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# Principle Structure and Architecture of a Code Generator

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# A Short Resume of the Presenter

Prof. Dr. **Andreas Schmidt** is a professor at the Department of Computer Science and Business Information Systems of the Karlsruhe University of Applied Sciences (Germany). He is lecturing in the fields of database information systems, data analytics and model-driven software development. Additionally, he is a senior research fellow in computer science at the Institute for Applied Computer Science of the Karlsruhe Institute of Technology (KIT). His research focuses on database technology, knowledge extraction from unstructured data/text, Big Data, and generative programming. Andreas Schmidt was awarded his diploma in computer science by the University of Karlsruhe in 1995 and his PhD in mechanical engineering in 2000. Dr. Schmidt has numerous publications in the field of database technology and information extraction. He regularly gives tutorials on international conferences in the field of Big Data related topics and model driven software development. Prof. Schmidt followed sabbatical invitations from renowned institutions like the Systems-Group at ETH-Zurich in Switzerland, the Database Group at the Max-Planck-Institute for Informatics in Saarbrukken/Germany and the Data-Management-Lab at the University of Darmstadt.

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# Research Interests

- For PIA Group at KIT see https://www.iai.kit.edu/english/941.php
- Additionally, all sort of database related stuff, like
  - Database Implementation
  - Graph databases
  - Semantic Text Analysis
  - Information Retrieval
  - ...

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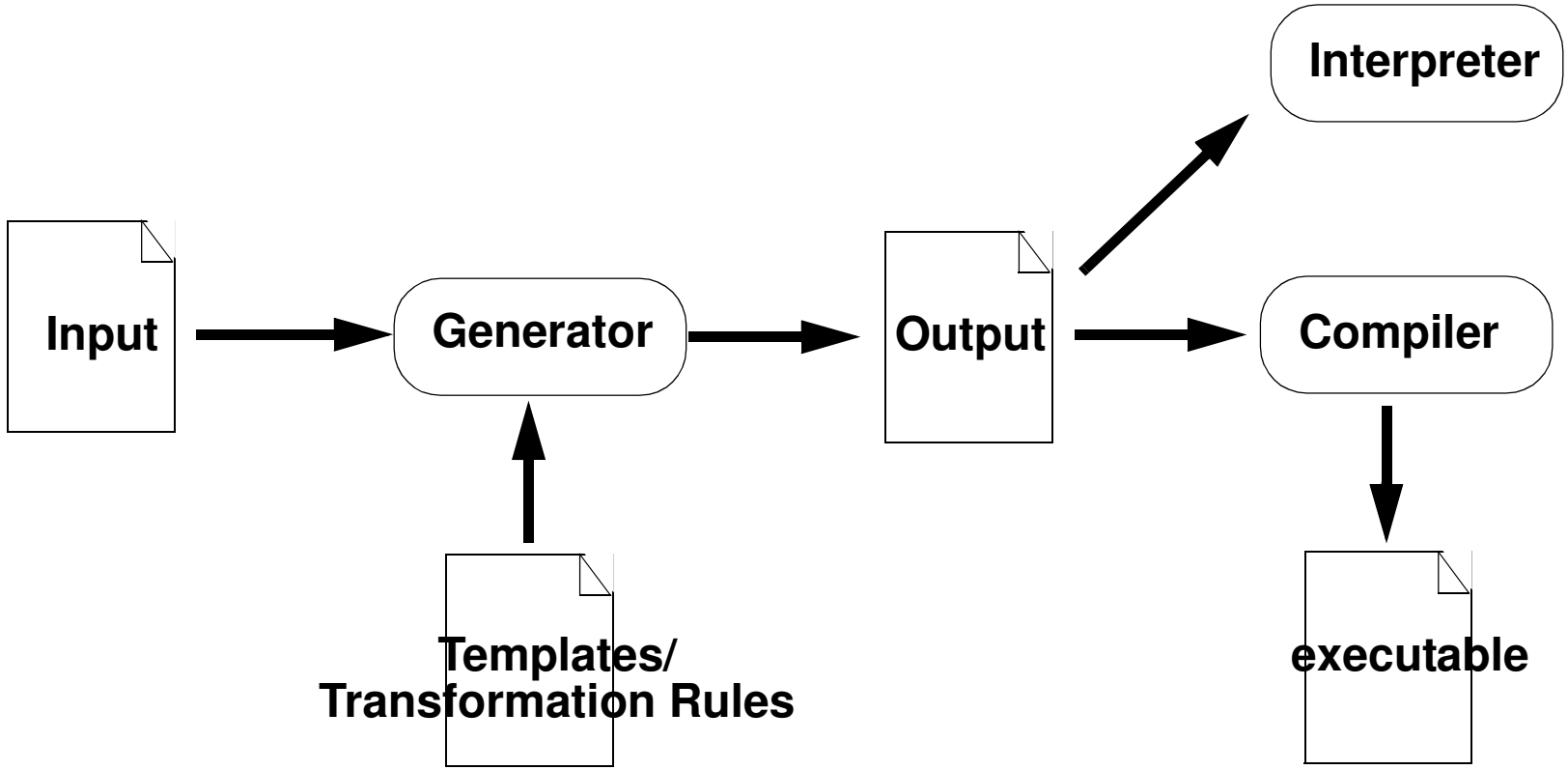
# Outline

