Balisage 2010

Reverse Modelling for Domain Driven Engineering of Publishing Technology

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Software Systems and data models

- Data modelling for Software Systems often does not start from scratch.

Software Systems and data models

- Existing model incarnation have to be taken into account.
- Examples for model incarnations: UML class diagrams and XML Schema.
- Problem: they share same conceptual idea but are often not equivilant

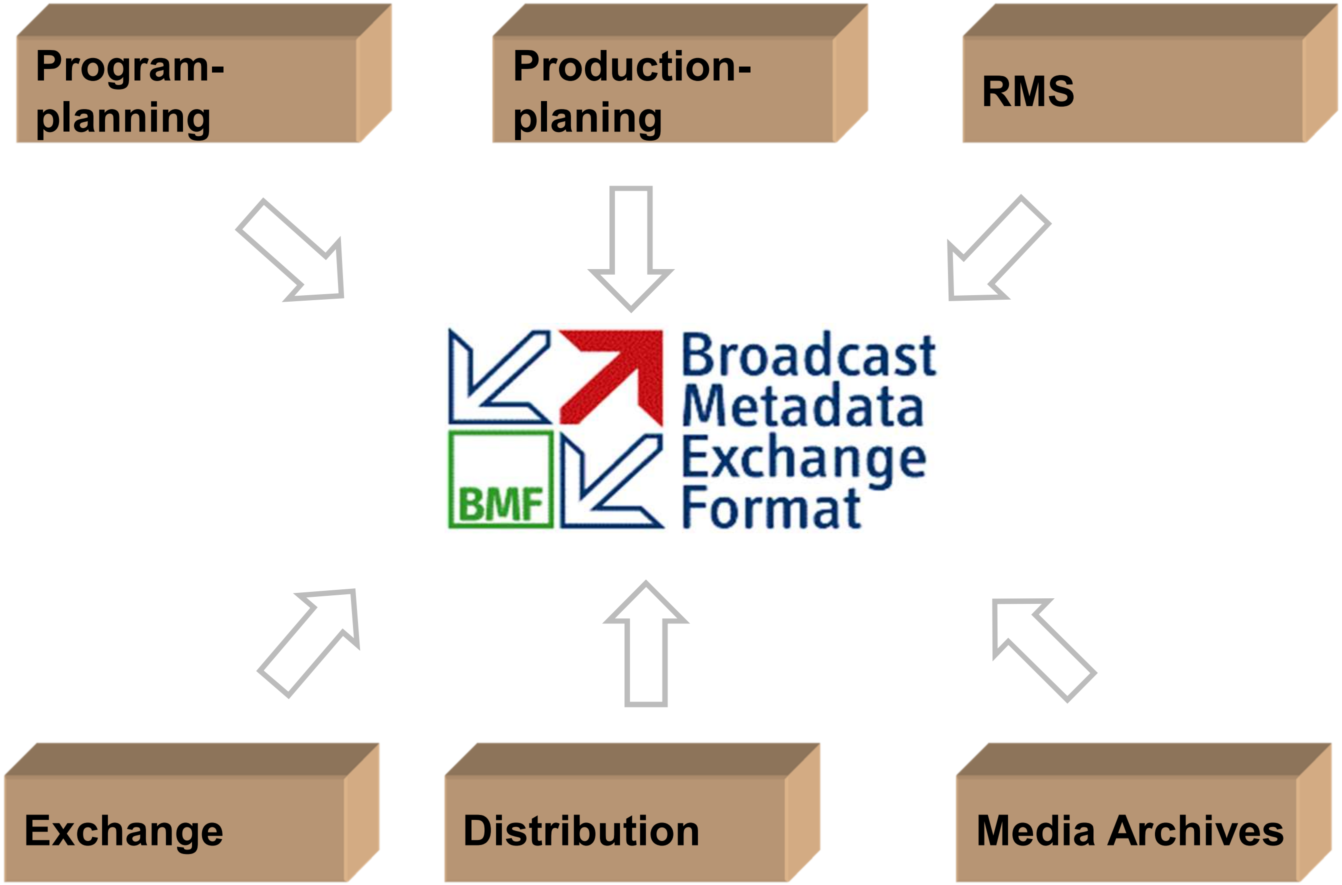
Case Study

- Reverse modelling as one possible approach to deal with this situation.
- *Instance Generator for the Broadcast Metadata exchange Format* as case study to illustrate approach.
- Case study is based on a master thesis written at the TU Munich and for the Broadcast Technology Institut (IRT).

Technische Universität München

Institut für Rundfunktechnik

The Broadcast Metadata exchange Format (BMF)



Program-planning

Production-planing

RMS

BMF
Broadcast
Metadata
Exchange
Format

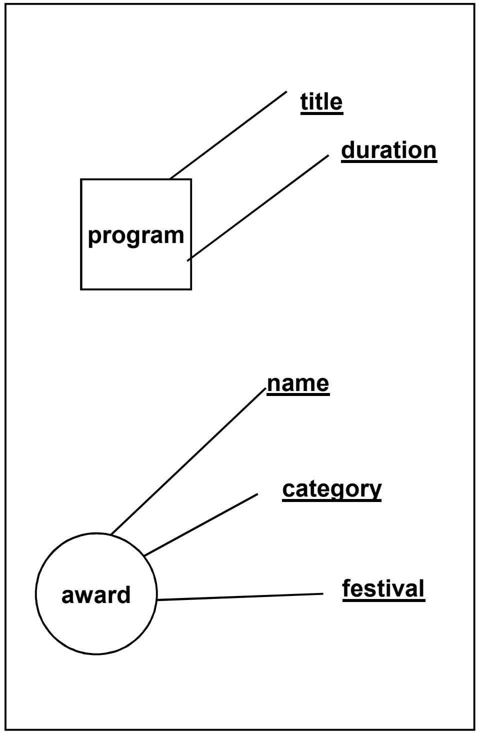
Exchange

Distribution

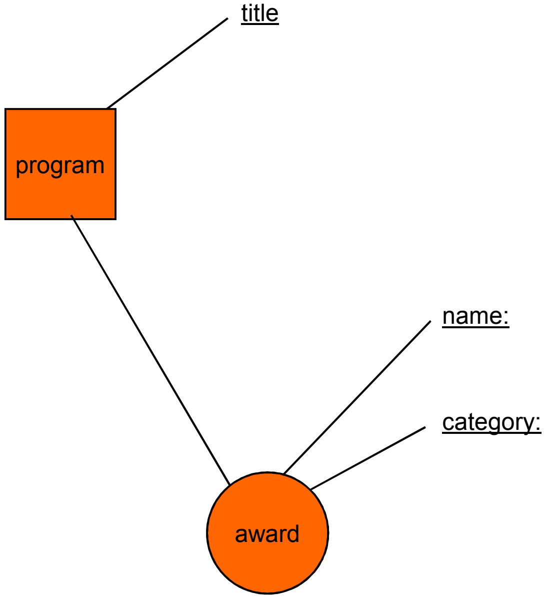
Media Archives

- BMF intermediates as lingua franca between different metadata formats in IT-based TV production.

