

50. Software Factories - Metamodelling in Heterogeneous Technical Spaces

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http://st.inf.tu-dresden.de/teaching/most
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1) Heterogeneous technical spaces

Obligatorische Literatur

- 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.
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The Book of the MOST Project for Multi-TS Development





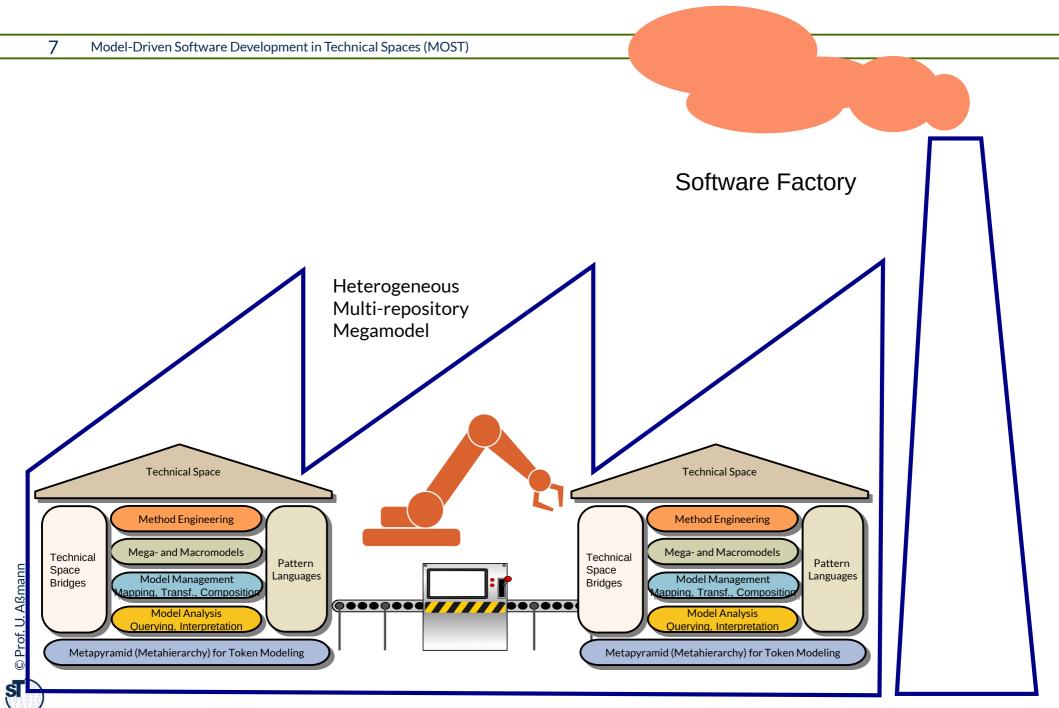




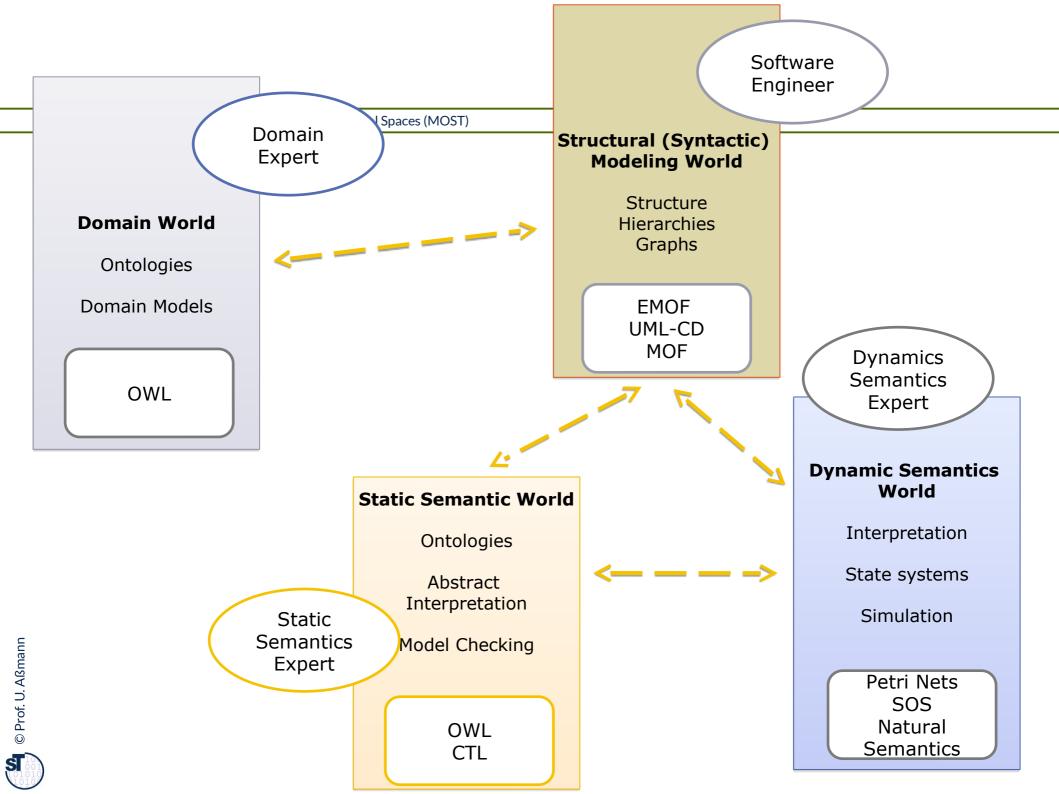
