

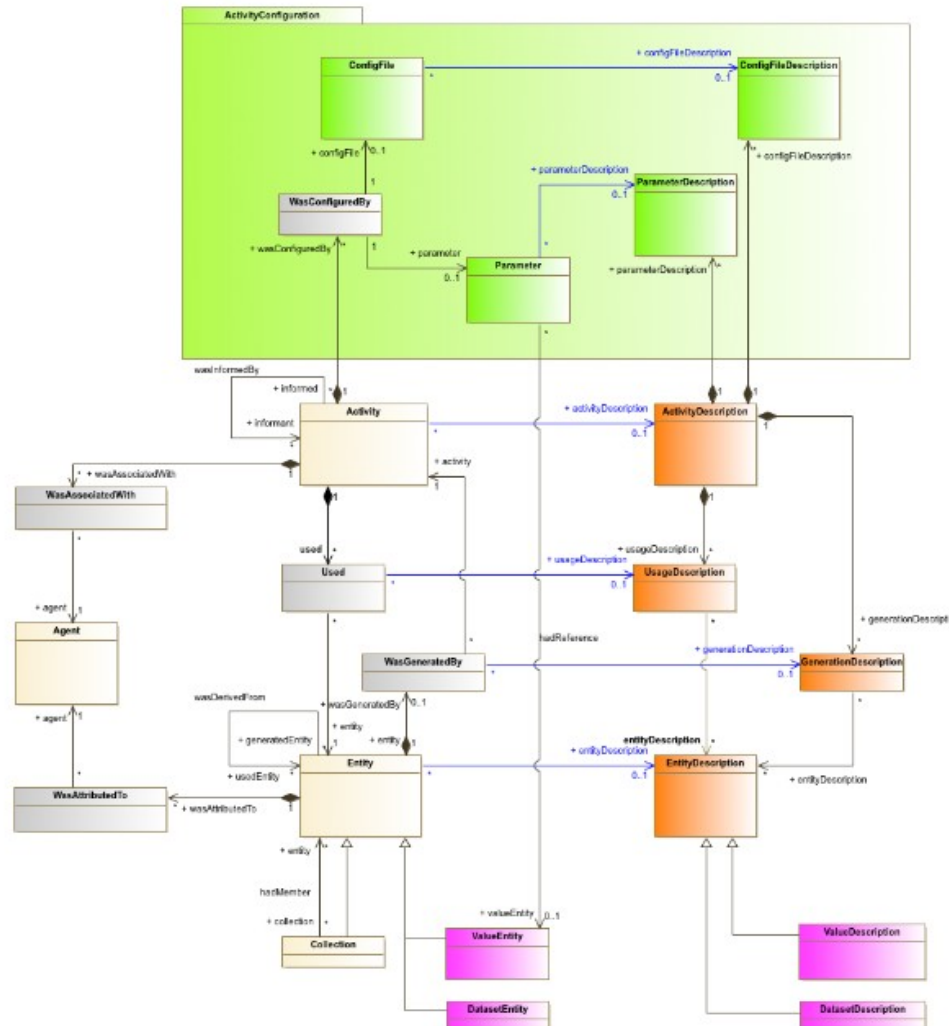


ProvTAP : restart and WorkingDraft

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- # IVOA provenance datamodel:
- a lot of additions to entity/activity/agent basics
 - issue for TAP : this is a loop graph



ProvTAP

- ProvTAP specification is mapping IVOA Provenance data model onto the TAP schema.
- The TAP schema defines
 - table and columns names,
 - Datatypes,
 - Units,
 - Ucds
 - and utypes (model attributed id)
 - → for each model feature !



TAP SCHEMA = Entity table

The screenshot displays the TOPCAT software interface. The main window shows a metadata browser with a tree view on the left and a details pane on the right. The tree view is expanded to show the 'entity' table under the 'TAP_SCHEMA.tables' folder. The details pane shows the 'Name: provenance' and 'Description: Provenance schema'.

A secondary window titled 'TOPCAT(3): Table Browser' is open, displaying a table of columns for the 'TAP_3 TAP_SCHEMA.columns' table. The table has 11 columns and 11 rows of data. The columns are: column..., table..., column_name, datatype, arraysize, size, descri..., utype, unit, ucd, indexed, principal, and std. The rows contain data for each column, including values like 'entity', 'e_id', 'VARCHAR', and 'voprov:Entity.id'.

