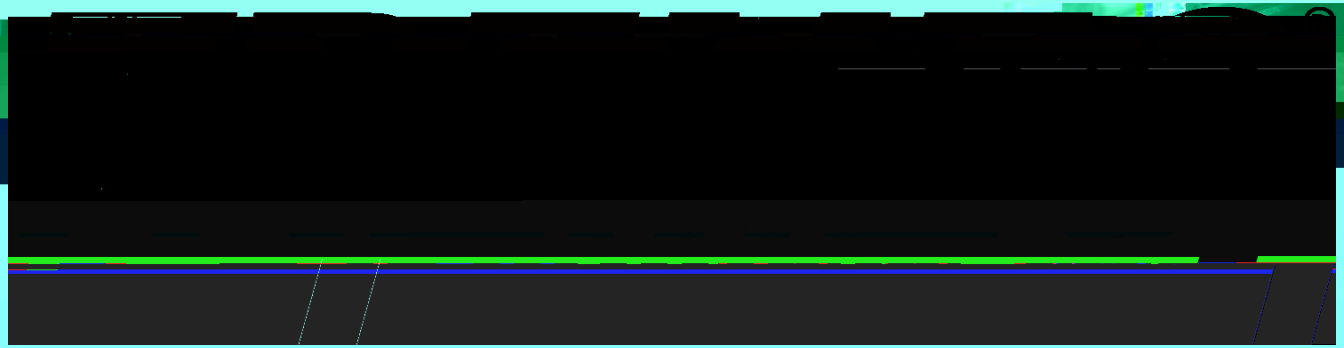


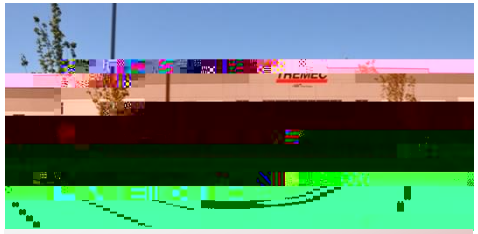
TM

Virtual ECUs for high performance transmissions

Presented by:
Ewaut Dewinter

Contents

Tremec Belgium focuses on DCT hardware and software

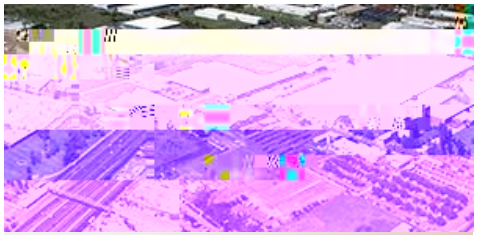


Sales & program management office for North-American OEM's

USA ς Wixom MI

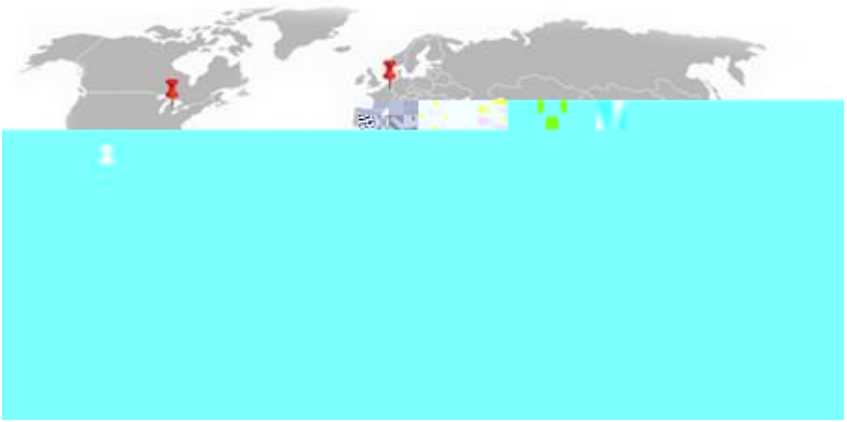
Hardware development of DCTs in the 600 Nm – 1000 Nm range
Development of Controls hardware and Controls software

