Last-step provenance

IVOA virtual 2021-11

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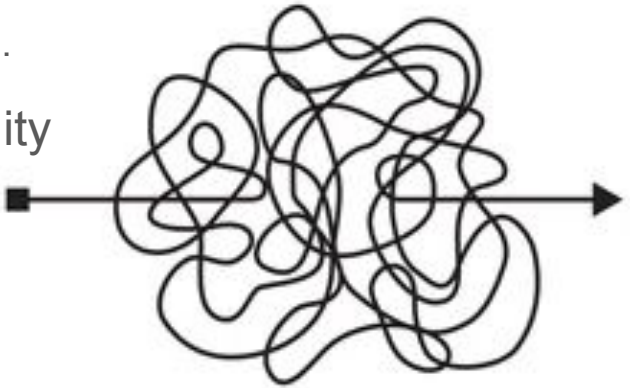
+ ESCAPE participants
+ CTA members

From F-A-I to FAIR

→ **ADASS XXXI talk O4-002**
"FAIR high level data for Cherenkov astronomy"

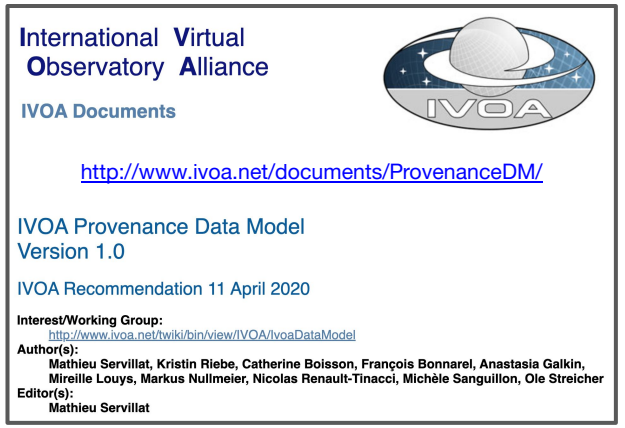
Findable
Accessible
Interoperable
Reusable?

- **Findable-Accessible-Interoperable**
  - Use the **Virtual Observatory standards**, protocols and services
  - Define community **standards** where required
  - To be discussed early in projects, but **technical solutions exist**
- **Reusability?**
  - Based on the **quality** / **reliability** / **trustworthiness** of the products
  - What calibration was applied? What tools were used and how?
    What assumptions were made during the data preparation?
  - **Sustainability**: with time, key information may disappear...
- **Provenance** information as an answer to reusability
  - Need for the **origin**, **trace**, and detailed manipulations
  - Need to **structure** this information
  - Need to **keep** it and **link** it to the data
  - IVOA Provenance data model!



IVOA Provenance status

- IVOA Provenance data model
  - Recommendation in April 2020
- ProvSAP: simple access protocole
  - Request provenance graph for an identifier (entity/activity)
  - Takes advantage of the W3C serializations (JSON, XML, SVG, PNG…)
  - `prov`/`voprov` Python package
  - Implementations : Pollux, OPUS (CTA, MASER, CompOSE), ...
    https://voparis-uws-test.obspm.fr/client/proxy/provsap?ID=a6018b&DESCRIPTIONS=1&CONFIGURATION=1&ATTRIBUTES=0
- ProvTAP: table access protocole *(→ DAL talk by François)*
  - TAP Schema
  - simplified views
  - Implementations : HiPS tiles provenance, …


