

Looking at LXI From a Supplier's Perspective

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Being an early adopter of a new standard for instrumentation control can seem a daunting prospect for any business and particularly so for smaller test and measurement companies. In the case of the LXI standard, the presence of virtually all the major test and measurement companies at the inaugural and subsequent LXI Consortium meetings meant that these industry heavyweights were firmly focused on this new technology.

There also was a good representation of smaller companies at those early meetings. These smaller companies have an important contribution to make to the promotion and adoption of the standard since they tend to be capable of changing direction quickly.

With lower cost structures, smaller companies can implement designs and address product niches that the larger companies would have little interest in pursuing because of moderate sales volumes or the need for product customization that does not fit their business model. Smaller organizations also tend to be closer to their customer base, making it easier for them to define and develop products in a relatively short time. With a combination of both large and small LXI vendors, the benefits to the end user include a broader range of products and more vendor choices.

Commercial Background

In the early days of LXI standardization, there was much talk about competition between LXI and PXI, with some members promoting LXI as a replacement for PXI. With PXI products accounting for approximately 70% of my company's revenue, there was concern about how LXI might influence the future of our PXI business.

Although there always will be competition among instrument standards, it quickly became evident that the very different architectures of LXI and PXI often would complement rather than compete. PXI is good at solving problems requiring dense and diverse instrumentation within a compact footprint, and LXI is better at addressing distributed test requirements, larger systems that might not easily fit into the PXI architecture, and high-performance or dedicated applications.

The challenge was how to exploit the benefits of LXI to access new markets by leveraging the company's current product technology.

While larger companies may have the option of starting with a clean sheet of paper when developing new platforms, smaller companies must think hard about the consequences of devoting most of their resources to a new instrumentation platform. It is financially inconvenient for a large company to get this transition wrong, but it can be fatal for a smaller company.

For Pickering, it was clear that we wanted to get involved in LXI early. But the question was how to do it and manage the risks.

Company Strengths

The experiences and expertise gained in the development of PXI switching products were our biggest strengths. However, the investment and experience were not just in hardware designs, but also in the software required to drive the switching products—a crucial asset that all too easily is overlooked.

Pickering had a big investment in switching hardware for several different control architectures, but we had an equally high investment in the software required to control the hardware. For us, the pragmatic solution was to leverage current technologies.

New Products

The first LXI product introduced by Pickering was a modular switching chassis, one of the first LXI-compliant products to be certified and known in the consortium as the *Toaster* (FIGURE 1). This product leveraged our current technology and allowed any Pickering PXI switching module to be controlled through an LXI-compliant interface. This immediately made a large variety of switching functions available for integration into LXI systems.

To leverage existing PXI switch modules into an LXI platform, a controller was required to support both a LAN interface and a PCI bus interface. In addition, software was needed to control the PXI cards, support a TCP/IP protocol



FIGURE 1. LXI MODULAR SWITCHING CHASSIS

stack, and execute driver commands received via the LXI interface.

One implementation that supports these hardware and software functions would be an embedded x86/Windows-based controller. However, the type of applications and costs associated with this type of product led us to consider other alternatives.

For signal-switching applications, the speed of execution for controlling the switch cards was not a key performance parameter. As relay closure times normally are specified in milliseconds and not nanoseconds, a high-powered, Windows-based processor for controlling the switch cards would be an overkill. As a result, we specified a lower-cost Linux-based embedded controller not ordinarily used for controlling PXI systems.

However, in this case, the embedded controller's task was relatively simple and limited to enumerating the PXI bus, controlling the PXI devices, and translating the commands received via the LXI interface to PXI device driver commands. This choice of controller resulted in significant savings in hardware and software licensing costs. **FIGURE 2** shows a block diagram of the modular switch/controller implementation.

Beyond the cost savings, we also had solved some important technology problems:

- Management of PCI-based PXI cards within an LXI compliant chassis via a cost-effective implementation.
- Compliance with the LAN aspects of the LXI standard.
- Generation of soft front panels by the use of Java downloads.
- Development of a common driver philosophy for LXI and PXI products.
- Restructure of our drivers to provide commonality between LXI and PXI, simplifying future code management.

