PRACTICAL SYSTEM SOLUTION

Obsolescence of instruments in automatic test equipment (ATE) systems presents problems for test system users and a challenge for test system manufacturers. A solution has to allow replacement while protecting investment

Traditional test programs usually have instrument commands hard-coded into them. These programs are heavily dependent on the behavioural responses of the associated instruments.

Virtual Instrument Software Architecture or VISA (**www.vxipnp.org**) and Interchangeable Virtual Instruments or IVI (**www.ivifoundation.org**) software standards are key examples of test programs which incorporate standardised behavioural models of instrument classes, instead of specific instrument commands. However, today's users of ageing test systems find themselves unable to replace or repair an obsolete instrument at the heart of their system.

Select a solution

One solution is to select a replacement instrument matching form, fit and function to the obsolete instrument. An older ATE is more likely to incorporate instruments whose commands and underlying behavioural models are manufacturer- and era- specific.

Alternatively, the test program can be adapted to support a different instrument command set, and subsequently prove and re-validate the test programs. However, where there are many complex test programs with significant behavioural differences, the cost can be very high.

TILS takes over

Racal Instruments has pioneered TILS technology (Technology Insertion into Legacy Systems), inserting a computational layer into the test system to emulate obsolete instrumentation. This layer provides a mapping between test programs that use the original instrumentation and new instruments in the modernised test system.

It runs on a Windows-based PC and intercepts commands, sent from the test programs. The program incorporates specific translators which dynamically convert the 'old' commands to those understood by the new, upgraded instrumentation.

This process intelligently accommodates timing idiosyncrasies, moreover instrument responses are processed to replicate those of the originals.

There are three main hardware configurations into which TILS can be easily incorporated. In the first, with a traditional rack-and-stack GPIB, bus-based, system, TILS is hosted on a PC which resides directly on the bus. This allows new instrumentation to be added with the inclusion of further command translator packages, ensuring no changes to existing test programs and drivers.

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GPIB to VXI

Another configuration is where GPIB instruments are upgraded to VXI instruments. TILS can reside in a VXI, slot 0 embedded PC running Windows, to intercept and translate the necessary commands and communicate directly with the new VXI instrumentation (see figure 1). Further VXI instruments can be added to the chassis; existing test programs and drivers need no modification. This configuration could also use PXI instruments as the upgrade path architecture.

The third is the 'in-controller' TILS solution which allows the software suite to co-reside with the Test Executive, assuming the system controller's technical platform is, or can be upgraded to be, compatible. Commands to existing instruments are 'passed through' while interception and translation of commands to upgraded instrument is undertaken.

The TILS software suite comprises the TILS infrastructure environment or system software and the Command Translator Pair software.

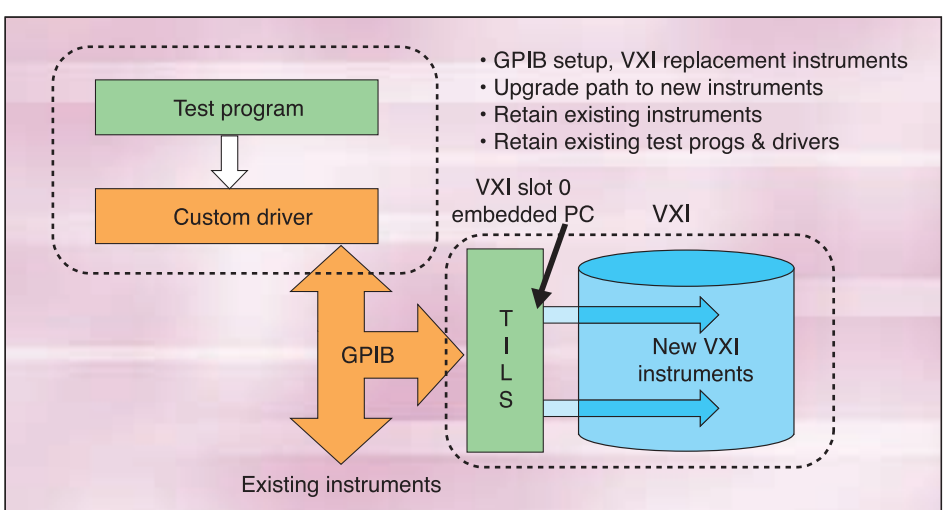


Figure 1: TILS can reside in a VXI, slot 0 embedded PC running Windows, to intercept and translate commands

