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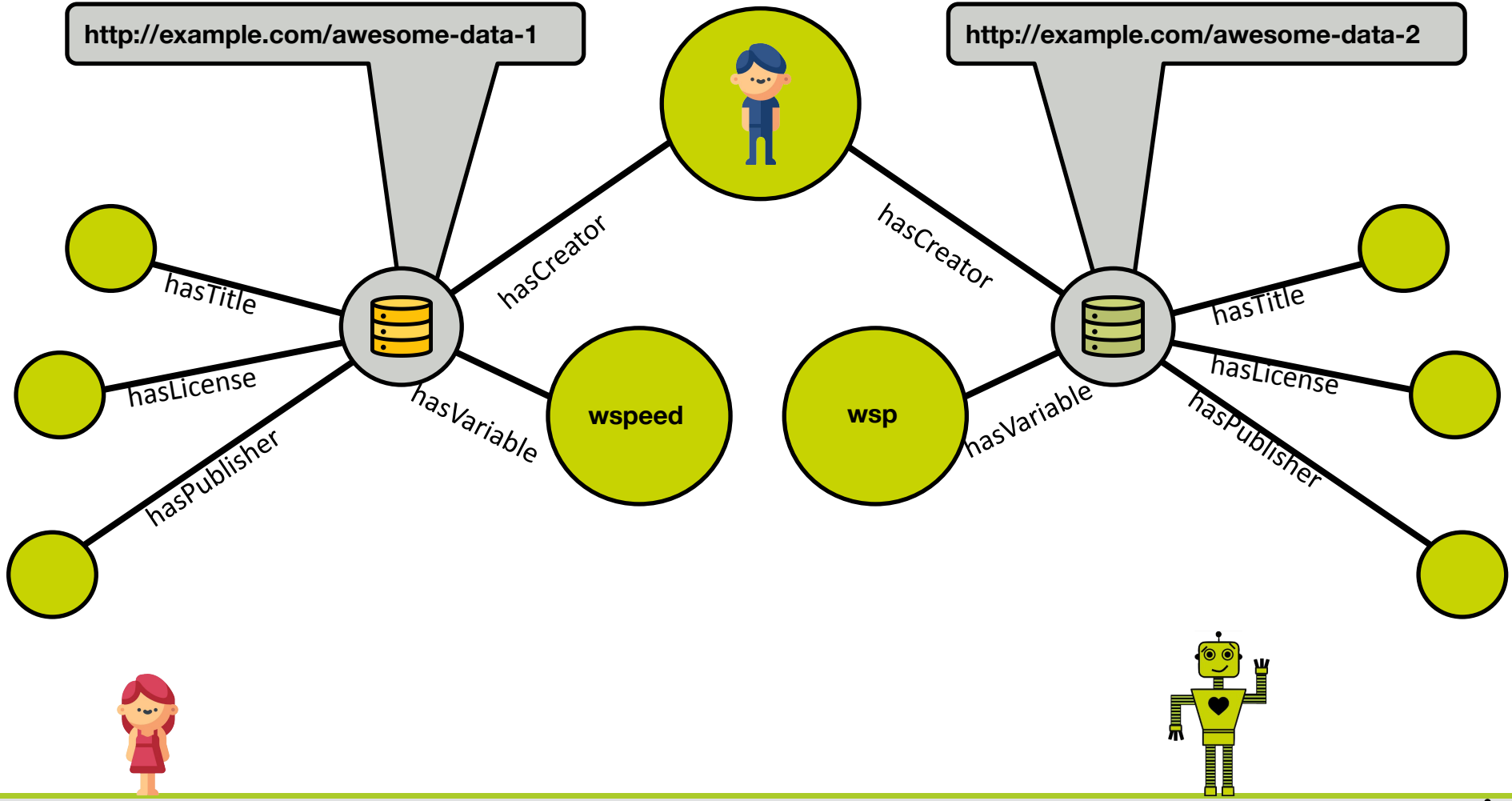
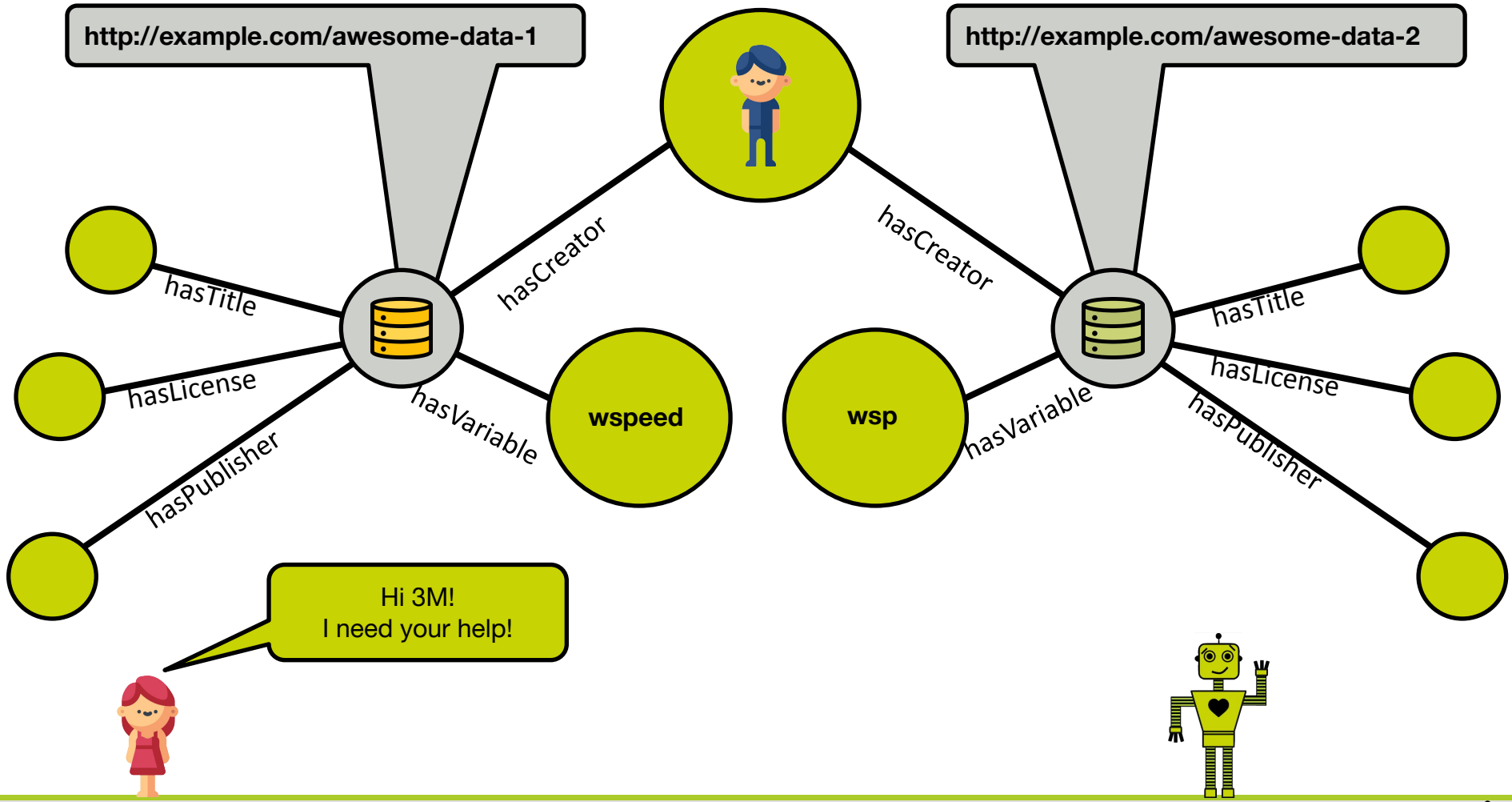
Introduction to controlled vocabularies and how to build them

