

# 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

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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***

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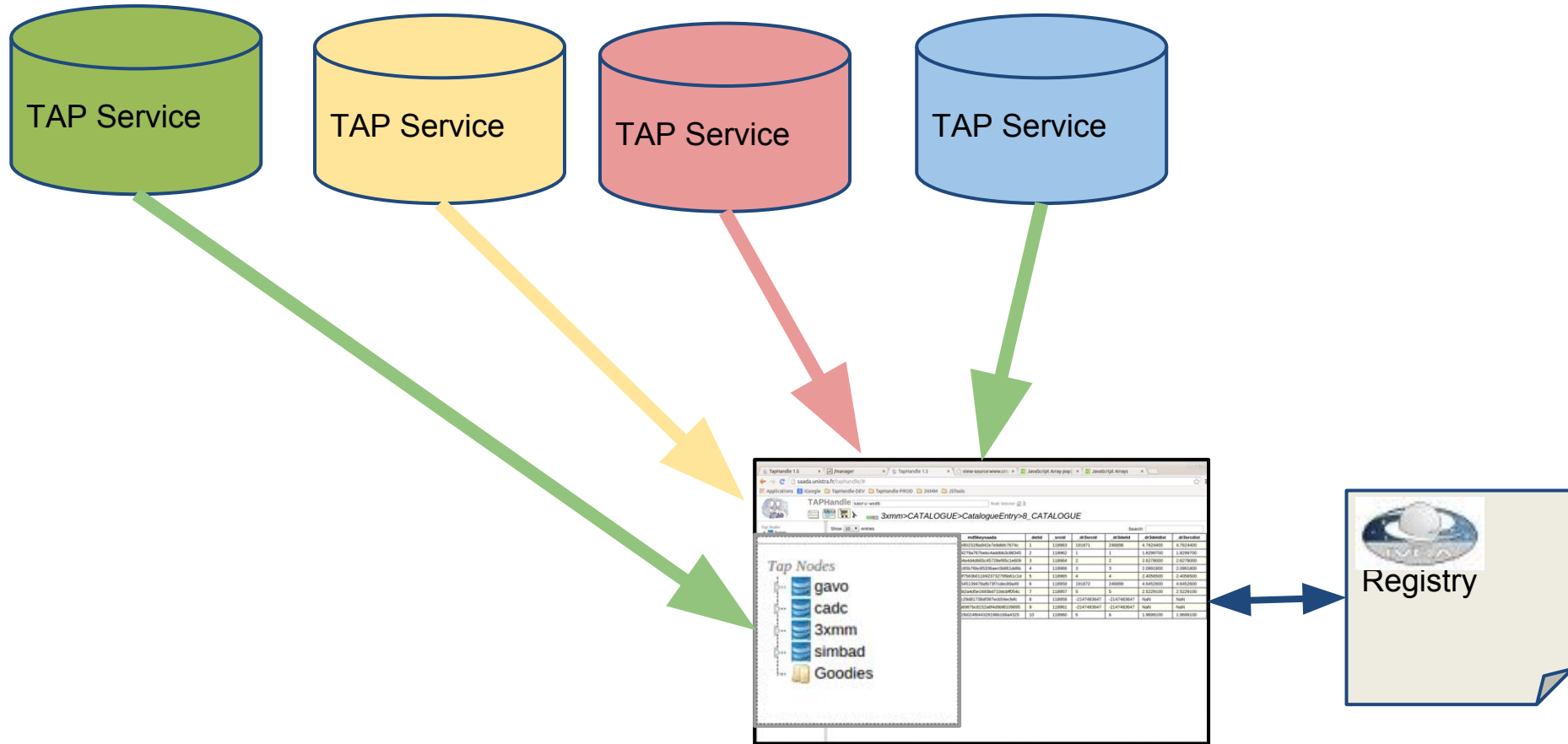
- **A tool designed for discovering data exposed in any TAP service.**
  - No prior knowledge about the data content
- **Accessing TAP services with a WEB browser.**
  - Accessing meta-data
  - Accessing data
  - Query editor
  - Downloading results
  - Interoperability
- **Accessing simultaneously multiple 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

