

NI VeriStand Custom Device for MTU MCS-5 CAN Protocol

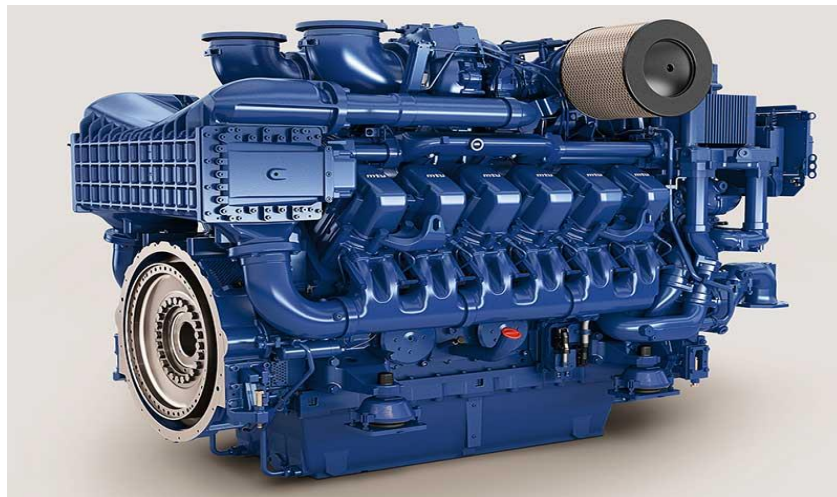
Anusha Gourishetty, Dipl. Ing. (FH) Jürgen Dodek
MTU Friedrichshafen GmbH

Agenda

- Introduction
- Challenges
- Realization
- System Setup Praxis
- Software Test Flow
- Conclusion
- Discussion

Introduction

- MTU is one of the world's leading manufacturers of large diesel engines and complete propulsion and Drive systems.



