Featured Model Types

Towards Systematic Reuse in Modelling Language Engineering

Gilles Perrouin, Moussa Amrani, Mathieu Acher, Benoît Combemale, Axel Legay, Pierre-Yves Schobbens

MISE@ICSE, Austin
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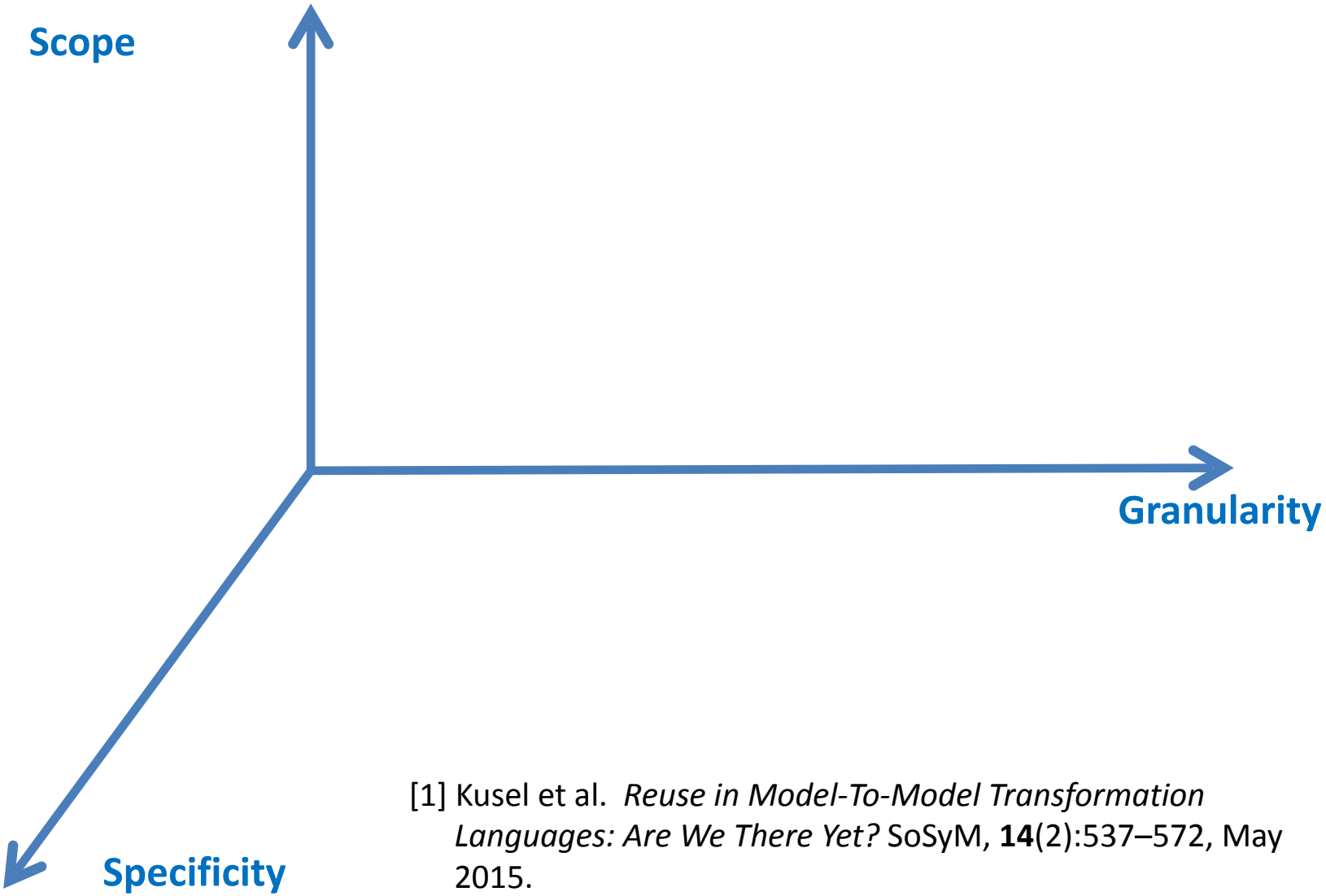
Reuse Dimensions [1]



