Practical Data Provenance in Distributed Environment or:

implementing Linked Data Broker using Microservices Architecture

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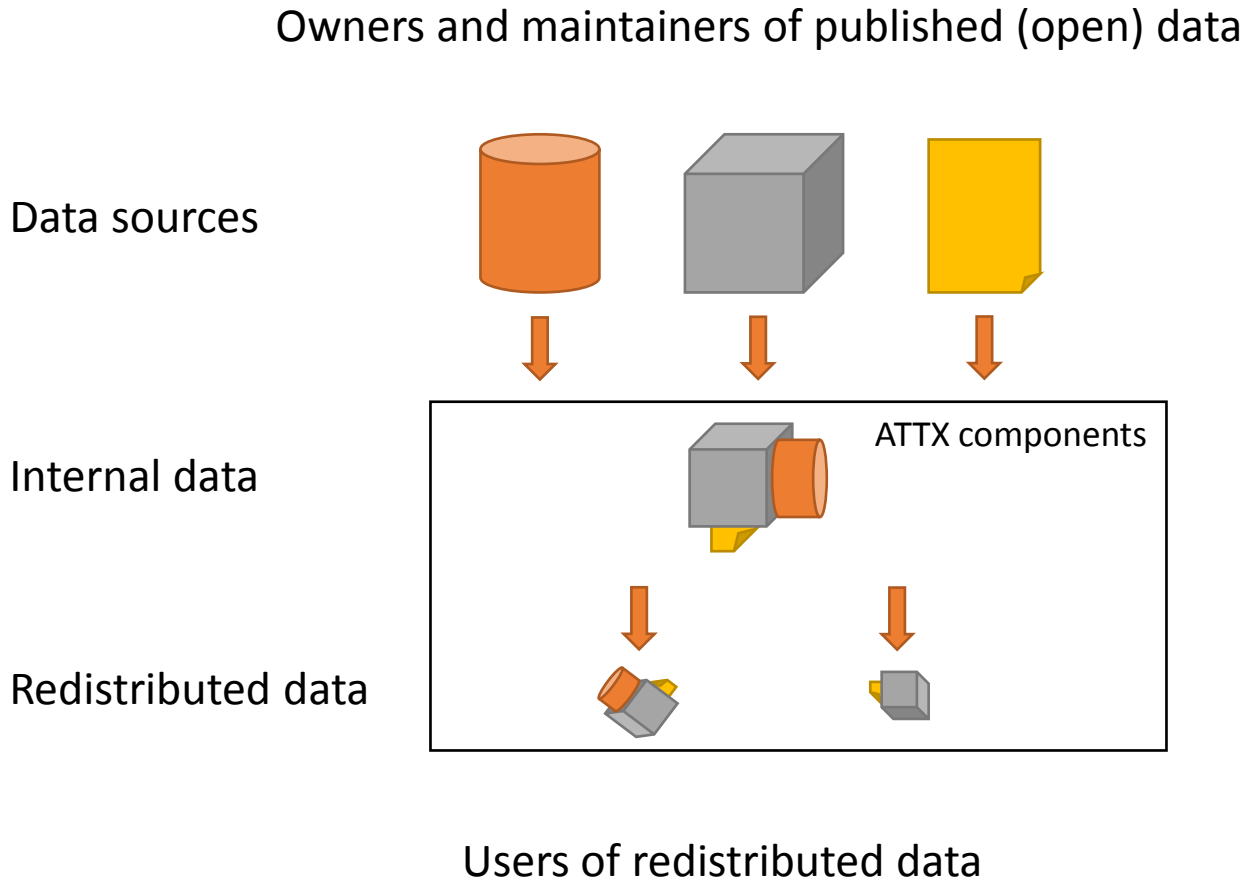
SWIB 2017

