





# Race to the Finish: Build an Automated Test System in 40 Minutes

NIDays 2015

# Aaron Edgcumbe

- Technical Marketing Engineer
  - Automated Test



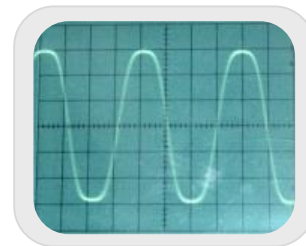
# Traditional Approach to Test



DC Offset



Rise Time



Edge Count



# Smarter Test Systems for Smarter Devices



Testing must be less expensive and faster.

# Building a Better Automated Test System

Use flexible hardware and scalable software

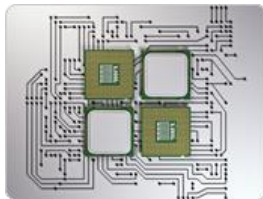


**Reduced Capital Equipment Costs and System Size**  
Deploy a complete test system at a lower cost with the same footprint as a single traditional instrument.



## Rapid Test Development

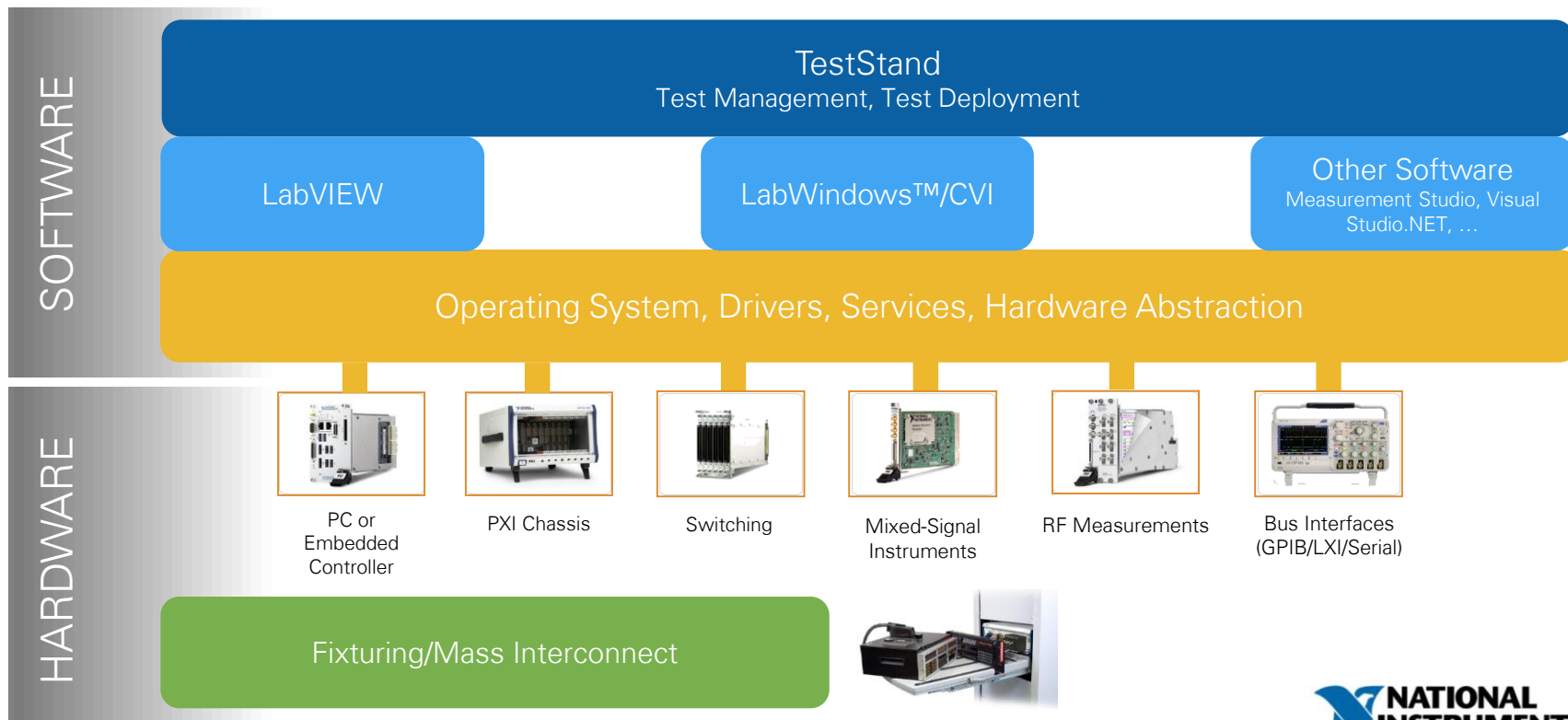
Develop innovative test systems to meet your challenging time-to-market and performance requirements.



## Faster Test Execution With Increased Flexibility

Pair an extensive portfolio of instrumentation with cutting-edge technology while using a common programming environment to create customized testing solutions and lower test times.

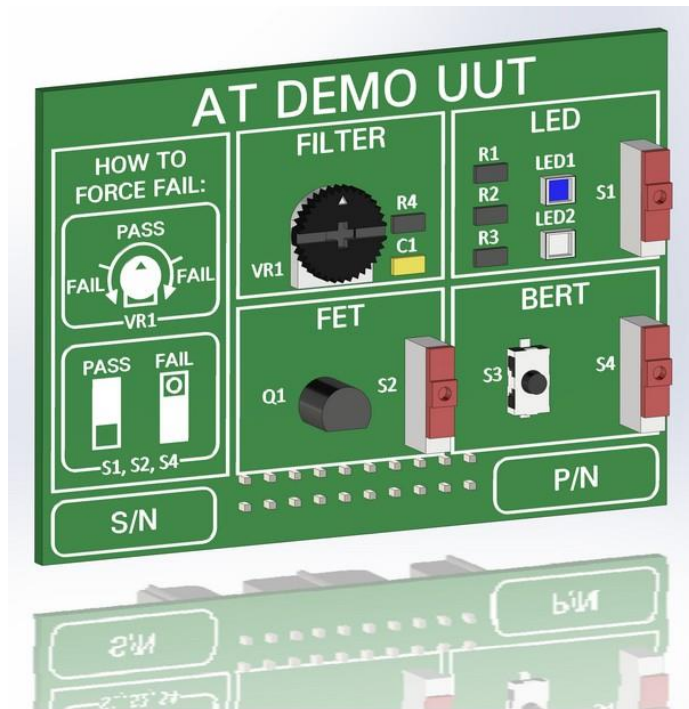
# NI's Automated Test System Solution





# Today's Challenge

- 3 tests on each unit under test
  - Bit error rate test (BERT)
  - LED functional test
  - Signal integrity test
- Test all four UUTs in less than 10 seconds
- Program test modules and test sequence in less than 40 minutes



