



KTH Engineering Sciences



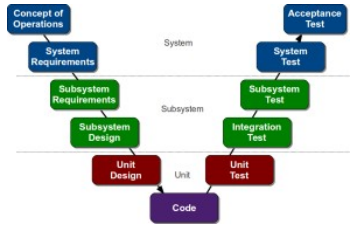
Empirical-Evolution of Frameworks Supporting Co-simulation Tool-chain Development

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Challenges of CPS Tool-chain Development



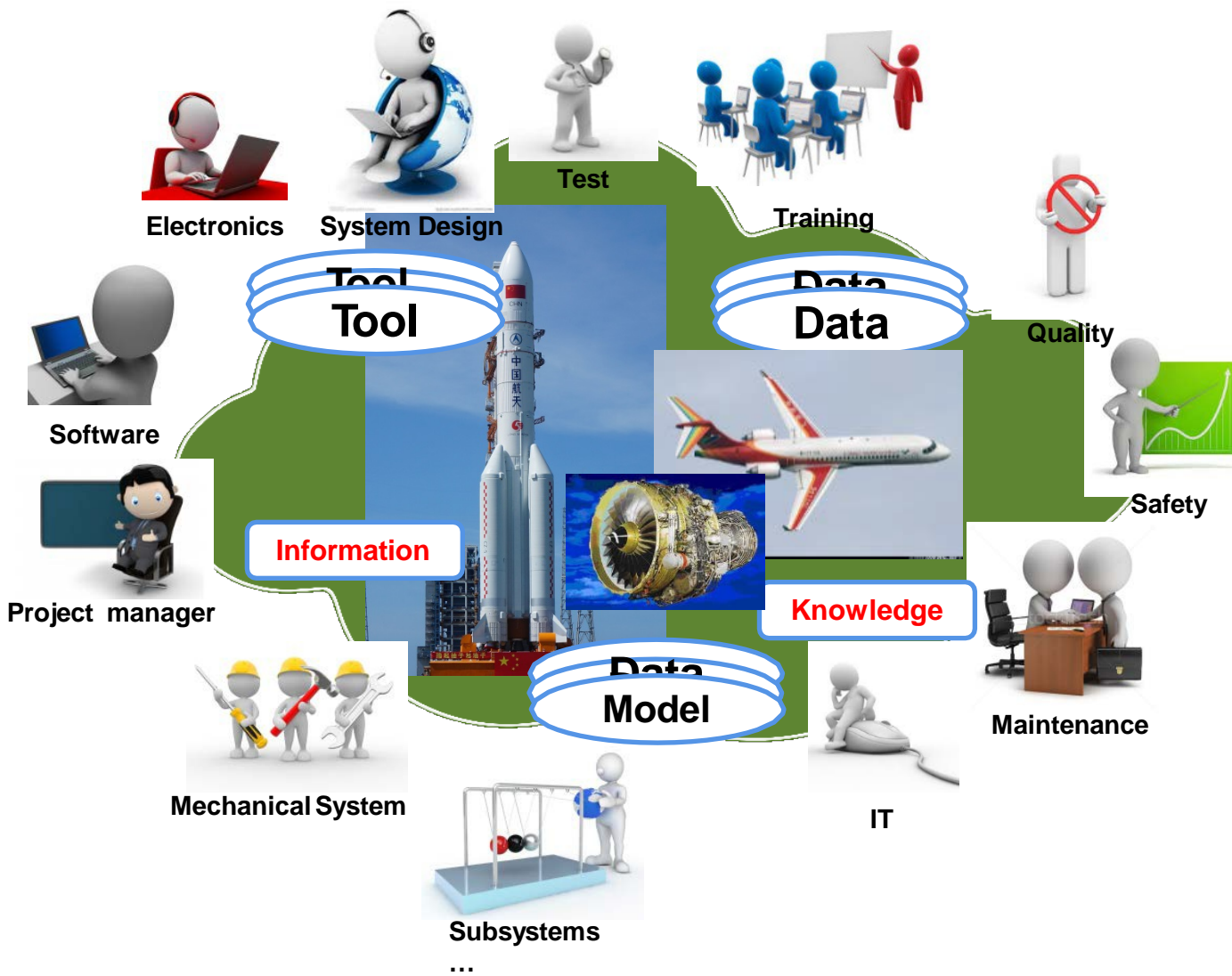
Standards



Process

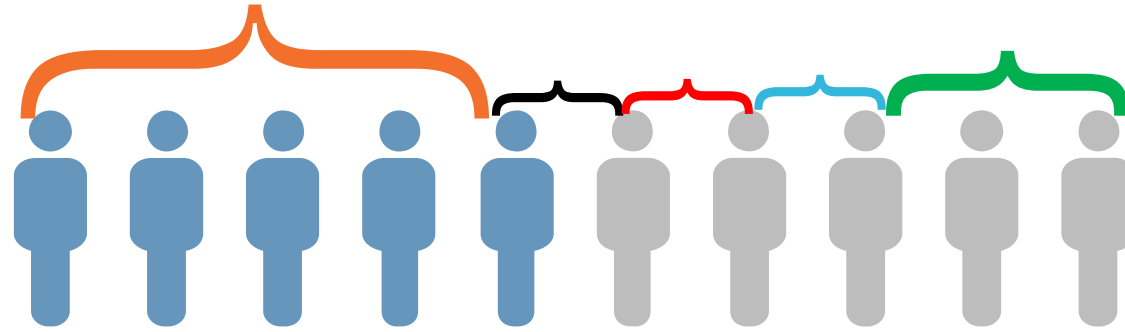


Business model



Investigation

54.55%

