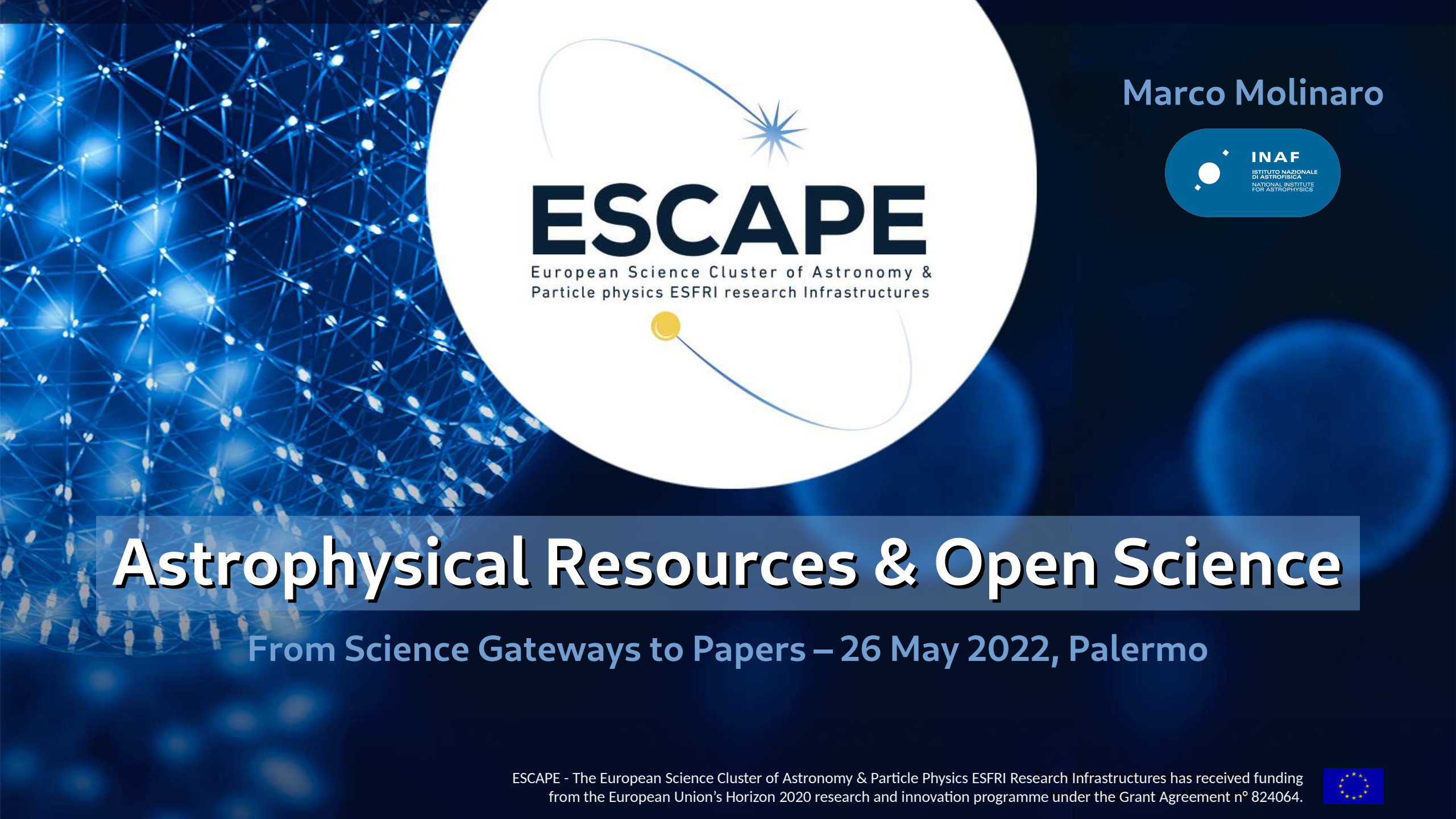


Marco Molinaro

INAF
ISTITUTO NAZIONALE DI ASTROFISICA
NATIONAL INSTITUTE FOR ASTROPHYSICS

Astrophysical Resources & Open Science

From Science Gateways to Papers – 26 May 2022, Palermo

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.

Outline

VO & IVOA

VO $\longleftrightarrow$ FAIR principles & Open Science

FAIR enabling standards

Metadata granularity

… closings …

Funded by the European Union's Horizon 2020 - Grant N° 824064

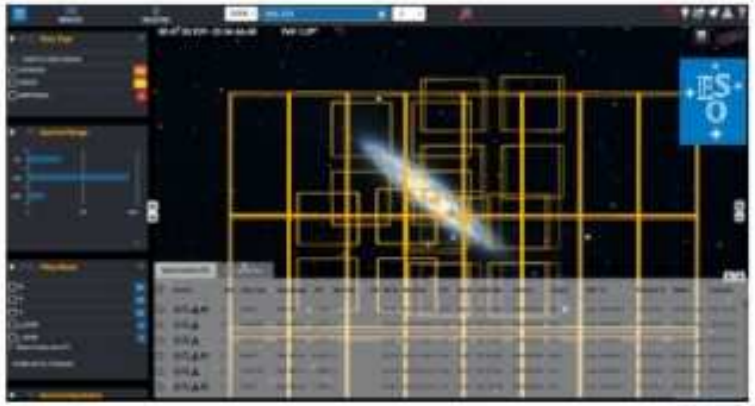
The Virtual Observatory

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

Many projects and data centres worldwide are working towards this goal.

