

BONSAI Climate Footprint Analyser

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Overview

- BONSAI and the BONSAI Climate Footprint Analyser
- Database workflow and structure
- Integration with Apache Airflow
- Where we are right now
- Our API
- The road ahead & how you can help!
- Questions and API demo

What's BONSAI?

- Non-profit organization
- Goal is to tackle the challenge of
 - Incomplete
 - Lacking in detail
 - Out-of-date
 - Difficult to access“product footprints”
- How?
 - Completely open source and open data
 - Automated data harvesting
 - Use of national and international statistic data that can be disaggregated using science based algorithms
 - Community involvement

BONSAI Climate Footprint Analyser

- Funded by KR foundation through 'getting the data right' project
- Project partners:
 - Aalborg University (lead)
 - CML, Leiden University
 - 2.-0 LCA consultants
 - CICERO, Oslo
- Heavily inspired by the hybrid version of Exiobase

Goals

- Provide up-to-date climate footprint generator
- Minimize effort for continuous updates
- Enhance internal models:
 - Household consumption patterns, carbon flows in ecosystems, uncertainty handling, ...
- Make it accessible!

Database key stats

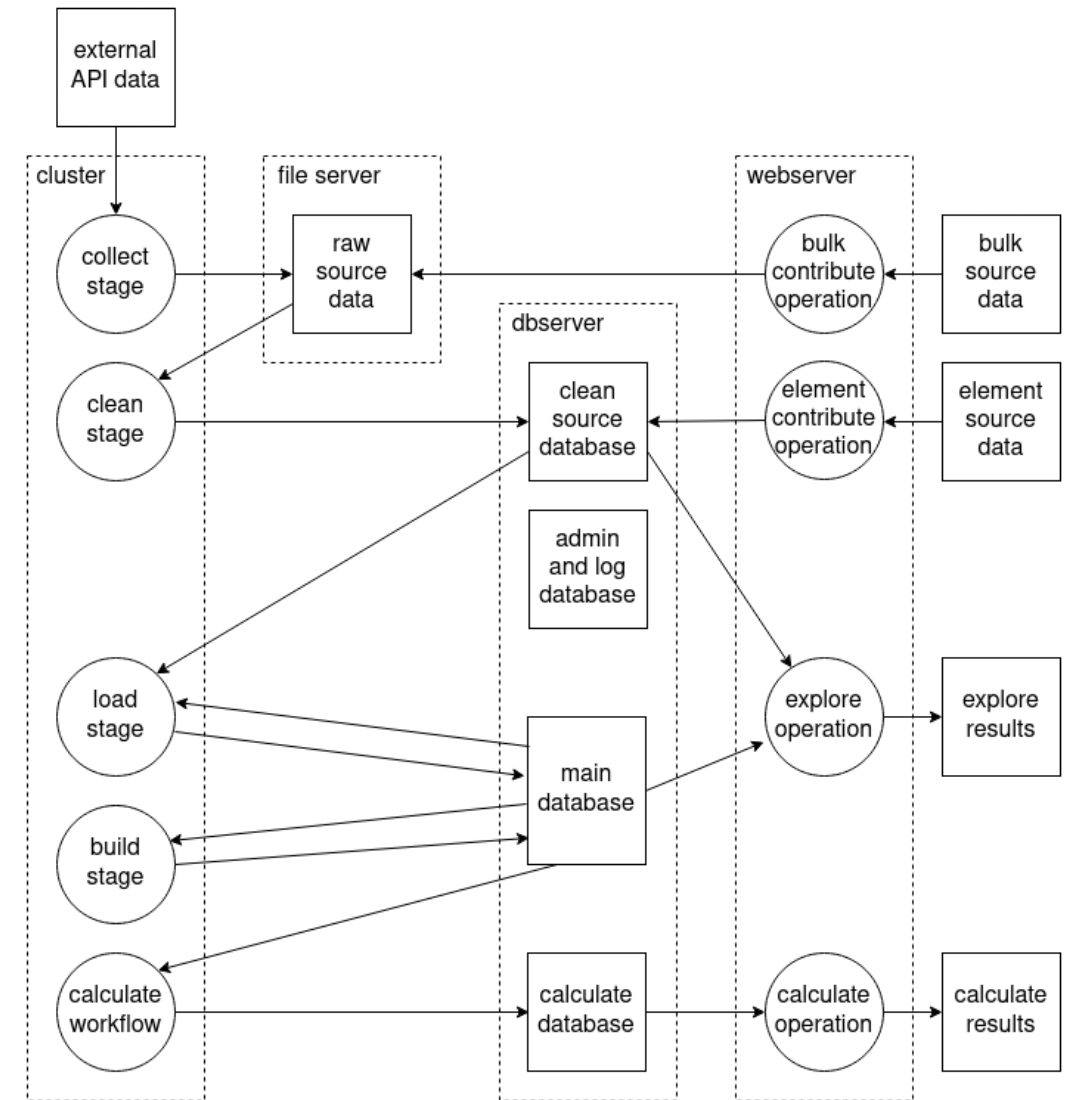
- Based on the hybrid version of Exiobase (v4)

