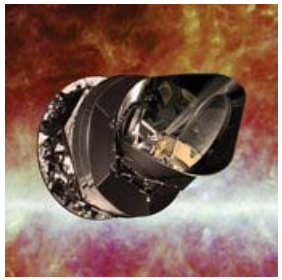
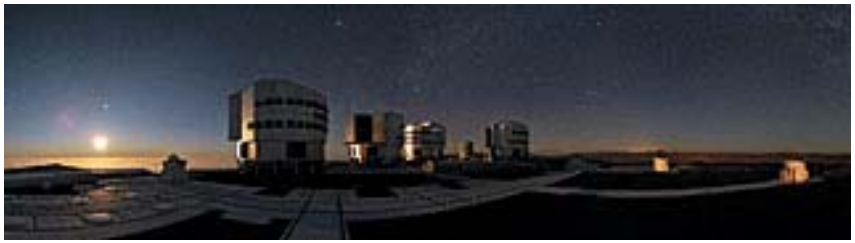
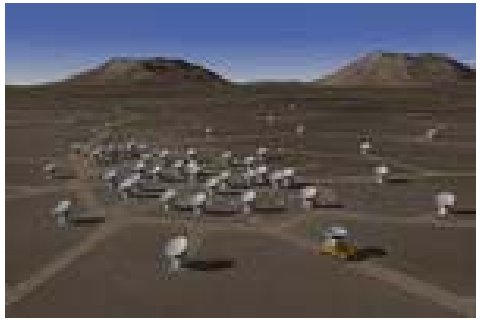
FAIR Principles and the VO DADI Status

Françoise Genova

Research infrastructures in astronomy







And data!

The astronomical data infrastructure

- Includes
  - Observatory archives
  - Very large surveys
  - Value-added databases
  - Journals and the ADS bibliographic database
  - Long tail of data (results attached to publications)
  - Modeling results

Early standards

- A long tradition of international collaboration to build telescopes and instruments
- Early work on standards by practitioners
  - Data format FITS (1977)
    - Integrates data & metadata
    - Enables sharing telescopic observations
    - Enables tool development
  - Bibcode (late 80's)
    - Identifies a bibliographic reference
    - Human readable
    - Long before DOIs!
    - Links between databases and journals

Early data sharing

- Open science is currently a hot topic
- Astronomy has been a pioneer
  - CDS created in 1972 (remote access to IBM mainframe!)
  - FITS data format 1977
  - IUE (1978-1996) database – remotely accessible
  - Bibcode (publication ID) end of 90's
  - Networked on-line data & bibliographic services started 1993-94
  - VO concept ~2000, precursors beforehand

The astronomical Virtual Observatory

- The astronomical interoperability framework
- Developed and maintained by the International Virtual Observatory Alliance
  - Created in 2002
  - Gathers national initiatives + Euro-VO + ESA
  - All continents represented
- IVOA oversees the development of interoperability standards
  - Thin interoperability layer on top of data holdings

