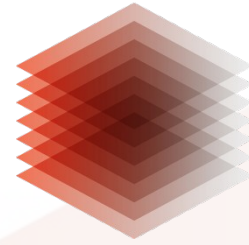

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TIB

Challenges in the Creation and Uptake of Ontologies

International Workshop on Data-driven Resilience Research 2022 (Leipzig)
Dr.-Ing. Felix Engel
06. Juli 2022

Agenda

1. **Ontologies to foster economic resilience**
2. **Terminology Service**
3. **Cross Stakeholder Visualisation**

Ontologies to foster economic resilience

Introduction

Resilience in economics, depends on well **informed decisions** [2]

*Businesses should invest in technologies that allow them to connect with suppliers and make use of real-time **data** that can enable the whole supply chain to operate more efficiently on the basis of better **informed** decisions.*

- ***Data** is raw, unorganized facts that need to be processed. Data can be something simple and seemingly random and useless until it is organized [1]*
- ***Information:** When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information. [1]*

One huge challenge: preparation of data and communication of information as *basis of better informed decisions*

[1] https://www.diffen.com/difference/Data_vs_Information

[2] <https://www.pinsentmasons.com/out-law/analysis/role-of-data-supply-chains-resilient>

Ontologies to foster economic resilience

Creating a shared, unambiguous and holistic understanding

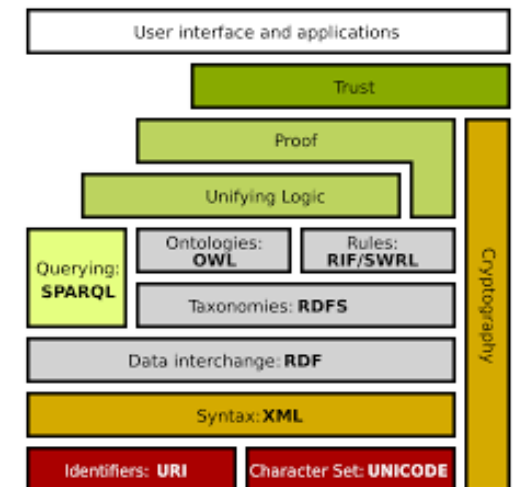
- **CoyPu** and **SC3 Project** makes use of **Ontologies** to build an unambiguous **communication framework**
 - Formal, shared description of knowledge
 - Machine processable to support automated inferences



- BMWK funded **CoyPu** (*Cognitive Economy Intelligence Plattform für die Resilienz wirtschaftlicher Ökosysteme*)
 - **COY-Ontology**: Upper and domain specific ontologies to formalize crisis relevant events and context information



- EC funded **SC3** (*Semantically Connected Semiconductor Supply Chains*)
 - **Digital Reference Ontology**: supply chains containing semiconductors



Ontologies to foster economic resilience

Core characteristics

Three general challenges in **ontology creation** and **uptake**

1. **Domain specific** (Engineering, Culture, Chemistry, ...) and **community specific**
2. **Evolving continuously and dynamically over time**

3. Must be **accepted, developed** and **maintained** by a **designated community (avoid isolated solution!)**. Includes a.o.

- a) promotion (make community aware of its existence)
- b) aligned with further initiatives (moving away from silos)

**Terminology
Service**

4. Development and maintenance is a **cooperation** between

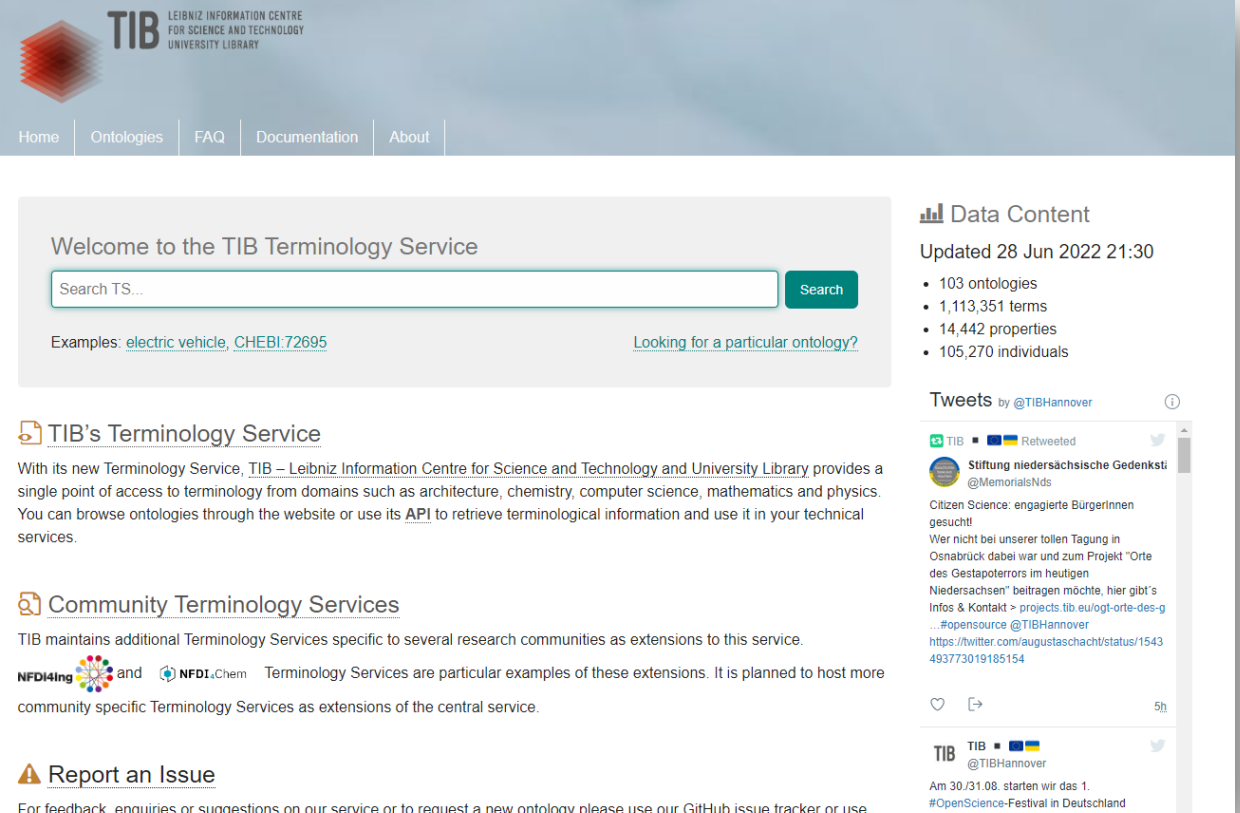
1. Domain experts (designated community)
2. Knowledge engineers