Our minimum goal for data coverage:

- > 55 countries
- ~ 2000 product flows

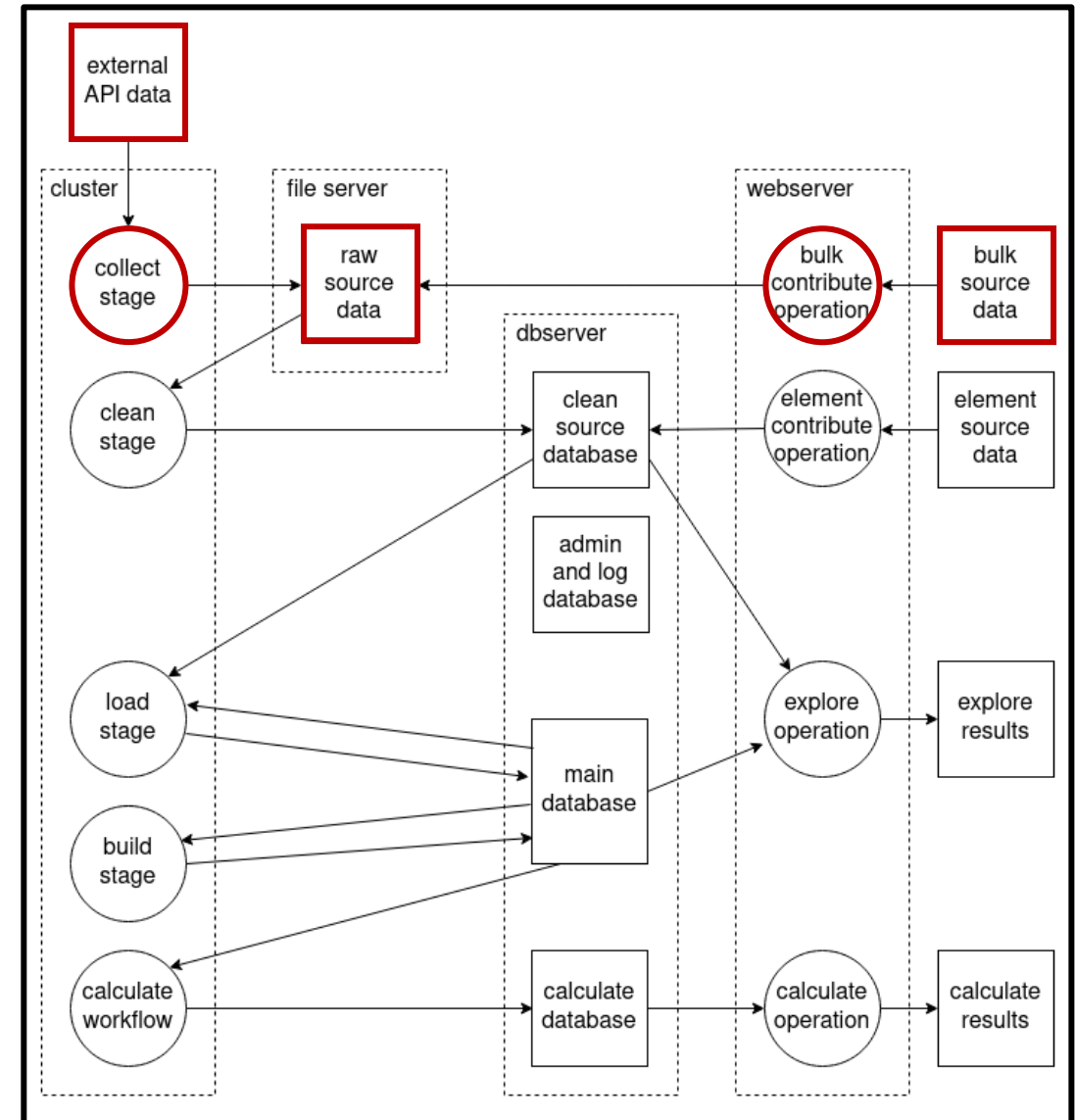
Database Workflow

- Webservice
 - React + Django
- DBServer
 - PostgreSQL
- Cluster workflow
 - Python
 - Apache Airflow
 - Kubernetes + Docker



