GreenDelta
sustainability consulting + software

openLCA

Flow mapping in LCA Software: current issues and potential solutions

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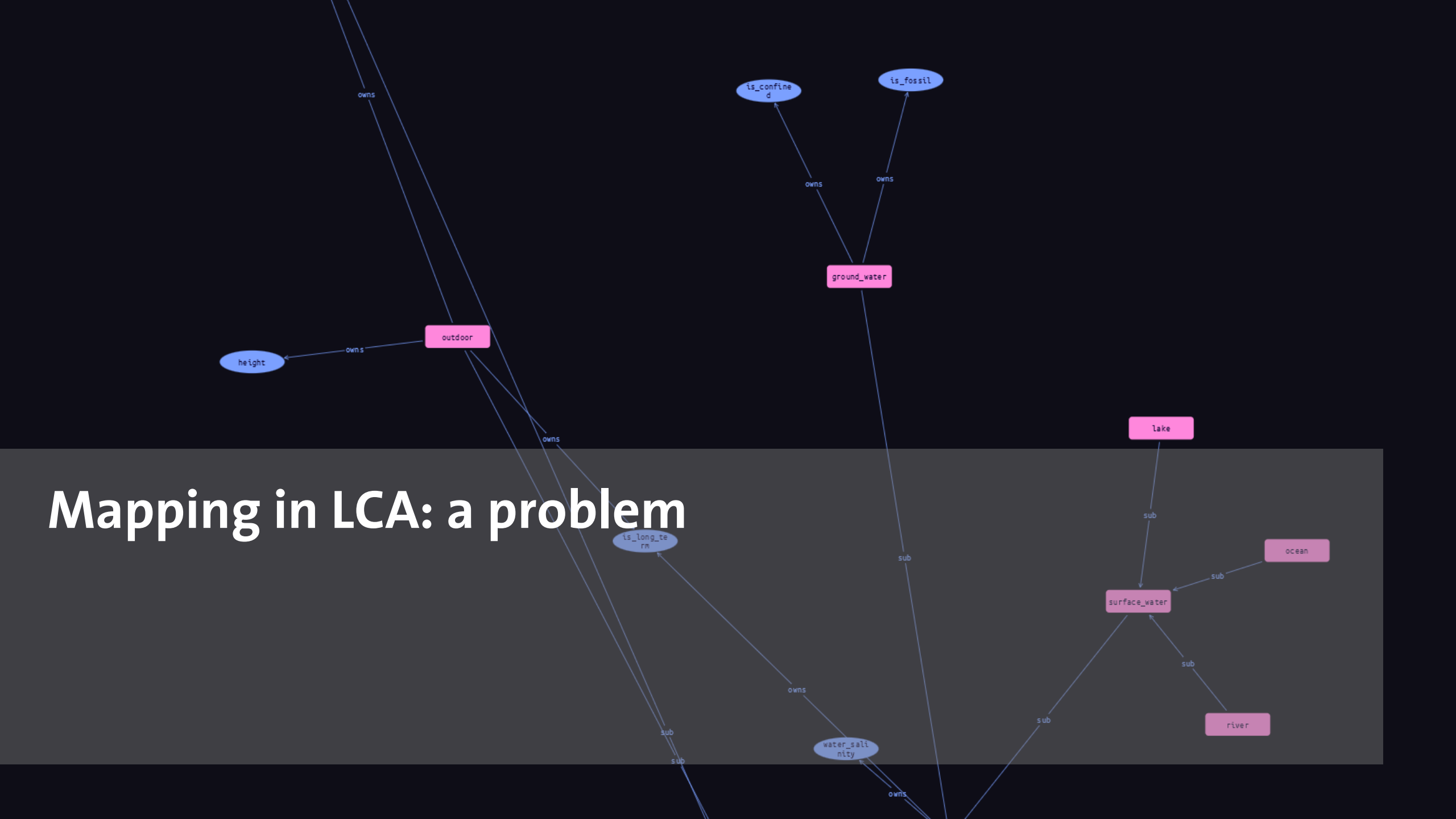
Topics

- Mapping in LCA: a problem since the start
- Why/ issues?
- Mapping in LCA software now: openLCA
- A potential solution
- What next



Mapping in LCA: a problem

Mapping in LCA

Dictionary

Definitions from Oxford Languages · Learn more

map·ping

/ˈmapiNG/

noun **MATHEMATICS • LINGUISTICS**

an operation that associates each element of a given set (the domain) with one or more elements of a second set (the range).

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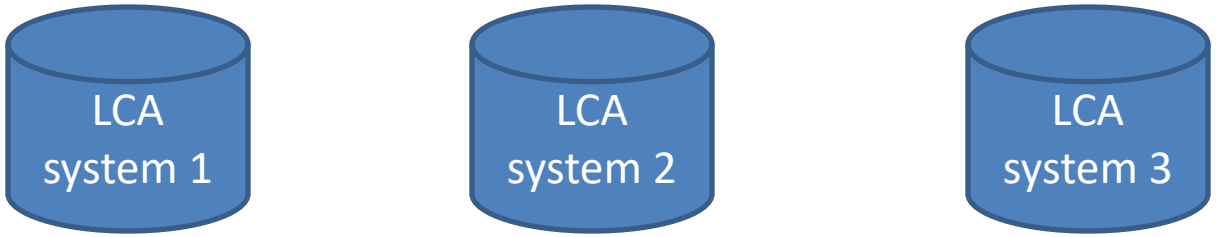
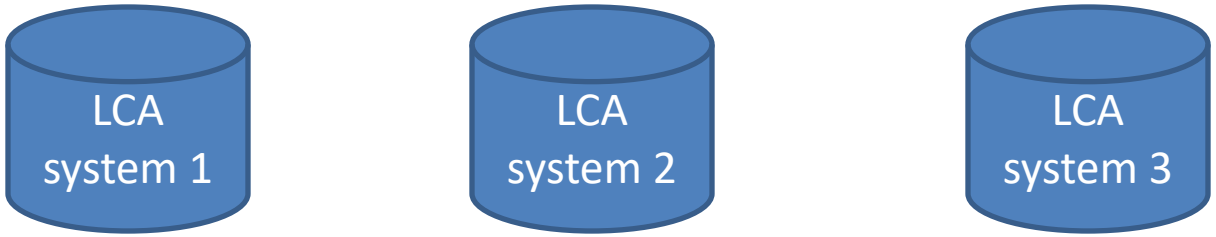
Mapping in LCA