The main window also shows a 'Service Capabilities' section with 'Query Language: ADQL-2.0', 'Max Rows: 1000000 (default)', and 'Uploads: unavailable'. Below this is an 'ADQL Text' section with 'Mode: Synchronous' and a query editor containing the text: 'select * from TAP_SCHEMA.columns where table_name = 'entity''. At the bottom of the main window, there is a 'Run Query' button.

column...	table...	column_name	datatype	arraysize	size	descri...	utype	unit	ucd	indexed	principal	std
1	0	entity	e_id	VARCHAR	-1	-1	voprov:Entity.id		meta.id	0	0	0
2	1	entity	e_name	VARCHAR	-1	-1	voprov:Entity.name		meta.title	0	0	0
3	2	entity	e_type	VARCHAR	-1	-1	voprov:Entity.type		meta.code.class	0	0	0
4	3	entity	e_rights	VARCHAR	-1	-1	voprov:Entity.rights		meta.code.class	0	0	0
5	4	entity	e_location	VARCHAR	-1	-1	voprov:Entity.location		meta.ref.url	0	0	0
6	5	entity	e_generated	VARCHAR	-1	-1	voprov:Entity.generatedAtTime		time.start	0	0	0
7	6	entity	e_invalidated	VARCHAR	-1	-1	voprov:Entity.invalidatedAtTime		time.stop	0	0	0
8	7	entity	e_comment	VARCHAR	-1	-1	voprov:Entity.comment		meta.description	0	0	0
9	8	entity	e_classtype	VARCHAR	-1	-1	voprov:Entity.classtype		meta.code.class	0	0	0
10	9	entity	e_value	VARCHAR	-1	-1	voprov:Entity.value		meta.description	0	0	0
11	10	entity	e_description	VARCHAR	-1	-1	voprov:Entity.description_id		meta.id	0	0	0

Run Query

ProvTAP specification

for IVOA provenance datamodel serialisation and metadata service

- specification will be published as a working draft just after the interop.

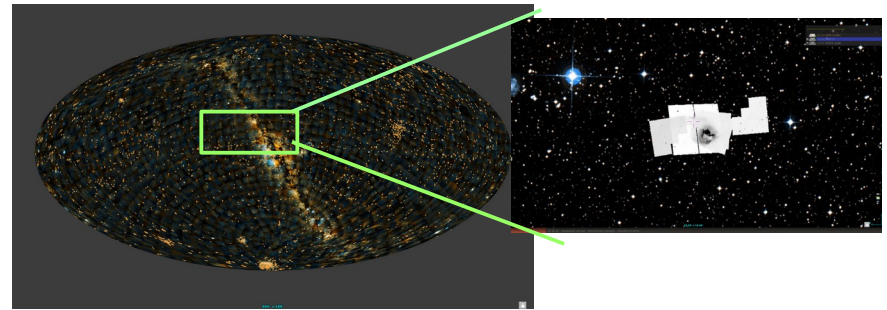


IVOA Provenance Table Access Protocol
(ProvTAP)
Version 1.0
IVOA Working Draft 1.0.0.0



ProvHiPS prototype

- Tracing **provenance of HST HiPS and HiPS tiles**
 - From **HiPS tiles** back to **raw HST images**,
 - through « **drizzled** » images
 - and « **calibrated** » images



- ProvHiPS is an example for « **On Top provenance** » for image processing in optical astronomy.
 - See examples next slides
 - *Will not become a real service due to lack of manpower*