Model and Instance: BMF-model



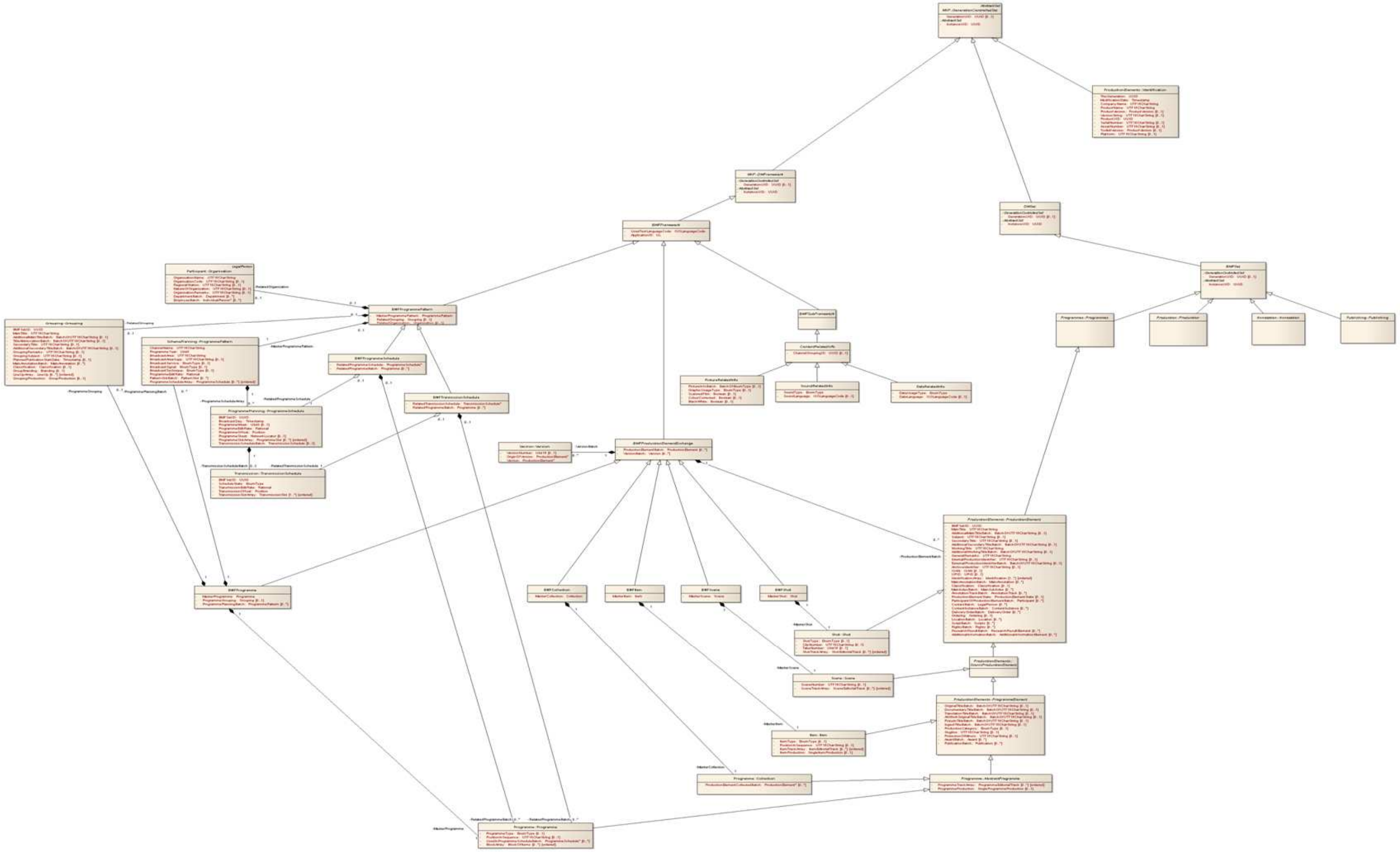
Model



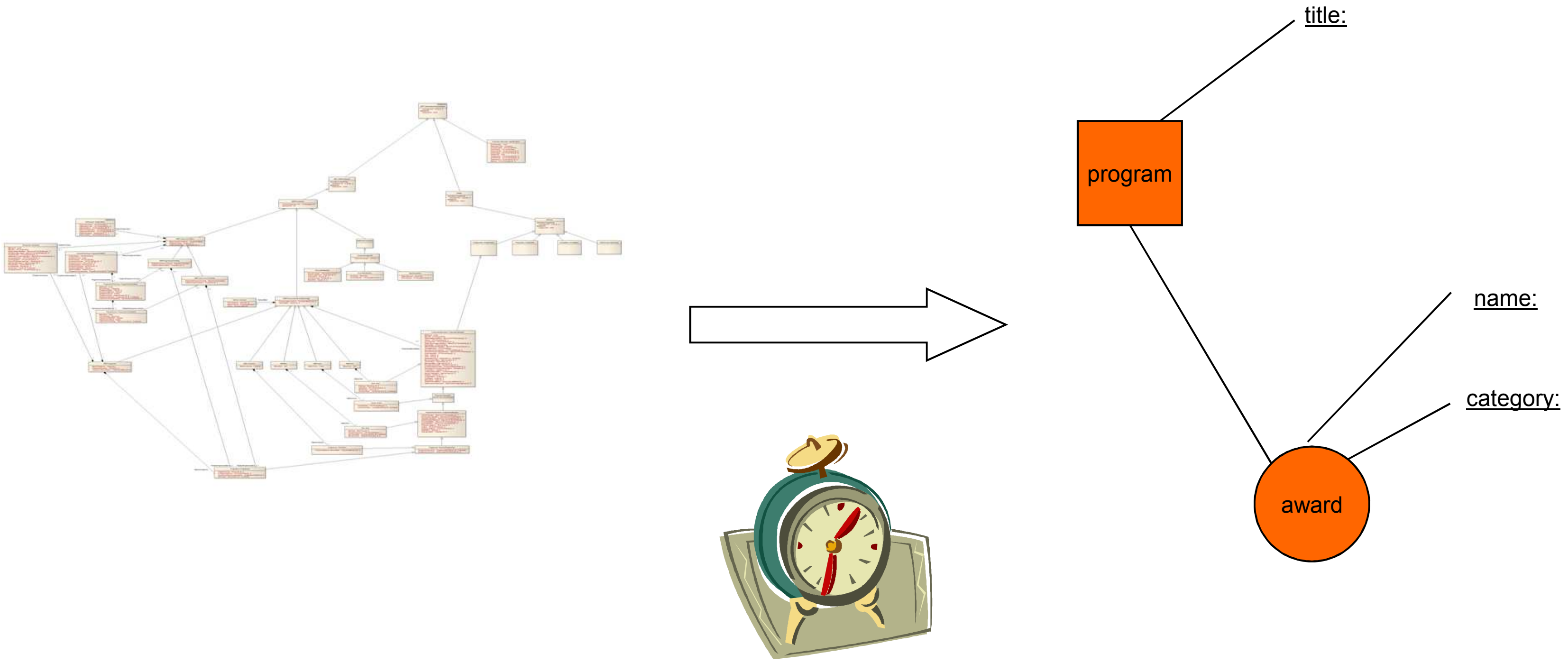
Instance

- Requirement of BMF project:
    - sample BMF-XML instances to design mapping from BMF to other metadata formats.

Model Complexity



- Complexity of BMF model as problem for building sample instances.