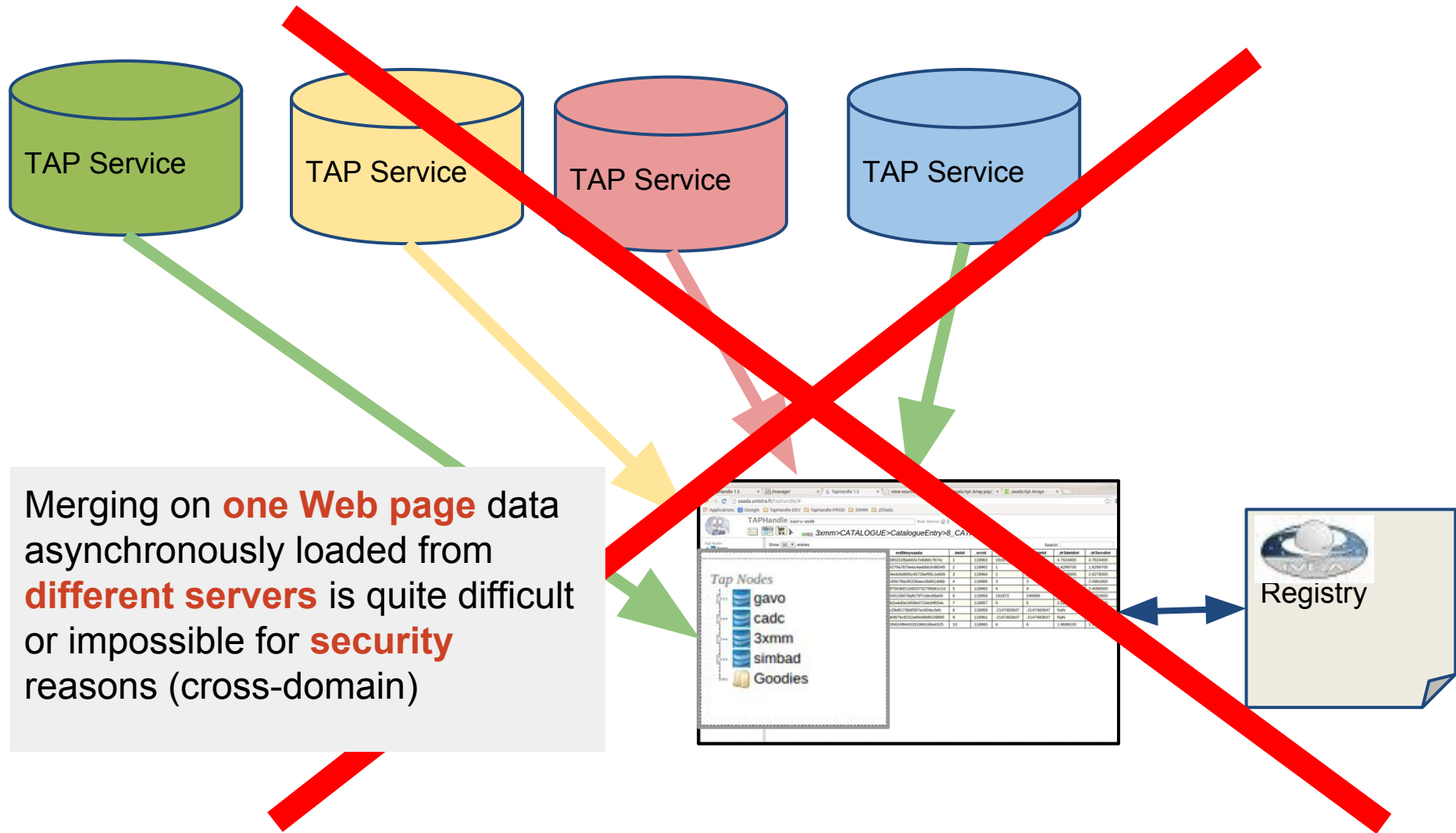


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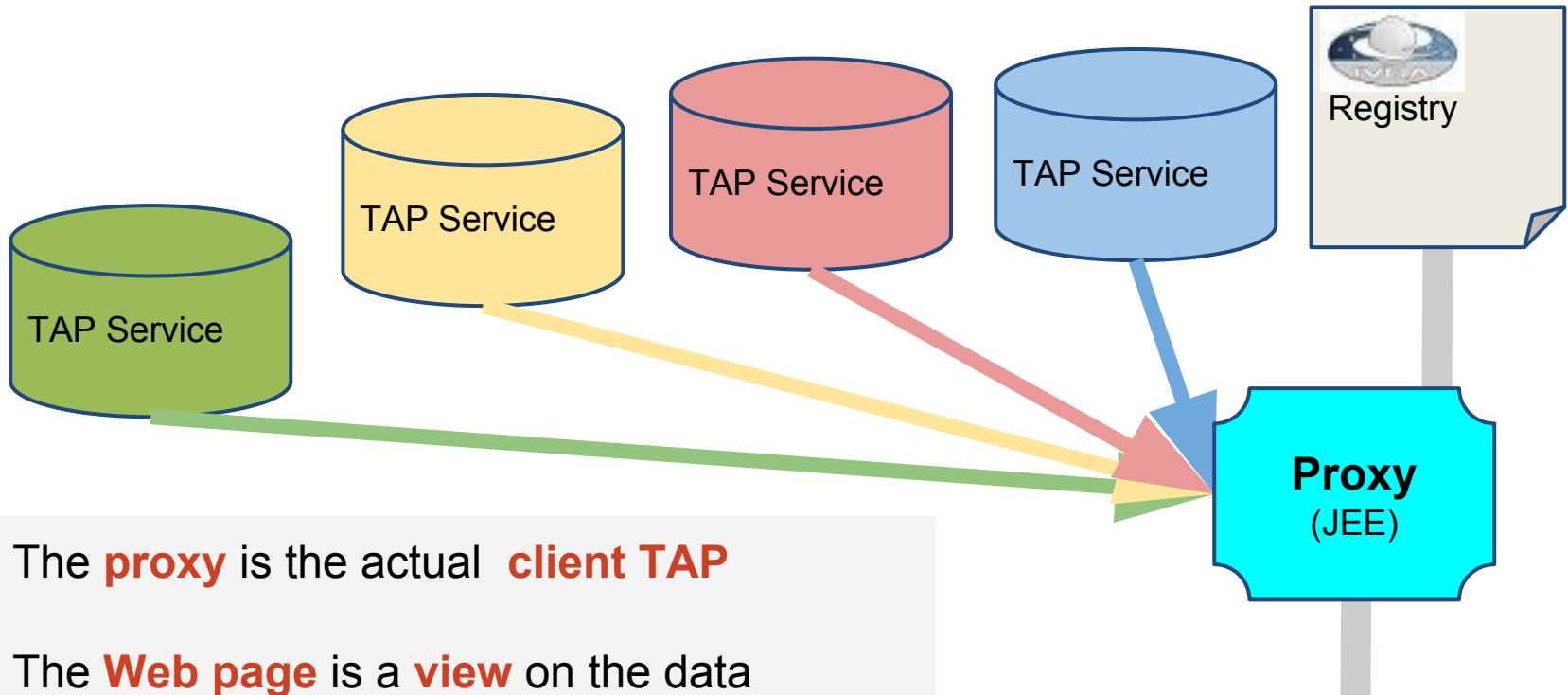
# TapHandle Architecture



