Formalism Transformation Graph Process Model

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The NECSIS Project

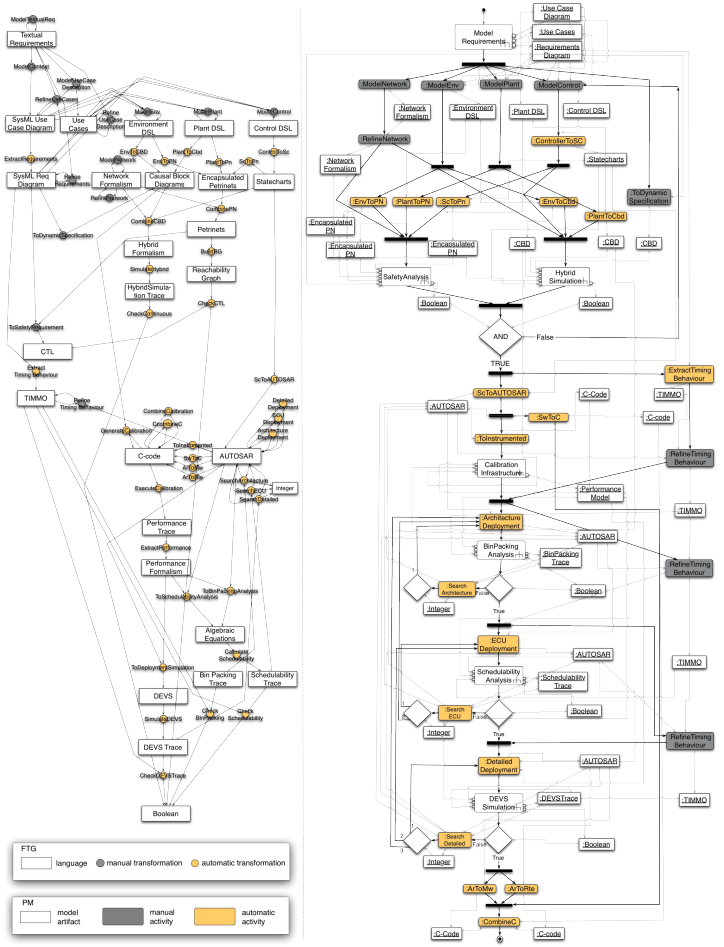
"NECSIS is focused on the advancement of a software methodology, called Model-Driven Engineering (MDE), that can yield dramatic improvements in software-developer productivity and product quality. "

Collaboration between:

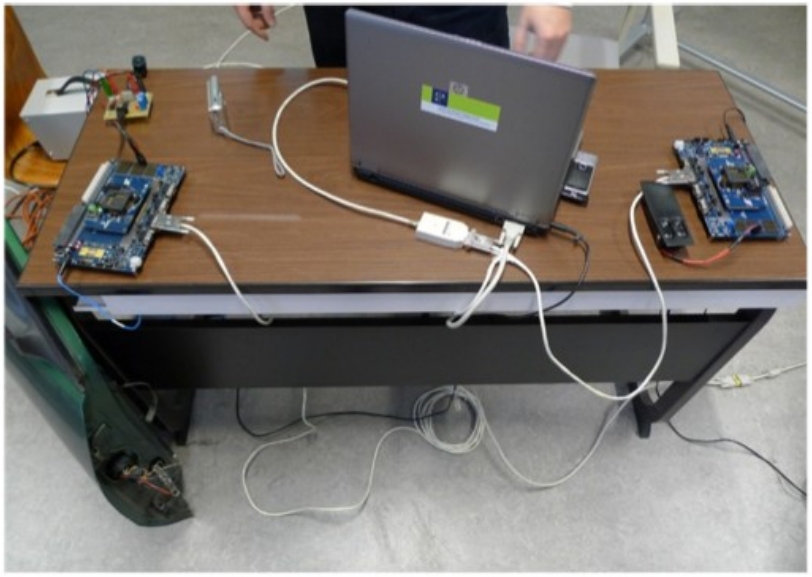
McMaster University, University of Waterloo, University of British Columbia, CRIM (Centre de recherche informatique de Montréal), **McGill University**, Queen's University, University of Toronto, University of Victoria and

General Motors of Canada, IBM Canada and Malina Software.

Case Study: MDE based development of control software for Automobiles' Power Windows