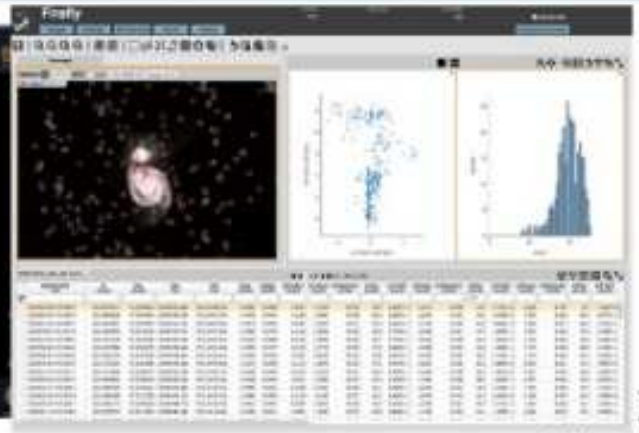
Funded by the European Union's Horizon 2020 - Grant N° 824064

VO embedded in astronomy services

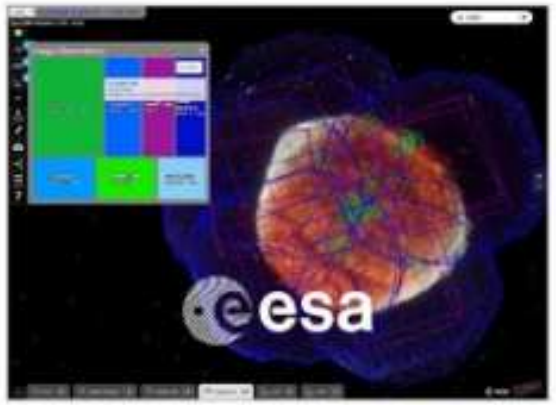


ESO Science Portal

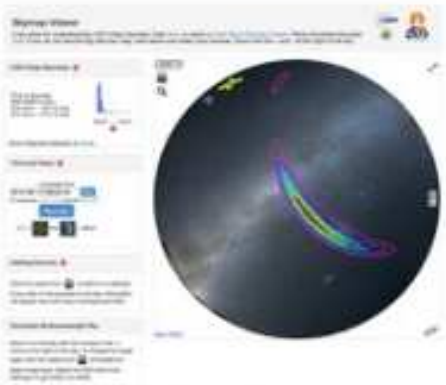
WWT



Firefly
Caltech-IPAC



ESA Sky



Grav. waves

CDS reference data service

SVO Filter Profile service

The International Virtual Observatory Alliance

INTERNATIONAL VIRTUAL OBSERVATORY ALLIANCE

The Virtual Observatory (VO) is the vision that astronomical datasets and other resources should work as a seamless whole. Many projects and data centres worldwide are working towards this goal. The International Virtual Observatory Alliance (IVOA) is an organisation that debates and agrees the technical standards that are needed to make the VO possible. It also acts as a focus for VO aspirations, a framework for discussing and sharing VO ideas and technology, and body for promoting and publicising the VO.

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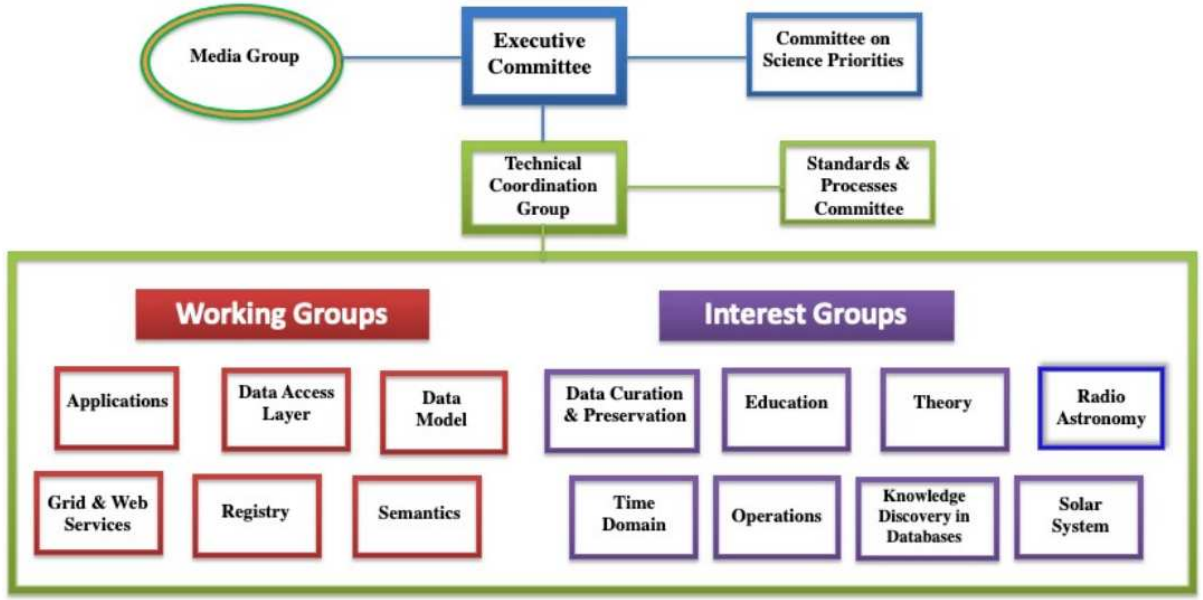
IVOA – members & organisation



