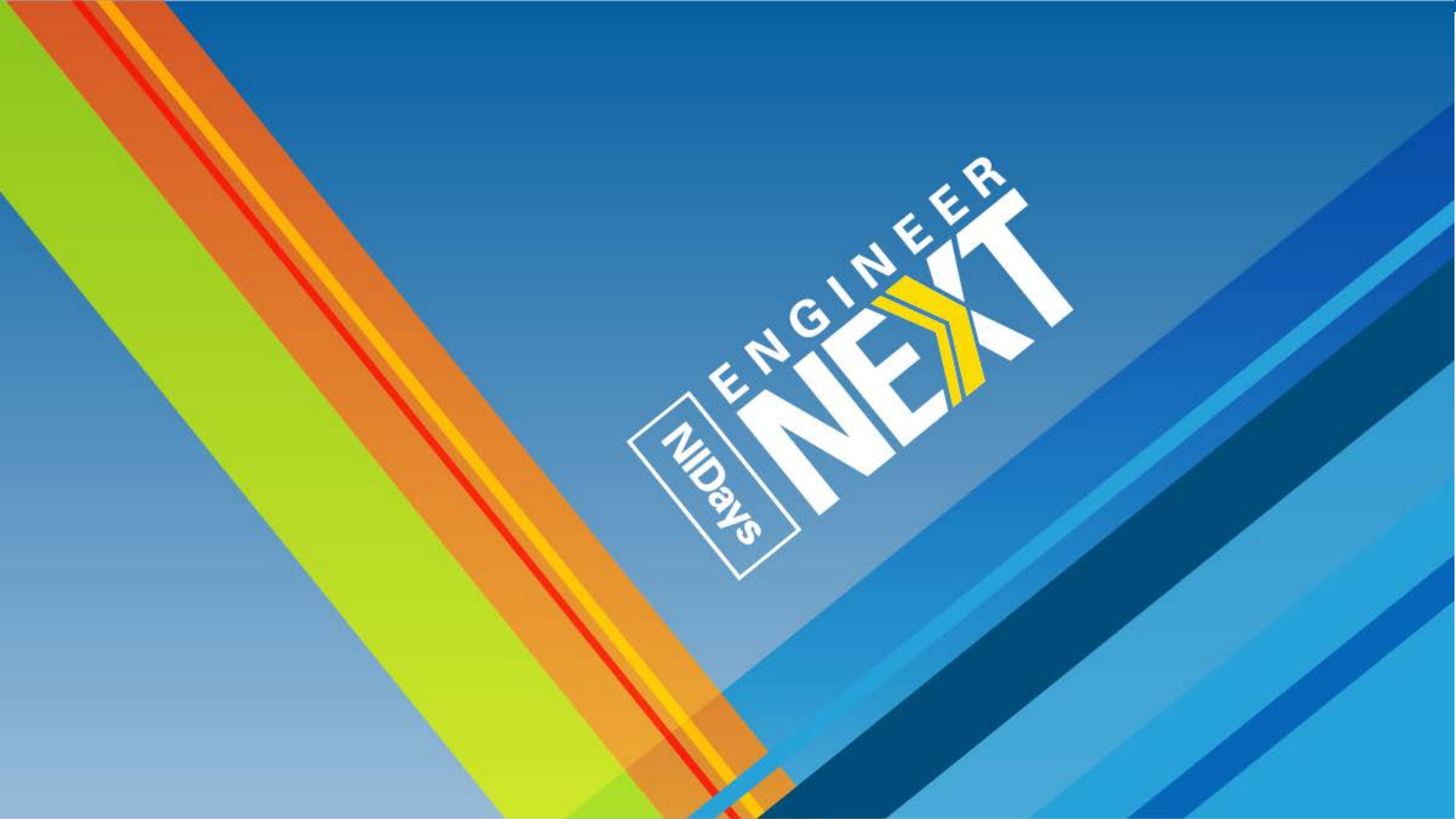

NIDays
ENGINEER
NEXT

NIDays

ENGINEER NEXT


NATIONAL
INSTRUMENTS™

Best Practices for Building Automated Test Systems

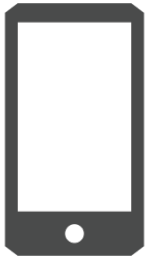
Smarter Test for Advanced Aerospace and Defense Electronics