Belgium ς Zedelgem



TREMEC center of competence for development & production of gear systems

Mexico ς Querétaro



Contents

- Tremec and high performance DCTs
- Transmission controls and Application Software
- Simulation and testing philosophy
- Performant Simulation Environment

Tremec has expertise in all disciplines needed for transmission control

Electronics

TCU using multicore technology
Design compatible with multiple transmission configurations

OBD

CARB 1968.2 compliance
Electrical, Controller, Consistency and Performance Diagnostics

Base software

AUTOSAR framework and Operating System
Control and diagnostics of IO
Communication with other ECUs

Safety software

ISO 26262 compliance
Safety goal monitoring

Application software

High level functionality for drivability
Mid level functionality for hydraulic and mechatronic control
Model based algorithms
Generic modules calibratable per application

Application software makes the difference in DCT applications

A DCT gearbox can handle a wide range of shift feelings

A brand specific car temperament can be created just by changing software

The same DCT gearbox can be used in different models

- different calibrations are used to match driveline experience with type of car

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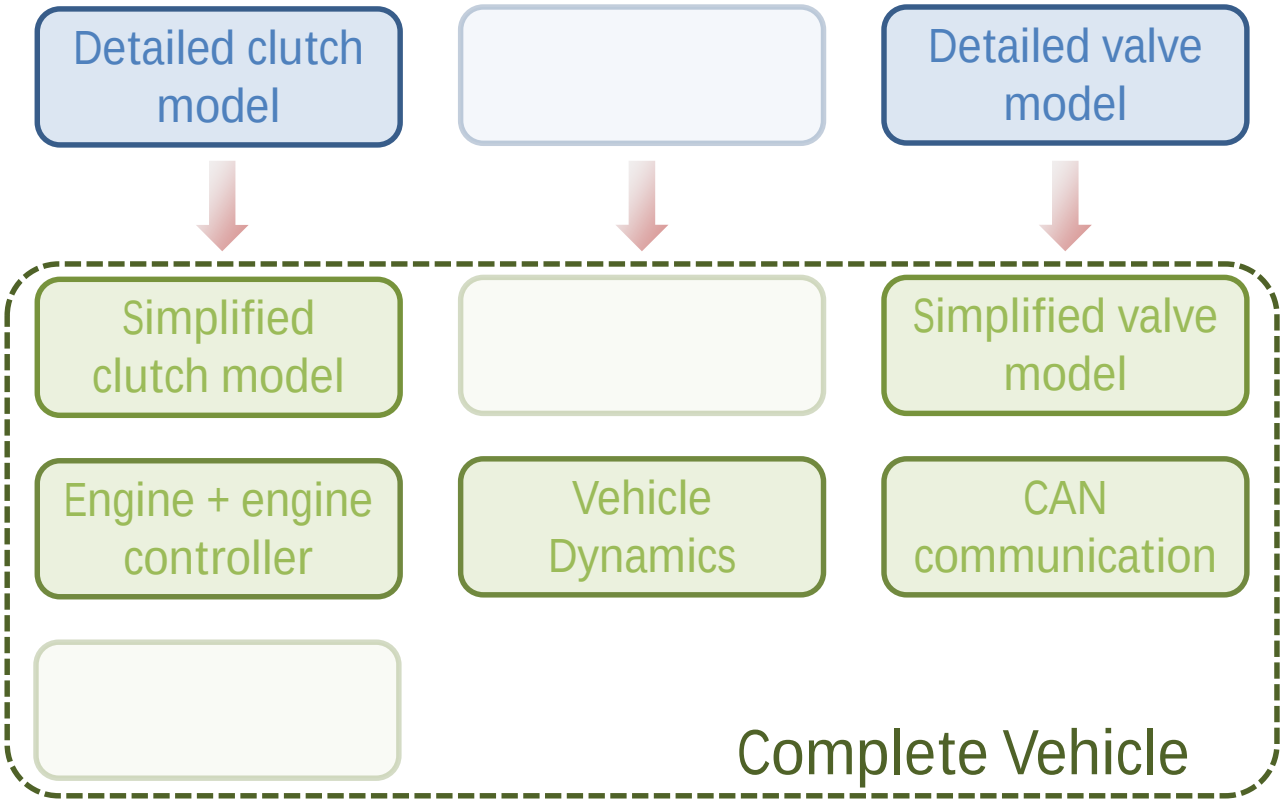
Complete powertrain simulation aids both the Hardware & Software design

