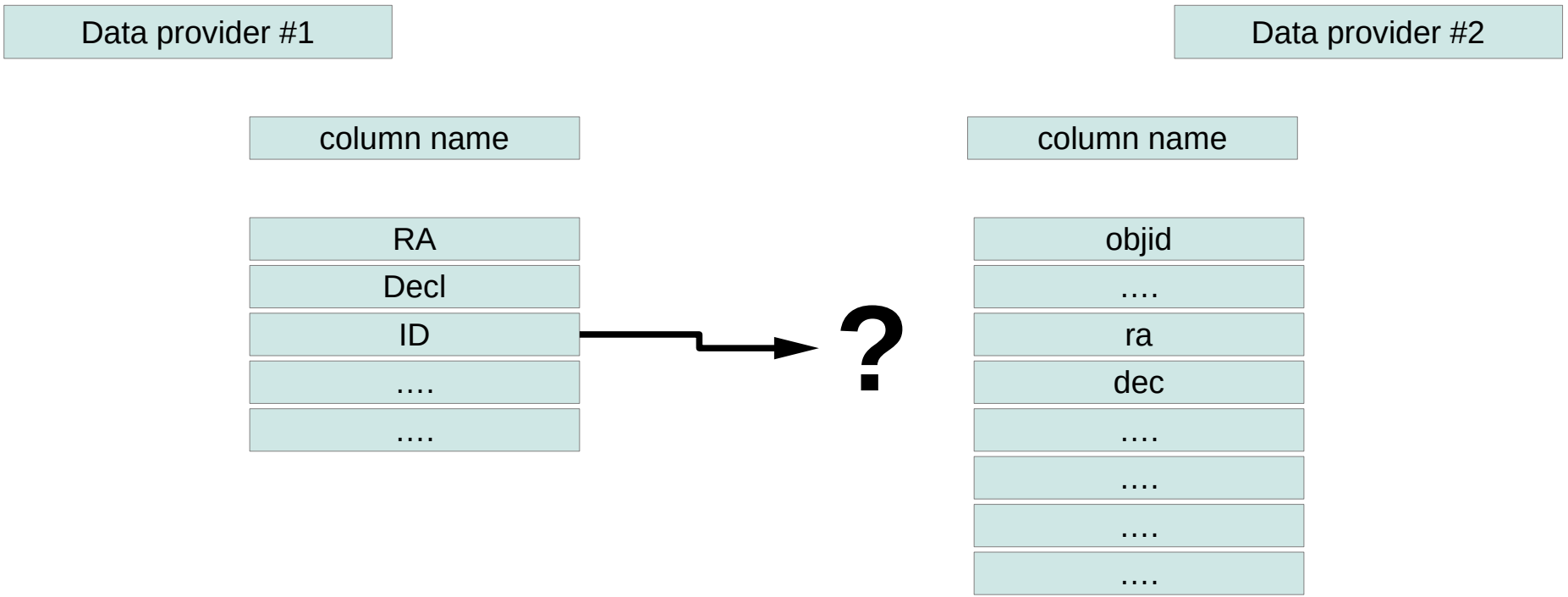
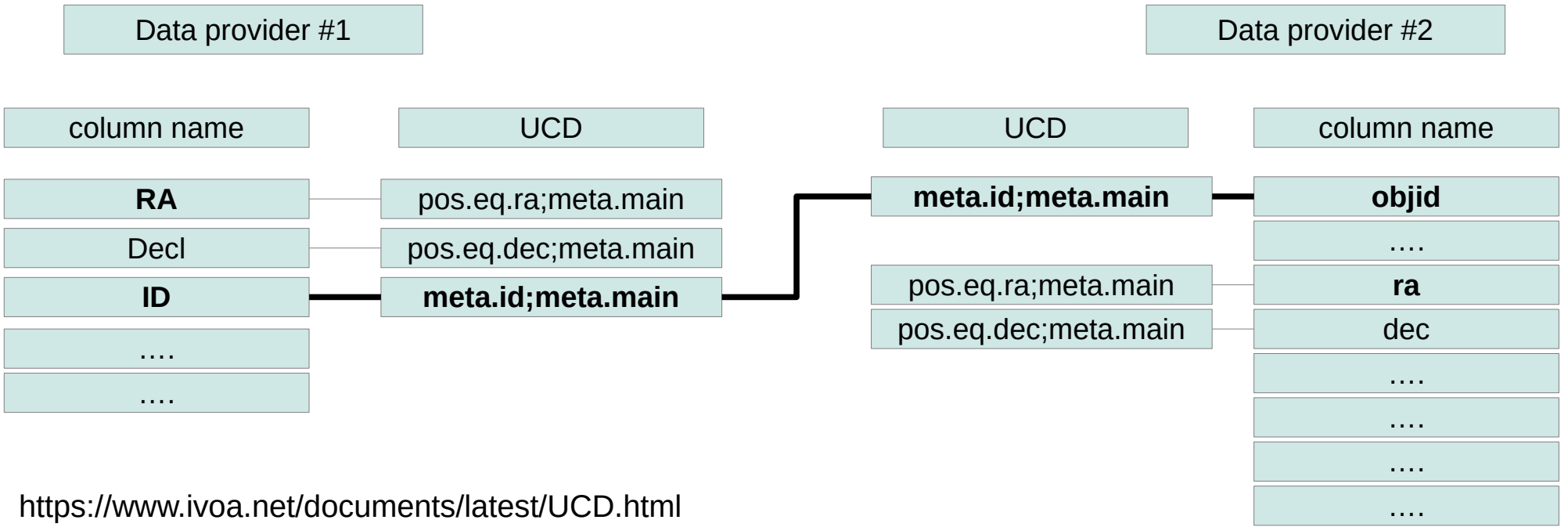
Unified Content Descriptors (UCD)