**Cross Stakeholder
Visualisation**

Terminology Service

3. *Must be accepted, developed and maintained by a designated community (avoid isolated solution!).*

- **In general:** A Terminology Service is a web based platform that support take-up and standardisation of ontologies
- **First version released July '21:** <https://service.tib.eu/ts4tib/index>
- **Some statistics**
 - ~ 100 Ontologies
 - 8 Collections
- **Functional service offer**
 - Freetext search searching (for- and within ontologies)
 - Browsing and filtering
 - Visualisation
 - Issue tracker
 - Machine to machine communication (REST interfaces)

The screenshot shows the TIB Terminology Service website. At the top, there is a navigation menu with links for Home, Ontologies, FAQ, Documentation, and About. Below the navigation is a search bar with the placeholder text "Search TS..." and a "Search" button. Below the search bar, there are examples of search terms: "electric vehicle" and "CHEBI:72695", and a link "Looking for a particular ontology?".

The main content area is divided into two columns. The left column contains the following sections:

- TIB's Terminology Service:** A paragraph describing the service as a single point of access to terminology from various domains, with a link to the API.
- Community Terminology Services:** A paragraph stating that TIB maintains additional services for research communities, with examples like NFDI4Ing and NFDI.Chem.
- Report an Issue:** A link to the GitHub issue tracker for feedback and suggestions.

The right column contains a "Data Content" section with the following statistics:

- Updated 28 Jun 2022 21:30
- 103 ontologies
- 1,113,351 terms
- 14,442 properties
- 105,270 individuals

Below the statistics is a "Tweets by @TIBHannover" section showing a tweet from the "Stiftung niedersächsische Gedenkstätten" (@MemorialsNds) about a citizen science project in Osnabrück.

Terminology Service

3. Must be accepted, developed and maintained by a designated community (avoid isolated solution!).

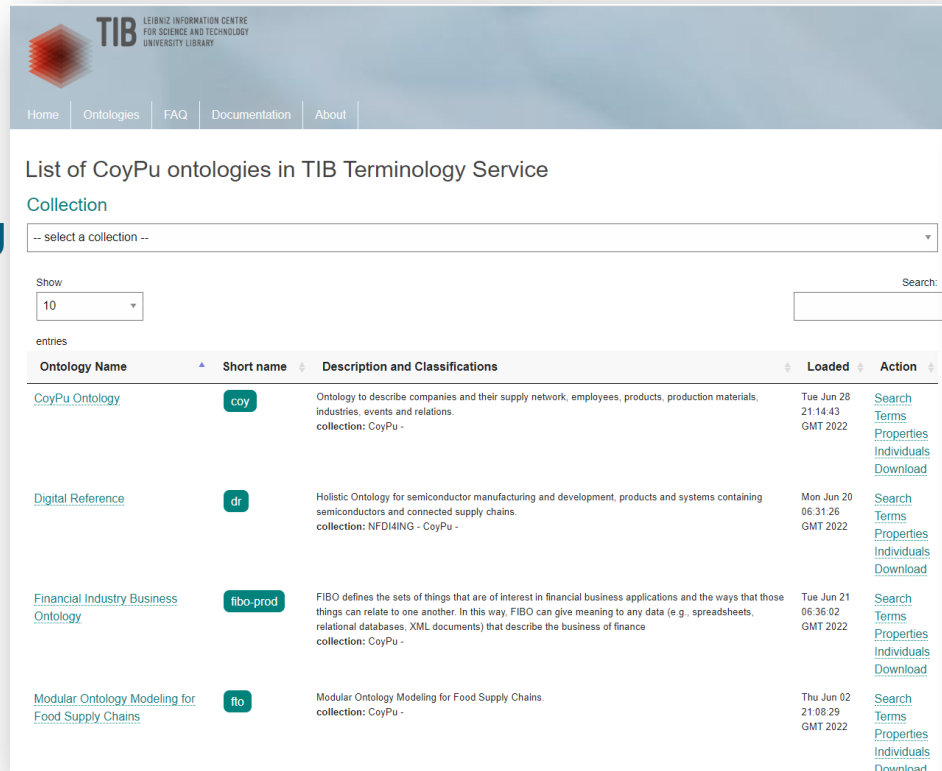
3. Must be accepted, developed and maintained by a designated community (avoid isolated solution!)

CoyPu Collection

- 6 ontologies
- extensible

CoyPu Mappings

- Visualization of communalities between ontologies
- TS wide and CoyPu wide
- Similarity calculation (shared resources)