Nikola Vasiljević, DTU Wind Energy


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
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hasVariable
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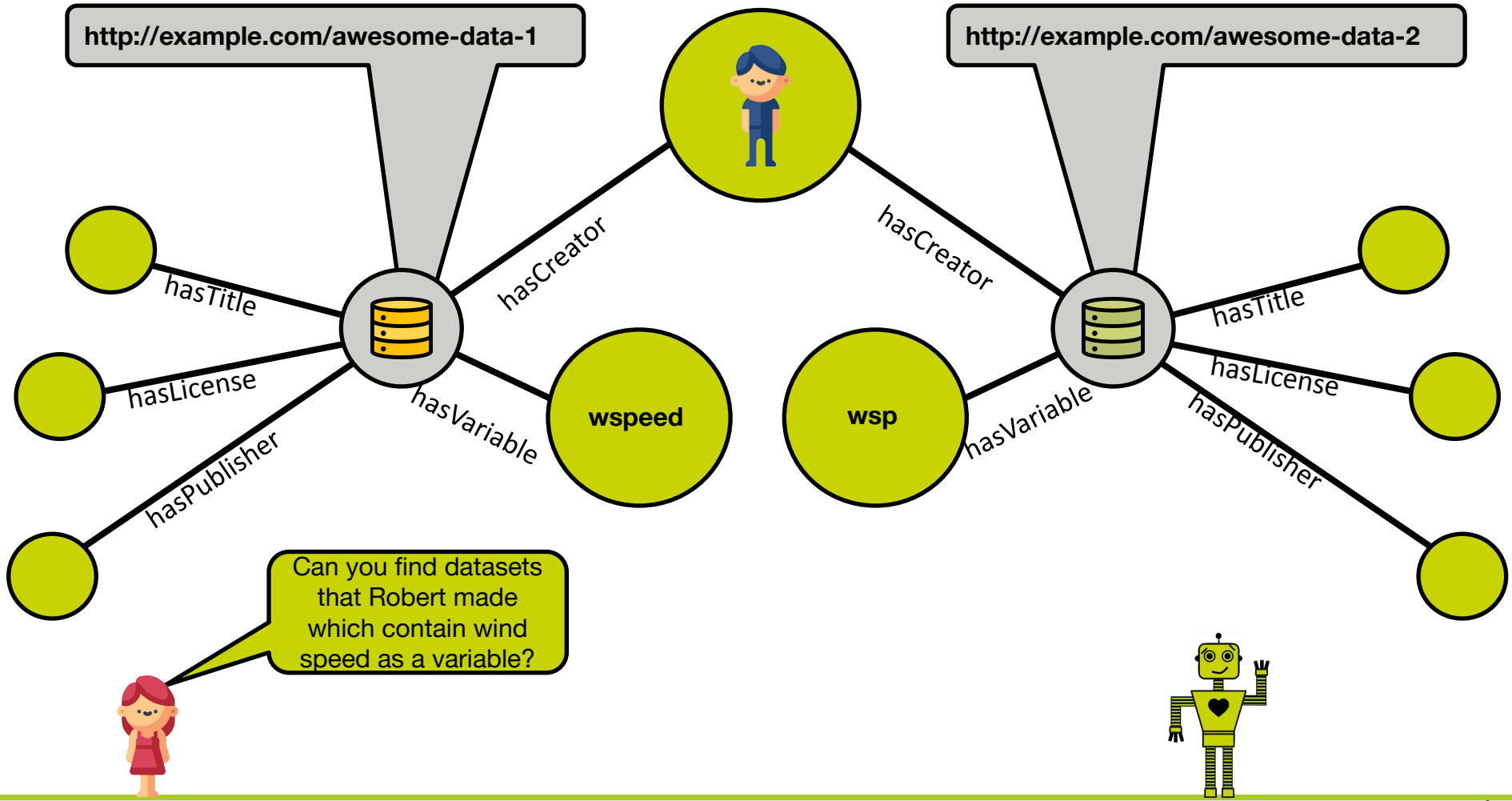
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp
Hi 3M!
I need your help!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
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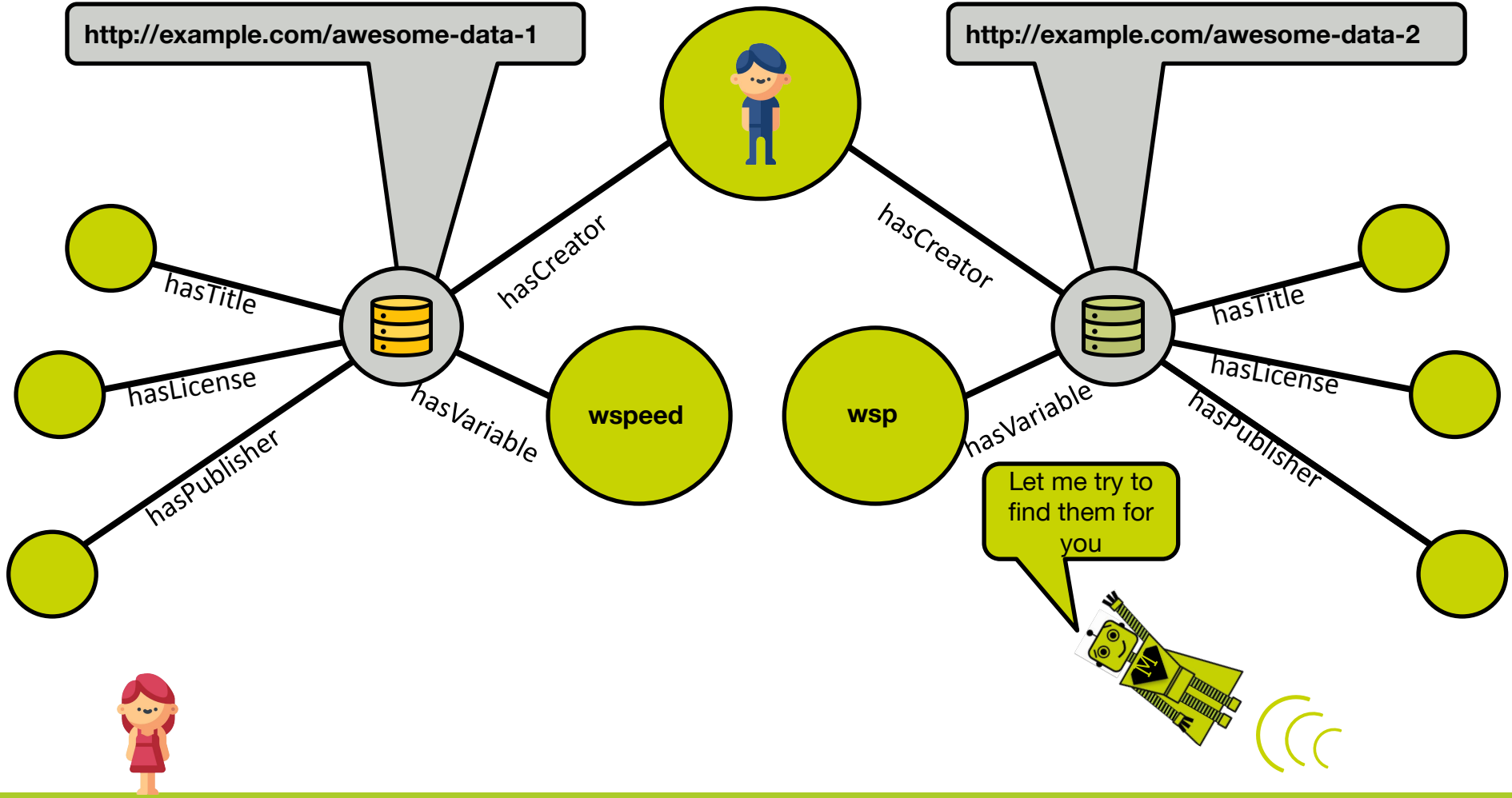
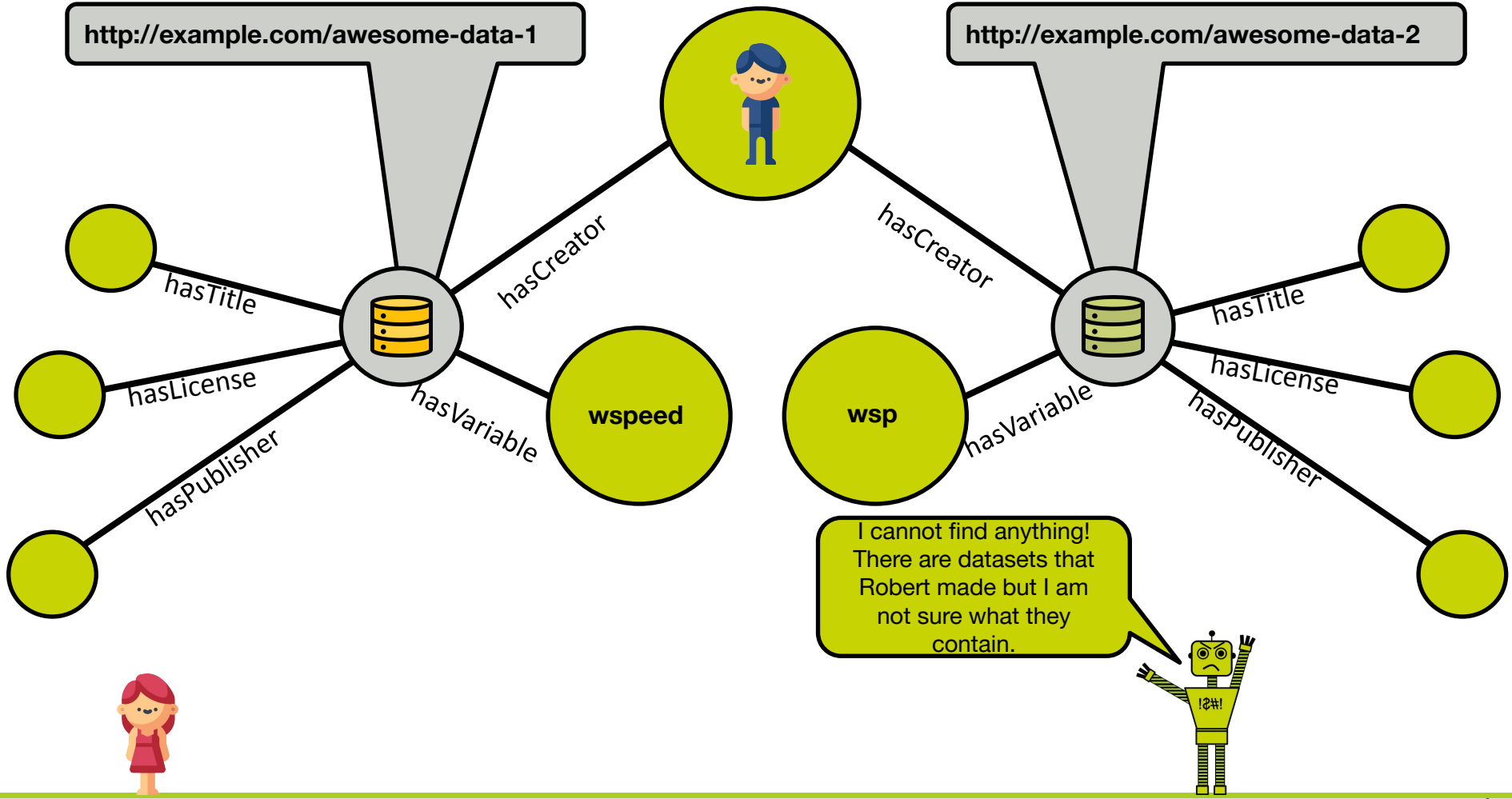
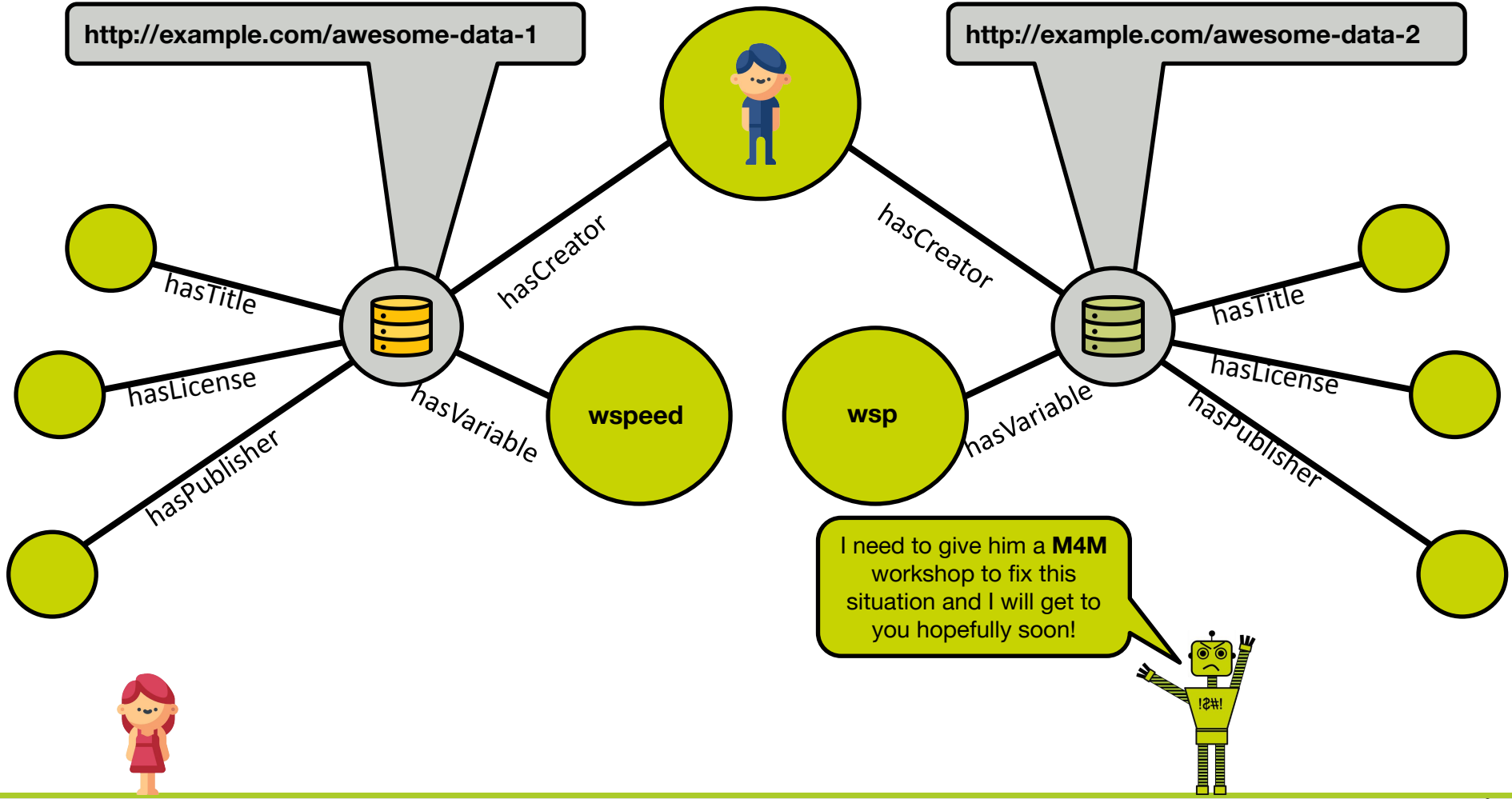
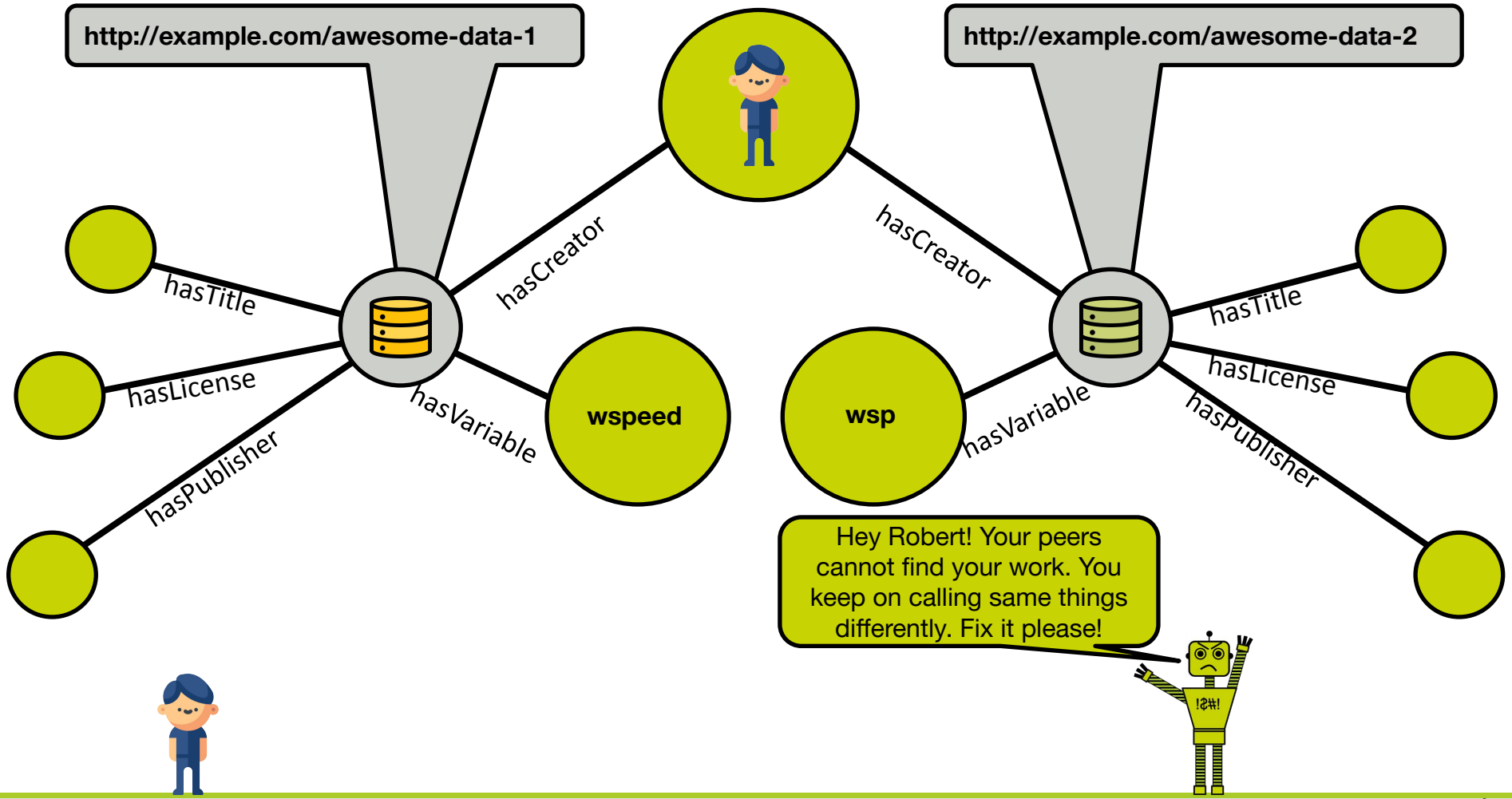
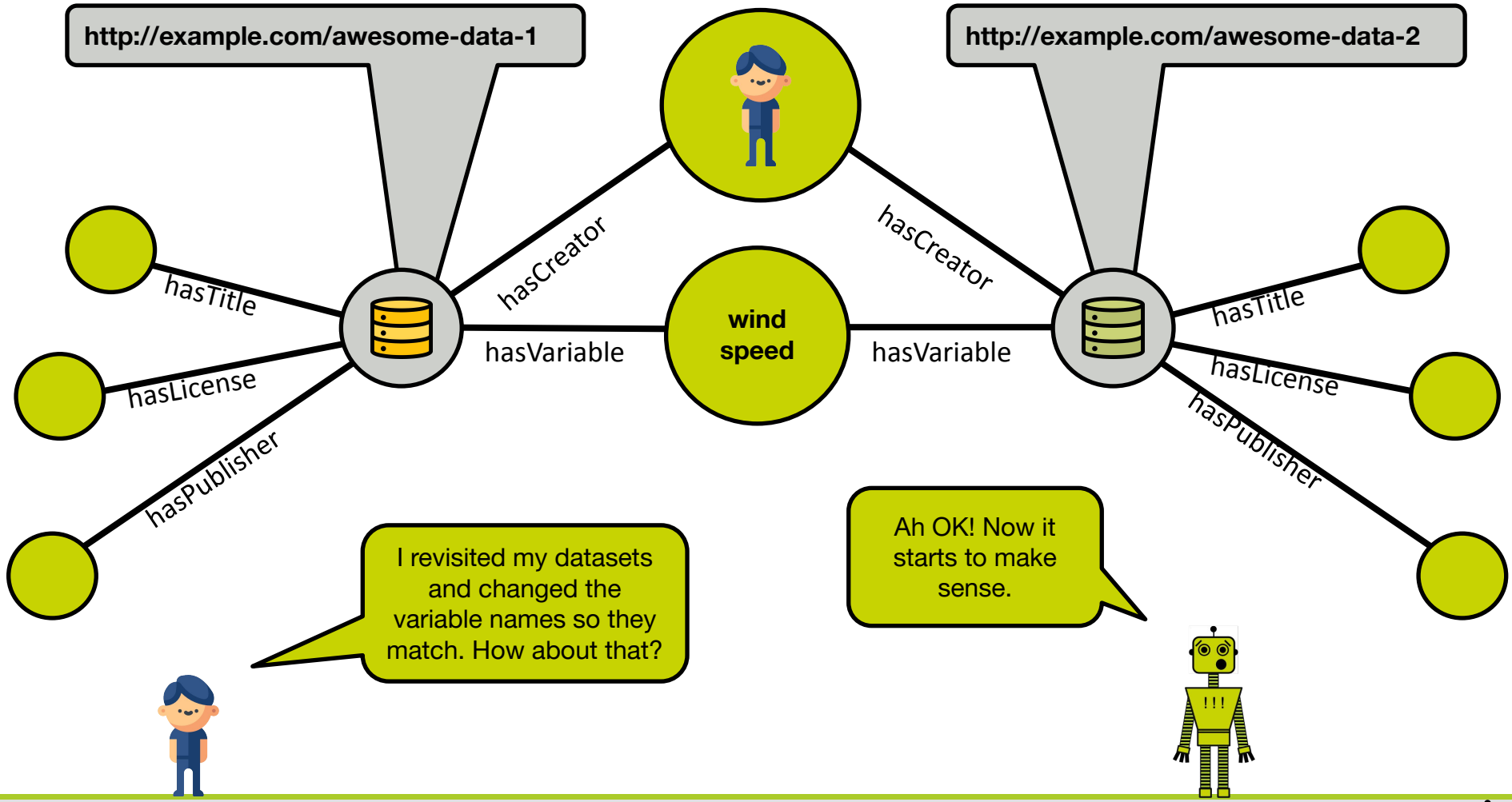
hasPublisher
hasVariable
wspeed
wsp
Can you find datasets that Robert made which contain wind speed as a variable?

