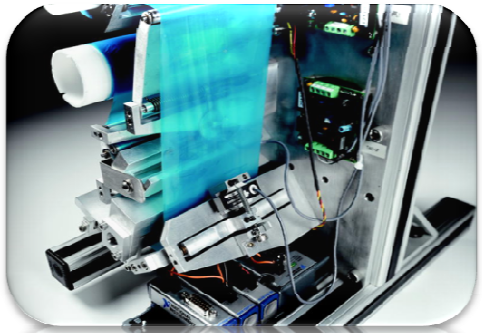
Creating Real-Time Testing Applications with a Configuration Based Testing Platform

Balázs Tóth – National Instruments

Dynamic Systems

Medical Devices



Industrial Machines

Power Generation Systems

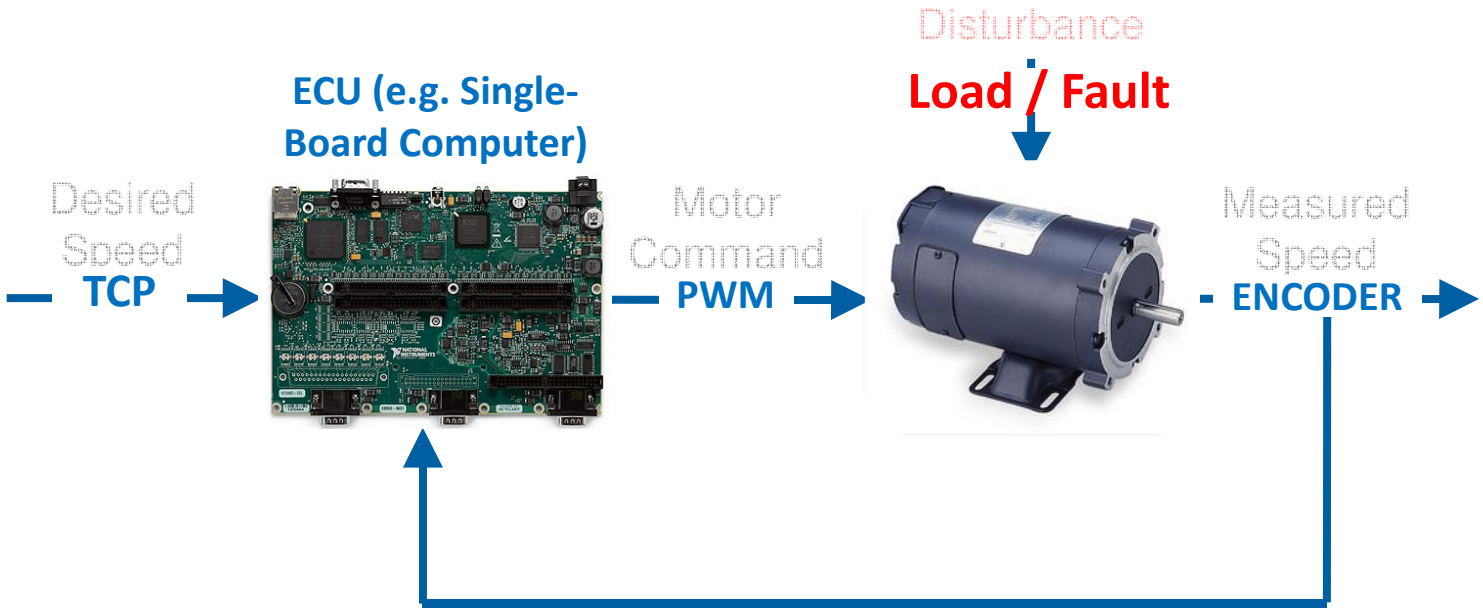
White Goods

Aerospace

Automotive

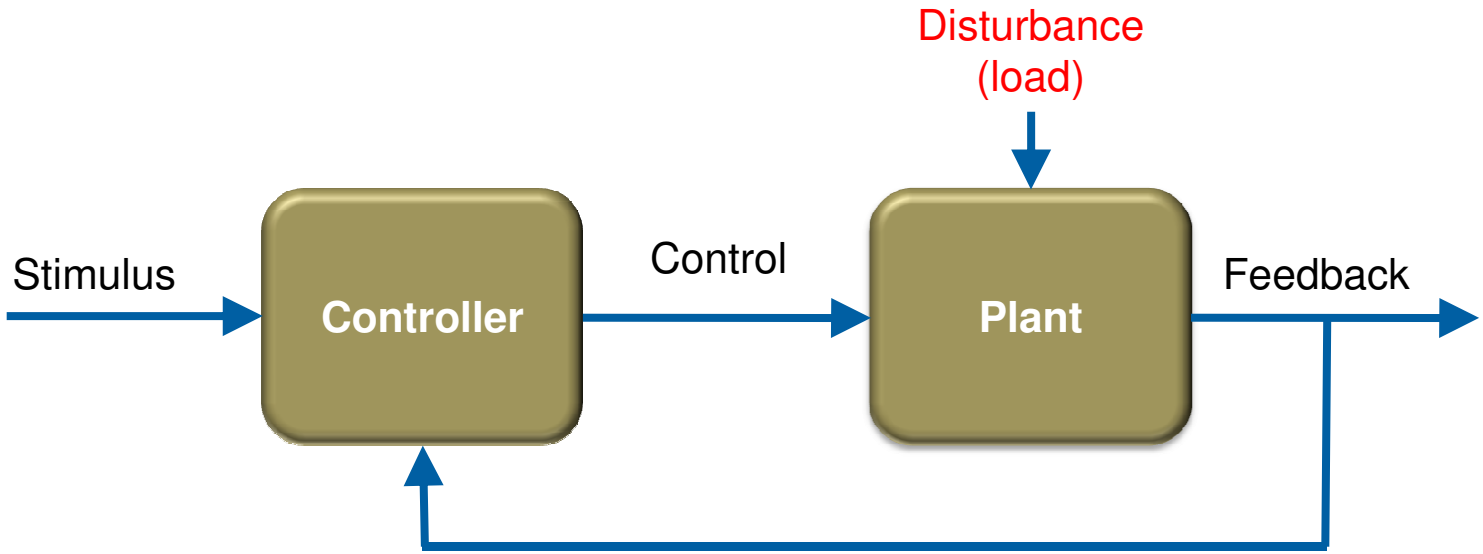
Controlling Dynamic Systems

Closed-Loop Control