International Virtual Observatory Alliance

IVOA Documents

http://www.ivoa.net/documents/ProvenanceDM/

IVOA Provenance Data Model
Version 1.0

IVOA Recommendation 11 April 2020

Interest/Working Group:
http://www.ivoa.net/twiki/bin/view/IVOA/IvoaDataModel
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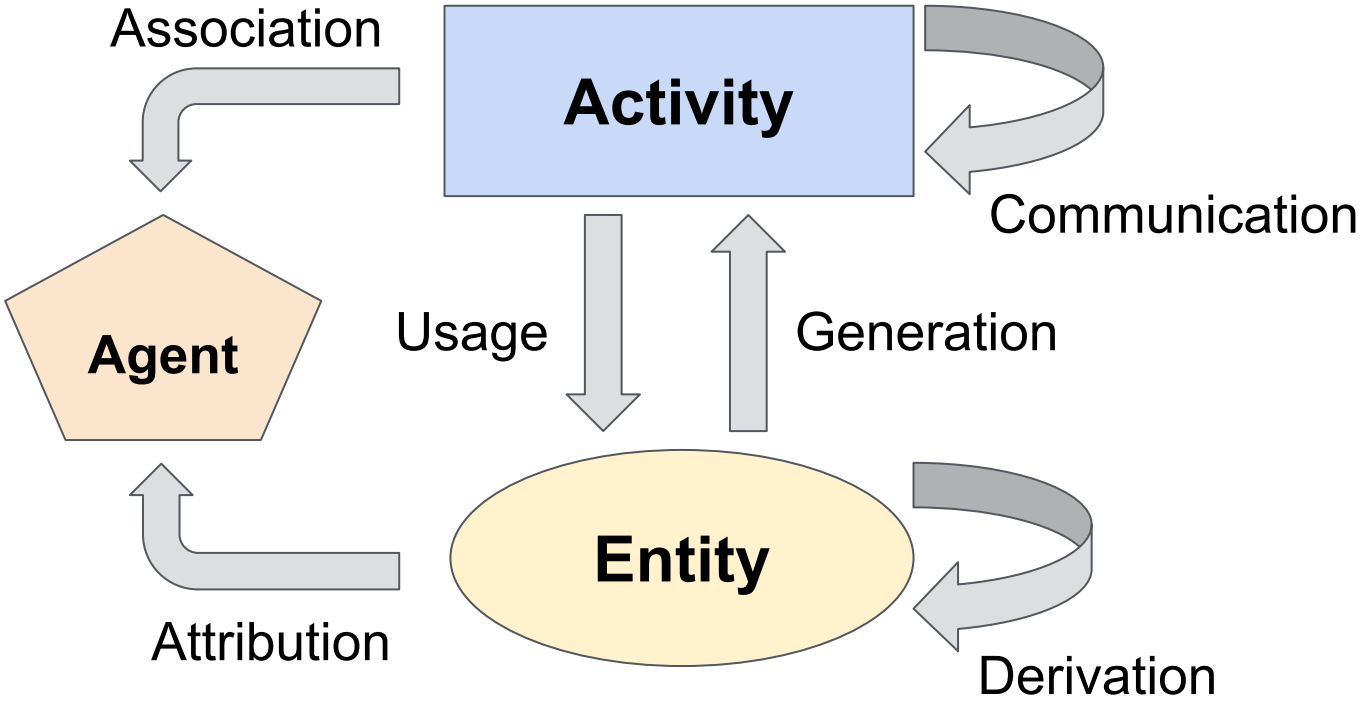
Provenance glossary