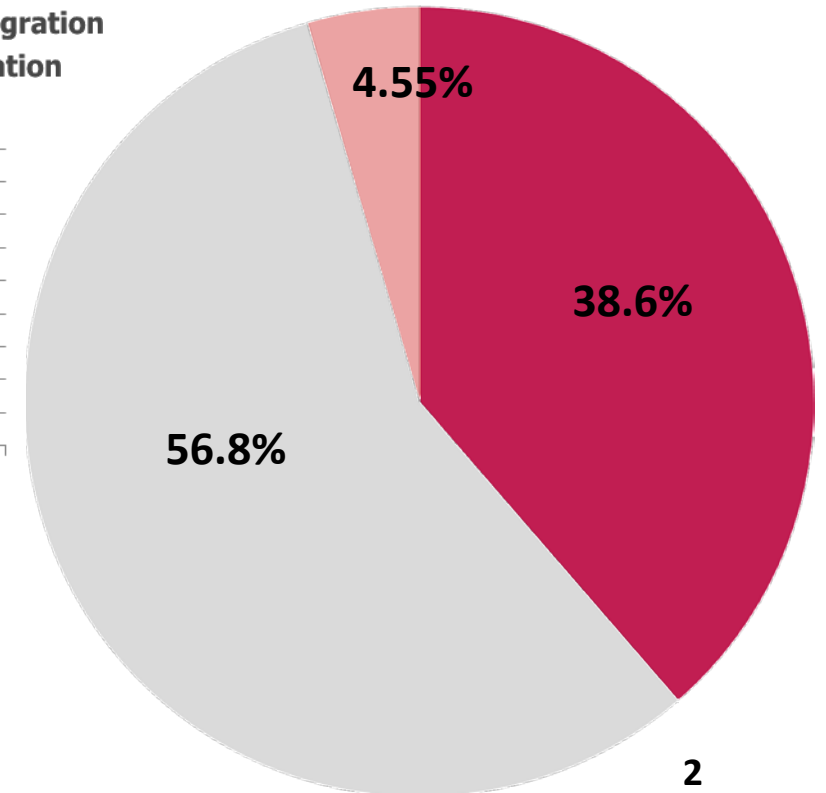


43% Aerospace
26% Others
11% Automotive
11% DoD
9% Tool suppliers

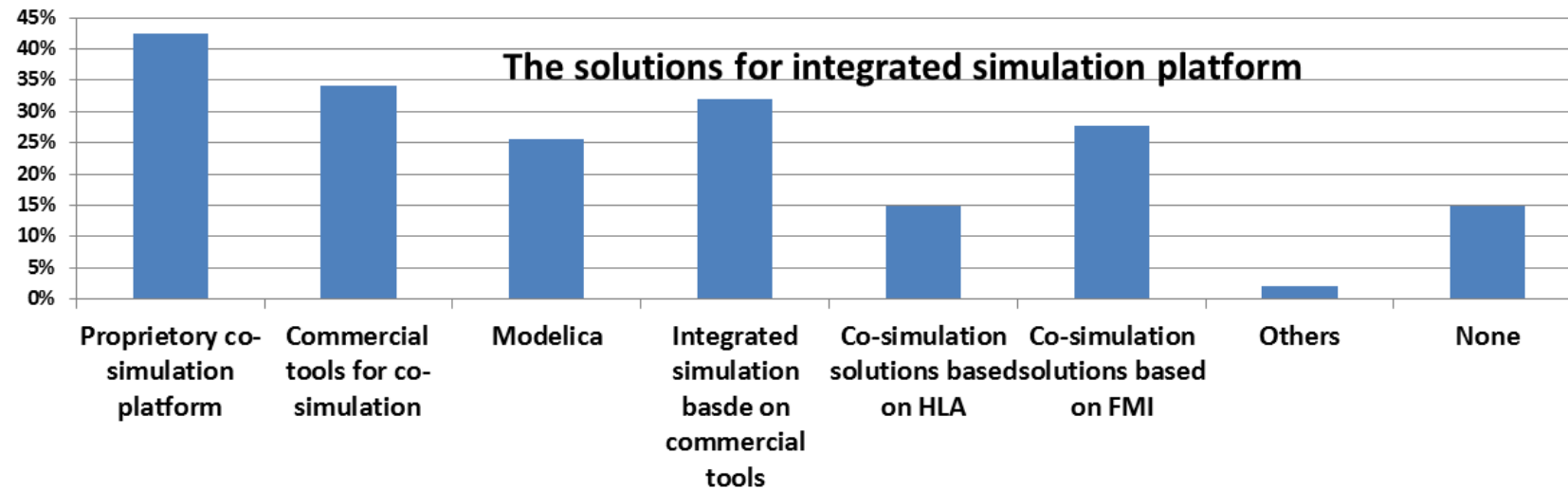
Of 58 Responders use MBSE.

Completeness of tool integration

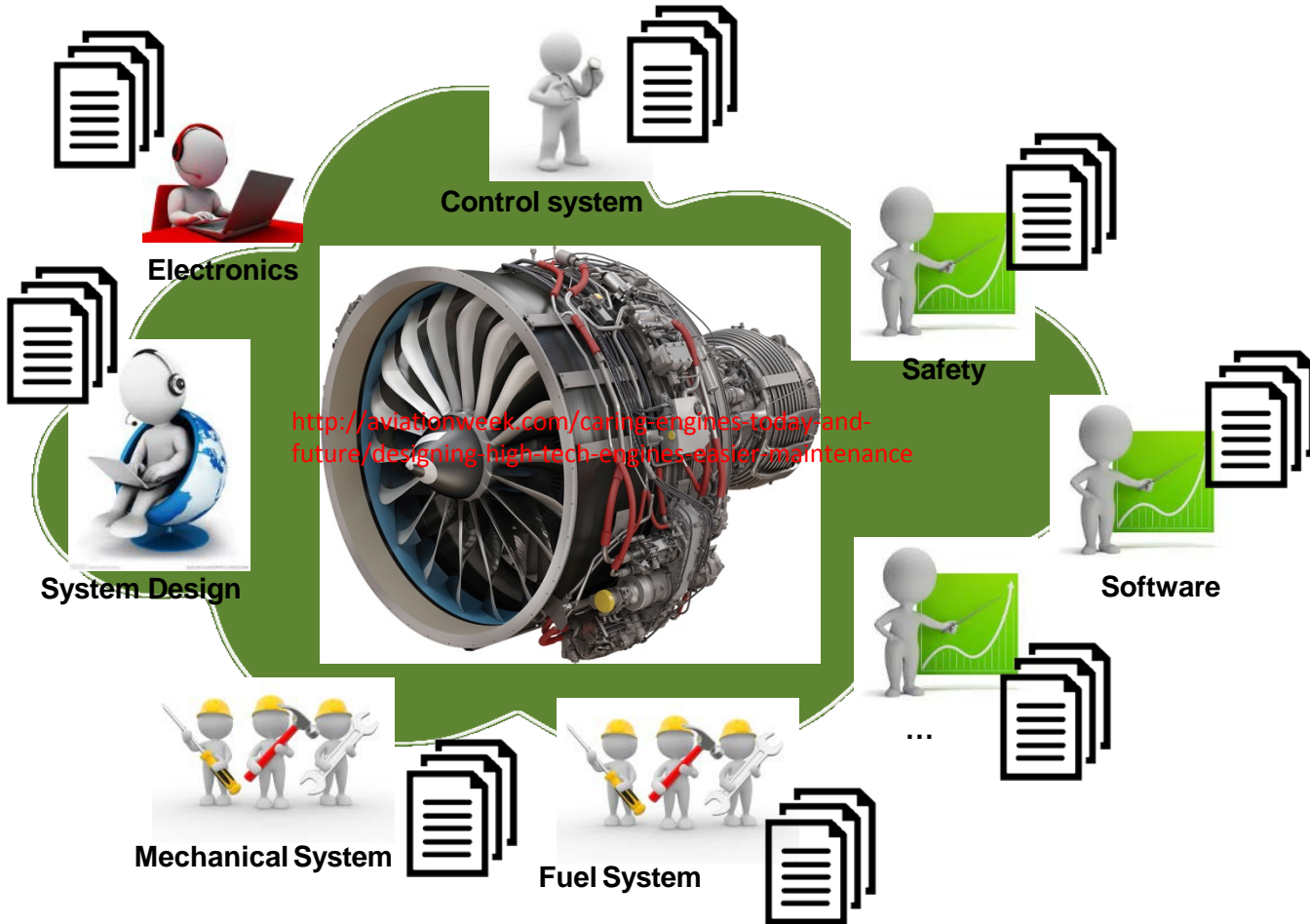
- No integration
- Partial integration
- Full integration



The solutions for integrated simulation platform



Motivation



No

How to deal with the co-simulation tool-chains?