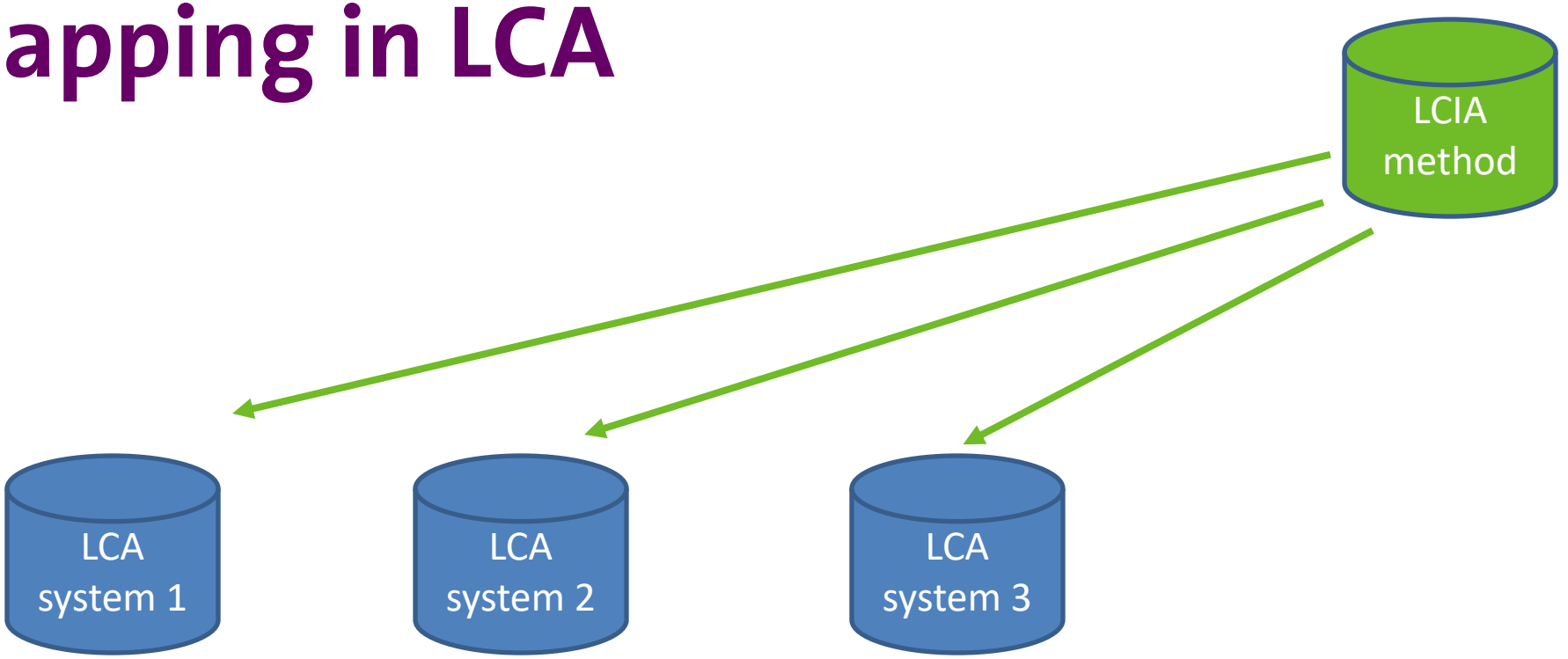


Mapping in LCA



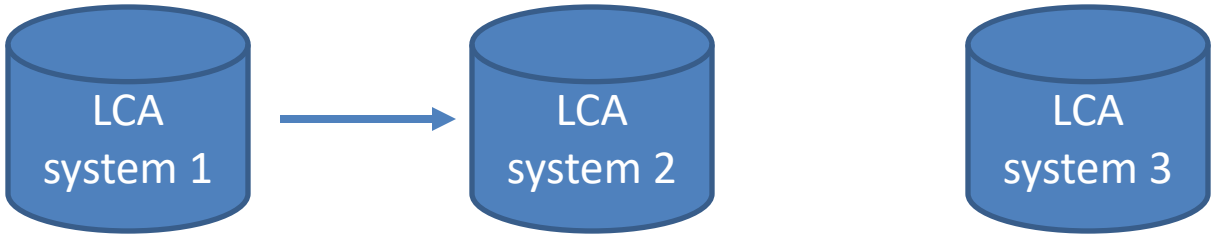
- Each of the systems has potentially different units, flows, … for the same things.

Mapping in LCA



- Each of the systems has potentially different units, flows, … for the same things.
- An LCIA method has even other units, flows, for the same things, and is to be included in all three systems

Mapping in LCA



- Each of the systems has potentially different units, flows, … for the same things.
- Someone wants to bring data from one system to another system

Mapping in LCA - issues

- How are things identified:
  - Names
  - UIIDs
  - …
- Are things clearly identified:
  - LCA systems nowadays typically messy, not well curated.
  - E.g., Environmental Footprint database of the EU: Identical UUIDs are used for different things
- Different granularity

Mapping in LCA – issues, 2

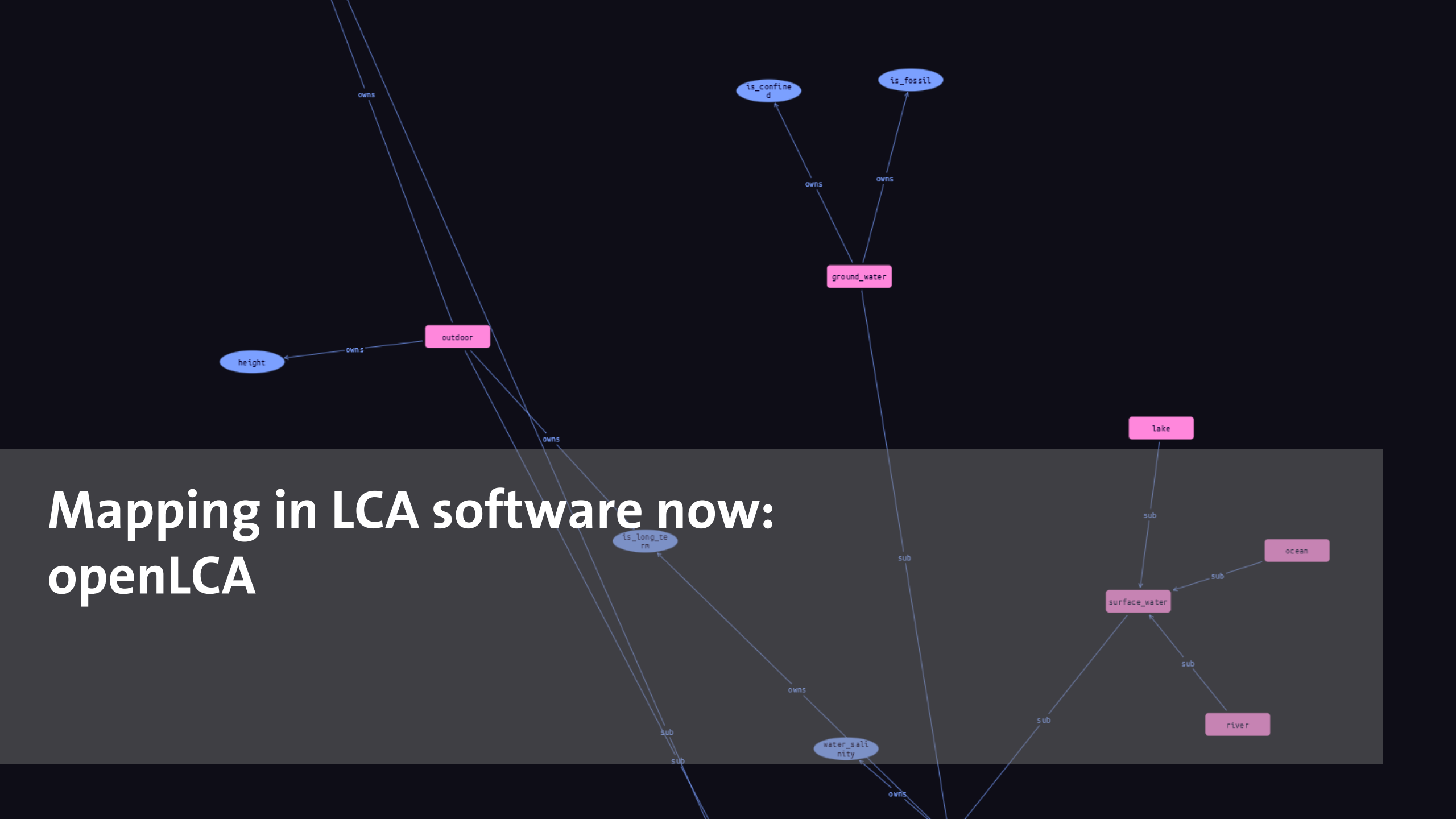
- Clusters, nonsense:

  “Alkane (unspecified)“; „Antimony, ion“, „Copper“ -> what are these, really?
- For flows: Need to map flow and also compartment

