

# Radio imaging cloud workflow for multiband transient source reconstruction

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## Abstract

New and large radio interferometers such as the upcoming SKA (Square Kilometre Array) deliver **massive** and **ever increasing amount of raw data** for astrophysical source observations. For this purpose, it is crucial to have a workflow that enables efficient transferring and processing data, in a **compute continuum** context. All the components should be **seamlessly orchestrated** while enabling the development, test and run **custom workflows**. Data can be hosted on various sites and the computing ressources can be spread country-wide and even internationally (e.g. Future SKA Region centers). In the context of the **EXTRACT** project, the development of interconnections between facilities allows a seamless usage of **data centers, HPC** and **computing clusters on the cloud**. We present two use cases: a demonstrator of the workflow design implemented between facilities, and a new deep learning imager for radio interferometric imaging to reconstruct radio transient sources using this framework (remote data, remote registry, HPC ressources using, etc)

## Current situation

- ▶ No existing compute continuum workflow that handles massive & multi-site data
- ▶ No satisfying method to process reconstruct huge dynamic data flows
- ▶ Increasing amount of astronomical observations data rate, e.g. **20 Tb/s** for SKA-Mid [1]

## EXTRACT Project

**Extreme Data**

Volume, Velocity and Variety (3V challenge)

Complexity and Diversity

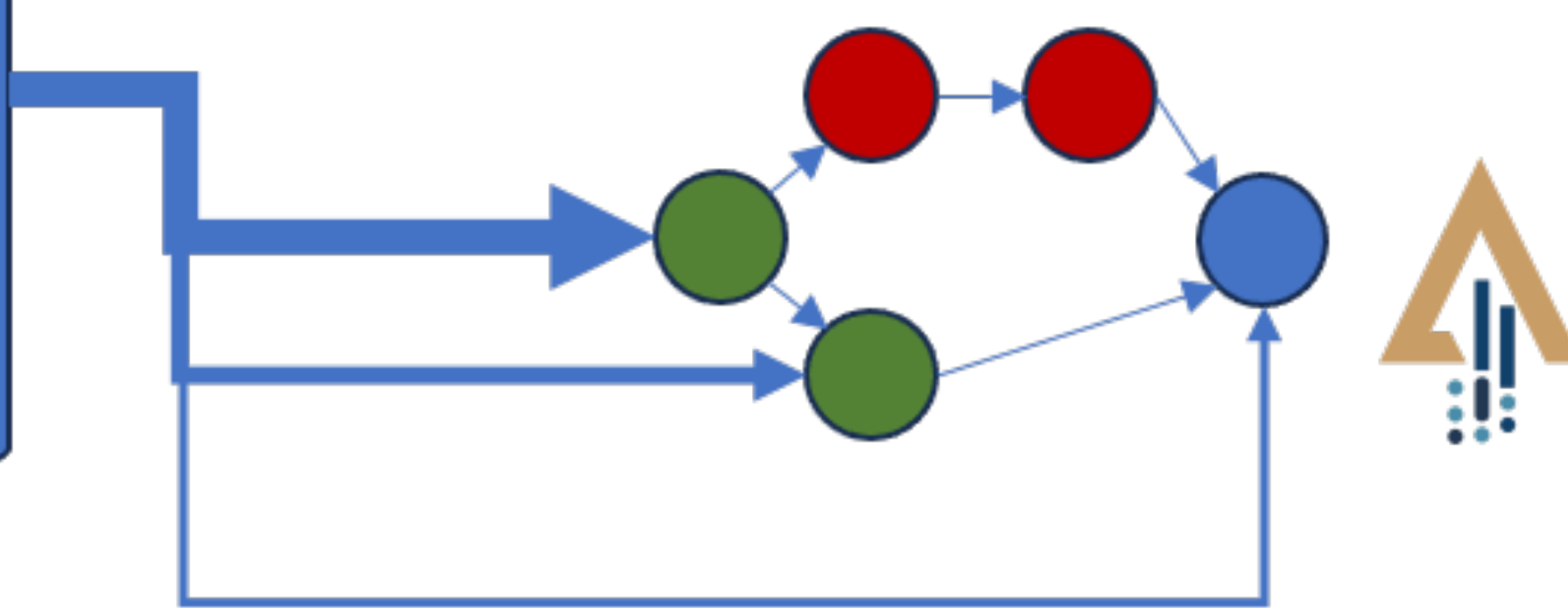
Sparse, Missing, Insufficient Data with Extreme Variability