Equally important, the development of this product gave Pickering knowledge and credibility about LXI. This insight helped when talking to customers about how LXI products might solve problems that were not easily addressed either technically or in terms of cost by PXI or GPIB solutions.

Our initial design efforts demonstrated just how easy it could be to control switching products through an LXI interface, particularly when the application did not require tight coupling between the controller and the switching system. By using LXI, we could leverage PXI switching products and offer a switching control solution comparable to a GPIB-controlled implementation.

An LXI-based solution provided additional tools to tackle new switching problems that might not be easily addressed by our other instrument architectures. In addition, by basing the LXI/PXI architecture on a common firmware and electrical platform, various other system configurations could be created using the same common technologies. The benefits of basing subsequent products on a common platform were twofold:

- LXI certification of these derivative products could be greatly simplified, with some products requiring only submission of a technical justification based on the commonality with the baseline product. The result is an expedited certification process, shortening the overall time to market for these products.

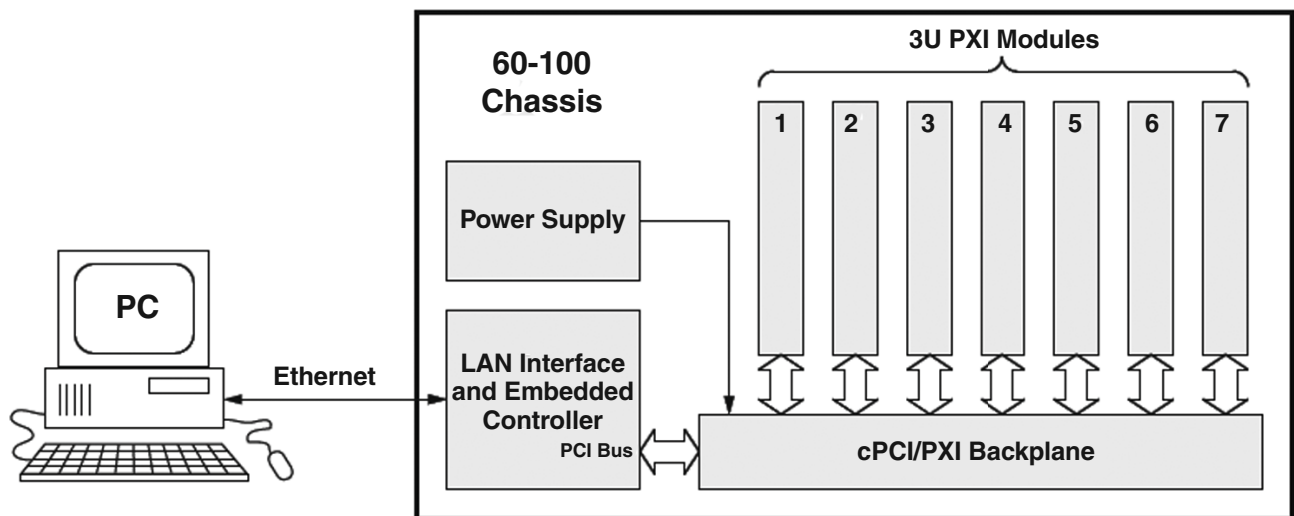


FIGURE 2. SIGNAL SWITCHING IN A PXI ENVIRONMENT CONTROLLED THROUGH A PCI INTERFACE USING AN EMBEDDED CONTROLLER

- By reusing common components, it would be possible to assemble other LXI products in a very short time, allowing the company to capitalize on new and time-critical opportunities presented by customers.

Moving On

Since the *Toaster* was introduced, other product opportunities have been successful. Applications include a video matrix and a microwave matrix, products built on a model that uses the same embedded controller that supports the LXI engine and controls the switching functions through an internal PCI interface.

This has proved to be a practical method of producing new designs

with a rapid turnaround from project start to finish. LXI supplies a platform that can use both standard and custom switching solutions with investment levels similar to those associated with comparable PXI solutions.

The use of a common LXI engine across a number of products also provides a major benefit when performing LXI compliance testing. The consortium requires that all products be certified through independent testing.