- Introduction
- Model Driven Software Development
- Architrecture of a General Purpose Software Generator
- Summary

# What is a Software Generator?

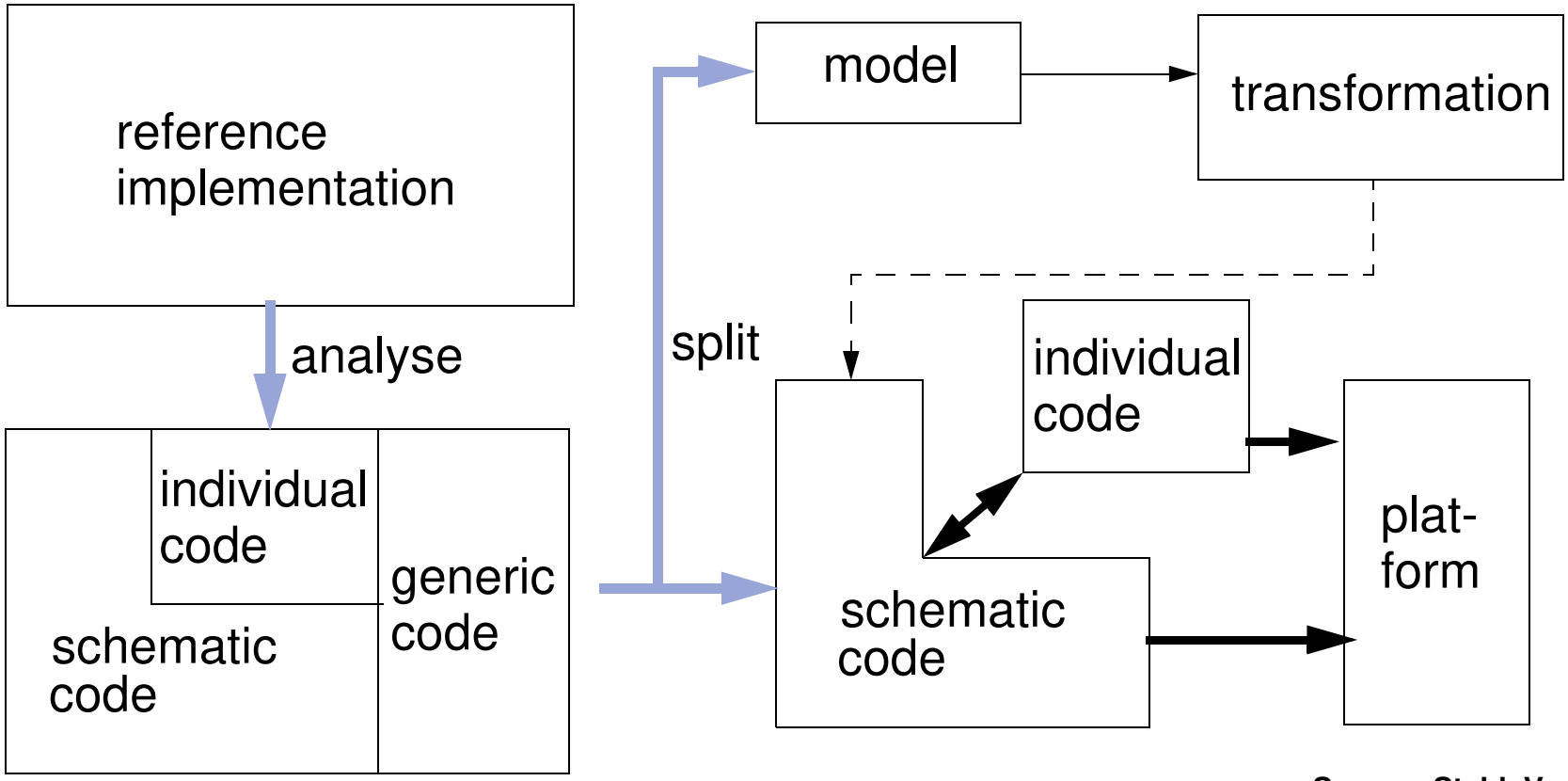
Principle



# Model Driven Software Development

- Partial or whole generation of programs, based on a formal model
- Model represents the problem space of the application
- Models could be transformed in other models or into source code
- Model representation:
  - Abstract and formal description (without implementation details) of a problem space
  - Notation:
    - text
    - xml
    - graphical representation

# Concept of MDSD




**Source: Stahl, Voelter, 2005**

# What can be generated ?

- Database Schema
- Data Access Layer
- User Interfaces
- Whole or part of the application logic
- Documentation
- Configurations
