Using VXI to reduce test-system size and cost

How VXI hardware and updated software can simplify the redesign of older test systems

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The decision to build a VXI-based test system requires an evaluation of all available products in terms of cost, performance, and development time. Consider product choices for redesigning a large test system used to perform long-term drift testing on precision voltage references.

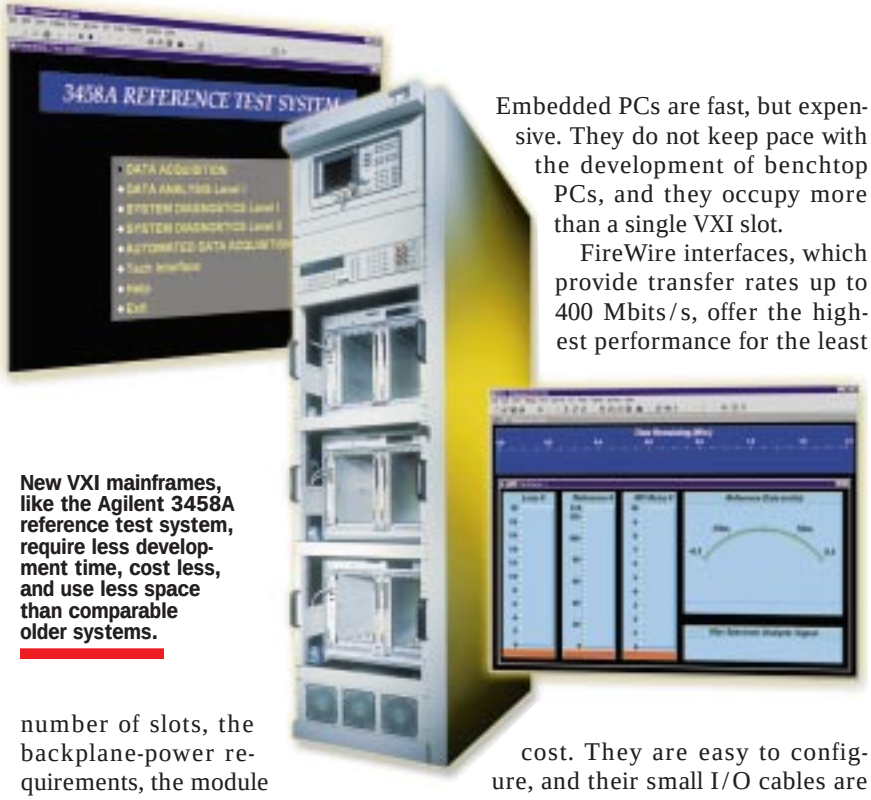
The system in question uses two rack cabinets implemented with a DMM, voltage standard, relay multiplexing, and a large commercial oven with a backplane to accommodate 22 motherboards that hold the reference assemblies. One entire rack cabinet houses the system's power supplies.

Three goals of such redesign are to minimize size, development time, and cost, as well as to ensure long-term hardware and software support. VXI is an attractive solution because of the wide array of available mainframes and modules. A mainframe could replace the backplane in the oven, and its power supplies could power the reference motherboards.

It would also be possible to use VXI switch modules instead of the rack and stack solution. This would reduce system-cable lengths to less than 2 ft.

Selection criteria for a redesign

In redesigning a system, the selection of the VXI mainframe is made first. The selection criteria are the number of slots, the backplane-power requirements, the module size, the system monitoring, the cooling capacity and fan noise, the interface availability, and the cost per slot.



New VXI mainframes, like the Agilent 3458A reference test system, require less development time, cost less, and use less space than comparable older systems.

C-sized modules are perhaps the most popular, and the availability of 1-kW mainframes would ensure sufficient power. The mainframe should also include enhanced monitoring capabilities. These capabilities will allow monitoring of power supply voltage, current, and power, as well as slot temperatures at three locations, intake air temperature, and fan speed.

The choice of controller interface depends on speed and cost goals. Embedded PCs are fast, but expensive. They do not keep pace with the development of benchtop PCs, and they occupy more than a single VXI slot.

FireWire interfaces, which provide transfer rates up to 400 Mbits/s, offer the highest performance for the least cost. They are easy to configure, and their small I/O cables are an asset when cabling a test system.

Can a VXI mainframe do the job?

The test system must make repeatable voltage measurements down to the sub-microvolt level over a period of several months. Questions about whether a VXI mainframe can perform adequately in this application are many.

For example, can a VXI-based DMM be used? Would the relay multiplexers have sufficiently low thermal offsets and offer the ability to switch repeatedly at levels below 2

µV? Will the switching power supplies' RF radiation interfere with measurements? How could the mainframe temperature be stabilized? Would an oven be necessary?

The DMM should be fully guarded and have at least a 7 1/2-digit resolution, a ppm-level accuracy, and excellent long-term stability. Choosing the relay multiplexer revolves around voltage and current levels, ac or dc switching, thermal offsets, channel count, matrix form, bandwidth, crosstalk, and switching speed.

Since only dc voltages under 10 V and virtually no current will be manipulated, the only limiting requirements are low thermal offsets and the number of channels. Using a relay multiplexer with 64 channels and thermal-offset specs of less then 2 µV would be satisfactory.

Regarding temperature control, the rack cabinet could be fit with solid front and rear doors and a bank of fans and a commercial temperature controller could be installed in the equipment rack. Using this approach, internal rack temperatures can be held to ±1° C and equipment temperatures vary less than ±0.2° C.

As an example of a final system redesign, three C-sized VXI mainframes can be installed in a single rack cabinet (see *photo)*. Each mainframe houses eight motherboard reference carriers capable of holding 16 references each, providing 128 reference outputs per mainframe.

The complete system contains the three C-size VXI mainframes, a DMM voltage standard, and a spectrum analyzer that is used to monitor potential RFI sources. Using two relay multiplexers and a FireWire interface, two slots are available. These could be filled with a breadboard card and a 64-channel scanning A/D converter. The new system requires 12 sq. ft of space, as compared to 35 sq. ft for the old system, and provides the same yield capacity.

The software platform is another part of the system redesign that needs significant upgrades. The new system has to be on-line in as short a time as possible. Using a visual programming environment could reduce test development time by up to a third.

With the exception of the breadboard card that is register programmed, all of the other VXI components use *VXIplug&play* drivers. The combination of a visual programming environment, *VXIplug&play* drivers, and a FireWire interface make program development almost easy. Using this approach, the total development time for the new system is about half that of the older system. EP