## **IVOA ProvTAP :**

### November 2021 status

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# Why Provenance in TAP ?

- Provenance information can be attached to data in various ways :
  - Embedded in the data « header » itself
  - Linked to the data record via DataLink or URL
  - Retrievable via ProvSAP via data id.
- In addition to that , Provenance metadata in a TAP service will allow to discover « data » by constraining Provenance features.
  - It's a « reverse » mechanism.

# « The » issue = complexity (see « FAIR high level data for Cherenkov astronomy » )



Figure 8: Full class diagram of the IVOA Provenance Data Model.

# « The » issue = complexity



Figure 8: Full class diagram of the IVOA Provenance Data Model.

# ->1 table per class ? --- $\rightarrow$ ProvTAP

# ProvTAP TAP\_SCHEMA: parameter table

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	Name	ucd	utype	datatype
	p_activity	meta.id	voprov:Parameter.activity_id	char
	p_id	meta.id	voprov:Parameter.id	char
	p_value	stat.value	voprov:Parameter.value	param dependent
	$\rightarrow$ p_description	meta.id	$voprov: Parameter. parameter Description\_id$	reference to parameter description

Table 8: Column description for Parameter table

# **ProvTAP** status

- There is an internal draft on the IVOA DAL page
- TAP schema mapping classes as tables
- ProvHiPS (provenance of HiPS and HiPS tiles) is an implementation prototype
- From now examples and demos from ProvHiPS



#### IVOA Provenance Table Access Protocol (ProvTAP)

#### Version 1.0

#### IVOA Working Draft 2018-03-22

Working group DM

This version http://www.ivoa.net/documents/ProvTAP/20180322 Latest version

http://www.ivoa.net/documents/ProvTAP Previous versions

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François Bonnarel

#### Abstract

This document describes the ProvTAP protocol for accessing provenance information according to the IVOA ProvenanceDM standard. It defines how the elements of ProvDM are described in the TAP schema tables and provides guidelines for impleminenting with TAP 1.1.

# ProvTAP TAP\_SCHEMA: Entity table

Name	ucd	utype	datatype	status
e_id	meta.id	voprov:Entity.id	char	М
e_name	meta.title	voprov:Entity.name	char	0
e_type	meta.code.class	voprov:Entity.type	char	0
e_rights	meta.code.class	voprov:Entity.rights	char	0
e_location	meta.ref.url	voprov:Entity.location	char	0
$e\_generated$	time.start	voprov:Entity.generatedAtTime	char	0
e_invalidated	time.stop	voprov: Entity. invalidated At Time	char	0
e_comment	meta.description	voprov:Entity.comment	char	0
e_classtype	meta.code.class	voprov:Entity.classtype	char OPTION	М
e_value	stat.value	voprov:Entity.value	char	0
$\rightarrow$ e_description	meta.id	voprov:Entity.description_id	reference	0

*Table 2:* Column description for Entity table. The e\_classtype column may have the following two values :"dataset" and "value"

# ProvTAP TAP\_SCHEMA: parameterDescription table

Name	ucd	utype	datatype
$pd\_activitydescription$	meta.id	voprov:ParameterDescription. activityDescription_id	char
pd_id	meta.id	voprov: Parameter Description.id	char
$pd_name$	meta.title	voprov: Parameter Description.name	param dependent
$pd\_description$	meta.description	voprov: Parameter Description. description	char
$pd_datatype$	meta	voprov: Parameter Description. data type	char
$pd\_unit$	meta.unit	voprov: Parameter Description.unit	char
$pd\_ucd$	meta.ucd	voprov: Parameter Description.ucd	char
$pd\_utype$	meta	voprov: Parameter Description.utype	char
$pd_min$	stat.min	voprov: Parameter Description.min	param dependent
$pd_max$	$_{\rm stat.max}$	voprov: Parameter Description. max	param dependent
pd_options	meta	voprov:ParameterDescription.options	param dependent

# ProvHiPS : a ProvTAP service for HST HiPS

- Everybody knows HiPS ?
- HiPS made of tiles at a given order
- Tiles have a couple of progenitors in the original data collection (HST Fits files – drizzled, simply calibrated or raw)
- Provenance of tiles

## ProvHiPS ADQL query examples :

Finding out drizzled images « progenitors » of a specific HiPS tile.



