# I-ADOPT Framework

A presentation on the I-ADOPT Framework created by the GO FAIR Foundation in collaboration with the Interoperable Descriptions of Observable Property Terminology, in short, I-ADOPT Working Group of the Research Data Alliance, RDA.

Created by: GO FAIR Foundation

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# The I-ADOPT Framework

RDA InteroperAble Descriptions of Observable Property Terminology WG (I-ADOPT WG)

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Created by GO FAIR Foundation

In collaboration with RDA Research Data Alliance I-ADOPT WG

Welcome to this presentation on the I-ADOPT Framework created by the GO FAIR Foundation in collaboration with the Interoperable Descriptions of Observable Property Terminology, in short, I-ADOPT Working Group of the Research Data Alliance, RDA.

Links: https://www.rd-alliance.org/groups/interoperable-descriptions-observable-property-terminology-wg-i-adopt-wg/

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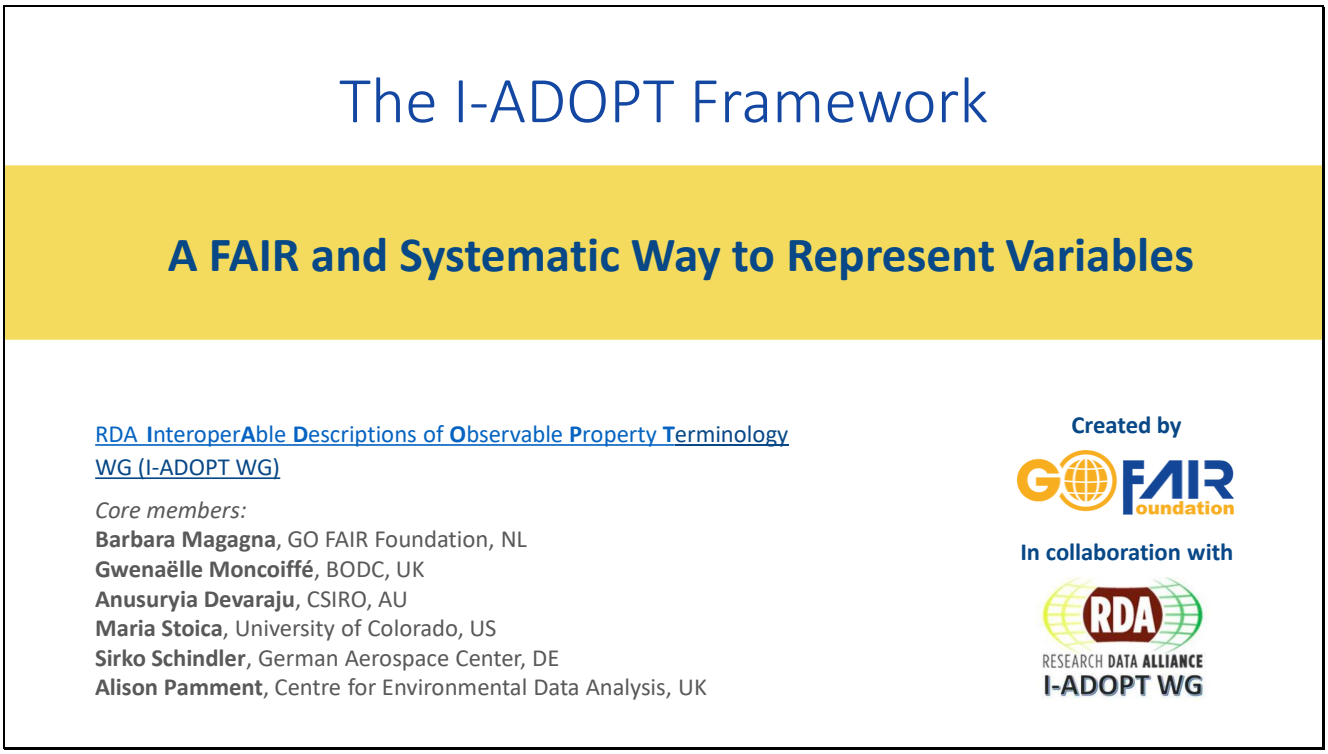


The core members of the RDA I-ADOPT Working Group developed a systematic way to represent variable descriptions in a FAIR way. This video helps to understand the I-ADOPT Framework.

Links: https://www.rd-alliance.org/groups/interoperable-descriptions-observable-property-terminology-wg-i-adopt-wg/

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## I-ADOPT Framework – A Semantic Broker

I-ADOPT provides a **standardized, more interoperable approach** for the **description of variables** by:

- Enabling mappings to a common representation
- Adding rich human & machine-readable descriptions
- Using qualified, language independent, references using object properties
- Specifying the role a concept plays within the variable description

With **no need to change existing** terms and structures

I-ADOPT is a framework to standardize the description of variables. This framework makes existing variable descriptions interoperable through machine readable metadata.

It acts as a semantic broker by enabling mappings to a common representation by adding rich human- and machine-readable descriptions. These descriptions are language independent because they are based on a semantic model that can be easily applied in multiple languages. These semantic enrichment are implemented with qualified references using so called object properties by specifying the role a concept plays within the variable description. One of the great benefits of using this framework is that the existing data structures do not need to be changed.

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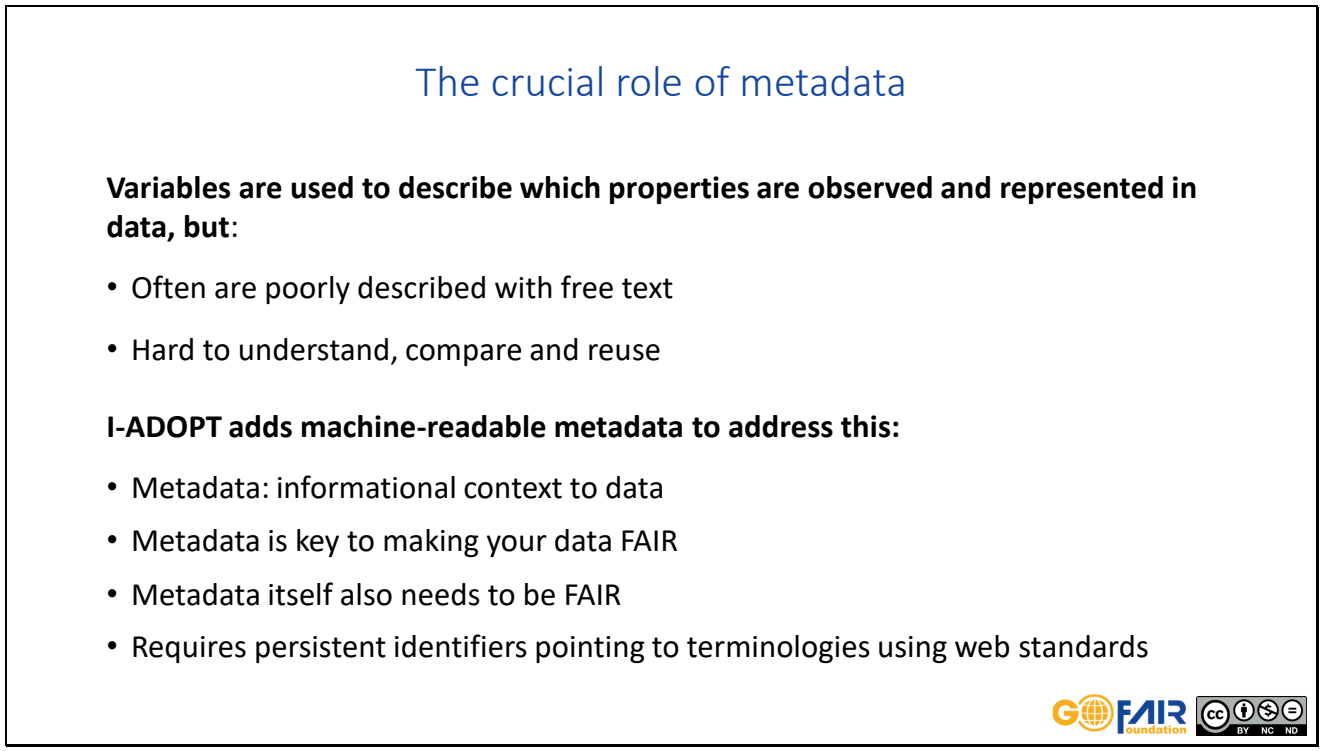


Variables are used to describe which properties are observed and represented in the data and are therefore at the core of observational science data. However, often they are not FAIR because they do not follow any syntax rules and use free text which makes them hard to understand, compare and reuse, especially for machines.