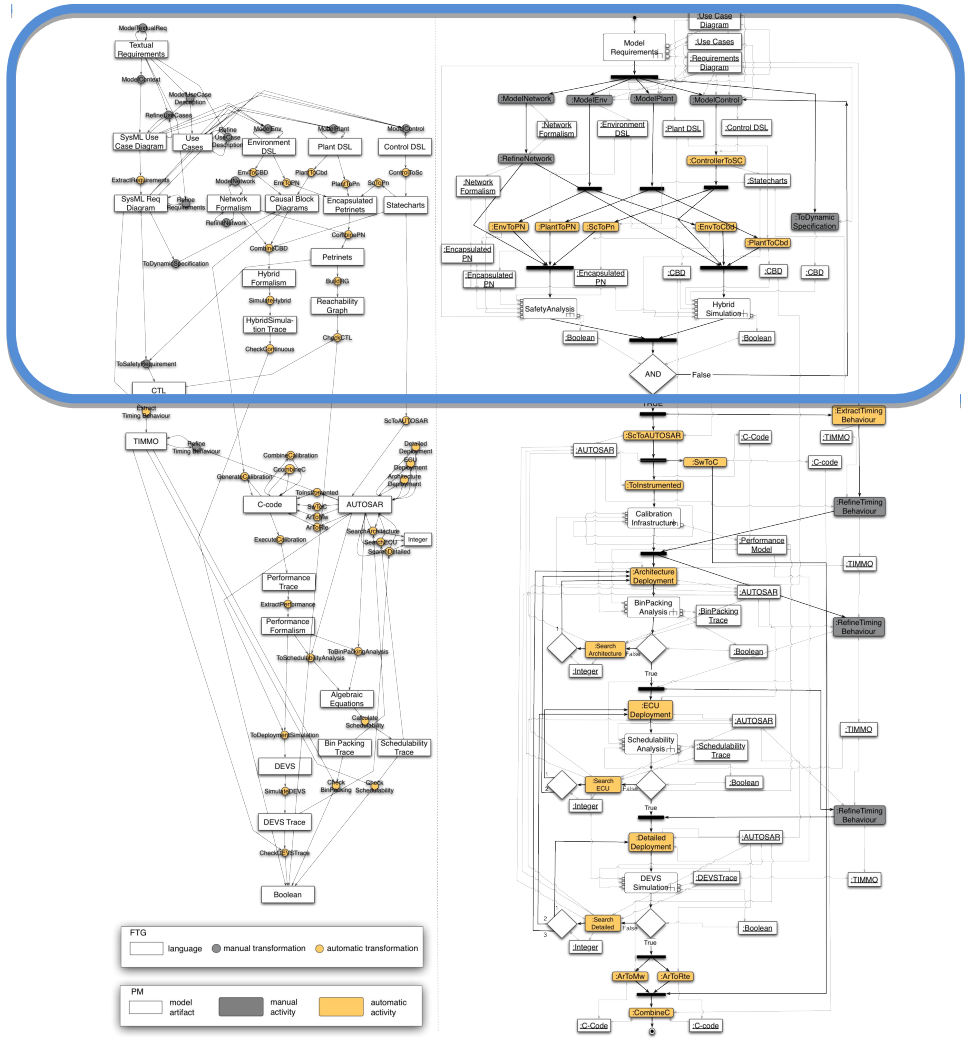
L. Lúcio, J. Denil, and H. Vangheluwe, "*An Overview of Model Transformations for a Simple Automotive Power Window*," McGill University, Tech. Rep. SOCS-TR-2012.1, 2012.



