



Centro de Investigación en Métodos
de Producción de Software



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Modelling language quality evaluation in model-driven information systems engineering: a roadmap

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- **Introduction & Motivation**
- Literature review design
- Quality issues detected
- Quality Challenges roadmap
- Conclusions

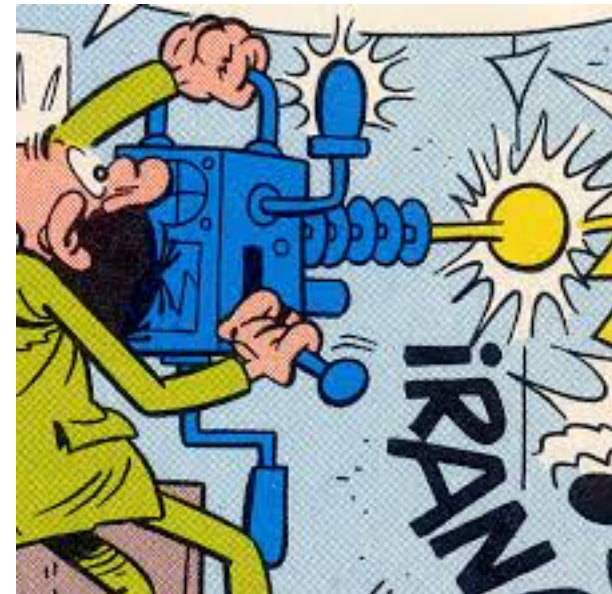
Introduction & Motivation (I)

- Assuring the **quality of models and modelling languages** is crucial due to its major role in information systems engineering and research...
- This is even more crucial in model-driven engineering! (MDE)
- Previous systematic literature review in RCIS 2014 revealed that the notion of *quality* in MDE is **ambiguous, inconsistent and trendy**.

Context:
Quality within model-driven engineering (MDE)



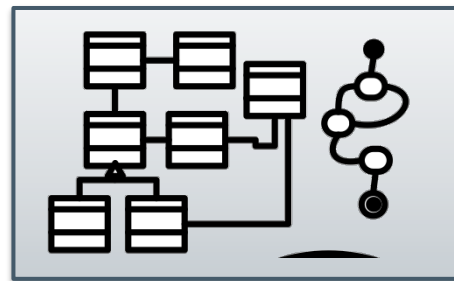
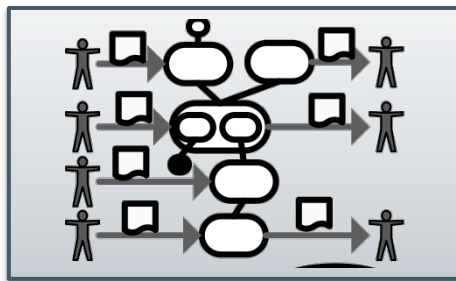
Industry



Academia

Introduction & Motivation (II)

Context:
Quality within model-driven engineering (MDE)



Context: ***Quality within model-driven engineering (MDE)***

- Problematic phenomena:
 - Existing MDE standards do not address quality.
 - No standard quality framework for MDE.
 - Are industrial and academic interests aligned?
- Research goal:
 - Review literature on model / modelling language quality including *grey literature*
 - Compare the interests of industry and academia.
 - Define a research challenges roadmap for modelling language quality evaluation within MDE

- Introduction & Motivation
- **Literature review design**
- Results achieved
- Discussion
- Conclusions

- Research questions:
 - **(RQ1):** *Which are the main issues reported by industrial literature regarding modelling language quality evaluation, in the context of MDE?*
 - **(RQ2):** *Which is the focus of research papers on modelling language quality evaluation?*
 - **(RQ3):** *Does the concept of modelling language quality evaluation have a similar meaning in industry and academy?*
 - **(RQ4):** *Is there a match between the issues reported by industry and the trends identified in research?*

- Snowballing sampling



Literature review design (I)

