

# International Virtual Observatory Alliance (IVOA) Newcomers Introduction

IVOA interop, April 2022

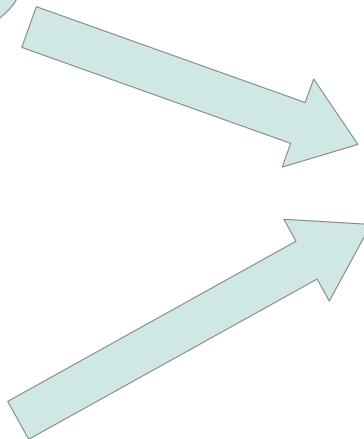
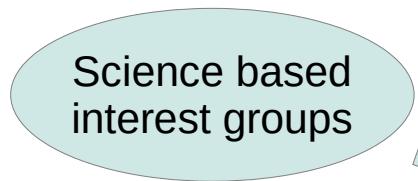
Henrik Heinl, Dave Morris

ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

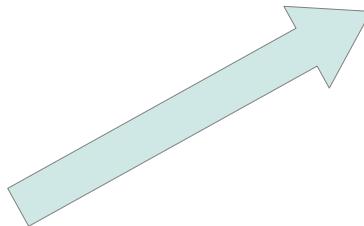




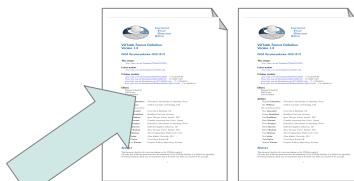
Everyone invited to develop  
science use cases



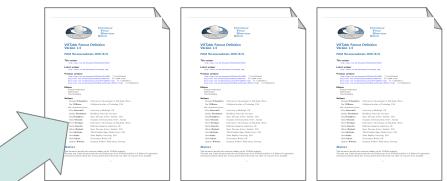
Scientists from IVOA members  
and major astronomy projects



Request For Comment  
(RFC) document



IVOA recommendation



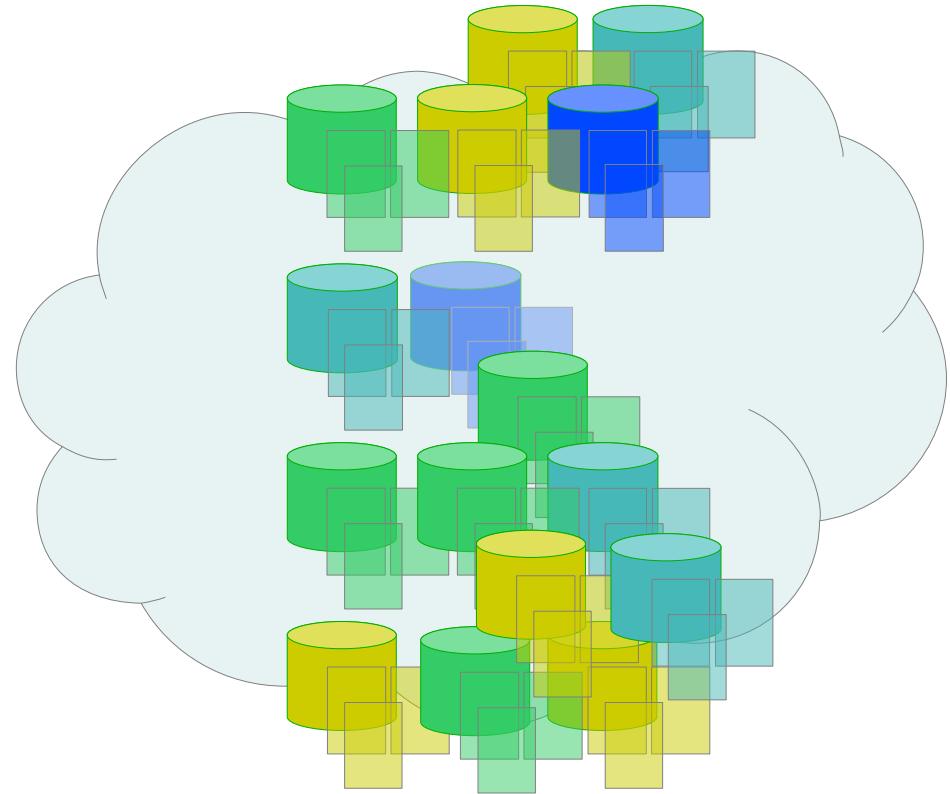
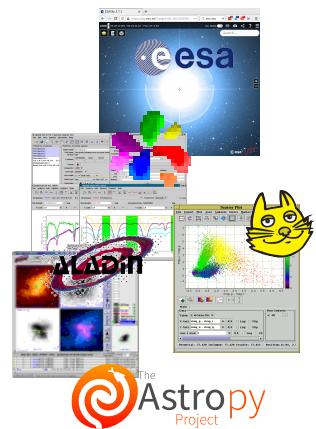
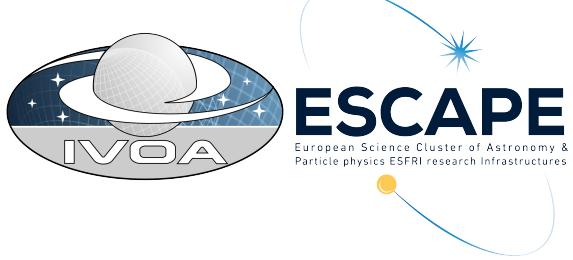
Everyone invited  
to comment



Anyone can  
raise issues



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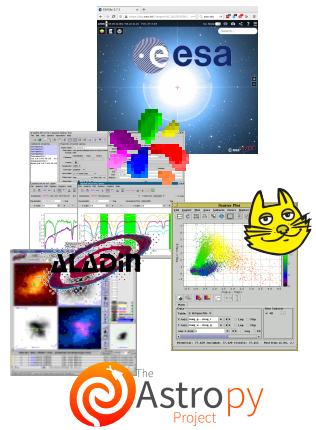
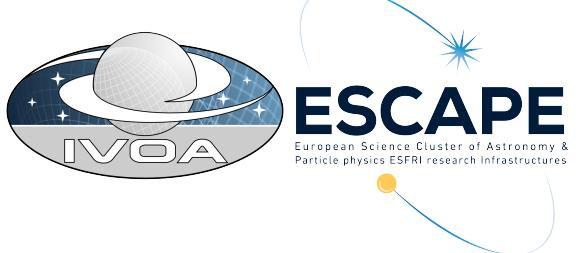
## The Virtual Observatory

