Asterics
Astronomy ESFRI & Research Infrastructure Cluster

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IVOA Science Priority Areas

Capturing use cases & requirements

Mark Allen (CNRS-OAS)

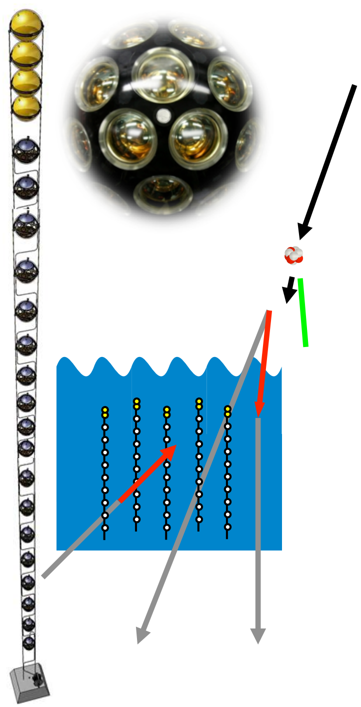
Identifying Priorities

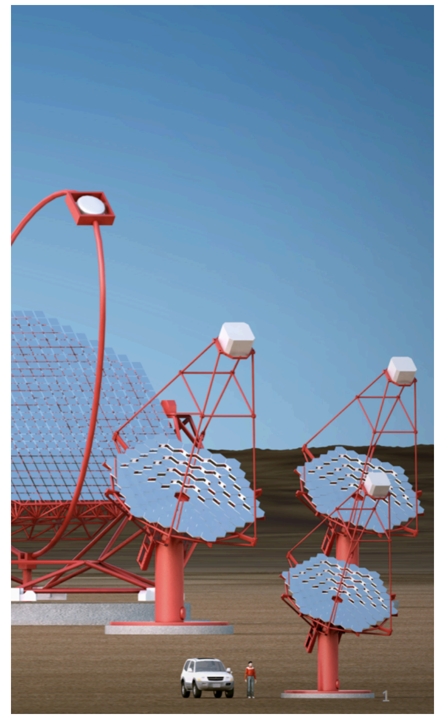
- CSP identifies common scientific needs
  - Via IVOA member projects and their Science Advisory Boards/Committees
  - By interacting with science communities
- Engagement with big projects
  - Focus sessions (May 2013, May 2014, June 2015)
  - Connections via IVOA member projects
  - Big projects more integrated with VO projects
  - ASTERICS !!!

IVOA approach

- Focus sessions invite projects to interact with IVOA to make sure VO is relevant to their needs
- Identify use cases
- Derive requirements with TCG
- Use requirements to guide the standards development in WGs, and to manage scope and timing

Make the big projects ‘**Participants**’ in the development of the VO, e.g. ASTERICS





Cluster of ESFRI projects and their pathfinders, and relevant research infrastructures

Current & emerging priorities

- Current priorities relevant to big projects coming in:
  - In particular the Multi-d next steps
  - Time domain
  - Provenance
- Emerging Priorities:
  - Interoperability of big projects
  - ‘Run the code next to the data’

Science Priority Areas

Multi-dimensional Data

Radio astronomy, Integral Field Spectroscopy, high energy, polarization, simulation, data mining datasets + ...

Time Domain Astronomy

Time Series, light curves, transient event reports, +...

- Need to ensure that these are accessible and useable within the VO

Science Drivers

- Uniform discovery and access to multi-d data

Use Cases : e.g. Search for water maser features in a star formation region
Need: 3-D image cube consisting of 2 space and 1 frequency/velocity axes, with ability to search in frequency/velocity at every spatial pixel

Show me a list of data that satisfies:
I. Datatype=cube with 3 dimensions
II. Axes include Frequency
III. Axes include RA
IV. Axes include DEC
V. Frequency range includes 22 GHz

- Interoperability of multi-d data
  - compare and combine at different levels, e.g. compare coverage, combine measurement axes
- Visualisation - big cubes, combined data

