CIRPASS-2 ontologies for semantic interoperability

Digital Product Passports Festival

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Core ontology task **objectives**

1. Ensure **semantic interoperability** within and across domains by offering a Digital Product Passport (DPP) core ontology proposal

   - Semantic interoperability:
     - Ability of computer systems to exchange data such that the receiving system not only understands the syntax but also the meaning of the data
     - Data human and machine readable
     - Controlled **vocabulary** and **ontology**

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Core ontology task **objectives**

2 A DPP **core ontology** used for product descriptions

- Published in a **public repository** (vocabulary hub)
- Used to indicate the meaning or/and structure of generic product descriptions
- Provide common vocabulary and agreed structure for DPP sectoral ontologies

- Formal representation of knowledge within a domain
- DPP **sectoral ontologies** and vocabularies will **inherit** from the core ontology and extend on it for ecosystem-specific needs
- The EU DPP core ontology (proposal) is a cross sectorial ontology

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Contributors

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Digital Product Passport

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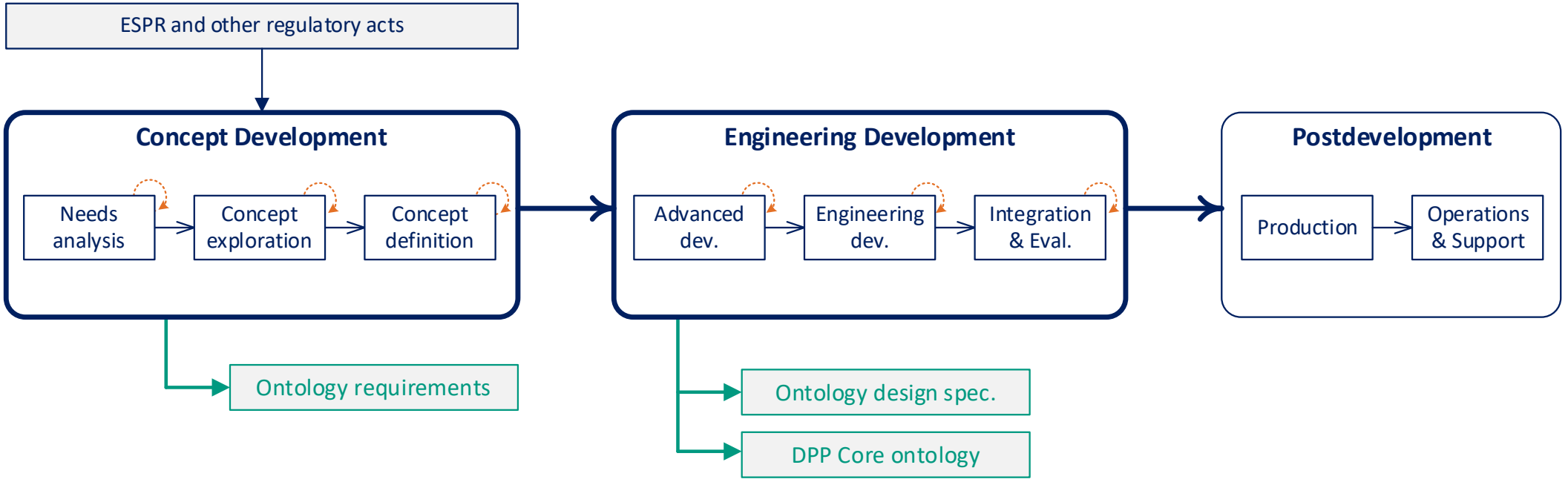
Development approach

- DPP as a complex system
  - Systems Engineering (SE) Life Cycle Model (LCM) as a guideline for the process
  - Agile approach on the development phases, and apply iterative and incremental development



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DPP Core ontology **requirements specification**

- Selection of an appropriate ontology development methodology
  → Modular ontology design (similar to MOMo methodology)
- Specification of non-functional requirements
- Specification of functional requirements
- Identification of key notions and core terms
- For this, more than 130 terms were extracted and analysed from regulatory acts, and 113 of them documented in the requirements document.

R. Maigre, H.-M. Haav, T. Robal, M.-A. Wolfand F. Danash, '*Ontology Requirements Specification for an EU DPP Core Ontology Proposal*'. CIRPASS-2 Consortium, Apr. 23, 2025. doi: 10.5281/zenodo.15270342