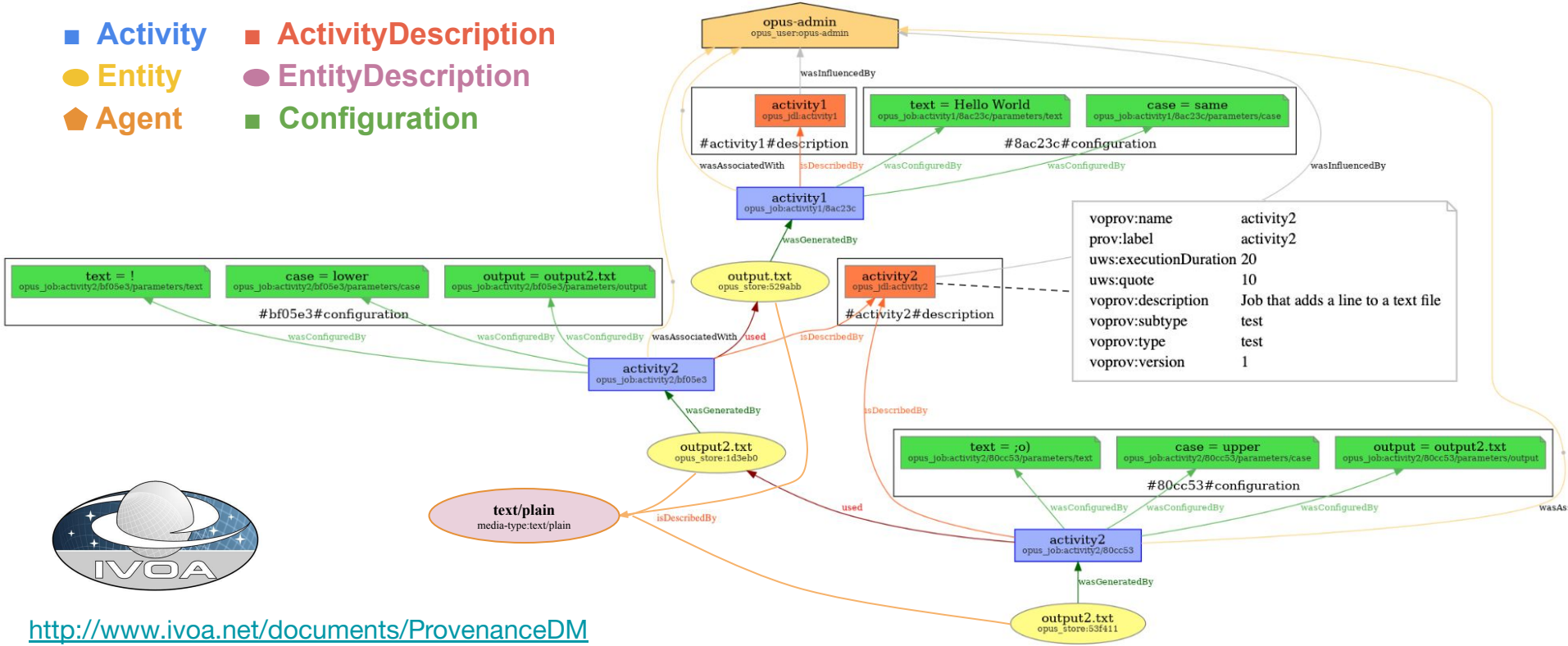


Word Wide Web Consortium

http://www.w3.org/TR/prov-overview

Full IVOA Provenance graph

- Activity
- ActivityDescription
- Entity
- EntityDescription
- Agent
- Configuration



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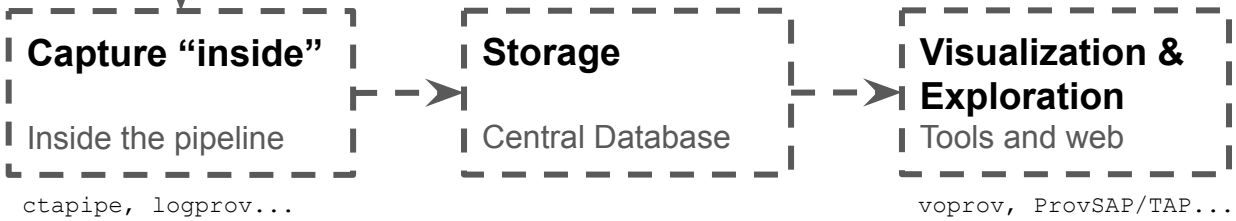
A provenance management system

- What scientists generally have in mind:

- But need for advanced provenance management:



Provenance Week 2021 proceedings : https://arxiv.org/abs/2109.07751

Some terminology

- **full provenance**: graph/tree/chain that **traces** activities and entities up to the raw data. This information is not hosted by the entities themselves, it should be stored in a central database, or as separate files.
- **end-user/specific "provenance"**: can be embedded into an entity, keywords or data that provides project specific **key information to use/analyse** the entity (e.g. for CTA: event class/type, telescope configuration, sky conditions, reco method...)
- **last-step provenance**: embedded into an entity as a list of keywords that gives some context and info on **last activity** (general workflow, software, versions, contact…), including the list of generated and used entity ids, so that a full provenance may be reconstructed from this minimum provenance.