Different data providers have a different table structures



Unified Content Descriptors (UCD)

TAP schema and UCDs enable **clients** to figure out the mapping



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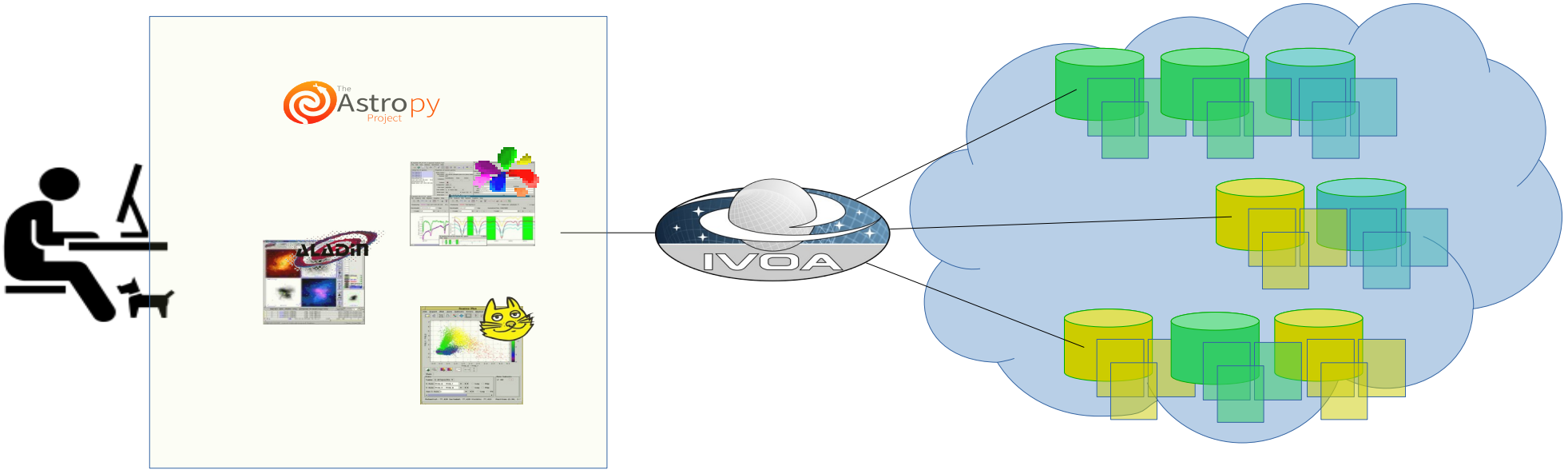
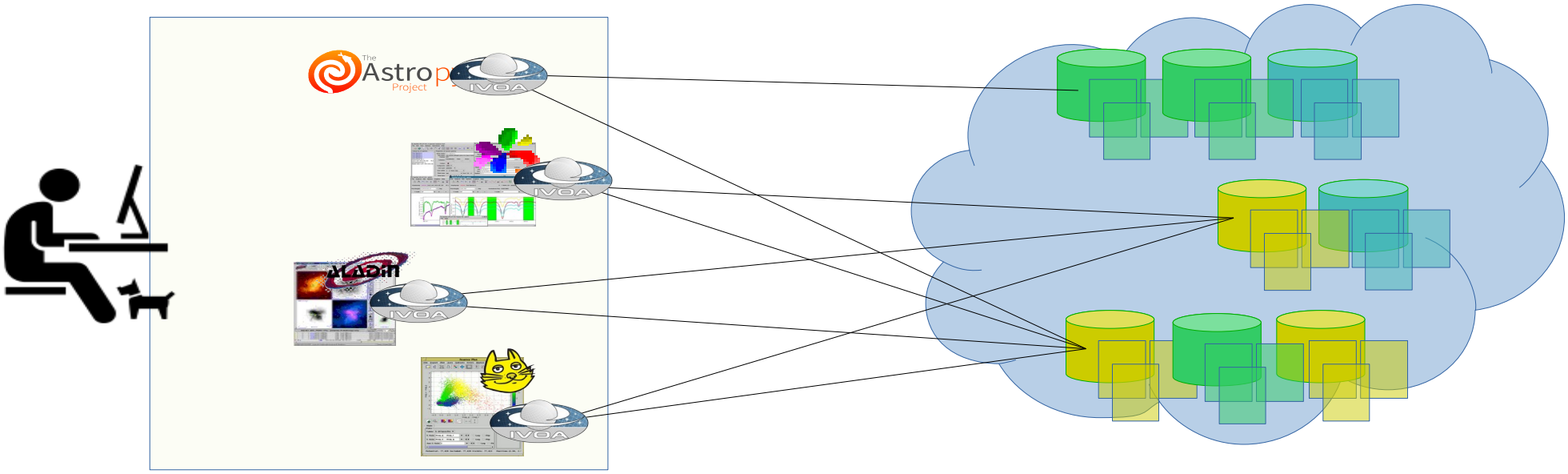


