

INTERFACE MICROSYSTEMS

MIL In Test-driven Development
For Achieving Agile ECU Development

Nukul Sehgal
Team Lead – Software Engineering

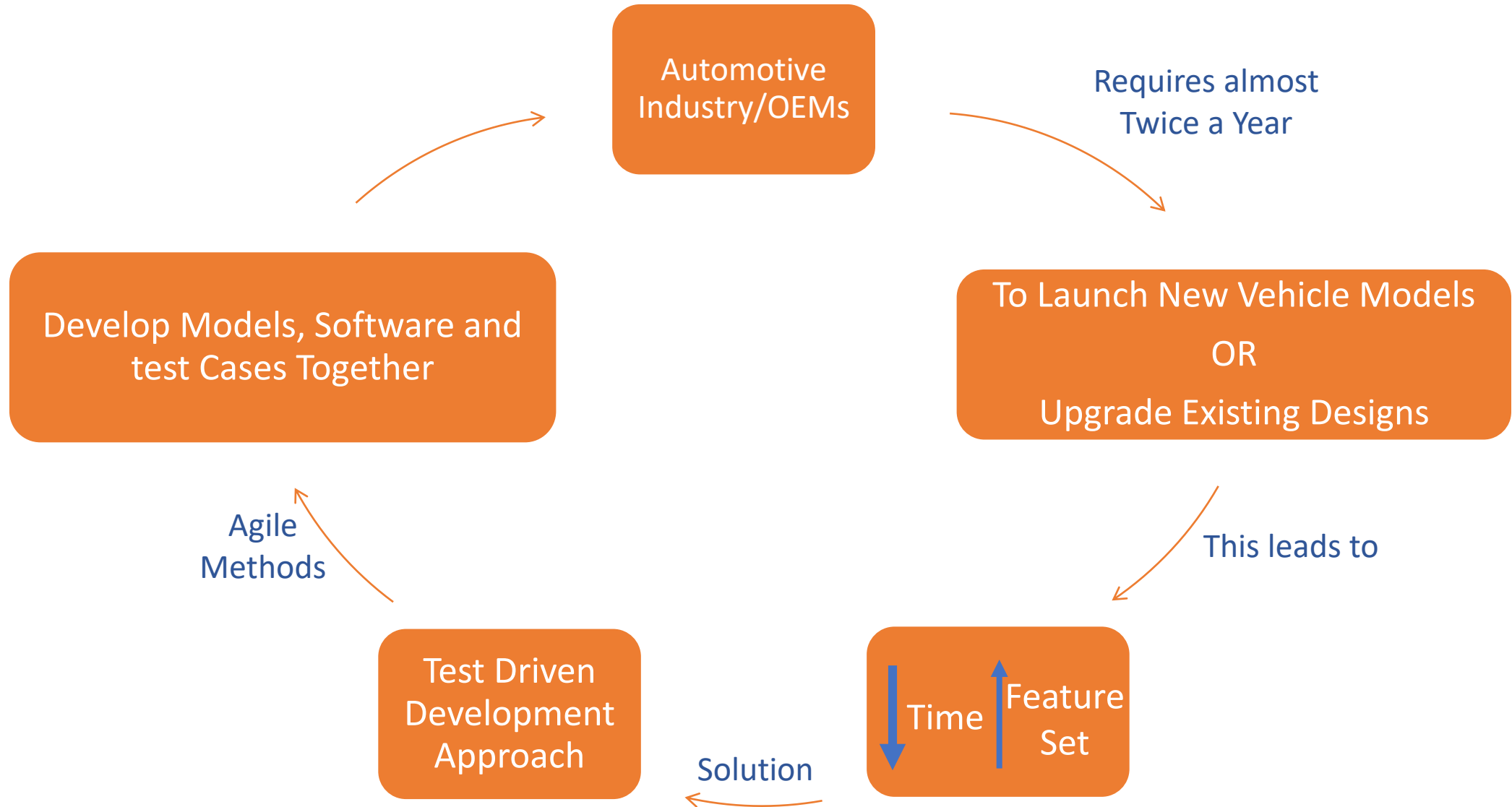
Srishti Sharma
Software Engineer

Headquarter

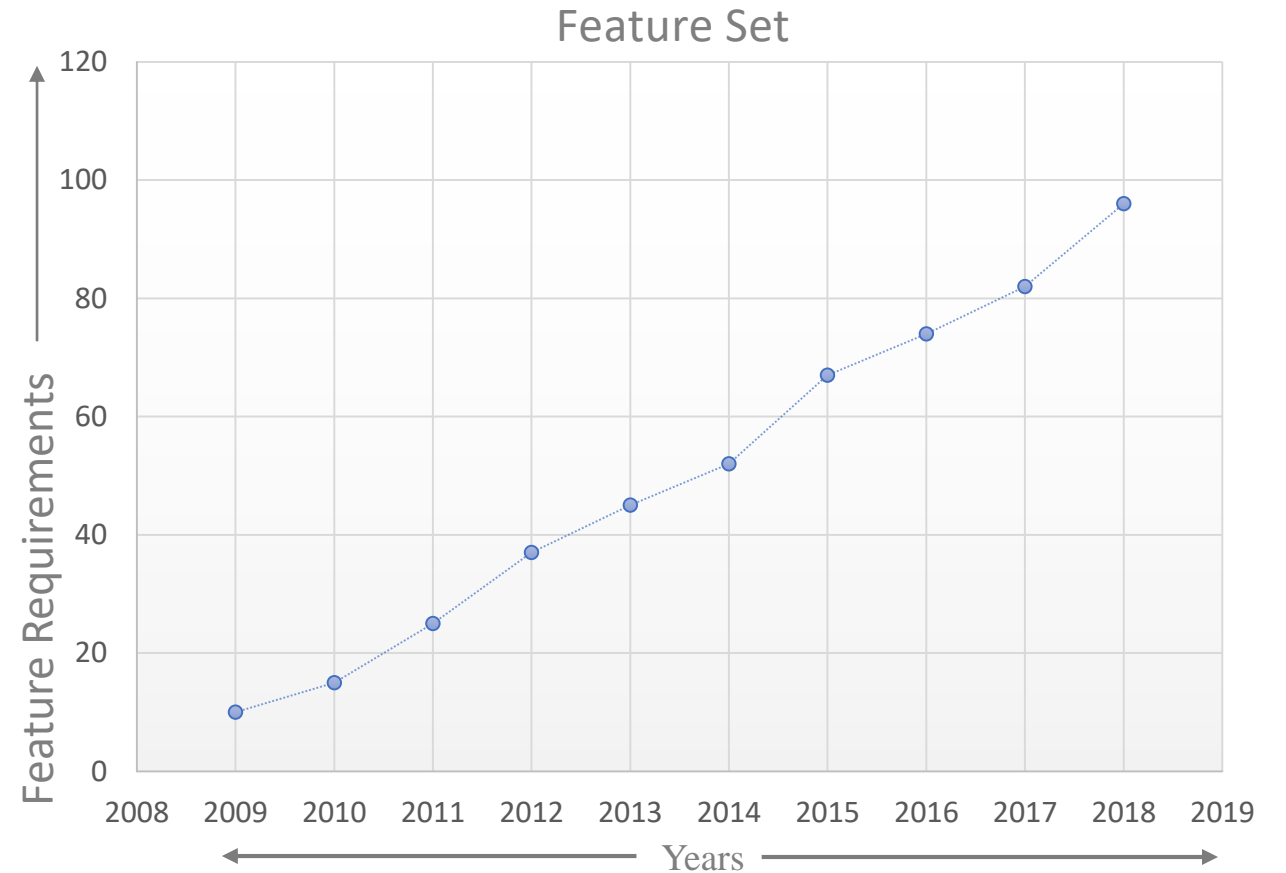
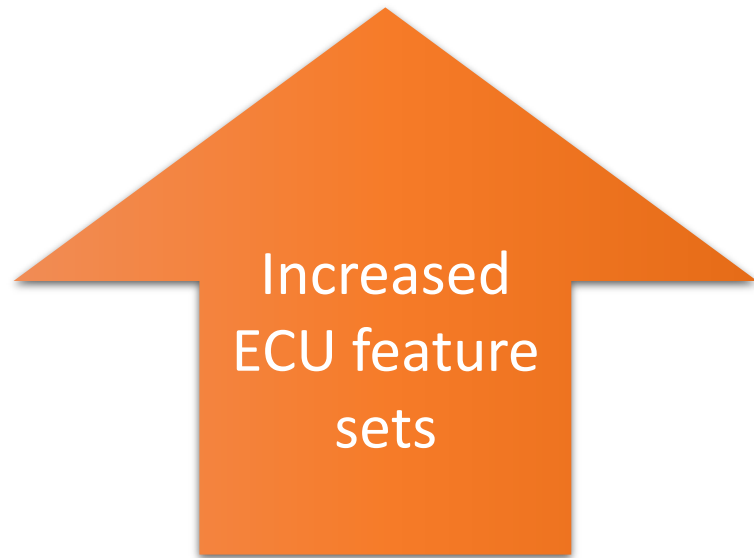
341-342, Udyog Vihar Phase II