T,E,R,A, Labs

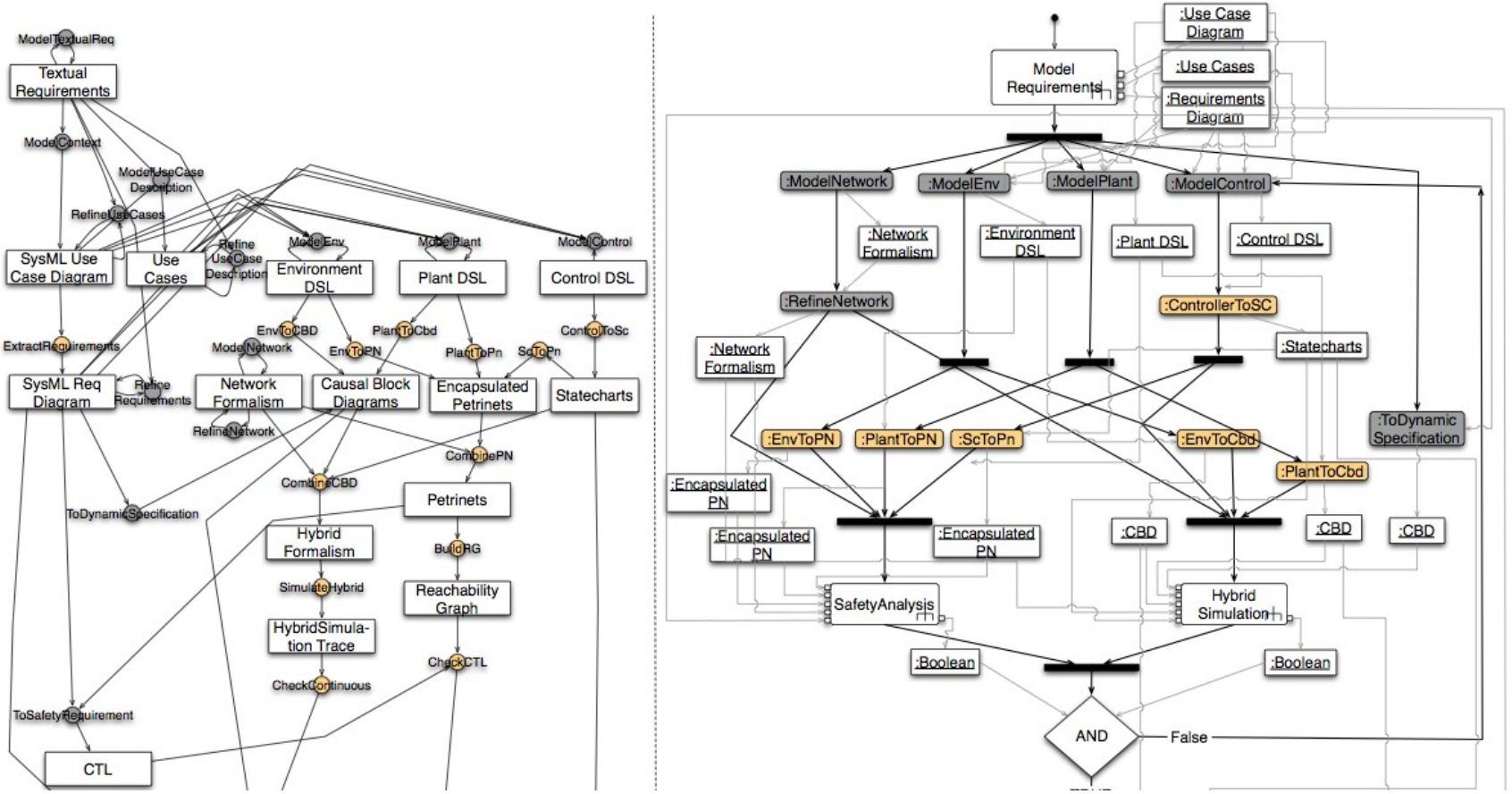
thinking big on small systems

Transformation Chains



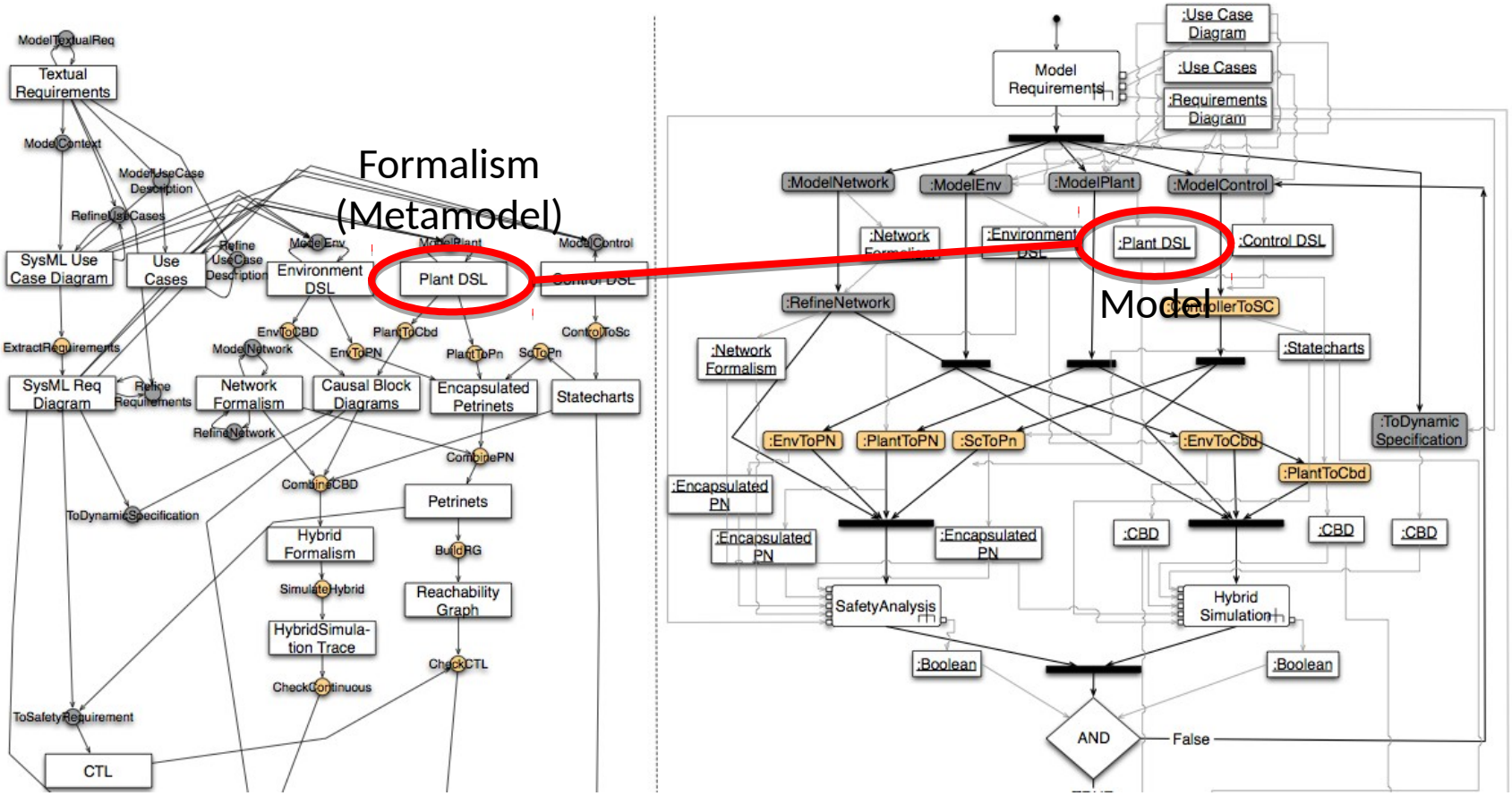
28 formalisms
50 transformations

Transformation Chains