Data from all over the world .... in the cloud

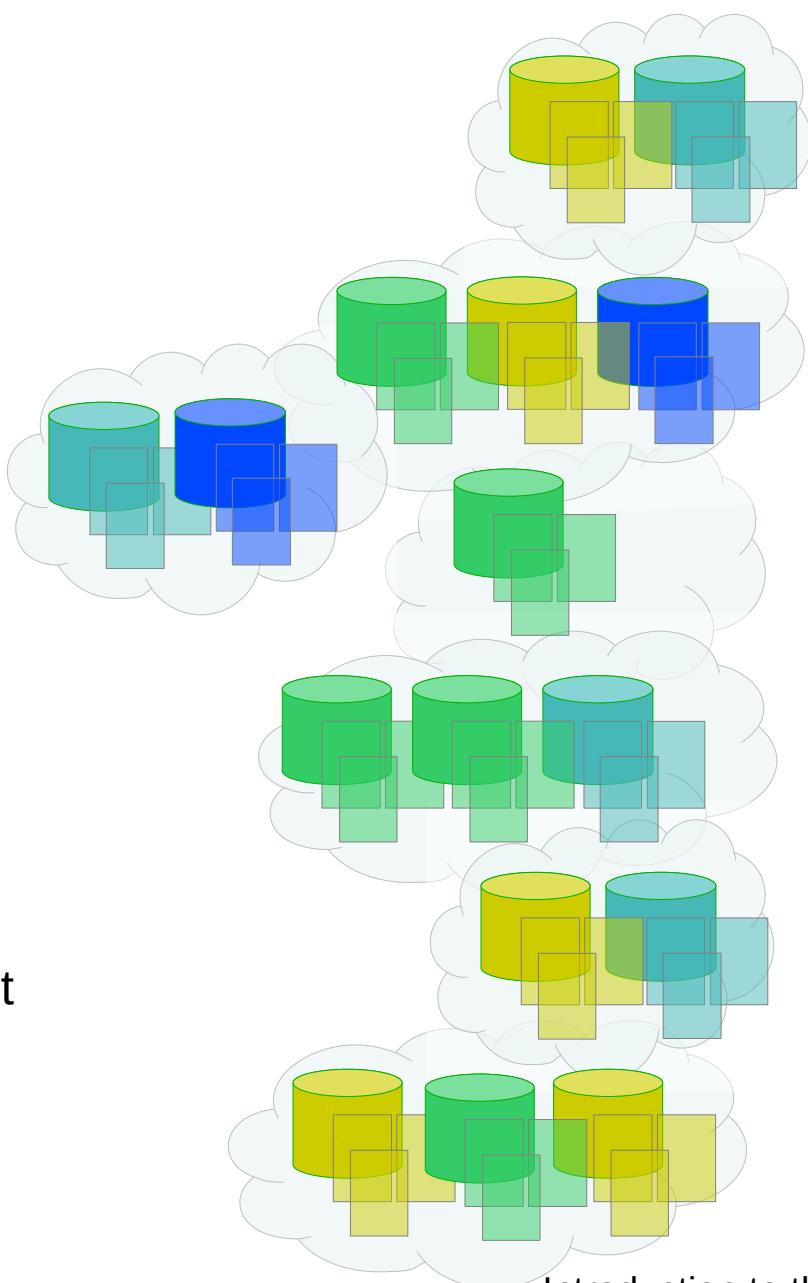
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Lots of individual services each playing their part  
But ... how do you know where everything is ?



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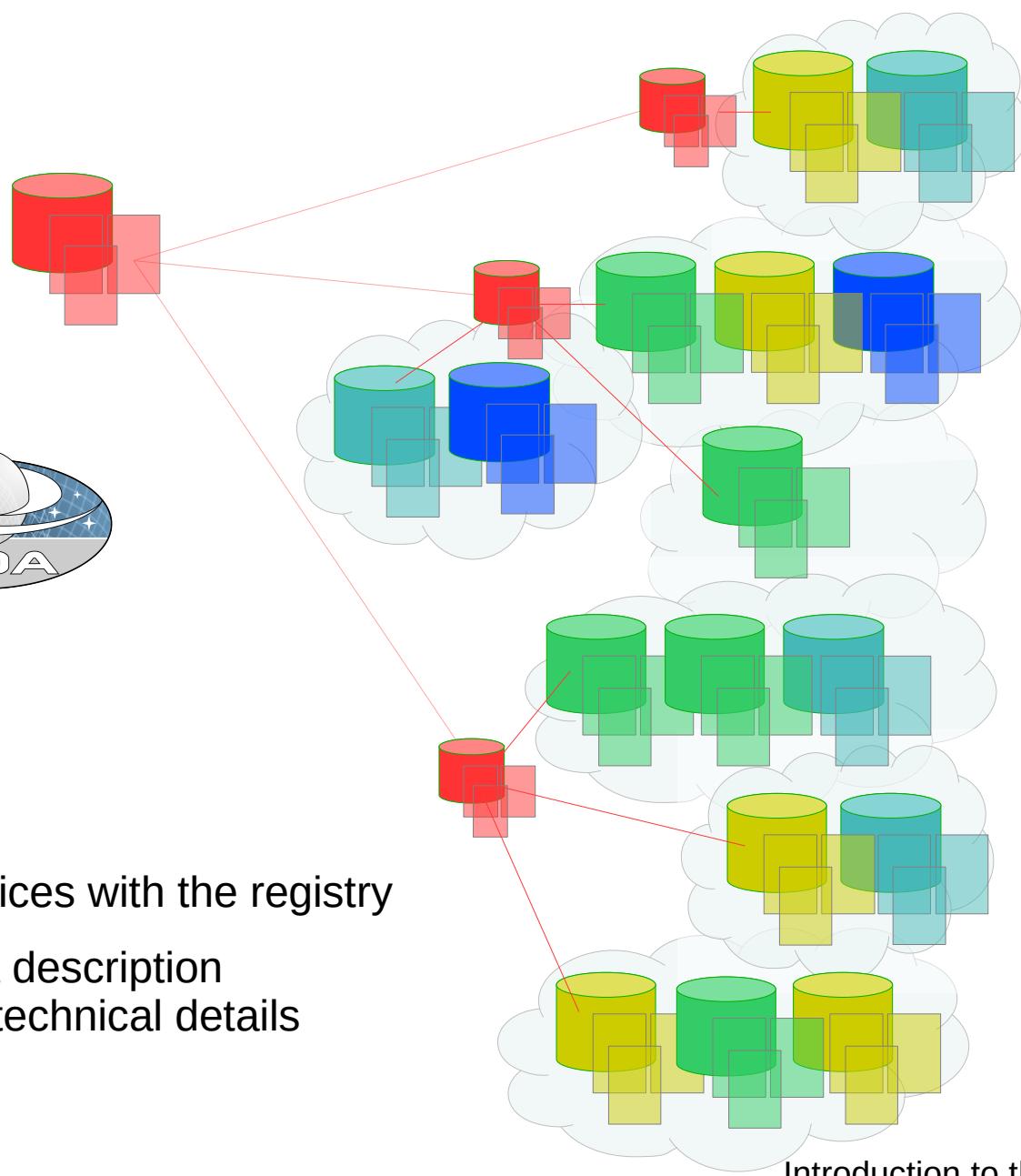