Dispersivity of Data Sources

Compute Continuum
HPC
Edge
Cloud

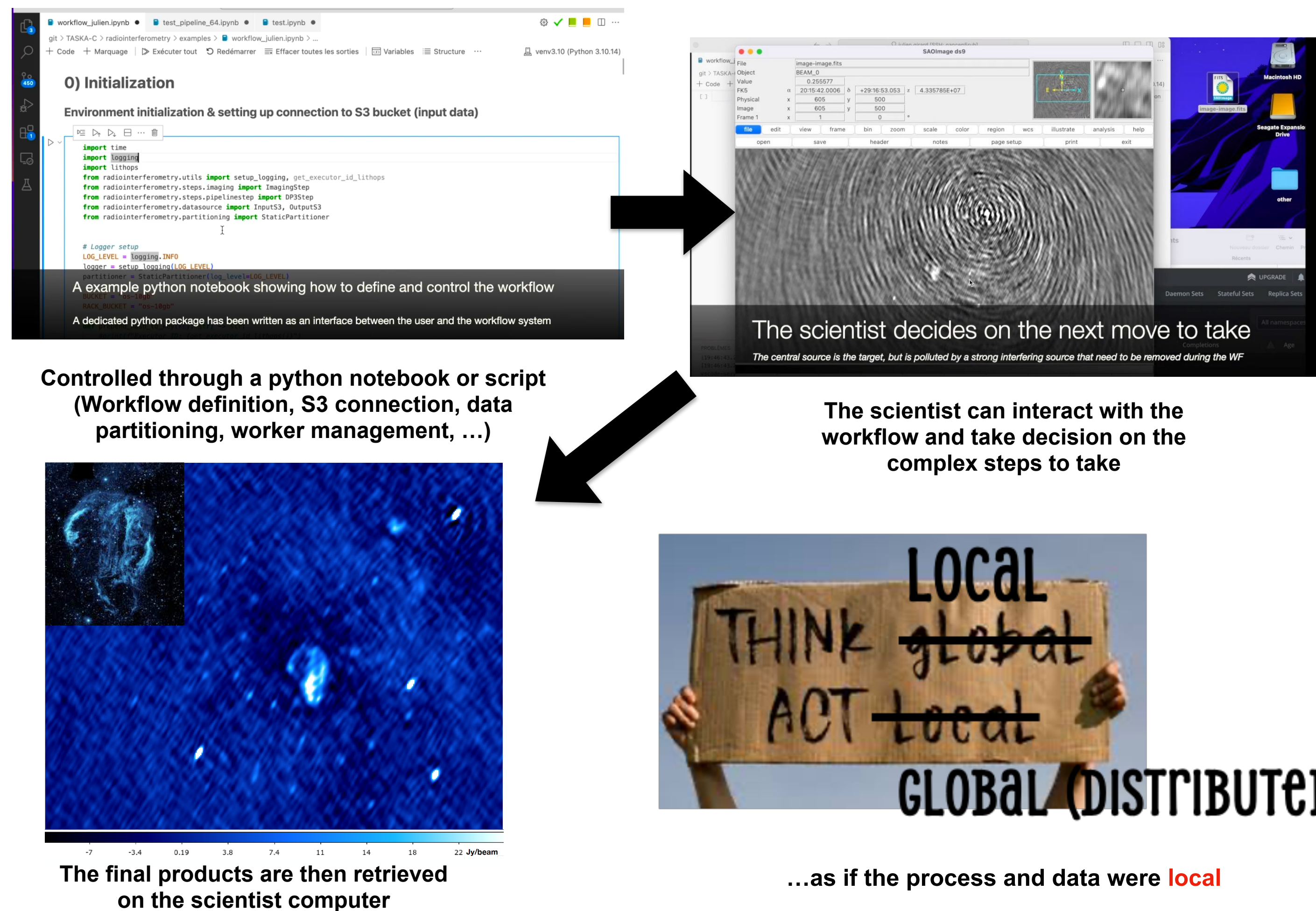
## Data Mining Software Platform

- Data infrastructures and AI & Big-data frameworks
- Data-driven orchestration
- Interoperability