ProvHiPS prototype access : try it to see limitations

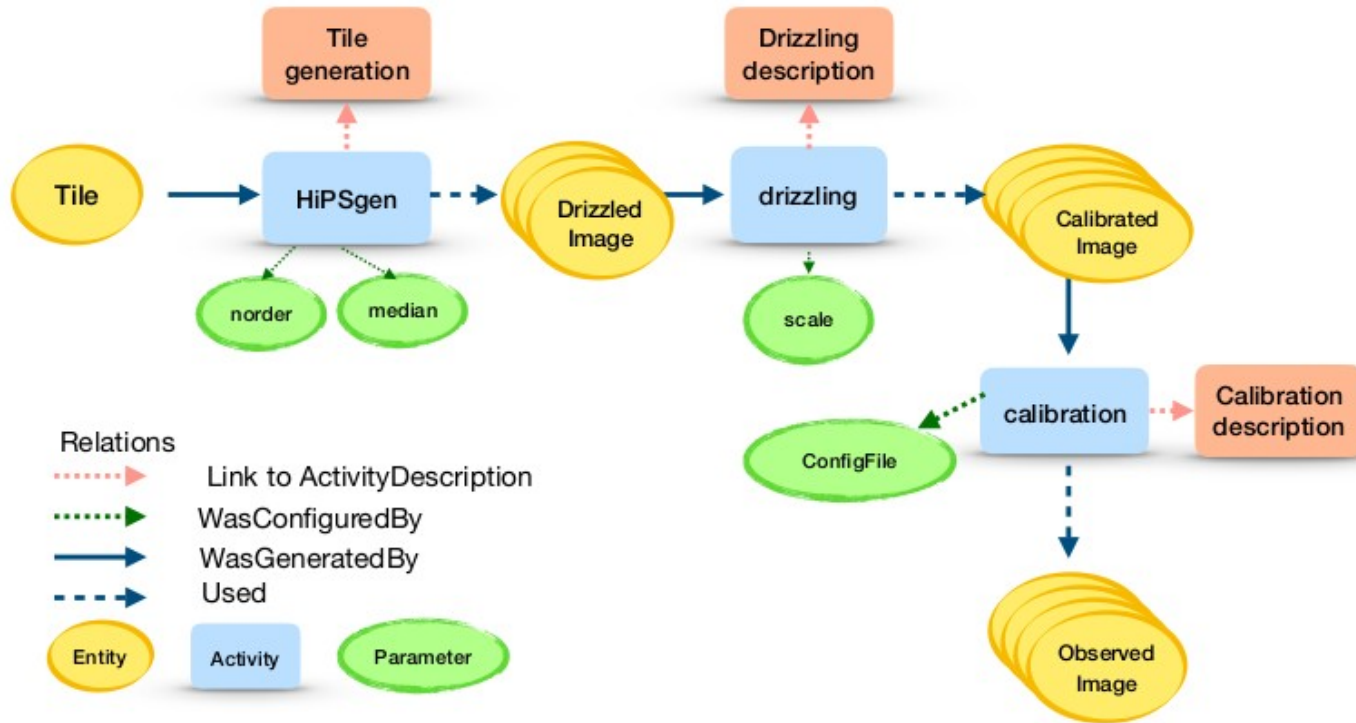
Via legacy TapHandle : <https://saada.unistra.fr/taphandle/?url=https://saada.unistra.fr/provta>

Via smart TapHandle:

https://taphandle.astro.unistra.fr/tapcomplex/app/Tap_Handle_MK2/taphandev.html?url=//saada.unistra.fr/provtap



«HiPS» Provenance diagram



Provenance tracking for Prov-HiPS



«HiPS» tiles at order 10 history

le Edit Image Catalog Overlay Coverage Tool View Interop Help

Available data → 27870
● in view ● out view

Collections → 27870
Image → 503
Data base → 4
Catalog → 26059
Cube → 27
Ancillary → 74
Outreach → 50
Others → 1153

Command: 05:41:17.74 -02:13:26.0

Frame: ICRS Projection: Aitoff

DSS PanSTARRS SDSS 2MASS GALEX Gaia Simbad NED +

DSS2 color

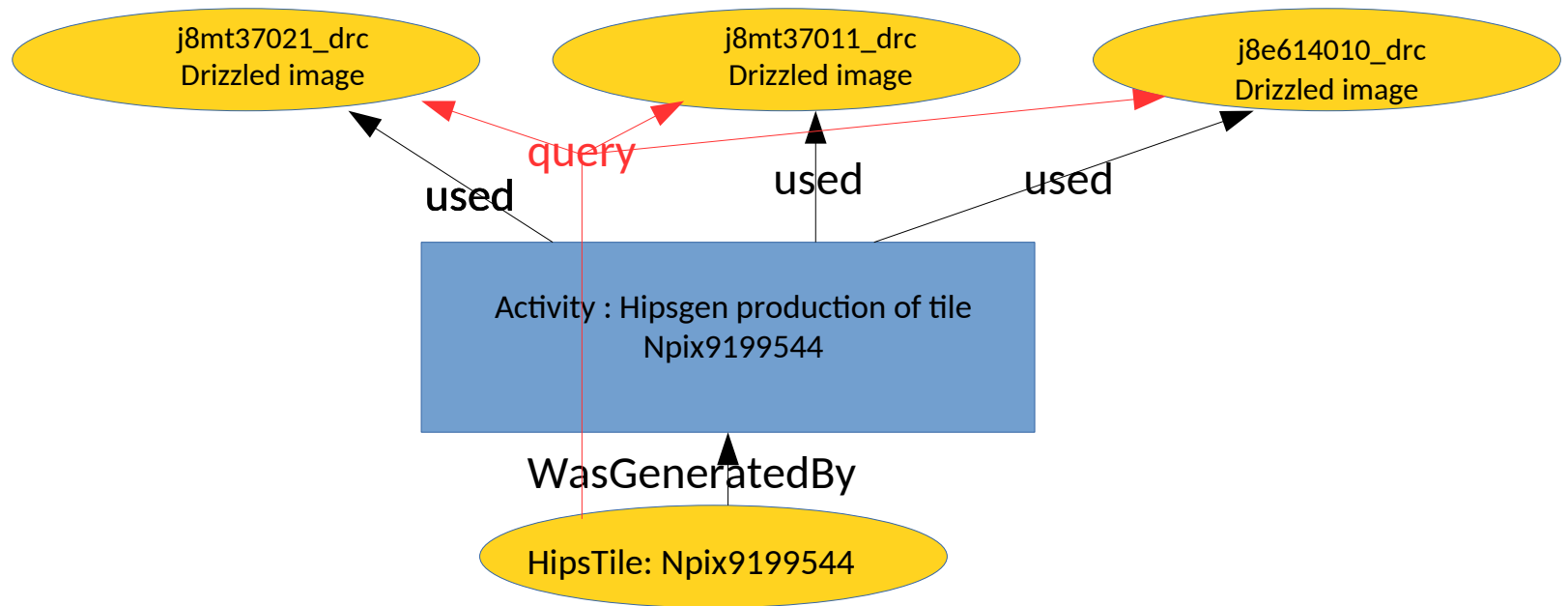
select
pan
dat
phot
draw
tag
moc
spect
filter
cross
xy
rgb
assoc
crop
cont
pixel
prop
del

