

Advanced Techniques for Model Based Design Using Veristand

Colin Freeman & Hanspeter Tang

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SYSTEMS AND ENGINEERING TECHNOLOGY



Model Based Design plays a key role in the modern systems engineering life cycle by reducing both development time and costs.

Explore the benefits of using Veristand with industry-standard modelling tools (The Mathworks, Inc. Simulink®, SCADE, LabVIEW) to implement a safety-critical control system using Model Based Design.



Powerful Out-of-the-Box Real-Time Testing Software!

Veristand is a software tool for performing real-time testing applications more efficiently



Veristand helps you get your hardware-in-the-loop or test cell control and monitoring system up and running quickly.

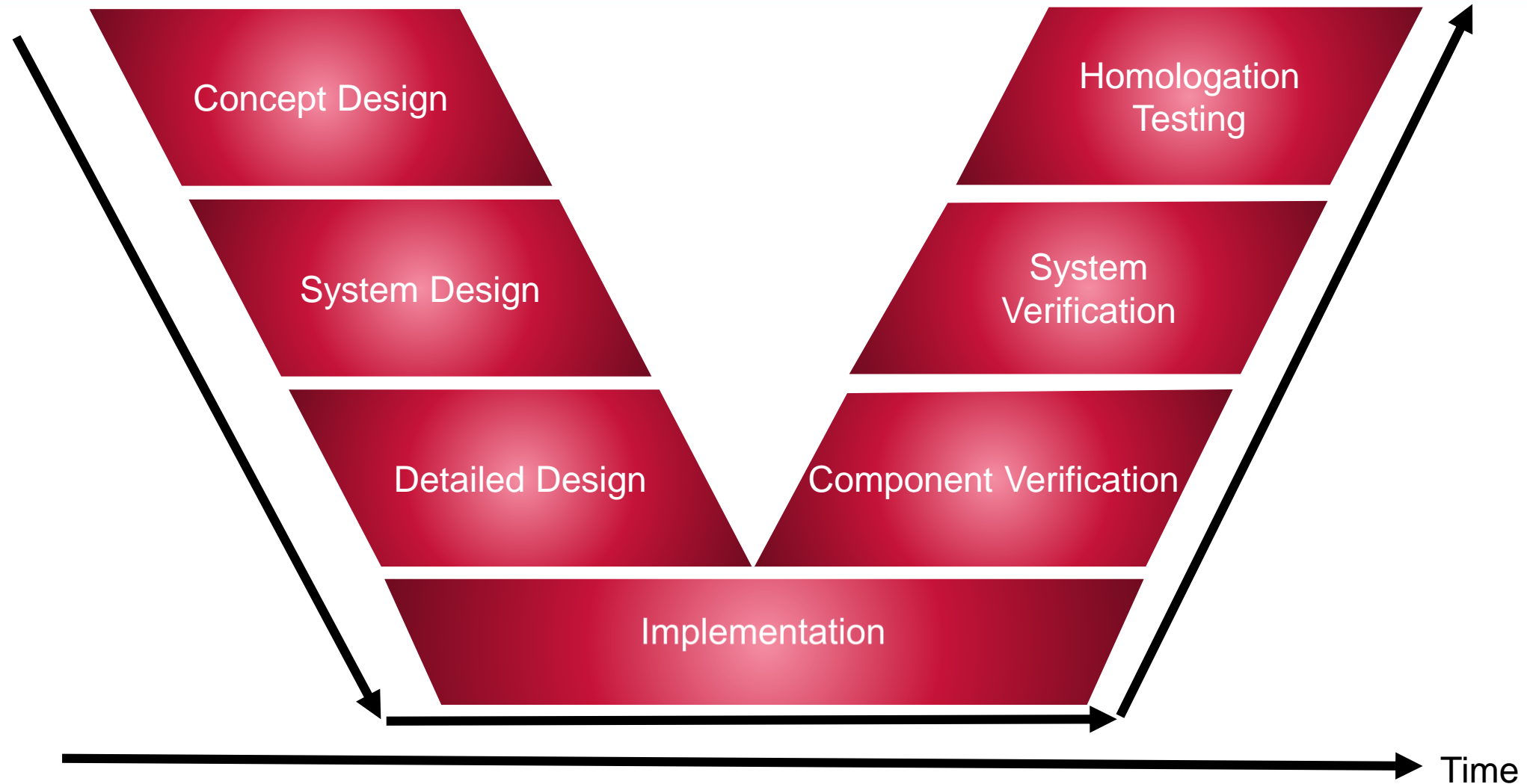
With a wide range of out-of-the-box functionality that includes configurable data acquisition and logging, test sequencing, and simulation model integration....



