

32) Domain Models and Product Lines

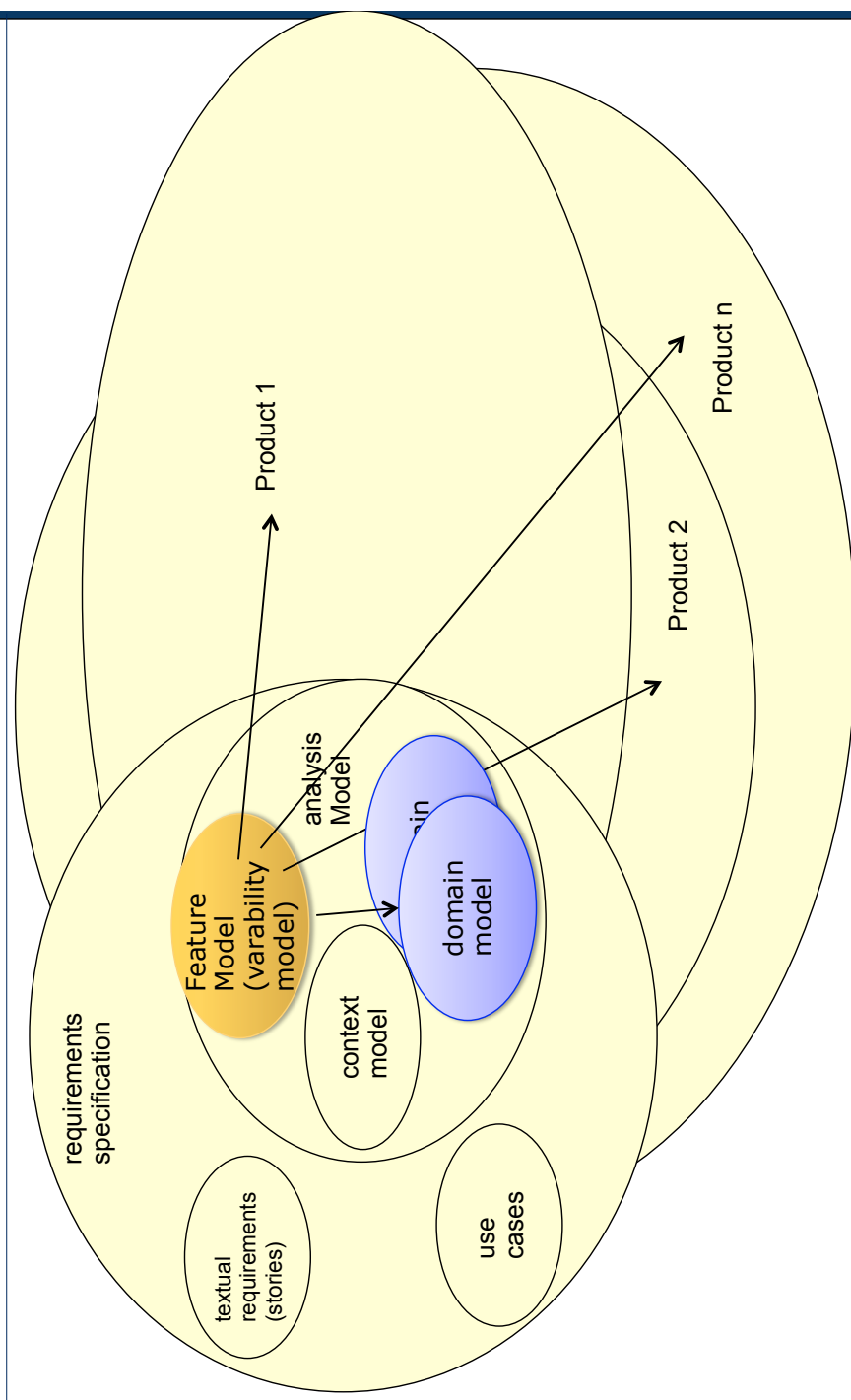
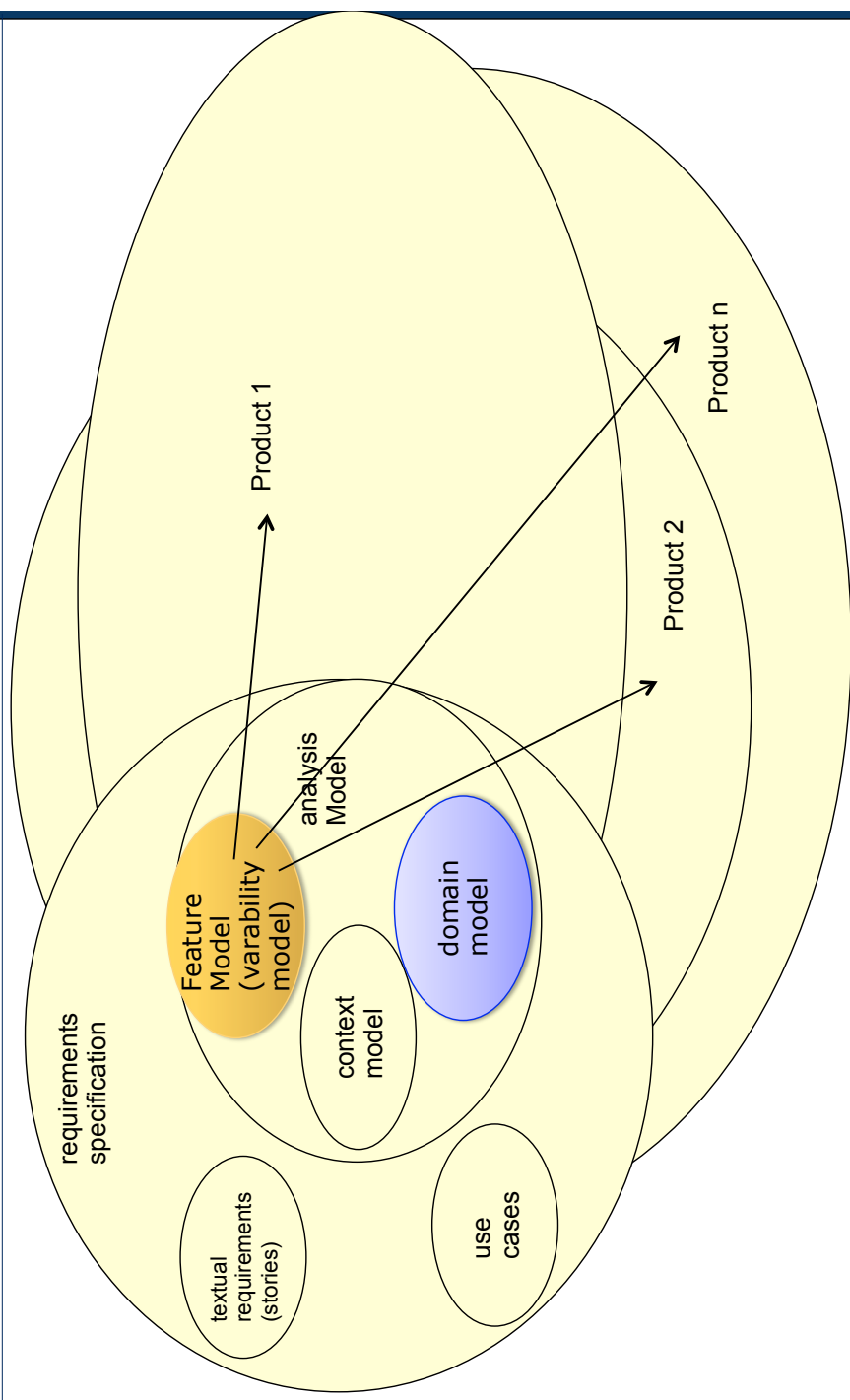
1. Domain Models and Product Lines
2. Domain Ontologies and the MDA