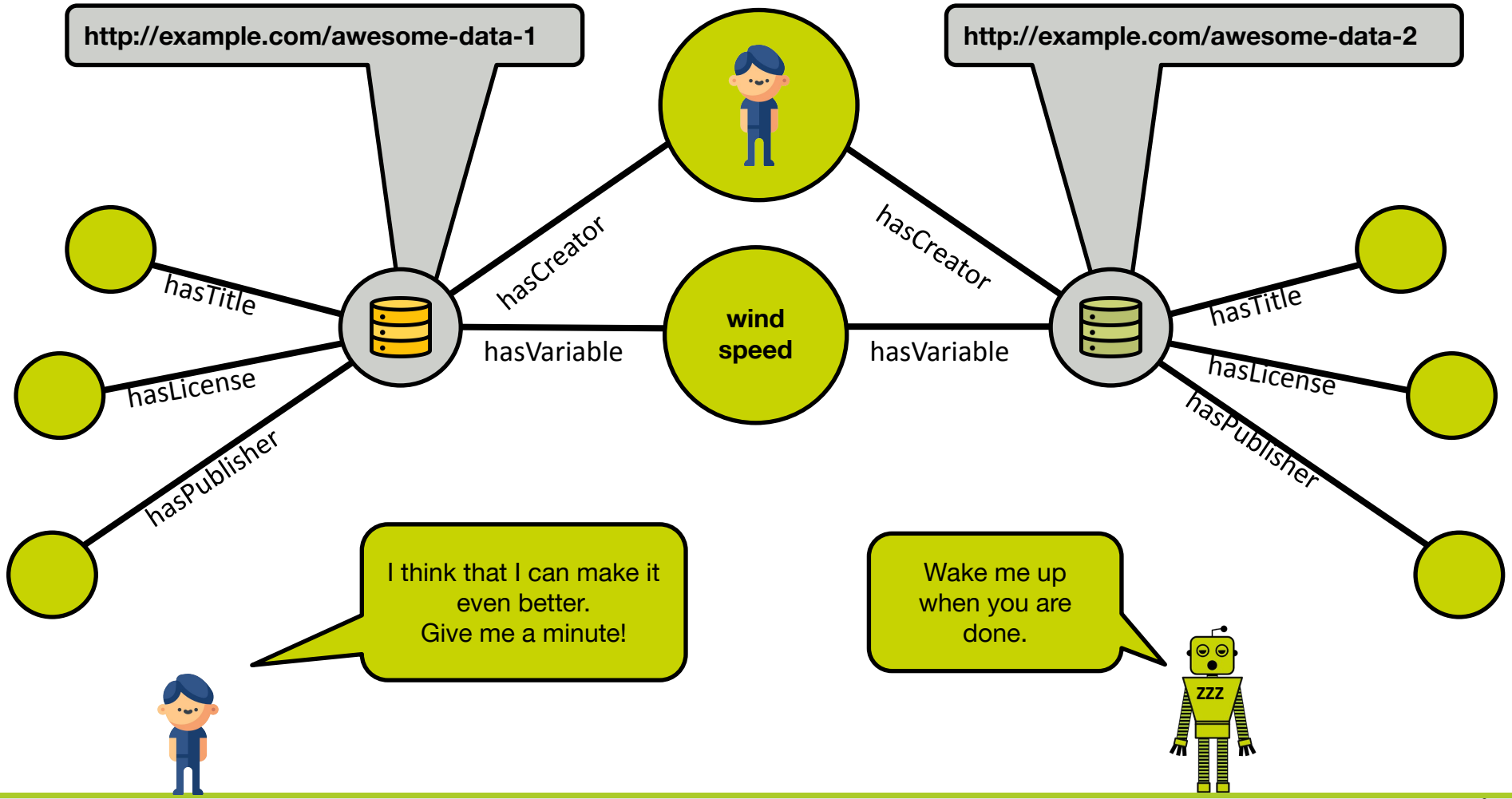

http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp
Let me try to find them for you

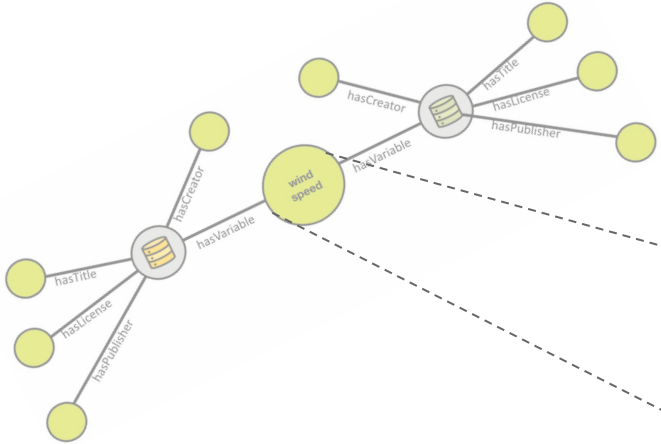

http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp
I cannot find anything! There are datasets that Robert made but I am not sure what they contain.


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp
I need to give him a M4M workshop to fix this situation and I will get to you hopefully soon!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasVariable
hasCreator
hasCreator
hasTitle
hasLicense
hasPublisher
hasVariable
wspeed
wsp
Hey Robert! Your peers cannot find your work. You keep on calling same things differently. Fix it please!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasCreator
hasVariable
wind speed
hasVariable
hasCreator
hasTitle
hasLicense
hasPublisher
I revisited my datasets and changed the variable names so they match. How about that?
Ah OK! Now it starts to make sense.
!!!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasCreator
hasVariable
wind speed
hasVariable
hasCreator
hasTitle
hasLicense
hasPublisher
I think that I can make it even better. Give me a minute!
Wake me up when you are done.
zzz