Hamburg

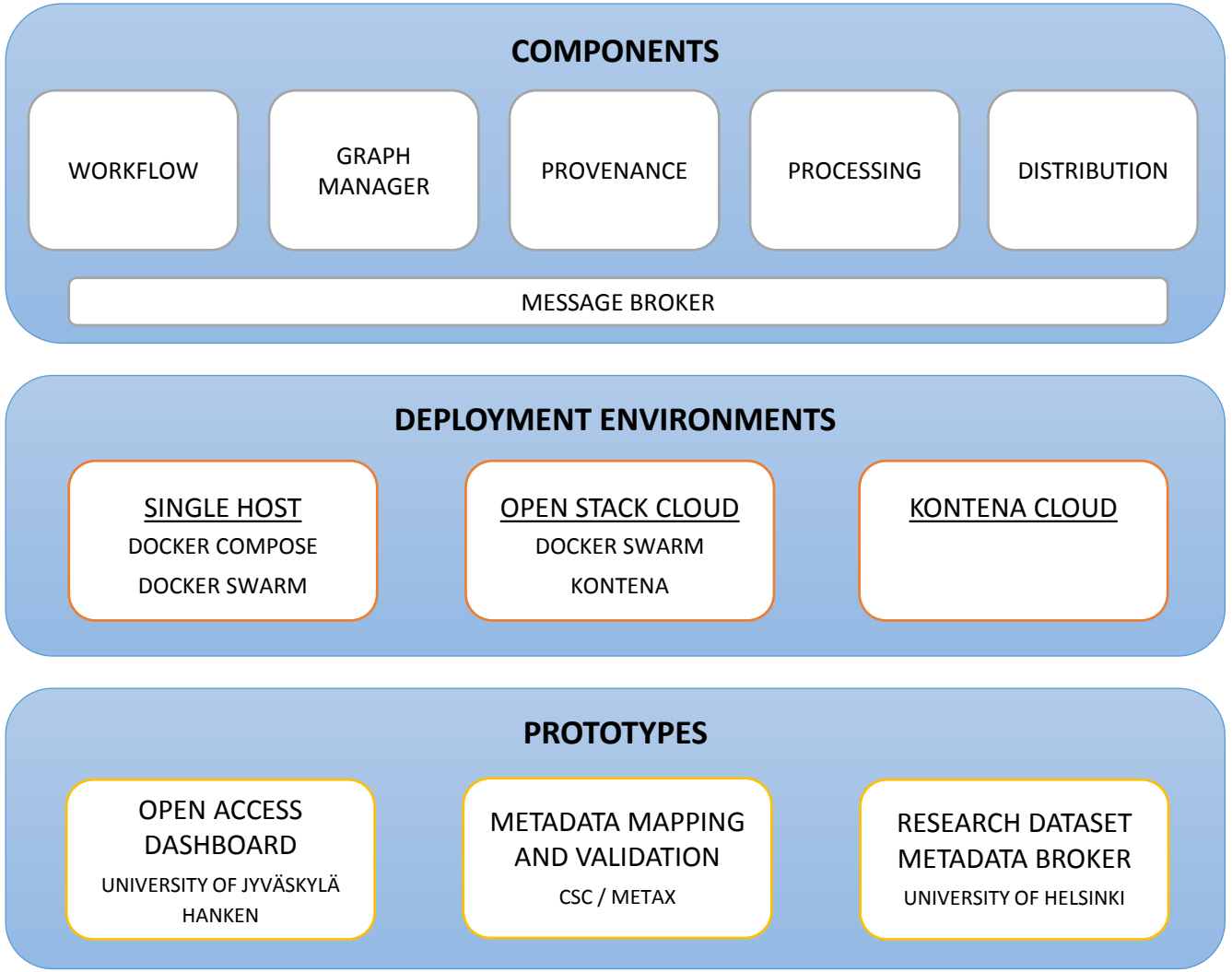
ATTX project

- 8/2016-4/2018
- Developing software component for building semantic data brokers
- Main features
  - ”Easy” & scalable deployment
  - Flexible & linked data
  - Full & usable provenance
- Funded by the Ministry of Education and Culture
- Executed by the Helsinki University Library
- http://attx-project.github.io
- https://www.helsinki.fi/en/projects/attx-2016

Data brokering and ATTX



ATTX deliverables



ATTX core components

- WorkflowManagent – UnifiedViews & custom provenance API
- GraphManager
  - Manages the state of the internal graph store
- MessageBroker – RabbitMQ
- Indexing
- Distribution
  - In JSON format using ElasticSearch
- Transformation to RDF
  - RML processor to transform from CSV, JSON and XML
- Transformation from RDF to JSON
  - JSON-LD Framing
- Provenance

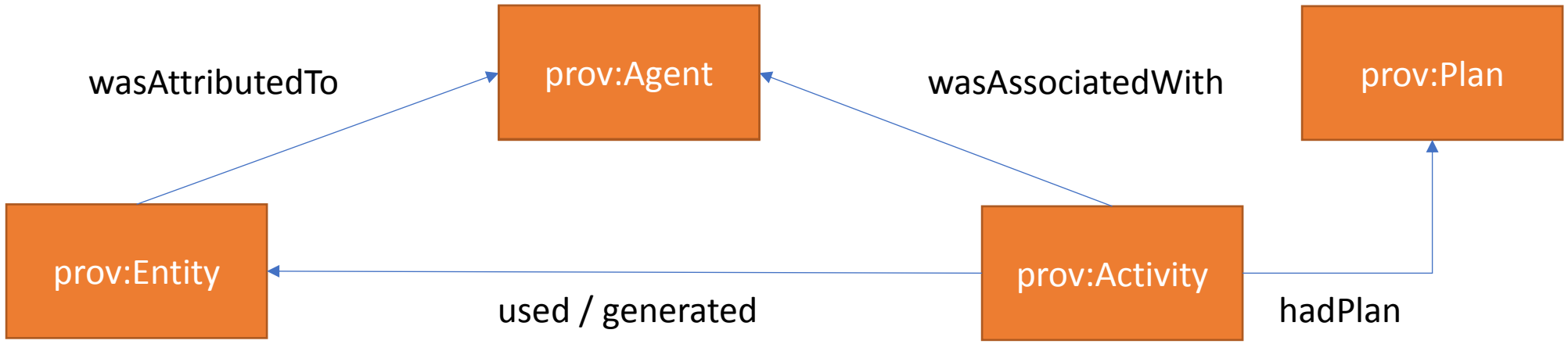
Provenance

"*Provenance is a record that describes the **people, institutions, entities, and activities** involved in producing, influencing, or delivering a **piece of data or a thing**. In particular, the provenance of information is crucial in deciding whether information is to be **trusted**, **how it should be integrated** with other diverse information sources, and how to **give credit** to its originators when **reusing** it. In an open and inclusive environment such as the Web, where users find information that is often contradictory or questionable, provenance can help those users to make trust judgements*."

Emphasis mine

K. Belhajjame, R. B'Far, J. Cheney, S. Coppens, S. Cresswell, Y. Gil, P. Groth, G. Klyne, T. Lebo, J. McCusker, S. Miles, J. Myers, S. Sahoo, C. Tilmes, L. Moreau, and P. Missier (Eds.), PROV-DM: The PROV Data Model, W3C Recommendation REC-prov-dm-20130430, World Wide Web Consortium (Oct. 2013). URL http://www.w3.org/TR/2013/REC-prov-dm-20130430/.

