VO Organisational & Technical Overview

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Outline

- VO & IVOA
- Processes (for standardisation)
- IVOA Architecture
- Technical landscape summary
- … VObs.it/Italian contribution

VO & IVOA

interoperable ecosystem



- **I**nternational **V**irtual **O**bservatory **A**lliance
- Formed in 2002
- Open standards organisation
- ***Interoperability*** as the core goal
- FAIR-enabling standards for astronomy

IVOA vision

The **Virtual Observatory (VO)** is the **vision** that astronomical datasets and other resources should **work as a seamless whole**. [...]

The **International Virtual Observatory Alliance (IVOA)** is an organisation that debates and agrees the **technical standards** that are needed to make the VO possible.

Family Picture

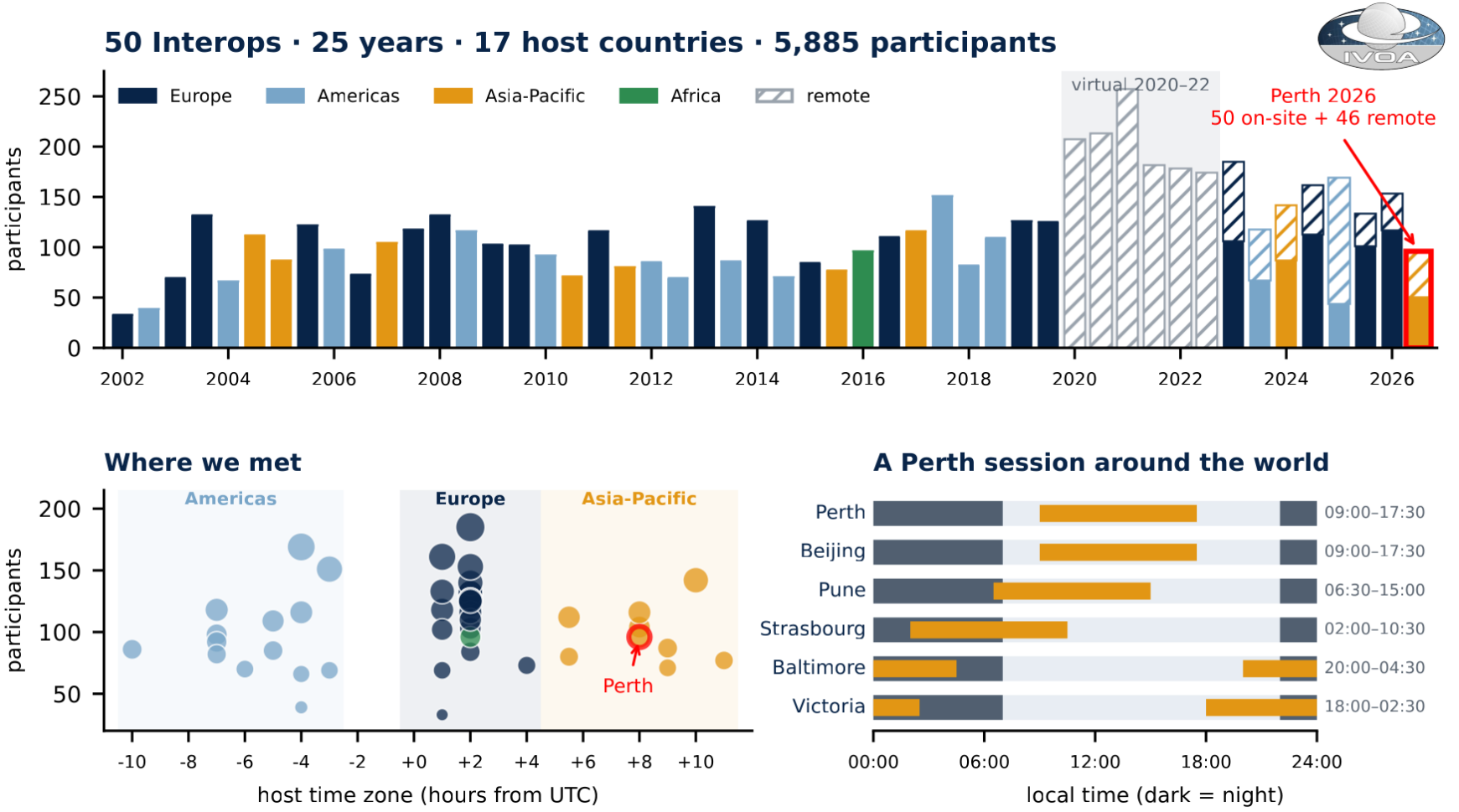


CTAO?

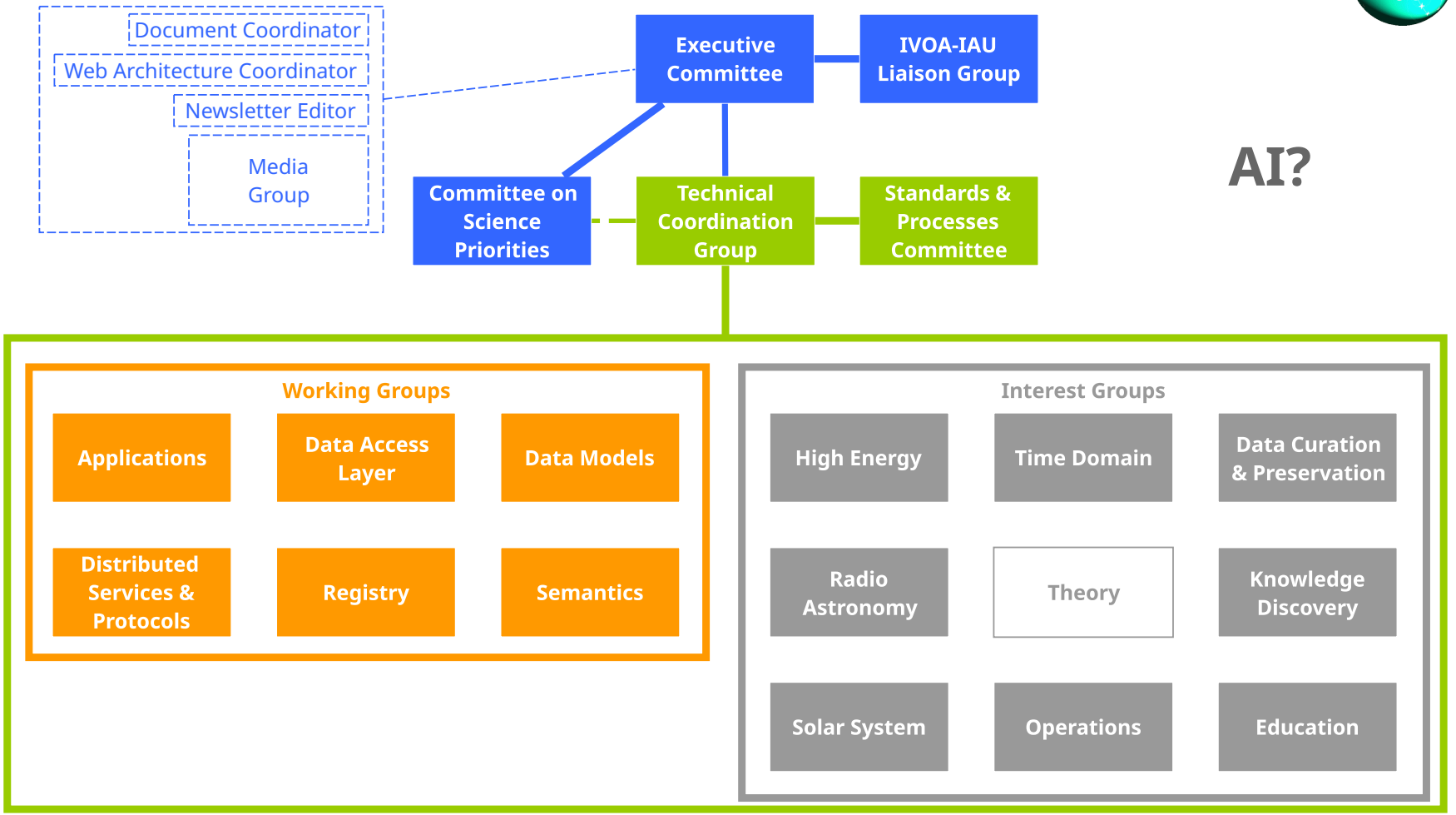
Czech-VO?

