50. Software Factories - Metamodelling in Heterogeneous Technical Spaces

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1) Heterogeneous technical spaces

Obligatorische Literatur

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Other Literature

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  - This PhD thesis lays the ground for component models and composition technology for modeling languages.
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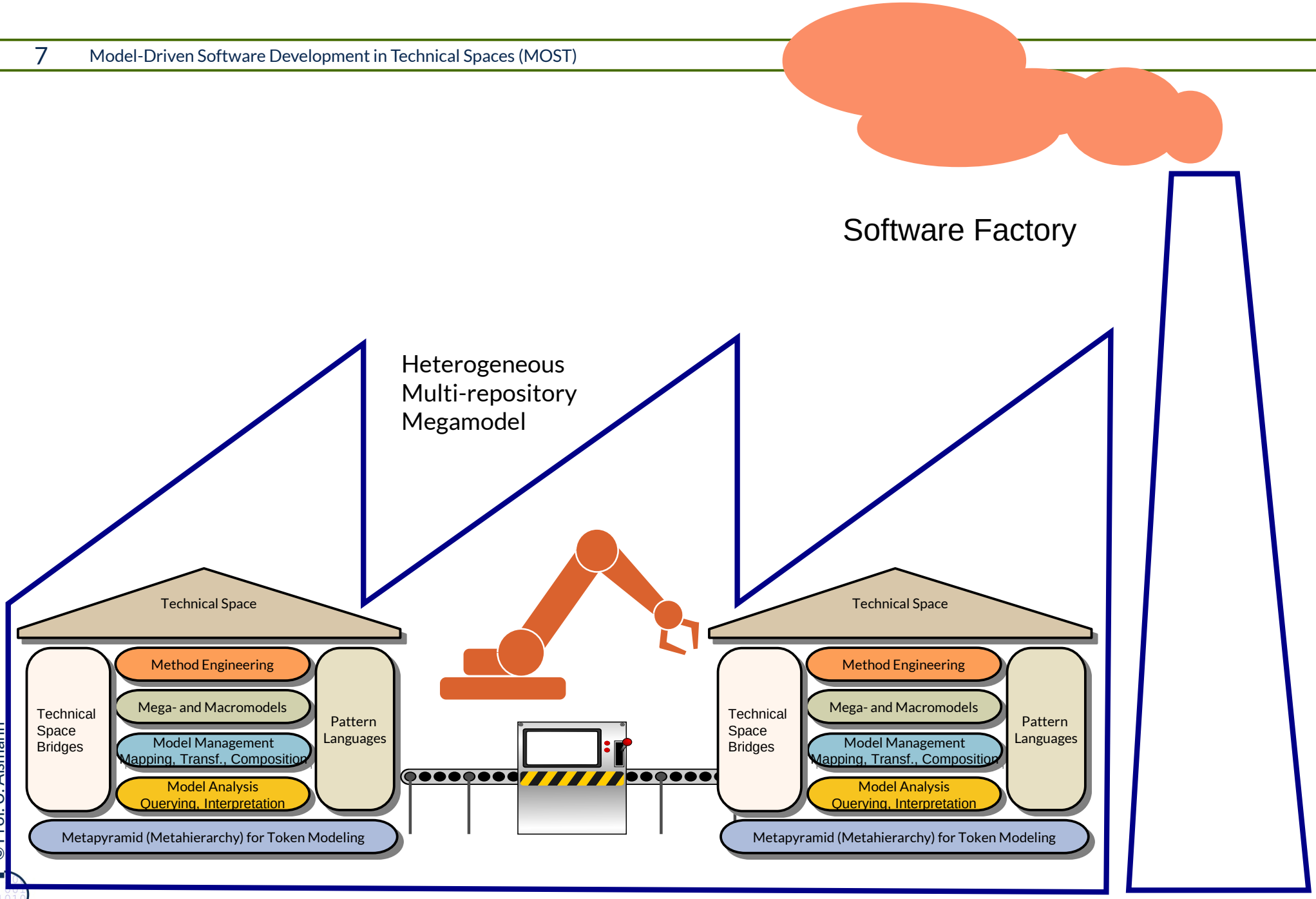
- Birgit Grammel. Automatic Generation of Trace Links in Model-driven Software Development. PhD thesis, Technische Universität Dresden, Fakultät Informatik, February 2014