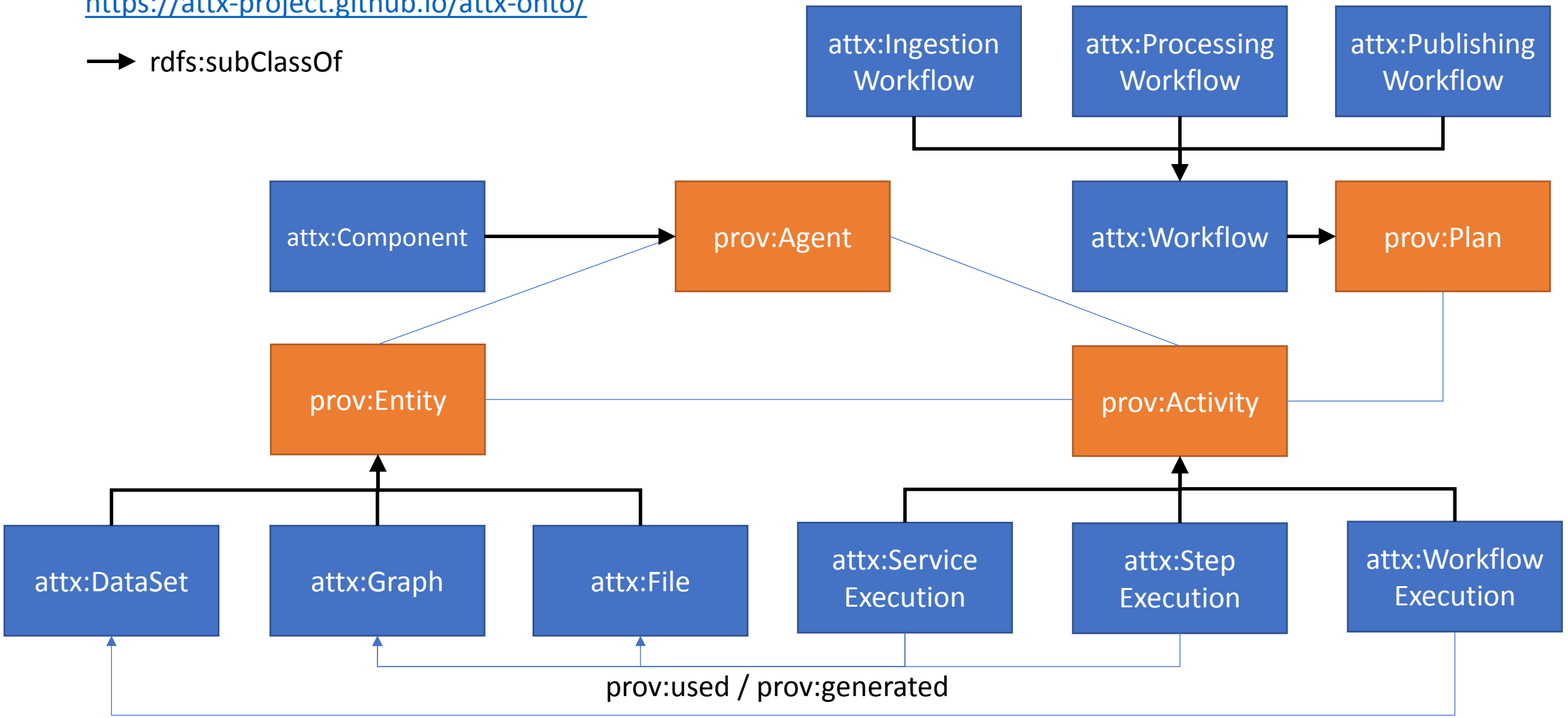
Prov-O - You know, for Provenance



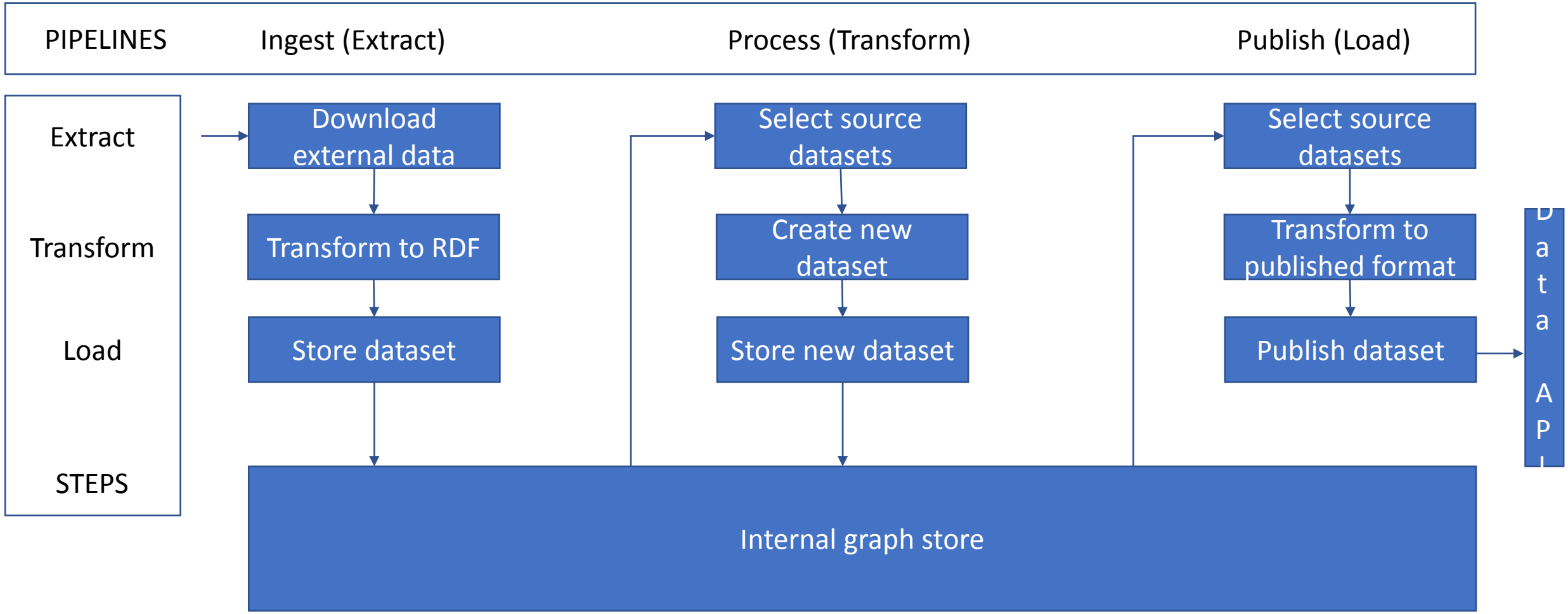
Adapted from https://www.w3.org/TR/prov-o/