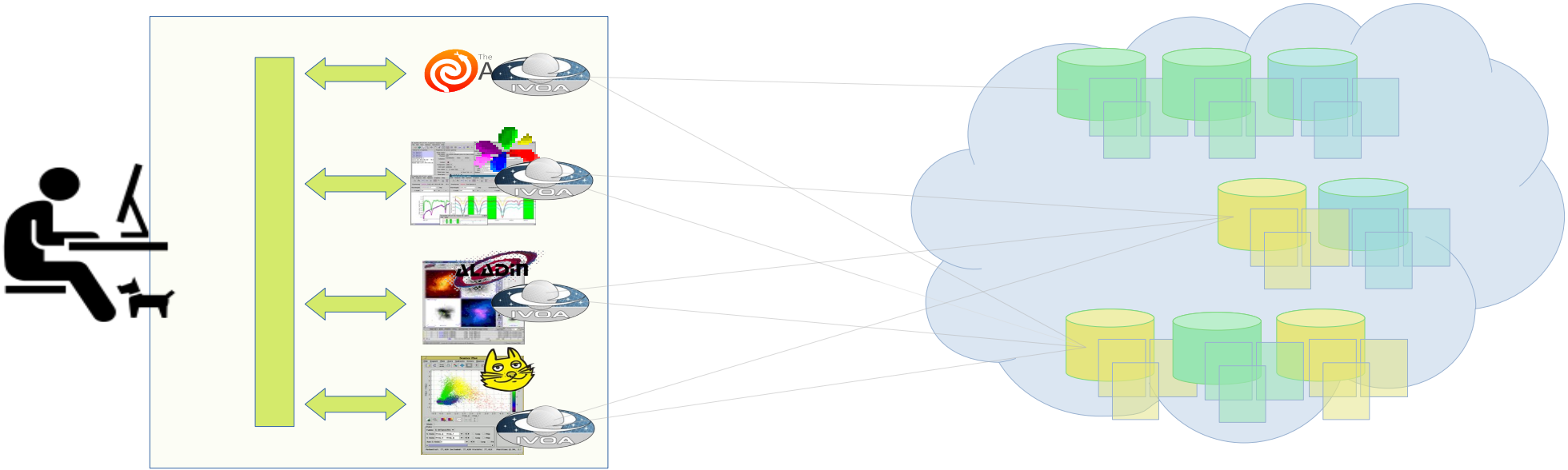
The Virtual Observatory

All the data from the cloud …. available on your desktop



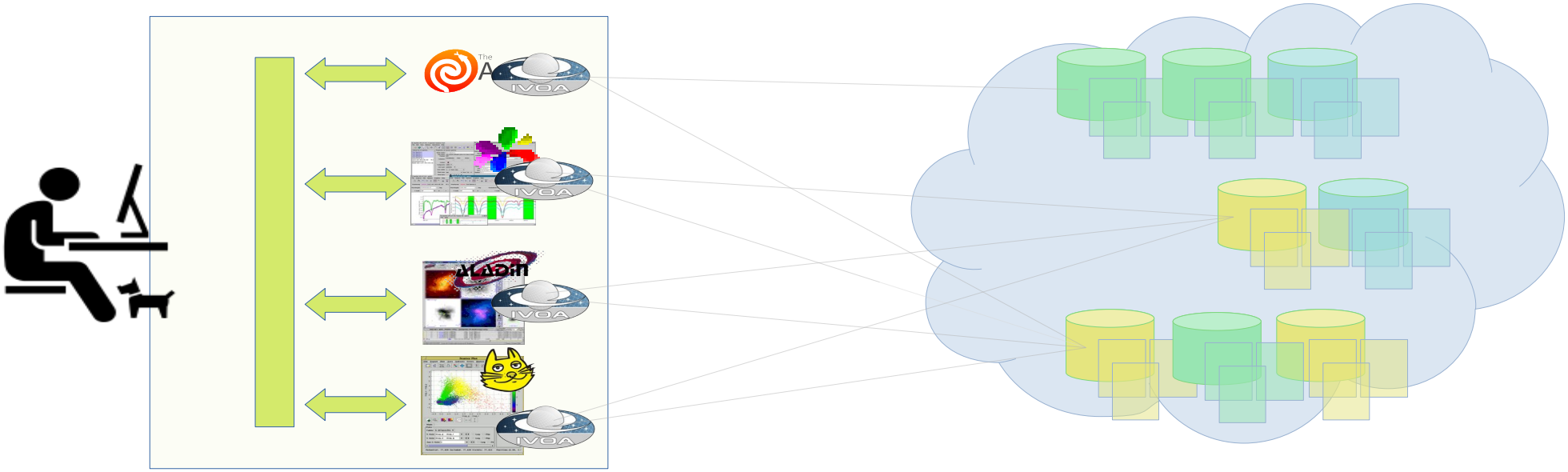
All the data from the cloud …. to each desktop app

Each application maintains its own connection to the VO



SAMP is a message bus within your local computer