# The Challenger

Kirtesh Mistry

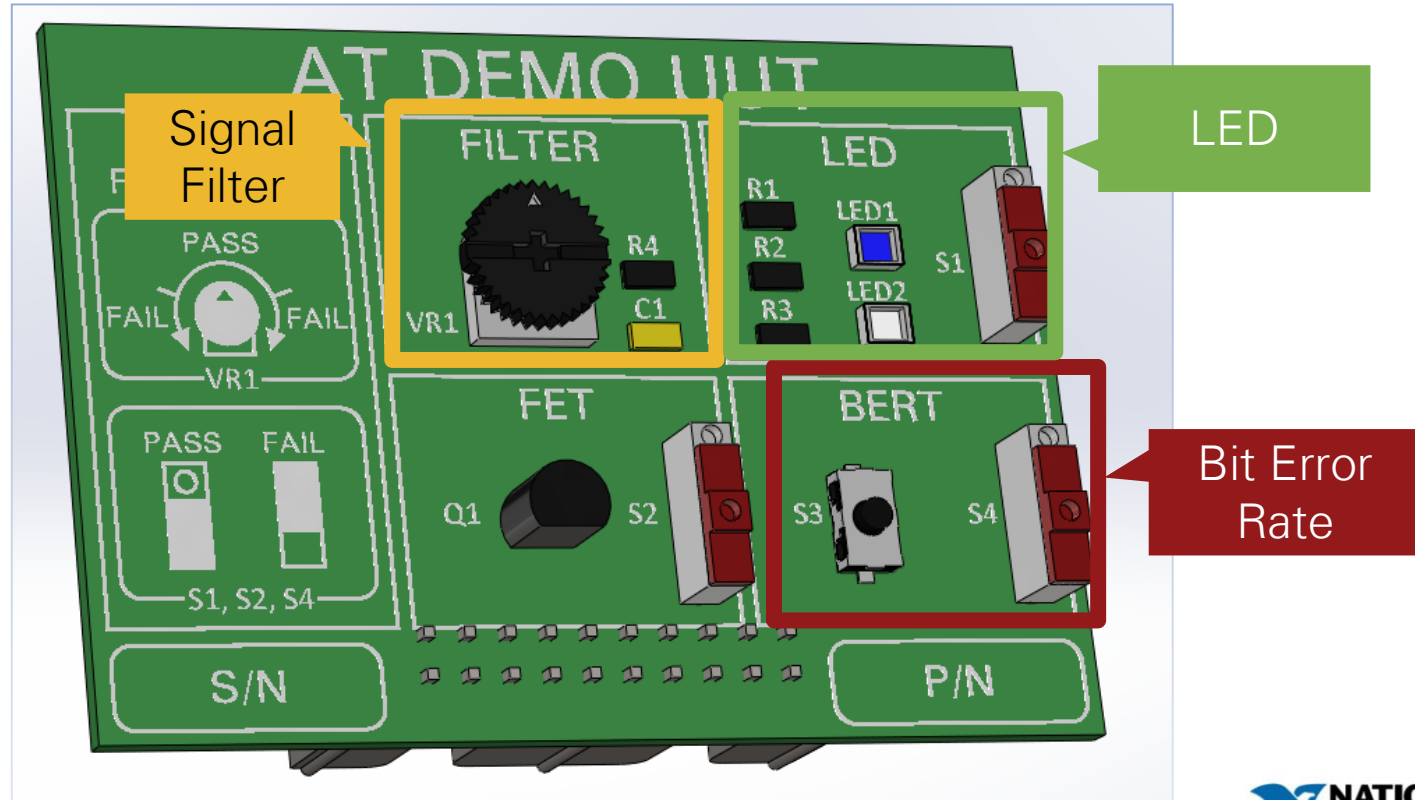
Inside Sales Engineer - Ireland  
CLAD



# Test Hardware



# Demo UUT



Ready?

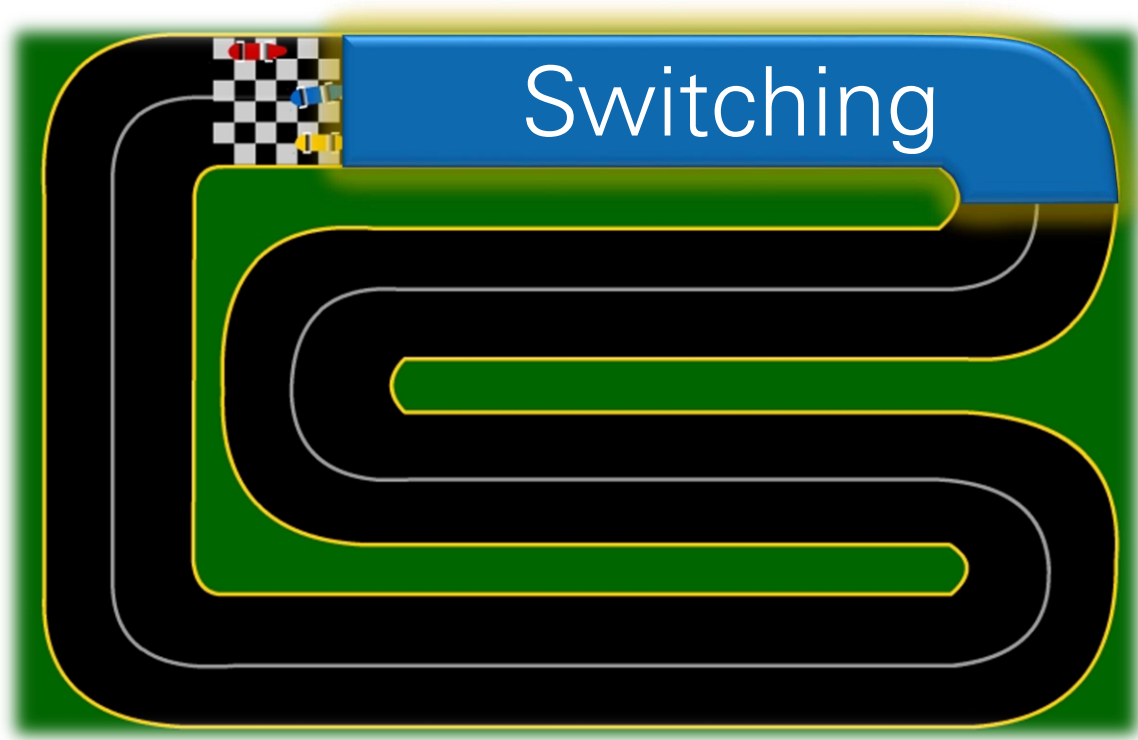
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2

