Bridging Gaps: MDE challenges from practice and research

MDENet Workshop

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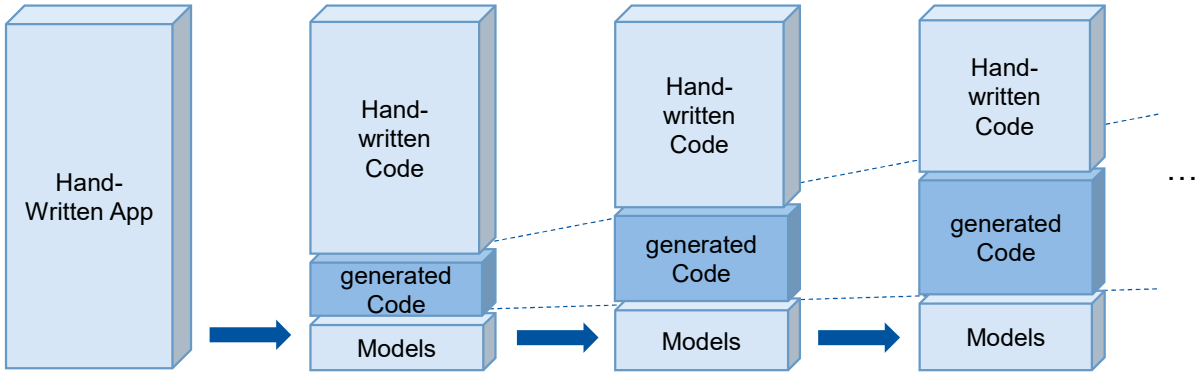
We need more experience in retrofitting of MDE methods into already existing applications!

- Green-field is often only a theoretical assumption
- Real-world systems
  - More complex, legacy, brown-field
- Retrofitting of MDE methods
  - into already existing applications

Open topics:

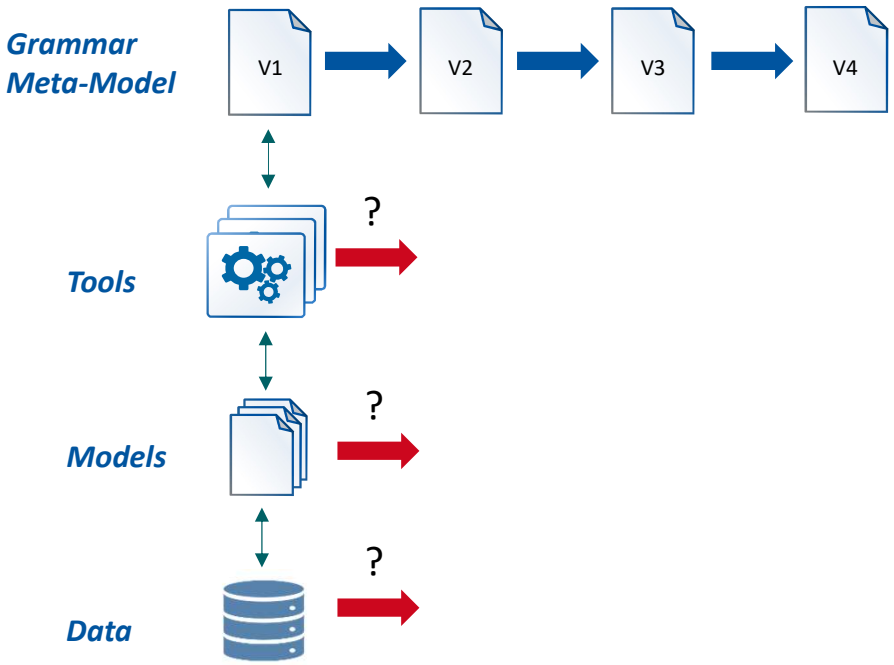
Create methods to support this retrofitting process, e.g., identify patterns & repetition in existing code, extract the run time environment, developer suggestions to improve the code,…



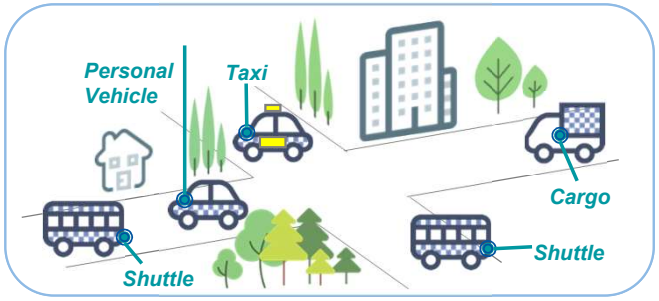
We still lack good methods for language, tool, model and data evolution!