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# 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 window displaying a data table. The table has columns for 'id', 'nom', 'adresse', 'ville', 'code', 'departement', 'region', and 'population'. The data is organized into a grid with alternating row colors. The browser's address bar shows the URL 'www.saga-da.com'. The page title is 'TAPHandle - user - saga - CATALOGUE=CatalogueEntry-8\_CATALOGUE'.

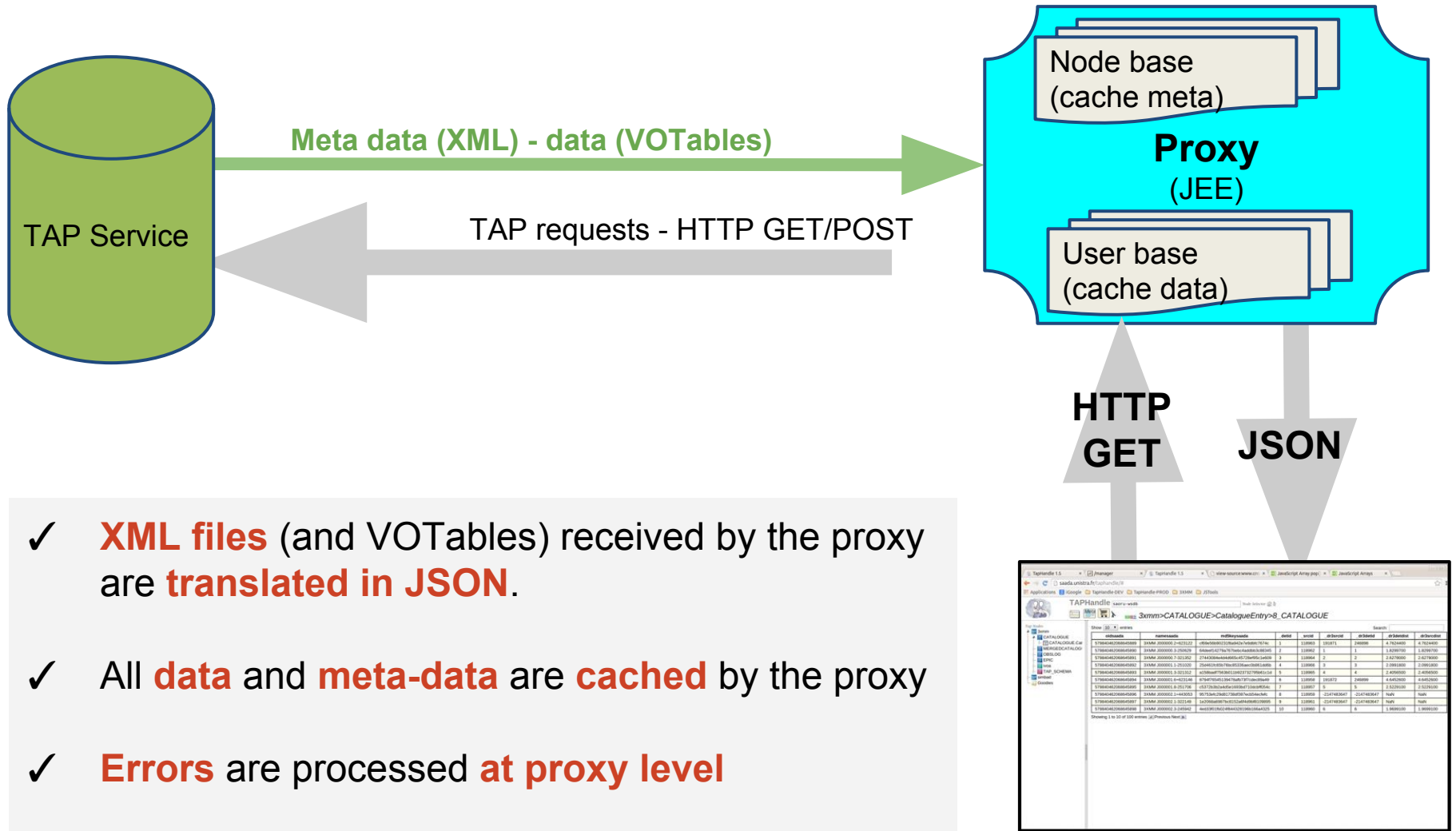
| id                   | nom  | adresse          | ville                            | code | departement | region | population |
|----------------------|------|------------------|----------------------------------|------|-------------|--------|------------|
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 1    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 2    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 3    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 4    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 5    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 6    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 7    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 8    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 9    | 130000      | 130000 | 47624400   |
| 57898400000000000000 | SAIM | 2000002-2-021022 | 48566000222222222222222222222222 | 10   | 130000      | 130000 | 47624400   |