### **ProvHiPS ADQL query examples :** Finding out drizzled images « progenitors » of a specific HiPS tile.

- select e.e\_name, e.e\_comment, a\_name, a\_starttime, a\_comment, ee.e\_name, ee.e\_comment from entity e
- join wasgeneratedby on e.e\_id = wgb\_entity
- join activity on wgb\_activity = a\_id
- join used on a\_id = u\_activity
- join entity ee on ee.e\_id = u\_entity
- where e.e\_name like '%Npix9199544'

## **ProvHiPS ADQL** query examples :

Finding out drizzled images « progenitors » of a specific HiPS tile.

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Finding agent and activity to whom entity is attributed and generating a given entity

 select ag\_name,ag\_type,ag\_comment, e\_name, e\_generated,e\_location, e\_comment, a\_name, a\_comment

from agent

join wasattributedto on ag\_id = wat\_agent

join entity on wat\_entity = e\_id

join wasgeneratedby on e\_id = wgb\_entity

join activity on a\_id = wgb\_activity

where e\_name = 'jbyq07020\_drc'

## ssues

- Table is denormalized : a lot of redundant information
- Loop issue : several occurances of the same triplet (name,utype,ucd) in the same table for different « objects »
- Let's try minimum or last step provenance by creating a standardized view

# Solutions -1 Single step = single table ( = join)

- The join is a permanent view described in the TAP schema
- Columns :

entity\_name, entity\_location, entity\_comment, ...

generating\_activity\_name, generating\_activity\_starttime, ....

agent\_role, agent\_name, ....

used\_entity\_list

- → Redundancy may be avoided if we group all used entities ids in a single cell
- $\rightarrow$  possible Recursivity

# Solutions Single step ( = join) - 1line per used entity

## • View (in postgres)

create view last\_step\_provenance as select

e.e\_name as entity\_name, e.e\_location as entity\_location, e.e\_generated as entity\_generated, e.e\_invalidated as entity\_invalidated, e.e\_comment as entity\_comment,

a\_name as generating\_activity\_name,a\_starttime as generating\_activity\_starttime, a\_endtime as generating\_activity\_endtime, a\_comment as generating\_activity\_comment,

wat\_role as agent\_role, ag\_name as agent\_name, ag\_type as agent\_type ,ag\_affiliation as agent\_affiliation, ag\_email as agent\_email, ag\_address as agent\_address, ag\_phone as agent\_phone, ag\_comment as agent\_comment,

ee.e\_name as used\_entity\_name from entity as e

# join wasgeneratedby on wgb\_entity = e.e\_id join activity on a\_id = wgb\_activity join used on u\_activity = a\_id join entity as ee on ee.e\_id = u\_entity join wasattributedto on wat\_entity = e.e\_id join agent on ag\_id = wat\_agent;

# **Solutions** Single step ( = join) 1 single line per generated entity

## • View (in postgres)

create view minimum\_provenance as select

e.e\_id AS entity\_id, e.e\_name AS entity\_name, e.e\_location AS entity\_location, e.e\_generated AS entity\_generated, e.e\_invalidated AS entity\_invalidated, e.e\_comment AS entity\_comment,

activity.a\_name AS generating\_activity\_name, activity.a\_starttime AS generating\_activity\_starttime, activity.a\_endtime AS generating\_activity\_endtime, activity.a\_comment AS generating\_activity\_comment,

wasattributedto.wat\_role AS agent\_role, agent.ag\_name AS agent\_name, agent.ag\_type AS agent\_type, agent.ag\_affiliation AS agent\_affiliation, agent.ag\_email AS agent\_email, agent.ag\_address AS agent\_address, agent.ag\_phone AS agent\_phone, agent.ag\_comment AS agent\_comment,

string\_agg(used.u\_entity::text, ','::text) AS used\_entities\_list
FROM entity e

JOIN wasgeneratedby ON e.e\_id::text = wasgeneratedby.wgb\_entity::text JOIN activity ON wasgeneratedby.wgb\_activity::text = activity.a\_id::text join used on u\_activity = a\_id join entity as ee on ee.e\_id = u\_entity join wasattributedto on wat\_entity = e.e\_id join agent on ag\_id = wat\_agent ; yypo

# Solutions

# Single step = view query execution

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# Two queries with these flat views

- select \* from last\_step\_provenance where entity\_name = 'j90x37020\_drc'
  - $\rightarrow$  response in several lines with redundancy
- select \* from minimum\_provenance where entity\_name = 'j90x37020\_drc'
  - $\rightarrow$  response in one line

# Success and limitations view 1

- Clear column names for distinct objects
- Rather simple recursivity to manage
- But :
  - Redondancy still there
  - No direct retrieval for chains of provenance

# Success and limitations view 2

- Clear column names for distinct objects
- No more redundancy
- But :
  - Complex recursivity to manage
  - No direct retrieval for chains of provenance

# Entity + dataset descriptions

• Finding datasetdescription for entities used by an activity started in november 2018.