- *Evolving languages*
  - for different DSLs
  - but also standards, e.g., SysML v1 -> v2
- Levels
  - Tool, model and data evolution
- Strategies
  - Only start with new models
    - Create new tools and data
  - Manually evolving
    - A lot of *manual effort*

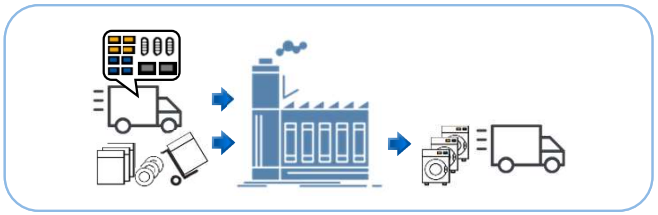
Open question:
How can we provide (semi-) automated evolution on all levels?



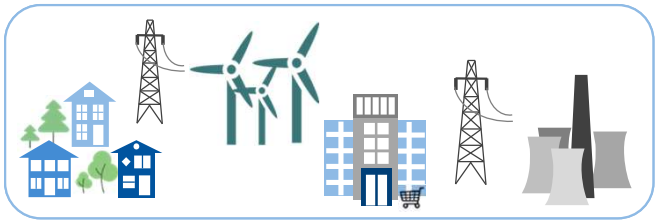
We lack approaches to work with multi-perspective models accross heterogeneous tools!



Transportation Systems

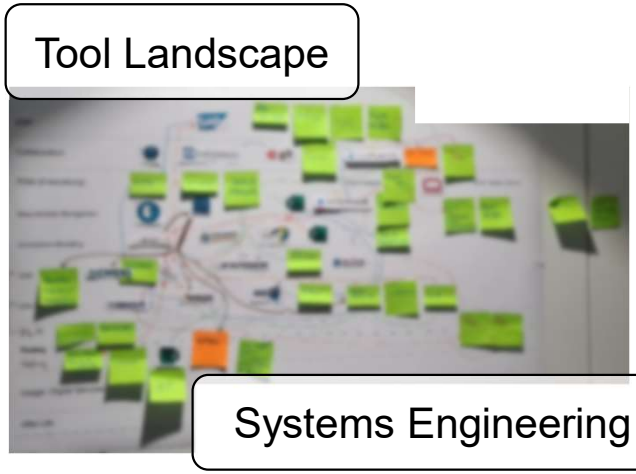


Production Systems



Energy Systems

- Engineering complex systems with heterogeneous engineering domains
  - Different tools
  - Overlapping information



Open question:
How can we connect information and multi-perspective models from different tools in an automated way?

- Needed, e.g., for
  - digital twins
  - model-based systems engineering

Why do we consider human factors so less in MDE?

- MDE supports cross-cutting aspects
  - Usability, Adaptability
  - Accessibility, e.g., vision impairments
- MDE and GUIs for vision impairment
  - Still not a standard in MDE approaches
- Even *modeling tools are not inclusive*
  - ER 2023 paper

How Inclusive is Conceptual Modeling?
A Systematic Review of Literature and Tools
for Disability-aware Conceptual Modeling