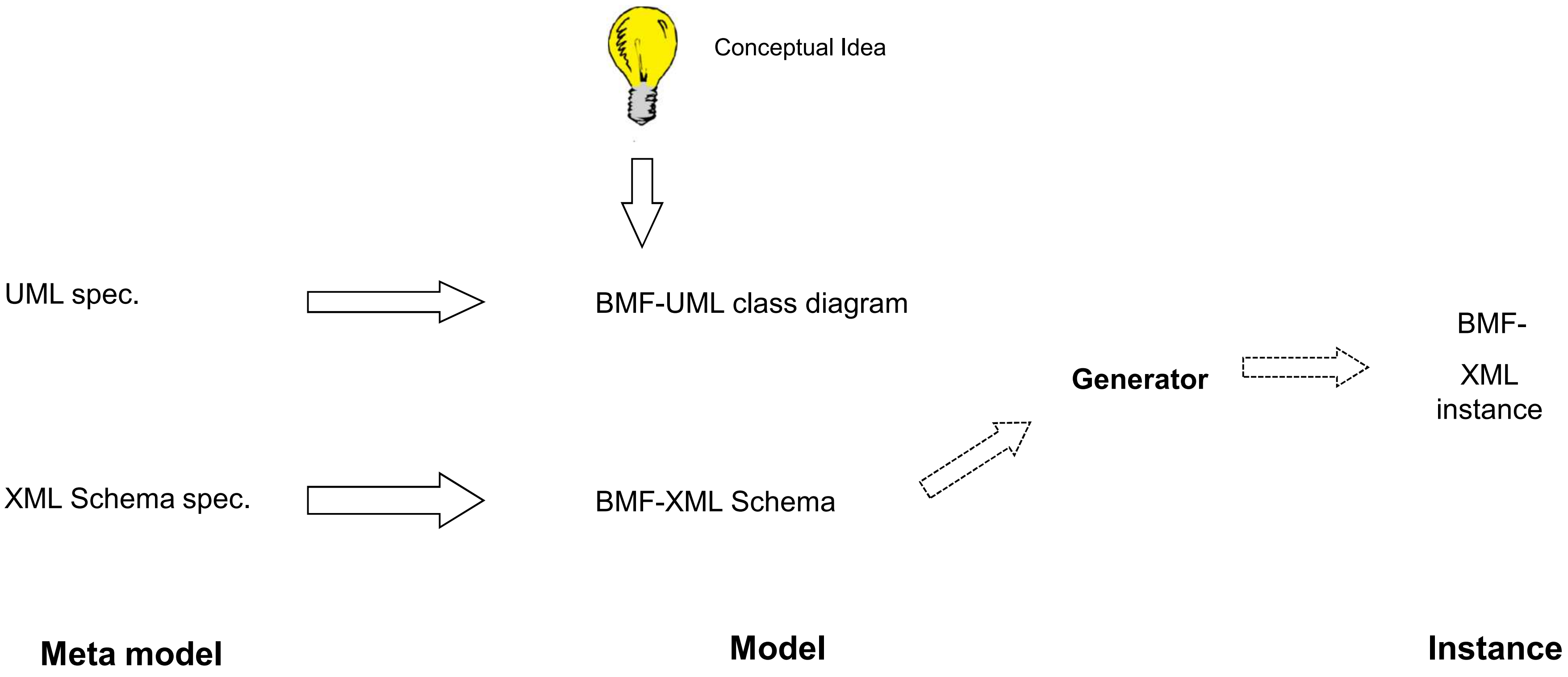


Model

Instance

- Manual generation of BMF-XML documents with XML editors too time-consuming.
- Instance generator should automate task.
- Goal: transparent and efficient generation of BMF-sample instances.

BMF Modeling Process



Conceptual Idea

UML spec.

BMF-UML class diagram

XML Schema spec.

BMF-XML Schema

Generator

BMF-

XML
instance

Meta model

Model

Instance

- First step: Analysis of BMF modelling process.
- BMF is formulated in different modelling technologies (e.g. UML and XML Schema.

Free the domain model

composition
element declaration
class BMF complex type definition
association

simple type definition
attribute
model group

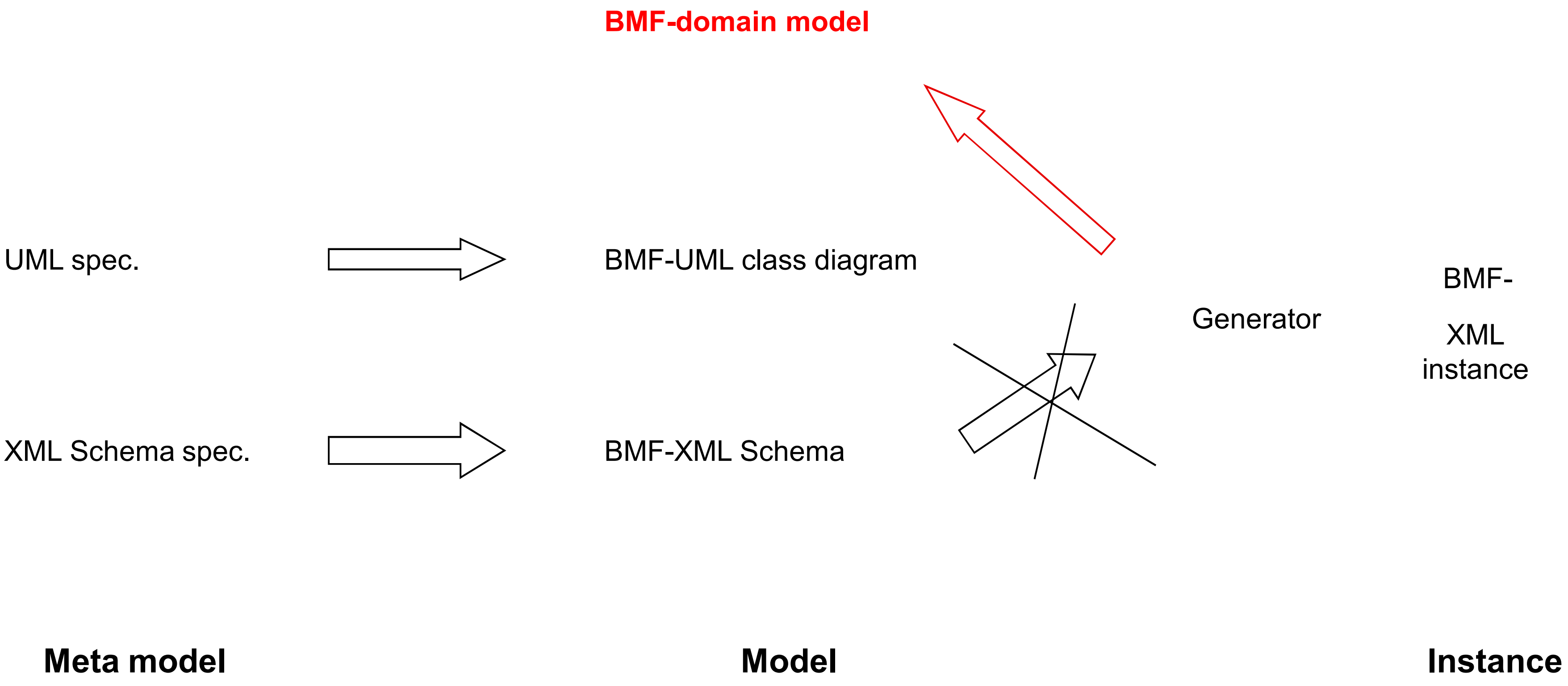
- Complexities of modelling technologies obscure conceptual idea of BMF.

Free the domain model

BMF

- Goal: domain model of BMF
- Domain model formulation should avoid complexities of UML and XML Schema.

Modelling Process



BMF-domain model

UML spec.

BMF-UML class diagram

Generator

BMF-

XML
instance

XML Schema spec.