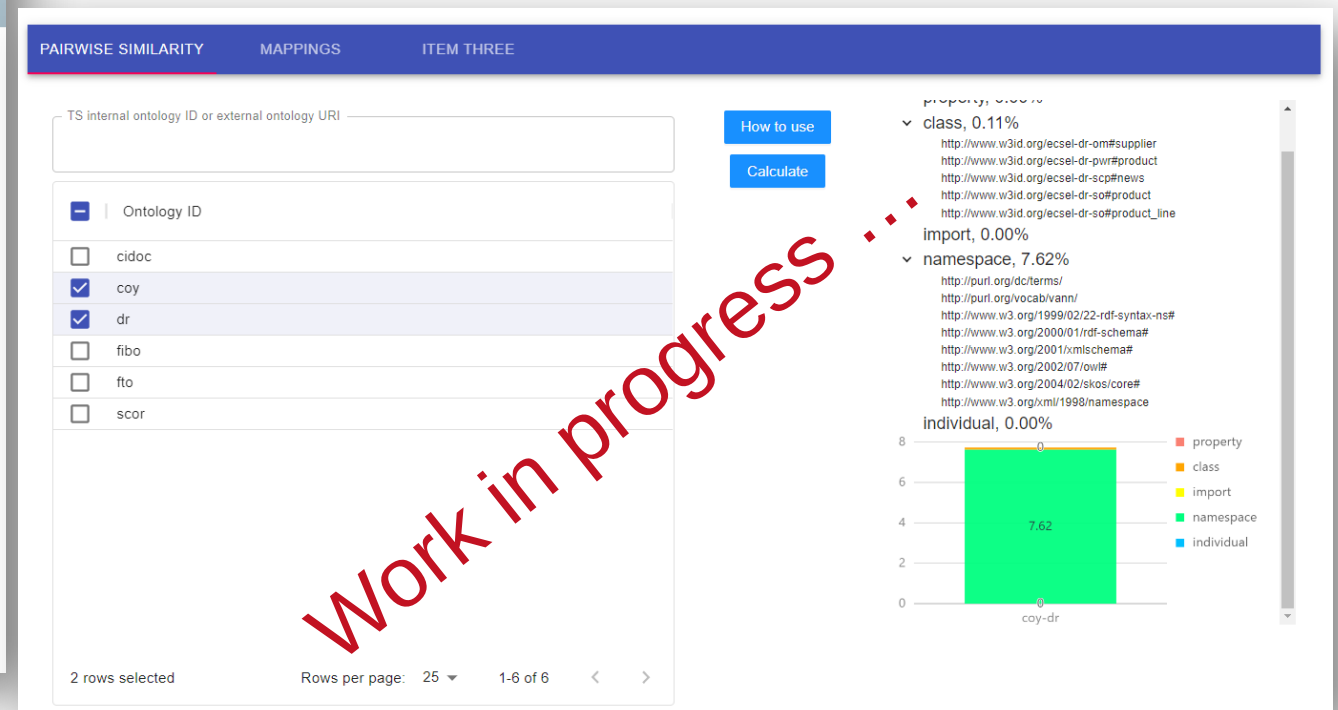



List of CoyPu ontologies in TIB Terminology Service

Collection: -- select a collection --

Show: 10

Ontology Name	Short name	Description and Classifications	Loaded	Action
CoyPu Ontology	coy	Ontology to describe companies and their supply network, employees, products, production materials, industries, events and relations. collection: CoyPu -	Tue Jun 28 21:14:43 GMT 2022	Search Terms Properties Individuals Download
Digital Reference	dr	Holistic Ontology for semiconductor manufacturing and development, products and systems containing semiconductors and connected supply chains. collection: NFDHING - CoyPu -	Mon Jun 20 06:31:26 GMT 2022	Search Terms Properties Individuals Download
Financial Industry Business Ontology	fib-prod	FIBO defines the sets of things that are of interest in financial business applications and the ways that those things can relate to one another. In this way, FIBO can give meaning to any data (e.g. spreadsheets, relational databases, XML documents) that describe the business of finance collection: CoyPu -	Tue Jun 21 06:36:02 GMT 2022	Search Terms Properties Individuals Download
Modular Ontology Modeling for Food Supply Chains	fto	Modular Ontology Modeling for Food Supply Chains. collection: CoyPu -	Thu Jun 02 21:08:29 GMT 2022	Search Terms Properties Individuals Download



PAIRWISE SIMILARITY MAPPINGS ITEM THREE

TS internal ontology ID or external ontology URI

How to use Calculate

Ontology ID

- cidoc
- coy
- dr
- fibo
- fto
- scor

2 rows selected Rows per page: 25 1-6 of 6

property, 0.00%

- class, 0.11%
 - <http://www.w3id.org/ecsel-dr-om#supplier>
 - <http://www.w3id.org/ecsel-dr-pwr#product>
 - <http://www.w3id.org/ecsel-dr-scp#news>
 - <http://www.w3id.org/ecsel-dr-so#product>
 - http://www.w3id.org/ecsel-dr-so#product_line
- import, 0.00%
- namespace, 7.62%
 - <http://purl.org/dc/terms/>
 - <http://purl.org/vocab/vann/>
 - <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
 - <http://www.w3.org/2000/01/rdf-schema#>
 - <http://www.w3.org/2001/XMLSchema#>
 - <http://www.w3.org/2002/07/owl#>
 - <http://www.w3.org/2004/02/skos/core#>
 - <http://www.w3.org/xml/1998/namespace>
- individual, 0.00%

7.62

coy-dr

property class import namespace individual

Work in progress

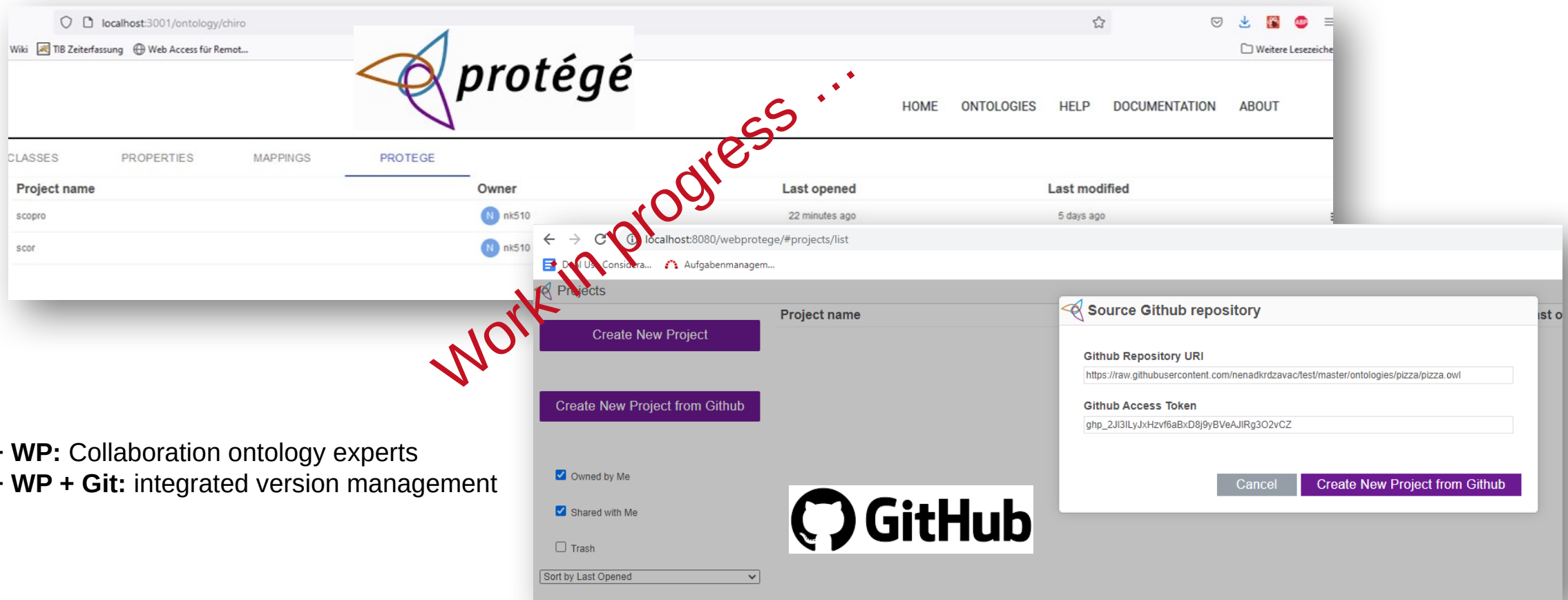
Terminology Service

3. *Must be accepted, developed and maintained by a designated community (avoid isolated solution!).*

3. Must be **accepted, developed** and **maintained** by a **designated community (avoid isolated solution!)**

Support for knowledge worker: **Terminology Service / WebProtege / Git integration**

COYPU



The screenshot shows the Protege web interface at localhost:3001/ontology/chiro. A table lists projects:

Project name	Owner	Last opened	Last modified
scopro	nk510	22 minutes ago	5 days ago
scor	nk510		

A dialog box titled "Source Github repository" is open, showing the following fields:

- Github Repository URI: `https://raw.githubusercontent.com/menadkrdzavac/test/master/ontologies/pizza/pizza.owl`
- Github Access Token: `ghp_2Jl3lLyJxHzvf6aBxD8j9yBVeAJIRg3O2vCZ`

Buttons: Cancel, Create New Project from Github

A large red watermark "Work in progress" is overlaid on the screenshot.