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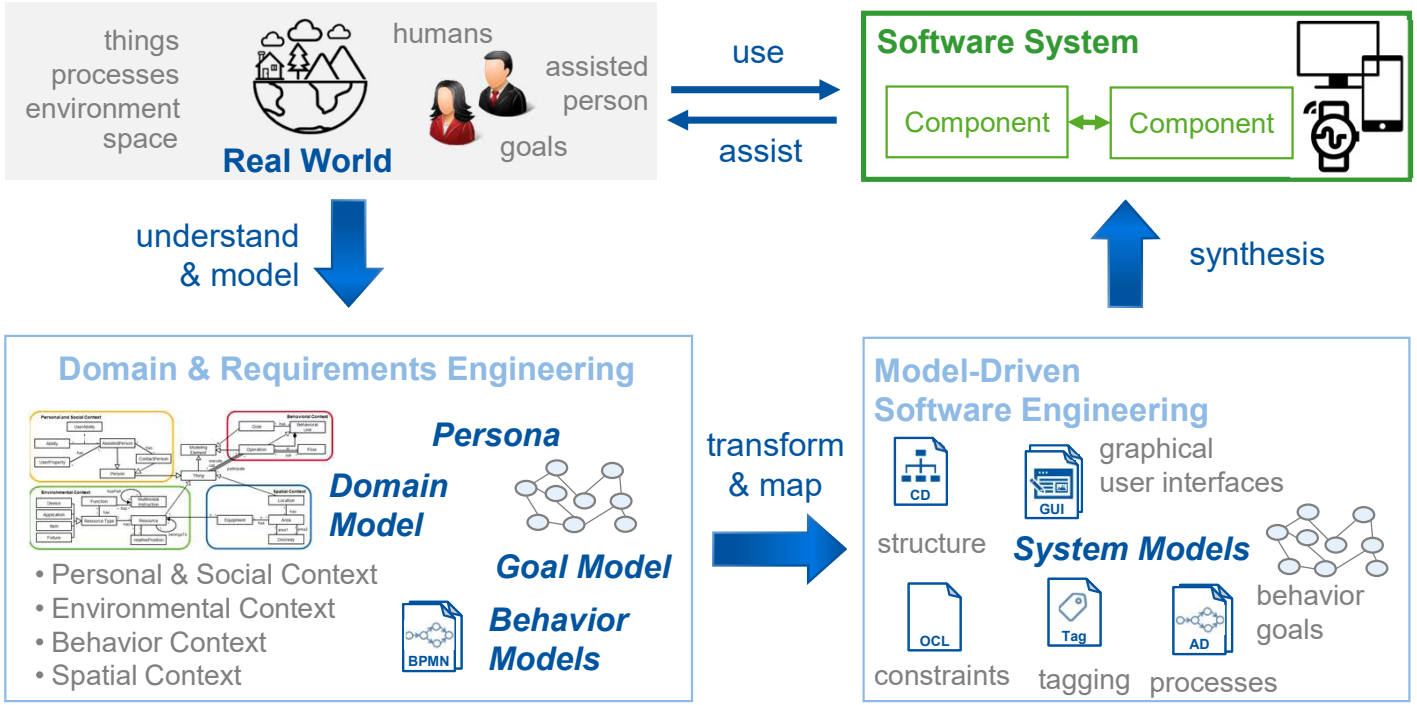
Open question:
How can we incorporate such cross-cutting aspects regarding human users better within MDE approaches?

How can we use automation earlier in the development process?

- Capturing the real world
  - Requirements elicitation
  - Requirements models
- Still using these approaches (mostly) decoupled from MDE artifacts