Closed-Loop Control — Common Terms

- **Plant** – Device to be controlled
  - Engine, Airplane, Wind Turbine
- **Controller** – Device to control the plant
  - Needs to be developed and tested



Dynamic Systems — Testing Challenges

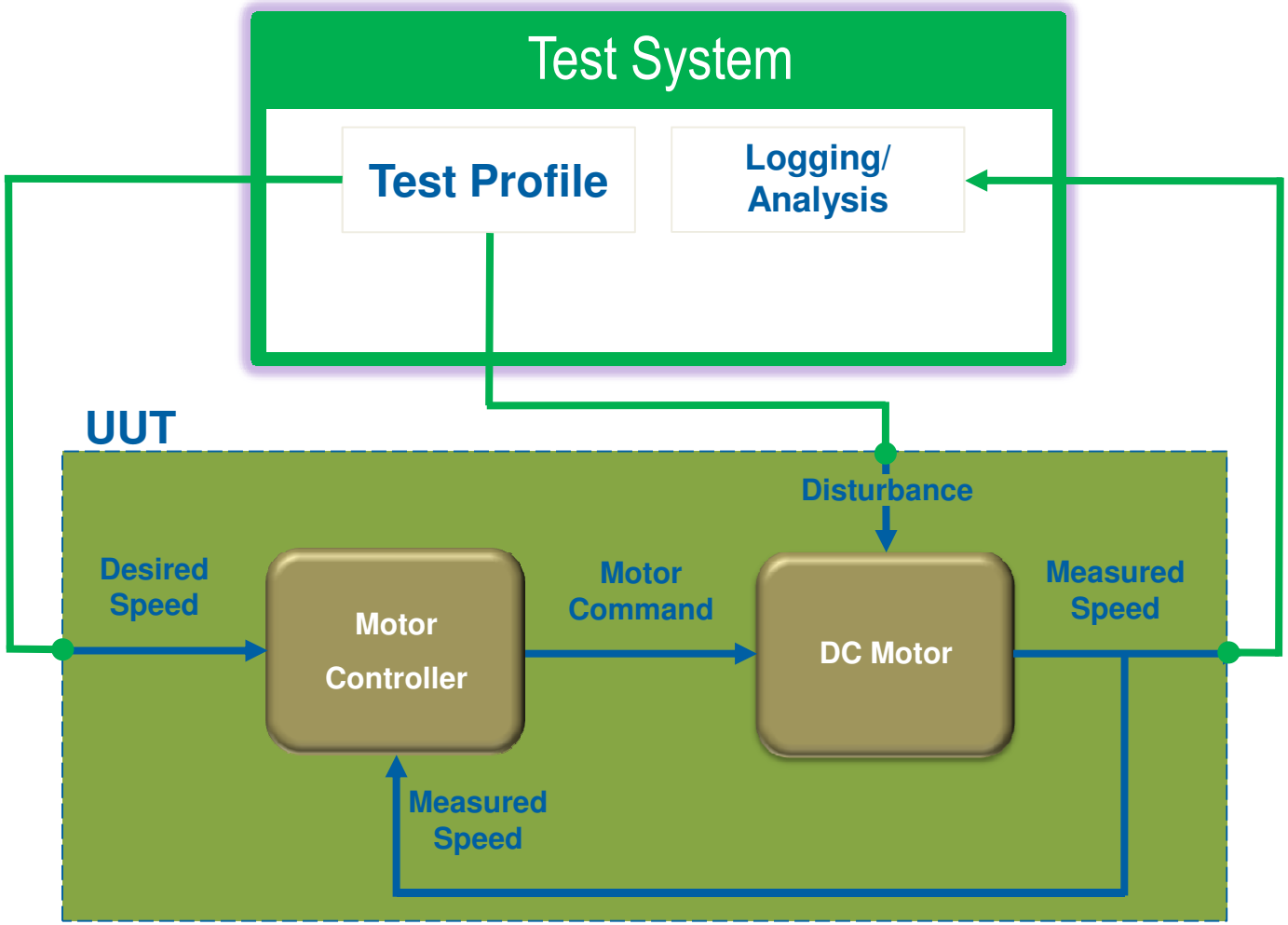
- Increasing application complexity
- Increasing reliability requirements

- Decreasing time-to-market
- Reduce development cost

Are these mutually exclusive?

