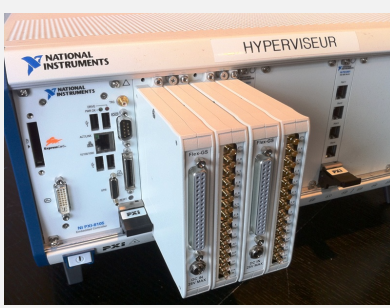


Managing Avionics Bus Obsolescence With an NI FlexRIO FPGA Module for Thales



DT2E developed an NI FlexRIO adapter module to adapt digital domain signals to the analog domain, and vice versa.

"The NI FlexRIO architecture easily integrates application-specific software and hardware."

- Jeremy MICHEL, DT2E

The Challenge:

Developing an avionics bus validation resource for equipment produced by Thales Avionics.

The Solution:

Using NI FlexRIO modules and embedded field-programmable gate array (FPGA) processing power in parallel with application-specific adapter modules to help Thales Avionics manage custom electronics. We also took advantage of the modular, scalable PXI platform by using a PXI chassis and PXI controller managed by the NI Real-Time Hypervisor, which can run Linux and LabVIEW Real-Time in parallel.

Author(s):

Jeremy MICHEL - DT2E

Avionics Test and Validation

In aeronautics, avionics equipment has a very long life (often several decades). Throughout this period, it is important to maintain test systems in operational condition so that they remain effective. Thales Avionics decided to use commercial off-the-shelf hardware and software components for testing and validation and chose NI PXI platform-based technologies to guarantee the modularity and scalability needed for this type of application.

In most cases, standard cards and other resources largely meet the needs. However, for signal generation or acquisition with nonstandard features, and for certain exotic buses, we needed to develop resources.

Modular Environment Versatility

The Thales Avionics test system environment is based on a PXI controller running the NI Real-Time Hypervisor. It runs both Linux and an NI real-time OS in parallel. To meet the needs of Thales Avionics, we optimized the Linux OS to interface with and simulate avionics systems. The NI real-time OS controls instruments and other specific resources and runs LabVIEW Real-Time applications. A remote PC running Windows controls all of the OSs. The test software, based on NI TestStand, sends TCP/IP and network shared variable requests to both environments so that the user can control all of the resources from a single user-friendly interface.

From User Interface to Resource

To meet the specific validation needs of an existing avionics bus for which historical test systems had become obsolete, DT2E proposed a solution based on NI FPGA technology. This solution uses NI FlexRIO modules that offer the advantage of being directly integrated in the Thales Avionics PXI test environment. Other advantages of these modules include FPGA processing power, associated high-speed memory, and adapter module interface digital I/O for custom electronic connections. Furthermore, we used shared variables to facilitate module integration in the test environment. The shared variables are passed from the Windows UI to the FPGA that runs the application-specific test software.

From Specifications to Test

Simulation and validation data are defined in XML—the same file format used for specifying Thales Avionics equipment embedded code. Using the same file format reduces test application conversion time and translation errors. These specification files are converted as vectors and can be both static and dynamic, depending on how they are specified in the XML file.

Open Architecture

The NI FlexRIO architecture easily integrates software and hardware. We developed the embedded FPGA program with the LabVIEW FPGA Module. For specific hardware connected to the module front panel (DAC and ADC), we encoded low-level management directly in VHDL. LabVIEW FPGA code is devoted to managing data exchange with the real-time program, managing the direct memory access, and sequencing the overall test application.

DT2E developed an adapter module that adapts the signals from the digital domain to the analog domain, and vice versa (DAC and ADC). Because the module is small, we can directly integrate it into the NI FlexRIO front panel, and therefore, the PXI chassis.

High Accuracy, Minimal Size

The system successfully addresses a significant number of constraints. Mechanically, it easily interfaces with the PXI chassis front panel, and therefore occupies minimal space in the final test bench. The software is an open, easily scalable, user-friendly development environment. Functionally, the real-time electrical signal level feedback control helps the system achieve high signal generation accuracy, temperature variation, and component aging resistance.