FTG (Formalism Transformation Graph) + **PM (Process Model)**, UML 2.0 Activity Diagrams

Transformation Chains



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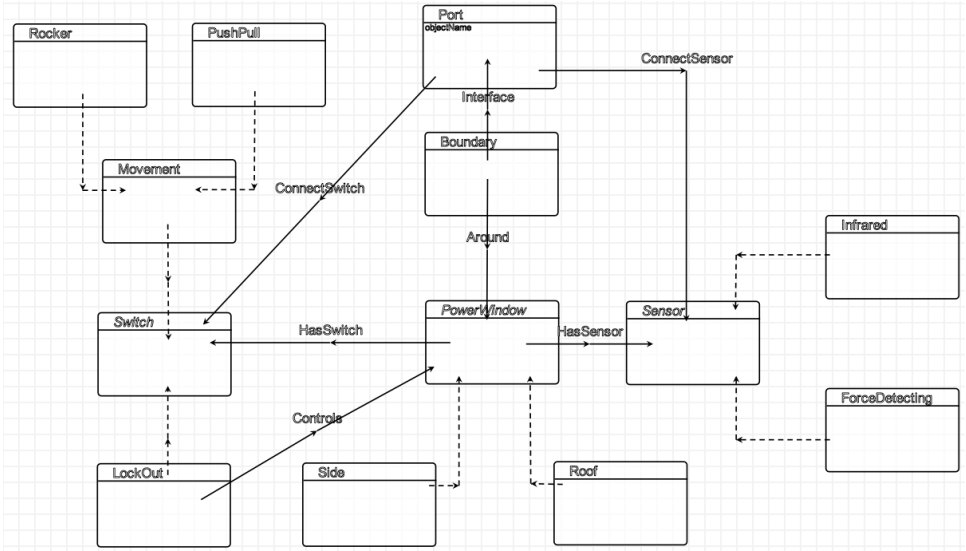
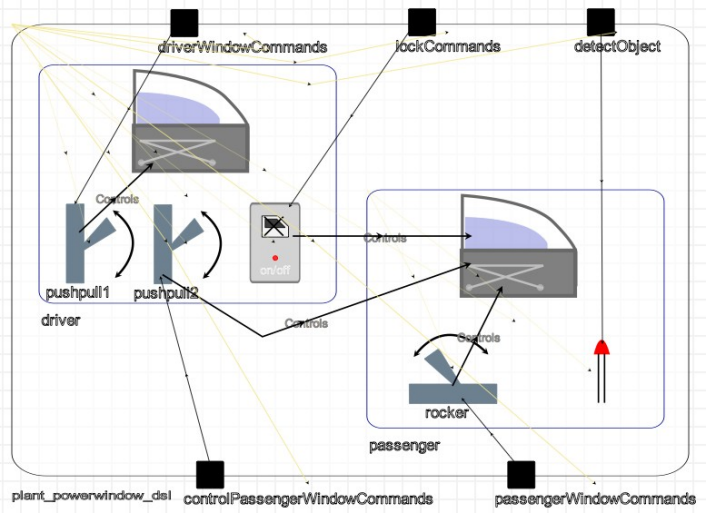