http://example.com/wind_speed

PID

name

wind speed

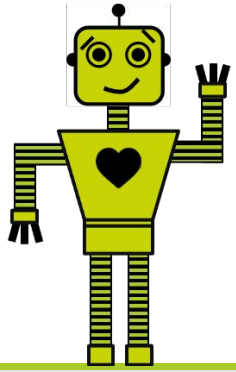
definition

Wind is defined as a two-dimensional…

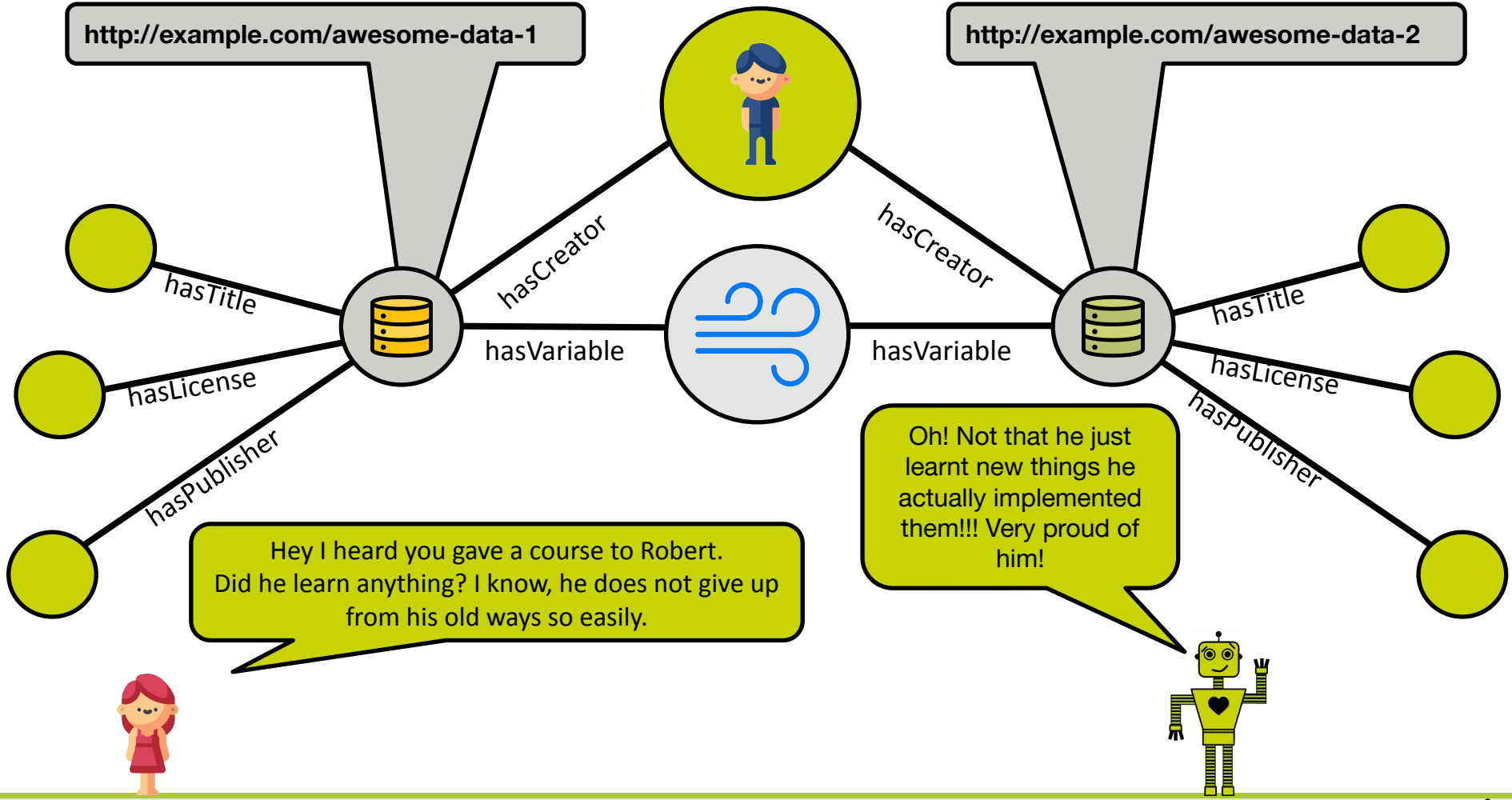
units

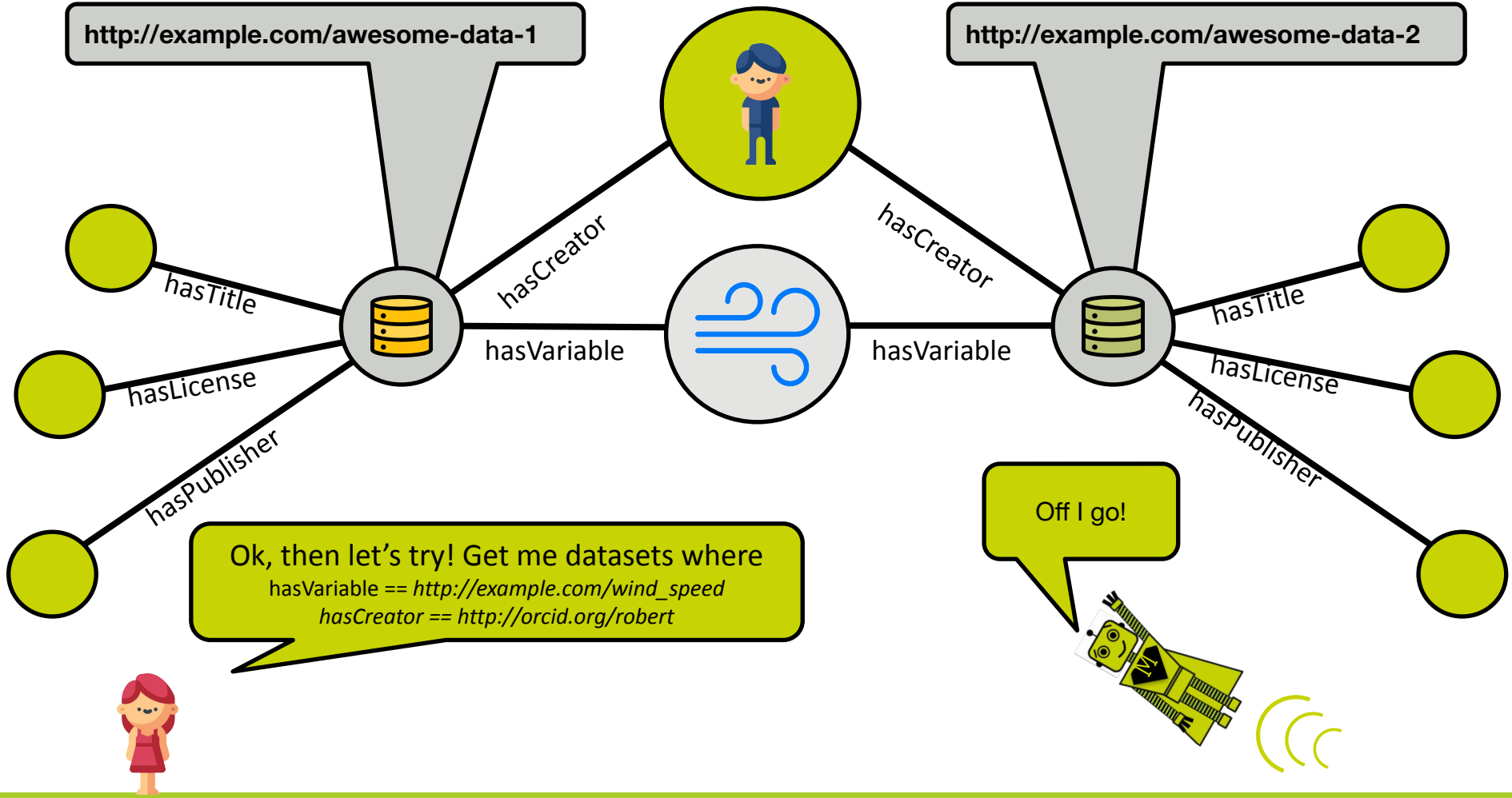
m.s^-1

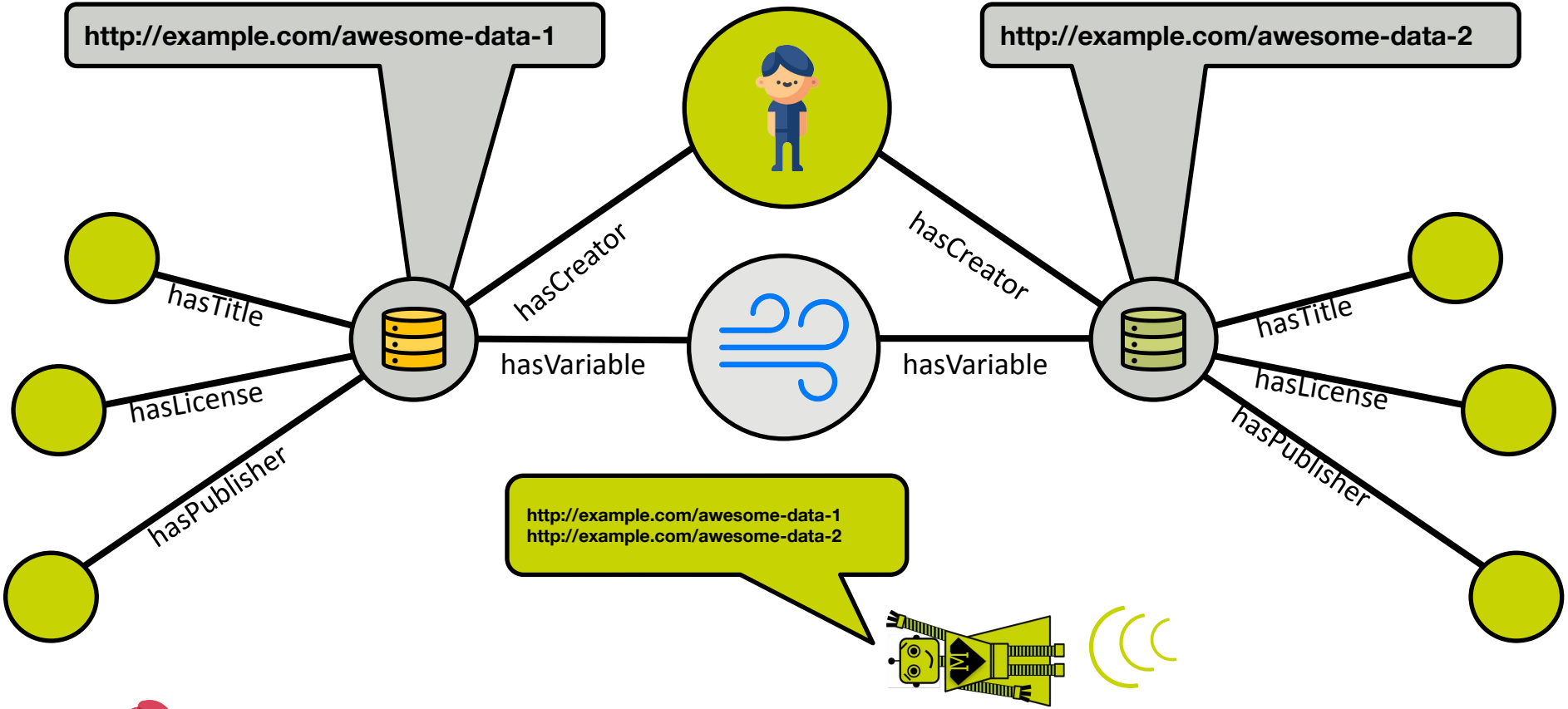
Do you like this?



Oh yes - I LOVE URLs!!!

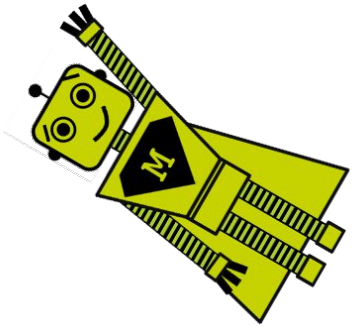

http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasCreator
hasVariable
hasCreator
hasVariable
hasTitle
hasLicense
hasPublisher
Hey I heard you gave a course to Robert.
Did he learn anything? I know, he does not give up from his old ways so easily.
Oh! Not that he just learnt new things he actually implemented them!!! Very proud of him!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasCreator
hasVariable
hasCreator
hasVariable
hasTitle
hasLicense
hasPublisher
Ok, then let's try! Get me datasets where
hasVariable == http://example.com/wind_speed
hasCreator == http://orcid.org/robert
Off I go!


http://example.com/awesome-data-1
http://example.com/awesome-data-2
hasTitle
hasLicense
hasPublisher
hasCreator
hasVariable
hasCreator
hasVariable
hasTitle
hasLicense
hasPublisher
http://example.com/awesome-data-1
http://example.com/awesome-data-2

Why should vocabularies be FAIR?*

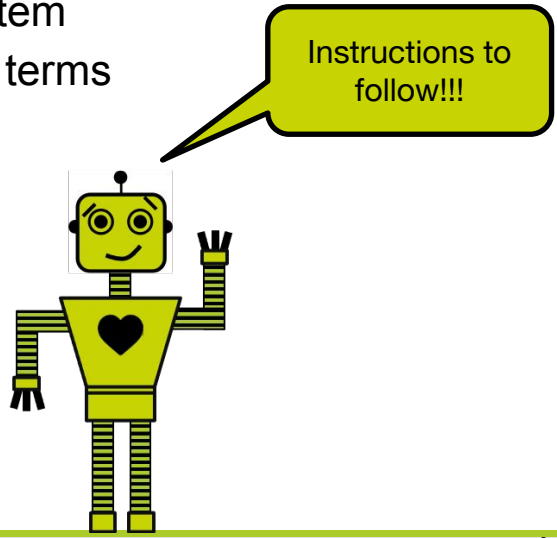
- We need to know if concepts in different datasets mean the same thing
- We want to annotate data using concepts from vocabularies
- We want to use vocabularies that are standard-based and machine-actionable
- We want to use vocabularies that are supported by the community



* Ten Simple Rules for making a vocabulary FAIR. 2021, http://arxiv.org/abs/2012.02325

Why should vocabularies be FAIR?*

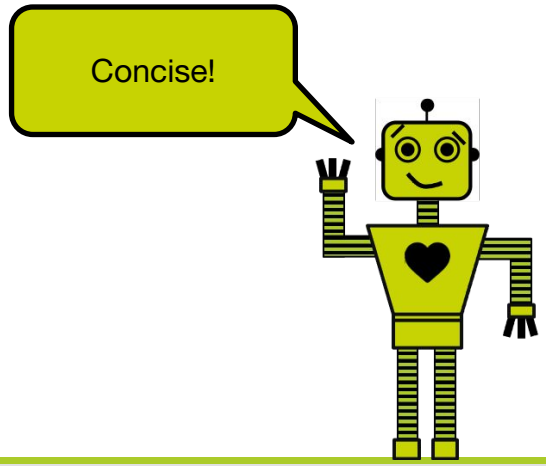
1. Governance arrangements for the legacy vocabulary
2. Licensing, legacy and new vocabulary
3. Check term definition completeness in legacy vocabulary
4. Establish a technical maintenance environment for the FAIR vocabulary
5. Assign a unique identifier to the vocabulary and to its each item
6. Create machine readable representations of the vocabulary terms
7. Add rich metadata
8. Register the vocabulary in a semantic repository
9. Make the identifiers of vocabulary and terms resolvable
10. Implement a process for maintaining the FAIR vocabulary



* Ten Simple Rules for making a vocabulary FAIR. 2021, http://arxiv.org/abs/2012.02325

Characteristics of FAIR vocabularies

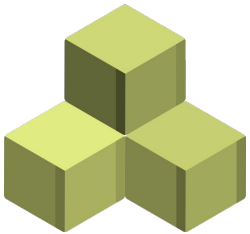
- **FINDABLE**: indexed and registered in a community or generic service
- **ACCESSIBLE**: retrievable on the web by both machine and humans
- **INTEROPERABLE**: encoded in standard representation, mapped to existing vocabularies
- **REUSABLE**: licensed under open license, maintained



* Ten Simple Rules for making a vocabulary FAIR. 2021, http://arxiv.org/abs/2012.02325

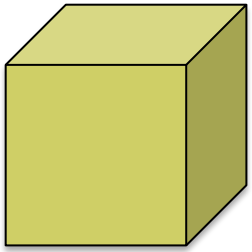
How to build controlled vocabularies ?