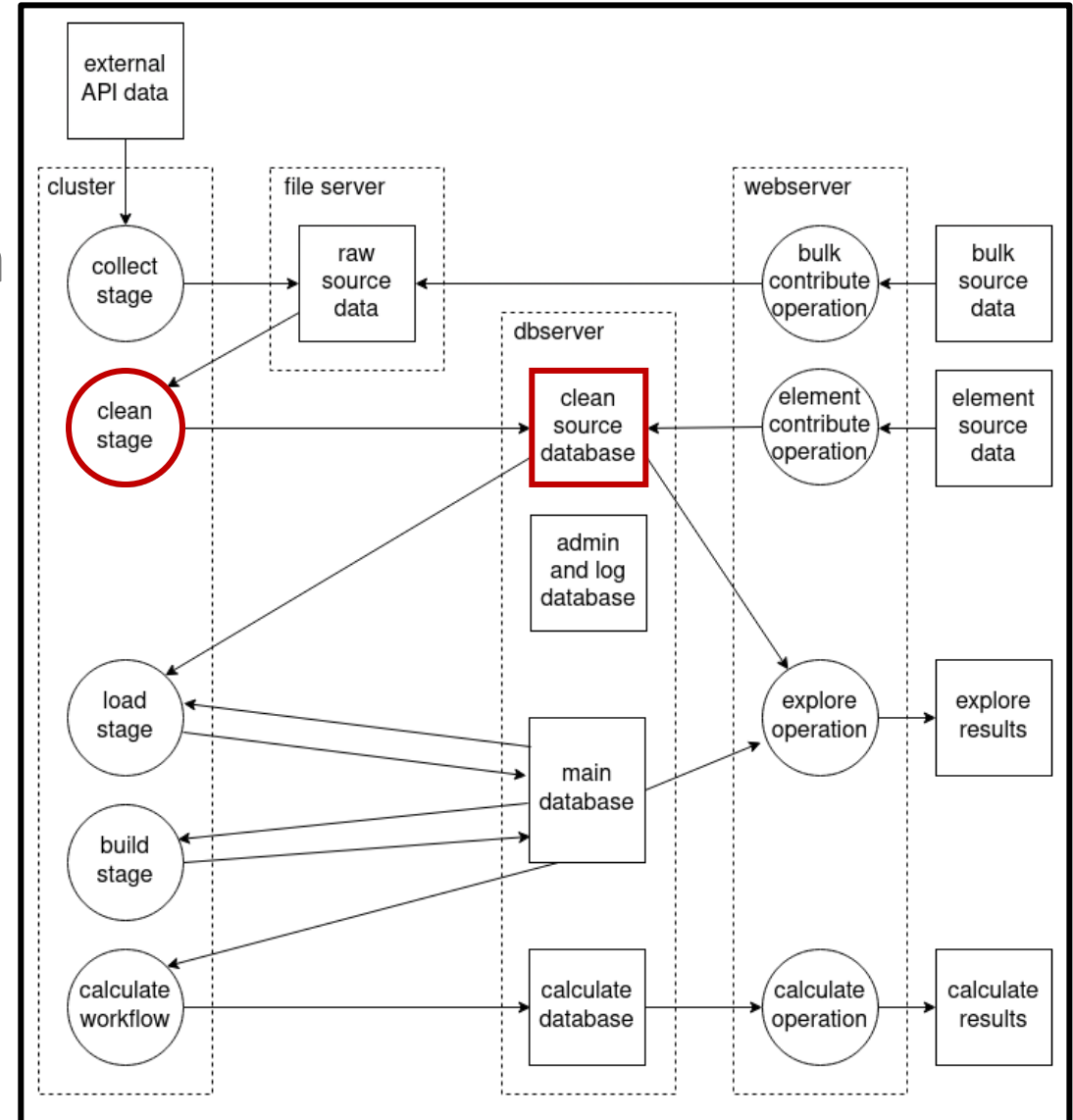
Collect and Clean Stage

- Input from external APIs and scraping websites
- Data stored as it comes
- Bulk contribution:
 - E.g.: Higher detail national SUT
 - Requires code contribution