Testing Dynamic Systems

System Level Testing

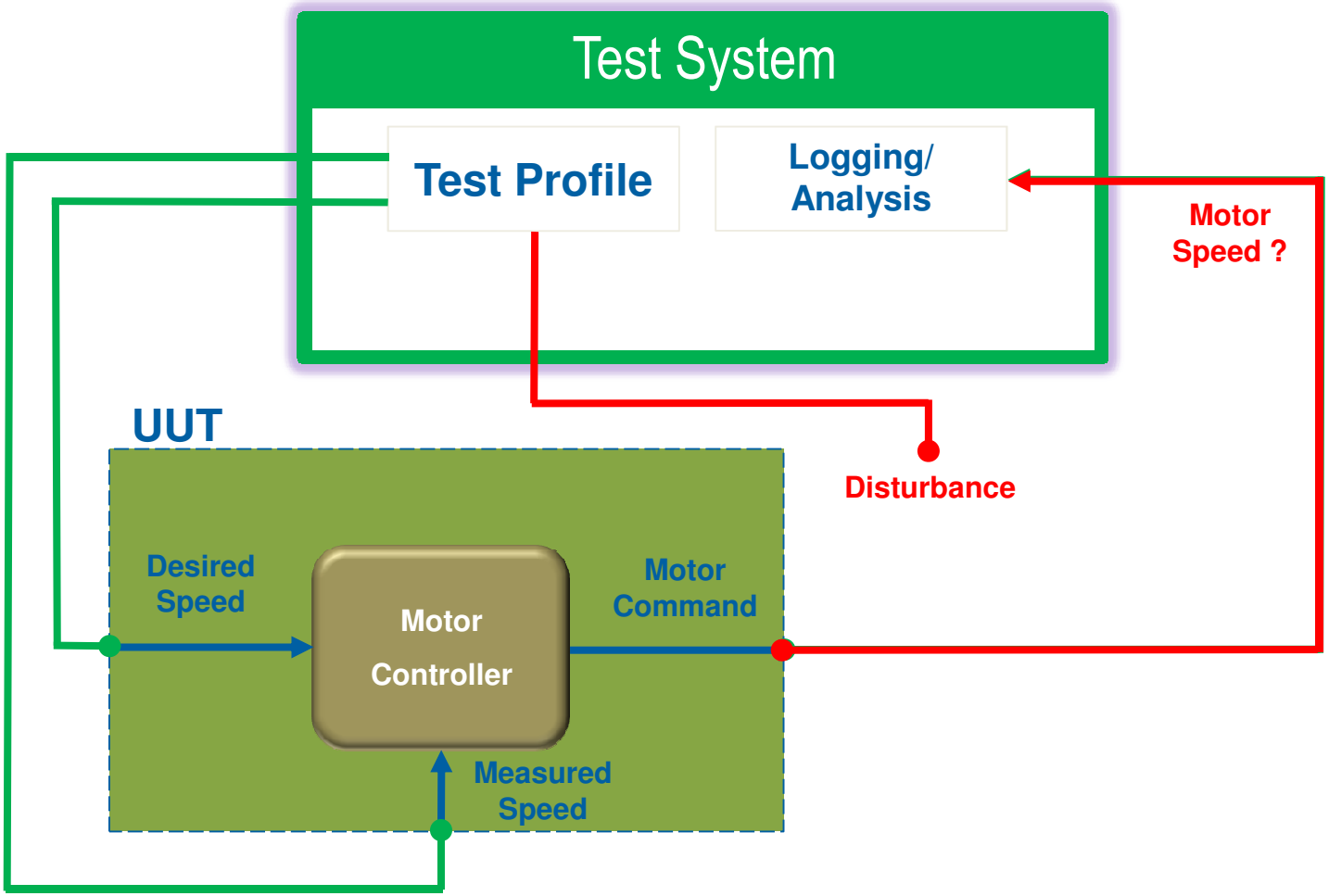


System Level Testing Challenges

- Cost to test (capital, maintenance, facilities)
- Cost of failure
- Availability
- System Variation
- Reproducibility

