

Exploring TAP services with **TapHandle**



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TAP and the Simple Protocols

Simple protocols (SIAP, SSAP, CSP SLAP...):

- *One data collection per service*
- *One data category per protocol*
- *Parameter query language*
- *Output format defined by the protocol*

TAP is **not a simple** protocol

- *TAP exposes tabular data*
- *TAP services are self-describing.*
 - *TAP_SCHEMA, capability /table*
- *Data are selected by a structured query language (derived from SQL)*
 - *Geometrical functions but neither database update nor procedure*
- *Asynchronous query processing*





The TAP Client Challenge

Being both **interactive** and **generic**.

- **The client doesn't know about the data it will access**
 - *Data are discovered thanks to both TAP_SCHEMA and /tables capability*
- **The query editor has to tackle with the meta-data of the current service**
 - *Designing an ADQL editor both rich and user friendly is not that easy*
- **The client has to tackle with the capabilities really available**
 - *TAP being a complex protocol, we have to consider dealing with partial implementations*



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The Goal of TapHandle

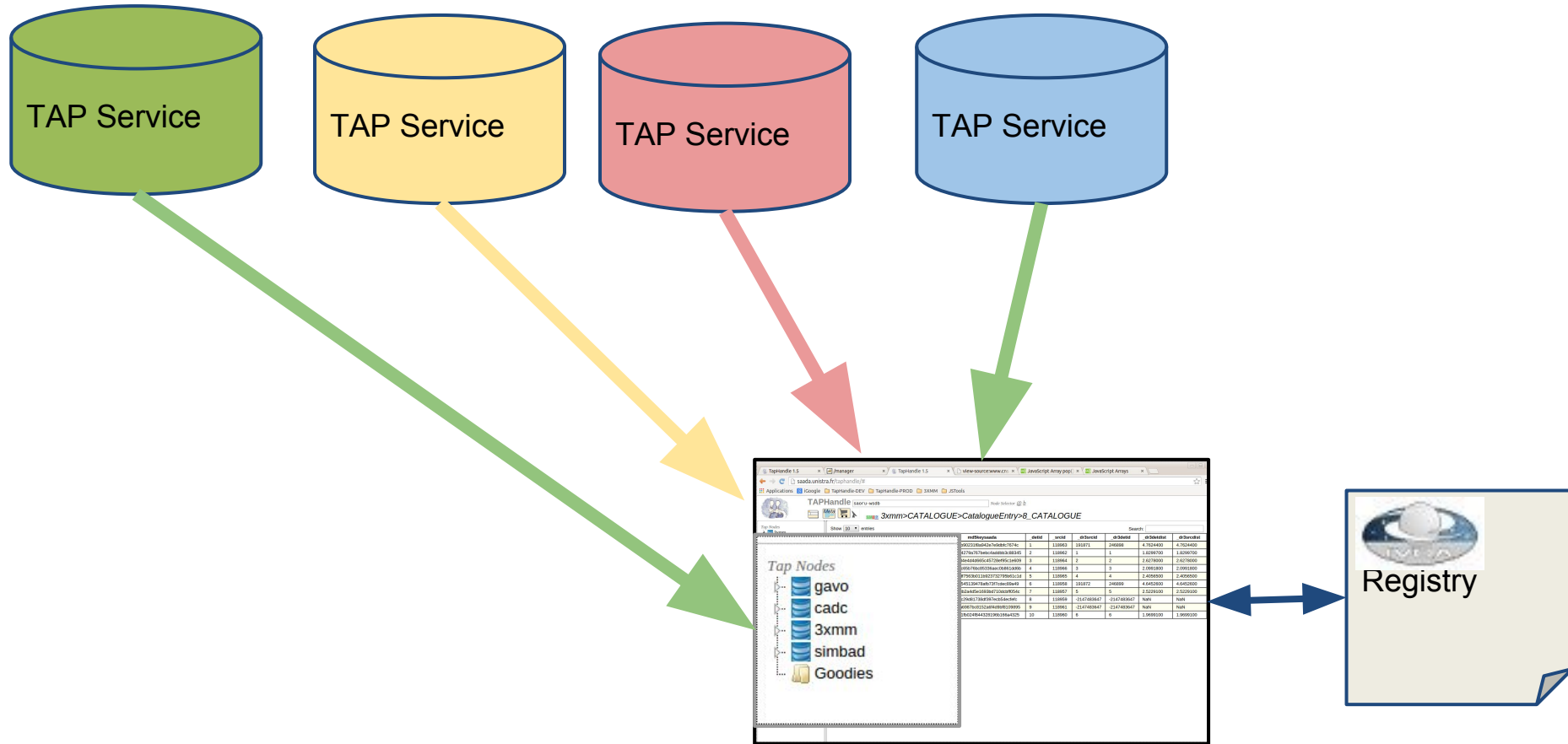
- **A tool designed for discovering data exposed in any TAP service.**
 - No prior knowledge about the data content
- **Accessing TAP services with a WEB browser.**
 - Accessing meta-data
 - Accessing data
 - Query editor
 - Downloading results
 - Interoperability
- **Accessing simultaneously multiple TAP services**
 - Services merged in a single view
- **Using the browser facilities as much as possible for data display**
 - VOTables displayed as HTML tables
 - File with universal types (PNG, JPEG, PDF, text...) are taken in charge by the browser
 - Astronomical data format can be redirected to SAMP clients