epoch -
size -
dens. -
opac. -
zoom -

22:47:38.58 +

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 tile.e_name, tile.e_comment, hipsgen.a_name,  
       hipsgen.a_starttime, hipsgen.a_comment, drizzle.e_name, drizzle.e_comment from  
       entity tile  
join wasgeneratedby on tile.e_id = wgb_entity  
join activity hipsgen on wgb_activity = hipsgen.a_id  
join used on hipsgen.a_id = u_activity  
join entity drizzle on drizzle.e_id = u_entity  
where tile.e_name like '%Npix9199544'
```



ProvHiPS ADQL query examples :

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

Window TAP Registry Edit Interop Help

TOPCAT(48): Table Browser

Table Browser for 48: TAP_54_entity,wasgeneratedby,activity,used,entit...

	e_name	e_comment	a_name	a_starttime	a_comment	e_name	e_comment
1	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8e614010_drc	Drizzled HST image from ACS centered on 53.0...
2	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37011_drc	Drizzled HST image from ACS centered on 53.0...
3	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37021_drc	Drizzled HST image from ACS centered on 52.9...
4	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37031_drc	Drizzled HST image from ACS centered on 52.9...
5	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38011_drc	Drizzled HST image from ACS centered on 53.0...
6	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38021_drc	Drizzled HST image from ACS centered on 53.0...
7	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38031_drc	Drizzled HST image from ACS centered on 52.9...
8	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt39011_drc	Drizzled HST image from ACS centered on 53.0...
9	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt39021_drc	Drizzled HST image from ACS centered on 53.0...
10	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt39031_drc	Drizzled HST image from ACS centered on 53.0...
11	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jbwj1020_drc	Drizzled HST image from ACS centered on 53.0...
12	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602010_drc	Drizzled HST image from ACS centered on 53.0...
13	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602020_drc	Drizzled HST image from ACS centered on 53.0...
14	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602030_drc	Drizzled HST image from ACS centered on 53.0...
15	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc604010_drc	Drizzled HST image from ACS centered on 53.0...
16	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc604020_drc	Drizzled HST image from ACS centered on 53.0...
17	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc609010_drc	Drizzled HST image from ACS centered on 52.9...
18	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc609020_drc	Drizzled HST image from ACS centered on 52.9...
19	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc611010_drc	Drizzled HST image from ACS centered on 52.9...

Total: 36 Visible: 36 Selected: 0

used
valuedescription
wasassociatedwith
unattributed

Service Capabilities

Query Language: ADQL-2.0 Max Rows: 1000000 (default) Uploads: unavailable

ADQL Text

Mode: Synchronous

```

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.

Table Browser for 48: TAP_54 entity,wasgeneratedby,activity,used,entit...

	e_name	e_comment	a_name	a_starttime	a_comment	e_name	e_comment
1	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8e614010_drc	Drizzled HST image from ACS centered on 53.0...
2	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37011_drc	Drizzled HST image from ACS centered on 53.0...
3	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37021_drc	Drizzled HST image from ACS centered on 52.9...
4	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt37031_drc	Drizzled HST image from ACS centered on 52.9...
5	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38011_drc	Drizzled HST image from ACS centered on 53.0...
6	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38021_drc	Drizzled HST image from ACS centered on 53.0...
7	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt38031_drc	Drizzled HST image from ACS centered on 52.9...
8	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt39011_drc	Drizzled HST image from ACS centered on 53.0...
9	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	j8mt39021_drc	Drizzled HST image from ACS centered on 53.0...
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11	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	bjwjq1020_drc	Drizzled HST image from ACS centered on 53.0...
12	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602010_drc	Drizzled HST image from ACS centered on 53.0...
13	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602020_drc	Drizzled HST image from ACS centered on 53.0...
14	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc602030_drc	Drizzled HST image from ACS centered on 53.0...
15	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc604010_drc	Drizzled HST image from ACS centered on 53.0...
16	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc604020_drc	Drizzled HST image from ACS centered on 53.0...
17	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc609010_drc	Drizzled HST image from ACS centered on 52.9...
18	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc609020_drc	Drizzled HST image from ACS centered on 52.9...
19	HST_V_Order10_Npix9199544	Npix9199544 tile of HST-V HiPS of size 12.25 a...	HST_V_Order10_Npix9199544 Generation	2019-01-09T02:34Z	hipsGEN version 10.101 generation of Npix91...	jc611010_drc	Drizzled HST image from ACS centered on 52.9...

