

Evaluation of Various Communication Schemes Using NI LabVIEW

By
Benjamin Rayner
Automation Architect
and
Brad Westfall
Senior Engineer
Data Science Automation, Inc.
USA

Category:
Design R&D

Products Used:
NI LabVIEW 8.5
NI Real-Time
NI PXI-1042
NI PXI-8106
NI PXI-6653
NI PXI-6608
NI PXI-6250

The Challenge:

Develop a software application to allow a wide range of communications schemes to be evaluated to assess their capabilities to provide reliable and deterministic interchanges of information between interconnected nodes.

The Solution:

Leveraging modular LabVIEW-based software architecture, Data Science Automation has created a system utilizing multiple PXI chassis's each containing a real-time controller with each chassis having a dynamically loaded application designed for testing the current communication scheme. Once testing has completed, corresponding data is returned to a central computer for analyzing.

Abstract:

The "Central Computer Test Executive" will allow a wide range of communications schemes to be evaluated to assess their capability to provide a reliable and deterministic interchange of information between interconnected nodes. The CCTE will allow a user to select and execute a test from a set of previously developed "Test Suites". Each "Test Suite" will allow for user defined parameters. Once setup has been completed, the CCTE will dynamically load and launch specific applications used to test the current communication scheme. Once each application has completed, the PXI chassis return to the CCTE all corresponding data for analysis.

Overview

The "Communication and Control System Technology Central Computer Test Executive" is an application designed to allow a central location for testing and validating numerous communication interfaces. The Central Computer Test Executive will allow a wide range of communications schemes to be evaluated to assess their capability to provide a reliable and deterministic interchange of information between interconnected PXI chassis or nodes. The Central Computer Test Executive will allow a user to select and execute a test from a set of previously developed Test Suites (Figure 1). Each Test Suite will allow the user to specify any options associated with the Test Suite (e.g. timing sources, selecting nodes, packet size, etc).