Applications can use SAMP to send messages to each other

table.load.votable <http://example.org/.../table.vot>
image.load.fits <http://example.org/.../image.fits>
coord.pointAt.sky <ra,dec>



Messages can be sent to specific applications

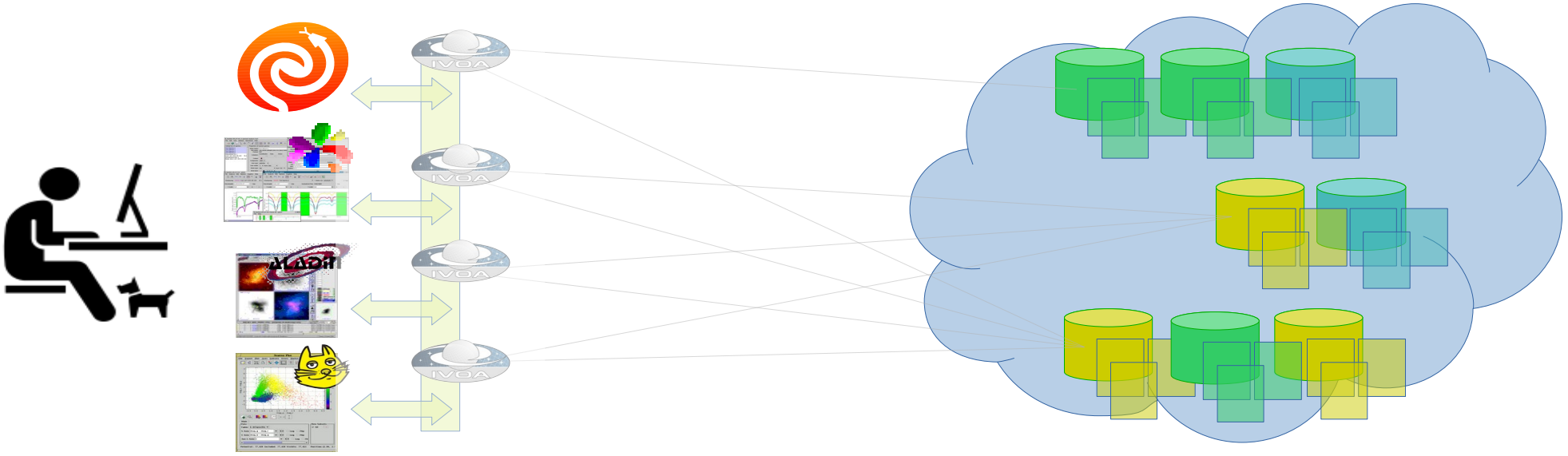
Send to Aladin:

image.load.fits <http://example.org/.../image.fits>

Or broadcast to all listeners

Send to all:

coord.pointAt.sky <ra,dec>



The Virtual Observatory

If we have done our job right, all the details disappear

All the data from the cloud appears to be one big dataset accessible through your desktop

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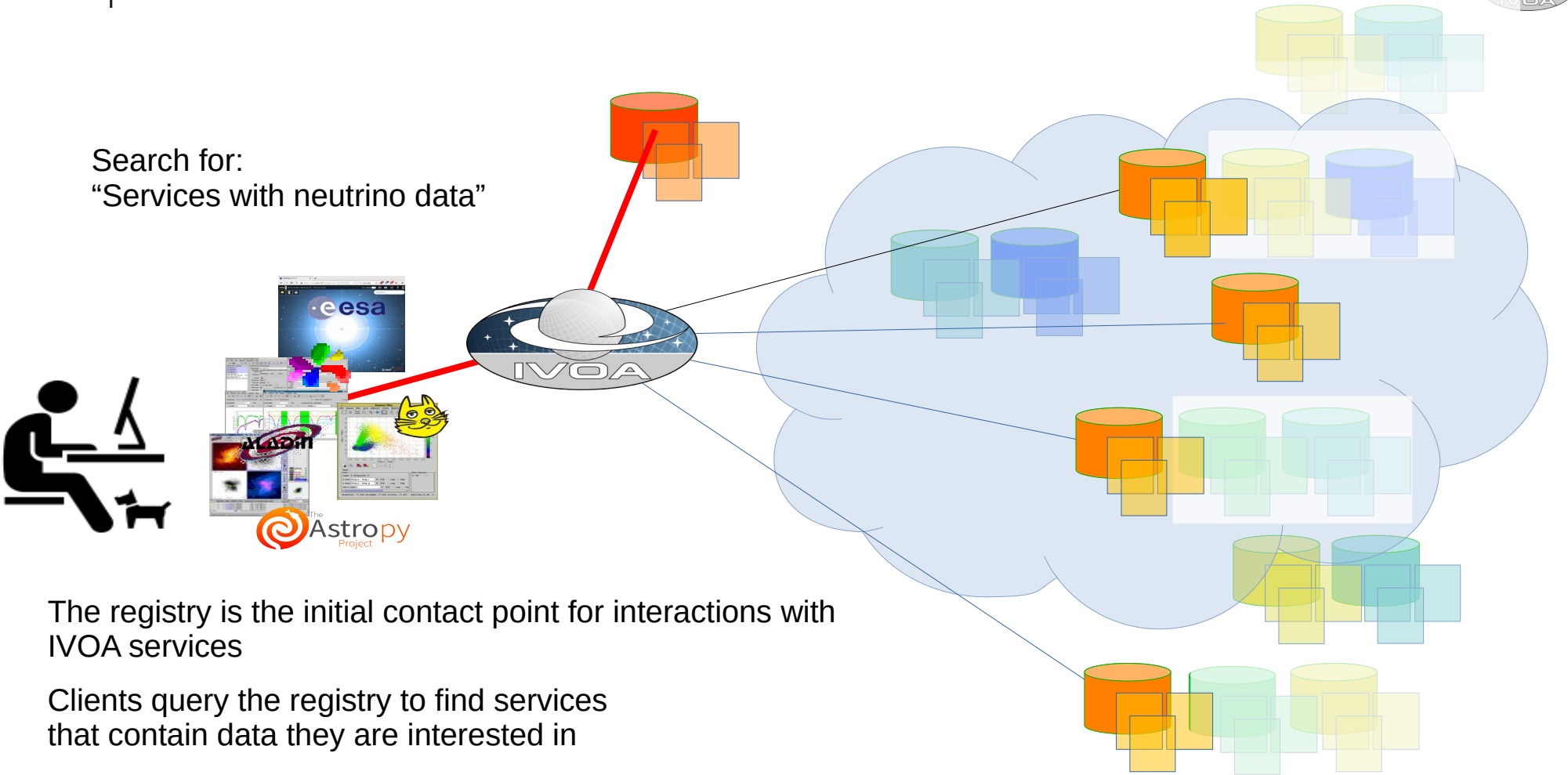
Search for:
“Services with neutrino data”