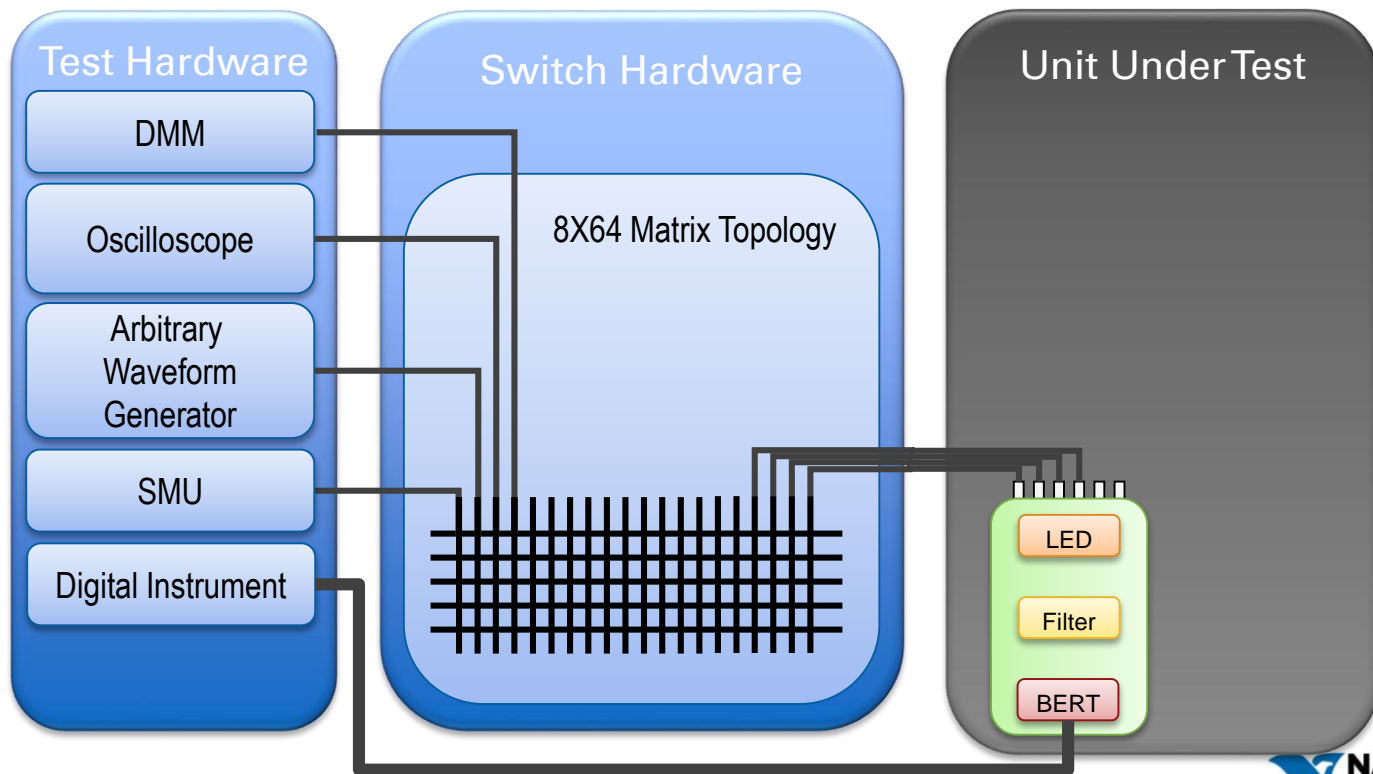
1

# Go!

# Switching



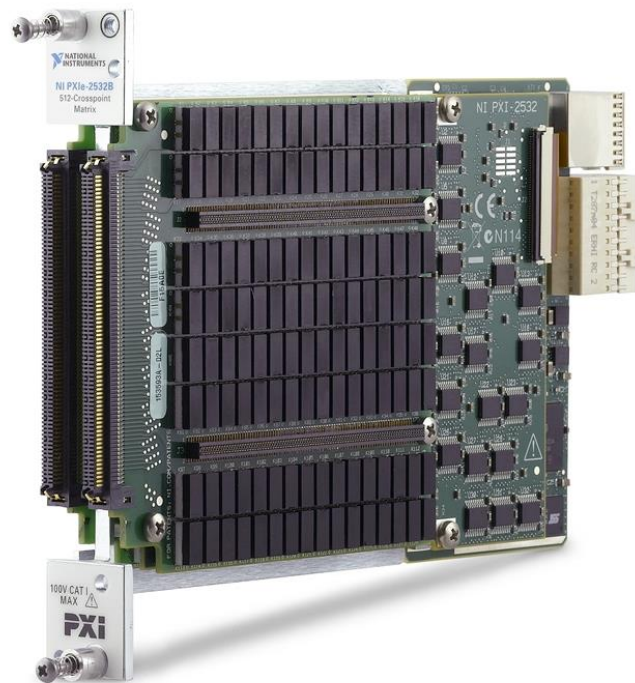
# Switch System Block Diagram





# PXI Switch Modules

- High-density switching systems with the PXI modular platform
- 544 channels in 3U PXI slot
- 600 Volts
- 40 Amps
- 26.5 GHz bandwidth
- 125k switching speed