RDF



DATA
MODEL

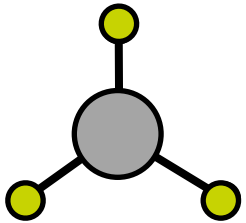
TURTLE
JSON-LD
XML-RDF



FORMAT

SKOS

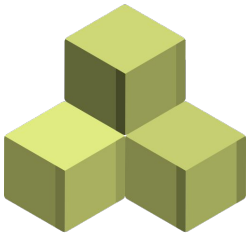
OWL



REPRESENTATION
LANGUAGE

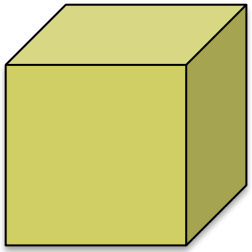
How to build controlled vocabularies ?

RDF



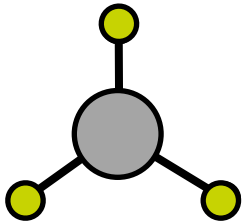
DATA
MODEL

TURTLE
JSON-LD
XML-RDF



FORMAT

SKOS
OWL



REPRESENTATION
LANGUAGE

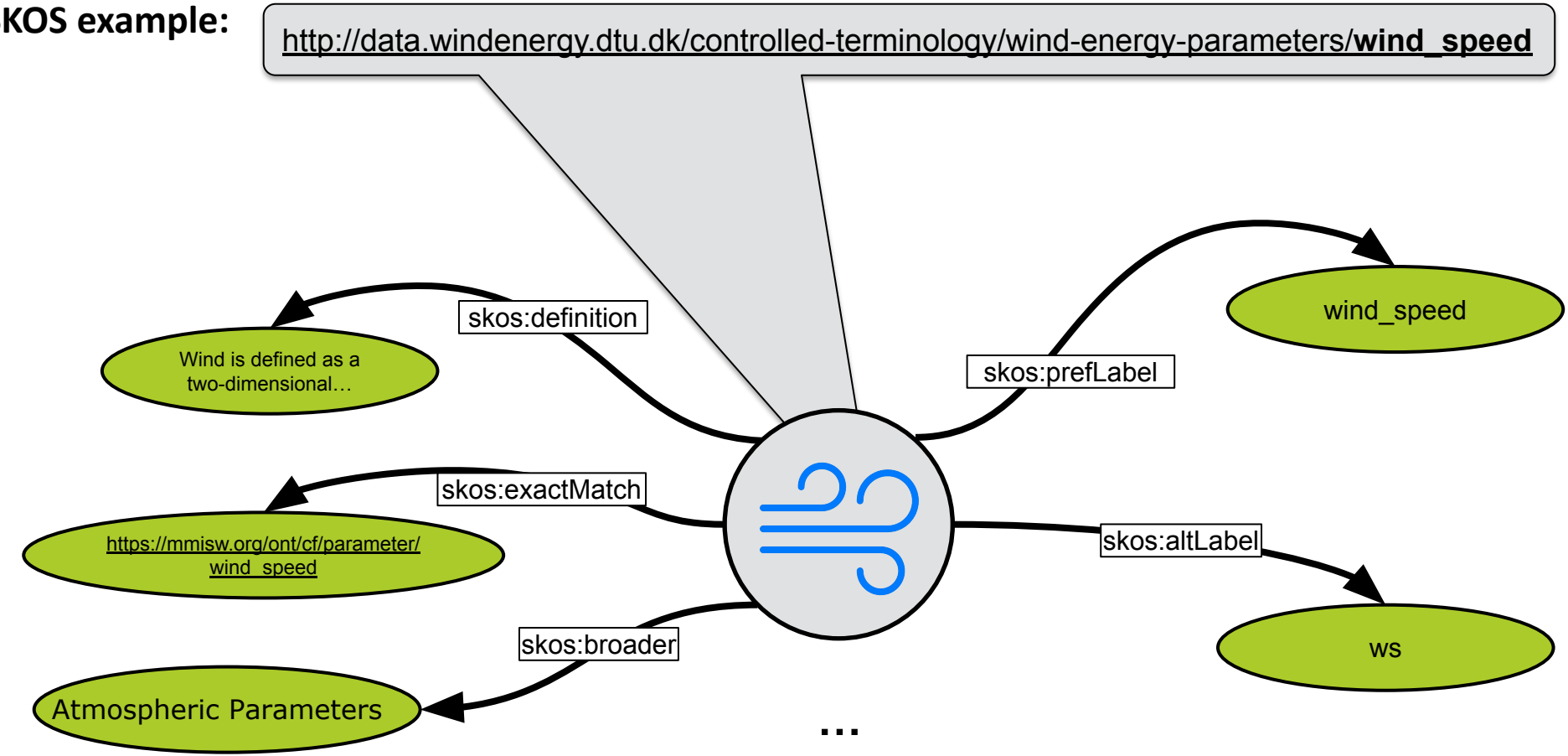
Why selecting RDF, Turtle and SKOS?

> **RDF** (Resource Data Framework) is a standard model for data interchange on the Web

> **Turtle** is a common, most human-readable and very compact data format for storing RDF data

> **SKOS** (Simple Knowledge Organization System) is a W3C recommendation designed for representation of thesauri, classification schemes, taxonomies, subject-heading systems, or **any other type of structured controlled vocabulary**.

SKOS example:



This is a graphical representation of a **knowledge graph**.

Encoding graph in RDF Turtle format

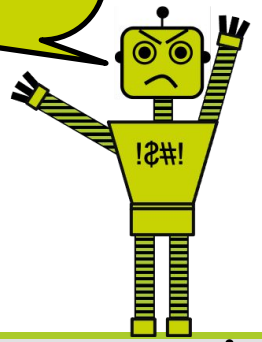
```
@prefix : <http://data.windenergy.dtu.dk/controlled-terminology/wind-energy-parameters/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

:wind_speed a skos:Concept;

    skos:prefLabel "wind_speed";
    skos:altLabel "ws", "horizontal wind speed" ;
    skos:definition "Wind is …"@en;
    skos:exactMatch <https://mmisw.org/ont/cf/parameter/wind_speed>;
    skos:broader :AtmosphericParameters.
```

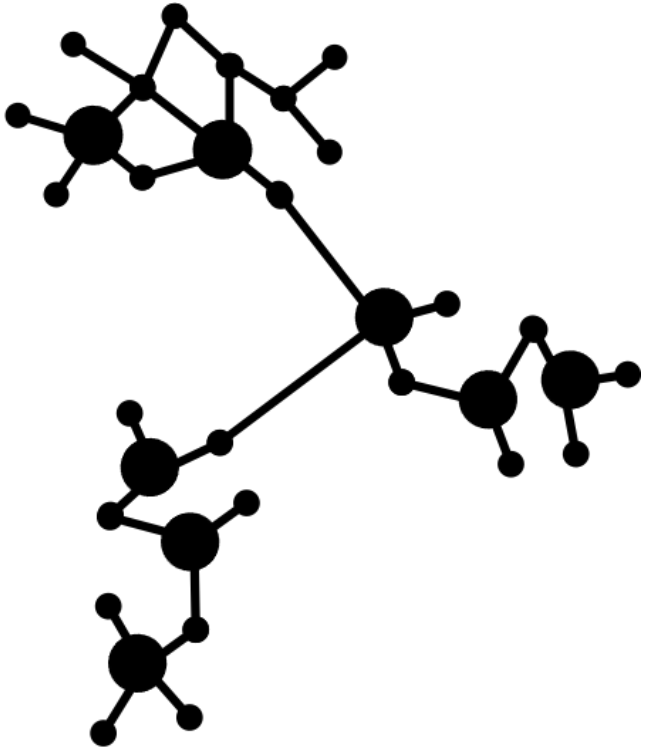
Hey Robert, you said it is the 'most' human readable format! The course participants will find this very **cryptic and nerdy**!!!

Can you make it **simpler**?!

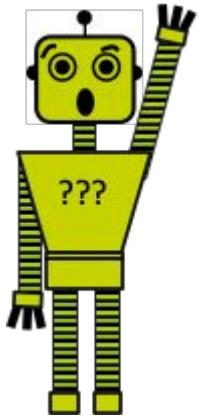


Yes I can! Check tools in slides after the break.

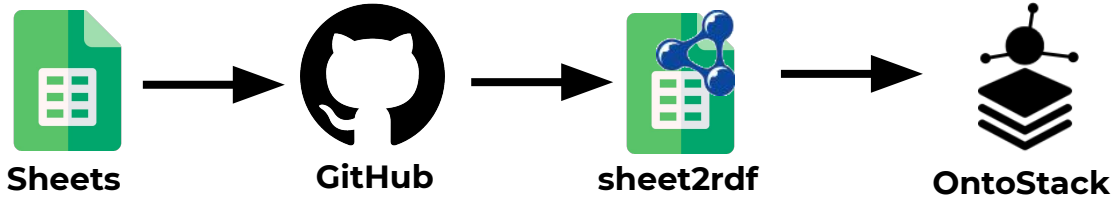
* *:wind_speed translates into http://data.windenergy.dtu.dk/controlled-terminology/wind-energy-parameters/wind_speed*

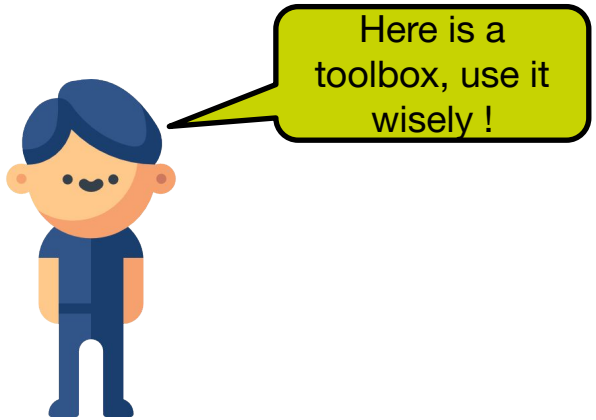


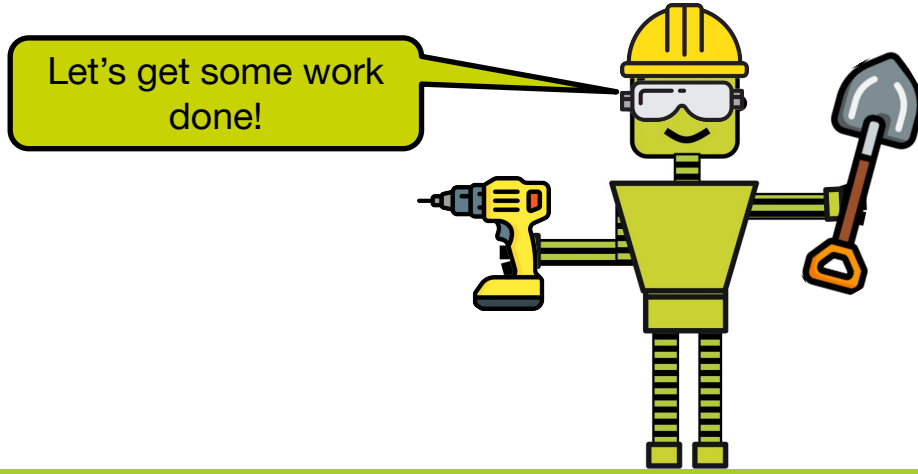
QUESTIONS???