Roman Vala

Account Manager

National Instruments

Best Practices Depend on Your Perspective



Latest Consumer Device

B-52 Stratofortress

Challenges of ATS Development and Proliferation

Development

- Fixed schedule and budget
- Future technology insertion
- Common versus custom

Maintenance

- Long product life cycle
- Obsolete equipment
- Instrument failure
- Costly TPS changes
- Total cost of ownership

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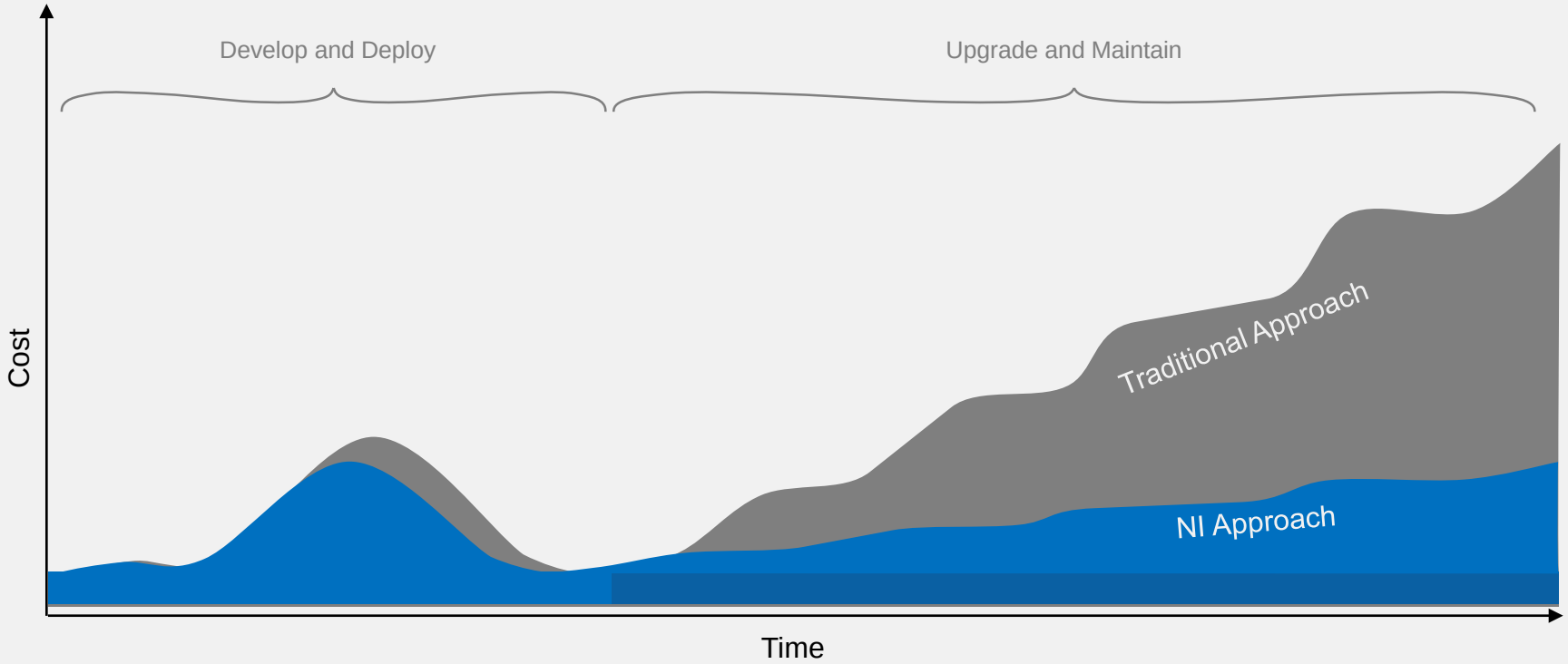
Total Cost of Owning an Automated Test System



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AEROSPACE
AND DEFENSE

HARRIS

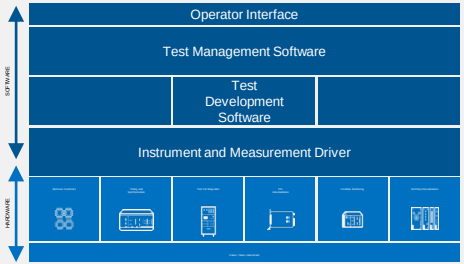
Harris Reduces Cost of Test While Increasing Test Throughput 400 Percent With NI

“The NI platform gave us the ability to significantly scale our production test throughput by 400 percent with an ROI of 185 percent while carefully maintaining the quality and performance standards that our military radios are known for.”

