Network for the Engineering of Complex Software-Intensive Systems for Automotive Systems

10 March 2015

NECSIS Partners

Network of **8** Academic Institutions

MDE Partner (GM)

- major source of MDE-related research problems
- primary beneficiary of research results

Tool Vendor (IBM Rational)

- source of MDE-related research problems
- generalize and commercialize research results

Consulting (Malina SW: Bran Selic)

NECSIS (2011-2015)

Goal: To ease the adoption and practice of MDE by

- increasing the value of models and modelling tasks
- improving methodologies, processes, and tooling
- automated analysis, verification, transformation

Theme 1 – Cognition, Collaboration

knowledge transfer among engineers
team communication
understanding models

Theme 2 – Automation

automated analyses
model transformations
testing and debugging

Theme 3 – Variability

variability management
feature-oriented requirements
feature interactions

Theme 4 – Pragmatics

model management
real-time, fault tolerance, safety
integrated development process and tools

Projects

- Information flow in modelling
- Team coordination
- Task-specific slices
- Model management
- Feature-oriented modelling and analysis
- Model transformations
- Automatic detection of model patterns
- Model-based testing (testing models not code); RT debugging
- Cross-cutting concerns (RT, safety, tool and data integration)

Cognition and Coordination Projects

Information Flow:

Understand how MDE at GM is undertaken and to identify the forces and frictions that make MDE work or not work

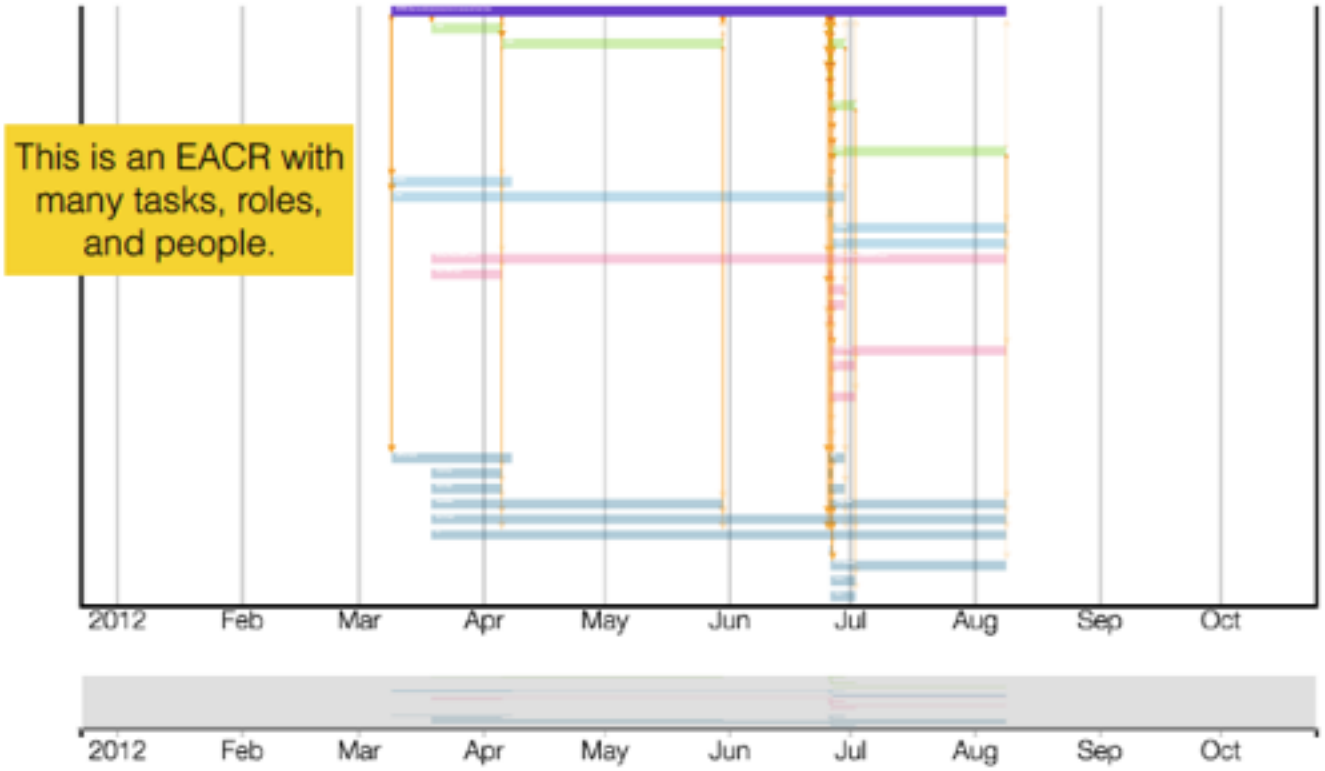
Team Coordination

Understand communication within modelling teams, provide coordination recommendations, and develop prototype tools that use social-network analysis to compute and visualize communication patterns