BMF-XML Schema

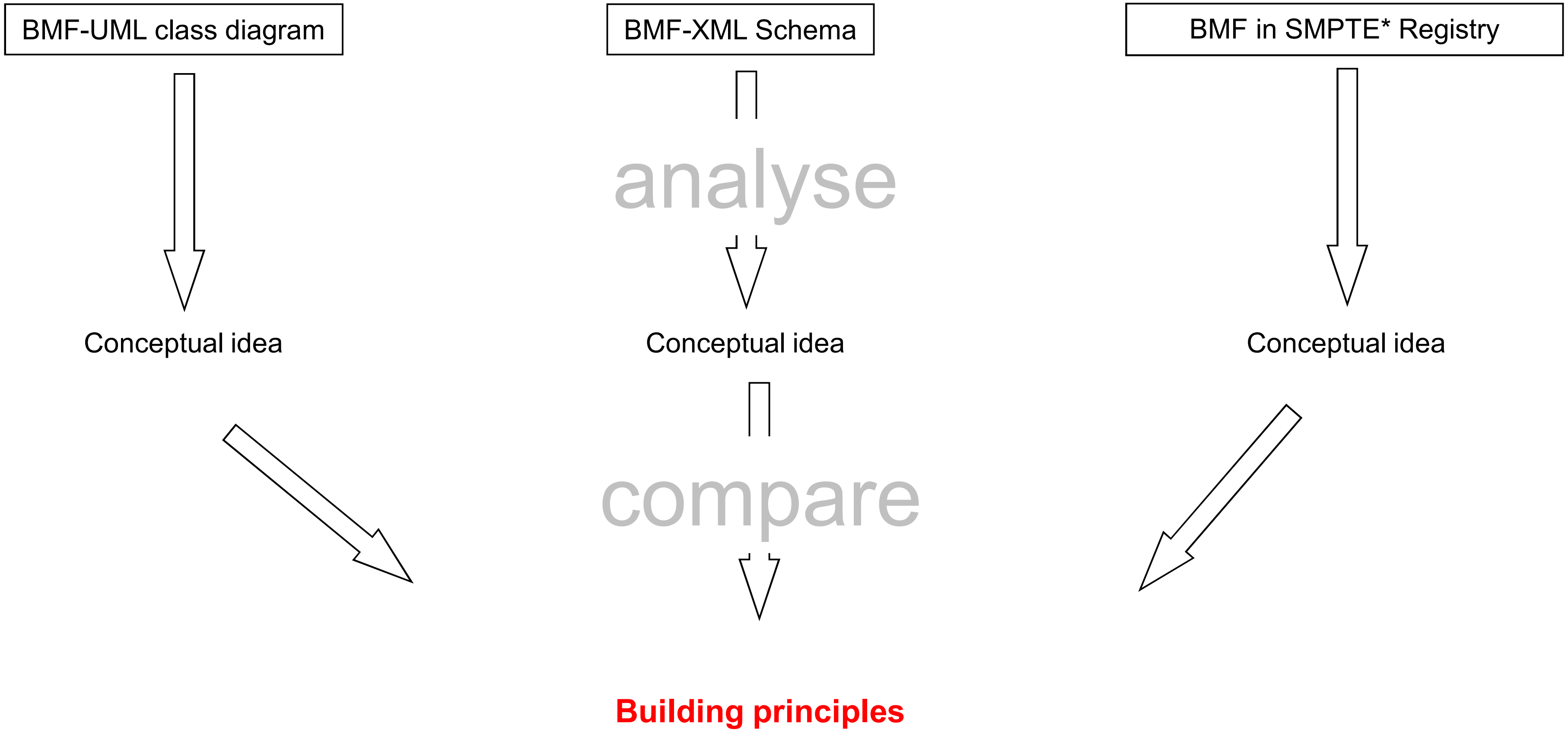
Meta model

Model

Instance

- Instance Generator should first be aligned with the domain model.

Reverse Modelling



BMF-UML class diagram

BMF-XML Schema

BMF in SMPTE* Registry

analyse

Conceptual idea

Conceptual idea

Conceptual idea

compare

Building principles

- Building principles constitute BMF model.
- Identification of building principles through reverse modelling.

* Society of Motion Picture and
Television Engineers

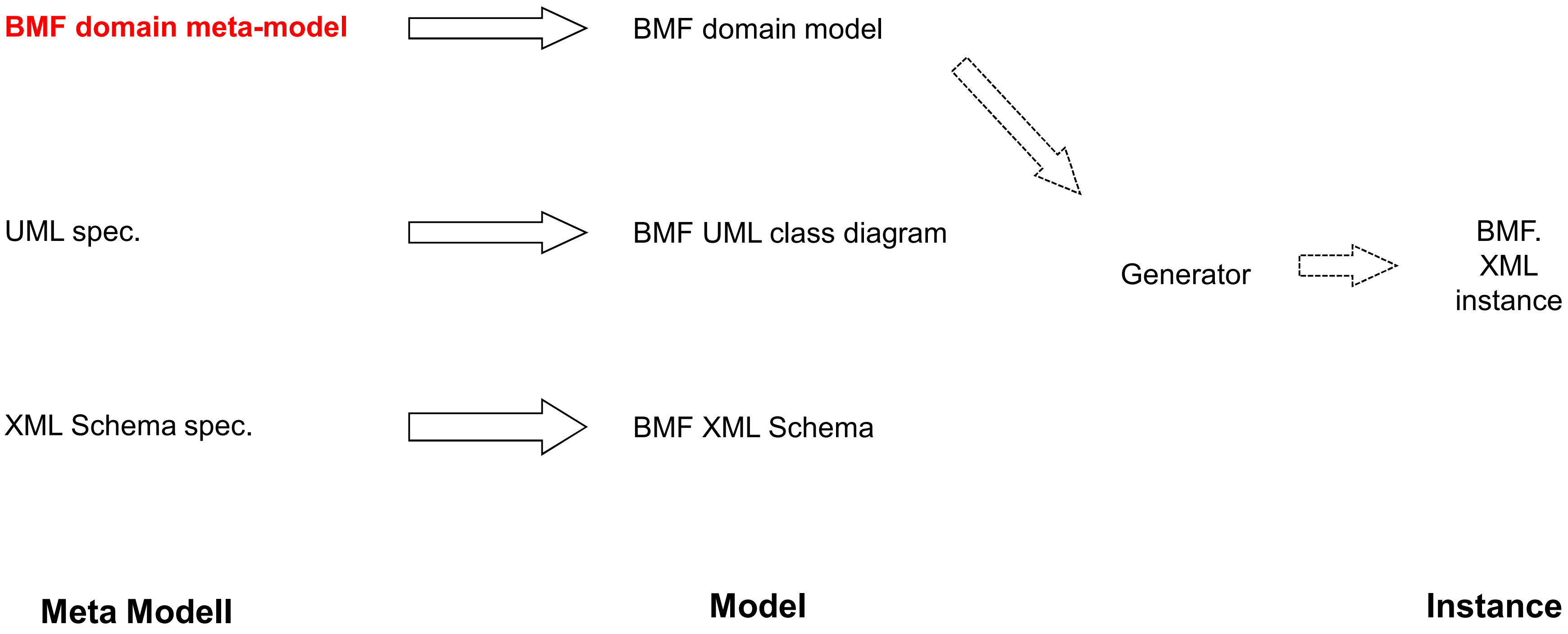
Building principles of BMF

- *Metadata sets group metadata elements.*
- *Metadata elements reference simple data types*

  or metadata sets.
- *Metadata elements in Metadata sets are unordered.*
- *....*

- Formulation of building principles in natural language.
- Requirements of building principles:
  - apply to every incarnation of BMF.
  - represent the concept of the BMF modeling team.
  - expressed as directly as possible.

Modelling Process



BMF domain meta-model

BMF domain model

UML spec.

BMF UML class diagram

Generator

BMF.
XML
instance

XML Schema spec.

BMF XML Schema

Meta Modell

Model

Instance

- Building principles are a model of the domain model.
- The model of the domain model is the domain meta model.

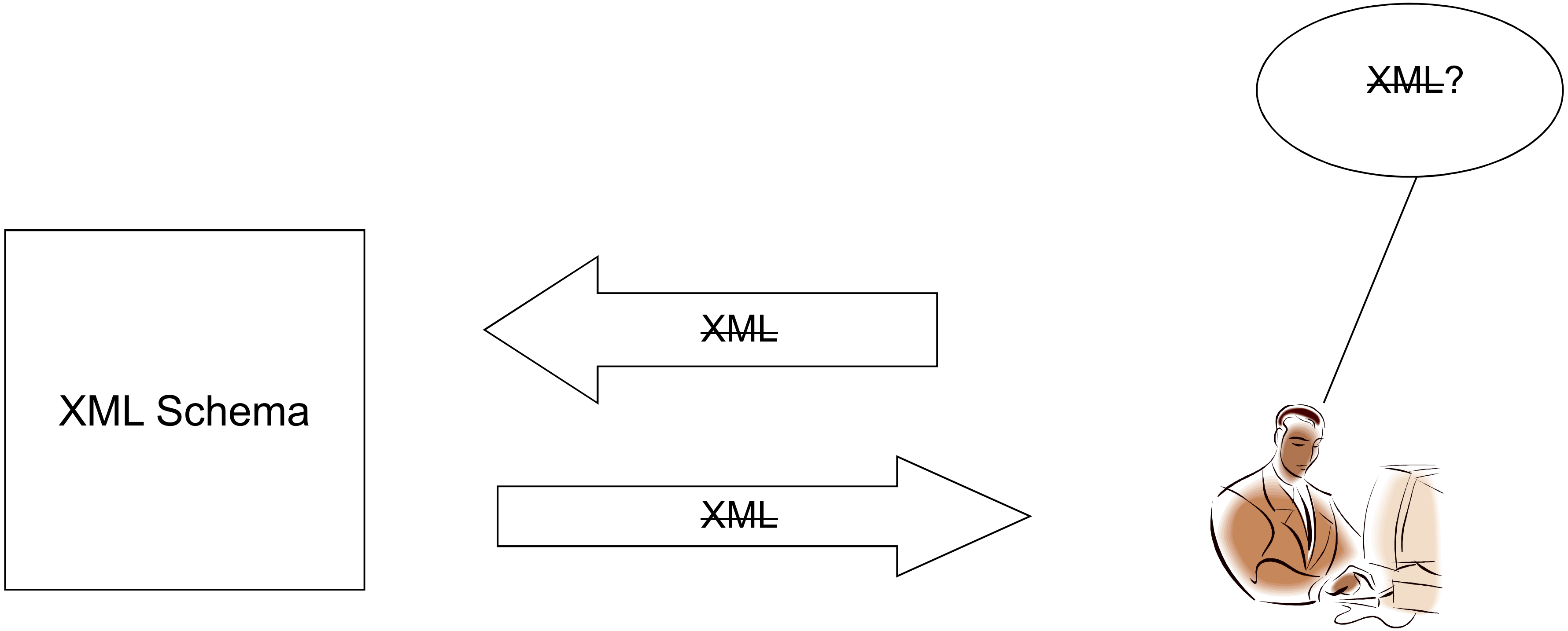
Implementation

Model
Query

Instance
onstruction

- Instance Generator is implementated in two main components.
- Both components implement domain meta model of BMF.