Gurgaon-122016, Haryana
Phone: +91-124 - 4736950
Fax: +91-124-4736960
Website: www.interfaceauto.com

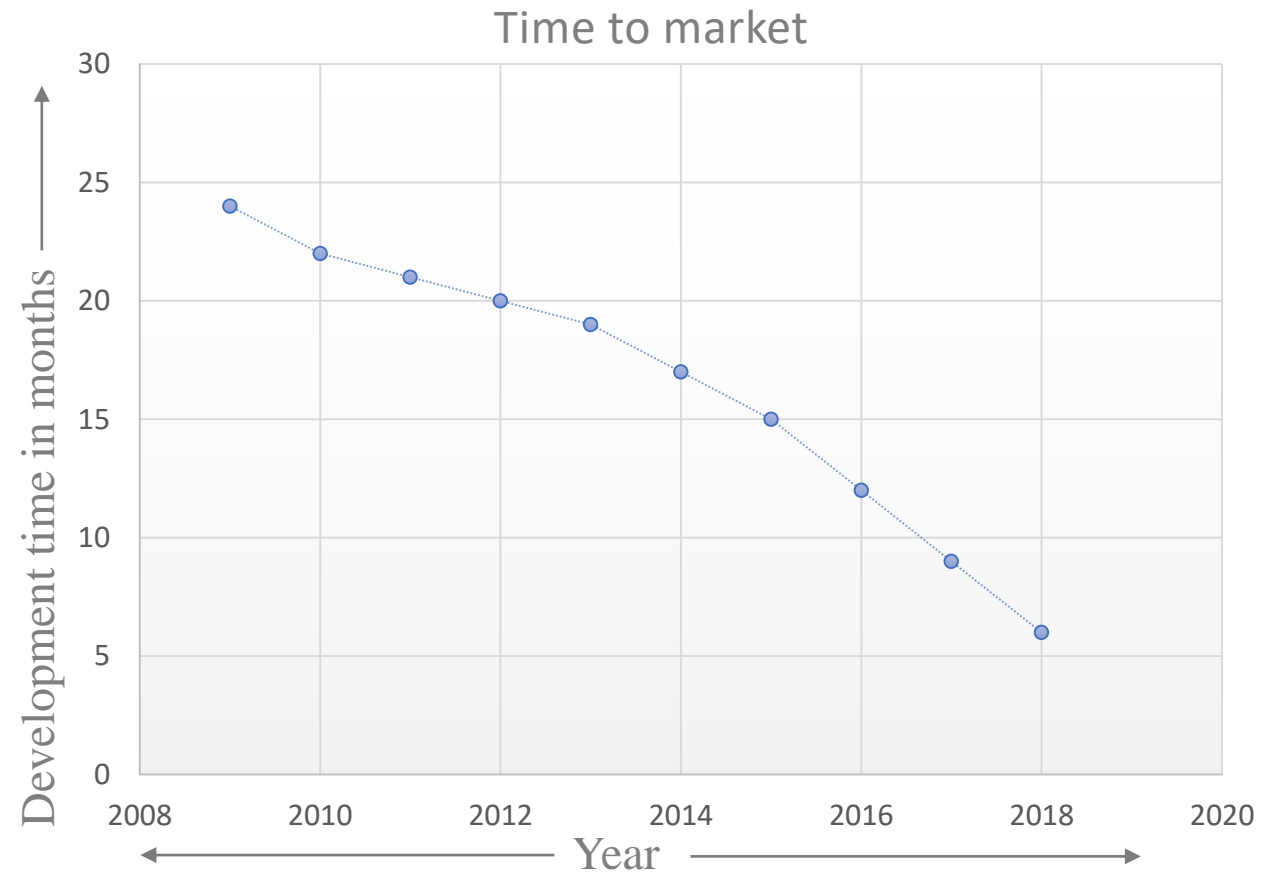


Problem Statement



Problem Statement





Development Strategy to solve the problem

Approaches discovered for different scenarios of ECU development requirements.