I-ADOPT is a framework that addresses this challenge by adding metadata to a digital object. Metadata provides informational context to data. Metadata is essential for making data Findable, Accessible, Interoperable and Reusable by machines and humans. To make data FAIR, the metadata itself also needs to be FAIR. FAIR metadata requires persistent identifiers pointing to terminologies using web standards

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## RDA I-ADOPT recommendations

1. Descriptions should be human and machine-readable
2. Descriptions should be explicit and sufficient
3. Use of semantic artefacts
4. Use of I-ADOPT ontology
5. Reuse of I-ADOPT aligned terminology

RESEARCH DATA ALLIANCE
I-ADOPT WG

DOI: 10.15497/RDA00071

The I-ADOPT working group published recommendations, endorsed by the Research Data Alliance in 2022. These include:

1. Data creators and data curators or data publishers should describe the variable(s) of their datasets in a human- and machine- readable format.
2. The variable description should contain sufficient information so that the data can be re-used with minimum reliance on free-text documentation.
3. The description should use FAIR semantic artefacts (e.g., controlled vocabularies or ontological relationships) and be compatible with Linked Data.
4. The description should follow a decomposition approach consistent with the classes and relations defined in the I-ADOPT ontology
5. Reuse existing terminologies that are aligned with the I-ADOPT Framework. If none is appropriate, you may either propose to extend existing terminologies or create a new variable description following the I-ADOPT framework.

Links: https://doi.org/10.15497/RDA00071

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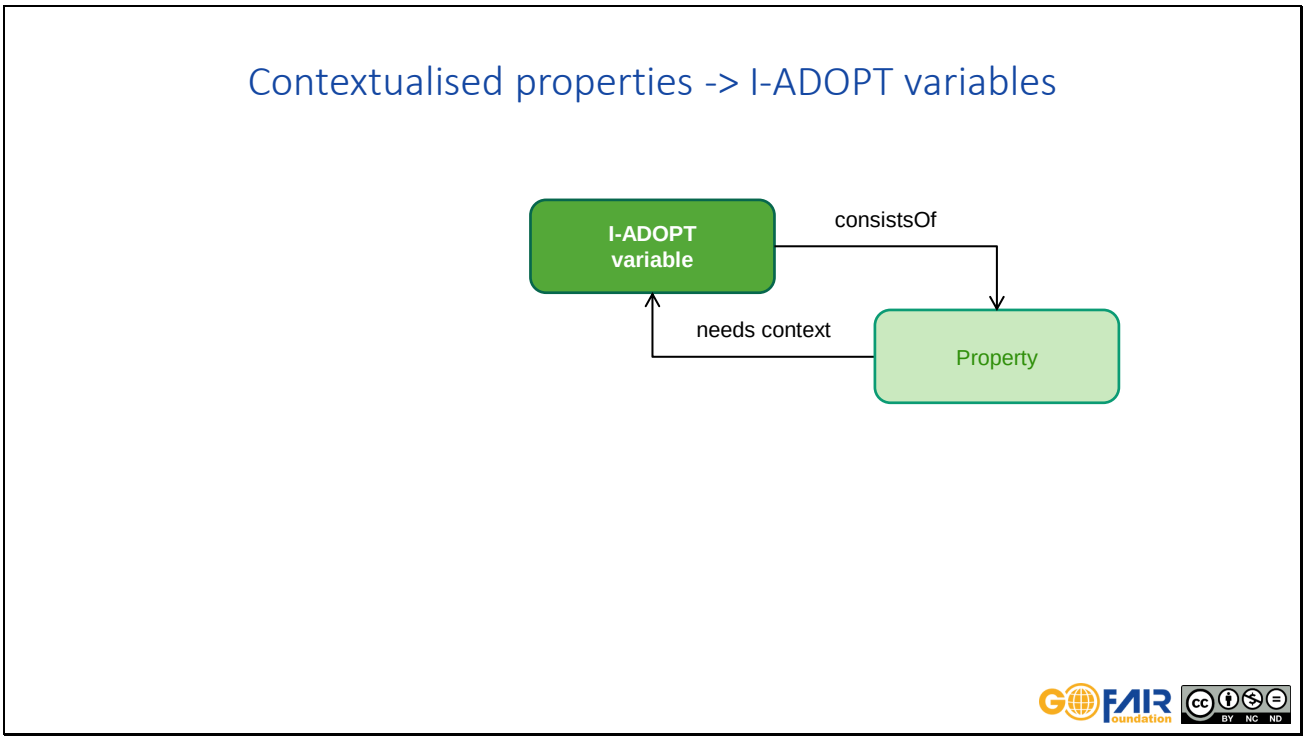


I-ADOPT helps to describe what we observe, so we look at a specific property, which can be a qualitative property like color or a quantitative property like temperature.

To be understandable the property description requires context, so the I-ADOPT variable is a contextualized property.

The I-ADOPT variable consists of a property but…

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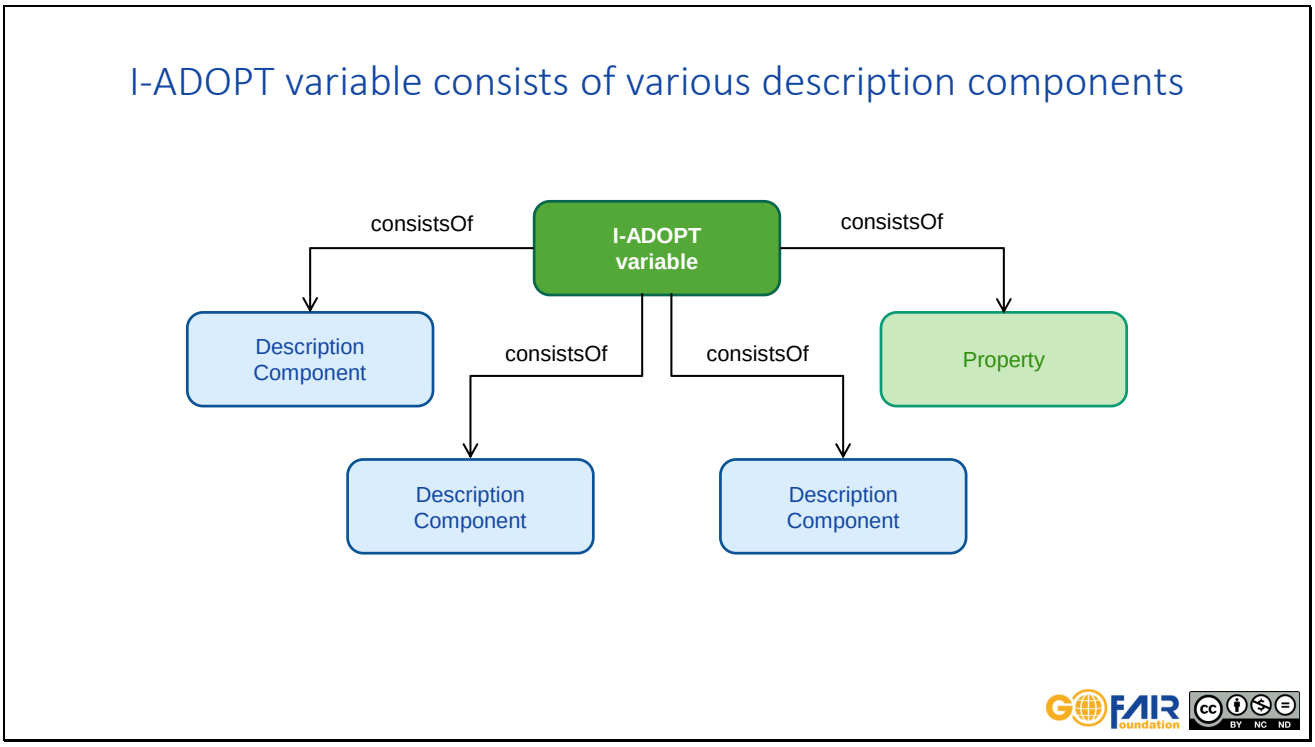


It needs additional description components. These are often multiple components.