Fakultät Informatik - Institut Software- und Multimediatechnik - Softwaretechnologie - Prof. Aßmann - Model-Driven Software Development in Technical Spaces

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

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



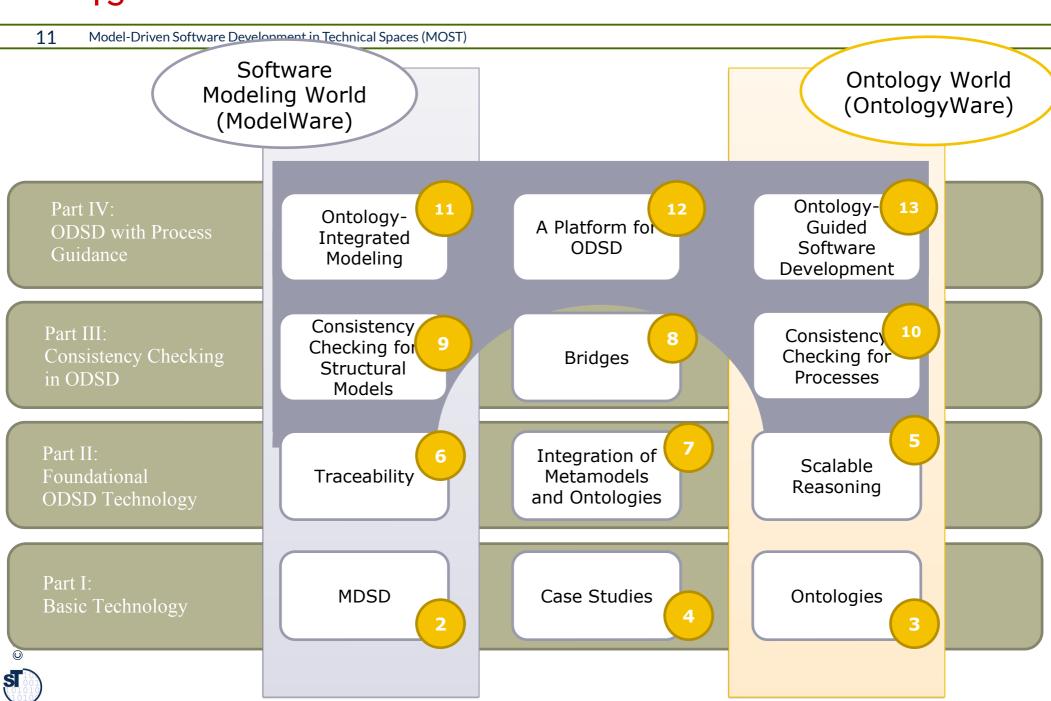
- Modern cars, cloud robots (Kiva robots), and other CPS live in several technical spaces:
 - Syntactic technical space
 - Static semantic technical spaces
 - Dynamic semantic technical space (usually one)
 - Domain world technical space