74% Decrease in Cost of Test

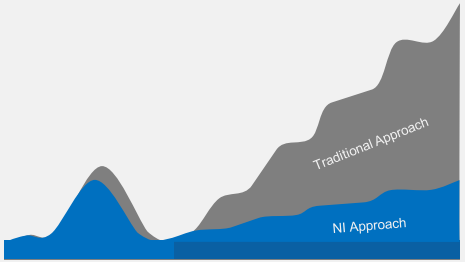
83% Reduction in Floor Space

3 Best Practices for Architecting an ATE System



Develop a Scalable and Reusable Software Architecture

Standardize on the Latest Off-the-Shelf Hardware



Plan for Obsolescence

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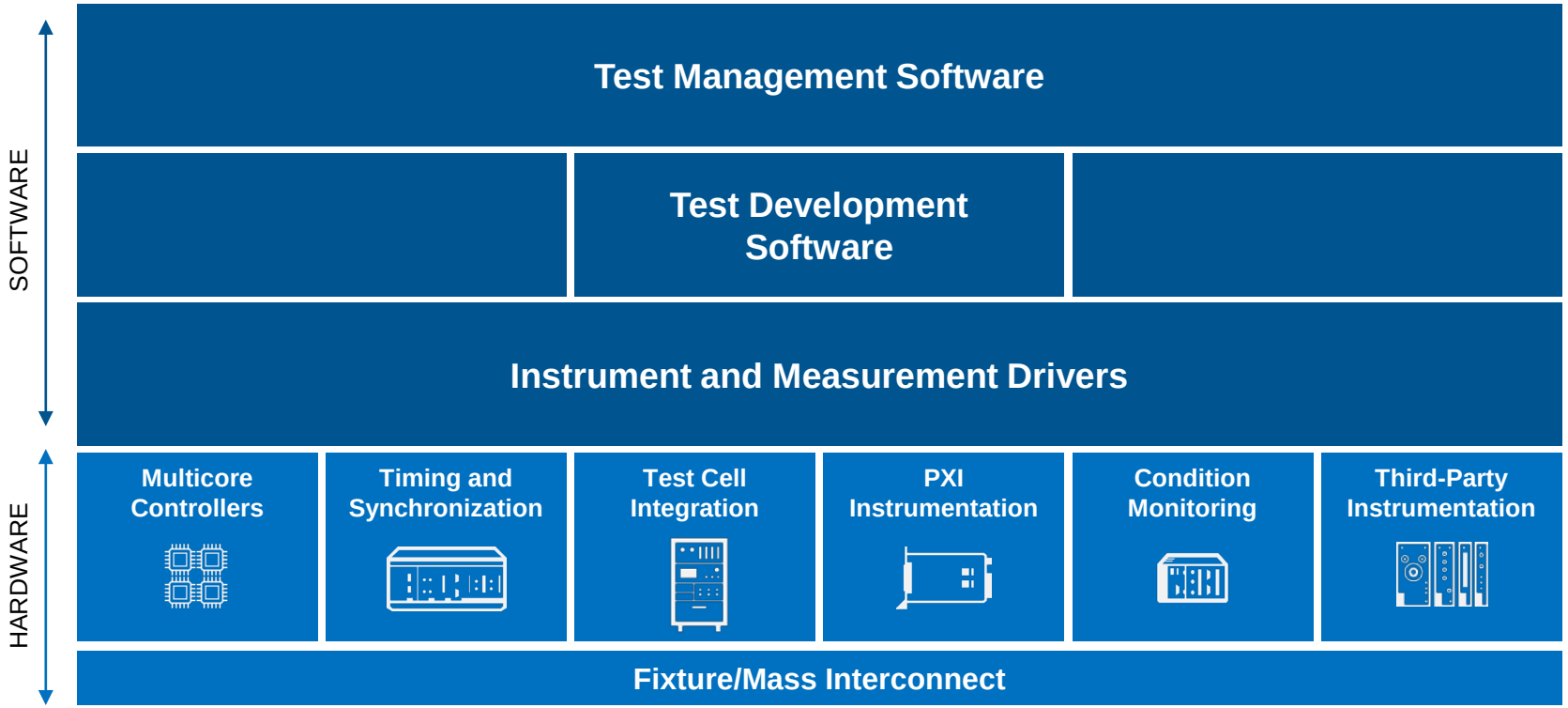
Develop a Scalable and Reusable Software Architecture