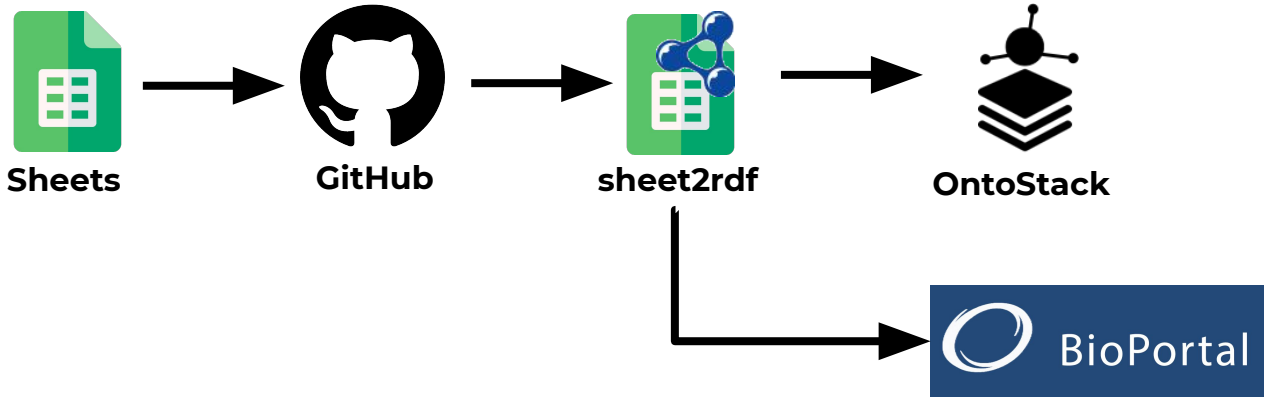
> Effective workflow for generating and publishing controlled vocabularies







Effective workflow for generating and publishing controlled vocabularies



Template Sheet

Template Sheet

Template Sheet

ConceptScheme URI	http://ontology.deic.org/cv/vocab-name/			
PREFIX	vocab-name	http://ontology.deic.org/cv/vocab-name/		
PREFIX	pav	http://purl.org/pav/		
PREFIX	dct	http://purl.org/dc/terms/		
PREFIX	owl	http://www.w3.org/2002/07/owl#		
PREFIX	xsd	http://www.w3.org/2001/XMLSchema#		
PREFIX	skos	http://www.w3.org/2004/02/skos/core#		
dct:title				
dct:description				
dct:creator				
dct:rights				
pav:version				
pav:createdOn				
pav:lastUpdatedOn				
Identifier	**skos:prefLabel@en**	**skos:altLabel(separator=",")**	**skos:definition@en**	**skos:broader(separator=",")**
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				
vocab-name:				

ConceptScheme URI	http://ontology.deic.org/cv/vocab-name/	
PREFIX	vocab-name	http://ontology.deic.org/cv/vocab-name/
PREFIX	pav	http://purl.org/pav/
PREFIX	dct	http://purl.org/dc/terms/
PREFIX	owl	http://www.w3.org/2002/07/owl#
PREFIX	xsd	http://www.w3.org/2001/XMLSchema#
PREFIX	skos	http://www.w3.org/2004/02/skos/core#
dct:title		
dct:description		
dct:creator		
dct:rights		
pav:version		
pav:createdOn		
pav:lastUpdatedOn		
Identifier	**skos:prefLabel@en**	**skos:altLabel(separator=",")**
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		
vocab-name:		

General setup

Controlled vocabulary metadata

Definition of terms and properties

General setup

Controlled vocabulary metadata

Definition of terms and properties

ConceptScheme URI	http://ontology.deic.org/cv/vocab-name/			
PREFIX	vocab-name	http://ontology.deic.org/cv/vocab-name/		
PREFIX	pav	http://purl.org/pav/		
PREFIX	dct	http://purl.org/dc/terms/		
PREFIX	owl	http://www.w3.org/2002/07/owl#		
PREFIX	xsd	http://www.w3.org/2001/XMLSchema#		
PREFIX	skos	http://www.w3.org/2004/02/skos/core#		

- **ConceptScheme URI**: This is a base URL for all your controlled terms (aka concepts in SKOS).
  In this example:
  http://ontology.deic.org/cv/vocab-name/

- **skos , dct, pav, xsd, and owl** are generic controlled vocabularies (ontologies) which contain properties that are used to define terms and metadata of a domain specific controlled vocabulary **:**
  skos – Simple Knowledge Organization System
  dct – Dublin Core Terms
  pav – Provenance Authoring and Versioning
  owl – Web Ontology Language
  xsd - XML Schema Definition

- **PREFIX**: A prefixed name is turned into an URL by concatenating the URL associated with the prefix.
  For example:
  vocab-name will be turned into **http://ontology.deic.org/cv/vocab-name/**
  pav will be turned into **http://purl.org/pav/**
  dct will be turned into **http://purl.org/dc/terms/**
  …

-

dct:title	Insert values here
dct:description	
dct:creator	
dct:rights	
pav:version	
pav:createdOn	
pav:lastUpdatedOn	

- It is recommended to re-use general ontologies to provide metadata about a controlled vocabulary, e.g.:
  - **dct:title –** controlled vocabulary title
  - **dct:creator –** ORCID ID of the vocabulary creator (full URL!), repeat this row as many time as there are vocabulary creators
  - **dct:rights –** usage license of the vocabulary, preferably chose license from https://spdx.org/licenses/ and place a full URL of it (e.g., http://spdx.org/licenses/CC0-1.0 for CC0-1.0 license)
  - **pav:version** – version of the controlled vocabulary, e.g. in a form of *majorChange.minorChange.bugFix*
  - **pav:createdOn** – initial datetime of the vocabulary creation in ISO 8601 format (include time zone!)
  - **pav:lastUpdatedOn** – datetime of the last vocabulary update in ISO 8601 format (include time zone!)

dct:title	Insert values here
dct:description	
dct:creator	
dct:rights	
pav:version	
pav:createdOn	
pav:lastUpdatedOn	

- Every time you update your control vocabulary update:
  pav:lastUpdatedOn
  and
  pav:version
  *small modifications → change last digit → 0.1.**0***
  *minor modifications → change middle digit → 0.**1**.0*
  *major modifications → change first digit → **0**.1.0*

- *Small, minor and major up to you to decide, but small changes could be spelling corrections, minor could be addition of new terms, major could be re-arrangement of hierarchy or deprecation/substitution of terms.*

Identifier	skos:prefLabel@en
vocab-name:	Insert values here
vocab-name:	
vocab-name:	

- Column **Identifier** will be automatically generated based on values in column **skos:prefLabel**, and it will be eventually turned into **URL!**

  NB: The URL (and thus the skos:prefLabel) should be composed from a limited set of characters (US-ASCII), i.e. digits (0-9), letters(A-Z, a-z), special characters ("-", ".", "_", "~")

- If you really need to use characters in **skos:prefLabel** column which does not satisfy the above requirement, then you need to manually edit **Identifier** column such that the requirement is satisfied!!!

Identifier	skos:prefLabel@en
vocab-name:	
vocab-name:	
vocab-name:	

Example:

prefLabel = Århus , results in **Identifier = vocab-name:Århus**, which is then turned into http://ontology.deic.org/cv/vocab-name/Århus and this is not a functional URL!

Therefore, if using 'Å' is important, you must manually replace **Identifier** with a value that can turn into a proper URL, for example:
Identifier = vocab-name:AArhus

Identifier	skos:prefLabel@en
vocab-name:	
vocab-name:	
vocab-name:	

- **@en** part in **skos:prefLabel@en** indicates in what language the preferred label is given (en = English).
- To change preferred label language tag find appropriate two-letter tag in: https://www.iana.org/assignments/language-subtag-registry/language-subtag-registry
- **You can have preferred labels in multiple language, but you can only have one preferred label per language tag!!!**
- **Terms must have unique preferred labels, i.e. two different terms cannot have same preferred labels!**

Identifier	skos:prefLabel@en	skos:altLabel(separator=",")
vocab-name:		
vocab-name:		
vocab-name:		

- **skos:altLabel** is an alternative label for the term you are defining. Unlike **skos:prefLabel** you can have both multiple alternative labels in multiple languages.
- To enter multiple **altLabel** in column simply separate them with “,” (comma), that’s why we have **(separator=“,”)** in **skos:altLabel(separator=“,”)**
- If you prefer other ways of separating values in this column change this value accordingly.

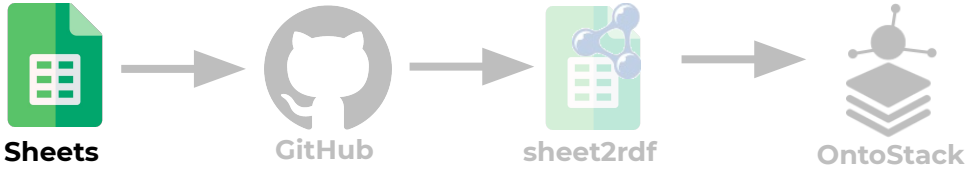
Identifier	skos:prefLabel@en	skos:altLabel(separator=",")	skos:definition@en
vocab-name:			
vocab-name:			
vocab-name:			

- **skos:definition** column is used to define your terms.
- Always define your terms! If you have trouble defining it yourself, get a domain expert(s) to help you.
- Similar to **skos:prefLabel,** you can have definitions in multiple languages, but there can be only one definition per language tag!
- Change the current language tag (**en**) or add additional **skos:definition** columns associate with different language tags as you like/need.

Identifier	skos:prefLabel@en	skos:altLabel(separator=",")	skos:definition@en	skos:broader(separator=",")
vocab-name:				
vocab-name:				
vocab-name:				

- **skos:broader** column is used to express hierarchy in your controlled vocabulary in cases when your controlled vocabulary is not a simple flat list of terms but has more of a tree structure (see taxonomies).
- Specifically, if your term is under some broader concept then you should put **Identifier** of that broader concept in this column.
- In case your term has several broader concepts, simply separate their corresponding **Identifiers** with comma.
- If a term is a top concept (i.e., does not have broader concepts) leave this column empty.

A few more columns you will encounter in the template…

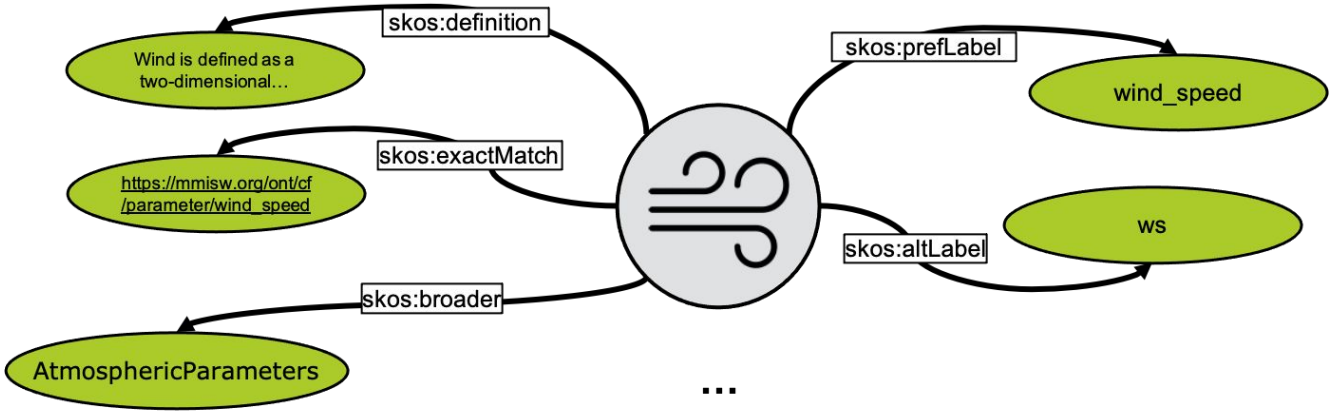


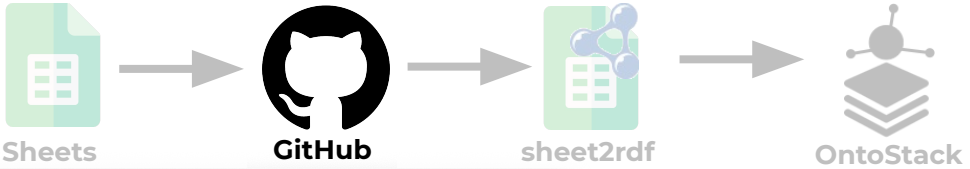
- **dct:source -** place reference, such as URL, to the source material that you used to define a term.
- **skos:closeMatch** - place Identifier of term from this or another vocabulary to which the term you defined is closely related
- **skos:exactMatch** - place Identifier of term from this or another vocabulary to which the term you defined is identical to the term you are defining
- **owl:deprecated -** in case term is deprecated set value to **true** in this column
- **dct:isReplacedBy -** in case when deprecated term has been replaced by another terms, put URL of new term in this column
- **dct:creator -** put ORCID ID of term creator, for multiple contributors separate their IDs with comma
- **dct:contributor -** put ORCID ID of term contributor, for multiple contributors separate their IDs with comma
- …

Example for wind speed

ConceptScheme URI	http://data.windenergy.dtu.dk/controlled-terminology/wind-energy-parameters/	
PREFIX	wep	http://data.windenergy.dtu.dk/controlled-terminology/wind-energy-parameters/
PREFIX	pav	http://purl.org/pav/
PREFIX	dct	http://purl.org/dc/terms/
PREFIX	owl	http://www.w3.org/2002/07/owl#
PREFIX	xsd	http://www.w3.org/2001/XMLSchema#
PREFIX	skos	http://www.w3.org/2004/02/skos/core#
dct:title	Wind Energy Parameters	
dct:description	Controlled vocabulary of parameters used in wind energy domain.	
dct:creator	https://ror.org/04qtj9h94	
dct:rights	https://spdx.org/licenses/CC0-1.0	
pav:version	0.1.0	
pav:createdOn	2020-10-22T22:00:00+01:00	
pav:lastUpdatedOn	2020-10-23T08:00:00+01:00	

Identifier	skos:prefLabel@en	skos:altLabel(separator=",")	skos:definition@en	skos:broader(separator=",")	skos:exactMatch(separator=",")
wep:AtmosphericParameters	Atmospheric Parameters		This is a category of parameters associated wi		
wep:wind_speed	wind_speed	ws	Wind is defined as a two-dimensional (horizon	wep:AtmosphericParameters	https://mmisw.org/ont/cf/parameter/wind_speed





m4m-dk/workshop-1-controlle

github.com/m4m-dk/workshop-1-controlled-vocabulary

This branch is 6 commits ahead, 3 commits behind niva83:main. Pull request Compare

github-actions new .ttl from Google sheet has been generated 64a8726 15 days ago 54 commits

.github/workflows	enable push to graph database	15 days ago
logs	new .ttl from Google sheet has been generated	15 days ago
src	cleaning up script	15 days ago
License.md	Update License.md	15 days ago
README.md	Update README.md	15 days ago
taxonomy.csv	new .ttl from Google sheet has been generated	15 days ago
taxonomy.ttl	new .ttl from Google sheet has been generated	15 days ago
taxonomy.xlsx	new .ttl from Google sheet has been generated	15 days ago

README.md

Sheet2RDF pa

workshop-1-controlled-vocabulary

This repository contains forked automatic workflow sheet2rdf, which:

- Converts Google Sheet to machine-actionable and FAIR RDF vocabulary
- Tests the converted vocabulary
- Commits conversion results and tests logs to this repository
- and deploy RDF vocabulary to OntoStack to be served to humans and machines

The workflow is used to created controlled vocabularies during Danish M4M Workshop No. 1.