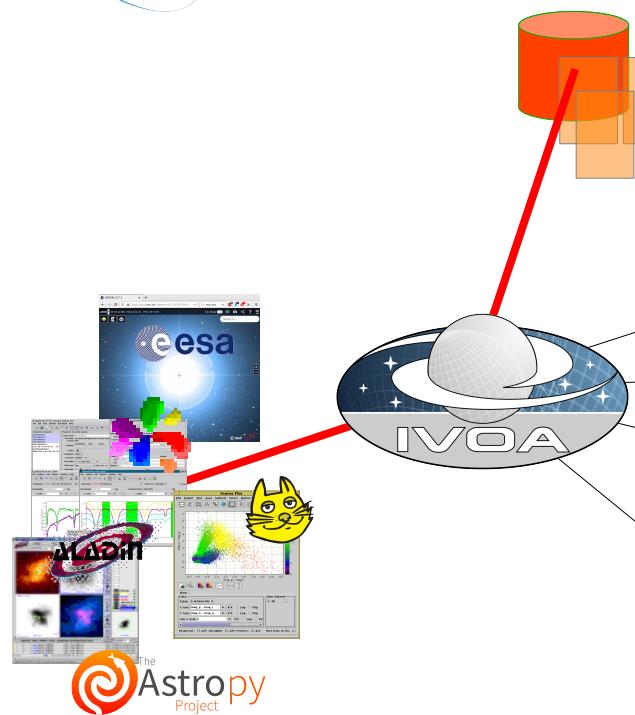
Data providers register their services with the registry

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

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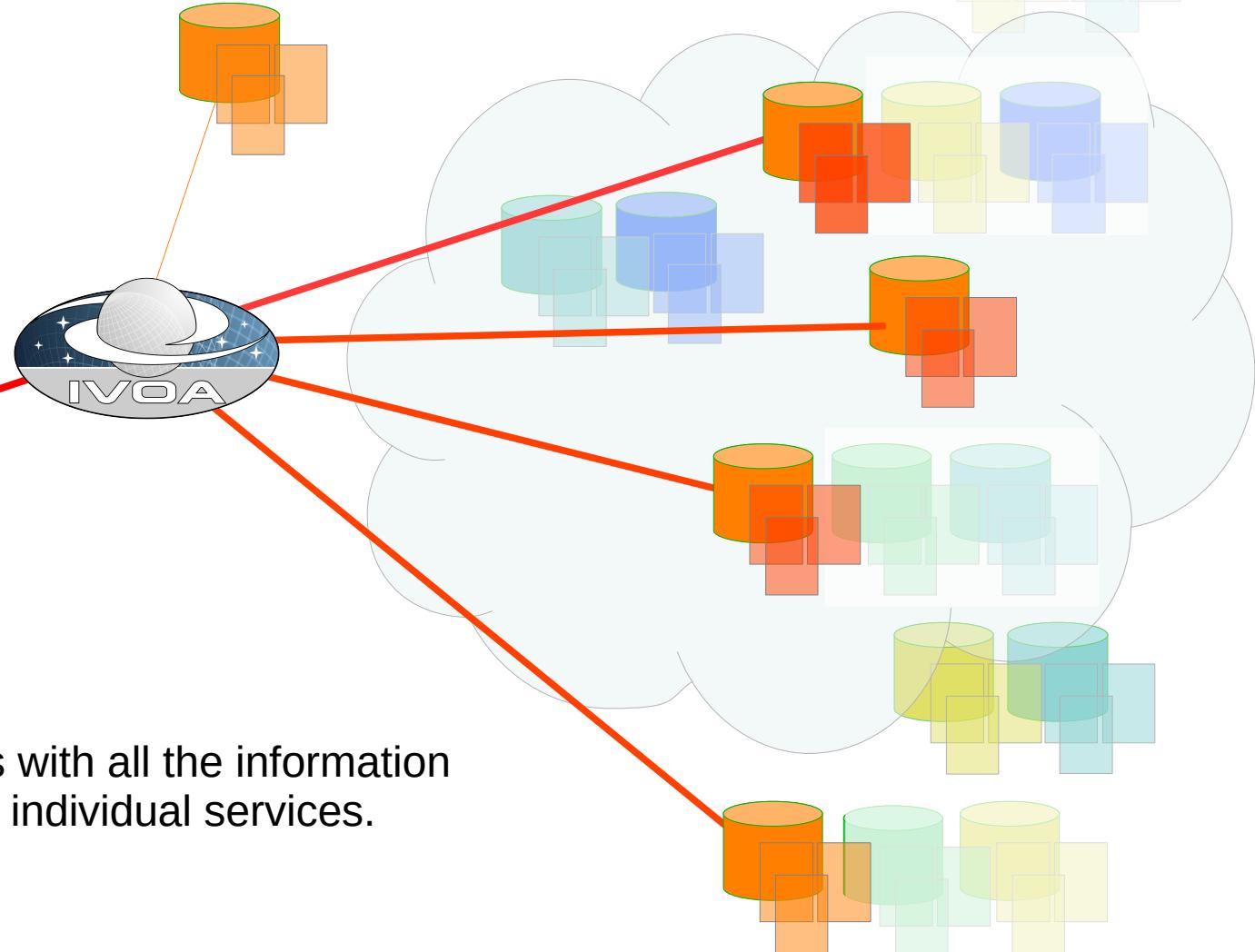
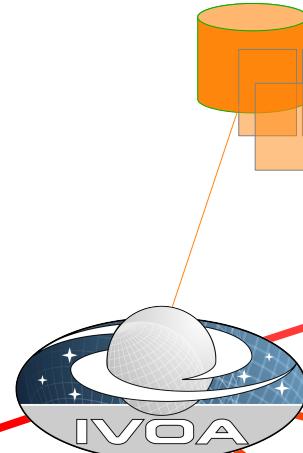