- Grey literature includes:
 - web portals of software development communities.
 - blogs
 - technical web sites
 - forums
 - social networks



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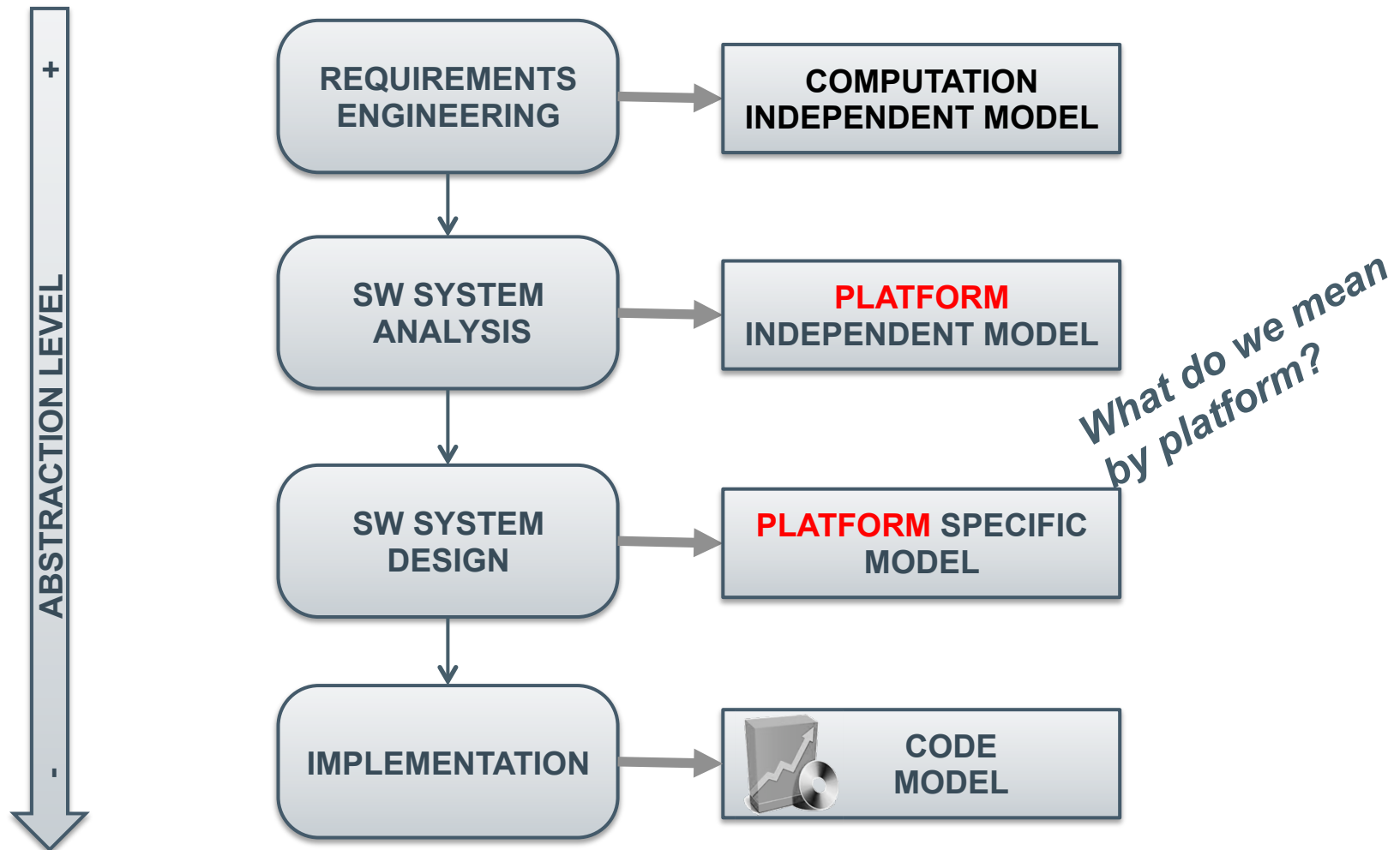
Quality issues