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➤ <http://st.inf.tu-dresden.de>
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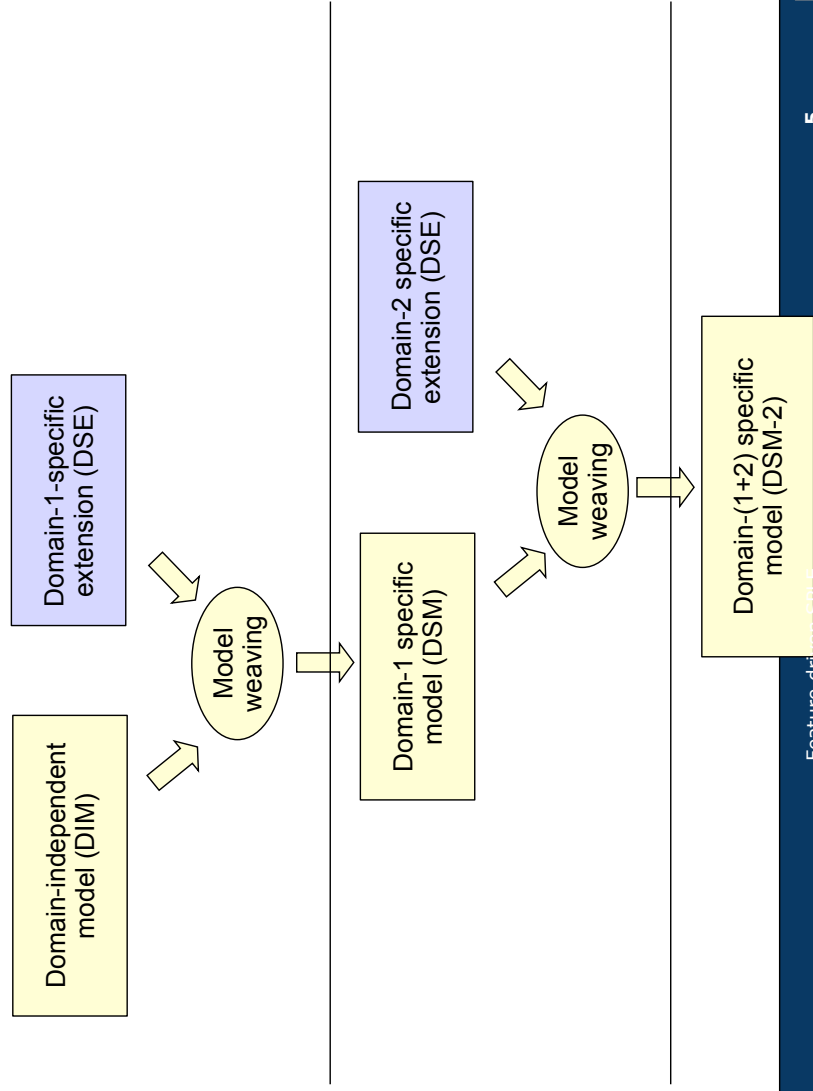