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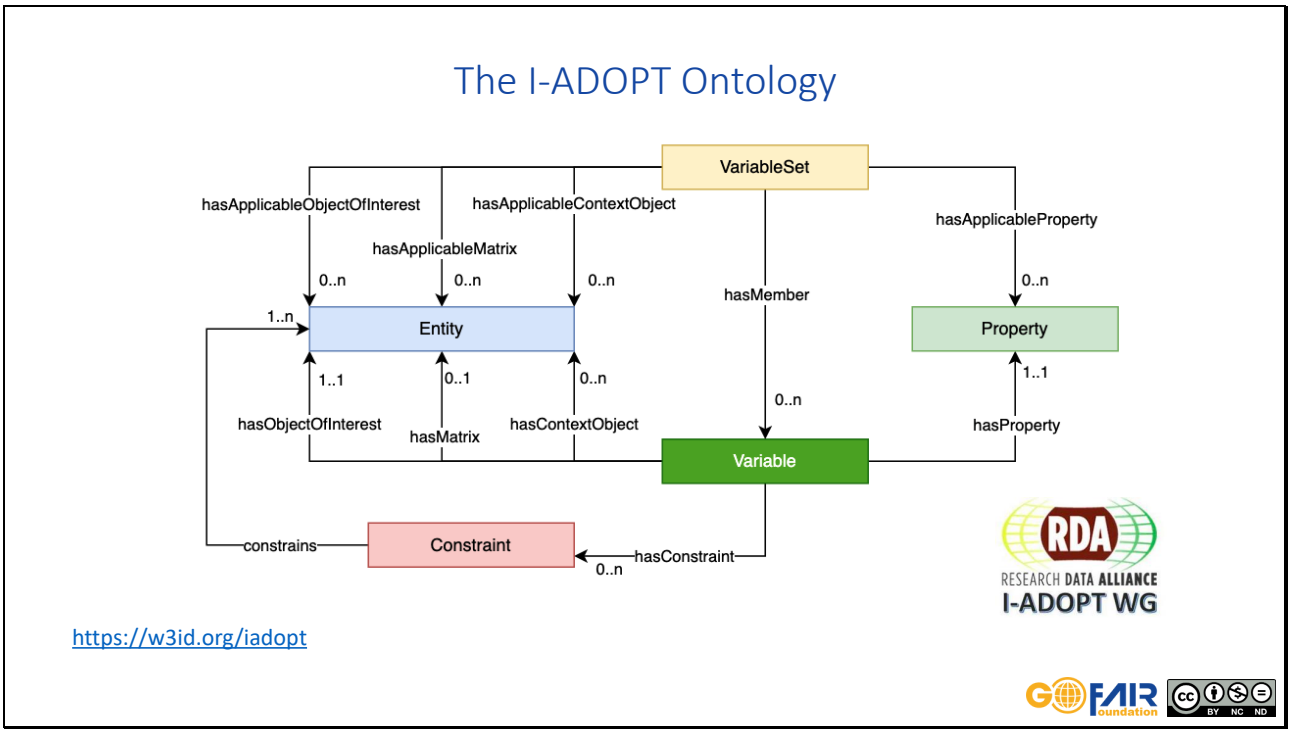


The WG I-ADOPT developed a simple OWL ontology for the description pattern of an I-ADOPT variable and an associated VariableSet.

Links: https://w3id.org/iadopt

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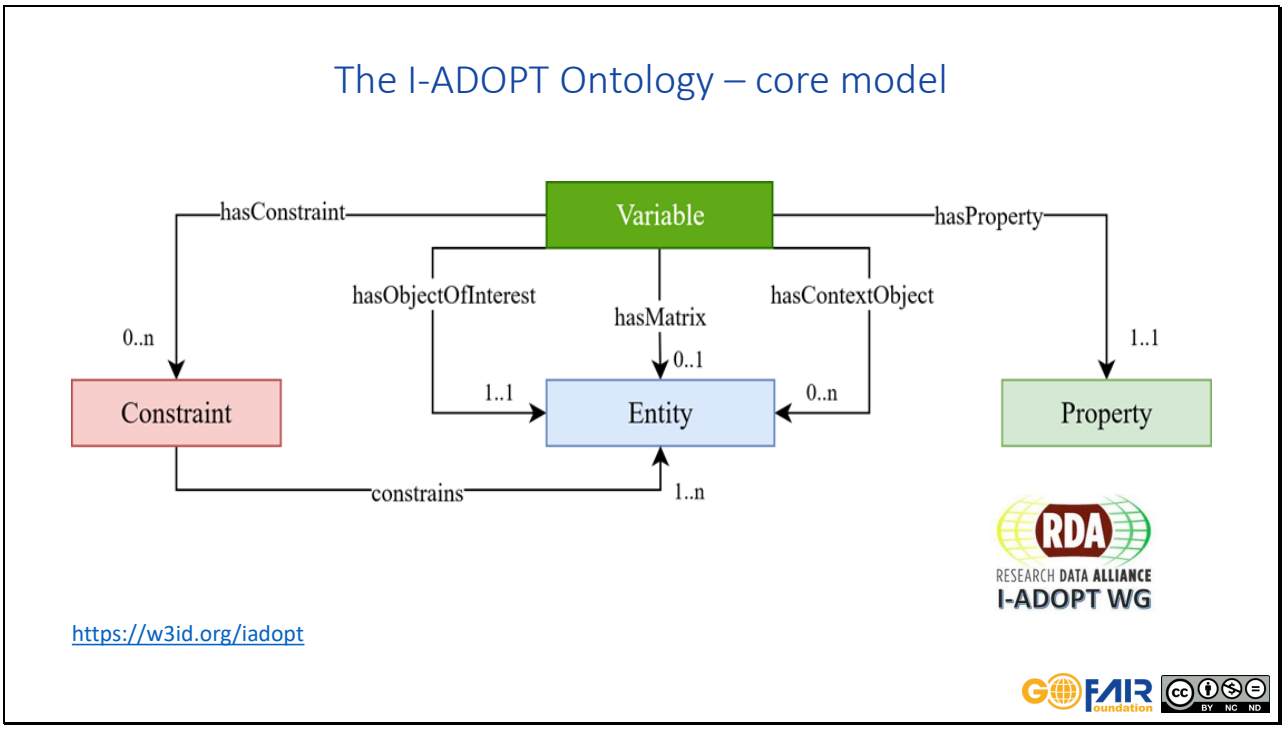


The I-ADOPT Variable Modelling Challenge focuses on the core model which ignores the variable set. The core model involves 5 classes and 11 object properties and cardinalities for each relation, like a Variable must have one and only one property (1..1), but can have, for example, an arbitrary number of Context Objects (0..n). In this overview we will not cover the VariableSet class which is an aggregation class to group a set of variables.

Links: https://w3id.org/iadopt

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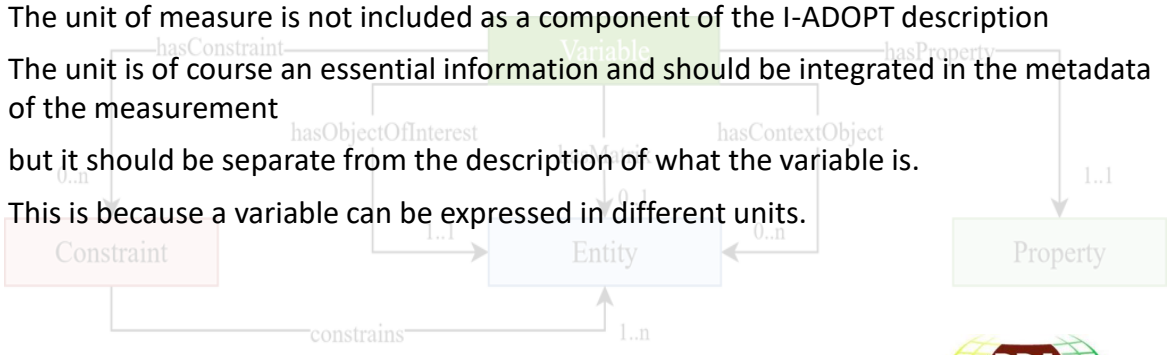
## The I-ADOPT Ontology

- The unit of measure is not included as a component of the I-ADOPT description
- The unit is of course an essential information and should be integrated in the metadata of the measurement
- but it should be separate from the description of what the variable is.
- This is because a variable can be expressed in different units.

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https://w3id.org/iadopt

Note that we do not include the unit of measure as a component of the description, which is very relevant for quantitative variables. The unit is an essential component of the metadata of a measurement as a whole and it must be specified but it should be separate from the description of what the variable is. This is because a variable can be expressed in different units.

