TOWARDS DATA INTEROPERABILITY FOR THE DIGITAL PRODUCT PASSPORT ECOSYSTEM

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Workshop on Semantic
Interoperability in Data Spaces 2024

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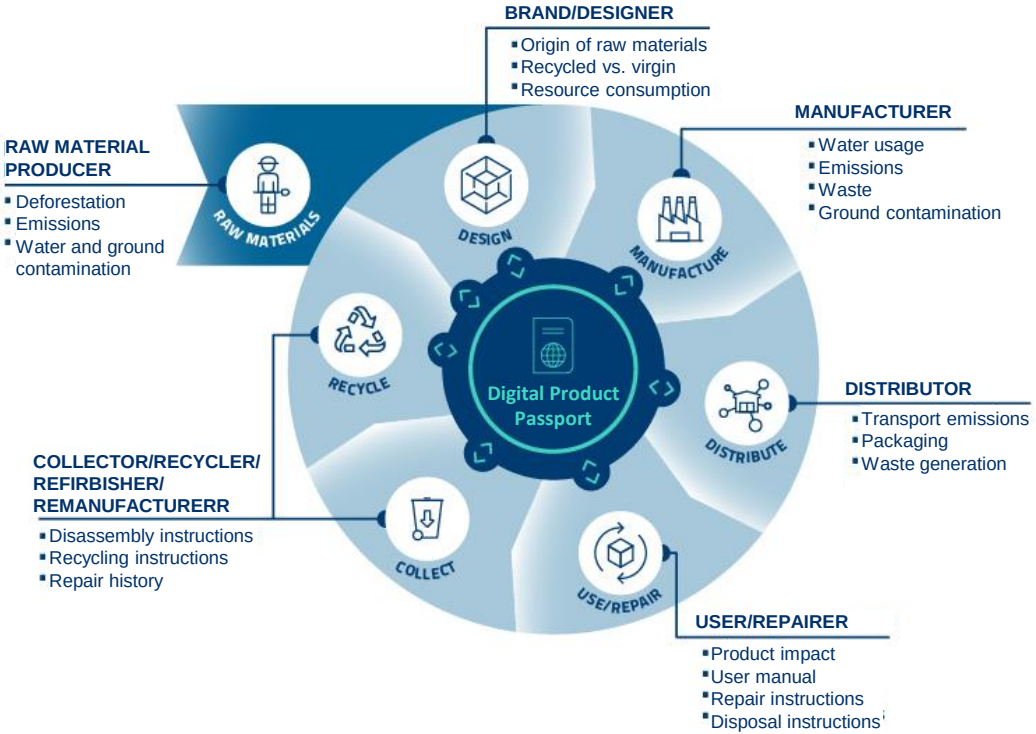
DIGITAL PRODUCT PASSPORT (DPP)



- Raw material producer
- Manufacturer
- Distributor
- Product user
- Repair shops
- Waste management companies