Literature

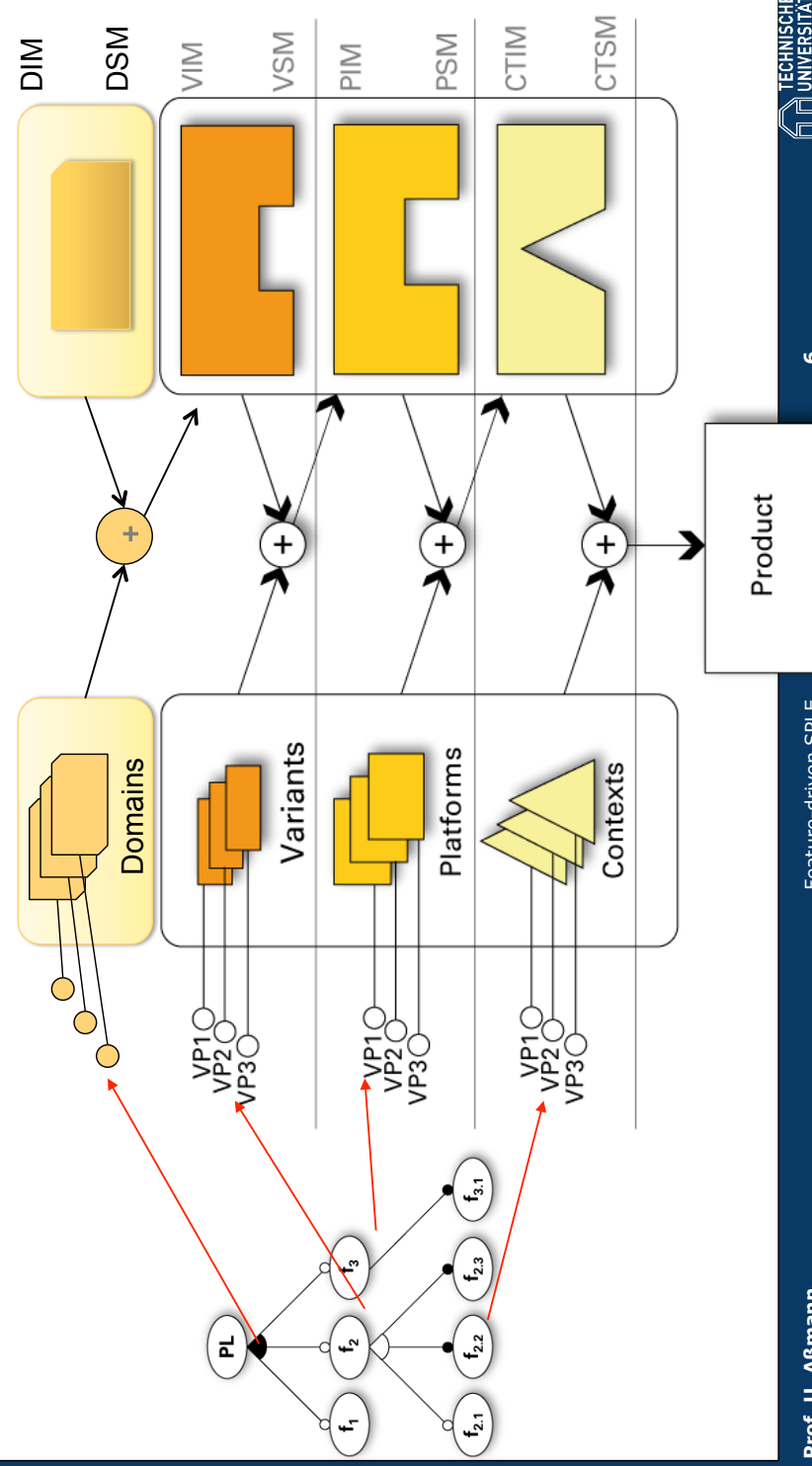
- Uwe Aßmann, Steffen Zschaler, and Gerd Wagner. Ontologies, meta-models, and the model-driven paradigm. In Coral Calero, Francisco Ruiz, and Mario Piattini, editors, *Ontologies for Software Engineering and Technology*. Springer, 2006.



- In a product line, domain-specific extensions can be treated like platform-specific extensions (see process FEASIBLE)



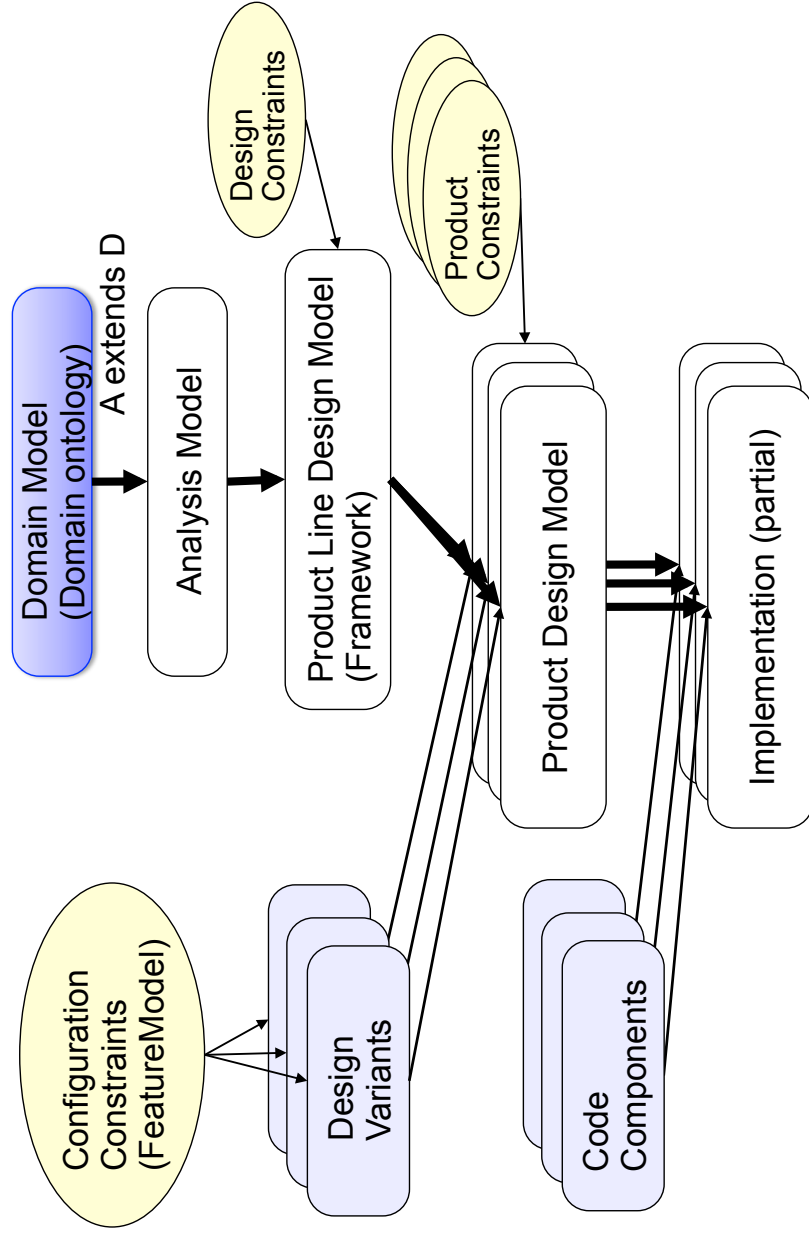
- FEASIBLE can be extended by a stage for selecting domain models