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The Concept of TapHandle



Several TAP services - One single view

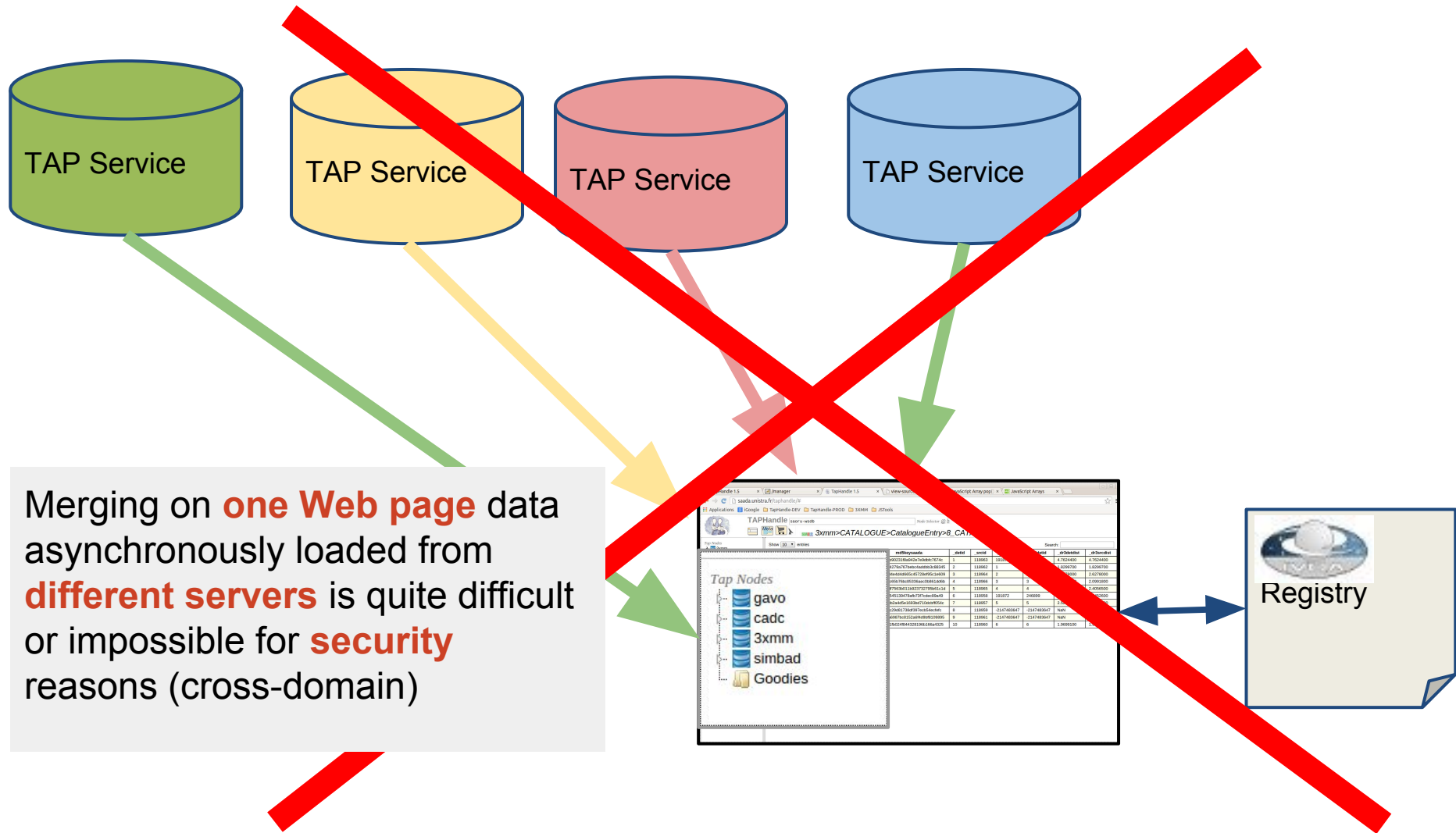


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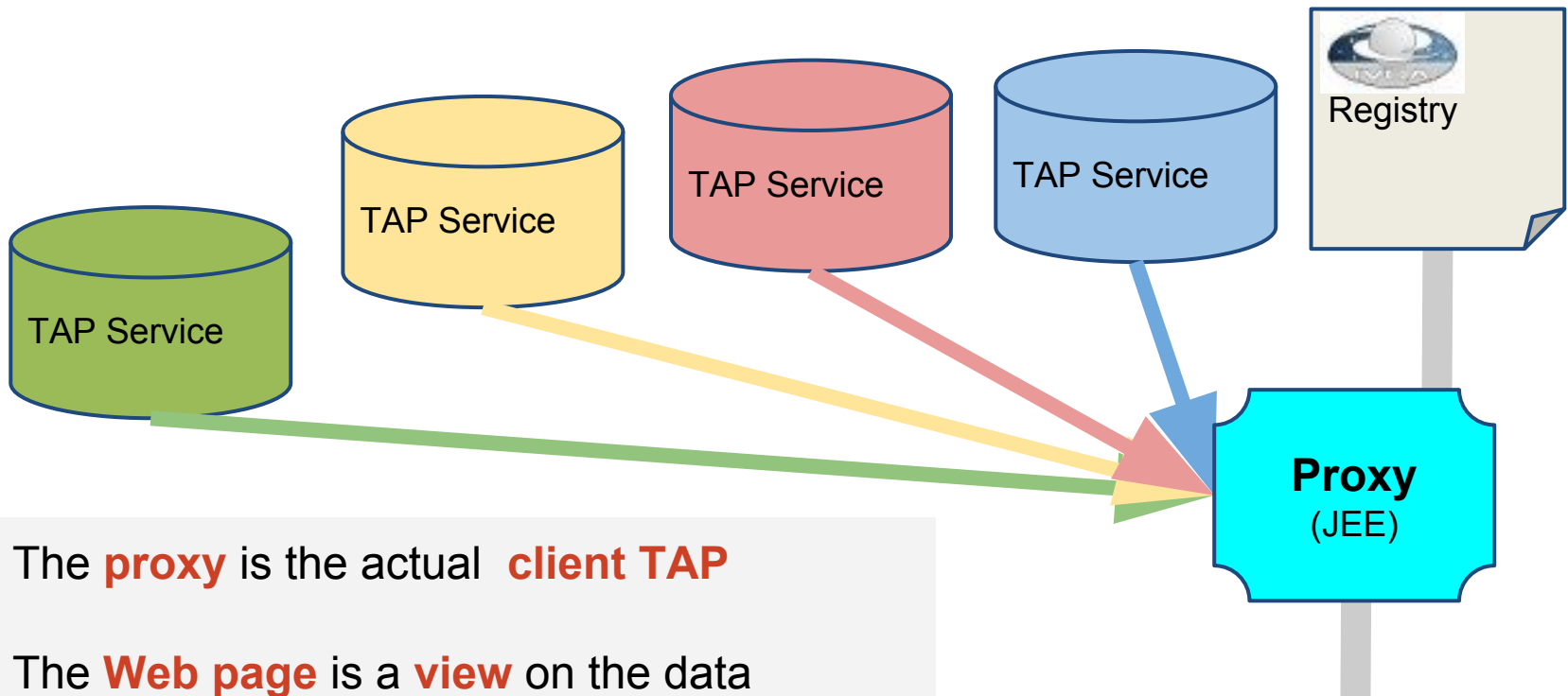