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The registry is the initial contact point for interactions with IVOA services

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



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

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## Back to the main session



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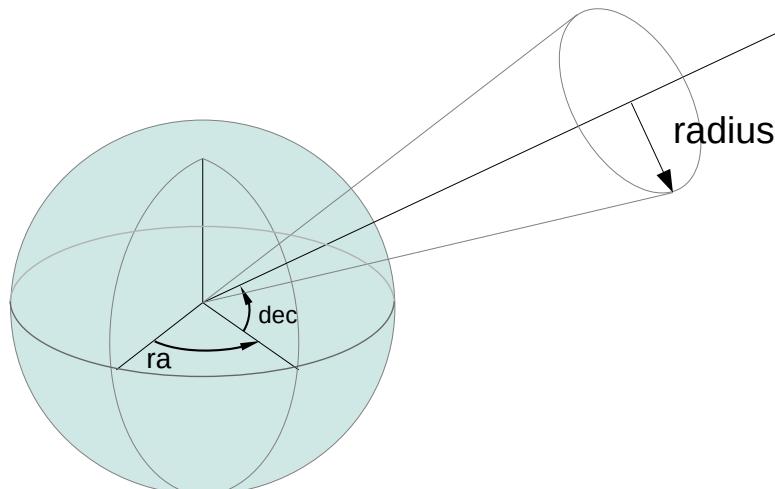
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# Simple Cone Search

One of the earliest services  
defined by the IVOA

RA =  $170^\circ$  (deg)  
DEC =  $25^\circ$  (deg)  
SR =  $30^\circ$  (deg)

Version 1.0 adopted as an  
IVOA recommendation in 2006



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



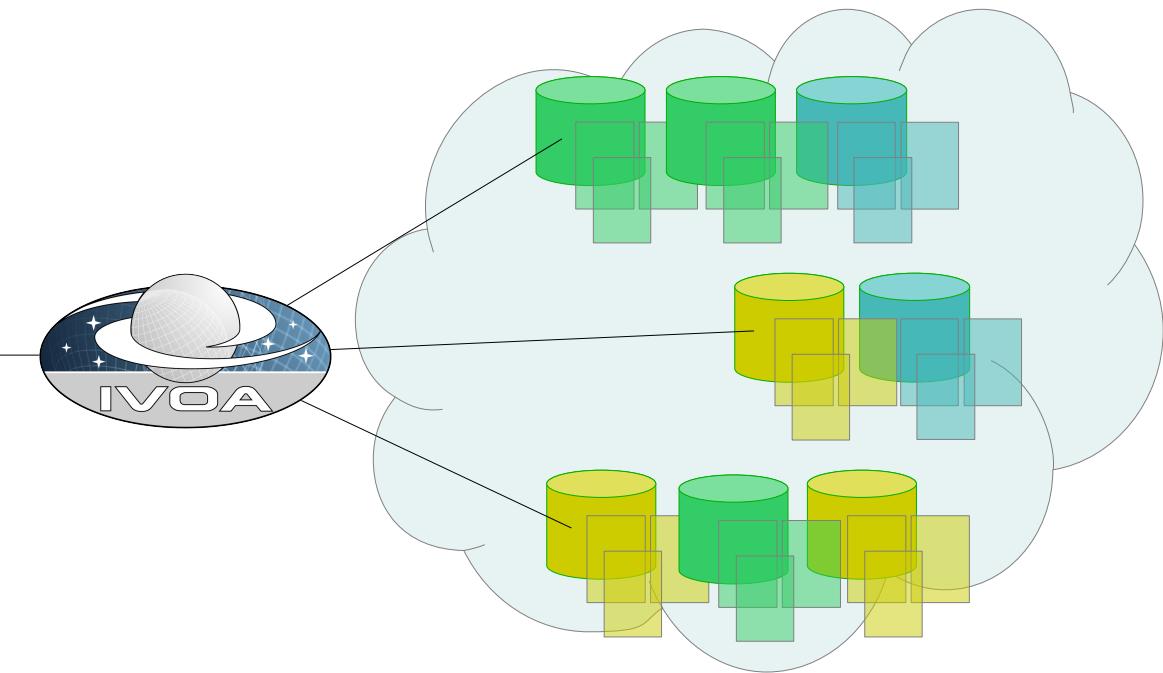
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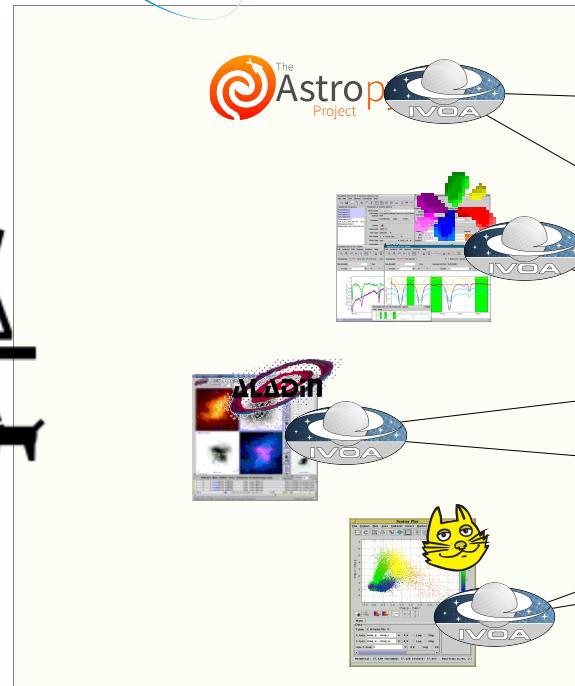