The registry is the initial contact point for interactions with IVOA services

Clients query the registry to find services that contain data they are interested in

Registry Resource Record :

Service capabilities

TAP, ObsTap, ConeSearch, SIAP, SSAP

Collection metadata

Sky coverage (MOC)

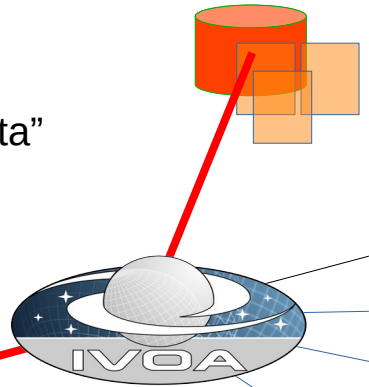
Waveband

Infra-red, optical, ultra-violet, xray

Database catalogs

Table and column metadata

Search for:
“Services with neutrino data”

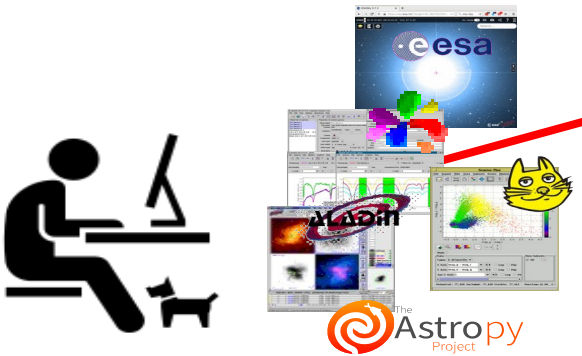


Data providers publish metadata about their services and the data they contain

Client applications can use standard terms to help the user discover the data they need

Registry Resource Record :

- Service capabilities
  - TAP, ObsTap, ConeSearch, SIAP, SSAP
- Collection metadata
  - Sky overage (MOC)
  - Waveband
    - Infra-red, optical, ultra-violet, xray
- Database catalogs
  - Table and column metadata



For more details on how to publish data:

https://wiki.ivoa.net/twiki/bin/view/IVOA/PublishingInTheVO

The service standards define what metadata is required for each type of service

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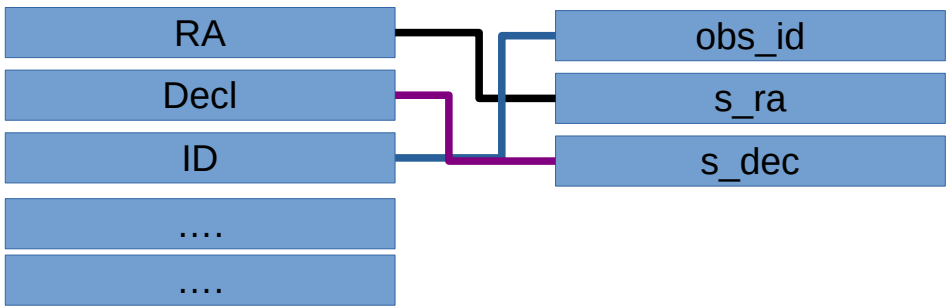
Observation Data Model Core Components