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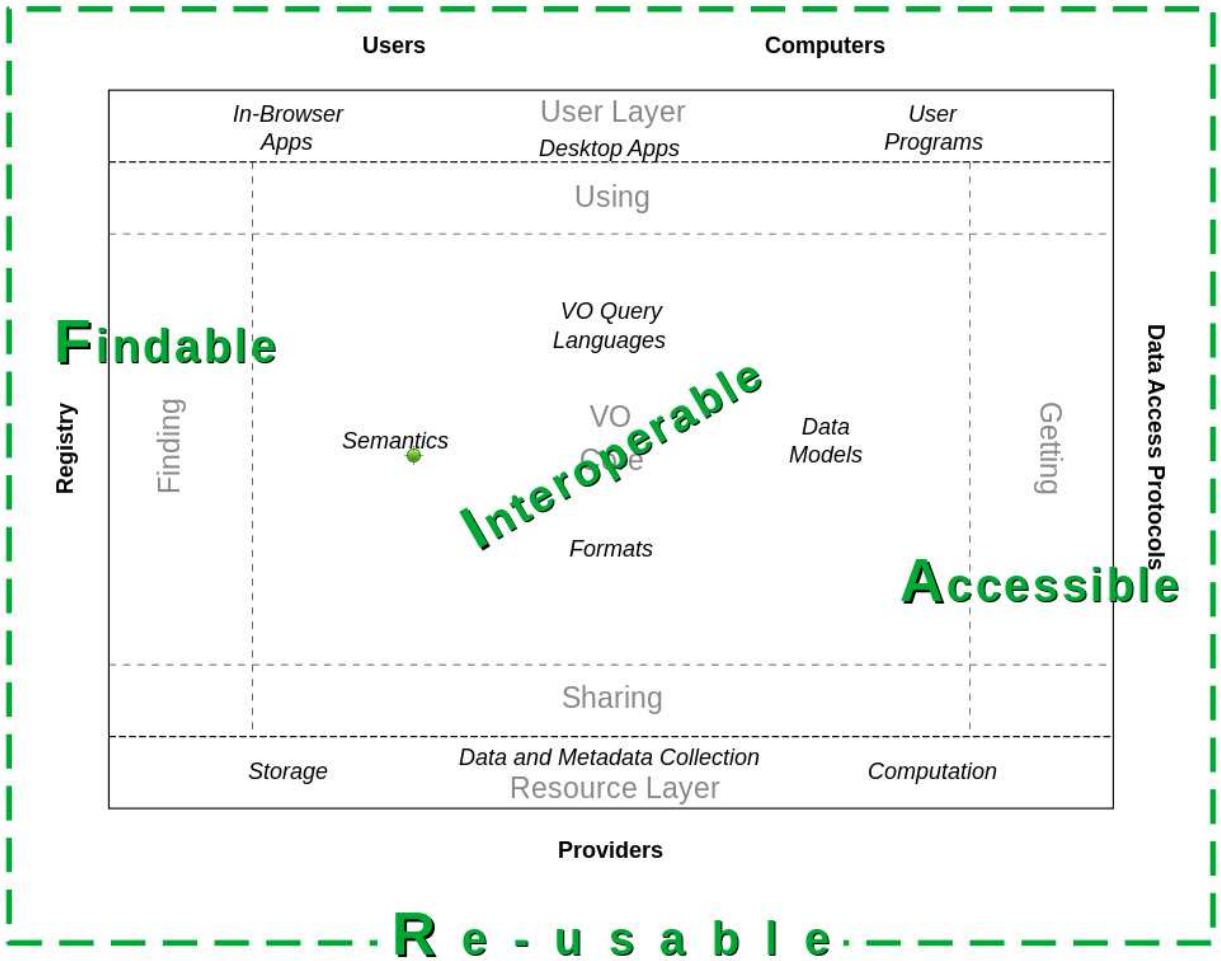
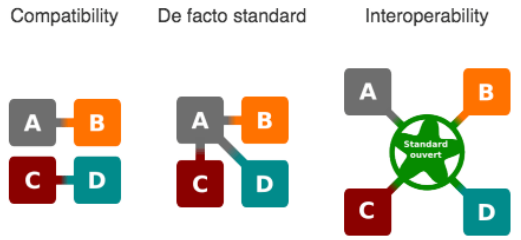
FAIR & IVOA Architecture

FIND
through the *Registry of Resources,*
ACCESS
them consuming *Data Access Layer*
protocol based services,
available via VO enabled *Applications,* that
INTEROPERATE
leveraging upon standardised:
Semantics, Data Models, Formats and Languages,
and *(Grid &) Web Services* technical standards.
Enable **RE-USE**
taking advantage of the above open standards.
(imagine a 3rd dimension on top of this diagram,
supported by Provenance metadata)





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Historical overview

Technical

Community

Semantics

FITS: Flexible Image Transport System
Discussed late ‘70, first formalisation 1981, version 4.0 2018
Focus on long term preservation and back-compatibility

ADASS: Astronomical Data Analysis Software & System
ADASS I, 1991 / ADASS XXXII, 2022
Community on data software and systems in astrophysics

IVOA: International Virtual Observatory Alliance
Formed 2002

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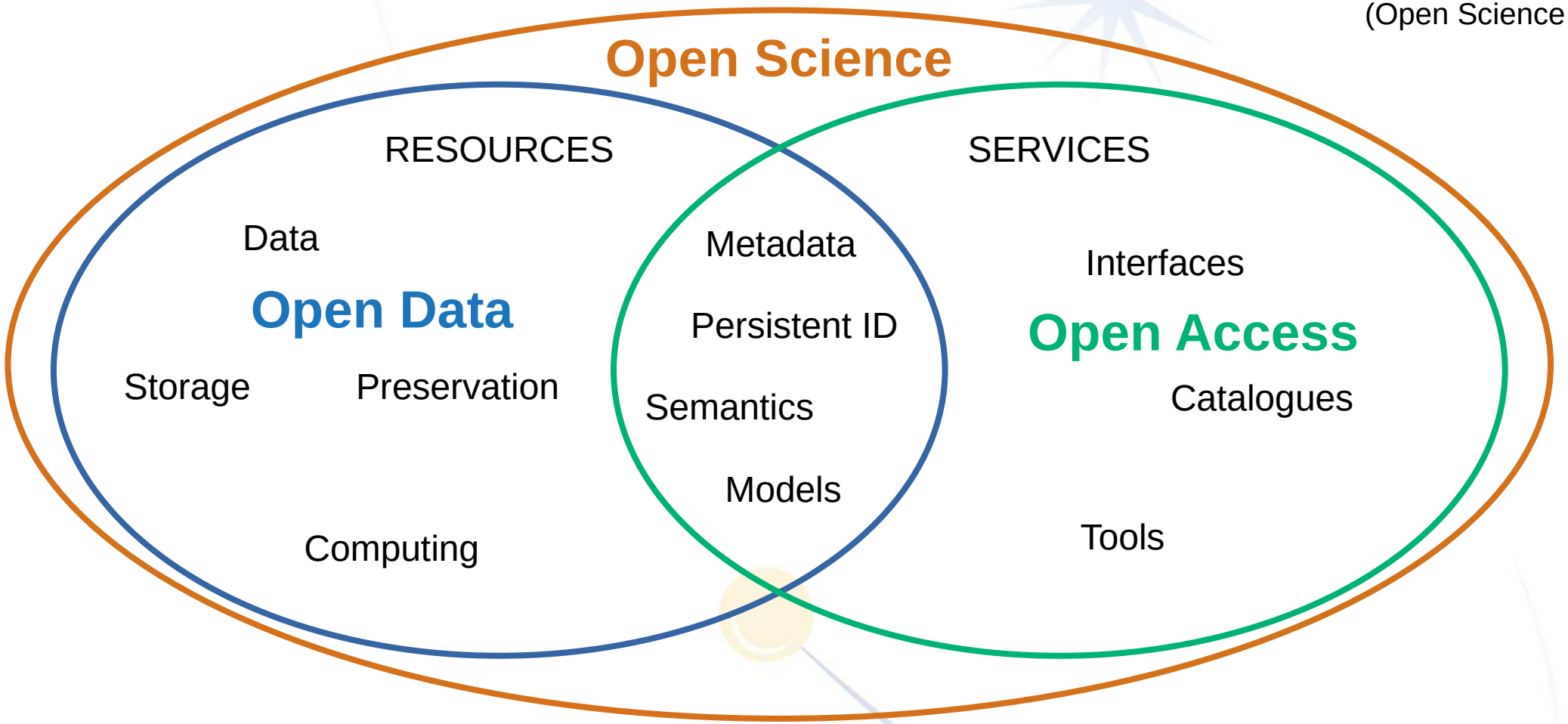
Open Science