ATTX provenance model

https://attx-project.github.io/attx-onto/



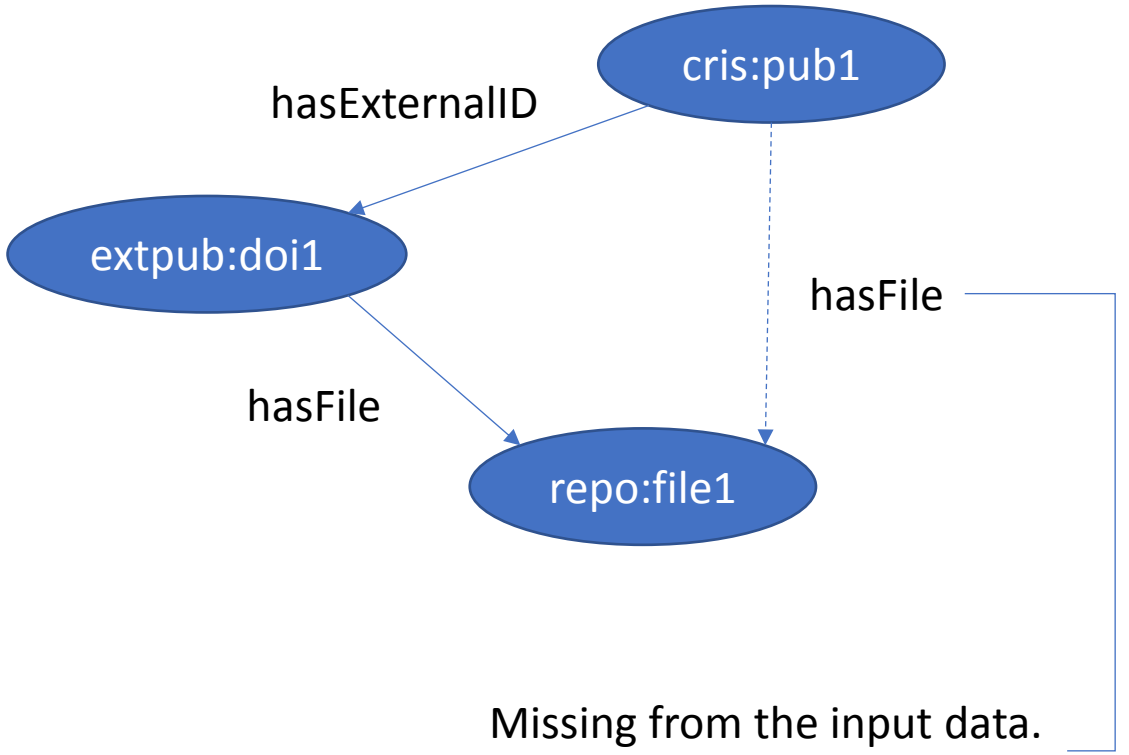
ATTX pipelines



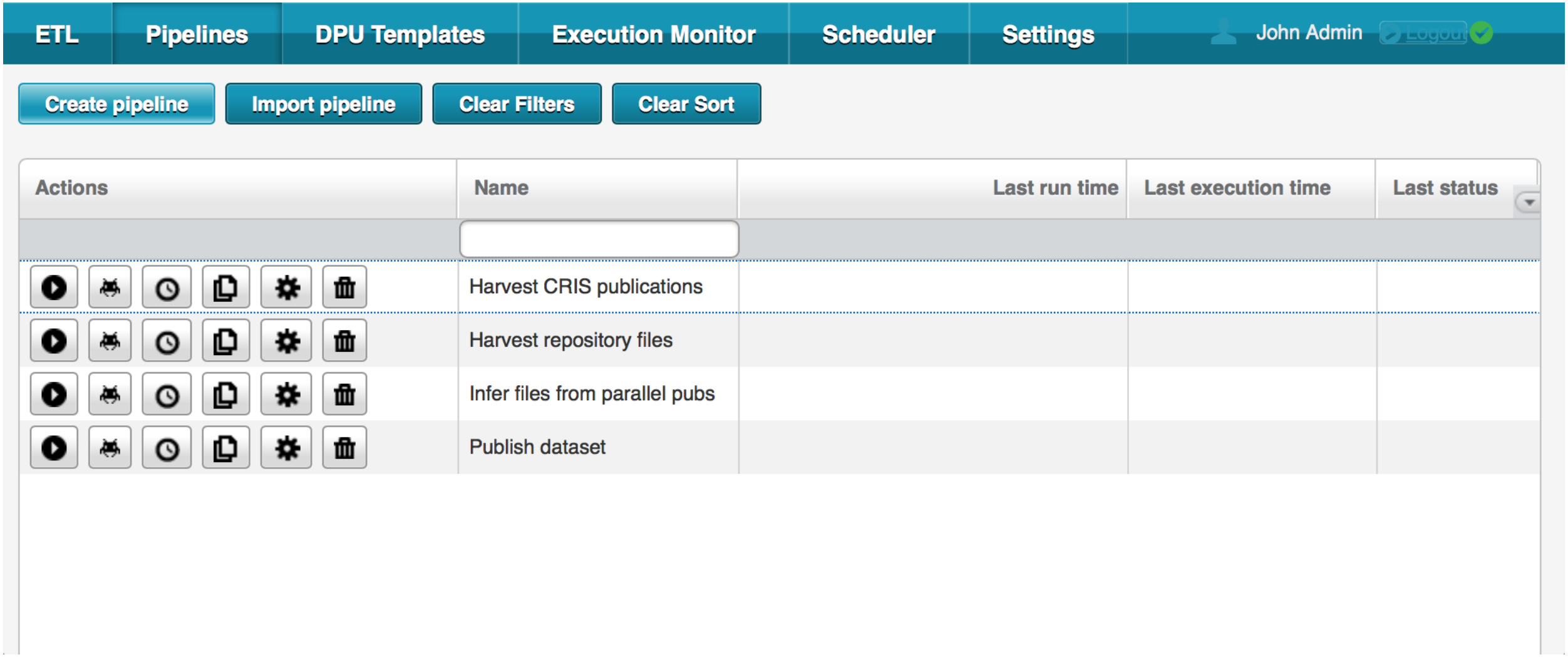
Example case
Connecting publications to files

- CRIS system is the source for publication metadata
  - ID = pub1
  - DOI = doi1
  - Title = “Simple example”
- Digital repository is the source for file metadata
  - ID = file1
  - DOI = doi1
  - Download link = link1
  - File type = “Publisher’s PDF”