512 Crosspoint Reed Relay Module  
PXIe-2532B

# Switch Executive

Intelligent switch management software

Easy channel aliasing

Automatic routing

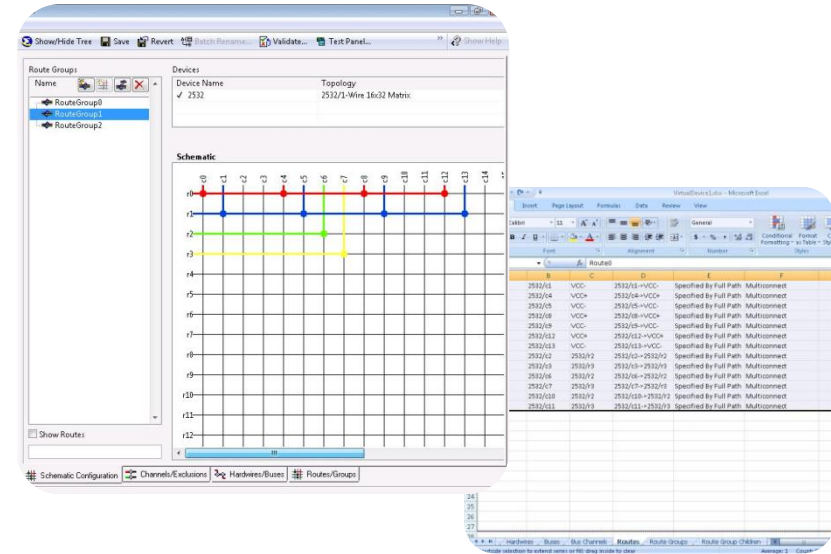
Interactive debug panel

Simplified ADE integration

Integrated TestStand deployment



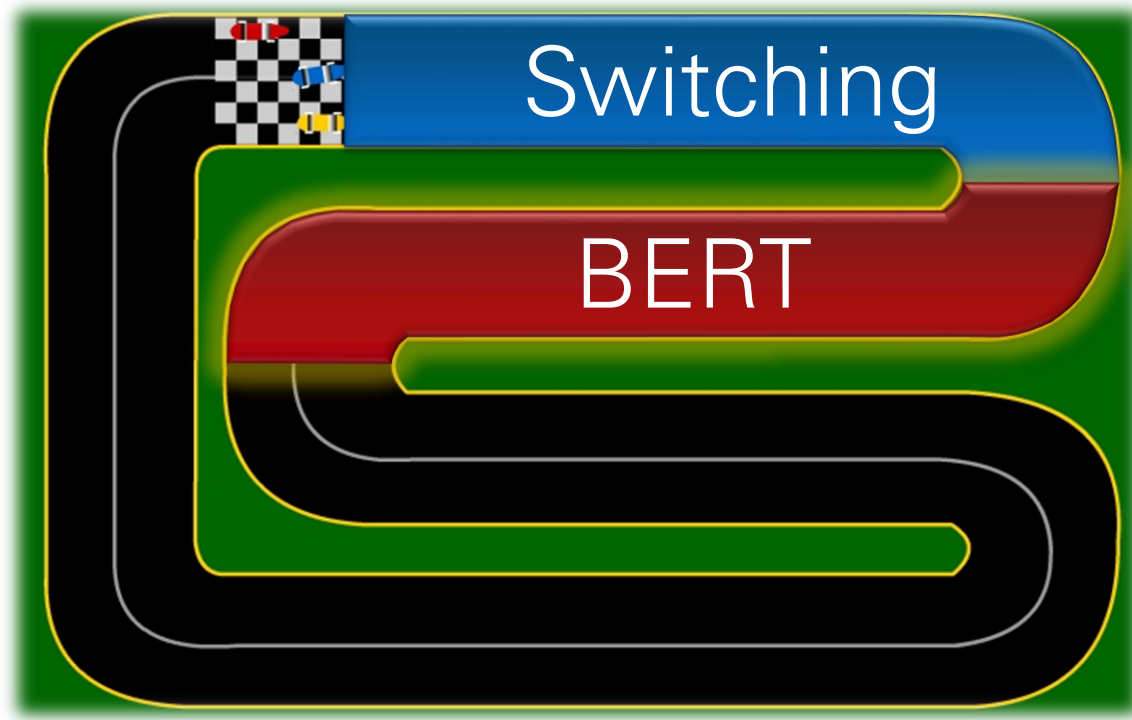
## Graphical Configuration



## Excel Integration

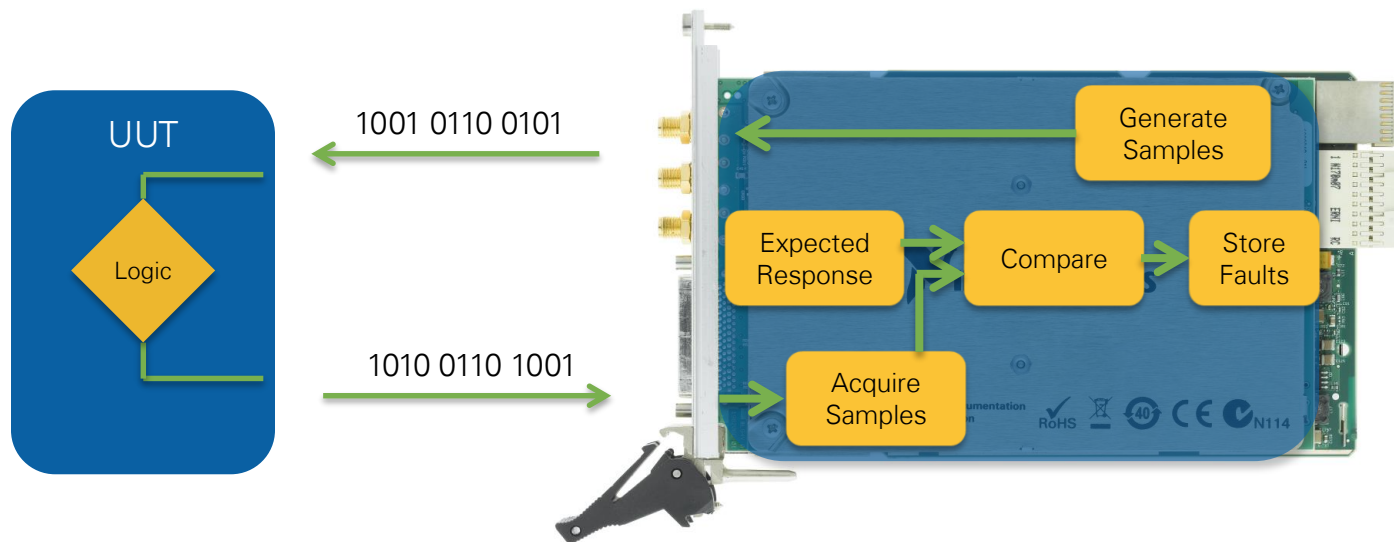
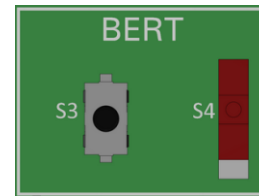