See ADASS XXX BoF proceedings : https://arxiv.org/abs/2101.08691
ESCAPE workshop on provenance : https://indico.in2p3.fr/event/21913/page/2641-summary

A provenance management system

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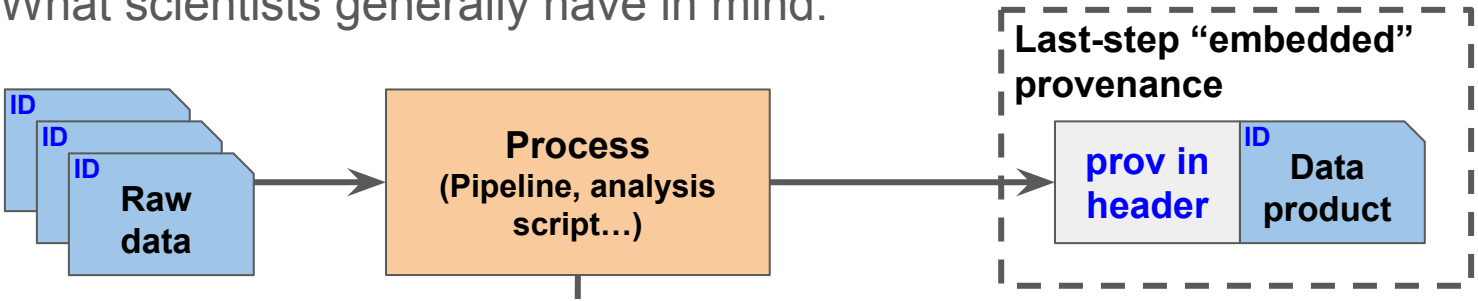

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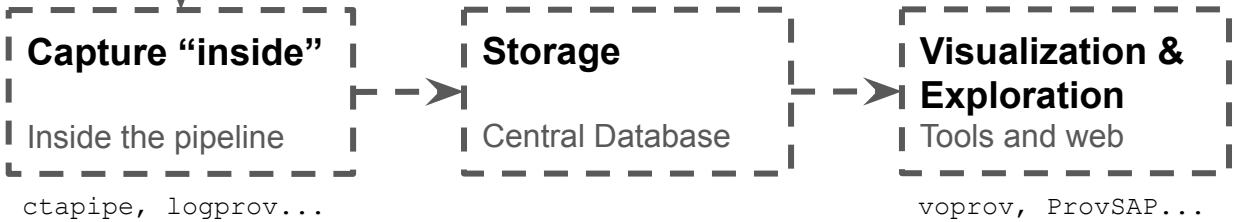

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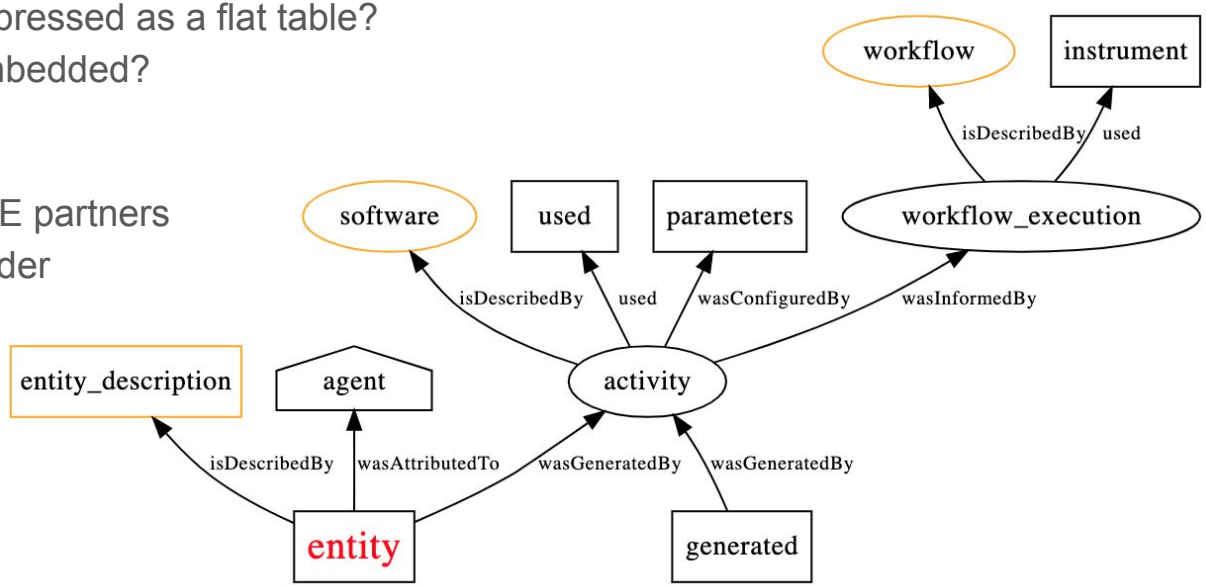
Last-step provenance

