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An Open Source Exploration of a Semantic Structure for Climate Accounting

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THE LINUX FOUNDATION

Hyperledger Climate Action and Accounting Special Interest Group (CA2-SIG)

https://wiki.hyperledger.org/display/CASIG/Climate+Action+and+Accounting+SIG+Home

Standards Working Group

https://wiki.hyperledger.org/display/CASIG/Standards+WG

Christiaan Pauw (Nova Institute)
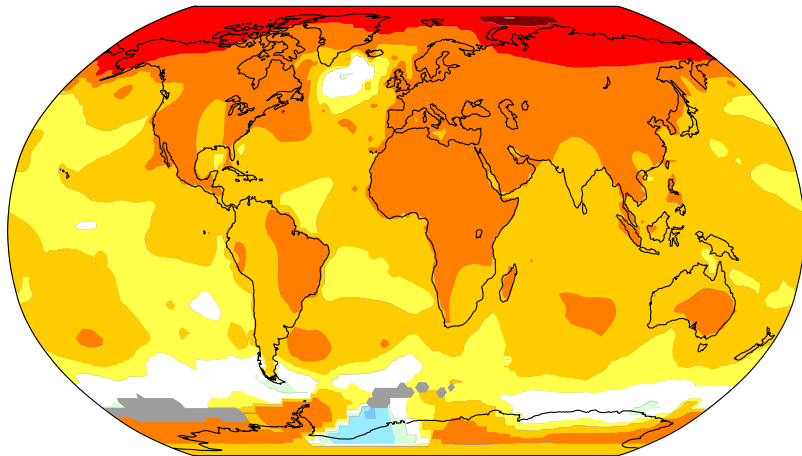Alex Howard (Independent)

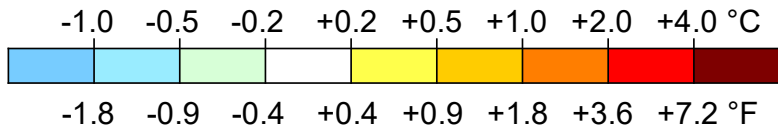Acknowledgements:
Kyle Robinson (Briartech Consulting Inc.)
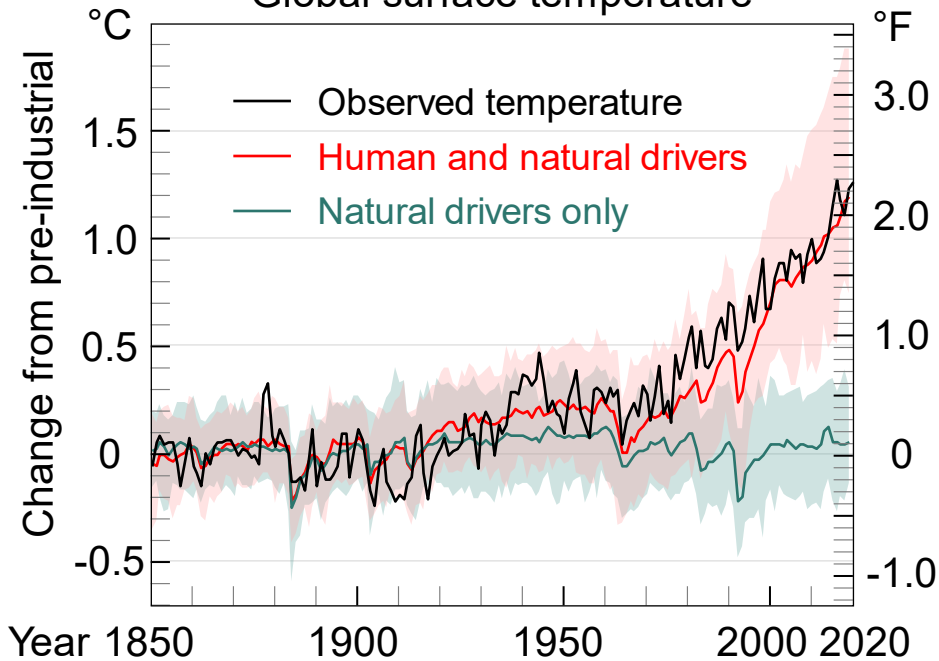Alfonso Govela (Hyperledger Latinoamerica Chapter)

The challenge

Temperature change in the last 50 years

2011-2021 average vs 1956-1976 baseline

-1.0 -0.5 -0.2 +0.2 +0.5 +1.0 +2.0 +4.0 °C

-1.8 -0.9 -0.4 +0.4 +0.9 +1.8 +3.6 +7.2 °F

Global surface temperature

— Observed temperature
— Human and natural drivers
— Natural drivers only

Year 1850   1900   1950   2000 2020

- To avoid catastrophic climate change, we need to dramatically reduce greenhouse gas emissions and increase carbon sinks
- For these processes to be managed, climate accounting must become ubiquitous
- But, there are different practices, protocols and standards that are used for different purposes …
- For climate accounting to become ubiquitous, the individual instances must interoperable

What is interoperability?