# Bit Error Rate Test



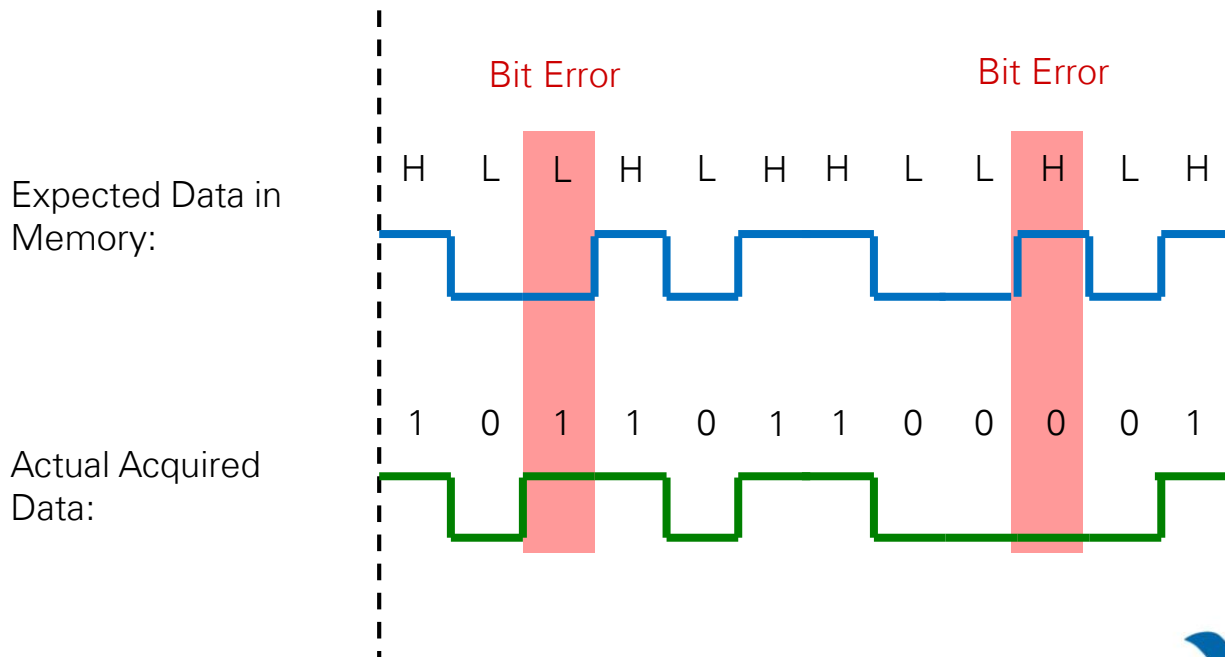
# Testing BER

Generate a known stimulus and compare it with an expected response



# Hardware Compare

Acquired bits are compared with expected values in memory



# PXI Digital Waveform Instruments

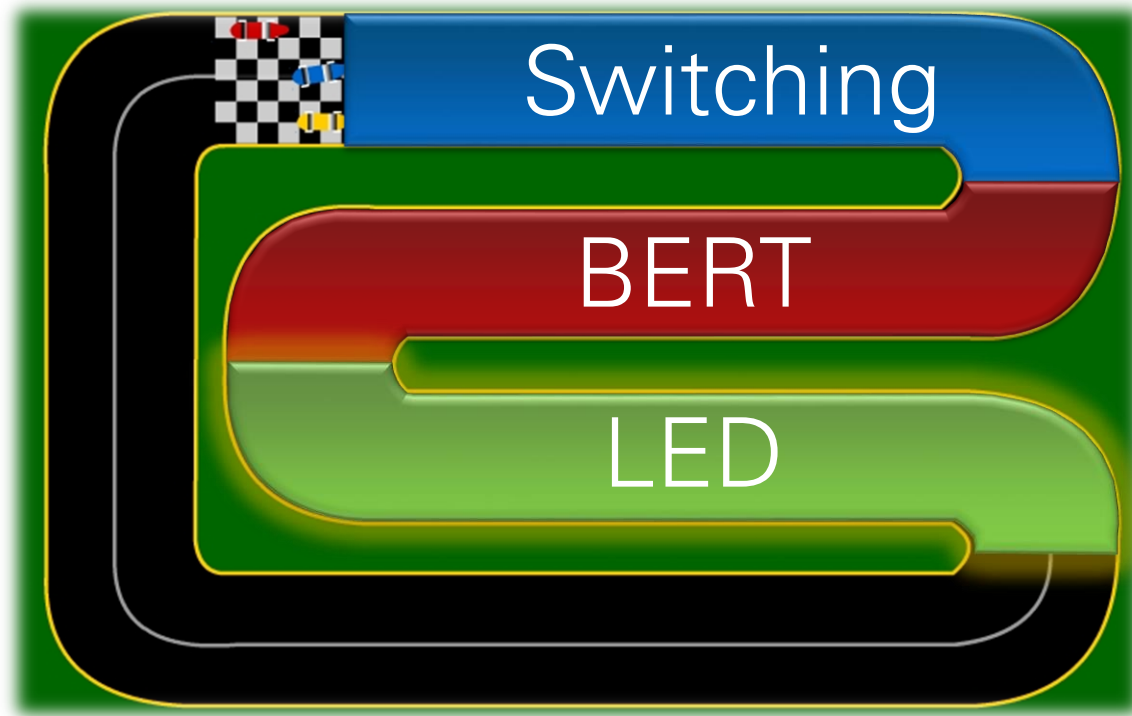
- Digital waveform instruments are ideal for functional test of parallel digital interfaces
- Data delay and deskew
- Programmable logic levels
- Parametric measurements
- 200 MHz



200 MHz Digital Instrument w/ PMU

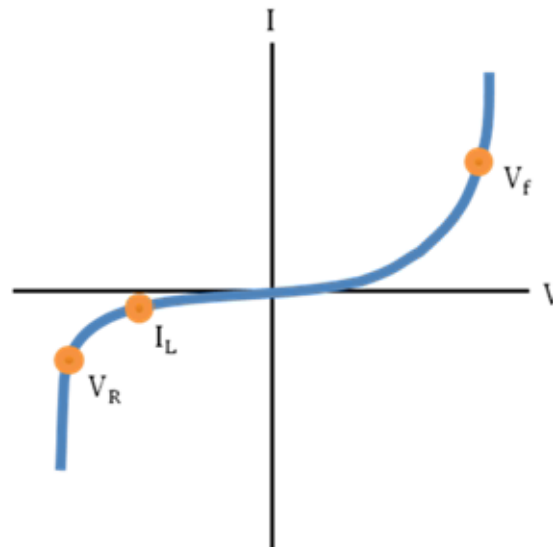
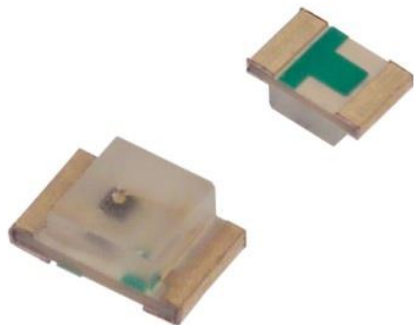
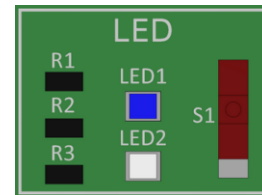
PXIe-6556