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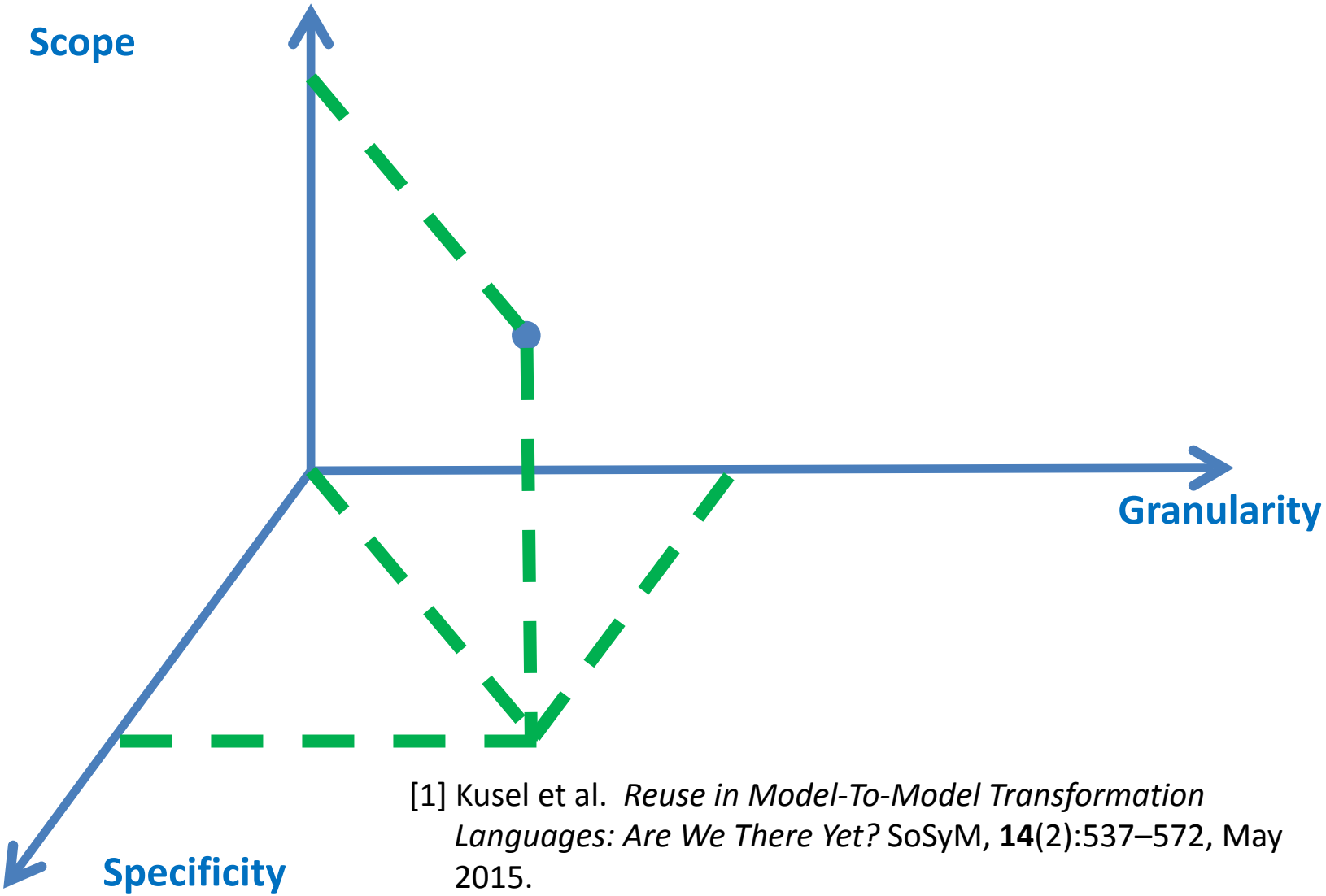

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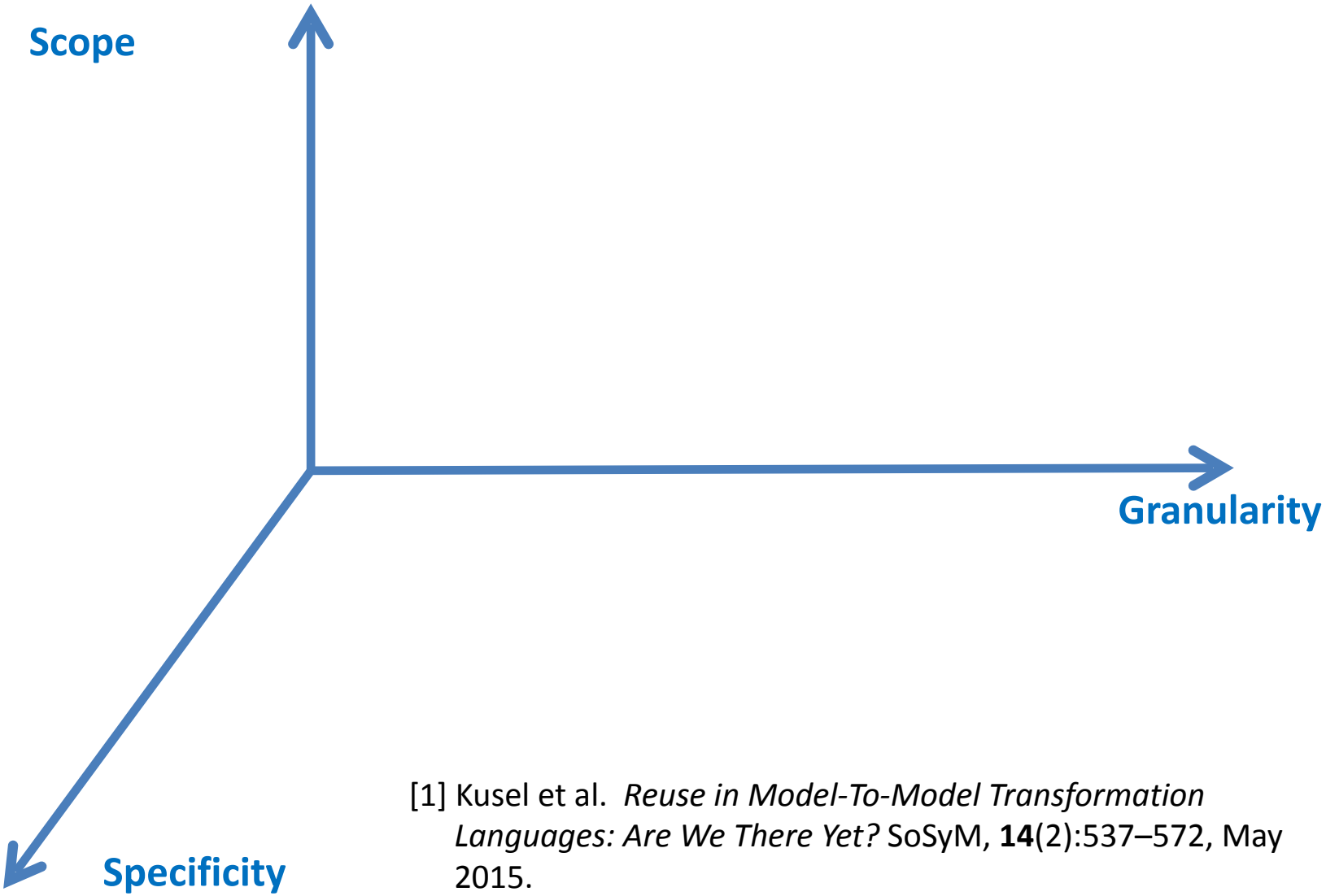