SELECT \* FROM datasetdescription join entity on e\_description = dd\_id join used on e\_id = u\_entity join activity on a\_id = u\_activity where a\_starttime like '2018-11%'

# Entity + dataset descriptions



Enter a TAP service URL or a keyword

Show 10 v entries

saadaunistrafrprovtap>provenance>entity>753



Q Search

#### Tap Nodes 🗼 🕕 📰 saadaunistrafrprovtap 🖘 🗛 TAP SCHEMA 📄 ivoa 🛓 💼 provenance entity datasetdescription valuedescription activity activitydescription agent Darameter parameterdescription 🕜 used usagedescription wasgeneratedby generationdescription wasassociatedwith wasattributedto wasinformedby wasderivedfrom Collection configfile

- 1 minimum provenance
- last\_step\_provenance

Configfiledescription

- wasconfiguredby
- Goodies (not used yet)

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Showing 1 to 10 of 509 entries

Hide q

Result Limit

100

SUBMIT Select What Where Position

n Plain Text Query Job Control



Widgets do not reflect the query anymore after you modified it directly

# Full entity view

This view gathers entity and datasetdescription columns in one single table

create view full\_entity as select e\_id,e\_name, e\_location, e\_generated, e\_invalidated, e\_comment dd\_name, dd\_type, dd\_subtype, dd\_doculink from entity join datasetdescription on dd\_id = e\_description ;

# Reduced query using the view

SELECT \* FROM full\_entity join used on e\_id = u\_entity join activity on a\_id = u\_activity where a\_starttime like '2018-11%';

# Reduced query using the view



Enter a TAP service URL or a keyword



#### 🛓 🕦 📰 saadaunistrafrprovtap SJAU TAP\_SCHEMA

saadaunistrafrprovtap>provenance>entity>60 Show 10 v entries

e_name	e_location	e_generated	e_invalidated	e_comment	dd_name	dd_type	dd_subtype	dd_doculink	u_entity	u_activity	u_time	u_usagedescription	a_id
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Showing 1 to 10 of 509 entries

Hide query

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Tap Nodes

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Goodies (not used yet)

SUBMIT	Select What Where Position Plain Text Query Job Control
Result Limit	SELECT * EROM full_entity join used on e_id = u_entity join activity on a_id = u_ectivity where a_starttime like '2018-11%' ;
	Widents do not reflect the group anymore ofter you medified it directly.

Q Search

# Other views : activity in workflow

### Activity in workflow :

- Important for CTA, SKA ??
- Activity is part of a workflow execution
- Workflow execution is a superactivity encompassing several activities
- It has an activityDescription
- The activityDescription can point to CWL description

# Other views : activity in workflow

• activity\_in\_workflow defined as following view :

create view activity\_in\_workflow as

Select a.a\_name as activity\_name,a.a\_starttime as activity\_starttime, a.a\_endtime as activity\_endtime, a.a\_comment as activity\_comment, sa.a\_name as workflow\_exec\_name, sa.a\_starttime as workflow\_exec\_starttime, sa.a\_endtime as workflow\_exec\_endtime, ad\_name as workflow\_name, ad\_type as workflow\_activity\_description\_type, ad\_doculink as workflow\_external\_description from activity a join wasinformedby on wib\_informed = a.a\_id join activity sa on sa.a\_id = wib\_informant join activitydescription on ad\_id = sa.a\_description Where workflow\_activity\_description type = « Workflow »

# Standard

- Add some of these views as standard official simplification
- Allow to create services providing only the simplified views

## New version of WD in progress

#### 4.3 standardized flat views

In order to simplify usage of ProvTAP we defined flat views implementating most useful complex joins in the database.

Next table shows how it's possible ti implement last\_step\_provenanece this way

Name	ucd	utype	datatype	status
$\rightarrow$ entity_id	meta.id	voprov:entity.identifier	char	М
$\rightarrow$ entity_name	meta.id	voprov:entity.name	char	M
$\rightarrow$ generating_activity_name	meta.id	voprov:entity.wasgenerateby.activity.name	char	M
$\rightarrow$ generating_activity_start time	meta.id	$vop {\it rov: entity. was generate by. activity. start time}$	char	Μ