Example: A Heterogeneous MDA (From MOST Project)

10 Model-Driven Software Development in Technical Spaces (MOST) Requirements Platform-**ModelWare** Model (CIM) Platform-**Syntactic** Specific Independent Model (PSM) Technical Space Model (PIM) CIM2PIM PIM **PSM** PIM2PSM Consistency Consistency Checker Checker **Business** Domain **Process** OntologyWare Ontology © Prof. U. Aßmann Ontology Static Semantic **Technical Space** Platform-Platform-Requirements Specific Ontology Independent Ontology Ontology ST

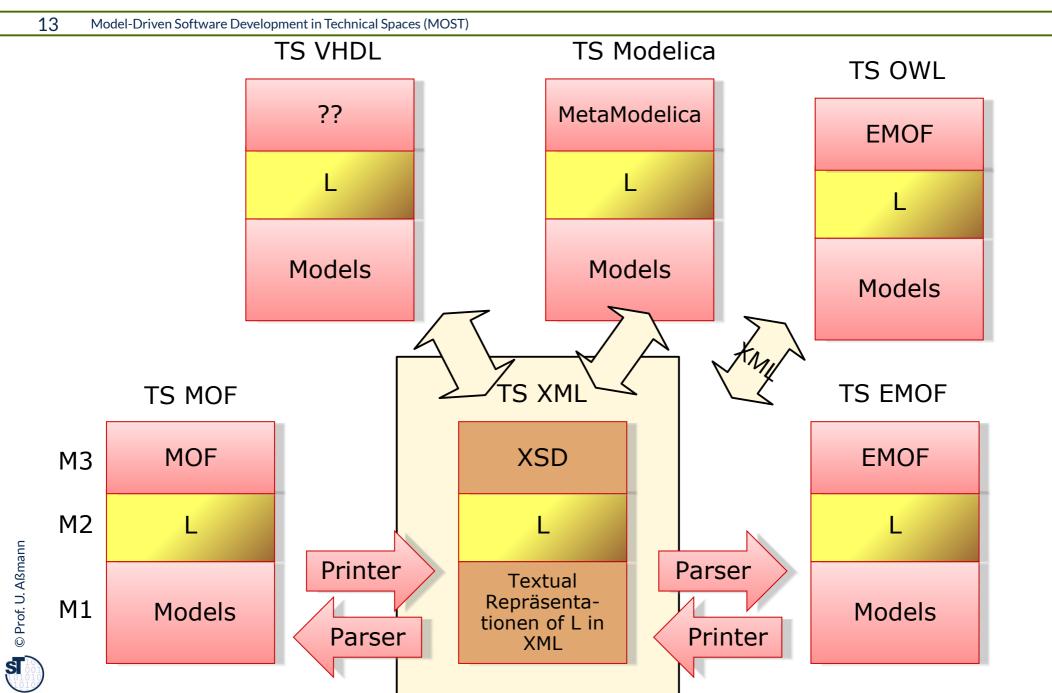
MOST: Tasks for Bridging between Syntactic and Semantic TS





50.2 Applications Working in Multiple Technical Spaces

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



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Multi-Technical-Space MDSD Tools (Software Factories)

Model-Driven Software Development in Technical Spaces (MOST)

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.

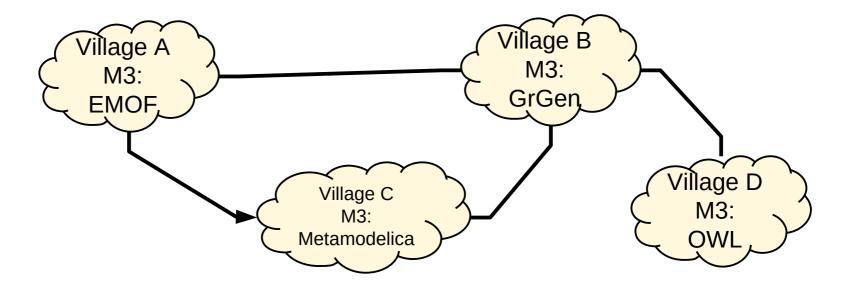


Jean Bezivin's Model Engineering Metapher:

"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)"

Multi-Technical-Space MDSD Toolkits (Software Factories)

The task of model engineering is to build bridges and streets in the modeling landscape

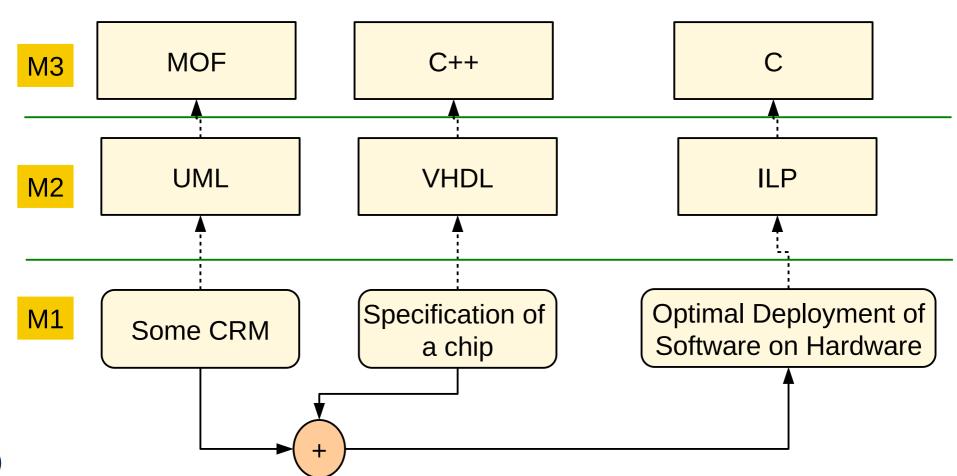


Model Engineering is is the engineering of software factories – the engineering with several technical spaces in multiple technological spaces



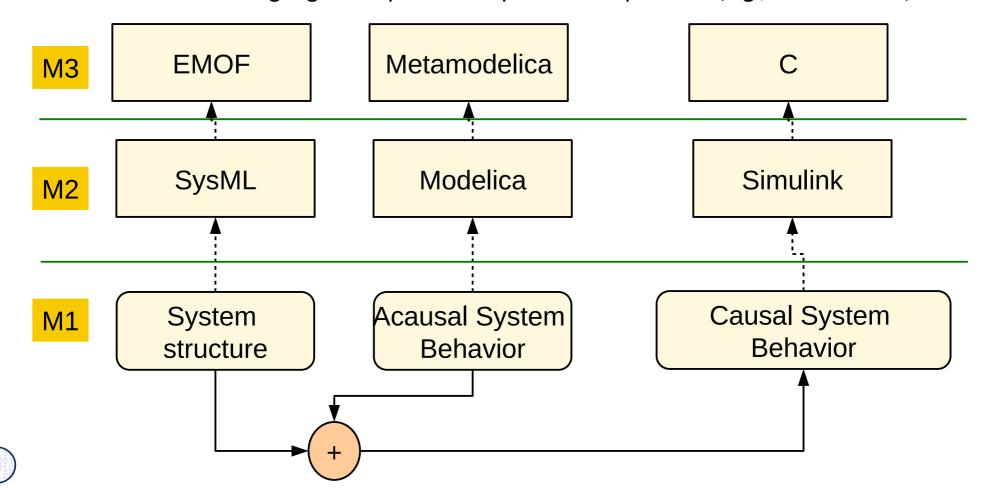
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- To automate the optimization of software systems you need
 - A language to describe software systems (e.g., UML in MOF)
 - A language to describe hardware (e.g., VHDL in C++)
 - A language to express the optimization problem (e.g., ILP in C)



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- To model advanced simulation software systems you need
 - A language to describe software structures (e.g., SysML in EMOF)
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50.2 Software Factories (Wrapup)