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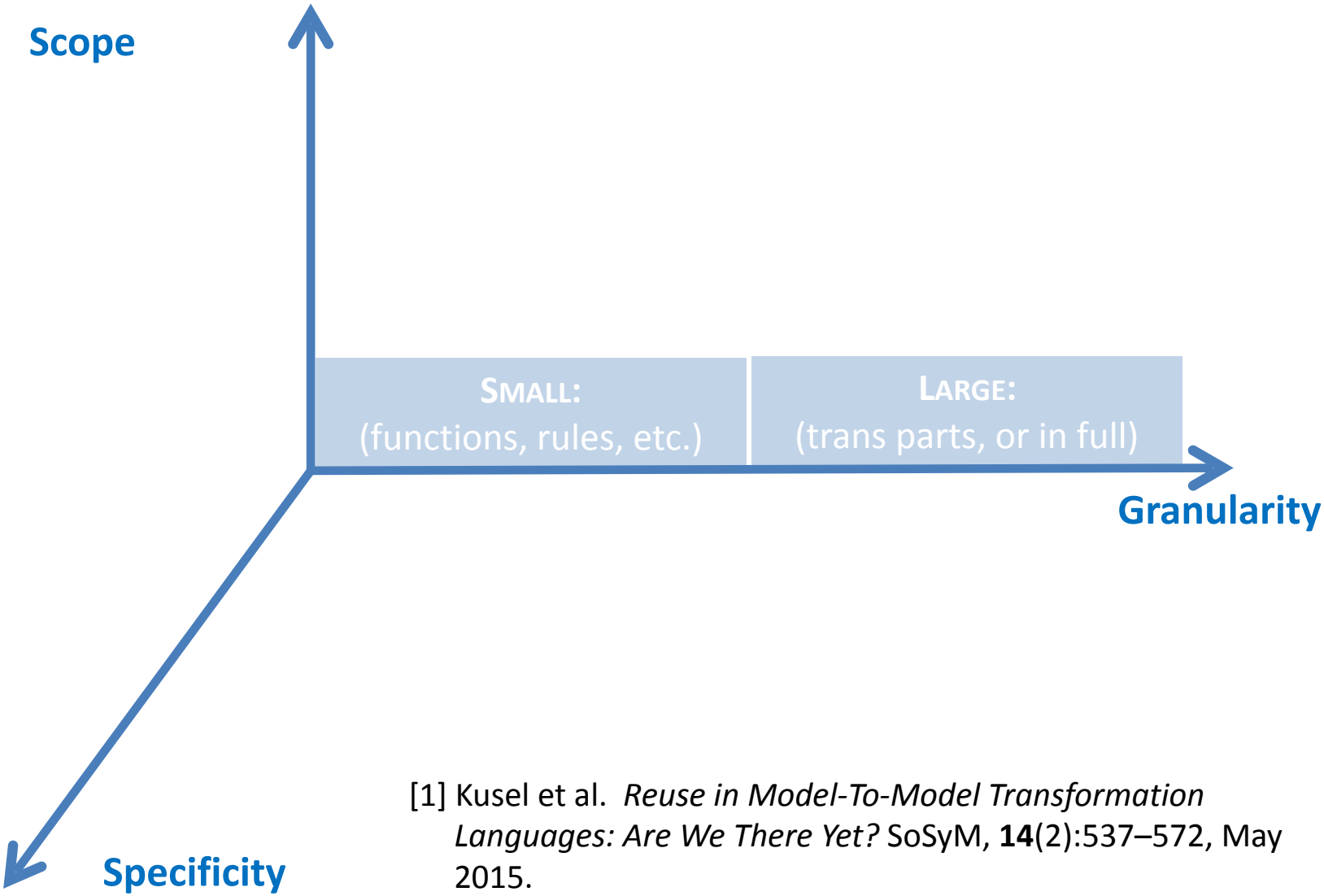