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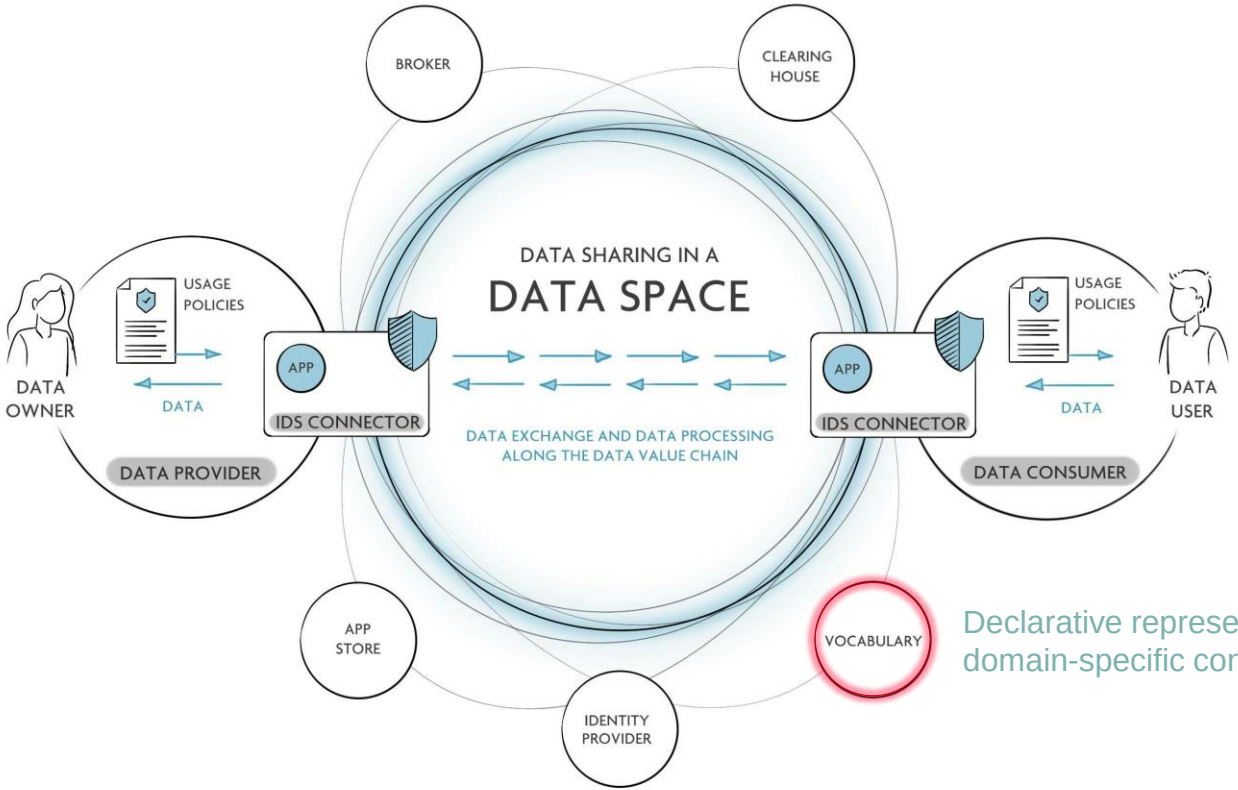
DATASPACE – SEMANTIC INTEROPERABILITY



Declarative representation of domain-specific concepts

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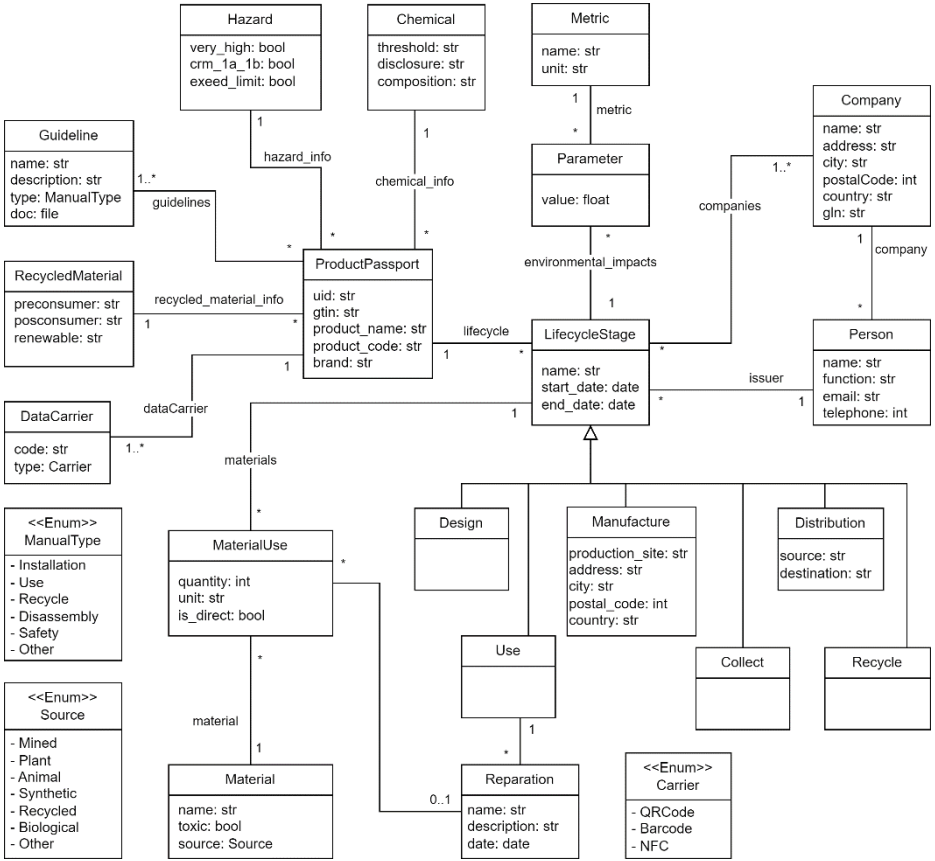
ENHANCING DATA INTEROPERABILITY WITH BESSER