# Field Effect Transistor Test



# Testing an LED

Provide power source and measure voltage drop across leads





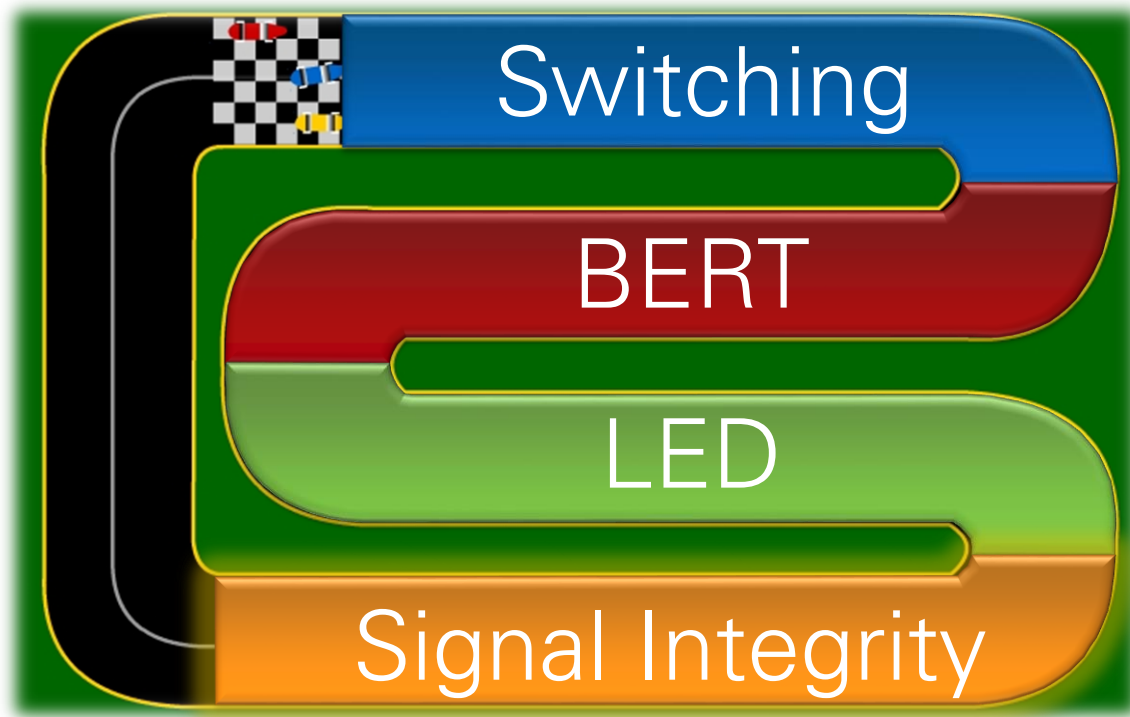
# PXI Source Measure Units

- Full portfolio of high current, high voltage, high power, and high channel density SMUs
- 1.8 MS/s digitizing rate
- 4 channels in 3U PXI slot
- 100 fA sensitivity
- Digital response control with SourceAdapt technology
- Extended pulsing capabilities



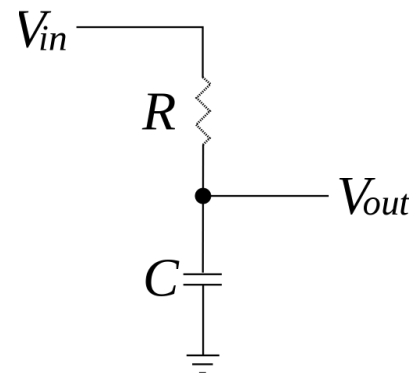
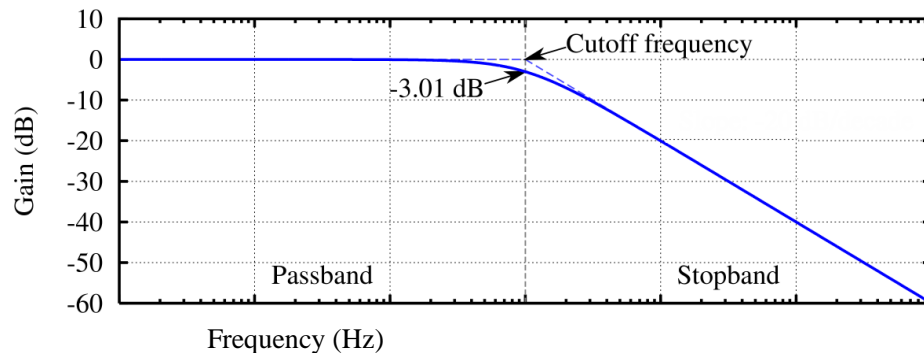
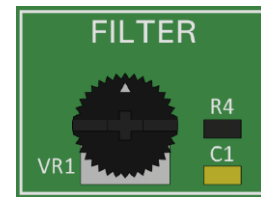
200 Volt SMU  
PXIe-4137

# Signal Integrity Test



# Testing for Filter Effects

Frequency response of sine wave through a signal path



# PXI Arbitrary Waveform Generators

- PXI modular waveform generators for high-density test systems
- 17 channels in 4U test rack
- 16-bit resolution
- Dynamic waveform streaming
- Deep onboard memory up to 256 MS



16-bit, 80 MHz Arbitrary Waveform Generator

PXIe-5442

# PXI Oscilloscopes

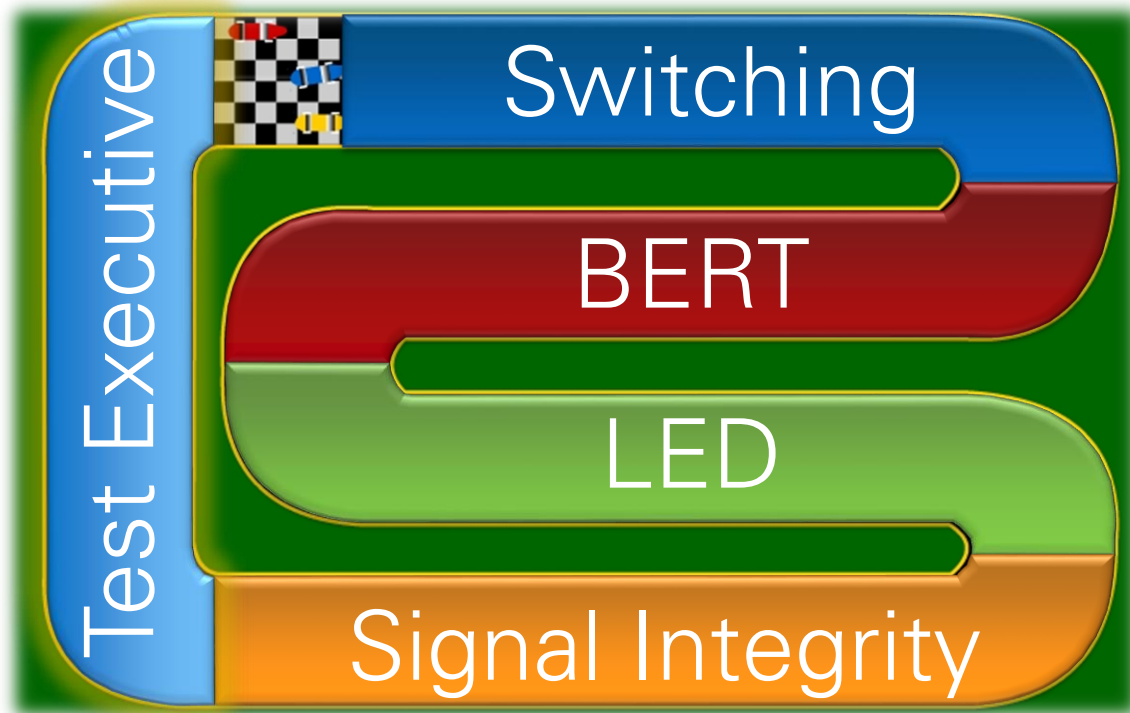
- PXI modular oscilloscopes enable up to 136 channels in a single 4U test rack
- 1 to 8 channels in a single PXI slot
- Reconfigurable oscilloscopes with user-programmable FPGAs
- 8- to 24-bit resolution
- Up to 1 GS of onboard memory