TapHandle Architecture



TapHandle Proxy



- ✓ The **proxy** is the actual **client TAP**
- ✓ The **Web page** is a **view** on the data available on the proxy
- ✓ The proxy/browser **communication** is done by **AJAX queries** with an **ad-hoc protocol**

The screenshot shows a web browser displaying a data table with columns: id, nom, prenom, adresse, code, ville, depart, cp, and statut. The table contains several rows of data, including entries for 'CATALOGUE' and 'ORFÈDRE'.

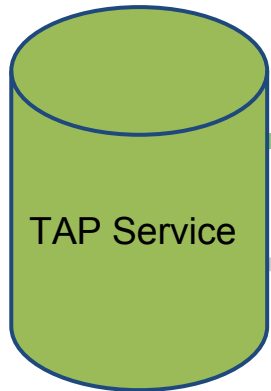
id	nom	prenom	adresse	code	ville	depart	cp	statut
517644500049000	20AM	XXXXXXXX	4836480902136424500481742	1	118983	118971	56856	4.762440
517644500049000	20AM	XXXXXXXX	48464212817764444444444444	2	118982	118972	56856	4.762440
517644500049000	20AM	XXXXXXXX	51433564444444444444444444	3	118984	118974	56856	4.762440
517644500049000	20AM	XXXXXXXX	25644444444444444444444444	4	118986	118976	56856	4.762440
517644500049000	20AM	XXXXXXXX	45564444444444444444444444	5	118988	118978	56856	4.762440
517644500049000	20AM	XXXXXXXX	87464444444444444444444444	6	118990	118980	56856	4.762440
517644500049000	20AM	XXXXXXXX	15152444444444444444444444	7	118992	118982	56856	4.762440
517644500049000	20AM	XXXXXXXX	95134444444444444444444444	8	118994	118984	56856	4.762440
517644500049000	20AM	XXXXXXXX	14334444444444444444444444	9	118996	118986	56856	4.762440
517644500049000	20AM	XXXXXXXX	44334444444444444444444444	10	118998	118988	56856	4.762440



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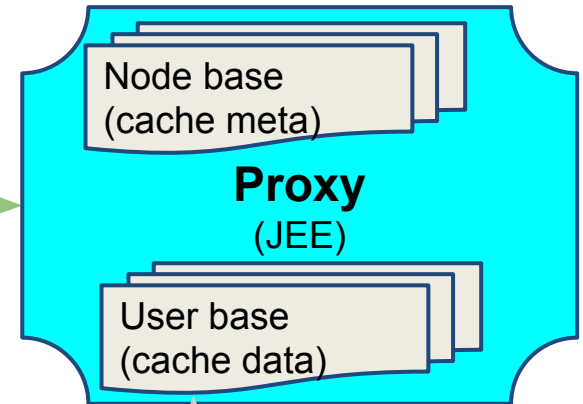


The TapHandle Proxy



Meta data (XML) - data (VOTables)

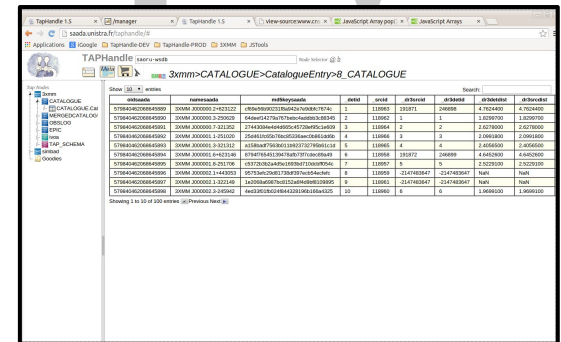
TAP requests - HTTP GET/POST



HTTP GET

JSON

- ✓ **XML files** (and VOTables) received by the proxy are **translated in JSON**.
- ✓ All **data** and **meta-data** are **cached** by the proxy
- ✓ **Errors** are processed **at proxy level**



id	catalogue	name	url	type	date	status	description	author	publisher
1	CATALOGUE	30AM	XXXXXX-1-1001-001	1	110001	100101	100101	100101	100101
2	CATALOGUE	30AM	XXXXXX-1-1001-002	2	110002	100102	100102	100102	100102
3	CATALOGUE	30AM	XXXXXX-1-1001-003	3	110003	100103	100103	100103	100103
4	CATALOGUE	30AM	XXXXXX-1-1001-004	4	110004	100104	100104	100104	100104
5	CATALOGUE	30AM	XXXXXX-1-1001-005	5	110005	100105	100105	100105	100105
6	CATALOGUE	30AM	XXXXXX-1-1001-006	6	110006	100106	100106	100106	100106
7	CATALOGUE	30AM	XXXXXX-1-1001-007	7	110007	100107	100107	100107	100107
8	CATALOGUE	30AM	XXXXXX-1-1001-008	8	110008	100108	100108	100108	100108
9	CATALOGUE	30AM	XXXXXX-1-1001-009	9	110009	100109	100109	100109	100109
10	CATALOGUE	30AM	XXXXXX-1-1001-010	10	110010	100110	100110	100110	100110

