The VizieR catalogues system certified by the "Data Seal of Approval"

LISA VIII
Strasbourg, 7/6/2017

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CENTRE DE DONNÉES
ASTRONOMIQUES DE STRASBOURG

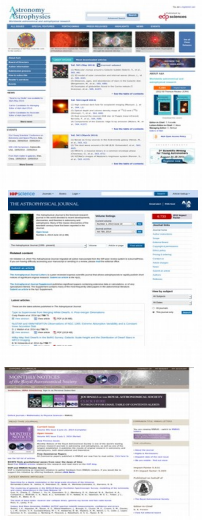
What is VizieR ?

Vizier gives a unified access to a very large collection of astronomical catalogues

- Provides a **free** access to **public** catalogues
- Long term **preservation**

The content origin

- **Tables** from papers published in the major **astronomical journals**
- **Reference catalogues & surveys** e.g. Gaia, SDSS, 2MASS, UCAC, WISE
- **Logs of observations** and incremental datasets updated periodically
- **Associated data:** spectra, images, time-series



VizieR in numbers

~15,000 catalogues,
~30,000 tables

Associated data:

~500 cats. with spectra
~200 cats. with images
~1,200 cats. with time-series

.. But VizieR is also a team

a close collaboration between astronomers, documentalists and engineers

Open Data, what does it means for data center ?

Open data is a very active concept, demanded by authorities for publicly funded, especially for science data.

- The first mission consists of data **preservation** and to give **free access**

  In returns users have to cite the origin (author, article) with persistent identifier

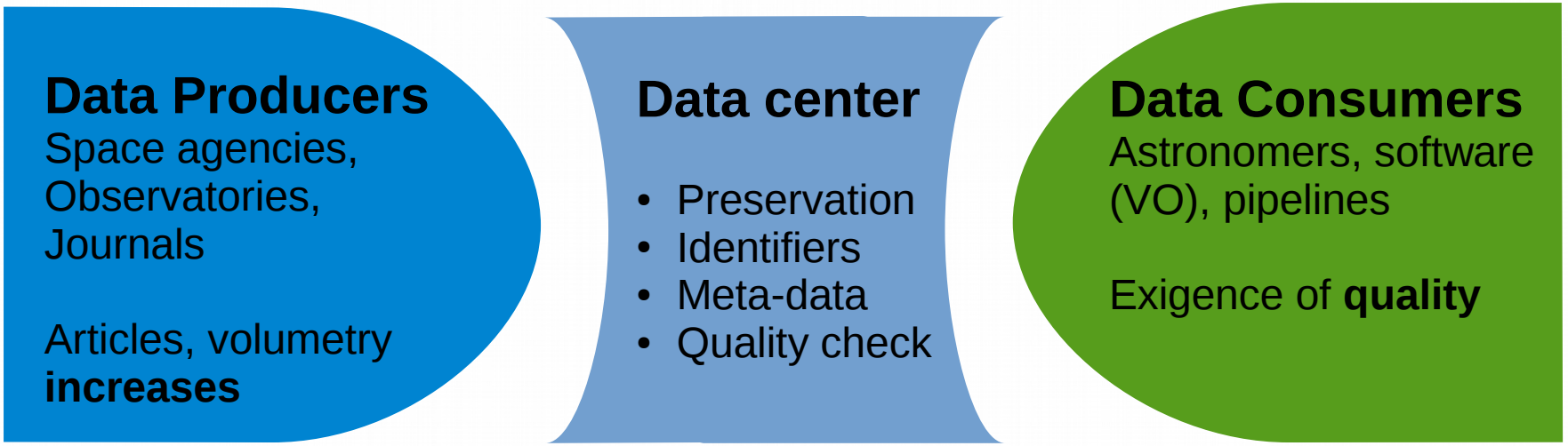
`2009A&A...501..539U`

- The second mission consists of providing **useful data**
  FAIR : **F**undable, **A**ccessible, **I**nteroperable, **R**eusable

  - The **basic meta-data**
    e.g. to provide table means the tables, column description, unit and everything needed for the data understanding
  - **Rich meta-data** which can be reused by softwares
    → interoperability : protocols, formats (IVOA)

Open Data : impacts on Data Centers

A challenge for Data Centers to deal with increasing volume in input and to ensure quality in output



Challenge becoming possible

- through cooperations: intercations with producers and completing the competences locally
- A continued effort to improve the Information Systems

A trustable repository, certified by an external evaluation

DSA certification

DSA: Data Seal of Approval
http://datasealofapproval.org/en/

- The first edition of the DSA : 2008
- Dedicated to science data repositories
- A trusted-based certification simple to get than ISO

To get the DSA certification

The CDS (VizieR) has been certified by the DSA since 2014

- 16 criteria to document
- Certification has to be renewed every 3 years

The DSA requirements

New set of requirements in 2017

- WDS (World Data System) and DSA announce unified requirements
  → Common board and same criteria issued from work in RDA
- Importance of **data reusability**