Technical Space

Technical Space **Bridges**

Tool Engineering Composition, Extension

Mega- and Macromodels Tracing, Regeneration, Synchronization

Model Management Composition, Mapping, Transformation

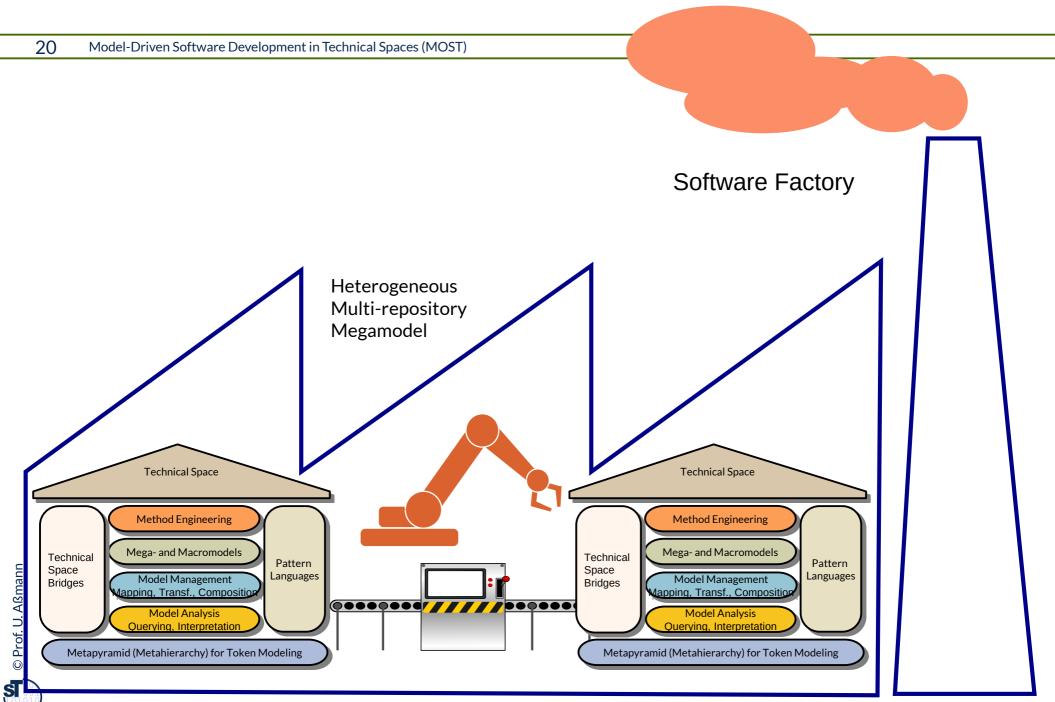
Model Analysis Querying, Attribution, Analysis, Interpretation

Metamodeling

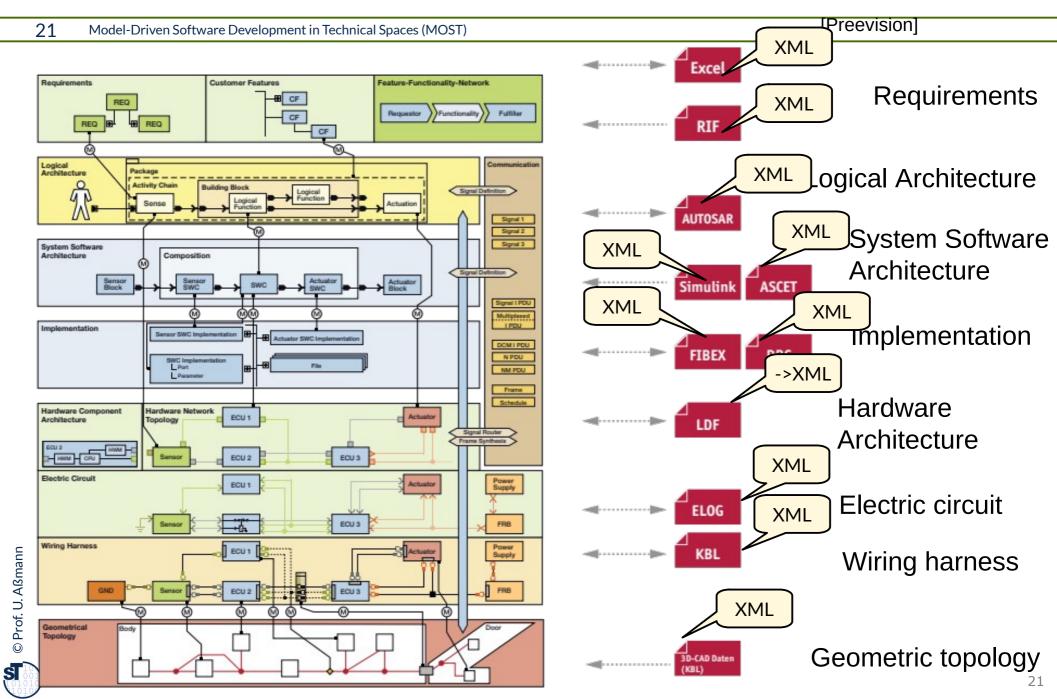
Metapyramid (Metahierarchy)