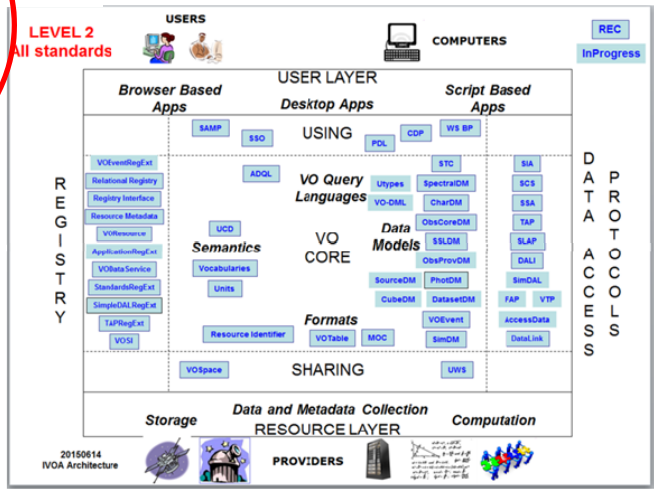
The VO architecture

INTEROPERATE

FIND

ACCESS

REUSABLE DATA



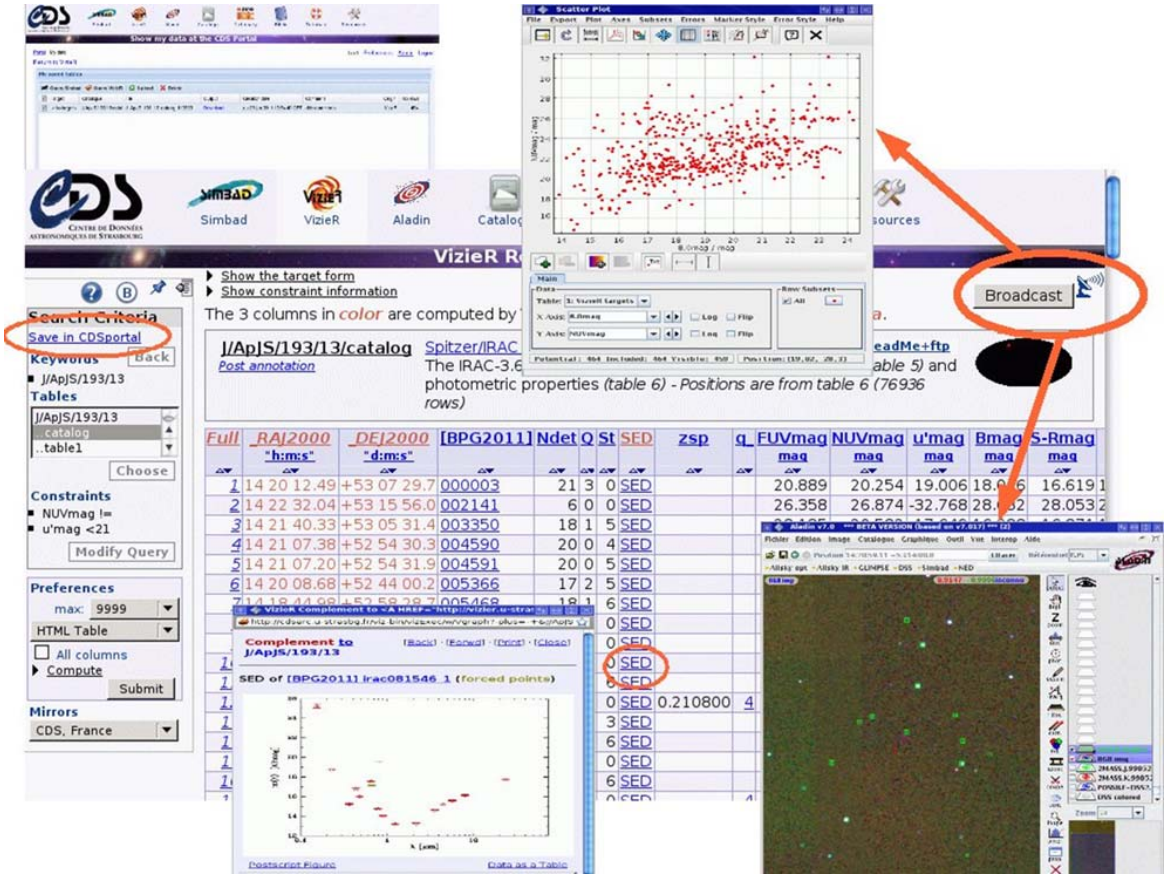
Astronomical data is open and FAIR

- Data providers
  - Reusable data (FITS)
  - In general short embargo period for observations
- VO developers
  - Framework to find, access, intereoperate data
  - Interoperable tools (Applications WG)

The astronomical Virtual Research Environement

- Open and inclusive
  - Anyone can register a resource
  - Anyone can develop an interoperable tool
- More than 100 authorities declared at least one resource in the IVOA Registry of Resources
  - Big players and smaller teams
- Operational and used

Interoperable VO tools



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- The VO framework is reused

ASTERICS WP4 DADI

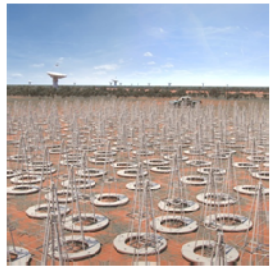
- Data Access, Discovery and interoperability
- Make the ESFRI and pathfinder project data available for discovery and usage by the whole astronomical community, interoperable in the VO, and accessible with a set of common tools
- Fully aligned with the current IVOA priorities
- Astronomy + astroparticle physics