RDF Vocabulary: (suggested by **IDS** and **GAIA-X)** defines a declarative representation of domain-specific concepts in machine readable format to improve semantic interoperability.

DPP STRUCTURAL DATA MODEL



Our model involves:

- Lifecycle stages of a Product
- Data carrier
- Guidelines
- Raw materials
- Chemical and hazard information
- Environmental impacts

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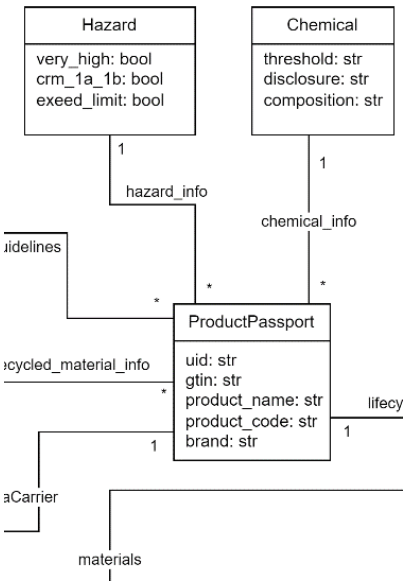
BESSER LOW CODE TO GENERATE THE VOCABULARY

DPP structural data model

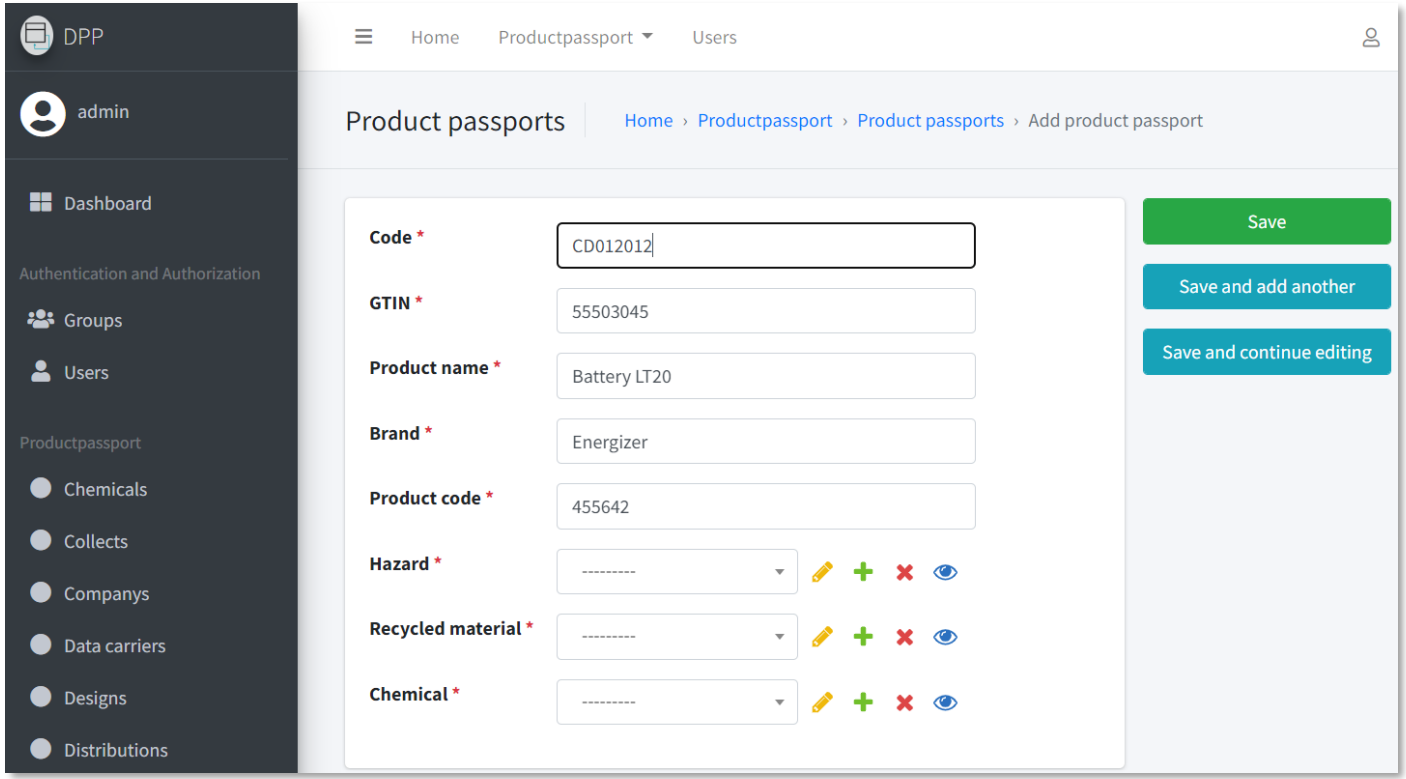


BESSER
better software faster

RDF Vocabulary

```
@prefix ex: <http://example.org/vocab#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

# Class definition
ex:LifecycleStage rdf:type rdfs:Class .

ex:ProductPassport rdf:type rdfs:Class .

ex:Manufacture rdf:type rdfs:Class ;
          rdfs:subClassOf ex:LifecycleStage .

ex:Distribution rdf:type rdfs:Class ;
          rdfs:subClassOf ex:LifecycleStage .
...

# Property definition
ex:start_date rdf:type rdf:Property ;
        rdfs:domain ex:LifecycleStage ;
        rdfs:range xsd:dateTime .

ex:GTIN rdf:type rdf:Property ;
        rdfs:domain ex:ProductPassport ;
        rdfs:range xsd:string .

ex:product_name rdf:type rdf:Property ;
        rdfs:domain ex:ProductPassport ;
        rdfs:range xsd:string .