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



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



Engineering of Multi-Technical Space Macromodels

22 Model-Driven Software Development in Technical Spaces (MOST)

- 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)
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- 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?



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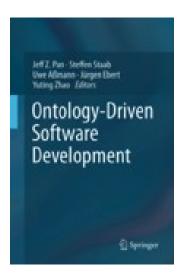
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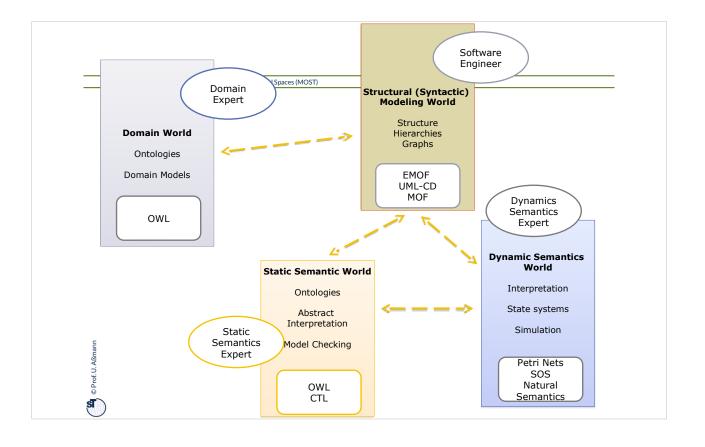
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The Problem: Heterogeneous Software Lives in **Several** Technical Spaces

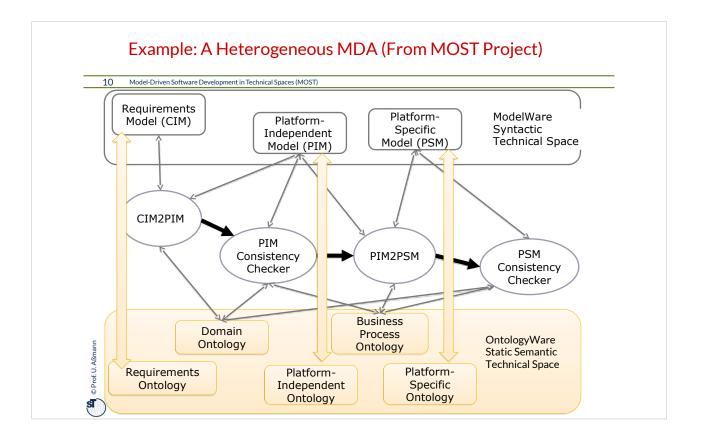
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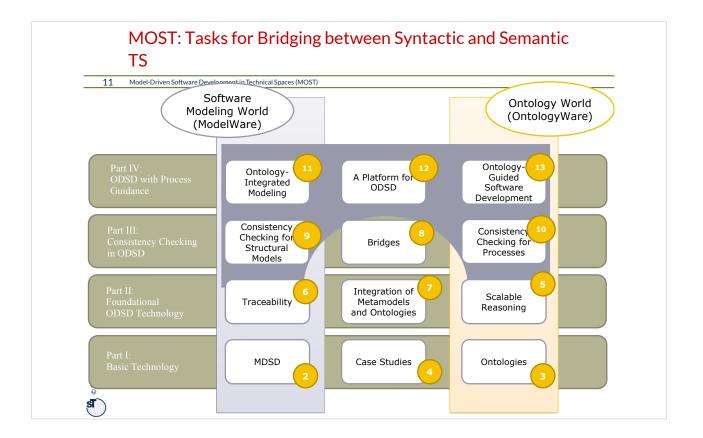
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Bridging.all-the-technical-spaces