Total: 36 Visible: 36 Selected: 0

Service Capabilities

Query Language: ADQL-2.0 Max Rows: 1000000 (default) Uploads: unavailable

ADQL Text

Mode: Synchronous

```
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'
```

ISSUE : how to find out our different « instances » within the response ? Utypes are insufficient. Aliases are non standard names. Look at the query ?
→ MIVOT annotation is a better solution



Using MIVOT annotations on the results 1) snippets

- The snippets are generated by *mivot-snippet-tool*

belonging to `mivot_validator` github project :

<http://github.com/ivoa/mivot-validator.git>

from IVOA provenance vo-dml-xml representation :

mivot-snippet-model <https://www.ivoa.net/xml/VODML/20191125/Provenance-v1.vo-dml.xml>

```
-<INSTANCE dmrole="" dmtype="provenance:Entity">
  <!--
    A thing which is consumed or produced in a task , namely here in the astronomical domain. It represents some data as single element or file or an instrument.
  -->
  "
  -->
  <ATTRIBUTE dmrole="provenance:Entity.id" dmtype="ivoa:string" ref="@@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Entity.name" dmtype="ivoa:string" ref="@@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Entity.location" dmtype="ivoa:string" ref="@@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Entity.generatedAtTime" dmtype="ivoa:datetime" unit="" ref="@@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Entity.invalidatedAtTime" dmtype="ivoa:datetime" unit="" ref="@@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Entity.comment" dmtype="ivoa:string" ref="@@@@@" value=""/>
  <INSTANCE dmrole="provenance:Entity.wasGeneratedBy" dmtype="voprov:WasGeneratedBy"/>
- <COLLECTION dmrole="provenance:Entity.wasAttributedTo">
  <INSTANCE dmrole="" dmtype="voprov:WasAttributedTo"/>
</COLLECTION>
- <COLLECTION dmrole="provenance:Entity.usedEntity">
  <INSTANCE dmrole="provenance:Entity.usedEntity" dmtype="voprov:Entity"/>
</COLLECTION>
  <INSTANCE dmrole="provenance:Entity.entityDescription" dmtype="voprov:EntityDescription"/>
</INSTANCE>
```

Entity class snippet

Using MIVOT annotations on the results

1) snippets

```
-<INSTANCE dmrole="" dmtpe="provenance:Activity">
  <!--
    A task executed at some time. It consumes products via relations of type Used and produces results via relations of type WasGeneratedBy.
    The method applied for this task is described in the ActivityDescription class and its subtree.
  -->
  <ATTRIBUTE dmrole="provenance:Activity.id" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Activity.name" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Activity.startTime" dmtpe="ivoa:datetime" unit="" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Activity.endTime" dmtpe="ivoa:datetime" unit="" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Activity.comment" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <COLLECTION dmrole="provenance:Activity.wasAssociatedWith">
    <INSTANCE dmrole="" dmtpe="voprov:WasAssociatedWith"/>
  </COLLECTION>
  <COLLECTION dmrole="provenance:Activity.used">
    <INSTANCE dmrole="" dmtpe="voprov:Used"/>
  </COLLECTION>
  <COLLECTION dmrole="provenance:Activity.wasConfiguredBy">
    <INSTANCE dmrole="" dmtpe="voprov:ActivityConfiguration.WasConfiguredBy"/>
  </COLLECTION>
  <COLLECTION dmrole="provenance:Activity.informant">
    <INSTANCE dmrole="provenance:Activity.informant" dmtpe="voprov:Activity"/>
  </COLLECTION>
  <INSTANCE dmrole="provenance:Activity.activityDescription" dmtpe="voprov:ActivityDescription"/>
</INSTANCE>
```