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# The TapHandle Proxy

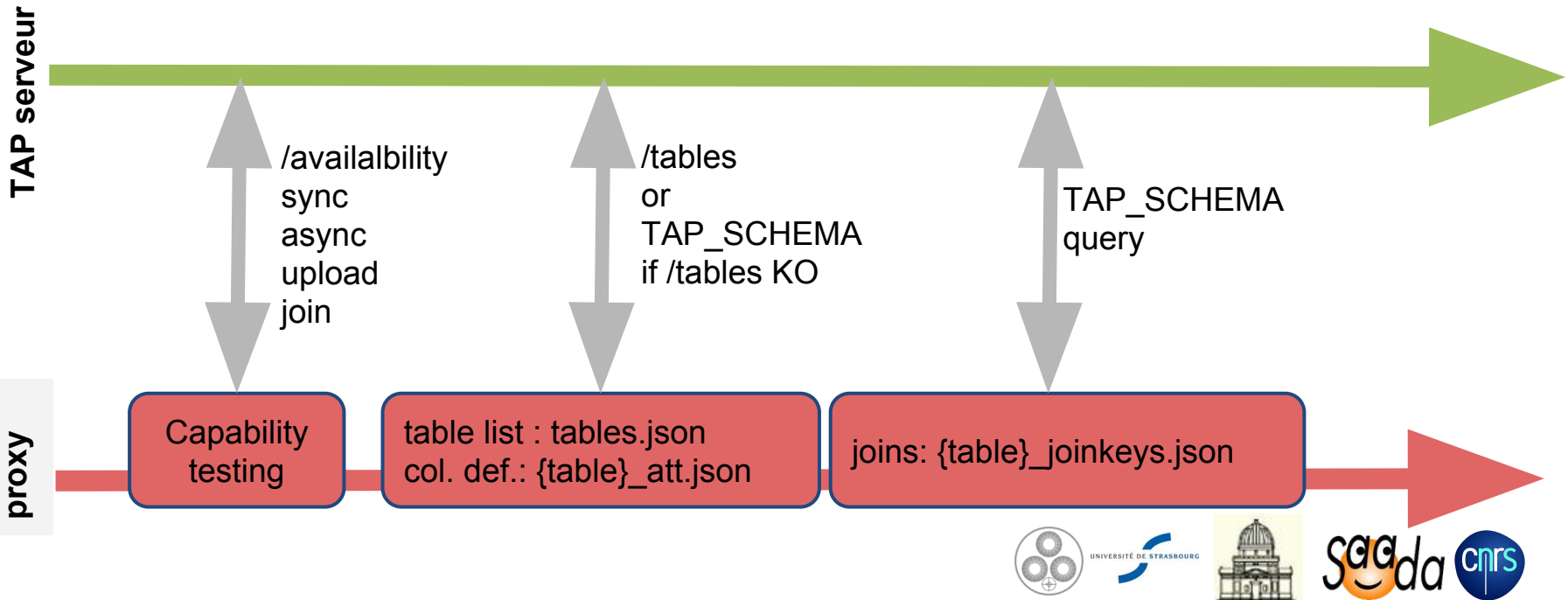


- ✓ **XML files** (and VOTables) received by the proxy are **translated in JSON**.
- ✓ All **data** and **meta-data** are **cached** by the proxy
- ✓ **Errors** are processed **at proxy level**



# 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 page title is 'TAPHandle' with a 'gavo' user indicator and a 'Node Selector' dropdown. The current path is shown as '3xmm>CATALOGUE>CatalogueEntry>8\_CATALOGUE'. On the left, a tree of accessible resources is visible, including 'gavo', 'cadc', '3xmm', 'CATALOGUE', 'MERGEDCATALOGUE', 'OBSLOG', 'EPIC', 'ivoa', 'TAP\_SCHEMA', 'simbad', and 'Goodies'. A search bar is located above the table. The table displays query results with columns: 'oidsaada', 'namesaada', 'md5keysaada', '\_detid', '\_srcid', and '\_dr3srcid'. Below the table, there is a 'Query editor' section with 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 | 64deef14279a767b9bc4addbb3c88345 | 2      | 118962 | 1           |
| 579840462068645891 | 3XMM J000000.7-321352 | 27443084e4d4d665c45728ef95c1e609 | 3      | 118964 | 2           |
| 579840462068645892 | 3XMM J000001.1-251020 | 25d461fc65b76bc85336aec0b681d68b | 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 | c5372b3b2a4d5e1693bd7100cb#054c  | 7      | 118957 | 5           |
| 579840462068645896 | 3XMM J000002.1+443053 | 95753efc29d81738df397ecb54ec1efc | 8      | 118959 | -2147483647 |
| 579840462068645897 | 3XMM J000002.1-322149 | 1e2068af987bc8152a6f4d9b8109896  | 9      | 118961 | -2147483647 |
| 579840462068645898 | 3XMM J000002.3-245942 | 4ed33f01fb024844328196b166a4325  | 10     |        |             |