MDE-related phenomena that affect modelling language quality evaluation

MDE industrial practices	Research field
MDA is not enough	Hard operationalization of model-quality frameworks
Implicit questions derived from the MDE adoption itself	Defects and metrics mainly over UML
Tools as a way to increase complexity	Specificity in the scenarios for quality in models
Organizational support for the MDE adoption	Software quality principles extrapolated at modeling levels

A complete list of evidences is available here: <https://goo.gl/0XiChP>

- *MDA is not enough*



Quality issues

- We noticed quality problems within the MDE industry that are **not addressed properly** by current academic research endeavours.
- There are **open challenges**.
- Therefore we consider necessary to list the open challenges and define a **research roadmap** that integrally cover the identified issues.



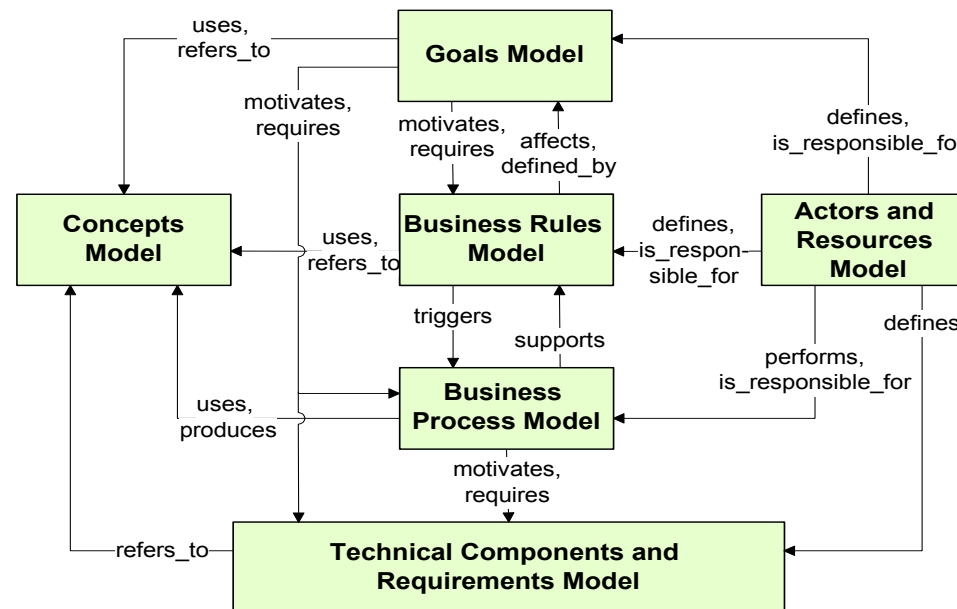
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■ ***MDE compliance***

- Due to the model-driven generality it is possible that any initiative can be model-driven without a strict fulfillment of minimum aspects necessary for a real applicability with a technological support
 - E.g. notations without abstract syntax associated, stereotyped of common modelling languages, or modelling proposals with particular intentions and poor adoption by model-driven practitioners.
- The definition about ***when something is in MDE*** or ***when something is MDE compliant*** must consider critical concerns beyond the simple usage of models or textual/graphical representations.

■ *Multiple modelling languages*

- *Industry often use a set of modelling languages in combination, as opposed to a single modelling language in isolation.*



