Comparing LXI and PXI for Switching Applications

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Pickering Interfaces

- Principal products are switching systems
- Sister company to Pickering Electronics
  - Manufacturer of instrument grade reed relays
- Company started with GPIB switching assemblies
- Later developed VXI and then PXI switching solutions
  - PXI now forms the major part of its switching business
  - But LXI is catching up quickly
- Board level members of both the PXISA and LXI Consortium

Switching

- It's not exciting
- But it is complicated with both obvious and subtle trade off's
  - Density
  - Cost
  - Voltage and Current rating
  - Path loss
  - BW
  - Configurations
  - Connectors
  - Software management
- So the solutions are diverse and choices not always clear

PXI Standard (1)

- Standardised around the PCI bus
  - With a PCI Express extension using a different interface
- PC Centric
  - Central processing model via a shared high speed backplane connection
    - Relatively simple modules, register controlled
    - Single controller
  - Embedded controller or remote controller via proprietary interface
- Modular
  - Fixed mechanical form factor
  - Shared central power supply
  - Shared cooling
  - Defined backplane connectivity for PCI/PCI Express and a trigger system

PXI Standard (2)

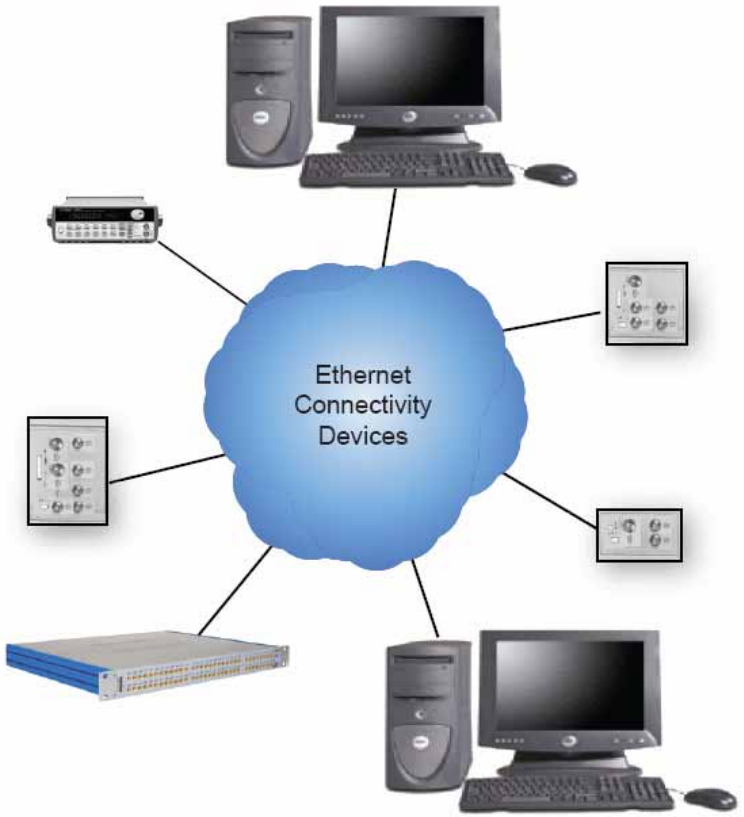
- Software framework
  - VISA drivers are required
  - Tends to be Windows centric
- Modules appear as an extension of the PC
  - Behave as though they are directly on the computers PCI Bus system
  - Tightly coupled to the PC hardware
    - So don’t hot plug and watch the power up sequence
- Large variety of functions available

What PXI does NOT define

- Cooling standards
  - Avoided because of the costs and past experience on VXI
- Detailed power supply specification
- Electrical interaction between modules
  - Radiated EMC
  - Conducted EMC
  - Module screening
- Simple ways of controlling at a distance
- Vendor specific features
  - Chassis indicators (power etc)
- No set compliance test procedure

LXI Distributed System

- LXI is distributed
  - Can have many controllers
  - Can have peer to peer
  - Can include VPN connections
  - It has a consistent LAN interface
    - Compliance tested by third party
- It is NOT a modular system



What the LXI Standard does NOT do

- Set any size constraints
  - Devices can be rack mount or any other format
- Control device cooling
  - It is up to the vendor to behave in a good neighbour way and provide enough cooling for the device to work
    - There is some guidance
- Control EMC or measure device performance
  - It is up to the vendor to make the product fit for purpose
    - Since most are self contained interaction problems are minimal