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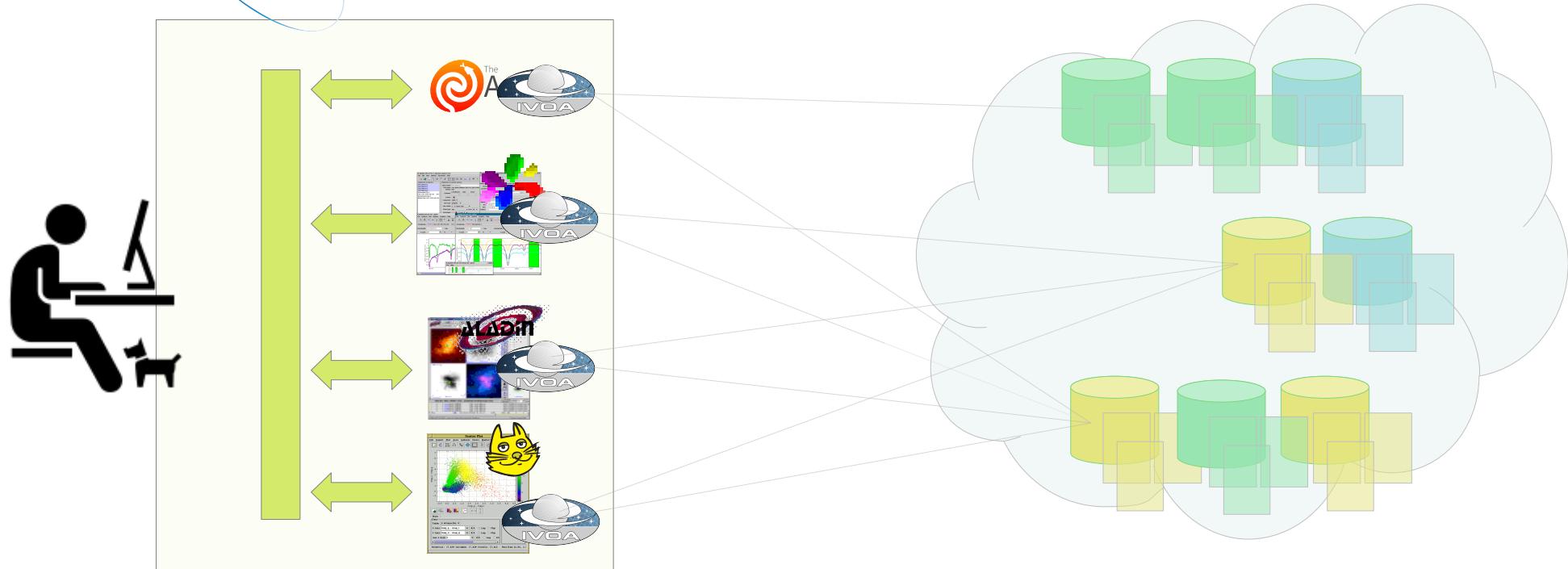
## The Virtual Observatory

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



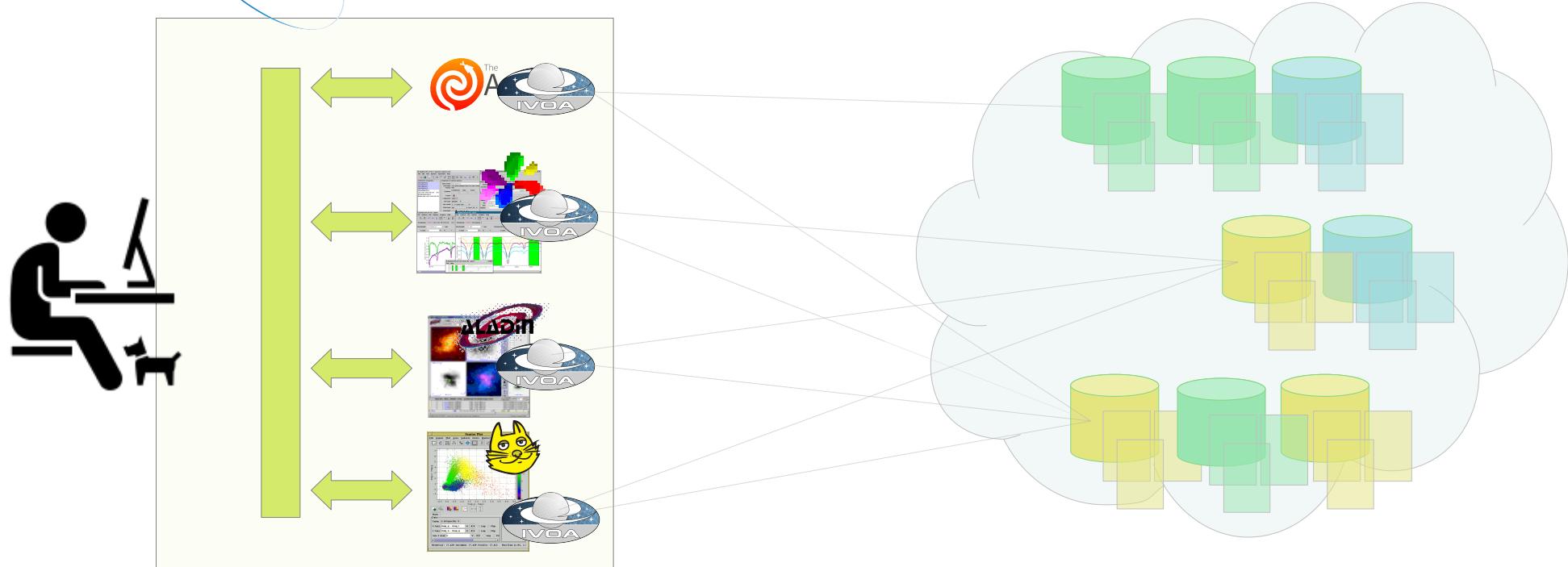
SAMP is a message bus within your local computer