  -> typically a flow is set in every possible compartment

  -> flow number is multiplication of “real flows” and compartments

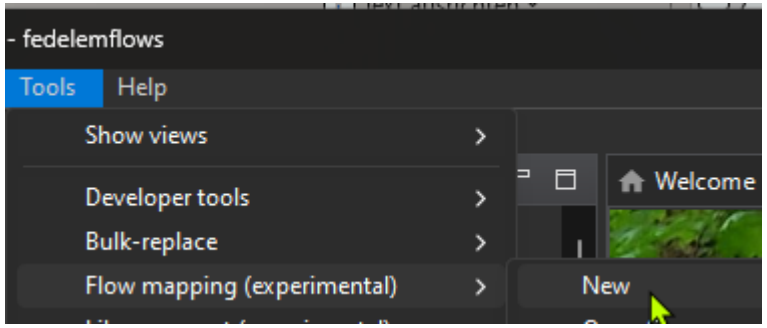
  -> LCA Commons: > 300,000 flows

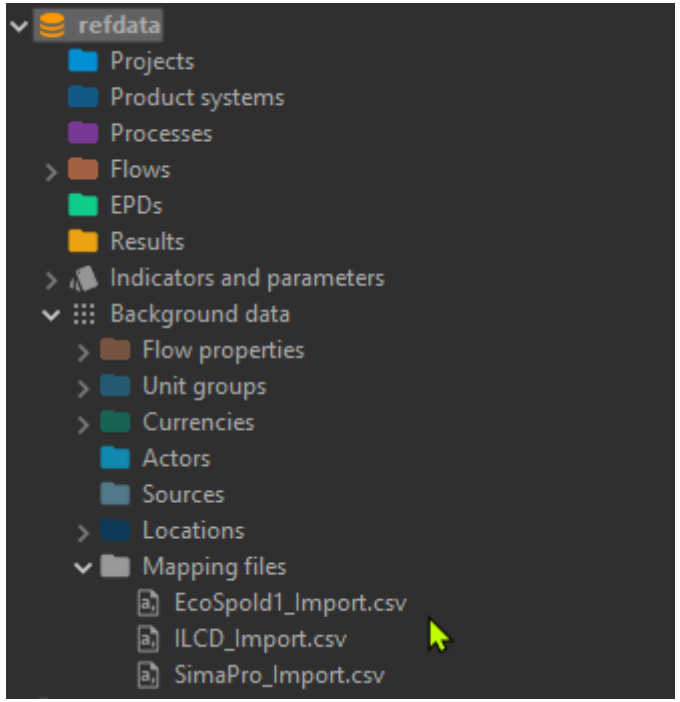


Mapping in LCA software now: openLCA

Mapping in LCA software: openLCA

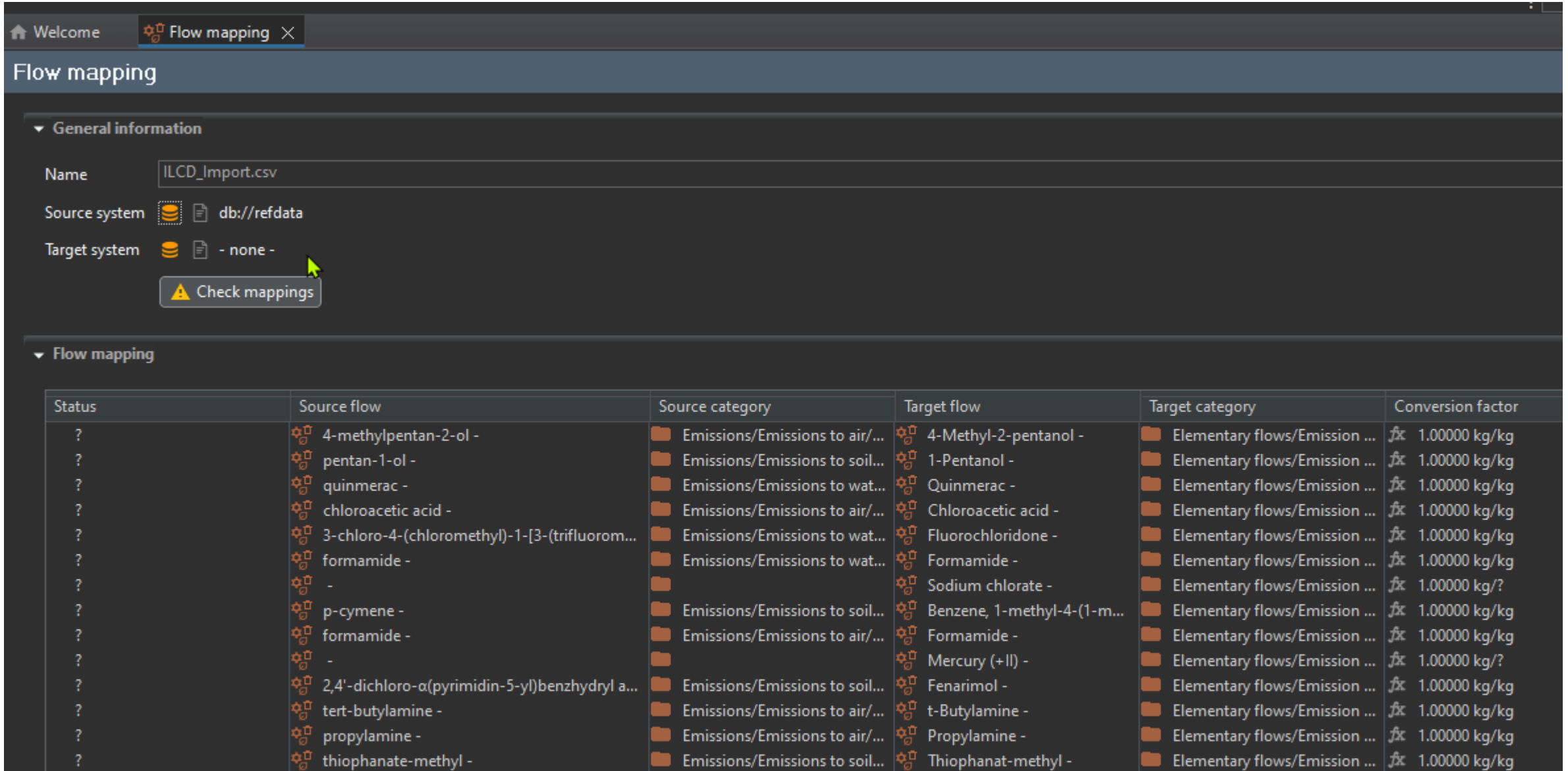
- While importing, while exporting, and within a database: it is possible to apply a mapping file