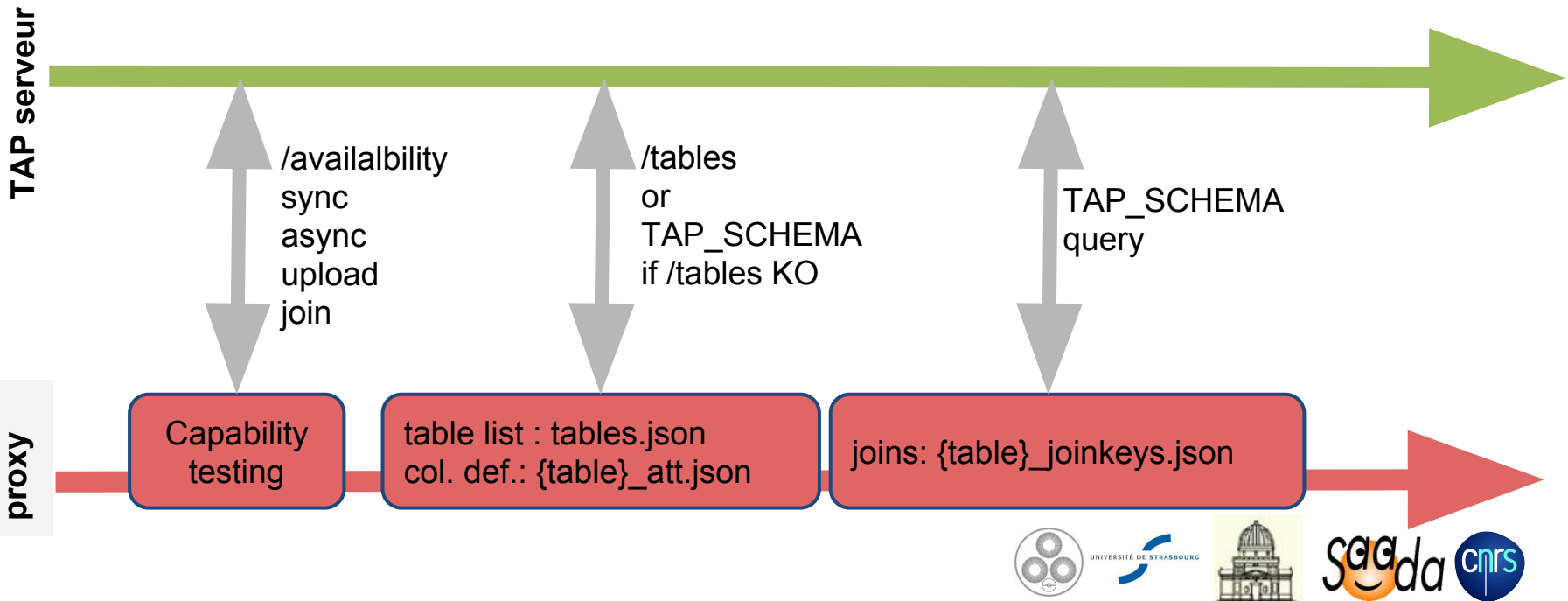


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TapHandle : Connecting a Service

- ✓ The */tables* output is split into individual per table files
- ✓ Documented table joins are taken out from the TAP_SCHEMA
- ✓ Declared capabilities are tested one by one
 - sync, async, upload, table joins
- ✓ Job results are converted on the fly in JSON messages (Stilts)



The TapHandle Main Screen

Tree of accessible resources

Search bar for TAP services

Path of the current resource

Query result

The screenshot shows the TapHandle web interface. At the top, the browser address bar displays 'saada.unistra.fr/taphandle/#'. Below the browser, the TapHandle logo and a search bar containing 'gavo' are visible. A breadcrumb path reads '3xmm>CATALOGUE>CatalogueEntry>8_CATALOGUE'. On the left, a 'Tap Nodes' tree lists resources like gavo, cadc, 3xmm, CATALOGUE, MERGEDCATALOGI, OBSLOG, EPIC, ivoa, TAP_SCHEMA, simbad, and Goodies. A table with 10 entries is displayed, showing columns for oidsaada, namesaada, md5keysaada, _detid, _srcid, and _dr3srcid. At the bottom, a 'Query editor' section includes a 'SUBMIT' button and tabs for 'Select What', 'Where', 'Plain Text Query', and 'Job Control'. The 'Job management' section shows a list of UWS jobs, including '3xmm.CATALOGUE.CatalogueEntry: job 8_CATALOGUE COMPLETED' and 'simbad.public.mesUVBY: job 1410421597305A COMPLETED'.

oidsaada	namesaada	md5keysaada	_detid	_srcid	_dr3srcid
579840462068645889	3XMM J000000.2+623122	cf69e56b90231f8a942e7e9dbfc7674c	1	118963	191871
579840462068645890	3XMM J000000.3-250629	64deef14279a767bebc4addbb3c88345	2	118962	1
579840462068645891	3XMM J000000.7-321352	27443084e4d4d665c45728ef95c1e609	3	118964	2
579840462068645892	3XMM J000001.1-251020	25d461fc65b76bc85336aec0b861dd6b	4	118966	3
579840462068645893	3XMM J000001.3-321312	a158badf7563b011b923732795b61c1d	5	118965	4
579840462068645894	3XMM J000001.6+623146	8794f76545139478afb73f7cdec89a49	6	118958	191872
579840462068645895	3XMM J000001.8-251706	c5372b3b2a4d5e1693bd710dcbff054c	7	118957	5
579840462068645896	3XMM J000002.1+443053	95753efc29d81738df397ecb54ecfefc	8	118959	-2147483647
579840462068645897	3XMM J000002.1-322149	1e2068a6987bc8152a6f4d9bf8109895	9	118961	-2147483647
579840462068645898	3XMM J000002.3-245942	4ed33f01fb024f844328196b166a4325	10		

Query editor

Job management



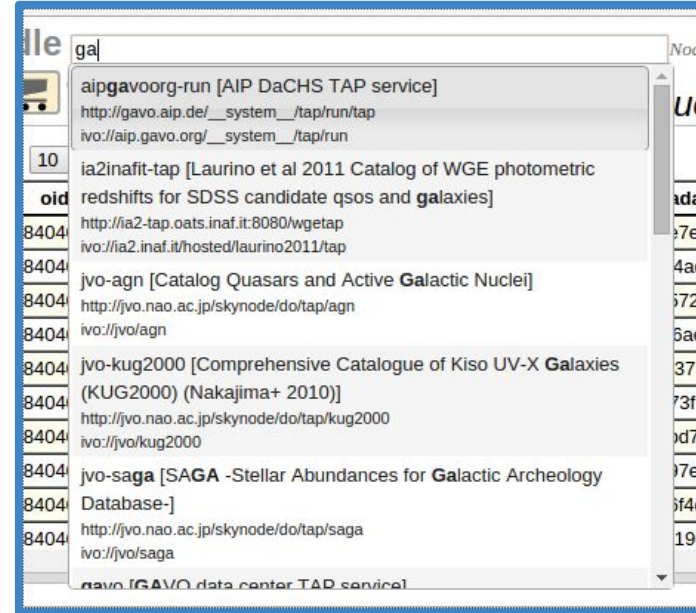
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Connecting the Registry