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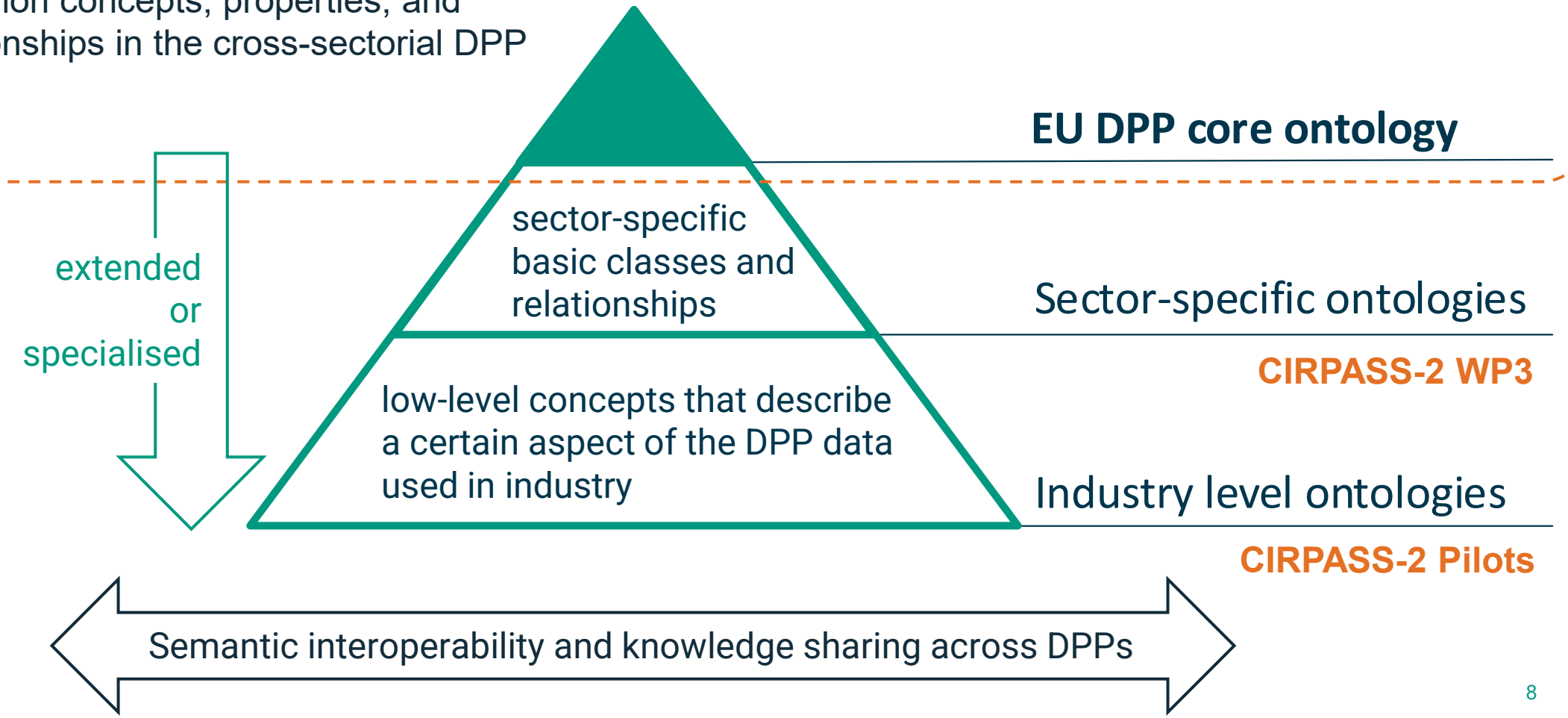
Hierarchy of DPP ontologies

High level of abstraction of the EU DPP domain

Common concepts, properties, and relationships in the cross-sectorial DPP

Focus of this task



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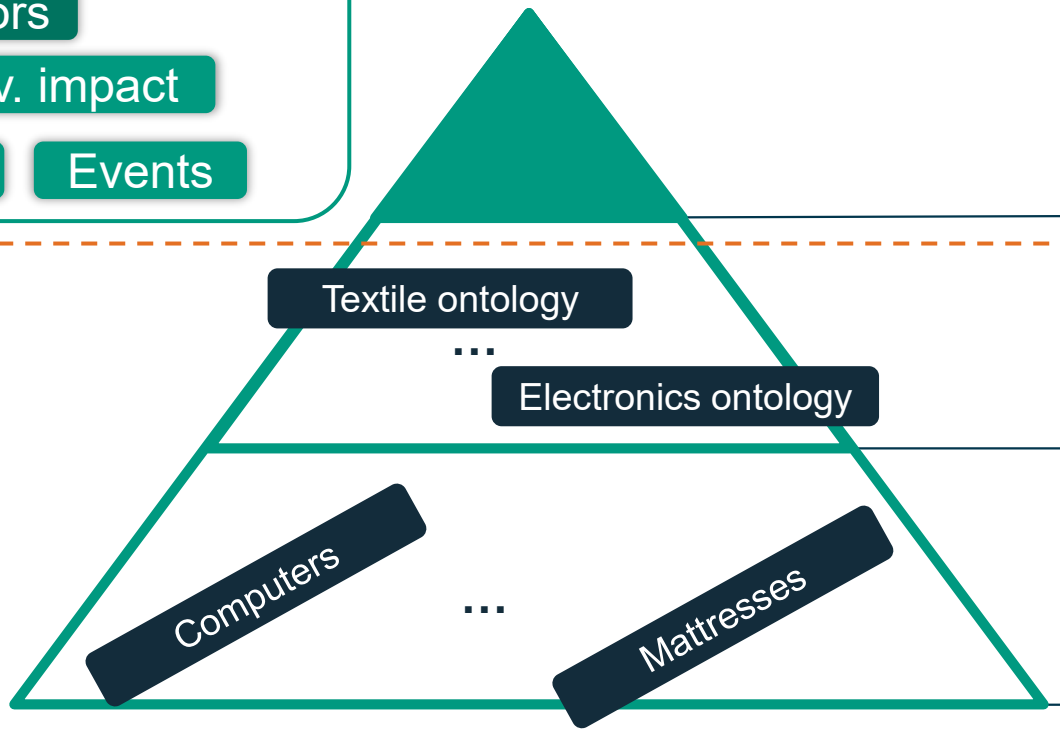
Core ontology for knowledge architecture