- Mapping files are provided with reference data

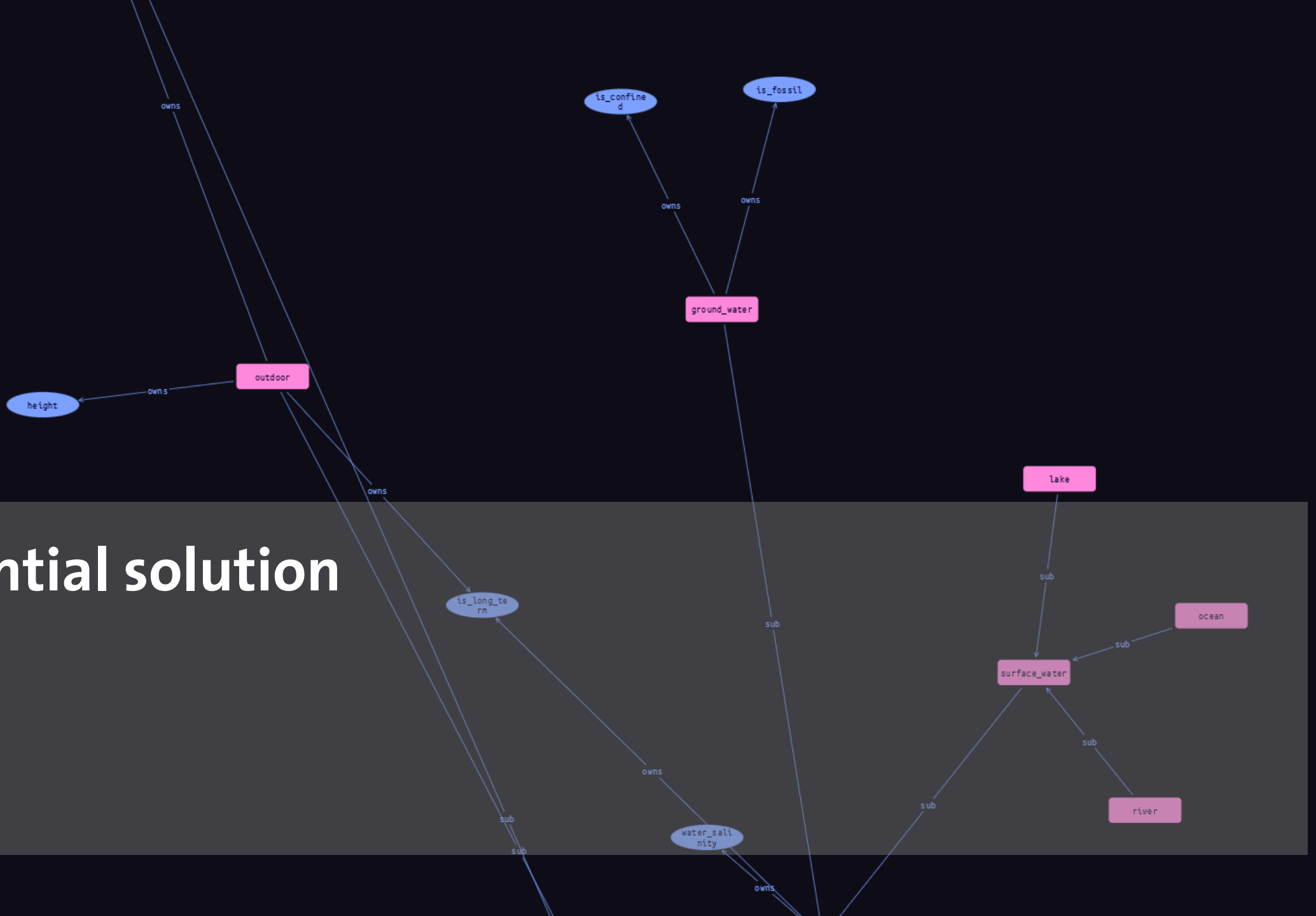
Mapping in LCA software: openLCA



Mapping in LCA software: openLCA

- This can of course be used. Issues so far:
  - Only flows addressed
  - Needs a simple flat file x is y.
- Using in import and export and within the software is useful

A potential solution

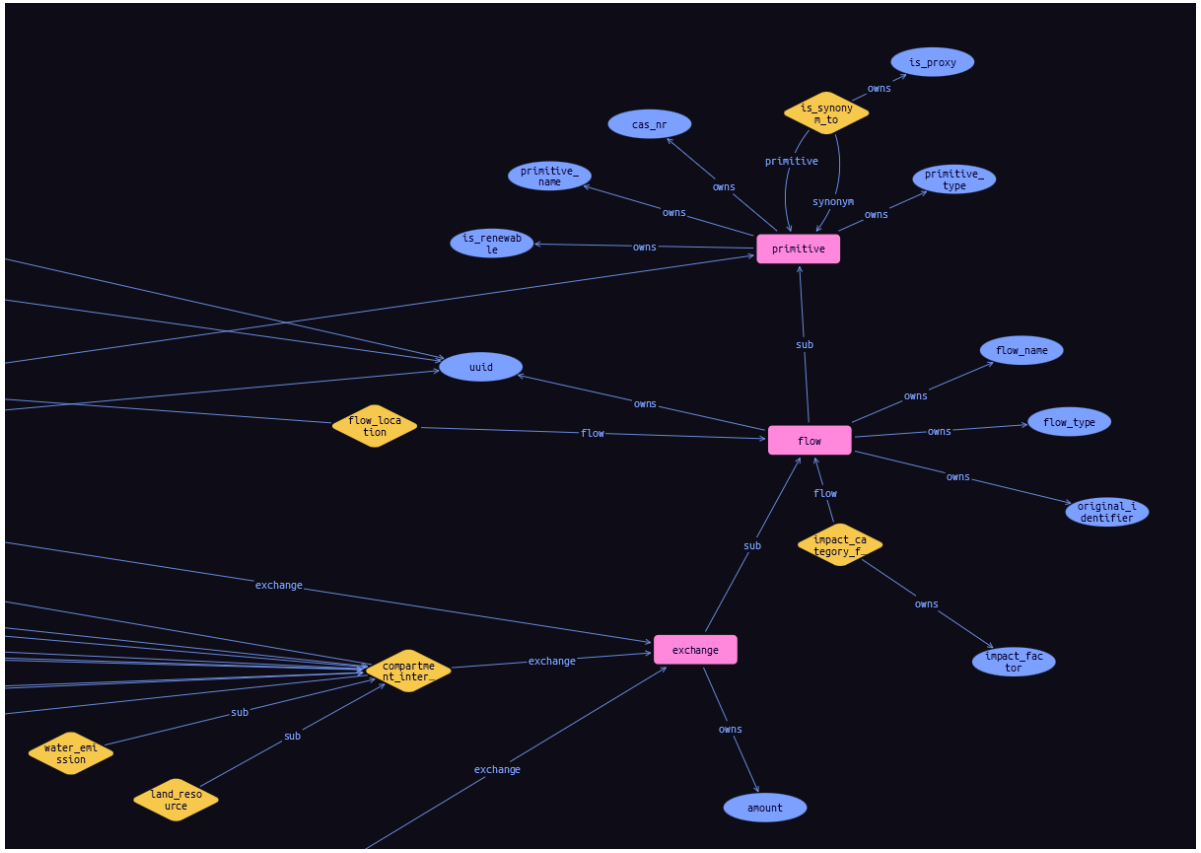


A potential solution

- Atomic modelling of flows
- Atomic modelling of compartments
- Implementation in graph database TypeDB which can infer
- Using Pubchem synonyms, CAS numbers, existing flow mappings, etc.

A potential solution

- Atomic modelling of flows




```
exchange sub flow,
  owns amount,
  plays exchange_unit:exchange,
  plays segment_exchanges:exchange,
  plays compartment_intervention:exchange;
  #location not needed as it is already specified for the flow
```

```
flow sub primitive,
    owns uuid,
    owns flow_name,
    owns flow_type,
    owns original_identifier, # eg the actual name of simaproflows
    plays flow_location:flow,
    plays impact_category_flow:flow;

    #flow is not emitted, only the exchange!
```

```
primitive sub entity,
    owns primitive_name,
    owns cas_nr,
    owns is_renewable,
    owns primitive_type,
    plays source_link:primitive,
    plays is_synonym_to:primitive,
    plays is_synonym_to:synonym;

    #this is the most basic flow thing, for substances etc.
```