...

# Relationship Definition
ex:lifecycle rdf:type rdf:Property ;
    rdfs:domain ex:LifecycleStage ;
    rdfs:range ex:ProductPassport .
```

DPP - DJANGO WEB APP



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SUMMARY

- We propose a **foundational data structural model** that represents the DPP ecosystem.
- We developed a code generator to **a first version of the Vocabulary in RDF Turtle format**.
- We used **BESSER to demonstrate how a DPP infrastructure can be rapidly generated** to instantiate the vocabulary concepts.

NEXT STEPS

- To enhance the RDF code generator for vocabularies that can both reuse and map to existing metadata vocabularies, such as the **IDS Information Model**.
- To incorporate new concepts (e.g., Contracts and Policies) and properties (e.g., description).

Thank you

BESSER

https://github.com/BESSER-PEARL/BESSER

> pip install besser

https://besser.readthedocs.io/en/latest/

ADDITIONAL SLIDES

BESSER (BETTER SMART SOFTWARE FASTER) PROJECT

01 BESSER is a low-code approach to develop AI-enhanced software

02 BESSER will provide a single editor to model both traditional and smart components as well as possible ethical concerns

03 BESSER will provide tools to generate and test all modeled components altogether (e.g. a chatbot, the web UI, the database, a prediction system…)