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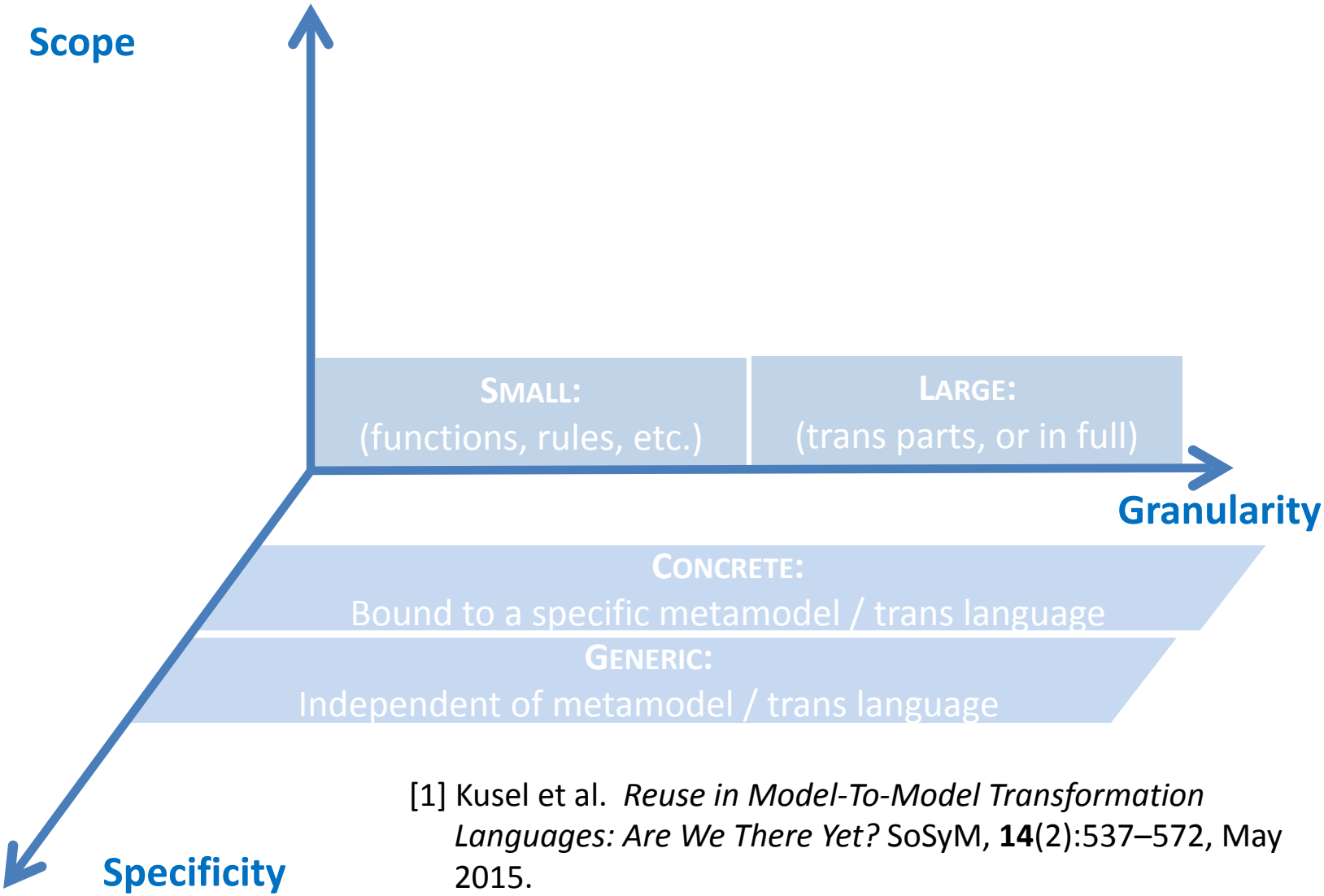