"Able to make use of information"

Hierarchy of interoperability

Description: Requires stable terminology

Comparison: Express in the same terminology

Aggregation: Express in the same metric

Description and discovery

Describing or discovering impact is a challenge because different words mean different things to different people.

Terms like *The environment* , *Climate neutral* and *Carbon Neutral* are commonly used but do not always denote to the same thing.

People are guided by different **interests** when speaking about impact

A global system of machine-readable claims about environmental impacts, without a shared language will either only exasperate the confusion or it will fragment into a myriad of definition sets and reporting formats for every interest group.

Comparison

Comparing is difficult because there are differences in:
- *What* is accounted for, and
- *How* accounting takes place

What is accounted for: E.g. differences in:
- organisational boundaries
- activity boundaries
- greenhouse agents

How accounting is done:
- Even where above corresponds, calculation methods may differ

Example

Even things that look the same are not the same:

Compare two project that both operate in the voluntary market, both involve improved cookstoves and both are located in South Africa.

- Fuel Efficient Cooking in South Africa (VCS 2505)
- Brickstar Wood Stove - Mahlaba Area (GS4536)

They differ in important ways:

- One encompasses the whole country, one a specific region
- One estimates the baseline wood use from a naive calculation using generic, country level data, the other from household surveys empirical observations.
- Different methodologies: Verra:VMR006 and Gold Standard:TPDDTEC

There is no simple way to compare these two projects.

Aggregation

It follows that *aggregation* is difficult when *description* and *comparison* are problematic.

Aggregation can only work if all assumptions are made explicit, e.g.

- accounting period
- emission factors

Lack of clarity or uncertainty leads to blurring and semantic "zoom-out".

Maybe standards are the solution… ?

What are standards for?

Standards aggregate *norms* that help shape interests, constrain behaviour, prescribe actions, and support a logic of appropriateness and consequences.

Norms are social constructs that emerge from persuasion, cascade through acceptance, and internalize compliant behaviour.

Examples of standards in use

GRI (Global Reporting Initiative)	ISSB (International Sustainability Standards Board)	SASB (Sustainability Accounting Standards Board)	TCFD (Task Force on Climate Related Financial Disclosure)	ISO (International Organization for Standardization)
ANSI (American National Standards Institute)	GHG Protocol (Greenhouse Gas) Standards	EPA (United States Environmental Protection Agency)	VERRA (Verified Carbon Standard)	CSA (Canadian Standards Association)
	BSI (British Standards Institute)	Carbon Trust PAS 2060	SCA (Standards Council of Canada)	

Different standards have different aims

Perspective of investor

Announced at COP26 in November 2021, the ISSB is a first step in developing a global, baseline, corporate reporting standard on climate change and sustainability. It aims to provide **investors** and other capital market participants with information about companies' **sustainability-related risks and opportunities** to help them make informed decisions. *Forging the path to international standards in sustainable finance. 2022 OMFIF.* [https://www.omfif.org/forging-the-path-to-international-standards-in-sustainable-finance/]

Regulatory perspective

Compliance to international treaties (EU, Paris) and local laws and regulations

"The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. It also aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts."

Voluntary climate action

"The Gold Standard (GSF) was established in 2003 by WWF and other international NGOs to ensure projects that reduced carbon emissions featured the highest levels of environmental integrity and also contributed to sustainable development."

"The VCS Program allows certified projects to turn their greenhouse gas (GHG) emission reductions and removals into tradable carbon credits."

(– narrow or broad context)

Project or institutional focus

Some activities are undertaken for the express purpose of achieving a social or environmental impact. Such activities are accounted for different compared to the normal operations of a business.

