

Simulink as Your **Enterprise Simulation Platform**

MATLAB EXPO 2017



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Why simulation?



Hyperloop



Hyperloop is a revolutionary concept for a new type of rapid, low-energy transport system using magnetic levitation, which would be capable of transporting people and goods through extremely low-pressure tubes at speeds of up to Mach .98, or 750 mph/1,200 kmh.

Enterprise Simulation Platform

Enterprise: connects complete product development process



Research



Development

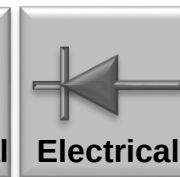
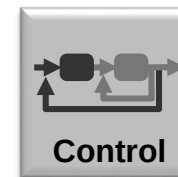


Production

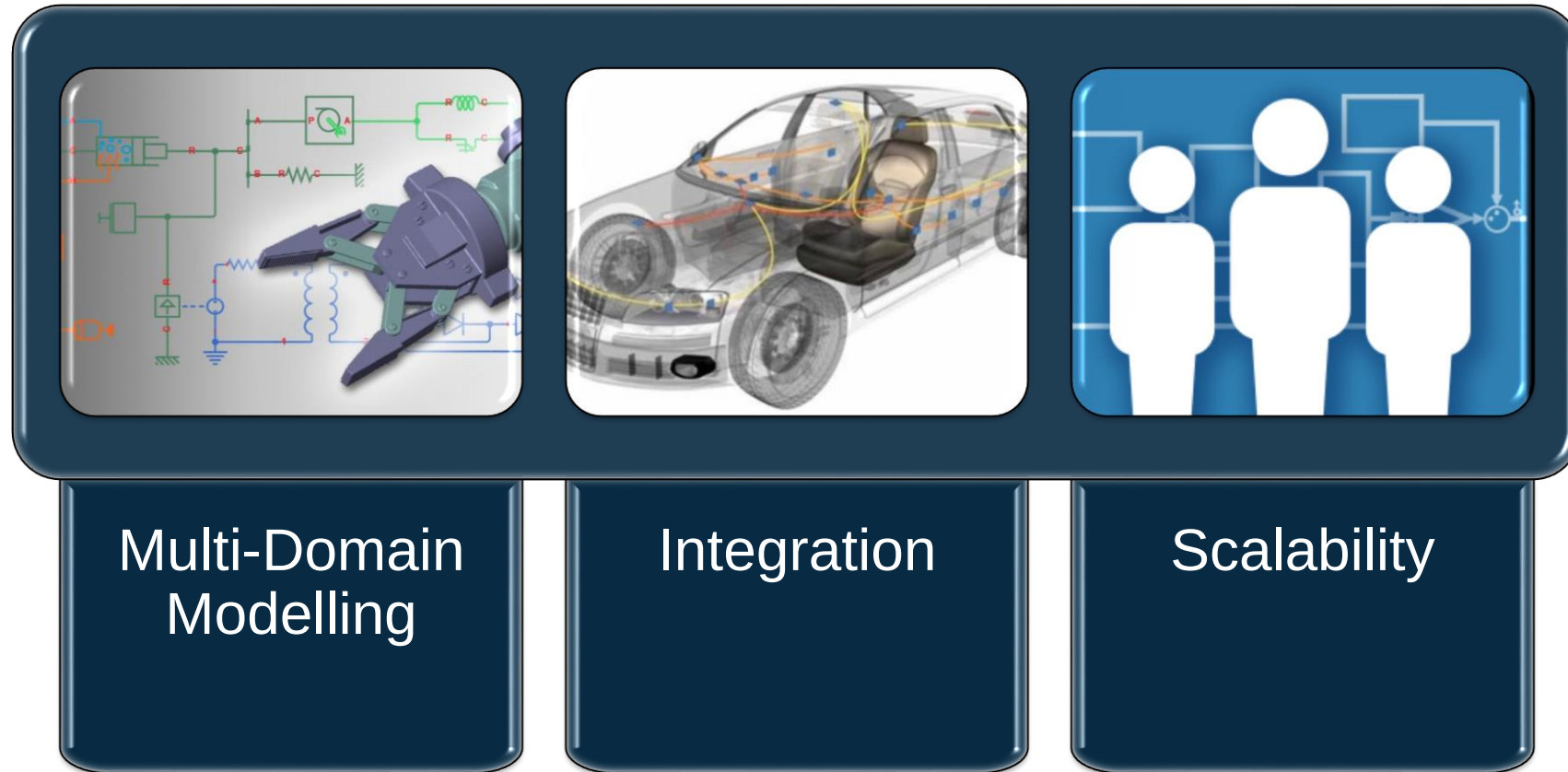
Simulation: evaluating system behavior through computation