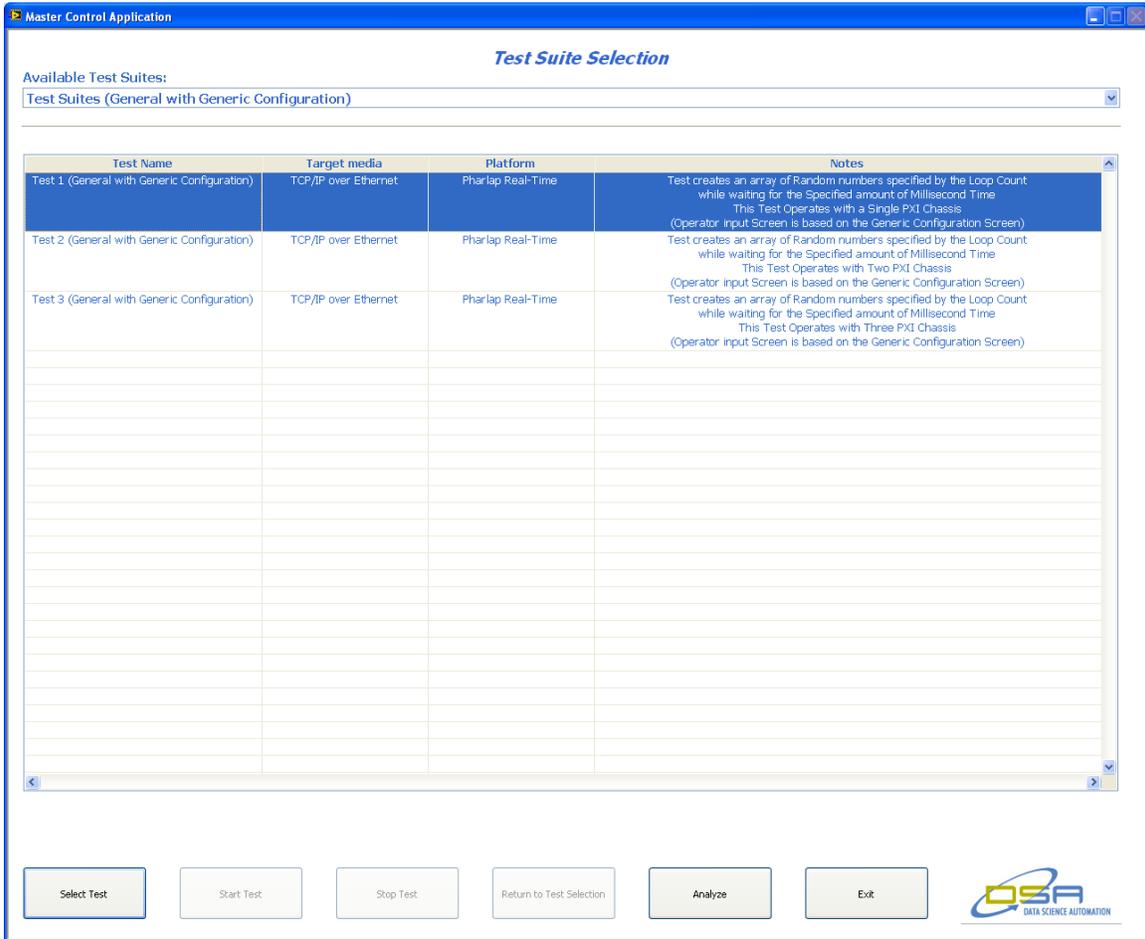


Figure 1 -Test Suite selection within the Central Computer Test Executive

Once a user has selected the Test Suite, the Central Computer Test Executive will present a Test Suite specific check-list (figure 2) that will guide the user through performing any manual set-ups required (Cabling configurations, powering-up required hardware, etc). If applicable to the test, the Test Suite Check-list will allow the user to specify the option and configuration settings. In addition to the check-list the user will be allowed to Start the test (if not running), Stop the test (if running), or Abort the currently selected Test Suite to allow another Test Suite to be selected.

After completion of the selected Test Suite the results or data collection will be collected from the various PXI nodes involved in the Test Suite. The results will be saved as tab delimited text files. The results will also be displayed graphically along with appropriate statistics summarizing the results (figure 3). This will allow a user the ability to display, print or save the analytical graphs for use in third party software for later presentations.