The *WBCSD/WRI GHG Protocol* contains and *GHG Project Protocol* for projects (i.e. undertaken with the express purpose of having environmental impact), and a *GHG Protocol Corporate Accounting and Reporting Standard* , for corporate-level GHG emissions inventories.

Standards use different metrics

Impacts can be described using different metrics:

- Performance standard (resource efficiency per output)
- Emission reduction / avoidance
- Net emissions

Performance standard is about efficiency and takes into account that there are simultaneous but possibly competing goals. Aims for most efficient allocation of resources.

Emission avoidance compares what happened against what would have happened (i.e. a counterfactual baseline). Aims to be better than baseline.

Net emissions balances carbon sinks and carbon emissions. Aims for net zero / negative.

The need for a "deep" shared ontology

Maybe standardisation is not the solution, because:

- There are different needs and interests and always will be there
- A prescriptive approach is inappropriate and will not work anyway

Find the conceptual bedrock that underlies all the standards

The origin of HTML demonstrates the power of consensus on profoundly simple, opportunity-generating, enabling frameworks.

World Wide Web

The WorldWideWeb (W3) is a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an executive summary of the project, Mailing lists , Policy , November's W3 news , Frequently Asked Questions .

What's out there?
    Pointers to the world's online information, subjects , W3 servers, etc.
Help
    on the browser you are using
Software Products
    A list of W3 project components and their current state. (e.g. Line Mode ,X11 Viola , NeXTStep , Servers , Tools , Mail robot , Library)
Technical
    Details of protocols, formats, program internals etc
Bibliography
    Paper documentation on W3 and references.
People
    A list of some people involved in the project.
History
    A summary of the history of the project.
How can I help ?
    If you would like to support the web..
Getting code
    Getting the code by anonymous FTP , etc.

The need for a "deep" shared ontology

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Find the conceptual bedrock that underlies all the standard

Html example (power of consensus on profoundly simple, opportunity-generating, enabling standards)

An agent engages in an activity that impacts an environment.

Somebody does something and it affects their surroundings.

The essentials

Premise: "An agent engages in an activity that impacts an environment."

First three classes:
- Agent
- Activity
- Environment

First two axioms:
- An agent engages in an activity.
- An activity impacts an environment.
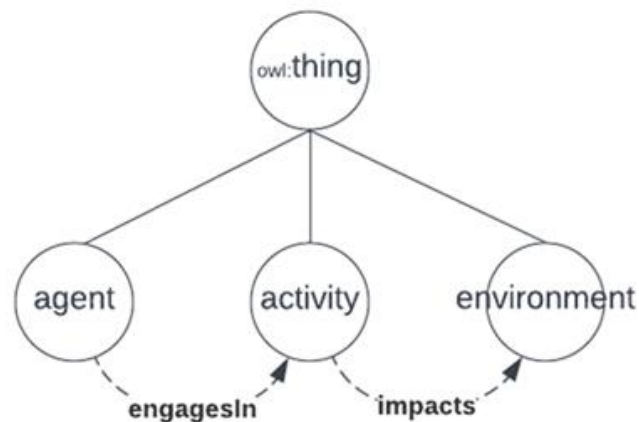
Describing and understanding 'environment'
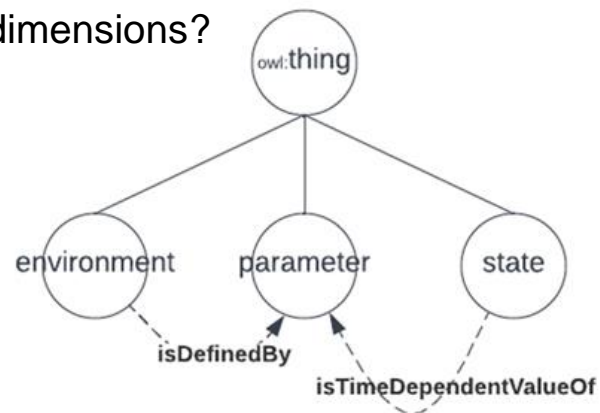
Things we typically want to know about an environment:

- Where is this environment (where are its physical boundaries)?
- When are we looking at it?
- What are the properties (of the environment) and their dimensions?

Classes:

- Parameter
- State

Axioms:

- An environment is defined by (interrelated) parameters.
- A state is the value of a parameter P at time t.

The impact of an event (activity, process, natural event…) on an environment is expressed as the changes in the environment's state that are attributable to the event.