Projects involved in ASTERICS/DADI

ESO – Associate Partner ELT/VLT

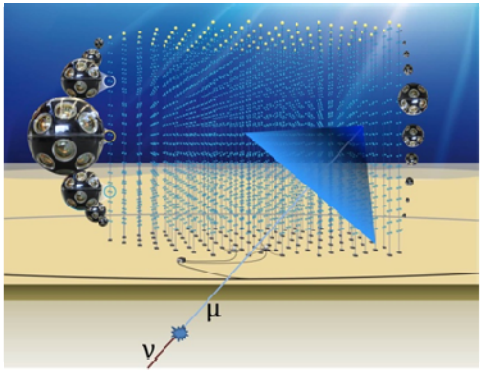
ESA – close collaboration – space requirements! (incl. Planetary sciences

CTA

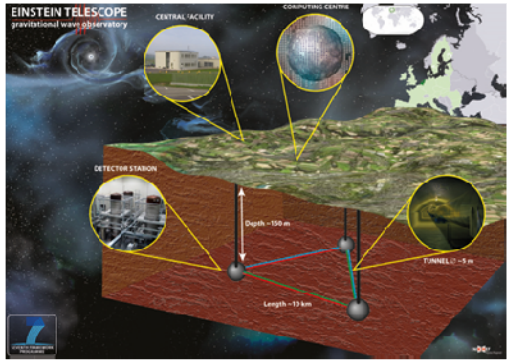


SKA

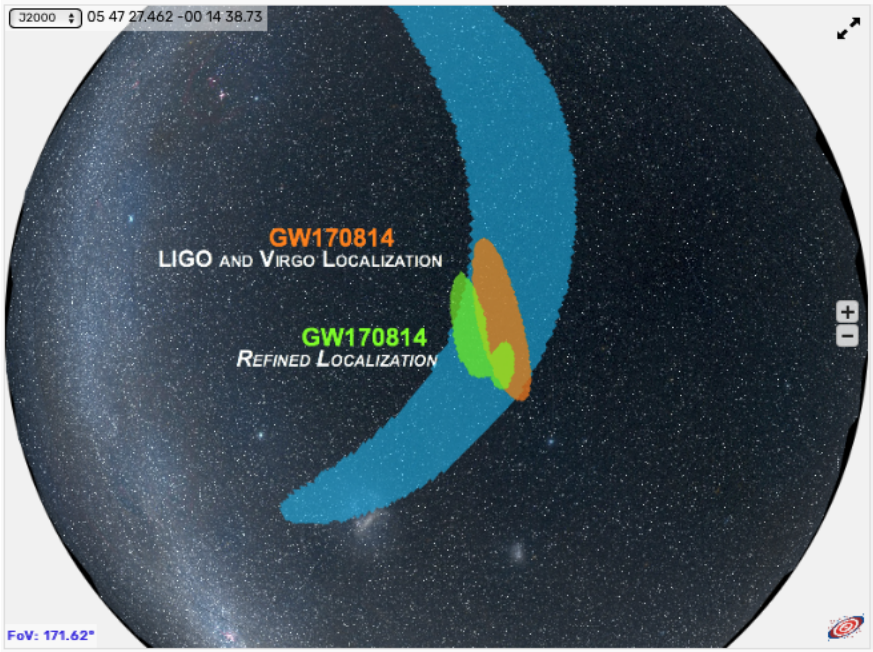
KM3Net



EGO/ET



An example of the results



Using the skymap

Click on the various options below to display information relating to each detection.

Detection	Sky localisation	Label	Pop-up info
GW170814 - L1/H1 only	✓	☐	☐
GW170814 - L1/H1/V1	☑	☑	☐
GW170814 - refined skymap	☑	☑	☐
GW150914	☐	☐	☐
GW151226	☐	☐	☐
GW170104	☐	☐	☐

Backgrounds

If you want to see the extension of these sky regions through the constellations you can select an artistic background image ○ **Constellations.**

You can also select various background images at different wavelengths, combining the electromagnetic data with the gravitational-wave information: ◉ **Mellinger (default)** ○ **WISE** ○ **2MASS** ○ **DSS color** ○ **XMM** ○ **Fermi**