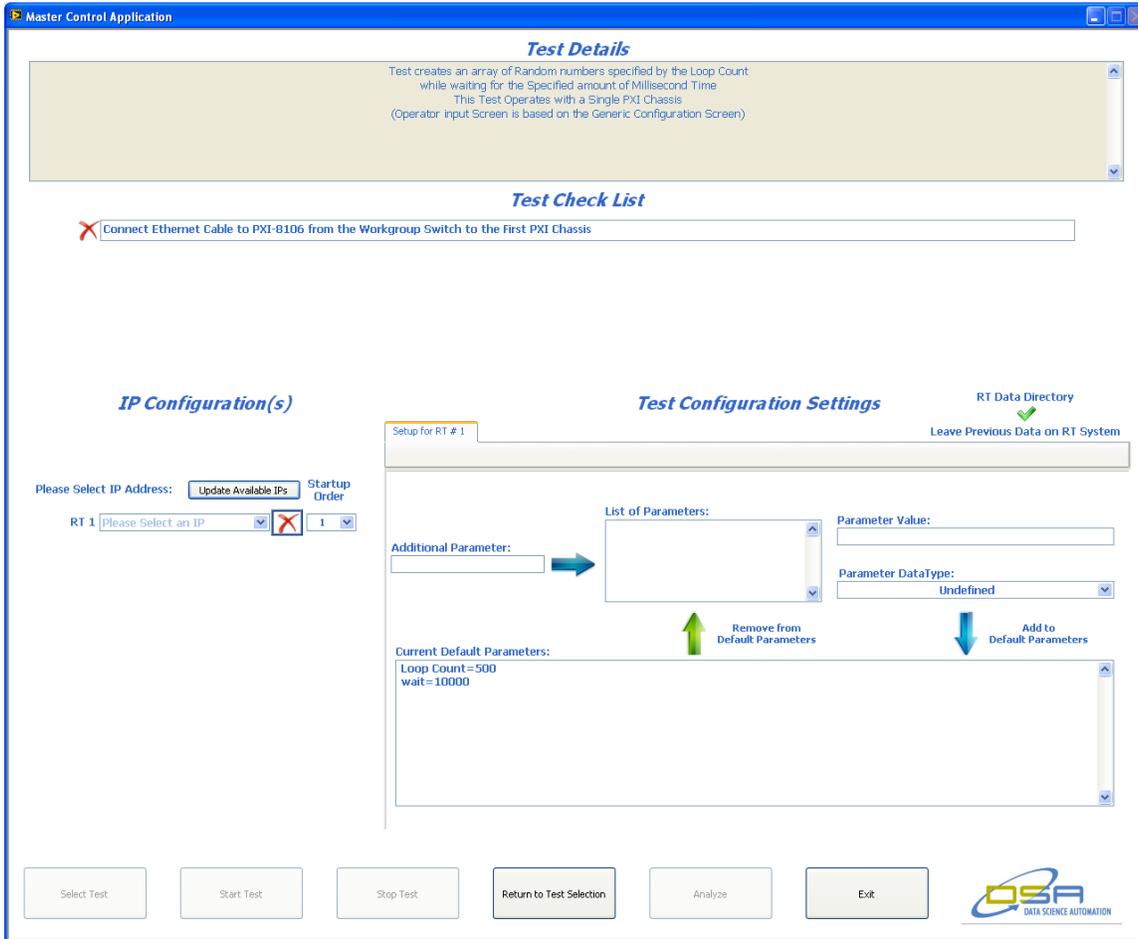


Figure 2 - Test Suite configuration within the Central Computer Test Executive

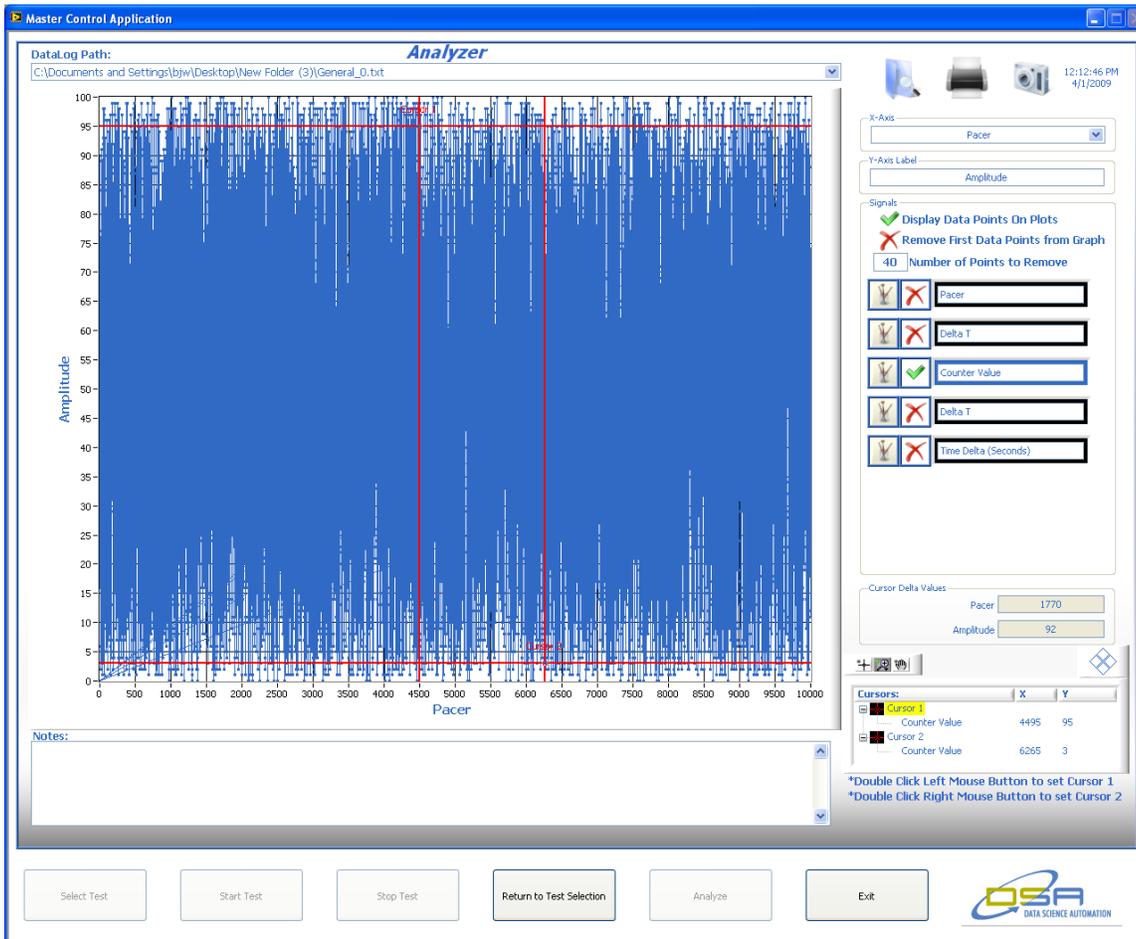


Figure 3 - Analytical Graphs display

Computer Functionality

The Central Computer Test Executive will ever as a single user interface for all Test Suite selection control and execution. It will coordinate the operations of all PXI nodes associated with the selected Test Suite. After completion it will download the data results from each of the PXI nodes using the File Transfer Protocol. Once the FTP process has been complete the application will display and save the results for further evaluation.