- ✓ The proxy gets the **description** of all TAP services harvested by the **GAVO TAP-Regext**
- ✓ Registry data are searched by a **TAP query**
- ✓ The list of **declared services** is sent to each client at **starting time**.



```
SELECT ivo_id, access_url, res_title
FROM rr.capability
      NATURAL JOIN rr.interface
      NATURAL JOIN rr.resource
WHERE  standard_id='ivo://ivoa.net/std/tap'
      AND intf_type = 'vs:paramhttp'
```



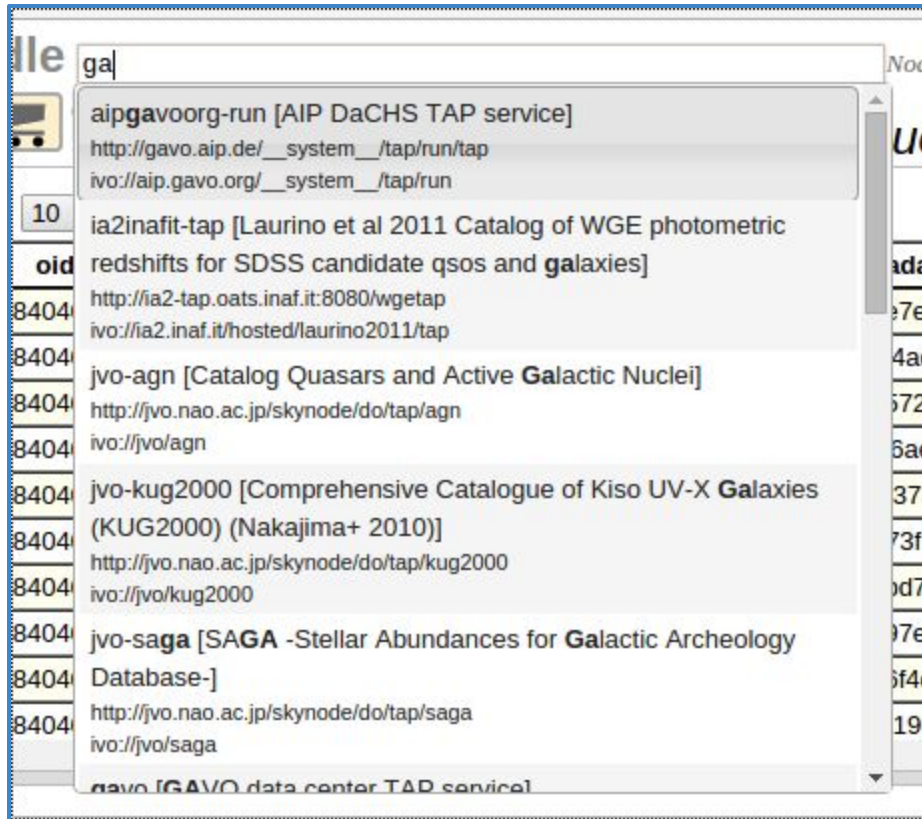
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Tap Service Selection

- ✓ A suggest-list shows out the TAP services matching the typed text.

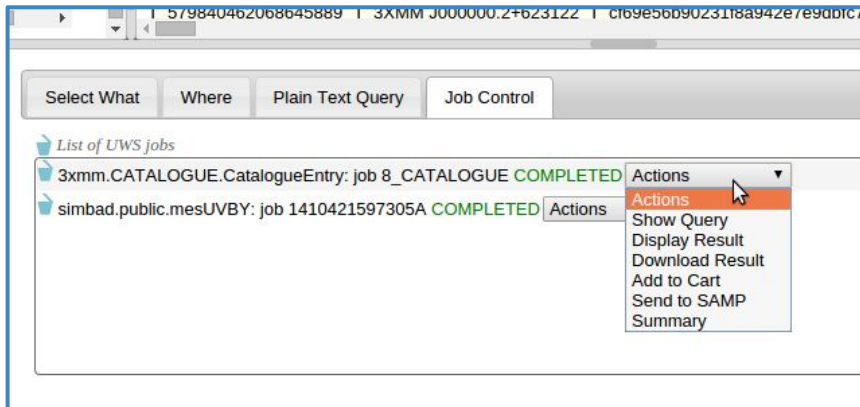


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Job Management



- ✓ Jobs are **systematically** executed in **asynchronous** mode (if supported).
- ✓ The interface waits **10"** **at the most** on the result.
- ✓ Output of **previous jobs** remain **accessible**
 - To display the result
 - To refine the query
 - To be put in the shopping cart
 - To be send to SAMP clients



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Query Editor

The screenshot displays the Query Editor interface with the following components:

- Navigation:** Buttons for "SUBMIT", "Select What", "Where", "Plain Text Query", and "Job Control".
- Table:** A table listing available columns with their data types and units.
- Form Fields:** "Coord/Name" (23.462083 +30.659917), "Radius(arcmin)" (1), and "System" (ICRS).
- Constraints:** A "List of Active Constraints" showing a stack of conditions: "wise.main.POSITION inCircle 23.462083, +30" and "AND wise.main.designation LIKE %M33%".
- SQL Preview:** A window showing the generated SQL query:

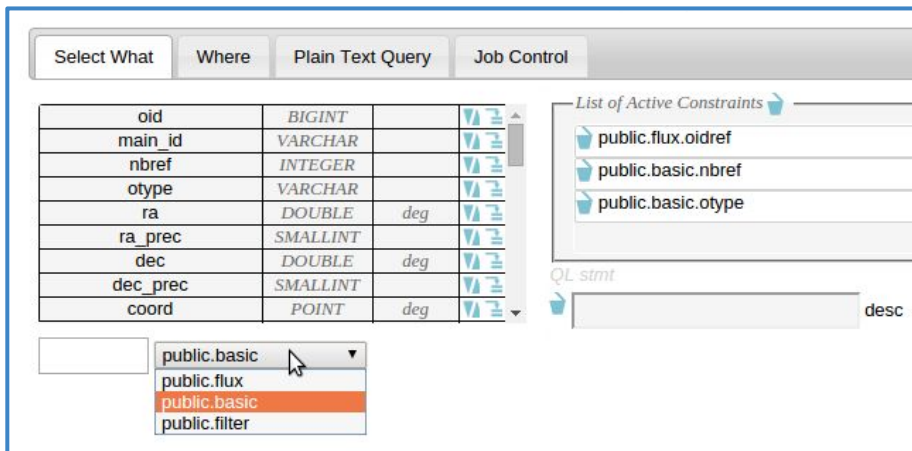
```
SELECT TOP 100 *
FROM wise.main
WHERE CONTAINS(POINT('ICRS', wise.main.ra2000, wise.main.dej2000), CIRCLE('ICRS', 23.462083, +30.659917, 0.016666666666666666)) = 1
AND wise.main.designation LIKE '%M33%'
ORDER BY wise.main.ra2000
```

- ✓ Constraints are **edited one by one** from the list of available columns.
- ✓ Constraints are **stacked** in a container.
- ✓ ADQL queries can be **refined by hand**



Table Join Management

- ✓ The query editor **gathers the tables** declared as **joined** in the TAP_SCHEMA
- ✓ **Join** statements are **automatically set** into the query



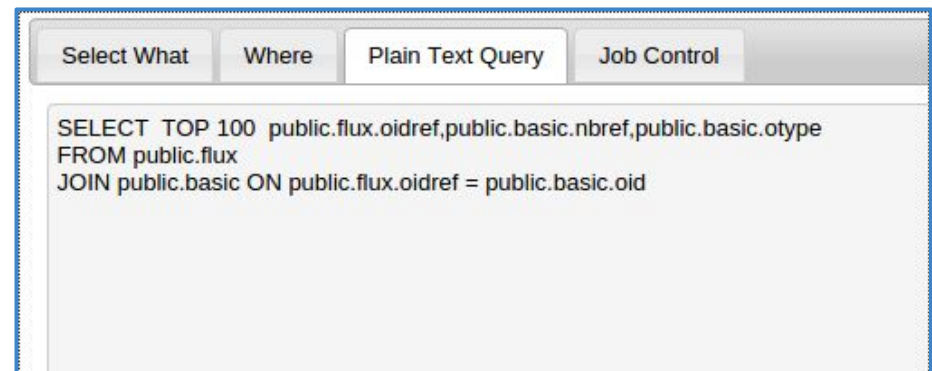
The screenshot shows a query editor interface with four tabs: "Select What", "Where", "Plain Text Query", and "Job Control". The "Select What" tab is active, displaying a table schema with the following columns:

oid	BIGINT		
main_id	VARCHAR		
nbref	INTEGER		
otype	VARCHAR		
ra	DOUBLE	deg	
ra_prec	SMALLINT		
dec	DOUBLE	deg	
dec_prec	SMALLINT		
coord	POINT	deg	

Below the table, a dropdown menu is open, showing the following options:

- public.basic
- public.flux
- public.basic
- public.filter

The "List of Active Constraints" section is empty. The "QL stmt" field is also empty.



The screenshot shows a query editor interface with four tabs: "Select What", "Where", "Plain Text Query", and "Job Control". The "Plain Text Query" tab is active, displaying the following SQL query:

```
SELECT TOP 100 public.flux.oidref,public.basic.nbref,public.basic.otype
FROM public.flux
JOIN public.basic ON public.flux.oidref = public.basic.oid
```



Shopping Cart Facility

- ✓ **Query results** or **data files** referenced by them can be put in the **cart**.
- ✓ The **shopping cart** content can be downloaded in a **ZIP archive**.
 - Asynchronously processed

job 35_ivoa COMPLETED Actions

Shopping Cart

▼Node undefined

Keep/Discard	Data Source	Resource Name	Resource URI
<input checked="" type="checkbox"/>	URL	preserve	http://xcatdb.unistra.fr/3xmm/getproduct?oid=866379999790235705
<input checked="" type="checkbox"/>	URL	preserve	http://xcatdb.unistra.fr/3xmm/getproduct?oid=866379999790235750

▼Node 3xmm

Keep/Discard	Data Source	Resource Name	Resource URI
<input checked="" type="checkbox"/>	Job	34_CATALOGUE	34_CATALOGUE

▼Node simbad

Keep/Discard	Data Source	Resource Name	Resource URI
<input checked="" type="checkbox"/>	Job	1410523617231A	1410523617231A

▼Processing status

Current Job Status nojob

Manage Content

Manage Job

Get the Result



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Interoperability

- ✓ **Data searched** in TAP nodes can be exported with **SAMP**
 - Query results
 - Data files referenced by query results

The screenshot displays the TOPCAT software interface. On the left, a 'Samp Info' window titled 'Available SAMP Clients' lists two clients: 'topcat Tool for OPerations on Catalogues And Tables' and 'Broadcast to any client'. The main window shows a 'Table List' with one entry selected, '13 / 3559 M'. To the right, the 'Current Table Properties' panel is visible, showing fields for Label, Location, Name, Rows, Columns, Sort Order, Row Subset, and Activation Action. Below this, the 'SAMP' section includes a 'Messages' field and a 'Clients' field with icons for the available clients. At the bottom, a table displays query results with columns for ID, Name, Location, and SAMP Client.

ID	Name	Location	SAMP Client
2	Eta Car	null	3XMM



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Resource Filtering

- ✓ Both **schemas and tables** exposed by a service can be **filtered**
 - Essential for huge resources like Vizier

Table Selector for node vizier

Give a filter on catalogue name or description:
- The filter is a RegExp case insensitive.
- Type [RETURN] to apply

The number of selected tables returned by the server is limited to 100 in any case.