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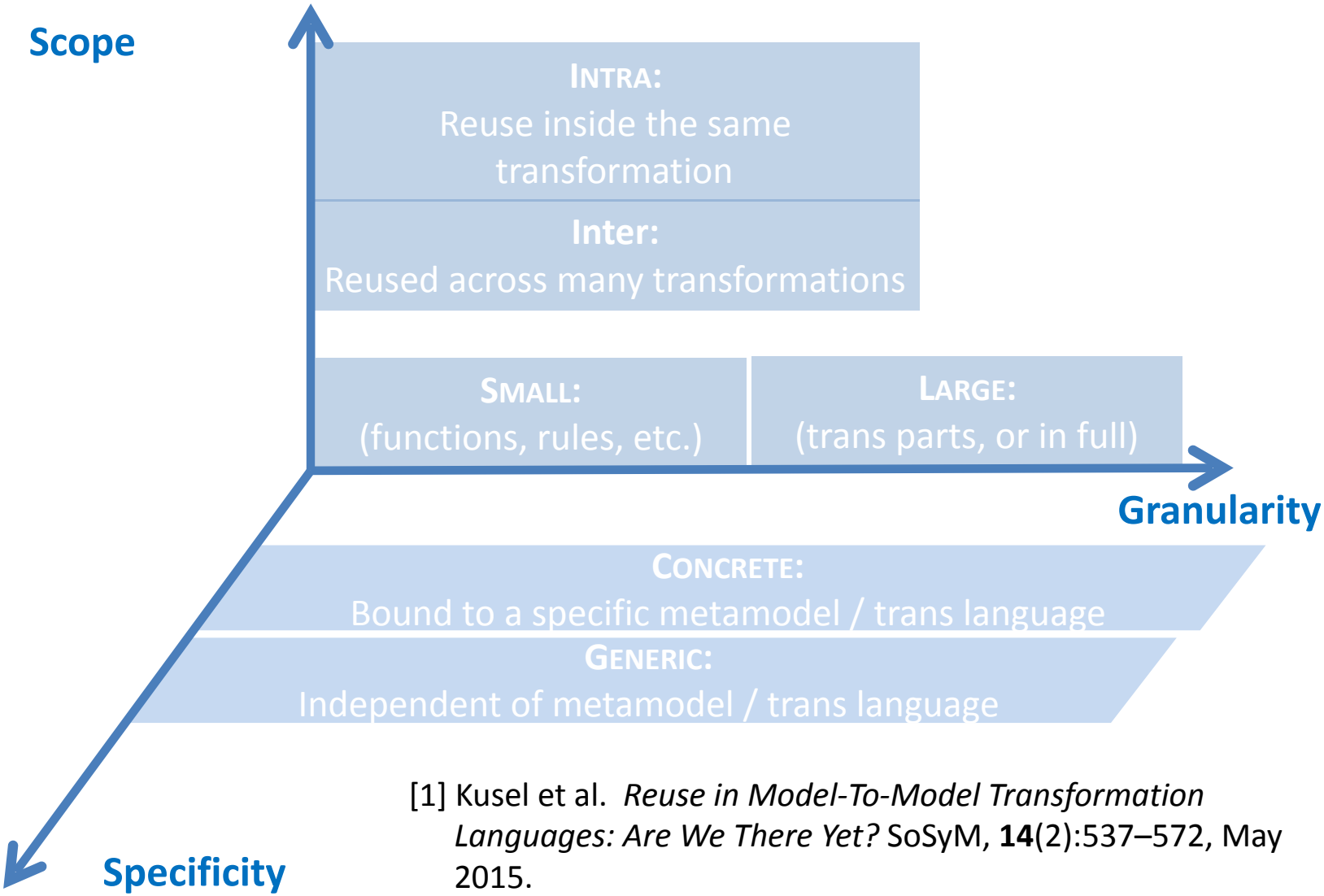

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Model Reuse Strategies

- By adapting the transformation to be reused

- By adapting the source metamodel

[1] Salay, Rick and Famelis, Michalis and Rubin, Julia and Di Sandro, Alessio and Chechik, Marsha. Lifting Model Transformations To Product Lines. ICSE, 2014.
[2] de Lara, Juan and Guerra, Esther and Cuadrado, Jesus Sanchez.A-posteriori typing for Model-Driven Engineering. MoDELS 2015.
[3] Tisi, Massimo and Jouault, Frédéric and Fraternali, Piero and Ceri, Stefano and Bézivin, Jean. On The Use of Higher-Order Transformations. MDA-FA, 2009.
[4] Guy, Clément and Combemale, Benoît and Derrien, Steven and Steel, James and Jézéquel, Jean-Marc. On Model Subtyping. ECMFA, 2012.
[5] Moha, Naouel and Mahé, Vincent and Barais, Olivier and Jézéquel, Jean-Marc. Generic Model Refactorings. MoDELS 2009.
[6] Sen, Sagar and Moha, Naouel and Mahé, Vincent and Barais, Olivier and Baudry, Benoît and Jézéquel, Jean-Marc. Reusable model transformations. SoSyM, **11**(1), 2010.