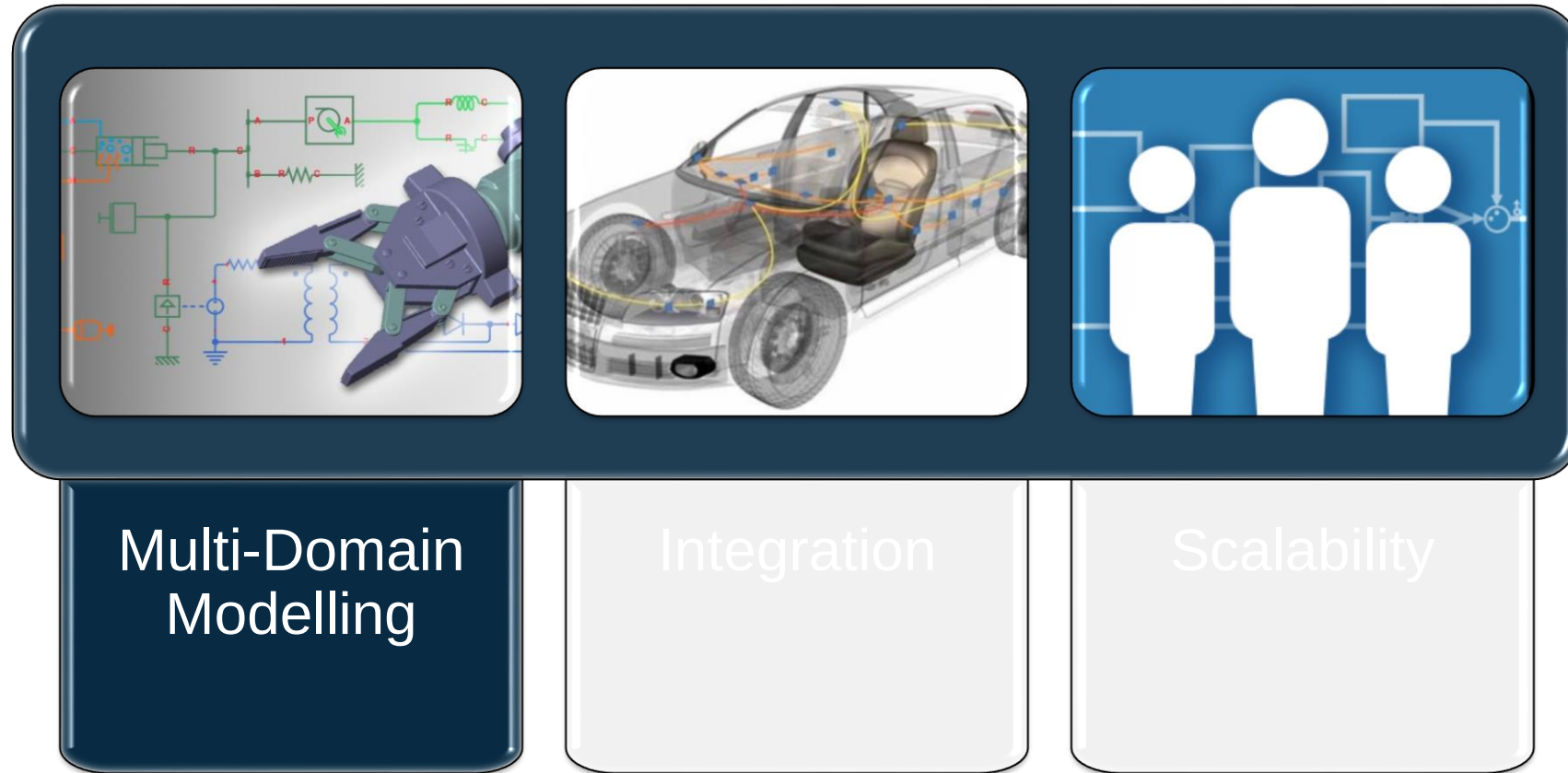


Platform: connects all relevant domains for modelling and simulation

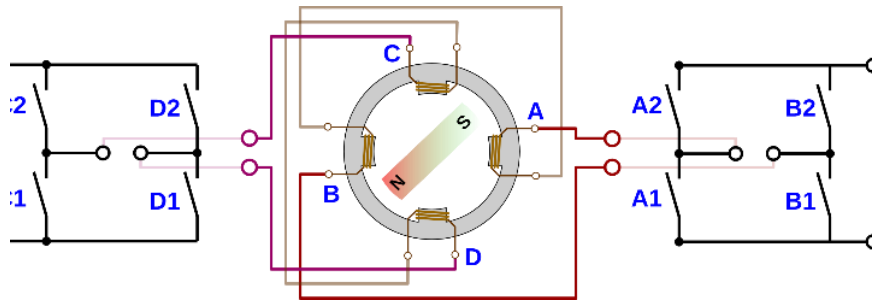


Enterprise Simulation Platform Enablers





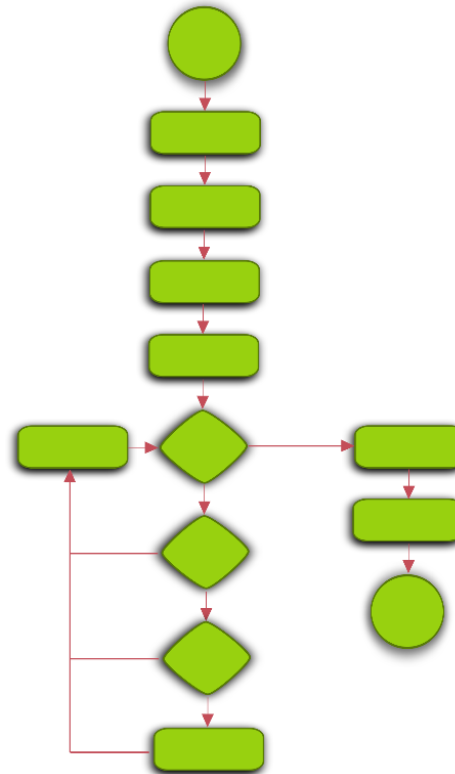
Multi-Domain Modelling in Simulink



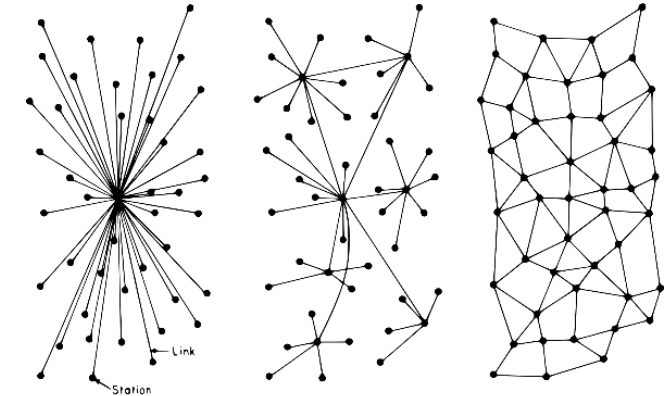
Dynamic Systems



Physical Modelling



State Machines

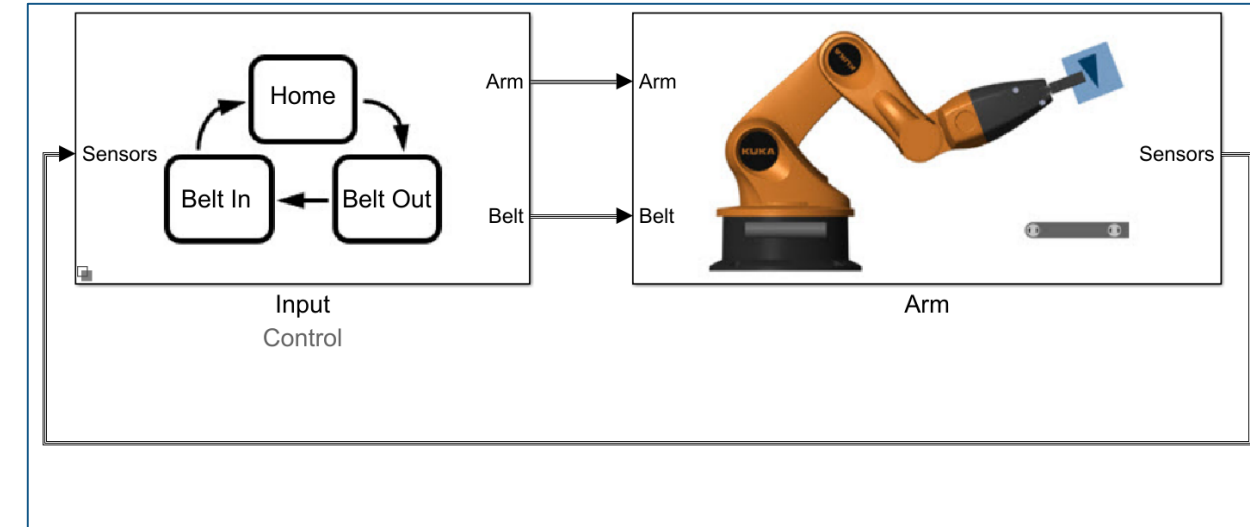
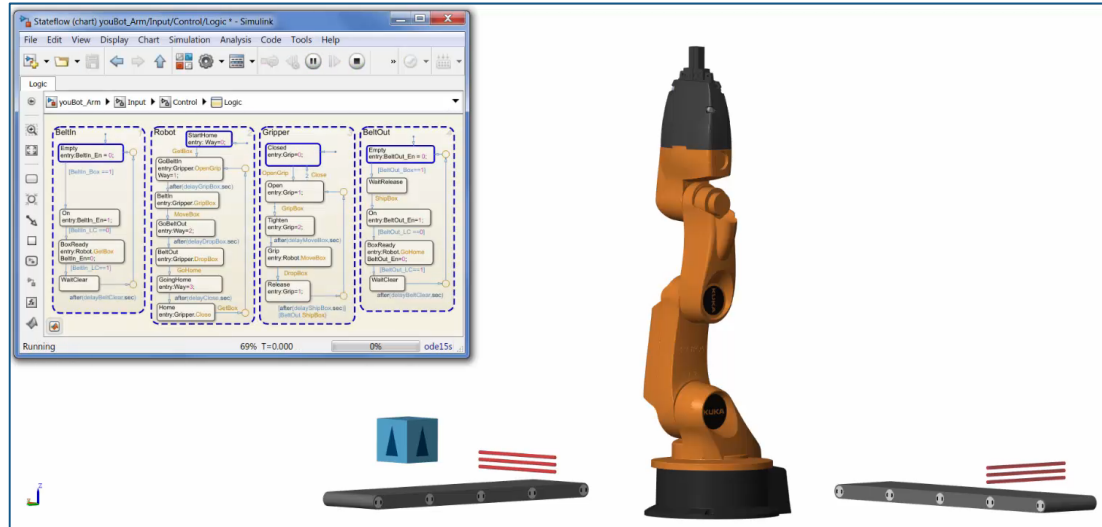


Discrete-Event Systems

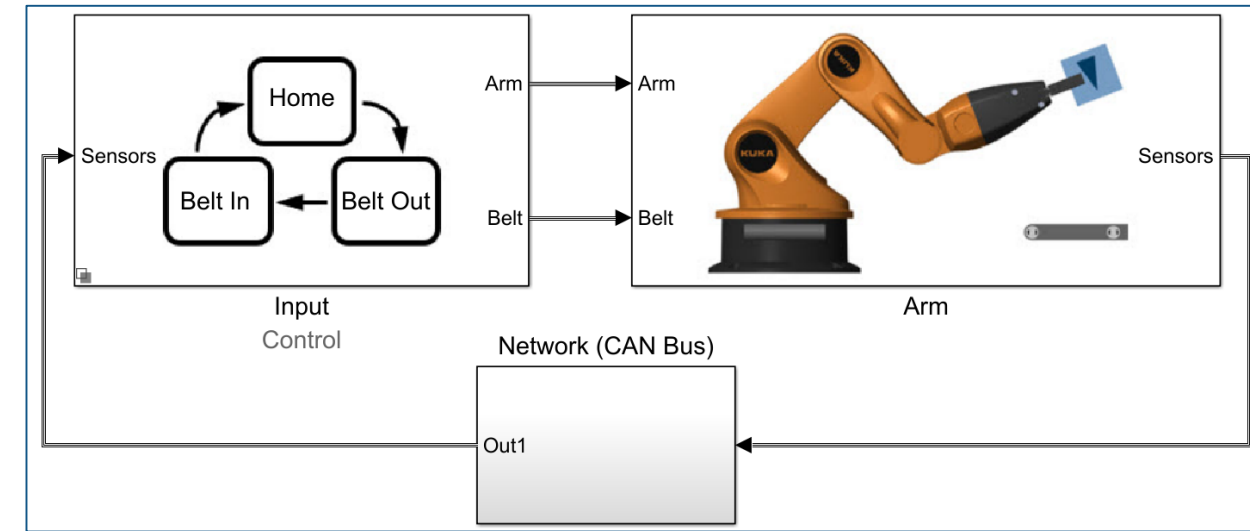
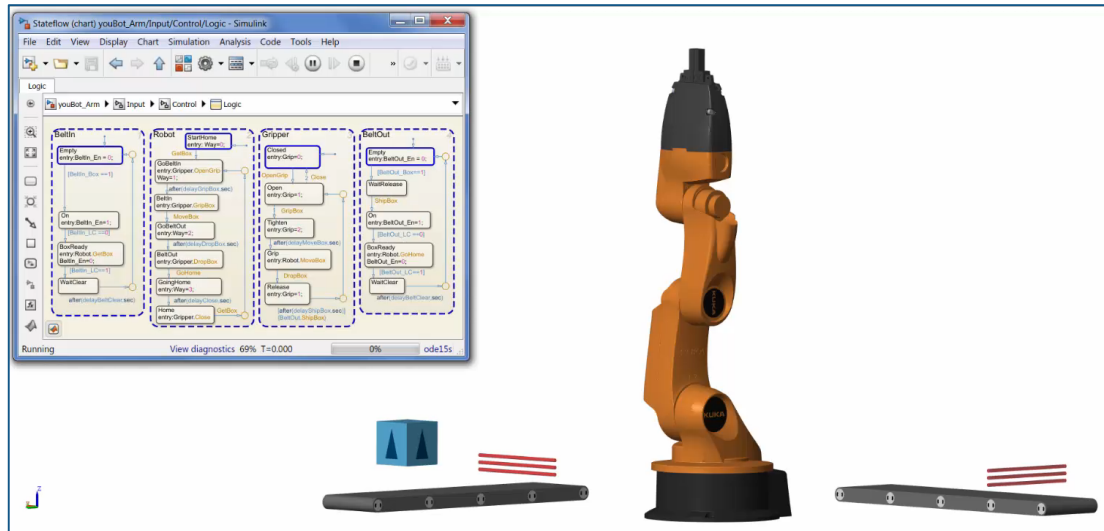