Links: https://w3id.org/iadopt

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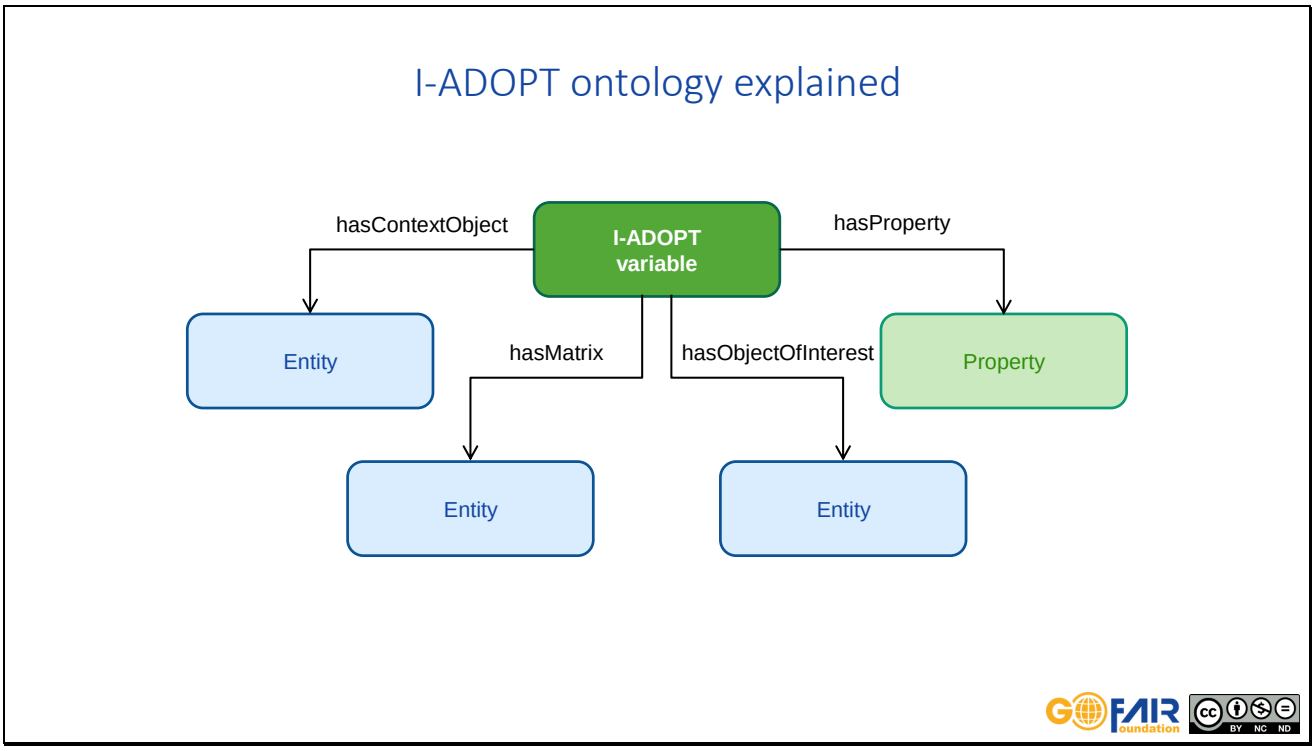


The description components of an I-ADOPT variable are the property and the various entities that serve different roles in the description. These roles are represented as specific relations, so called object properties in the ontology. While the role representation is semantically correct, this can be translated into…

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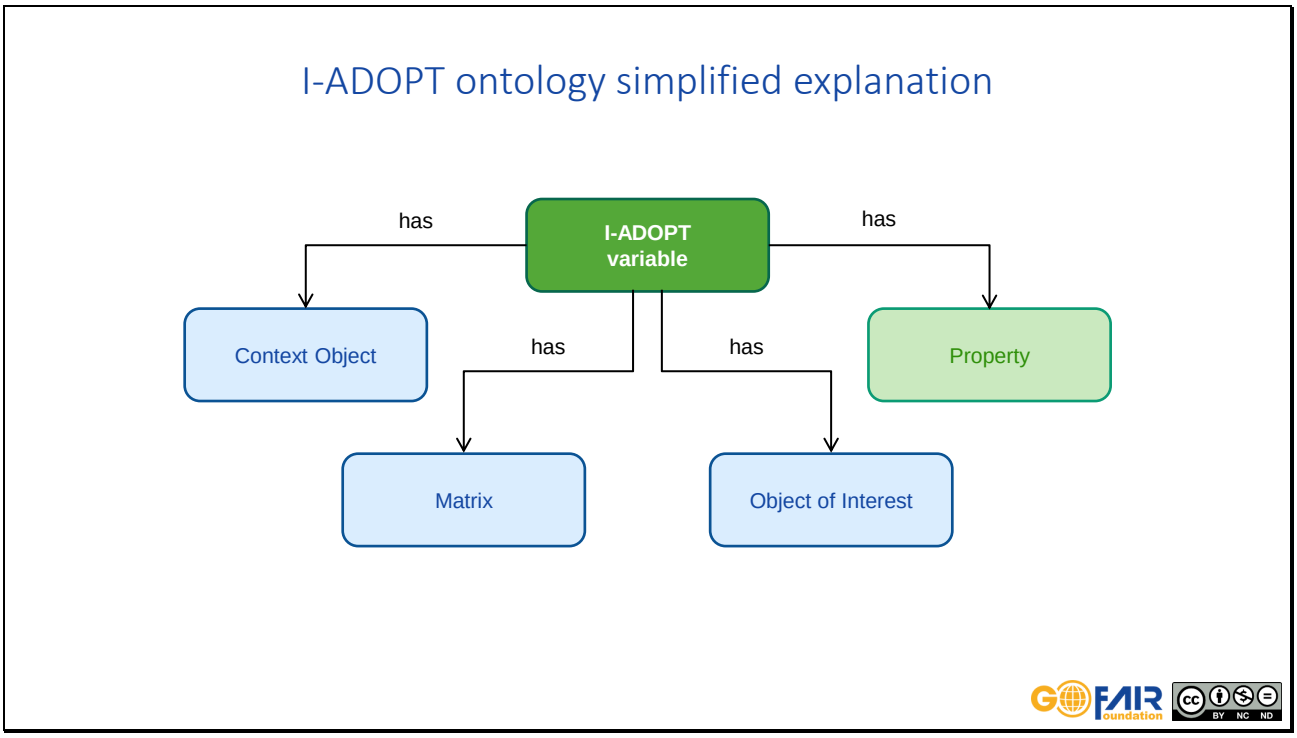


A simplified view, where an I-ADOPT variable has these components: property, object of interest, matrix and context object.

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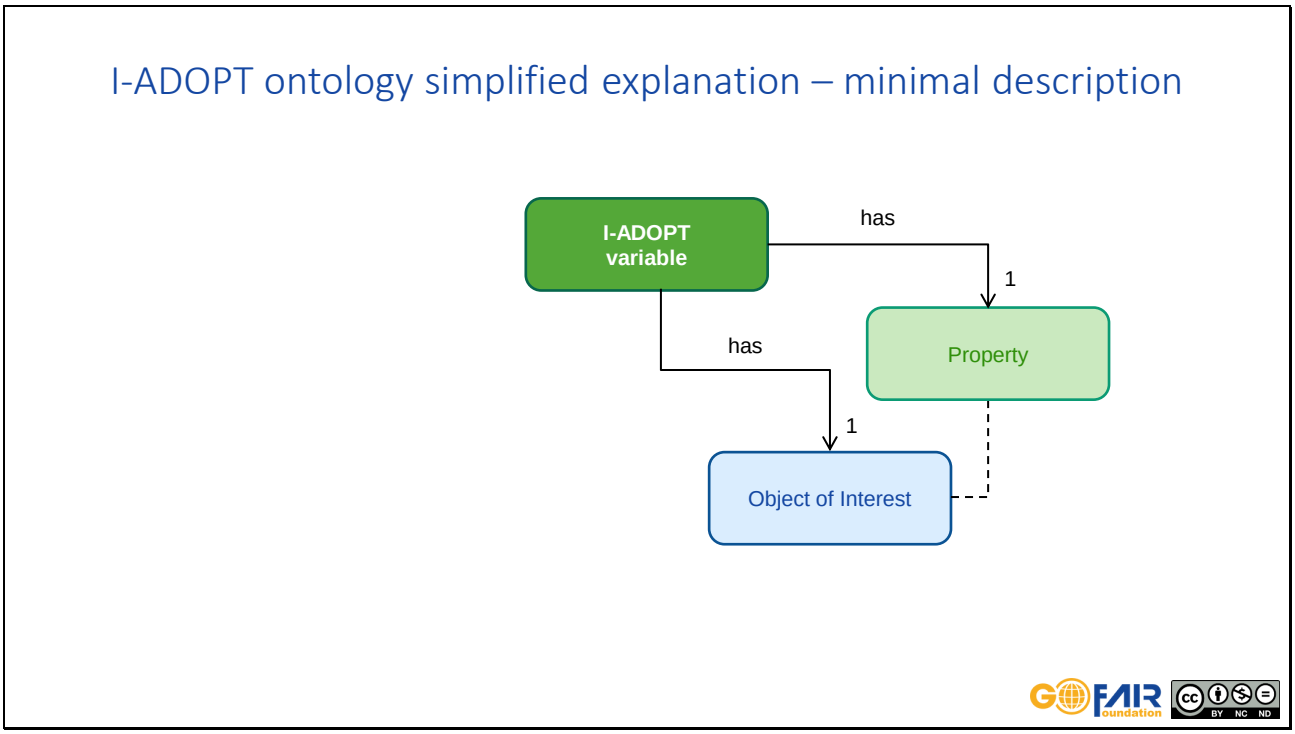