1. Requirement of software development on an existing ECU hardware.

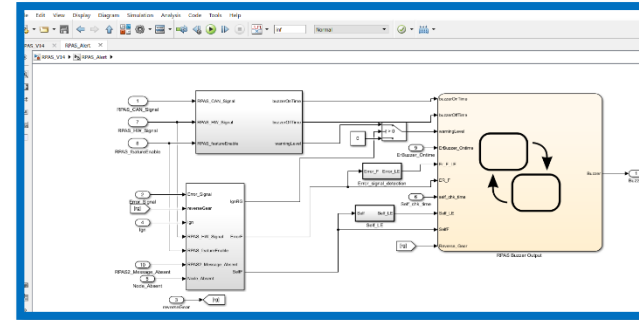


2. Requirement of a whole new ECU software and hardware.

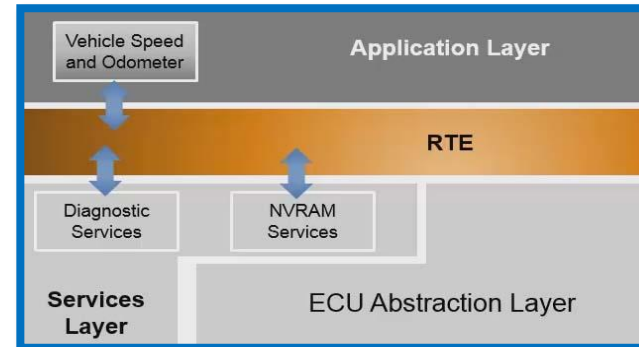


Development Strategy to solve the problem

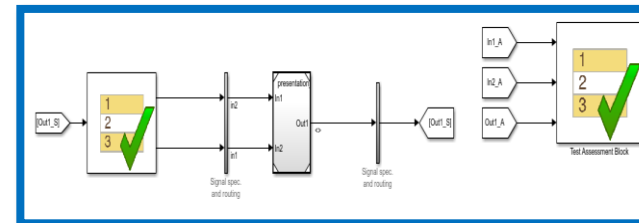
Model based
Development

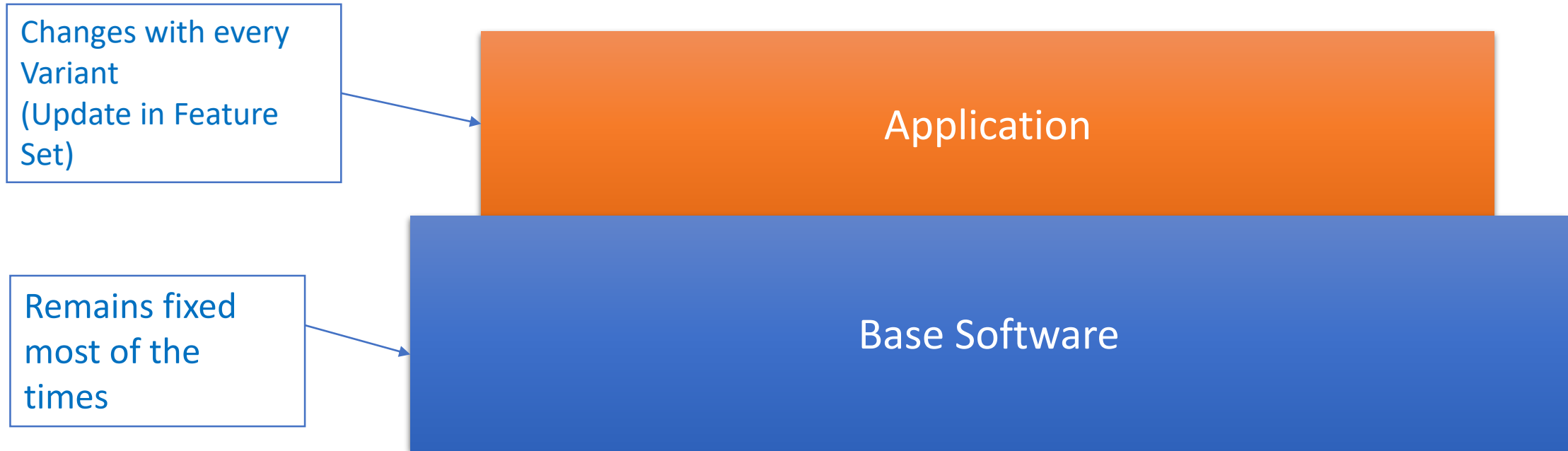


AutoSAR Platform
Approach

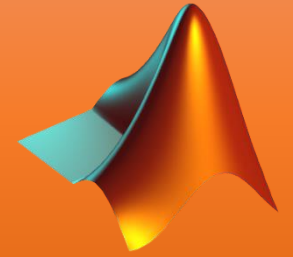


Test Driven
Development





Application Model



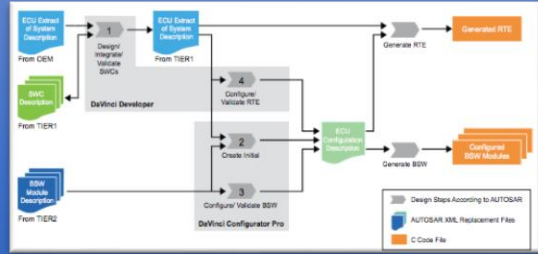
MIL with ECU
Hardware

MIL with HIL
System

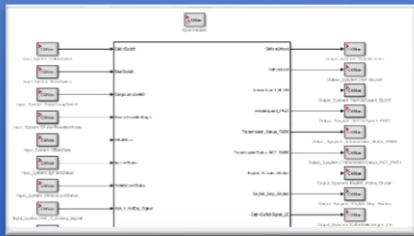