License

This work is licensed under Apache 2.0 License.

Automatic workflow tuned for generation and deployement of controlled vocabularies from Google Sheets.

metadata fair-data m4m machine-actionable

Readme

View license

Releases

1 tags

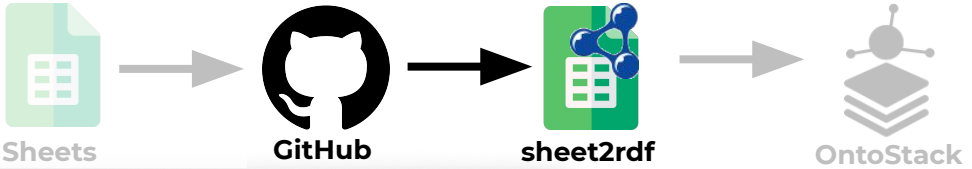
Create a new release

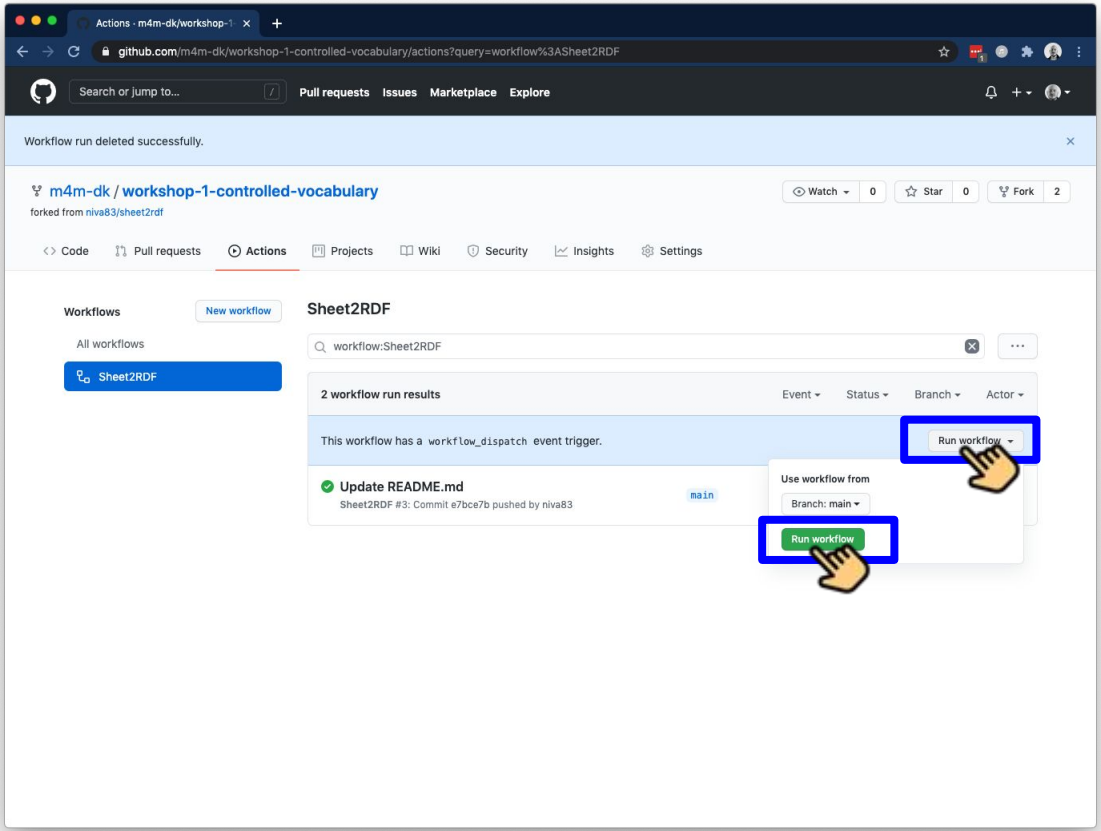
Packages

No packages published
Publish your first package

Languages

Python 70.9% Shell 29.1%


Sheets
GitHub
sheet2rdf
OntoStack


Actions · m4m-dk/workshop-1
github.com/m4m-dk/workshop-1-controlled-vocabulary/actions?query=workflow%3ASheet2RDF
Search or jump to...
Pull requests
Issues
Marketplace
Explore
Workflow run deleted successfully.
m4m-dk / workshop-1-controlled-vocabulary
forked from niva83/sheet2rdf
Watch 0
Star 0
Fork 2
Code
Pull requests
Actions
Projects
Wiki
Security
Insights
Settings
Workflows
New workflow
All workflows
Sheet2RDF
Sheet2RDF
workflow:Sheet2RDF
2 workflow run results
Event
Status
Branch
Actor
This workflow has a workflow_dispatch event trigger.
Run workflow
Update README.md
Sheet2RDF #3: Commit e7bce7b pushed by niva83
main
Use workflow from
Branch: main
Run workflow

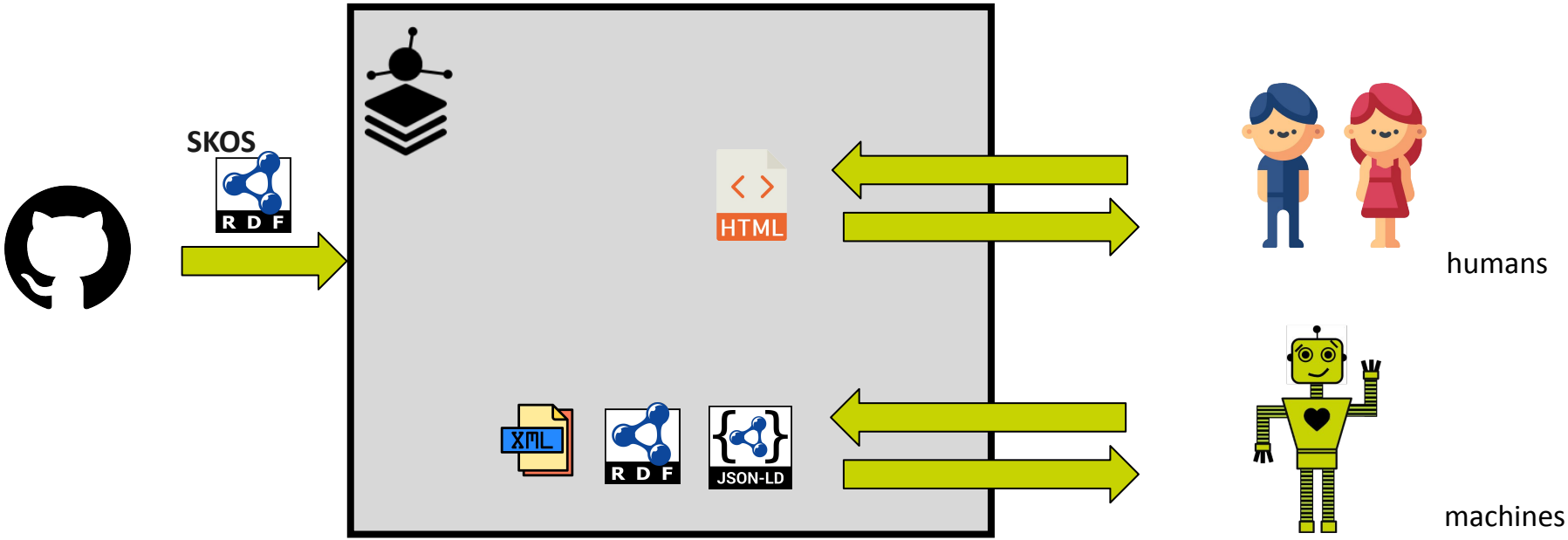
Sheet2RDF

- Automatic workflow executed by means of GitHub actions
- Contains underlying shell, python and java programs which:
  - (1) converts the previous Google Sheet to the machine-actionable controlled vocabulary
  - (2) tests the derived controlled vocabulary
  - (3) commits the conversion results and tests logs to a Git repository
  - (4) deploys the vocabulary to **OntoStack to be served to humans and machines**
- **Sheet2RDF** is used by:
  - DTU Wind Energy
  - DeiC
  - International Energy Agency WIND Task 32
  - Dutch COVID program
  - …

https://github.com/fair-data-collective/sheet2rdf

OntoStack

> A set of orchestrated micro-services configured and interfaced such that they can intake terminologies and serve them to humans or machines

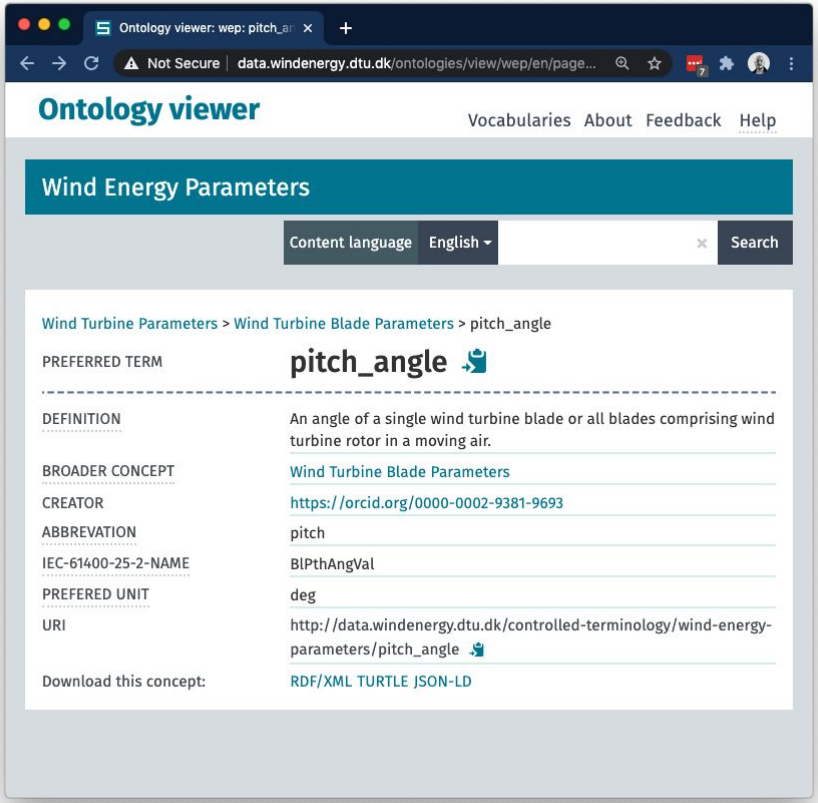


OntoStack in its core

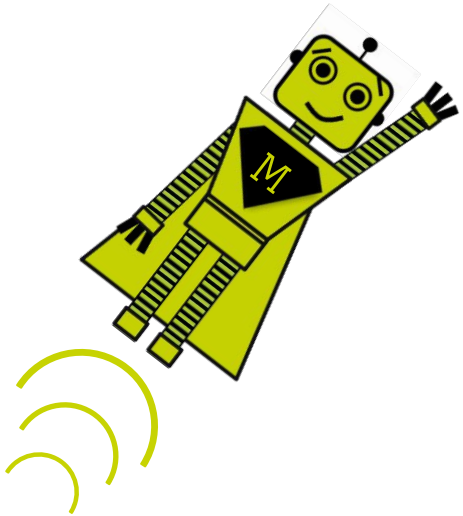
- A set of orchestrated micro-services:
  - Edge router (**Traefik**)
  - Graph database (**Apache Jena Fuseki**)
  - Web-based terminology browser/UI (**SKOSMOS**)

- Four instances of OntoStack:
  - Departmental:
    http://data.windenergy.dtu.dk/ontologies/view
  - National:
    http://ontology.deic.dk
  - International:
    http://vocab.fairdatacollective.org/
    http://vocab.ieawindtask32.org/