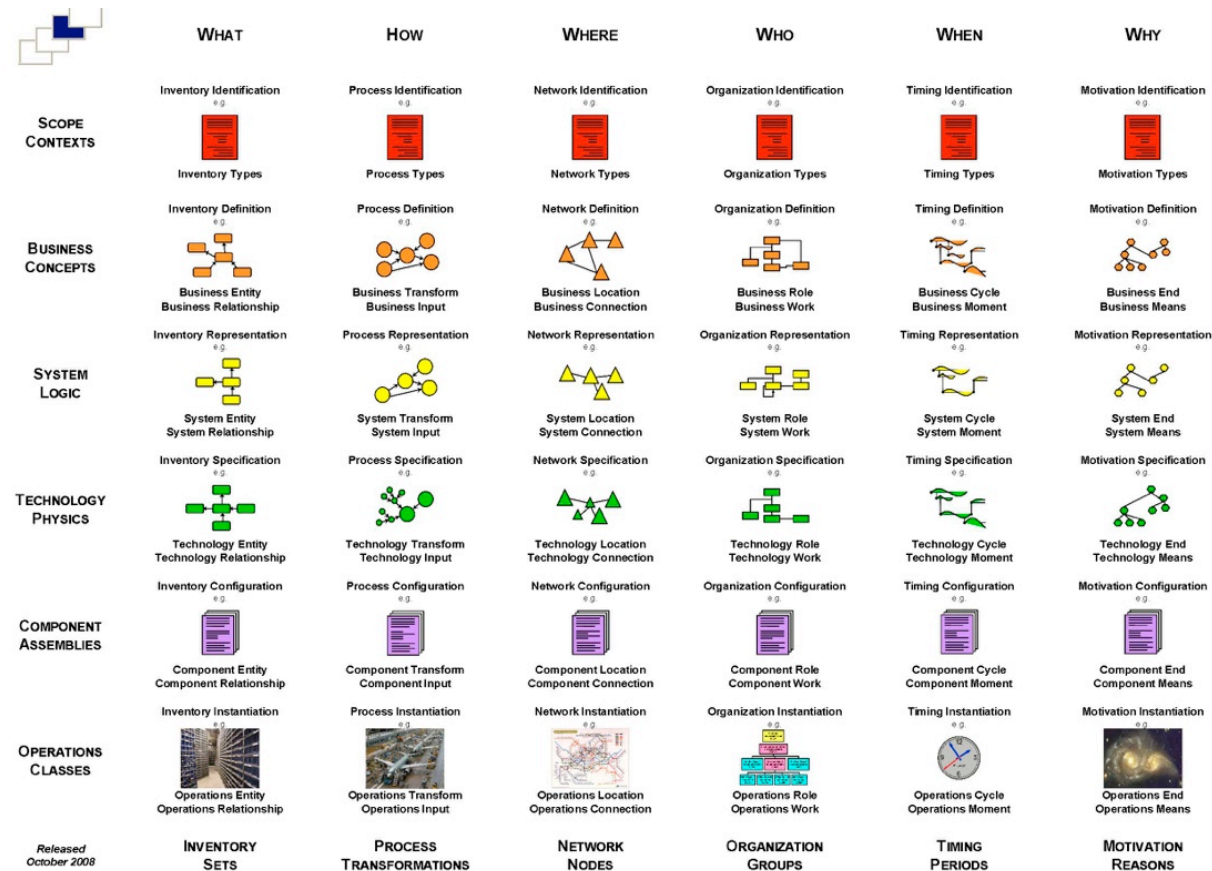
- *E.g. the FP7 project CaaS is using the 4EM enterprise modelling language (formerly EKD), as the basis for the Capability Driven Development paradigm.*

■ *Multiple modelling languages*

- The quality of a **single modelling language** vs. the quality of a **set of modelling languages** (the whole being greater of that the sum of the parts; emergence of quality characteristics).
- Quality questions are derived from this IS feature:
 - ***suitability*** of the languages employed
 - ***coverage*** level of the modelling proposals
 - ***relevance/pertinence*** regarding to the particular intention of modelling
 - ***degree*** of utility of a modelling language

Research challenges (II)

■ *Multiple modelling languages*



- *E.g. sets of modelling languages typically cover several perspectives of an organisation or software system (see the Zachman framework above).*