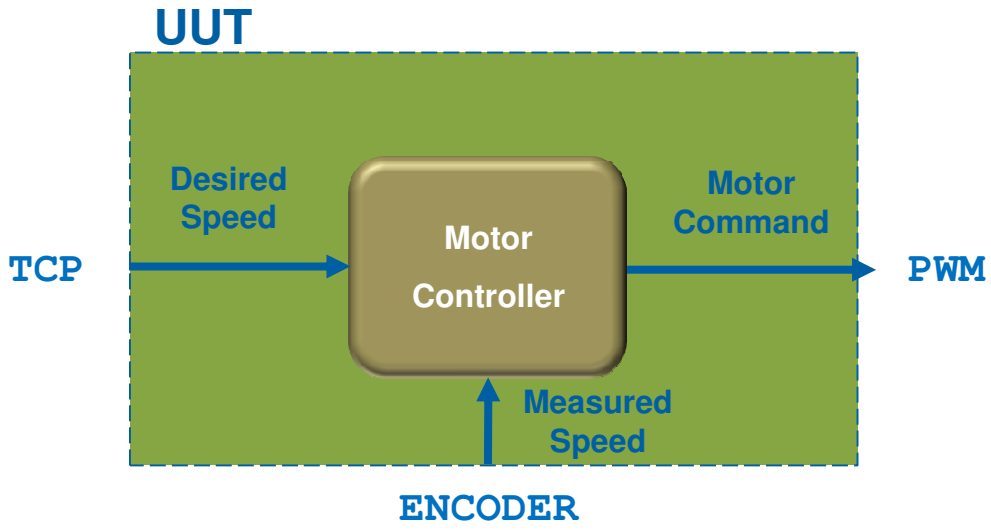
Testing Dynamic Systems

Component Level Testing Challenges



Virtual Reality for your UUT

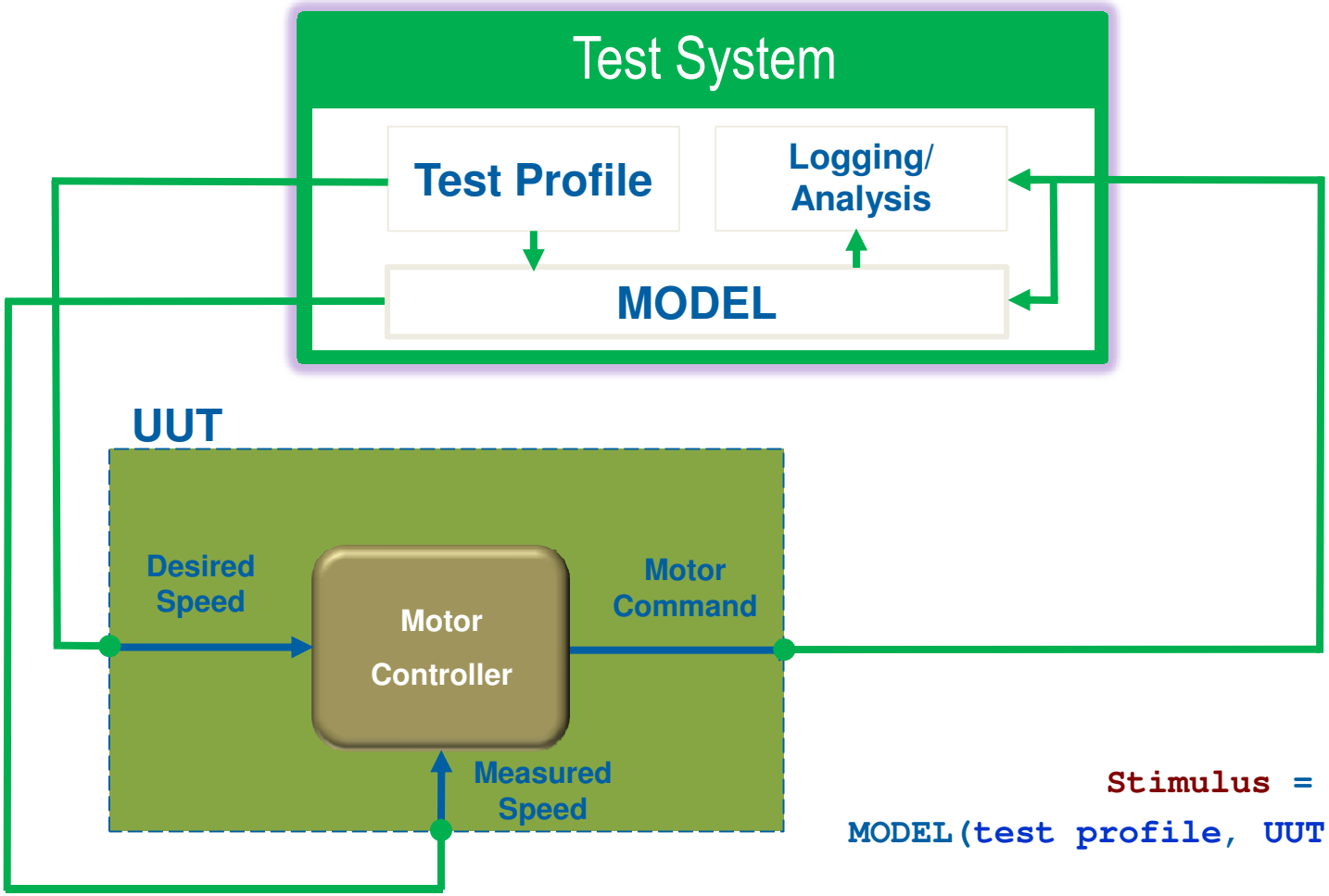
What does your UUT *know* about the world around it?