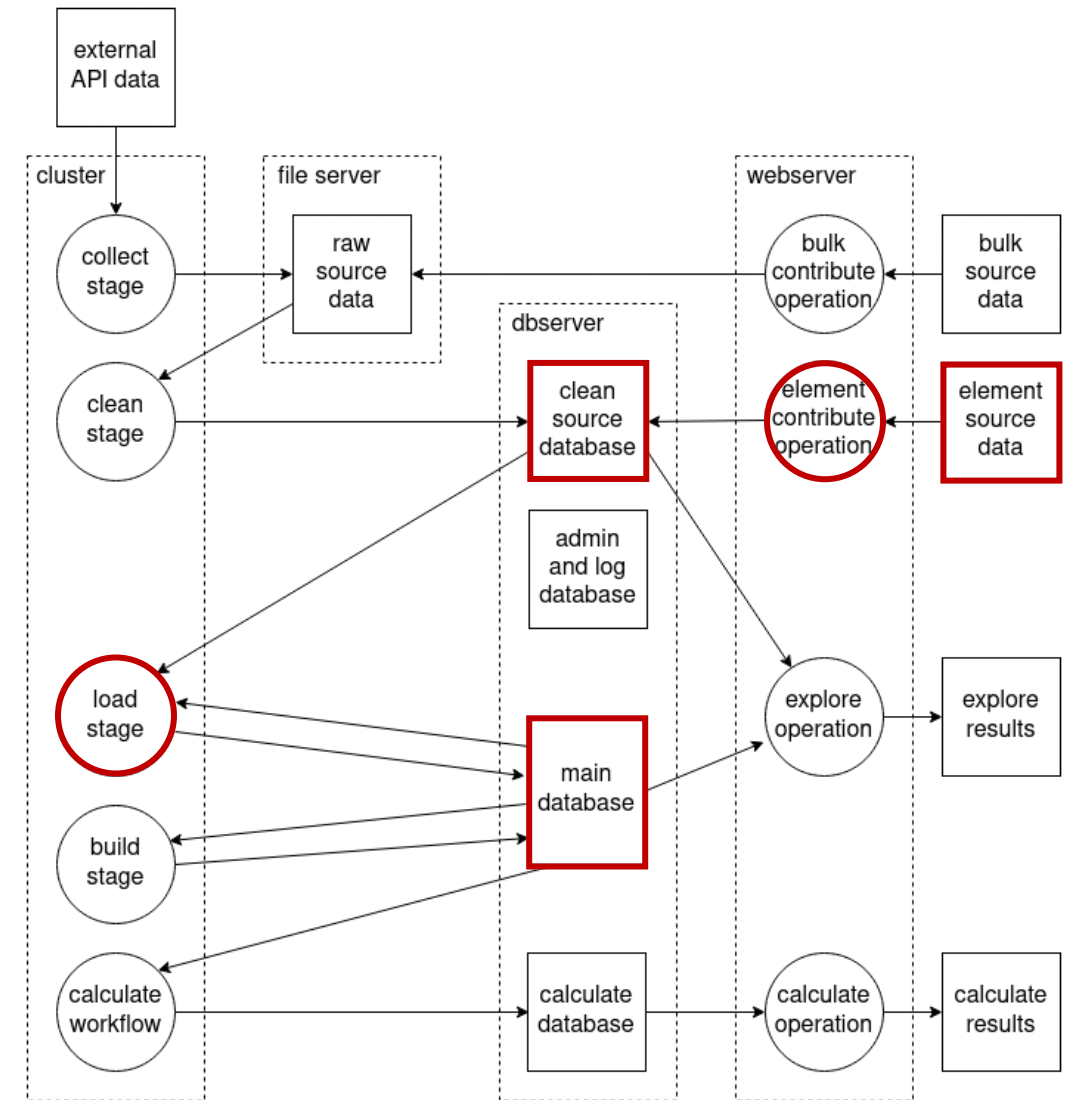
Clean Stage

- Data transformed to relational form
- Cleaning strategies applied
- Database and .csv files