(ESO?)

Community


50 Interops · 25 years · 17 host countries · 5,885 participants
Europe
Americas
Asia-Pacific
Africa
remote
virtual 2020–22
Perth 2026
50 on-site + 46 remote
participants
0
50
100
150
200
250
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
Where we met
Americas
Europe
Asia-Pacific
Perth
participants
50
100
150
200
-10
-8
-6
-4
-2
+0
+2
+4
+6
+8
+10
host time zone (hours from UTC)
A Perth session around the world
Perth
Beijing
Pune
Strasbourg
Baltimore
Victoria
09:00–17:30
09:00–17:30
06:30–15:00
02:00–10:30
20:00–04:30
18:00–02:30
00:00
06:00
12:00
18:00
24:00
local time (dark = night)

Organisation



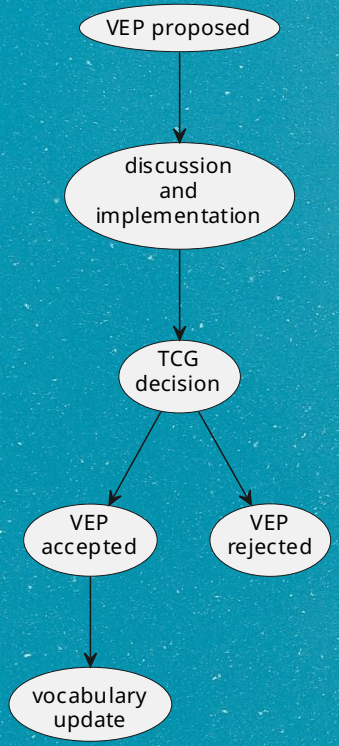
AI?

Standardisation Processes

Standard Processes

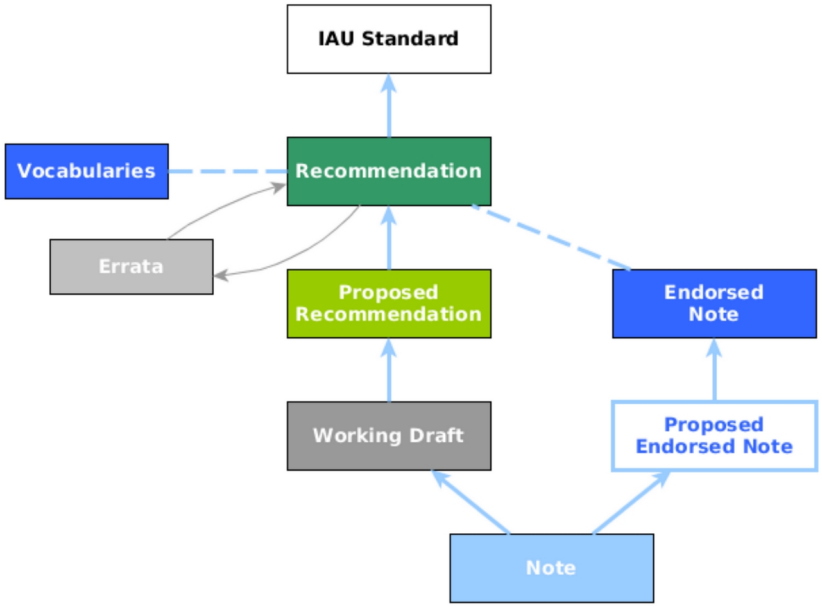
- IVOA Document Standards 2.0
  - 10.5479/ADS/bib/2017ivoa.spec.0517G
  - https://github.com/ivoa-std/DocStd
  - under revision
- Vocabularies in the VO 2.1
  - 10.5479/ADS/bib/2023ivoa.spec.0206D
  - https://github.com/ivoa-std/vocinvo

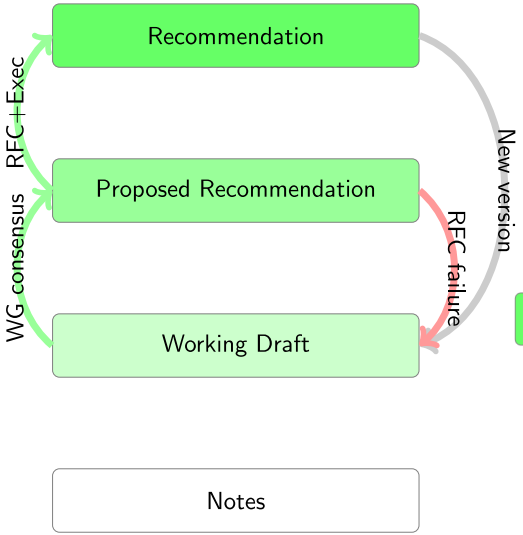
Vocabularies



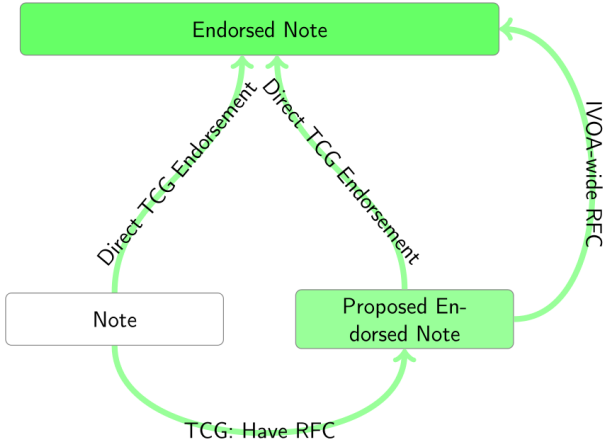
- make semantic artefacts independent with respect to standards management
- new vocabularies usually happen at document release
- Vocabulary Enhancement Proposal(s) – VEPs take care of updates
- Unified Content Descriptors (UCDs) moving to use to process