- Voltage
- Current
- Impedance
- Timing

Testing Dynamic Systems

Virtual System Level Testing

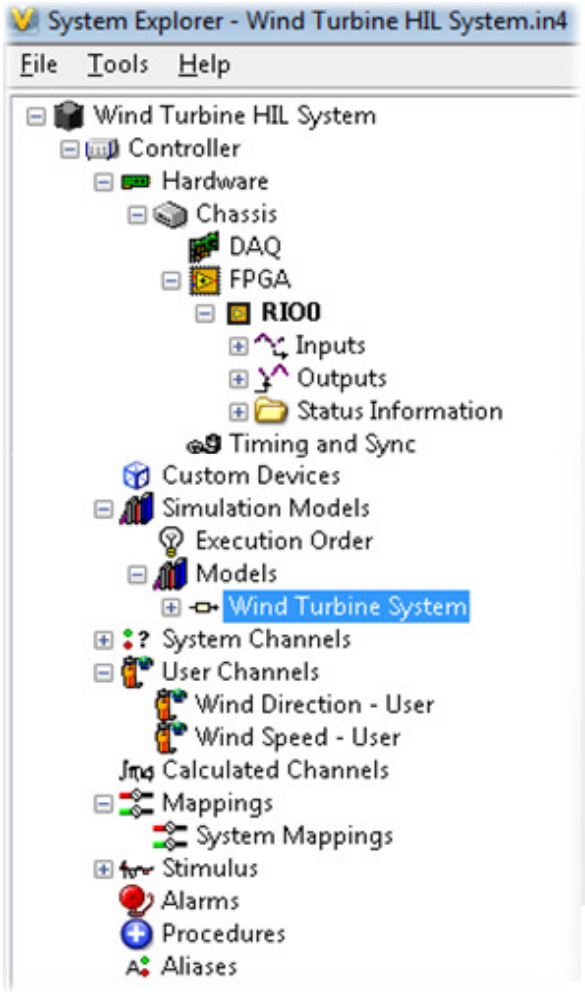



```
Stimulus =
MODEL(test profile, UUT response)
```

Test System Requirements

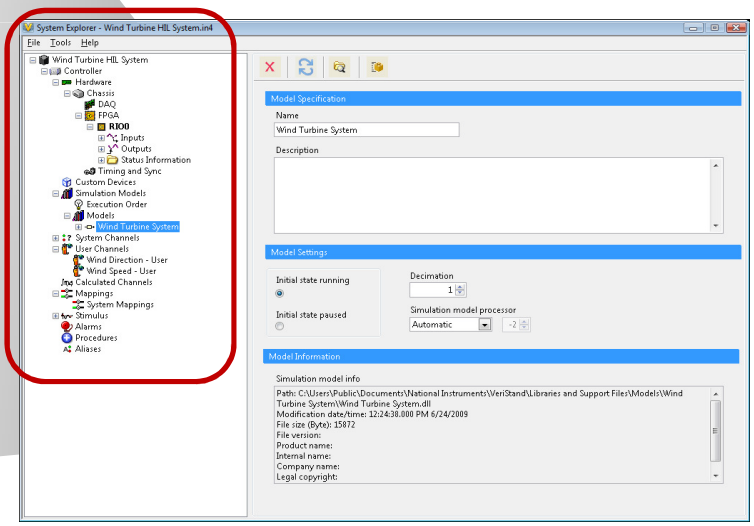
- Run-time Editable User Interface
- User Management
- Scalable
- Open Architecture
- Extendable
- Real-Time Stimulus Generation
- Data Logging in Real-Time
- Configurable I/O
- Closed-Loop Control
- Deterministic Model Execution

NI VeriStand Framework



SYSTEM EXPLORER

Engine Resources
I/O
Model(s)
Calc Ch / User Ch
Resource Mapping
Alarms/Procedures
Aliases