Historical views of co-simulation

Co-simulation based on Matlab/Simulink, LMS Motion and AMESim

Hydraulic system

AMESim

Position

Control Signal

Force

Position

Control system

Matlab



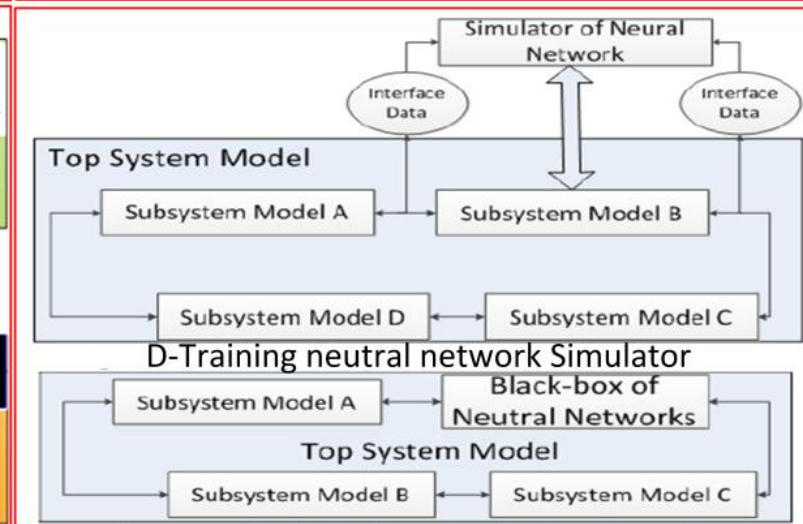
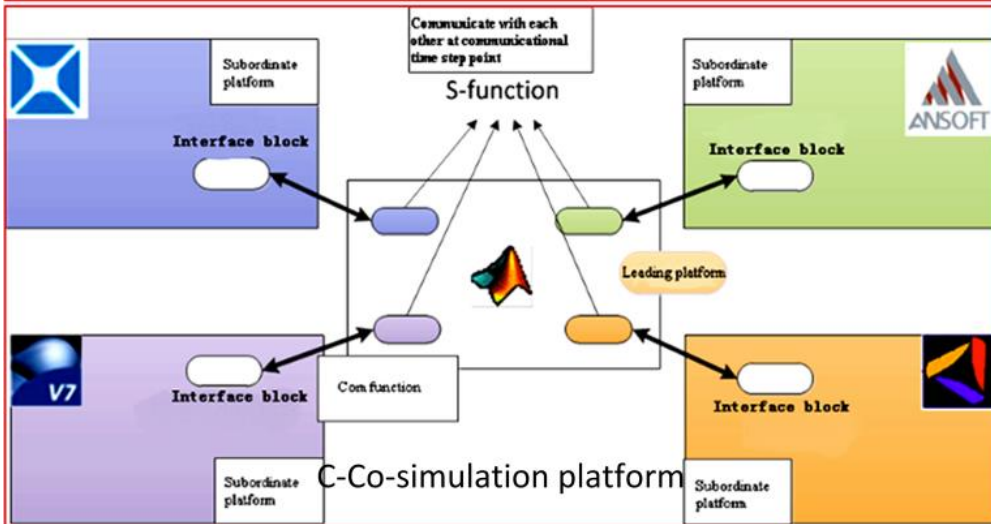
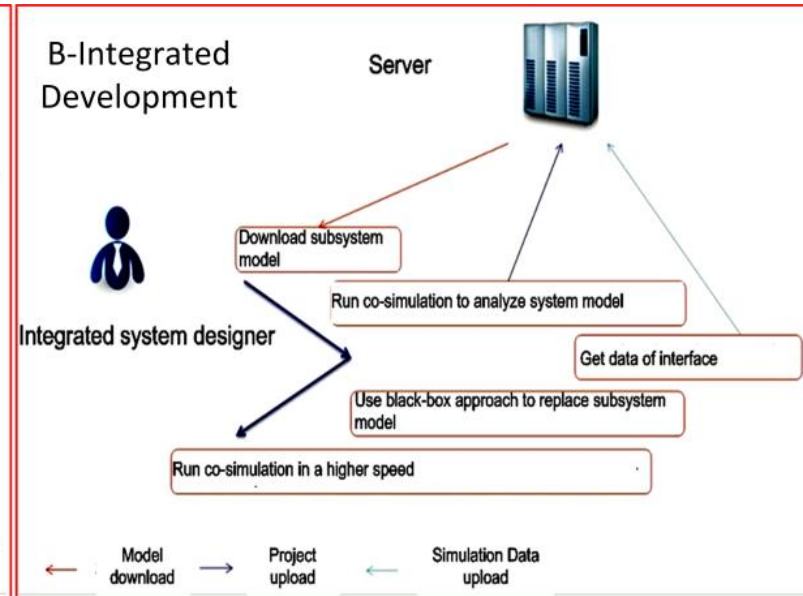
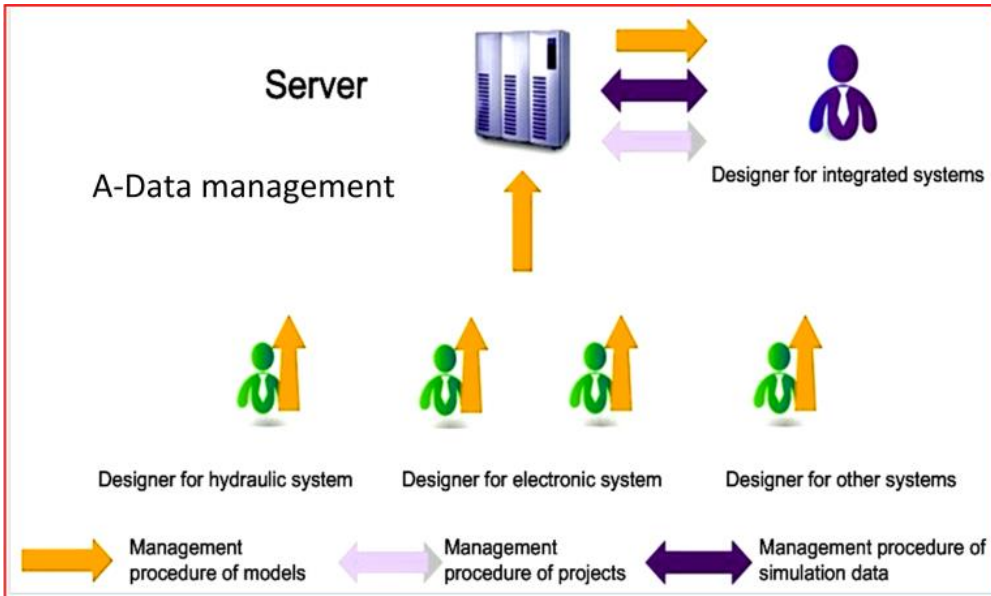
Multi-body system