Standards Processing





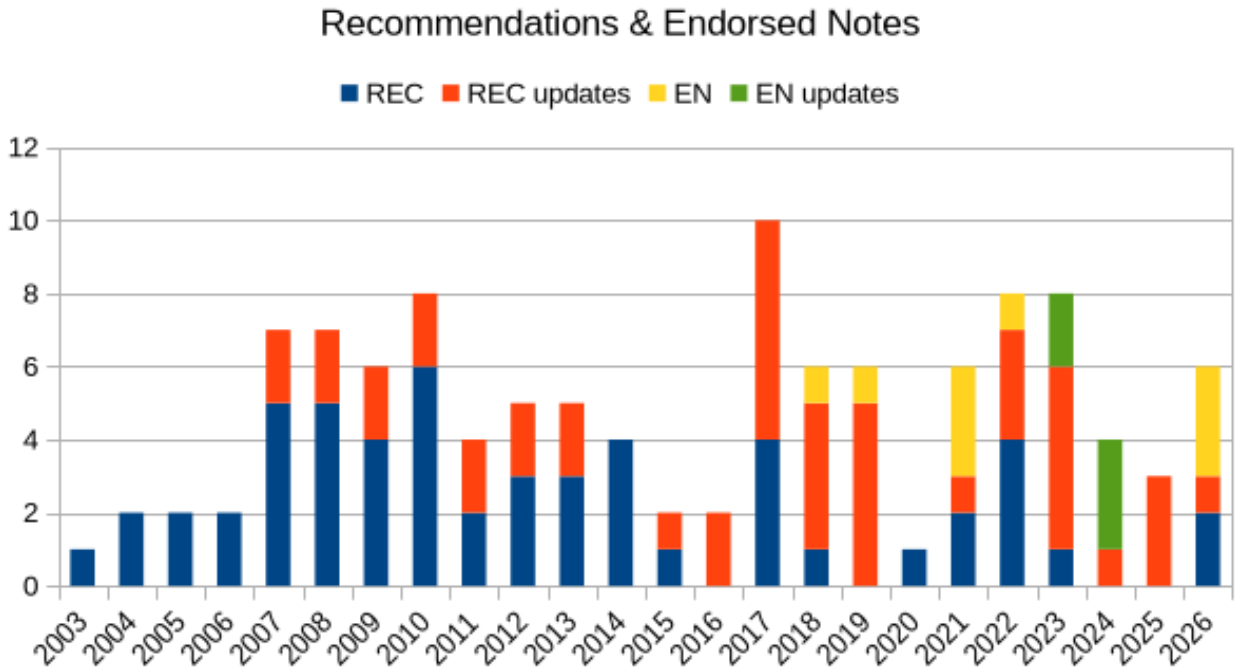
proposed changes





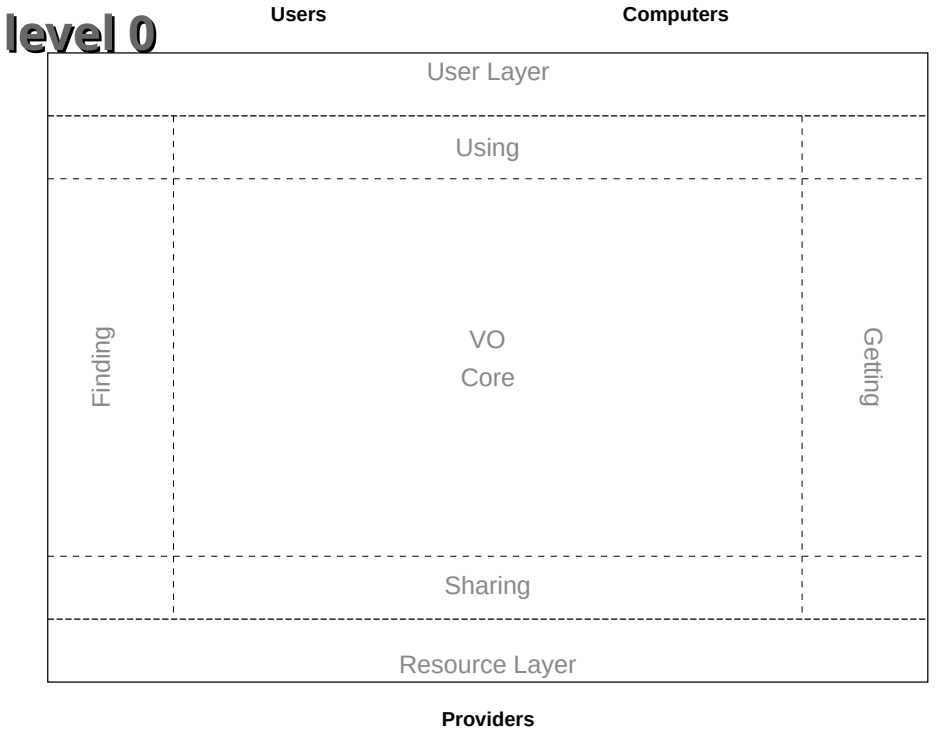
historical record

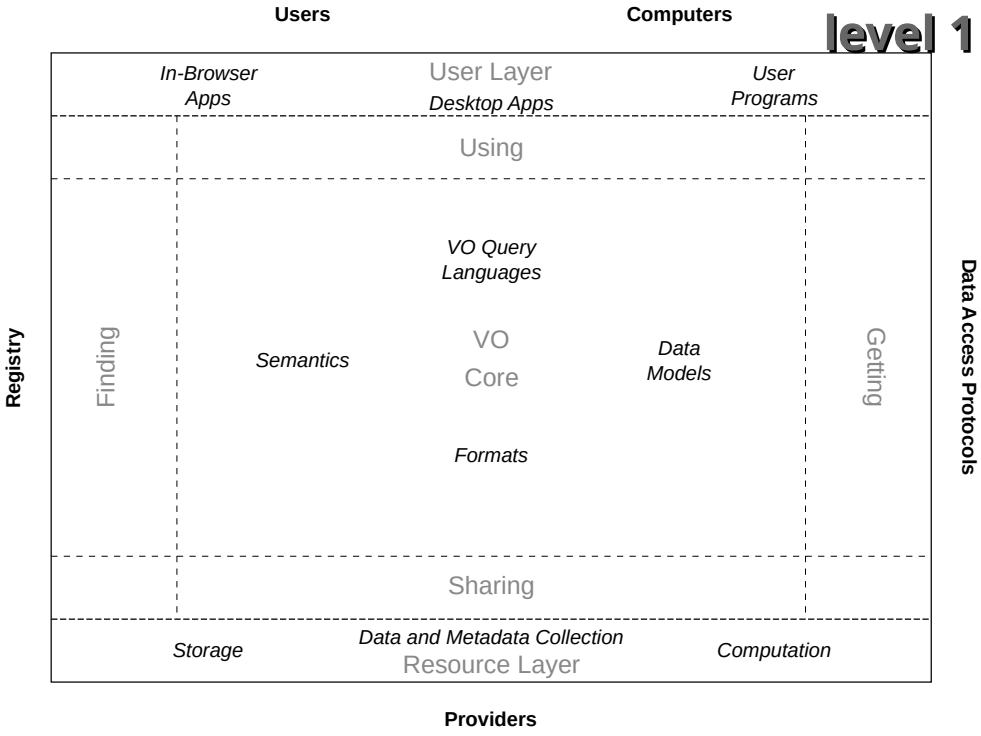
recommendations (standards) are
agreed on consensus