ObsCore adds a standard view to the data in each data provider

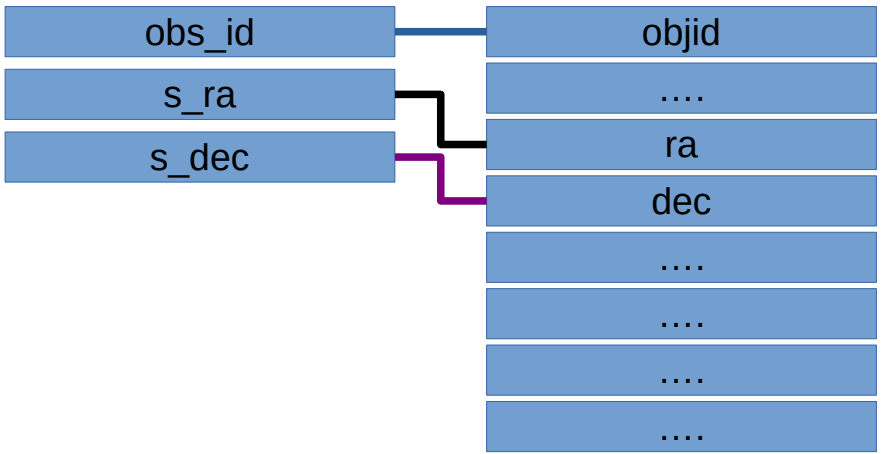
Data provider #1

CREATE VIEW ivoa.ObsCore (….)



Data provider #2

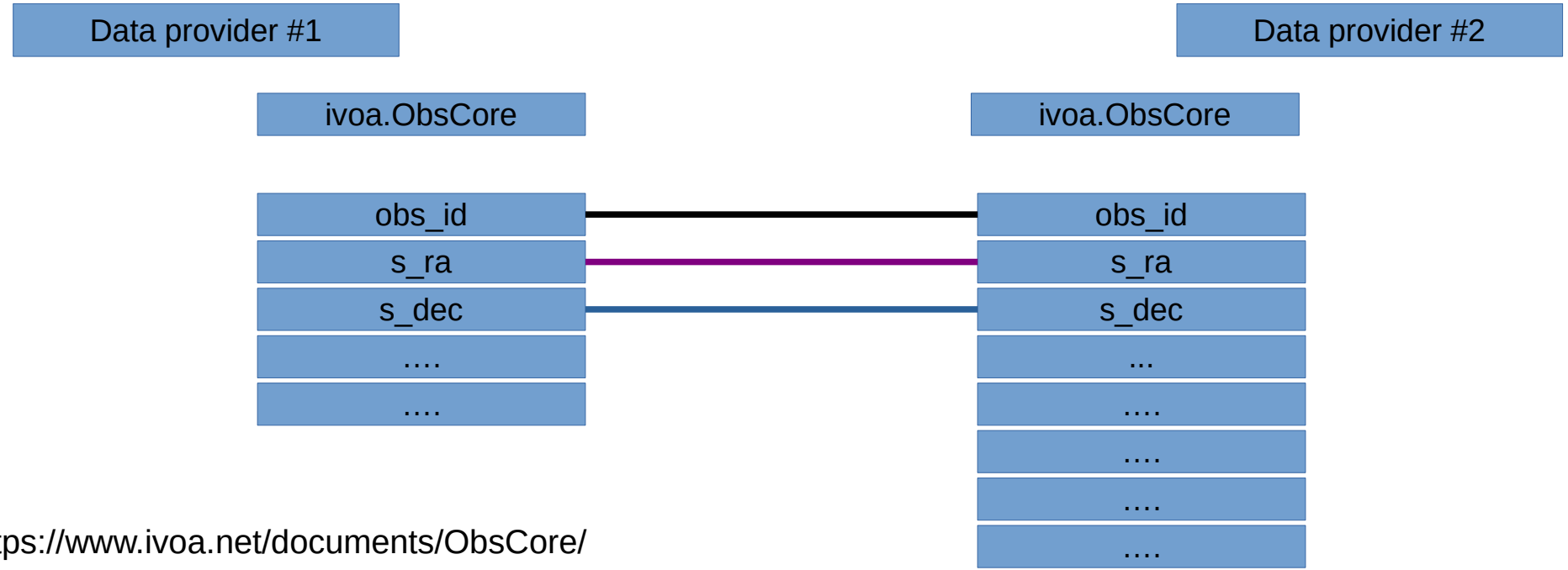
CREATE VIEW ivoa.ObsCore (….)