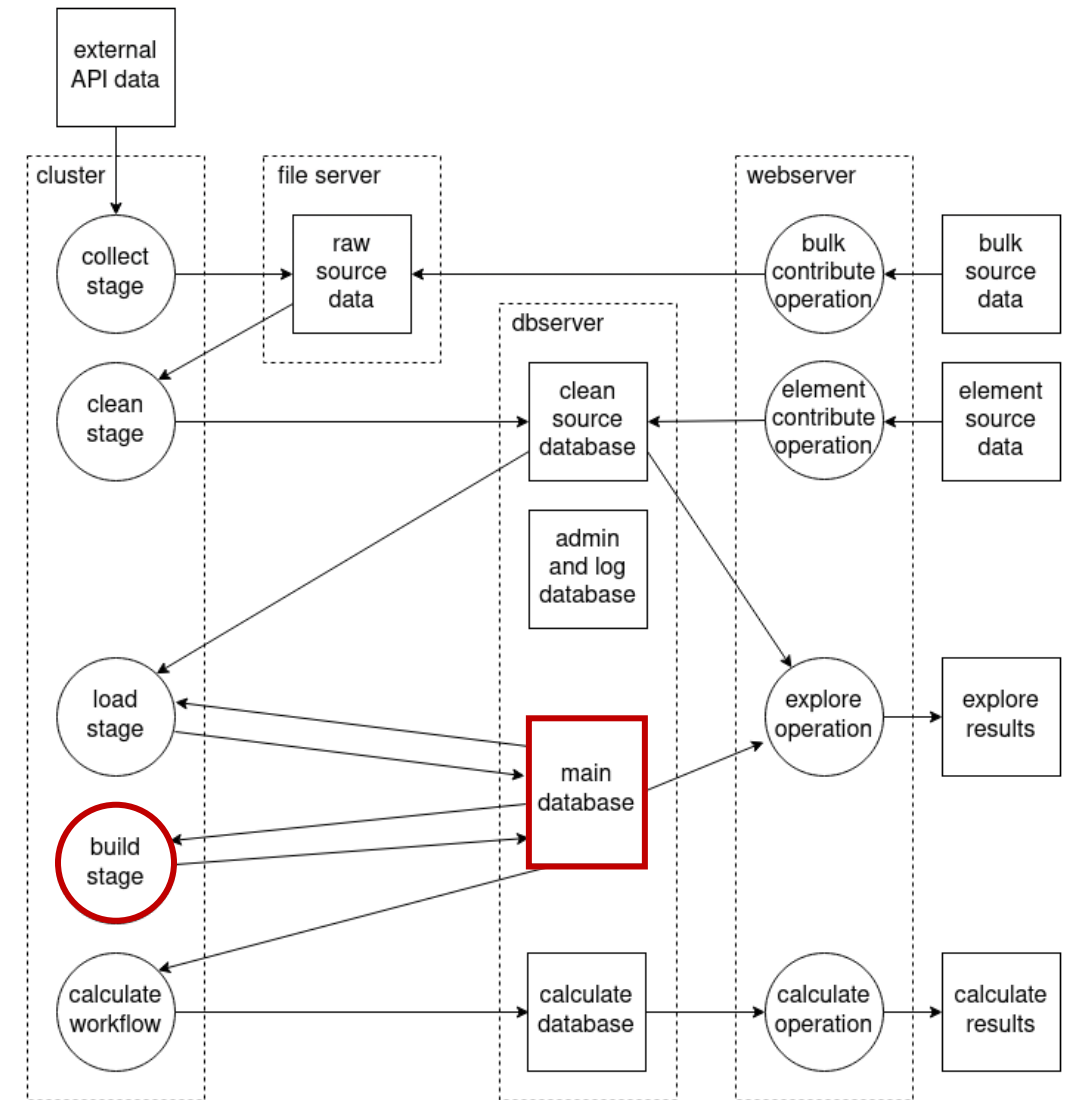
Load Stage

- Element contribution:
 - Highlight/edit erroneous data
- Reads and harmonizes clean data