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Provide documentation, pre-conditions,

test models, formal requirements, etc

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Systematic reuse is not there yet

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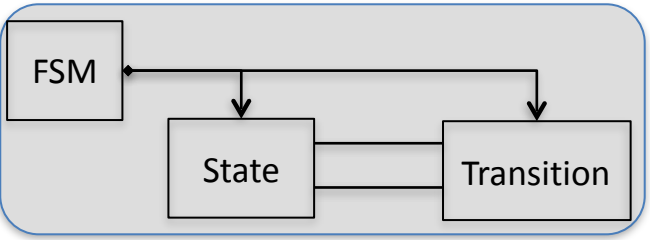
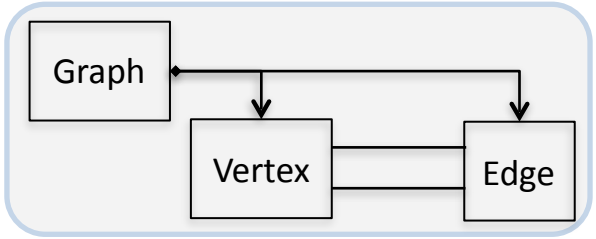
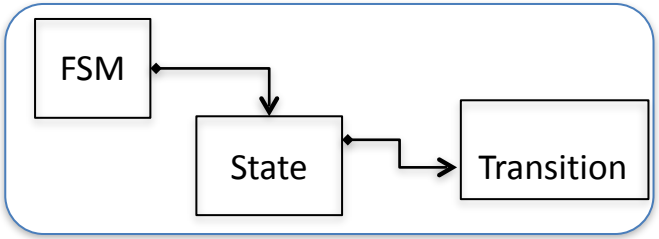
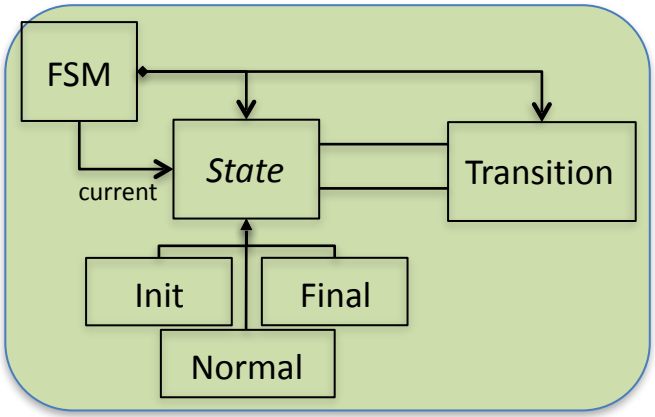
Systematising model reuse by adopting a product line approach

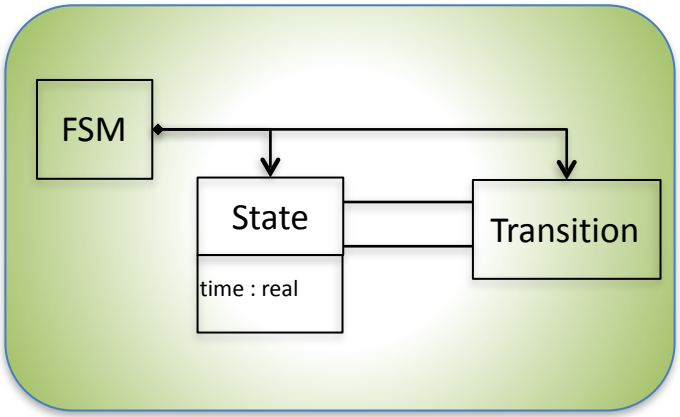
Variations over an FSM











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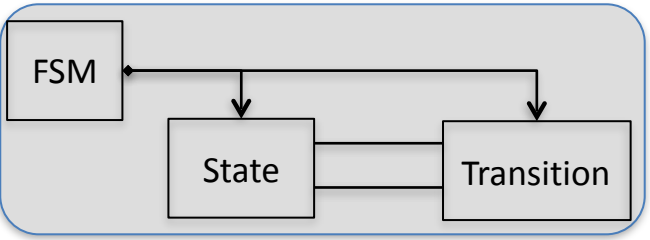
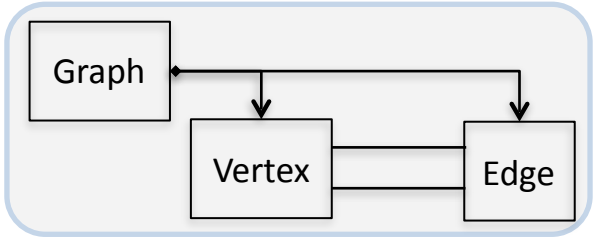
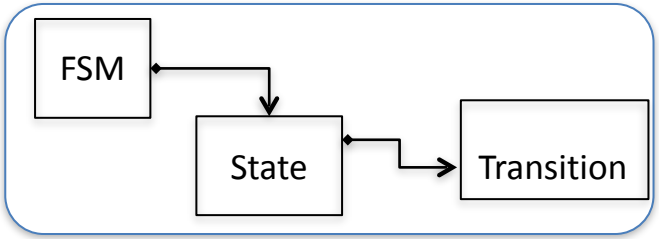
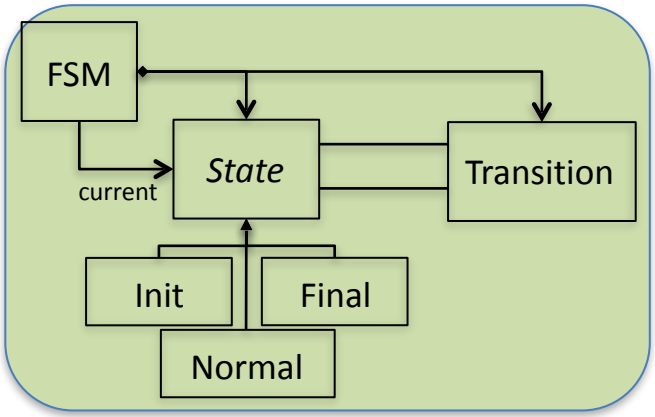