Marine



Industry



Heavy land



Rail



Oil and gas

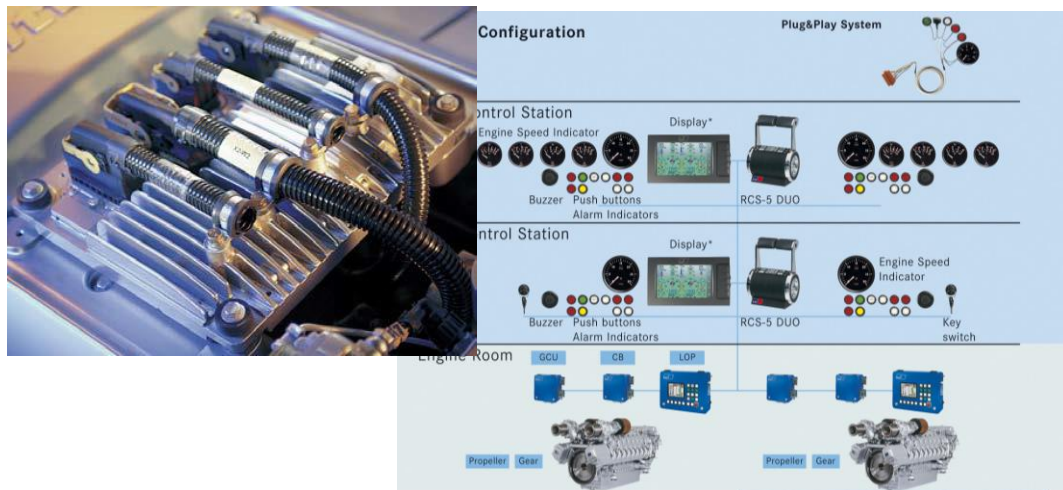


Defense Vehicles



Introduction

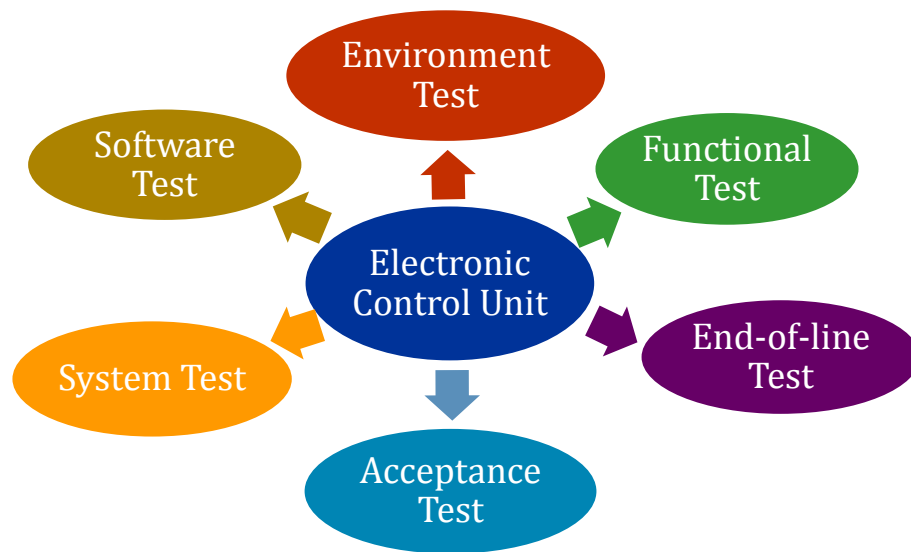
The company also manufactures tailor-made electronic control and monitoring systems for engines and for propulsion and drive systems.



Introduction : Test on ECU Units

Electronic Control Unit (ECU):
Embedded system that controls electrical systems.

- Data of the ECU is accessed using the standard CAN Protocoll



Types of tests on ECU Units

Introduction : Current Test Process



1. Host Software to visualises the results and allows to implement post processing. The data is accessed using a proprietary API
2. Vector CANoe Diagnoses interface extracts Data
3. ECU (unit under test) build into the motor allows to access data via CAN Bus

Challenges : Replacing Vector



1. Host Software to visualises the results and allows to implement postprocessing. The data is accessed using a USB or Ethernet
2. National Instruments Embedded controller with NI-XNET CAN Module for CAN communication between ECU and Host software
3. ECU build into the motor allows to access data via the CAN Bus

Challenges : Communication Test of ECUs

Fundamental need for testing the communication of ECUs is the routing of signals from one ECU to another

- Transmitting and receiving all or specific messages that are defined in CAN DBC file
- Transfer and receive Messages from PC-based software with Commercial of the Shelf (COTS) to ECU.
- Transfer the messages between PC and ECUs with-in a specified time period.

Realization : Hardware

NI CompactRIO Embedded Controller : NI cRIO-9064

- 667 MHz dual-core ARM Cortex-A9 Processor with Linux Real-Time Operating System
- Reconfigurable FPGA
- Four C series Module (Inter changeable I/O Module)



NI cRIO-9064

Realization : Hardware

CAN Module : NI XNET 9862

- High Speed CAN Module with one connector
- Develop application with NI-XNET driver
- External Power supply 9 to 30V for CAN operations
- NI 9862 electrical Characteristics allows 110 CAN Ports on Network
- CAN Transceiver supports baud rates up to 1Mbps
- Port has Bosch DCAN Controller



NI XNET 9862

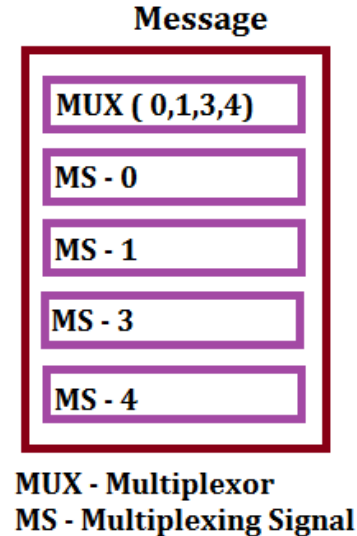
Realization : Host Software NI VeriStand

NI VeriStand is a ready-to-use tool that provides a configuration-based software environment to create real-time testing applications including Hardware-In-the-Loop (HIL) test systems.