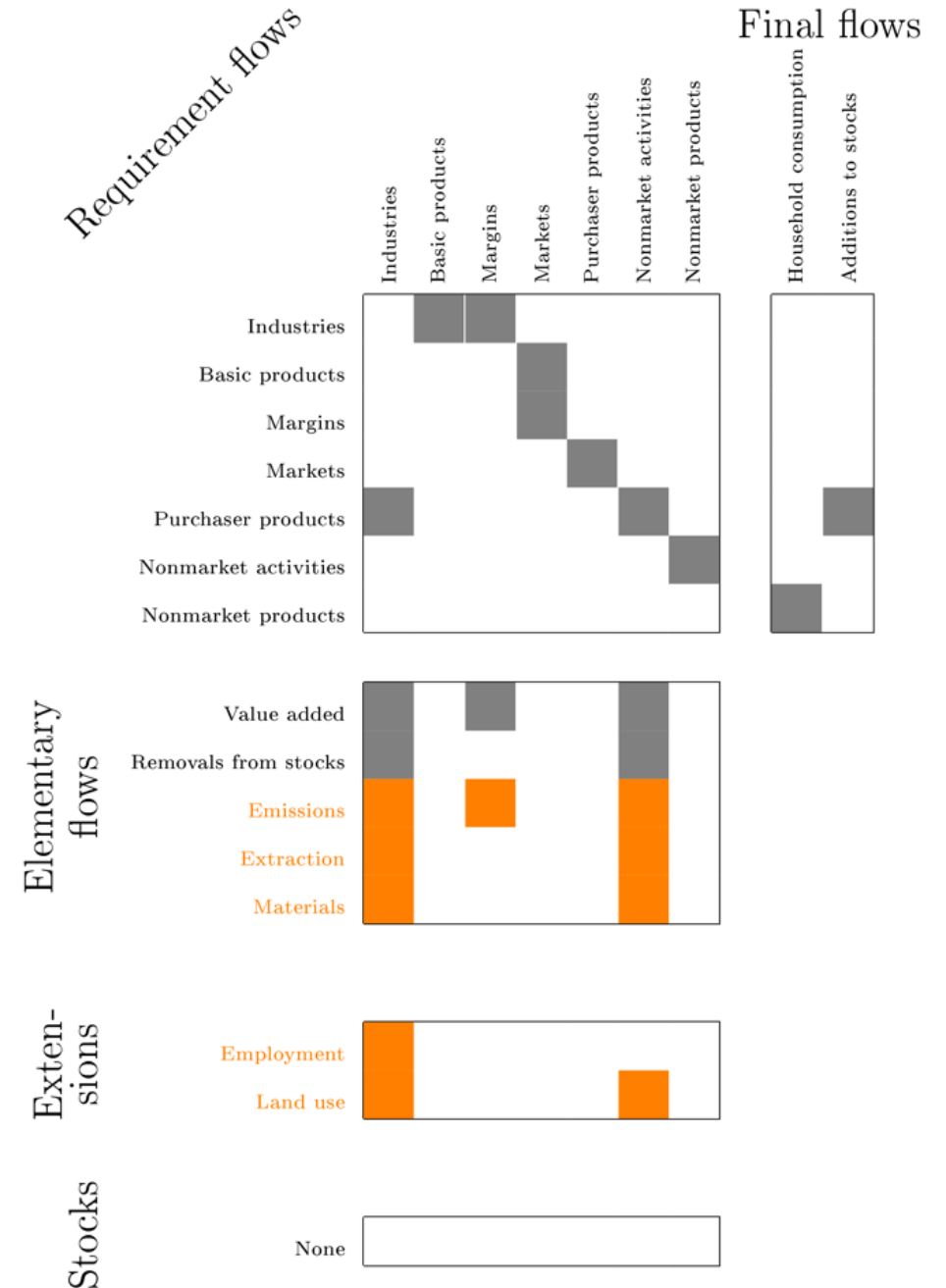
Build stage

- Transforms data
- Clean data to IO system
- Only interacts with main database



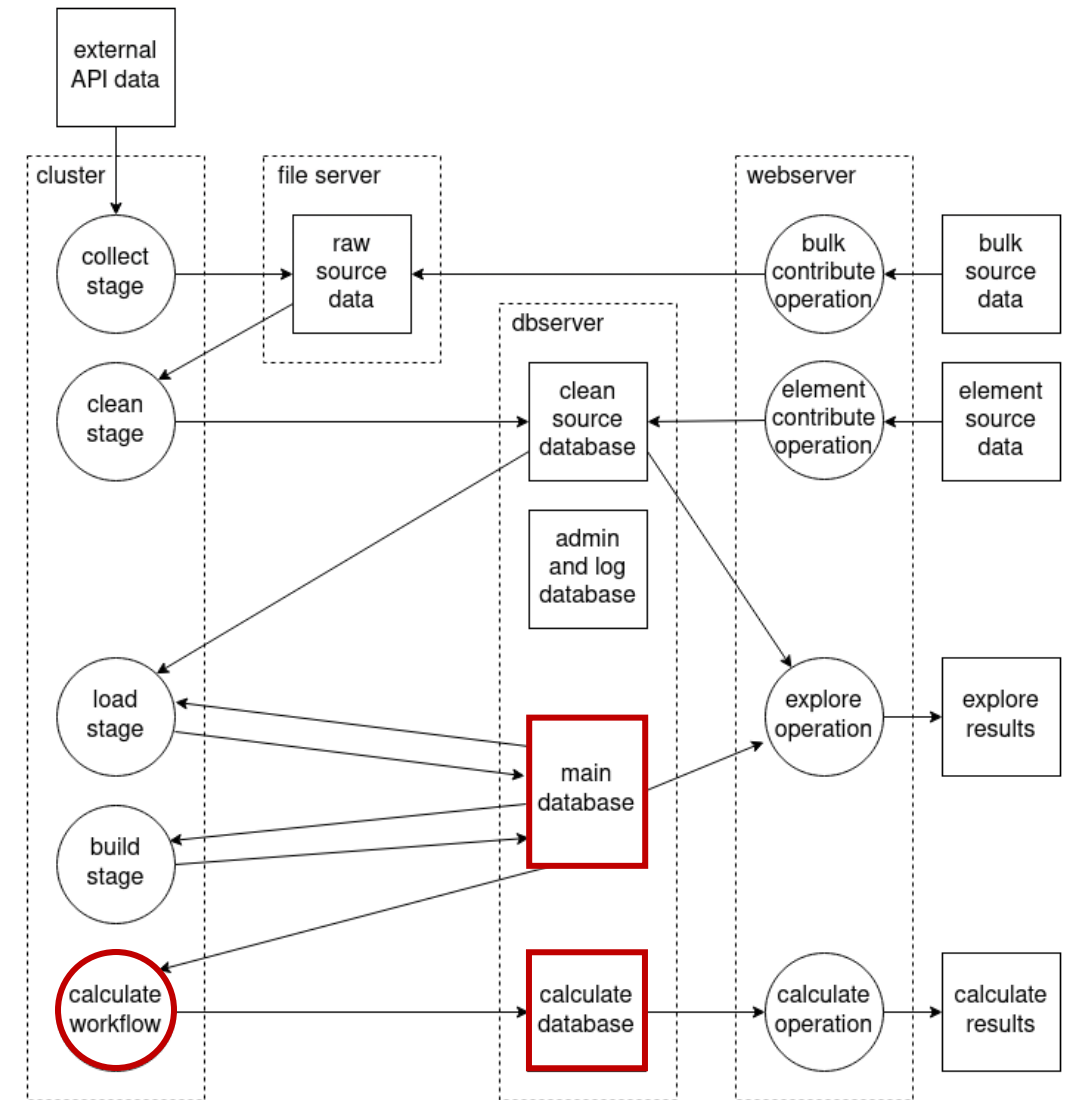
Build Stage

- Gap filling
- Decomposition of industries
- Parametrized production functions
- Modelling of sub-regional data
- Balancing



Calculate Stage

- Generates footprint results
- Generates hotspot/contribution analysis
- Results cached but not persistent