IVOA Architecture

structure



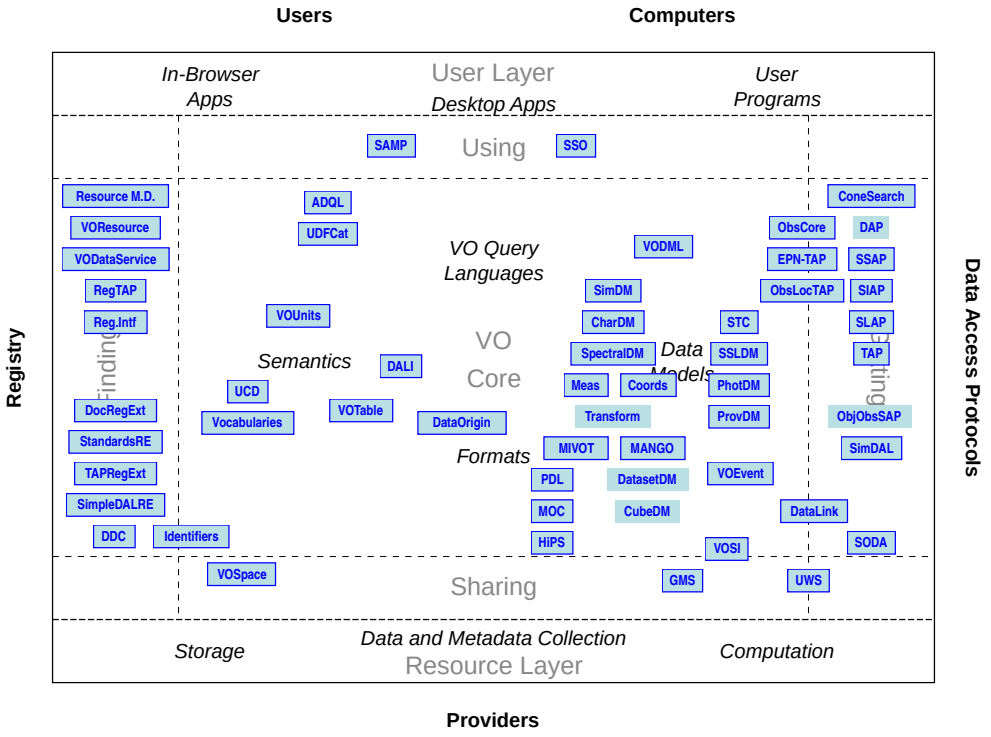


IVOA Architecture 2.1

https://ui.adsabs.harvard.edu/abs/2024ivoa.spec.1114E

standards

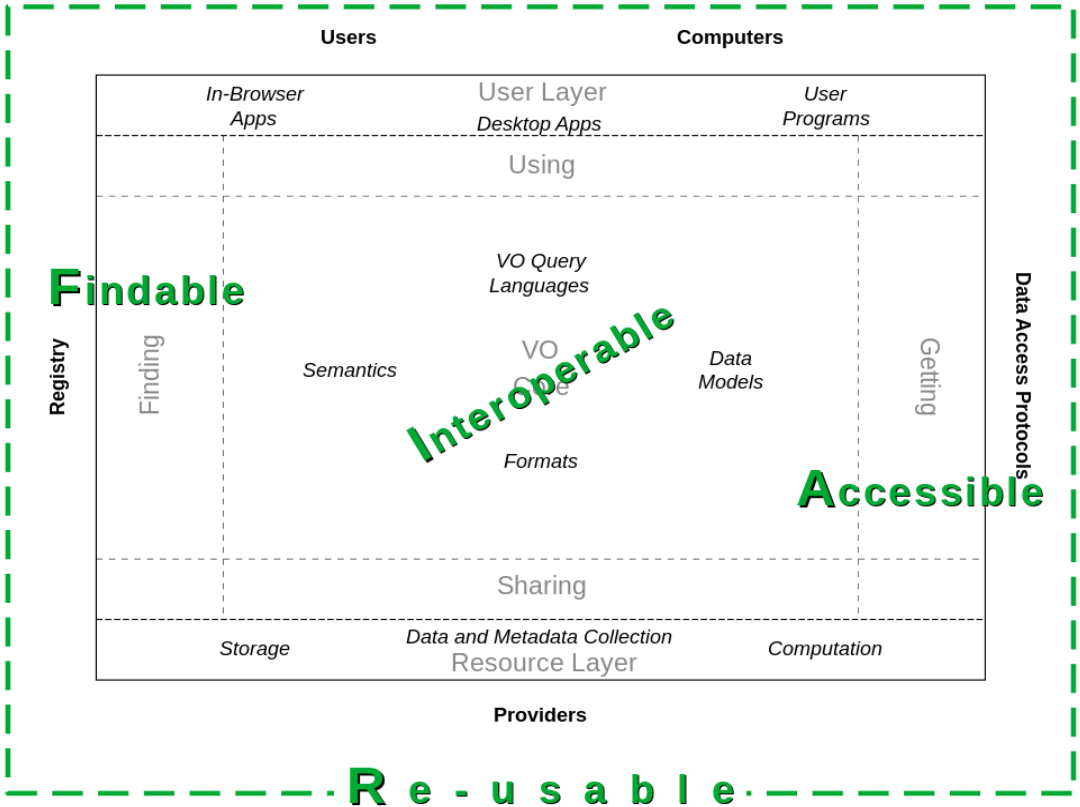
level 2

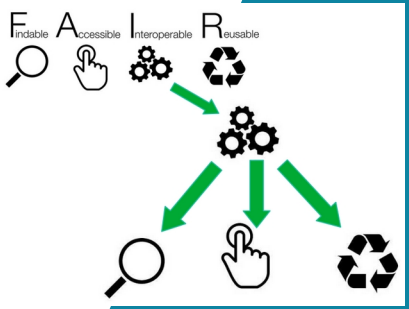


IVOA Architecture 2.1

https://ui.adsabs.harvard.edu/abs/2024ivoa.spec.1114E

FAIR-ness

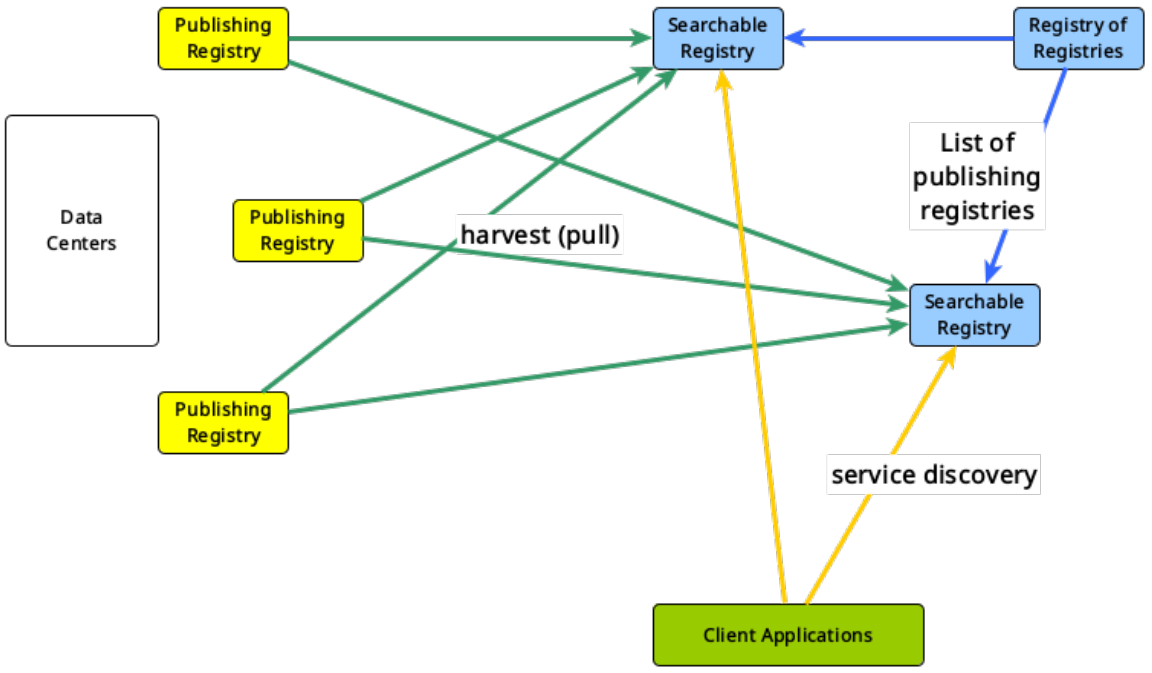

Users
Computers
In-Browser Apps
User Layer
Desktop Apps
User Programs
Using
VO Query Languages
Findable
Registry
Finding
Semantics
VO
Interoperable
Data Models
Getting
Data Access Protocols
Formats
Accessible
Sharing
Storage
Data and Metadata Collection
Resource Layer
Computation
Providers
Re-usable