An I-ADOPT variable requires at least one property and one object of interest. The property is a characteristic of an entity which plays the role of an object of interest. Some of the simpler variables will not need more.

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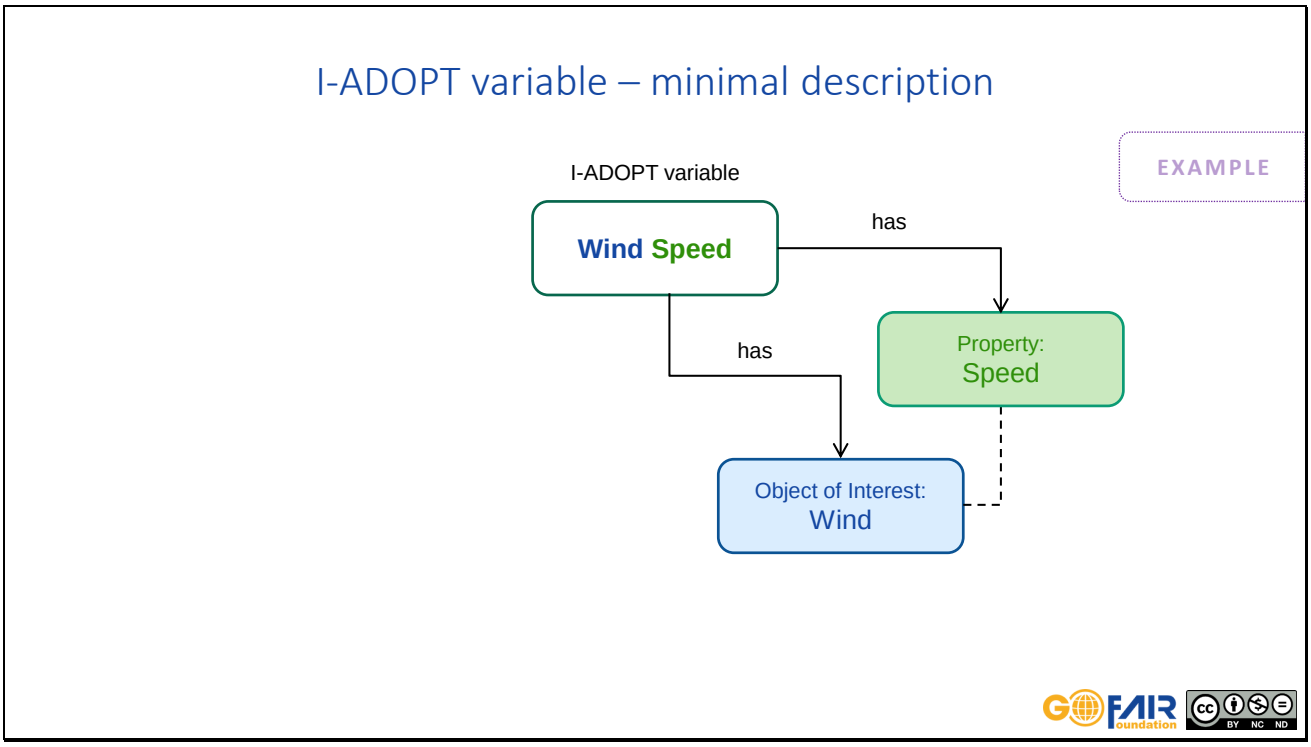


Let's illustrate this with an example. Wind speed is a non-complex variable.

Wind speed can be decomposed into two components: wind and speed,

where wind is the entity in the role of the object of interest and speed is the observed property of the wind.

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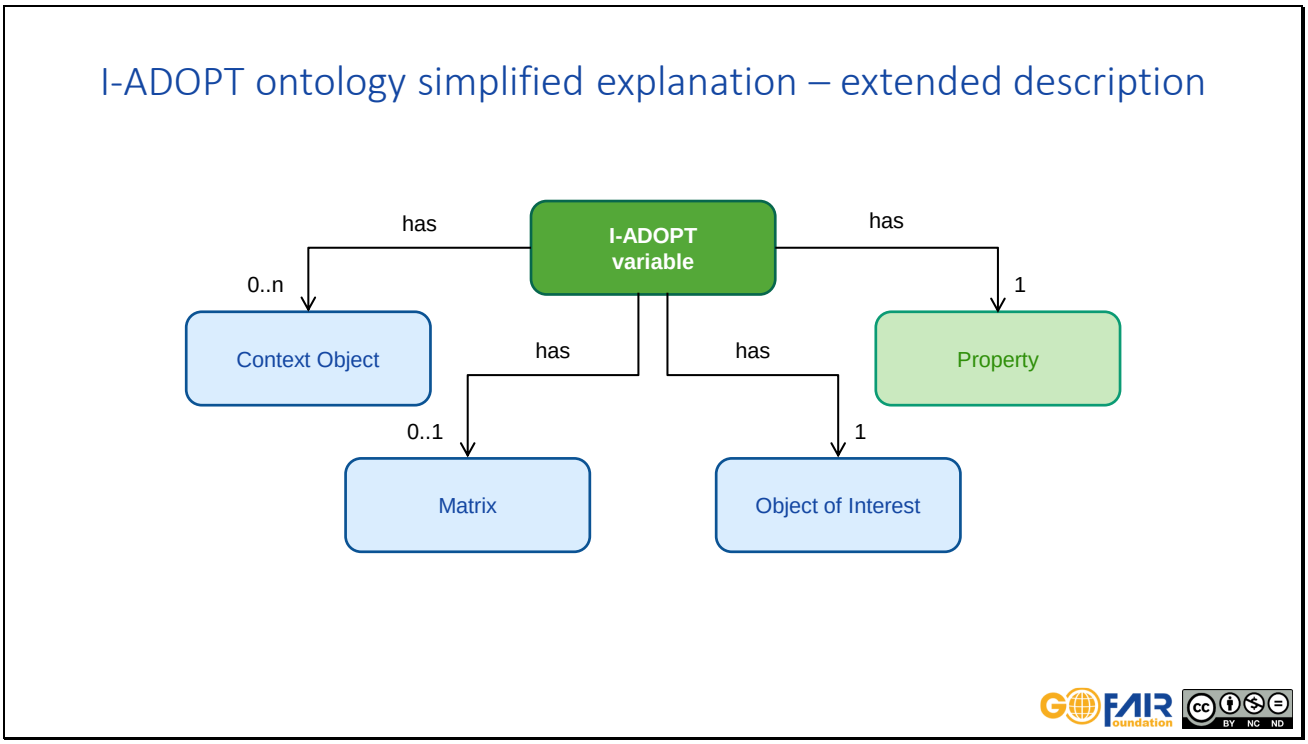


Most variables are more complex and require more description components. In addition to property and object of interest, they can have an optional matrix, which is an entity in which the ObjectOfInterest is contained. They can also have several context objects, that are entities that provide additional background information regarding the ObjectOfInterest.