Author Information:

Jeremy MICHEL

DT2E

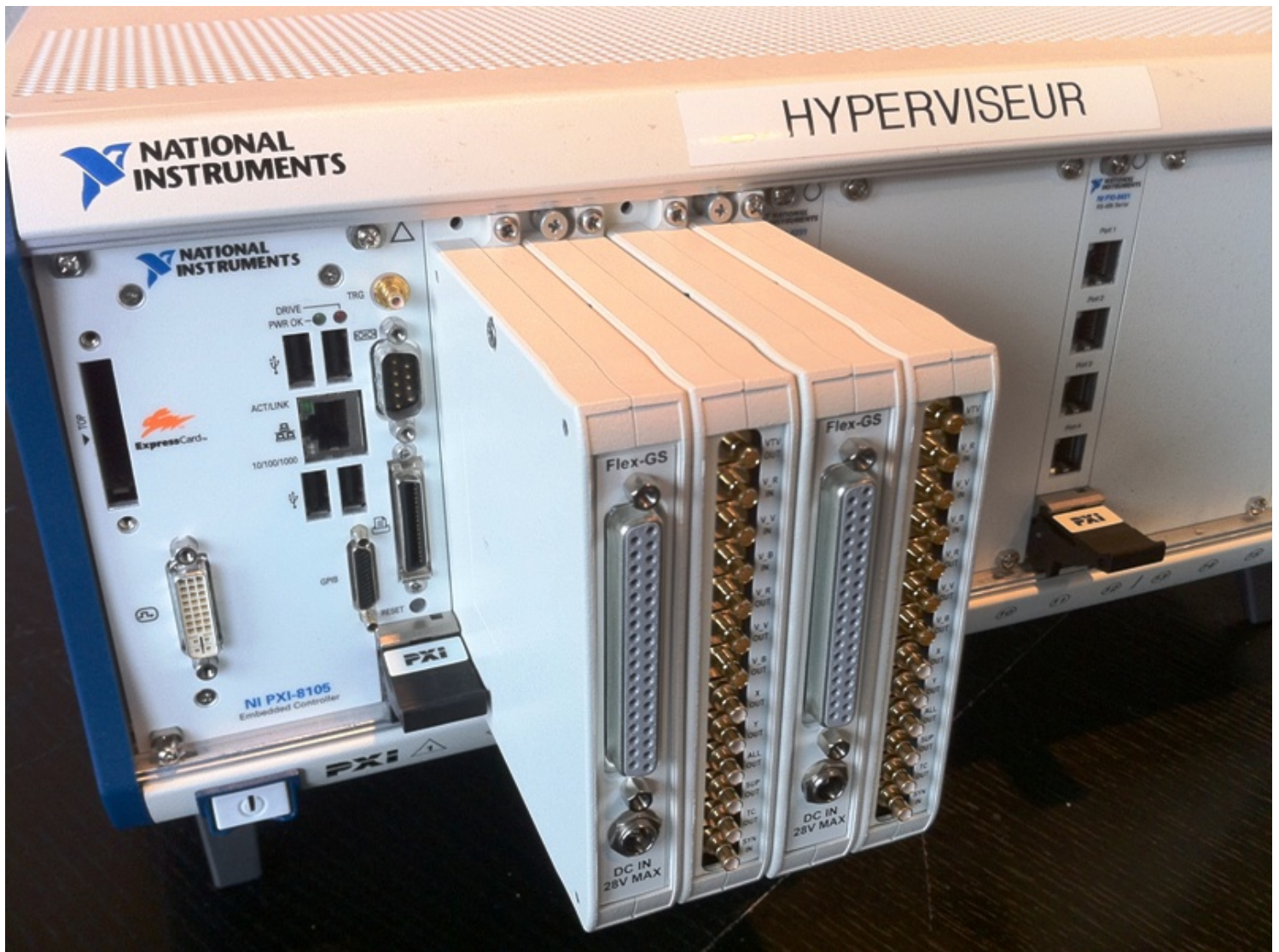
55, allée de Mégevie

33170 Gradignan

France

Tel: +33 (0)5 56 39 03 50

contact@dt2e.fr



DT2E developed an NI FlexRIO adapter module to adapt digital domain signals to the analog domain, and vice versa.

Legal

This case study (this "case study") was developed by a National Instruments ("NI") customer. THIS CASE STUDY IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND AND SUBJECT TO CERTAIN RESTRICTIONS AS MORE SPECIFICALLY SET FORTH IN NI.COM'S TERMS OF USE (<http://ni.com/legal/termsofuse/unitedstates/us/>).