NI Technical Symposium 2016
How can Modular Instruments reduce the Cost of Test?

Fanie Coetzer
Field Sales Engineer
National Instruments
Inserting New Technology
The Reality

- Vendor-defined measurements
- Complex software integration
- Large footprint
- High power consumption
- Poor inter-device synchronization
A Better Approach

Cost Savings and Flexibility
Modular Instrument Platforms
PXI Revenue Forecast for Test Applications

Source: Frost and Sullivan
PXISA—PXI Systems Alliance

- Organized in 1997
- Founded in 1998
- PXISA goals:
  - Maintain the PXI specification
  - Ensure interoperability
  - Promote the PXI standard
- The PXISA comprises 70+ members

pxisa.org
PXI: The Industry-Leading Platform for Test, Measurement, and Control

**PXI Controllers**
- Performance embedded - Windows or RT OS
- Remote control via desktop or laptop

**Software**
- Flexible driver APIs, example code, soft front panels, and configuration

**PXI Chassis**
- Options ranging from low-cost, 4-slot to high-performance 18-slot

**PXI Modules**
- >1,500 options from over 70 PXI vendors
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PXI Chassis

High Bandwidth and Performance

- System bandwidth up to 24 GB/s
- 8-slot and 18-slot versions
- 5U of 19in. rack space

High-Availability

- Hot-swappable, redundant (available) DC power supplies
- Hot-swappable, front-accessible, redundant cooling fans

Low-Noise & Footprint, Portable

- Ideal for desktop use
- Integrated MXI control option available
- 4-slot and 5-slot versions
The PXI Express Backplane

- System Controller Slot
- System Timing Slot
- Peripheral Slots (Hybrid Compatible)
Advantages of PXI: High Throughput and Low Latency

Increasing Bandwidth [MByte/s] vs. Decreasing (approx.) Latency [μs]

- USB 3.0
- USB 2.0
- Gigabit Ethernet
- VME/VXI
- GPIB (488.1)
- GPIB (HS 488)
- PCI/PXI Express 1.0 (x8)
- PCI/PXI Express 2.0 (x8)
- PCI/PXI Express 3.0 (x8)

64X More Throughput

1000X Less Latency

ni.com
Increasing PXI Chassis System Bandwidth

- PXI with PCI
- PXIe with PCIe Gen 1
- PXIe with PCIe Gen 2
- PXIe with PCIe Gen 3

Total System Bandwidth [GB/s]
Integrated Timing and Synchronization

- External Clock Source
- Box Instrument 1
- Box Instrument 2
- Box Instrument 17

Single-Ended Triggers
- 10 MHz Clock

100 MHz Differential Clock
100 MHz Sync Clock
Single-Ended Star Trigger
Differential Star Triggers

PXIe Controller
Instrument 1
Instrument 2
...
Instrument 17

PXI Instruments

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ni.com
PXI System Controllers

Embedded
- Complete system within a single chassis
- Ability to run both standard and Real-Time OSs
- Integrated peripherals

Rack-Mount Controllers
- High-performance multicore processors
- RAID 0 configurations for high-speed streaming
- 1U form factor

Remote Controllers
- Use the latest, high-performance PCs
- Extend existing PCI or PCI Express bus
- Take advantage of laptop control for portable solutions
PXI Embedded Controllers
Best-in-Industry Performance and Widest Range

- Leverage the latest Intel processors
- Easily upgrade system performance
- Wide range of offerings: best performance to best value
- Runs OS and application software

I/O Connectivity
- Dual Gigabit Ethernet
- Super Speed USB 3.0, serial, parallel, GPIB
- Display ports with multimonitor support
Reduced Test Times with PXI

Traditional Box Instruments

PXI Based Test Systems

Time

Processing Power

Moore’s Law

Performance Gap

Dual-Core CPU

Quad-Core CPU

Octo-Core CPU

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Industry-Leading NI PXI Controller Portfolio

- **PXI-8156**: Intel® Pentium® MMX 166 MHz, 16 MB RAM
- **PXI-8176 RT**: Real-Time OS
- **PXIe-8103**: PXI Express Technology
- **PXIe-8106**: Dual-Core Processing
- **PXIe-8135**: Quad-Core Processing
- **PXIe-8880**: Octo-Core Processing

NEW! PXIe-8880 Octo-Core Processing
PXI: The Industry-Leading Platform for Test, Measurement, and Control

- **PXI Controllers**: Performance embedded - Windows or RT OS. Remote control via desktop or laptop.
- **PXI Chassis**: Options ranging from low-cost, 4-slot to high-performance 18-slot.
- **PXI Modules**: >1,500 options from over 70 PXI vendors.
- **Software**: Flexible driver APIs, example code, soft front panels, and configuration.
## Modular Capability for Every Application

<table>
<thead>
<tr>
<th>DAQ and Control</th>
<th>Instruments</th>
<th>Interfaces</th>
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</thead>
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<tr>
<td>Multifunction I/O</td>
<td>Oscilloscopes</td>
<td>GPIB, USB, LAN</td>
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<td>FPGA</td>
<td>High-Speed Digital I/O</td>
<td>RS232/RS485</td>
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<td>Digital I/O</td>
<td>Digital Multimeters</td>
<td>CAN, LIN, FlexRay</td>
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<td>Analog Input/Output</td>
<td>Signal Generators</td>
<td>Avionics Buses</td>
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<tr>
<td>Vision and Motion</td>
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<td>Counter/ Timer/Clock</td>
<td>RF Analyzers and Generators</td>
<td>Boundary Scan/JTAG</td>
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<tr>
<td>Sensor Measurements</td>
<td>Power Supplies</td>
<td>DeviceNet, PROFIBUS</td>
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<td>Reconfigurable I/O</td>
<td>Dynamic Signal Analyzers</td>
<td>SCSI, Ethernet</td>
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<td>Signal Conditioning</td>
<td>SMUs</td>
<td>VXI-VME</td>
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**NI Offers 600+ PXI Products**