MDSD-Integrated-Services



BookRoadmap



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50.2 Applications Working in Multiple Technical Spaces

Language Mapping between Several TS via XML Data Exchange via Link Trees 13 Model-Driven Software Development in Technical Spaces (MOST) TS VHDL TS Modelica TS OWL ?? MetaModelica EMOF L L L Models Models Models TS MOF TS EMOF М3 MOF XSD **EMOF** M2 L L L Printer Textual Repräsenta-tionen of L in XML Parser М1 Models Models Parser Printer

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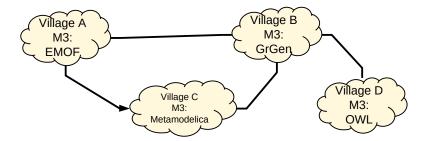
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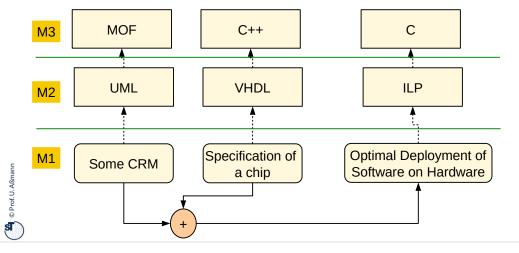


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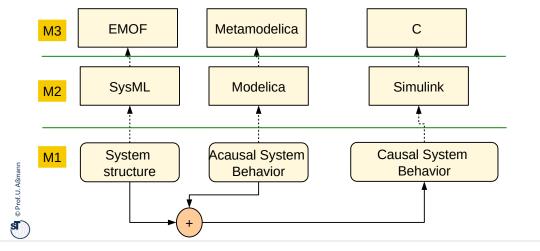
Example: Hardware Design

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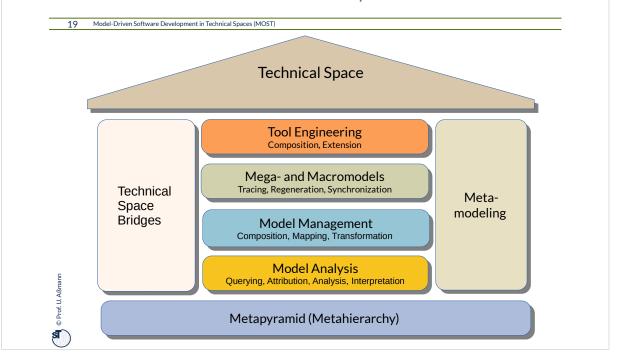




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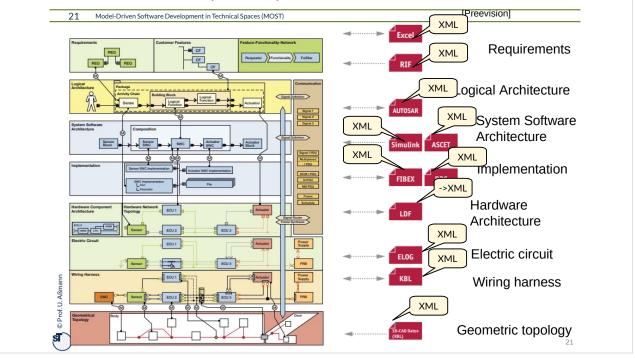
50.2 Software Factories (Wrapup)

Q10: The House of a Technical Space



Q13: A Software Factory's Heart: the Multi-TS Megamodel 20 Model-Driven Software Development in Technical Spaces (MOST) Software Factory Heterogeneous Multi-repository Megamodel Technical Space Method Engineering Method Enginee

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The End

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