Plant DSL Formalism

Plant DSL Model



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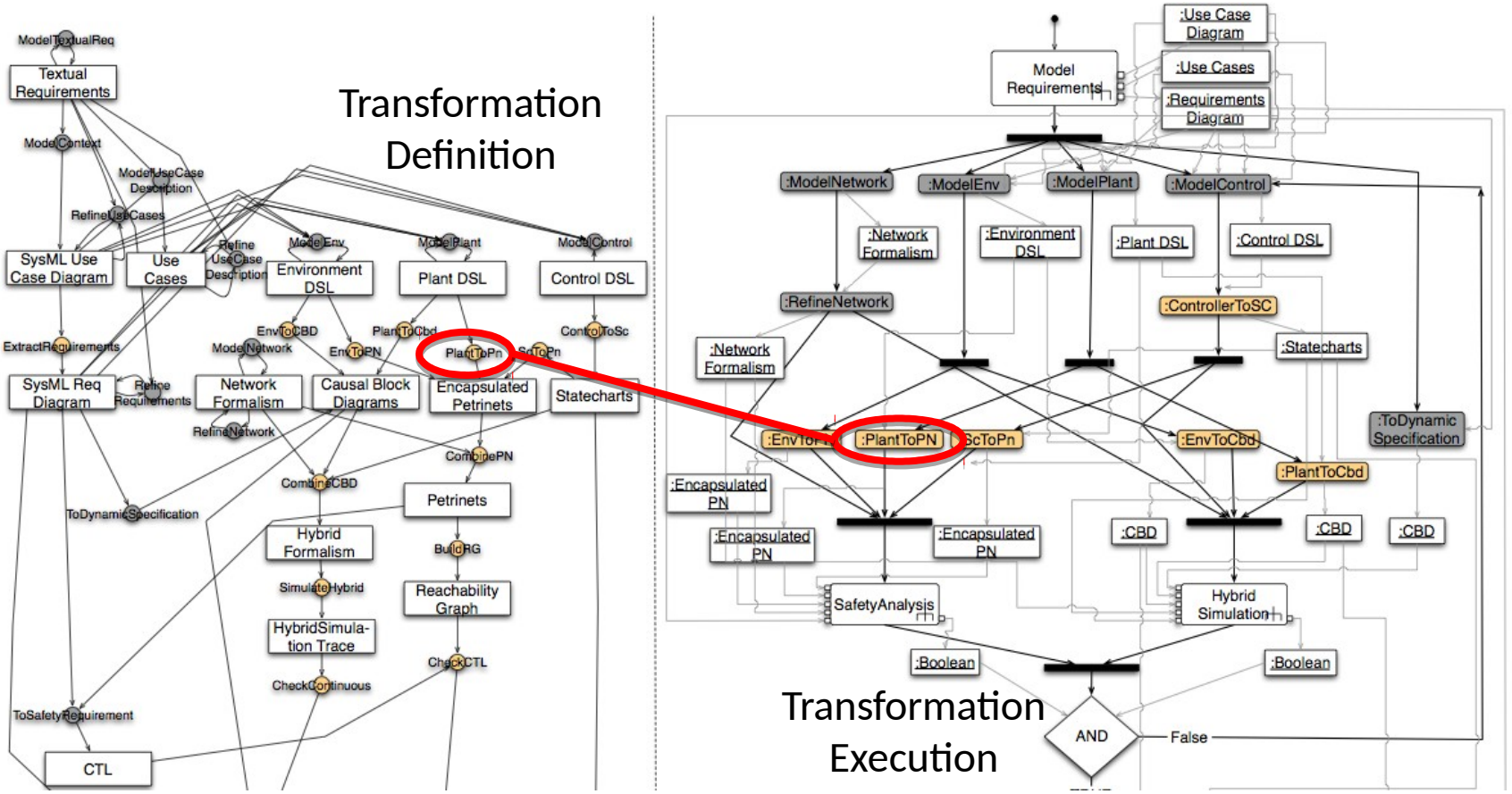
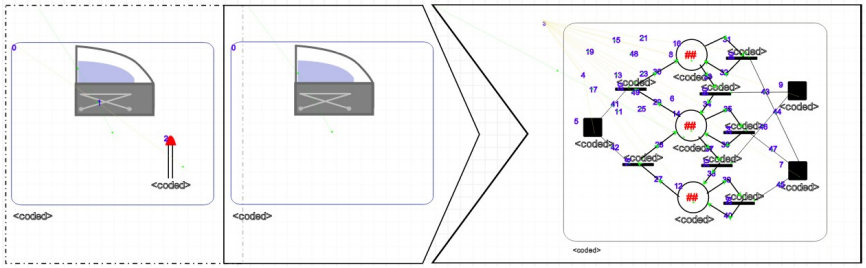
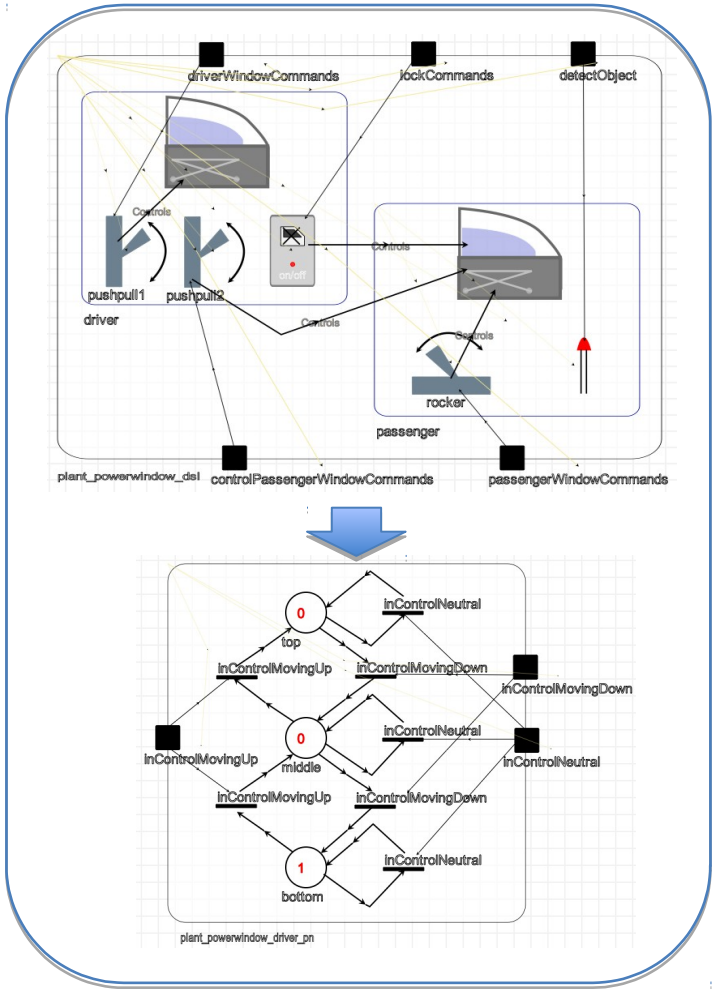