- **TS + WP:** Collaboration ontology experts
- **TS + WP + Git:** integrated version management

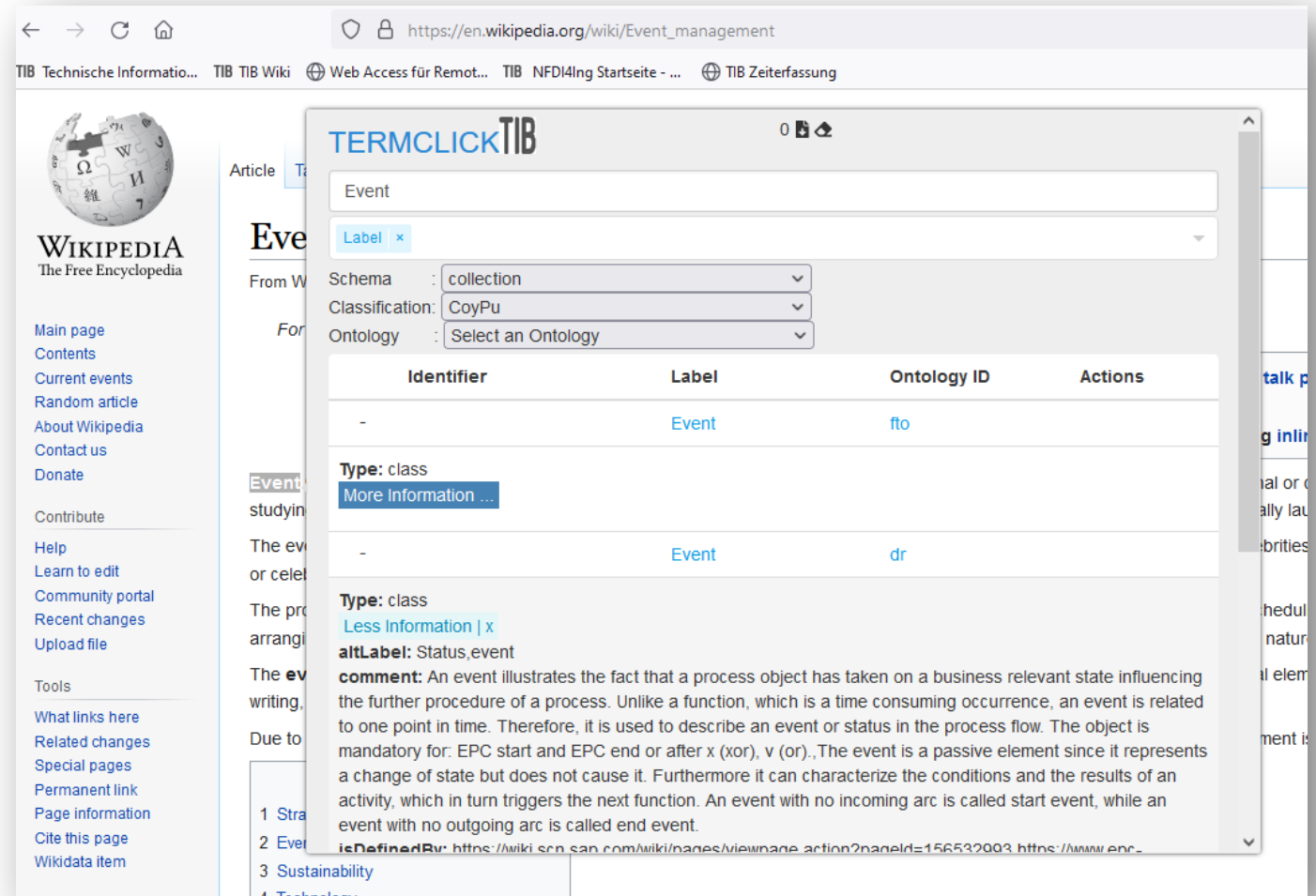
Terminology Service

3. *Must be accepted, developed and maintained by a designated community (avoid isolated solution!).*

3. Must be **accepted, developed and maintained** by a **designated community (avoid isolated solution!)**

TermClick

- FF Plugin that queries the COY from TS
- Mark a word in an arbitrary website
- Get a COY definition



The screenshot shows a browser window with the URL https://en.wikipedia.org/wiki/Event_management. A TermClickTIB overlay is active, displaying search results for the term 'Event'. The overlay includes a search bar with 'Event' entered, a 'Label x' dropdown, and three dropdown menus for Schema (collection), Classification (CoyPu), and Ontology (Select an Ontology). Below these are two search results in a table:

Identifier	Label	Ontology ID	Actions
-	Event	fto	
Type: class More Information ...			
-	Event	dr	