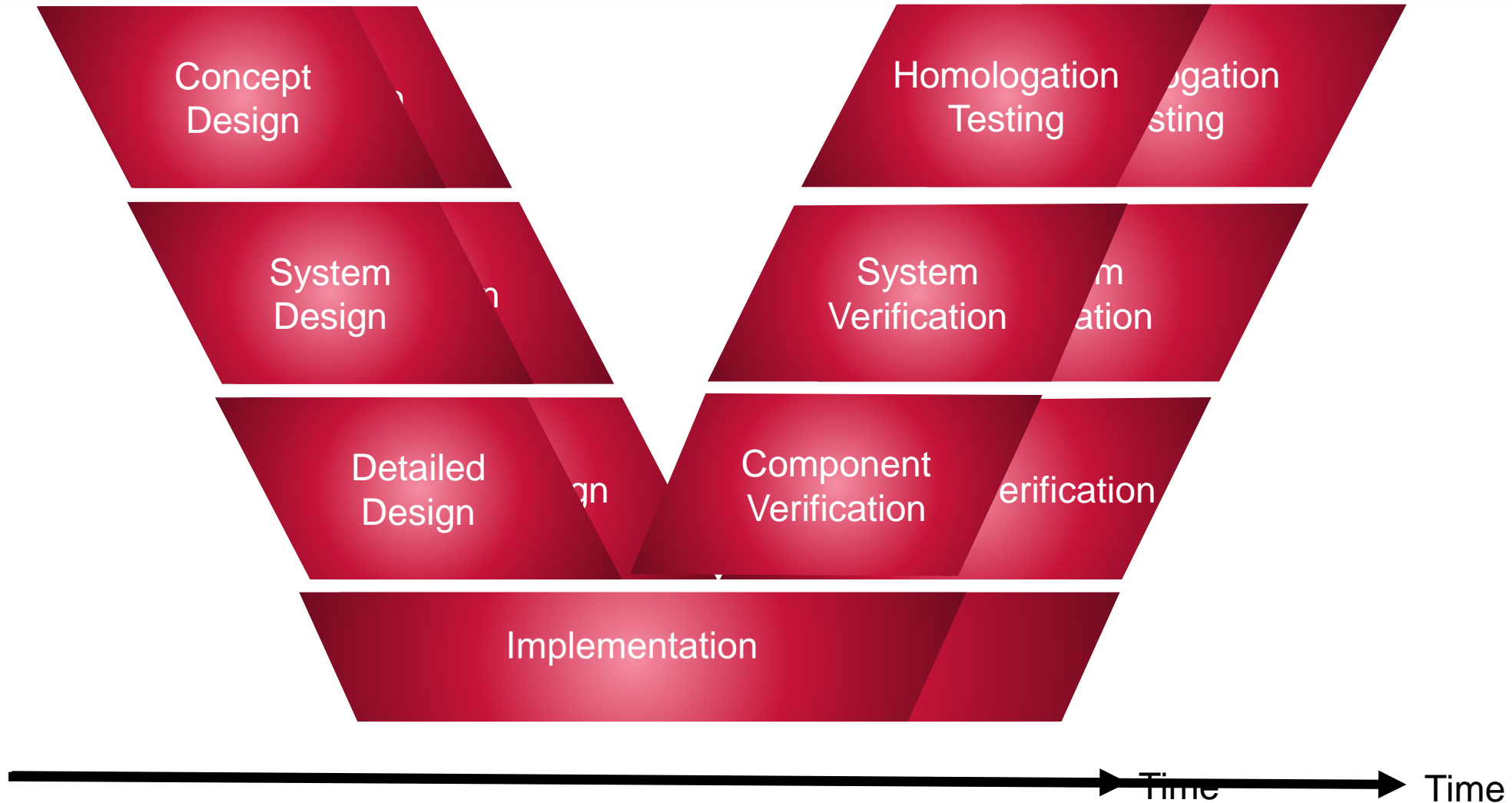
Veristand reduces the time needed to test your products. You can also use a variety of software tools to add custom functionality to Veristand, which makes it flexible enough to adapt to even the most complex applications.

Choosing Veristand gives you the confidence that your test system will perform reliably while providing the flexibility you need to meet your real-time test requirements