NI VeriStand Framework – System Explorer

SYSTEM EXPLORER

I/O Configuration
Model(s)
Calc Ch / User Ch
Resource Mapping
Alarms/Procedures

NI VeriStand Host Server

NI VERISTAND ENGINE

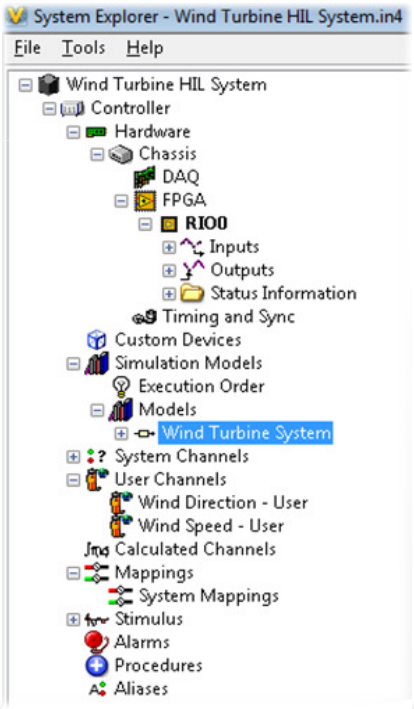
Server Communication

I/O
Channel Forcing
Model DLL Execution
Parameter Updates

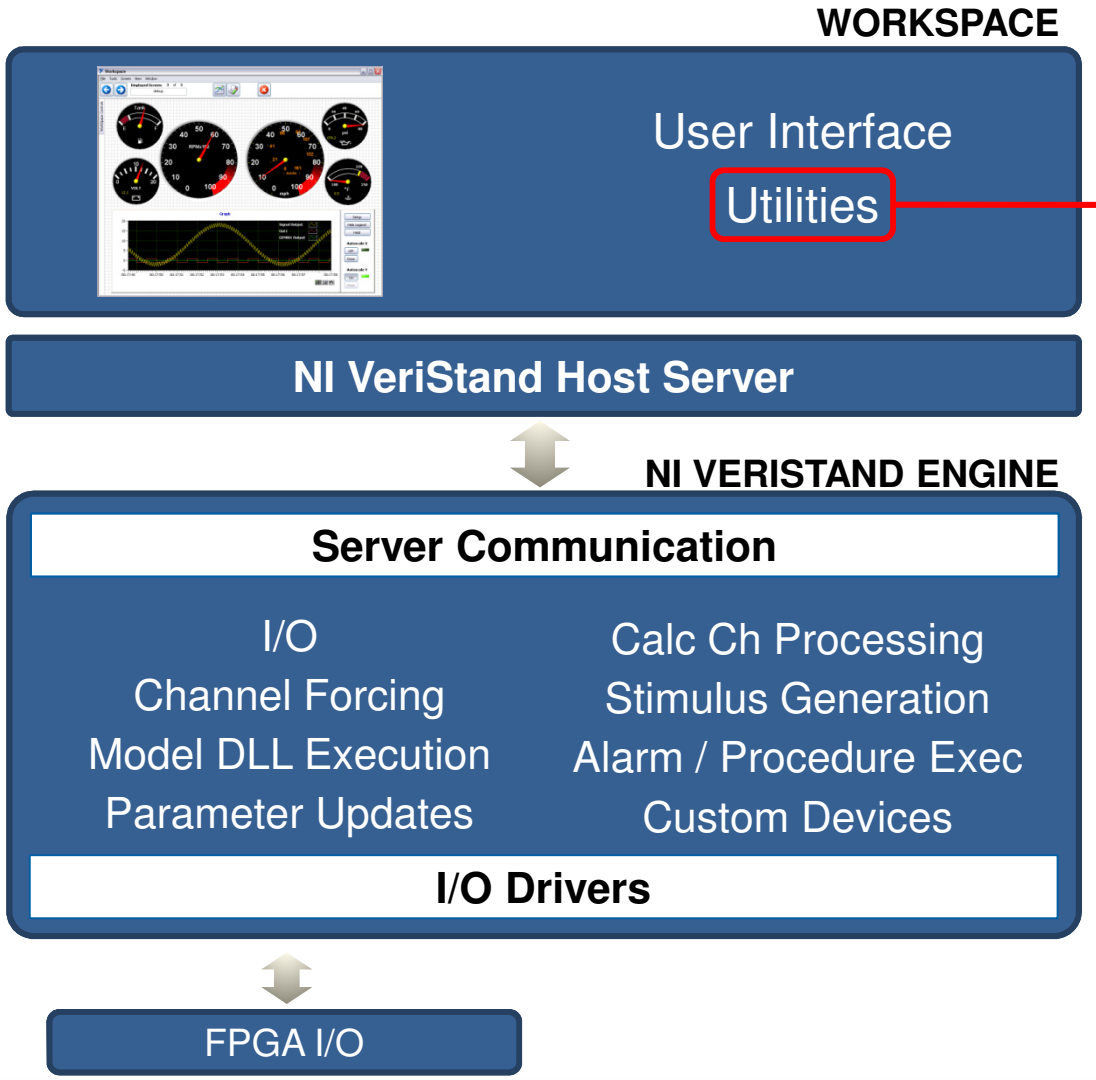
Calc Ch Processing
Stimulus Generation
Alarm / Procedure Exec
Custom Devices

I/O Drivers

FPGA I/O



NI VeriStand Framework – Workspace



OBSERVE:

- Alarm Monitor
- CAN Bus Monitor
- Channel Data Viewer
- TDMS File Viewer
- RT Console Viewer

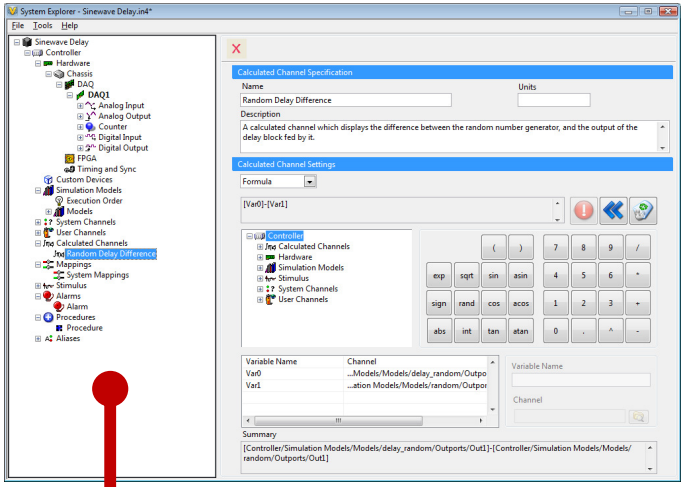
ACTION:

- Channel Scaling & Calibration
- Channel Value Forcing
- Stimulus Profile Editor

CONFIGURATION:

- Model Parameter Manager
- Alarm Manager

Configure Real-Time Application



I/O
Calc Ch's
Alarms
Controllers
…

Deploy Real-Time Stimulus/Logging Profiles

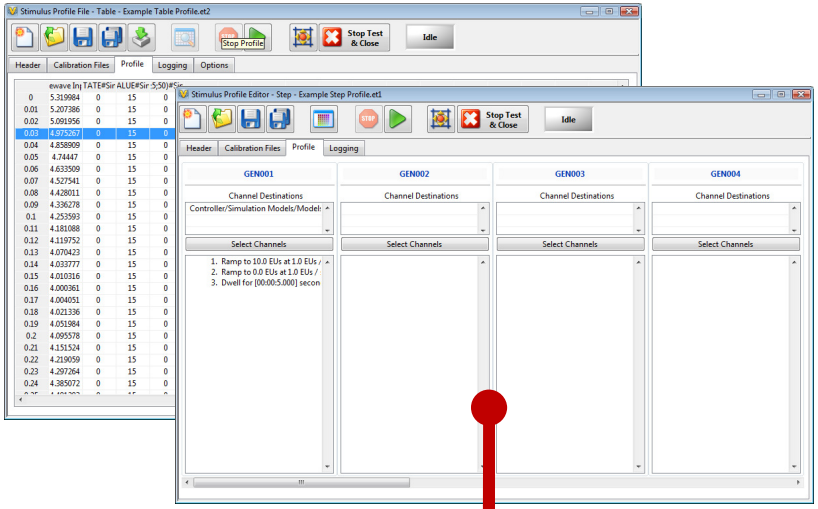
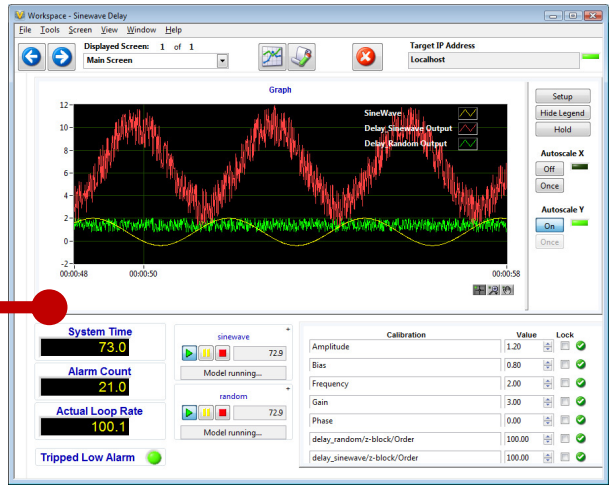