Open Science involves transitioning from a system in which it is **difficult** to access and locate the results of scientific research to one that **openly** distributes results to all kinds of end users […]

(Open Science Conference, EU 2016)



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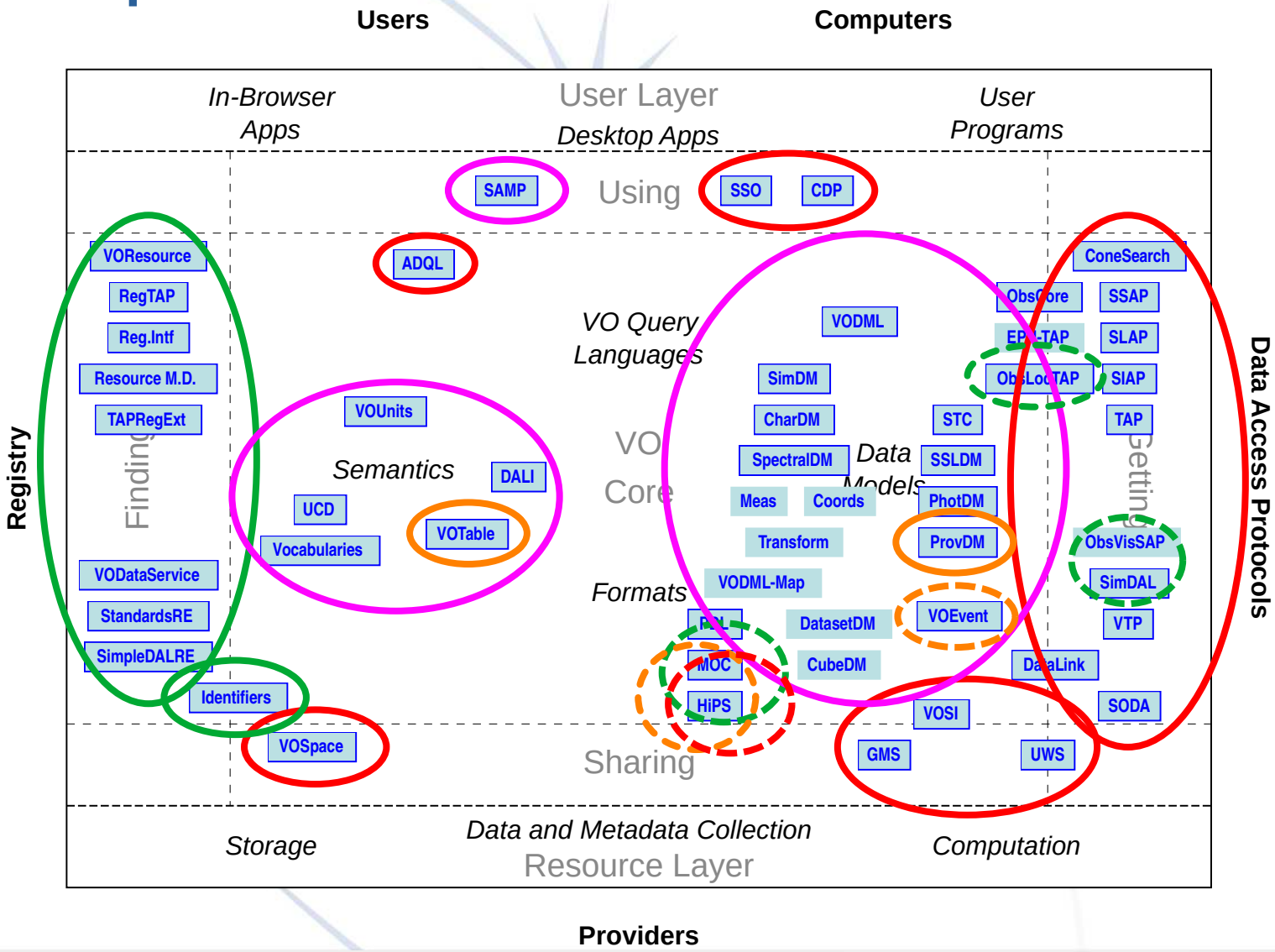
Enabling FAIR principles