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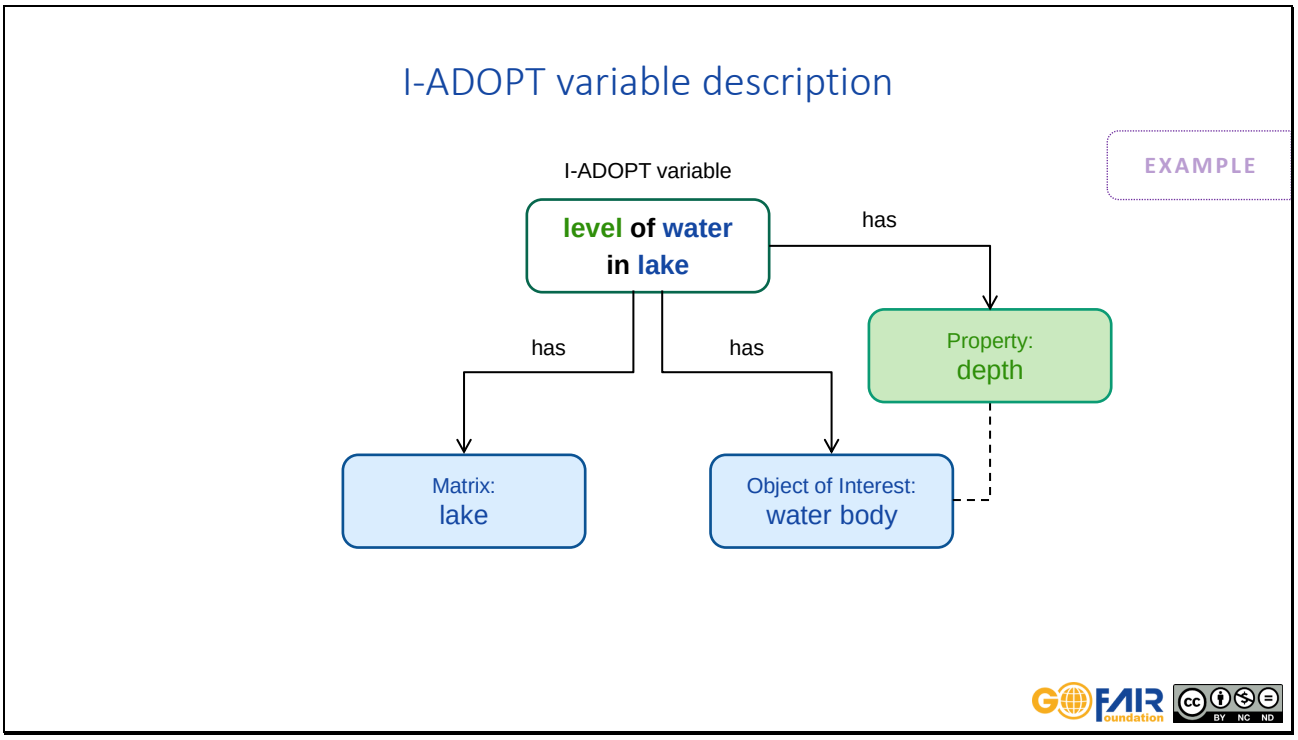


Let‘s analyse a more complex variable and apply the I-ADOPT Framework to it: water level of a lake

We can identify three different atomic parts in the description: level, water and lake

The “water level” needs to be interpreted and some domain knowledge is required in order to describe it as a property. It is defined as the vertical measure of length (distance) from the surface to the bottom of a water body, in other words the depth. The entity “water body” needs to be introduced as the object of interest so that it can be associated with its property “depth”. “Lake” is the matrix in which the observed water body is contained.

Links: https://blog.aem.eco/fundamentals_of_water_level_measurement

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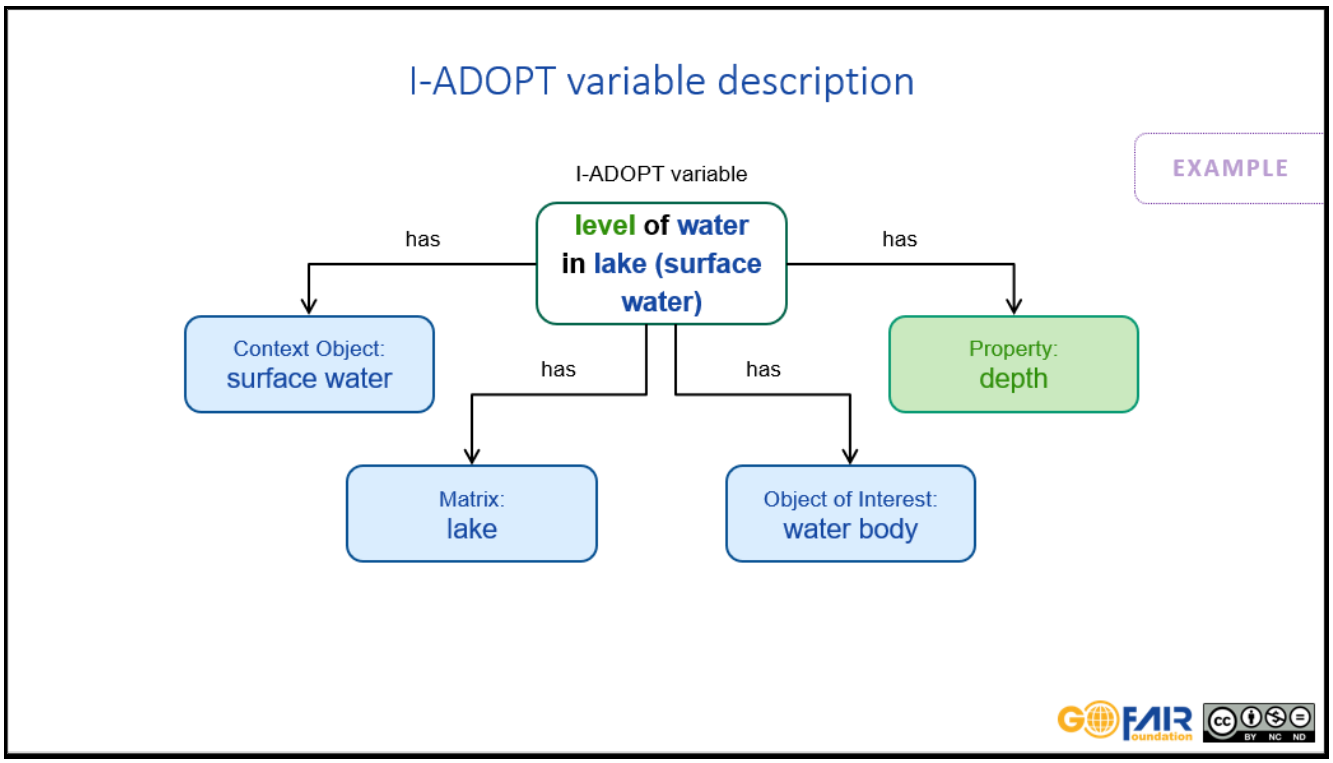


If required, “surface water” can be added as a context object to ensure the variable is clearly labelled as relating to surface water and not ground water (disambiguation).

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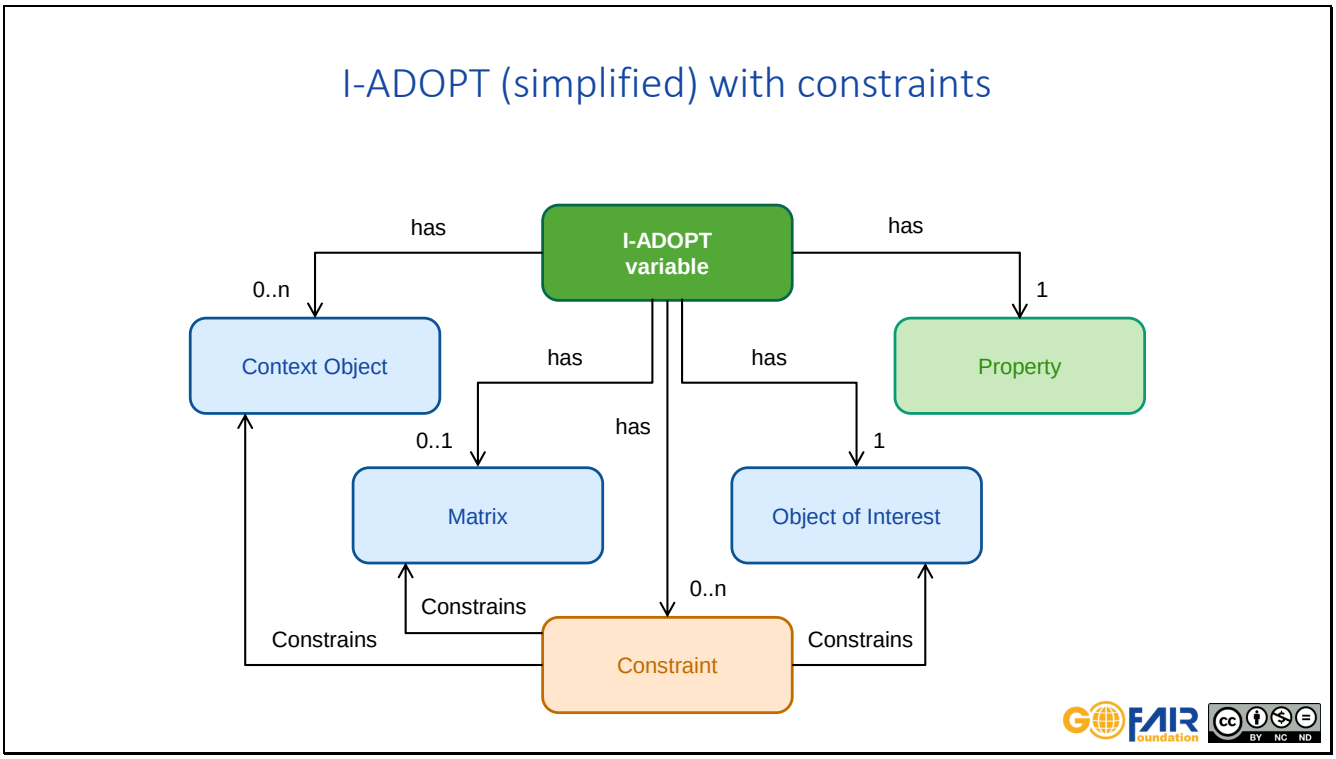