Schema viz7

- viz7.J/A+A/521/A55/bh Catalog of the massive black hole used to construct the mass function
- viz7.J/A/J/145/31/table6 Host/nuclei parameters and central Black Hole masses
- viz7.J/Ap/J/746/169/table2 Binned DR7 Virial black hole mass function (BHMF)

Schema vizB

- vizB.J/Ap/J/701/587/table6 Black Hole Mass

Schema vizA

- vizA.J/other/ChA+A/32.351/table1 The redshift, VFWHM, black hole mass and Eddington accretion rate of the Seyfert galaxies and quasars studied in this paper
- vizA.J/A+A/505/417/table1 INTEGRAL AGN catalogue with type, position, redshift, exposure time, black hole mass
- vizA.J/Ap/J/699/800/sdss SDSS color-selected quasars parameters {*lem* (table 4)} and black hole mass estimates {*lem* (table 5)}
- vizA.J/Ap/J/690/20/bh Black Hole mass functions {*lem*(table 3)} and duty cycles {*lem*(table 4 of the paper)}
- vizA.J/Ap/J/699/800/table3 Basic properties of LBQS sources without black hole mass estimates
- vizA.J/Ap/J/699/800/lbqs LBQS line widths and nuclear luminosities {*lem* (table 1)} and black hole mass estimates {*lem* (table 2)}

Schema viz6

- viz6.J/A+A/492/637/tablea1 Black hole masses and Eddington ratios estimated from the MgII emission line
- viz6.J/A+A/492/637/tablea2 Black hole masses and Eddington ratios estimated from the CIV emission line
- viz6.J/Ap/JS/176/355/table1 Black Hole Parameters of the Sample

Unselect the tables you not want to access ([select](#) / [unselect all](#))
Caution: You cannot refine your selection once it is accepted (Version 1.1)

accept (Type [ESC] to close the window)



Data Formatting

target_name	s_ra	s_dec	s_fov	s_region	s_resolution	t_min	t_max	t_exptime	t_resolution	em_min	em_max	em_res_power
W1.-2+3.E1.3	32.244389	-3.8589288	0.50648608		NaN	55469.409	55469.410	75.000000	75.000000	9.7000000e-7	0.0000010700000	10.200000
STC Region ✕ Polygon ICRS UNKNOWNREFPOS SPHERICAL2 32.06562726133924 -3.680003365166722 32.42346588825577 -3.6796485652807047 32.42348705531371 -4.037751281998095 32.06496742236085 -4.0382418218178175												
D2	150.11367	2.2113134	1.4004640		NaN	53848.384	53848.388	360.07100	360.07100	8.1590000e-7	0.0000010007000	4.9150433
0420+2706	65.162500	27.111111	0.0051854497		NaN	55603.257	55603.263	360.00000	NaN	0.0013623167	0.0013637810	NaN

bibcode
2013AJ...146...78G
1063Aa1...137...141K

position_naxes	position_naxis	position_scale
2		
Data Array ✕ Array[0.3037147065806119 0.3037147065806119]		

Search	
access_url	
	applic
	applic

STC Region Viewer ✕

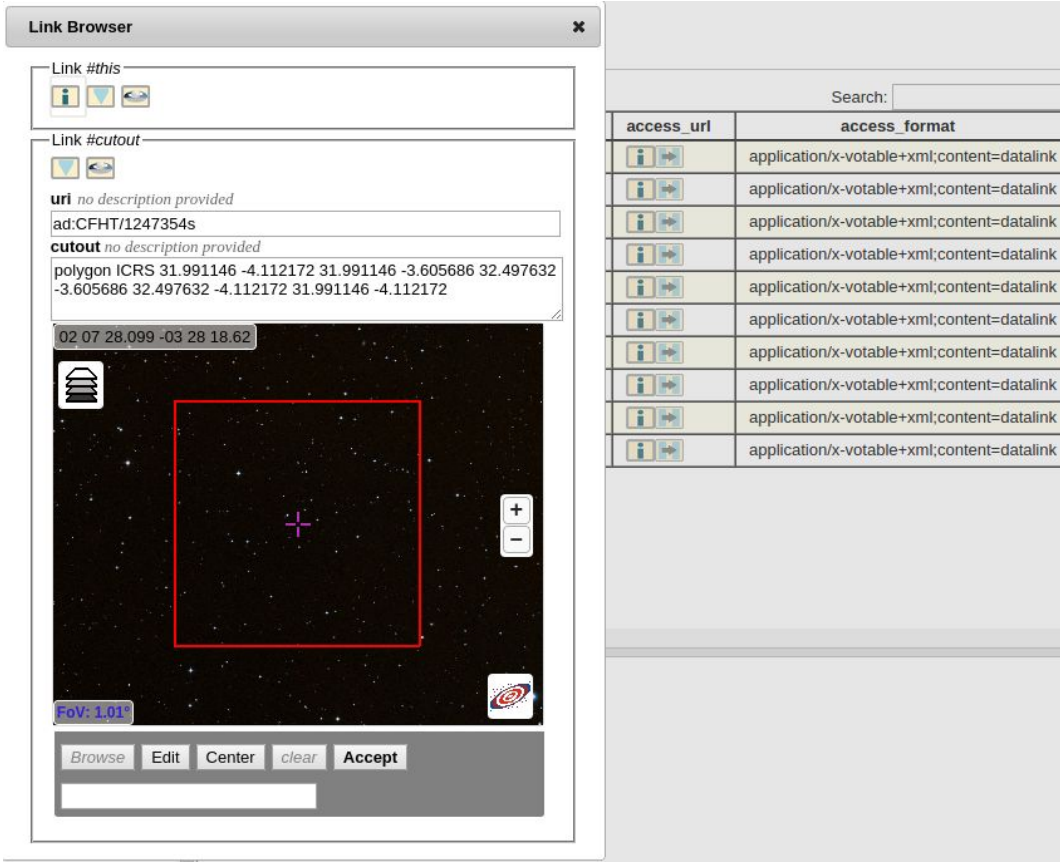
Polygon ICRS UNKNOWNREFPOS SPHERICAL2
 32.06562726133924 -3.680003365166722 32.42346588825577
 -3.6796485652807047 32.42348705531371 -4.037751281998095
 32.06496742236085 -4.0382418218178175

s_region





















- ✓ Displayed data are **formatted on the fly**
 - URLs
 - Vectors
 - Bibcodes
 - STC Regions