The testing is a constructive process, performed by engineers with a common goal of achieving a consistent interpretation of the specification (see sidebar). Once you have proven that an instrument's LXI engine is compliant, compliance for further products based on

The Certification Process

Developing a product that is LXI compliant is a well-documented process and detailed by the LXI specification. Once you have designed a product, the road to conformance is well defined. Here are some of the questions and processes your company will go through as part of the certification process.

How do you start?

First, you need to either join the LXI Consortium or acquire a license to use the LXI logo. Then, submit your product for compliance testing. You must not promote or deliver product with the LXI logo until after it is declared conformant.

Is the LXI logo protected?

Yes, and to ensure product integrity, the LXI Consortium will take action to prevent the use of the logo by unauthorized companies.

How do I get a product compliance tested?

The simplest way is to submit the product for compliance testing at an LXI Consortium event called a PlugFest. Future events, locations, and who to contact can be found on the LXI Consortium website.

Who does the testing?

Until now, testing has been conducted by LXI Consortium members who are experts in the various areas covered by the specification.

Does this raise competitive issues?

There was concern it would. But in practice, this has not been a problem, and many companies have benefited significantly from the advice offered by the experts doing the tests. Very often, they will tell you exactly what changes are needed to gain compliance.

Are there other ways to have my product tested?

The consortium is moving to start third-party compliance testing, initially within a PlugFest event. There also are plans to develop test suites to simplify testing procedures.

If my product fails, do I need to wait for the next PlugFest?

Not necessarily. Experience has shown that many products have failed for minor reasons, and these can be fixed relatively quickly. If you clearly show what actions have been taken to correct deficiencies, then you can gain compliance before the next PlugFest.

What happens to the test results?

These are collected on a spreadsheet as the products undergo testing. At the end of the testing, the results are reviewed and compliance or deficiencies noted. The details are not submitted to the whole LXI Consortium membership.

What do I do to get a compliance declaration?

Submit the test results to the Compliance Group chairman along with a declaration that indicates the class of LXI device being claimed. It will be considered by the group and, if accepted, submitted to the board of directors for final approval. This process usually takes less than two weeks. The product then can be added to the LXI Consortium website and can display the LXI logo.

Do I need to submit every product for testing?

No. If you can show that a new product shares the same LXI interface as a previous product and you have tested the product to the standard, you can make a submission to the Compliance Group based on the previous product. If products are found to have compliance problems, the LXI Consortium can insist corrective action be taken.

the same LXI engine can be demonstrated by completing a technical justification and a compliance test spreadsheet. Those documents are submitted to the Compliance Group for approval.

User Reaction

User reaction to the LXI products has been very positive. The LXI products can be easily configured, and the interface provides a high degree of isolation between the user's controller platform and the functions within the LXI device. The common driver approach also has made it easy for users familiar with our PXI products to translate their experience to LXI.

Lessons Learned

Pickering's experience has shown that, by judiciously leveraging a company's current technology, small as well as large test and measurement companies can make successful LXI products. Small companies need to choose their design methodology carefully and ensure that it can be used across a range of products. Ideally, they need to choose a methodology that takes advantage of their core competencies rather than embarking on new technologies.

There certainly could be a need for a significant initial investment; but once made, the barriers to creating more products are low. Reuse is the best way of ensuring successful product development.

LXI offers opportunities for both large and small suppliers. By leveraging current technologies, the investment to create the first LXI device can be moderate with the resulting product providing an entry into a new market segment with growth opportunities.

ABOUT THE AUTHOR

David Owen is the business development manager for Pickering Interfaces. Over the last 30 years, he has held key engineering, product management, and strategic marketing positions with Marconi Instruments, then IFR. Mr. Owen, the innovator of more than 10 patents in the field of RF signal generation and analysis, currently is involved in the PXI and LXI standards and serves as deputy chair of the LXI Compliance Working Group. Pickering Interfaces, Stephenson Rd., Clacton-on-Sea, Essex, CO15 4NL U.K., +44 1255-687900, e-mail: david.owen@pickeringtest.com



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