Architecture of an Automated Test System



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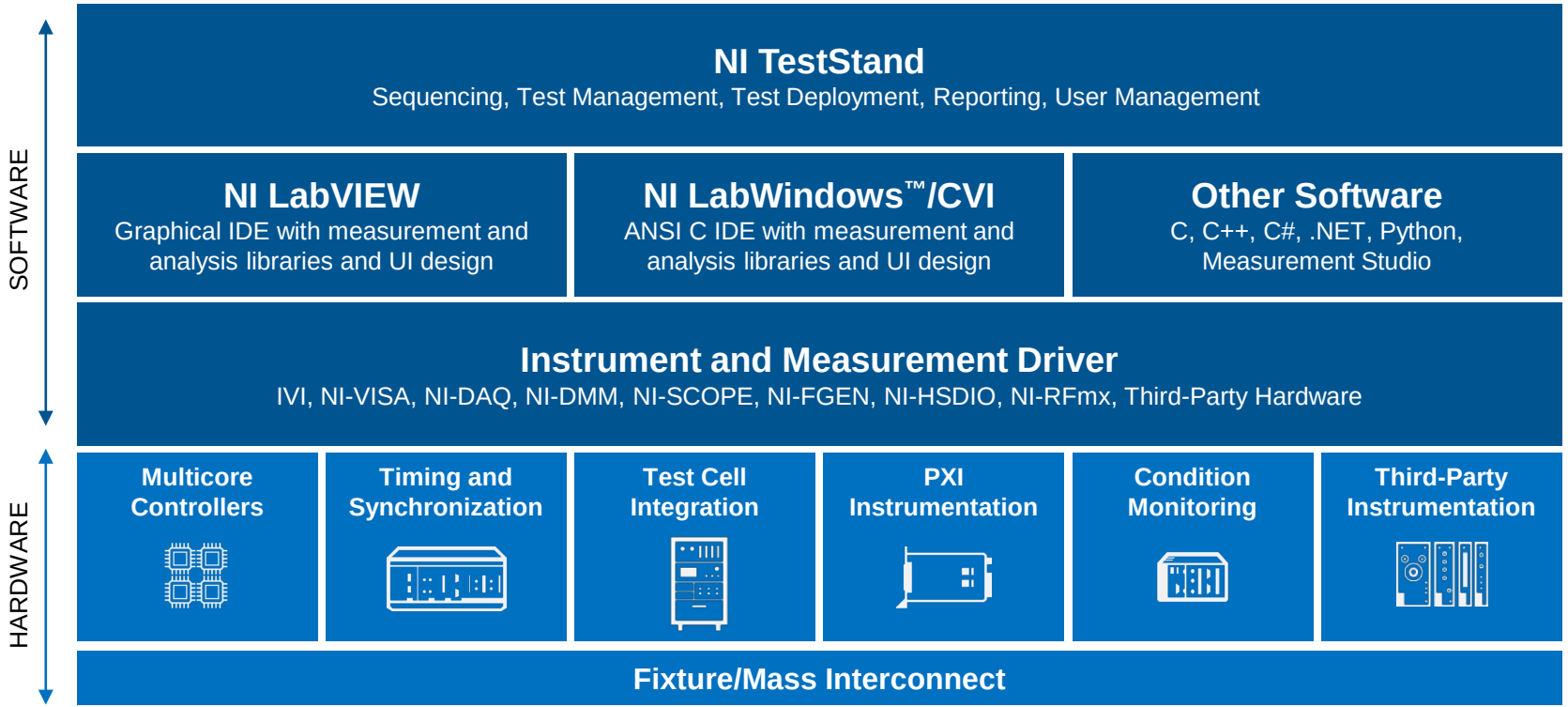
Architecture of an Automated Test System



Separating Software Responsibilities

COMMON

Test Management Software

- Limit checking
- Integration of system-level requirements
- Results processing
- Shared measurements
- Operator interface
- User management
- Test flow control

UNIQUE

Test Development Software

- Instrument control
- Stimulus
- Analysis code
- DUT control
- DSP
- Tracking of individual test requirements