Minimal requirements

Multi-dimensional Data Access minimal requirements:

- Data Discovery (Query)
  - A service shall be able to receive queries regarding its data collection(s) from a client, with the client placing one or more of the following constraints:
    - RA,Dec
    - Frequency/wavelength
    - Polarization states
    - Spatial size
    - Angular resolution
    - Integration time
    - Time of observation
  - A service shall return to the client a list of observations, and the corresponding metadata for each observation, meeting the user-imposed constraints. In the event that the user places no constraints, the entire list of observations, and the corresponding metadata for each data set, shall be returned. In the event that no data meet the user's constraints, the service shall indicate the absence of any matches.
- Data Access
  - Once a user has the list of observations that satisfy the constraints, they select all or a subset of the observations and:
    - Download the complete science data for each of the selected observations (the service shall return the complete multi-dimensional science data and metadata for each selected observation) or;
    - Download simple cutouts of the science data for each of the selected observations (the service shall be able to extract and return a user-specified subset of the complete multi-dimensional science data and metadata for each selected observation).
- Simple Cutout
  - For a simple cutout, the user-specified subset is restricted to be a contiguous interval within each dimension of the multi-dimensional science data. The user should *not* be allowed to specify subsets with "gaps" or resampling or anything like that.
    - Spatial: (a coordinate and a radius)
    - Energy: one interval (from energy1 to energy2)
    - Time: one interval (from time1 to time2)
    - Polarization: a list

Priority Area Status

- Convergence of 1st set of Multi-d standards
  - Finalising stds will allow moving to the next steps
  - Implementations being presented here
  - Feedback is precious
- Time Domain
  - Transient event networks:
    - VOEvent infrastructure well defined
  - Time series area being re-motivated
  - Looking for 'champions' of the cause

CASDA SIA2 Implementation

James Dempsey | CASDA Project Engineer
30 October 2015

CSIRO INFORMATION MANAGEMENT & TECHNOLOGY
www.csiro.au

ASKAP Data Products

- Calibrated visibility data files (CASA)
- Image cubes (FITS)
- Single plane images (FITS)
- Catalogues

SIA 2 and friends

1. Simple Image Access v2 – discovery
2. DataLink – list the access methods
3. Access Data – file or subset access
   - Sync, async access
   - Cutouts
   - Thumbnails

Why SIAP 2

1. Multi-dimensional support
2. Future of image access in VO
3. Sufficiently stable
4. Flexible

Summary

CASDA SIA2 implementation

- At minimum viable product stage
- Being expanded currently

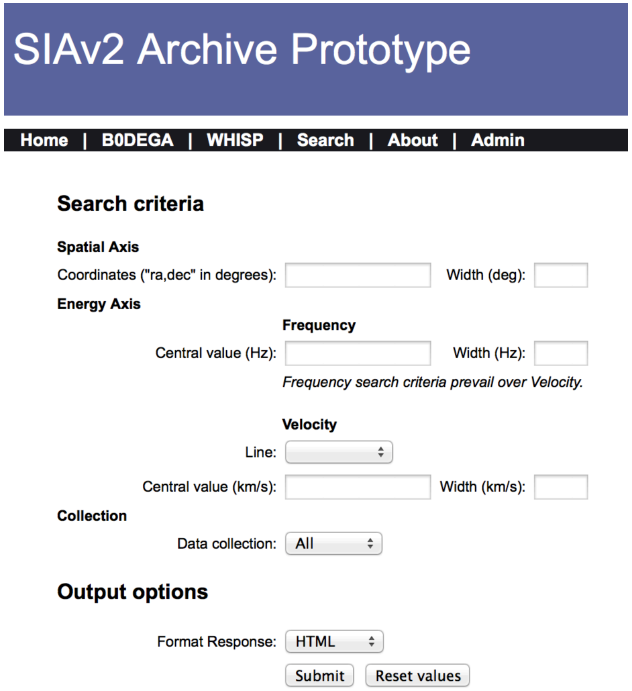
Reusable products

- VO tools package – TAP, SCS, SIA2, DataLink, Ac
- Validation tools for SIA2, DataLink, AccessData

Standards workable and clear to impleme

Reference Implementations

- **AMIGA SIAv2 Archive Prototype**
- **CADC implementation of the SIA-2.0**
- **Client implementation**
  - ALADIN



Amazing tools for using SIA v2…

CASA viewer?