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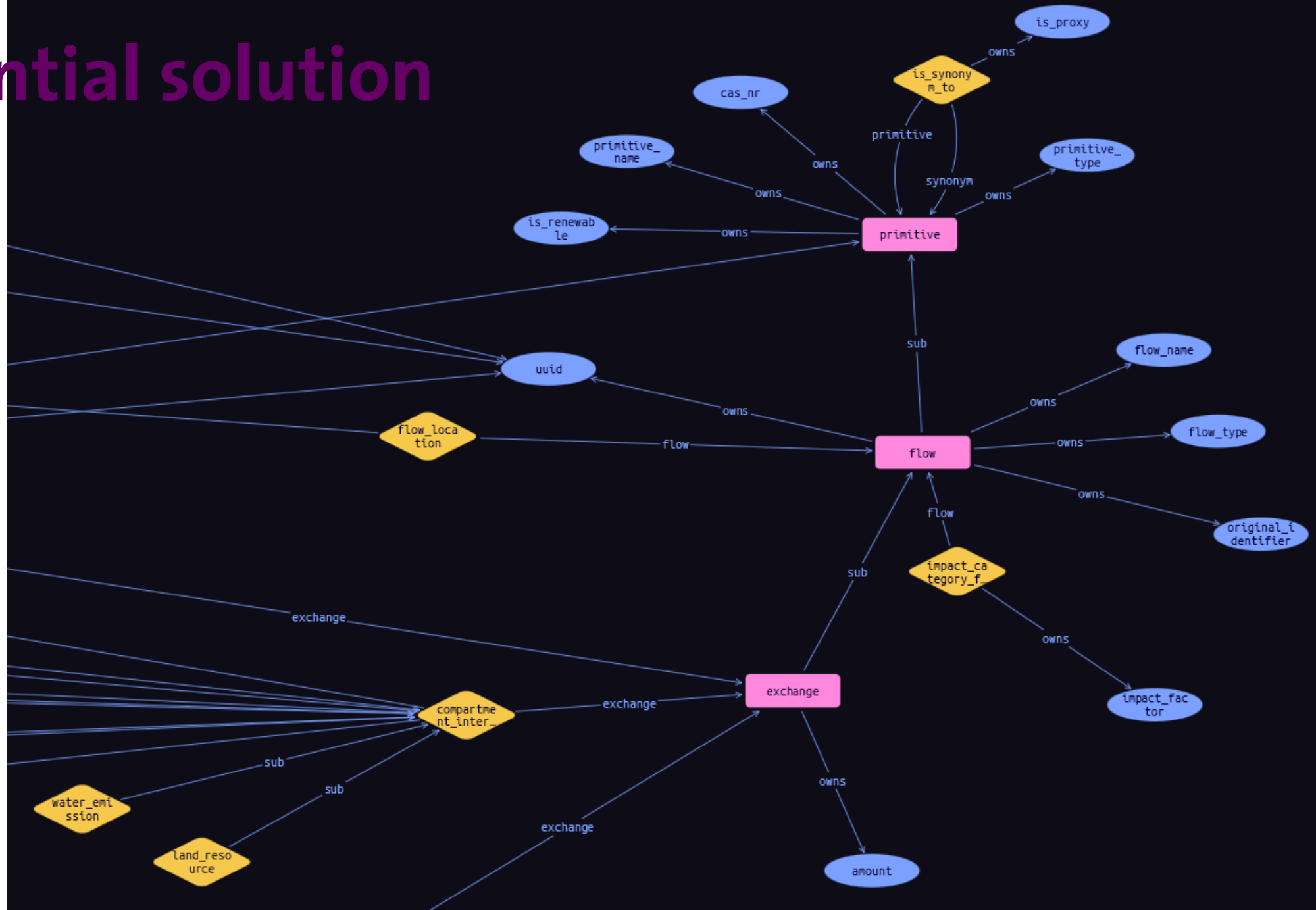
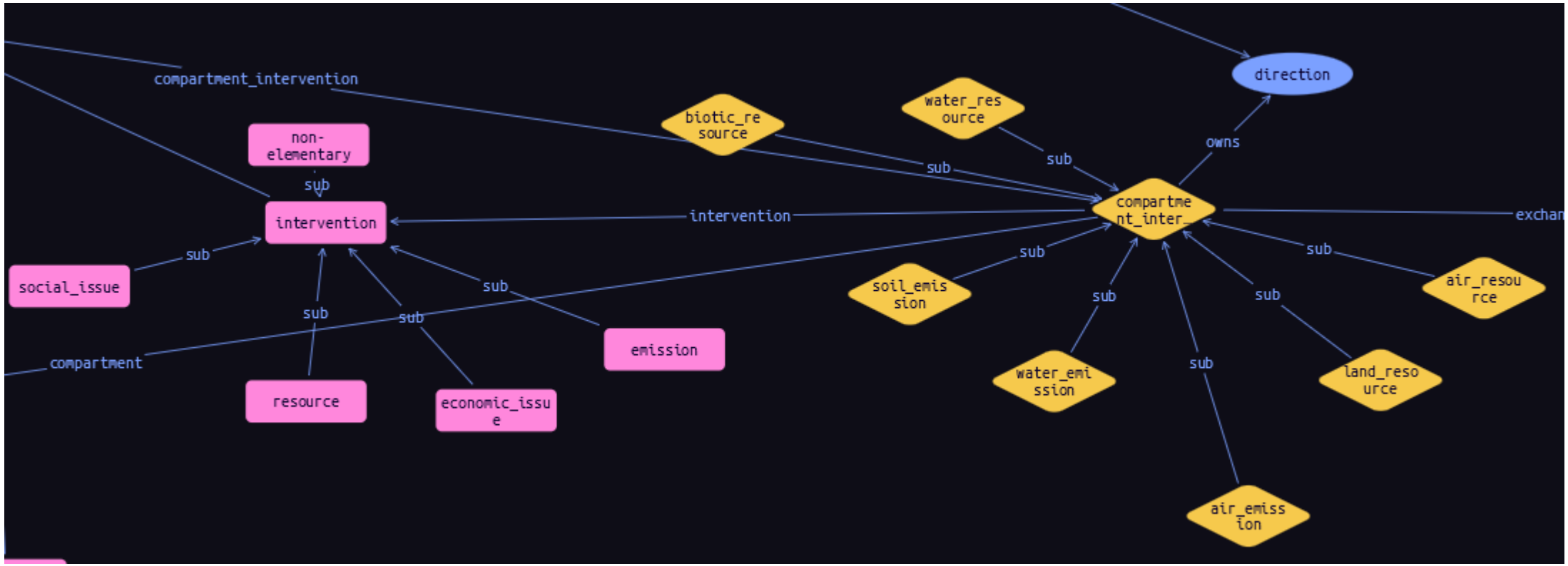
A potential solution