Activity class snippet

```
-<INSTANCE dmrole="" dmtpe="provenance:Agent">
  <!--
    A person or an organisation that was involved in the follow-up of an Activity, or can be credited for the production of an Entity.
  -->
  <ATTRIBUTE dmrole="provenance:Agent.id" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.name" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <INSTANCE dmrole="provenance:Agent.type" dmtpe="voprov:AgentType"/>
  <ATTRIBUTE dmrole="provenance:Agent.comment" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.email" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.affiliation" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.phone" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.address" dmtpe="ivoa:string" ref="@@@@" value=""/>
  <ATTRIBUTE dmrole="provenance:Agent.url" dmtpe="ivoa:anyURI" unit="" ref="@@@@" value=""/>
</INSTANCE>
```

Agent class snippet



2) finding out « drizzle » progenitors

response annotation

Model structure is mapped
Onto the response TABLE

```
-<RESOURCE type="meta">
-<VODML>
  <REPORT status="OK"/>
  <MODEL name="voprov" url="https://www.ivoa.net/xml/VODML/20191125/Provenance-v1.vo-dml.xml"/>
  <MODEL name="ivoa" url="https://ivoa.net/xml/VODML/IVOA-v1.vo-dml.xml"/>
-<TEMPLATES tabref="res1">
-<INSTANCE dmttype="voprov:Entity">
  <ATTRIBUTE dmrole="voprov:Entity.id" dmttype="ivoa:string" ref="@@@@"/>
  <ATTRIBUTE dmrole="voprov:Entity.name" dmttype="ivoa:string" ref="tile_name"/>
  <ATTRIBUTE dmrole="voprov:Entity.location" dmttype="ivoa:string" ref="@@@@"/>
  <ATTRIBUTE dmrole="voprov:Entity.generatedAtTime" dmttype="ivoa:string" ref="@@@@"/>
  <ATTRIBUTE dmrole="voprov:Entity.invalidatedAtTime" dmttype="ivoa:string" ref="@@@@"/>
  <ATTRIBUTE dmrole="voprov:Entity.comment" dmttype="ivoa:string" ref="tile_com"/>
  <ATTRIBUTE dmrole="voprov:Entity.classType" dmttype="ivoa:string" ref="@@@@"/>
  <ATTRIBUTE dmrole="voprov:Entity.value" dmttype="ivoa:string" ref="@@@@"/>
-<INSTANCE dmrole="voprov:Entity.wasGeneratedBy" dmttype="voprov:WasGeneratedBy">
-<INSTANCE dmrole="voprov:WasGeneratedBy.activity" dmttype="voprov:Activity">
  <ATTRIBUTE dmrole="voprov:Activity.name" dmttype="ivoa:string" ref="gen_name"/>
  <ATTRIBUTE dmrole="voprov:Activity.startTime" dmttype="ivoa:string" ref="gen_start"/>
  <ATTRIBUTE dmrole="voprov:Activity.name" dmttype="ivoa:string" ref="gen_com"/>
-<INSTANCE dmrole="voprov:Activity.Used" dmttype="voprov:Used">
  <COLLECTION dmrole="Used.entity">
    <INSTANCE dmttype="voprov:entity">
      <ATTRIBUTE dmrole="voprov:Entity.name" dmttype="ivoa:string" ref="driz_name"/>
      <ATTRIBUTE dmrole="voprov:Entity.comment" dmttype="ivoa:string" ref="driz_com"/>
    </INSTANCE>
  </COLLECTION>
</INSTANCE>
</INSTANCE>
</INSTANCE>
</INSTANCE>
</TEMPLATES>
</VODML>
</RESOURCE>
-<RESOURCE type="results">
-<TABLE ID="res1" name="result_S1716147506717" nrows="3">
  <PARAM arraysize="2" datatype="char" name="QUERY_STATUS" value="OK"/>
  <PARAM arraysize="3" datatype="char" name="PROVIDER" value="CDS"/>
  <PARAM arraysize="482" datatype="char" name="QUERY" value="select tile.e_name as tile_name, tile.e_comment as tile_comment, hipsgen.a
as hipsgen_start, hipsgen.a_comment as hipsgen_comment, drizzle.e_name as drizzle_name, drizzle.e_comment as drizzle_comment from entity tile
join activity hipsgen on wgb_activity = hipsgen.a_id join used on hipsgen.a_id = u_activity join entity drizzle on drizzle.e_id = u_entity where tile.e_n
<FIELD ID="tile_name" arraysize="*" datatype="char" name="tile_name" ucd="meta.title" utype="voprov:Entity.name"/>
<FIELD ID="tile_com" arraysize="*" datatype="char" name="tile_comment" ucd="meta.description" utype="voprov:Entity.comment"/>
<FIELD ID="gen_name" arraysize="*" datatype="char" name="hipsgen_name" ucd="meta.title" utype="voprov:Activity.name"/>
<FIELD ID="gen_start" arraysize="*" datatype="char" name="hipsgen_start" ucd="time.start" utype="voprov:Activity.startTime"/>
<FIELD ID="gen_com" arraysize="*" datatype="char" name="hipsgen_comment" ucd="meta.description" utype="voprov:Activity.comment"/>
<FIELD ID="driz_name" arraysize="*" datatype="char" name="drizzle_name" ucd="meta.title" utype="voprov:Entity.name"/>
<FIELD ID="driz_com" arraysize="*" datatype="char" name="drizzle_comment" ucd="meta.description" utype="voprov:Entity.comment"/>
-<DATA>
-<TABLEDATA>
  <TR>
    <TD>HST_B_Norder10_Npix9199544</TD>
    <TD>
      Npix9199544 tile of HST-B HiPS of size 3.5*3.5 and including position 53.069038233321 and -27.822573192919
    </TD>
    <TD>HST_B_Norder10_Npix9199544_Generation</TD>
    <TD>2018-11-25T22:01Z</TD>
  </TR>
  <TR>
    <TD>
      hipsGEN version 10.101 generation of Npix9199544tile of HST-B HiPS
    </TD>
    <TD>jcn614030_drc.fits</TD>
  </TR>
  <TR>
    <TD>
      Drizzled HST image from ACS with filterCLEAR1L and F435W centered on 53.00678473642296 , -27.78192665265288 , with a position ang
      arcsec x 4238*0.05 arsec field of view
    </TD>
  </TR>
</TABLEDATA>
</TR>
```