04 BESSER is a 5-year FNR PEARL project.

05 The core BESSER components will be released as OSS.

06 Open to external collaborations. Commercial extensions will be allowed.

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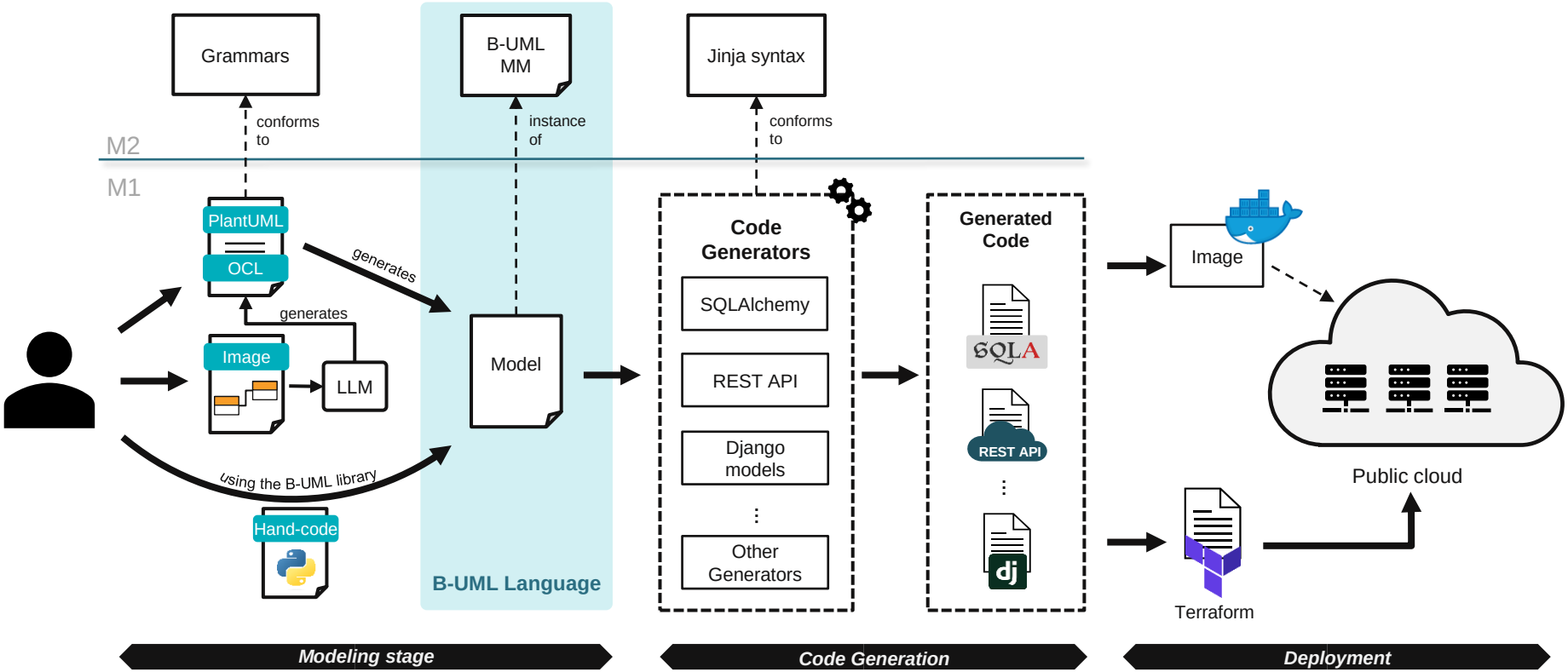
BESSER LOW-CODE (BLC) PLATFORM