Pre-Requisites



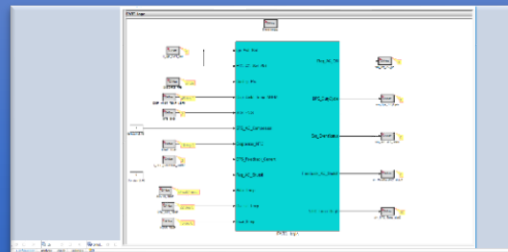
ECU H/W



Established BSW



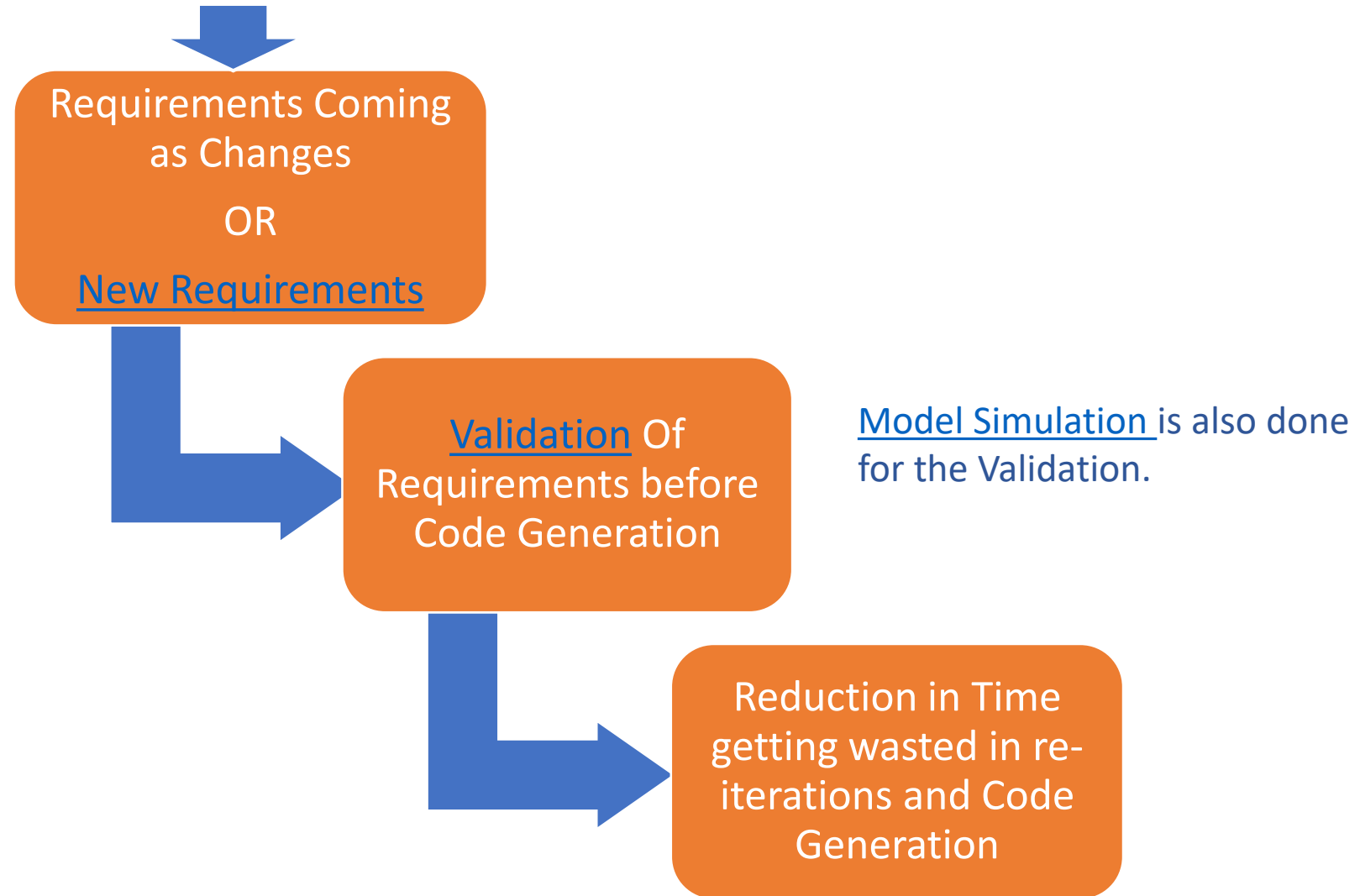
COMM Layer



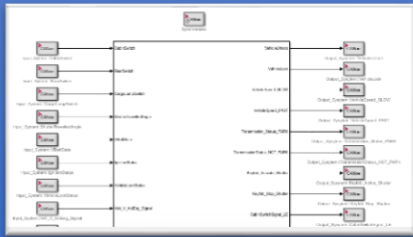
Test Setup MIL Capabilities

Benefits

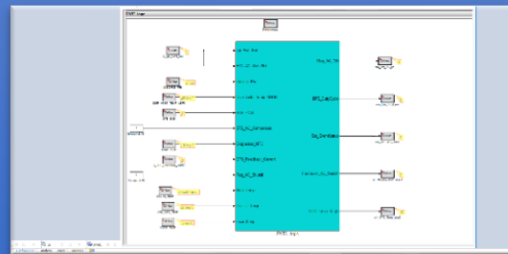
- ✓ Actual H/W in-loop to drive the loads.
- ✓ Closed loop testing with actual sensor and load feedback.
- ✓ Model Developer does not need to wait for Software Integrator.
- ✓ Model and Signals can be traced/logged.
- ✓ Minimal change in HIL Setup and test cases when testing production ready part with Integrated H/W and S/W.