- Tests
- Wrapper
- Import/Export modules
- ...

# Advantages of Software Generation

- Higher productivity
  - Tedious parts can be automated
  - Reduced reaction time on design changes/change requirements

- Improved quality
  - The transformation (template) is responsible for the quality of the code
  - Integrated architecture in templates defined
  - Automatic transformations (no careless errors)

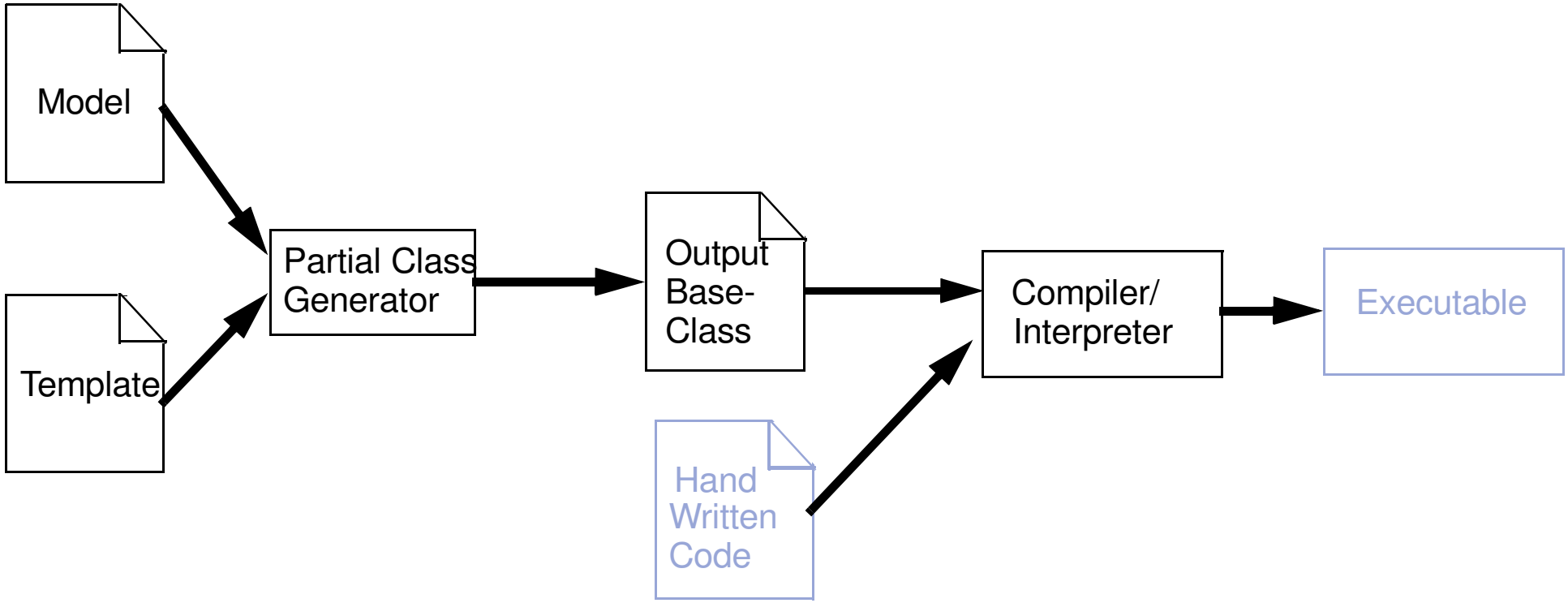
# Advantages of Software Generation

- Higher abstraction
  - Model represents an abstract description of the application
  - Business rules can be review by domain experts
  - easier change to new technology (change templates)
  - reuse of already developed transformation rules (software factories)
  - better handling of complexity (reduction to essential)