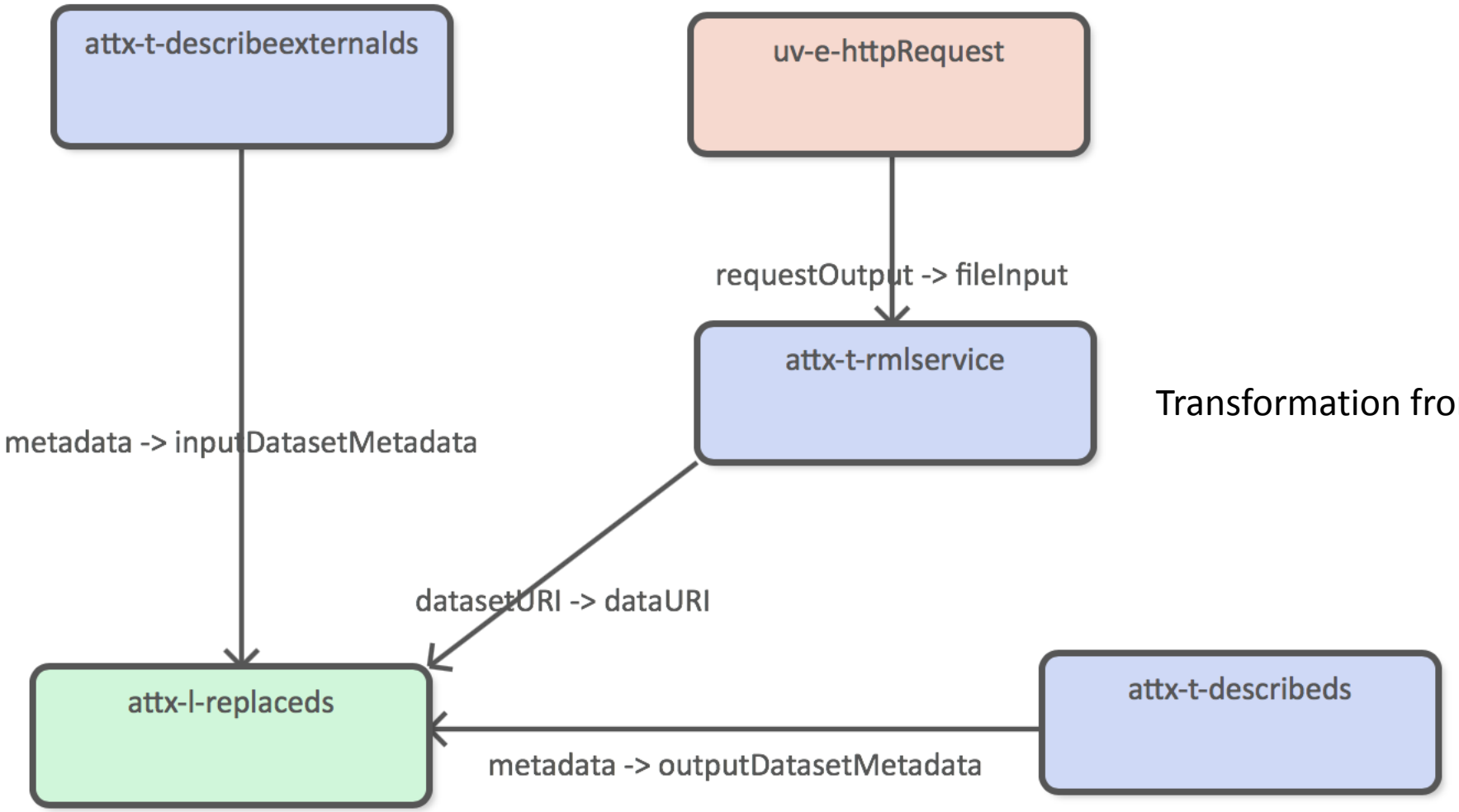
- Data broker’s internal data



Example case – Pipelines in UnifiedViews (UV)



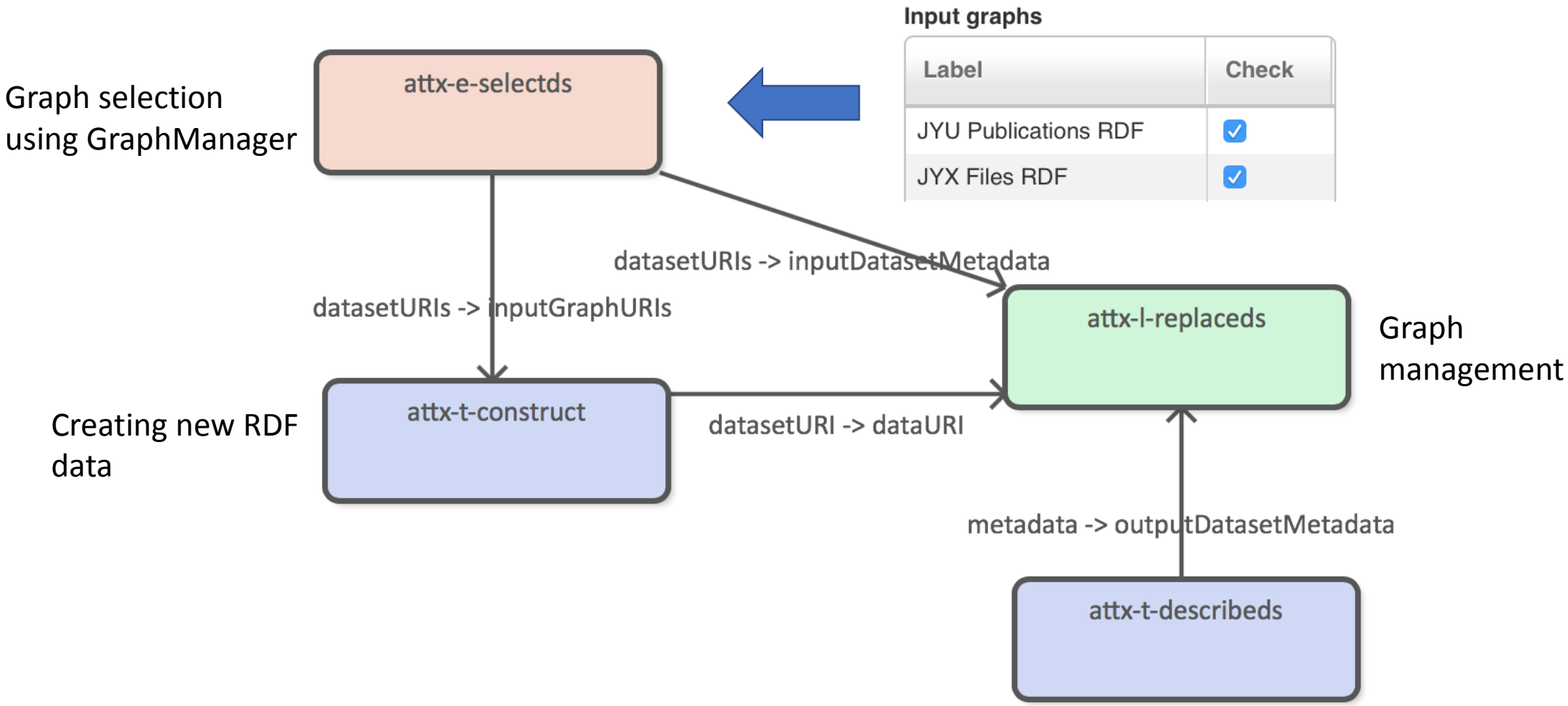
Example case – Ingestion pipeline (UV)