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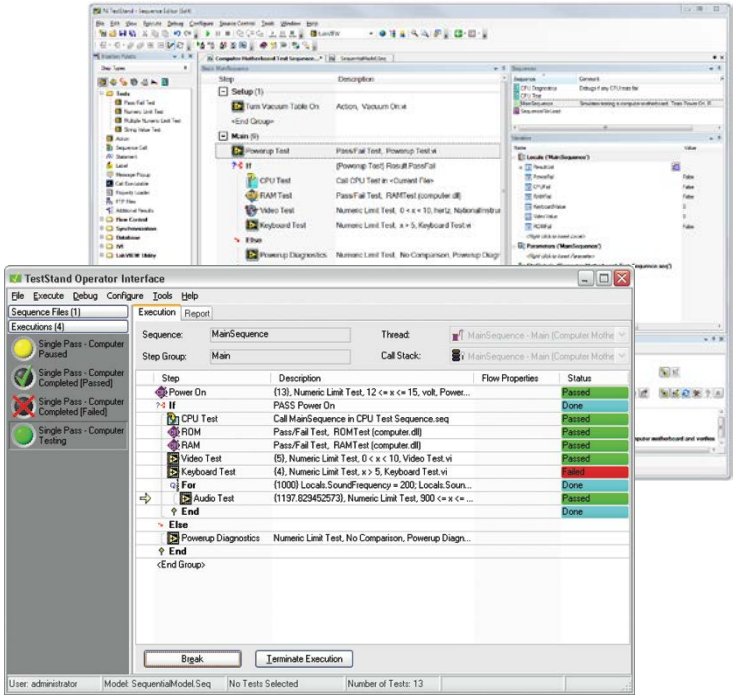
TestStand

Industry-Standard Test Management Software

- Author, execute, and debug test sequences
- Leverage test code developed in **any language**
- Test many devices in parallel
- Generate reports
- Integrate with databases
- Extend the software to meet custom requirements
- Develop professional operator interfaces



6,000+
COMPANIES WORLDWIDE

10,000+
EXISTING DEVELOPERS

1,500+
NEW DEVELOPERS TRAINED ANNUALLY

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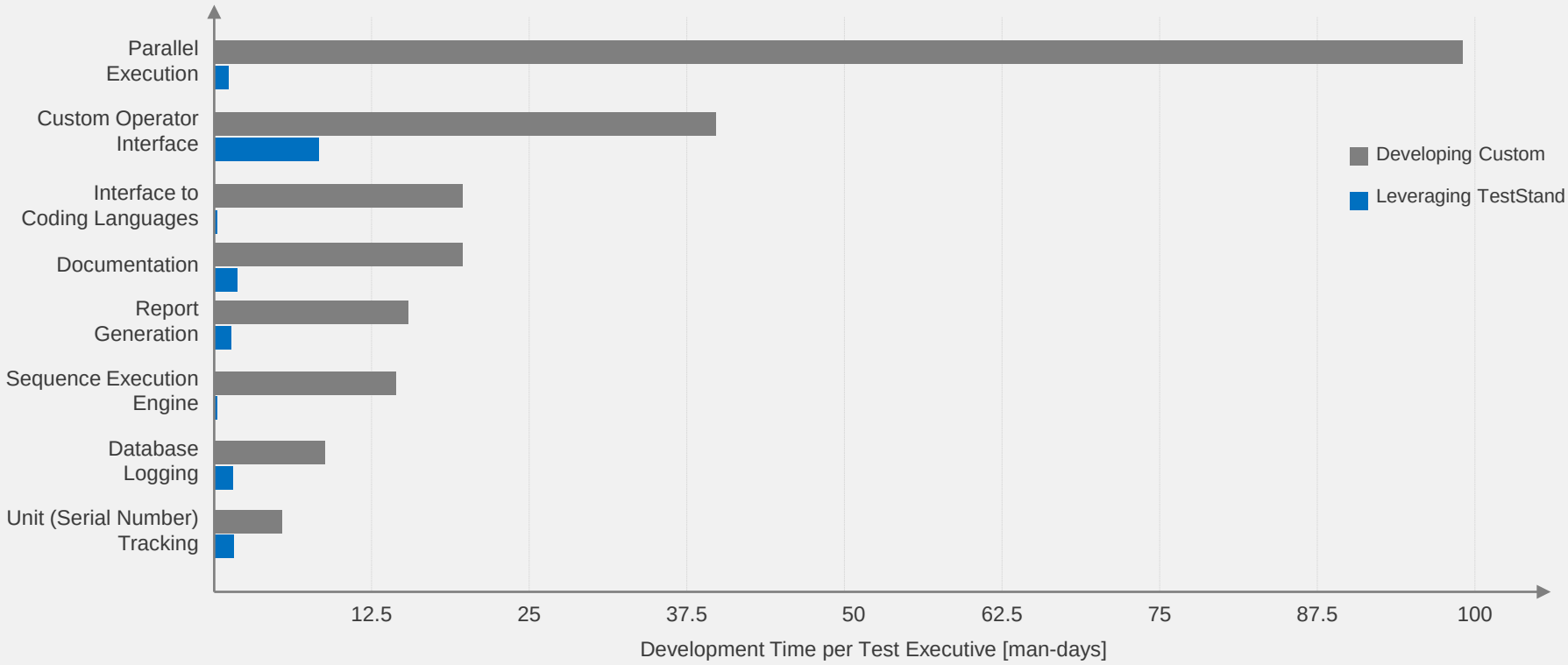
Increase Productivity With COTS Test Management Software