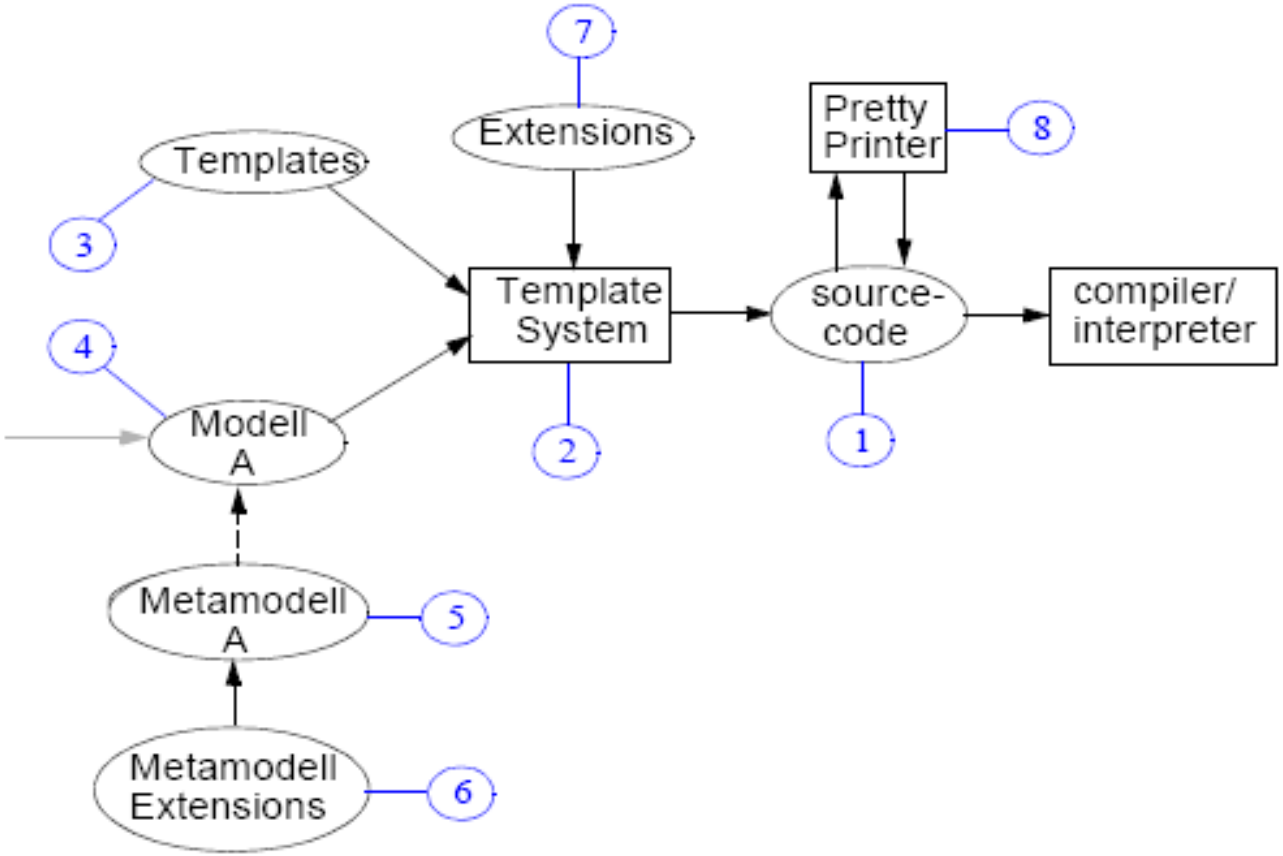
- consistency of application
  - code generated based on rules is very consistent (naming conventions, parameter passing, ...) and so easy to understand and use
  - cross cutting concerns bundled in a central place (template/rule)