All the entities, but not the property, included in the description, can be constrained by one or more constraints. A constraint must include the pointer to the entity it constrains.

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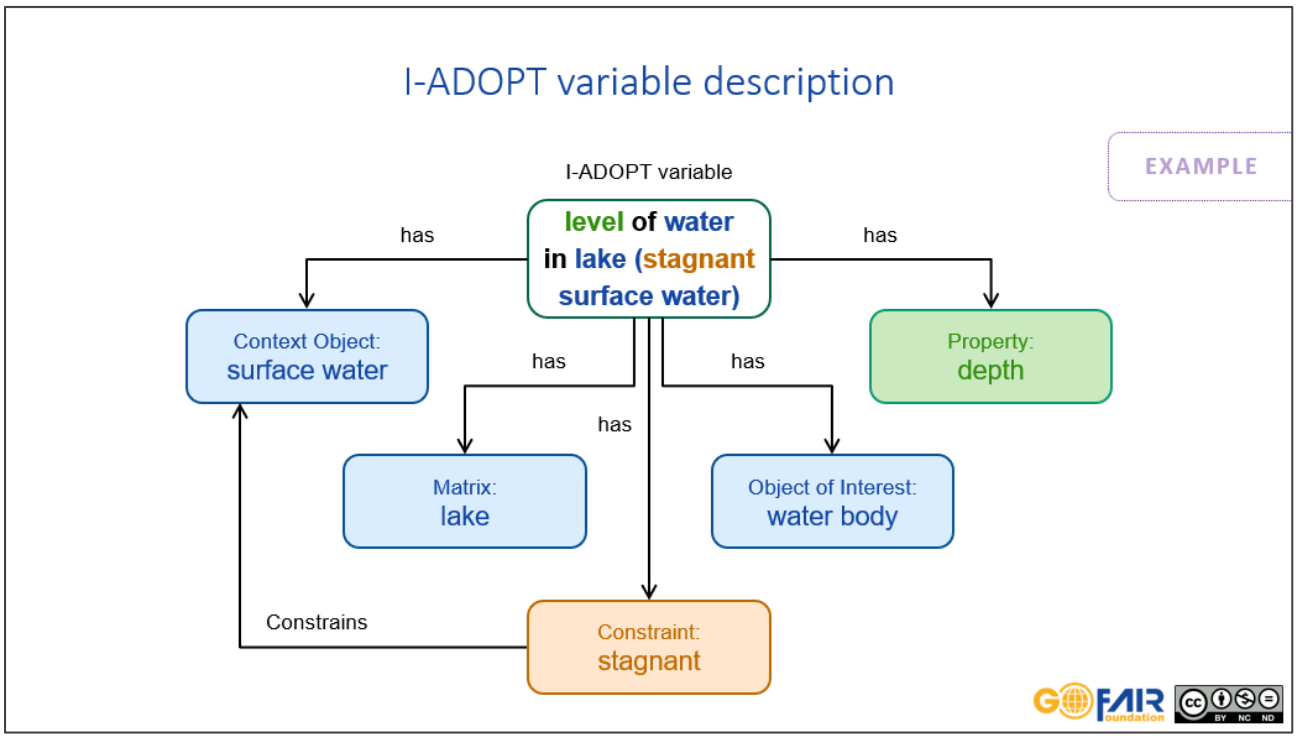


Applied to our example, we may need to add constraints if the variable is: level of water in lake (stagnant surface water). The constraint “stagnant“ constrains the context object “surface water“. Nevertheless, this variable can also be represented without using a constraint if a more specific term for the context object is available e.g. “stagnant surface water“ which is a narrower concept than “surface water“. Using mappings between these different representations it is possible to accept both variants.

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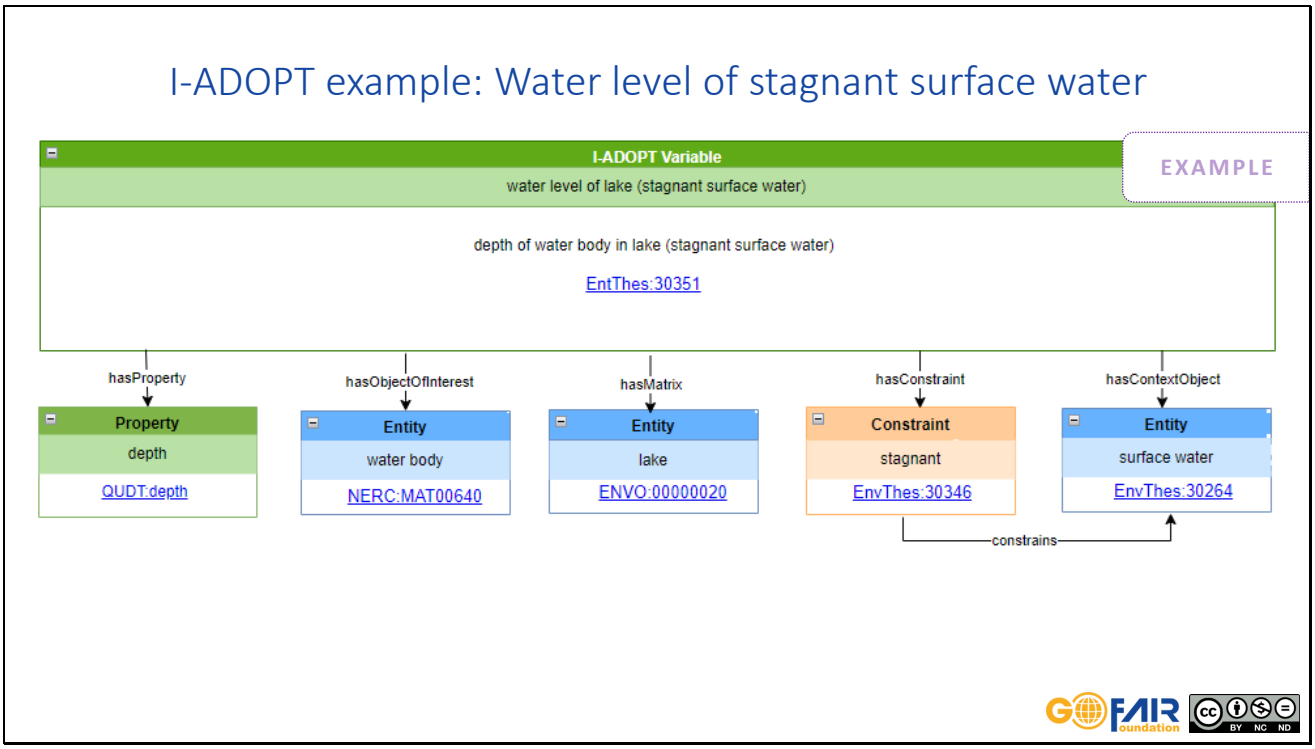


After decomposing the description of I-ADOPT into logical atomic parts we need to find appropriate terms from terminologies like thesauri or ontologies. For this example we use the QUDT ontology for the property “depth”, term from the NERC Vocabulary Server for the entity “water body”, EnvO for “lake”, and for the others we use EnvThes. For the description terms you can use any terminology as long as it is maintained and interoperable with other terminologies.