Function and Object-Oriented

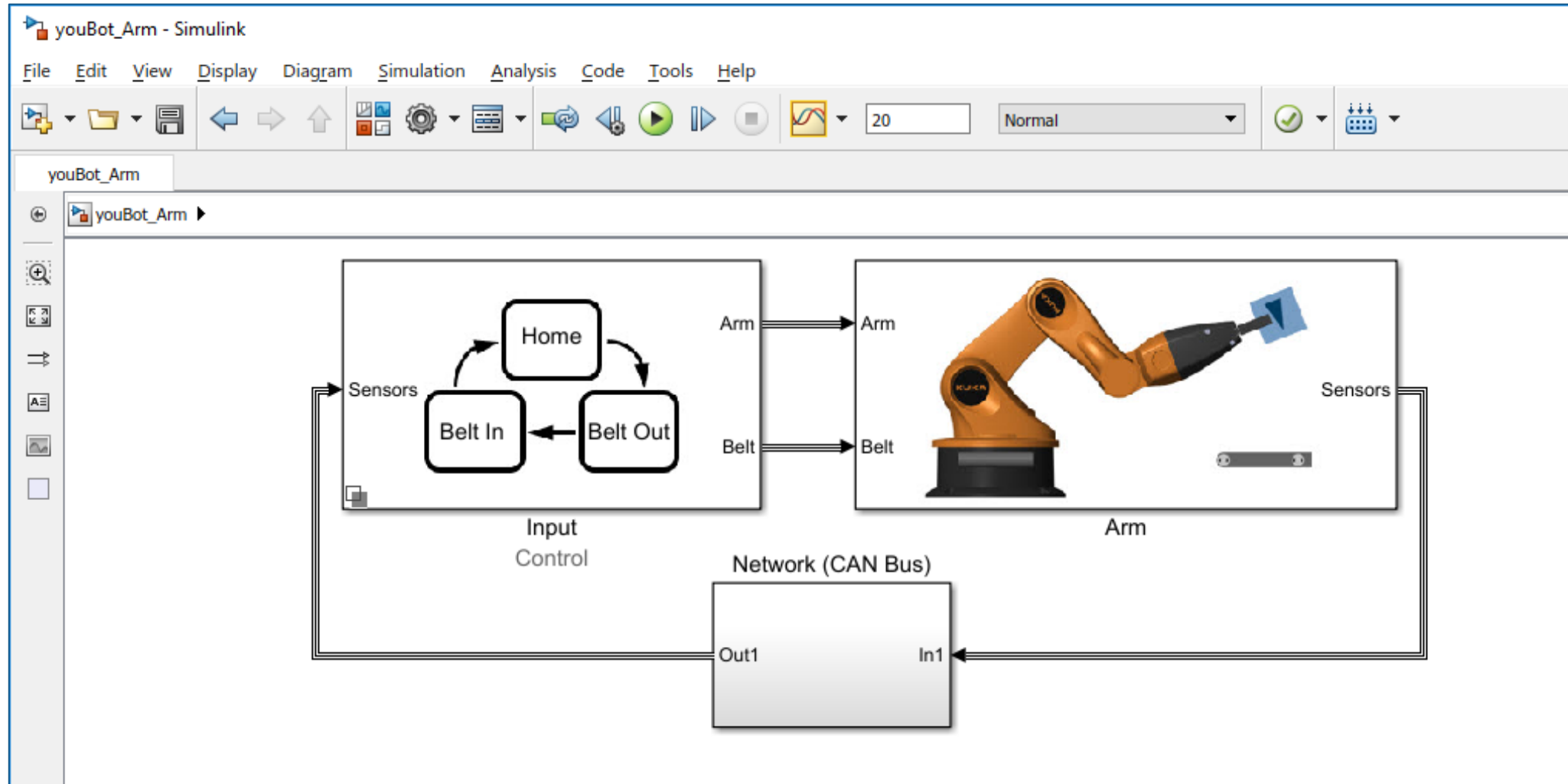
Need for Multi-Domain Simulation



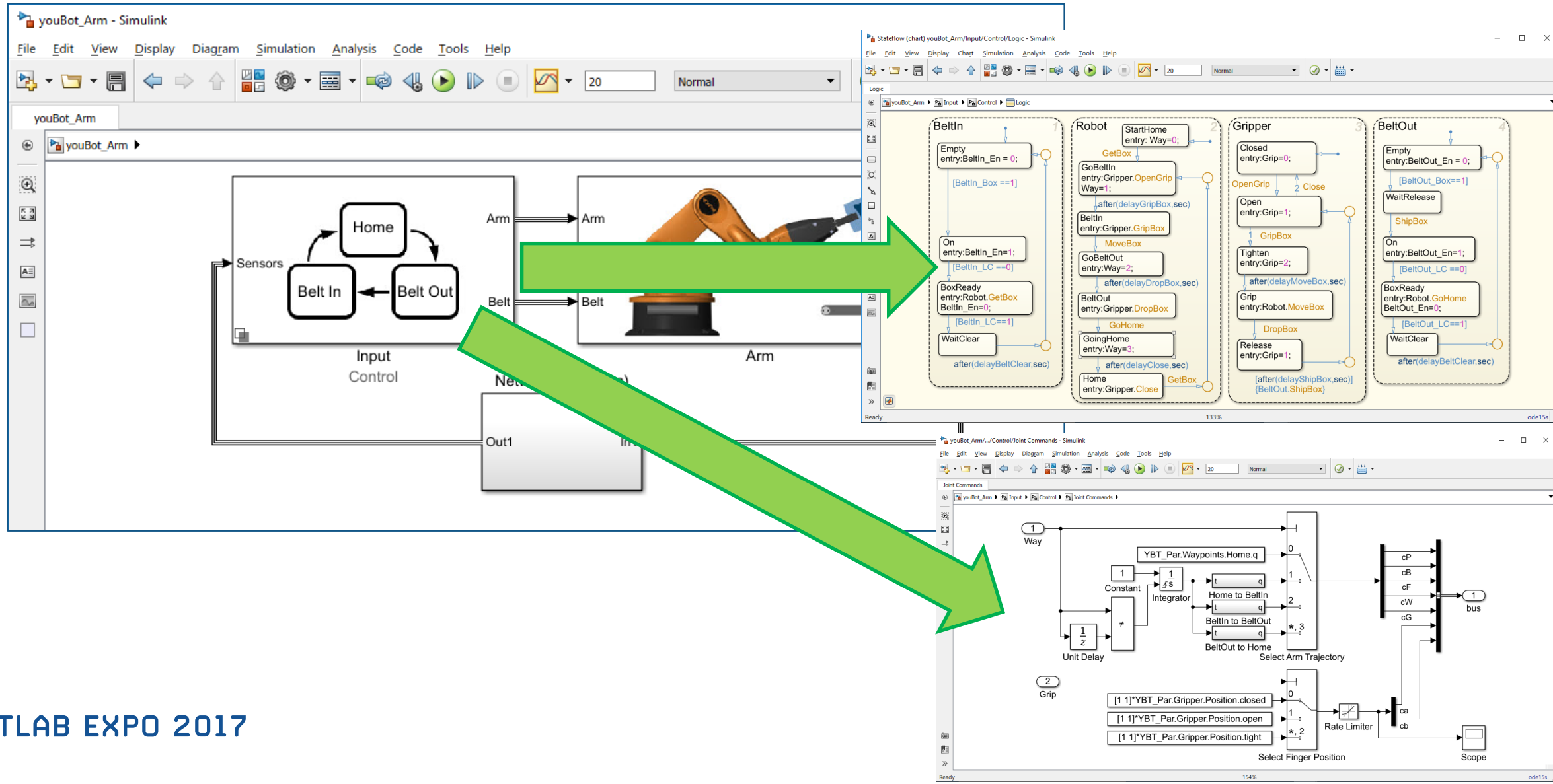
Need for More Multi-Domain Simulation



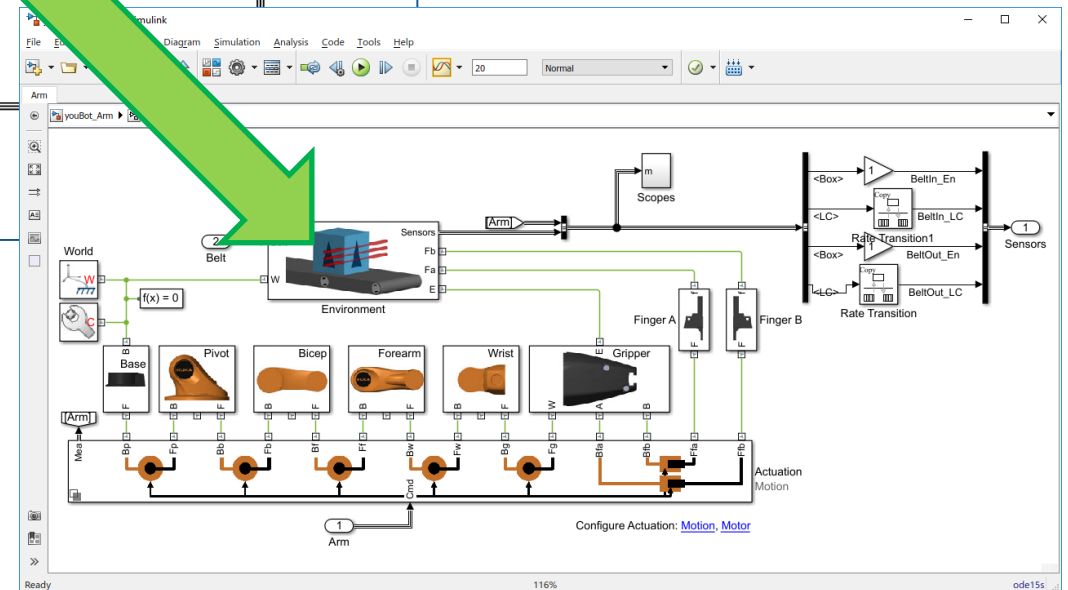
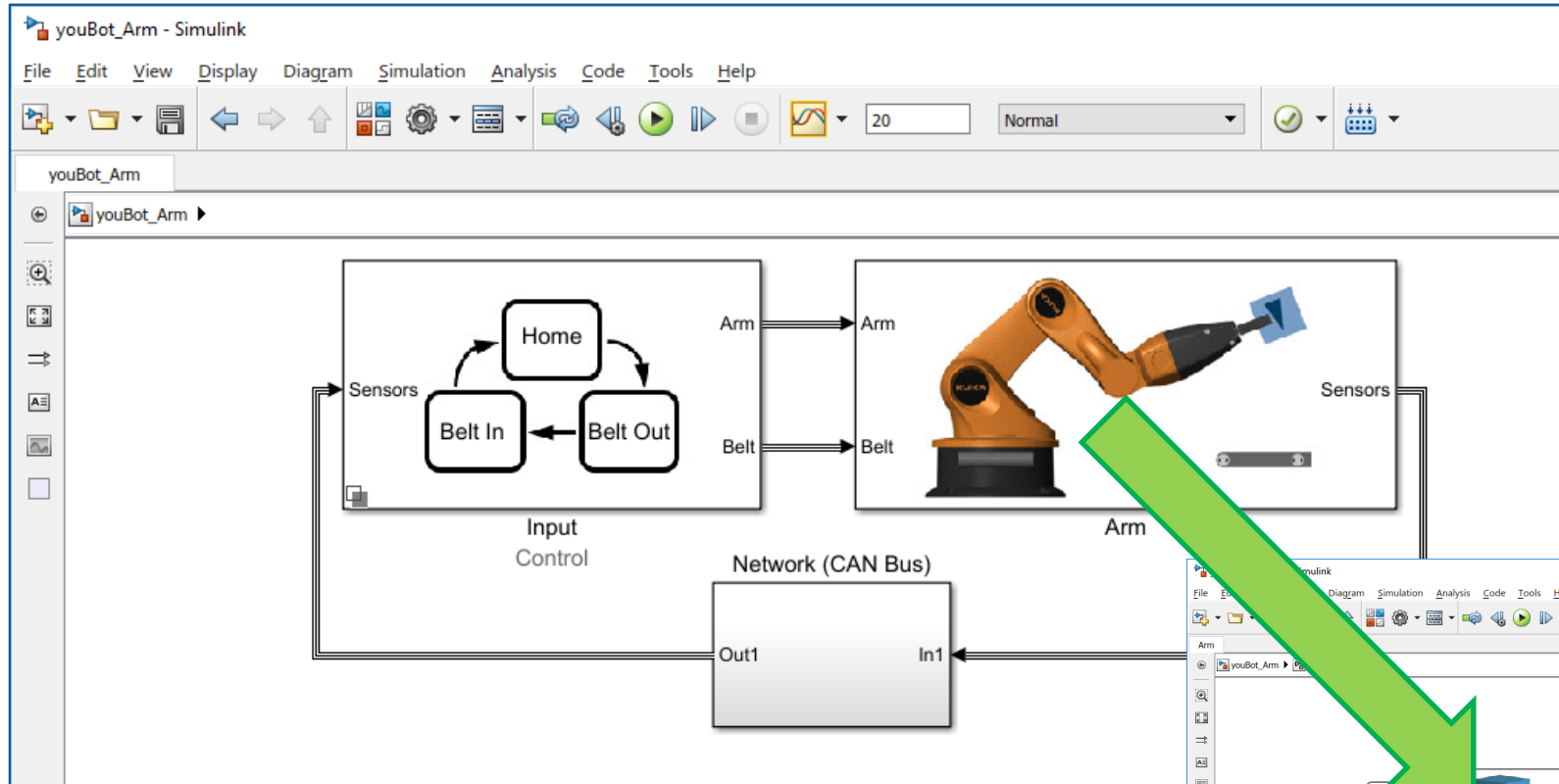
Multi-Domain Model