Transformation Chains

Transformation Definition (1 rule)



Transformation Execution



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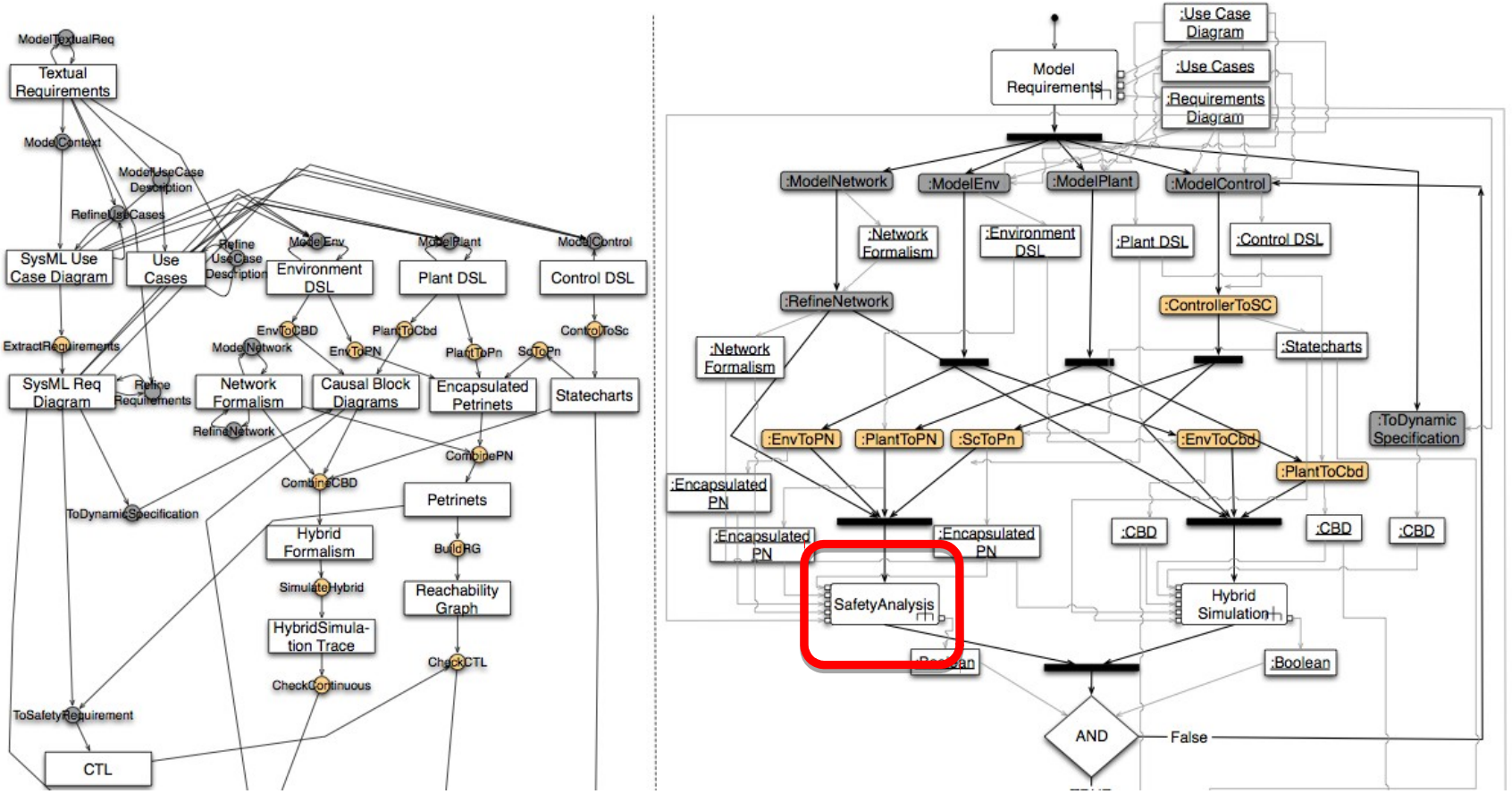