Query editor

Job management



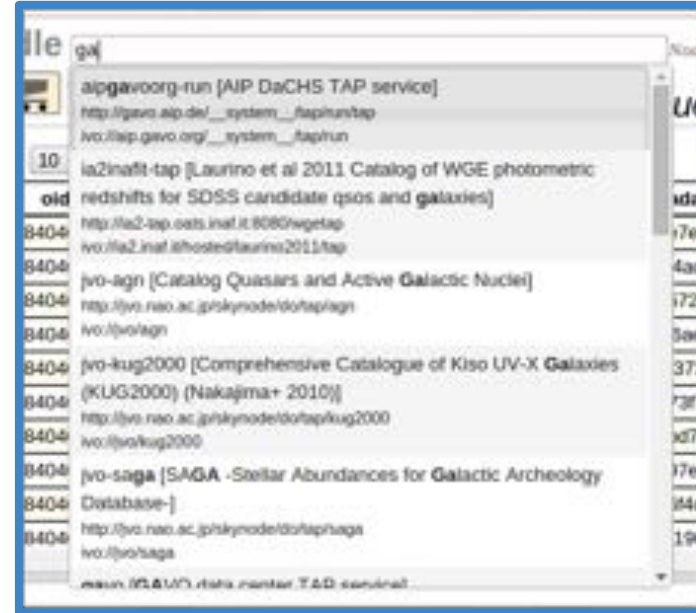
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# Connecting the Registry