Virtual.Lab Motion

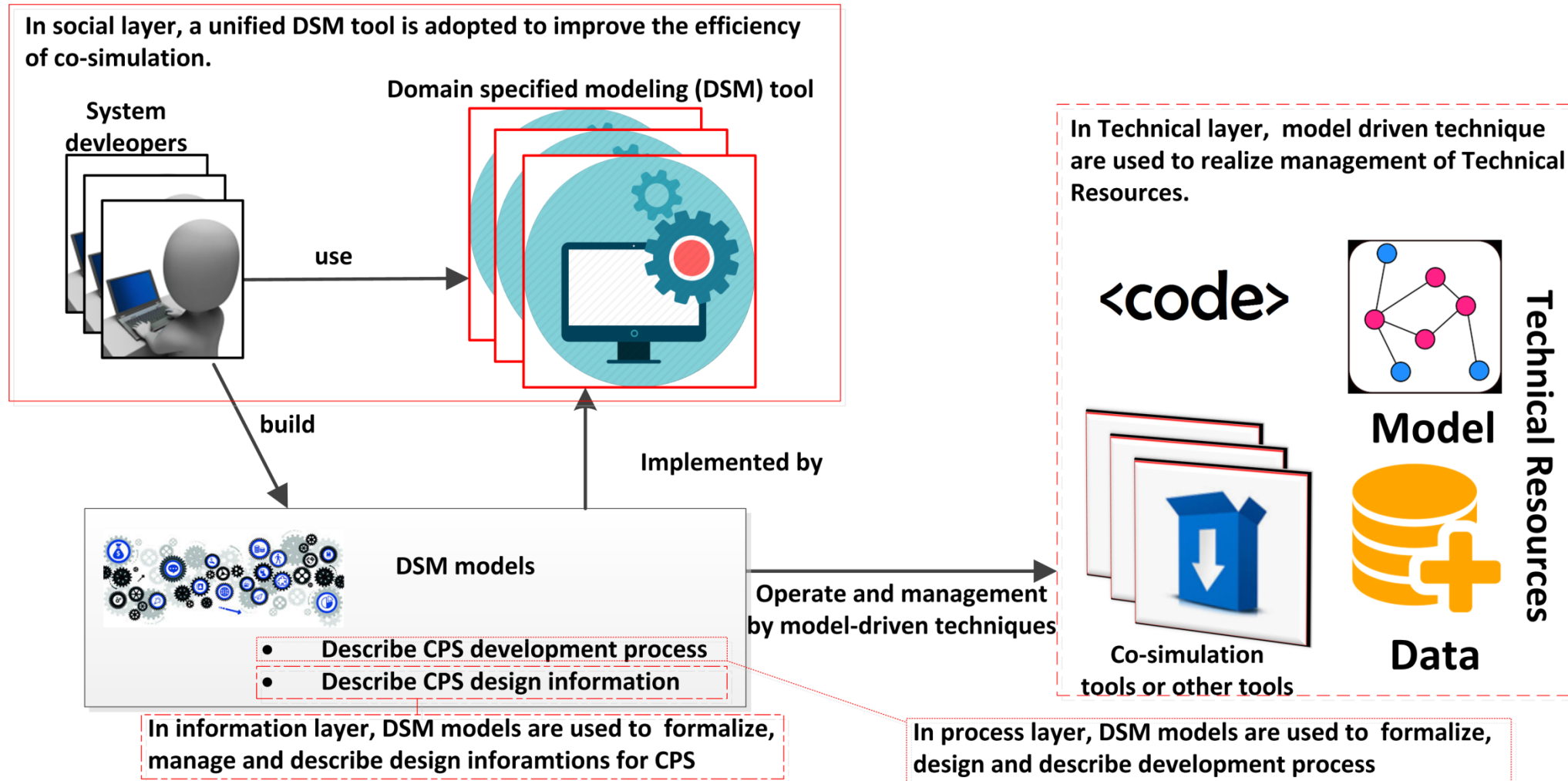


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Historical views of co-simulation