Systems Engineering Life Cycle



Systems Engineering Life Cycle

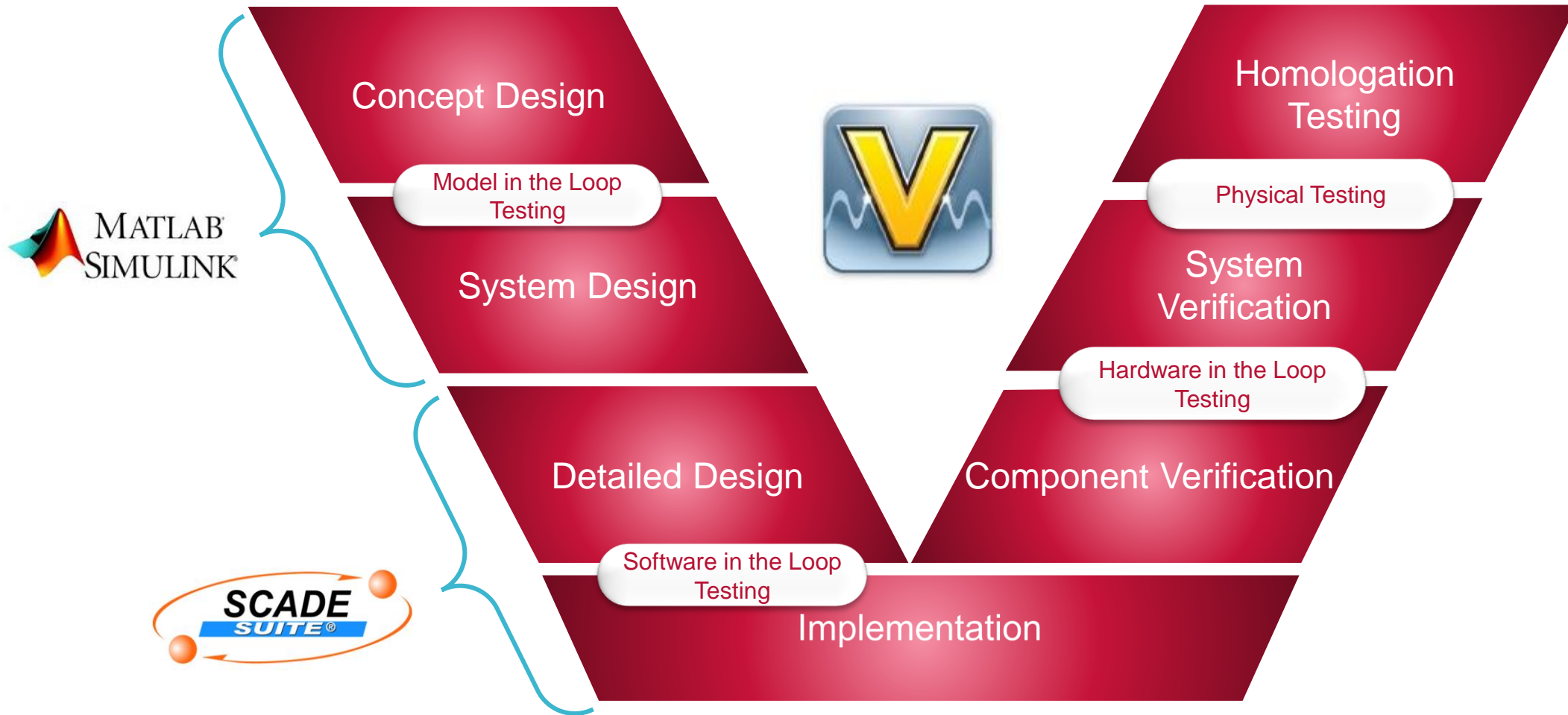


The Process

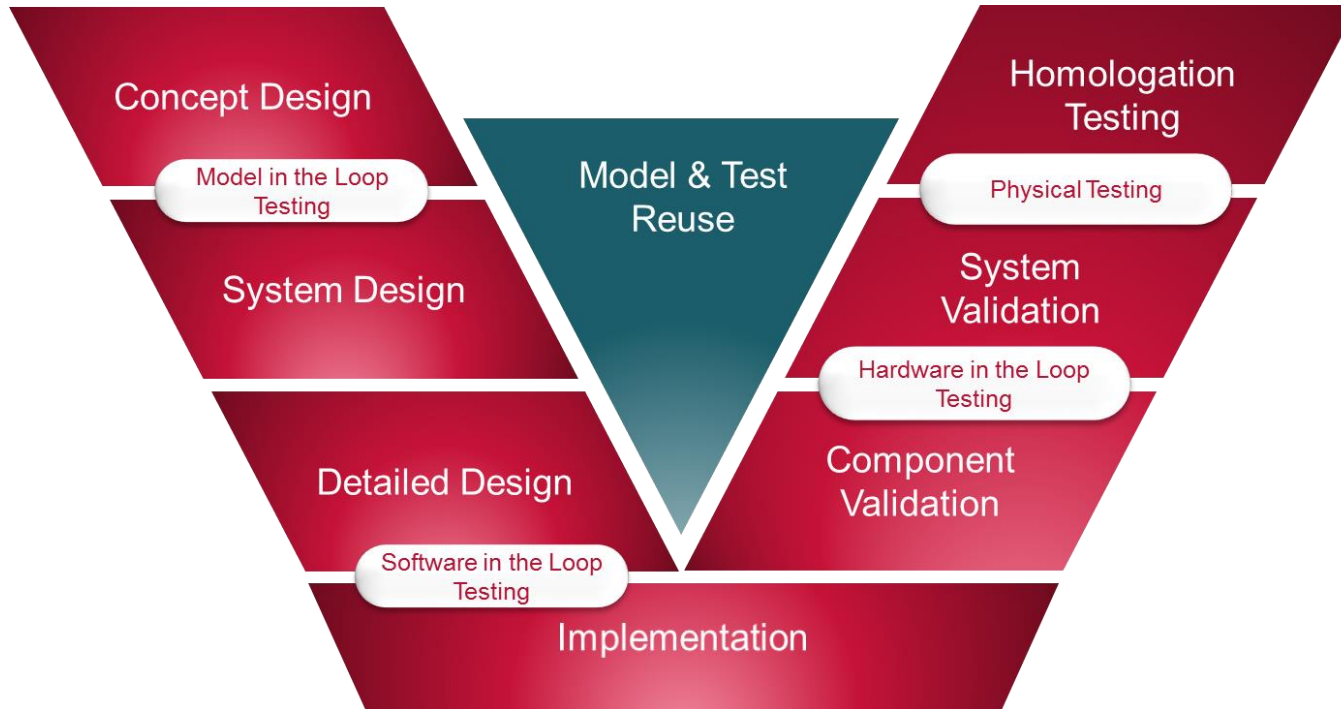
Challenges



- ▶ What do we want from our ideal process?
 - ▶ Shortest possible time to market
 - ▶ High quality product
 - ▶ Lowest possible cost
- ▶
 - ▶ Lowest Risk - Fewest possible faults and rework