Core and modules

Product&DPP | Actors | SoC | LCA | Env. impact | Compliance | Units | Events

Focus of this task



EU DPP core ontology

Sector-specific ontologies

Industry level ontologies

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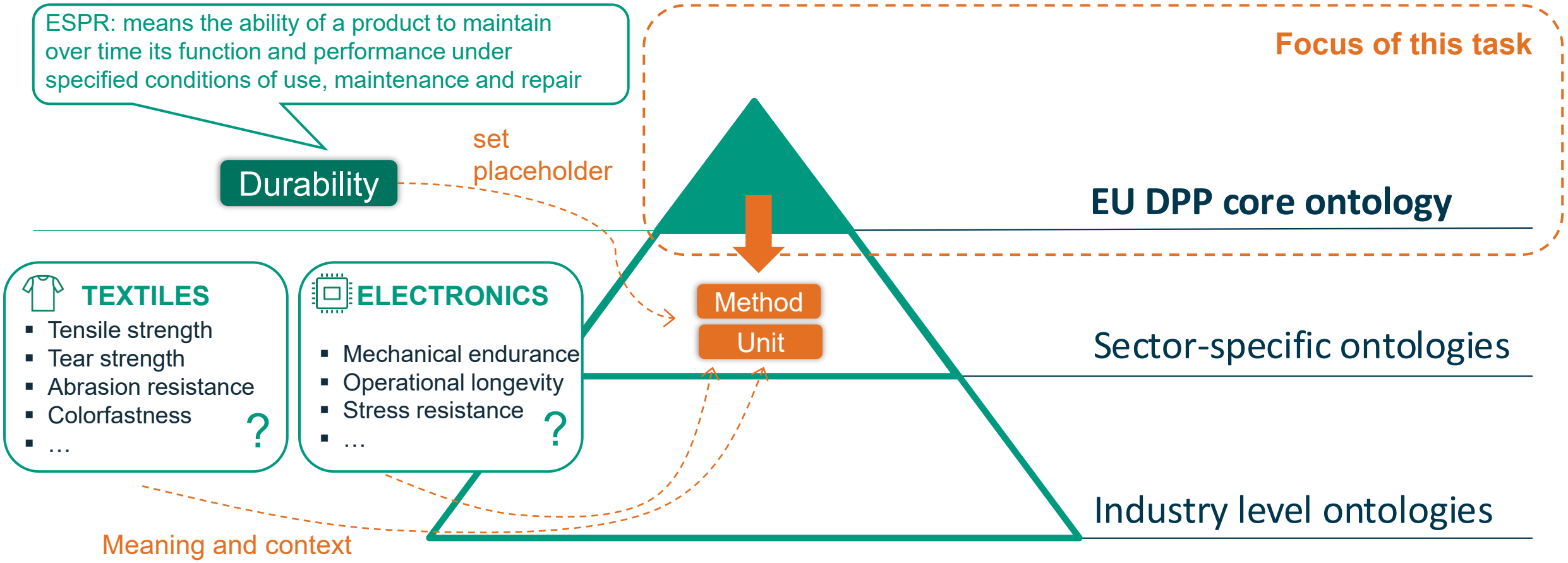
Core ontology for knowledge architecture – EXAMPLE