HW: Component design
SW: Control algorithm development

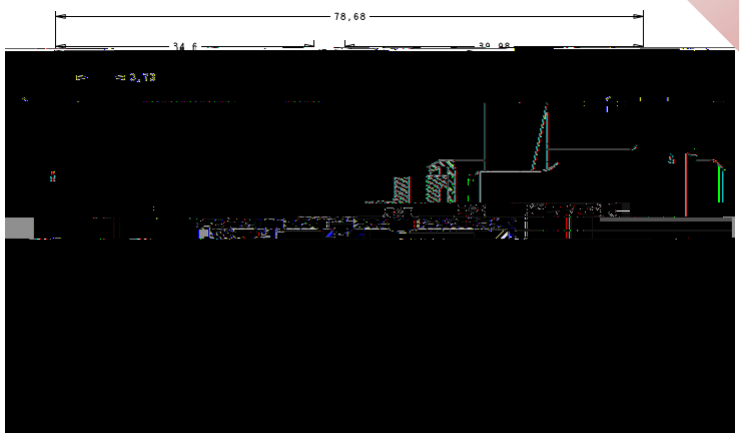
HW: System behavior
SW: Testing of complete application

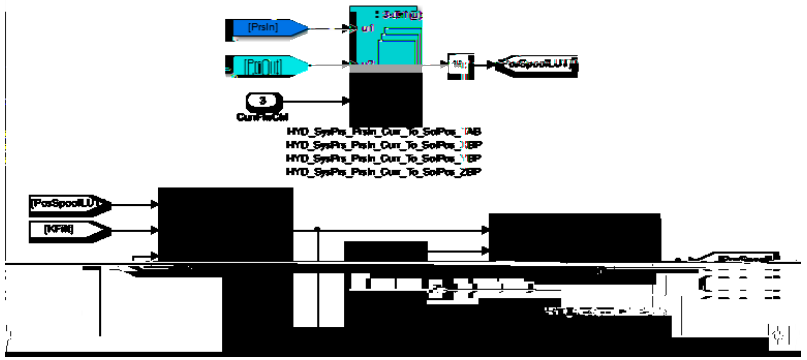


Different simulation models are used for different goals

Detailed dynamics
Variable step solver
Focus on correct behavior
No focus on performance

Simplified dynamics
Fixed step solver
Focus on execution time
Approach real behavior





Different simulation models are used for different goals

Detailed dynamics
Variable step solver
Focus on correct behavior
No focus on performance

Simplified dynamics
Fixed step solver
Focus on execution time
Approach real behavior

Verifying hardware design
Developing dedicated controls application

Real-time testing of application on a real or virtual TCU

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Business case
Tremec targets high performance applications

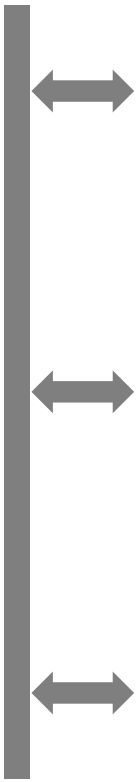
Parallel development of all components (short time to market)

- SW development needs to start before HW is finalized
- Limited availability of test vehicles