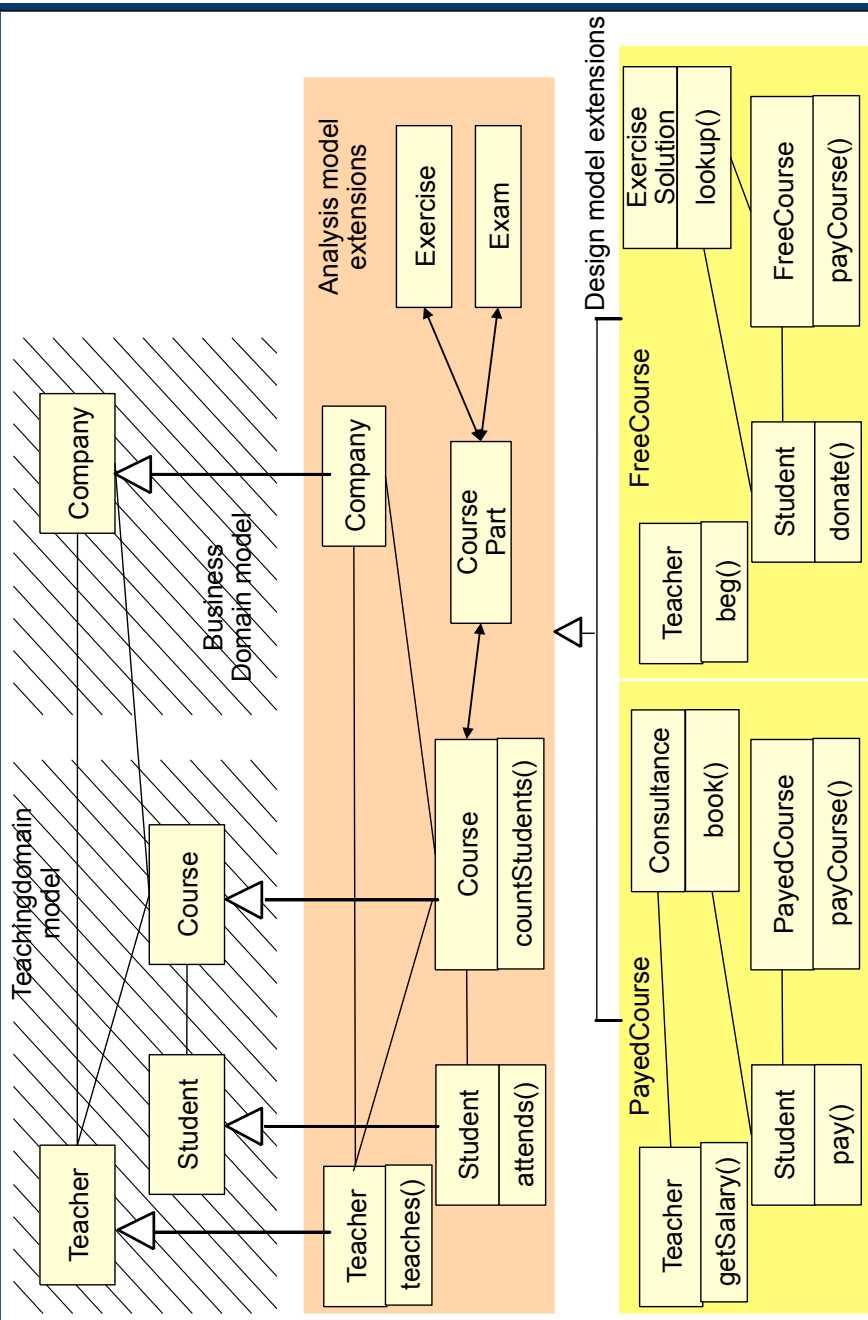


32.1 DOMAIN MODELS AND PRODUCT LINES

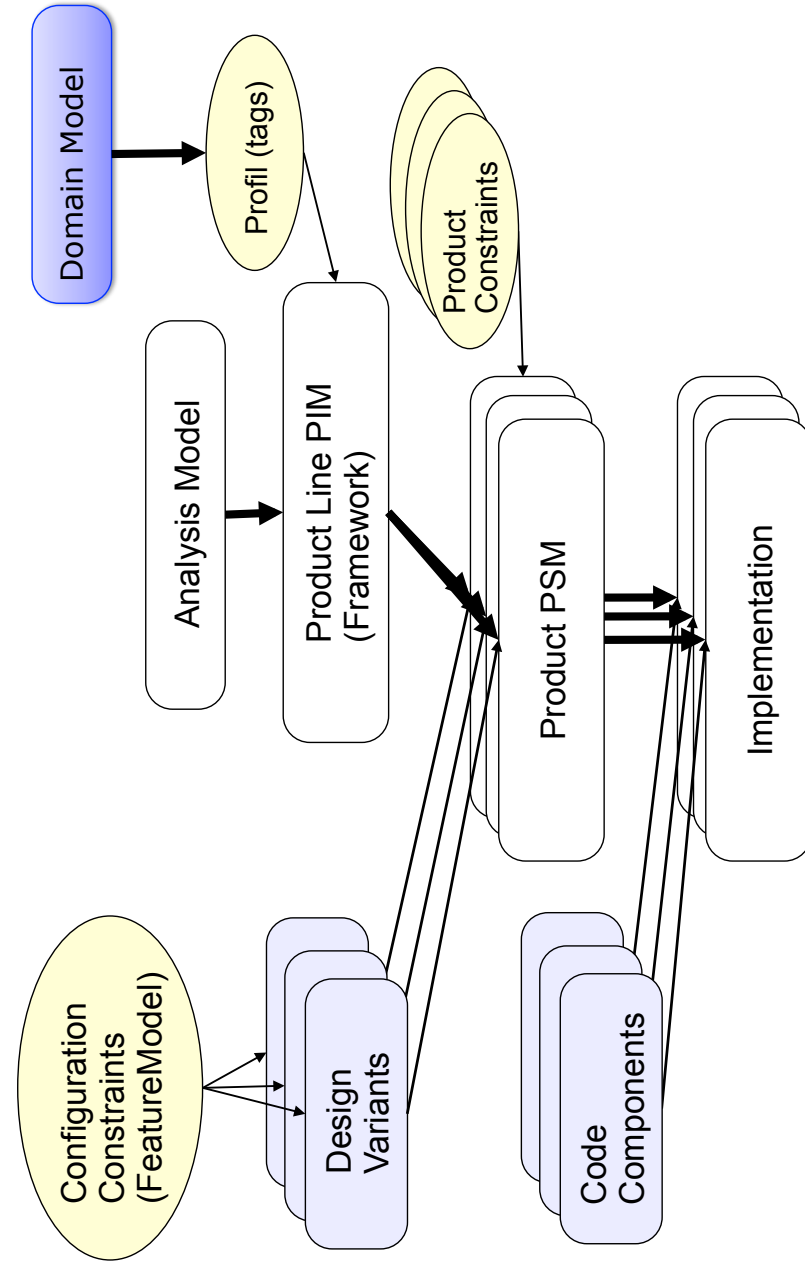
Domain Models can be Integrated into PL in Different Ways

