Telecommunications Protocol Analysis Tool

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The Challenge: Developing a protocol analysis tool that runs on both Sun and PC computers for the software development of the Motorola™ Satellite Series 9500 portable telephone.

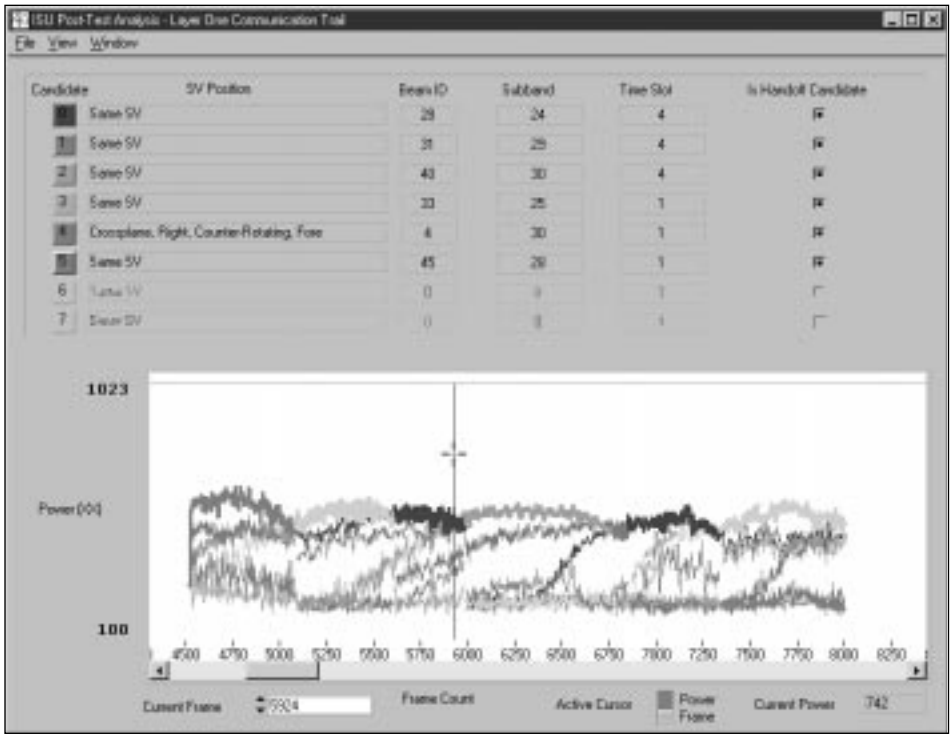
The Solution: Using the multiple platform capabilities of National Instruments LabWindows/CVI to develop an application with graphical summaries and textual output.

Introduction

Digital cellular systems use a layer-based protocol to transfer information between the telephone and the network. Each layer implements a functional component of the protocol. The implementation of the protocol is handled by real-time software that executes on a microprocessor in the telephone. Motorola hired Alliance Technologies Group (ATG) to develop a protocol analysis tool for a digital cellular phone it was developing.

With the graphics generated by the LabWindows/CVI application, users can see that the telephone performed the handoffs so it could remain on the most powerful beam, thus obtaining the best call quality.

During development, software emulators and source debuggers are used to test protocol analysis software. Some tests, though, require the software to operate without any intrusion to help ensure that we maintain millisecond response times. In these situations, the user relies on logged messages generated by the software during execution.



The National Instruments-based sunroof durability test system controls and analyzes testing of sunroof velocity, voltage, current, and other data.

Process and Development

First, messages are sent from the phone to a host computer in binary form. The data log contains both network-related and product-specific information for debugging the phone's software. After the test is complete, the user analyzes the data log.

Prior to the LabWindows/CVI-based solution, the software developer would examine a textual version of the data log. By using LabWindows/CVI, we maintained the same textual output capability and added several easy-to-use graphical representations. These new graphs present the data in a logical manner so users can focus on their area of development.