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:

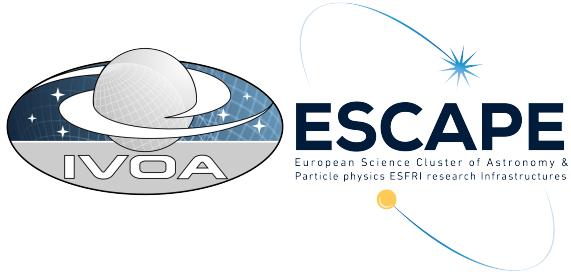
`coord.pointAt.sky <ra,dec>`



## 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



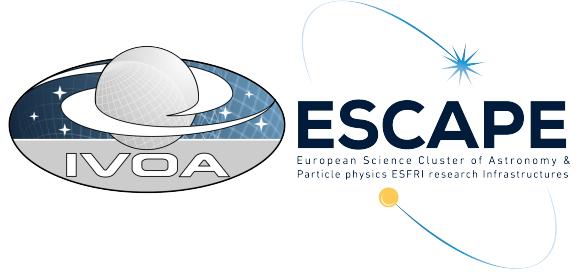
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# Unified Content Descriptors (UCD)

Different data providers have a different table structures

Data provider #1

column name

RA

Decl

ID

....

....

Data provider #2

column name

objid

....

ra

dec

....

....

....

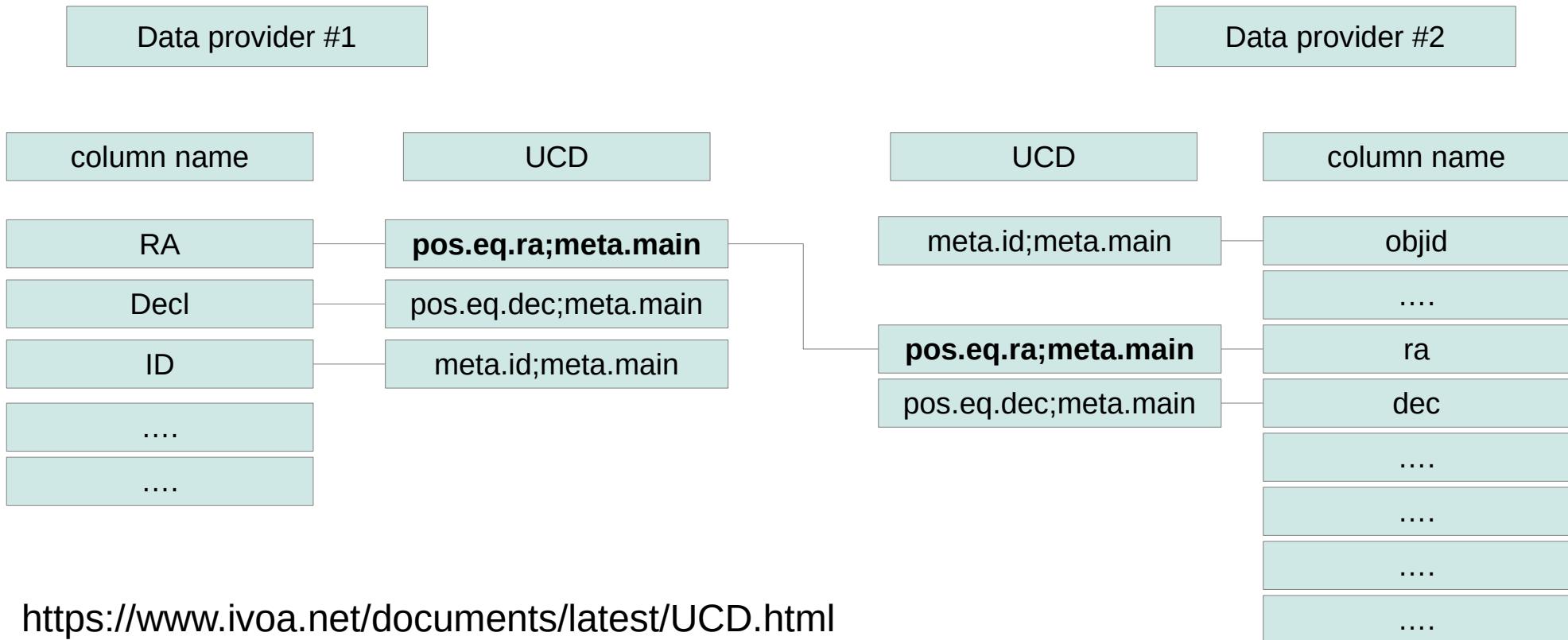
....