DSA requirements based on the following five criteria:

- The data can be found on the Internet
- The data are accessible (clear rights and licences)
- The data are in a usable format
- The data are reliable
- The data are identified in a unique and persistent way so that they can be referred to

DSA criteria

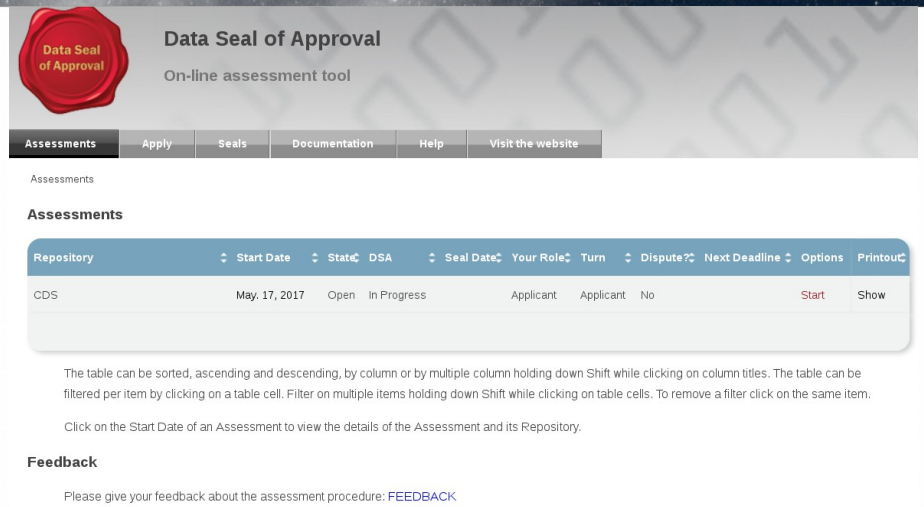
- *Crit. 1: Mission/Scope : The repository has an explicit mission to provide access to and preserve data in its domain.*
- *Crit. 2:Licences : The repository maintains all applicable licenses covering data access and use and monitors compliance.*
- *Crit. 3 : Continuity of access : The repository has a continuity plan to ensure ongoing access to and preservation of its holdings.*
- *Crit. 4: Confidentiality/Ethics : The repository ensures, to the extent possible, that data are created, curated, accessed, and used in compliance with disciplinary and ethical norms.*
- *Crit. 5 : Organizational infrastructure : The repository has adequate funding and sufficient numbers of qualified staff managed through a clear system of governance to effectively carry out the mission.*
- *Crit. 6: Expert guidance: The repository adopts mechanism(s) to secure ongoing expert guidance and feedback (either in-house, or external, including scientific guidance, if relevant).*
- *Crit. 7: Data integrity and authenticity: The repository guarantees the integrity and authenticity of the data.*
- *Crit. 8: Appraisal : The repository accepts data and metadata based on defined criteria to ensure relevance and understandability for data users.*
- *Crit. 9 : Documented storage procedures : The repository applies documented processes and procedures in managing archival storage of the data.*
- *Crit. 10: Preservation plan : The repository assumes responsibility for long-term preservation and manages this function in a planned and documented way.*
- *Crit.11: Data quality : The repository has appropriate expertise to address technical data and metadata quality and ensures that sufficient information is available for end users to make quality-related evaluations.*
- *Crit. 12: Workflows : Archiving takes place according to defined workflows from ingest to dissemination.*
- *Crit. 13 : Data discovery and identification : The repository enables users to discover the data and refer to them in a persistent way through proper citation.*
- *Crit. 14: Data reuse : The repository enables reuse of the data over time, ensuring that appropriate metadata are available to support the understanding and use of the data.*
- *Crit. 15: Technical infrastructure : The repository functions on well-supported operating systems and other core infrastructural software and is using hardware and software technologies appropriate to the services it provides to its Designated Community.*
- *Crit. 16: Security : The technical infrastructure of the repository provides for protection of the facility and its data, products, services, and users.*

16 criteria grouped into 3 topics

- **Organization** (4 criteria)
  - Mission
  - Continuity of access
  - contracts ...
- **Data management** (9 criteria)
  - Licences
  - Integrity and authenticity checking
  - identification
  - meta-data assignment
  - SI description (OAIS)
  - scientific expertise
- **Technology & security** (3 items)
  monitoring, softwares, backup, ...