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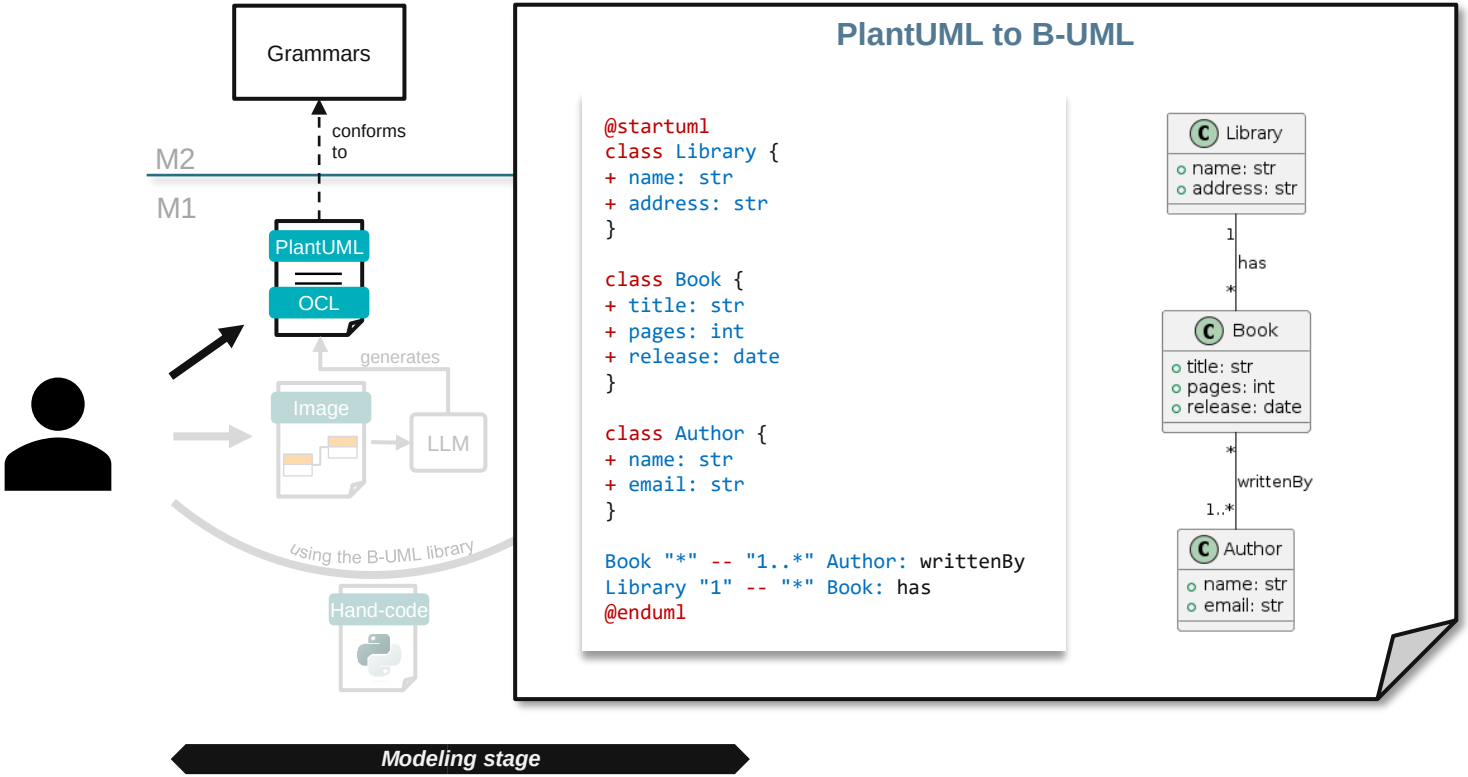
BLC: CONCRETE SYNTAX



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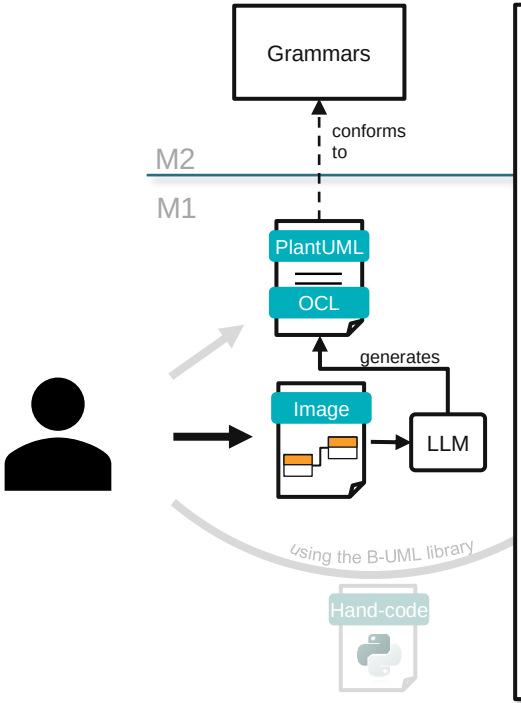
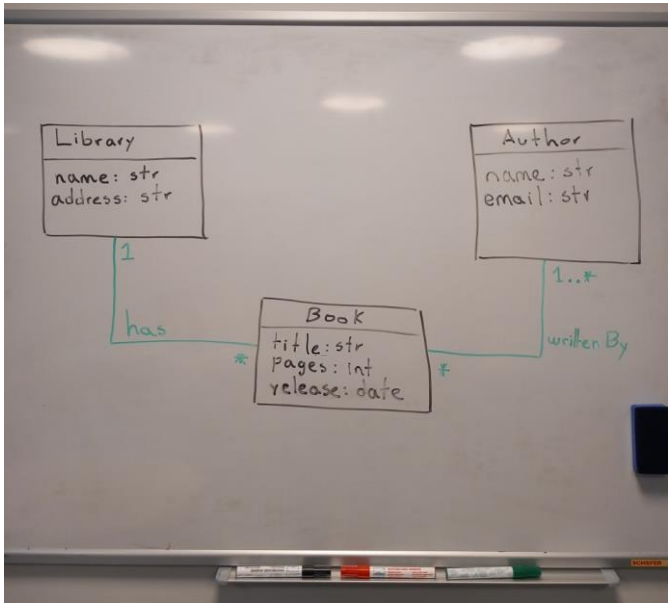
BLC: CONCRETE SYNTAX