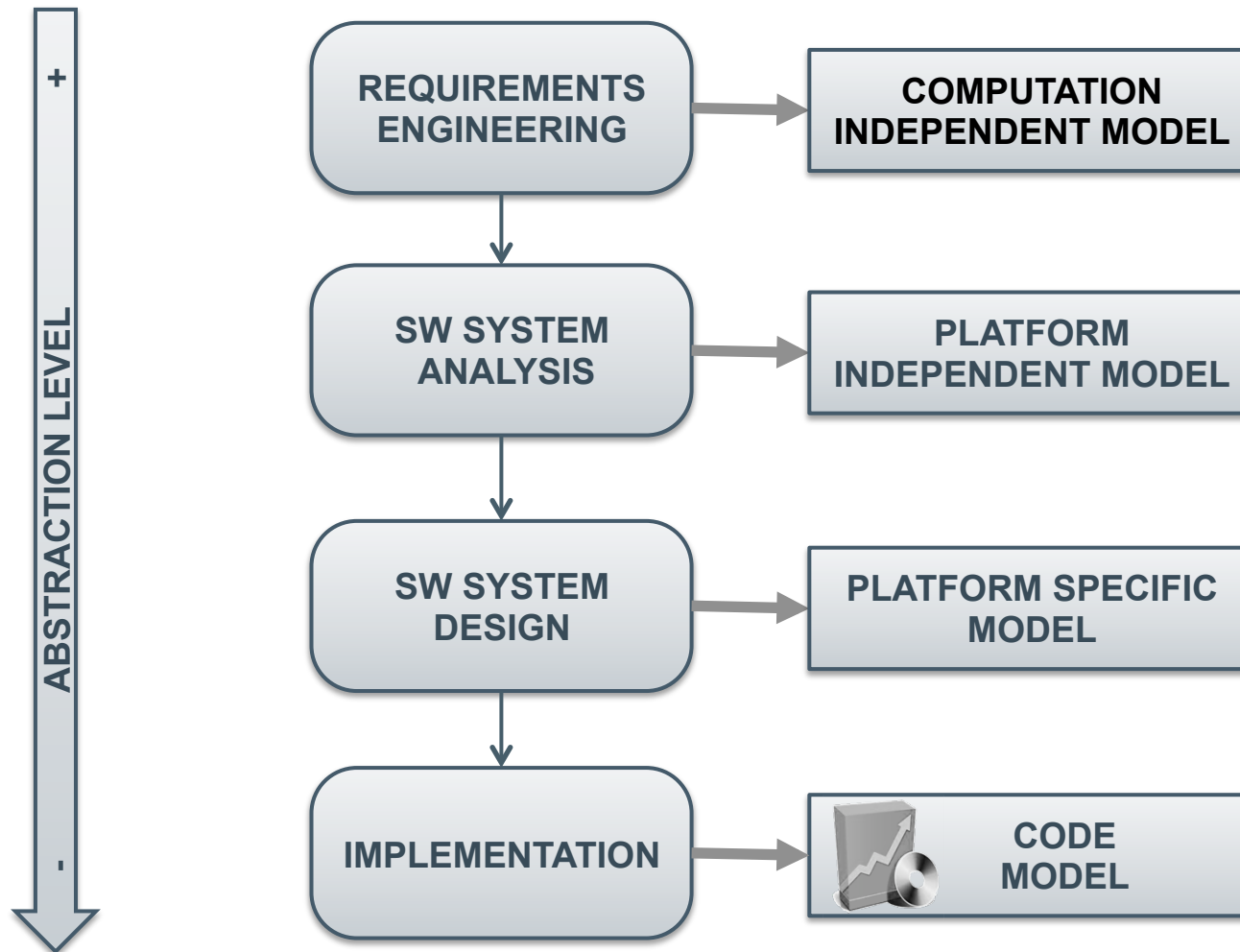
- ***Explicit management of abstraction levels***
 - They are a critical approach to understand Information Systems and to define the alignment of model-driven initiatives with business, system or technical scenarios within an IS architecture (in concordance with the MDA foundation).
 - They make explicit the purpose that any modelling approach under analysis should support, so that, a posterior inference process determines the suitability of the modelling proposal.