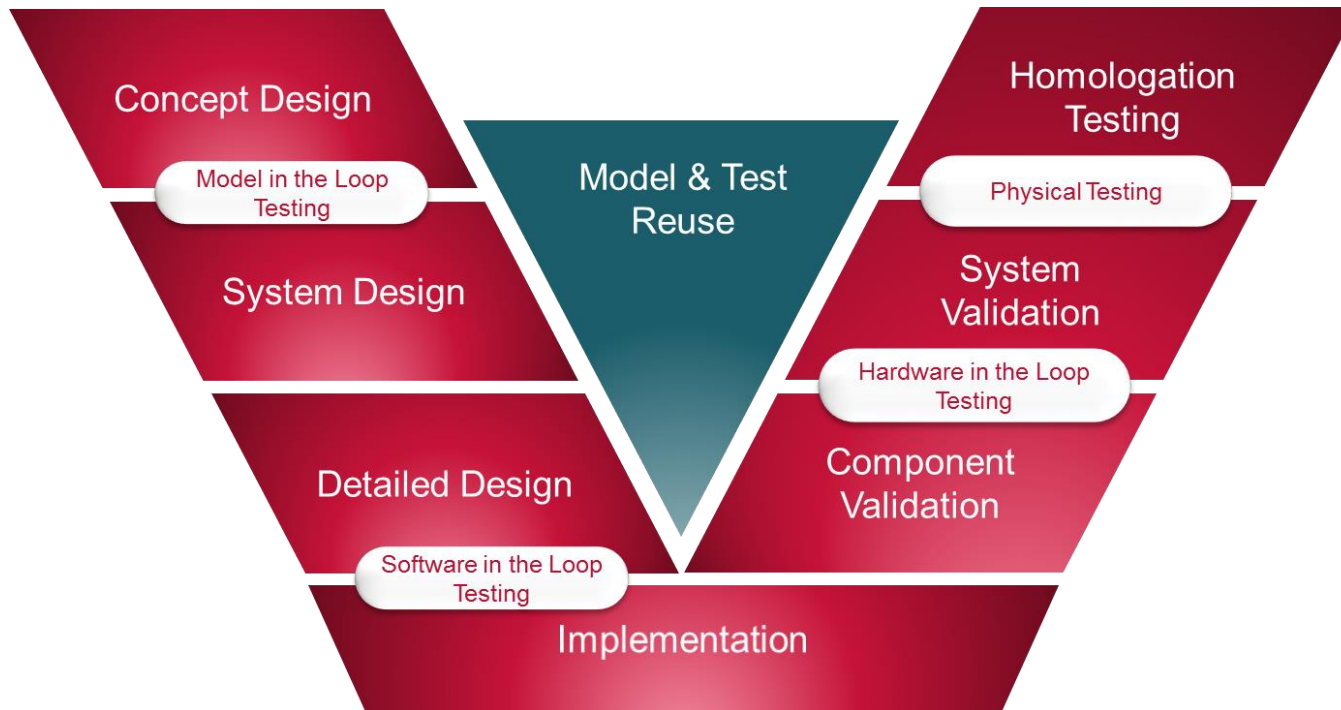
Systems 'V' Lifecycle – Artefact Reuse



Reusable Artefacts

- Models
 - Controller Simulink model as test oracle
 - Plant models to support test throughout lifecycle
- Test scenarios generated from MiL Testing
 - Use in SCADE Test
 - SiL testing
 - HiL testing
- Expected test results
 - Dynamically by using a test oracle
 - Reuse MiL test results

Systems 'V' Lifecycle – Artefact Reuse



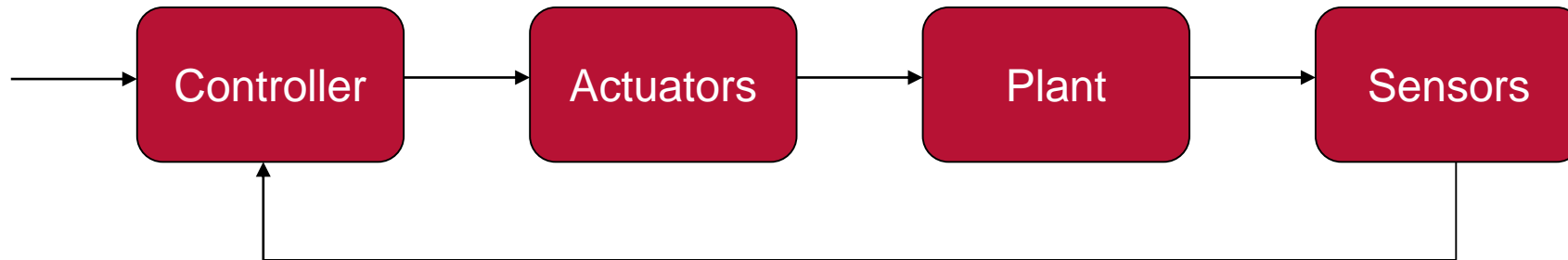
Benefits

- Expected behaviour to test against from very early in the process
- Requirements validation and verifiability assessment
- Earlier detection of errors
- Reuse of artefacts reduces development cost and timescales
- Rework of tests due to requirement change is reduced as many artefacts are common across phases

How To Achieve This?