- ✓ 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'
```



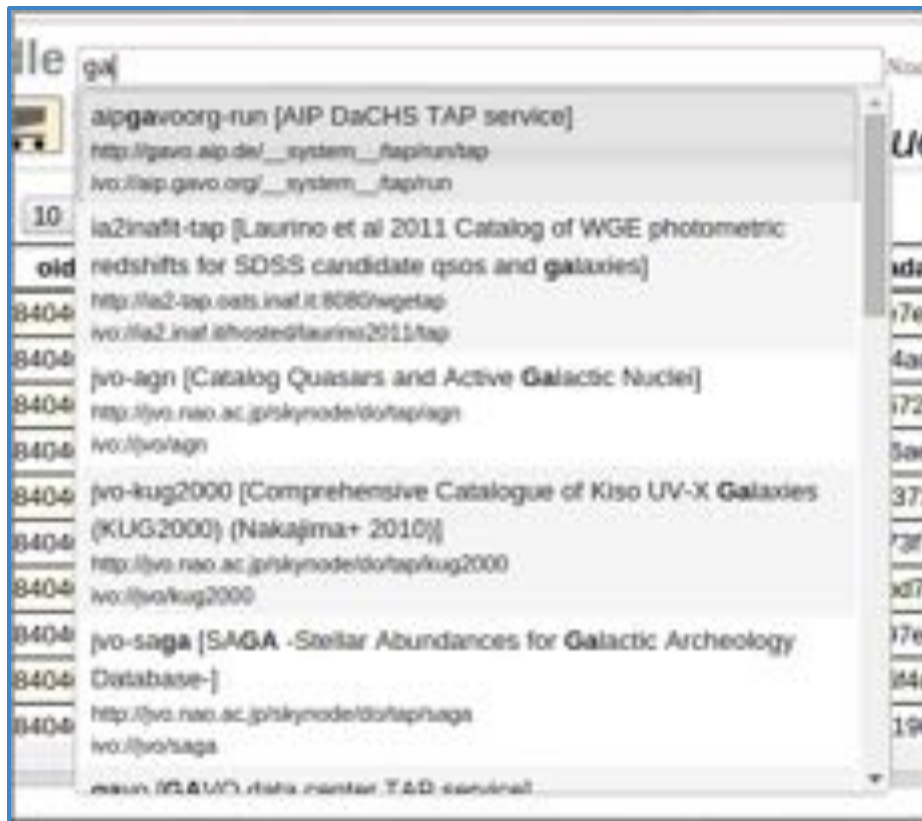
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# Tap Service Selection

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

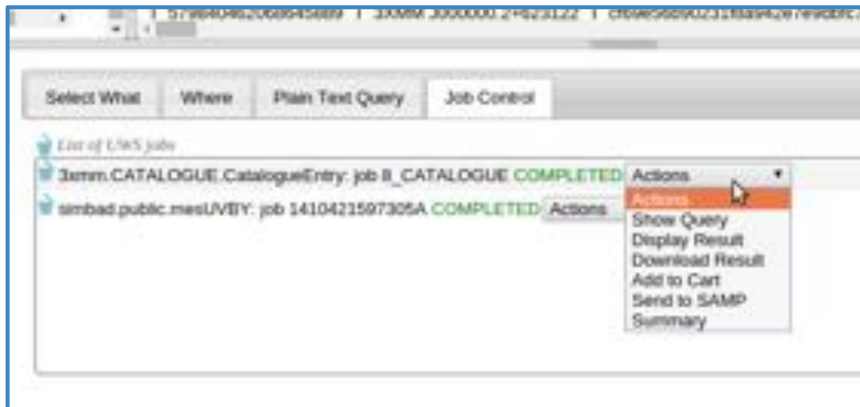


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# Job Management



- ✓ 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



# Query Editor

The screenshot displays the Query Editor interface. On the left, there is a 'Result Limit' field set to 100. Below it is a table of available columns:

| designation | char(*)   |     |  |
|-------------|-----------|-----|--|
| raj2000     | double(I) | deg |  |
| dej2000     | double(I) | deg |  |
| sigra       | float(I)  | deg |  |
| sigdec      | float(I)  | deg |  |
| sigradec    | float(I)  | deg |  |
| glon        | double(I) | deg |  |
| glat        | double(I) | deg |  |
| wx          | float(I)  | pix |  |

On the right, there is a 'List of Active Constraints' section. It shows a coordinate '23.462083 +30.659917' and a radius of 1. The constraints are:

- wise.main.POSITION inCircle 23.462083, +30
- AND wise.main.designation LIKE %M33%

Below the constraints, there is a preview of the generated SQL query:

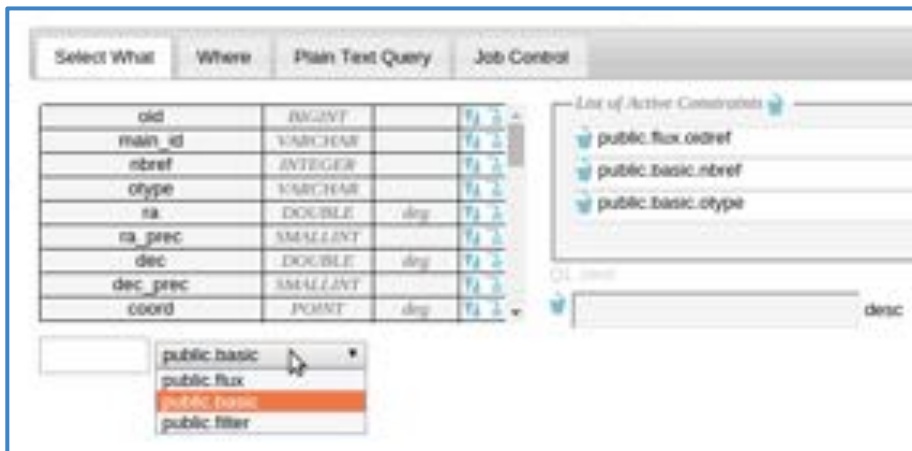
```
SELECT TOP 100 *
FROM wise.main
WHERE CONTAINS(POINT('ICRS', wise.main.raj2000, wise.main.dej2000), CIRCLE('ICRS', 23.462083, +30.659917, 0.016666666666666666)) = 1
AND wise.main.designation LIKE '%M33%'
ORDER BY wise.main.raj2000
```

- ✓ 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**



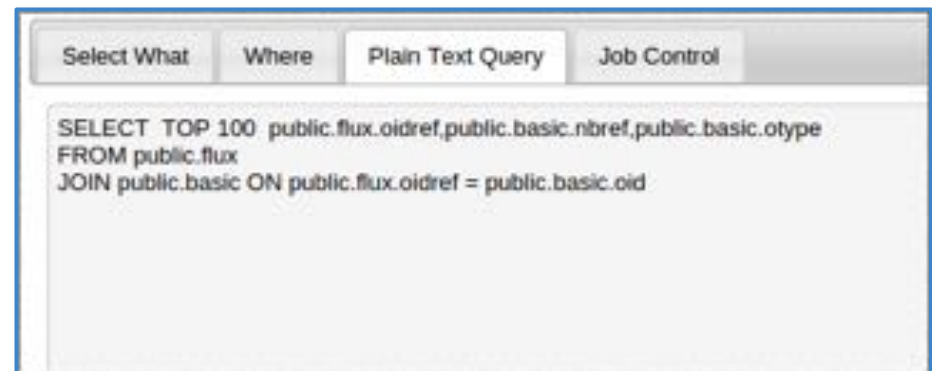
# Table Join Management

- ✓ 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 structure with columns and data types. A dropdown menu is open, showing a list of tables: "public basic", "public flux", "public basic", and "public filter".

| Column Name | Data Type | Flags |
|-------------|-----------|-------|
| oid         | BIGINT    |       |
| main_id     | VARCHAR   |       |
| nbref       | INTEGER   |       |
| otype       | VARCHAR   |       |
| ra          | DOUBLE    | drop  |
| ra_prec     | SMALLINT  |       |
| dec         | DOUBLE    | drop  |
| dec_prec    | SMALLINT  |       |
| coord       | POINT     | drop  |



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 a SQL query:

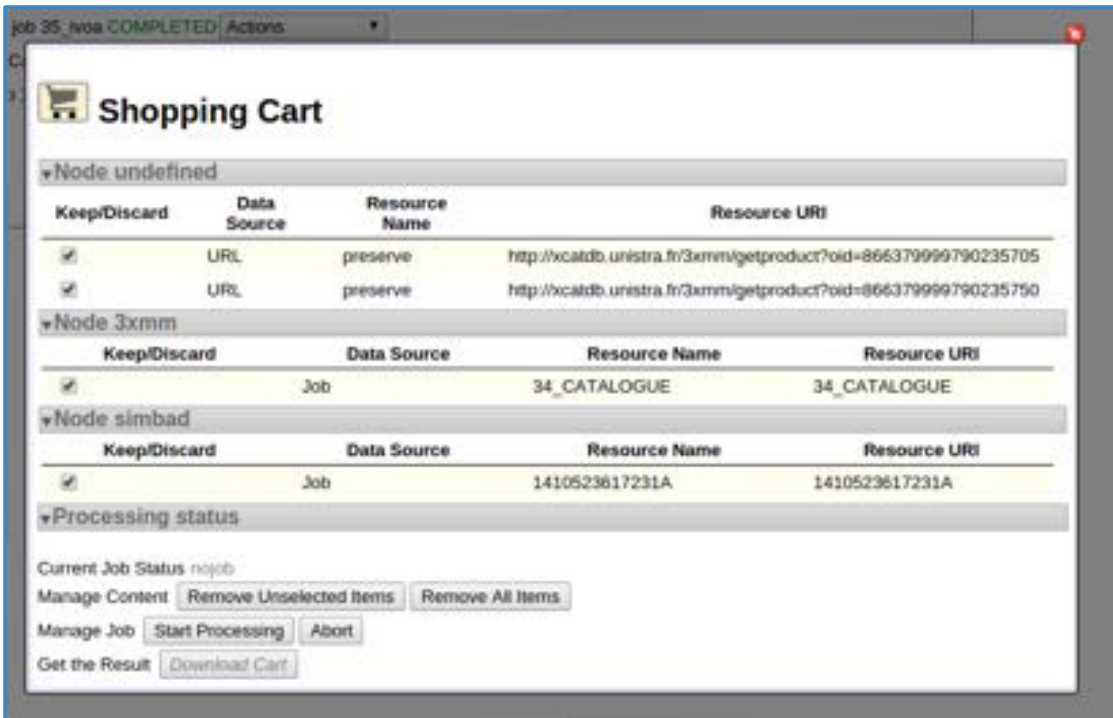
```
SELECT TOP 100 public.flux.oidref,public.basic.nbreff,public.basic.otype
FROM public.flux
JOIN public.basic ON public.flux.oidref = public.basic.oid
```





# 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:





# Interoperability

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

The screenshot displays the TAPHandle software interface. On the left, a 'Samp Info' window titled 'Available SAMP Clients' lists clients for data export. The main window shows a 'Table List' and 'Current Table Properties' for a selected table. A 'SAMP' section at the bottom provides controls for messages and clients.

| ID | NAME    | TYPE   | IP          | PORT  | STATUS |