Findable
Accessible
Interoperable
Reusable

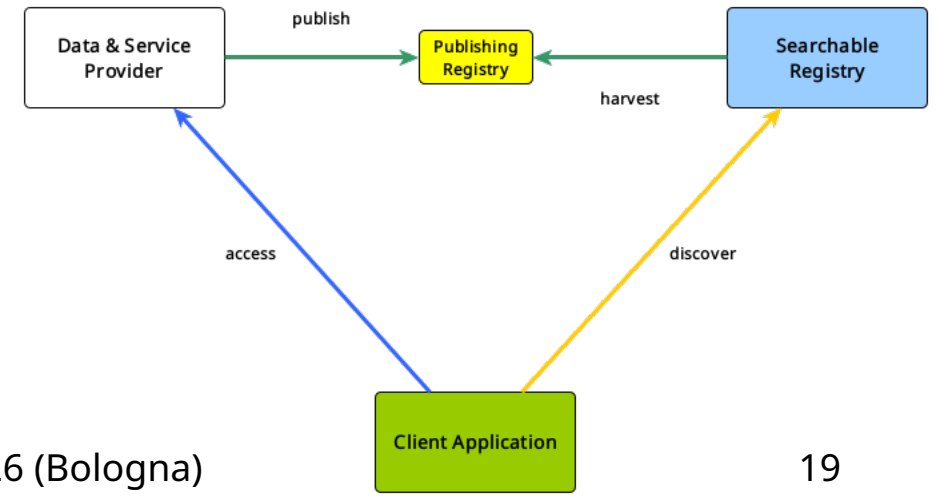

Findable
Accessible
Interoperable
Reusable
enablers

Technical Landscape Summary

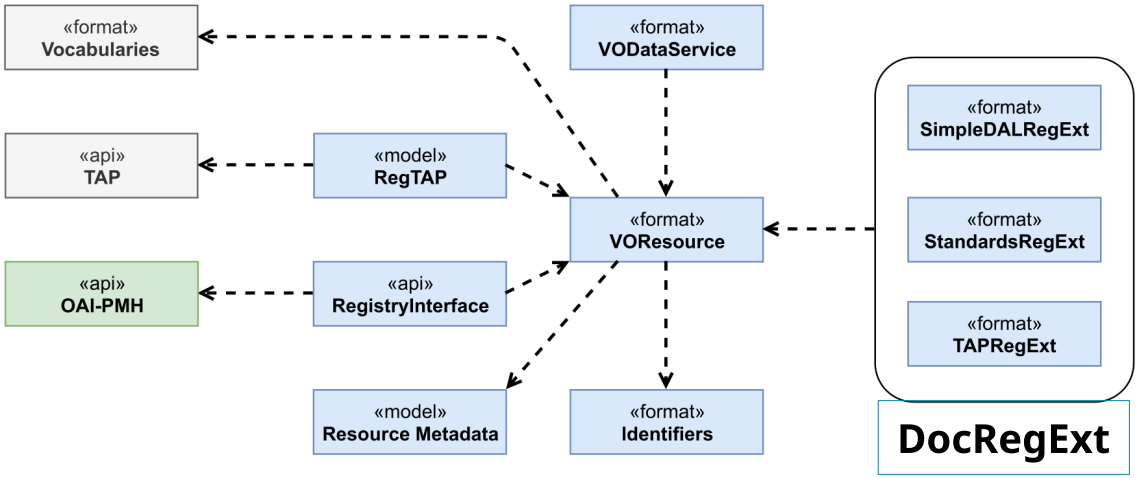
Registry



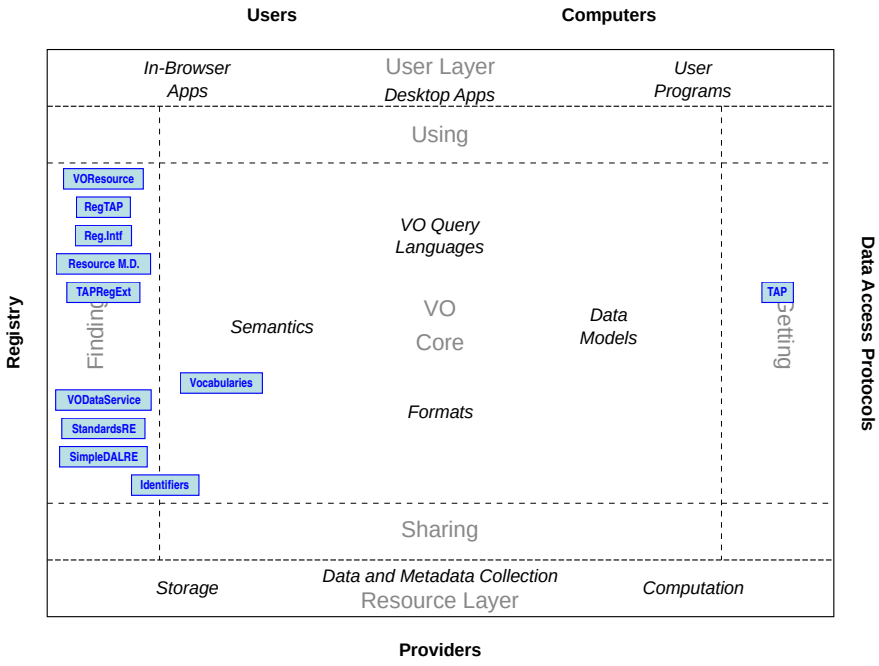
- Data Collections
- Source Catalogues
- Access Services (standardised)
- Protocols
- Registries (themselves)
- IVOA standards



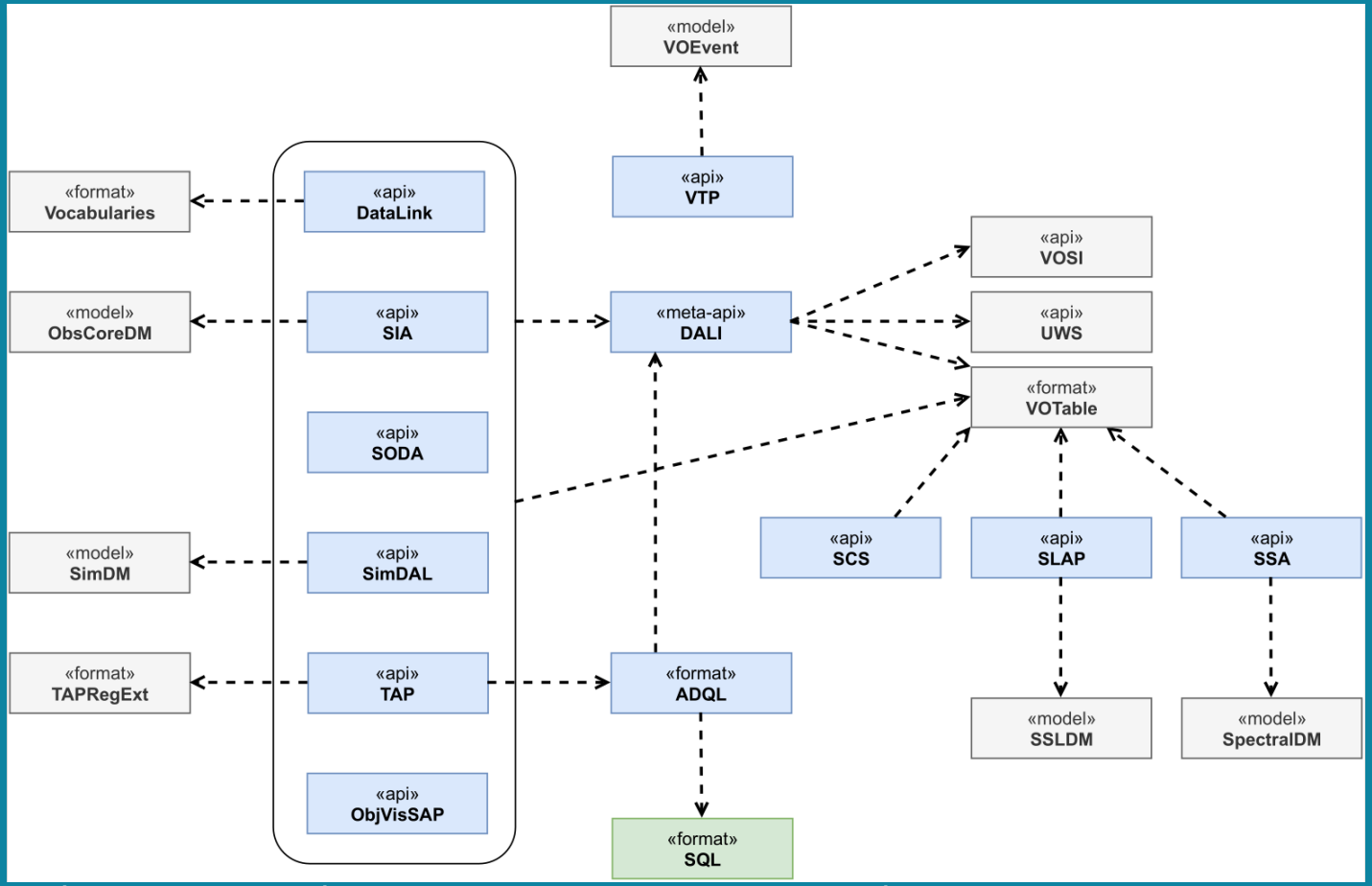
Registry



- stable structure
- metadata schemata solutions challenged by external infrastructures