Transformation from JSON to RDF

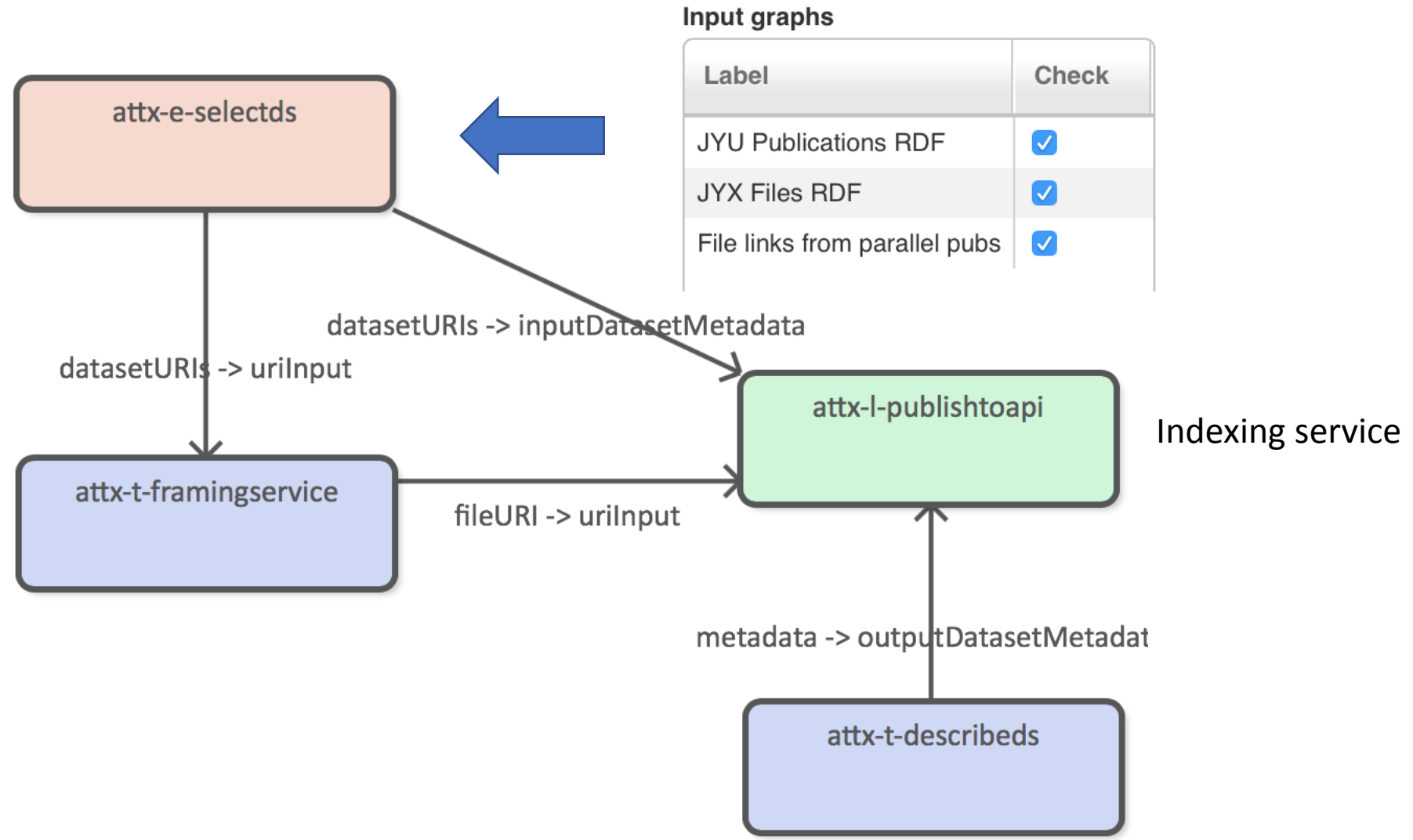
Graph management

Example case – Processing pipeline (UV)



Example case – Publishing pipeline (UV)