- Problematic
  - Provenance graphs are complex, cannot be embedded in entities
  - Is there a minimum provenance?
  - Can provenance be expressed as a flat table?
  - Can provenance be embedded?
- Use cases
  - Workshop with ESCAPE partners
  - CTA data products header
- Content
  - 1 chain link
  - subgraph
  - keyword list
  - FITS keywords



Last-step provenance - keyword list - entity/agent

keyword	UType	FITS keyword	Alternative
entity_id	Entity.id	ENT_ID	
entity_location	Entity.location	ENT_LOC	
entity_generatedAtTime	Entity.generatedAtTime	ENT_GTIM	
entity_name	EntityDescription.name	ENT_NAME	
entity_type	EntityDescription.type	ENT_TYPE	
entity_content_type	EntityDescription.content_type	ENT_CTYP	
entity_docurl	EntityDescription.docurl	ENT_DURL	
entity_comment	Entity.comment	ENT_COMM	
agent_id	Agent.id	AGT_ID	
agent_name	Agent.name	AGT_NAME	
agent_type	Agent.type	AGT_TYPE	
agent_email	Agent.email	AGT_MAIL	

Last-step provenance - keyword list - context

keyword	UType	FITS keyword	Alternative
workflow_id	Activity.id	WKF_ID	
workflow_name	ActivityDescription.name	WKF_NAME	
workflow_type	ActivityDescription.type	WKF_TYPE	
workflow_comment	Activity.comment	WKF_COMM	
instrument_id	Entity.id	INS_ID	
instrument_location	Entity.location	INS_LOC	
instrument_name	EntityDescription.name	INS_NAME	
instrument_type	EntityDescription.type	INS_TYPE	
instrument_docurl	EntityDescription.docurl	INS_DURL	
instrument_comment	EntityDescription.comment	INS_COMM	

Last-step provenance - keyword list - activity

keyword	UType	FITS keyword	Alternative
software_name	ActivityDescription.name	SFW_NAME	
software_version	ActivityDescription.version	SFW_VERS	
software_description	ActivityDescription.description	SFW_DESC	
software_type	ActivityDescription.type	SFW_TYPE	
software_docurl	ActivityDescription.docurl	SFW_DURL	
activity_id	Activity.id	ACT_ID	
activity_name	Activity.name	ACT_NAME	
activity_start_time	Activity.startTime	ACT_STIM	
activity_end_time	Activity.endTime	ACT_ETIM	
activity_comment	Activity.comment	ACT_COMM	

Last-step provenance - keyword list

keyword	UType	FITS keyword	Alternative
activity_parameters	List of Parameter.name=value	PARN_001 to PARN_999 PARV_001 to PARV_999	
used_ids	List of Entity.id	USD_001 to USD_999	
generated_ids	List of Entity.id	GEN_001 to GEN_999	

- Entity.id for used and generated entities
  - Link to next part of the chain
  - Can be used in queries (ProvSAP, ProvTAP)
  - Potentiel reconstruction of a full provenance