

- IVI™
- LabVIEW™
- SQL Toolkit
- TestStand™

Using TestStand for Testing Cellular Base Stations

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The Challenge: Developing a single test software application capable of testing a wide variety of Motorola cellular base station products.

The Solution: Creating a test specification and procedures database in Oracle and a database-driven test application using National Instruments TestStand, LabVIEW, and the SQL Toolkit.

Introduction

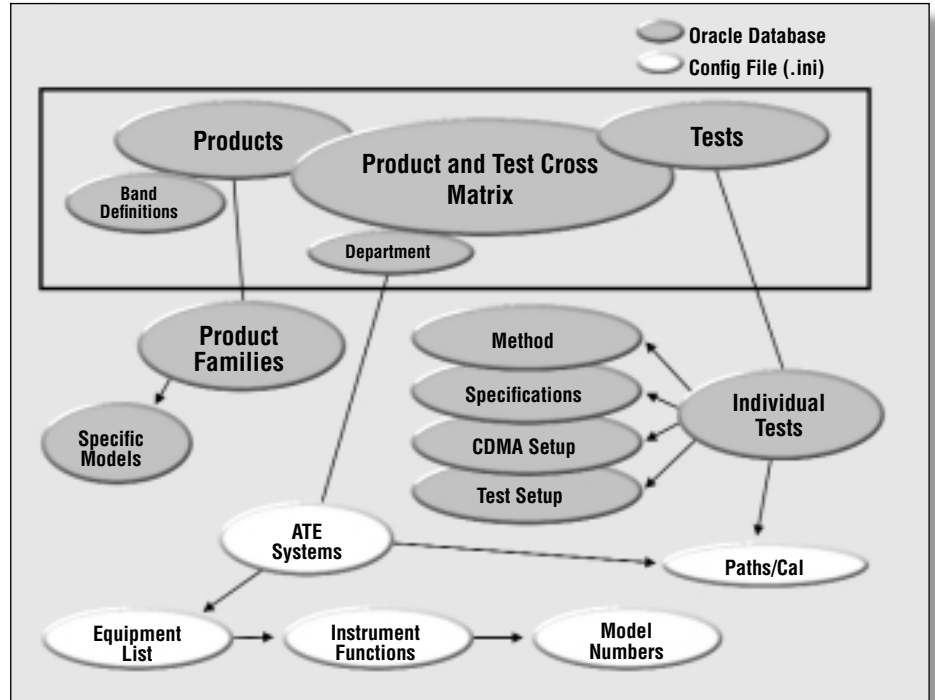
Motorola recently embarked on a software process improvement effort within our Integration Test and Certification (ITC) and Assembly Test Engineering (ATE) test software groups. ITC and ATE teamed to develop a common solution to bolster software innovation and maximize collective reuse.

LabVIEW graphical programming language is perfect for test automation. It is simple to code and offers numerous functions for maximum productivity.

This effort, coupled with a desire for standardization and conformity, resulted in the idea of common test software for all Motorola cellular base station products. Using National Instruments TestStand and LabVIEW, we developed a database-driven, standardized test executive with common software classes.

The goals of the project were to:

- Create one common core set of software for use by both ITC and ATE
- Standardize software processes within and across ITC and ATE groups
- Maximize reuse while minimizing duplicated effort
- Reduce manpower per product test capability
- Dramatically reduce future time-to-test



Oracle Relational Database Map

Representatives from each group began reviewing the existing test code with these established goals in mind. After reviewing several test applications, we decided on the key components for a common test software model. These include a centralized test executive, a smart task manager for looping, interchangeable device and product drivers, and an external database for product information and test specifications.

System Components

We chose National Instruments TestStand as the test executive. TestStand is an ActiveX-based test executive with prototype adapters for LabVIEW, LabWindows™/CVI, Visual Basic, and C++/DLL. Software modules from any of these languages are combined or used exclusively to create test routines.