The Book of the MOST Project for Multi-TS Development

MOSTPROJECT
http://most-project.eu

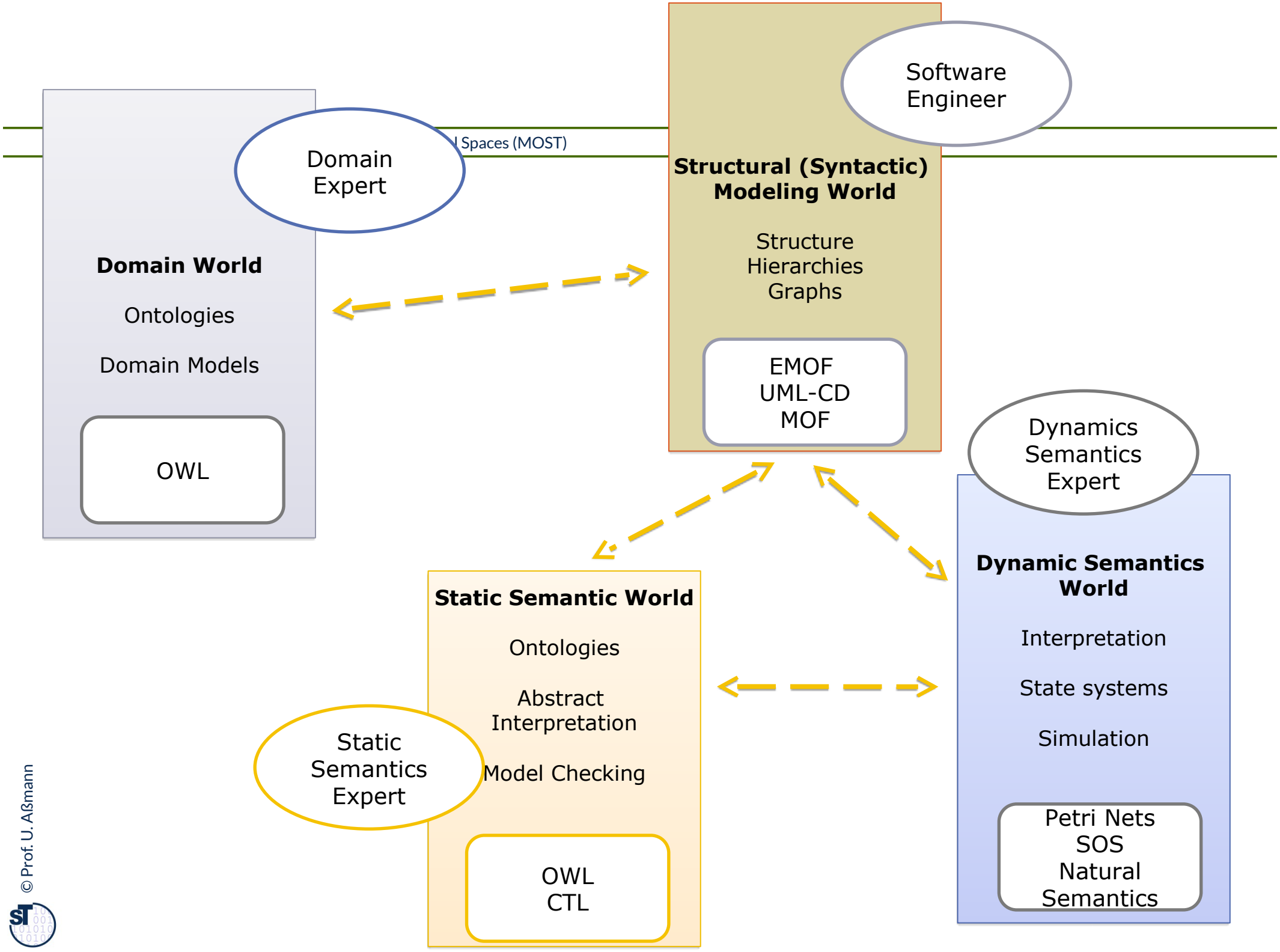
50.1 MDSD in Multiple Technical Spaces (Multi-TS Development)