# General Purpose Generator

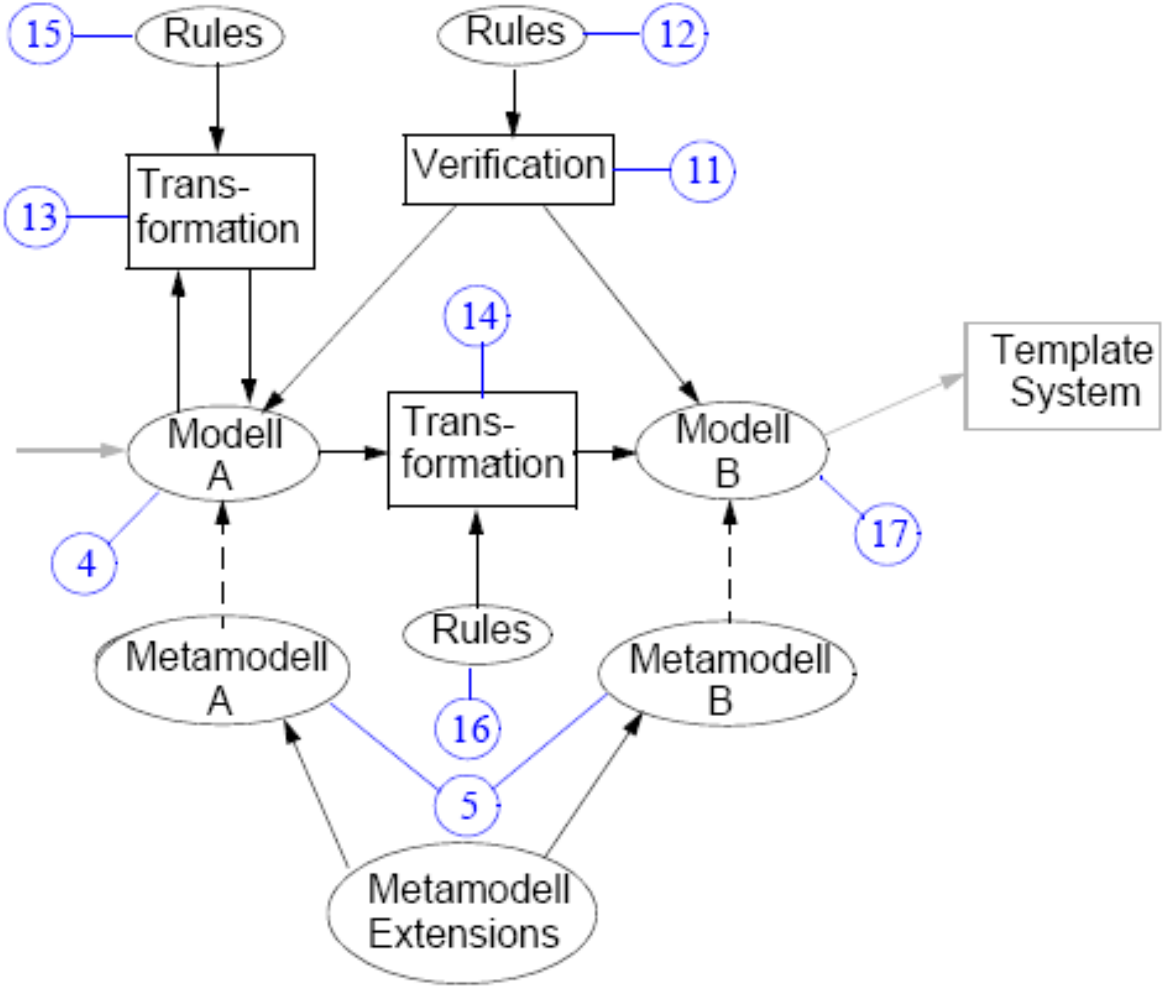
- Workflow



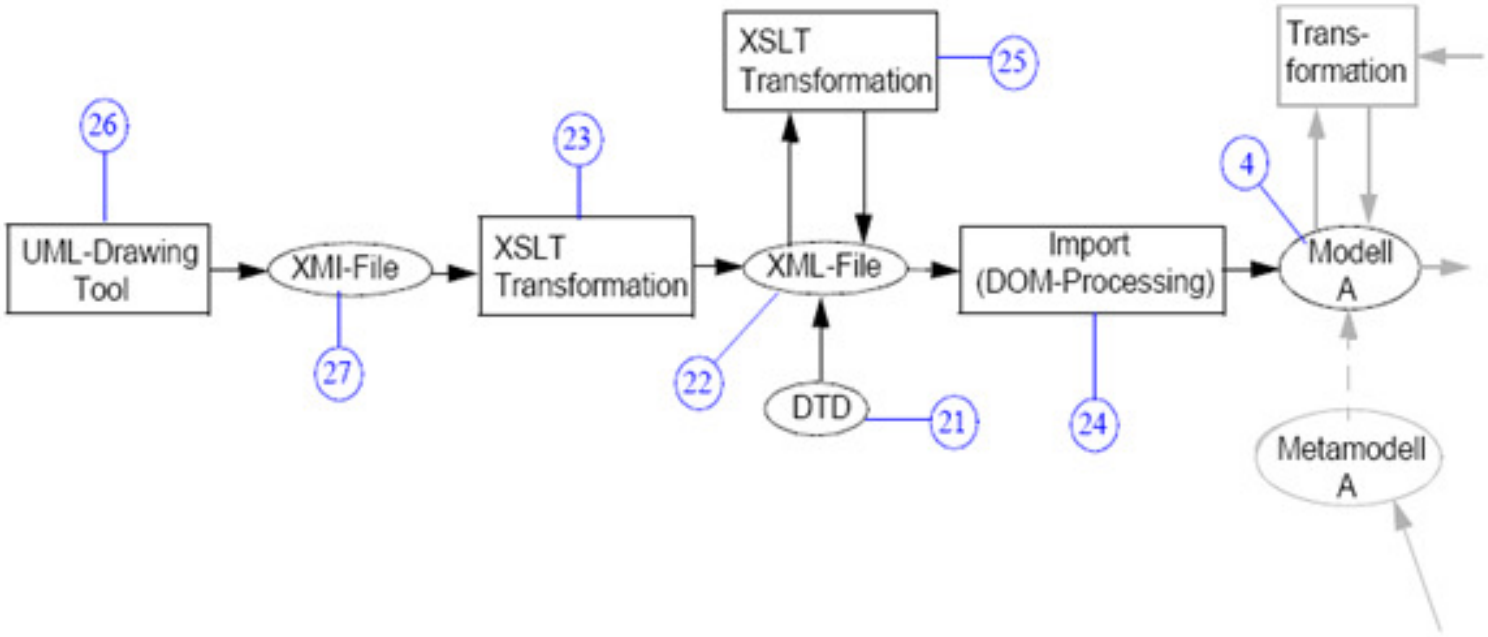
# Generator Backend



# Generator Kernel



# Generator Frontend



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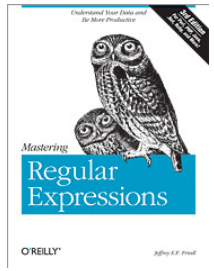
# Next Steps

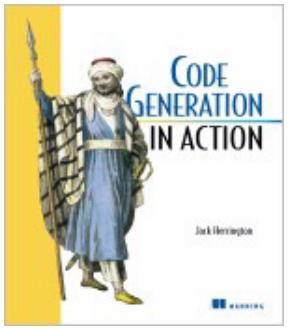
- Take a look at the Tutorium at DBKDA-2020 entitled „**Codegeneration for Database Developers**“
- Take a look at the Resources section of this slideset

# Resources

- Jeffrey E. F. Friedl, Mastering Regular Expressions, Third Edition, O'Reilly, August 2006



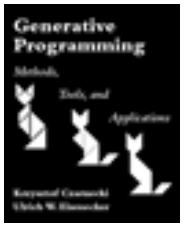

- Jack Herrington: *Code Generation in Action*. Manning Verlag, 2003, 350 Seiten, ISBN: 1930110979



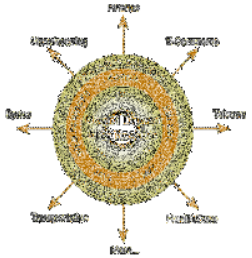

- http://www.codegeneration.net/

# Resources

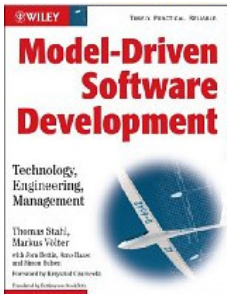
- Krzysztof Czarnecki, Ulrich Eisenecker: *Generative Programming: Methods, Tools, and Applications*, Addison-Wesley Professional; 1. Auflage, 2000




- http://www.omg.org/mda/



- Markus Völter, Thomas Stahl: *Model-Driven Software Development - Technology, Engineering, Management.* Wiley & Sons, May 2006




- Homepage Markus Völter: http://www.voelter.de/services/mdsd.html