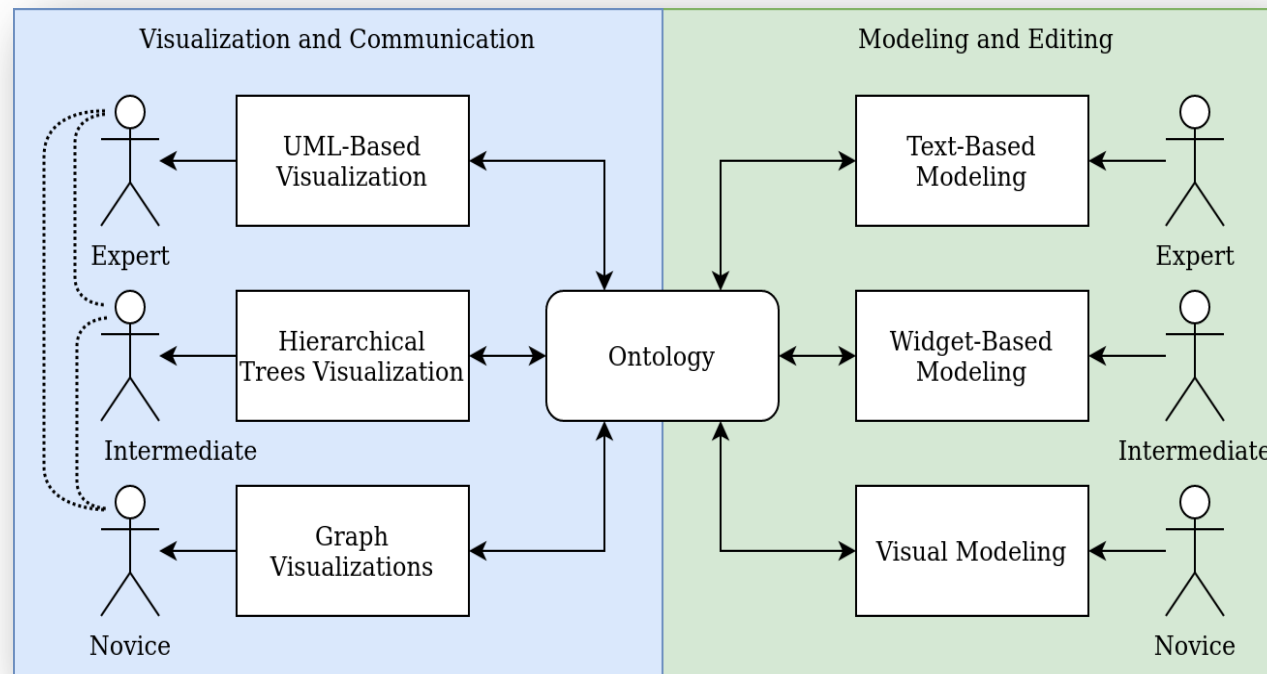
Below the table, there is a section for 'Type: class' with a link to 'Less Information | x'. The 'altLabel' is 'Status,event'. The 'comment' states: 'An event illustrates the fact that a process object has taken on a business relevant state influencing the further procedure of a process. Unlike a function, which is a time consuming occurrence, an event is related to one point in time. Therefore, it is used to describe an event or status in the process flow. The object is mandatory for: EPC start and EPC end or after x (xor), v (or). The event is a passive element since it represents a change of state but does not cause it. Furthermore it can characterize the conditions and the results of an activity, which in turn triggers the next function. An event with no incoming arc is called start event, while an event with no outgoing arc is called end event.'

The 'isDefinedBy' field contains the following URLs: <https://wiki.scp.san.com/wiki/pages/viewpage.action?pageId=156532993> and <https://www.erc->

Cross Stakeholder Visualisation

4. Collaborative development and maintenance

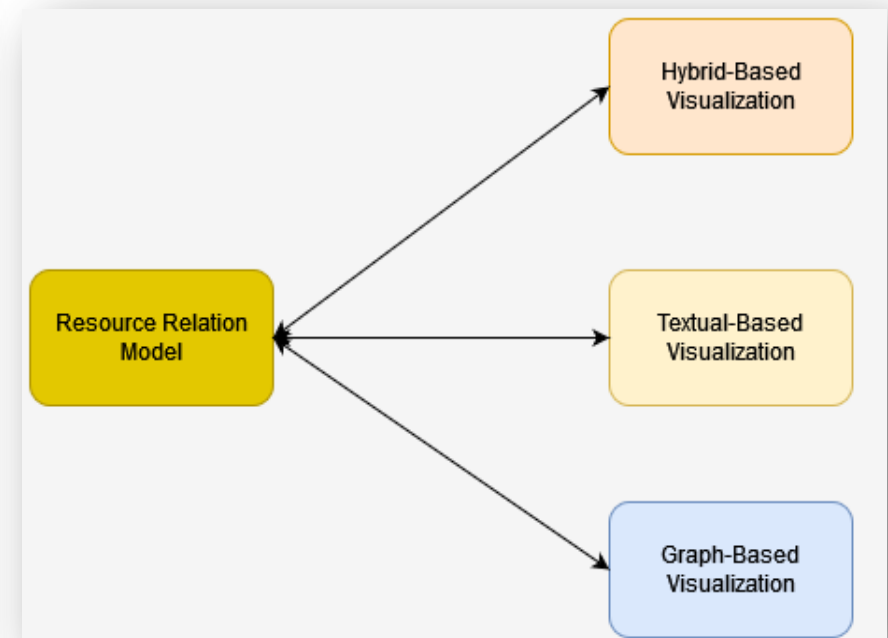
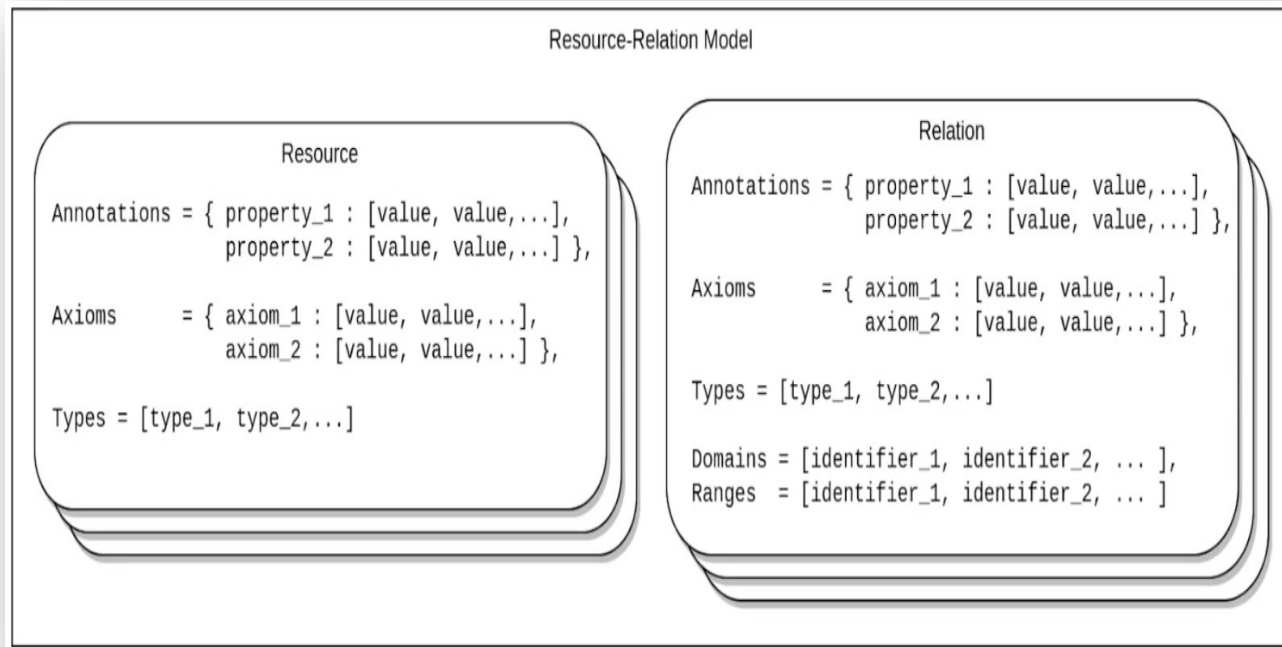
- A **cooperation** between
 - a. **Knowledge engineers**
 - b. **Domain experts (designated community)**
- Requires **translation**, between
 - implementation of a technical specification with high degree of details
 - Non overloaded (reduced) views on ontologies