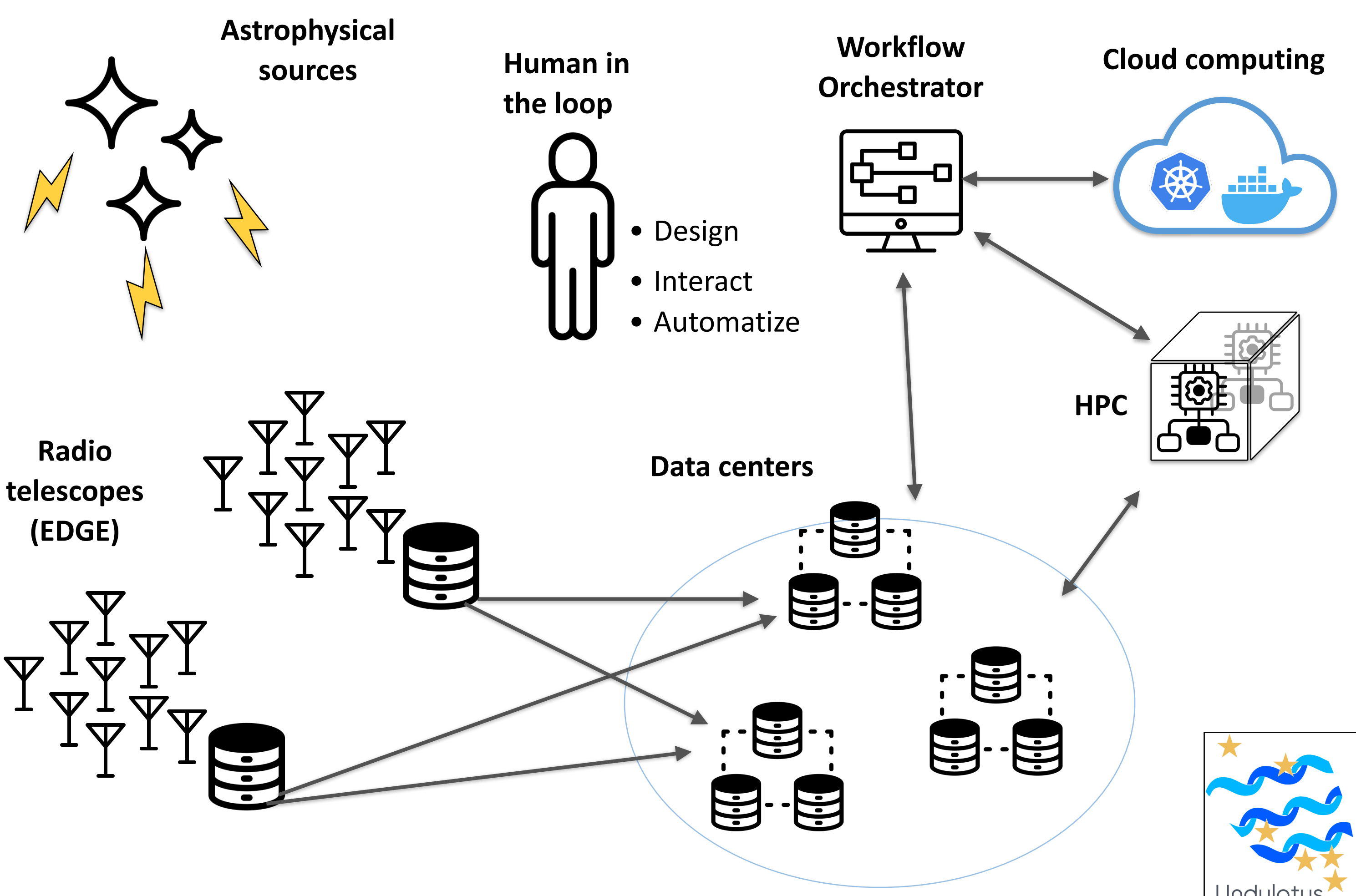


## TASKA Transient Astrophysics with an SKA pathfinder

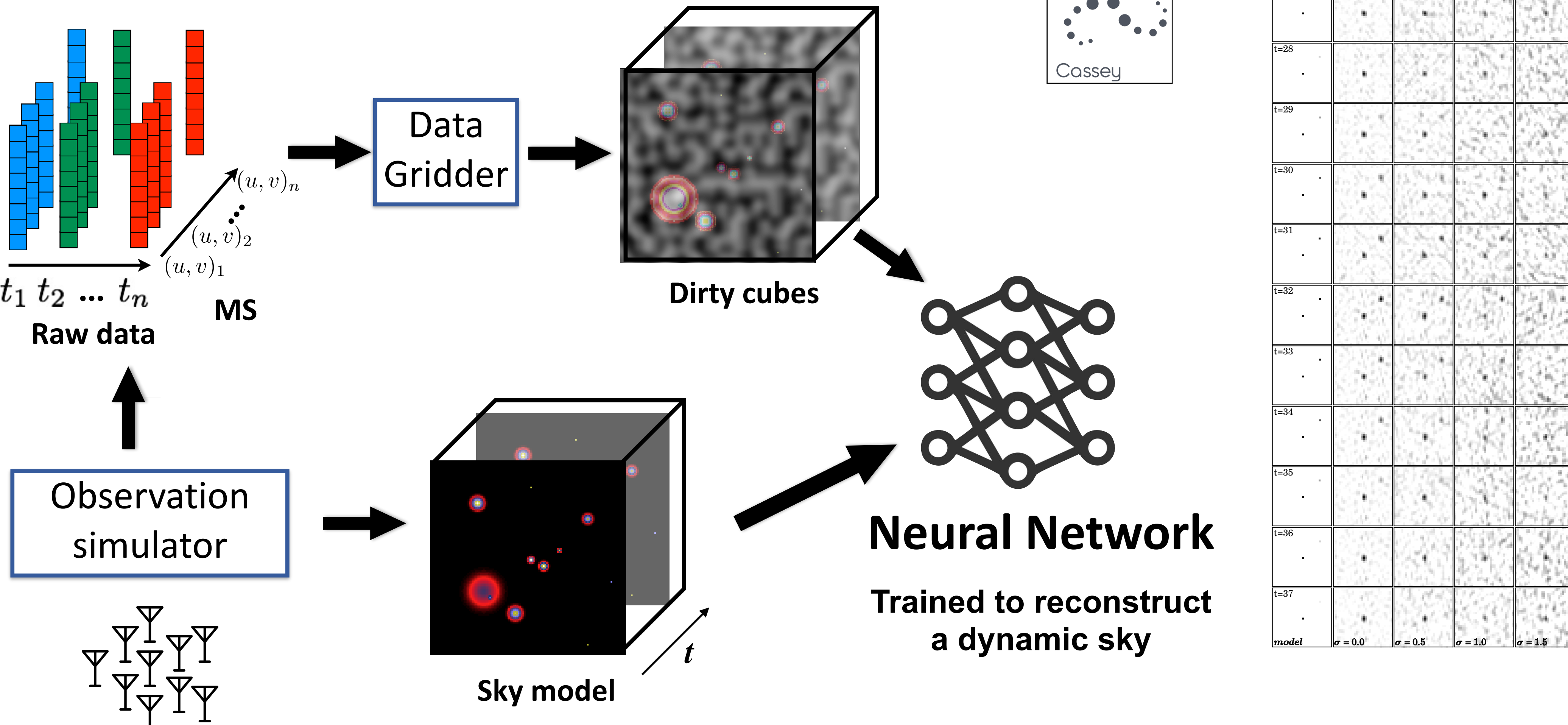
### Workflow management from the user side



## Undulatus workflow



## Cassey imager and training pipeline



- ▶ At low SNR, classical imagers have problematic reconstruction and cannot leverage temporal structures in signals
- ▶ The network we chose is able to capture the coherent time structure of the signal
- ▶ Currently, the network is trained for one specific telescope
- ▶ Realistic simulation of observations (source visibility, instrumental PSF, data rate and format) built using Codex Africanus library [2]

## Future works & next steps

- Public release of open-source code
- Test case on real data
- Extended method to emission transients

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