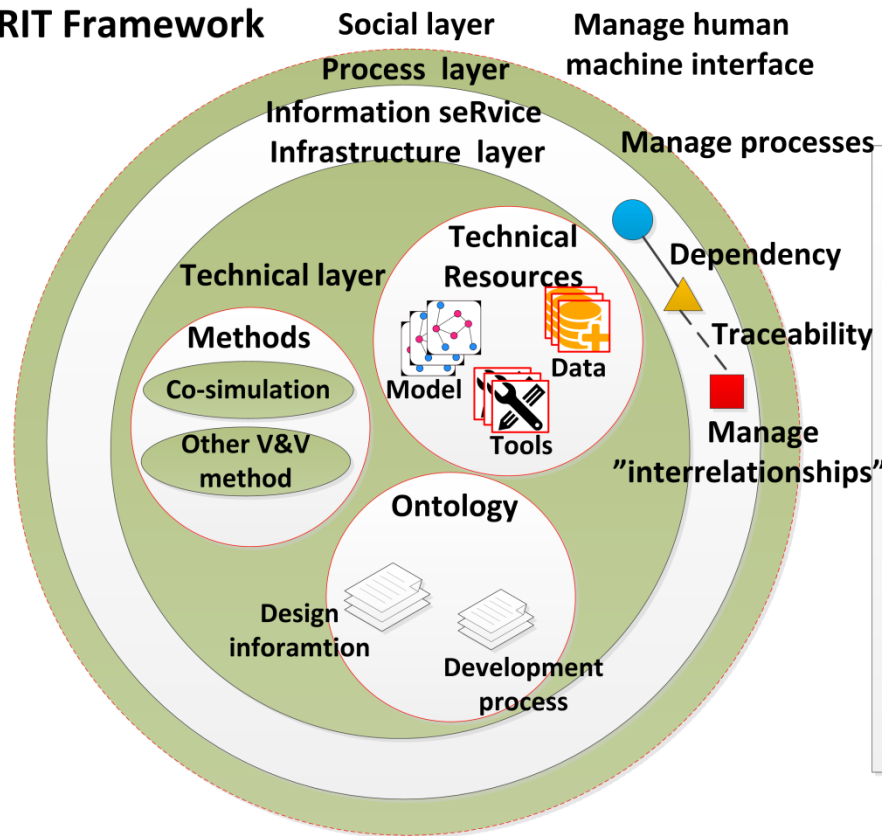


Historical views of co-simulation

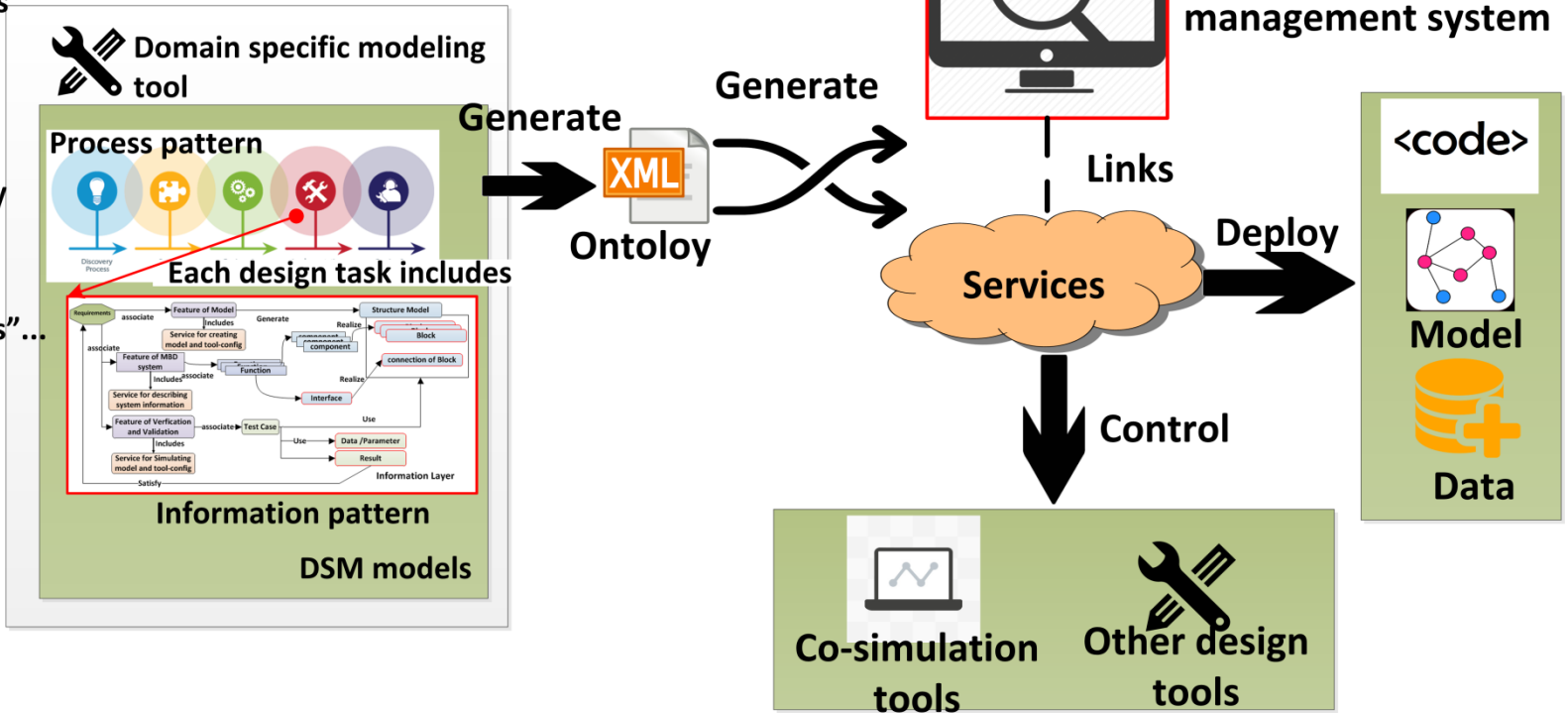


Historical views of co-simulation

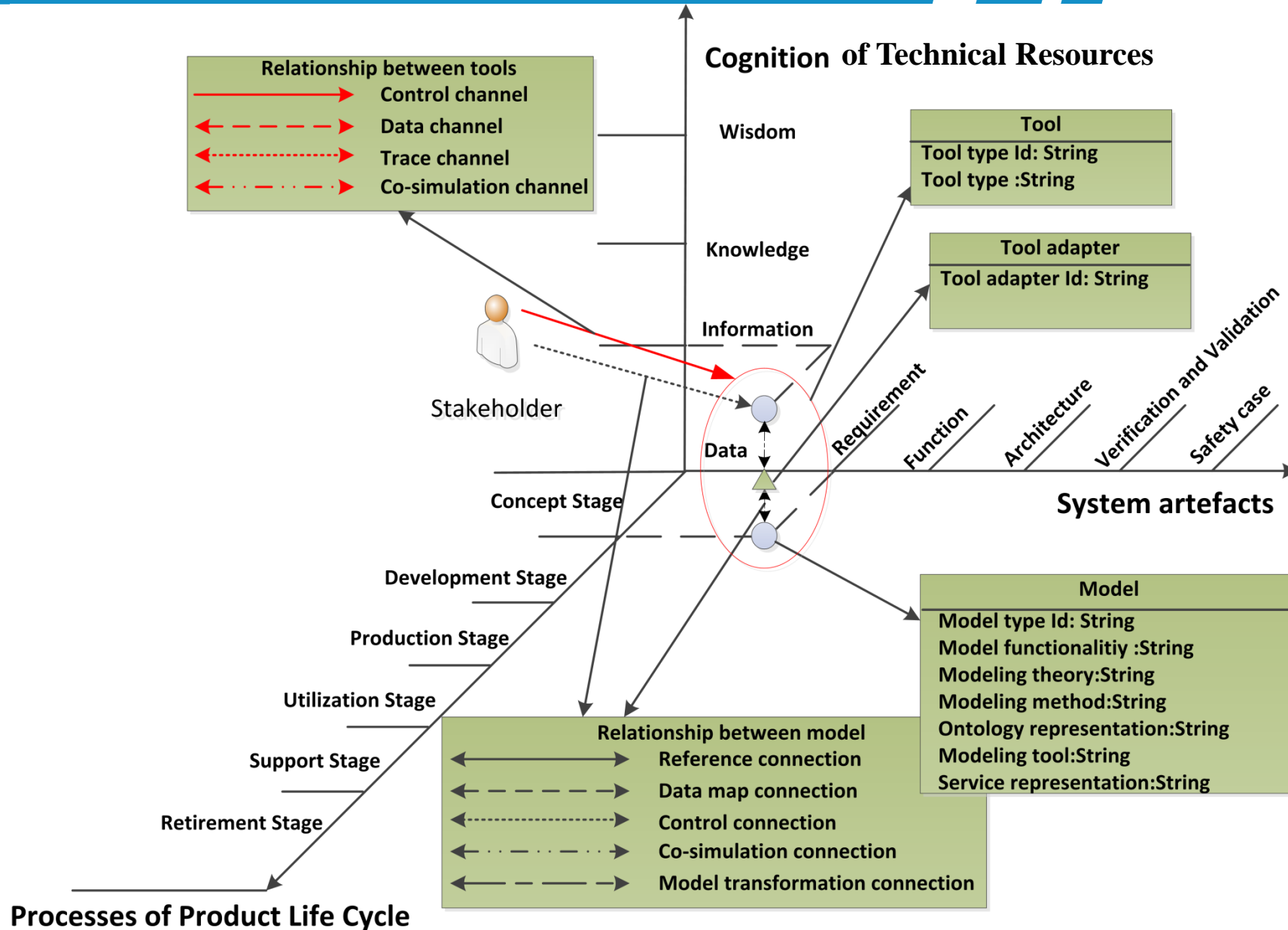
SPIRIT Framework



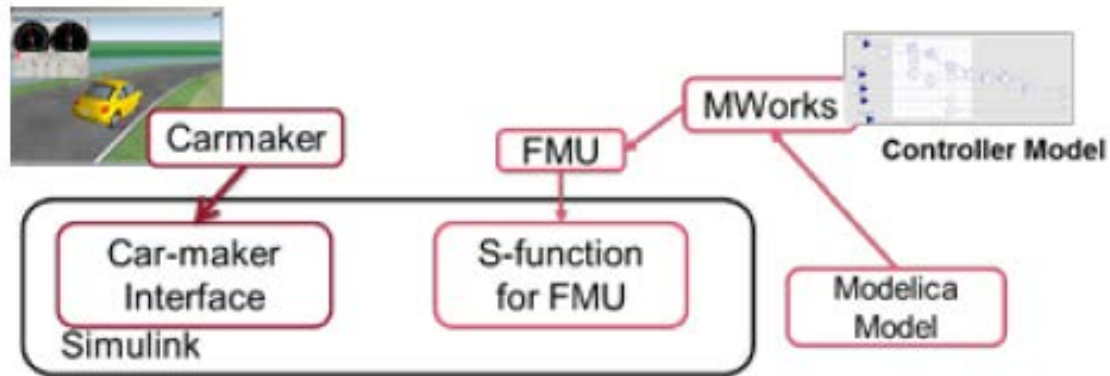
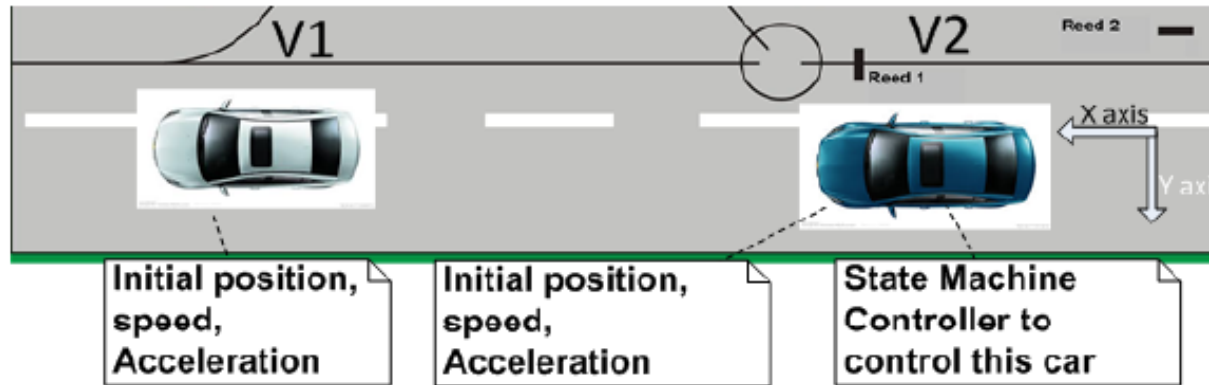
Workflow of tool-chain based on SPIRIT Framework