From an image to B-UML



Modeling stage

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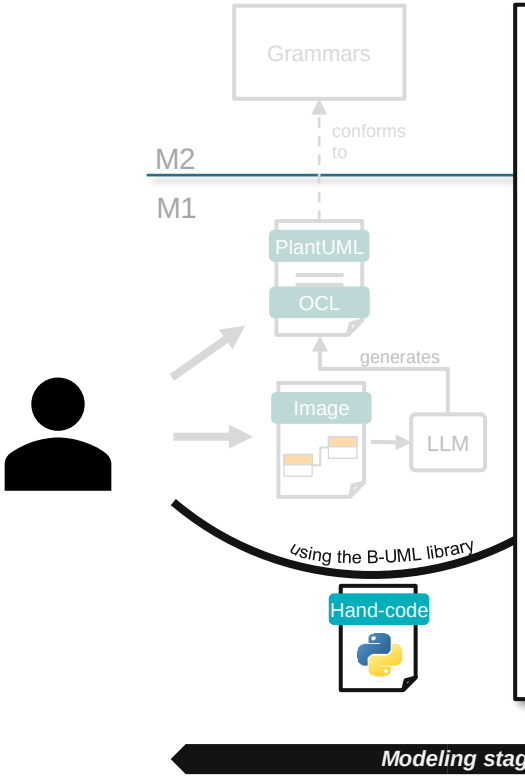
BLC: CONCRETE SYNTAX



Instantiating the B-UML metamodel

```python
from besser.BUML.metamodel.structural import DomainModel, Class, Property, \
    PrimitiveDataType, Multiplicity, BinaryAssociation

# Primitive DataTypes
t_int: PrimitiveDataType = PrimitiveDataType("int")
t_str: PrimitiveDataType = PrimitiveDataType("str")
t_datetime: PrimitiveDataType = PrimitiveDataType("datetime")

# Library attributes definition
library_name: Property = Property(name="name", type=t_str)
address: Property = Property(name="address", type=t_str)
# Library class definition
library: Class = Class(name="Library", attributes={library_name, address})

# Book attributes definition
title: Property = Property(name="title", type=t_str)
pages: Property = Property(name="pages", type=t_int)
release: Property = Property(name="release", type=t_datetime)
# Book class definition
book: Class = Class(name="Book", attributes={title, pages, release})
```

BLC – CODE GENERATORS

Django

Model layer of your web application

SQLAlchemy

Module constructors for the structure of a DB

FastAPI

Produce a RESTful service

Flutter

Produce mobile applications

SQL

SQL statements for your database structure

Terraform

IaC to deploy your application

Python

Python domain model

Java

Java domain model

Pydantic

Generation of Pydantic classes

Backend

- RESTAPI
- SQLAlchemy
- Pydantic

HOW CAN BESSER HELP YOU ?

You are a company or public organization

- Exchange experiences and best practices with other organizations through deep dive case studies
- Develop proof of concepts of advanced software development tools using the open source BESSER lab components
- Use BESSER for application interoperability and portability
- Use BESSER sandbox for training both professional developers and citizen developers in your organization
- …

You are a researcher

- Develop proof of concepts of advanced software development tools using the open source BESSER lab components
- Enhance and extend BESSER lab via plug-ins
- Contribute to the BESSER lab open-source project and community
- Accelerate your low-code/no-code research by leveraging the BESSER labs
- …

You are a teacher or student

- Develop teaching materials on low code/no code/MBE for both professional developers and citizen developers
- Develop training exercises that students can perform in the BESSER sandbox
- Participate to teacher and student forums to exchange training materials and exercises
- Learn low-code and no-code concepts that you could then transfer to other proprietary tools
- …

STRUCTURAL MM