Q13: A Software Factory's Heart: the Multi-TS Megamodel

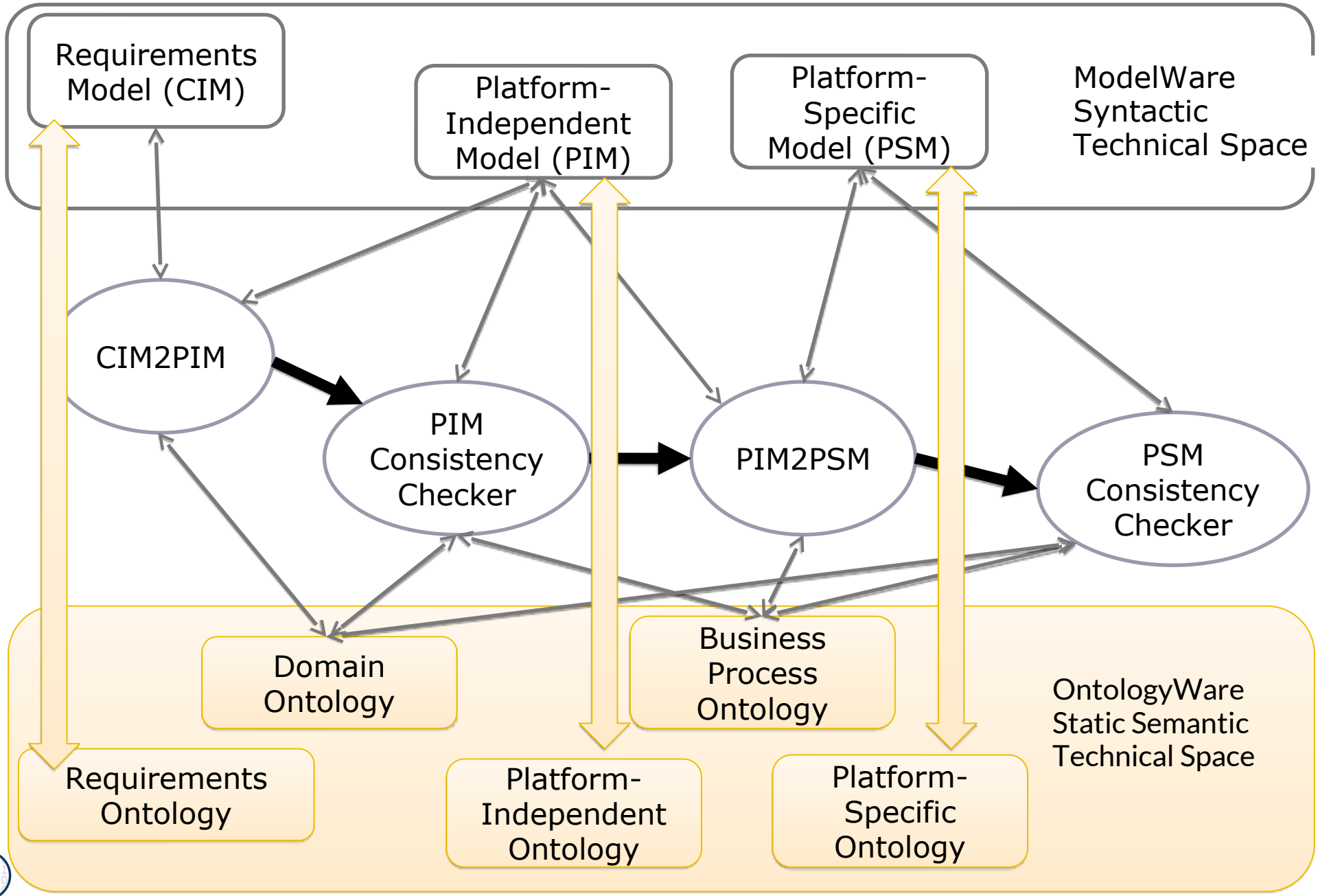


The Problem: Heterogeneous Software Lives in **Several** Technical Spaces

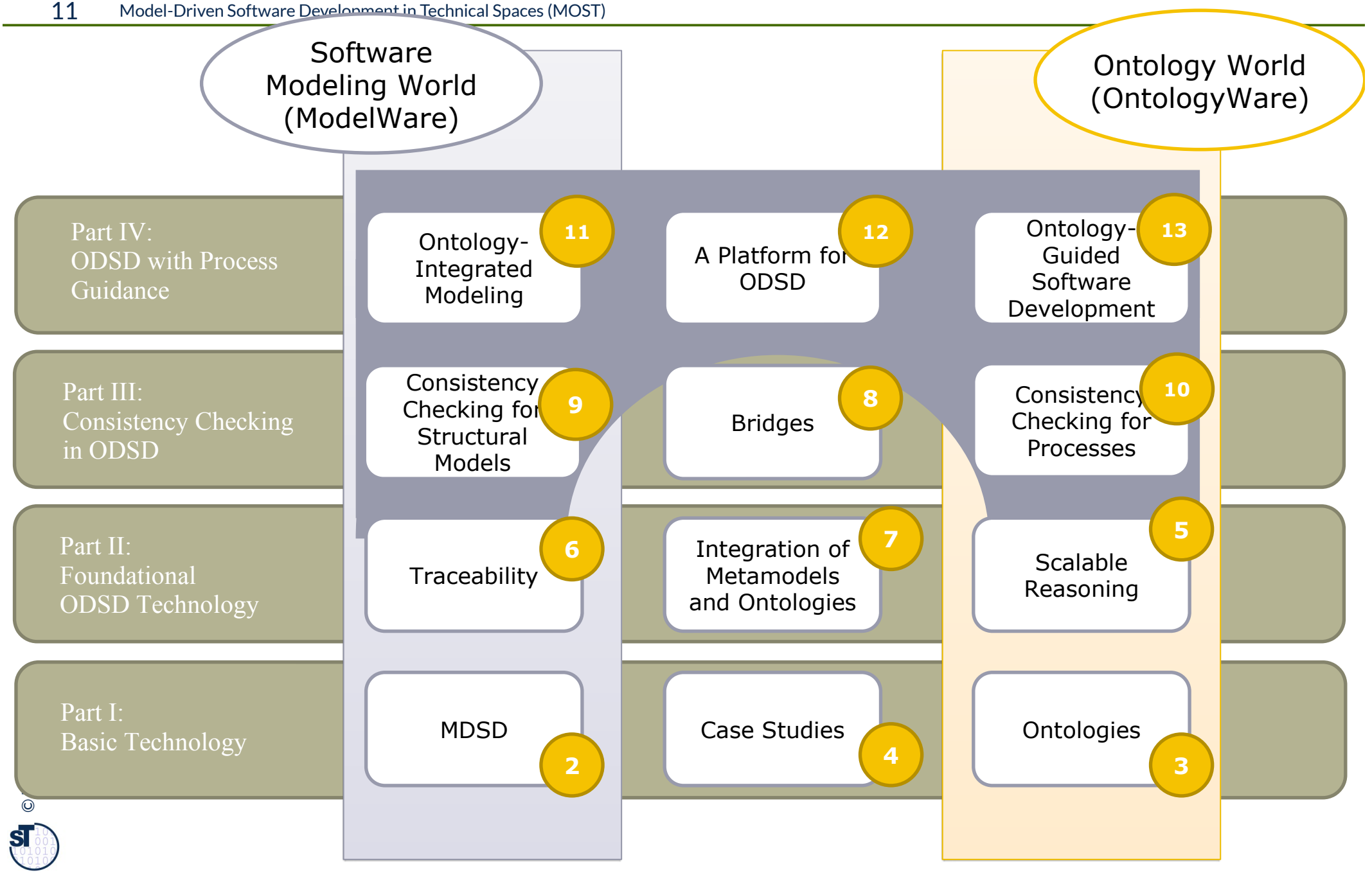
- Modern cars, cloud robots (Kiva robots), and other CPS live in several technical spaces:
  - Syntactic technical space
  - Static semantic technical spaces
  - Dynamic semantic technical space (usually one)
  - Domain world technical space



Example: A Heterogeneous MDA (From MOST Project)