■ ***Metrics over models***

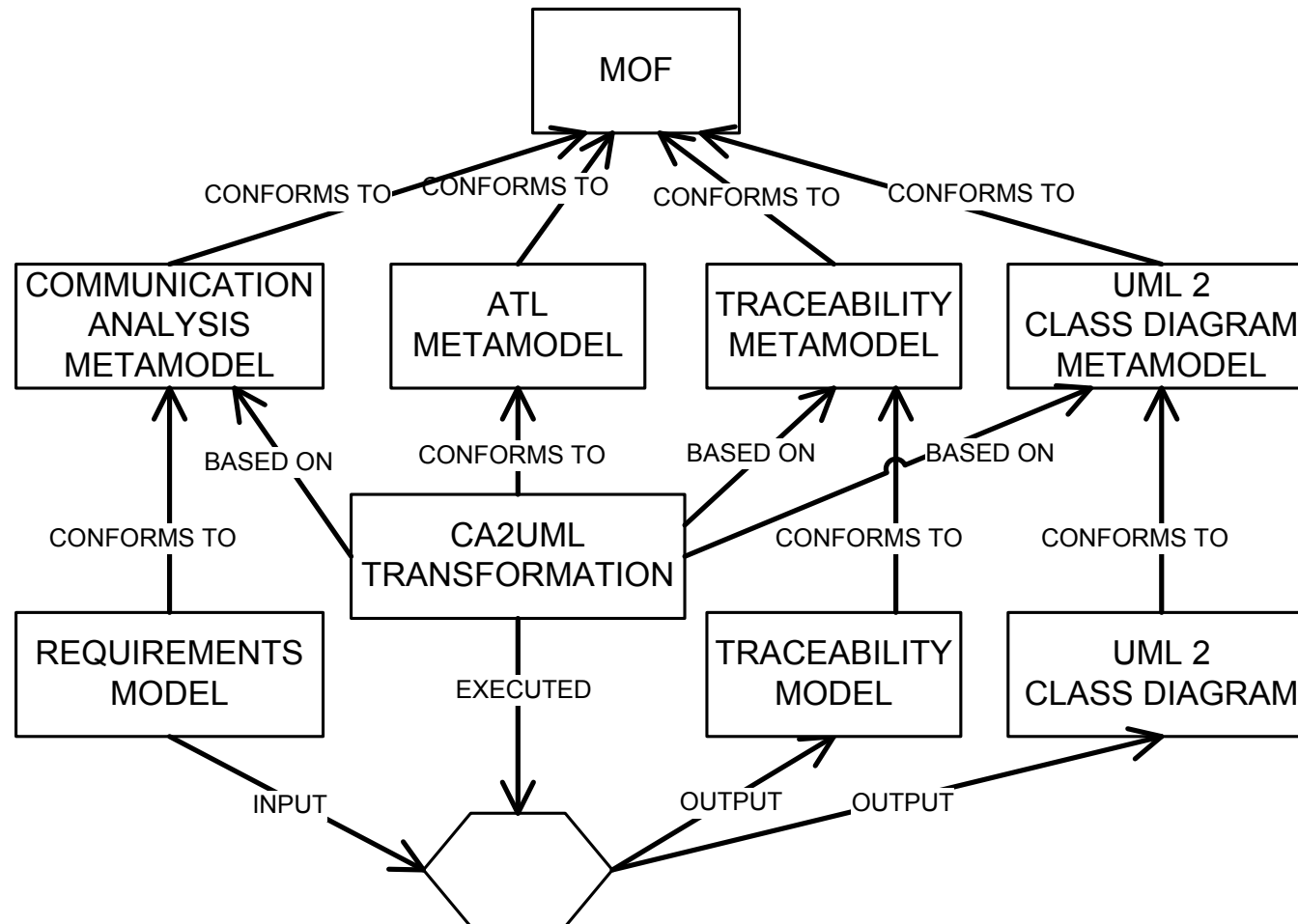
- The usage and applicability of metrics in model-driven context is highly subjective.
- These have been employed to rate specific elements associated to model-driven projects, e.g.:
 - the presence of defects
 - the size of diagrams (commonly UML diagrams)
 - model transformations
 - metamodels
 - controlled experiments
- Metrics over quality features, as exposed above, could be inferred in a systemic way.