Data Access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VOEvent
«api»
VTP
«format»
Vocabularies
«api»
DataLink
«model»
ObsCoreDM
«api»
SIA
«meta-api»
DALI
«api»
VOSI
«api»
UWS
«format»
VOTable
«api»
SODA
«model»
SimDM
«api»
SimDAL
«api»
SCS
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SLAP
«api»
SSA
«format»
TAPRegExt
«api»
TAP
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ADQL
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SSLDM
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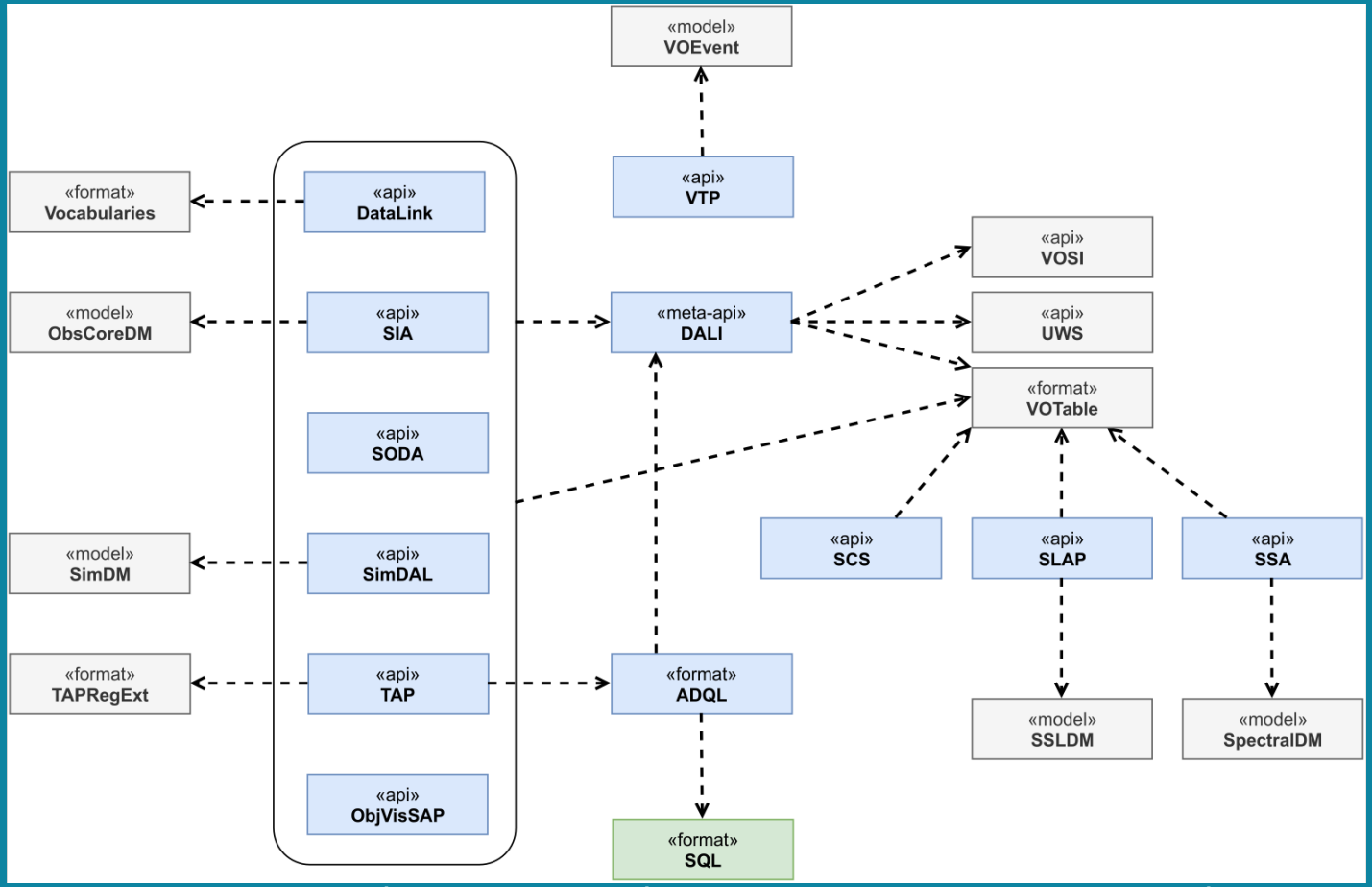
SpectralDM
«api»
ObjVisSAP
«format»
SQL

Data Access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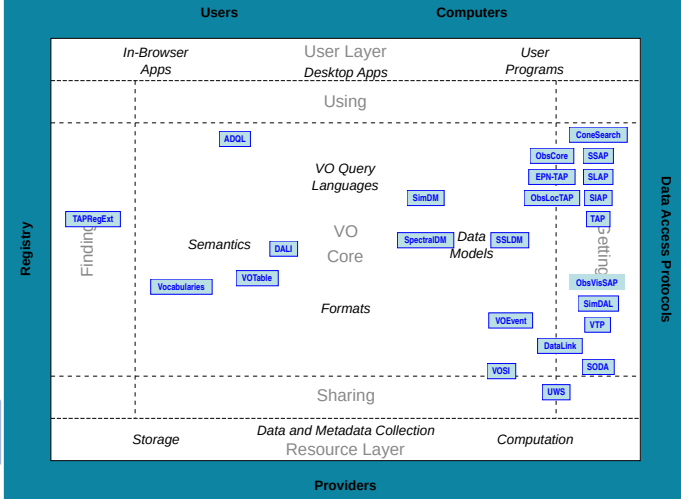
SQL


Users
Computers
In-Browser Apps
User Layer
Desktop Apps
User Programs
Using
Registry
Finding
Getting
Data Access Protocols
ADQL
ConeSearch
ObsCore
SSAP
EPN-TAP
SLAP
ObsLocTAP
SIAP
TAP
TAPRegExt
VO Query Languages
SimDM
Semantics
DALI
VO Core
SpectralDM
Data Models
SSLDM
VOTable
Vocabularies
ObsVisSAP
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Formats
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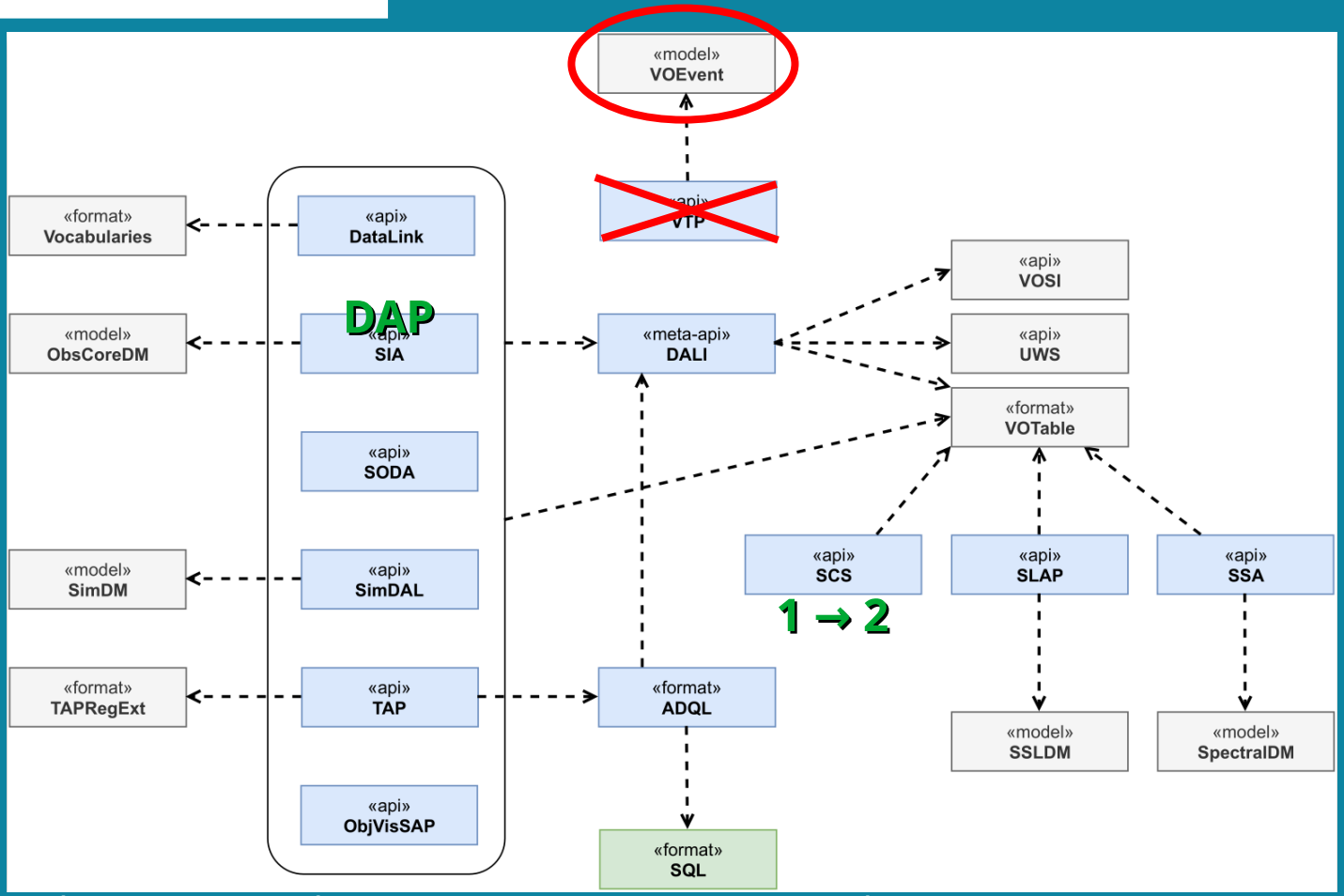
VOSI
SODA
Sharing
UWS
Storage
Data and Metadata Collection
Resource Layer
Computation
Providers