Datalink Support



The screenshot displays the 'Link Browser' interface. On the left, a 'Link #this' window shows a 'Link #cutout' section with a 'uri' field containing 'ad:CFHT/1247354s' and a 'cutout' field with a polygon ICRS coordinate string. Below this is a region editor showing a star field with a red rectangular cutout and a purple crosshair. The region editor includes a 'FoV: 1.01°' label and buttons for 'Browse', 'Edit', 'Center', 'clear', and 'Accept'. On the right, a table lists datalink responses with columns for 'access_uri' and 'access_format'. The table contains 10 rows, each with a small icon and the format 'application/x-votable+xml;content=datalink'.

access_uri	access_format
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink
 	application/x-votable+xml;content=datalink

- ✓ Datalink responses are shown as **forms built on the fly**
 - SAMP connection for linked files
 - Region editor for cutouts
 - HTML forms when input parameters are requested





Service Survey

- ✓ Capabilities as tested by TapHandle
 - One row per server (not per service)

A	B	C	D	E	F	G	H	I	J
http://dc.zah.uni-heidelberg.de/tap	ivo://org.gavo.dc	gavo-tap	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	GAVO Data Cent
http://wfaudata.roe.ac.uk/6df-dsa/TAP	ivo://wfau.roe.ac	wfauroe-6df-dsa	CAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	6dF Galaxy Surv
http://dsa.roe.ac.uk/ukidssDR4-v1/TAP	ivo://wfau.roe.ac	wfauroe-ukidssdr4	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	UKIDSS DR4 (S
http://www.cadc-ccda.hia-ih.nrc-cnrc.gc.ca/ivo://cadc.nrc.ca	ivo://cadc.nrc.ca	cadc	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	CADC Table Que
http://cda.harvard.edu/cxctap	ivo://cxc.harvard.edu	cxcharvardedu-c	CAPABILITY	TABLES	NOJOIN	NOSYN	NOASYN	NOUPLOAD	Chandra X-ray O
http://voparis-tap.obspm.fr/_system_/tap/ivo://vopdc.obspm	ivo://vopdc.obspm	voparis-epn	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	Auroral Planetary
http://ia2-tap.oats.inaf.it:8080/wgetap	ivo://ia2.inaf.it/h	ia2inafit-tap	CAPABILITY	TABLES	NOJOIN	SYNC	ASYN	UPLOAD	Laurino et al 201
http://tools.asdc.asi.it/TAP	ivo://asdc/tap	asdc-tap	CAPABILITY	TABLES	JOIN	SYNC	ASYN	NOUPLOAD	ASDC TAP Servi
http://ia2-tap.oats.inaf.it:8080/epntap	ivo://ia2.inaf.it/h	ia2inafit-nasadus	CAPABILITY	TABLES	NOJOIN	SYNC	ASYN	UPLOAD	INAF-IAPS RDB
https://tao.asvo.org.au/tao/tap	ivo://swinburne/t	swinburne-tao	CAPABILITY	TABLES	NOJOIN	NOSYN	NOASYN	NOUPLOAD	Theoretical Astro
http://cdpp-epntap.cesr.fr/_system_/tap/ivo://cdpp/amda	ivo://cdpp/amda	cdpp-amda	CAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	CDPP AMDA Da
http://machotap.asvo.nci.org.au/macho-tap/ivo://nci.org.au/n	ivo://nci.org.au/n	nciorgau-tap	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	MACHO TAP
http://wiggleztap.asvo.nci.org.au/wigglez-tap/ivo://nci.org.au/v	ivo://nci.org.au/v	nciorgau-tap	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	WiggLeZ Final Da
http://hipasstap.asvo.nci.org.au/hipass-tap/ivo://nci.org.au/h	ivo://nci.org.au/h	nciorgau-tap	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	HIPASS TAP
http://cas123-zone1.ast.cam.ac.uk/2dFGR/ivo://uk.ac.cam.c	ivo://uk.ac.cam.c	camast-object_c	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	2dF Galaxy Reds
http://heasarc.gsfc.nasa.gov/xamin/ivo/tap	ivo://nasa.heasa	heasarc-xamin	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	HEASARC Xami
http://data.csiro.au/psrdavo/TAP	ivo://au.csiro/psr	csiro-atnf_pulsar	CAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	ATNF Publishing
http://simbad.u-strasbg.fr:80/simbad/sim-tap/ivo://cds.simbad	ivo://cds.simbad	simbad	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	SIMBAD TAP qu
http://tapvizier.u-strasbg.fr/TAPVizieR/tap/ivo://cds.vizier/t	ivo://cds.vizier/t	vizier	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	TAP VizieR quer
http://jvo.nao.ac.jp/skynode/do/tap/akari	ivo://jvo/isas/ake	jvo-fis_v1	CAPABILITY	TABLES	NOJOIN	NOSYN	NOASYN	NOUPLOAD	AKARI Far-infrar
http://www.sao.ru/dsa-cats/TAP	ivo://sao.ru/dsa-	saoru-wsdb	NOCAPABILITY	NOTABLES	NOJOIN	SYNC	ASYN	NOUPLOAD	Special Astrophy
http://gavo.aip.de/tap	ivo://aip.gavo.org	aipgavoorg-tap	CAPABILITY	TABLES	JOIN	SYNC	ASYN	UPLOAD	AIP DaCHS TAP





Prospects

- **Scheduled**

- Uploading position lists
- Uploading job results
- Support of extended functions by the query editor
 - Aggregation (count, min, max...)
 - ADQL functions.
- Better error handling
- Lot of minor changes making together the interface more comprehensive



- **Thinking about a better use of the meta data**

- Better representation of joined table sets.
- Extended use of the meta data
 - plain text meta data
 - Units
 - UCDs

- **Thinking about persistence for the query results**

- User sessions
- Connecting VOSpace?



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