Pre-Requisites



COMM Layer

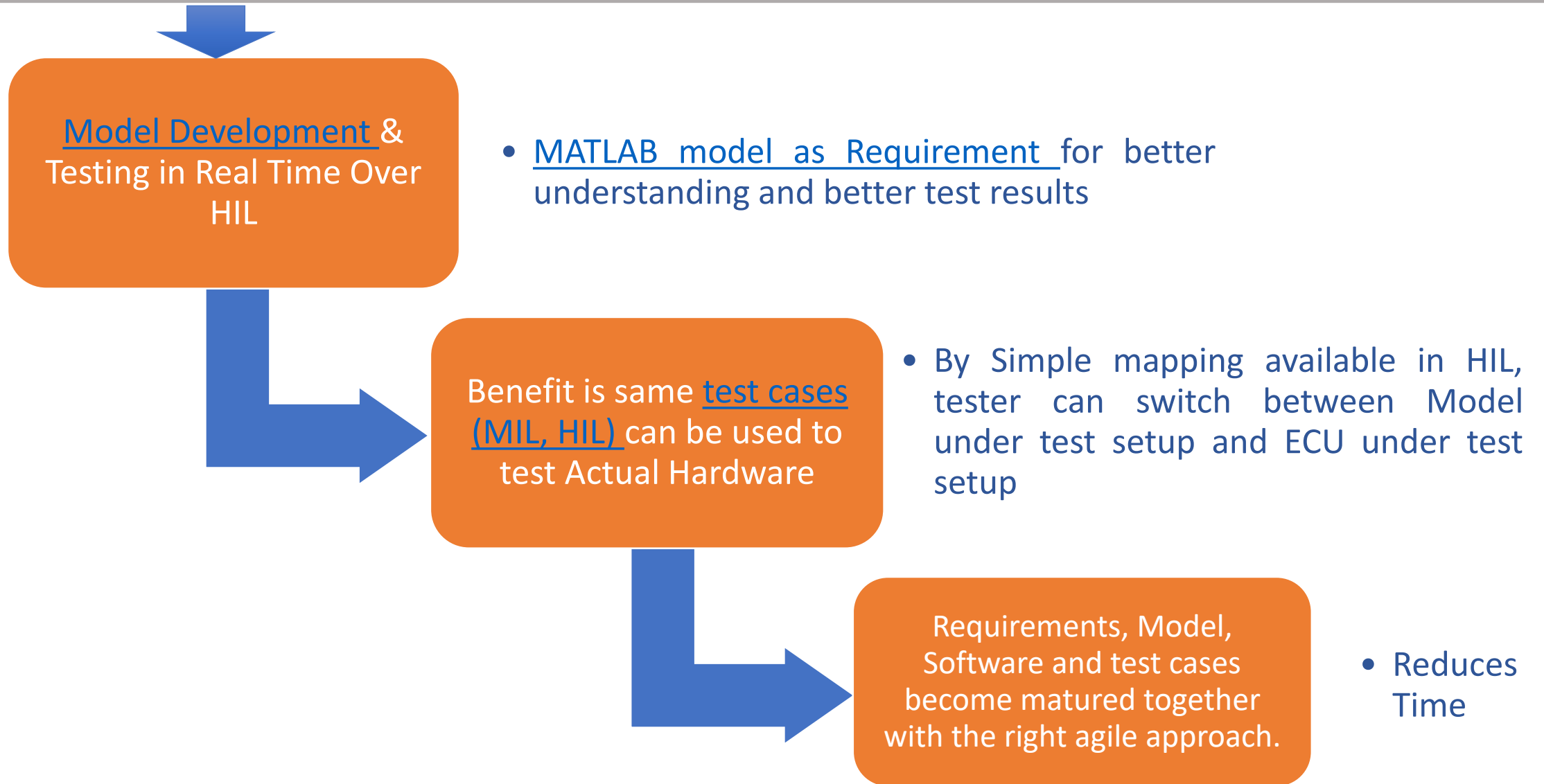


Test Setup with MIL Real Time

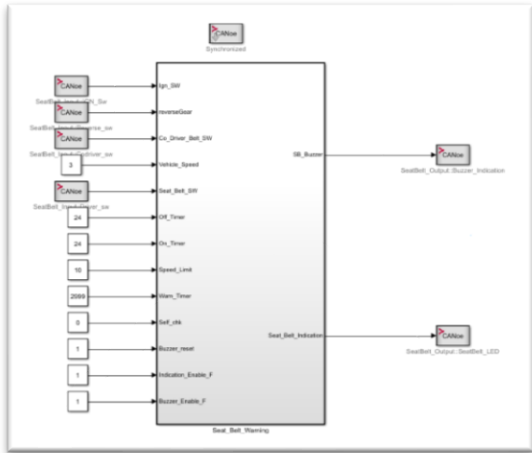
Benefits

- ✓ No actual H/W required to drive the loads.
- ✓ Closed loop testing with actual sensor and load feedback.
- ✓ Model Developer need not to wait for Software Integrator.
- ✓ Co-development of Model and Test cases.
- ✓ Model and Signals can be traced/logged.
- ✓ Minimal change in HIL Setup and test cases with each iteration.

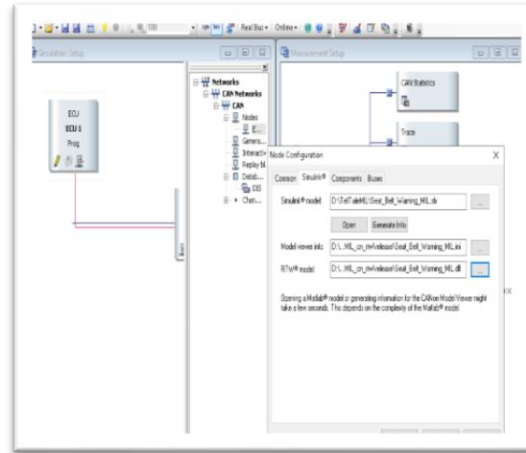
MIL with HIL System



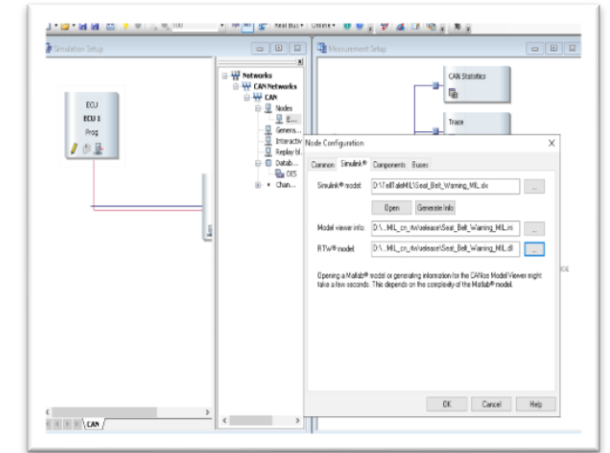
Work Flow for MIL in Test-Driven Development