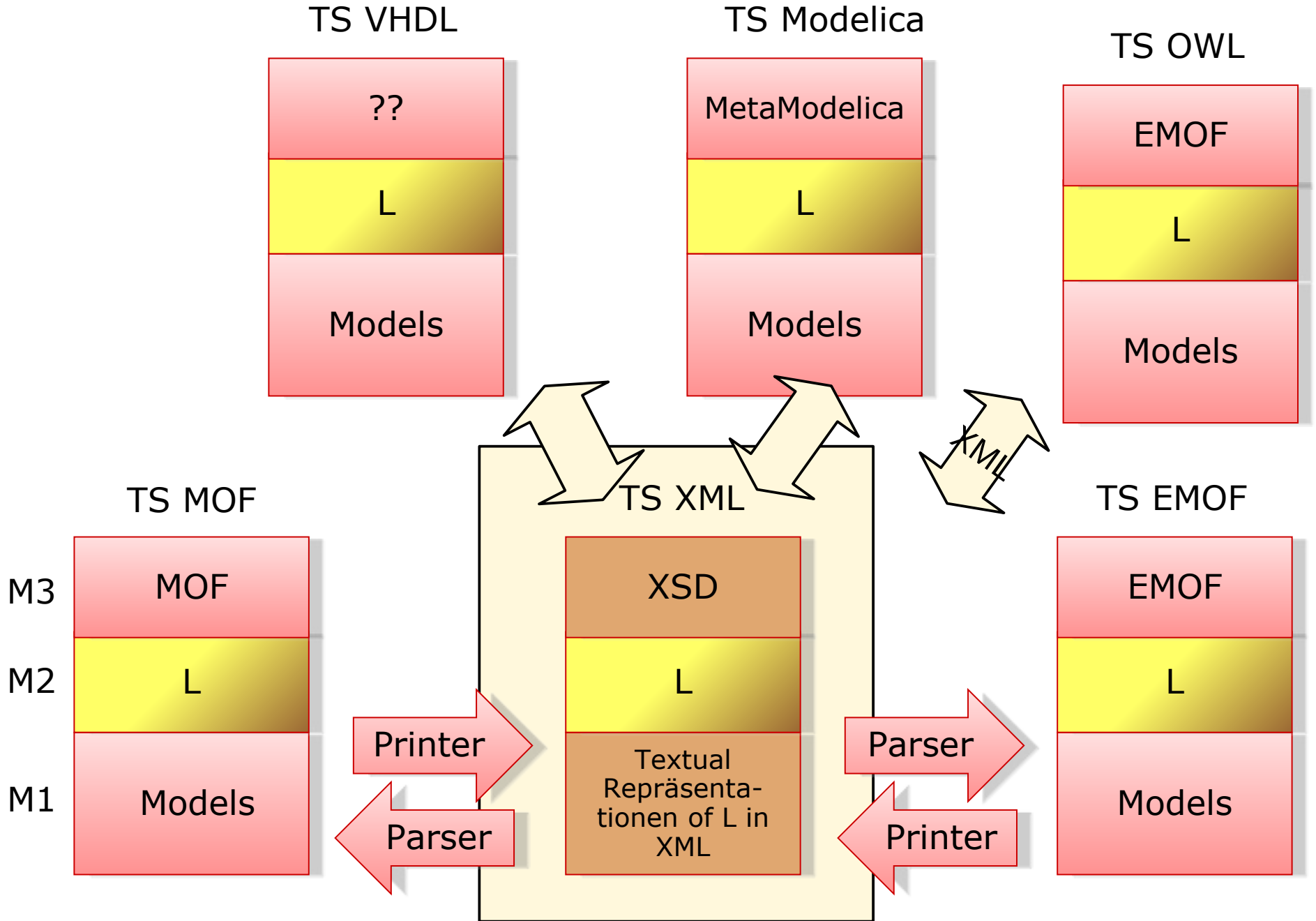


MOST: Tasks for Bridging between Syntactic and Semantic TS



50.2 Applications Working in Multiple Technical Spaces

Language Mapping between Several TS via XML
Data Exchange via Link Trees



Multi-Technical-Space MDSD Tools (Software Factories)

A **heterogeneous software factory** is a multi-TS IDE using several technical spaces at the same time.

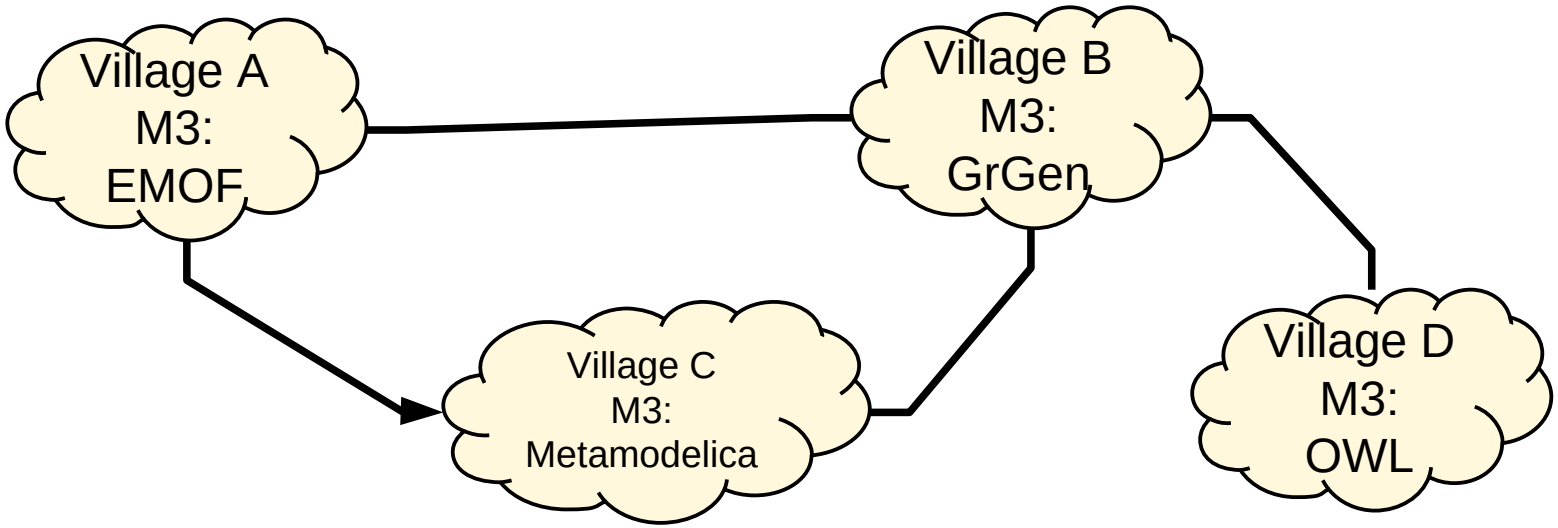
- Today, most MDSD toolkits work in one technical space.
- However, industrial software development usually is heterogeneous and several technical spaces must be used (XML, Java, C++, UML, csv, ...)
- PreeVision, ASCET are software factories

A software factory produces heterogeneous software product lines in several technical spaces.

A software factory benefits from a multi-TS macromodel.