DSA evaluation

1. Answer the criteria and make the documentation
   - The DSA provides an online assessment service
   - Auto-evaluation to indicate compliance levels for each criteria
     - Not applicable
       e.g.: crit. confidentiality/ethic : VizieR is not subject to disclosure risk
     - 4 levels: Not considered it → implemented



2. DSA Peer review evaluation
   - 1 DSA + 1 WDS reviewer evaluate the responses and write a report
   - The Board examines the report and decides whether to allow the Seal to the data center
3. The Data center certification seal

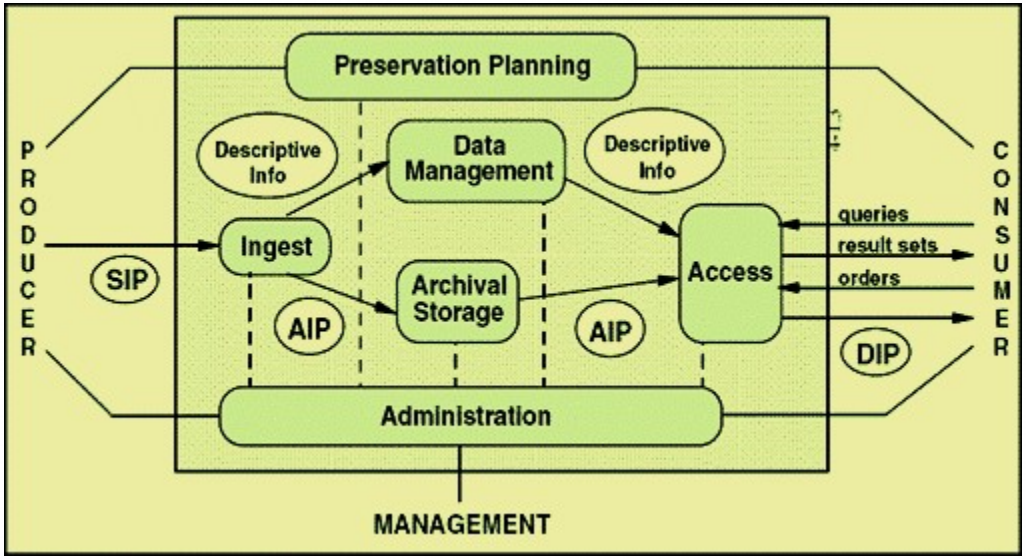
The answers will be public and available in the DSA website and the DSA logo can be displayed in the data center website

Describing the Information System

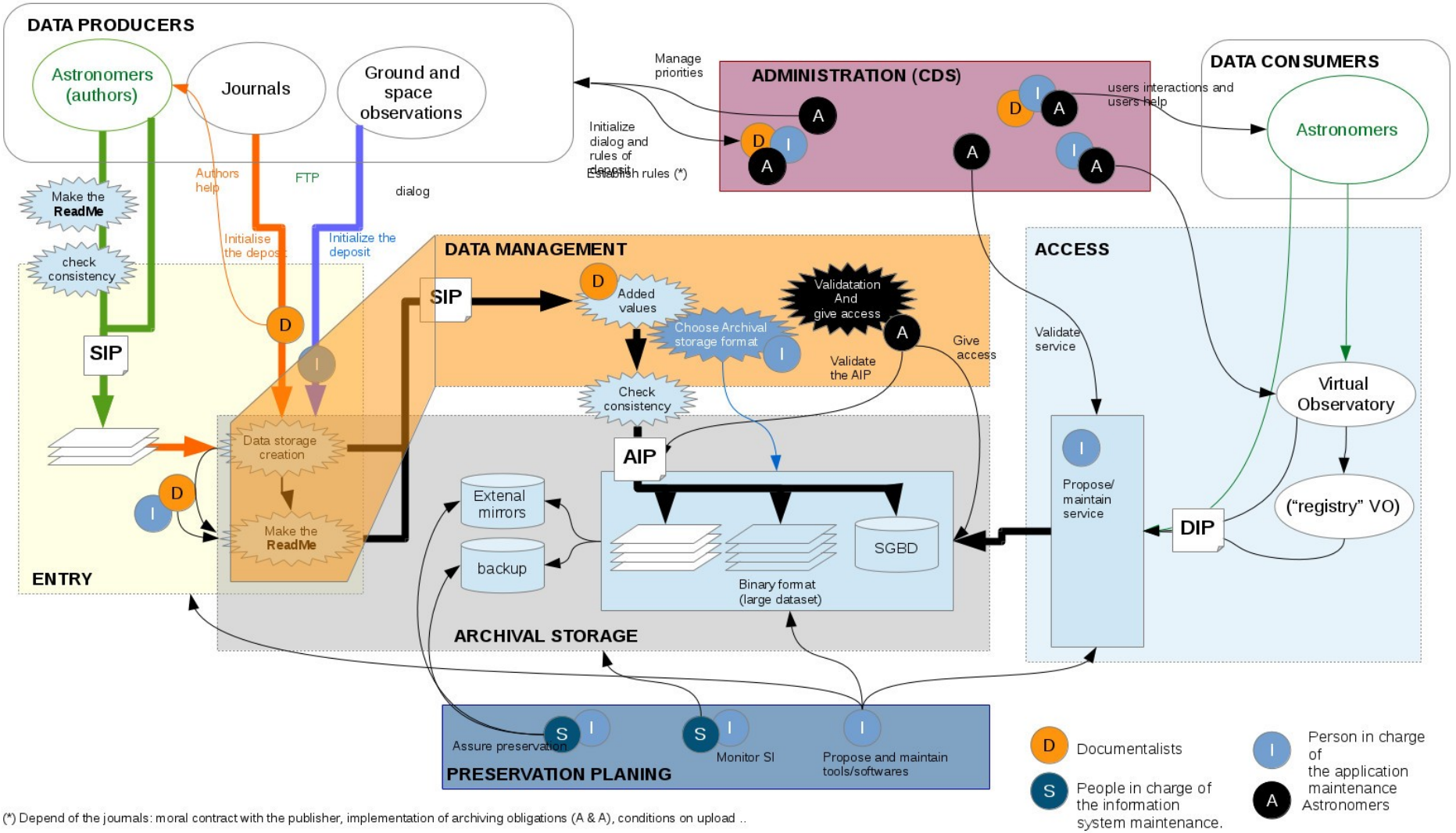
OAIS: Open Archive Information System (norme OAIS, ISO 14721)