Euro3D ?

VISIVO?

DS9?

QFitsView?

KARMA?

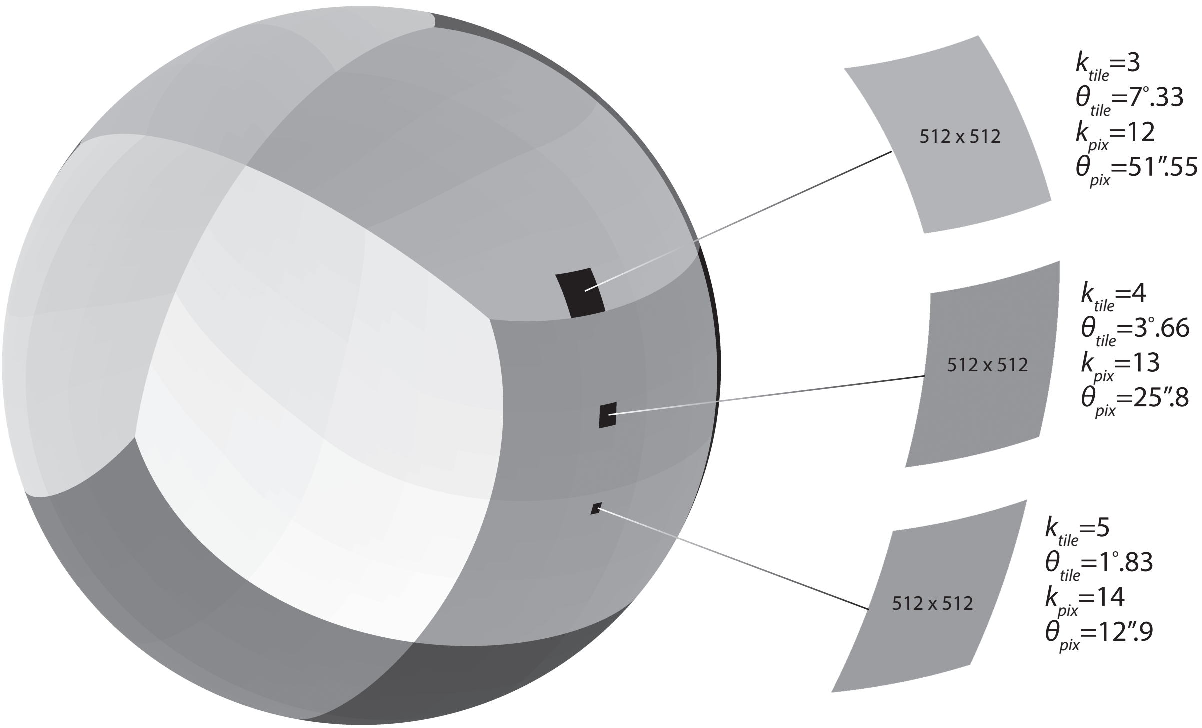
Current activity

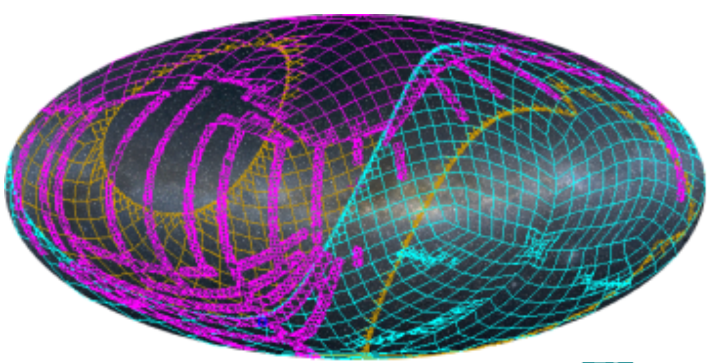
- Programmatic testing of implementations
- Feedback expected on May 2016 timescale
- Identify benefits of Simple ‘cube’ access
- Review scientific directions and realistic goals for implementations and tools
- Links with other emerging approaches