Cross Stakeholder Visualisation

4. Collaborative development and maintenance

- **Resource Relation Model (Vitalis Wiens)**
 - A data model which serves as a foundation for visualizations and synchronization between different modes of operation
 - It is a textual representation of the ontology
 - Created through pre-processing step
 - provides some re-organization of triple statements to enable different modes of operation



Cross Stakeholder Visualisation

4. Collaborative development and maintenance

Experts and Intermediate
Enable more detailed views

- Textual visualisation
- Hybrid visualisation (text and vis.)
 - Meta information
 - Description
 - Version
 - ...
 - Vis. resource in context
 - Annotation view
 - Description view



```

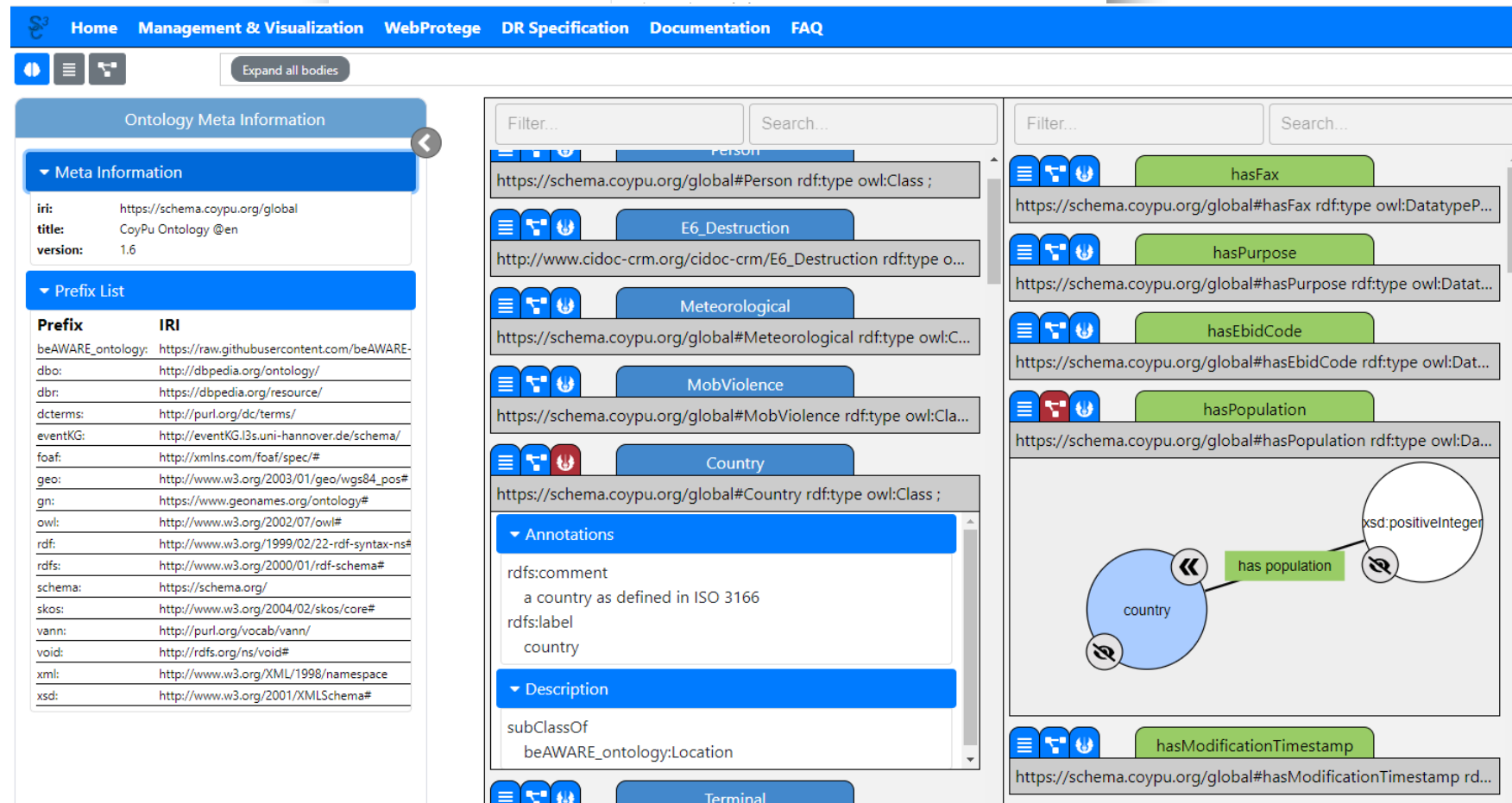
Home  Ontology Editor  DR Specification  Documentation  FAQ

@prefix dc: <http://purl.org/dc/elements/1.1/> .
@prefix ex: <http://example.com/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix vs: <http://www.w3.org/2003/06/sw-vocab-status/ns#> .
@prefix wot: <http://xmlns.com/wot/0.1/> .
@prefix xml: <http://www.w3.org/XML/1998/namespace> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

#####
# Ontology
#####
<http://example.com/> rdf:type owl:Ontology ;
    dc:description "Advanced Example Ontology. Holding multiple sub ontologies" .

#####
# Classes
#####

```



The screenshot shows the WebProtege interface with the following components:

- Navigation Bar:** Home, Management & Visualization, WebProtege, DR Specification, Documentation, FAQ.
- Expand all bodies:** A button to expand all ontology bodies.
- Ontology Meta Information:**
 - Meta Information:**
 - iri: <https://schema.coypu.org/global>
 - title: CoyPu Ontology @en
 - version: 1.6
 - Prefix List:**