Defines a reference model and an editing guideline to describe an Information System (including the system, architecture, staff).

- The packaging information describes data together with meta-data
  - **SIP** : Submit Information Package
  - **AIP** : Archival Information Package
  - **DIP** : Diffusion Information Package
- The OAIS **entities**
  - the worflow description from the input to the dissemination
  - the preservation strategy for the long term
  - The data management
  - The archivage storage
  - The administration



The VizieR Information System



(*) Depend of the journals: moral contract with the publisher, implementation of archiving obligations (A & A), conditions on upload ..

Curation operated by documentalists and validated by astronomers

Ingestion according to relevant criteria

- The data provenance is defined by the CDS Administration
- Data and meta-data contents are subject to criteria defined by the CDS

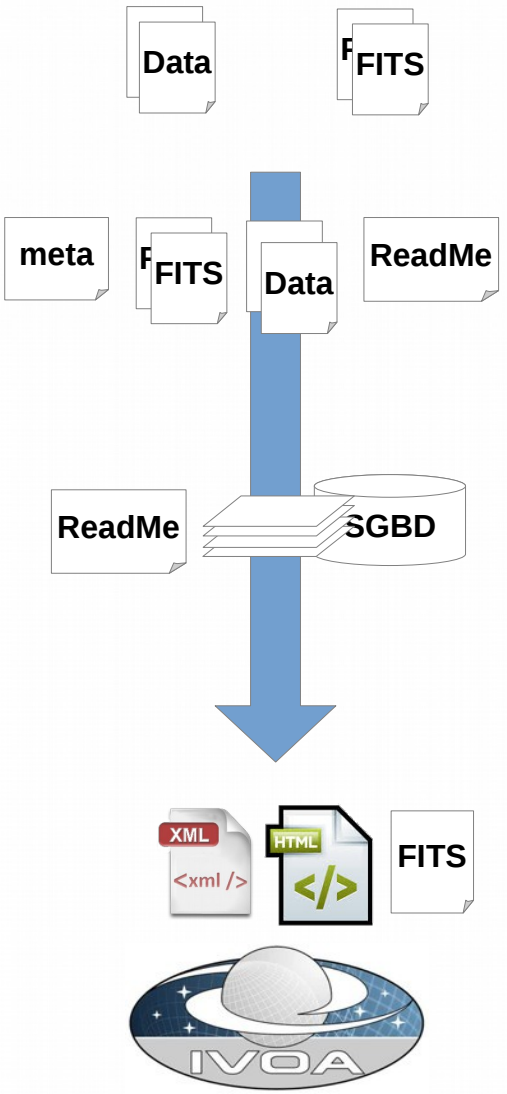
Providing tools and submit services

The input data consists of tables or other types of data, associated with minimal meta-data

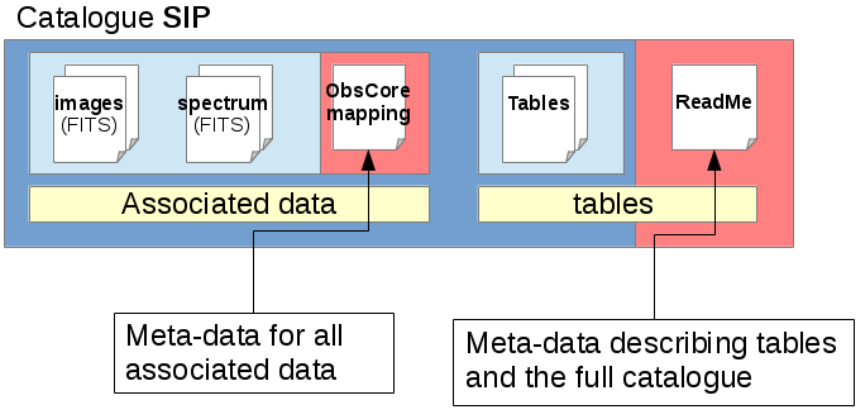
The documentalist's curation

- Homogenisation work to standardize data format and the basic meta-data
- Rich meta-data assignment
- Clarification of data which looks erroneous