PXI and LXI comparison

- The standards are quite different
- PXI focus is a central processing model based on the PC using relatively simple mechanically defined instruments requiring a very high speed bus
  - Just like any other card you might insert in a PC
  - It REQUIRES a high speed bus to work
- LXI focus is on a distributed system using intelligent boxes of any size communicating by a message based interface over a fast bus
  - Some similarity to GPIB but with more options
  - It is much less reliant on a high speed bus to work

Some clear areas of difference (1)

- **Parametric performance**
  - LXI has freedom of size and vendor specific conditioning to get the very best performance
  - PXI is limited by module size and lack of inter-module specifications in a relatively unshielded environment
- **Supporting large components**
  - Mechanical freedom of LXI is an advantage
  - PXI implementations can be cumbersome and not very cost effective
- **Supporting large solutions**
  - LXI has the advantage of space to implement large arrays of components as a single entity
  - PXI has to build these up from separate entities with module and interconnection overheads and additional software complexity

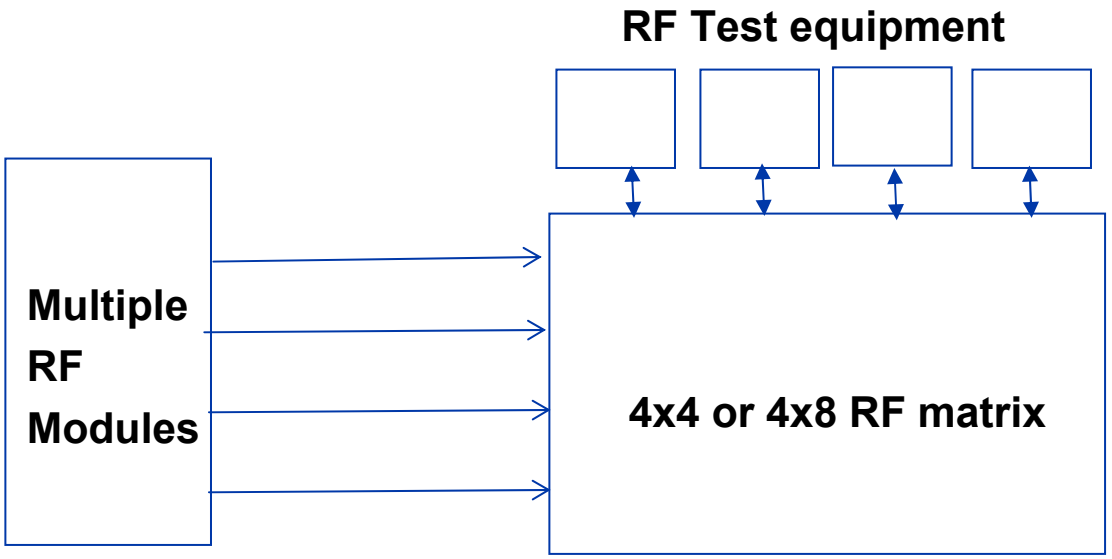
Some clear areas of differences (2)

- **Supporting large variety of functions in a small volume**
  - **PXI has the clear advantage since a chassis can support diverse functions such as switching, data acquisition, signal generation and measuring devices if the functionality can be fitted comfortably in the PXI mechanical profile**
  - **LXI has the high overhead on each function of its embedded controller**
    - **Minimum feature set to support web etc.**
- **Control at a distance**
  - **LXI has the advantage because it can operate over continental distances through standard IT networks.**

- **Now some specific case examples**

The component size issue

- Customer needed a 4x4 RF matrix
  - Needed good RF performance to beyond 3 GHz
  - Testing RF modules supporting multiple air interface standards over several frequency bands



Each module is tested by up to 4 RF testers

4 testers used because of legacy purchases and ability to use the best solution for that band

Matrix used to allow concurrent testing

Customer feedback

- Using 30-750 Pickering VXI solution
- Concerned about using VXI
  - Cost
  - Future availability
  - Physical size
    - Had no other need for VXI products in the chassis since air interface test instruments were GPIB based
- Had to be rack mounted
- Two routes were offered
  - PXI (existing product)
  - LXI (new product)

