Developing a LabVIEW-Based, Enterprise-Wide, Test Management System

by John W. Morrissey, Advanced Manufacturing Technology Department, Tellabs Wireless Systems

The Challenge: Consolidating testing, data collection, failure analysis, and CM processes into a single integrated software application for automated quality assurance of wireless telecommunications equipment.

The Solution: Creating the Test Management Toolkit (TMT), a suite of LabVIEW applications tightly integrated with a networked SQL database.

Introduction
As a part of Tellabs Corp., Tellabs Wireless Systems is primarily a design center, supported by the Advanced Manufacturing Technologies Department (AMT), which is tasked with developing functional test solutions and transferring manufacturable designs to the production facilities in Illinois and Texas.

Faced with a number of new testing challenges in AMT, we set out to significantly change our test, data collection, failure analysis, and CM processes with a single integrated software application. The result of this redefinition and design is the Test Management Toolkit (TMT), a suite of LabVIEW applications tightly integrated with a networked SQL database.

Design Objectives
The architecture of the new test system control software was defined with a test executive and database at the center of an interconnected suite of tools. We approached the new design with the following general goals:

- Central data collection
- Networked test equipment
- Fault tolerance (network and server)
- Universal look and feel
- Structured, automated software CM
- Functional test sequencing
- Integrated station confidence
- Logging of test results and data
- Tracking of previously tested hardware
- Automatic test program set (TPS) selection
- SPC and test data analysis
- ATE usage monitoring
- Remote system monitoring

System Components
Based on these requirements, for our server we chose a Pentium 166 MHz PC running Windows NT 4.0 and the Microsoft SQL Server 7.0 RDBMS. We based our ATE equipment on a Pentium 200 MHz running Windows 95, equipped with LabVIEW; the LabVIEW SQL toolkit; the LabVIEW Test Executive; and GPIB, data acquisition, and VXI driver software from National Instruments. Desktop machines were Pentium 200 MHz PCs running either Windows NT or 95, equipped with LabVIEW, the Test Executive, and the SQL and SPC Toolkits.

Software Organization
Test Manager
With the Test Manager, the top level software system controller, the user can select ATE Control, Data Analysis, TPS Development, System Administration, or Remote Control applications. In addition to mode selection, the Test Manager displays the current user, network, and database status.

Test Executive
We modified the National Instruments Test Executive to include several new features:
- Instrument address data is exclusively stored in the database and retrieved when a product is selected. This feature removed the need to hard code instrument addresses in the LabVIEW test VIs.
- A low-level confidence test is performed on all of the instrumentation required by a particular UUT. This feature will eliminate test hang ups due to cable disconnects, incorrect address settings, and off-line instruments.
- Test data and the overall test results are now entered directly into the SQL Server database at the completion of UUT testing. You can run in Diagnostics mode without logging results to the database.
- The latest released test software is automatically selected and downloaded from the server, based on the part number and revision that is scanned in from the UUT.
- Test sequences can be created and manipulated using database tools for faster development and upgrade times.
- A newer user interface was also added to the Test Executive to give all of the TMT applications a universal look and feel.

Database and SQL Interface
Because the database is the critical center of the design, we spent a great deal of time structuring the data dictionary and tables. Major TMT input data tables were set up for system users, ATE equipment, test software files, instruments, products,
TPSs, and test sequences. Major TMT output data tables were developed for test results, test data, system status, rework data, and run-time errors. With this set of data tables, almost any piece of production test information can be retrieved or stored and later manipulated. We used the National Instruments SQL Toolkit to build an interface for database access.

**Developer Tools**
- Developer File utility used for TPS integration and later, by the administrator for TPS release.
- Test Sequence Manipulation – Due to the repetitive nature of the software release process, these tools were created to help developers release their test solutions faster, with fewer errors.

**Administrator Tools**
- User Manager – Adds and updates user information in the system.
- Instrument Manager – Adds and updates instrument addresses, calibration dates, and rack locations.
- TPS Release Tool – When supplied with a developer file and test software, this tool will automatically update the database and release the test software to a controlled location on the server.

**Analysis Tools**
- Pareto – Analysis of most common defects and failure modes.
- Test Data Retrieval and Sorting – Test data is the parametric data generated by the UUT during testing.
- Test Results Retrieval and Sorting – Test result records contain the high-level data related to a test run such as pass/fail, time, date, duration, and operator.

**Future Plans**
- Remote Control – We plan to add the capability to connect to the server and access the database from an off-site manufacturing facility. We will investigate using the National Instruments Internet Developers toolkit.
- Rework Tracking – We will require operators to log the type of rework required to fix particular failures.

**Summary**
The project has progressed with very few technical complications. The server and database were easier to work with than originally anticipated. The incorporation of LabVIEW, the Test Executive, and the SQL and SPC toolkits, running under Windows 95 on the client side has proved very successful. The TMT has performed well and is now being used by several other Tellabs test groups for system integration testing, in addition to the production testing for which it was designed and built.

For more information, contact John Morrissey, Advanced Manufacturing Technology Department, Tellabs Wireless Systems, 30 North Avenue, Burlington, MA 01803, tel (617) 273-1400 X6536, fax (781) 273-4160, e-mail jmorrissey@wireless.tellabs.com