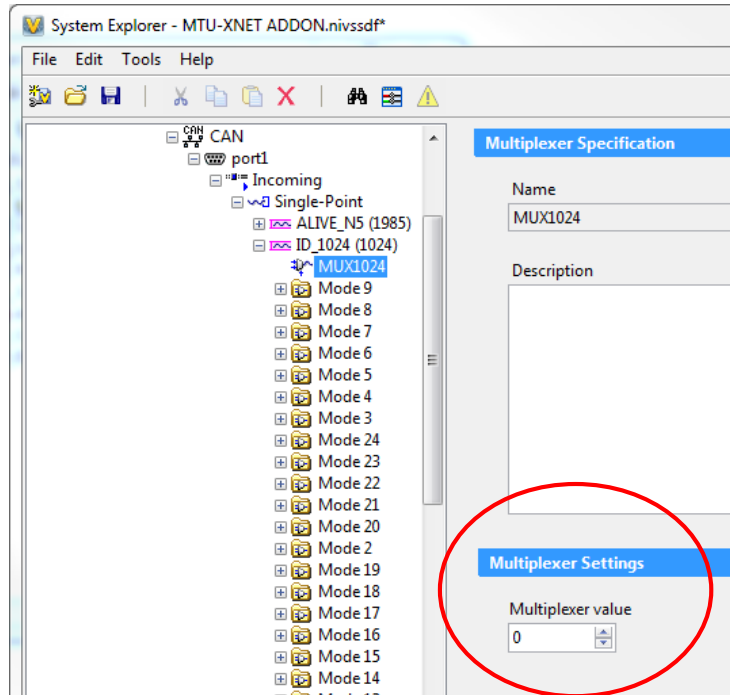
- Configure analog, digital, protocol, and FPGA-based I/O interfaces
- Build test system interfaces quickly using a run-time-editable user interface
- Custom functionalities using LabVIEW, NI TestStand, Iron Python, and other software environments

System Setup Praxis: MCS-5 CAN Protocol

- MCS-5 stand for Monitoring and Control system
- DBC file is database for CAN written in CANdb++ editor.
- Special about MCS-5 protocol was Multiplexer and Multiplexing Signal



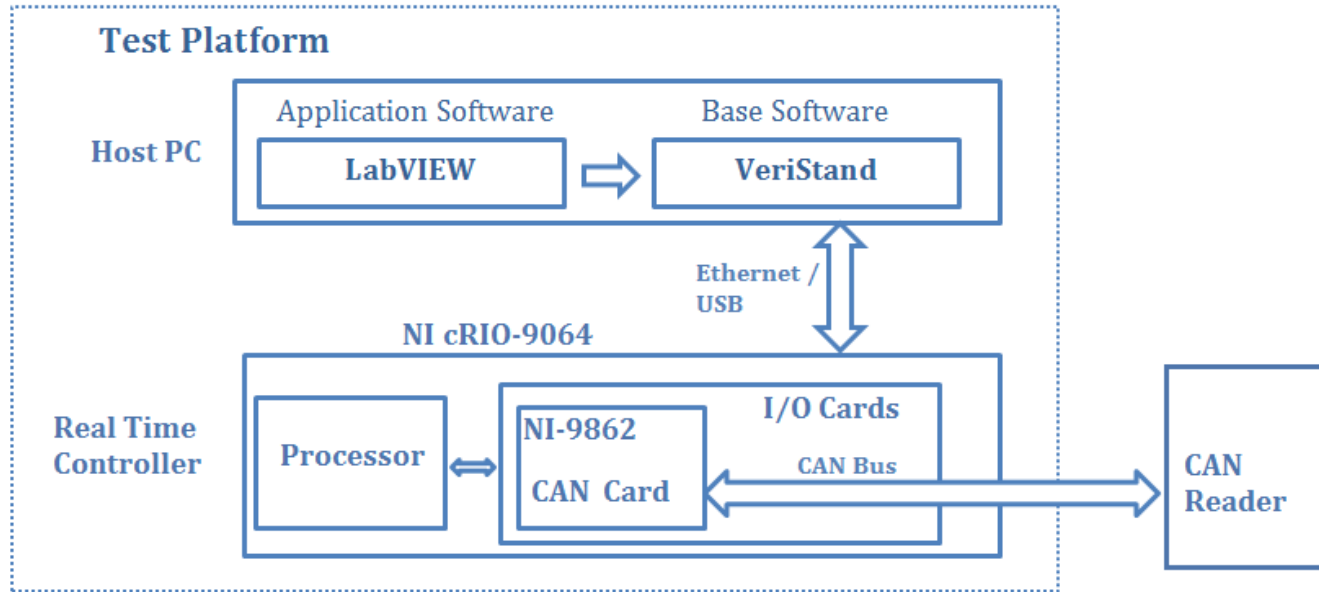
System Setup Praxis: Need Of Custom Device