FINDABLE

ACCESSIBLE

INTEROPERABLE

RE-USABLE



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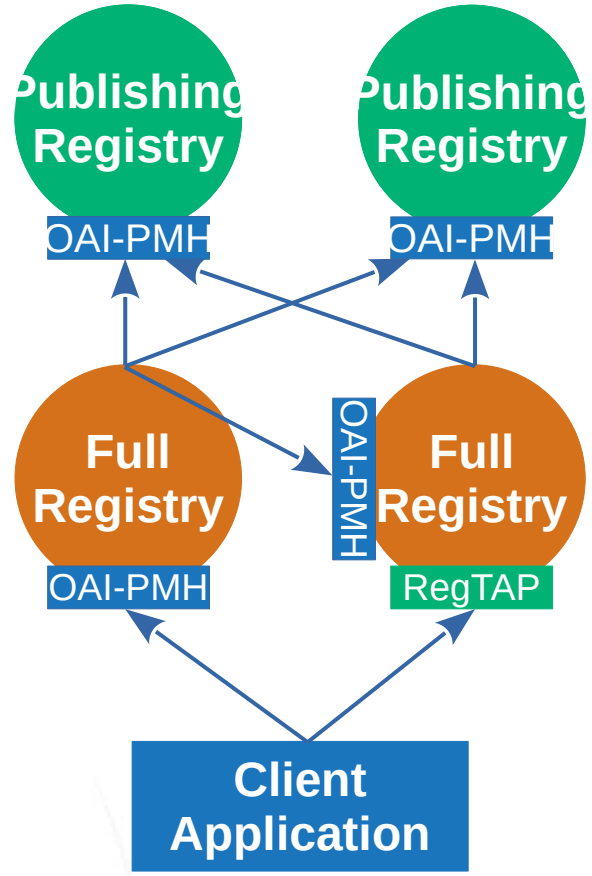
Findable

F1. (Meta)data are assigned a globally unique and persistent identifier

F2. Data are described with rich metadata (defined by R1 below)

F3. Metadata clearly and explicitly include the identifier of the data they describe

F4. (Meta)data are registered & indexed in a searchable resource



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Accessible

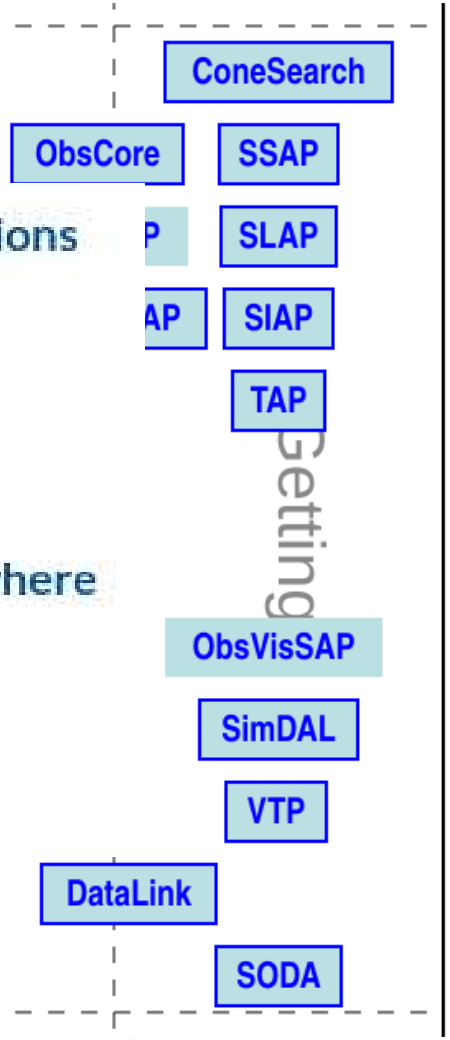
Data Centres / Archives Managed

A1. (Meta)data are retrievable by their identifier using a standardised communications protocol

A1.1 The protocol is open, free, and universally implementable

A1.2 The protocol allows for an authentication and authorisation procedure, where necessary

A2. Metadata are accessible, even when the data are no longer available



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Interoperable

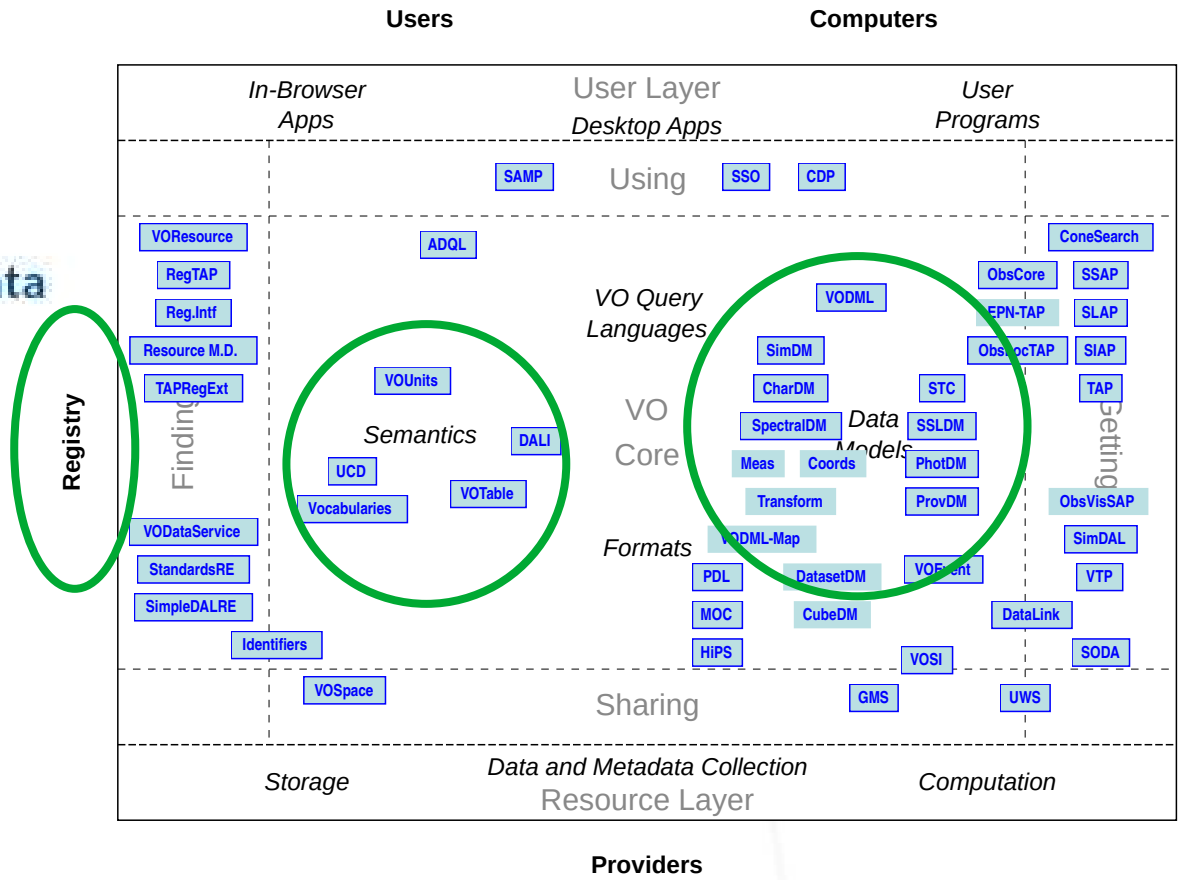
I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.