Task-Specific Slices

Reduce cognitive overhead of MDE by building recommenders that identify which artefacts (and parts of artefacts) that are needed to perform some development task

Example: Change Request Visualization



Title: E53029: Early low side fuel pump prime to improve cold start times
Subtitle :
Start : Fri Mar 09 2012 00:00:00 GMT-0800 (PST)
Description : Currently the low pressure fuel pump inside the fuel tank primes when run/crank transitions from low to high. This does not always provide enough time before starter engagement to adequately pressurize the fuel system using the low pressure feed pump. The result of an inadequate prime is poor start quality and longer crank time. Develop a strategy to prime the low side pump prior to the run/crank transition from low to high. One suggested solution is to start the pump prime once the key is detected in the ignition switch. Change is needed to improve GMUT start quality.

tasks

keywords

roles

people

Interest in incorporating visualizations into IBM tools

Reasoning, Analysis, and Transformation

Model Transformations

Transformation languages for constructing transformations; analysis and verification of model transformations; and analysis and verification of state-machine models

Model-Based Testing

Automate test-case generation from models, automate test-quality improvement, and test optimization

Model-Based Debugging

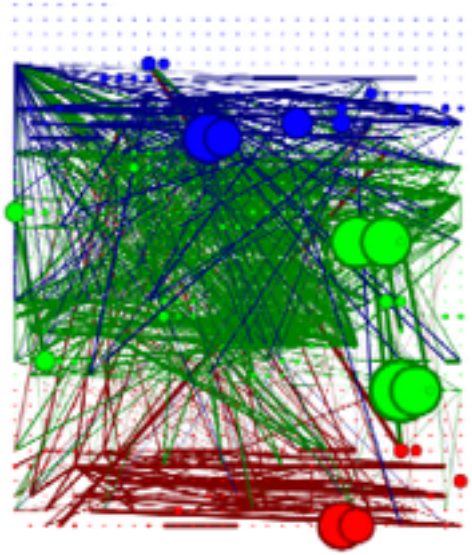
Support debugging of models (rather than of code) through dynamic instrumentation of executable models.

Model Pattern Engineering

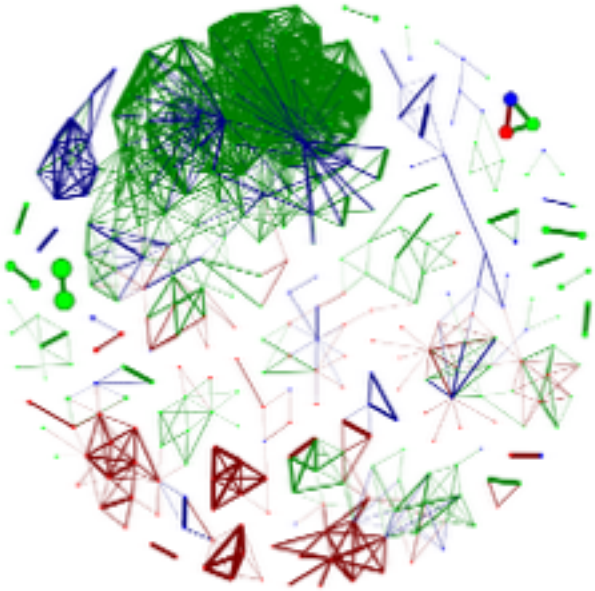
Automatically detect sub-patterns in GM models, with the goal of formulating a taxonomy of patterns and their variants

Example: Pattern Mining in GM Models

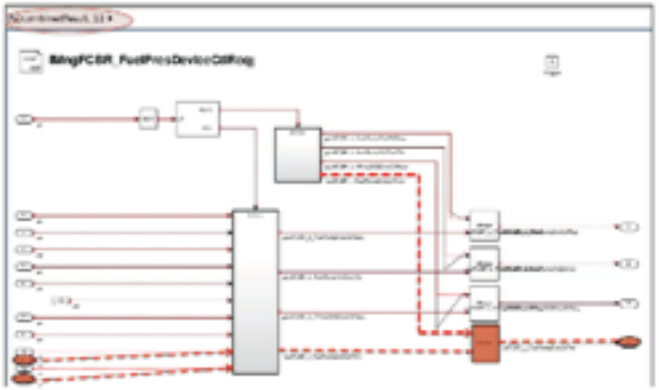
Near-matches among subsystems



Clusters of near-clones



Sub-model pattern



Setting up analysis tools at GM

uses

- reuse in model development
- standards/consistency enforcement
- change propagation
- test optimization

Variability Management Projects

Feature-Oriented Modelling and Analysis

Support modelling and analysis of feature-oriented requirements; and support modelling, analysis, and visualization of large-scale variability models