Query the model: Language of the domain



~~XML~~?

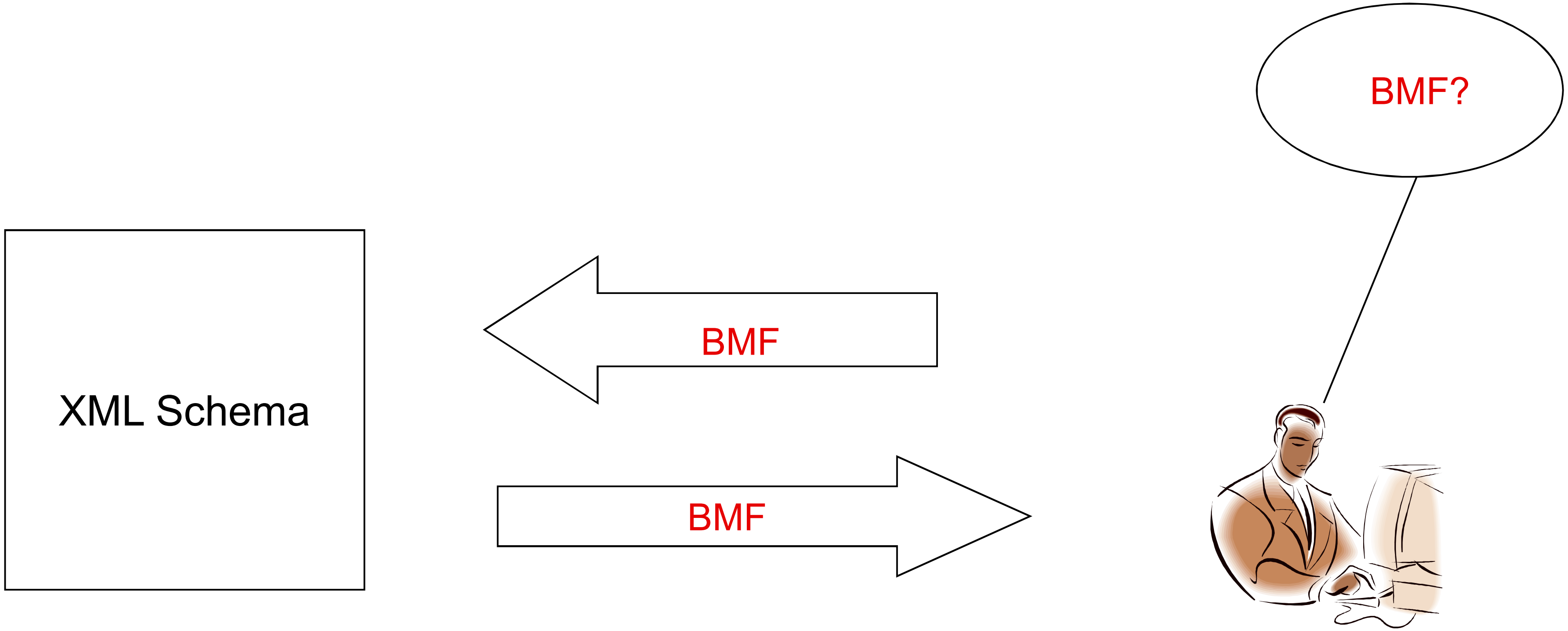
XML Schema

~~XML~~

~~XML~~

- Queries to the model should be independent from implementation technology.

Query the model: Language of the domain



BMF?

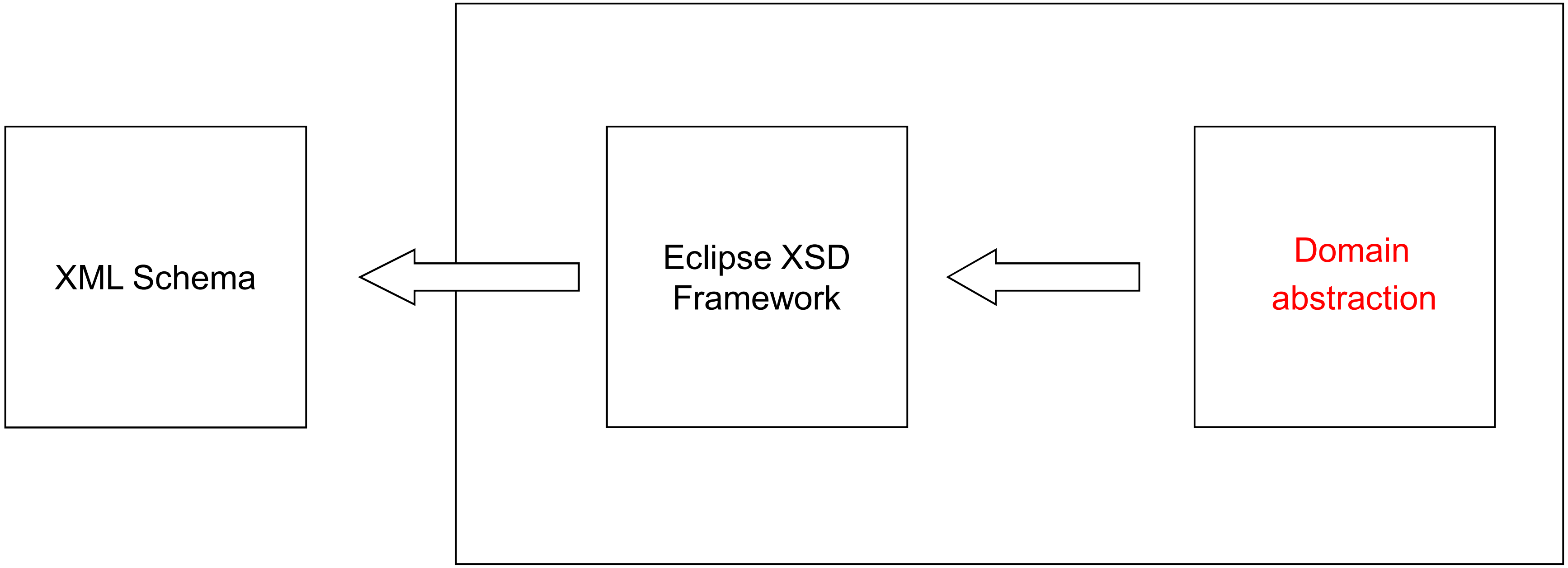
XML Schema

BMF

BMF

- Queries to the model should be formulated in the terminology of domain meta-model.