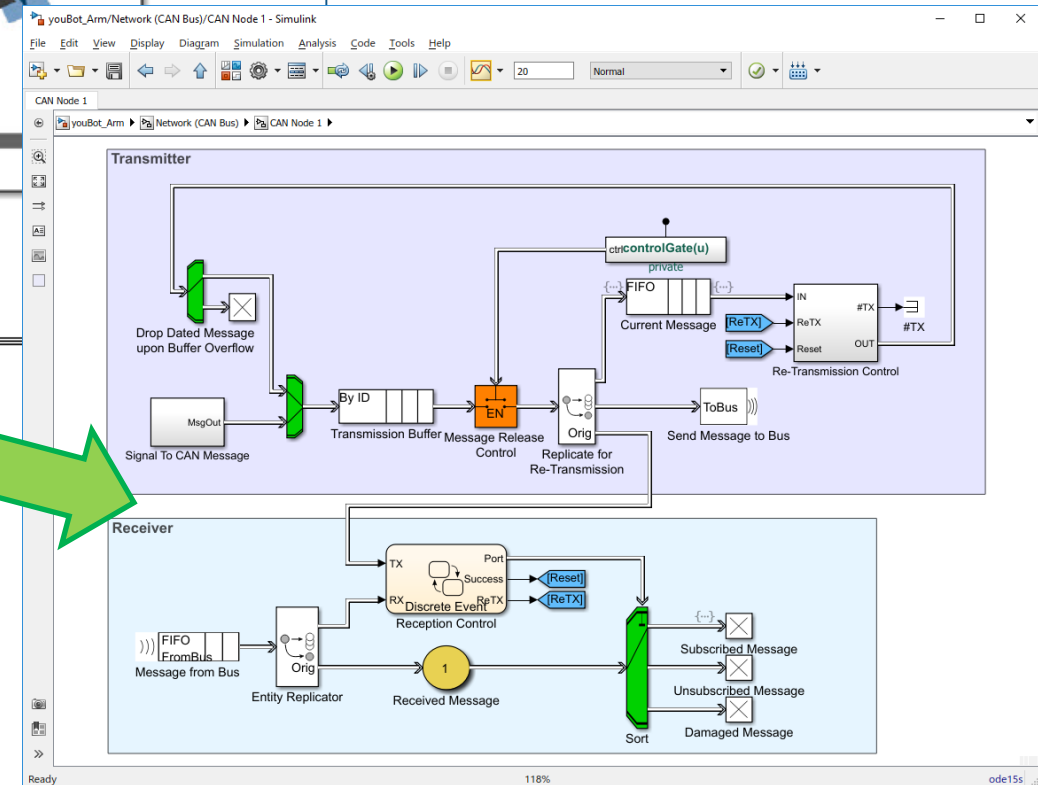
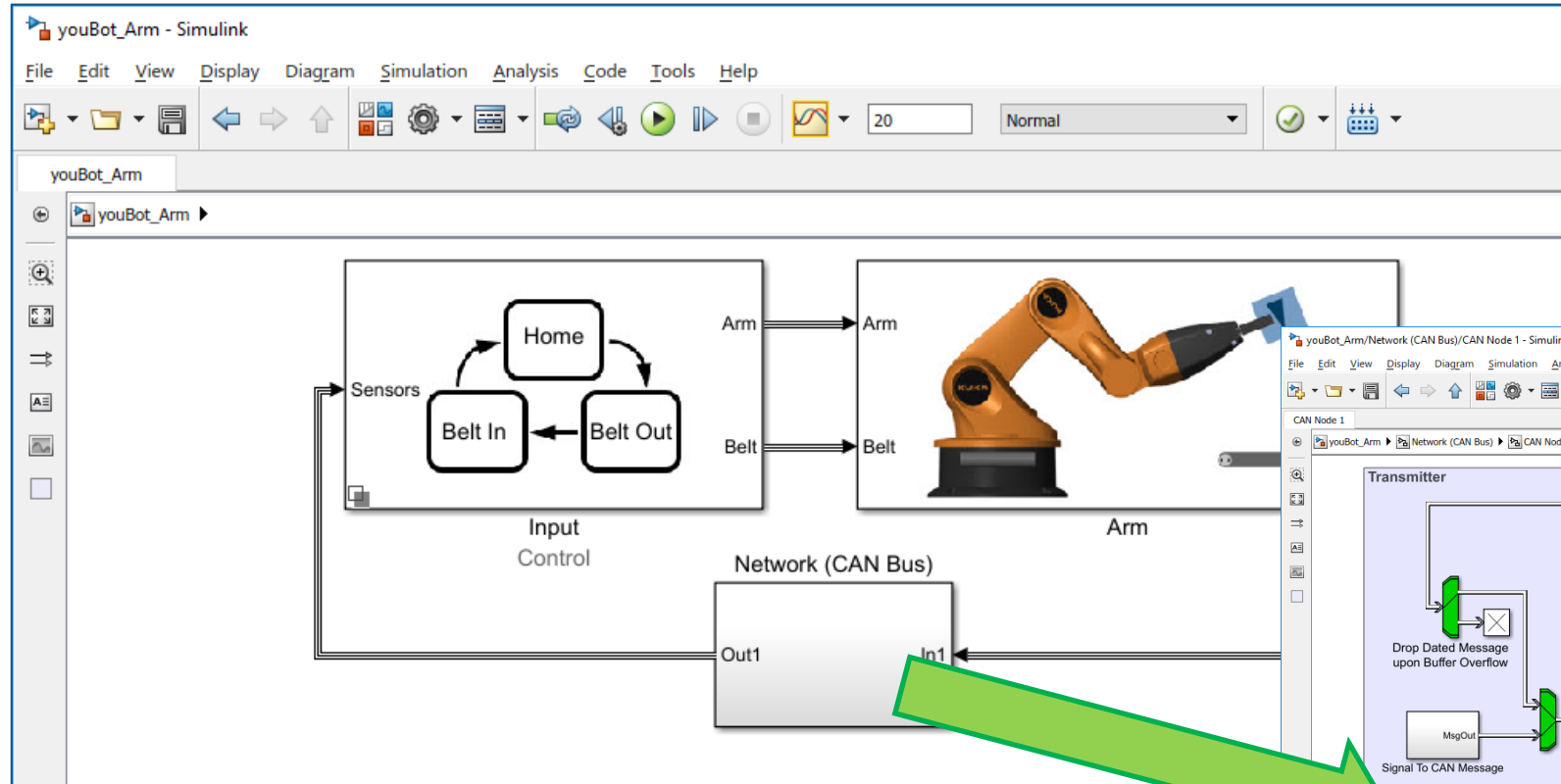
State Charts and System Dynamics



Physical Modeling

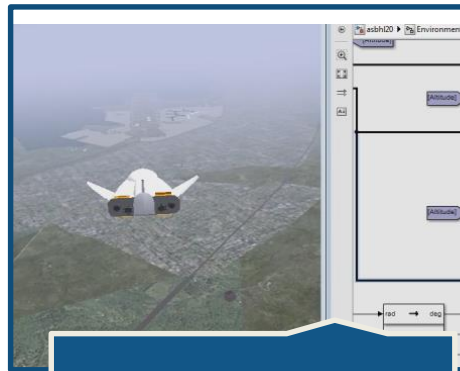


Discrete-Event Modeling

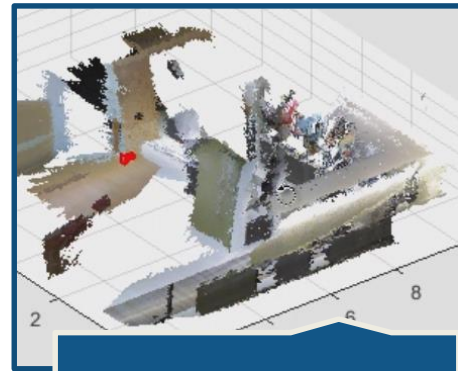


Domain-Specific Extensions

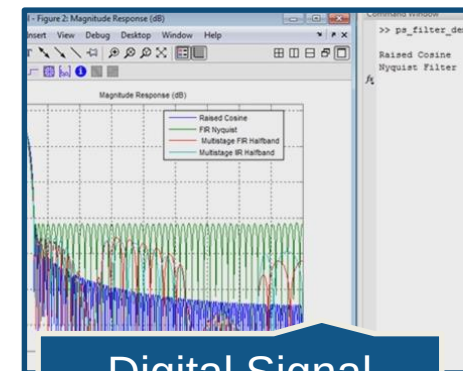
Simulink has numerous domain-specific capabilities, for example:



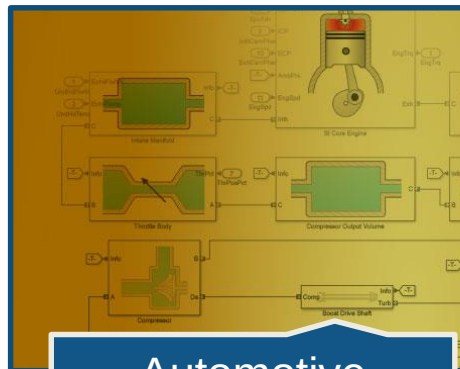
Aerospace



Computer Vision



Digital Signal Processing



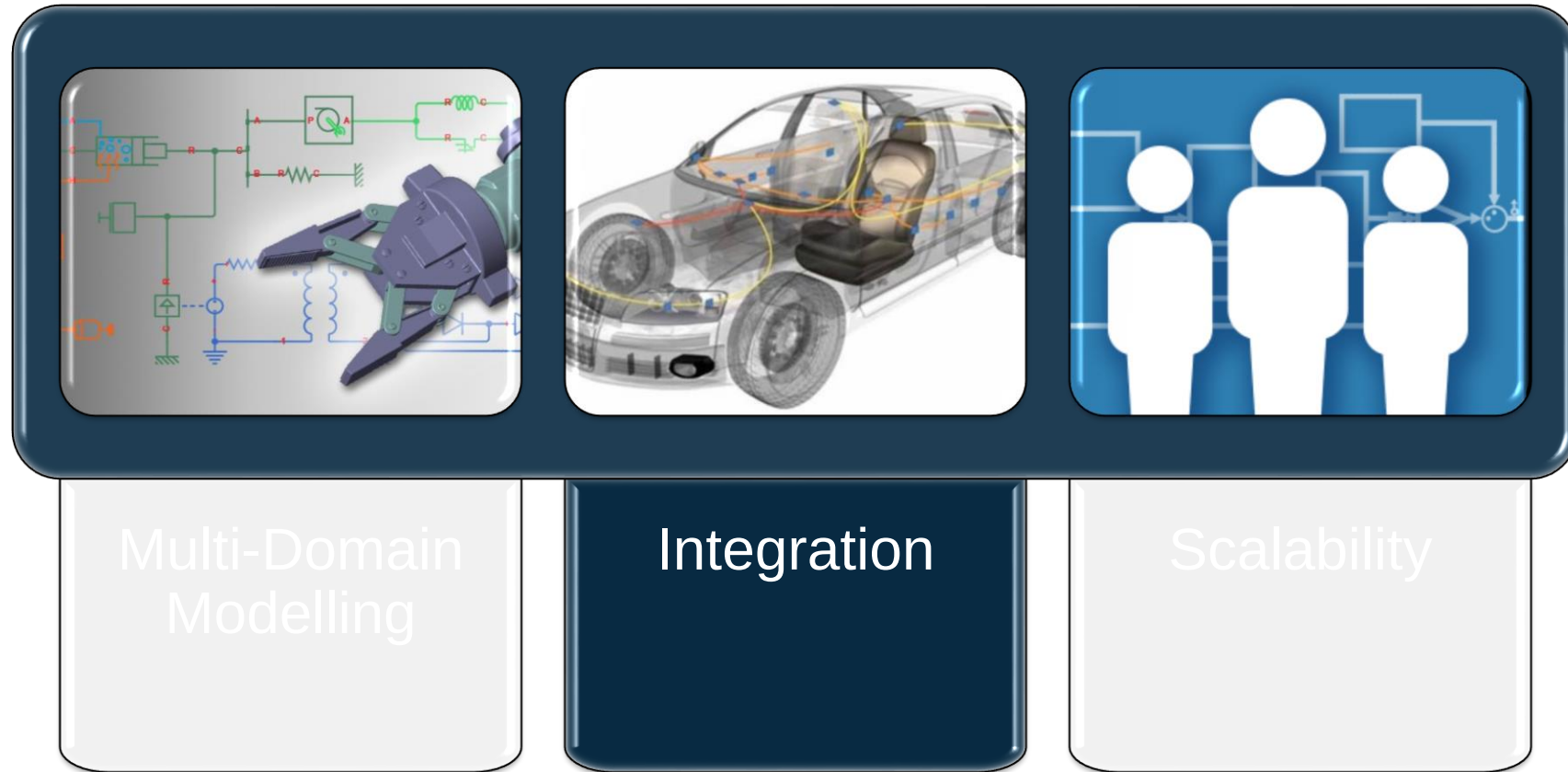
Automotive Powertrains

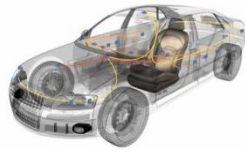


Robotic Applications



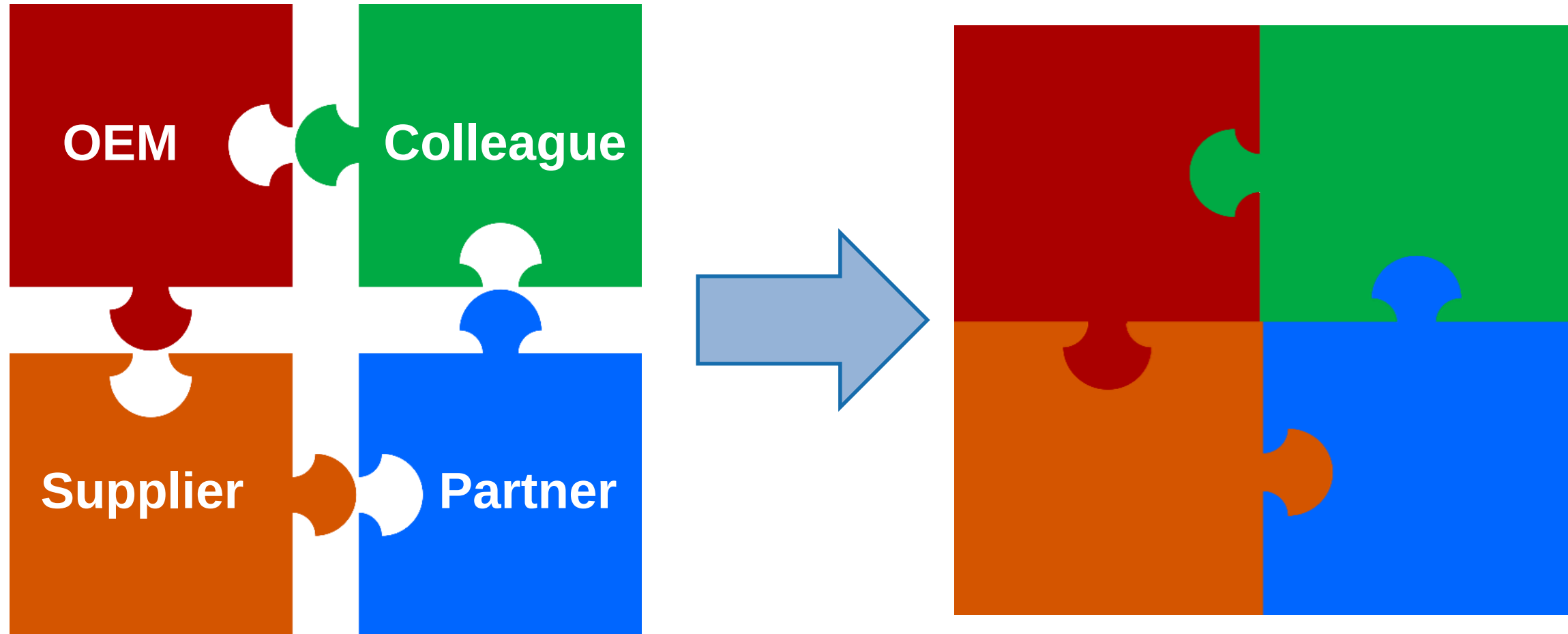
+More

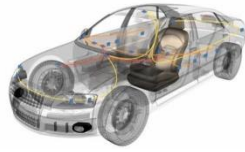




Integration Challenges

Your IP exists in many forms and in many locations, making integration difficult



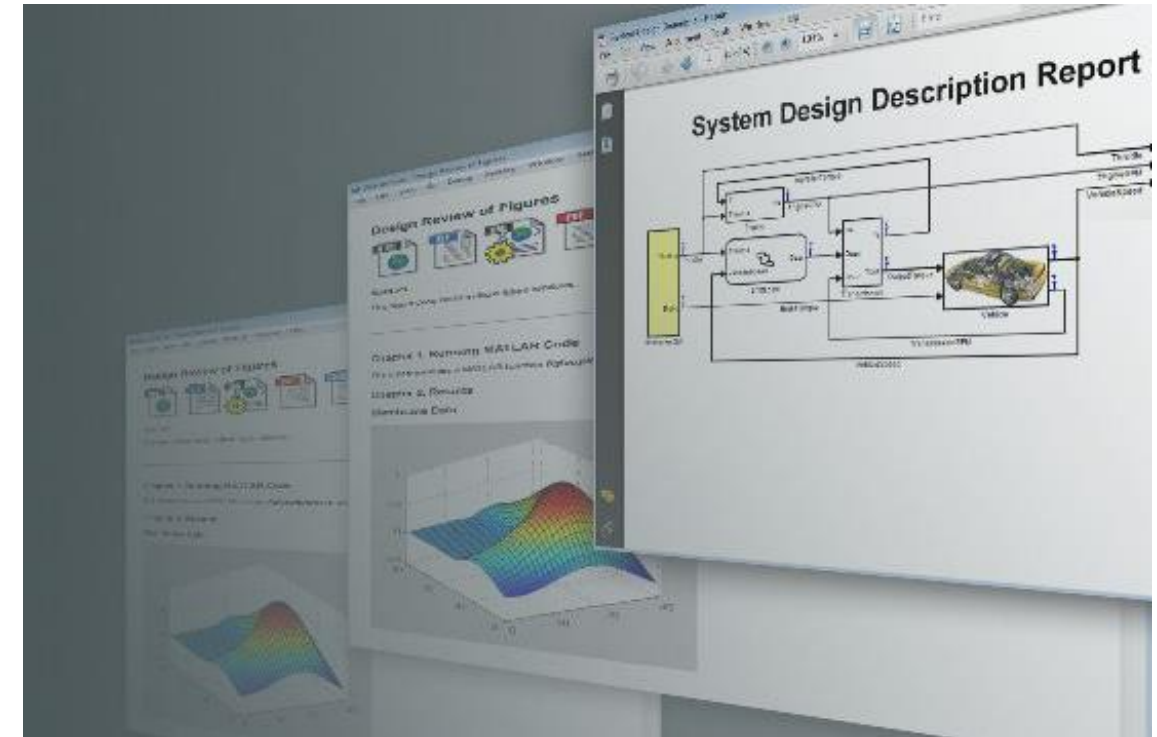


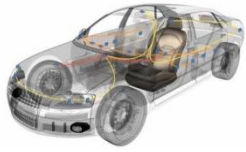
Integrating by Sharing Models

Quick File
Packaging

Model Protection
(IP Management)

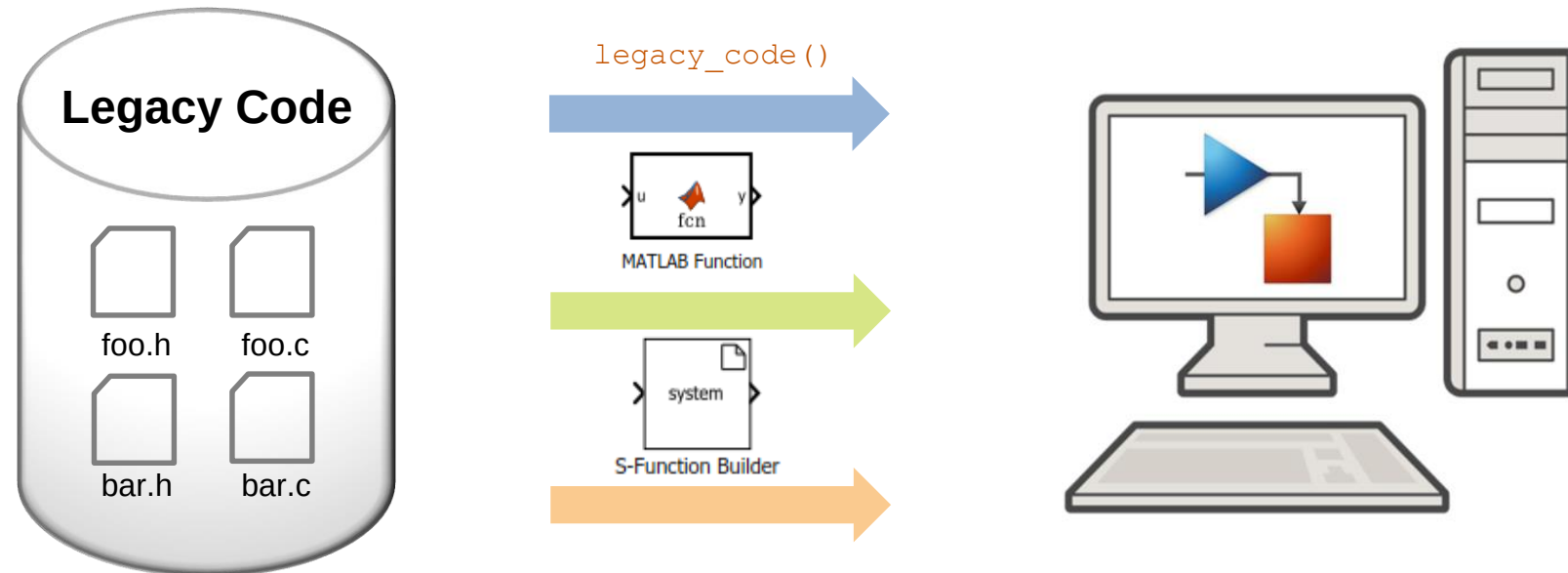
Reporting and
Documentation

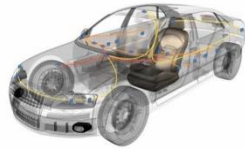




Integrating Your Code

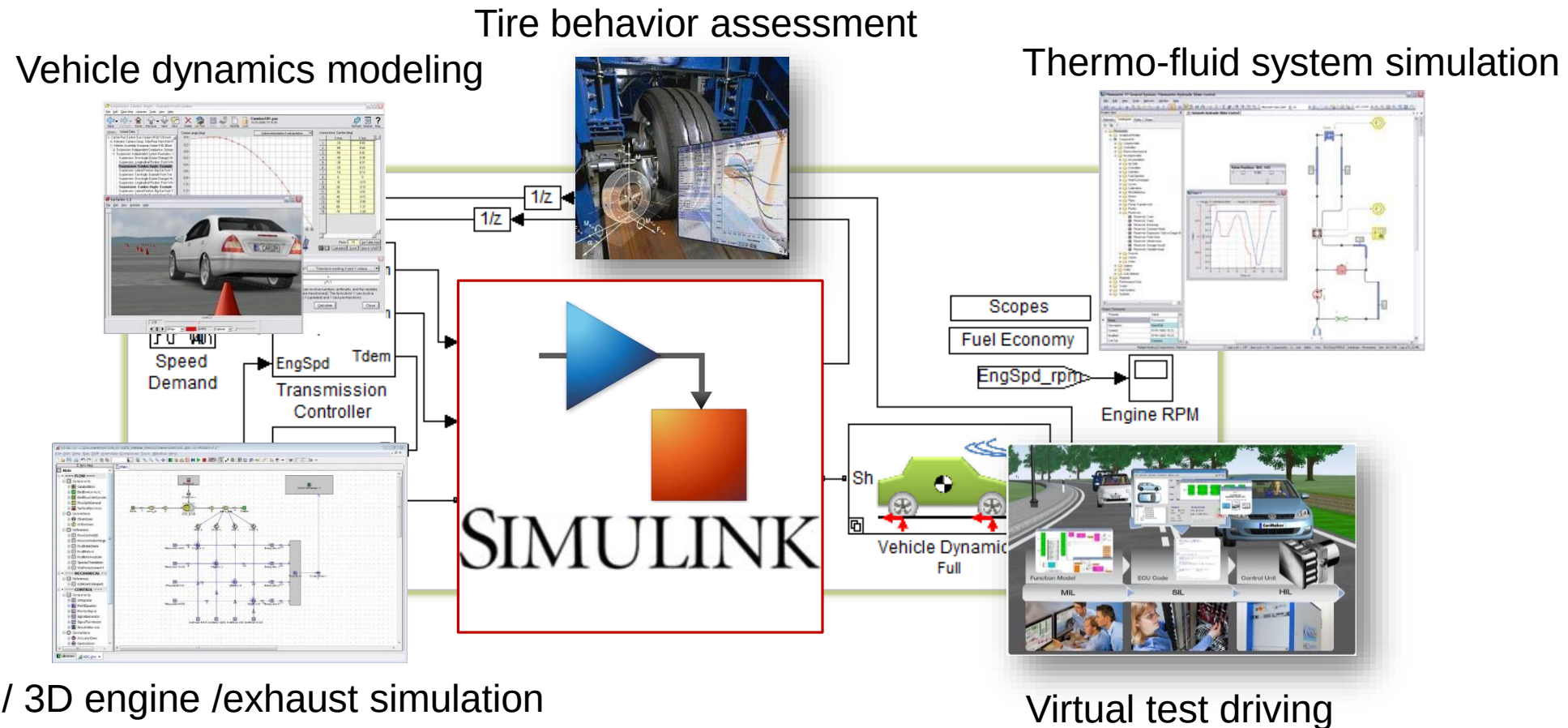
Multiple ways to reuse your legacy code with Simulink