Prefix	IRI
beAWARE_ontology:	https://raw.githubusercontent.com/beAWARE-ontology
dbo:	http://dbpedia.org/ontology/
dbr:	https://dbpedia.org/resource/
dcterms:	http://purl.org/dc/terms/
eventKG:	http://eventKG.l3s.uni-hannover.de/schema/
foaf:	http://xmlns.com/foaf/spec/#
geo:	http://www.w3.org/2003/01/geo/wgs84_pos#
gn:	https://www.geonames.org/ontology#
owl:	http://www.w3.org/2002/07/owl#
rdf:	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs:	http://www.w3.org/2000/01/rdf-schema#
schema:	https://schema.org/
skos:	http://www.w3.org/2004/02/skos/core#
vann:	http://purl.org/vocab/vann/
void:	http://rdfs.org/ns/void#
xml:	http://www.w3.org/XML/1998/namespace
xsd:	http://www.w3.org/2001/XMLSchema#
- Class List:**
 - Person:** <https://schema.coypu.org/global#Person> rdf:type owl:Class ;
 - E6_Destruction:** http://www.cidoc-crm.org/cidoc-crm/E6_Destruction rdf:type o...
 - Meteorological:** <https://schema.coypu.org/global#Meteorological> rdf:type owl:C...
 - MobViolence:** <https://schema.coypu.org/global#MobViolence> rdf:type owl:Cl...
 - Country:** <https://schema.coypu.org/global#Country> rdf:type owl:Class ;
- Annotations for Country:**
 - rdfs:comment: a country as defined in ISO 3166
 - rdfs:label: country
- Description for Country:**
 - subClassOf: beAWARE_ontology:Location
- Property List:**
 - hasFax:** <https://schema.coypu.org/global#hasFax> rdf:type owl:DatatypeP...
 - hasPurpose:** <https://schema.coypu.org/global#hasPurpose> rdf:type owl:Datat...
 - hasEbidCode:** <https://schema.coypu.org/global#hasEbidCode> rdf:type owl:Dat...
 - hasPopulation:** <https://schema.coypu.org/global#hasPopulation> rdf:type owl:Da...
 - hasModificationTimestamp:** <https://schema.coypu.org/global#hasModificationTimestamp> rd...
- Visual Representation:** A graph showing the 'country' class with a 'has population' property pointing to a 'xsd:positiveInteger' datatype.

Cross Stakeholder Visualisation

4. Collaborative development and maintenance

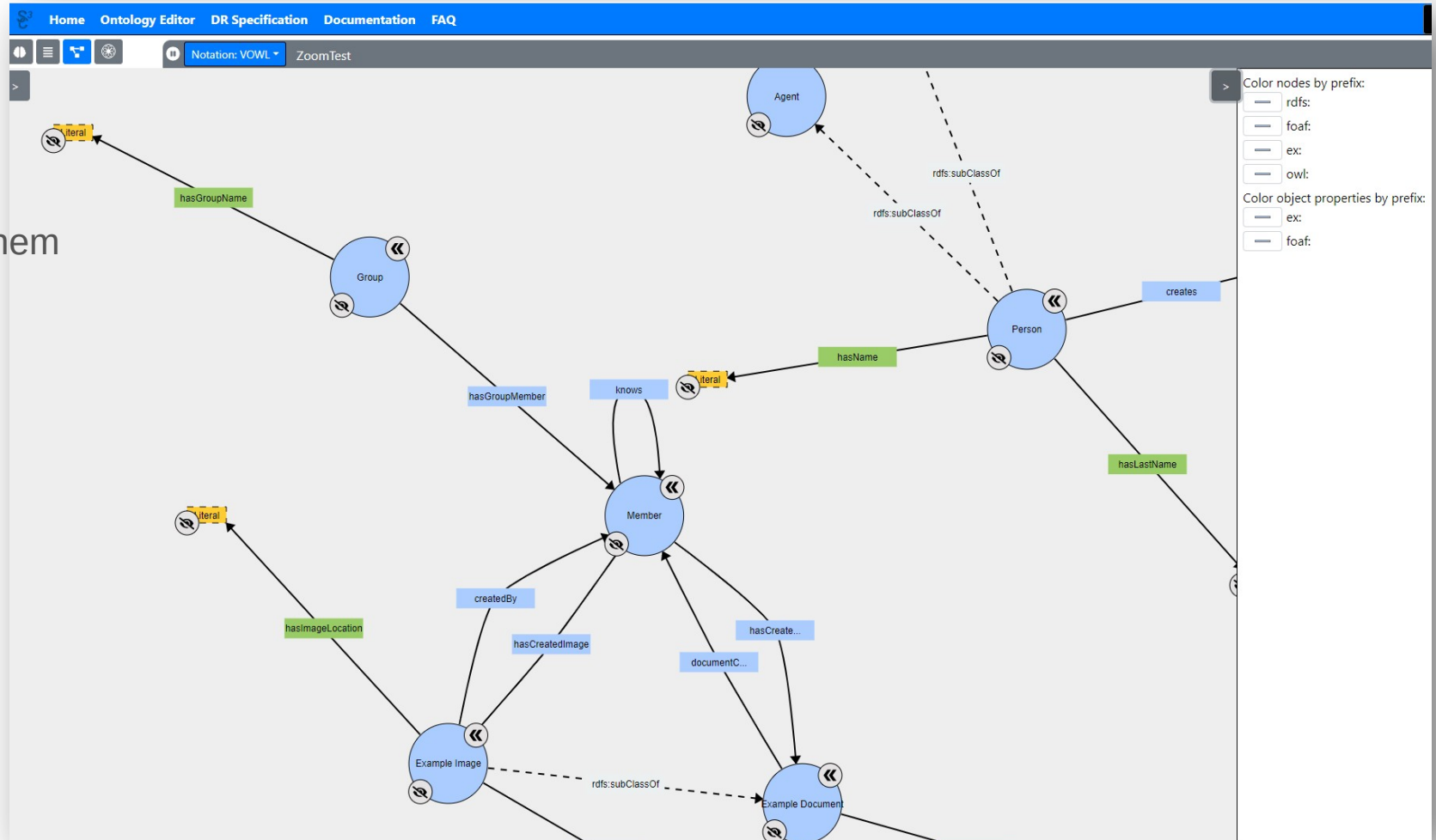
Novices: Graph Visualisation

WebVowl representation

Concepts: circular arcs

Properties: directed arrows

- Color nodes differently to highlight them
- Zoom in and out
- Hide nodes
- Navigate