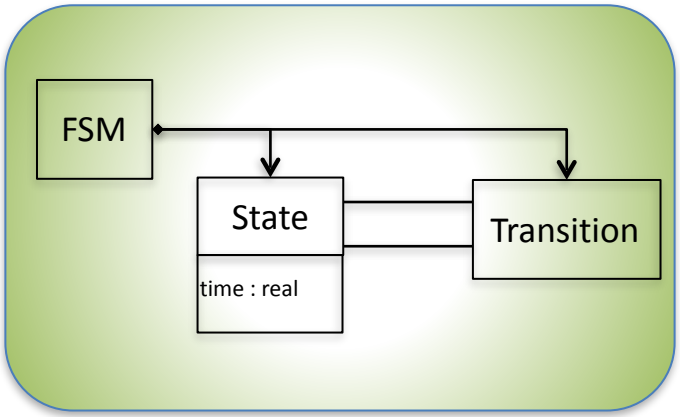
Applicable transformations:

`minimize() : FSM`



Applicable transformations:

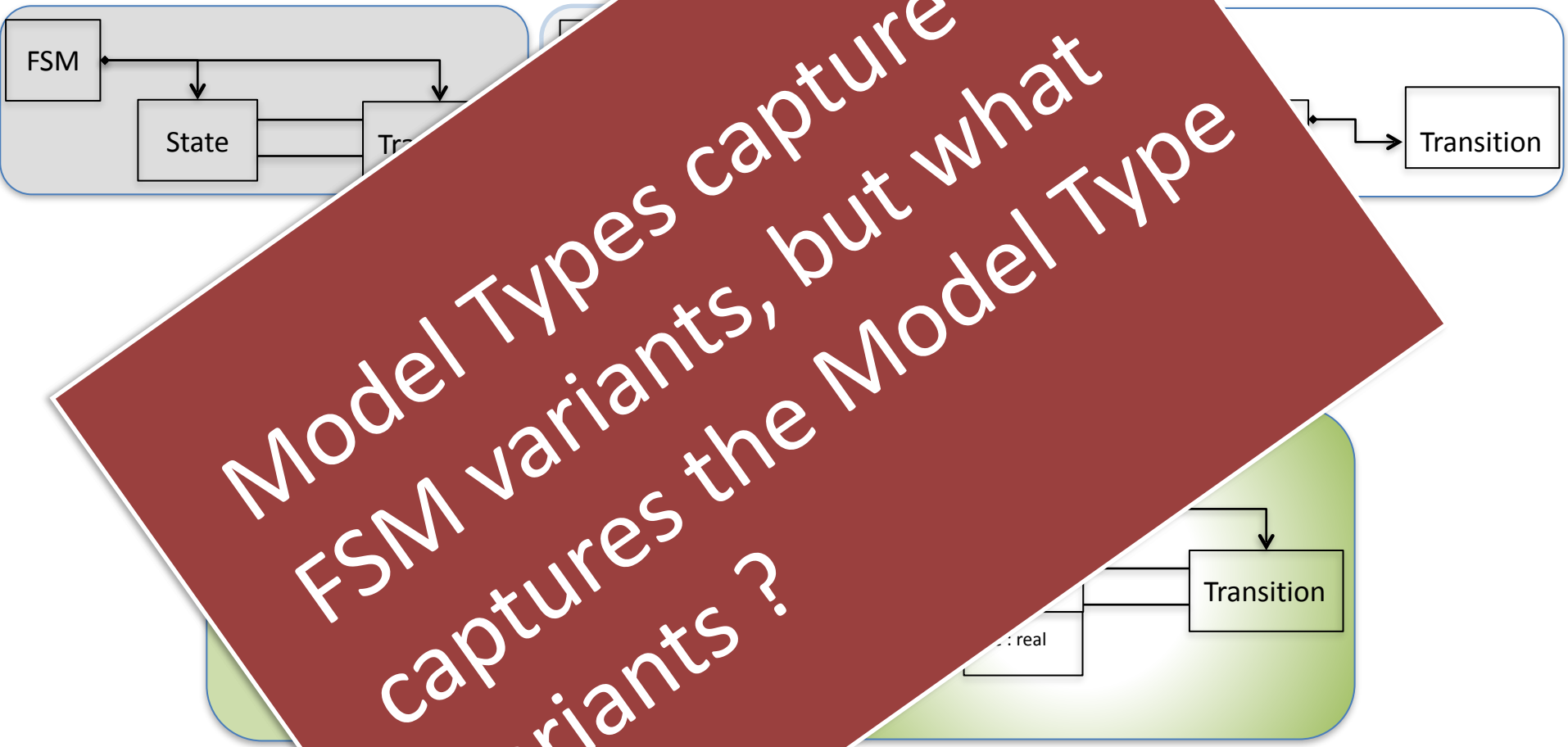
`accept() : boolean`



Applicable transformations:

`wcet() : real`

Variations o SM



Model Types capture the FSM variants, but what captures the Model Type Variants ?

Applica

accept

Applicable transformations:

`wcet() : real`

FMT: What's in a name?

***Intent:* Do not reinvent the wheel !**

Reuse existing techniques as much as possible!

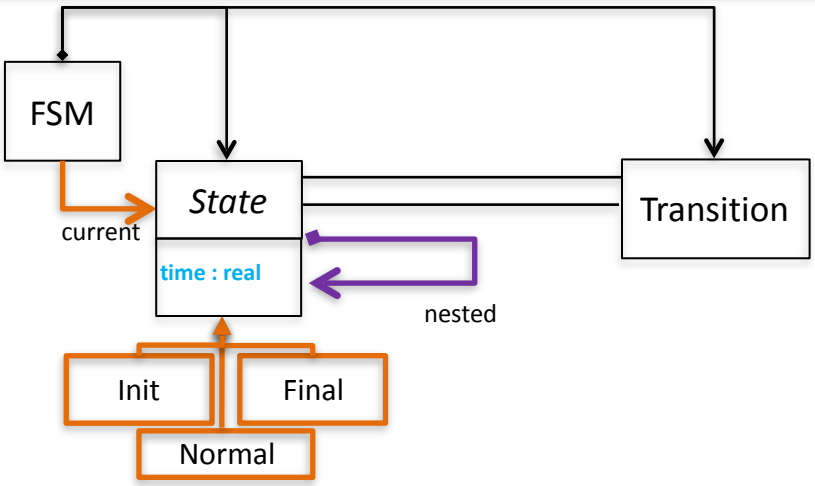
Manage explicitly your language assets

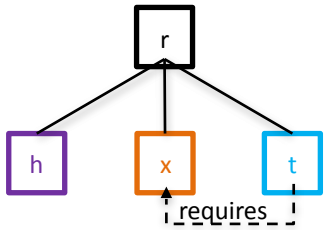
Operate with multi-granularity (both coarse-/fine-grained);

Create repositories of specialised domain assets

Configure your language !

FSM_FMT






```
r           / minimise() : FSM
r ∧ h       / flatten() : HFSM
r ∧ t ∧ x   / wcet() : real
r ∧ x       / accept() : Boolean
```

Domain Engineering Activities

Building FMTs

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Purpose

Define FMT construction approaches:

"Big Bang": Design FMTs explicitly w.r.t SPL paradigm

"Incremental": Start from a MT and incrementally add features and MM elements

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"Incremental": Start from a MT and incrementally add features and MM elements

Challenges: providing construction primitives that support merging similar elements and features, correct by construction FMTs, evolution…

Validate FMTs

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Dealing with FMTs inconsistencies

Structural: conflicting Names, references/ multiplicities mismatches => Can be addressed with variability-aware type checking