|----|---------|--------|-------------|-------|--------|
| 1  | PLA...  | PLA... | 192.168.1.1 | 10000 | ONLINE |
| 2  | Ela Car | Full   | 192.168.1.2 | 10001 | ONLINE |



# 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 RegEx case sensitive.  
- Type [RETURN] to apply

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

**Schema viz7**

- viz7.JIA+A/521/A55/bh Catalog of the massive black hole used to construct the mass function
- viz7.JIAJ/145/31/table6 Host/nuclei parameters and central Black Hole masses
- viz7.JIAp/1746/169/table2 Binned DR7 Virial black hole mass function (BHMF)

**Schema viz8**

- viz8.JIAp/1701/587/table6 Black Hole Mass

**Schema vizA**

- vizA.JIAp/1699/900/ids SDDS color-selected quasars parameters (see (table 4)) and black hole mass estimates (see (table 5))
- vizA.JIA+A/505/417/table1 INTEGRAL AGN catalogue with type, position, redshift, exposure time, black hole mass
- vizA.JIAp/1699/20/bh Black Hole mass functions (see (table 3)) and duty cycles (see (table 4 of the paper))
- vizA.JIAp/1699/900/table3 Basic properties of LBQS sources without black hole mass estimates
- vizA.JIAp/1699/900/bqs LBQS line widths and nuclear luminosities (see (table 1)) and black hole mass estimates (see (table 2))

**Schema viz6**

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

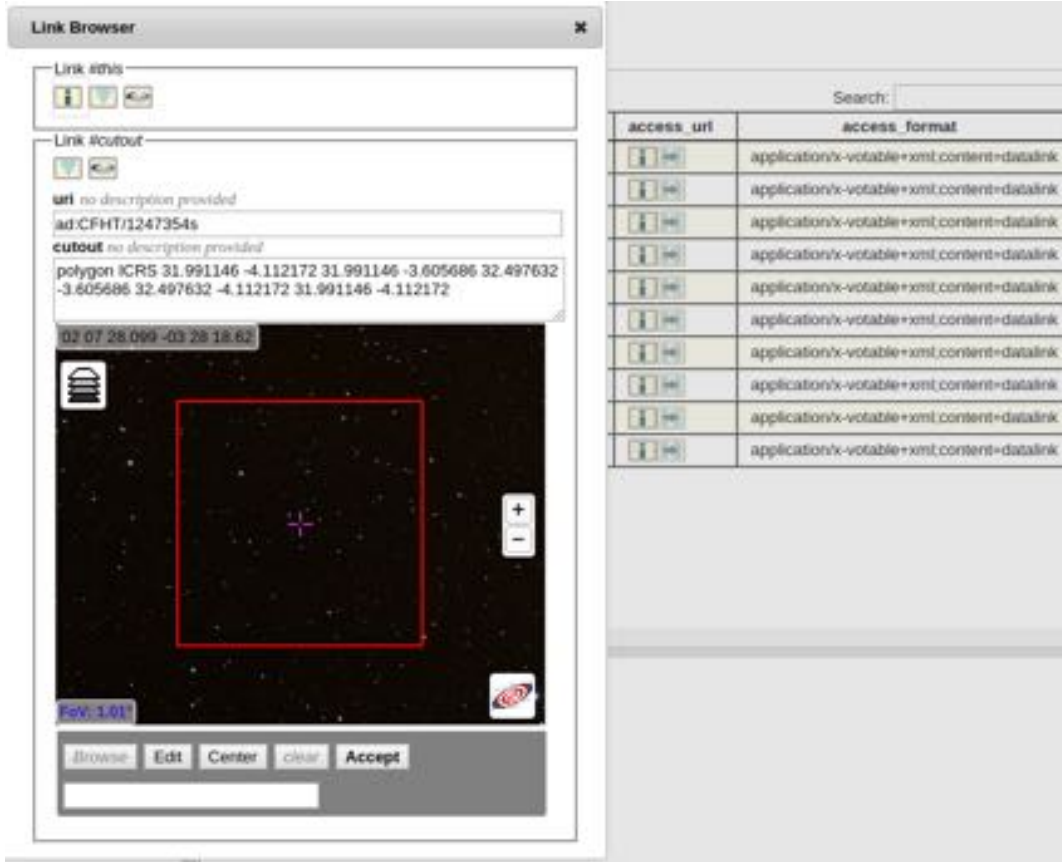
Unselect the tables you not want to access (select / unselect all)  
Caution: You cannot refine your selection once it is accepted (Version 1.1)

(Type [ESC] to close the window)





# Datalink Support



The screenshot displays the 'Link Browser' window. On the left, there are two sections: 'Link #this' and 'Link #cutout'. The 'Link #cutout' section shows a 'url' field with 'no description provided', an 'id' field with 'CFHT1247354s', and a 'cutout' field with 'no description provided'. Below this is a 'polygon' field containing the coordinates: 'ICRS 31.991146 -4.112172 31.991146 -3.605686 32.497632 -3.605686 32.497632 -4.112172 31.991146 -4.112172'. A central panel shows a dark image with a red rectangular cutout and a crosshair. Below the image are 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, all with the same 'access\_format' value: '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://wfauroe.ac.uk/wfauroe-6df-dsa      |   | CAPABILITY   | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | 6df Galaxy Surv   |
| http://dsau.roe.ac.uk/ukidssDR4-v1/TAP       | ivo://wfauroe.ac.uk/wfauroe-ukidssdr4-v1 |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | UKIDSS DR4 (5-    |
| http://www.cadc-cada.hia-ihp.nrc-cnrc.gc.ca  | ivo://cadc.nrc.ca/cadc                   |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | CADC Table Que    |
| http://cda.harvard.edu/cxctap                | ivo://cxc.harvard.edu/cxchavardedu-c     |   | CAPABILITY   | TABLES   | NOJOIN | NOSYN | NOASYN | NOUPLOAD | Chandra X-ray O   |
| http://voparis-tap.obspm.fr/_system_/tap/    | ivo://vopdc.obspm.fr/voparis-epn         |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | Auroral Planetary |