Query the model: Model Adviser



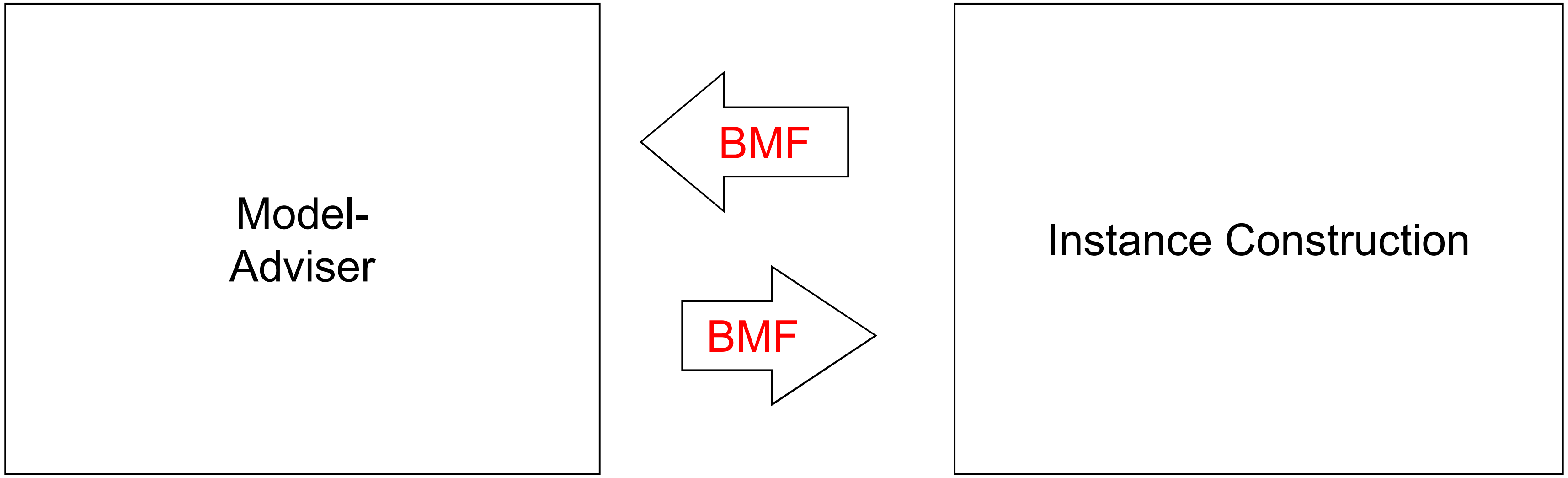
XML Schema

Eclipse XSD Framework

Domain abstraction

- Model advisor exposes query interface of Java methods to access BMF-XML Schema.
- Query interface use terminology of domain meta model (e.g. *metadataset*).

Query the model: Model Adviser



Model-
Adviser

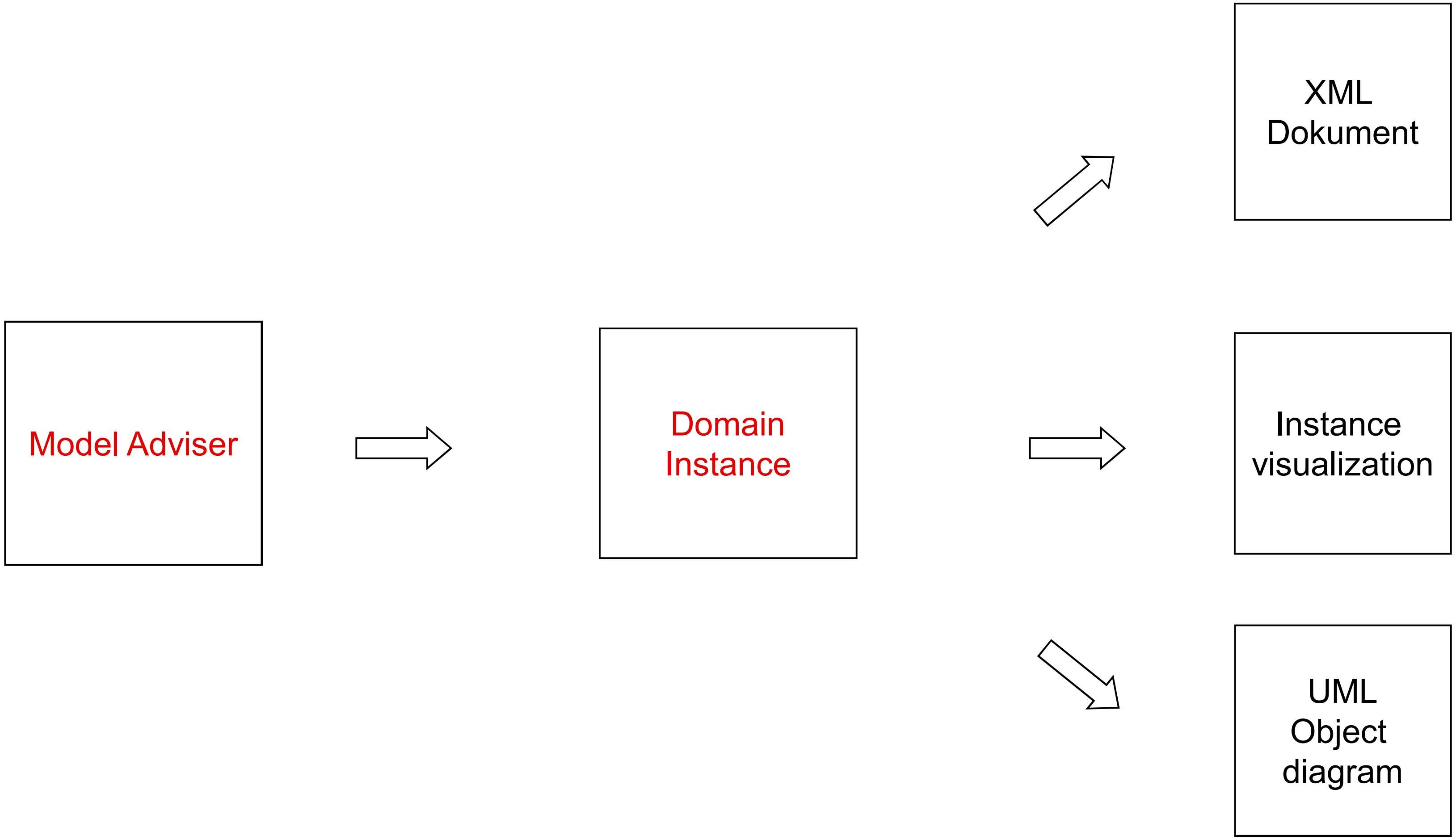
BMF

BMF

Instance Construction

- BMF-Query API is used by the instance contruction component.

Building the instance



Model Adviser

Domain Instance

XML Dokument

Instance visualization

UML Object diagram

- Domain abstraction enables building of domain instance.
- Domain instance can be transformed in more output formats than just XML.

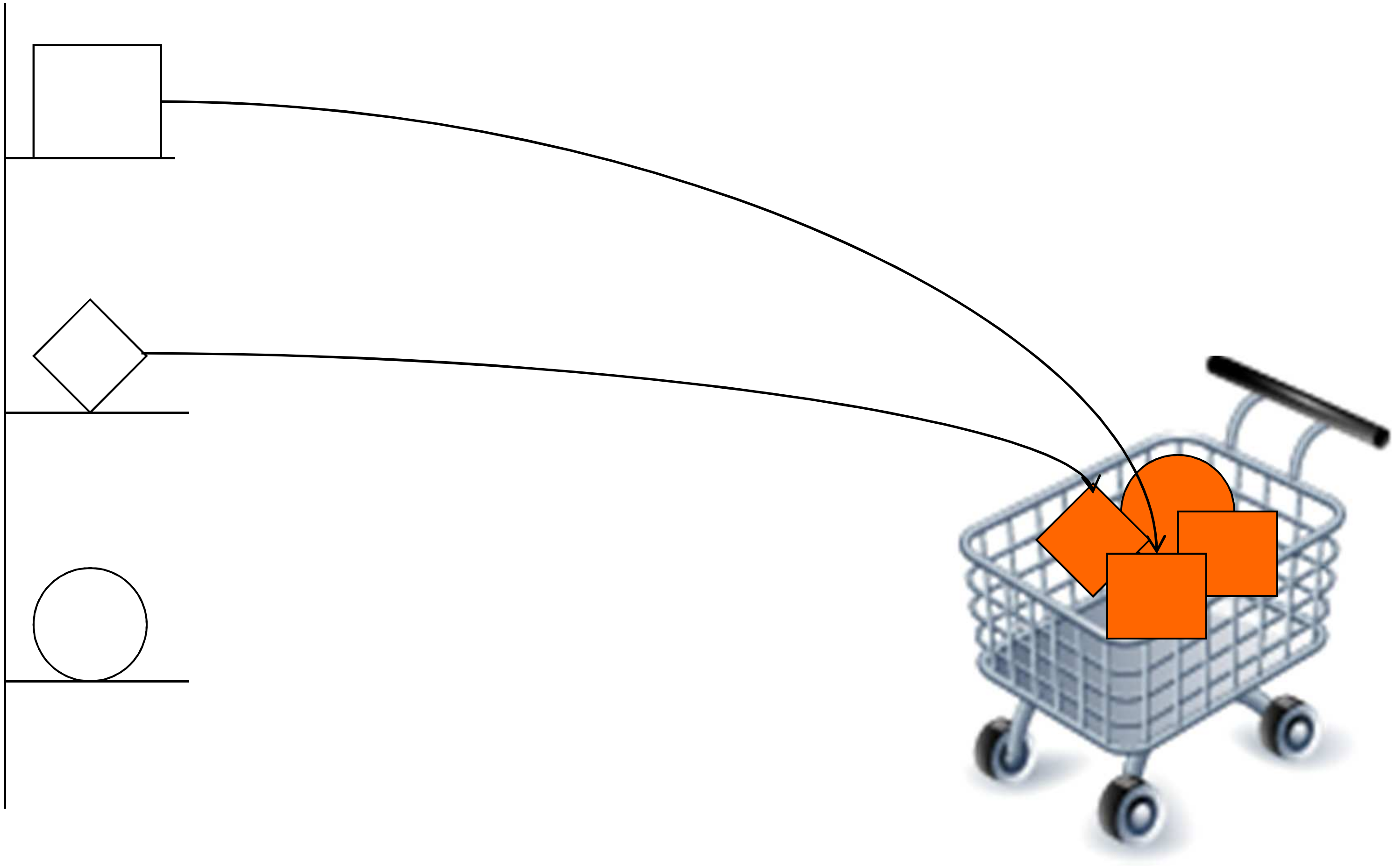
Sub-Components for instance construction