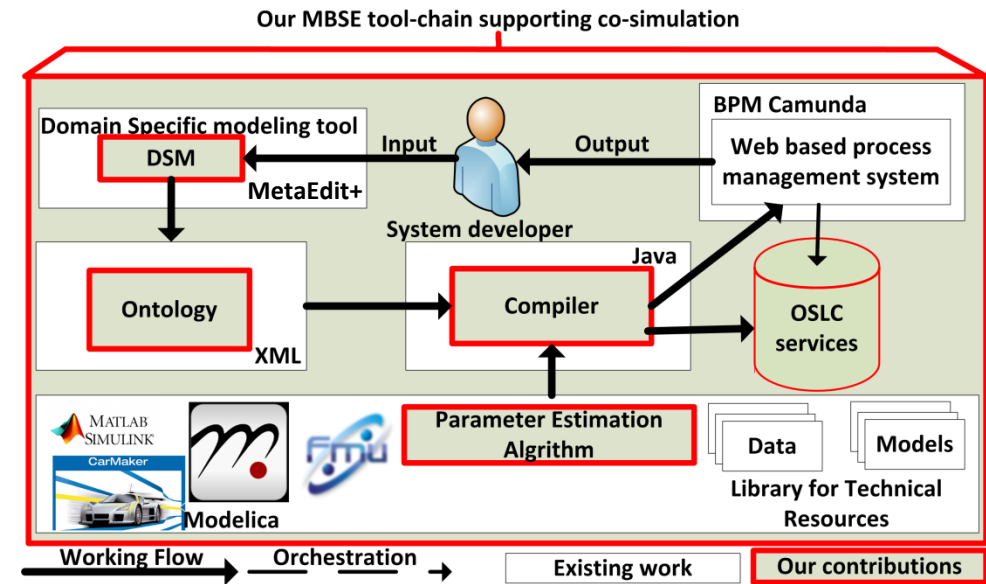
Formalisms of co-simulation tool-chains



Demos

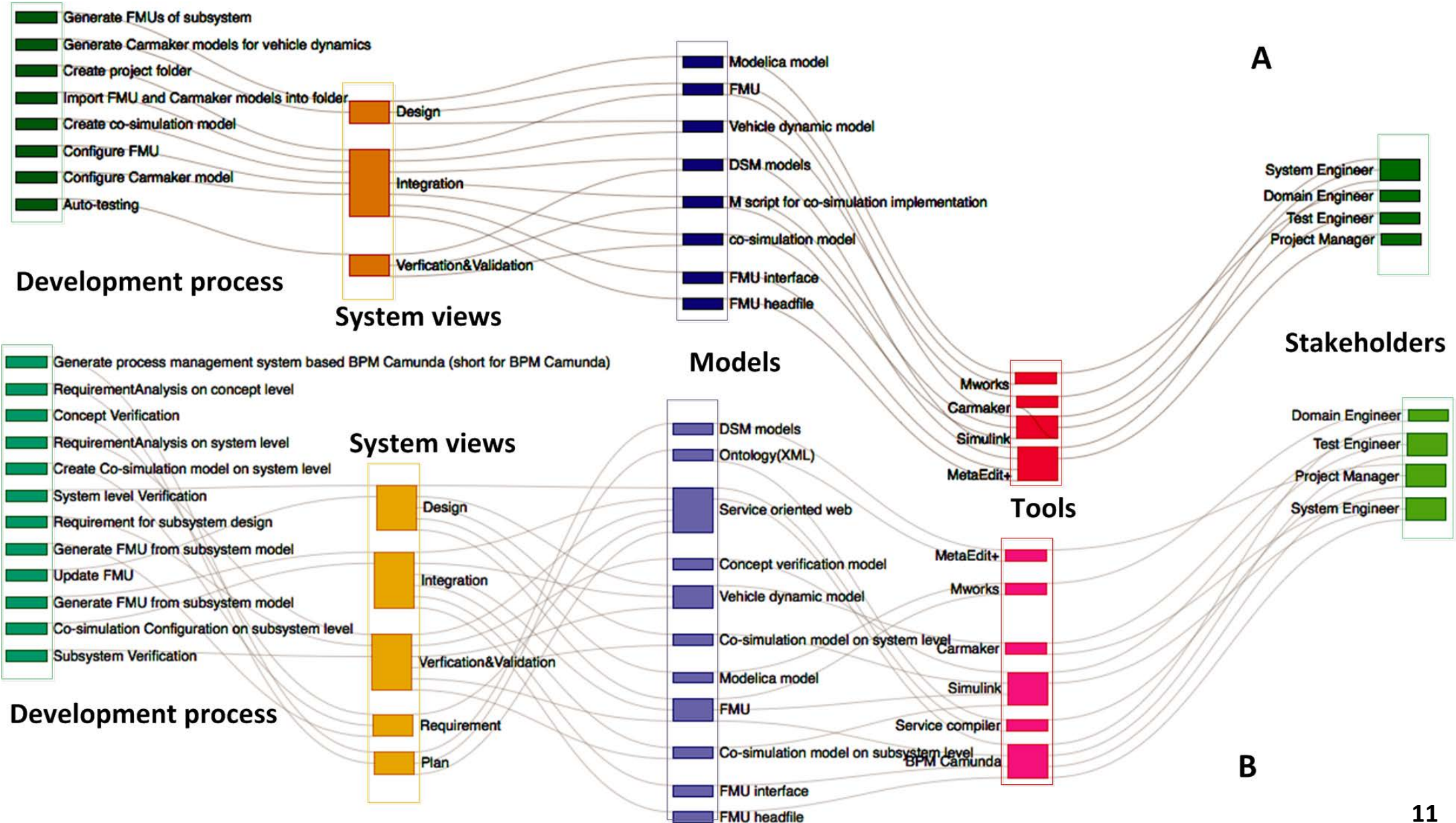


Case A

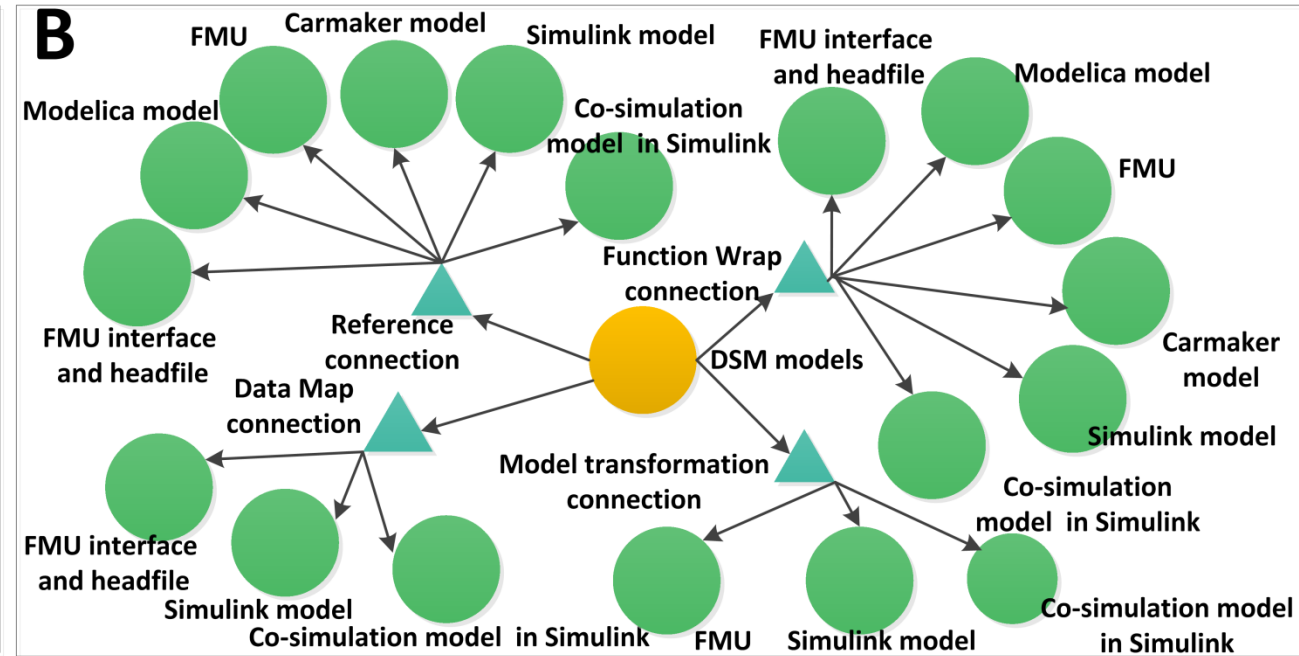