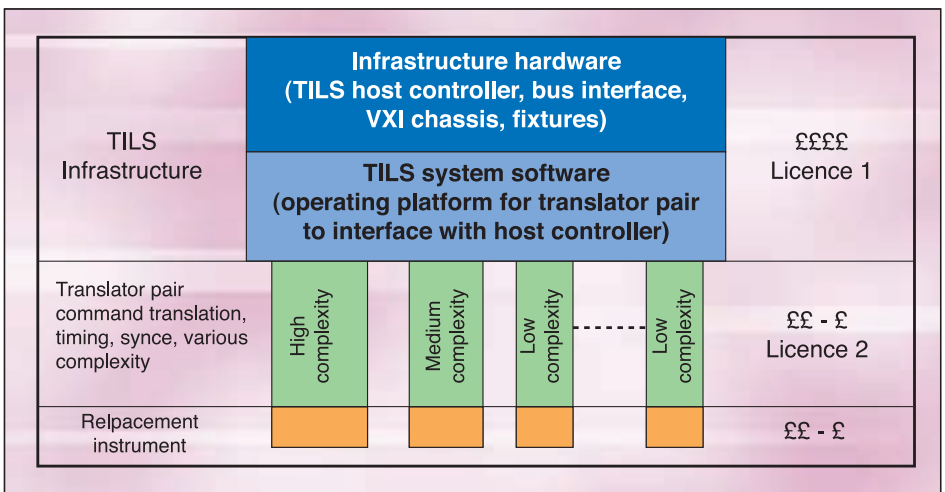
Software functions

The system software, which resides on the TILS host controller, performs the interception of commands and determines which commands require translation. This environment also interfaces between the TILS host controller and the Command Translator Pair software.

The Command Translator Pair software is the specific language translator for each instrument's command set performing the dynamic translation and providing for any timing or synchronisation requirements between the test programs and the instruments.

The Command Translator Pair software component of TILS contains information about the command set of the original instrument and details of the command set of the replacement instrument. It also contains specific information about how the replacement instrument should be used in response to the original, to effect equivalent instrument behaviour, including functionality for mapping parameter formats.

This third area allows differences in behavioural model to be tolerated. For example, if an original instrument automatically enabled an output when the associated level was set, then both a level setting command and an output enable command could be associated in the command map with the original instrument's level setting command.



TILS infrastructure - showing the Command Translator Pair component

Signal generator example

For example, in the application of modulation to the output of a signal generator, in one instrument, the act of enabling and disabling modulation may be combined with selection of modulation type. Possible parameters to the relevant command might be AM, FM and OFF. In an equivalent instrument, the two actions might be implemented independently, i.e. a modulation enable command might exist with possible parameters ON and OFF, and a distinct modulation type command might have the parameters AM and FM. In this case, information about the most recently

selected modulation type is lost when modulation is turned OFF.

In the case of the first instrument, information about the most recently selected modulation type persists when modulation enable is turned off, and, in the absence of another modulation type command being received, will be the type of modulation that is applied when modulation is re-enabled.

If the first instrument is intended as a replacement for the second, a strict 'command-translation-only' approach would be ineffective. The only solution is to maintain a full state model of the original instrument within the Command Translator Pair of TILS, where one-or-many commands for one instrument can be translated to one-or-many commands for the replacement instrument.

A further area within Command Translator Pair construction allows for timing considerations to be taken into account.

Timing concerns

If a replacement instrument makes a measurement slightly earlier than the original, or a source instrument takes slightly longer to settle, then the integrity of the tests may be compromised.

The Command Translator Pair can incorporate pre-execution delays. When there is concern that the replacement measurement instrument takes readings sooner, following receipt of a command, than did the original instrument, a delay can be executed by TILS before processing the command.

It can also include bus hold-offs. Some bus types provide features, which allow instrumentation to temporarily suspend activity on the bus controller. This is useful if the replacement source instrument could take longer to produce an output than did the original. For example, replacing an analogue function generator with an arbitrary waveform generator, a bus hold-off can be used to suspend controller execution of the test program while the output settles.

Like-for-like

When there is concern that the emulator releases the bus more quickly than the original instrument did, giving previously configured source instruments less time to settle, a bus hold-off can be inserted.

Using these extra features, provided that the chosen replacement can adequately perform the same measurement functions as the original instrument, accurate mapping and translation of the required functionality can be affected.

General purpose ATE housed in EVRs (electronic repair vehicles), such as those used by the British Army, are deployed in the field to perform second line tests on multiple digital and analogue, electrical and electronic sub-systems. Test instruments within the ATE have a service life considerably less than that of the ATE itself.

The TILS solution is currently being installed in a number of the British Army's general purpose ATE vehicles, providing mobile support of thermal imaging, communications and weapons electronics systems.

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