Graph selection
using GraphManager



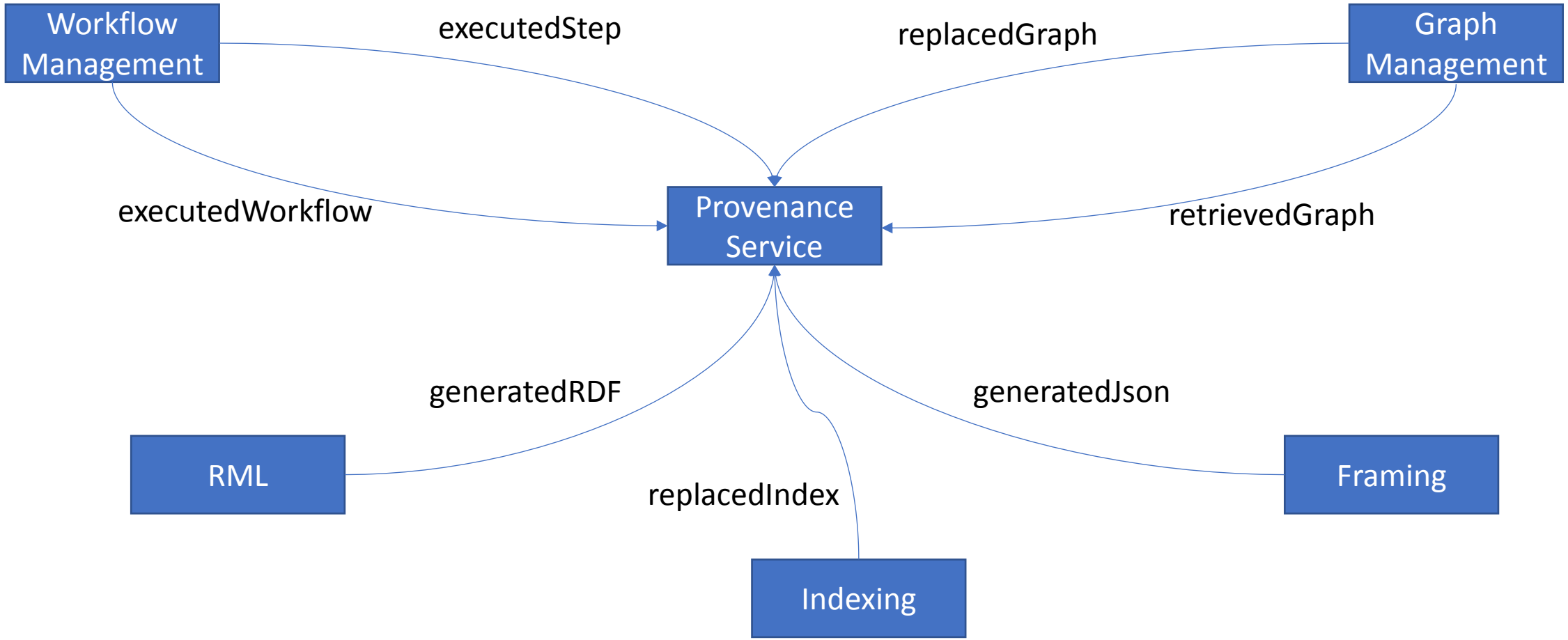
Indexing service

Transformation
from RDF to JSON

Collecting provenance data

- Explicit messages
  - “I did this”
- “Fire-and-forget” type of operation
  - Message broker is responsible for getting message to the provenance service using message persistency and automatic retries
- Activities are connected through shared input/output entities
- Resulting provenance graph is generated from bits and pieces sent in by multiple components running in different containers and possibly on different nodes

Provenance messages



Publishing provenance

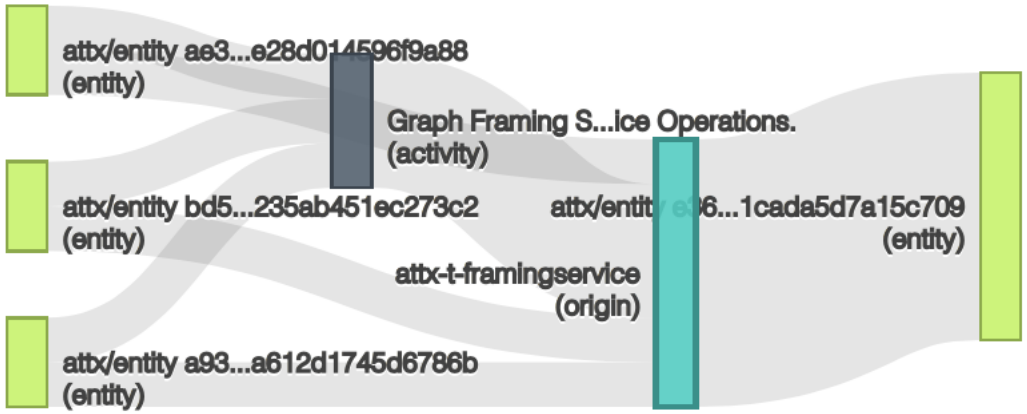
- Provenance service is updating the ElasticSearch index with the up-to-date information automatically
- Provenance graphs are converted to JSON using JSON-LD framing
- Documents related a single provenance graph, i.e. provenance related to single workflow execution, is indexed under common document type
  - GET /prov/workflow1_activity1

Using provenance

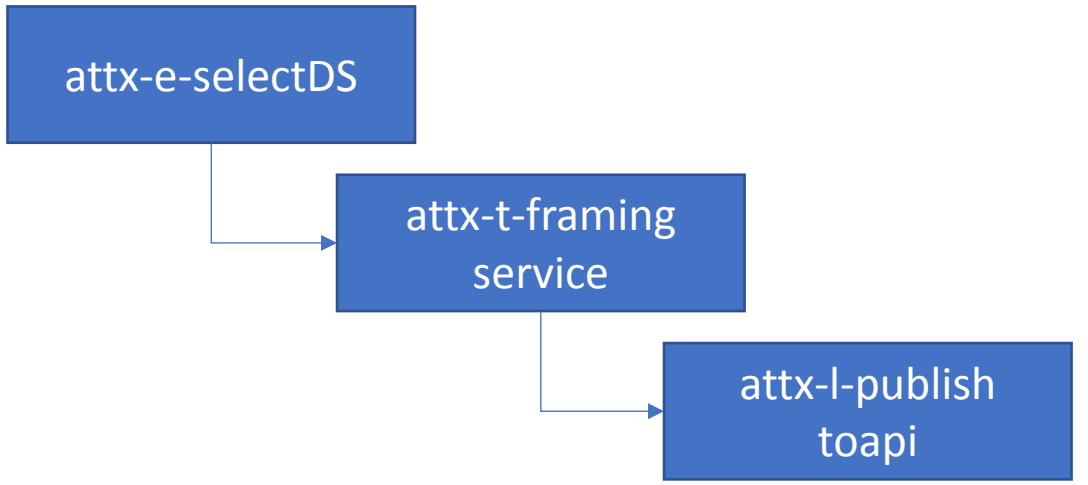
- Provenance use case scenarios
  - How are the inputs and outputs of the pipelines related to one another?
  - Document was downloaded from an endpoint X, what are the data sources and transformations related to that endpoint?
- Provenance browser (PoC)
  - Workflow, step and service level information
  - Connections between pipelines
    - WF B used the data generated by WF A as a data source