- As supermodel of the analysis model: analysis classes inherit from domain classes (standard was of ST-I)

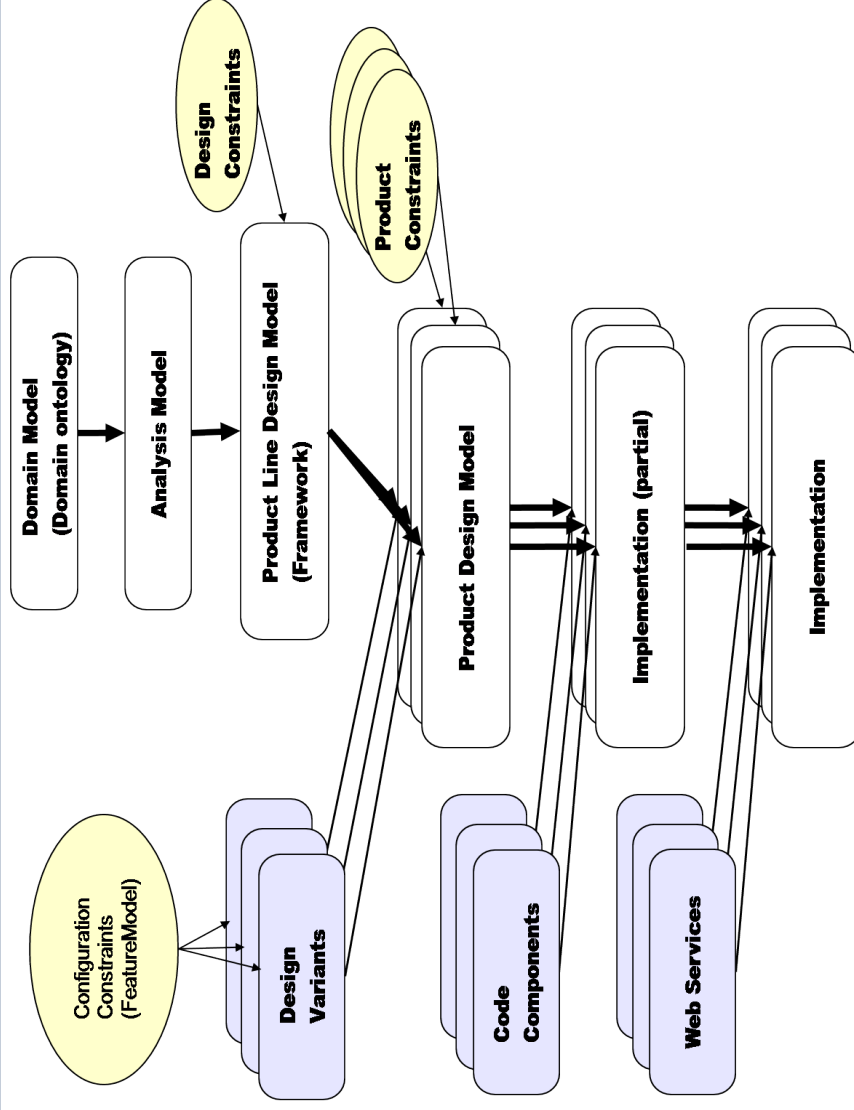
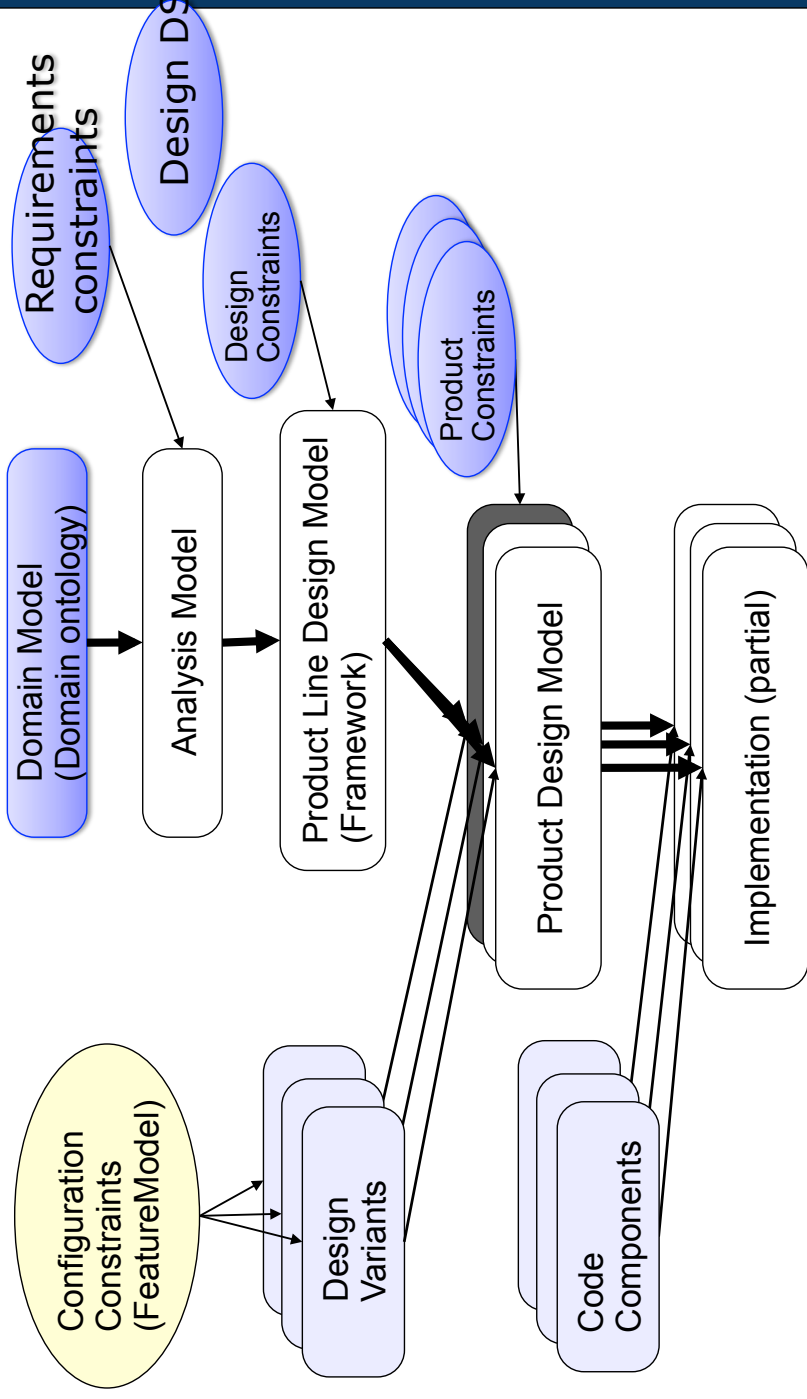