The Central Computer Test Executive when started will access a folder where all available Test Suites Descriptor Files will be located. Each of the Test Suite Descriptor File will include information that will define a formal name of the Test Suite as well as briefly describe the nature of the Test Suite. This information will be display for the user so that he or she can make the appropriate Test Suite Selection (Figure 1). The Test Suite description will describe the nature of the test performed by each Test Suite.

In addition to the information displayed on the Center Computer Test Executive the Test Suite Descriptor File will contain links to the files required to configure, deploy execute and monitor the Test Suite. Due to the nature of the various transport mediums and platforms on which they will execute, there will be limits of the capabilities of some of the Test Suites. To minimize these limitations Data Science Automation designed a user interface capable of collected and deploying data sets based on user defined parameters (Figure 4).

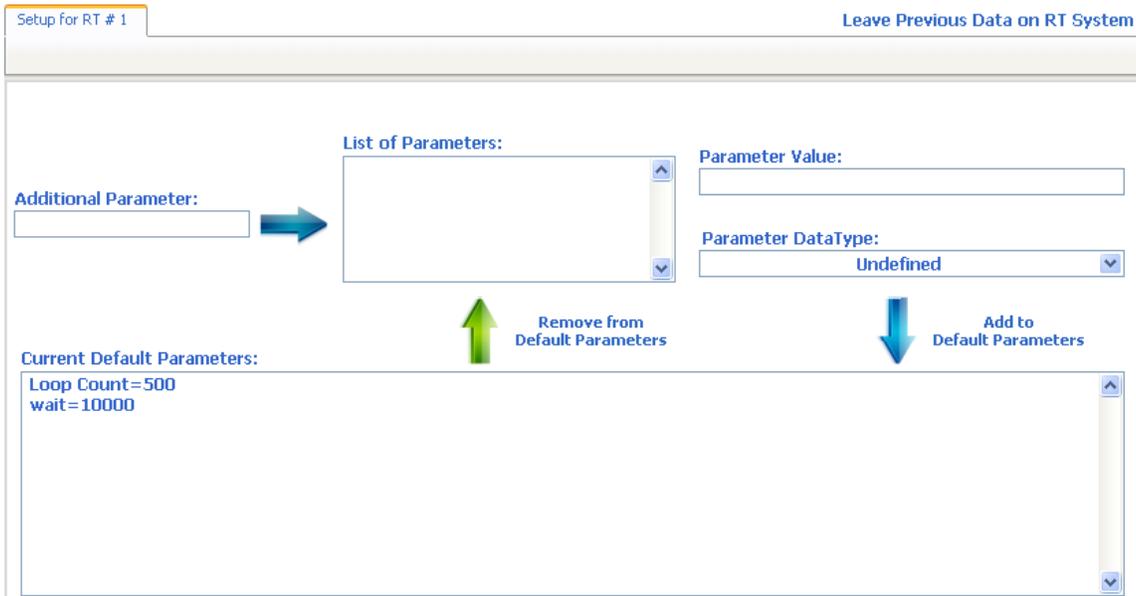


Figure 4 - User interface generated for allowing dynamically set Test Suite Parameters

Deploying & Executing

Once a Test Suite Description File has been selected by a user, the contained links will be invoked to allow configuration of the Test Suite. Provided the Configuration options are deemed valid and the user did not abort the Test Suite, the indicated methods specified in the Test Suite Description File and user input will be utilized to deploy and execute the Test Suite. To deploy the Test Suite the Center Computer Test Executive using LabVIEW built in FTP protocol toolkit to transfer all executable, application and support files to the current PXI chassis via the Test Suite Description File and IP Address. Using the FTP Toolkit, the application can monitor progress of file being transfer to the remote PXI Chassis. This progress is display for the user on the Center Computer Test Executive for validation of testing progress (figure 5) Once the Center Computer Test Executive has deployed all files to all remote PXI Chassis the Executive launches all application remotely using built in LabVIEW VI Server technology. Also prior to executing all remotely launched application, the Center Computer Test Executive transmits the parameters for the application again utilizing the VI Server technology.