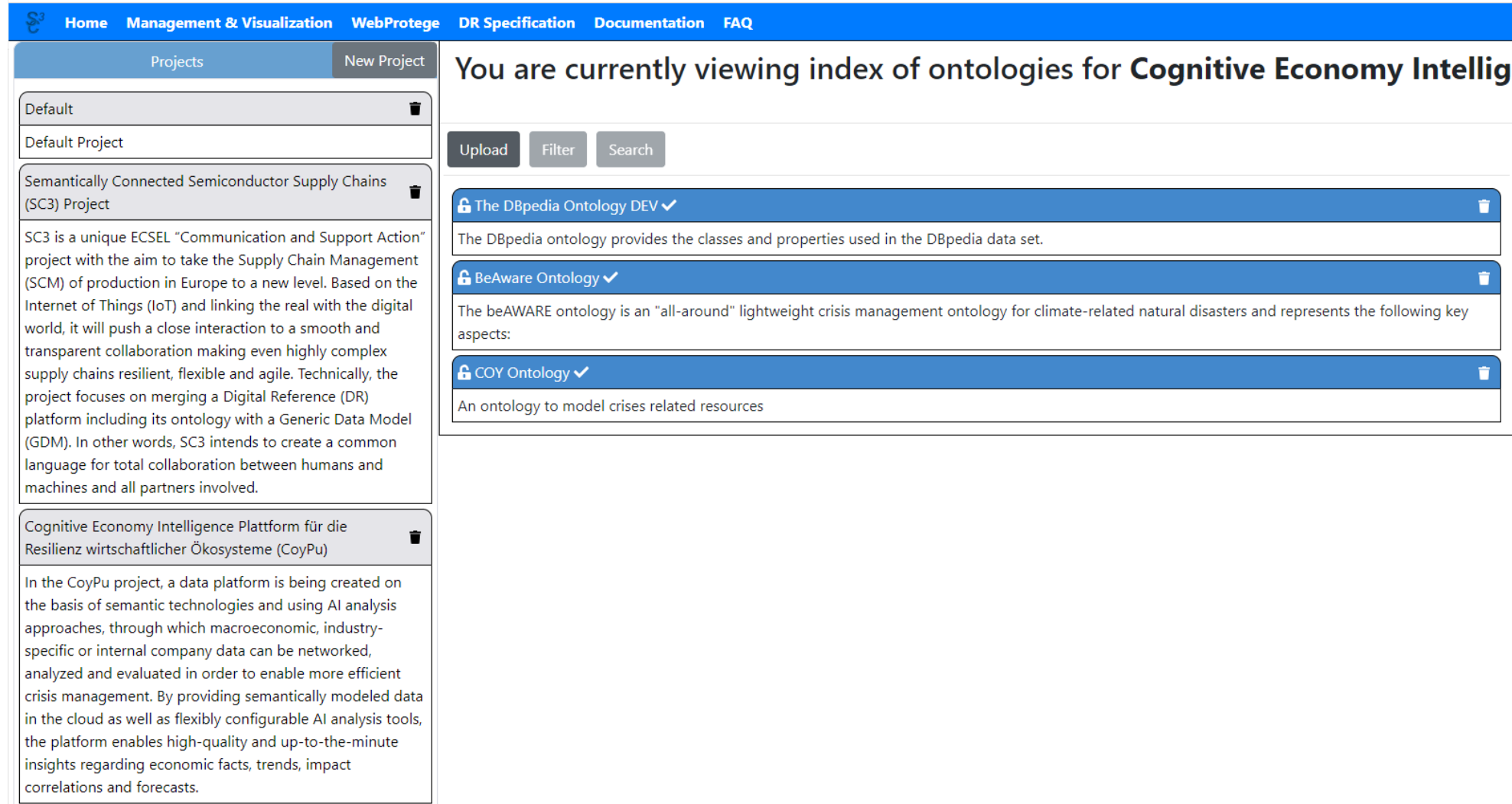


Cross Stakeholder Visualisation

4. Collaborative development and maintenance

Project Management

- Create new projects
- Register users
- Role management
- Add ontologies to project

The screenshot shows a web application interface for project management. The top navigation bar includes links for Home, Management & Visualization, WebProtege, DR Specification, Documentation, and FAQ. The main content area is divided into two panels.

Left Panel: Project Management

- Projects** (New Project button)
- Default** (Default Project)
- Semantically Connected Semiconductor Supply Chains (SC3) Project**
 - SC3 is a unique ECSEL "Communication and Support Action" project with the aim to take the Supply Chain Management (SCM) of production in Europe to a new level. Based on the Internet of Things (IoT) and linking the real with the digital world, it will push a close interaction to a smooth and transparent collaboration making even highly complex supply chains resilient, flexible and agile. Technically, the project focuses on merging a Digital Reference (DR) platform including its ontology with a Generic Data Model (GDM). In other words, SC3 intends to create a common language for total collaboration between humans and machines and all partners involved.
- Cognitive Economy Intelligence Plattform für die Resilienz wirtschaftlicher Ökosysteme (CoyPu)**
 - In the CoyPu project, a data platform is being created on the basis of semantic technologies and using AI analysis approaches, through which macroeconomic, industry-specific or internal company data can be networked, analyzed and evaluated in order to enable more efficient crisis management. By providing semantically modeled data in the cloud as well as flexibly configurable AI analysis tools, the platform enables high-quality and up-to-the-minute insights regarding economic facts, trends, impact correlations and forecasts.

Right Panel: Ontology Index

You are currently viewing index of ontologies for **Cognitive Economy Intellig**

Buttons: Upload, Filter, Search

- The DBpedia Ontology DEV** ✓
 - The DBpedia ontology provides the classes and properties used in the DBpedia data set.
- BeAware Ontology** ✓
 - The beAWARE ontology is an "all-around" lightweight crisis management ontology for climate-related natural disasters and represents the following key aspects:
- COY Ontology** ✓
 - An ontology to model crises related resources

Summary

- Collaborative work on ontologies is **challenging!**
 1. **Agility and acceptance:** Must be accepted, developed, and maintained by a **designated community**
 2. **Development and maintenance** requires complementary competencies



1. CoyPu tooling for collaborative ontology creation and community Hub

- Terminology Service
- WebProtege
- GitHub integration



2. SC3 Platform: Cross stakeholder visualisation tool

- **Resource Relation Model**
- **Mapping between various ontology visualisation**

THANKS

Ontologies to foster economic resilience

Introduction

- **Resilience** has recently been discovered as potential remedy for dealing with **crises** [1]
 - Chip shortage
 - Supply bottlenecks of a general nature
- **Definition, with respect to economics:** E.g. **Supply chain resilience** is "the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function"
- Risks, on continuity of operations are manifold:
 - Environmental disasters (Floods , ...)
 - War outbreaks (Ukraine, ...)
 - Pandemics (Corona)
- The connectedness of partners on the one hand strengthens resilience, but also poses the challenge that all involved need a **shared, unambiguous and holistic understanding** of the supply contexts in order to develop compensation strategies.