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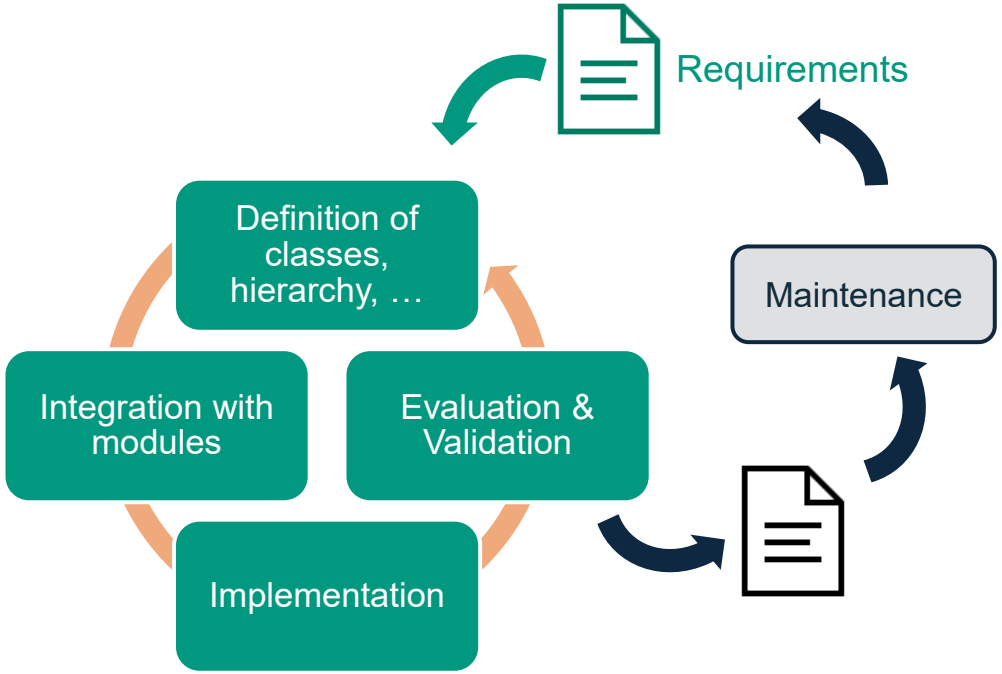
Core ontology development

- Version 1.x
- **Iterative development process**
- Released on the DPP Vocabulary Hub: https://dpp.vocabulary-hub.eu
- 3 modules + Core
  - Product & DPP
  - Actors & Roles
  - Substance of Concern



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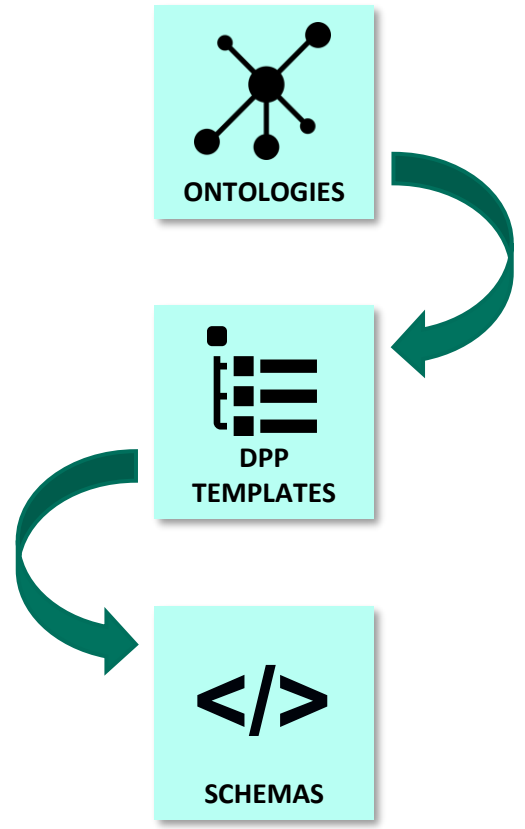
Public repository

- Vocabulary Hub service from TNO – Semantic Treehouse
- Public access: https://dpp.vocabulary-hub.eu

- GUI-based ontology manipulation, facilitates:
  - Publication, editing, and browsing of ontologies
  - Reuse of existing knowledge
  - Creation of DPP Templates from ontologies
  - Templates for DPPs
  - Exporting DPP templates as integration schemas (JSON/OpenAPI/XML)
  - Validation of DPP instances



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Core ontology v.1 – Design

- DPP Core ontology
  - Imports the modules
  - Connects modules
    - through 9 object properties

- Product and DPP module
  - 14 primary level classes, elaborate to 61 more detailed classes
  - 27 object properties and 19 data properties
- Actors and Roles module
  - 4 primary level classes, elaborated into 32 more detailed classes
  - 5 object properties and 7 data properties
- Substance of Concern module
  - 1 primary level class
  - 2 object properties and 9 data properties

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Next period

- Alignment with JTC24 – JSON-based ontology, data model conformance
- Refinement of existing modules
- Verification & Validation of DPP Core version 1.x
  - WP3, Pilots
- Continue module development:
  - LCA
  - Environmental impact
  - Events
  - …

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Thank you!

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