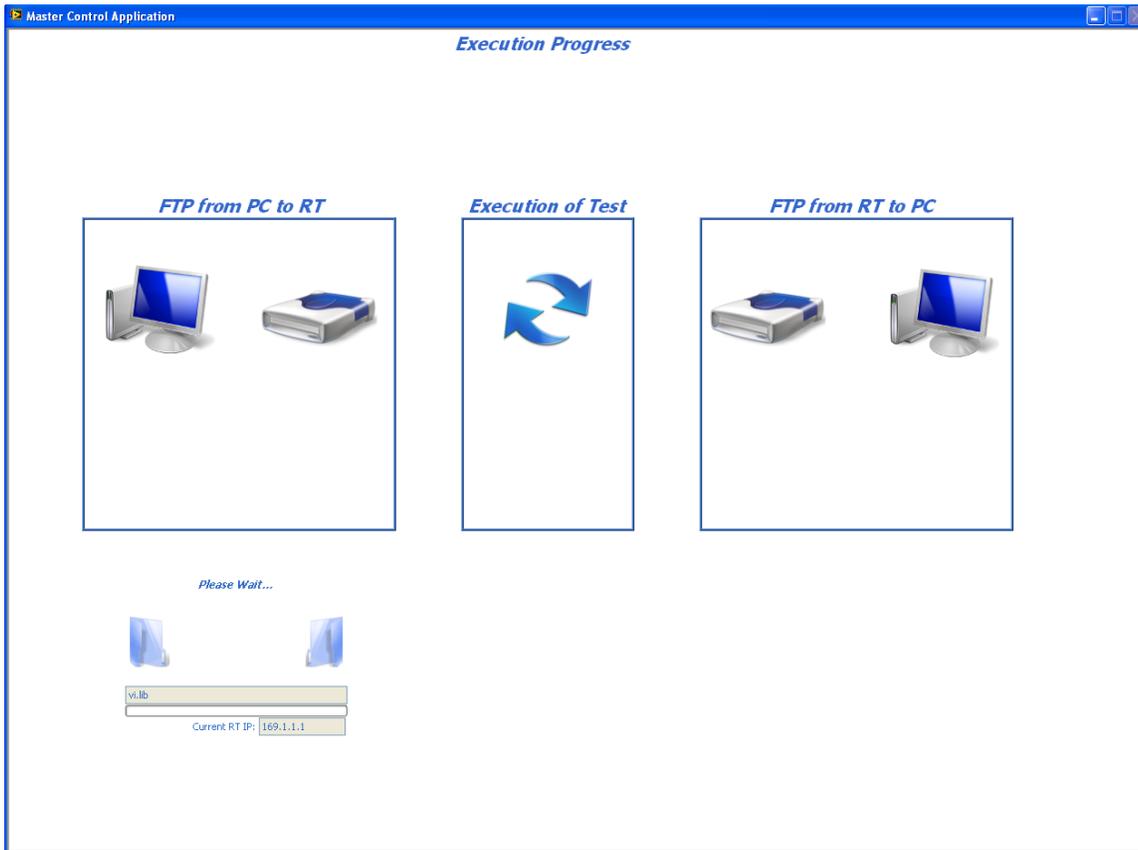


Figure 5 - Execution Progress Screen used to demonstrate to operation Test Suite progress

Analytical Display

On successful completion of all remote application, the results will be retrieved using the methods specified in the Test Suite Description File and the Test Suite specific analysis, display and archiving will be executed. The Test Suite Description File will determine what files need transferred back to the Central Computer along with their file location on the remote PXI chassis. The Test Suite specifications will specify any analytical displaying algorithms along with what data needs to be preserved on the Center Computer and where that data shall be stored. The analytical display (figure 3) will also provide the user with the ability to save and print graphs at their on discretion. The application will also allow for simple peak or point distance calculations using simple mouse clicks, along with functionality for saving and loading previous data.

The Bottom Line

By integrated National Instruments hardware and software Data Science Automation was able to create a centralized test application to evaluate and validate various capabilities of numerous different communication platforms.