Data Access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«model»
SimDM
«api»
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SCS
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SLAP
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SSA
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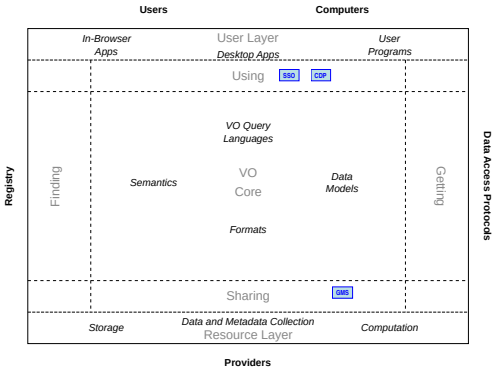
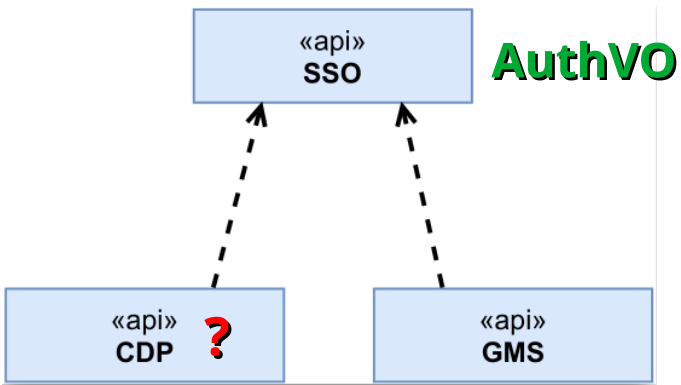
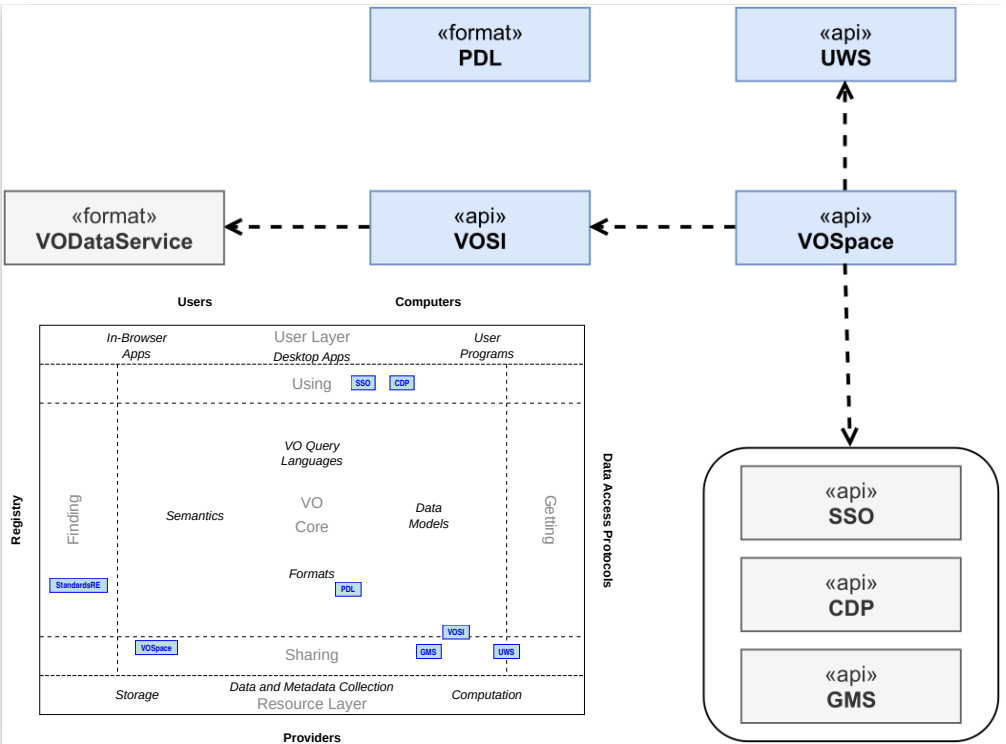
TAPRegExt
«api»
TAP
«format»
ADQL
«model»
SSLDM
«model»
SpectralDM
«api»
ObjVisSAP
«format»
SQL

Services

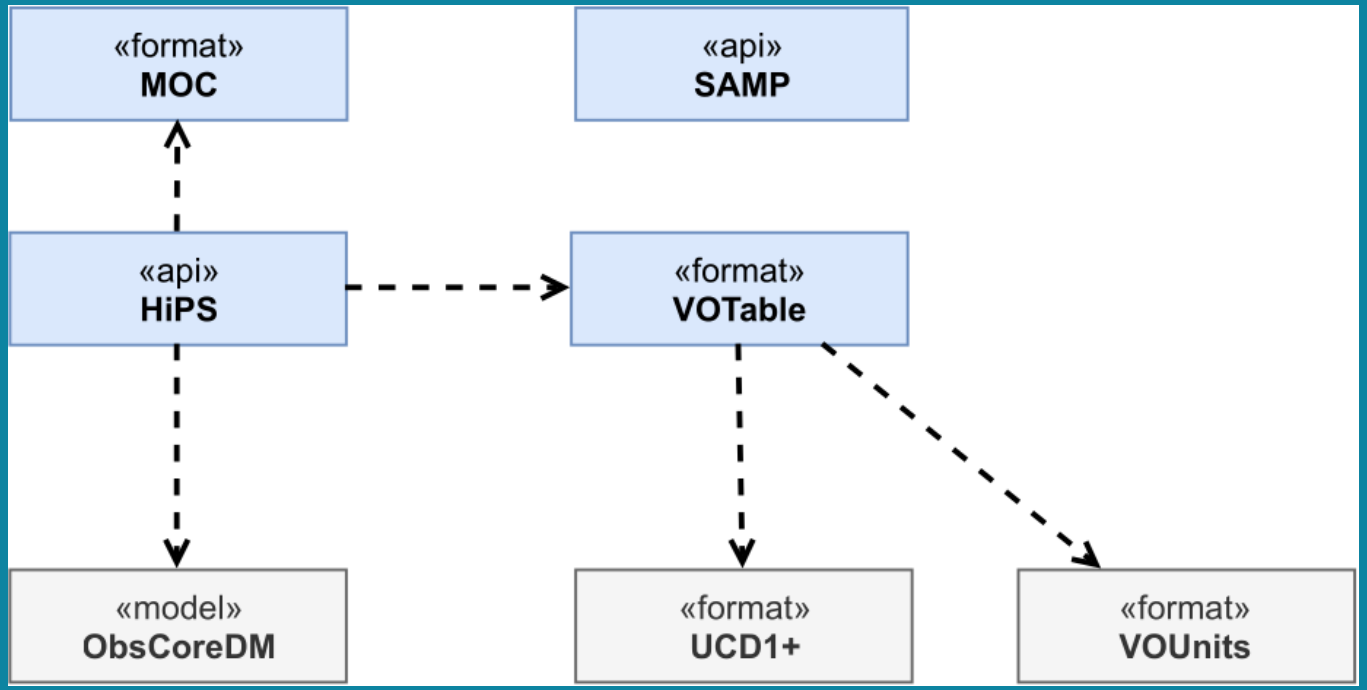
Grid & Web Services → Distributed Services & Protocols