Catalogue validation by CDS astronomers



Assign the basic meta-data



FITS The Astronomical Image and Table Format
Flexible Image Transport System

fits

```
-----------------------------------------------
image: liste (669)
              hdu: -1
      target_name: OBJECT
            s_ra: WCS.getCenter(1)
           s_dec: WCS.getCenter(2)
           s_fov: WCS.getFieldOfView()
        s_region: WCS.getWorldPixelRegion()
    s_resolution: WCS.getWorldPixelSize()
          system: WCS.getAstroFrame()
           t_min: DATE-OBS
           t_max:
      t_exptime:
   t_resolution:
         em_min: WCS.getMin(1)
         em_max: WCS.getMax(1)
  em_res_power:
        spcunit:
        em_band:
     pol_states: WCS.getStokes()
instrument_name:
  facility_name: TELESCOP
```

Tables

```
G010.4413+00.0101 10.440+0.011      4.4 272.1581 -19.8997    7.5   32.5  13.1   8.1 MAGPIS HII region  *
G010.5975-00.3838 10.598-0.384      0.6 272.6066 -19.9531   66.1  136.6   7.7   4.7 MAGPIS HII region  *
G010.5975-00.3838 10.597-0.383      6.0 272.6047 -19.9534   52.0  105.6  12.6   2.4 MAGPIS HII region  *
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G019.6095+01.1873 G019.6096+01.1876 1.3 275.6252 -11.2788   47.1   60.7   0.9   0.6 MMS   PN
```

ReadMe

```
J/A+A/424/545       Optically faint obscured quasars          (Padovani+, 2004)
================================================================================
Discovery of optically faint obscured quasars with Virtual Observatory tools.
     Padovani P., Allen M.G., Rosati P., Walton N.A.
    <Astron. Astrophys., 424, 545-559 (2004)>
    =2004A&A...424..545P
================================================================================
ADC_Keywords: QSOs ; Active gal. nuclei ; X-ray sources
Keywords: astronomical data bases: miscellaneous - methods: statistical -
          galaxies: quasars: general - X-rays: galaxies

Abstract:
    We use Virtual Observatory (VO) tools to identify optically faint,
    obscured (i.e., type 2) active galactic nuclei (AGN) in the two Great
    Observatories Origins Deep Survey (GOODS) fields. By employing
    publicly available X-ray and optical data and catalogues we discover
    68 type 2 AGN candidates.

File Summary:
--------------------------------------------------------------------------------
 FileName   Lrecl  Records   Explanations
--------------------------------------------------------------------------------
ReadMe         80        .   This file
table1.dat     90       47   Type 2 AGN candidates, HDF-N
table2.dat     90       21   Type 2 AGN candidates, CDF-S
table4.dat     90        3   Type 2 AGN candidates, UDF
--------------------------------------------------------------------------------

See also:
 J/AJ/126/539   : The Chandra Deep Fields North and South (Alexander+, 2003)
 J/ApJS/155/271 : Chandra Deep Field-South: Optical spectroscopy (Szokoly+ 2004)
          II/258 : Hubble Ultra Deep Field Catalog (UDF) (STScI, 2004)
          II/261 : GOODS initial results (Giavalisco+, 2004)

Byte-by-byte Description of file: table*.dat
--------------------------------------------------------------------------------
   Bytes Format Units   Label    Explanations
--------------------------------------------------------------------------------
    1- 19  A19   ---     GOODS    GOODS designation (JHHMMSS.ss+DDMMSS.s)
   22- 25  I4    ---     UDF      ? UDF designation (Cat. II/258, table 4 only)
   27- 29  I3    ---     A03      Alexander et al. (2003, Cat. <J/AJ/126/539>
                                  sequential number, [ABB2003] CDFN NNN (table1)
                                   or [ABB2003] CDFS NNN (table2&3) in Simbad
   31- 33  I3    ---     S04      ? Szokoly et al. (2004, Cat. <J/ApJS/155/271>
                                  sequential number, [SBH2004] XID NNNa in Simbad
                                  (table2 only)
       34  A1    ---   m_S04      [a] Multiplicity index on S04
   35- 36  I2    h       RAh      Right ascension (J2000.0)
   38- 39  I2    min     RAm      Right ascension (J2000.0)
   41- 45  F5.2  s       RAs      Right ascension (J2000.0)
```

To assign rich meta-data: the added values

Constitution of the Archival package (AIP)