Publish pipeline execution

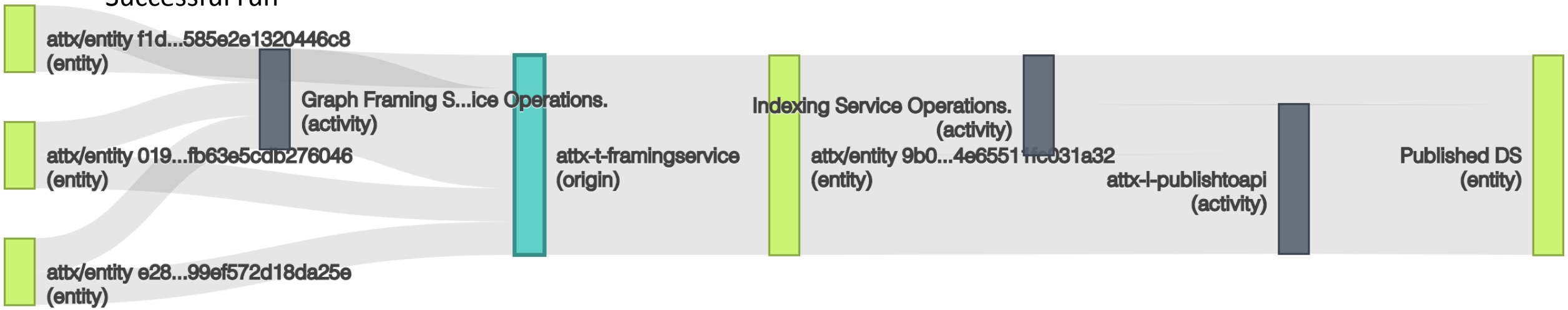
Failed run – indexing part is missing



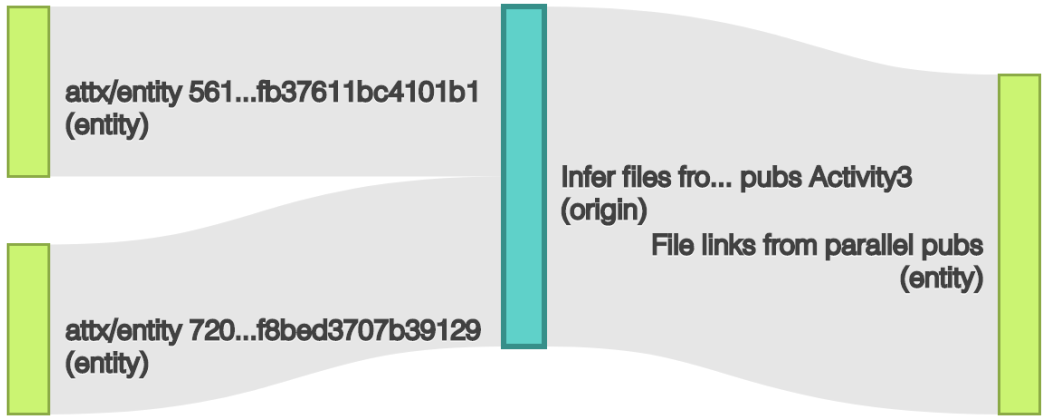
Plan



Successful run

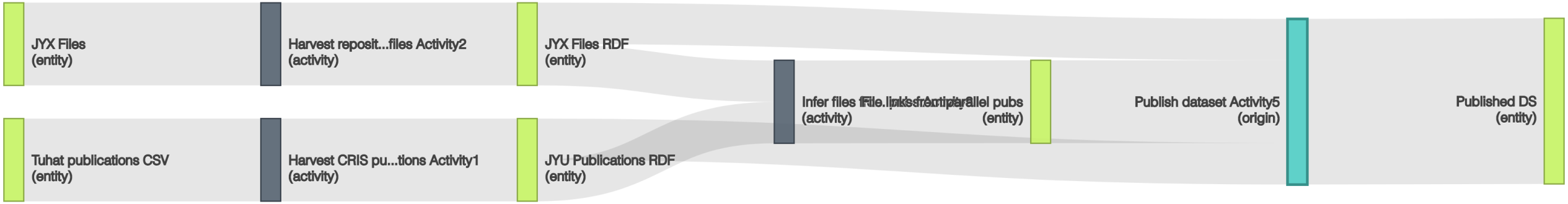


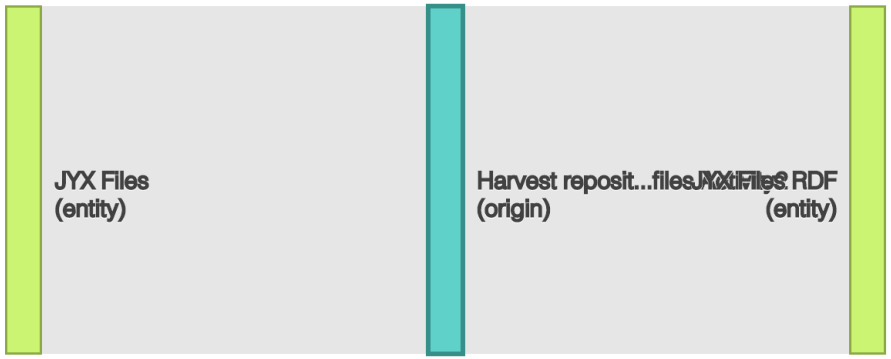
Connected datasets



Input graphs

Label	Check
JYU Publications RDF	☑
JYX Files RDF	☑





Created using Prov-O-Viz
http://provoviz.org/

Input graphs

Label	Check
JYU Publications RDF	☑
JYX Files RDF	☑
File links from parallel pubs	☑

The TODO

- Provenance for incrementally harvested datasets
  - Datasets that have subsets
- Integrating Service Registry to the provenance data
  - More information about the component in a common manner
- Implicit provenance
  - Routing all the messages to the provenance service
  - Creating the request-response patterns based on provenance contexts

Thank you

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