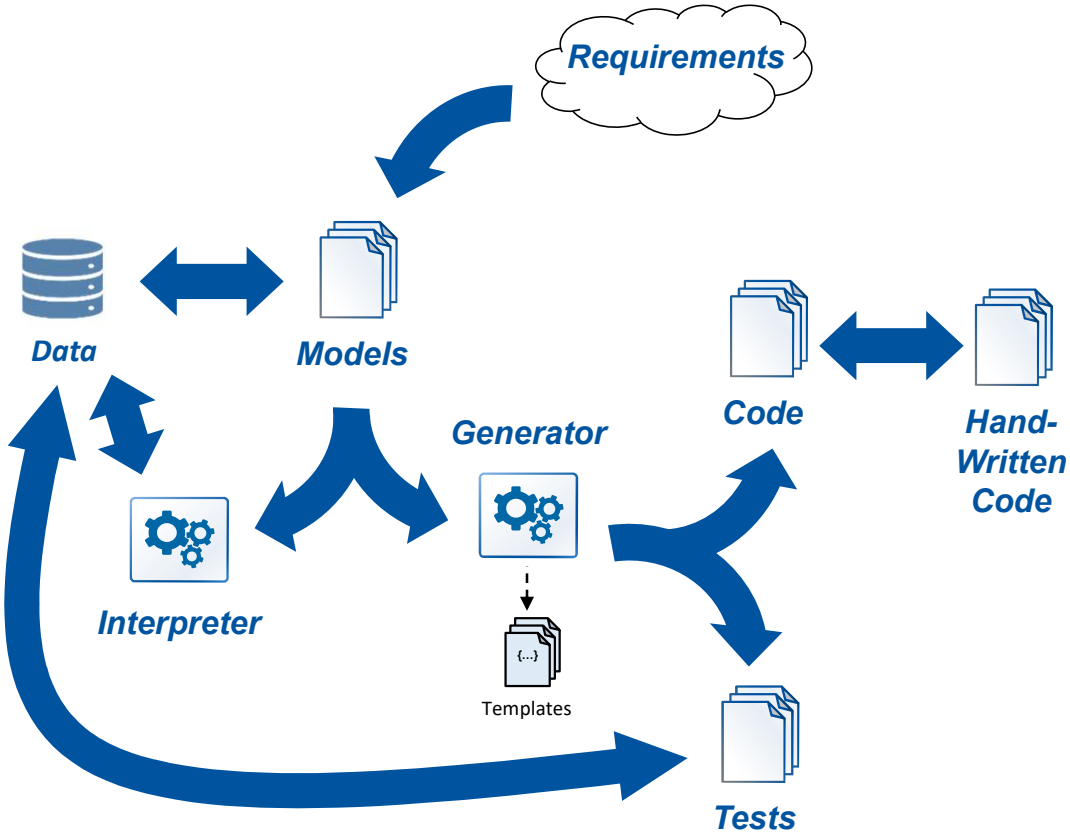
Open question:
How can we reuse requirements engineering models and artifacts within MDE processes?

- Connection to RE community



How can we improve MDE processes by using AI methods?

- Investigate all aspects of MDE processes
- Constructive / Synthetic
  - Transition from one representation to the next
  - Special: textual requirements to models
  - Technology-specific additions (APIs for storage, etc.)
- *Analytical*
  - Model reviews
  - Recognize errors
  - Detect or rectify incompleteness (e.g. in behavior)
  - Consistency between two models
  - Complete missing tests
- *Explaining*
- *Optimizing*
  - Various criteria (robust, efficient, resource-saving)

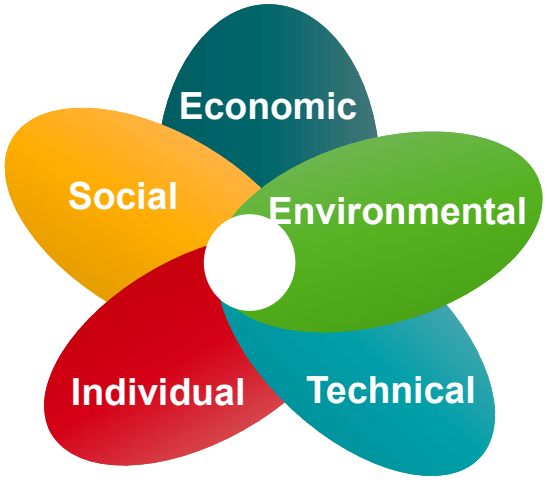


How can we incorporate sustainability in MDE?

- *2 levels*
  - Sustainability of the *systems* we develop
  - Sustainability of *MDE processes*

Open question(s):
How can we incorporate sustainability in MDE processes and the systems we develop?

- *Model sustainability explicitly for MDE processes*
  - Non-functional requirements
- *Understand the costs of automation*
  - balance high quality in engineering processes vs. not wasting resources
  - analyze processes
- *Collaboration with various other fields of research needed*



Conclusion

It's great, we have a lot of challenging questions to solve!

- *Collaboration and Cooperation*
  - RE, MDE, Human Factors
  - Data Engineering, MDE
  - Sustainable X, Energy Systems, MDE
  - Academia and Industry

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