I2. (Meta)data use vocabularies that follow FAIR principles

I3. (Meta)data include qualified references to other (meta)data

There should be a reason why the
VO community
gets together twice a year in

IVOA Interoperability Meetings



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Re-usable

R1. (Meta)data are richly described with a plurality of accurate and relevant attributes

R1.1. (Meta)data are released with a clear and accessible data usage license

R1.2. (Meta)data are associated with detailed provenance

R1.3. (Meta)data meet domain-relevant community standards

International Virtual Observatory Alliance

uptake

IVOA Provenance Data Model
Version 1.0

IVOA Recommendation 2020-04-11

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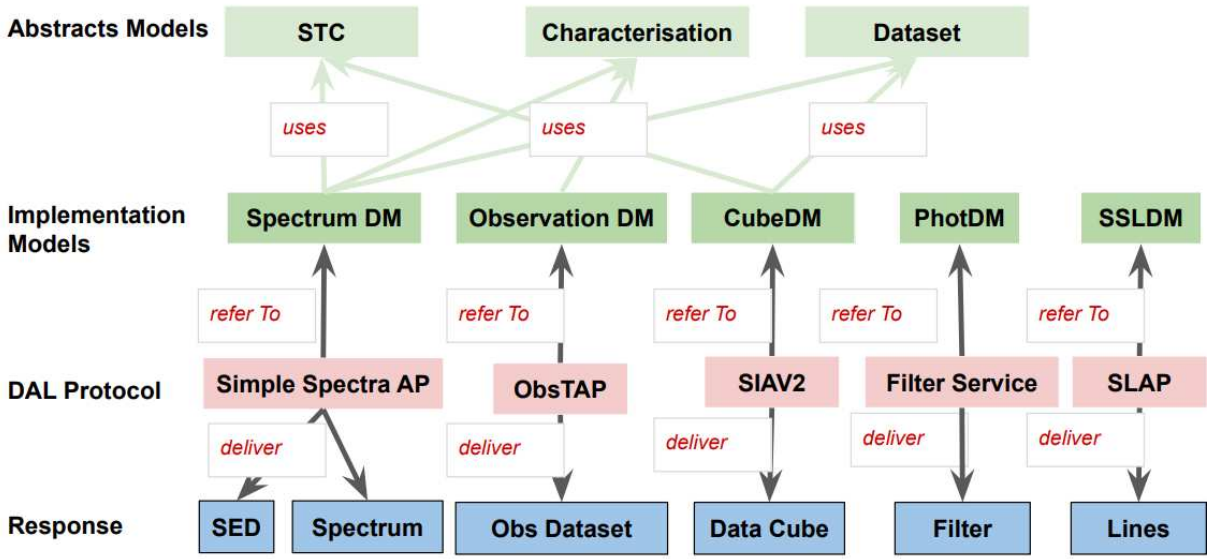
Metadata granularity

Documentation: Binding DAL protocols with models



Responses are all VOTables
VOTable fields and params are defined by the DAL protocol
They match the model by construction

7

Laurent Michel, Jesus Salgado -- Locktown - 2020

Resource level
- Identification, curation, content, coverage
- interfaces & capabilities

Dataset annotation
- spatial, spectral, temporal, messenger, observables…
- Access, data linking (W3C~like)

Tableset annotation
- Similar, at column/field level

Provenance

- All based upon
  - conceptual models
  - metadata models
  - controlled lists
  - vocabularies/ontologies
- Plus an extra abstraction layer
  - Data Modelling Language
    - [UML profile]