- ***Models Transformations as a managed process***
 - The inherent complexity of transformations must be tamed by a process, where main features of the transformation can be identified and managed.
 - All decisions about transformations should not be delegated exclusively to the model transformation language employed
 - It is an artifact of the model transformation process itself.

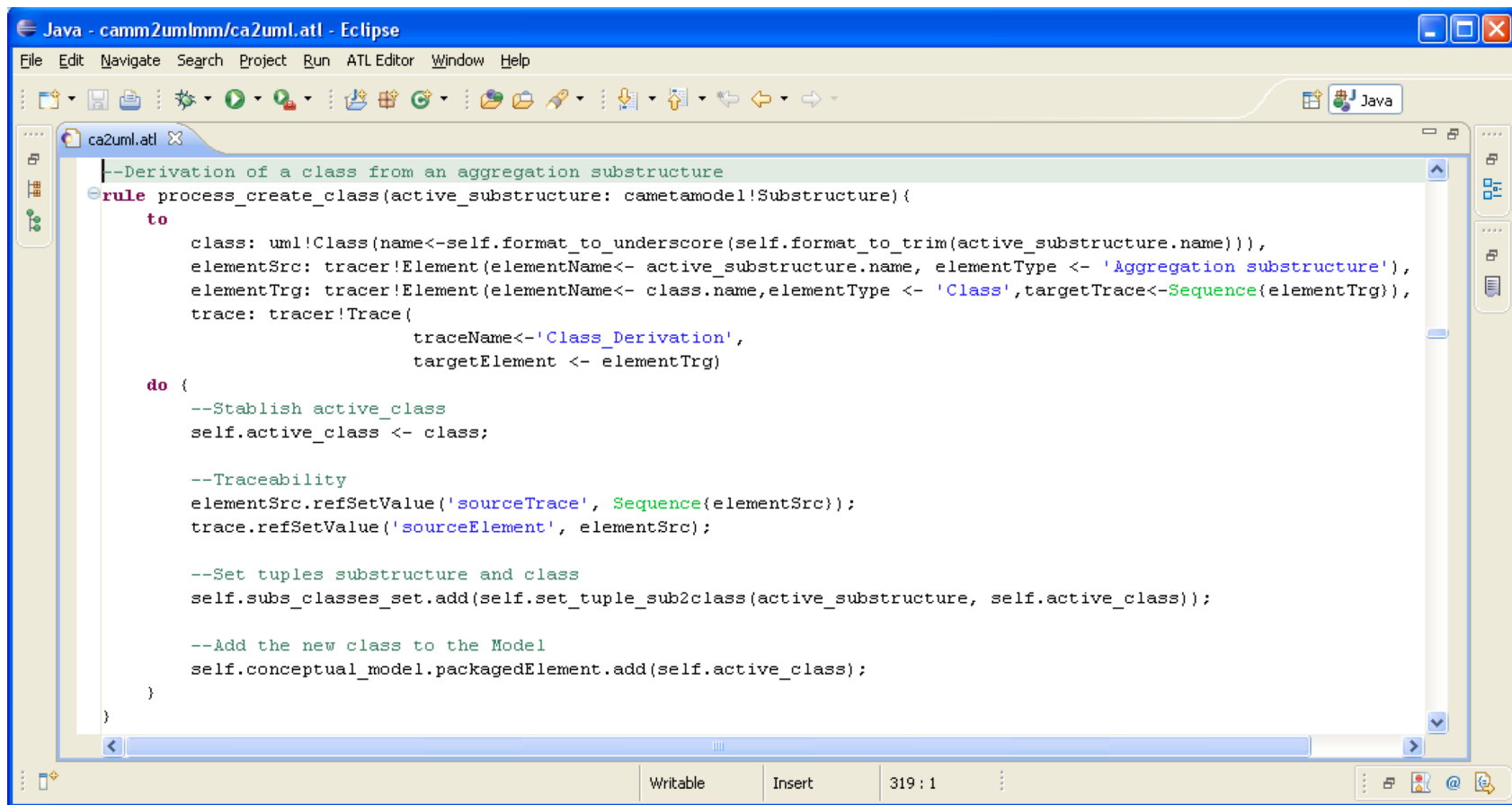
- *Models Transformations as a managed process*