https://www.ivoa.net/documents/ObsCore/

Observation Data Model Core Components

Now the public tables in **both** providers are the same



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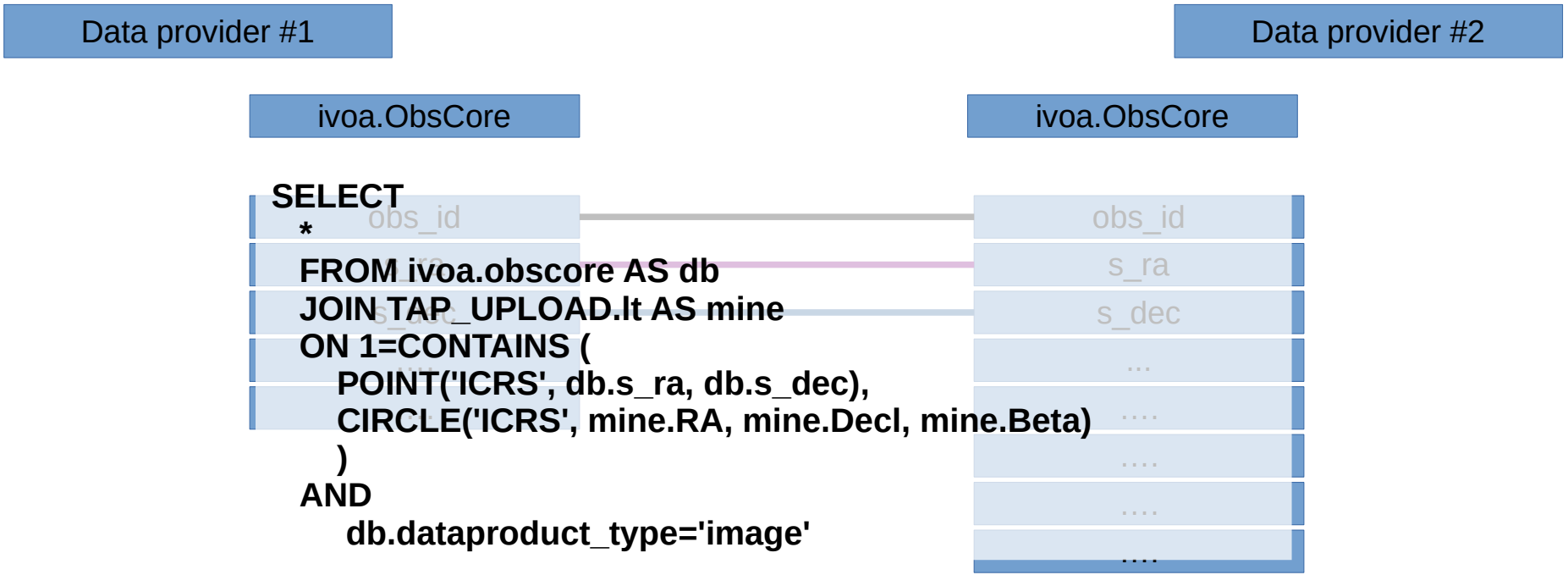
Observation Data Model Core Components

Now, the same query can be applied to **both** services



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Working group discussions

Everyone invited to develop science use cases

Science based interest groups

IVOA working groups

Everyone invited to discuss

Science priorities committee

Scientists from IVOA members and major astronomy projects

Request For Comment (RFC) document

IVOA recommendation

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Working group email list

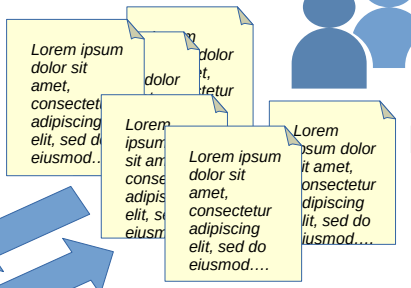
Everyone invited to develop science use cases

Science based interest groups

Scientific use cases

theory

time-series



Everyone invited to discuss

IVOA working groups, e.g. DataAccessLayer Applications, Semantics

New standards being developed

ObjVisSAP ObsLocTAP

TIMESYS Multi-order Coverage (MOC)

Hierarchical Progressive Surveys (HiPS)

Science priorities for the IVOA

Science platforms

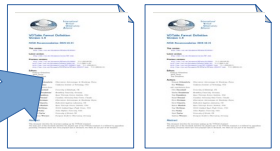
Machine learning

Multi-messenger astronomy

Science priorities committee

Scientists from IVOA members and major astronomy projects

Request For Comment (RFC) document



IVOA recommendation

Everyone invited to comment

Anyone can raise issues

GitHub