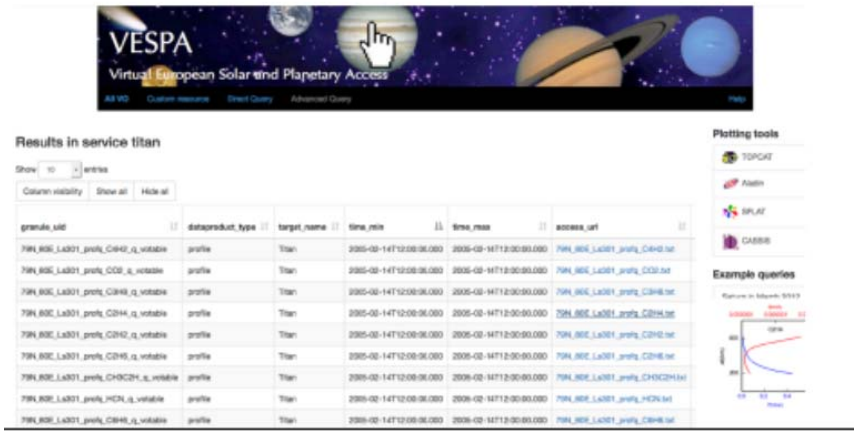
The VO is reused

- Starting point: Thin interoperability layer for astronomy
- Building blocks reused by data providers in the archival systems
- ASTERICS: Astrophysics/Astroparticle physics
- Standards and tools customized by planetary studies & the Virtual Atomic and Molecular Data Centre
- Registry customized by Material Sciences in a RDA Working Group

Cross-disciplinary use

VESPA data services

- **A table describing each of the service files (using std parameters)**
- **Stored in postgresql + TAP-handling application at the institutes**
- **Searches through an optimized interface, connected to VO tools**



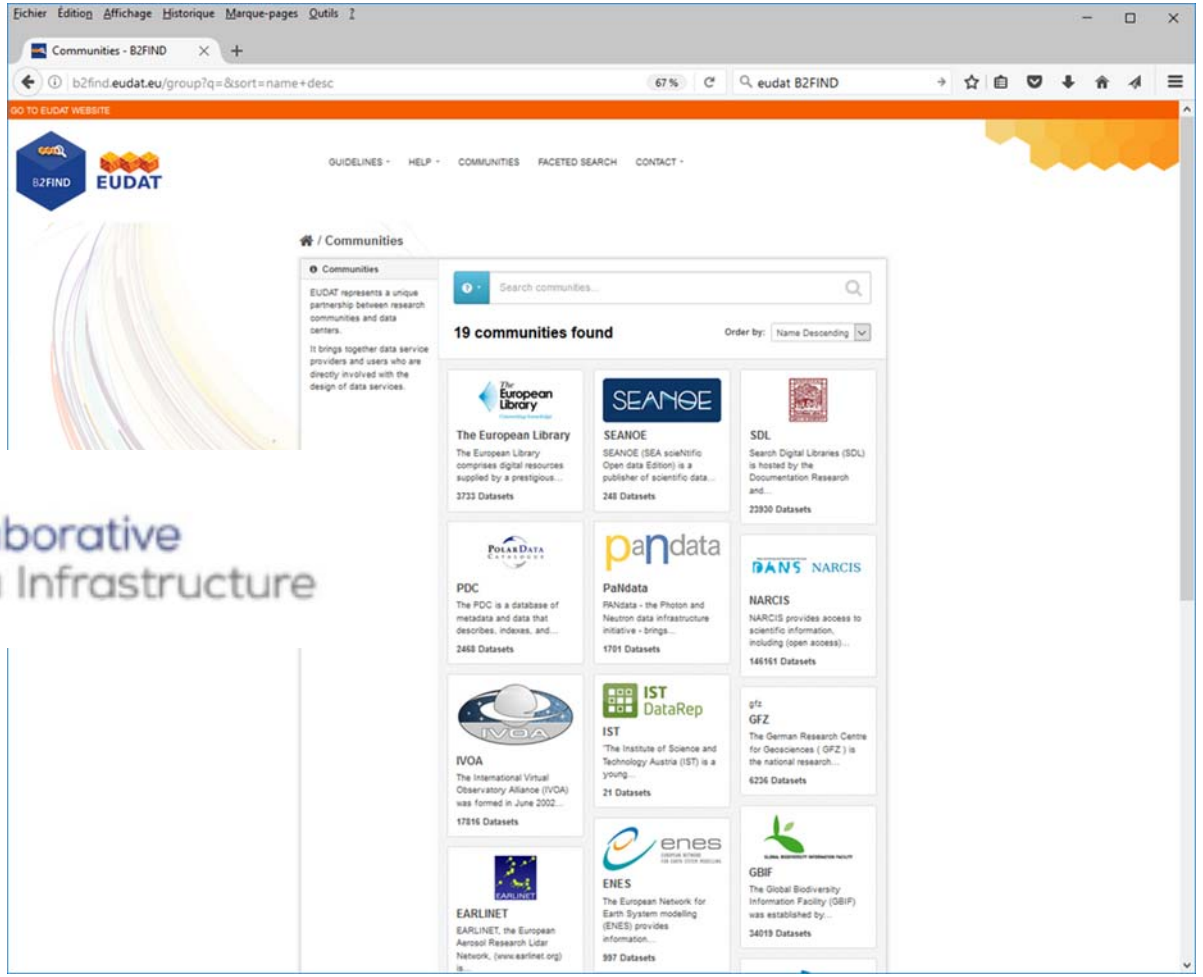
- Planetary sciences
  - EuroPlaNet/VESPA
  - IVOA IG
- Virtual Atomic and Molecular Data Centre VAMDC