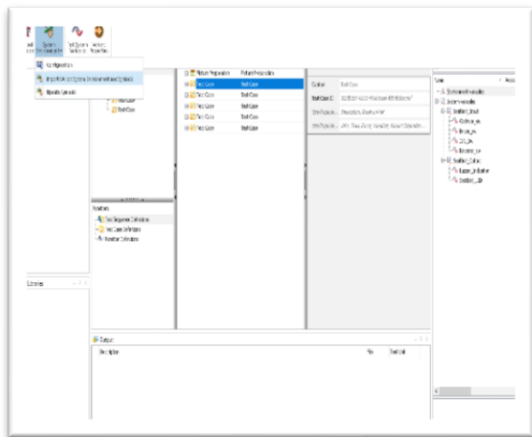
Create model & map to signals/system variables



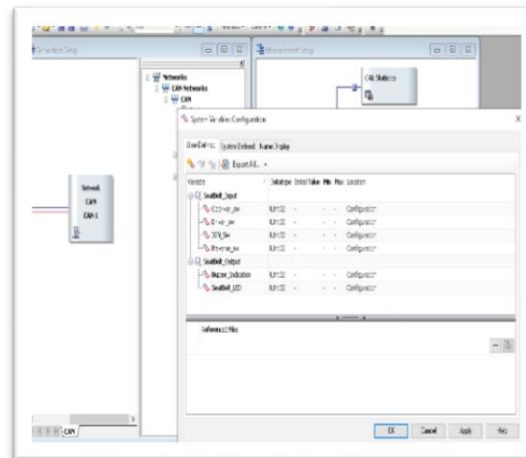
Create Configuration in test environment