Multi-Technical-Space MDSD Toolkits (Software Factories)

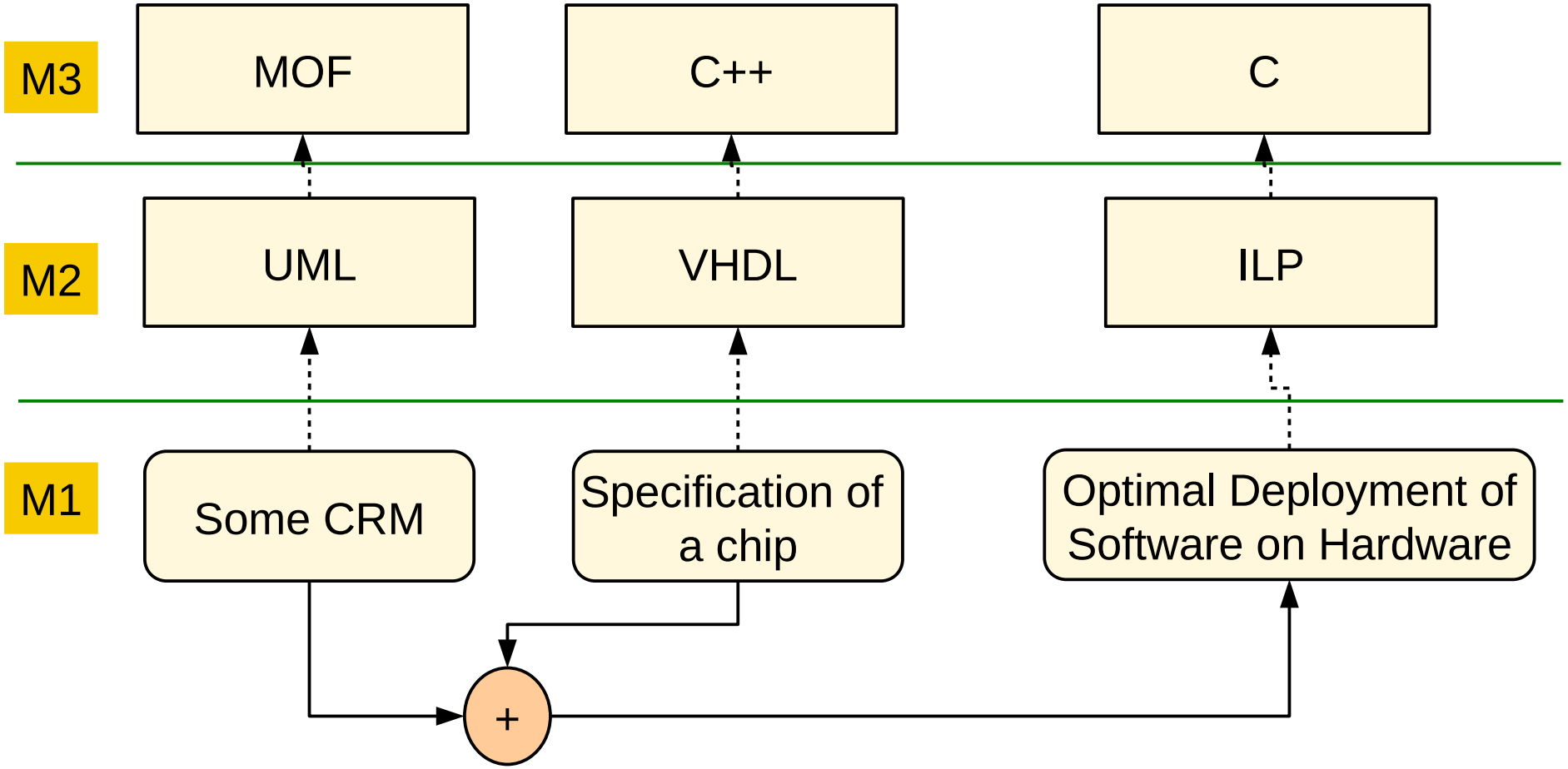
- Jean Bezivin's *Model Engineering Metapher*:
- **"The world of Model Engineering consists of different villages connected by streets. Every sort of engineer maintains one or several "model villages" (technical spaces) or "model towns" (or technological spaces)"**
- The task of model engineering is to build bridges and streets in the modeling landscape



Model Engineering is is the engineering of software factories – the engineering with several technical spaces in multiple technological spaces