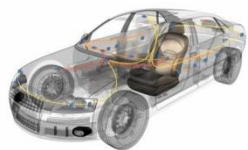
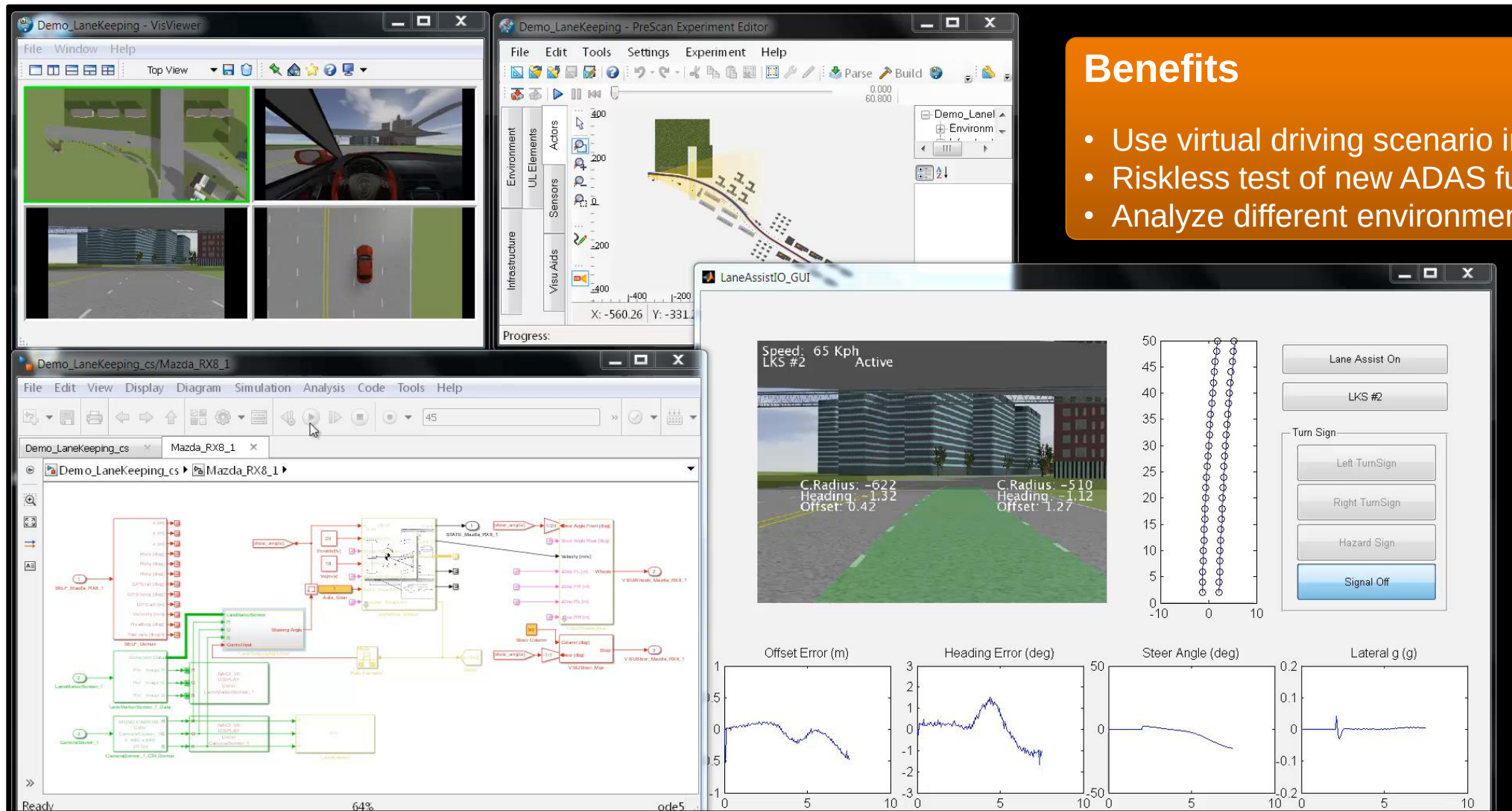


Integrating Third-Party Simulation Tools

Mature and extensive APIs for third-party tool integration

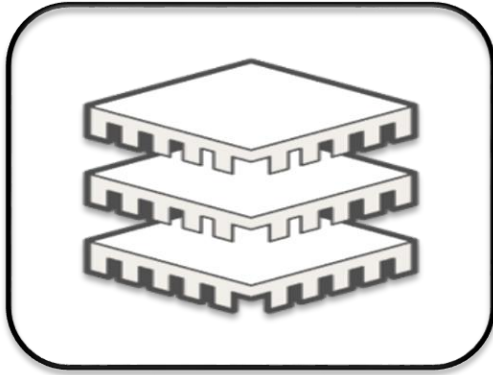


ADAS System Level Simulation – Lane Keeping Support at TASS





Scalability Challenges

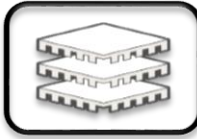


Performance

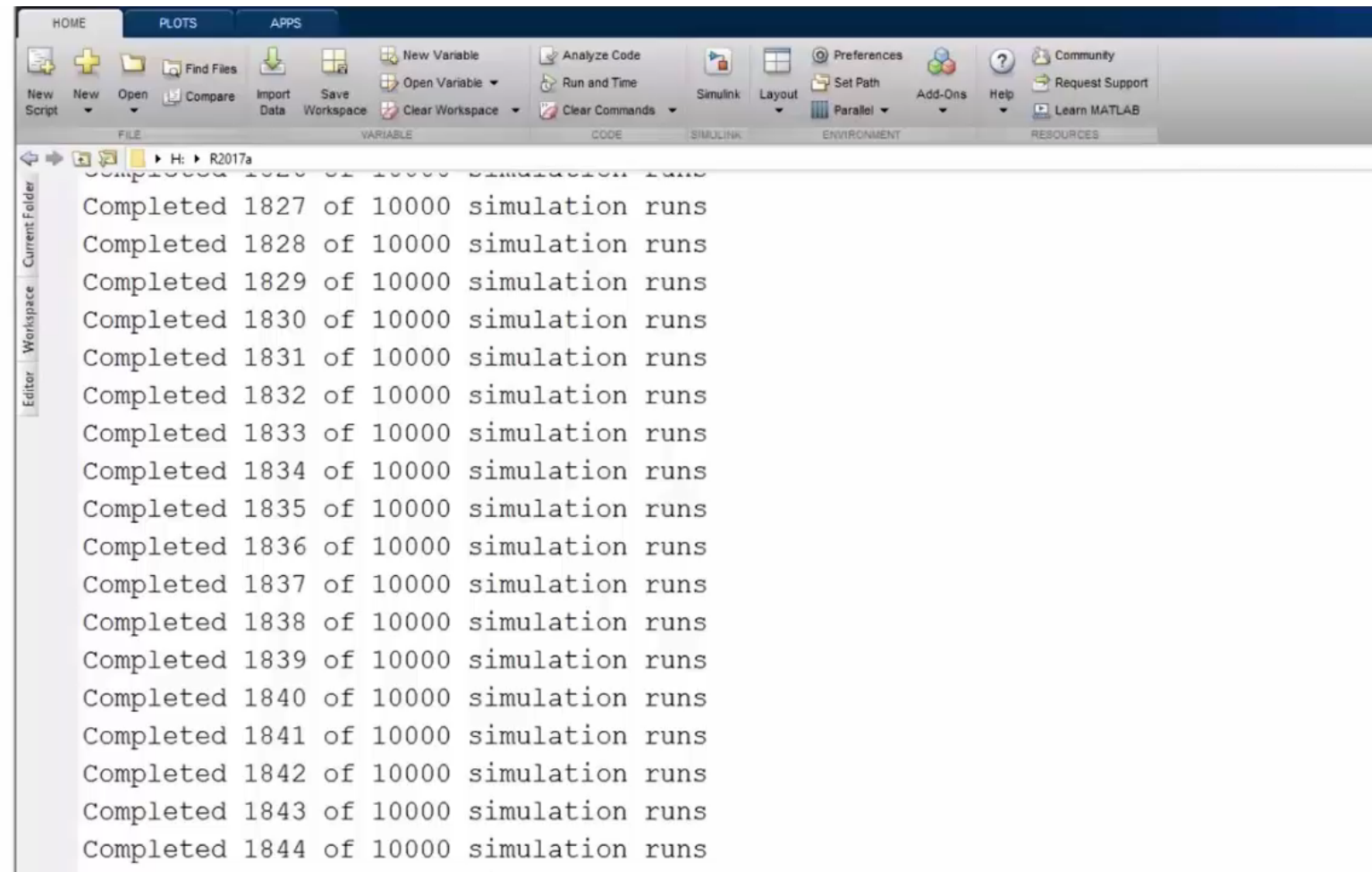


Team
Workflows

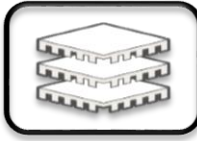
Performance Scalability



Easy scalability to multicore or cluster/cloud computation environment

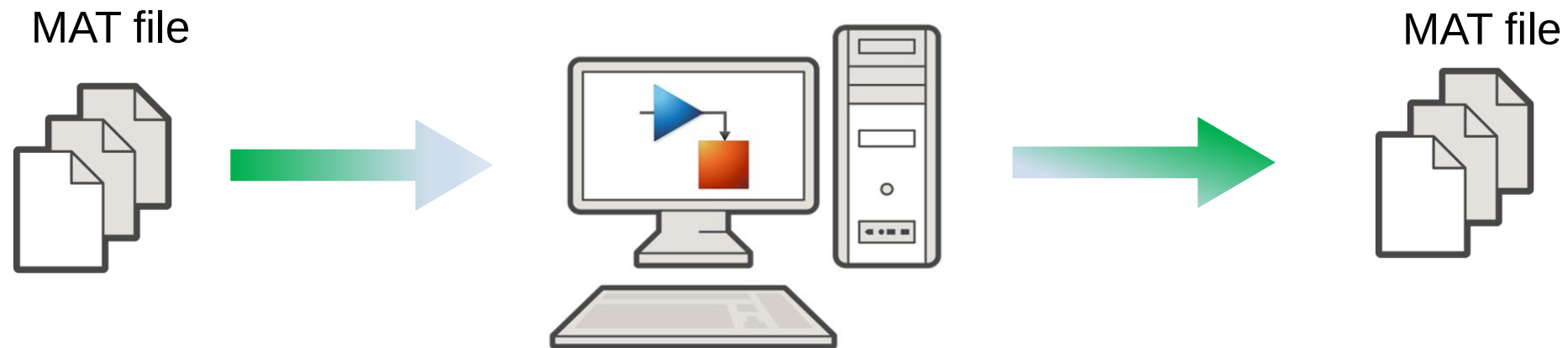


Performance Scalability

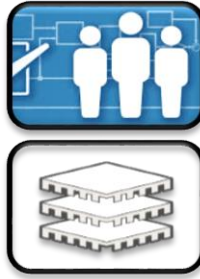


Big data workflow

- Processing large amount of simulation inputs / outputs

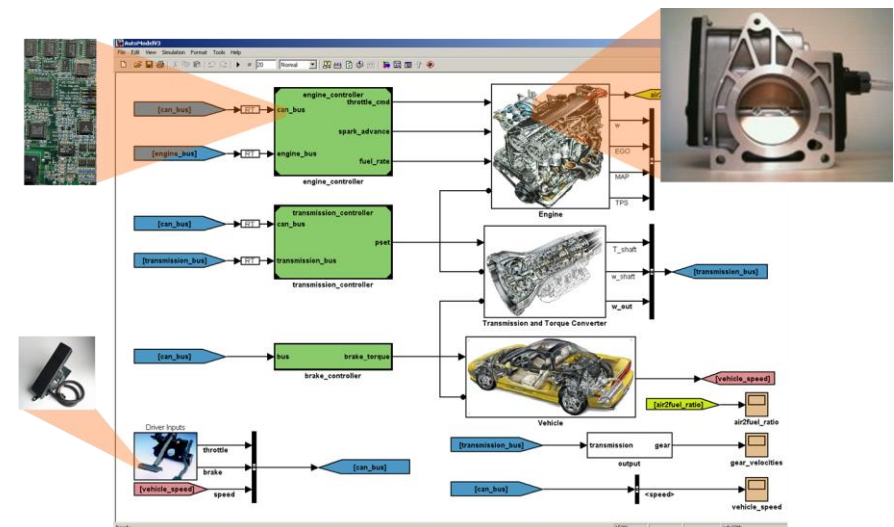
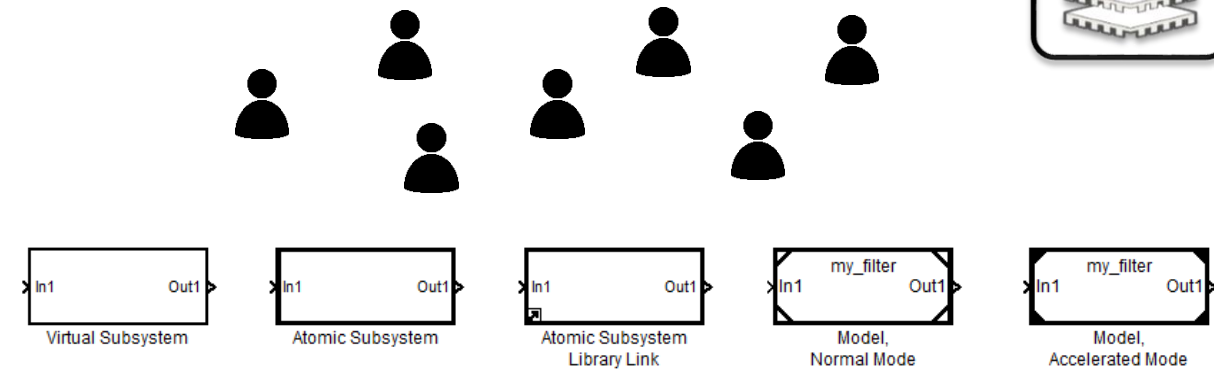