- Atomic modelling of flows



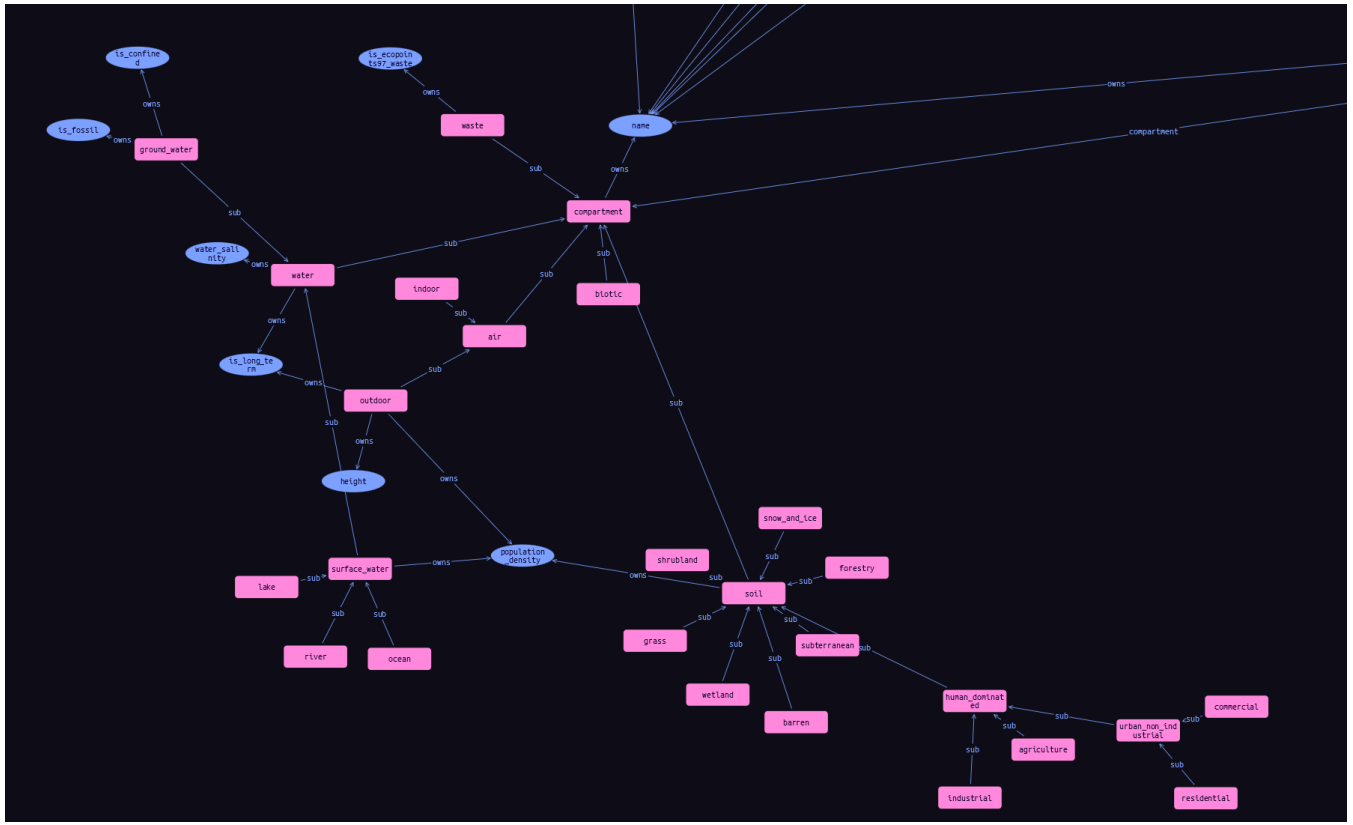
A potential solution

- Atomic modelling of compartments: interventions, …



A potential solution

- Atomic modelling of compartments: ..and compartments



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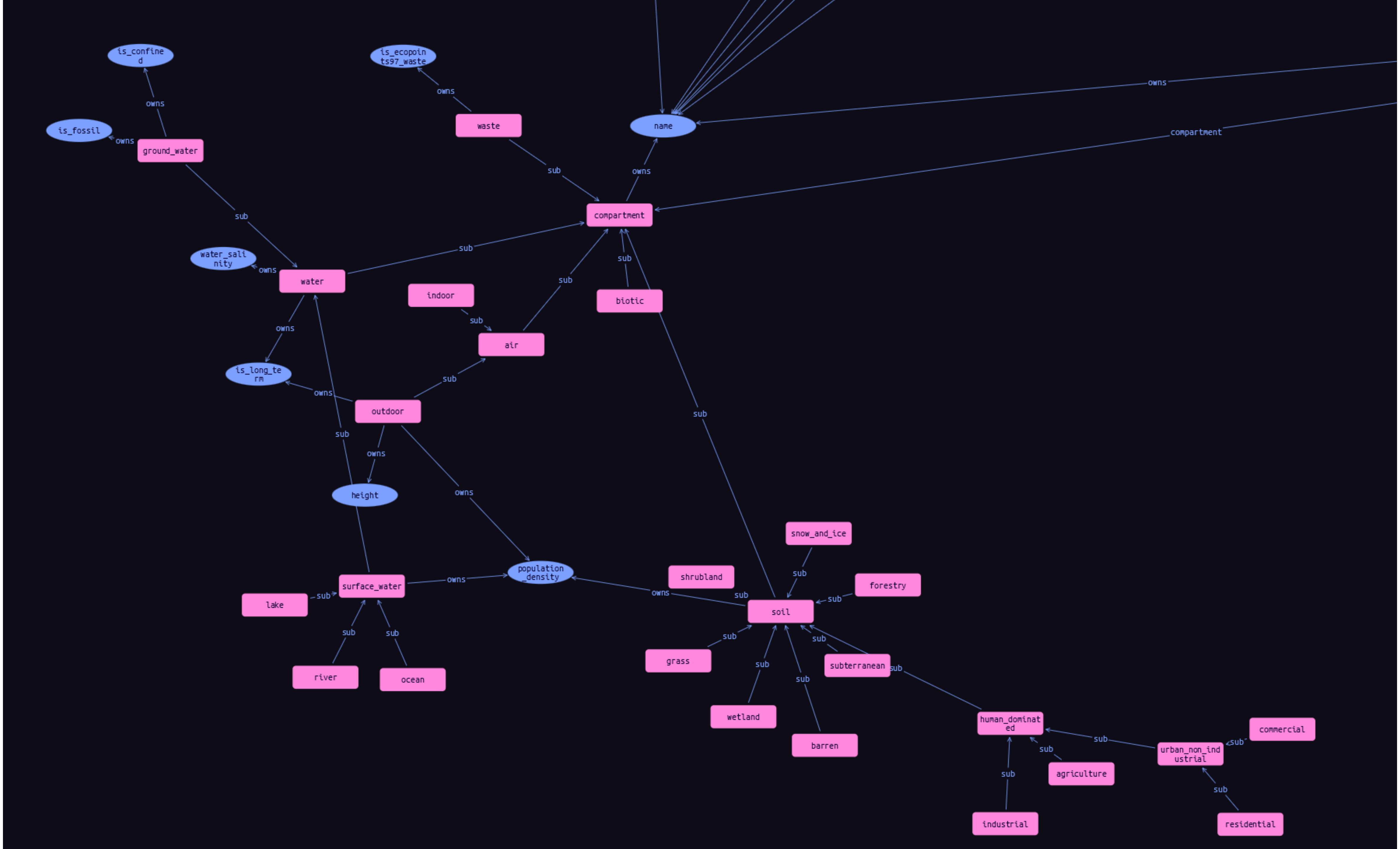
is_confine
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is_ecopoin
ts97_waste
is_fossil
ground_water
waste
name
owns
compartment
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water_sali
nity
water
indoor
biotic
air
is_long_te
rm
outdoor
height
population
_density
surface_water
lake
river
ocean
shrubland
snow_and_ice
forestry
soil
grass
subterranean