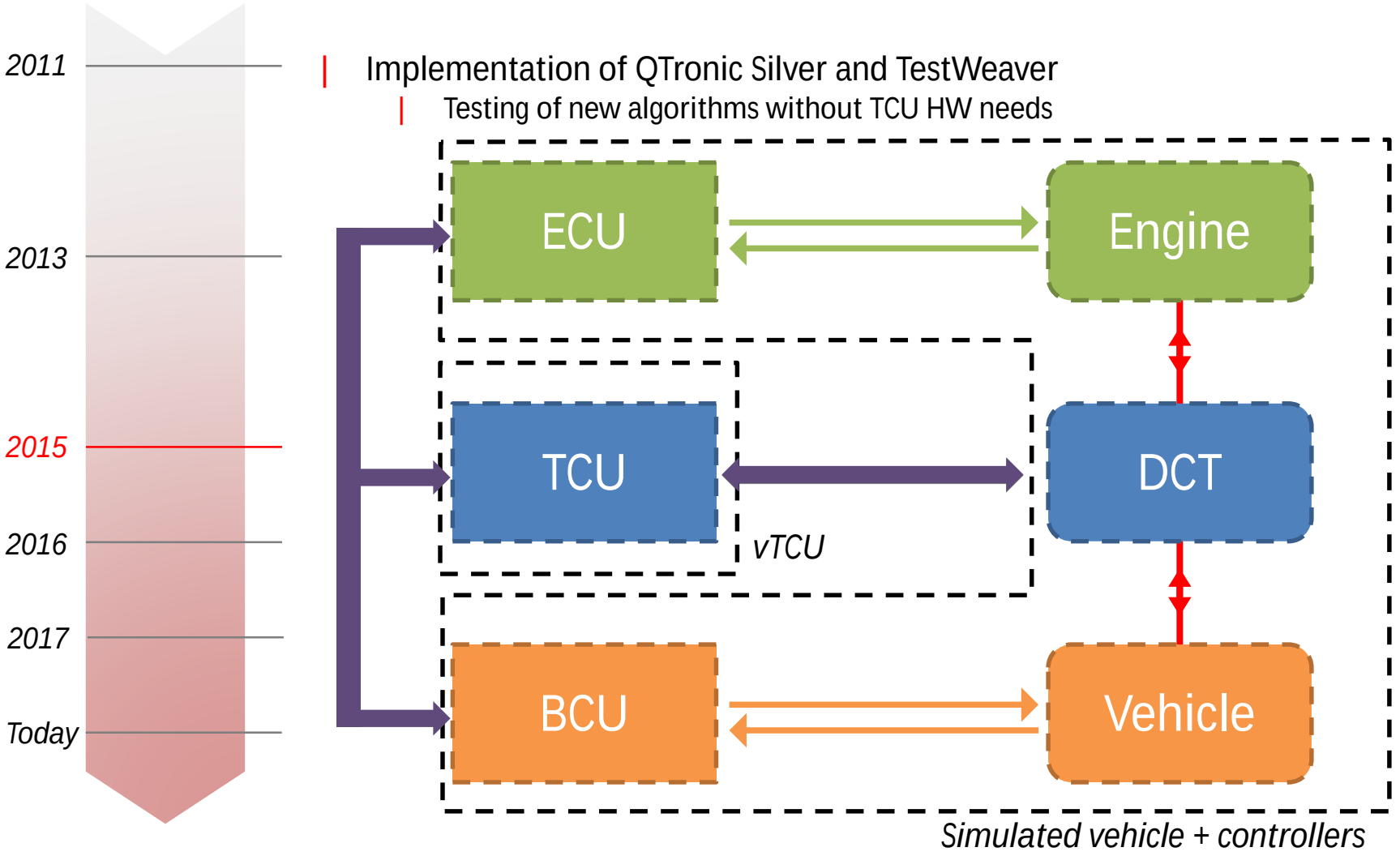
OEMs want unique character and stand-out features