1.5 GHz, 10-Bit Oscilloscope

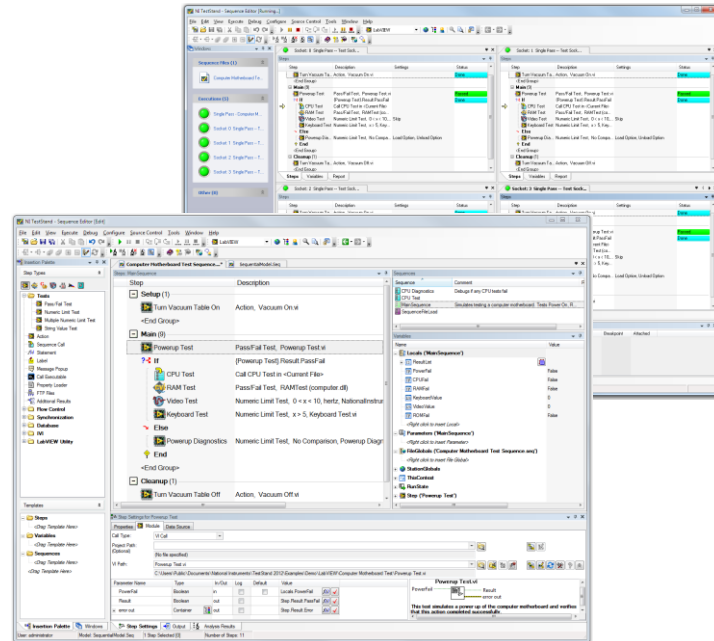
PXIe-5162

# Test Executive

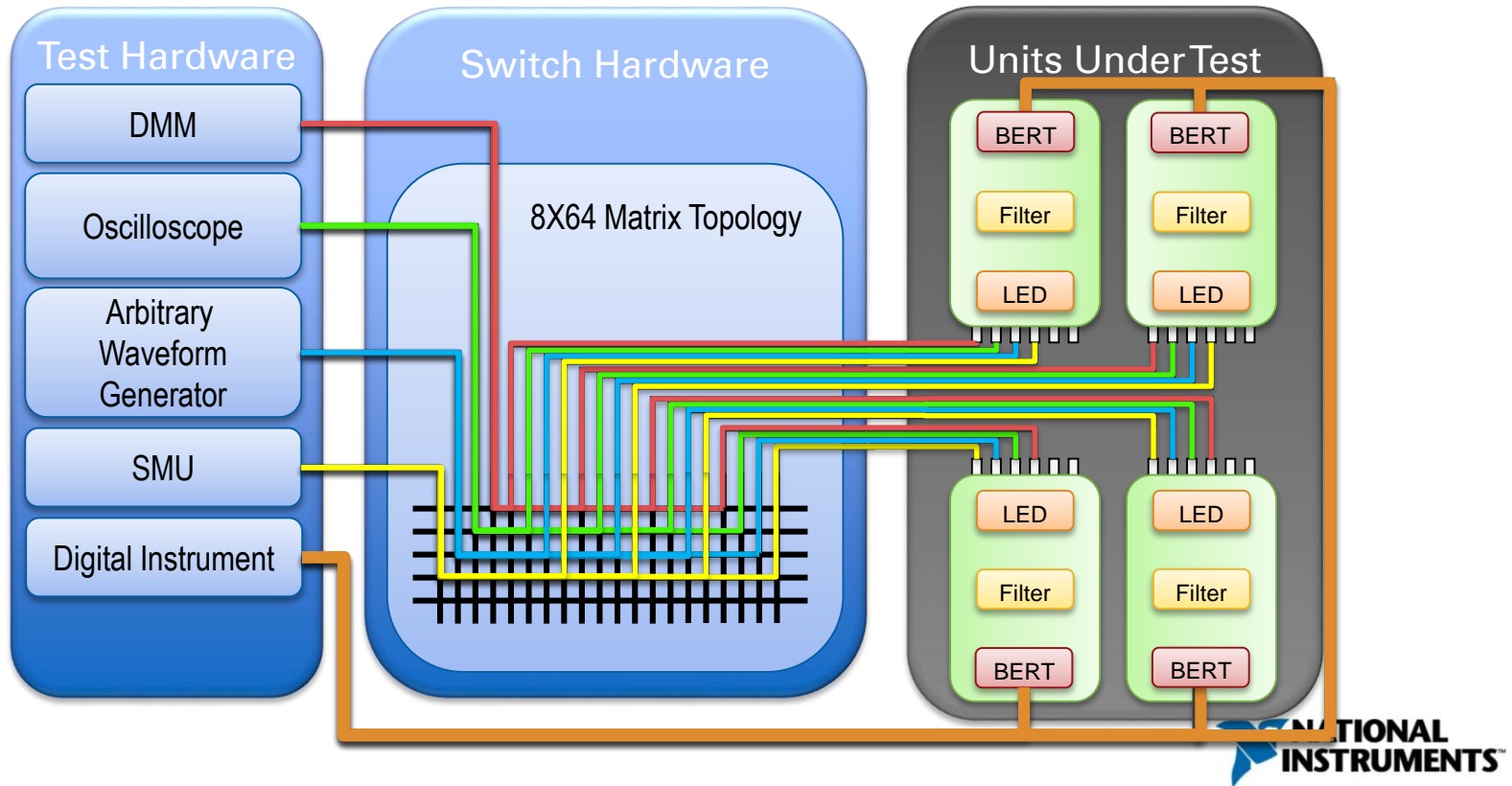


# TestStand Test Management Software

- Graphical development environment
- Ability to automate tests written in any language
- Multithreaded sequence execution
- ASCII, HTML/Web, XML, and ATML report generation
- Access, Oracle, and SQL Server database connectivity



# Switch System Block Diagram





# Sequential vs. Parallel vs. Auto-Scheduled Execution

Sequential												
UUT 1	Test 1	Test 2	Test 3									
UUT 2				Test 1	Test 2	Test 3						
UUT 3							Test 1	Test 2	Test 3			
UUT 4										Test 1	Test 2	Test 3

- Simple 1 UUT test fixture
- Extremely simple code structure
- 12 time blocks for 4 units

Parallel Testing											
UUT 1	Test 1	Test 2	Test 3								
UUT 2		Test 1	Test 2	Test 3							
UUT 3			Test 1	Test 2	Test 3						
UUT 4				Test 1	Test 2	Test 3					

- Multiple UUTs in parallel
- Switching allows hardware to be shared
- ~30–60% decrease in testing time