➤ Marked PIM in MDA



➤ **As design constraints, as product constraints, as domainmodell**



32.2 USING DOMAIN ONTOLOGIES IN THE MDA

Motivation

- **Ontologies offer reasoning power**
 - Ontologies are modeled by domain experts and standardized
 - Gene Ontology, SnoMed, Mouse Ontology, ..
 - OWL language is standardized, reasoners are available
- **Can we use them in the Product-Line Engineering, resp. MDA?**
- **How do ontologies and system models relate?**
 - Ontology
 - Metamodels
 - Model-Driven Engineering (MDE)
 - Model-Driven Architecture (MDA)

➤ How can we find a place for ontologies in the world of MDA?

A model is an external and explicit representation of a part of reality as seen by the people who wish to use that model to understand, change, manage, and control that part of reality. [Pidd]

A model of a system is a description or specification of that system and its environment for some certain purpose. [MDA Guide]

But....

Ontologies are formal explicit specifications of a shared conceptualization. [Gruber]

➤ [Abmann, Zschaler, Wagner 06]

An **ontology**:
 a standardized,
 descriptive model,
 representing reality
 by a set of concepts, their
 interrelations, and constraints
 under
 open-world assumption.

A **system model**:
 a non-standardized,
 prescriptive model,
 representing a set of systems
 by a set of concepts, their interrelations,
 and constraints
 under
 closed-world assumption.

A model can be *descriptive* or *prescriptive*.
[Seidewitz CACM 03]

- Models describe or control reality.
- If they describe, they monitor reality and form true, or faithful, abstractions (Analysis, Reengineering)
- If they control, they prescribe reality (Construction, Specification)

- ▶ Ontologies need the **open-world assumption**
 - Analysis perspective
 - **Anything not explicitly expressed is unknown**
 - Ontologies use a form of partial description to abstract
- ▶ System models need **closed-world assumption**
 - Design perspective
 - **Anything not explicitly expressed is wrong**
 - System models specify completely