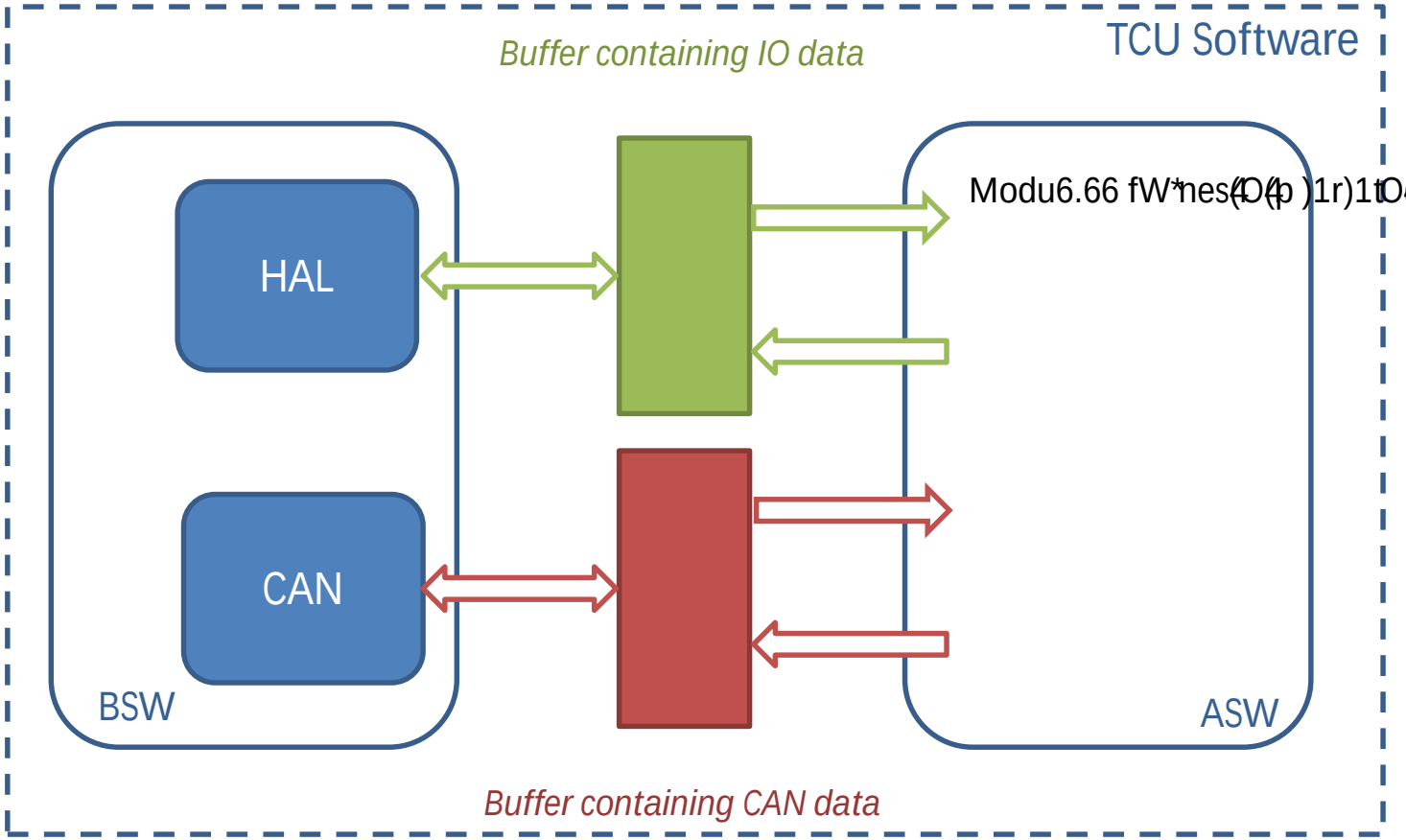
- Agile SW implementation and testing environment
- Confidence in new algorithms before vehicle testing
- Possibility to explore new concepts and variants

Tremec needs a performant simulation environment to reach the desired SW maturity



Performant Simulation Environment
Further steps towards SiL testing




TCU Software
Buffer containing IO data
HAL
CAN
BSW
ASW
Buffer containing CAN data