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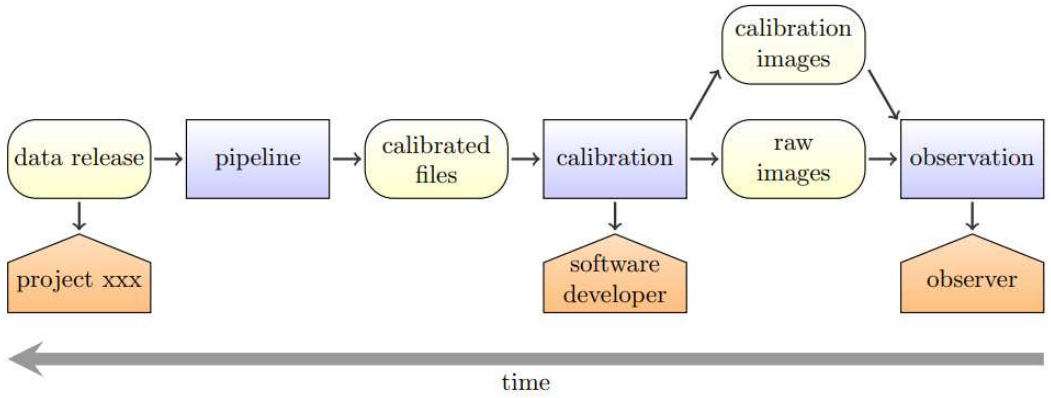
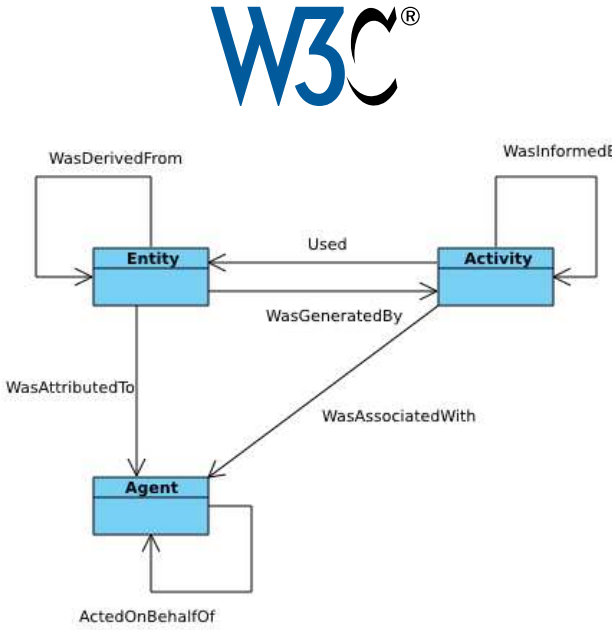
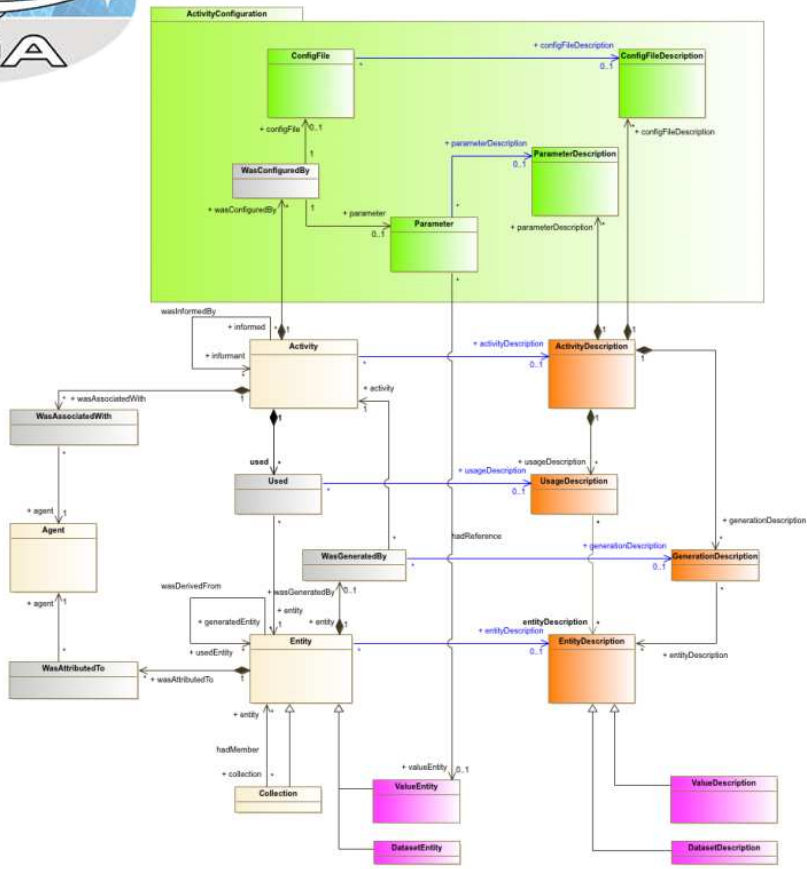
Provenance

- Annotate activities and processes leading to a resource
- Can be used to enable re-use
- Finer granularity leads to complexity in representation
- Difficult to keep all information in one place







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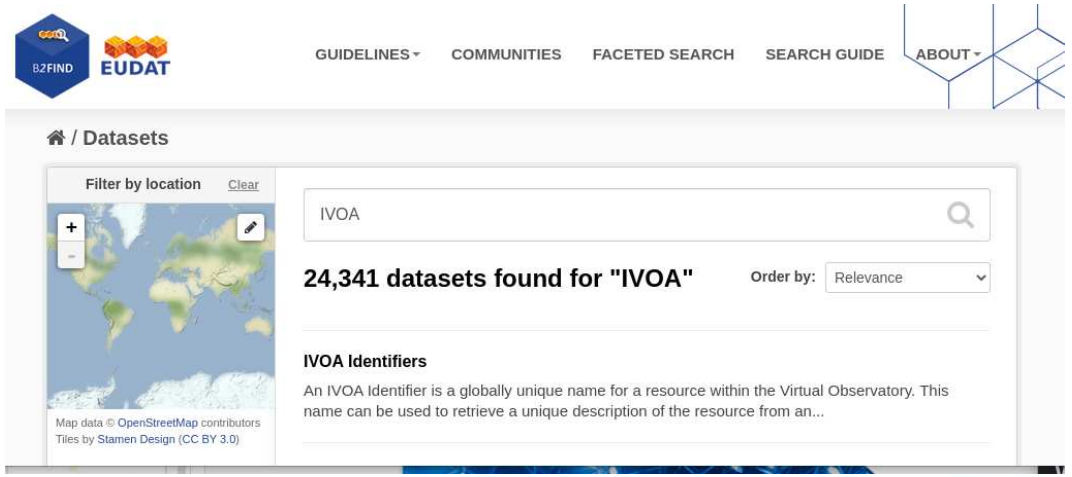
ESCAPE

- Keeps alive (mainly with CEVO) VO flavoured interoperability
  - VO integration in EOSC
    - IVOA Registry of Resources in EUDAT (OpenAIRE?)
    - **Semantic Interoperability** TF
  - Update of the IVOA standards from ESFRI requirements
    - Including Radio IG efforts
    - ESAP joint effort
      - Execution Planner standardisation effort
- Continue(d) VO School dissemination