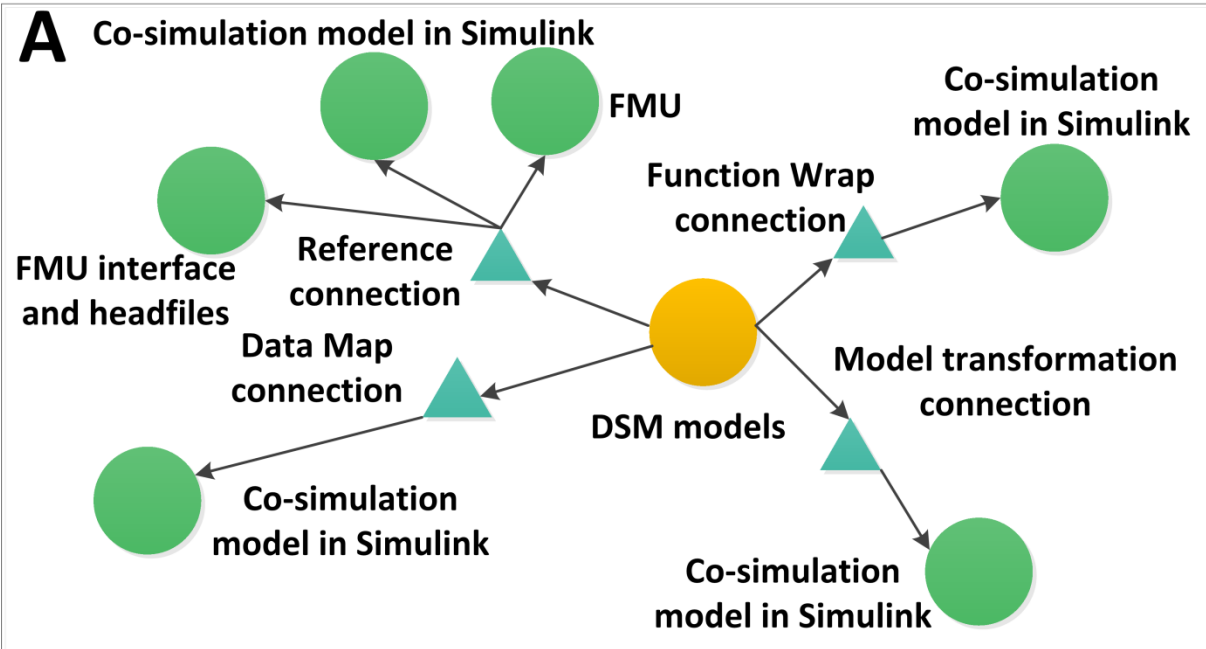


Case B

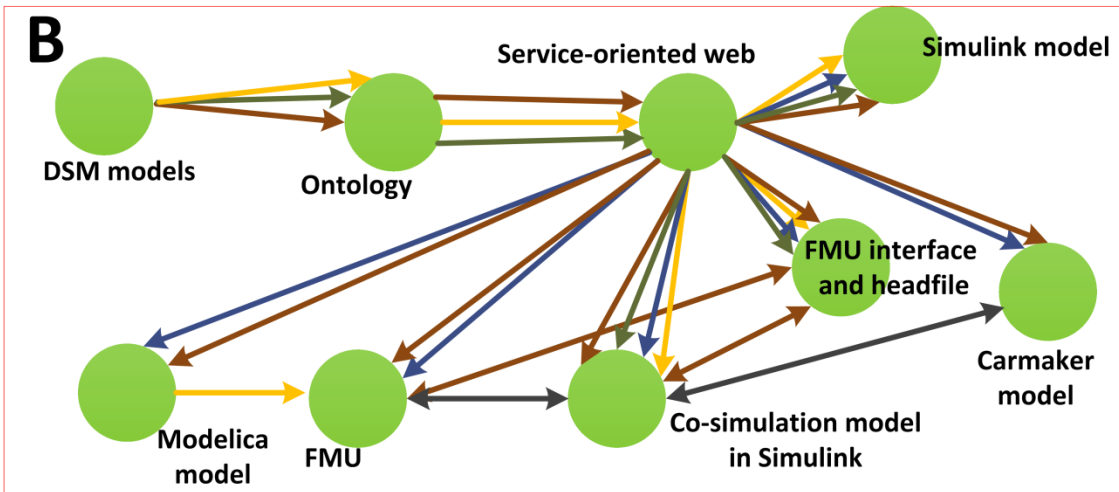
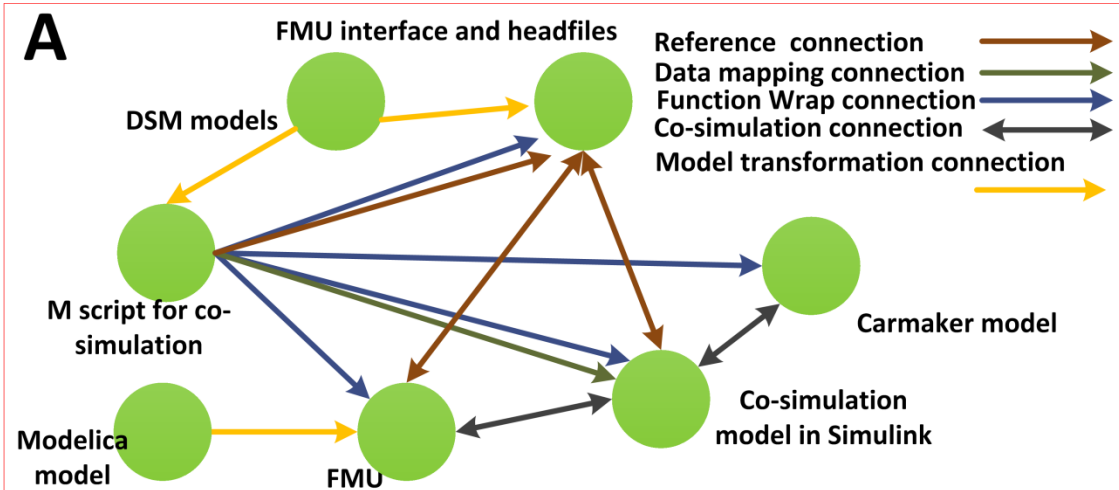
Complexities of tool-chains



