Model management for Automotive Software

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Automotive Software and Model Driven Development

- Importance of software rapidly increasing in the automotive industry. But Automotive Software faces unique issues.
- Fragile balance between demands for high quality and safety and issues arising from rapid, industrialized mass production.
- MDD is an approach that enables **high-level design** and **code generation** for rapidly changing embedded software systems in cars, while allowing for more formal approaches to **evaluating and ensuring software quality**.
- General Motors has used the approach with particular characteristics such as highly stylized models and custom code generators.

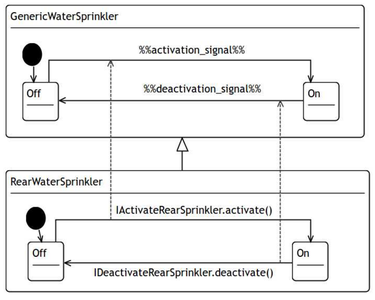
Our Goal

- We aim to create support for MDD tasks such as:
  - **Model building** and development
  - Validation and **consistency checking**
  - Traceability and **model evolution**
- Our approach:
  - Make the relations between models **first class items**.
  - To **formalize** and check them automatically.

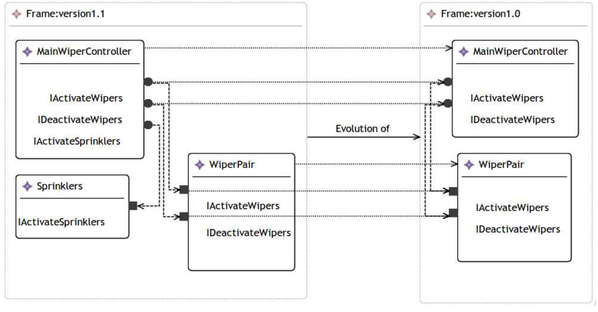
Relationships Between Models

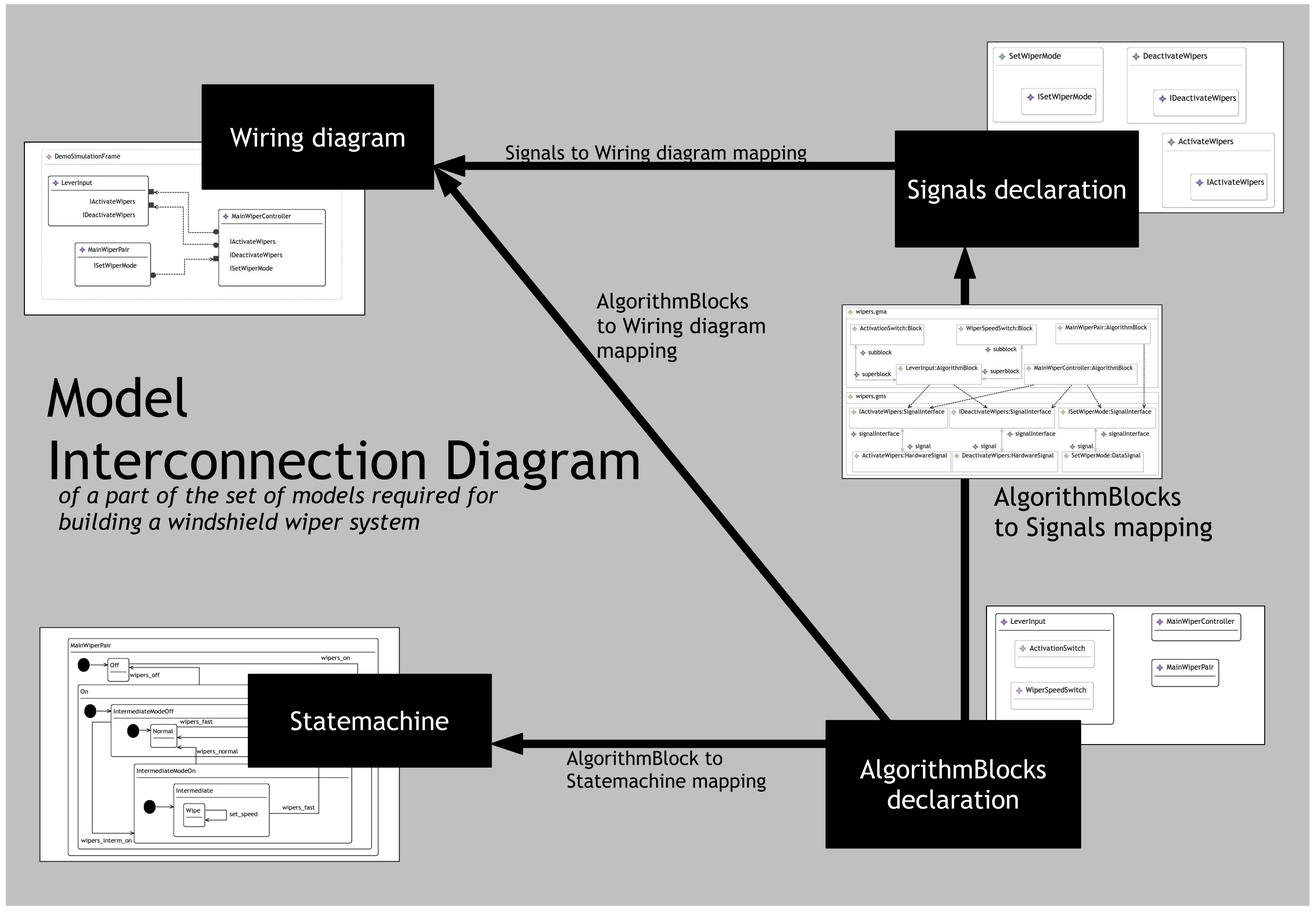
- We are exploring three types of relations in particular:
  - **Inheritance** relationship
  - Representing model **evolution**
  - Capturing information about **usage of calibration data**
- We aim to provide semantic definitions, as well as create **OCL constraints** to represent them in our framework.

Inheritance Relationship

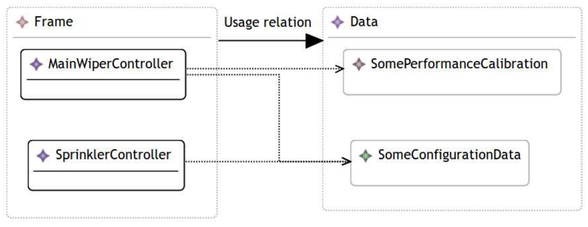


Evolution Relationship





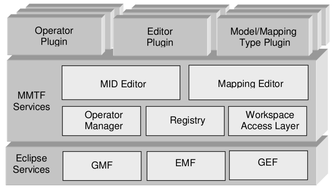
Data Usage Relationship



Model Management Tool Framework

- Eclipse-based tool framework for software model management.
  - Based on the idea of **Model Interconnection Diagrams**.
  - Support for different **types of models** and **relationships** between them.
  - Support for **consistency checking** and **operations** on Model Interconnection Diagrams.

MMTF Implementation Overview



- Support for types of models with their own GMF editors.
- OCL constrained sub-types (light types) of models.
- Relations as models using concrete syntax in Ecore.
- Support for validation of models.

Status and Future Work

- Currently formalizing the identified relations and implementing support for validating them in MMTF for couples of models that are so related.
- In the future we aim to:
  - Formalize the relations using the **QVT** framework.
  - Identify and formalize **other interesting relations**...
  - ...with additional focus on reasoning for **Software Product Lines** in the context of Automotive Software.

(The poster is available for download at: `http://www.cs.toronto.edu/~famelis/cascon09.pdf`)