Key building blocks for disciplinary reuse

- Registry of resources
  - OAI-PMH
  - Dublin Core with disciplinary extensions
- Vocabularies: W3C SKOS-RDF

RELATIONSHIP WITH GENERIC INITIATIVES

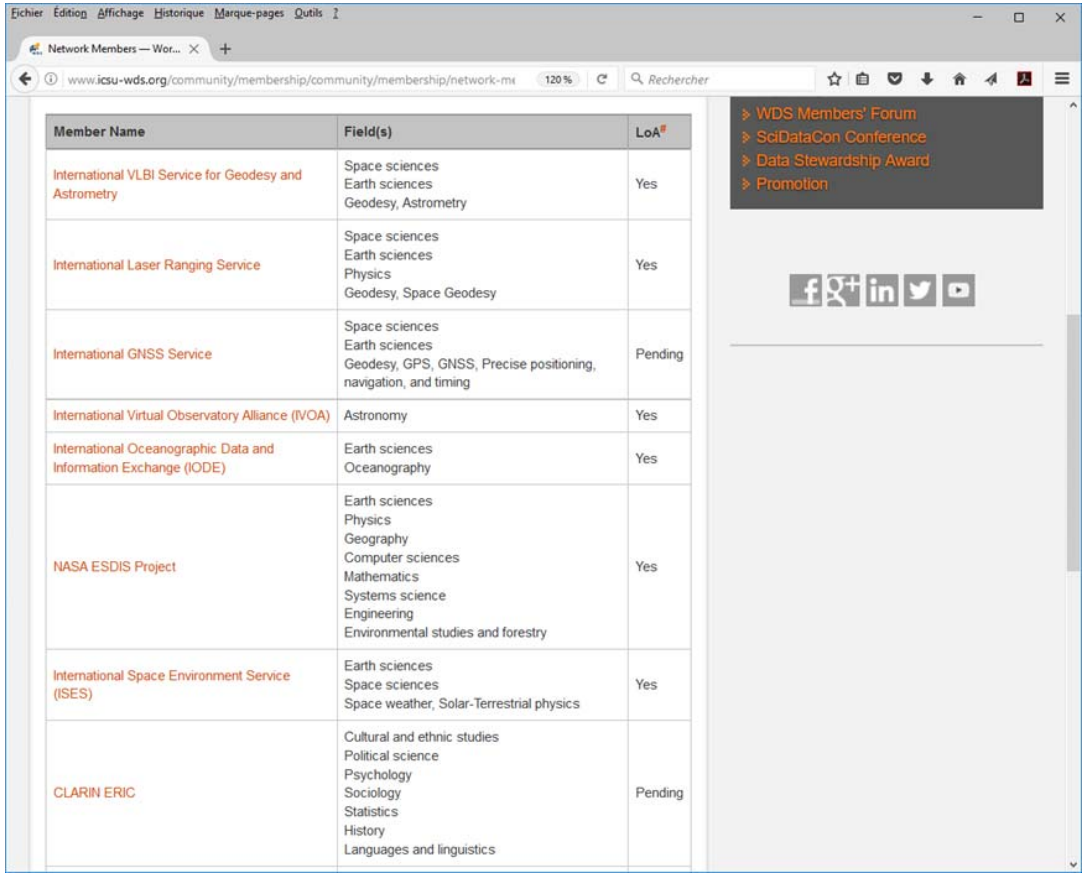
IVOA in EUDAT B2FIND Registry



EUDAT Collaborative Data Infrastructure

IVOA is a WDS Network member

ICSU WORLD DATA SYSTEM



Fichier Édition Affichage Historique Marque-pages Outils ?