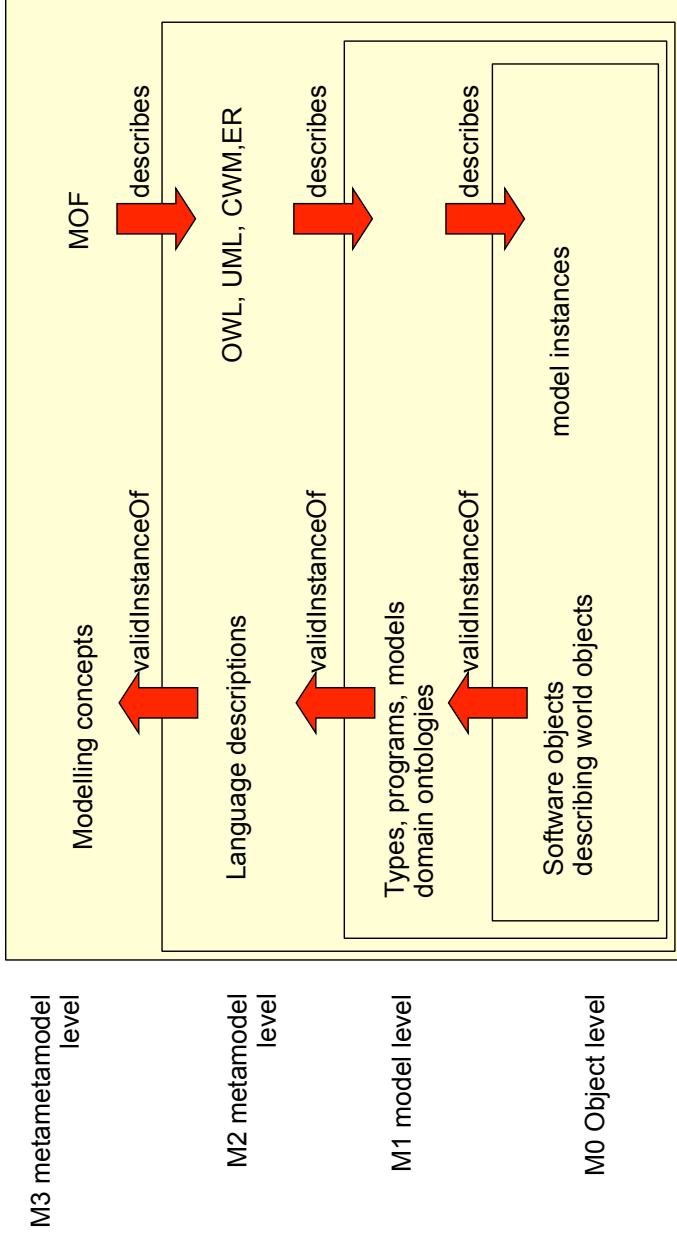
Descriptive

Prescriptive

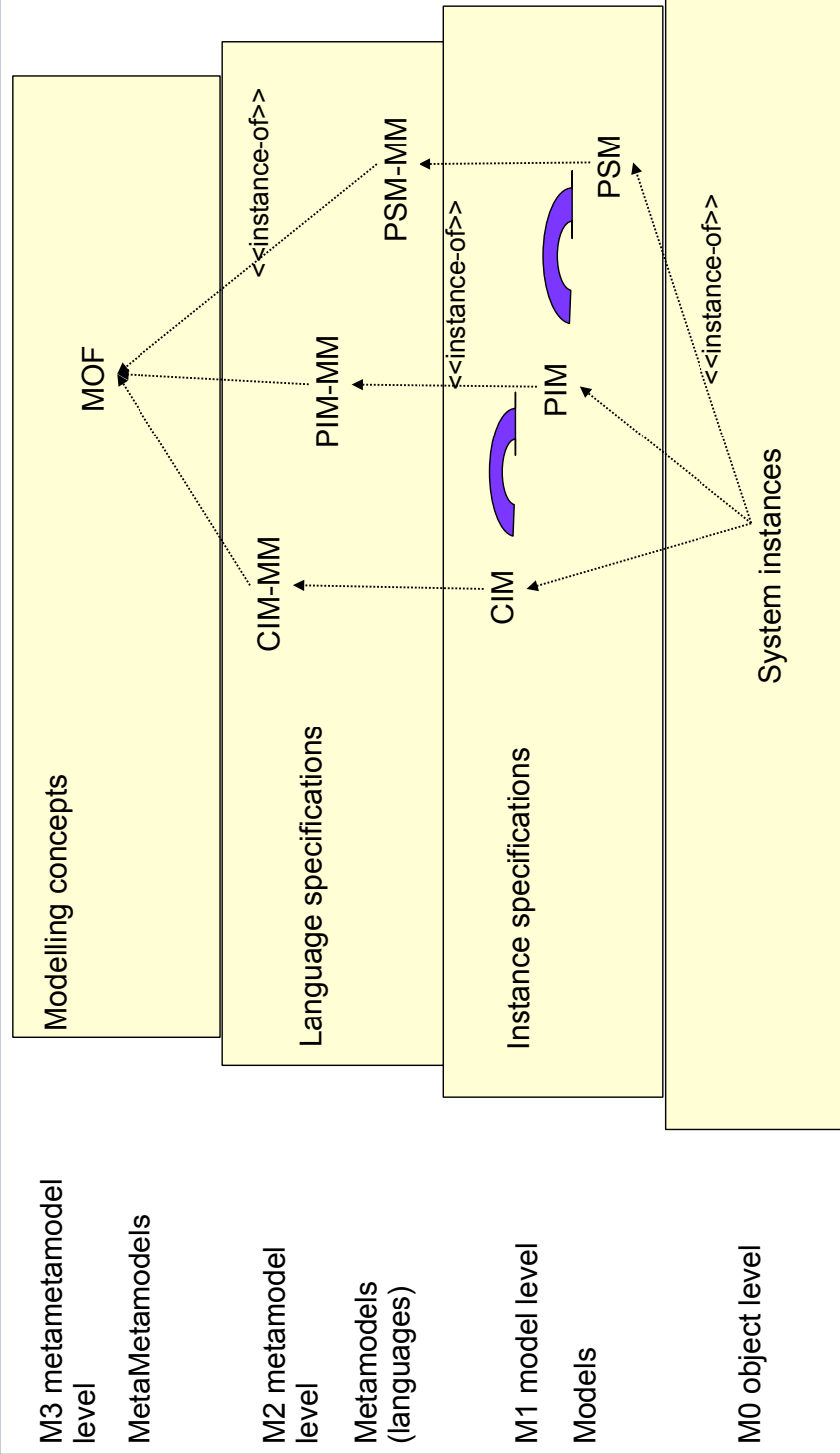
What to Do with What

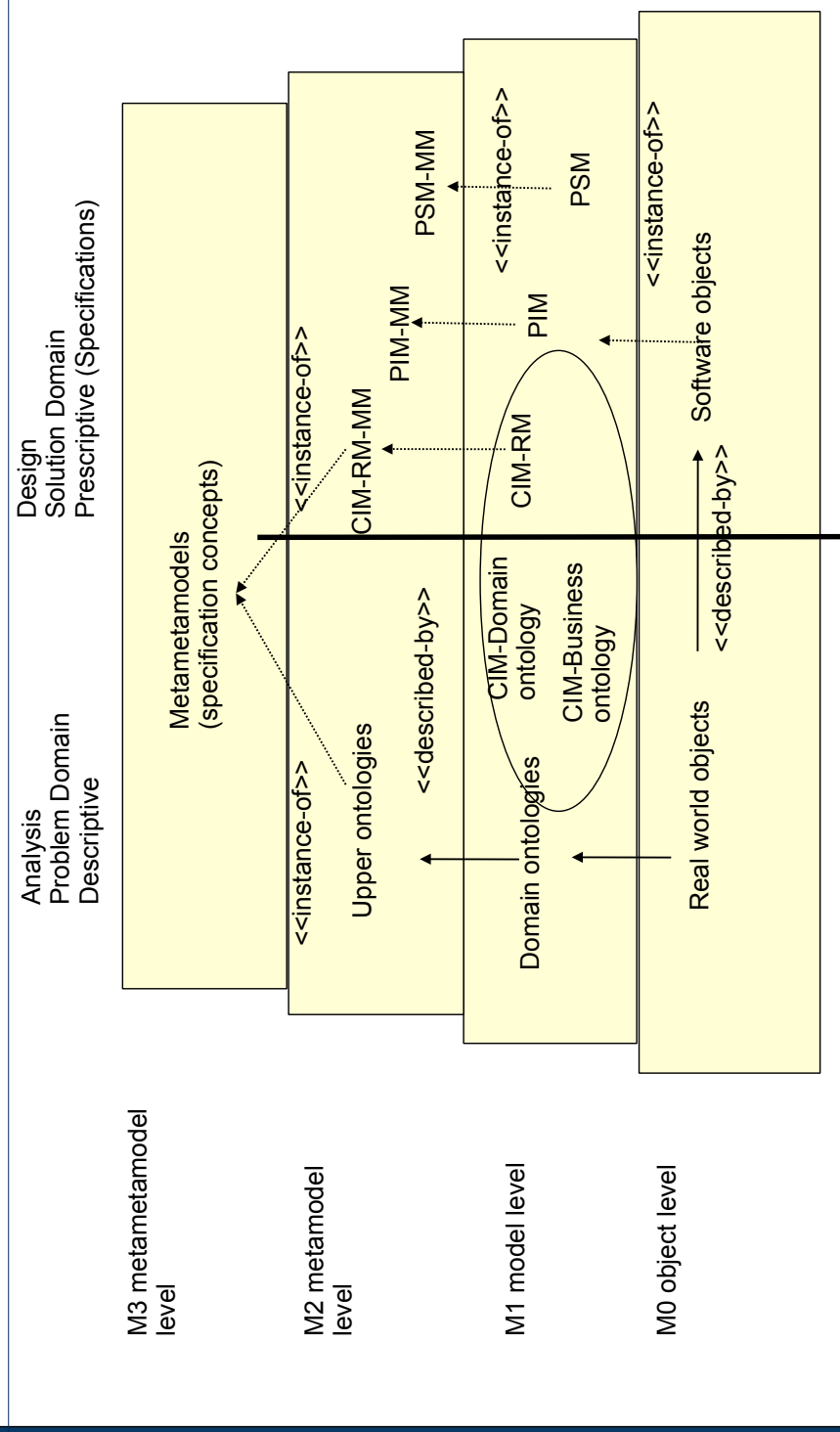
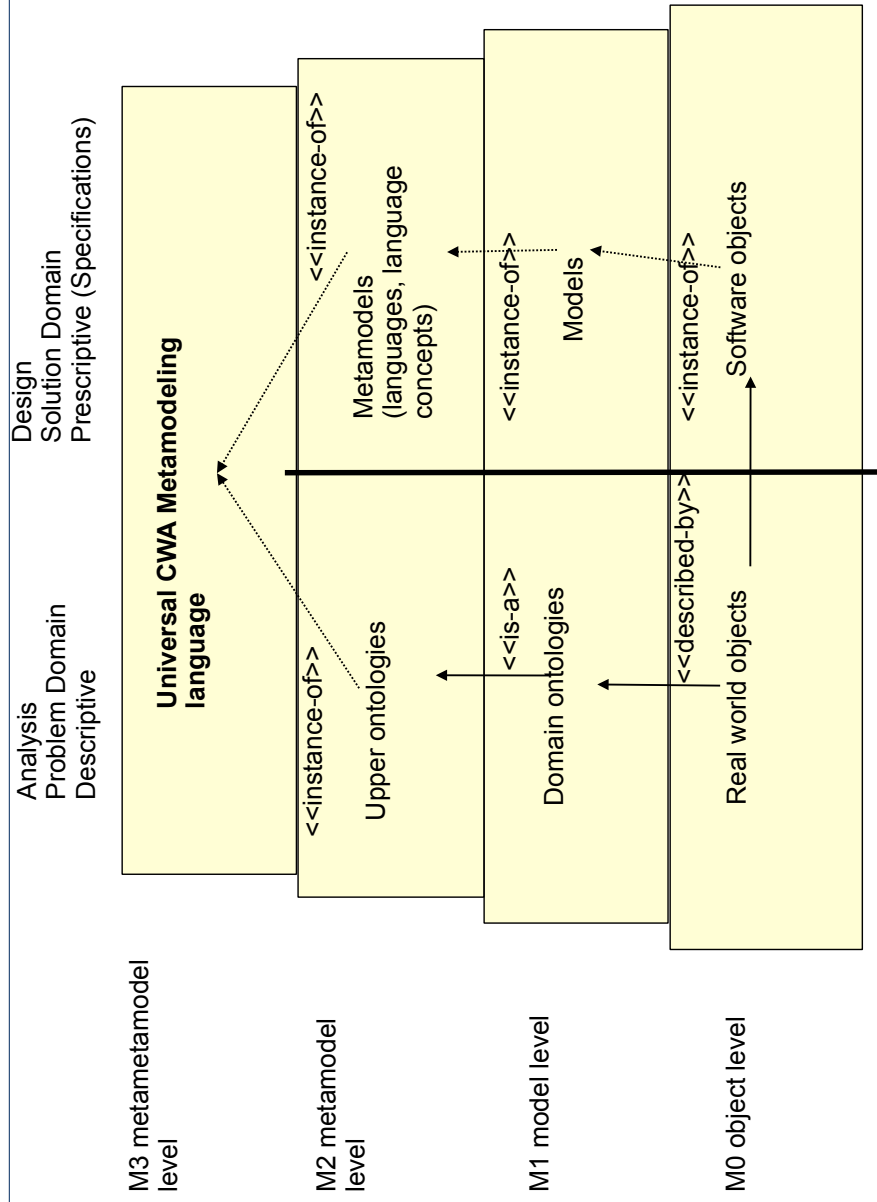
- ▶ **With Closed World Assumption (Reasoning)**
 - Querying
 - needs CWA to exclude erroneous data
 - Metamodeling:
 - needs CWA to exclude erroneous programs
 - Integrity constraints
 - needs CWA to exclude erroneous models
- ▶ **With Open World Assumption**
 - Domain modeling
 - needs OWA because of partial specification of domain

➤ aka *metapyramid*



The MDA Embedded in the MOF Metapyramid





- **Ontologies are advantageous in PLE for**
 - domain ontologies
 - integrity constraint ontologies in product lines
- **but...**
 - Ontologies should not be misused as system models
 - Ontologies *complement* system models
 - Ontologies in OWA for domain modeling, CWA for the rest
- **Integration technology and tools needed!**
- **MOST project (Marrying Ontologies and Software Technology)**
- www.most-project.eu