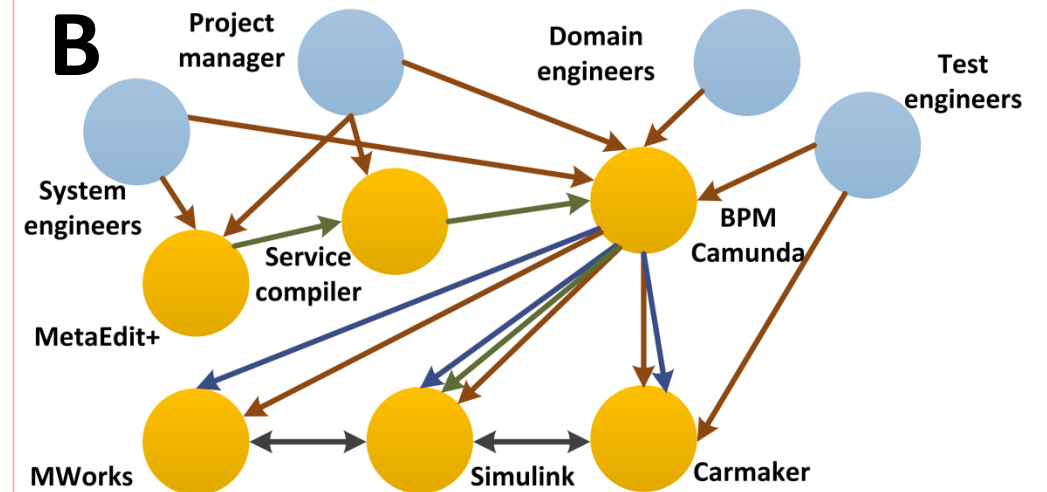
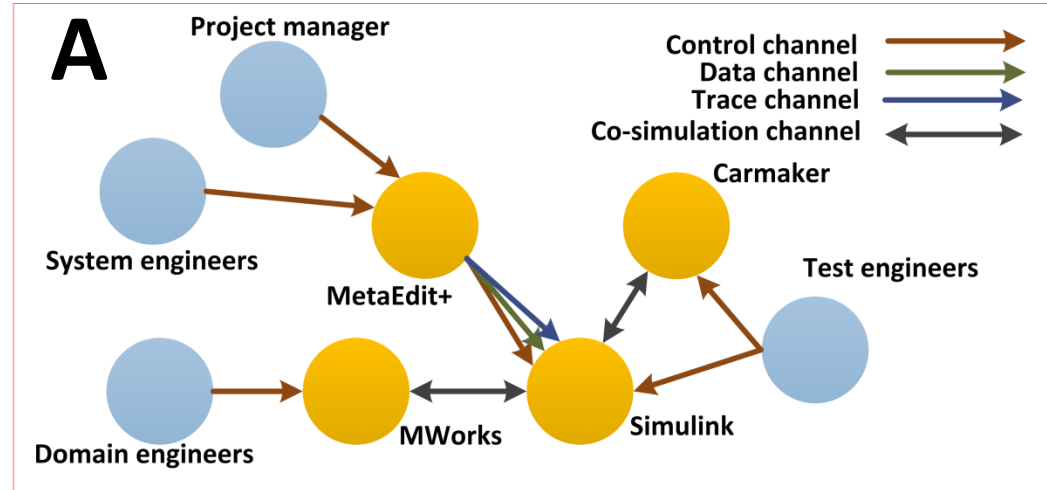
Automation of tool-chains



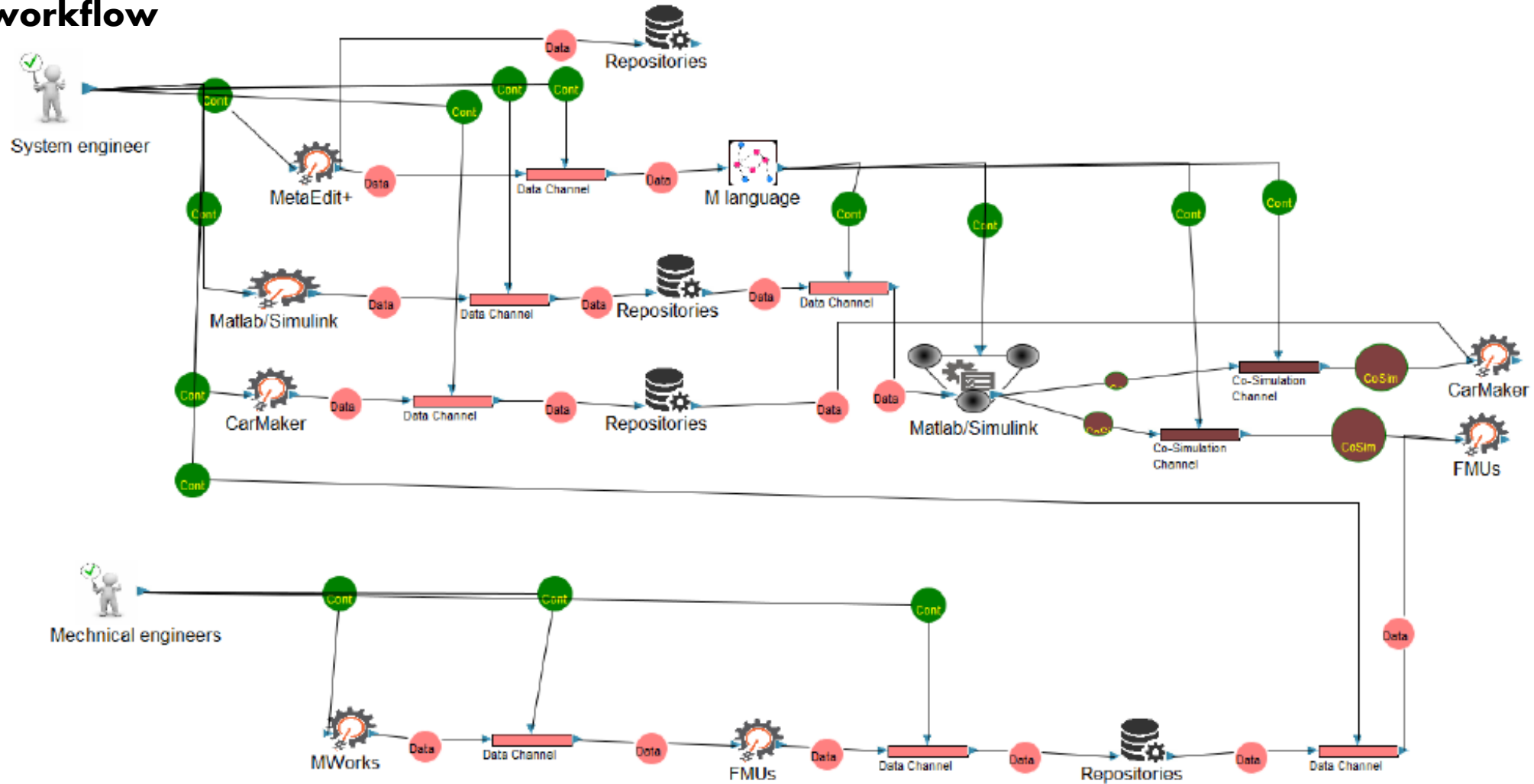
Workflow of tool-chains



Social networks of tool-chains



Domain specific model representing Tool-chains' structure and workflow



Rule to assess tools