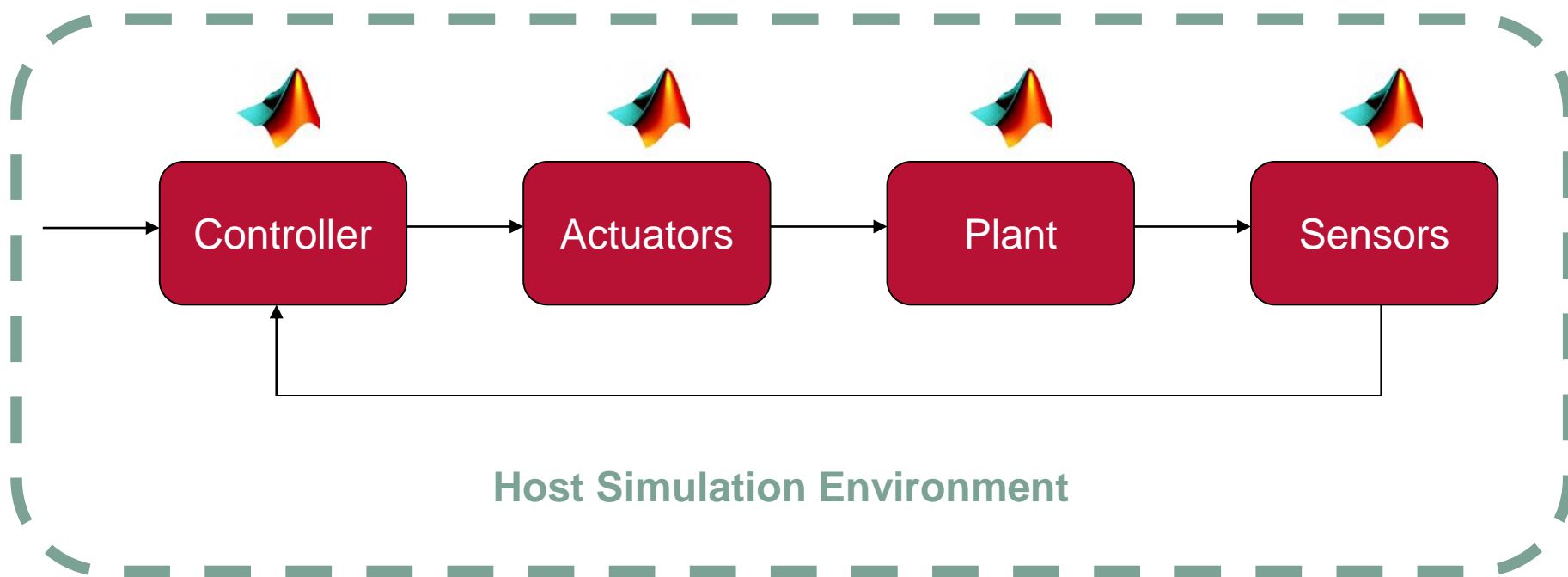
- ▶ Modular model architecture
- ▶ A flexible hardware and software platform for real time test
 - ▶ Support a variety of modelling toolsets
 - ▶ Wide range of hardware to support processing and I/O needs
 - ▶ Allow the changing of configurations easily