ProvHiPS ADQL complex query examples : using MIVOT annotations on the results

2) finding out « drizzle » progenitors MiVOT « viewer » (pyvo) reading the table

Producing a dictionary

```
[103]: votable = "../pyvo-ci-sample/ProvTap-result-1.xml"
# init the MIVOT viewer from a VOTable file, parsed VOTable or DAL response
mivot_viewer = MivotViewer(votable)
print(mivot_viewer.dm_instance)
```

```
},
  "Entity_wasGeneratedBy": {
    "dmrole": "wasGeneratedBy",
    "dmtype": "WasGeneratedBy",
    "WasGeneratedBy_activity": {
      "dmrole": "activity",
      "dmtype": "Activity",
      "name": {
        "value": "hipsGEN version 10.101 generation of Npix9199544tile of HST-B HiPS"
      },
      "startTime": {
        "value": "2018-11-25T22:01Z"
      },
    },
    "Used": {
      "dmrole": "Used",
      "dmtype": "Used",
      "Used.entity": [
        {
          "dmtype": "entity",
          "name": {
            "value": "jcn614030_drc.fits"
          },
          "comment": {
            "value": "Drizzled HST image from ACS with filterCLEAR1L and F435W centered on
53.00678473642296 , -27.78192665265288 , with a position angle of 85.04776551398835 and 4214
*0.05 arcsec x 4238*0.05 arcsec field of view"
          }
        }
      ]
    }
  }
}
```

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ProvHiPS ADQL complex query examples : using MIVOT annotations on the results

2) finding out « drizzle » progenitors MiVOT « viewer » (pyvo) reading the table

Class instances generattion

```
mivot_viewer.rewind()
while mivot_viewer.next():
    name = mivot_instance.name.value
    bby = mivot_instance.Entity_wasGeneratedBy.WasGeneratedBy_activity.name.value
    # Object generation flaw with collection management: to be fixed
    using = mivot_instance.Entity_wasGeneratedBy.WasGeneratedBy_activity.Used.__dict__["Used.entity"][0].name.value
    print(f"{'{name}'} generated by '{bby}' using '{using}'")
```

```
'HST_B_Norder10_Npix9199544' generated by 'hipsGEN version 10.101 generation of Npix9199544tile of HST-B HiPS' using 'jcn614030_drc.fits'
'HST_B_Norder10_Npix9199544' generated by 'hipsGEN version 10.101 generation of Npix9199544tile of HST-B HiPS' using 'jcn609020_drc.fits'
'HST_B_Norder10_Npix9199544' generated by 'hipsGEN version 10.101 generation of Npix9199544tile of HST-B HiPS' using 'j8mt37011_drc.fits'
```



Another use case with a different solution :