Performant Simulation Environment
Extension of testing equipment with HiL

2011

2013

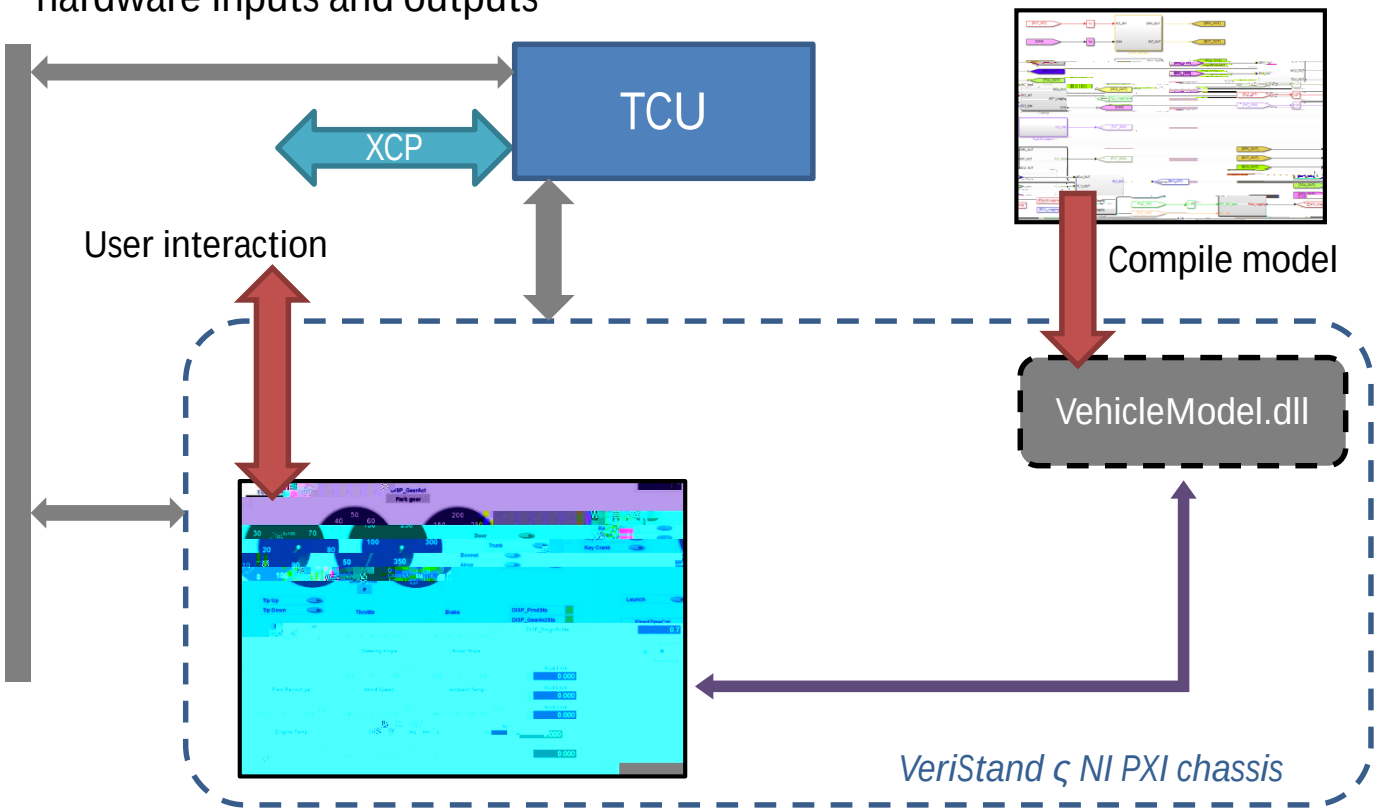
2015

2016

2017

Today

- Transition of PiL setup from Windows desktop to Real Time computer
- Development of HiL setup as an extension of PiL setup with hardware inputs and outputs