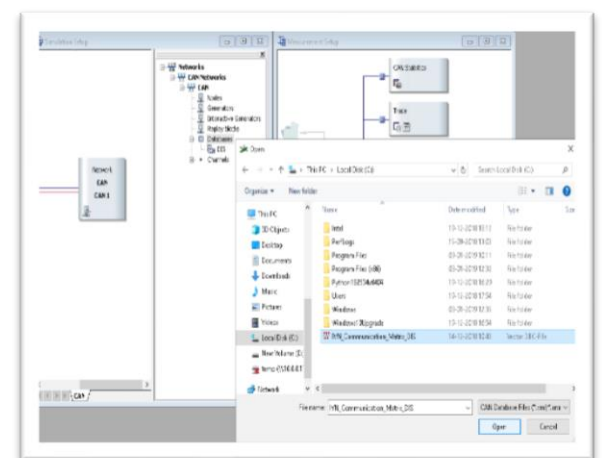
Build model for Test Environment & Load



Run model & test Cases in the test env

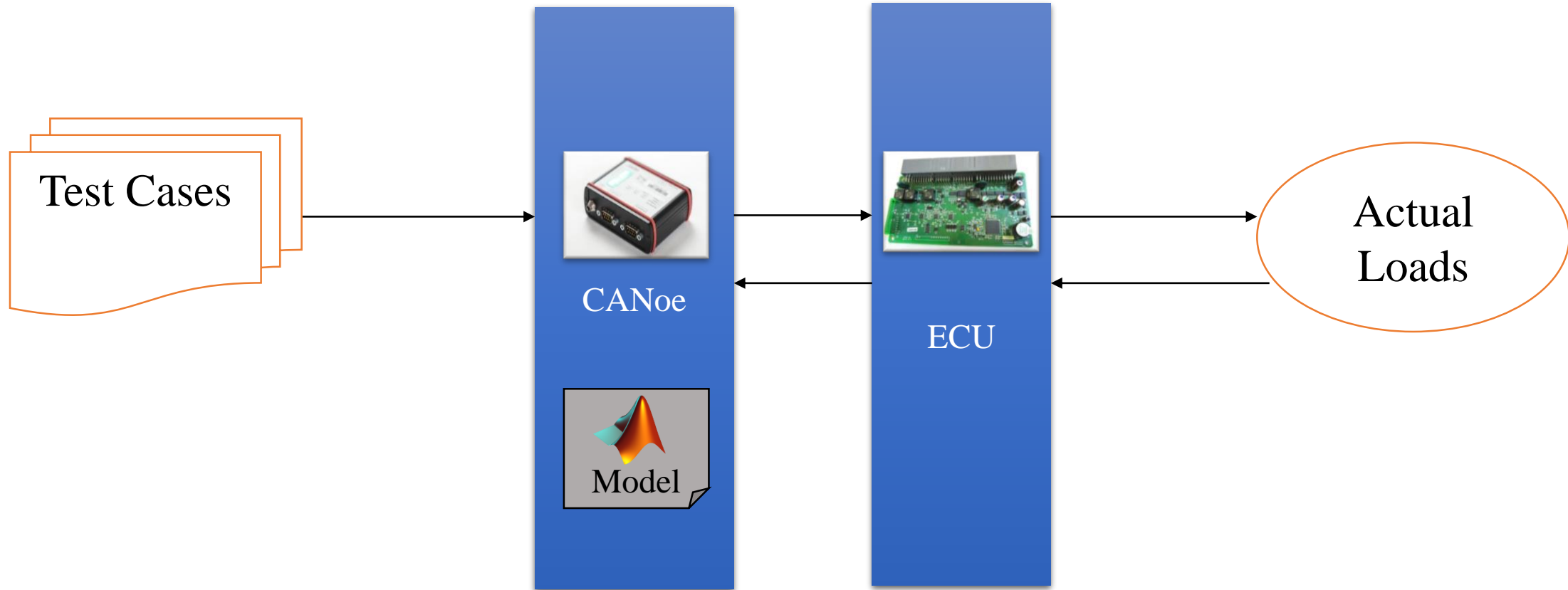


Map System Variables with model & H/W IOs

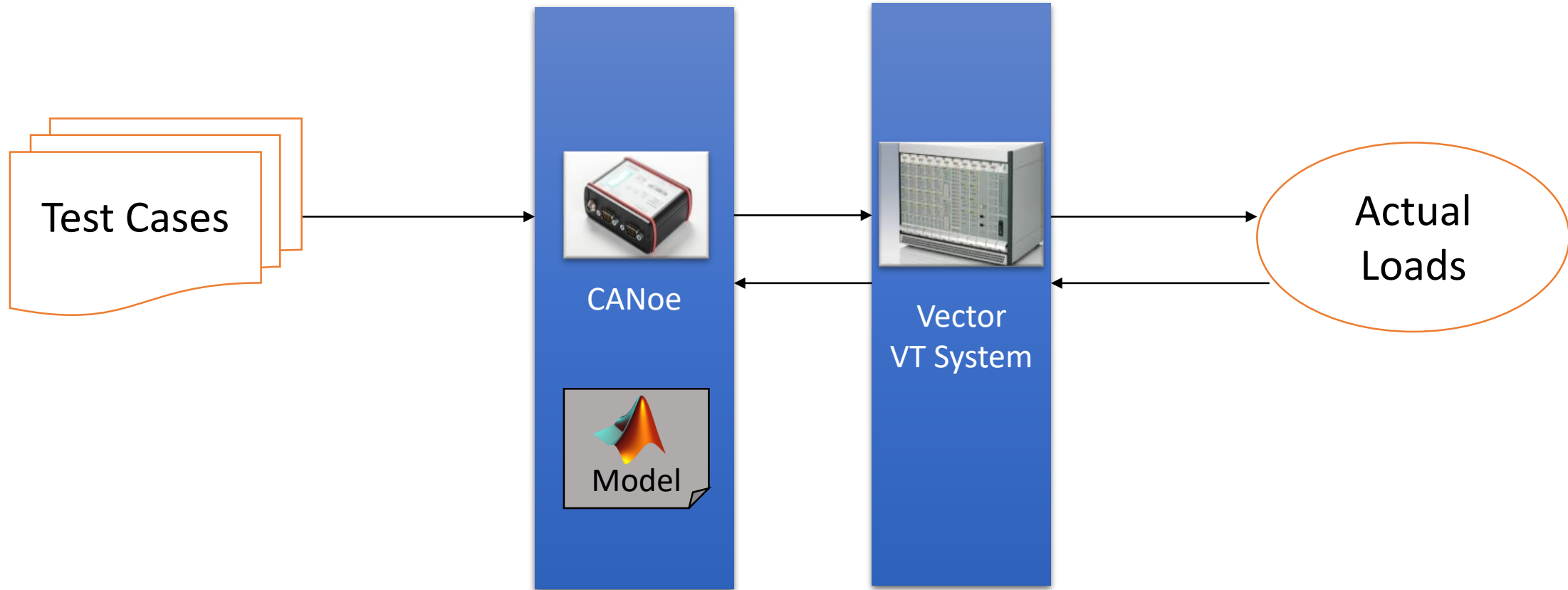


Load CAN database in Test Environment

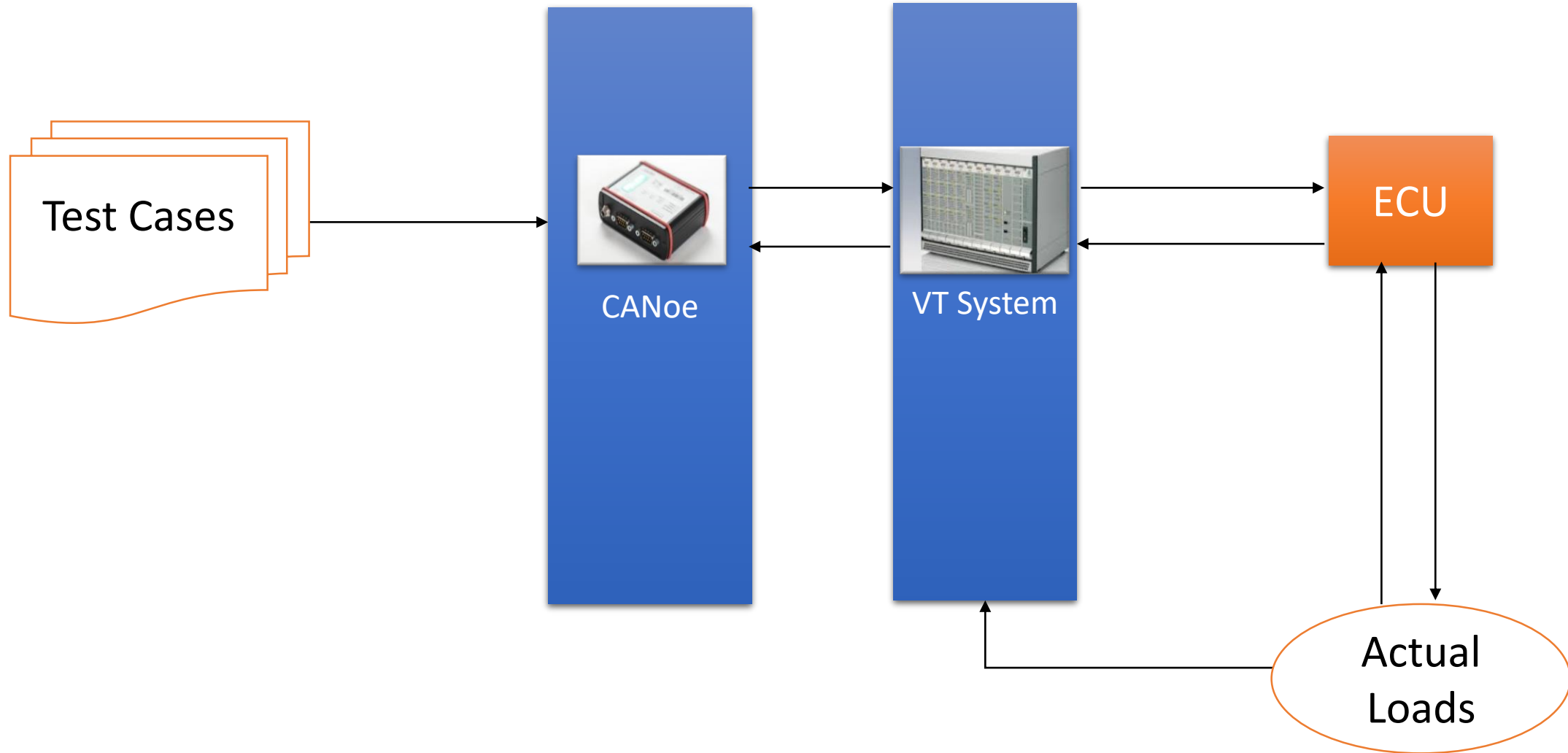
MIL with ECU Hardware System - Testing Flow Diagram