Complex Design Development through Componentization



- Improving performance
 - Incremental loading and code generation
 - Simulation speed
 - Memory usage

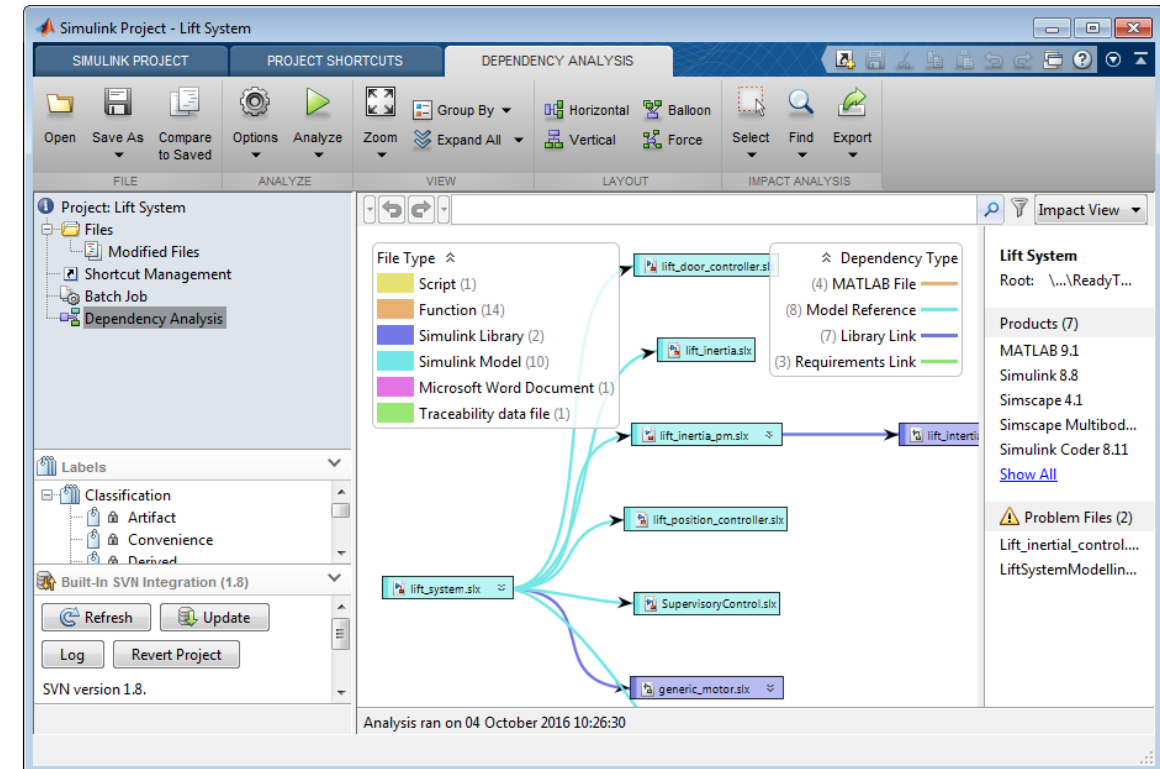
- Supporting team workflows
 - Faster modular development
 - More effective verification
 - Increased reusability



Capabilities Enabling Team Workflows



- Source control
- Design comparison and merging
- Dependency analysis
- Task automation





Source Control Integrations

Microsoft Team Foundation Server (TFS) integration available now from MathWorks File Exchange



Products Solutions Academia Support **Community** Events

File Exchange

TFS Version Control Integration

by [Jasper Schneider](#)

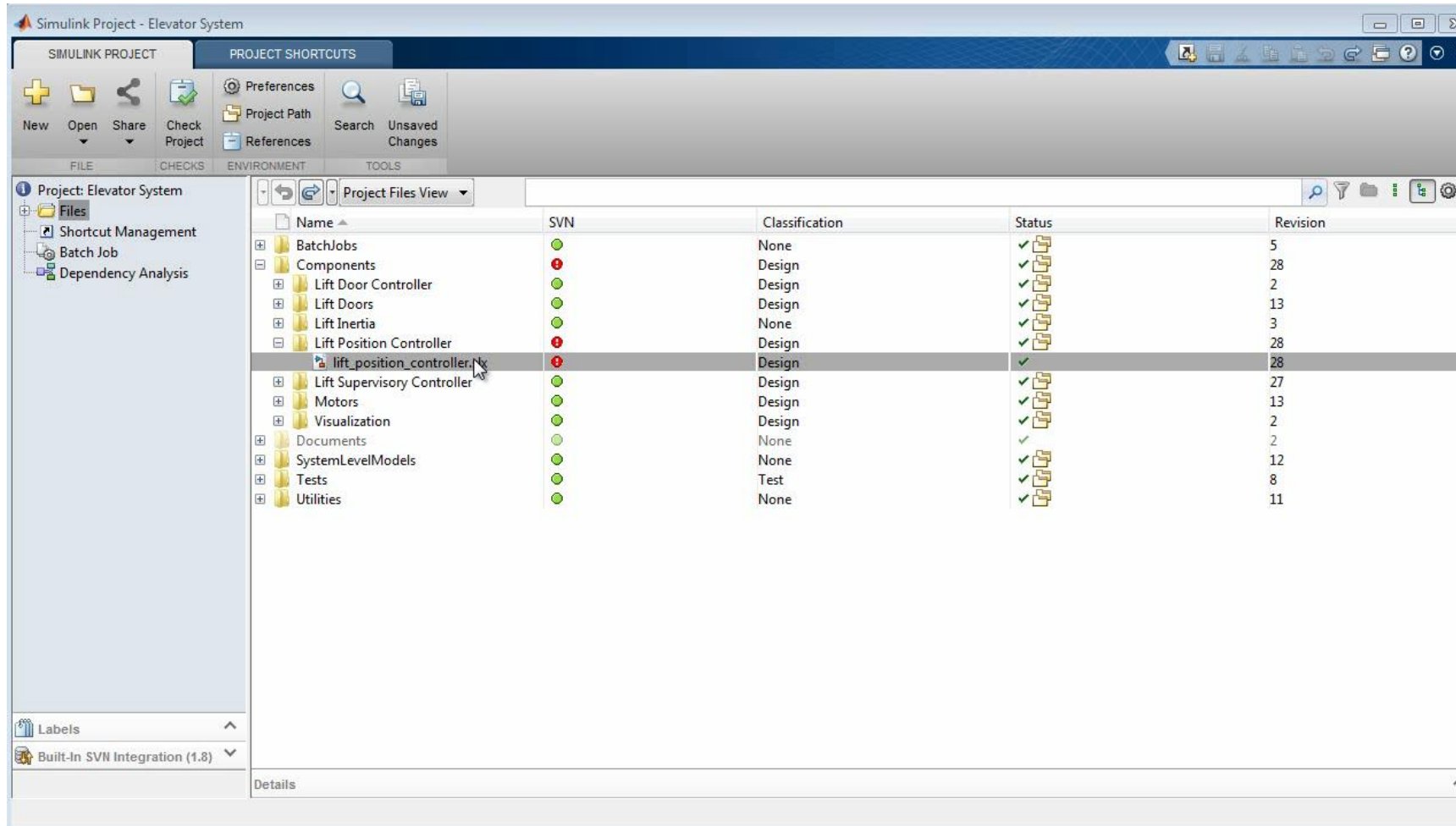
17 May 2016 (Updated 26 May 2016)

TFS Version Control integration in MATLAB and Simulink

[Watching this File](#)



Integrating Work from Different Engineers via Merge



- Supports concurrent engineering
- Lets you concentrate on design



Dependency Analysis – Modular Development

Simulink Project - Elevator System

SIMULINK PROJECT | **PROJECT SHORTCUTS**

MANAGE | DOCUMENTATION | ENVIRONMENT | TOP LEVEL MODELS | UTILITIES

Project: Elevator System

- Files
- Shortcut Management
- Batch Job
- Dependency Analysis

Project Files View

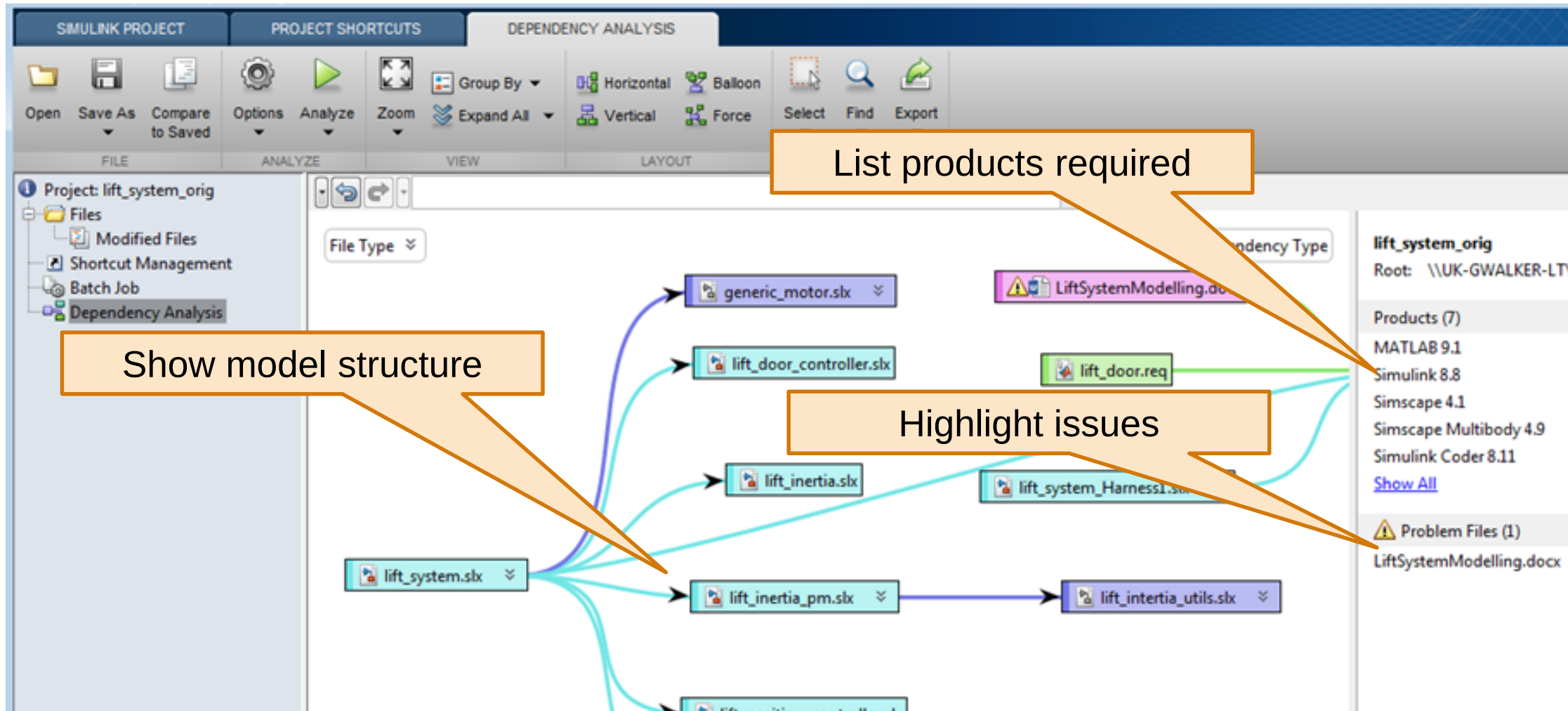
Name	Path	Status	Classification
Lift	\$\Tests	✓	Test
Lift Door Controller	\$\Components	✓	Design
Lift Door Controller	\$\Tests	✓	Test
Lift Doors	\$\Components	✓	Design
Lift Doors	\$\Tests	✓	Test
Lift Inertia	\$\Components	✓	None
Lift Motor	\$\Tests	✓	Test
Lift Position Controller	\$\Components	✓	Design
Lift Position Controller	\$\Tests	✓	Test
Lift Supervisory Controller	\$\Components	✓	Design
Lift Supervisory Controller	\$\Tests	✓	Test
Motors	\$\Components	✓	Design
SystemLevelModels	\$\	✓	None
Tests	\$\	✓	Test
Utilities	\$\	✓	None
Visualization	\$\Components	✓	Design
Visualization	\$\Tests	✓	Test
basic_animation.slx	\$\Components\Visualization	✓	Design
ElevatorTemplate.slx	\$\Utilities	✓	Other
exportToR2016a.m	\$\BatchJobs	✓	Design
generateBillOfMaterials.m	\$\BatchJobs	✓	Design
generateICD.m	\$\Utilities	✓	Design
generic_motor.slx	\$\Components\Motors	✓	Design
history.m	\$\Utilities	✓	Design
lift_door.req	\$\Components\Lift Doors	✓	Design
lift_door.slx	\$\Components\Lift Doors	✓	Design
lift_door_controller.slx	\$\Components\Lift Door Controller	✓	Design