Performant Simulation Environment
Extension of testing equipment with HiL

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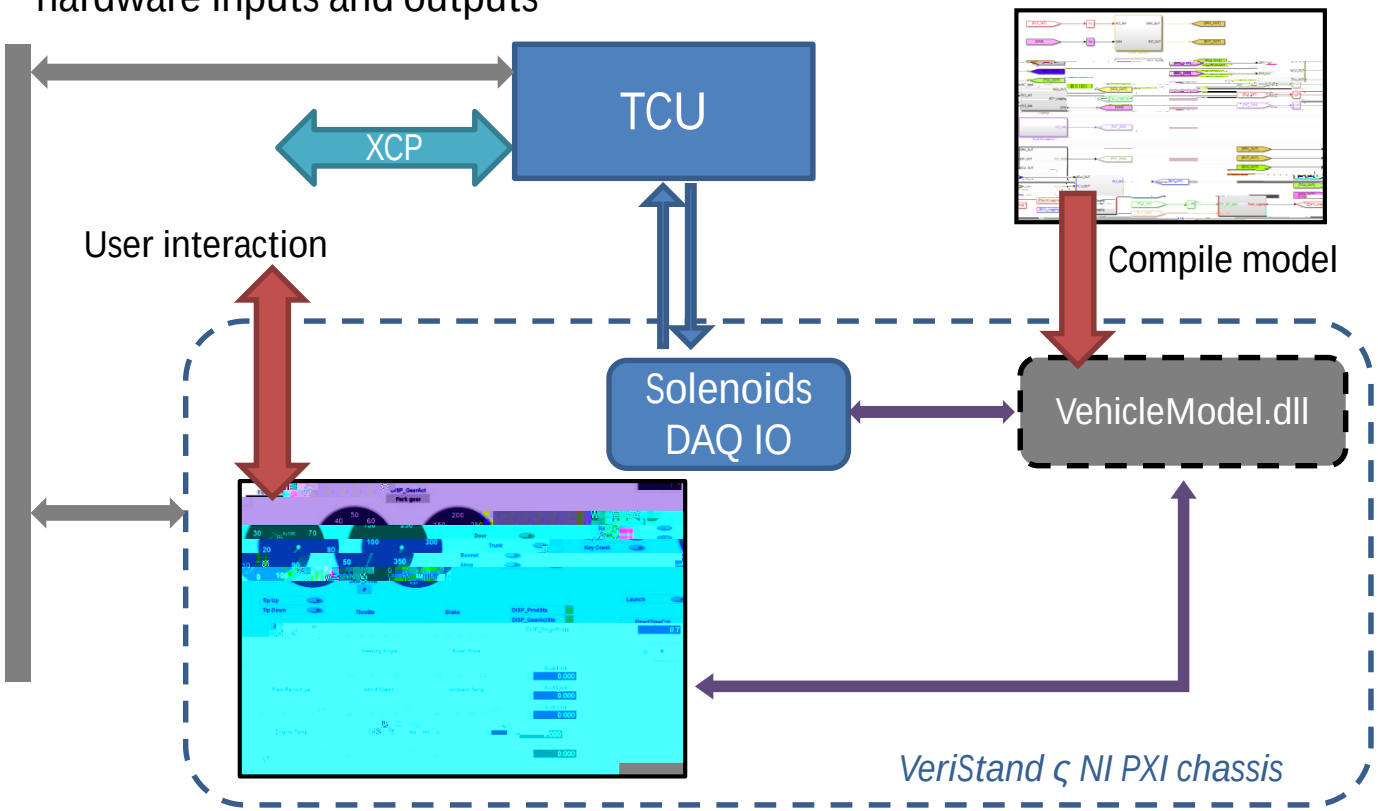


TestWeaver is used for regression testing and software release validation

2011

2013

2015

2016

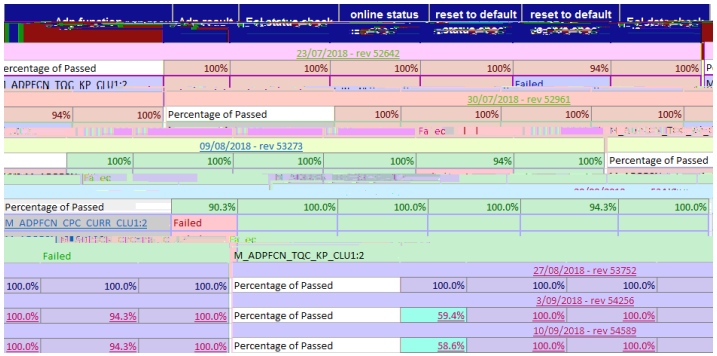
2017

Today

Regression testing using TestWeaver

Weekly TestWeaver run

- Python scripts for regression
- Automatic script generation



SW release TestWeaver run

- Regression test of diagnostic routines
- Release documentation

Performant Simulation

Parallel development of all components (short time to market)

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Questions

TM