HiPS

- HiPS: **Hi**erarchical **P**rogressive **S**urveys
  - Multi-resolution HEALPix data structure for
    - *Images*
    - *Catalogues*
    - *3-dimensional data cubes*
  - Conserves scientific data properties alongside visualisation considerations
  - Implemented for ~250 data sets and growing
  - New levels of interoperability

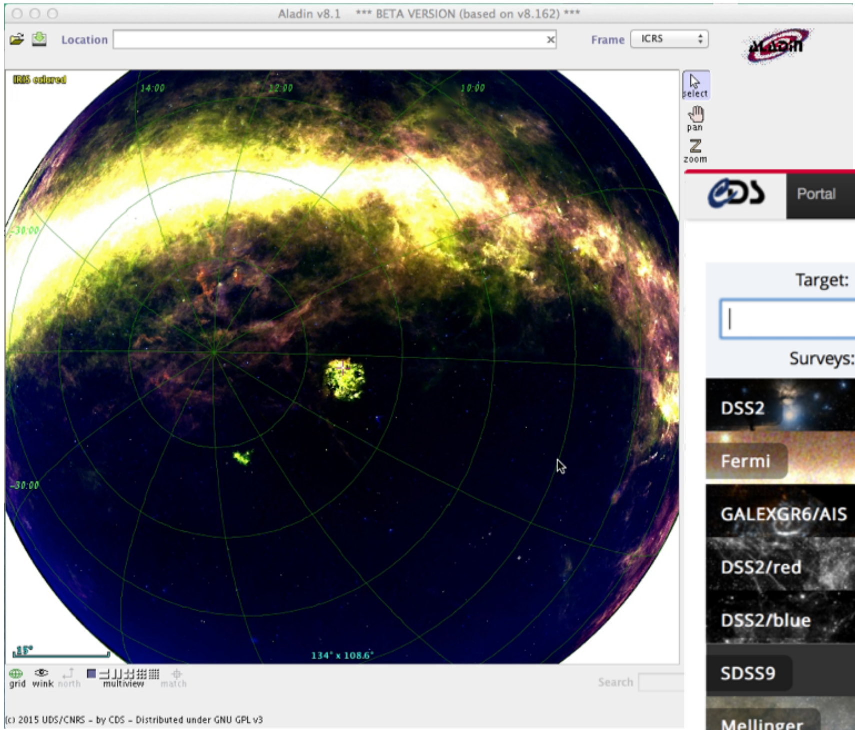
HiPS – Tiles and Pixels, and MOC

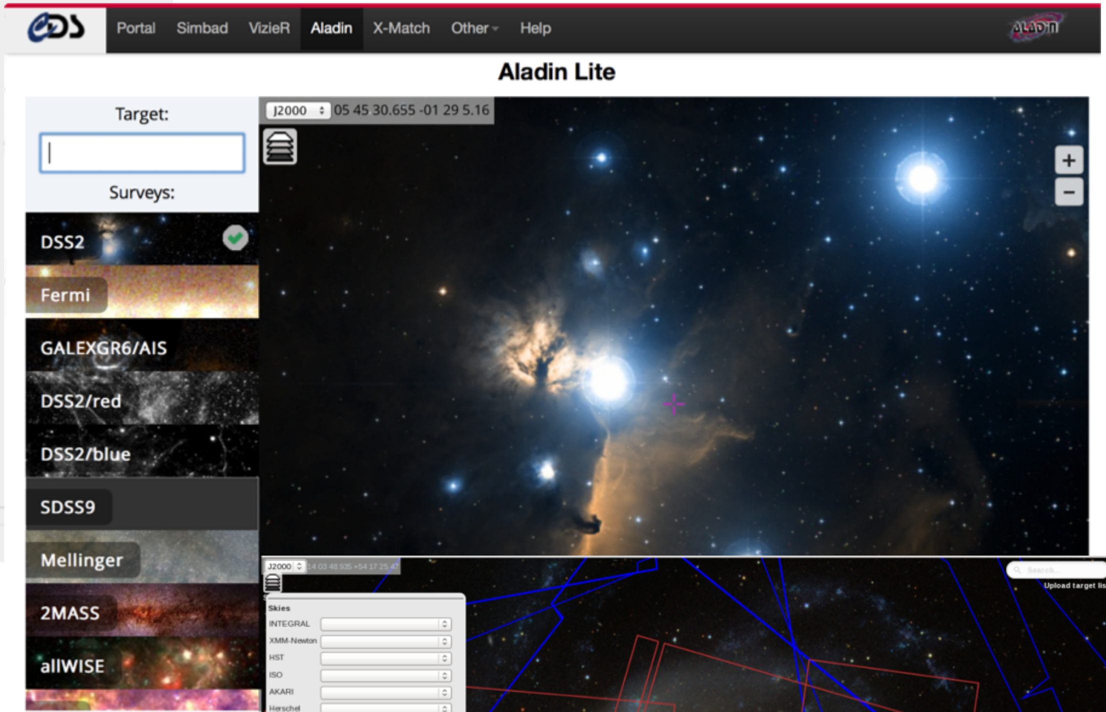


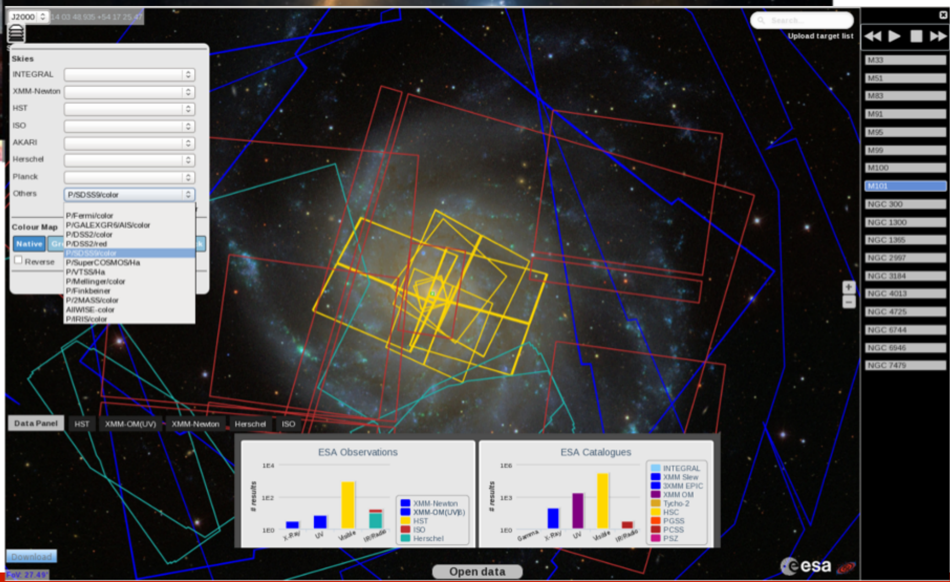


-------- Tiles --------

k	$N_{side} = 2^k$	N_{pix}	θ_{pix}	$k_{tile,512}$	$N_{tile,512}$	$\theta_{tile,512}$	
0	1	12	58°.6				
1	2	48	29°.3				
2	4	192	14°.7				
3	8	768	7°.33				
4	16	3072	3°.66				
5	32	12,288	1°.83				
6	64	49,152	55′.0				