Labels

Details

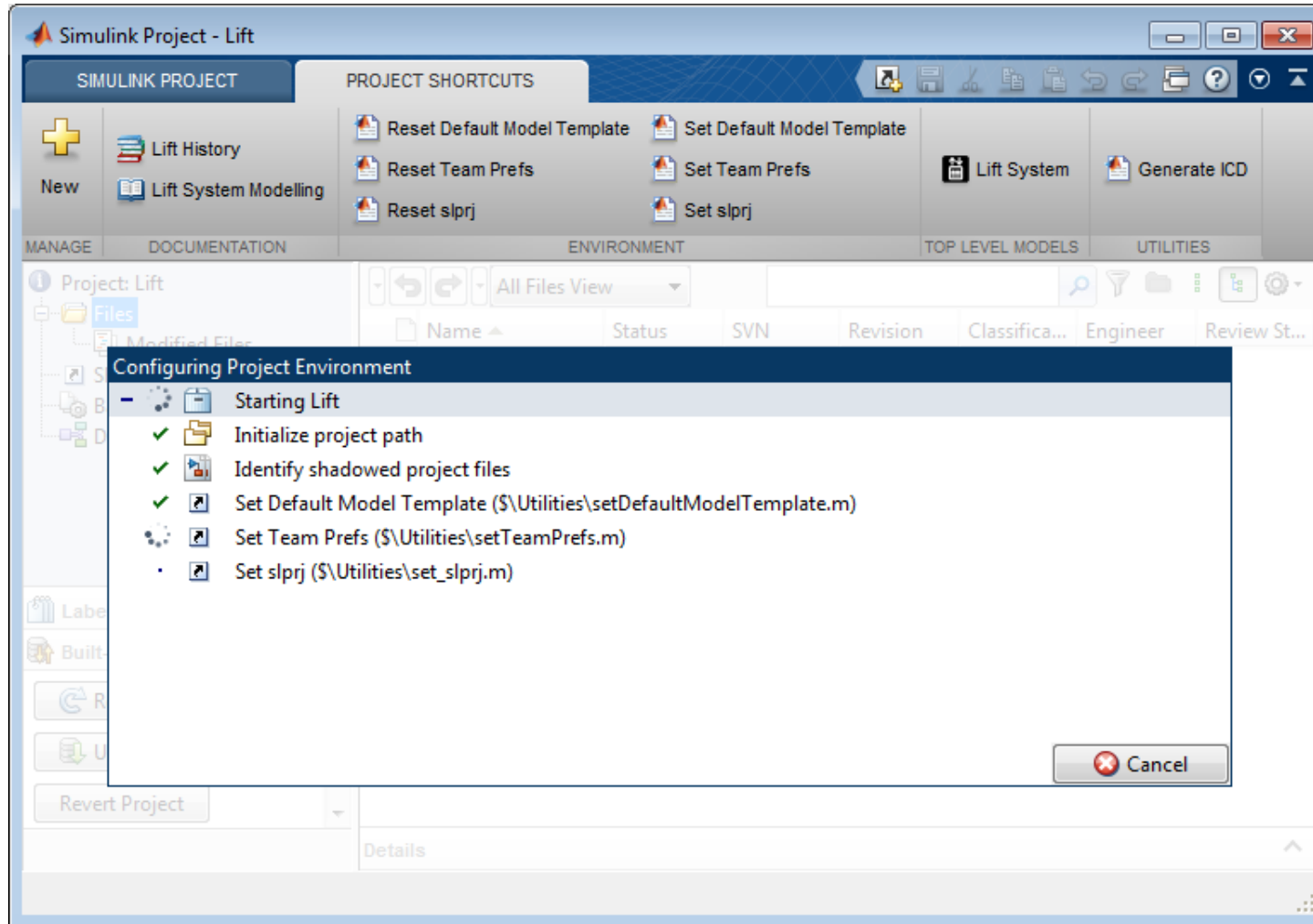


Dependency Analysis – Modular Development



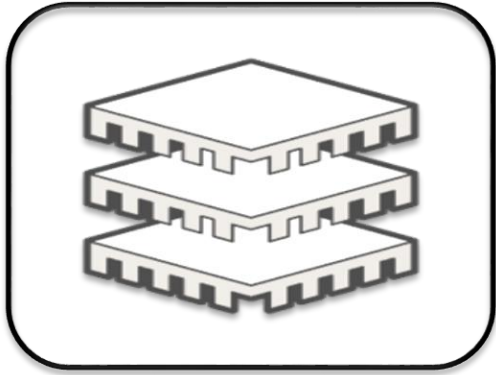


Task Automation – Configuring Project Environment



- Robustly configure the team environment
- For everyone
- Automatically

Simulink Addressing Scalability Challenges

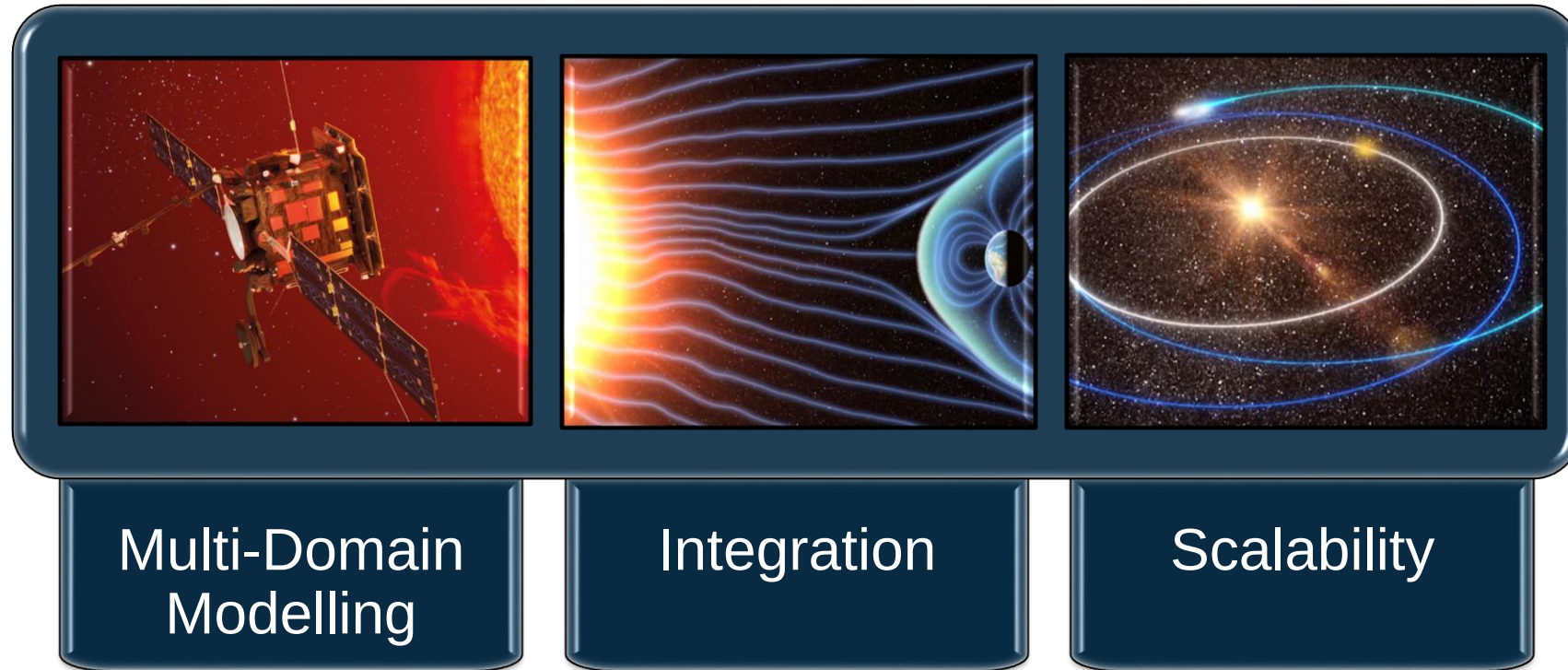


Performance



Team
Workflows

Enterprise Simulation Platform Enablers



"No other tool gives us the multidomain simulation capability and block diagram environment in a way that is scalable to represent complex systems. That is why we use Simulink."

Andrew Pollard
Tessella

How to get started?

Public

On-Site

- Model-Based Design
- Stateflow
- Simscape

MATLAB[®]

Data Analytics

Data Processing and Visualization
Statistics
Machine Learning
Optimization Techniques
Parallel Computing

Application-Specific

Control System Design
Signal Processing
Communication Systems
LTE Systems

Application Development

Programming Techniques
Building Interactive Applications
Object-Oriented Programming

Code Generation

MATLAB Coder
Interfacing with C-code

Computational Finance

Risk Management
Time-Series Modelling

Signal Processing

Using MATLAB
Using Simulink

Image and Video Processing

Image Processing
Computer Vision

SIMULINK[®]

Model-Based Design

Implementing MBD Workflow
Model Management and Architecture
Verification and Validation

Stateflow[®]

Event-Based Modeling

Simscape[™]

General Simscape[™]
Simscape Multibody[™]
Simscape Driveline[™]
Simscape Fluids[™]
Simscape Power Systems[™]

Code Generation

Rapid Prototyping and HIL-Simulation
Embedded Systems
FPGA Design
Generating HDL Code
Xilinx Zynq SoCs
AUTOSAR

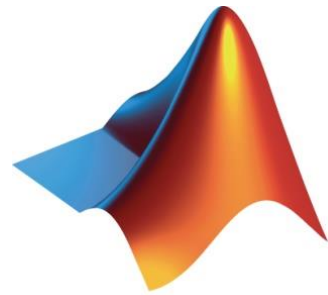
Code Integration

Integrating C and MATLAB

Polyspace[®]

Polyspace Code Prover[™]

<https://nl.mathworks.com/services/training.html>



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