Semantic: unintended interactions amongst transformations, transformations not meant to work on hierarchies, …

Can be addressed via SPL testing or verification

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Challenges: Scalability of analyses, “verifiability” of transformations

Application Engineering

Configure and Derive an MT Product

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Purpose

Configure your DSML the same way you configure your car…

Configurator partially generated from the feature model

Product derivation techniques (e.g. pruning) to build desired MT automatically

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Product derivation techniques (e.g. pruning) to build desired MT automatically

Challenges

Partial configuration, user guidance on the relevance of elements (documentation issues)

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Perform QA activities that are too expensive at the domain engineering level (e.g. “integration” tests)

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Challenges

Reusing validation artifacts from domain engineering, validating them (e.g. Mutation Analysis)

Matching and Customising MTS

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Challenges

Dealing with partial MTs => “variability-aware” matching

Conclusion

We proposed a vision leveraging Model Types and Feature Modelling to support product-line engineering of modelling languages

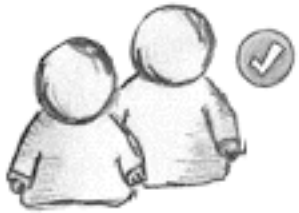
FMTs = support to manage reusable MM assets

Wishlist of high-level operations to work with FMTs

Future Work

Clafer

Lightweight Modeling Language



Designed with
usability in mind