7	128	196,608	27′.5				
8	256	786,432	13′.7				
9	512	3,145,728	6′.87	0	12	58°.6	- **WMAP**
10	1024	12,582,912	3′.44	1	48	29°.3	
11	2048	50,331,648	1′.72	2	192	14°.7	- **PLANCK HFI**
12	4096	201,326,592	51″.5	3	768	7°.33	- **IRAS**
13	8192	805,306,368	25″.8	4	3072	3°.66	
14	2^{14}	3.22×10^9	12″.9	5	12288	1°.83	- **NVSS**
15	2^{15}	1.29×10^{10}	6″.44	6	49152	55′.0	
16	2^{16}	5.15×10^{10}	3″.22	7	196608	27′.5	- **SCUBA**
17	2^{17}	2.06×10^{11}	1″.61	8	786432	13′.7	
18	2^{18}	8.25×10^{11}	0″.81	9	3,145,728	6′.87	- **DSS**
19	2^{19}	3.30×10^{12}	0″.40	10	12,582,912	3′.44	- **SDSS**
20	2^{20}	1.32×10^{13}	0″.20	11	50,331,648	1′.72	
21	2^{21}	5.28×10^{13}	0″.10	12	201,326,592	51″.5	- **CFHTLS**
22	2^{22}	2.11×10^{14}	50.3 mas	13	805,306,368	25″.8	