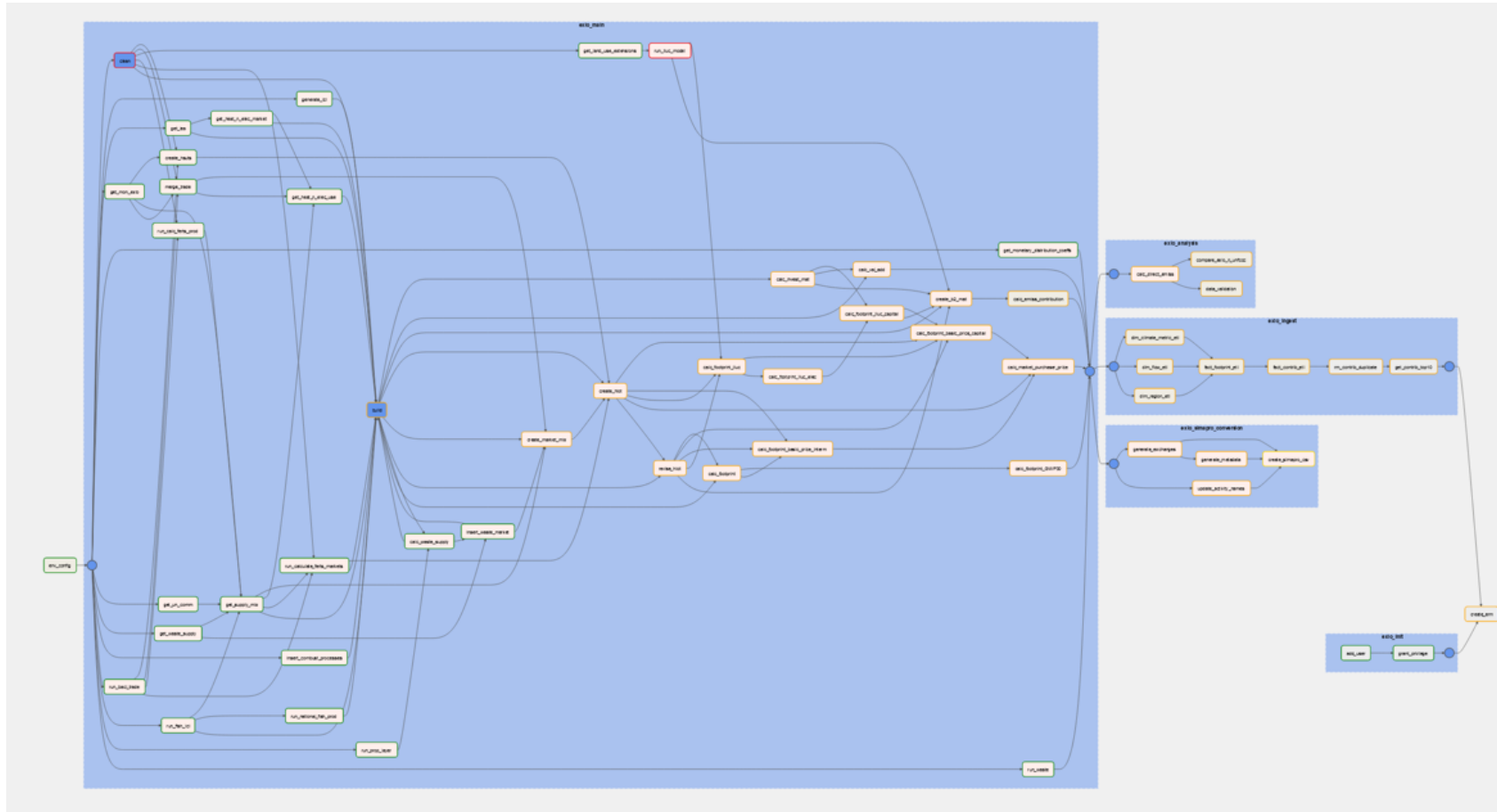




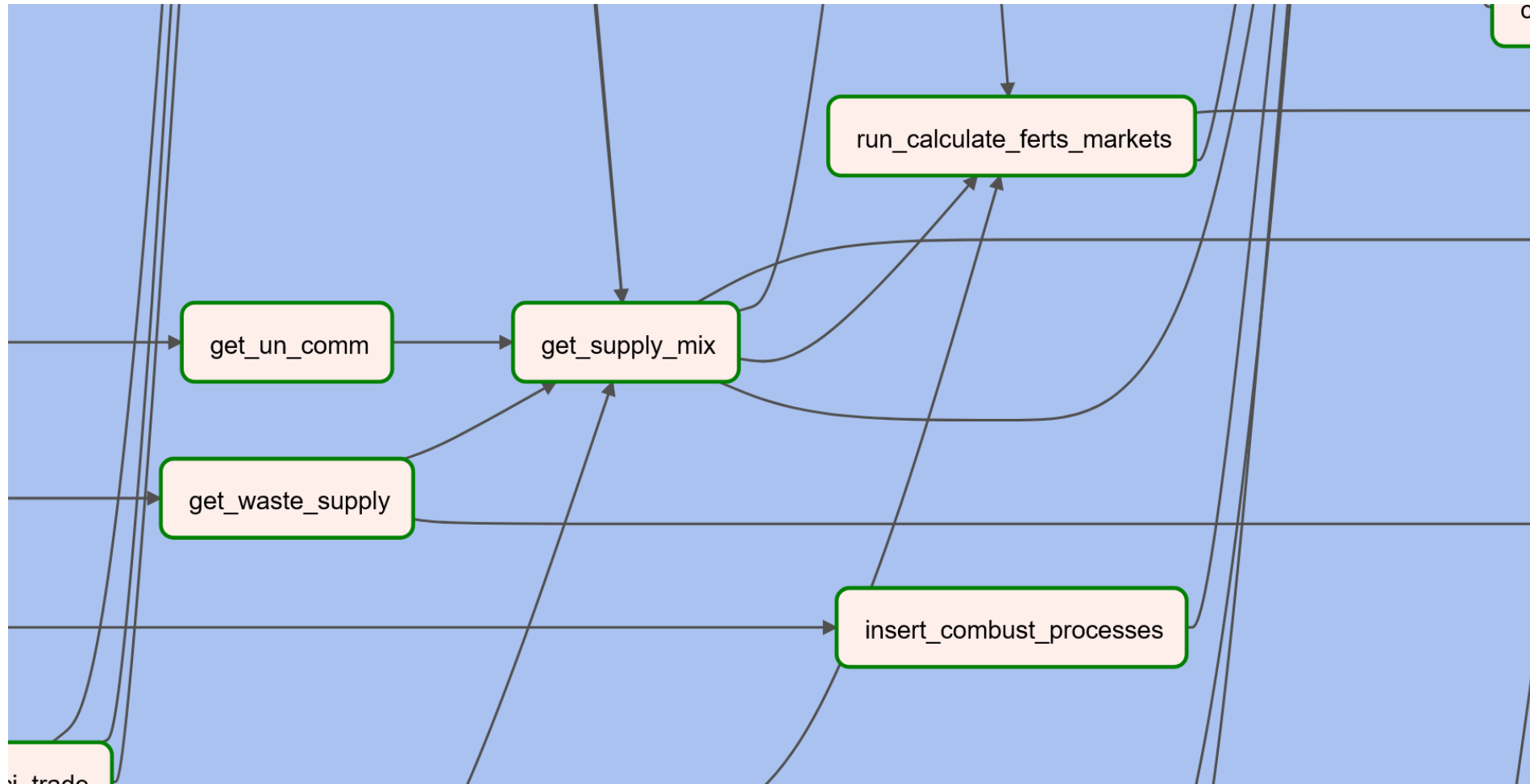
Integration with Apache Airflow

- Workflows can be stored under version control
- Allows to build a Directed Acyclic Graph (DAG)
- Manages task execution and load balancing
- Self-contained tasks for easier collaboration
- Airflow allows automatic scheduling of tasks
 - Triggers are automatic or manual
- Only necessary parts of workflow are executed

Integration with Apache Airflow



Integration with Apache Airflow



Parallelization using Docker + Kubernetes

- Each task can run on its own
- Tasks are launched as docker containers
- Distributed over several worker nodes
- Worker orchestration is done via a Kubernetes cluster



Where are we right now?

BONSAI Climate Footprint Analyser

CONTRIBUTE

Footprint

ProductCountry

Footprint type ⓘ

Cradle to gate (i.e. production) ▼

Product ⓘ

aluminium and aluminium pro... ▼

Location ⓘ

Australia ▼

Year ⓘ

2016

Climate metric ⓘ

GWP100 ▼

AnalyseAdd to comparison

aluminium and aluminium products

Cradle To Gate

Australia | 2016 | GWP100

1 kg equal

5.94

kg CO₂-eq

Where do emissions for 1 kg come from?

Process emissions: 1.44 kg CO₂-eq

Inputs	Country	Input	Emissions [kg CO ₂ -eq]
electricity	AU	37 MJ	2.1
fuel mix and combustion for non-ferrous metals	AU	25.7 MJ	1.98
other land transportation services	AU	0.0432 EUR	0.16
Sum of not-displayed inputs		-	0.118
petroleum coke	AU	0.0447 kg	0.0518
services relating to the collection and sorting of scrap/secondary materials (excl the material)	AU	0.101 EUR	0.0405
sea and coastal water transportation services	AU	0.00975 EUR	0.0206
furniture; other manufactured goods n.e.c.	AU	0.000225 kg	0.0139
hotel and restaurant services	AU	0.0136 EUR	0.0139
financial intermediation services, except insurance and pension funding services	AU	0.0802 EUR	0.0129

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API documentation about

Our current API

- Currently at: <https://lca.aau.dk/api/docs/>
- Available data:
 - Footprints for product/market flows
 - Production recipes for product flows
 - Market composition for market flows
- Endpoints for available flows/countries/units

The Road Ahead & How You Can Help!

- Contact us if you have data!
- We want to start open-sourcing our pipeline start of next year
 - Frontend + API
 - IPCC package
 - Parametrized Models

Questions + Live Demo