- Models Transformations as a managed process***



■ *Models Transformations as a managed process*



```
Java - camm2umlmm/ca2uml.atl - Eclipse
File Edit Navigate Search Project Run ATL Editor Window Help

ca2uml.atl
--Derivation of a class from an aggregation substructure
rule process_create_class(active_substructure: cametamodel!Substructure){
  to
    class: uml!Class(name<-self.format_to_underscore(self.format_to_trim(active_substructure.name)),
    elementSrc: tracer!Element(elementName<- active_substructure.name, elementType <- 'Aggregation substructure'),
    elementTrg: tracer!Element(elementName<- class.name,elementType <- 'Class',targetTrace<-Sequence(elementTrg)),
    trace: tracer!Trace(
      traceName<- 'Class_Derivation',
      targetElement <- elementTrg)

  do {
    --Stablish active_class
    self.active_class <- class;

    --Traceability
    elementSrc.refSetValue('sourceTrace', Sequence(elementSrc));
    trace.refSetValue('sourceElement', elementSrc);

    --Set tuples substructure and class
    self.subs_classes_set.add(self.set_tuple_sub2class(active_substructure, self.active_class));

    --Add the new class to the Model
    self.conceptual_model.packagedElement.add(self.active_class);
  }
}
```

■ *Semantic in the diagram*

- A diagram must *reflect the semantic of the language*, i.e., natively the semantic could be derived from the diagrams.
- MDA 2.0 encourages **model analytics**: do not just capture information in models... use that information! (querying, analyzing, reporting, simulating and transforming).
- **Diagram as a user-interface**: shift the focus to **quality in use** vs. the common-place internal and external quality.
- Important notions:
 - context of use
 - pragmatic quality
 - cognitive fit of the modelling language


■ *Agile ontological analysis*

- Ontological analysis has been popular in academia: deep understanding of the modelling languages.
- Ontological analysis includes procedures at **philosophical levels** which may not be accessible (or interesting) for model-driven industry (and for part of the research community).
- Most of the model-driven community are final users of modelling languages and developers, so that their interest are focused in the **applicability** of languages over a domain.
- An **agile ontological approach** is needed in order to facilitate the analysis and reasoning about the applicability of modelling languages according to the particular characterizations of the domain under modelling.

- ***Incorporation of quality in models as technical debt issues in MDE managed process***
 - Most of the existing model quality frameworks act over specific model artifacts, abstract syntax or concrete syntax.
 - These frameworks do not consider the implications around the ***performed activities over models*** in terms of the consequences of the **good practices that have not been performed**.
 - Unlike technical debt within traditional software development, the consequences of MDE activities could cover all abstraction levels involved, including business and organizational concerns.

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- **Modelling language quality evaluation:**
MDE industrial practice vs. academic research.
- Identified characteristics, mechanisms, practices that influence quality evaluation.
 - E.g., in the context of MDE, quality is not only related to the satisfaction of user needs, constraints and expectations, but it also requires to take into account the multiview nature of IS development, the fact that MDE practitioners often combine **several modelling languages in the same project**.
- **Roadmap** with some of the main challenges that MDE quality research needs to address.
- We expect this work to provide a path for future research endeavours.



Thanks! Time for questions, but...

Ask me the difficult questions:
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Valencia, Spain, November 10-12, 2015