- Documentalists complete the ReadMe:
  e.g.: VizieR identifier, more complete description, references..
- Private data
  e.g.: Logs of the action performed, emails, checksums
- Enrich the ReadMe file with added values driven by a configuration file containing instructions that enables
  - Generation of links to Simbad, reference catalogues or external links
  - Visualisation of spectra, time-series
  - Operation on tables. e.g. : join table into a single table
  - Addition of computed columns (positions)
- .. but also other meta-data
  - Standardized definition (VO) for columns
  - Photometry assignment

The difficulties to find meta-data

Example of known-filter assignment : *catalogue 2015AJ....150..176C*

THE ASTRONOMICAL JOURNAL

WIDE FIELD NEAR-INFRARED PHOTOMETRY OF 12 GALACTIC GLOBULAR CLUSTERS: OBSERVATIONS VERSUS MODELS ON THE RED GIANT BRANCH

Roger E. Cohen[1], Maren Hempel[2], Francesco Mauro[3], Douglas Geisler[1], Javier Alonso-Garcia[3,4], and Karen Kinemuchi[5]

Published 2015 November 17 • © 2015. The American Astronomical Society. All rights reserved.

2. OBSERVATIONAL DATA

2.1. Observations and Pre-processing

Observations of our 12 target clusters were obtained with the Infrared Side Port Imager (ISPI) mounted on the 4 m Blanco telescope at Cerro Tololo Inter-American Observatory. The HAWAII-2 2048 × 2048 pixel detector has 0.″305 pixel^{-1}, giving a field of view 10.25 arcmin per side. Imaging

astrometric rms (<0.″2), isolated (lacking neighbors within 4 mag inside a 2.″5 radius, corresponding to a contaminating flux of <2.5%) and be bright enough to remain unaffected by crowding in 2MASS (see below). To calculate transformations from the instrumental magnitudes in our PSF catalogs to the 2MASS photometric system, we employed classical linear transformation equations of the form $m - M = a + b(J - K_S)$, where m and M denote instrumental and standard magnitudes respectively. We solve for the coefficients a and b using least squares fitting, but employing weighting factors to downweight discrepant data points in lieu of a sigma clip[8] (Mauro et

The filter given is not used in VizieR.
The article stipulates a transformation into 2MASS system

Byte-by-byte Description of file: table3.dat

Bytes	Format	Units	Label	Explanations
1- 3	A3	---	---	[NGC]
5- 8	I4	---	NGC	NGC number of cluster
10- 19	F10.6	deg	RAdeg	Right Ascension in decimal degrees (J2000)
21- 30	F10.6	deg	DEdeg	Declination in decimal degrees (J2000)
32- 38	F7.4	mag	Jmag	The J band magnitude in 2MASS photometric system
40- 45	F6.4	mag	e_Jmag	The 1σ uncertainty in Jmag
47- 53	F7.4	mag	Ksmag	The Ks band magnitude in 2MASS photometric system
55- 60	F6.4	mag	e_Ksmag	The 1σ uncertainty in Ksmag

Providing useful data

Constitution of the Diffusion package (DIP)