wetland
barren
human_dominat
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commercial
urban_non_ind
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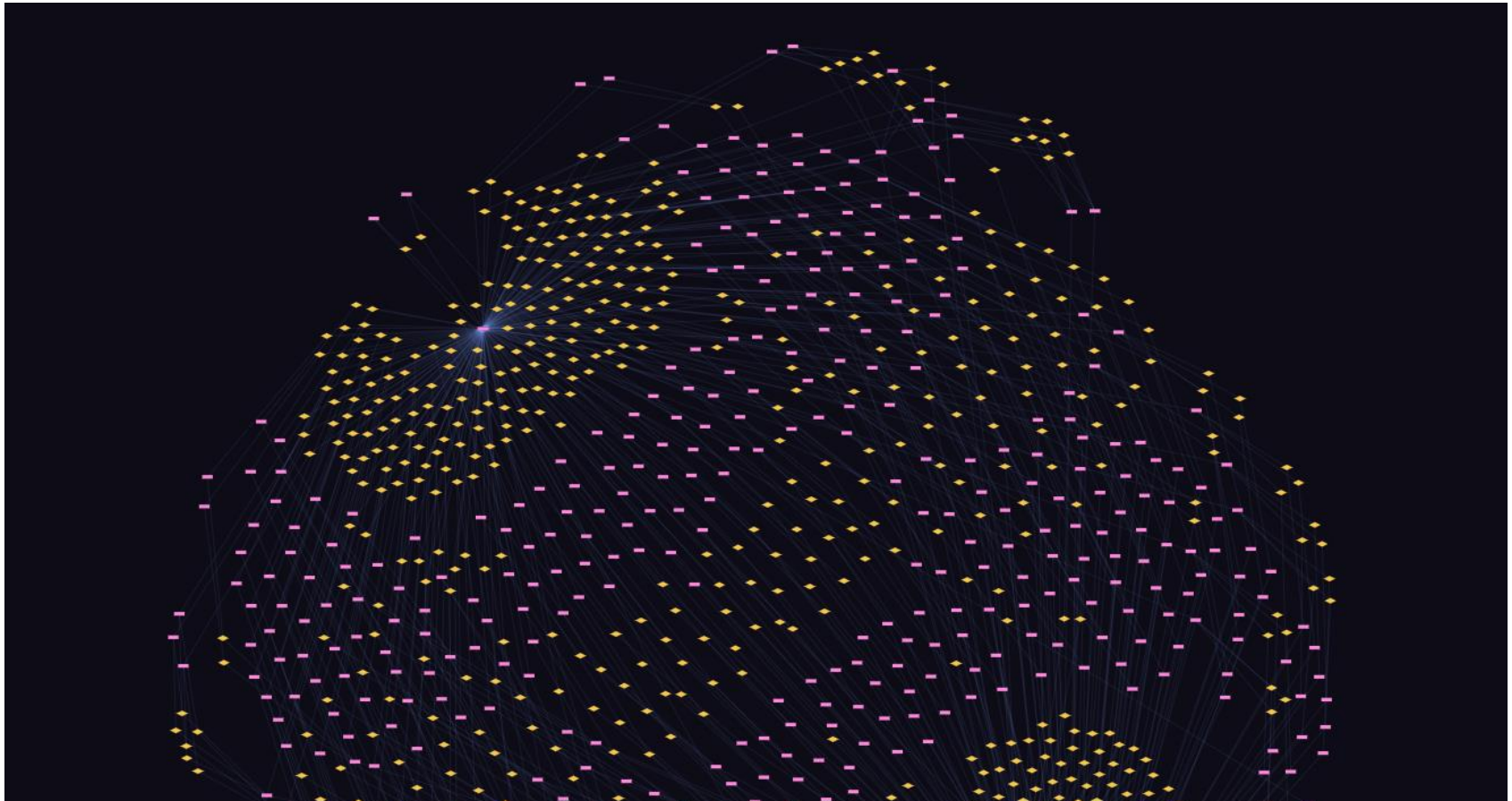
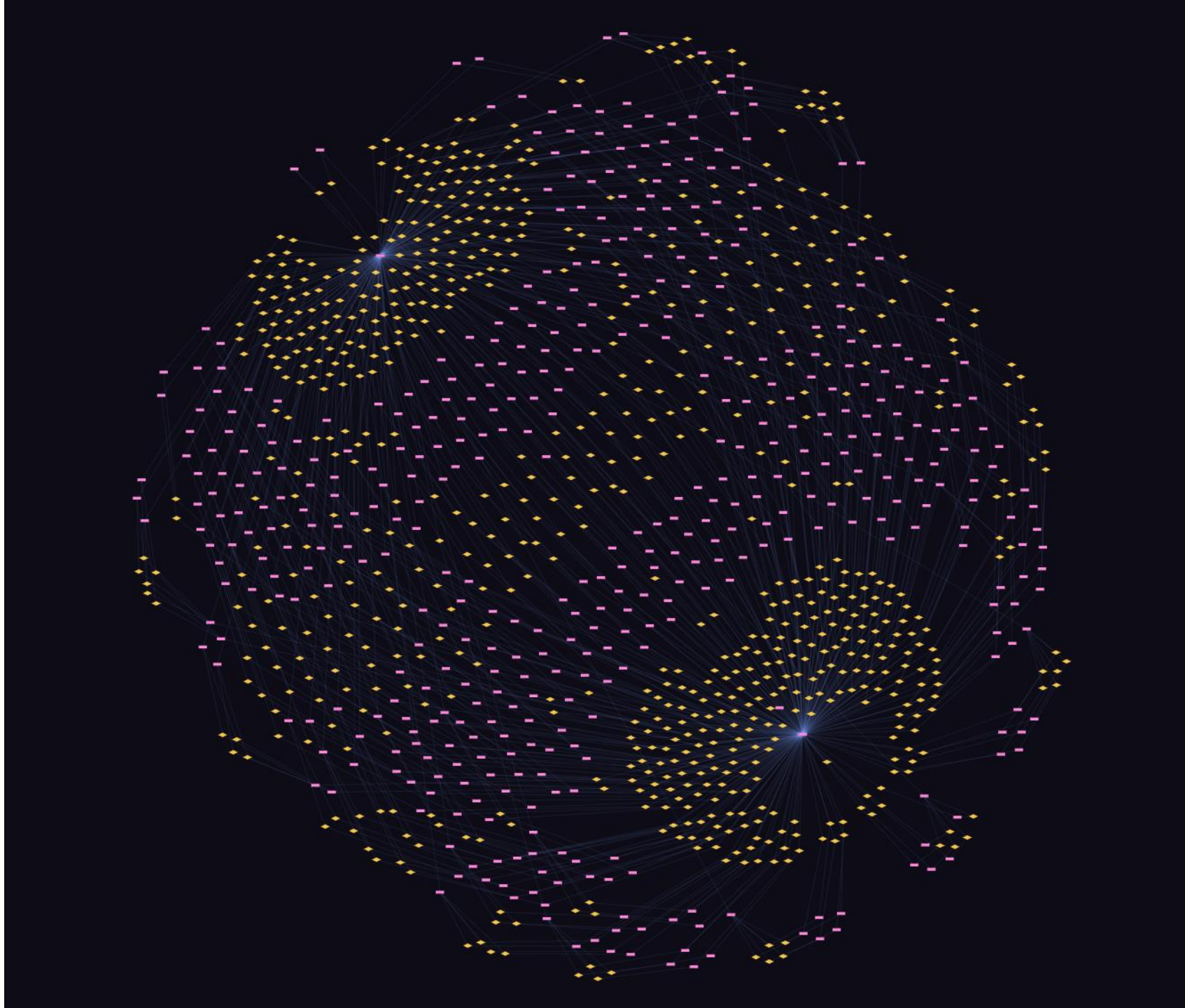
agriculture
industrial
residential

A potential solution

- E.g. mapping primitives of ecoinvent 3.10 and LCAC 1.2.4



- E.g. mapping primitives of ecoinvent 3.10 and LCAC 1.2.4
- There is also a JSON result available



A potential solution: what does this change

- Atomic modelling of everything is much better able to address imperfect modelling:

  a, everything can find a fitting counterpart (“air, unspecified” is just “air”)