Network Members — Wor...

www.icsu-wds.org/community/membership/community/membership/network-m

120 %

Rechercher

Member Name	Field(s)	LoA
International VLBI Service for Geodesy and Astrometry	Space sciences Earth sciences Geodesy, Astrometry	Yes
International Laser Ranging Service	Space sciences Earth sciences Physics Geodesy, Space Geodesy	Yes
International GNSS Service	Space sciences Earth sciences Geodesy, GPS, GNSS, Precise positioning, navigation, and timing	Pending
International Virtual Observatory Alliance (IVOA)	Astronomy	Yes
International Oceanographic Data and Information Exchange (IODE)	Earth sciences Oceanography	Yes
NASA ESDIS Project	Earth sciences Physics Geography Computer sciences Mathematics Systems science Engineering Environmental studies and forestry	Yes
International Space Environment Service (ISES)	Earth sciences Space sciences Space weather, Solar-Terrestrial physics	Yes
CLARIN ERIC	Cultural and ethnic studies Political science Psychology Sociology Statistics History Languages and linguistics	Pending

WDS Members' Forum
SciDataCon Conference
Data Stewardship Award
Promotion

IVOA gateways to RDA

- FG co-chair of RDA Technical Advisory Board
- Lessons learnt from building the IVOA are taken into account
- Staff from several IVOA national initiatives participate actively

  Certification, Long Tail of Data, Provenance, Dynamic Data Citation, Federated Identity Management, Research Data Repository Interoperability, Repository Platforms for Research Data, Units of Measures
- Participation in ENVRI-RDA Summer School (MM)
- Disciplinary Collaboration Framework IG (D. Schade)
- Discussion of RDA status and activities at each IVOA meeting

RDA Research Data Sharing without barriers
RESEARCH DATA ALLIANCE

DADI STATUS

https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:start

2017 Deliverables

- Third Technology Forum, 22-23 March, Strasbourg
- Third School, 14-16 November, Madrid
- This ESFRI Forum & Training Event
- Repository of DADI Products