Example: the VOTable (XML) output of images meta-data for the catalogue *The RMS survey (J/A+A/501/539)*

```
<?xml version="1.0" encoding="UTF-8"?>
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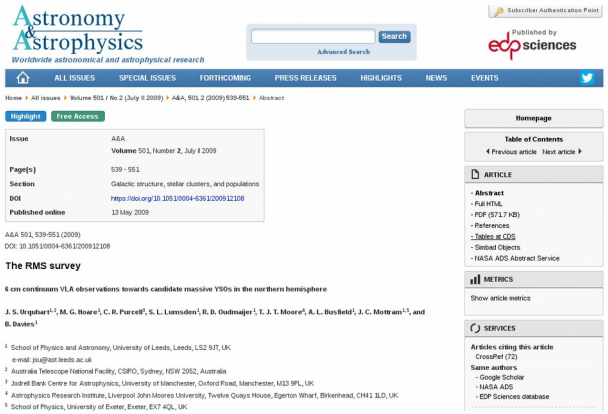
Providing useful data with added values



Full	RadioName	Im	offset arcsec	Field	Sp mJy	e_ mJy	Sint mJy	L	Maj arcsec	Min arcsec	MSXoff arcsec	MSX	FITS	PS	MSX6	RAJ2000 deg	DEJ2000 deg
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2	G010.3924+00.5390	Im	1.0	G010.3920+00	0.7	0.12	2.2		4.6	2.1	2.3	G010.3930+00.5389	FITS	PS	MSX6	271.6428	-19.6848
3	G010.5959-00.8734	Im	2.1	G010.5960-00	11.3	0.36	59.4		1.5	1.4	2.9	G010.5956-00.8740	FITS	PS	MSX6	273.0623	-20.1903
4	G010.5971-00.3893	Im	96.2	G010.5888-00	8.2	1.46	22.5		2.3	1.4			FITS	PS	MSX6	272.6112	-19.9562
5	G010.6003-00.8320	Im	151.4	G010.5960-00	1.8	0.16	3.2		0.8	0.4			FITS	PS	MSX6	273.0259	-20.1666
6	G010.6161-00.3921	Im	126.9	G010.5888-00	32.8	2.39	99.1		2.4	1.5			FITS	PS	MSX6	272.6236	-19.9410
7	G010.6221-00.3788	Im	175.8	G010.5888-00	42.6	3.74	104.1		2.8	0.8			FITS	PS	MSX6	272.6143	-19.9293
8	G010.6234-00.3838	Im	166.3	G010.5888-00	212.2	10.98	1055.0		3.3	2.2	1.5	G010.6235-00.3834	FITS	PS	MSX6	272.6196	-19.9306
9	G010.6240-00.3812	Im	174.4	G010.5888-00	33.6	2.61	86.6		1.9	1.6	8.3	G010.6235-00.3834	FITS	PS	MSX6	272.6175	-19.9288
10	G011.1073+00.4272	Im	74.5	G011.0909+00	1.2	0.25	1.6		1.7	0.6			FITS	PS	MSX6	272.1150	-19.1146
11	G011.4201-01.6819	Im	1.6	G011.4201-01	0.8	0.11	3.2		1.9	1.5	1.1	G011.4201-01.6815	FITS	PS	MSX6	274.2371	-19.8523
12	G011.6218+01.1804	Im	48.8	G011.6294+01	4.3	0.28	4.7		0.5	0.4			FITS	PS	MSX6	271.6841	-18.2989