Modular Model Architecture



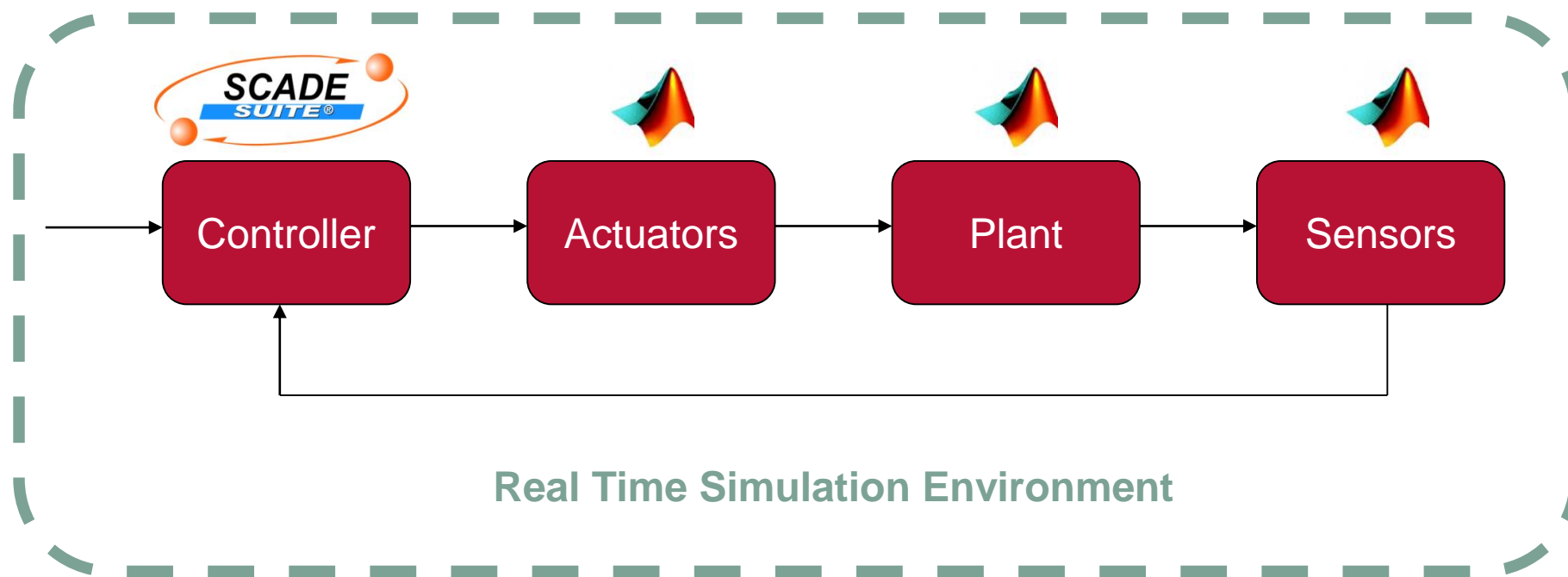
Modular Model Architecture

Model in the Loop



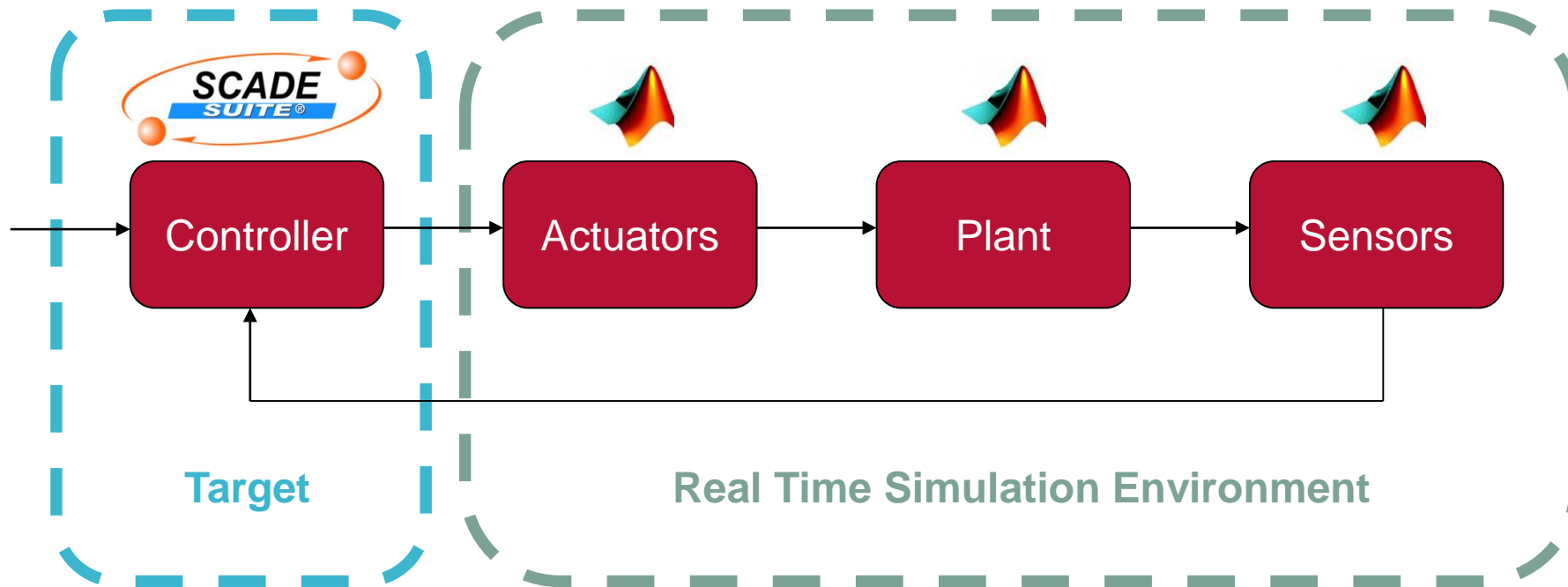
Modular Model Architecture

Software in the Loop



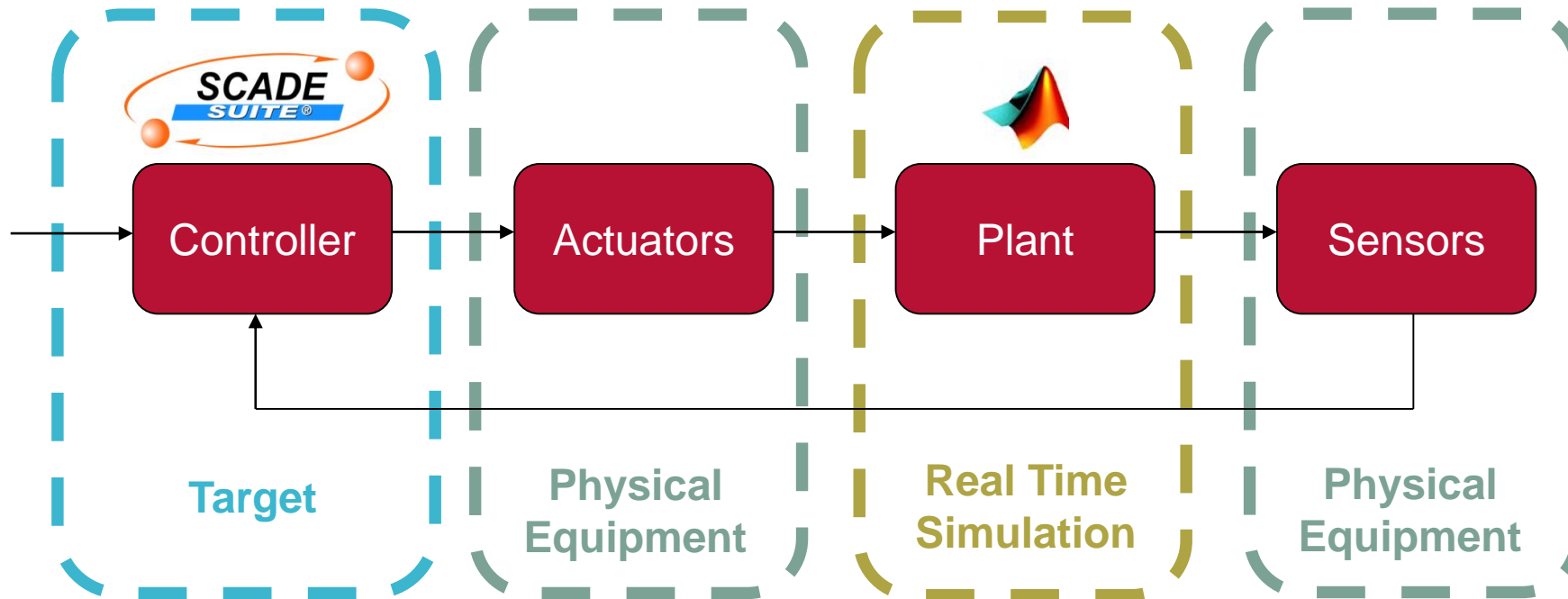
Modular Model Architecture

Hardware in the Loop



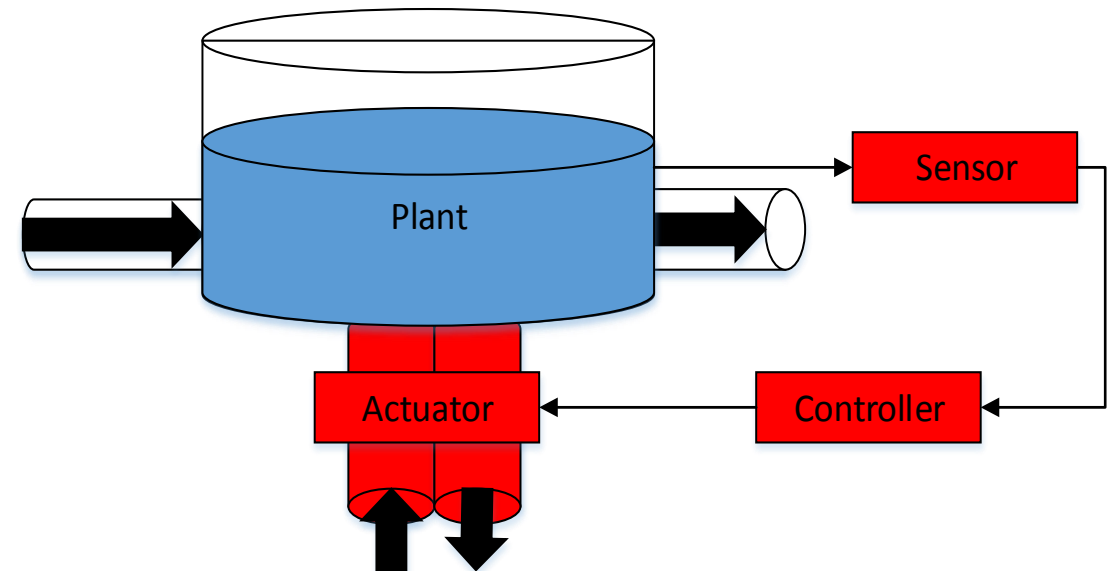
Modular Model Architecture