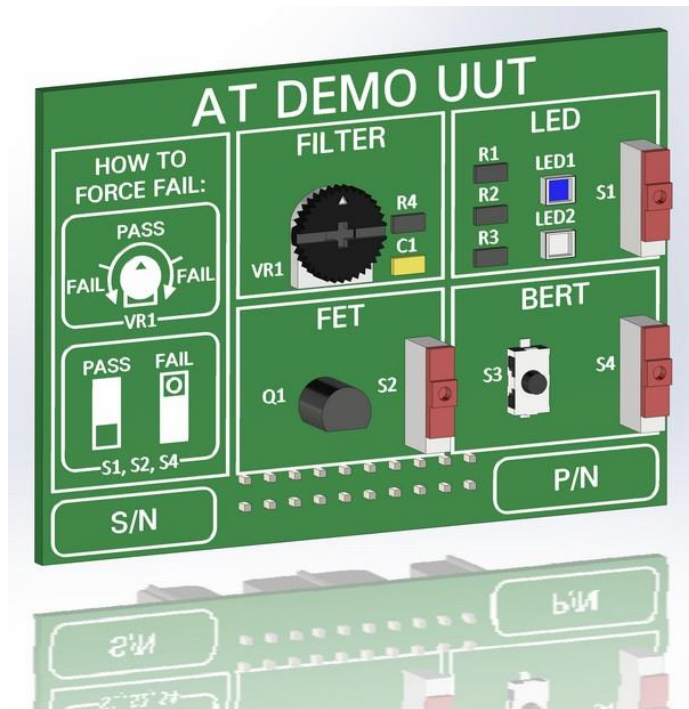
Auto-Schedule											
UUT 1	Test 1	Test 2	Test 3								
UUT 2	Test 2	Test 3		Test 1							
UUT 3	Test 3		Test 1	Test 2							
UUT 4		Test 1	Test 2	Test 3							

- Same HW setup as above
- TestStand auto-schedules resources
- ~15–20% further decrease in testing time

# Did We Achieve the Goal?

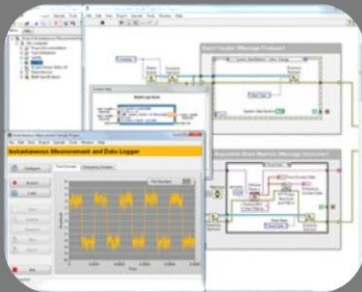
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# NI's Core Automated Test Platform



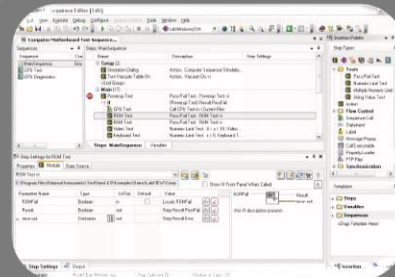
## LabVIEW

LabVIEW is the leading system design software for automated test that helps you develop powerful test software quickly.



## PXI

PXI is the leading modular instrumentation platform used to build compact, high-performance automated test systems.



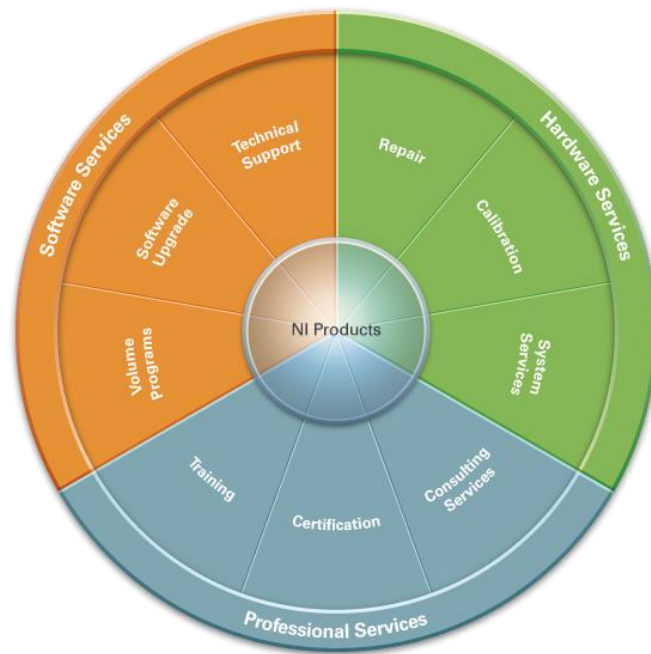
## TestStand

NI TestStand is a powerful ready-to-run test management environment that helps you develop automated test and validation systems faster.

NI also provides C/C++/.NET development environments, data management software, interactive instrument panels, and connectivity to box instruments for hybrid systems.

# NI Services and Support

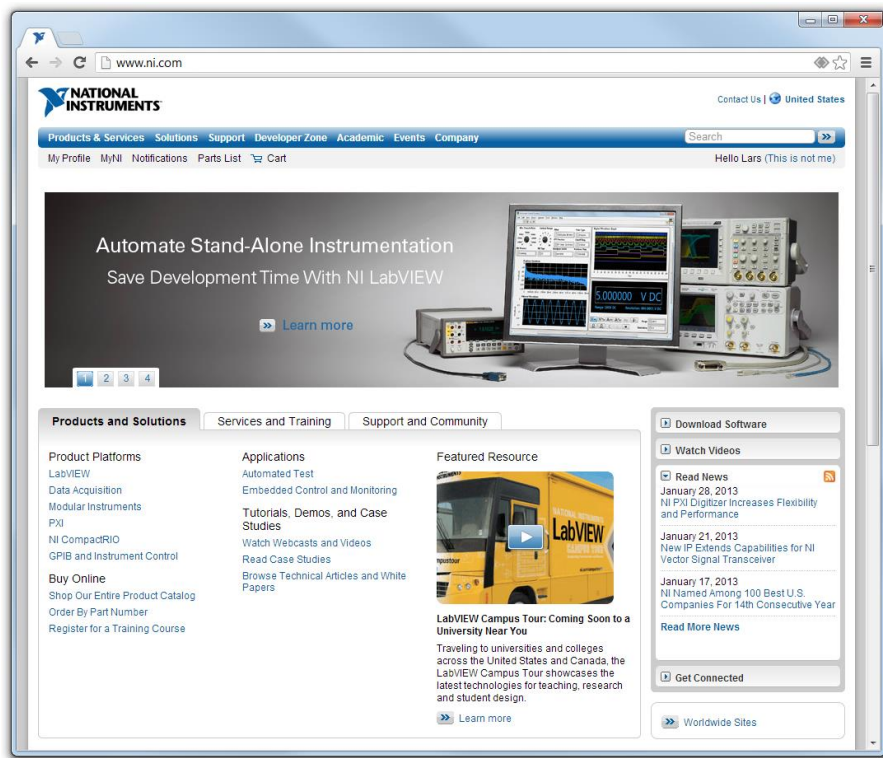
- Technical Support
  - Web support resources
  - Applications engineers worldwide
  - Premier support
- Instructor Led Training
  - TestStand 1-Test Development
  - TestStand 2-Framework Development
  - Thousands of engineers trained each year
- Certification
  - Certified TestStand Developer (CTD)
  - Certified TestStand Architect (CTA)



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# Alliance Partner Network

- Nearly 900 alliance partners to help get your system up and running
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    - Industry
    - Application Area
    - Services Offered
      - System integration
      - Hourly consulting
      - Training





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