Describing and understanding 'activity'

Firstly, a specific activity (e.g. travelling) can be performed in different ways (different procedures, different means/instruments).
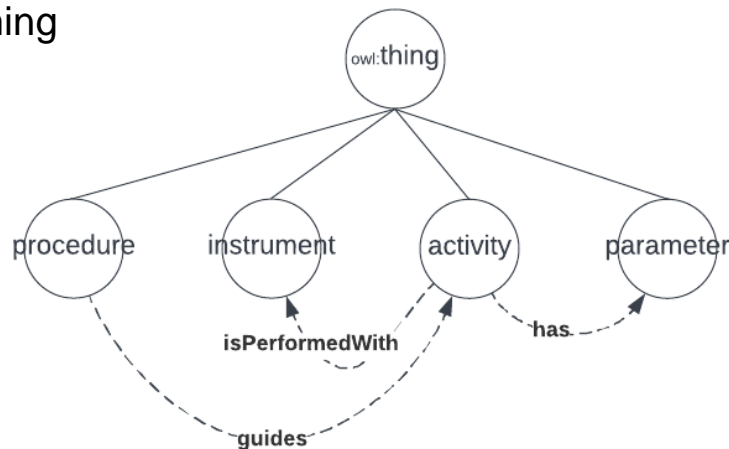
The different ways of performing the activity have different impacts on the environment.

So, to distinguish between the different ways of performing an activity, we need at least two more **classes** in our ontology:

- Instrument
- Procedure

Axioms:

- A procedure guides an activity.
- An activity is performed with an instrument.

Describing and understanding 'activity'

Secondly, different activities (by means of different instruments and procedures) have different inputs and outputs.

Do not need additional classes for the inputs and outputs – express the inputs and outputs as parameters (i.e., use the parameter class).

We do need two more axioms:
- An activity has at least one input.
- An activity has at least one output.

Measuring parameters is an activity in itself.
Some of the biggest challenges in the field of impact accounting is that people/standards measure/treat the same parameters differently. They use/prescribe different instruments, follow different methods, report the measurements at different levels of precision etc. Sometimes they don't measure the actual values and instead use 'default' values listed in some database.
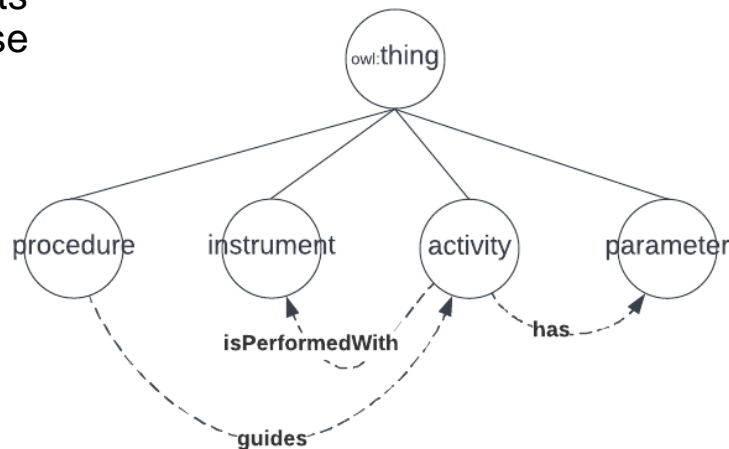
Describing and understanding 'agent'

Already covered the relationship between agents and activities, and between agents and instruments.

One aspect not covered yet: roles.

An agent can have multiple roles, most notably:

owner, operator, claimant and auditor.

Add 'role' as class to ontology.

Axioms:

- An agent enacts a role.
- An owner (role) is an agent who owns some specific thing.
- An operator (role) is an agent who operates some specific instrument.
- A claimant (role) is an agent who makes a claim.
- An auditor (role) is an agent who audits a claim.
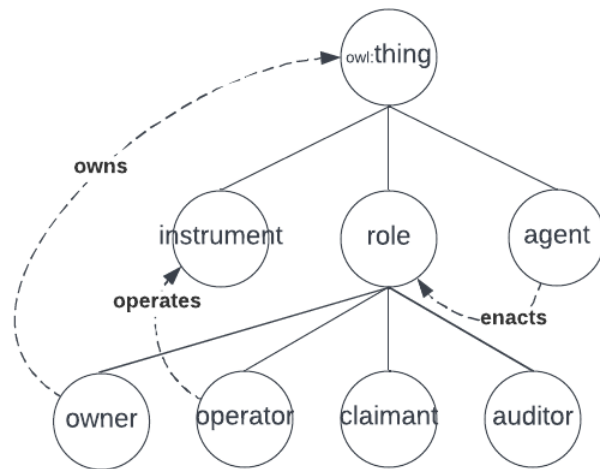
Claims