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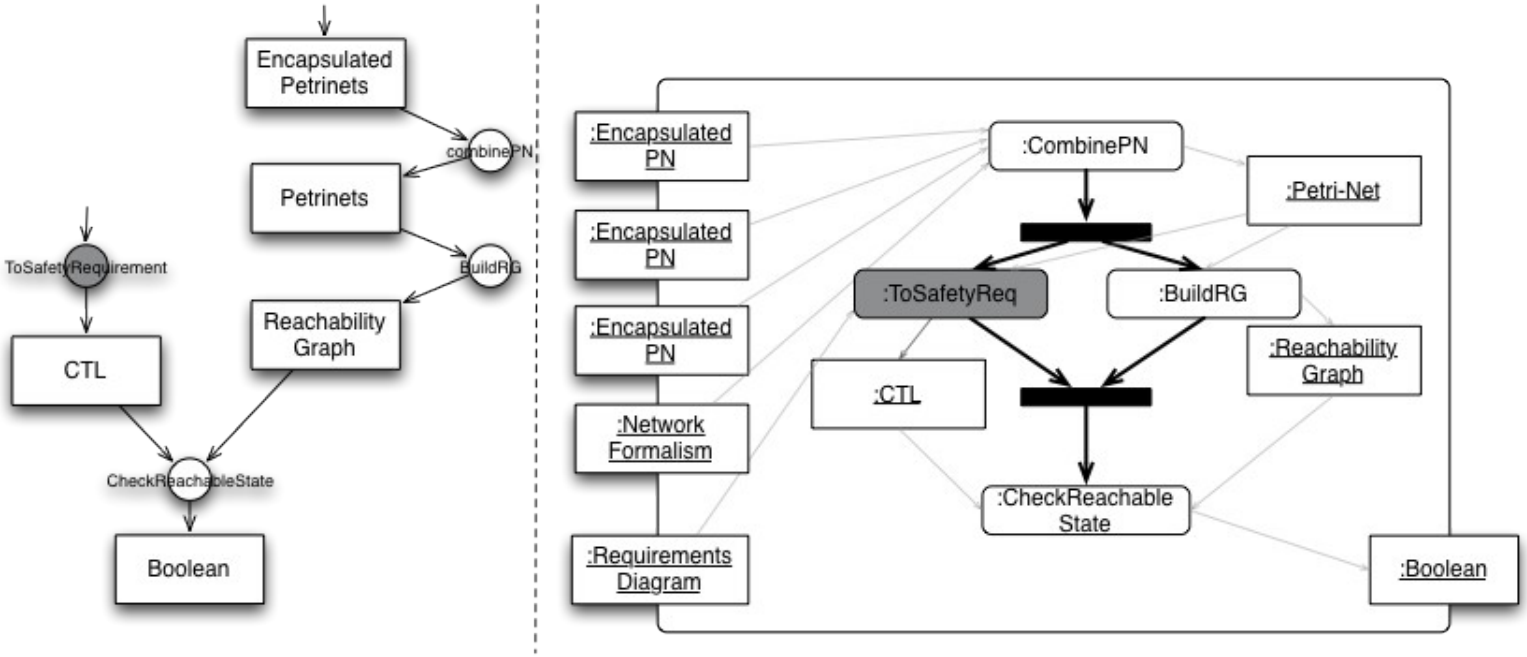
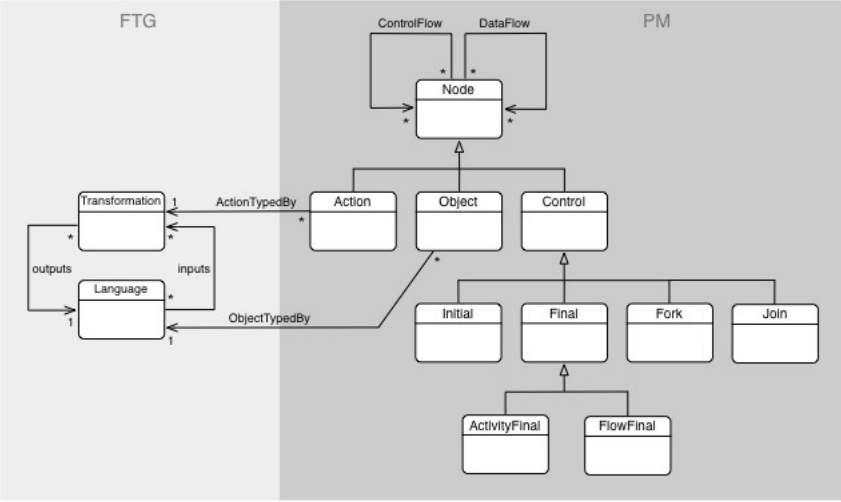


We have formalised the FTG+PM language…



Definition 3. *Formalism Transformation Graph (FTG)*
A formalism transformation graph is a tuple $\langle L, \tau \rangle \in \text{FTG}$, *where* $L \subseteq \text{LANGUAGE}$ *and* $\tau \subseteq \text{TRANSFORMATION}^L$.