NI VeriStand System Explorer Window

- In built NI Veristand software alone is not sufficient because its send only one CAN signal under one Multiplexer
- All signals under multiplexer are needed to send
- Custom functionality of NI Veristand called Custom Devices
- Custom Devices are done in LabVIEW

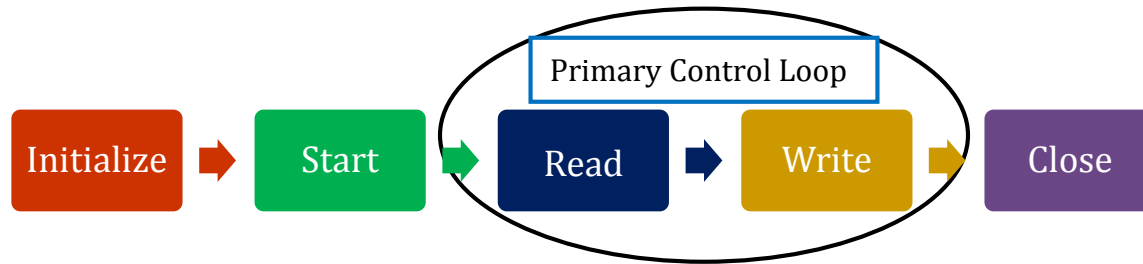
System Setup Praxis: Over View of Test Platform