Shopping Mall

Building Site

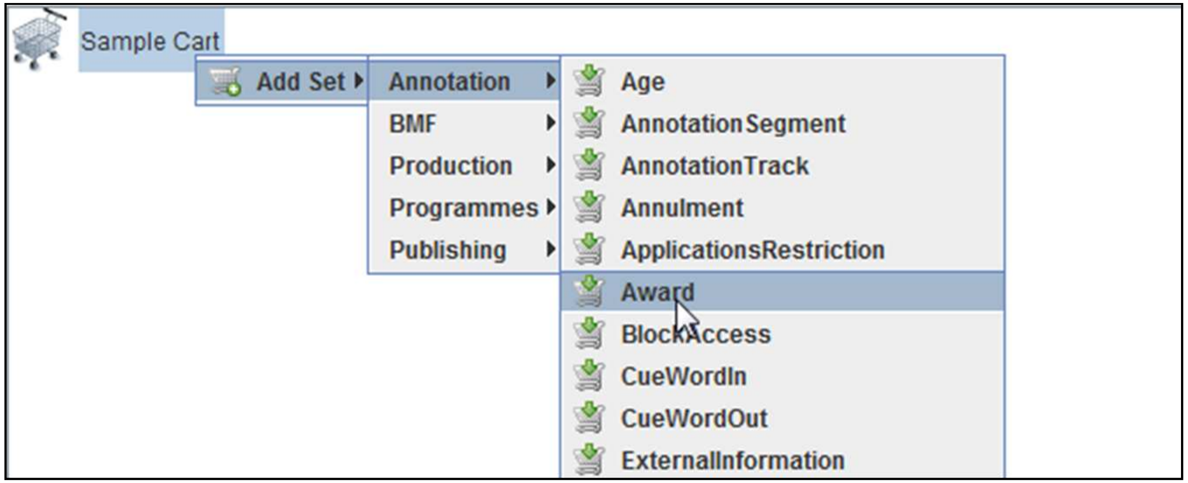
- Shopping Mall: User selects model elements.
- Building Site: User assembles model elements.

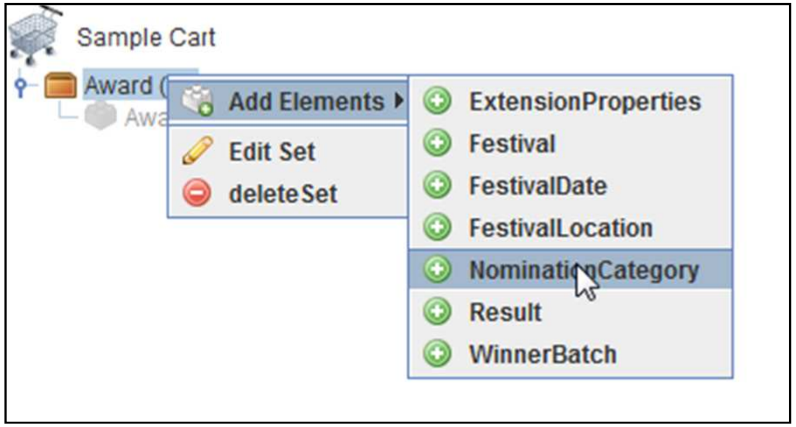
Instance construction: Shopping Mall



- User selects model elements like products from a supermarket shelf.

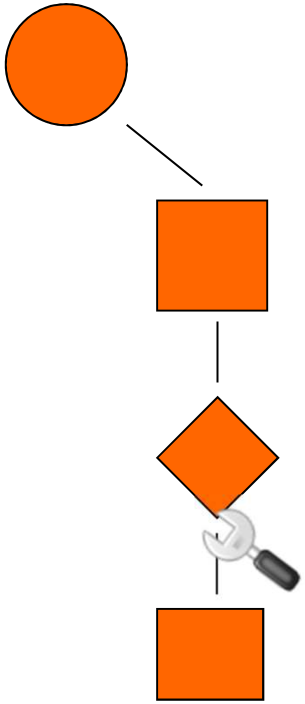
Instance construction: Shopping Mall-GUI



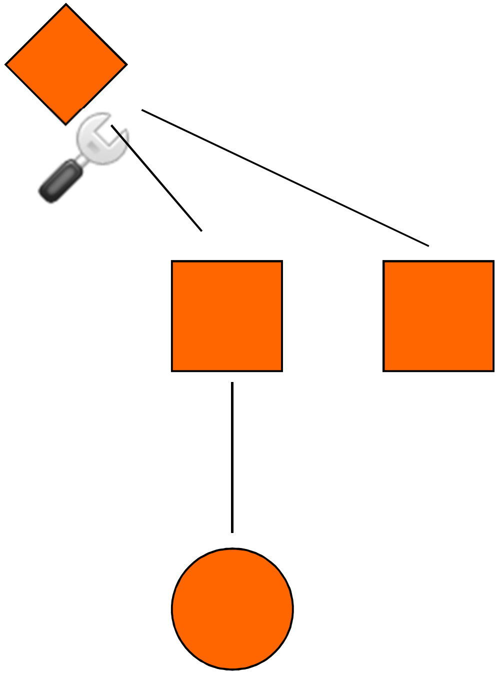


- User builds flat list of metadatasets with metadata elements.

Instance construction: Building site

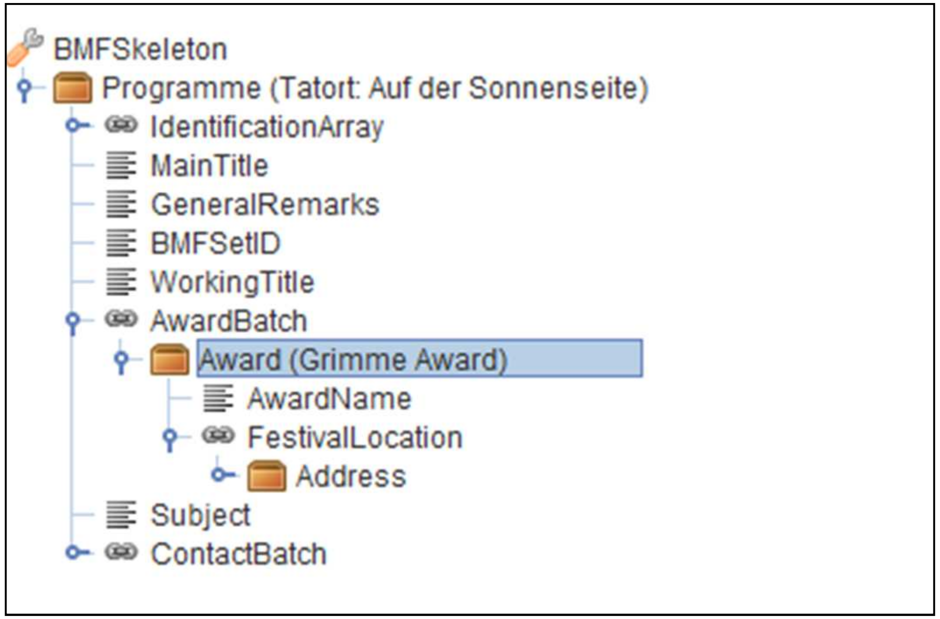


or



- User assembles shopped model elements to an instance.