Links:

Variable (water level of lake): http://vocabs.lter-europe.net/EnvThes/30351

Property (depth): http://qudt.org/vocab/quantitykind/Depth

ObjectofInterest (water body): http://vocab.nerc.ac.uk/collection/S26/current/MAT00640/

Matrix (lake): http://purl.obolibrary.org/obo/ENVO_00000020

ContextObject (surface water): http://vocabs.lter-europe.net/EnvThes/30264

Constraint (of surface water) (stagnant): http://vocabs.lter-europe.net/EnvThes/30346

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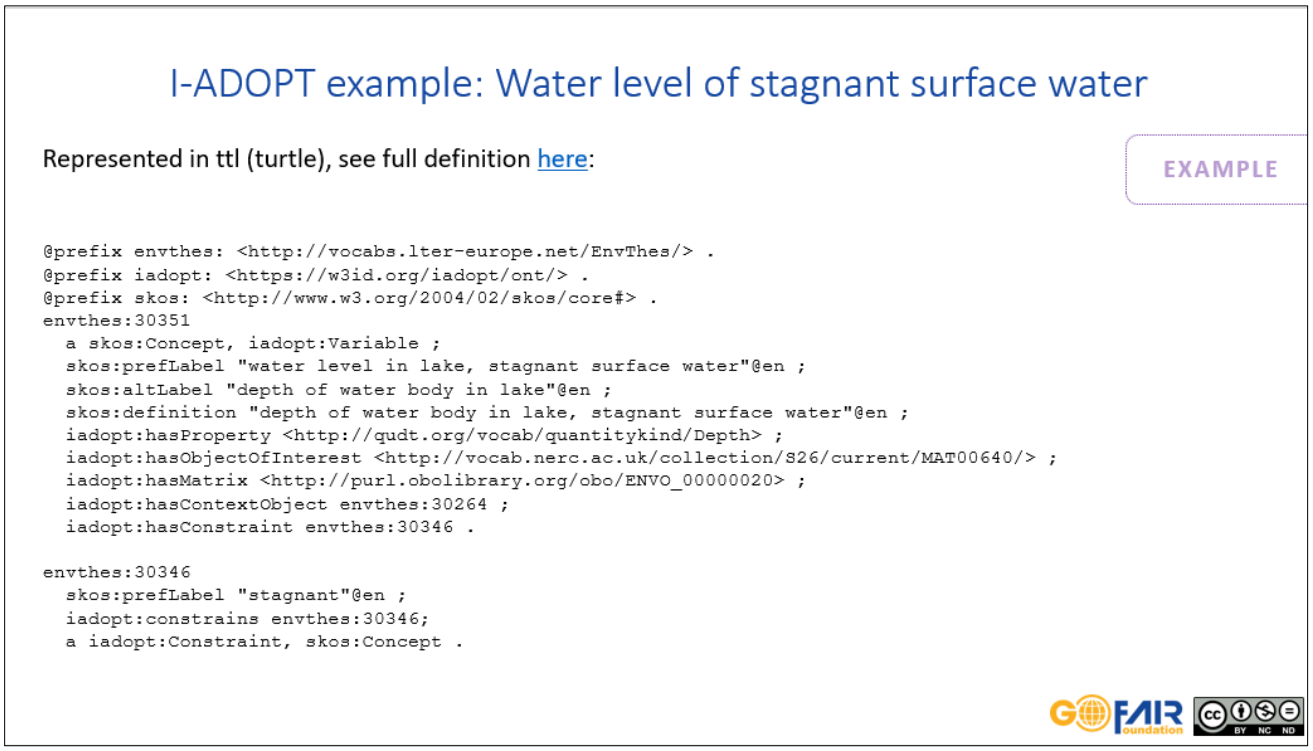


Here, you can also see how the representation is expressed as machine readable RDF in turtle syntax.

Link to turtle file: https://raw.githubusercontent.com/i-adopt/examples/main/EnvThes/30351.ttl

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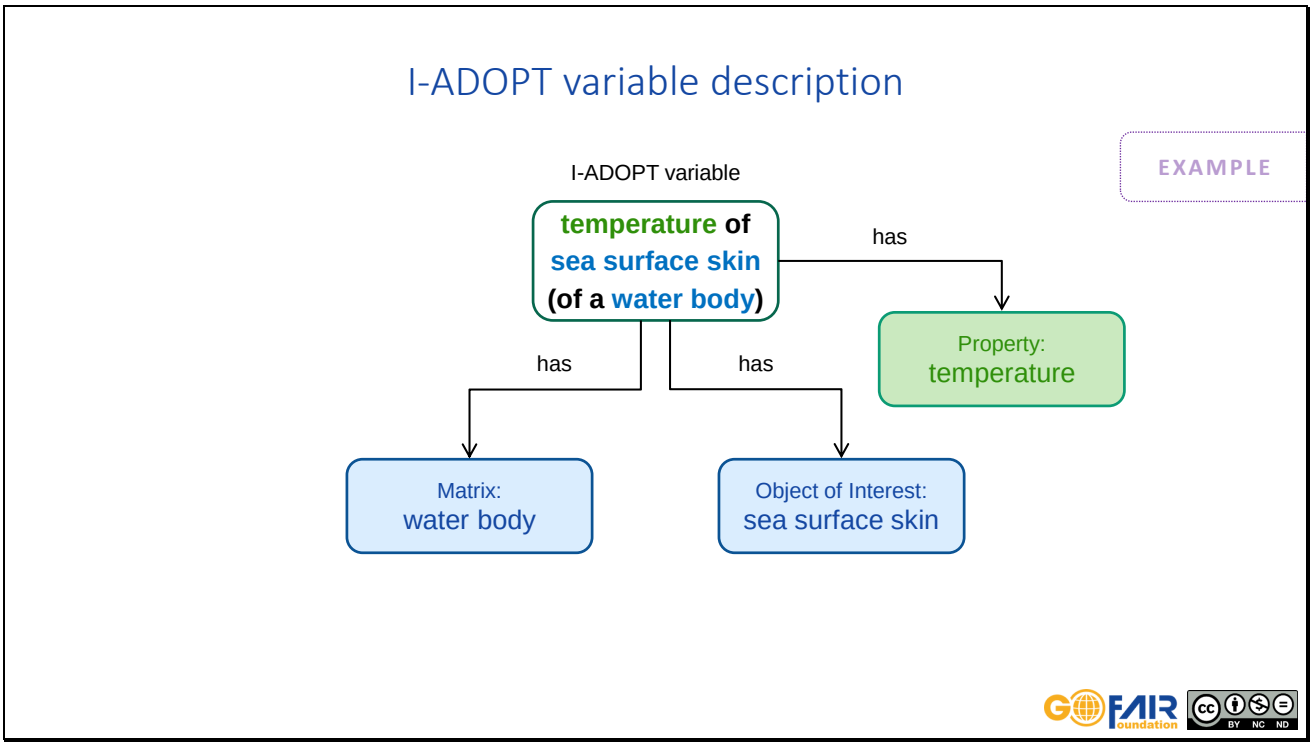


Let‘s take another example that is also about the property of a water body: Sea surface skin temperature.

In this example, the temperature measured is that of the sea surface skin layer which is thus the object of interest. This entity is contained within a broader matrix environment which is the “water body”. However the variable could be minimally defined with Temperature as the property and sea surface skin as the object of interest. But “water body” can also be added as the matrix to further define the context of the variable and facilitate consistency and interoperability.

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## Acknowledgements and further reading

**Other examples:**

- https://i-adopt.github.io/examples/index.html
- https://i-adopt.github.io/examples/EnvThes/22035.ttl.html
- The associated turtle file can be seen here: https://i-adopt.github.io/examples/EnvThes/22035.ttl



**Created by:** GO FAIR foundation **In collaboration with:** RDA RESEARCH DATA ALLIANCE I-ADOPT WG

Find other modelled variable examples on this website, where you can see how the description components have been annotated and represented as turtle files.

Links

• https://i-adopt.github.io/examples/index.html

Example Air temperature:

• https://i-adopt.github.io/examples/EnvThes/22035.ttl.html

• The associated turtle file can be seen here: https://i-adopt.github.io/examples/EnvThes/22035.ttl