# Unified Content Descriptors (UCD)

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

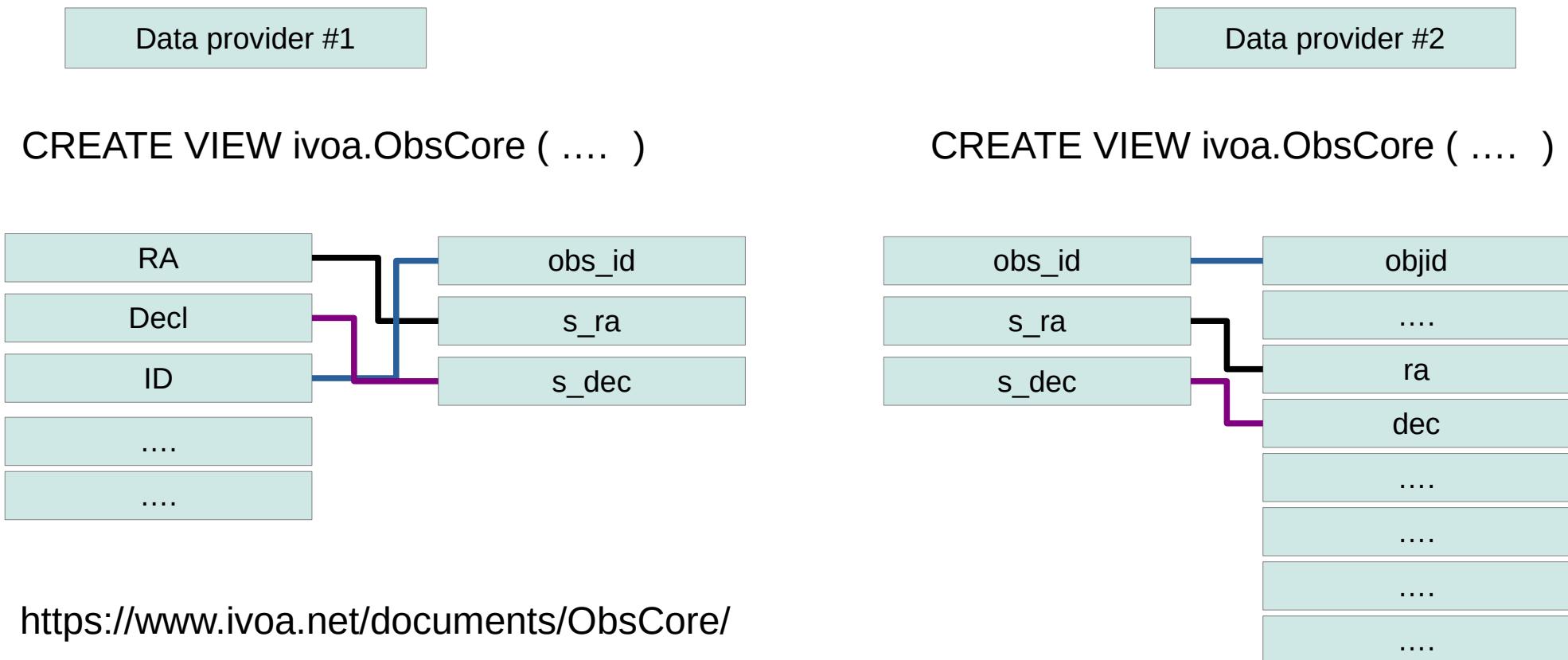


<https://www.ivoa.net/documents/latest/UCD.html>



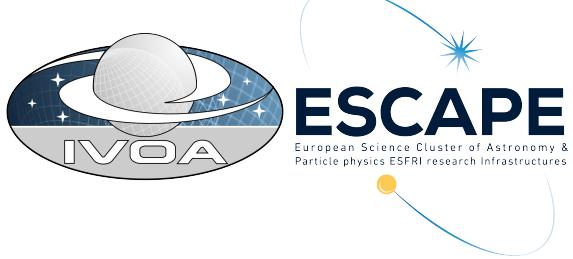
# Observation Data Model Core Components

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



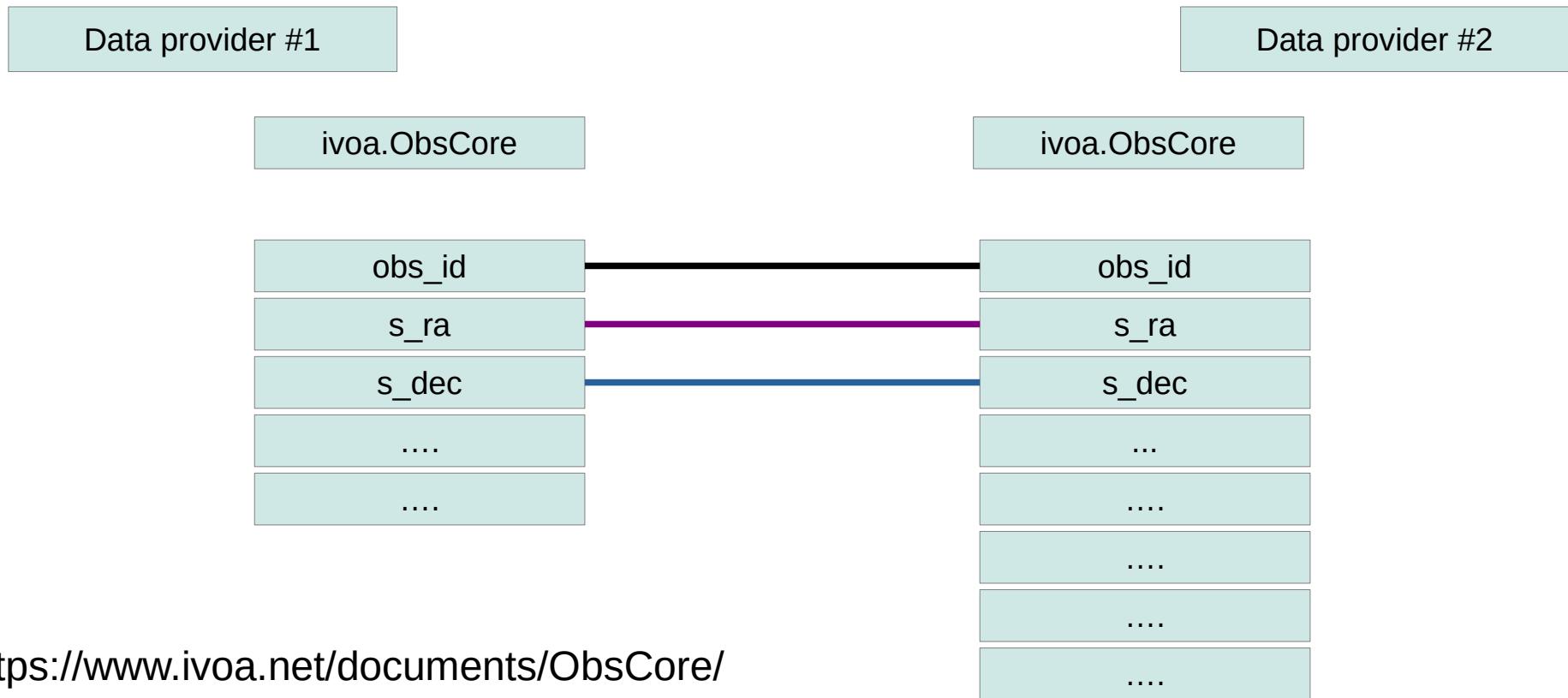
<https://www.ivoa.net/documents/ObsCore/>