OntoStack response to Resolvable Identifier



OntoStack response to Resolvable Identifier



data.windenergy.dtu.dk/ontolo

Not Secure | data.windenergy.dtu.dk/ontologies/view/rest/v1/wep/d...

```
@prefix wep: <http://data.windenergy.dtu.dk/controlled-terminology/wind-energy-parameters/>
.
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix dc: <http://purl.org/dc/terms/> .

wep:abbrevation
  skos:definition "A shortened form of a parameter label used as a short name of parameter
in different applications."@en ;
  rdfs:label "abbrevation"@en .

wep:WindTurbineBladeParameters
  skos:prefLabel "Wind Turbine Blade Parameters"@en ;
  a skos:Concept ;
  skos:narrower wep:pitch_angle .

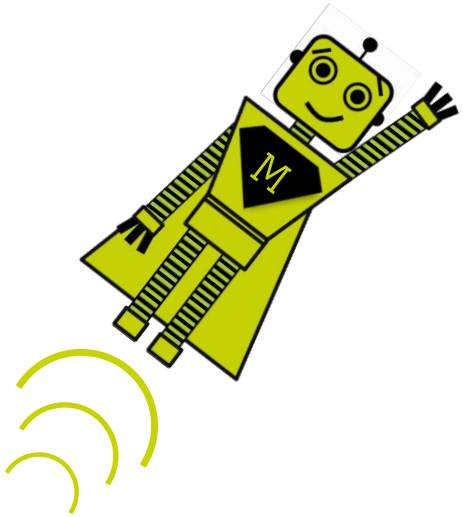
wep:
  skos:prefLabel "WindEnergyParameters"@en ;
  a skos:ConceptScheme .

wep:iec-61400-25-2-name
  skos:definition "IEC 61400-25-2 standardized name of a parameter"@en ;
  rdfs:label "iec-61400-25-2-name"@en .

wep:pitch_angle
  skos:broader wep:WindTurbineBladeParameters ;
  wep:long-name "Pitch Angle"@en ;
  skos:definition "An angle of a single wind turbine blade or all blades comprising wind
turbine rotor in a moving air."@en ;
  wep:prefUnit "deg"@en ;
  dc:creator <https://orcid.org/0000-0002-9381-9693> ;
  a skos:Concept ;
  wep:iec-61400-25-2-name "BlPthAngVal"@en ;
  wep:abbrevation "pitch"@en ;
  skos:inScheme wep: ;
  skos:prefLabel "pitch_angle"@en .

wep:prefUnit
  skos:definition "A prefered unit for a given parameter"@en ;
  rdfs:label "prefered unit"@en .
```

OntoStack response to Resolvable Identifier



data.windenergy.dtu.dk/ontolo

Not Secure | data.windenergy.dtu.dk/ontologies/view/rest/v1/wep/d...


```
{
  "@context": {
    "skos": "http://www.w3.org/2004/02/skos/core#",
    "isothes": "http://purl.org/iso25964/skos-thes#",
    "rdfs": "http://www.w3.org/2000/01/rdf-schema#",
    "owl": "http://www.w3.org/2002/07/owl#",
    "dct": "http://purl.org/dc/terms/",
    "dc11": "http://purl.org/dc/elements/1.1/",
    "uri": "@id",
    "type": "@type",
    "lang": "@language",
    "value": "@value",
    "graph": "@graph",
    "label": "rdfs:label",
    "prefLabel": "skos:prefLabel",
    "altLabel": "skos:altLabel",
    "hiddenLabel": "skos:hiddenLabel",
    "broader": "skos:broader",
    "narrower": "skos:narrower",
    "related": "skos:related",
    "inScheme": "skos:inScheme",
    "exactMatch": "skos:exactMatch",
    "closeMatch": "skos:closeMatch",
    "broadMatch": "skos:broadMatch",
    "narrowMatch": "skos:narrowMatch",
    "relatedMatch": "skos:relatedMatch"
  },
  "graph": [
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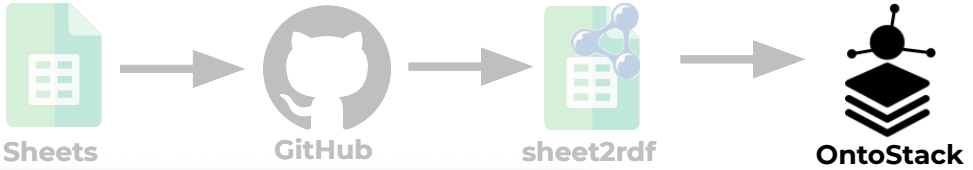
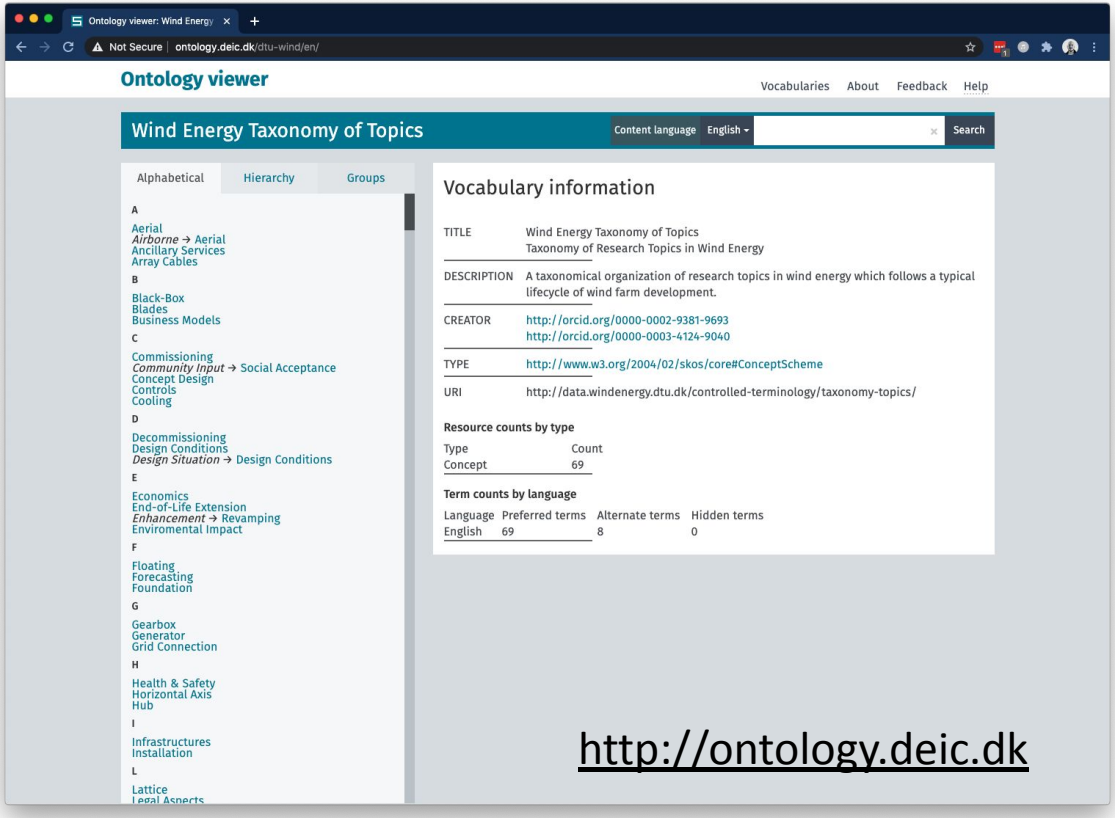
JSON-LD





http://ontology.deic.dk

BioPortal

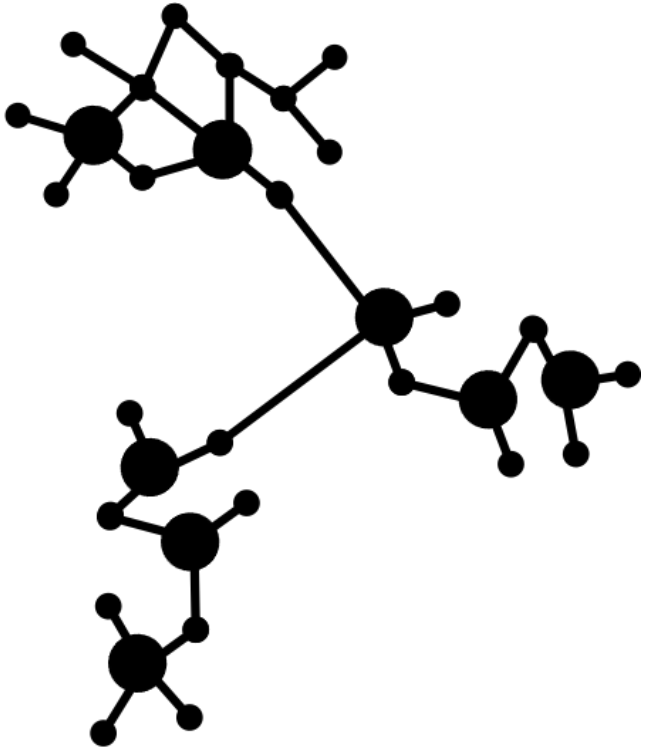
BioPortal allows you to:

- Browse the library of ontologies
- Search for a term across multiple ontologies
- Browse mappings between terms in different ontologies
- Receive recommendations on which ontologies are most relevant for a corpus
- Annotate text with terms from ontologies
- …
- **Make use of controlled vocabularies in CEDAR Workbench**

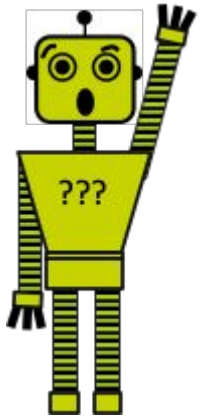
Configure BioPortal to automatically load sheet2rdf vocabularies

1. Go to the ***Github*** repository which is configured to run ***sheet2rdf*** workflow
2. Find ***vocabulary.ttl*** file in the repository
3. Click on ***vocabulary.ttl***
4. Click on the ***Raw*** button
5. Copy the resulting link from the browser bar
6. Open another tab and go to ***BioPortal*** (make sure you have a BioPortal account that you are logged in)
7. Click on ***Ontologies***
8. Click on ***Submit New Ontology***
9. Fill in necessary fields
10. Click ***Create ontology***
11. Fill in necessary fields
12. In Location select ***Load from URL***
13. Past the link you copied before
14. Click ***Add submission***
15. Click on the link that ***BioPortal*** generated for you which will be landing page for your vocabulary in ***BioPortal***

Every night ***BioPortal*** will check if there is new version of the vocabulary and register it if there is.
A video walkthrough: **http://bit.ly/m4m-bioportal-github**



QUESTIONS???



CREDITS

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Vasiljevic, Nikola. (2021).
MetaManMachine. Zenodo.
http://doi.org/10.5281/zenodo.4471098
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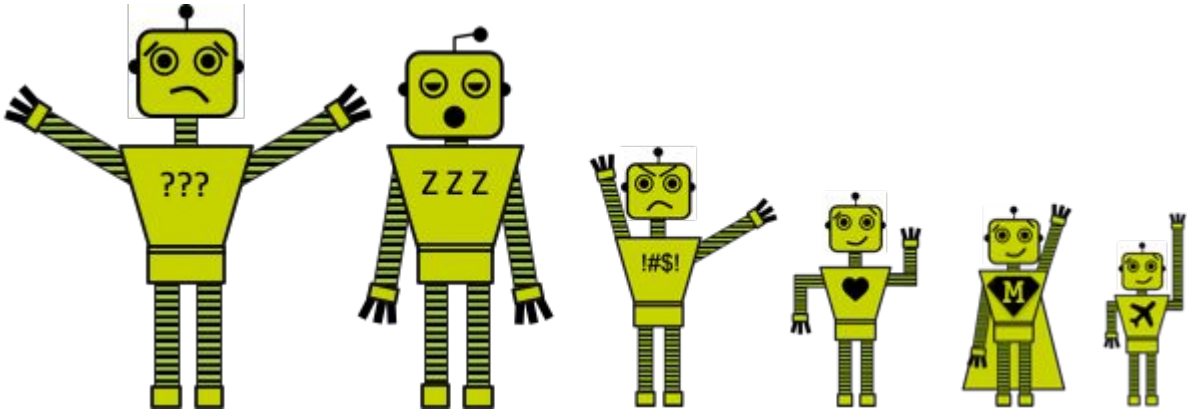

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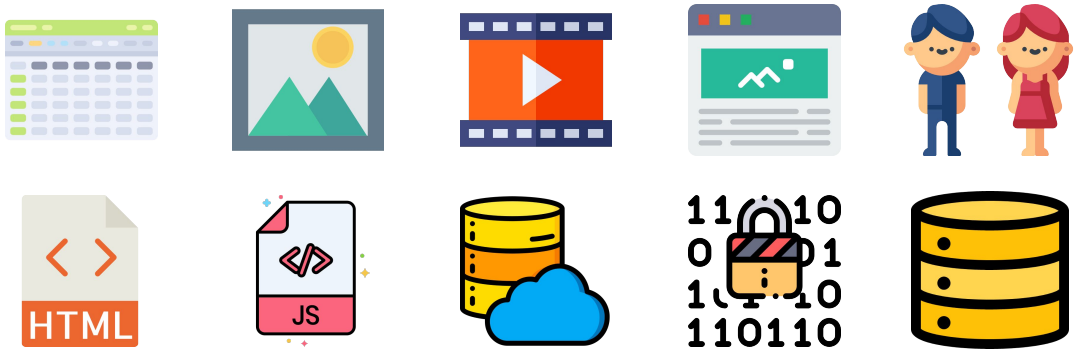

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