Comparing solutions

4x4 Microwave Matrix PXI

- 40-789 Single
  - 10 PXI slots for one matrix
  - 4/5U High in a rack

4x4 Microwave Matrix LXI

- 60-750 Dual Version
  - 2U for single or dual matrices

LXI solution chosen

- Lower cost
  - No chassis or controller interface
  - Easier mechanical design
- More compact physical size
- More robust operation
  - Not an extension of the PCI Bus
- Easier to transport to overseas factories
  - Including China
- Once the first system was up proved easy to deploy
  - It worked first time

The single switching entity example

- User was testing displays systems requiring 75Ω impedance
  - 8 video input signals being routed to a bank of displays in turn for soak testing
- Needed a configurable video matrix
  - Some basic systems at 24x8
  - Other applications 48x8 or a dual 24x8
- Two routes discussed
  - PXI
  - LXI

Video Multiplexer Example

- **Multiplexer built up PXI**
  - **40-726 12x8 matrix multiple slots**
- **Single entity Multiplexer LXI**
  - **60-711 dual 24x8 matrix**

Problem for PXI is number of connections, configuring and relay count

Comparing the solutions

- PXI built up from multiple modules in a PXI chassis
  - Cabling costs
  - High infrastructure overhead
- LXI is an integrated solution
  - PCB traces replace cables
  - Single controller interface
- LXI was the clear user choice
  - No configuration cables
    - Time to configure
    - Cost of cabling
  - Easier to programme
  - More compact
  - Easier to understand

Control at a distance

- User was testing cables in an airframe
  - Fuselage testing
  - Wing testing
  - Integrated airframe testing
- Using a Fluke tester to check for data cable (Ethernet like) integrity
- An aircraft is big
  - Needed switching to loop cables back
    - Both wings
    - Fuselage
  - And wanted to be able to control the switching from the cockpit or anywhere else they were working

Hardware solution available in PXI

- Established range of PXI modules designed for this type of application
- But control at a distance in PXI is not that easy
  - and they had concerns over robustness of hanging switching cards of the PCI bus
- In LXI its much simpler

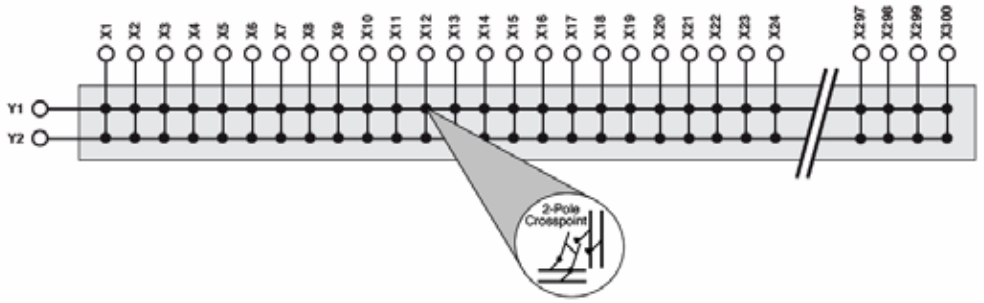
The 60-100A allows Pickering switching modules to be supported through an LXI conformant interface, providing discovery, programmatic and soft front panels with web access

Why 60-100A?

- We already had suitable modules for testing the cables
  - Designed for differential pairs
- 60-100A supports these modules in an LXI environment
  - Provides discovery for the modules
  - Provides SFP for each module
  - Programmatic interface very similar to PXI
  - The distances involved are bridged very easily using standard CAT5 cables

High Voltage Insulation Testing Airframe

- Cable insulation testing
- Again distance issues involved
- 60-310 300x2 matrix 1kV rating
  - With high closure capacity for insulation testing



Be careful about LXI and PXI comparisons

- **These examples chosen to show the differences where LXI has an advantage**

- **Where PXI is better we simply offer it unless there are other reasons**
  - **Where switching is mixed in with instruments**
  - **Where there is a high diversity of switching functions we offer PXI modules in PXI or LXI environment using 60-100**
    - **The user decides**

Our View on LXI and PXI

- They are complimentary solutions
  - LXI does things that are hard or impossible in PXI
  - PXI does things that may have too high an overhead in LXI
- LXI can then be used to implement bigger versions with higher performance levels
  - With lower cost for larger systems
- Both product platforms have their attractions
  - So both platforms will continue to grow with LXI enabled product being the largest element
- Hybrid systems will be common
  - PXI and LXI solutions supporting different parts of the system