And there are over 1500 PXI modules from 70+ vendors on the market today.
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Software
Flexible driver APIs, example code, soft front panels, and configuration
Developing Applications with NI PXI
Quick System Setup and First Measurements

Measurement & Automation Explorer (MAX)
NI-SCOPE and NI-FGEN Soft Front Panels
Modular Automated Test System

SOFTWARE
- Test Management Software
- Test Development Software
- OS, Drivers, Services, Hardware Abstraction

HARDWARE
- PC or Embedded Controller
- PXI Chassis
- Switching
- Signal Generation
- RF Measurements
- Bus Interfaces (GPIB/LXI/Serial)

Fixturing/Mass Interconnect

ni.com
NI’s Automated Test System Solution

SOFTWARE
- LabVIEW
- LabWindows™/CVI
- TestStand
  Test Management, Test Deployment
- Other Software
  Measurement Studio, Visual Studio.NET™, ...

HARDWARE
- PC or Embedded Controller
- PXI Chassis
- Switching
- Signal Generation
- RF Measurements
- Bus Interfaces (GPIB/LXI/Serial)
- Fixturing/Mass Interconnect

IVI, VISA, NI-DAQ, NI-DMM, NI-SCOPE, NI-FGEN, NI-HSDIO, …

ni.com
Reducing Test Time with Parallel Device Test

**Sequential**

<table>
<thead>
<tr>
<th>UUT 1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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**Pipelined**

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**Auto-Schedule**

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Test Time
Begin customizing your system with sample projects and LV Examples

- Recommended starting points for common LabVIEW applications
- Clearly indicates where to add or change functionality
- Shows best practices for code design, documentation, and organization
- Add custom templates and sample projects
Questions
Qualcomm Atheros Improves WLAN Test Speed and Coverage

The Challenge
Keeping WLAN test costs low and test accuracy high while reducing characterization times as device complexity grows.

The Solution
Reducing test time by 200X using a custom, flexible WLAN test system developed on the NI PXI platform with the NI VST and the NI LabVIEW FPGA Module.

Learn more about how NI helped Qualcomm. Visit [ni.com/case-study/qualcomm](http://ni.com/case-study/qualcomm)
Guest Case Study

Winston Arendse

Mix Telematics
ABOUT US

MiX Telematics is a global provider of fleet and mobile asset management solutions.

Using the Software-as-a-Service (SaaS) delivery model, MiX Telematics delivers its solutions to customers in more than 120 countries, across 6 continents.
ABOUT US

Presently, over 450,000 mobile assets – from trucks and buses, to vans, cars, motorbikes and trailers – are actively managed by MiX Telematics; and we’re growing…

Our products are designed, developed and manufactured locally.

>100K fleet\tracking devices produced in 2015.
PRODUCT QUALITY

• Every product manufactured is tested on the production line ie. No sample testing
• Aim for 100% component coverage and <5ppm out of box failures/field returns
• Every product is traceable throughout production from component batch and reels to bulk packaging box delivered to our stores.
Test Automation
OVERVIEW

Test Equipment Hardware based on PXI, PXIe and CDAQ platforms from National Instruments.

Sequencing done using TestStand an Labview

Test Data analyzed using Diadem
APPLICATION

Test Operator scans the tracking serial number associated with DUT and inserts DUT into Test Equipment.

Test Sequence auto starts and selects the appropriate tests to run based on DUT tracking serial number.

Test Data written into Results Database.
INTEGRATION

- Test Data replicated to our offices for analysis using Diadem.
- Process stability (cPK) and test limits derived
INTEGRATION

- Test Data consumed by online production dashboard.

- Real-time view of production throughput and yield as well as Test Equipment stability.
INTEGRATION

• Virtual “Job Card” created for each failure on the production line.

• Production Technicians capture every repair step performed.

• Repair and failure information fed back to CEM and used for process improvement
Test Throughput
OVERVIEW

• Every minute of testing and integration time affects the price of the final product.

• Significant focus given to “ease of manufacturability” as well as test coverage during product design and development.

• Quicker tests + simpler integration = lower man. cost
IMPROVEMENT

• Traditional Switching\measurement techniques -> NI Switch Scanning (average reduction of 1 min. per test per product)

• TestStand Sequential Testing -> Parallel\Batch Models (double throughput)
IMPROVEMENT

• GSM Module Testing: “Connected Data Call” -> Connectionless Test methodology using NI VST (±30 sec -> 4 sec)

• NI VST – one device used to test 5 modules (BT, Wifi, GSM, GPS, 433MHz Radio)
Questions?
Modular Instrumentation Advantages

- Speed
- Flexibility
- Integration
- Size
- Cost
- Scalability
Visit ni.com/pxi

- Learn about the products
  - PXI, LabVIEW, TestStand, and more

- Read case studies
  - Explore business and technology impact

- Access test development resources
  - System design templates
  - Reference guides
  - Optimization strategies
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