Pragmatics-of-MDE Projects

Model Management

Formally characterize the relationships between models, to support analyses and transformations on heterogeneous models; explicitly represent uncertainty and partiality in models; and adapt analyses to apply to partial models containing uncertainty

Cross-Cutting Concerns

Support modelling, analyses, and synthesis of designs that have real-time and fault-tolerance requirements; integration of architectural solutions that achieve distinct quality-attribute req; integration of software artefacts; integration of MDE tools

Proposal for an NSERC Strategic Network on Automotive Supply Chain Ecosystems and Tooling

OEMs

Tier 1

Tier 2

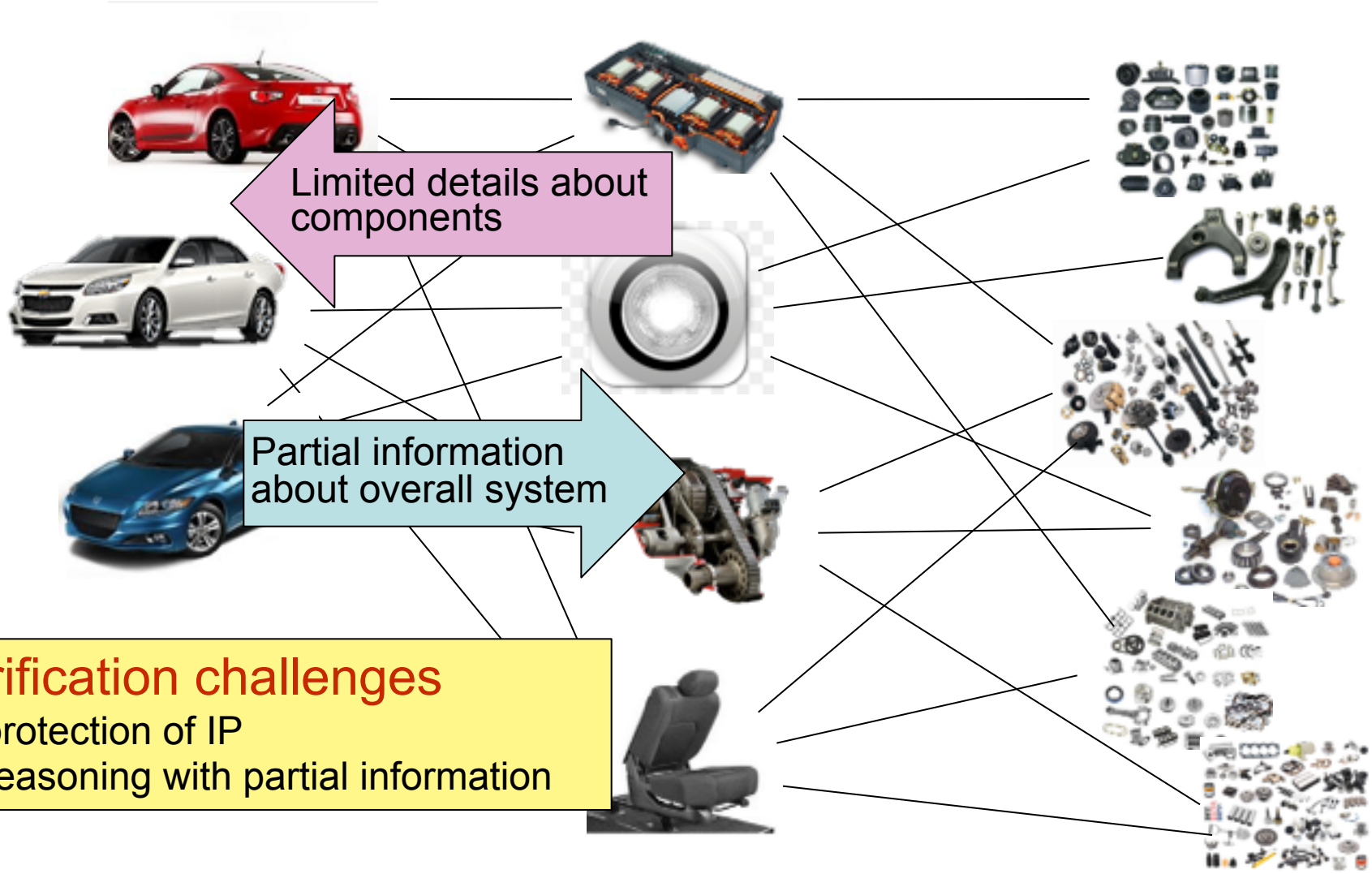
Interoperability challenges

- shared communication bus
- shared computational resources
- shared sensors
- shared actuators

OEMs

Tier 1

Tier 2



Verification challenges

- protection of IP
- reasoning with partial information