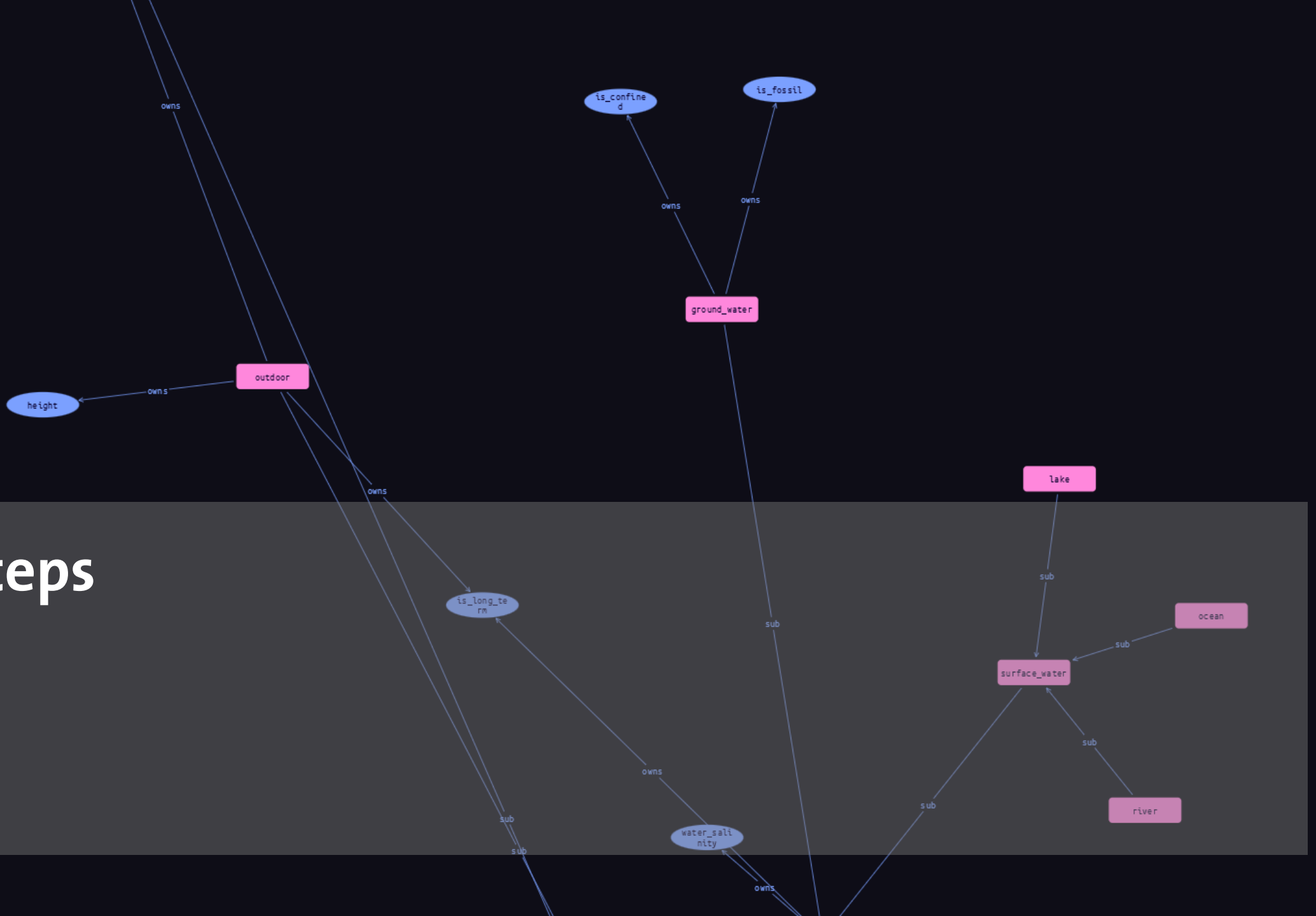
  b, expressing the diversity in nomenclatures makes it possible to deal with it, explicitly (what to do if the height of the air emission does not fully fit? Is this ok, not ok?)

  c, a goodness of fit indicator can be calculated

  (quite simply,

  perfect fit = 0; attribute not fitting -0.1; primitive hierarchy mismatch: -0.25, compartment hierarchy mismatch: -0.1; intervention mismatch: -0.1, property mismatch: -0.25)

Next steps


owns
is_confined
is_fossil
owns
owns
ground_water
outdoor
owns
height
owns
lake
sub
is_long_term
sub
ocean
sub
surface_water
sub
river
owns
sub
sub
water_salinity
owns

Next steps

- The mapping was developed as part of the MSDB massive sustainability database at GreenDelta, to allow “casting” the results in different formats and target nomenclatures
- We will evolve this further, feedback welcome
- This work may have an effect on the openLCA data structure
- Ben Young has done somewhat similar work, we will need to explore
- We plan to talk to LCIA method developers

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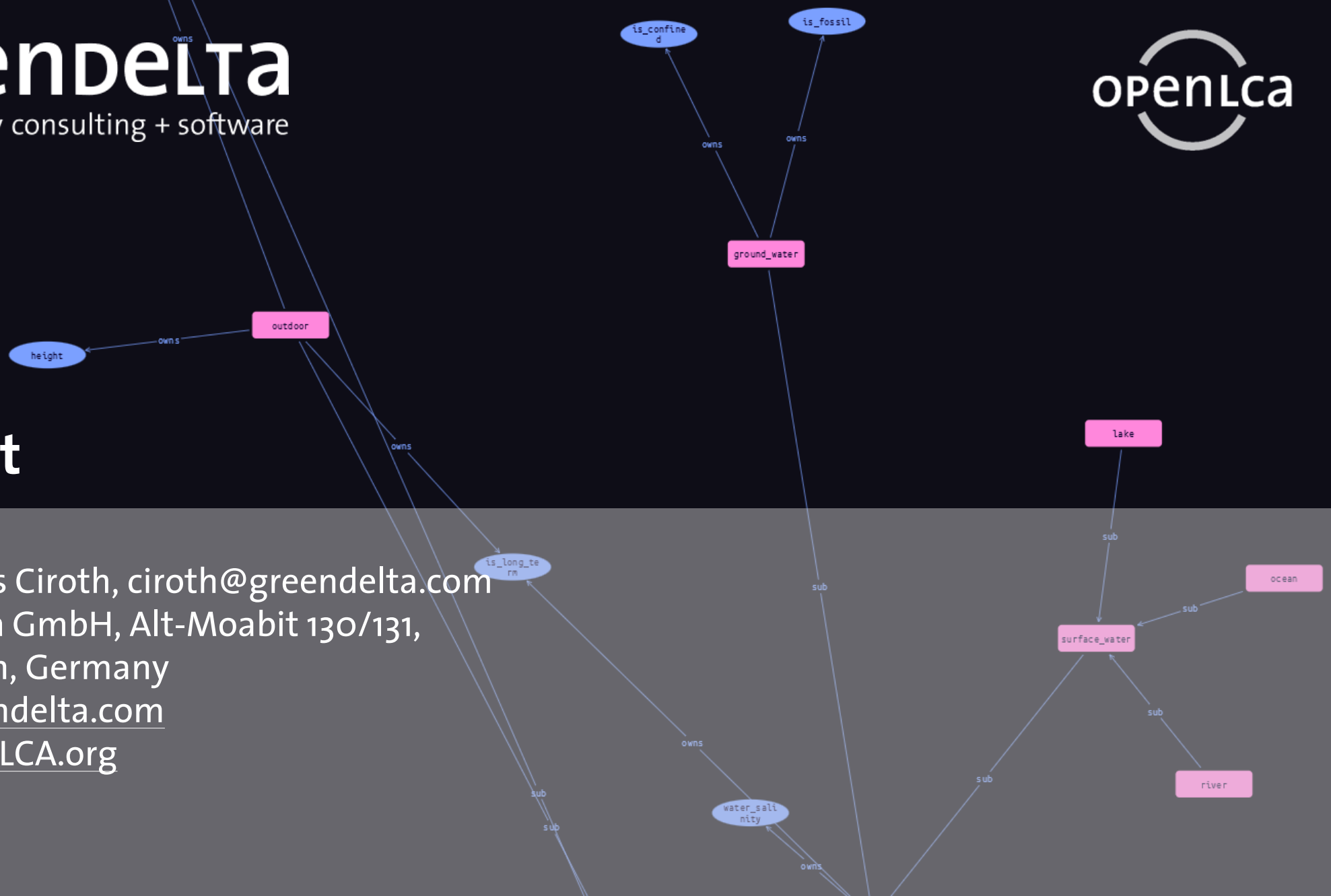

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