Physical Testing



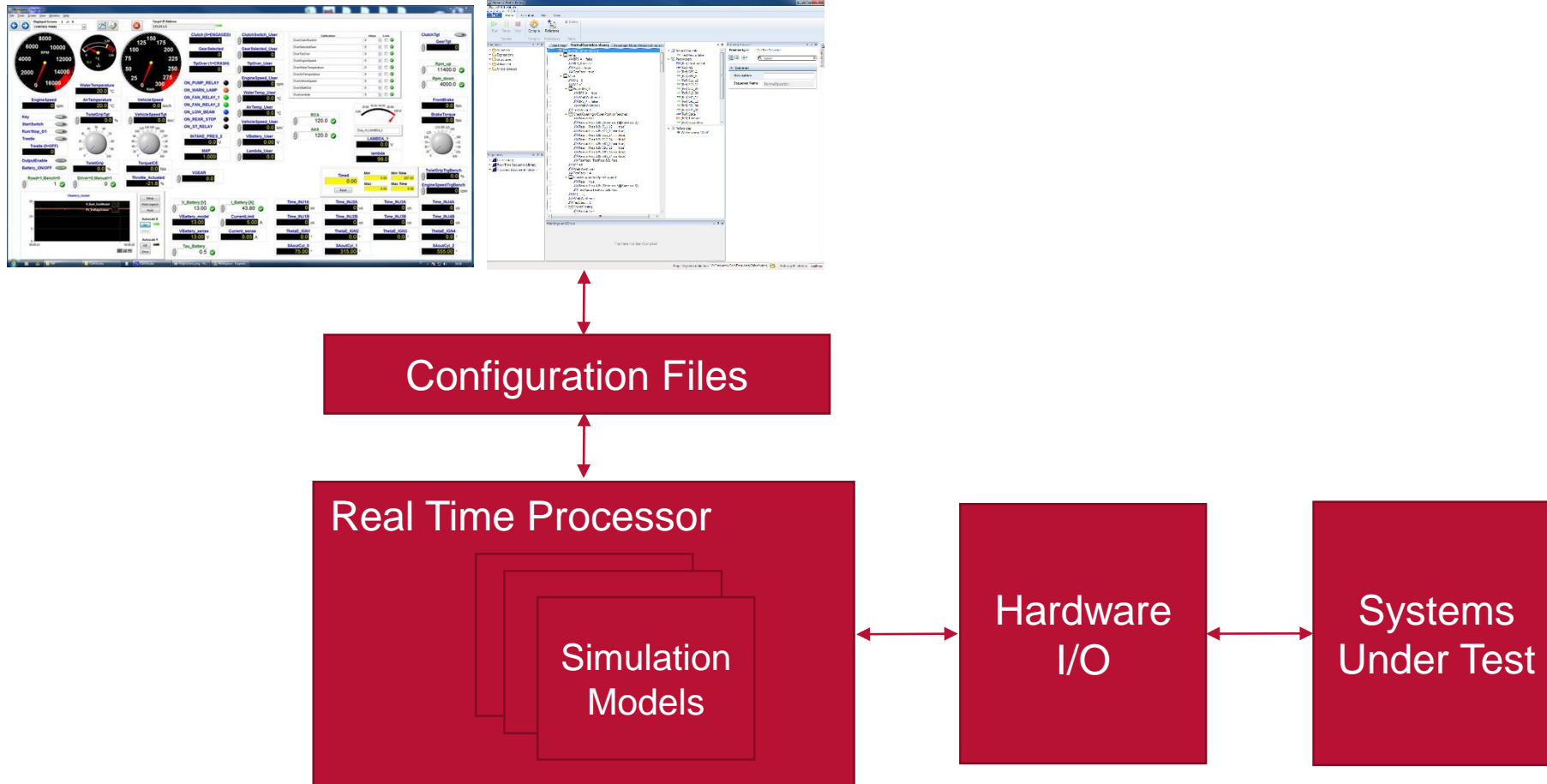
SCADE and NI Platform Integration Demo

- ▶ Create a system to automatically control tank pressure
- ▶ Test plan created from requirements
- ▶ Use NI VeriStand to manage testing environment
- ▶ NI hardware providing I/O
- ▶ SCADE for controller software development
- ▶ Controller deployed on Frazer-Nash prototype hardware