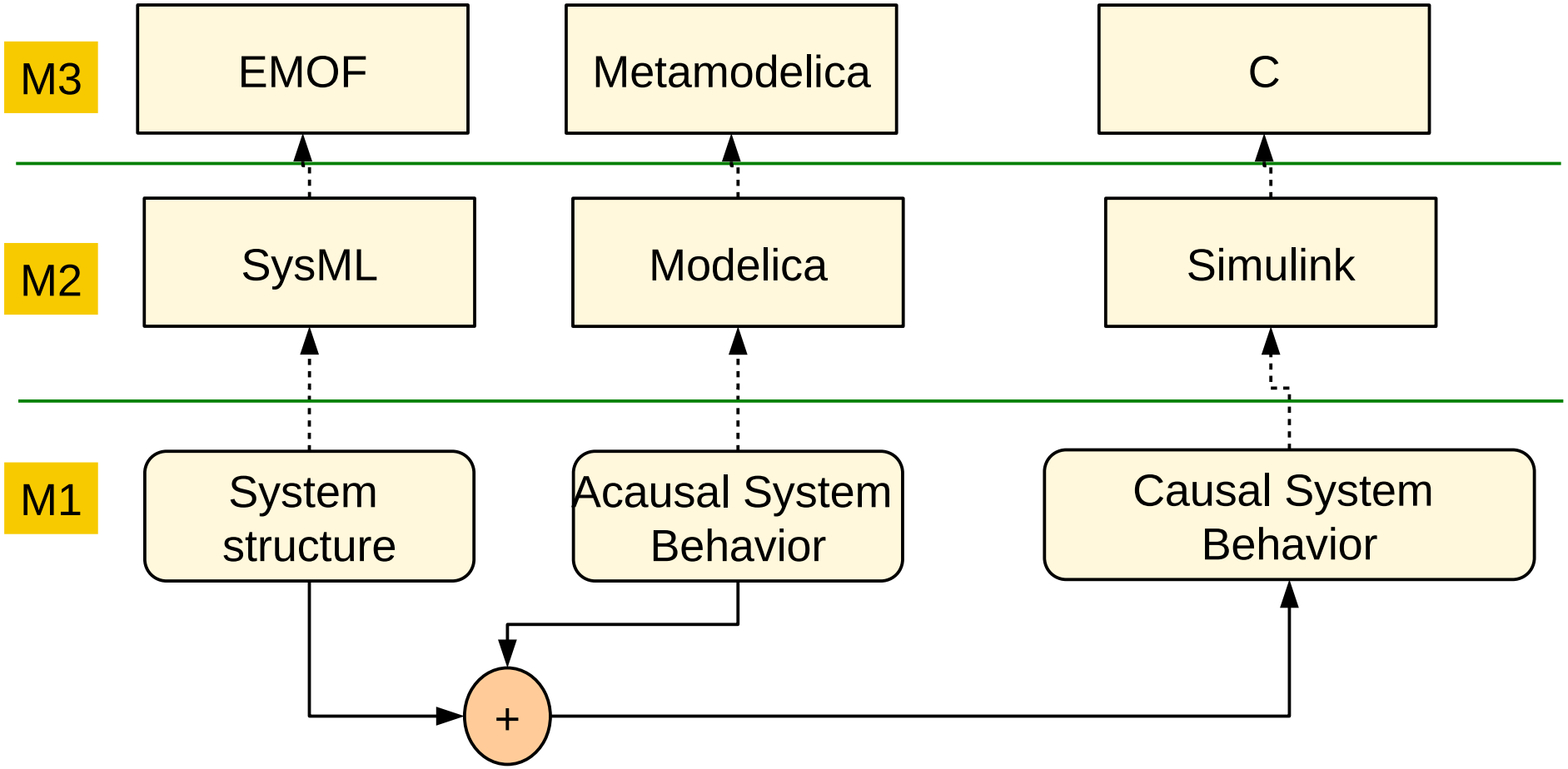
Example: Hardware Design

- To automate the optimization of software systems you need
  - A language to describe software systems (e.g., UML in MOF)
  - A language to describe hardware (e.g., VHDL in C++)
  - A language to express the optimization problem (e.g., ILP in C)



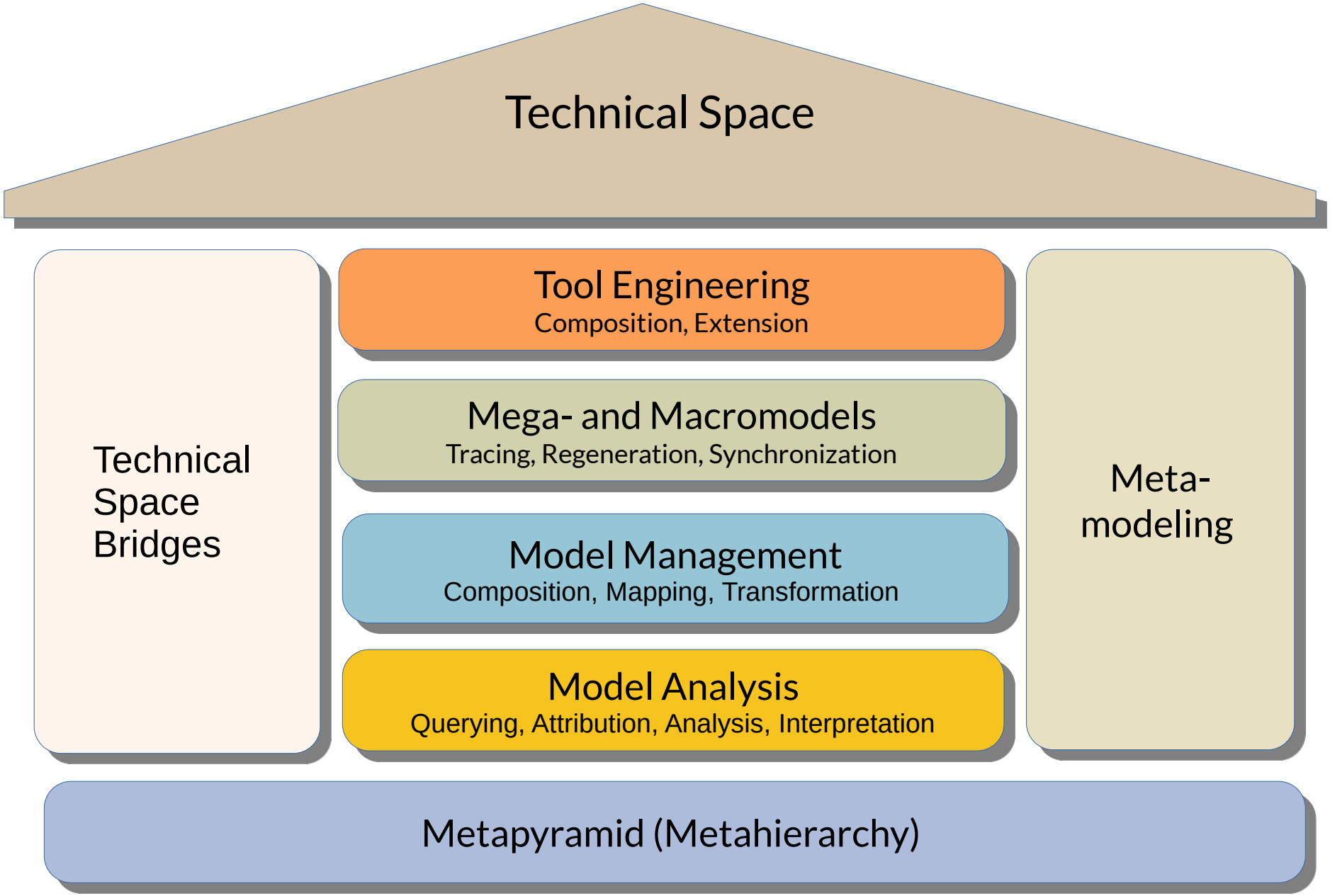
Example: Simulation

- To model advanced simulation software systems you need
  - A language to describe software structures (e.g., SysML in EMOF)
  - A language to describe simulations (e.g., Modelica in Metamodelica)
  - A language to express the optimization problem (e.g., Simulink in C)