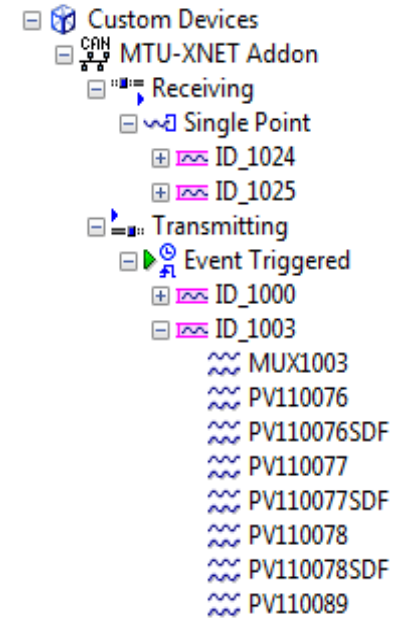
Modified Test Platform

System Setup Praxis: Implementation of Custom Device

- Channel
- Sections
- Hierarchy
- Pages and Extra Pages
- Device Type

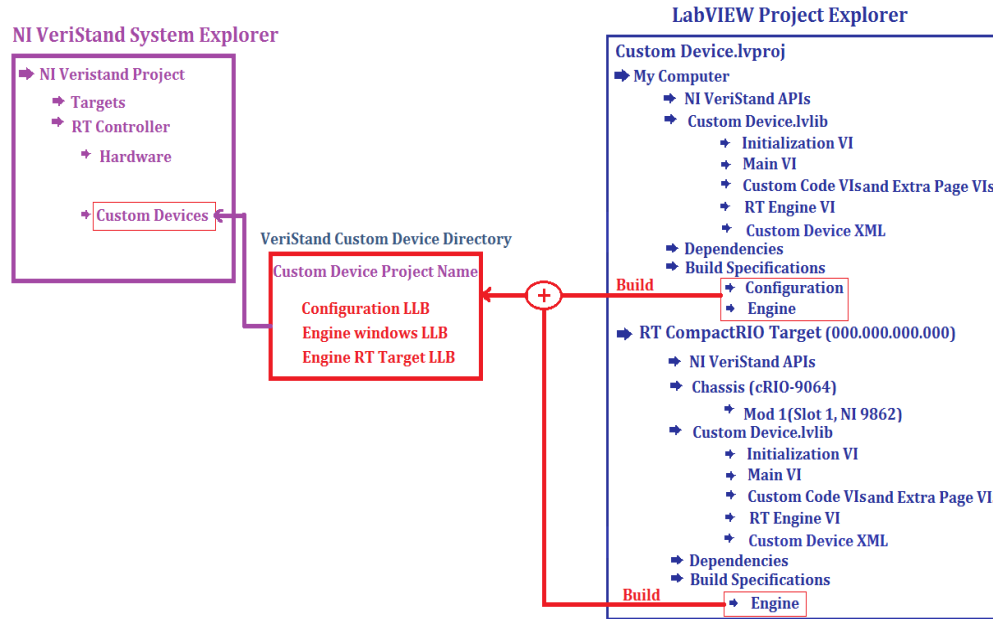


Inline Hardware Custom Device Execution Order



Hierarchy

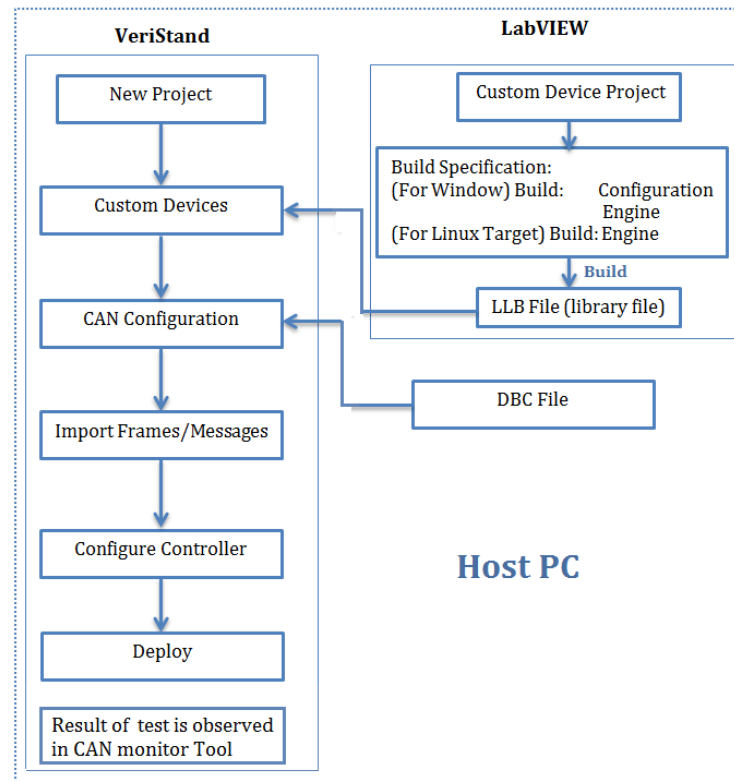
System Setup Praxis: Building Custom Devices to VeriStand



- Process of building custom devices to run in NI VeriStand
- Making Custom Device suitable for Compact RIO Target (embedded controller)

Software Test Flow

- Library file in LabVIEW for VeriStand
- Add Custom Device to VeriStand
- Run the VeriStand
- Results can be seen in CAN monitor tool.



Conclusion

- Flexible to test the Communication
- Reduces the cost
- Platform independent
- Implement additional NI I/O Hardware

Discussion

Thanks your attention