Premise: "An agent engages in an activity that impacts an environment."
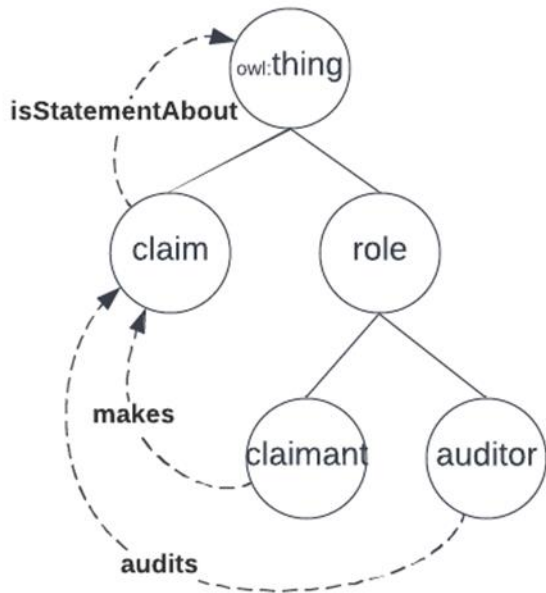
Impact accounting is the discipline that deals with **claims** about agents, environments, activities and their impact.

Classes:

— Claim

Axioms:

— A claim is a statement about a (some specific) thing.

Standards

Finally, we've reached the point where standards link up with the rest of the ontology, because *a standard guides a claim*.
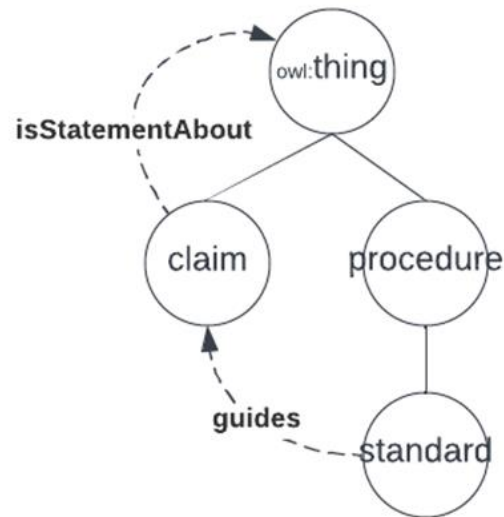
Classes:

- Standard

Axioms:

- A standard guides a claim.

Tells us

- how to measure
- what to measure
- when to measure
- how to report
- how to verify

etc.