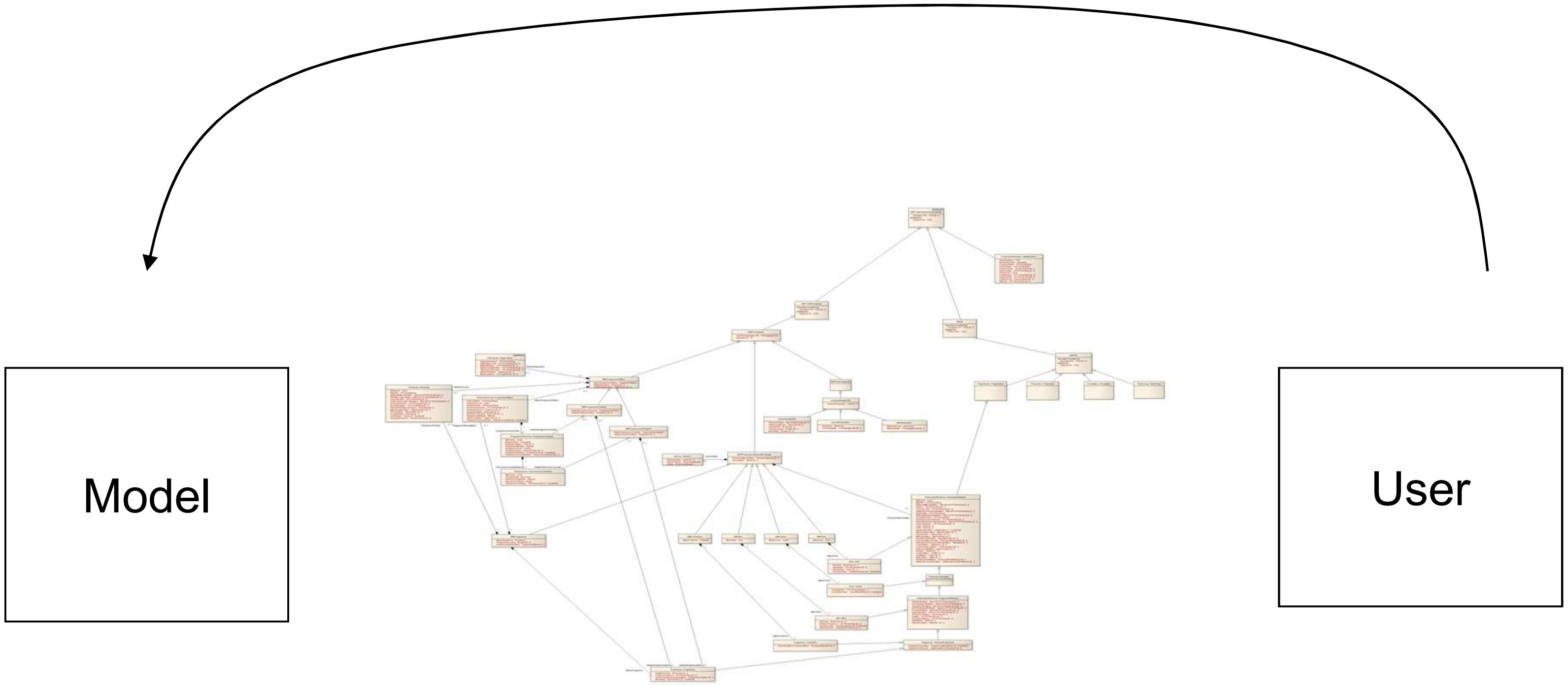
Instance construction: Building Site-GUI



BMFSkeleton
Programme (Tatort: Auf der Sonnenseite)
IdentificationArray
MainTitle
GeneralRemarks
BMFSetID
WorkingTitle
AwardBatch
Award (Grimme Award)
AwardName
FestivalLocation
Address
Subject
ContactBatch

- User assembles metadata sets and metadata elements to an instance tree.

Model complexity

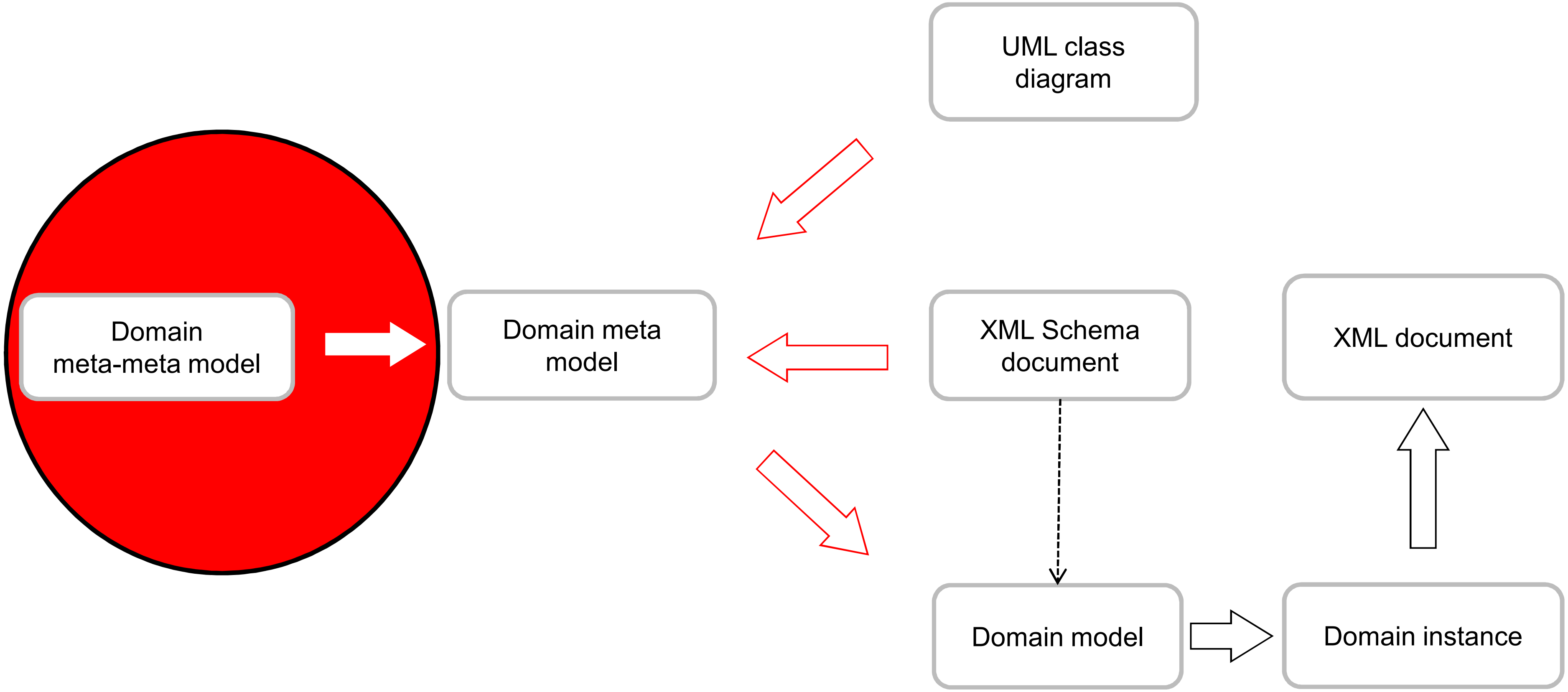


- Domain focus in programming API and GUI of instance generator helps to bridge complexity gap between user and model.

What did we gain?

- Efficient instance generation
- Usable model
- Broader audience in the domain

Further work



Domain meta-meta model

Domain meta model

UML class diagram

XML Schema document

XML document

Domain model

Domain instance

- Devlopment of a meta-meta model facility to build customized domain meta models.

Merci beaucoup :)