To help ensure platform independence, we developed a method of converting the data in the binary log file to a representation that mirrored the C structure of the message. The software that performed this conversion operated on the Sun and PC computers without modification or conditional compiling. By formatting the data into the C structure representation, we could use the structure fields to easily process and analyze the data log.

Next, we set out to create user interfaces and analysis routines to logically present the data in the log. We chose to present data related to each layer of the protocol stack:

- Layer one (physical layer) – includes unacknowledged communication and data used to establish an initial link to the system
- Layer two (data link layer) – messages used to transfer higher layer messages to the receiving entity
- Layer three (network layer) – messages used to manage the communication link

For layer one analysis, the users need to

see a bounce diagram showing the messages sent between the phone and the satellites, communication trail showing the handoffs

With the flexibility of LabWindows/CVI, Motorola can create applications from a single version of software stored in a location accessible by both Sun and PC computers.

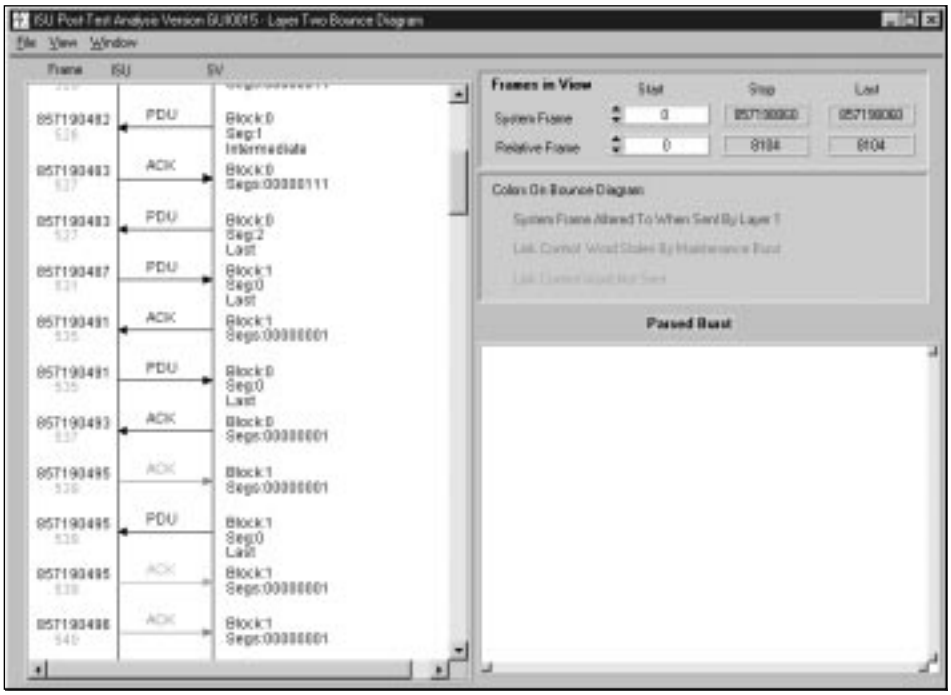
the phone made during the phone call, and the link statistics of the phone call. The users need to view the handoff events to see if the phone operates properly.

With the graphs generated by the LabWindows/CVI-based application, users can see that the telephone performed handoffs so it could remain on the most powerful beam, thus obtaining the best call quality.

For layer two and three analysis, the user needed a bounce diagram showing the flow of messages between two peer entities. With the application we developed, users can see a layer two analysis screen containing a bounce diagram showing the messages transferred during the test.

Results

LabWindows/CVI was crucial in providing a graphical analysis application that can operate on Sun or PC platforms using the same source code. With the flexibility of LabWindows/CVI, Motorola can create applications from a single version of software stored in a location accessible by both Sun and PC computers. Motorola developers now have an effective tool to analyze the operation of their phones in the lab environment or in the field.



The LabVIEW runtime test screen provides the user with a comprehensive yet simple view of the entire system.

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