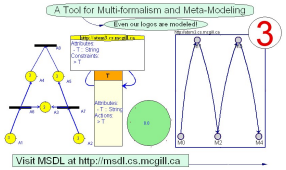
In what follows we use the notation $\mathbf{V}_s$ to denote the set of variables over set s.

Definition 4. *Process Model (PM)*
Let $ftg = \langle L, \tau \rangle \in \text{FTG}$. *A process model of* ftg *is a tuple* $\langle Action, Object, ControlNode, ControlFlow, DataFlow, ControlNodeType \rangle \in \text{PM}^{ftg}$, *where:*

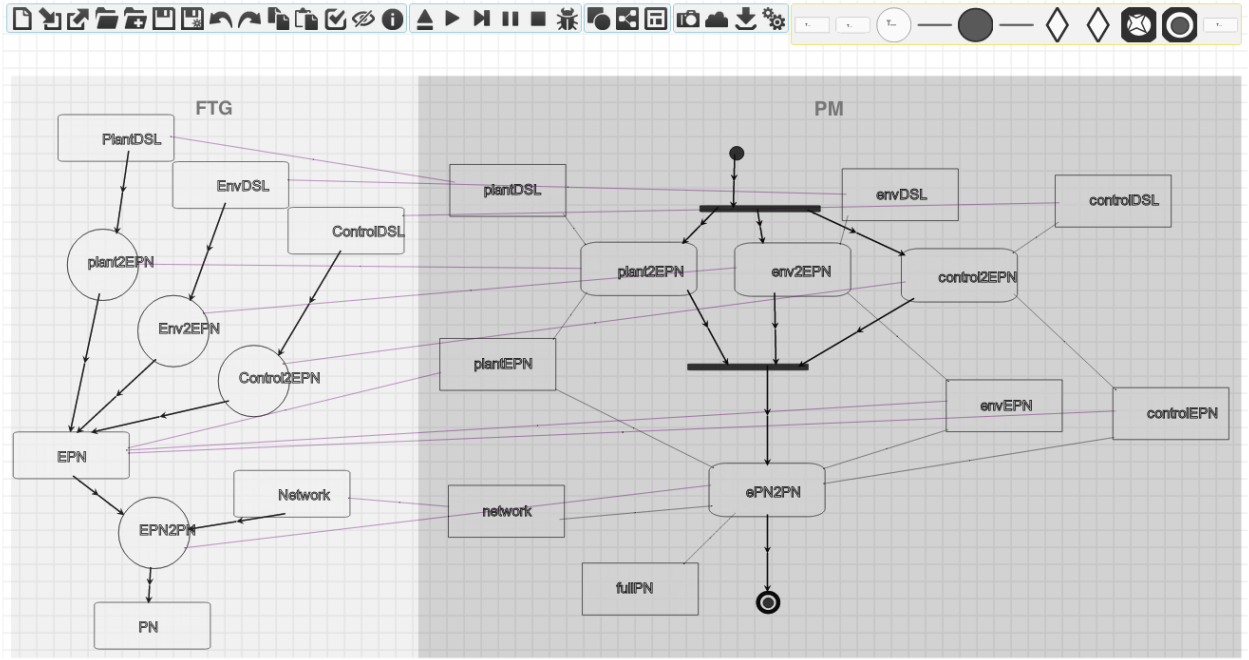
- $Action \subseteq \bigcup_{ex=\text{EXEC}^t} \mathbf{V}_{ex}$ *such that* $t \in \tau$
- $Object \subseteq \bigcup_{mod=\text{MODELS}^f} \mathbf{V}_{mod}$ *such that* $l \in L$
- $ControlNode \subseteq NodeID$, *where* $NodeID$ *is a set of control node identifiers;*
- $ControlFlow \subseteq (Action \times Action) \cup (Action \times ControlNode) \cup (ControlNode \times Action)$
- $DataFlow \subseteq (Action \times Object) \cup (Object \times Action) \cup (Action \times Node)$
- $ControlNodeType : ControlNode \rightarrow \{forkJoin, begin, end\}$

Levi Lúcio, Joachim Denil, Sadaf Mustafiz and Hans Vangheluwe, "*The Formalism Transformation Graph as a Guide to Model Driven Engineering*", School of Computer Science, McGill University, March 2012, SOCS-TR-2012.1

… and implemented it in AToMPM



? AToMPM !



Sadaf Mustafiz, Joachim Denil, Levi Lúcio, Hans Vangheluwe, "*The FTG+PM Framework for Multi-Paradigm Modelling: An Automotive Case Study*" MPM'2012@MoDELS

Advantages of having an explicit representation of the MDE process

- Repository of formalisms
- Repository of transformations
- Automation
- Reuse
- Mining of higher order transformation chain data becomes possible…
- … among which properties of model transformations and their chains.