- ▶ VeriStand is a software environment for configuring real-time test applications
- ▶ Import control algorithms, simulation models and other software from NI LabVIEW, Simulink, SCADE and other third-party environments
- ▶ Interaction of multiple models from different development environments
- ▶ Sequence engine provides a means of automated test and model validation
- ▶ Allows the real time deployment of models which can be configured to interact with representative IO (analogue, digital, databus, custom protocols and hardware standards)
- ▶ Distributed IO and expandable architecture

National Instruments Platform



Test Continuity Through Test Component Reuse

Model in the Loop	Software in the Loop	Hardware in the Loop	Physical Testing
System (Simulink)	System (Simulink)	System (Simulink)	System
Controller (Simulink)	Controller (SCADE)	Controller (SCADE)	Controller (SCADE)
Test Components	Test Components	Test Components	Test Components

NI
VeriStand

Key

Host Sim

Real Time Sim

Real

User Interface
Stimulus
Analysis
Reports
Requirements

NI Platform Scalability – Train Zero



Technological Innovation
Winner 2014

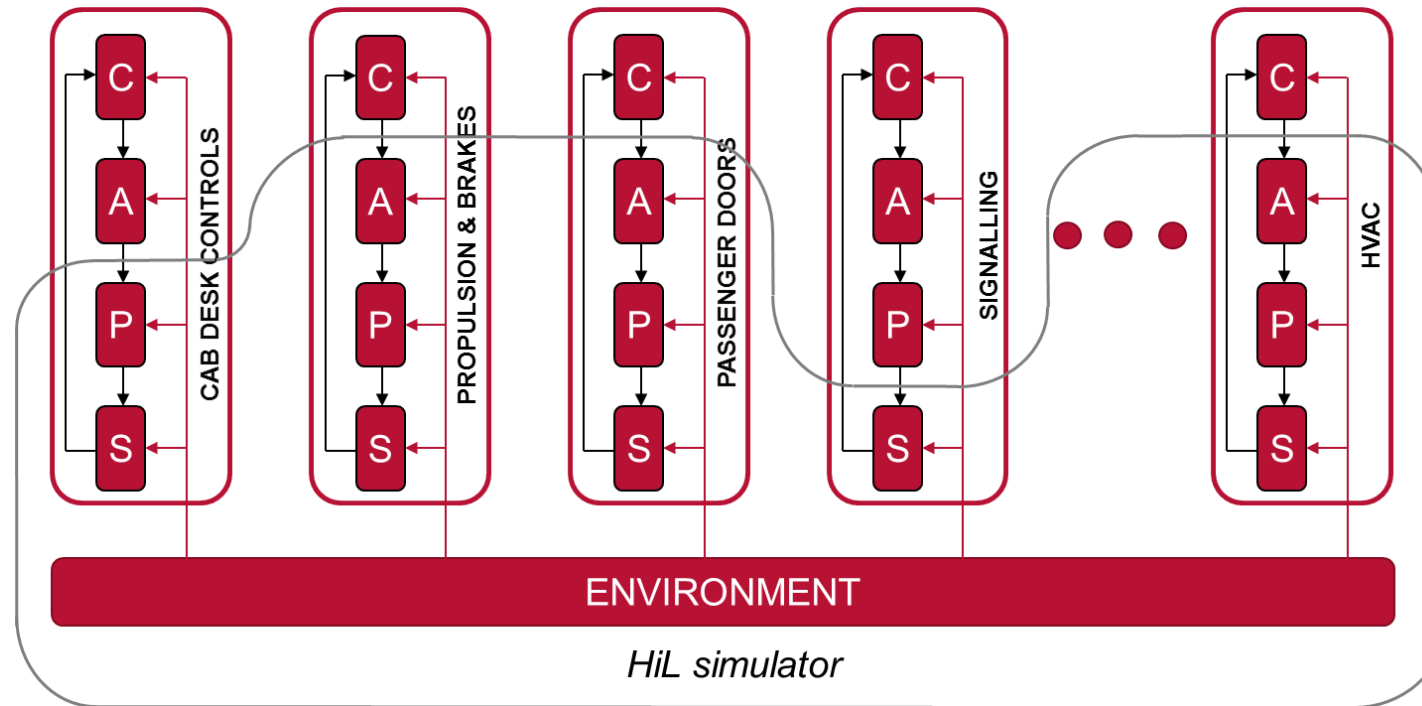
NI Engineering Impact Awards

WINNER

Electronic Test & Measurement

Bombardier - Train Zero Model Based Design Facility

NI Platform Scalability – Train Zero



- ▶ Supports a staged approach to integration so can begin sooner
- ▶ Allows integration and testing to begin when some hardware or systems are not available

Summary

- ▶ Apply the model based design philosophy to the whole system lifecycle
- ▶ Reuse the models and tests developed at the concept phase throughout the development lifecycle
- ▶ Use SCADE to develop the safety critical control software
- ▶ Utilise a flexible real time test platform throughout development
- ▶ This leads to:
 - ▶ Earlier error detection
 - ▶ Reduced development cost and time
 - ▶ Maximised return on investment