Table- and
Step-based
Stimulus

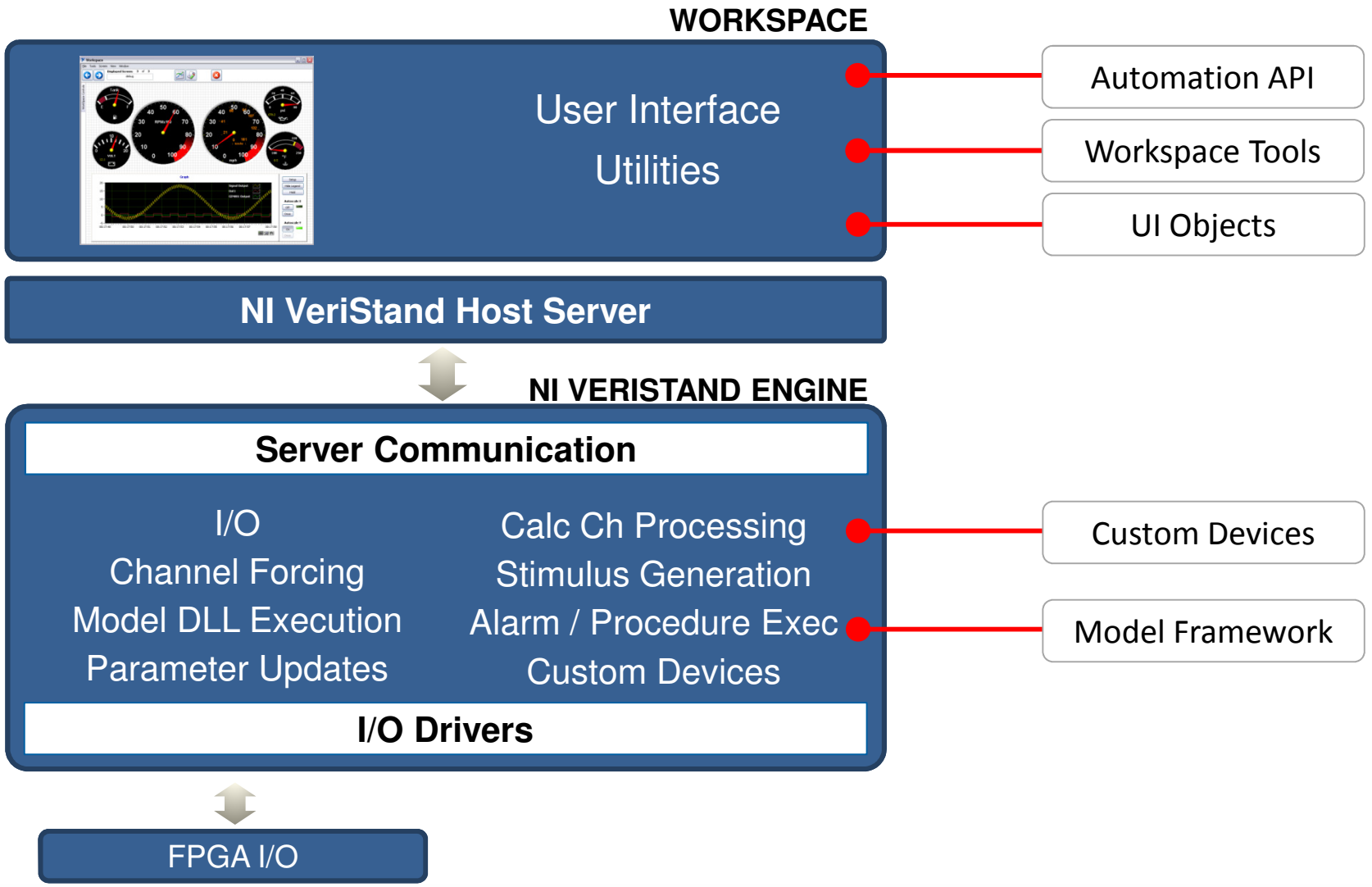
Run-time
Editable



Create UI at Run-Time

NATIONAL INSTRUMENTS

NI VeriStand Framework – Customization



Supported Modeling Environments

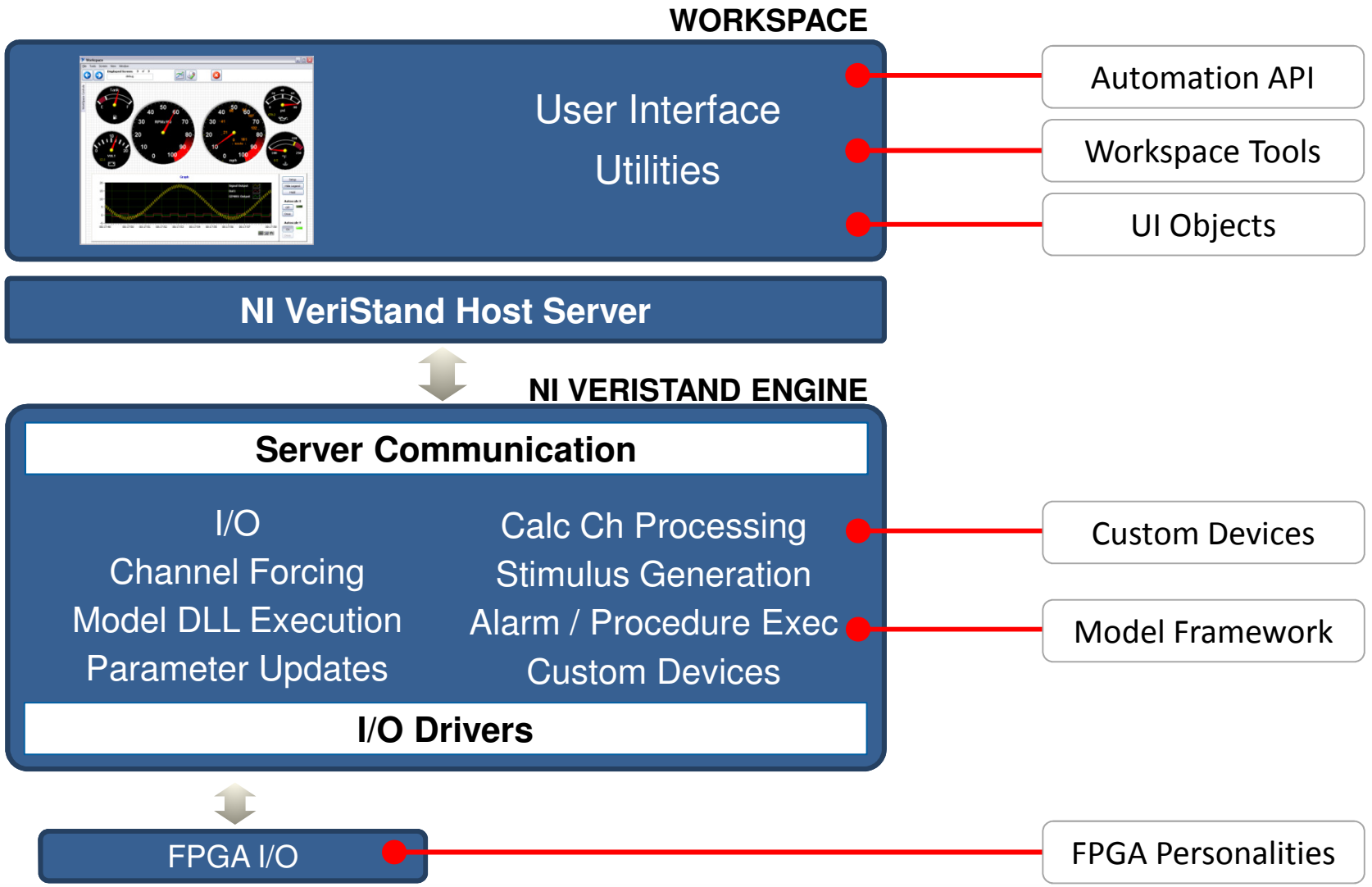
Supported:

- The MathWorks Simulink ®
- LabVIEW CD & Sim
- MapleSim models from MapleSoft
- SimulationX from ITI
- Tesis DYNAware models
- NI MATRIXx SystemBuild
- Esterel Scade Suite
- C/C++

In-Work:

- CarSim from Mech Sim Corp.
- GT-Power engine models from Gamma Technologies, Inc
- AmeSim models from LMS
- WaveRT from Ricardo
- VI-Grade models
- Visual Solutions (VisSim)
- DynaSim models from Dymola

NI VeriStand Framework – Customization



Hardware Support

- NI-DAQmx Devices (incl. X-series & SCXI)
- R-series Devices
- NI-CAN Devices
- Goepel LIN Interface

- Lambda Power Supply
- NI Timing and Sync
- NI-XNET (FlexRay, etc…)*
- NI-FIU*
- *Custom Devices**

**Available as Add-on*

Additional Resources…

www.ni.com/veristand

- Demonstration Videos
- Getting Started Resources
- White Papers
- Add-ons
- Download Evaluation Version