Zanichelli Tue. 24/5

Bertocco Tue. 24/5



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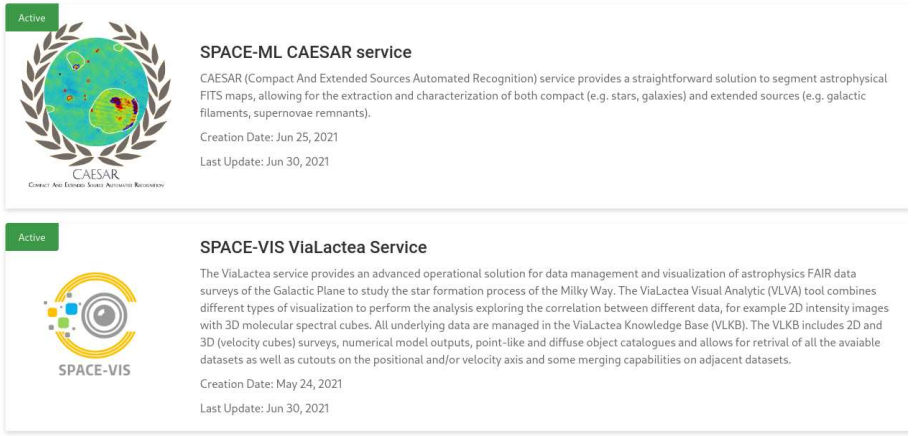
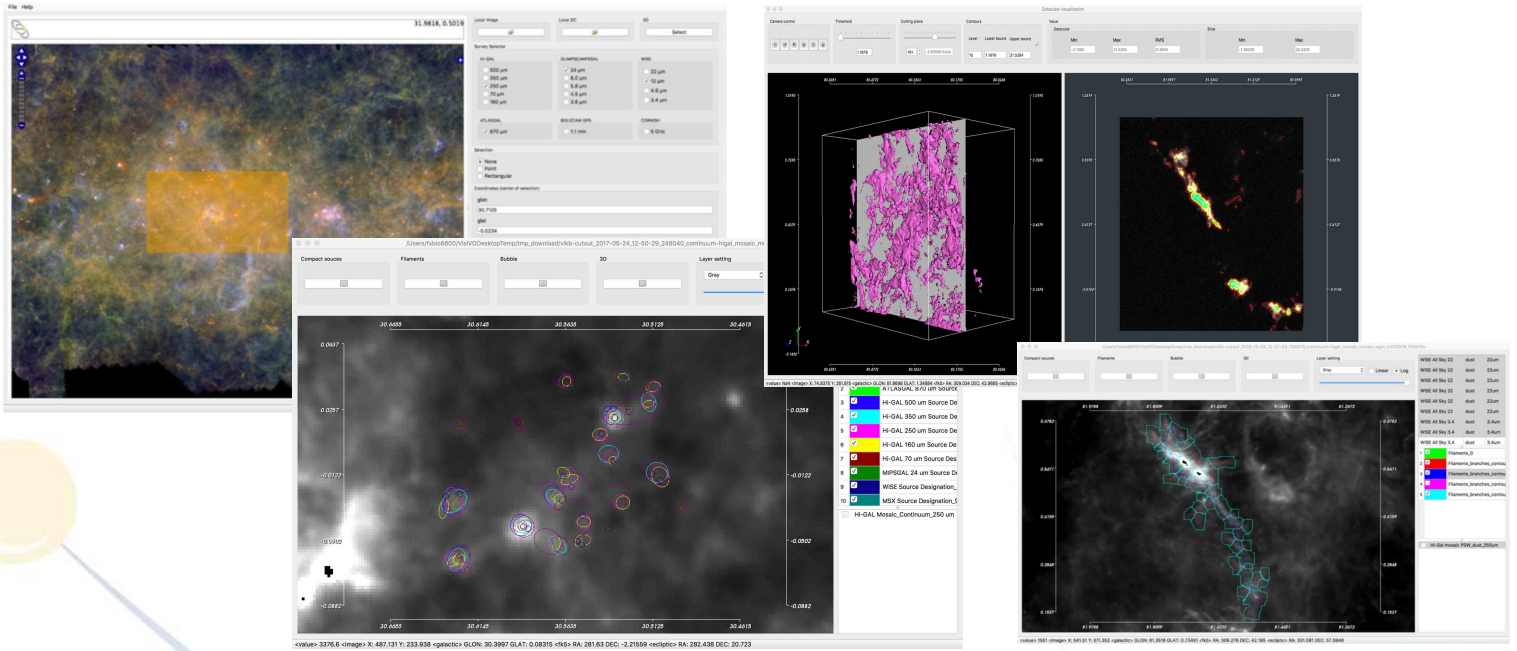
NEANIAS/VLKB

Sciacca Tue. 24/5

- NEANIAS
  - **Technical Interoperability**
  - Integration of data & services in EOSC
  - Cloud solution
- VLKB
  - Heterogeneous data collection
  - Project customised solutions
  - Bring them to interoperability



Vitello Tue. 24/5



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… more work, more projects, different *astro*domains …

- EPN-2024-RI / VESPA
- SOLARNET
- ASPIS prototype (CAESAR)
- …
- IVOA CSP restarted community engagement
- …

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ESCAPE … closing (?)

Lessons Learned II

- **Let machines do the work for us!**
  - nice idea, but not feasible now; even not (yet) google dataset search - all for SEO?
  - in reality most data are not exposed at all but 'hidden' in community specific repositories
  - those that are exposed use varying metadata schemas, even those who use 'standards' do this differently
  - making data FAIR is a good way – but it just started and it must be *done* by someone
- **B2FIND**
  - an entry point to search for research data
    → we can´t (and don´t intend to) replace existing search portals
  - given the flexible metadata ingestion, B2FIND is not only a metadata aggregator but also a metadata curator
    → make b2f specific mappings reusable by others!
  - consulting/advice is extremly important – communication is key!

February 24th 2022 Fair´s´Fair Webinar 17

Claudia Mertens (DKRZ)
Metadata exchange issues (webinar)
“Practical advice and lessons learned from the B2FIND perspective”

“Metadata is what holds the VO together”

Dave Morris (ROE/UEDIN)
ESCAPE Cross-WP meeting, 24 May 2022

If you want to go fast go alone,
If you want to go far go together.

(African proverb)

Thanks!

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