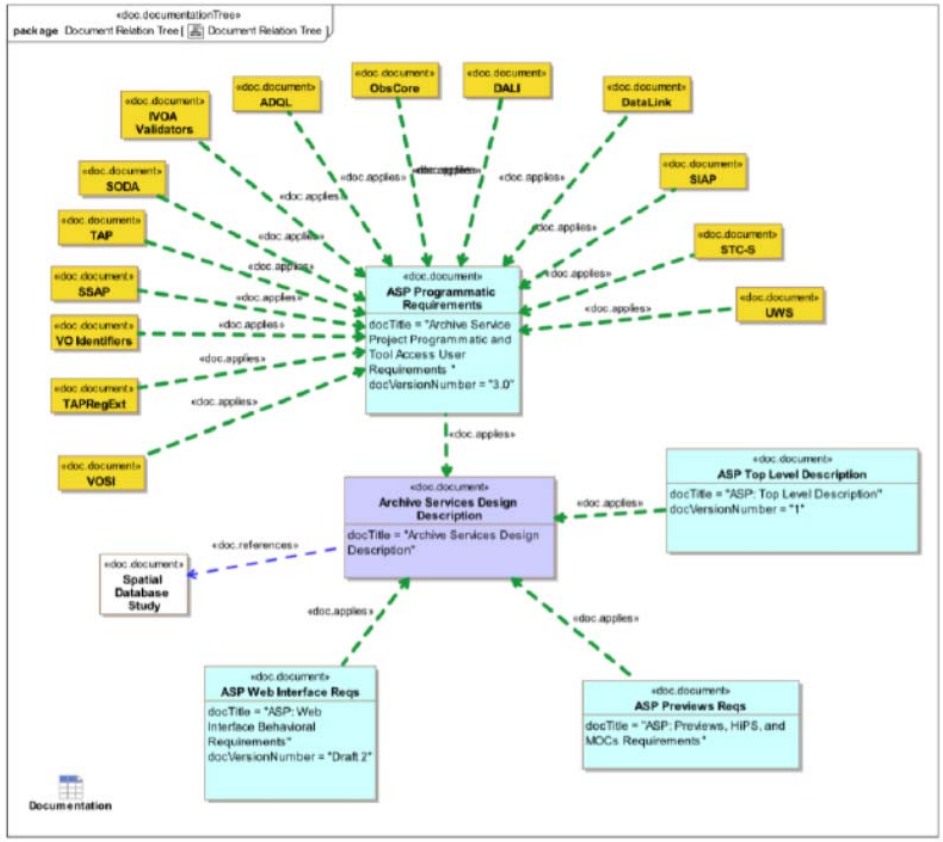
2017 Milestones and RDA

- Two IVOA Interoperability meetings
  - 14-19 May, Shanghai
  - 27-29 October, Santiago (+ADASS)
- Two RDA Plenary meetings
  - P9 Barcelona, 5-7 April
  - P10 Montreal, 19-21 September

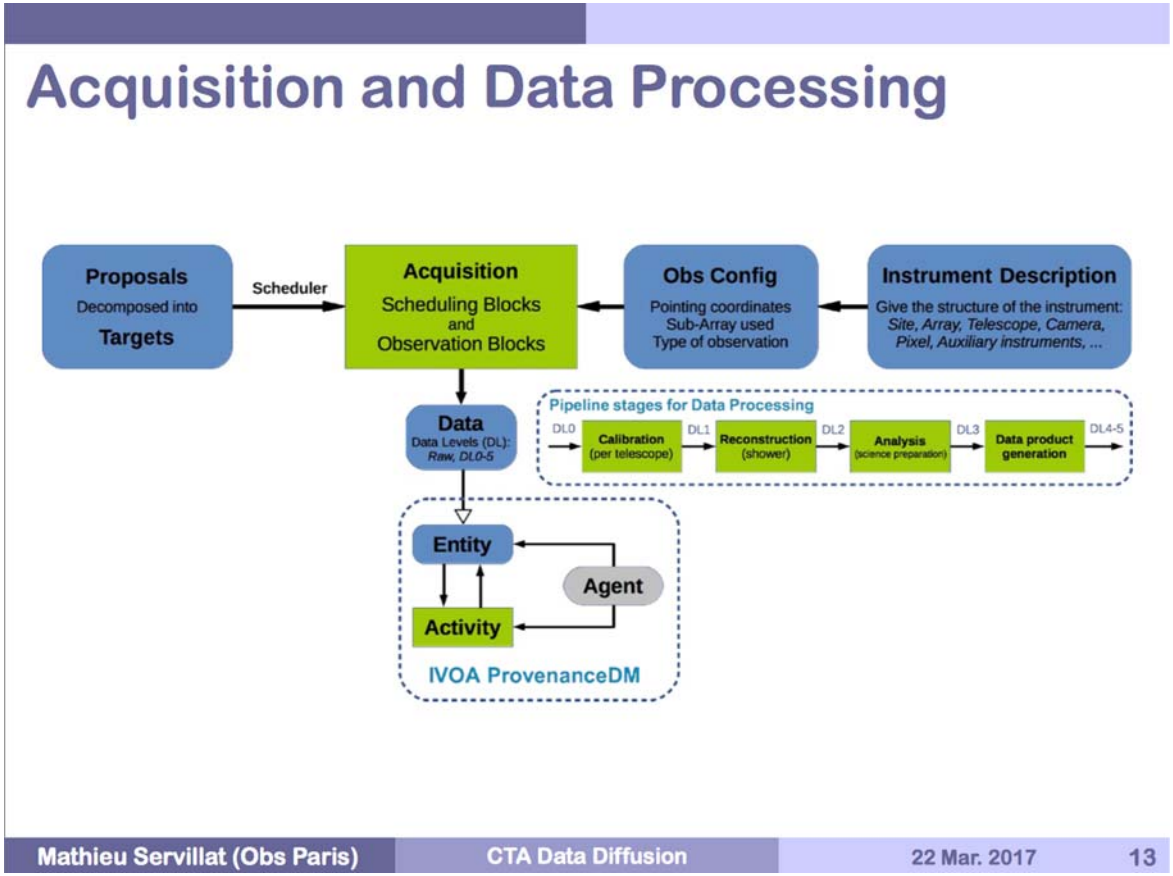
Specific meetings

- SVO School, 6-8 March, La Palma
- DADI-CLEOPATRA Time Domain meeting, 21 March, Strasbourg
- Provenance Day, 3-4 May, Montpellier
- GAPS Time Series face-to-face, 22 June 2017, Padova
- Third Cosmology School, Cracow, 10-23 July
- Observatoire Virtuel 2017 @ OCA, 26-27 September, Nice
- Time Series Data Meeting, 5-6 December, Strasbourg