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 = 'j8f627010_drz.fits'
```



# Issues

- Table is denormalized : a lot of redundant information
- Loop issue : several occurrences 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
- → possible Recursivity



# Solutions

minimum provenance(= 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*

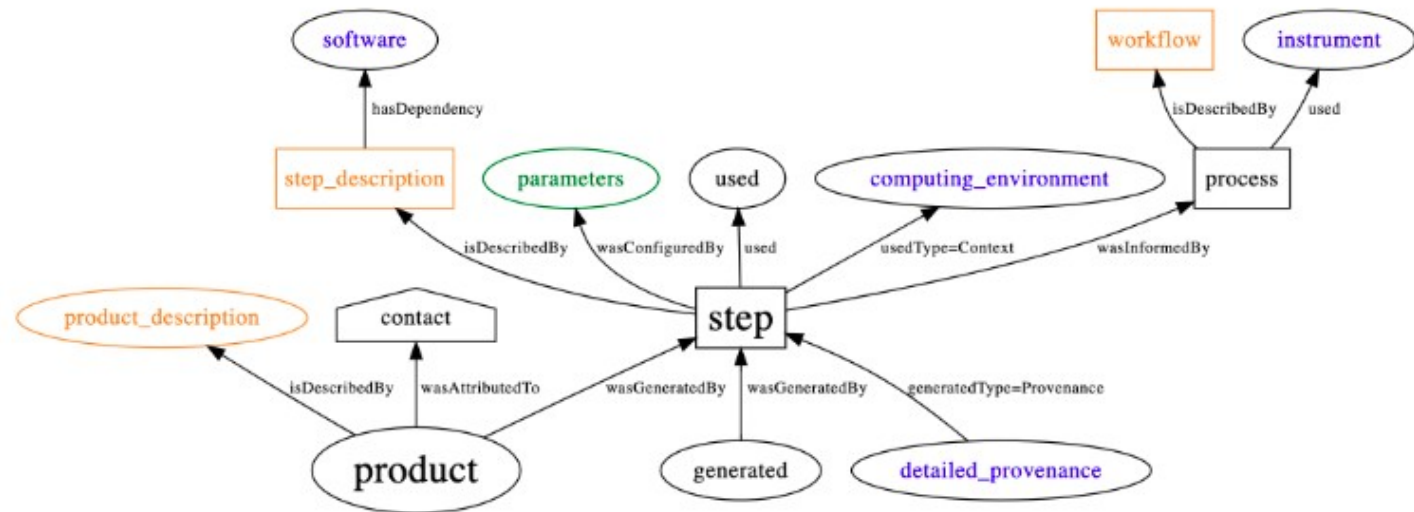


# Solutions

one step provenance

(see DM2 tomorrow -Mathieu Servillat)

- Changing the names (product, step, process)
- Add « descriptions »

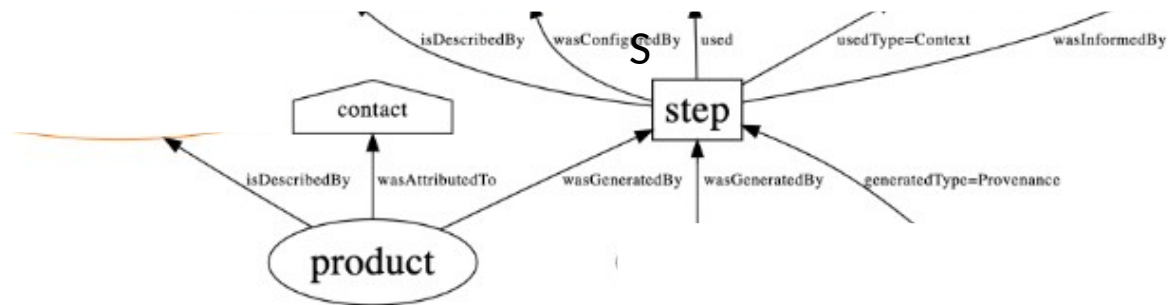


# Solutions

one step provenance

(see DM2 tomorrow -Mathieu Servillat)

- To keep it simple
  - Put only references (ids) to additional material
  - Recursivity





# Solutions

## last step provenance in ProvTAP

- View (in postgres)

```
create view one_step_provenance as select
```

```
e.e_id AS product_id, e.e_name AS product_name, e.e_location AS product_location, e.e_generated AS
product_generated, e.e_description as product_description,
```

```
 e.e_invalidated AS product_invalidated, e.e_comment AS product_comment,
```

```
activity.a_name AS step_name, activity.a_starttime AS step_starttime, activity.a_endtime AS step_endtime,
activity.a_comment AS step_comment, a.a_description as step_description,
```

```
wasattributedto.wat_role AS contact_role, agent.ag_name AS contact_name, agent.ag_type AS contact_type,
```

```
 agent.ag_affiliation AS contact_affiliation, agent.ag_email AS contact_email, agent.ag_address AS contact_address,
```

```
 agent.ag_phone AS contact_phone, agent.ag_comment AS contact_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 ;
```



# Future work

- Last step provenance and MIVOT annotation in an appendix of the specification
- Release ProvTAP WD
- Implement this in the CTA data archive project.