23	2^{23}	8.44×10^{14}	25.1 mas	14	3.22×10^9	12″.9	- **HST ACS**
24	2^{24}	3.38×10^{15}	12.6 mas	15	1.29×10^{10}	6″.44	





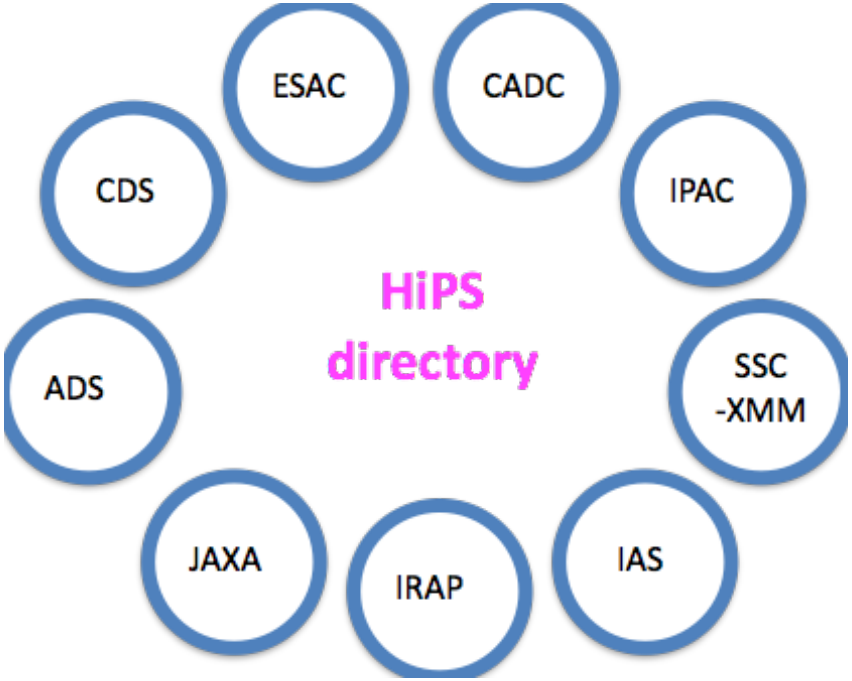


Aladin & Aladin Lite

… and ESA Sky built on Aladin Lite

HiPS at IVOA

- Standardisation in discussion
- ObsCore
- Register HiPS nodes
- HiPS network simple but practical – matching needs



Capturing use cases and requirements

- What are the **data access, discovery and interoperability** aspects of your project?
- Simple statements on use cases
  - What parameters need to be searchable
  - Use case scenarios
- Requirements to be derived from use cases
- IVOA use cases/requirements to be more formalised in 2016
- ASTERICS partner uses cases – discuss here!