VO standards in ESO plans

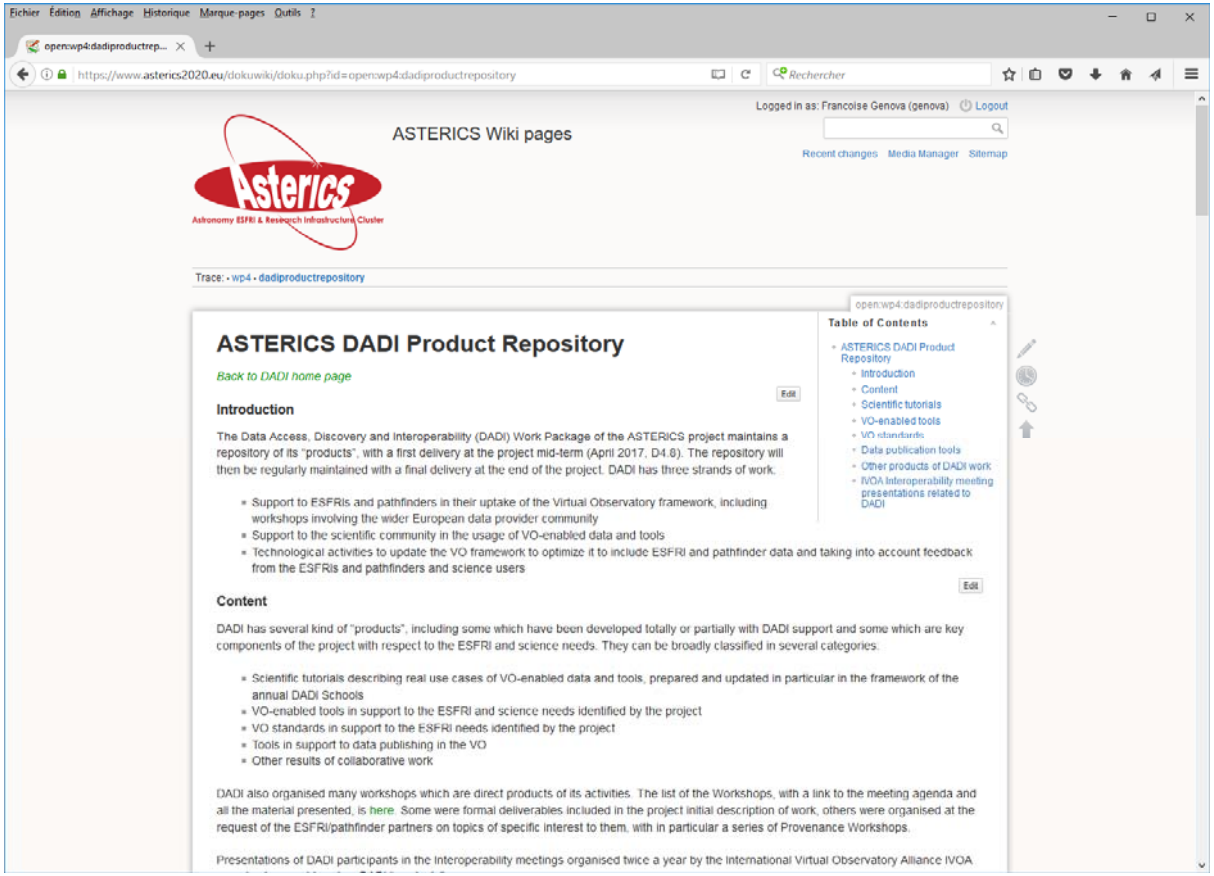


… and in CTA pipeline



D4.8 Repository of DADI « products »

A living document



Next year

- Fourth Technology Forum, March?, Edinburgh
- Data Providers Forum & Training Event, 27-28 June, Heidelberg
- Fourth School, November?, Strasbourg

DADI Impact

- The ESFRIs and pathfinders become consumers AND actors of the VO
- High impact on the IVOA standards, tools and topics (requirements/feedback/effort/expertise), among which
  - Milestone reached with the completion of the Multi-D standards
  - Key role also on leadership & activity in the Time Domain
  - Impact of the Education activities & leadership
- Good relationship with RDA from its beginning
- Ready to highlight impact at IAU & in the ASTERICS Integration Event