| http://la2-tap.oats.inaf.it:8080/wgetap      | ivo://la2.inaf.it/la2rafit-tap           |   | CAPABILITY   | TABLES   | NOJOIN | SYNC  | ASYN   | UPLOAD   | Laurino et al 201 |
| http://hods.asdc.asi.it/TAP                  | ivo://asdc.tap.asdc.tap                  |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | NOUPLOAD | ASDC TAP Servi    |
| http://la2-tap.oats.inaf.it:8080/epntap      | ivo://la2.inaf.it/la2rafit-nasdc         |   | CAPABILITY   | TABLES   | NOJOIN | SYNC  | ASYN   | UPLOAD   | INAF-IAPS RDB     |
| https://tao.asvo.org.au/taotap               | ivo://swinburne.it/swinburne-tao         |   | CAPABILITY   | TABLES   | NOJOIN | NOSYN | NOASYN | NOUPLOAD | Theoretical Astrc |
| http://cdpp-epntap.cesr.fr/_system_/tap/     | ivo://cdpp/amda.cdpp-amda                |   | CAPABILITY   | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | CDPP AMDA Da      |
| http://machotap.asvo.ncl.org.au/macho-tap/   | ivo://hcl.org.au/hclnclorgau-tap         |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | MACHO TAP         |
| http://wiggletap.asvo.ncl.org.au/wigglez-tap | ivo://hcl.org.au/hclnclorgau-tap         |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | WigglerZ Final Da |
| http://hipastap.asvo.ncl.org.au/hipass-tap/  | ivo://hcl.org.au/hclnclorgau-tap         |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | HIPASS TAP        |
| http://cas123-zone1.ast.cam.ac.uk/2dFGR      | ivo://uk.ac.cam.uk/camast-object_c       |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | 2dF Galaxy Red    |
| http://heasarc.gsfc.nasa.gov/xamir/vo/tap    | ivo://hassa.heasarc.gsfc.nasa.gov/xamin  |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | HEASARC Xami      |
| http://data.csiro.au/prdavo/TAP              | ivo://au.csiro.au/prdvo-atnf_gulbar      |   | CAPABILITY   | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | ATNF Publishing   |
| http://simbed.u-strasbg.fr/80/simbed/sim-tap | ivo://cda.simbed.u-strasbg.fr/simbed     |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | SIMBAD TAP qu     |
| http://tapvizier.u-strasbg.fr/TAPVizieR/tap  | ivo://cda.vizier.u-strasbg.fr/vizier     |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | TAP VizieR quer   |
| http://vo.nso.edu/jp/skynode/dotap/akari     | ivo://vo.nso.edu/jp/skynode/dotap/akari  |   | CAPABILITY   | TABLES   | NOJOIN | NOSYN | NOASYN | NOUPLOAD | AKARI Far-infrar  |
| http://www.sao.ru/dsa-cats/TAP               | ivo://sao.ru/dsa-cats/saoru-wsdb         |   | NOCAPABILITY | NOTABLES | NOJOIN | SYNC  | ASYN   | NOUPLOAD | Special Astrophy  |
| http://gavo.sp.de/tap                        | ivo://tap.gavo.org/epgvoorg-tap          |   | CAPABILITY   | TABLES   | JOIN   | SYNC  | ASYN   | UPLOAD   | AIP DaCHS TAP     |



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# Prospects

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- **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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