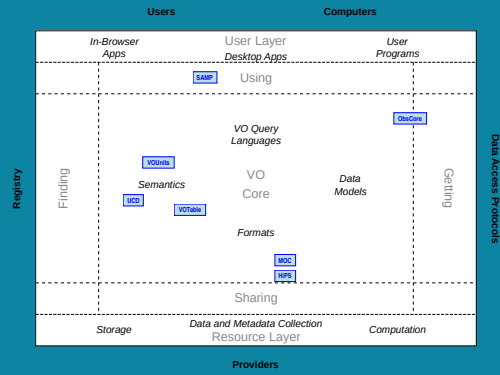




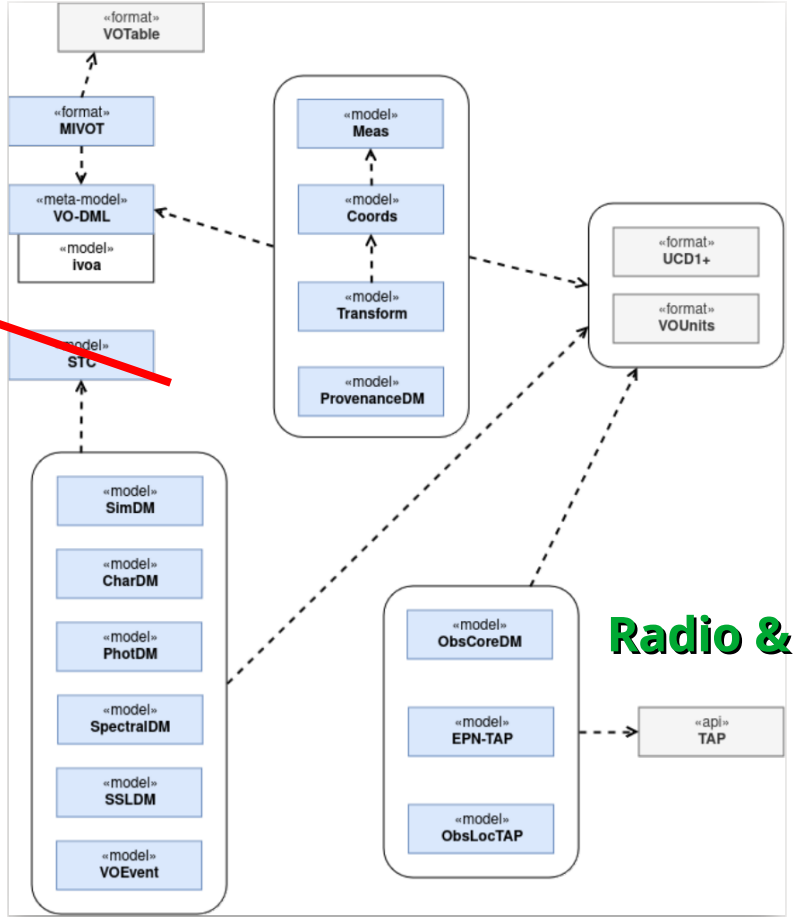
Formats



- tessellation
  - (ST)MOC
  - HiPS
  - HATS
- enriched formats
  - VO-parquet

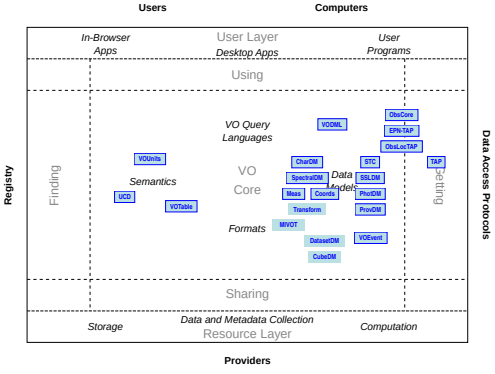


~Models~

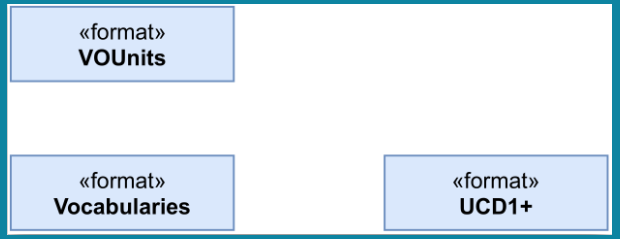


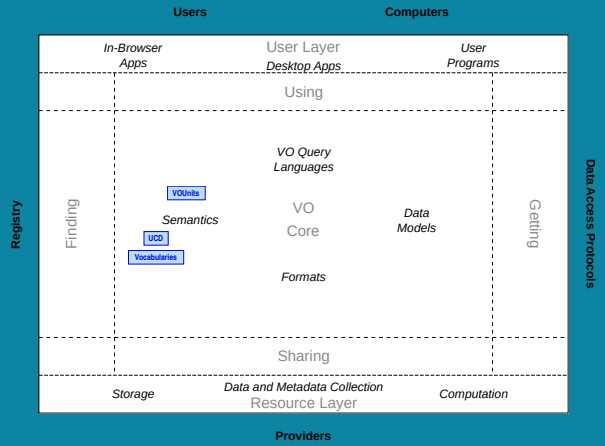
- metadata schemata
- data objects/structure annotations
- usability in discovery & access solutions
- community take up
- semantics connection

Radio & High Energy - extensions



Semantics





Name	Last Change	URI	Description
Content levels for VO resources	2016-08-17	http://www.ivoa.net/rdf/voresource/content_level	This vocabulary enumerates the intended audiences for resources in the Virtual Observatory. It is designed to enable discovery queries like "only research-level data" or "resources usable in school settings".
Content types of VO resources	2016-08-17	http://www.ivoa.net/rdf/voresource/content_type	This vocabulary enumerates types of resources in the Virtual Observatory in a very general manner. Most actual services will be one of Archive, Catalog, or Survey.
DALI Examples	2023-05-07	http://www.ivoa.net/rdf/examples	A vocabulary for expressing examples for the use of protocols. It contains concepts such as which parameters to pass to services or the standards implemented by it. Its main use is in RDFa documents described by section 2.3 of the DALI specification, <https://ivoa.net/documents/DALI/>.
Data Product Type	2026-01-15	http://www.ivoa.net/rdf/product-type	This vocabulary gives a high level classification for data products in astronomy. It is derived from a word list used by obscore to facilitate by-product type discovery ("find spectra") and is intended to cover similar use cases elsewhere (e.g., "find services serving spectra" in Registry). A related use case this is supposed to cover is "route data products to applications that can handle them," in particular in Datalink content_qualifier.
Datalink core	2022-01-27	http://www.ivoa.net/rdf/datalink/core	Terms in this vocabulary relate (abstract) datasets to files or other electronic artefacts, giving the relation between the two. They are originally intended for use in the semantics column in the output from the DataLink-1.0 {links} capability. As specified in DataLink-1.0, terms from this vocabulary are used in the semantics column of {links} output output using only the identifier prefixed with a hash (i.e., "#word").

https://www.ivoa.net/rdf/

...not to forget about

Operation

Data Curation & Preservation

Knowledge Discovery

AI

Italian Contribution

to the ecosystem

Coordination efforts
Resource contribution
Standardisation contributions

… let’s discuss how to keep on

to the organisation

DNS & domain names
mailing lists
wiki
website
documents repository (and coordinator)





Thank you for your attention!