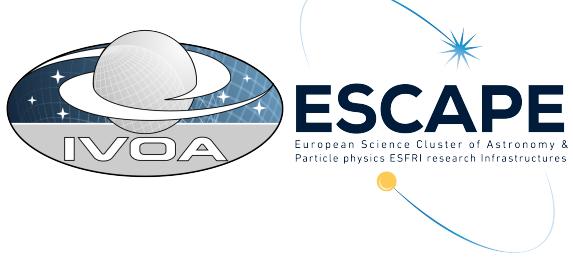
# Observation Data Model Core Components

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



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





# Observation Data Model Core Components

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

Data provider #1

ivoa.ObsCore

```
SELECT
  * obs_id
FROM ivoa.obscore AS db
JOIN TAP_UPLOAD.It AS mine
ON 1=CONTAINS (
    POINT('ICRS', db.s_ra, db.s_dec),
    CIRCLE('ICRS', mine.RA, mine.Decl, mine.Beta)
)
AND
db.dataproduct_type='image'
```

A diagram illustrating the flow of a query between two data providers. At the top, there are two light green boxes labeled "Data provider #1" and "Data provider #2". Below them are two dark green boxes labeled "ivoa.ObsCore". A grey arrow points from the "ivoa.ObsCore" box on the left down to the "SELECT" statement. Another grey arrow points from the "ivoa.ObsCore" box on the right up to the "ivoa.ObsCore" box on the left. The "SELECT" statement itself is contained within a light green rectangular box. To the right of the "SELECT" statement is a vertical stack of several light green rectangular boxes, each representing a data row. The first box contains "obs\_id", the second contains "s\_ra", the third contains "s\_dec", and the fourth contains three ellipses (...). This visualizes how the query is being processed and returned by both providers.

Data provider #2



## Back to the main session



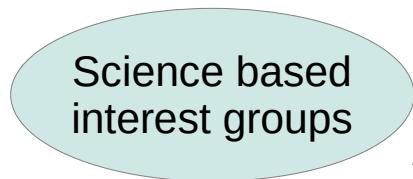
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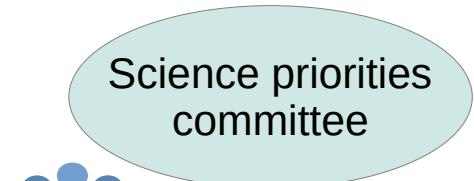
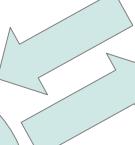
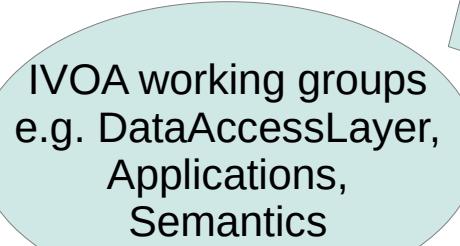


Everyone invited to develop  
science use cases



Scientific  
use cases

theory  
time-series



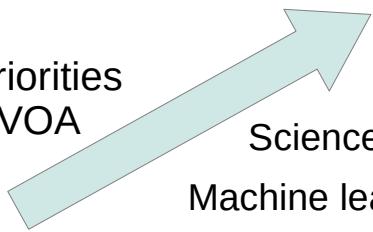
Science platforms

Machine learning

Multi-messenger  
astronomy



Scientists from IVOA members  
and major astronomy projects



Everyone invited  
to comment

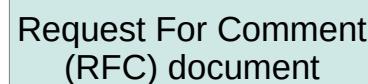


New standards being developed

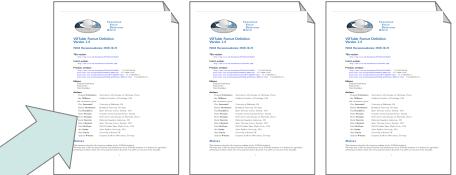
ObjVisSAP ObsLocTAP

TIMESYS Multi-order Coverage (MOC)

Hierarchical Progressive Surveys (HiPS)

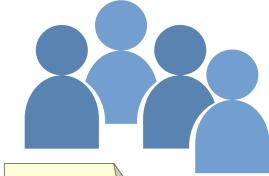
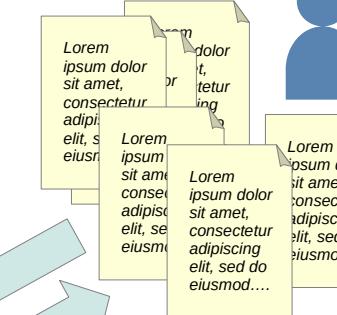


IVOA recommendation



Anyone can  
raise issues

Working group email list



Everyone invited  
to discuss