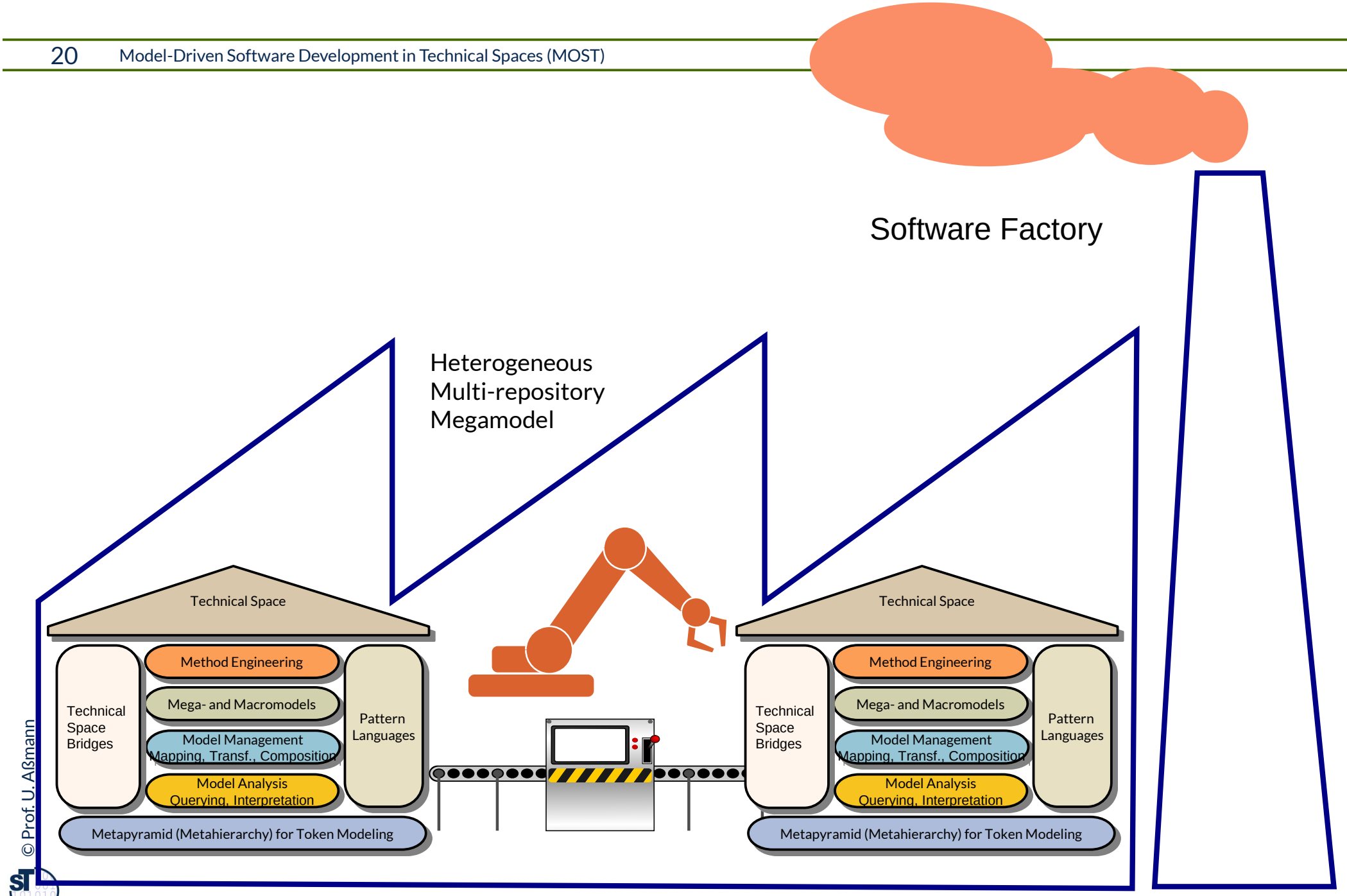


50.2 Software Factories (Wrapup)

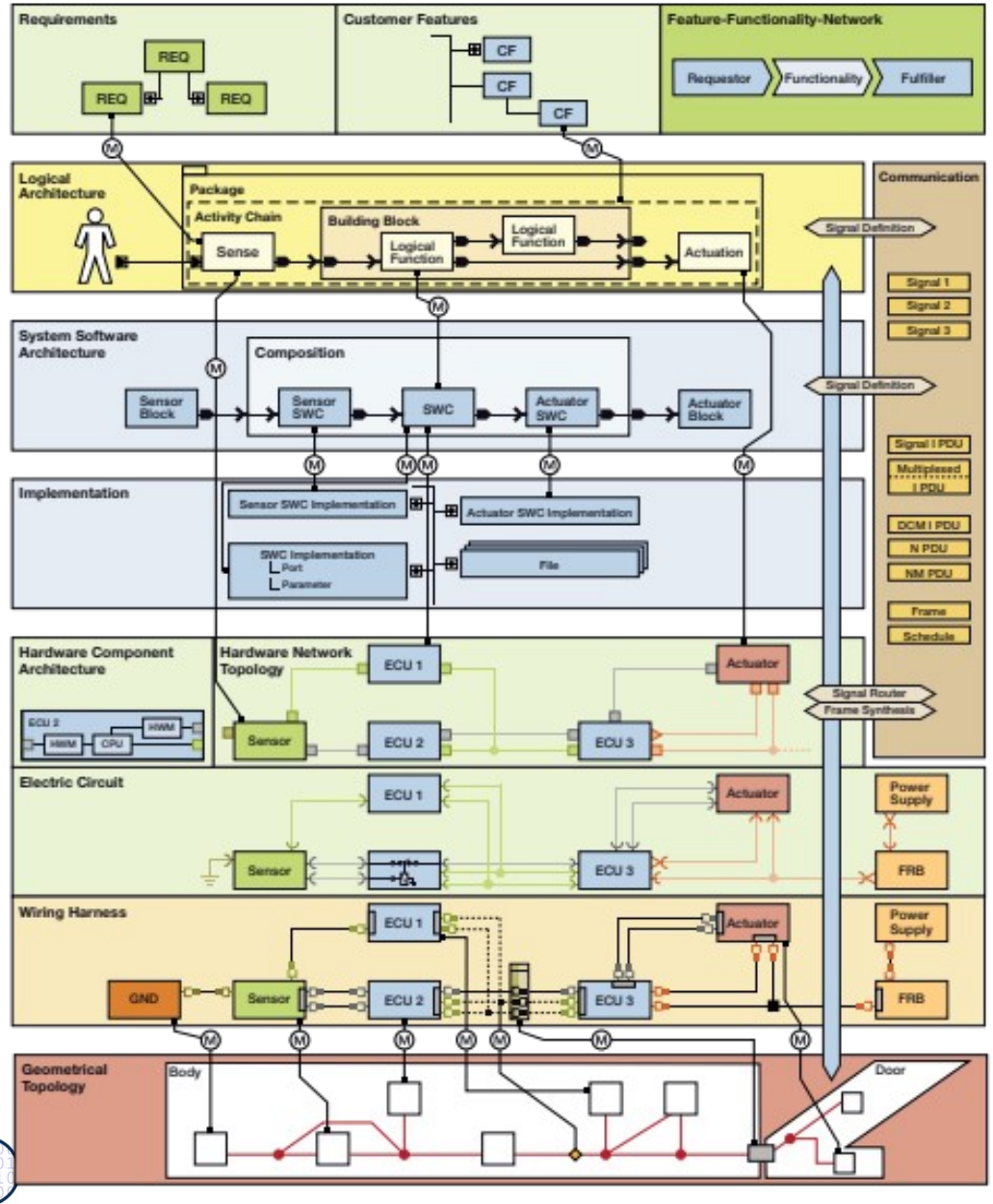
Q10: The House of a Technical Space



Q13: A Software Factory's Heart: the Multi-TS Megamodel



Remember the Big Example: Car Design with PREEVision (Vector): Interoperability with XML Link Trees



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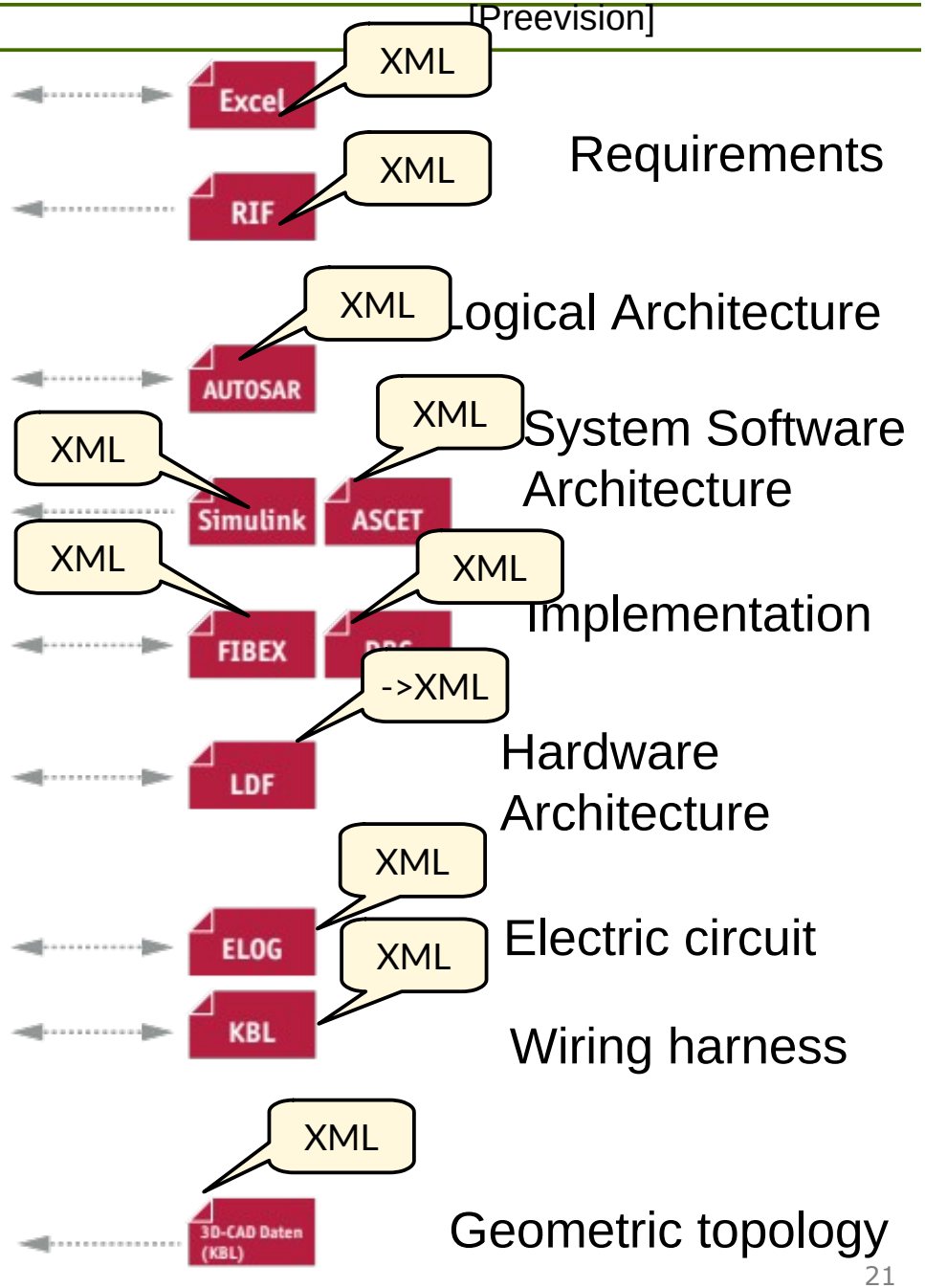

Engineering of Multi-Technical Space Macromodels

- Engineering of Technical Spaces and Macromodels is one of the most important topics of the future of software development
- Dresden has modern technologies and tools
  - Analysis tools (such as Relational RAG)
  - Transformation tools (such as RACR)
  - Invasive composition (of snippets), with metacomposition tools (Reuseware)
  - CROM (Role-based metalanguages)
  - Round-Trip Engineering protocols

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The End

- Explain why future toolkits to design complex things will be multi-TS software factories
- What is different in the handling of a multi-TS megamodel compared to a 1-TS megamodel?
- Which technical space would you choose to exchange data in a software factory? Why?
- Why will all engineering disciplines do software factories in 50 years from now?