The full ontology to date

1. An agent engages in an activity.

2. An activity impacts an environment.

3. An environment is defined by (interrelated) parameters.

4. A state is the value of a parameter P at time t.

5. A procedure guides an activity.

6. An activity is performed with an instrument.

7. An activity has at least one input.

8. An activity has at least one output.

9. A claim is a statement about a (some specific) thing.

10. A standard guides a claim.

11. An agent enacts a role.

12. An owner (role) is an agent who owns some specific thing.

13. An operator (role) is an agent who operates some specific instrument.

14. A claimant (role) is an agent who makes a claim.

15. An auditor (role) is an agent who audits a claim.

What an implementation of the ontology could look like
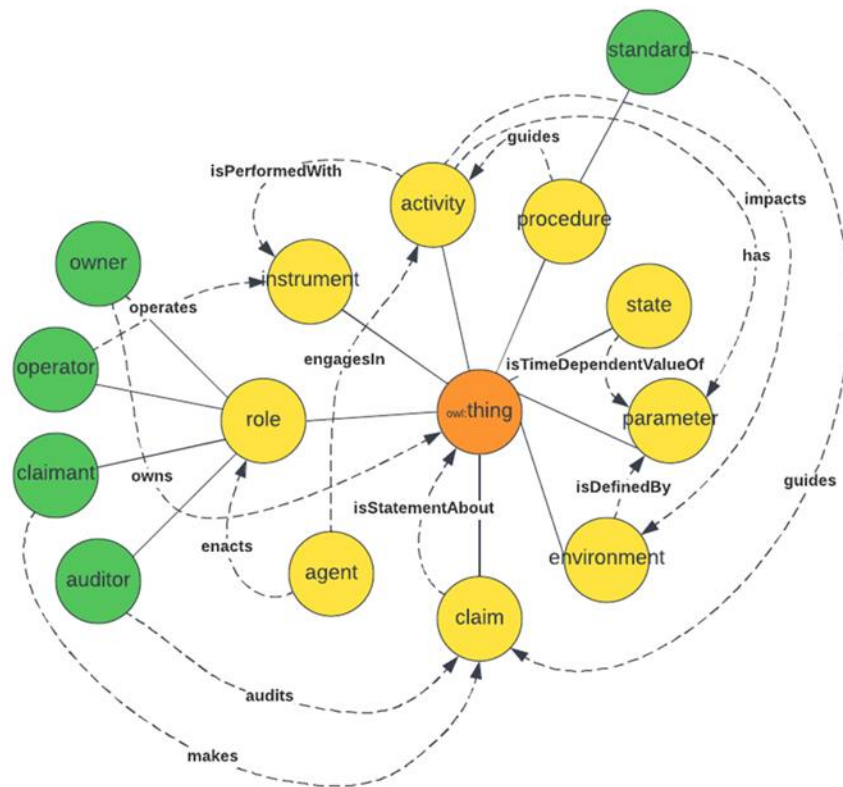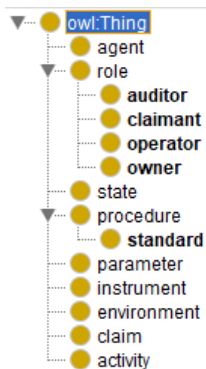
Use of the ontology: Description
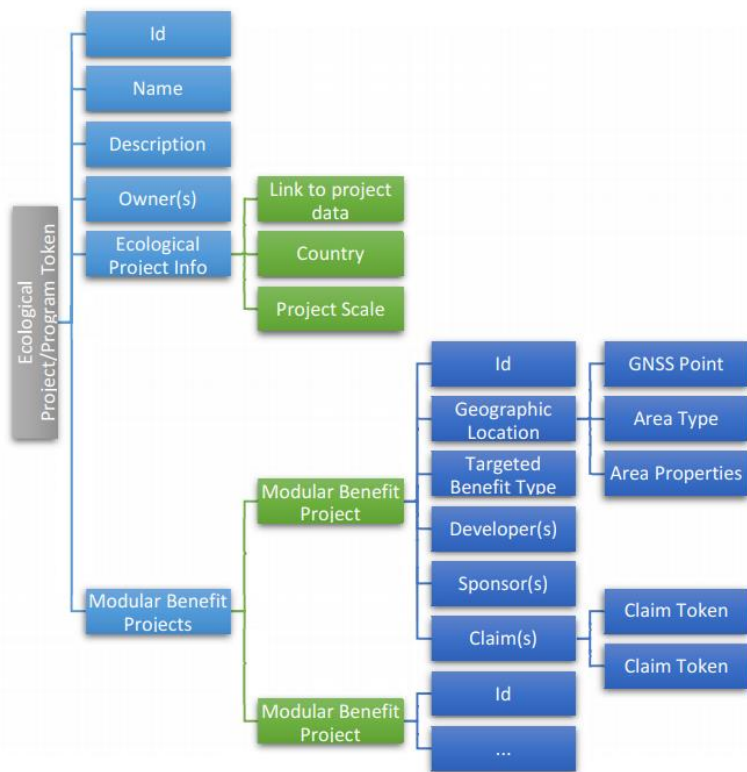
The ontology helps clarify the meaning of terms.

Use of the ontology: Comparison

The ontology helps translate between different standards (like Rosetta Stone).

Use of the ontology: Aggregation

Understanding what terms mean and making assumptions explicit will lead to better aggregation.

What's next and how to get involved

What's next?

1. Expand the second and third… n levels of the ontology, as necessary.
2. Embed ontology into BFO and its extensions.
3. Develop tools for applying the ontology.

Contacts and channels

https://wiki.hyperledger.org/display/CASIG/Standards+WG

https://lists.hyperledger.org/g/climate-sig

Christiaan: christiaan.pauw@nova.org.za

Q&A

Sources

https://interwork.org/wp-content/uploads/2021/05/Voluntary_Ecological_Markets_Overview_Revised.pdf

https://obofoundry.org/ontology/bfo.html