MIL with HIL System - Testing Flow Diagram



Production Ready HIL Setup - Testing Flow Diagram

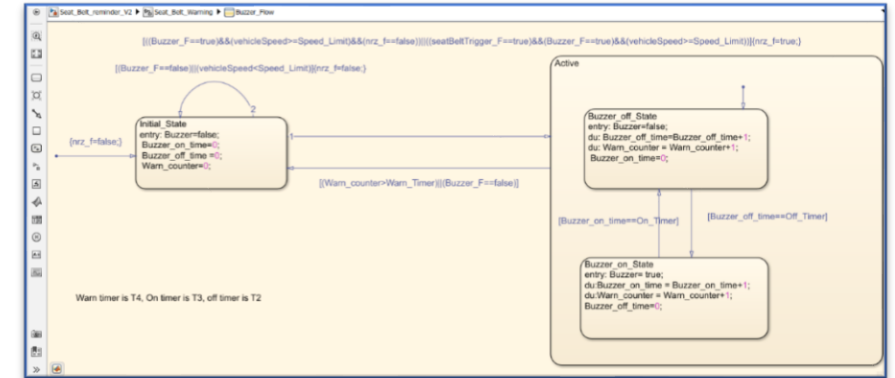


Tools Required

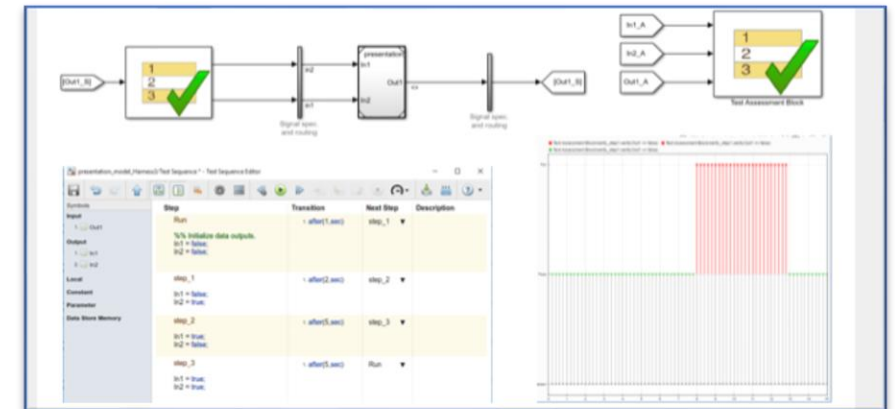


Application Design
Through Model
Based Approach

Design - Simulink/State-Flow



Simulation & Test - Design
Verifier/Simulink test



Tools Required



Application Design
Through Model
Based Approach

Code Generation – Embedded
Coder/AutoSAR Tool Box

Change Management- Integrated
Version Control-Git

Contents

- Summary
- Subsystem Report
- Code Interface Report
- Traceability Report
- Static Code Metrics Report
- Code Replacements Report

Generated Code

- [-] Model files
 - AIS145_V3.c
 - AIS145_V3.h
 - AIS145_V3_private.h
 - AIS145_V3_types.h
- [-] Data files
 - AIS145_V3_data.c
- [+] Utility files (1)
- [+] Interface files (4)
- [+] RTE files (5)

Code Generation Report for 'AIS145_V3'

Model Information

Author	NukuSehgal
Last Modified By	NukuSehgal
Model Version	1.18
Tasking Mode	SingleTasking

Configuration settings at time of code generation

Code Information

System Target File	autosar.tlc
Hardware Device Type	NXP->Cortex-M3
Simulink Coder Version	8.13 (R2017b) 24-Jul-2017
Timestamp of Generated Source Code	Thu Nov 29 23:59:06 2018
Location of Generated Source Code	D:\MATLAB\Srishri\TejTale\AIS145_V3_autosar_rtw\
Type of Build	Model
Objectives Specified	Execution efficiency, RAM efficiency, ROM efficiency, MISRA C

Additional Information

Code Generation Advisor	N
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```
enum class ZoneDetection : Simulink.IntEnumType
{
    ZONE_1 (1)
    ZONE_2 (2)
    ZONE_3 (3)
    ZONE_4 (4)
    ZONE_5 (5)
};

methods (Static = true)
```

Details

- Sandbox: D:\Matlab Workspace\Ford_Motor\MATLAB\Ford_RSCM_Software_Design_Repo
- Source control integration: Git
- Repository path: \\10.0.0.17\temp\jagtedra\Ford_RSCM\Git_Repository\
- Git information: Current branch: master, Branch status: Normal, Coincident with /origin/master

Summary

➔ Requirement of less time to deliver and huge feature set for ECUs are challenging in traditional ECU development approach.



➔ Re-using test cases used in MIL testing with actual ECU with less or no efforts in test case change further saves time to deliver and reduces number of iterations.

Interface Microsystems

341 ~ 342, Udyog Vihar, Phase -2, Gurgaon – 122 016, Haryana, India

Tel: +91 124 4736950, Fax: +91 124 4736951

Email: marketing@interfaceauto.com

Website: www.interfaceauto.com