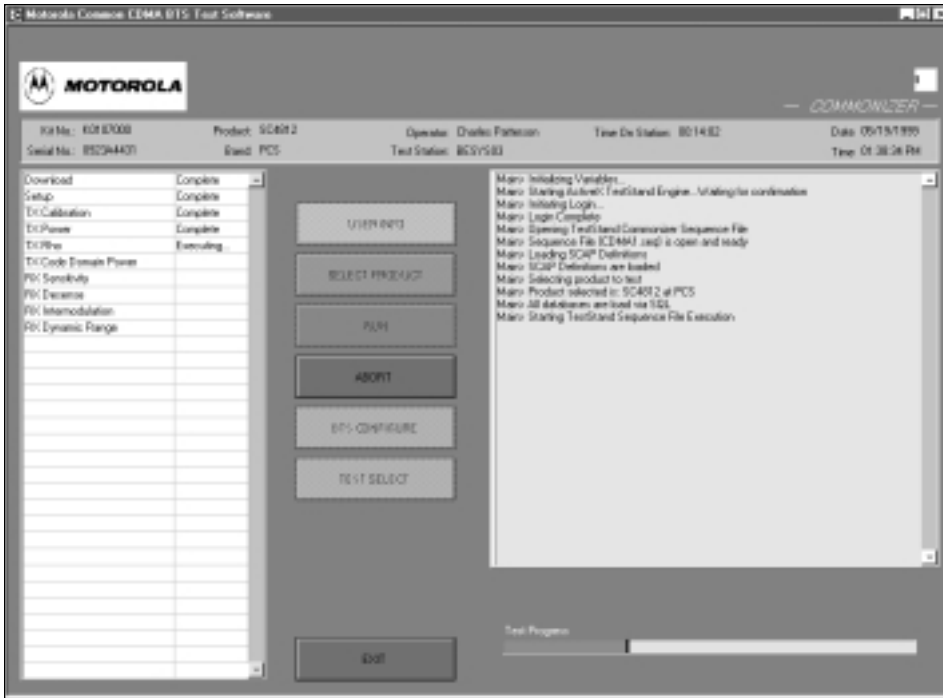
With TestStand as the executive, we decided on LabVIEW as the software for the following reasons – LabVIEW graphical programming language is perfect for test automation. It is simple to code and offers numerous functions for maximum productivity.

The team chose an interchangeable state-caching driver approach based on the concept of National Instruments Interchangeable Virtual Instruments (IVI).

IVI, at the time a new product, was not readily available for the specialized instrumentation required for cellular base station testing. However, we developed drivers that could be replaced with IVI once IVI drivers became available.

Adaptability

We accomplished instrument and product interchangeability by defining instruments and products as classes according to a certain instrument's functions. Within each instrument class, we designed function drivers with the defined inputs necessary at that function. Beneath the class layer, we used model and brand-specific function drivers to convert the class function to the actual instrument function. These classes can point to any instrument defined without changing the test software. With this modular approach, we add new brands and models with minimal impact to the core application.



projected new product test development costs fell from roughly \$200,000 to \$25,000. Finally, development and maintenance savings combined to equal \$475,000 a year.

Results

Using TestStand, a commercial-off-the-shelf (COTS) software package, Motorola was able to concentrate on developing tests rather than executives. The primary benefits of this solution are a reduction in development and maintenance costs, elimination of duplicated efforts, maximization of reuse, and the centralization of all specifications and procedures in a single database.

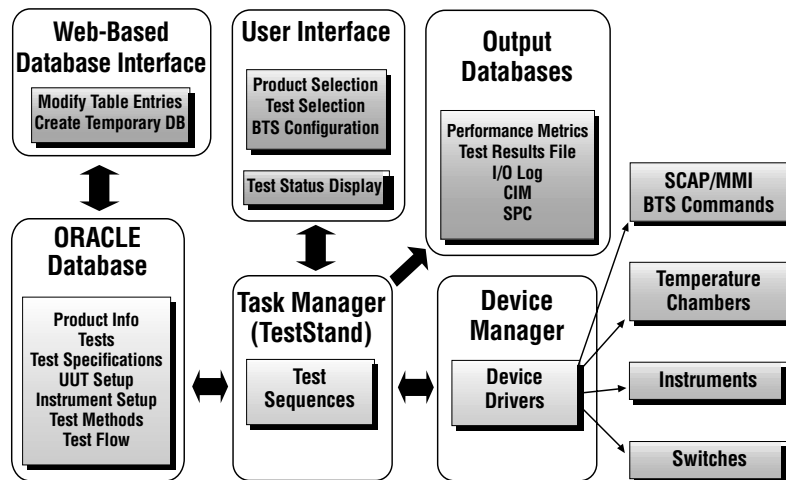
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TestStand and LabVIEW Main User Interface Screen

Reduced Cost

Creating a common test application resulted in a large cost reduction. In the past, the ITC and ATE groups maintained a total of eight separate test applications. By combining efforts between the ITC and ATE groups and developing a single modular test application, our combined annual maintenance costs were reduced from \$700,000 to \$400,000. The annual

With LabVIEW, development and maintenance savings combined to equal \$475,000 a year.



Common Cellular Base Station Test Software Model



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