13	G011.8724+02.2273	Im	173.5	G011.8974+02	3.8	0.33	4.9		0.9	0.3			FITS	PS	MSX6	270.8532	-17.5683
14	G011.9221+02.1957	Im	94.7	G011.8974+02	189.2	5.19	340.9		1.0	0.7			FITS	PS	MSX6	270.9076	-17.5406
15	G011.9278+02.1917	Im	110.8	G011.8974+02	26.7	0.71	45.2		1.0	0.4			FITS	PS	MSX6	270.9142	-17.5376
16	G012.1098+01.2250	Im	104.9	G012.1165+01	3.3	0.27	4.6		1.9	0.8			FITS	PS	MSX6	271.8930	-17.8509
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19	G012.4317-01.1112	Im	1.8	G012.4314-01	8.1	0.33	105.2		3.7	3.1	2.2	G012.4314-01.1117	FITS	PS	MSX6	274.2135	-18.6912
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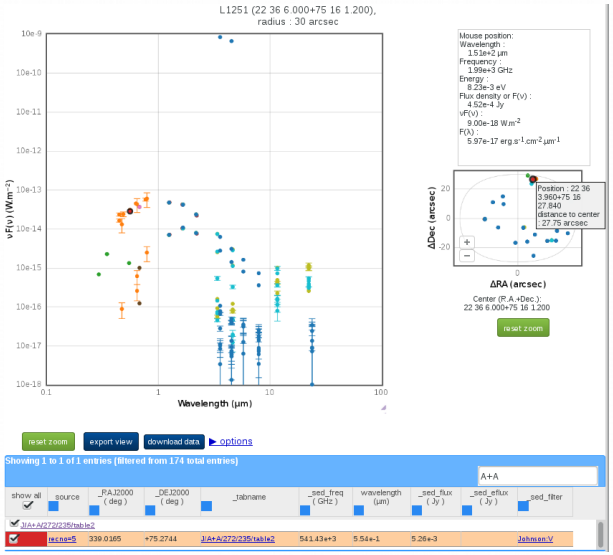
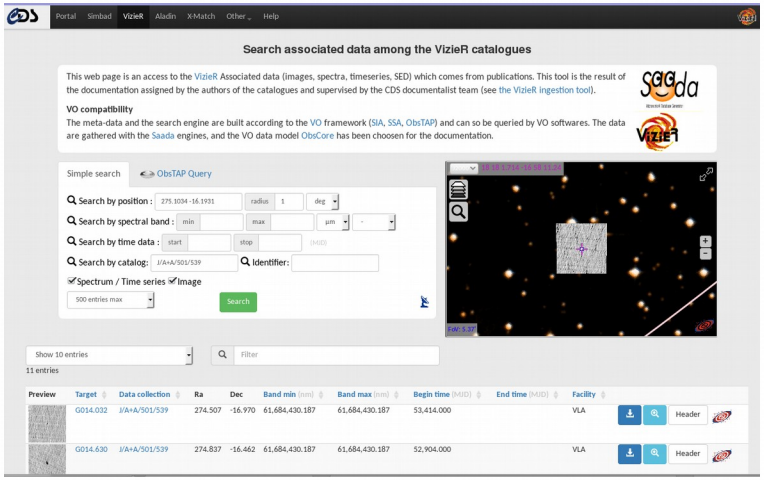
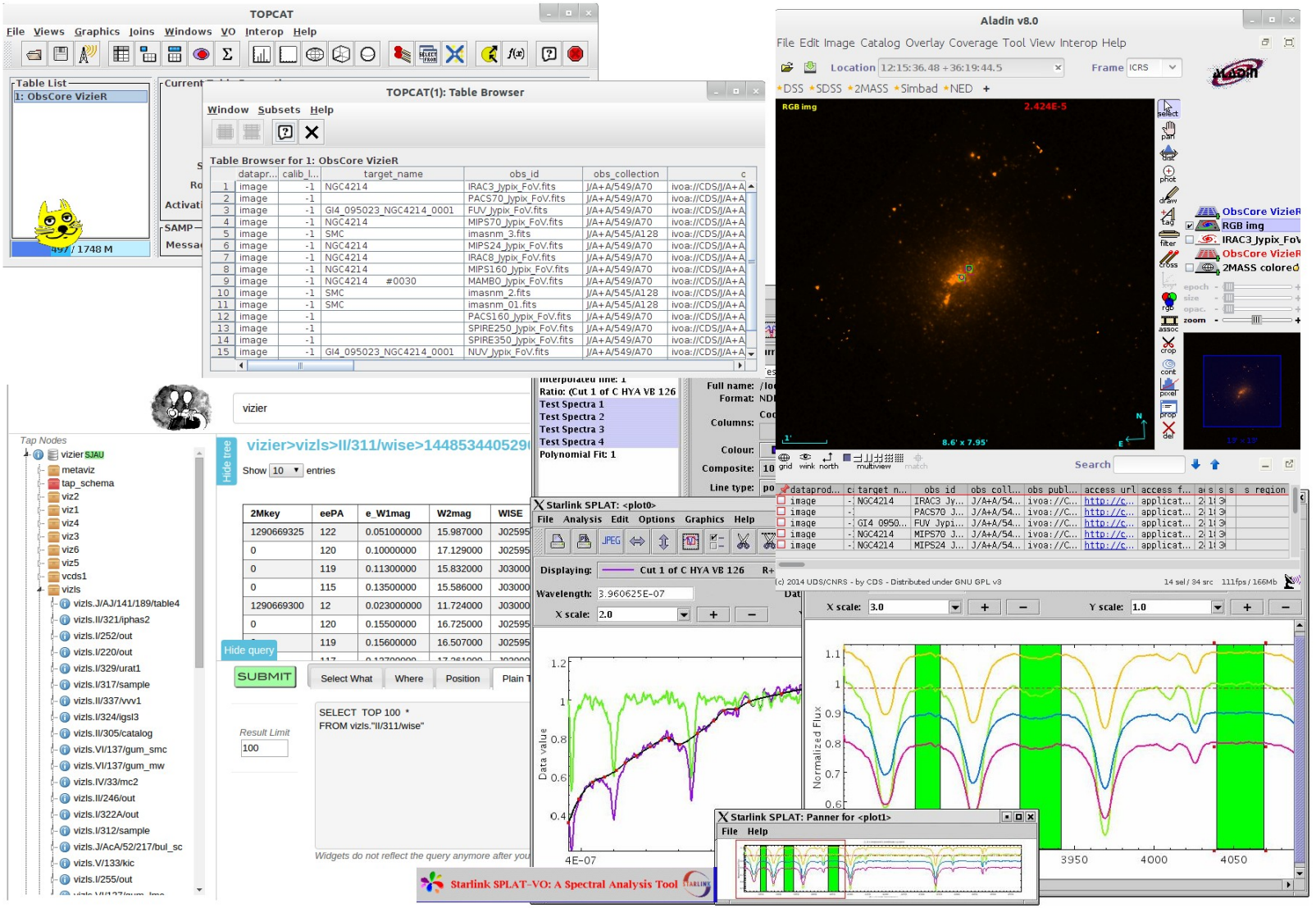
21	G012.8616+00.8776	Im	77.9	G012.8741+00	1.6	0.23	1.8		0.8	0.2			FITS	PS	MSX6	272.5938	-17.3616
22	G012.9630+00.9441	Im	58.8	G012.9719+00	1.2	0.22	1.2	<	2.2	0.6			FITS	PS	MSX6	272.5840	-17.2406
23	G012.9712+00.9055	Im	8.1	G012.9719+00	1.3	0.25	1.3	<	2.2	0.6	10.0	G012.9731+00.9036	FITS	PS	MSX6	272.6235	-17.2521





Providing useful data with added values



Conclusion

A good description of the workflows is an important part of the documentation required to get the DSA certification.

However, there are other important aspects (not developped in this talk)

- Political aspects : the continuity of access & funding
- Technical infrastructure : redundancy and data security level
- Long term preservation strategy …

The new criteria are adapted to VizieR in the astronomical context which has an advanced disciplinary data sharing framework with the Virtual Observatory that enables interoperability