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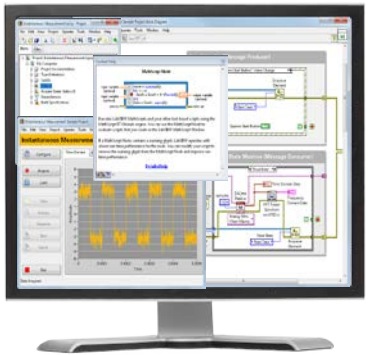
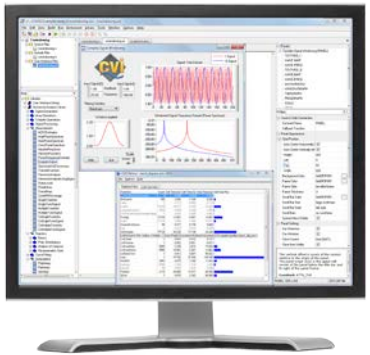
TPS Application Development Environments (ADEs)

LabVIEW



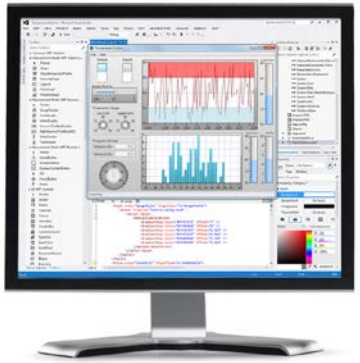
System Design Software

LabWindows™/CVI



Proven ANSI C IDE and Engineering Toolbox

Measurement Studio



.NET Tools Designed for Engineering

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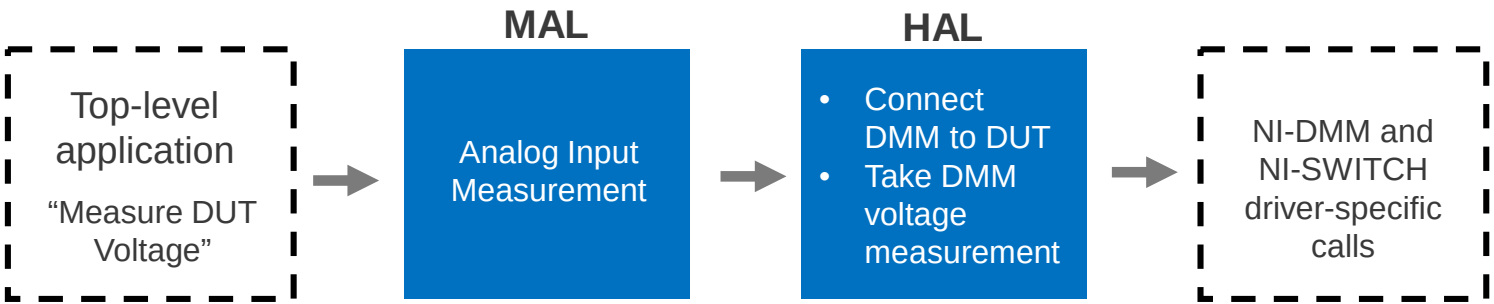
Architecting for Scalability and Reusability

Hardware Abstraction Layer (HAL): layer of programming that allows an automated test system to interact with a hardware device at a general level or an abstract level rather than at a detailed hardware level

Measurement Abstraction Layer (MAL): layer of programming that allows an automated test system to interact with a DUT through high-level actions rather than at a detailed hardware level



Implementing an Abstracted Architecture

Abstraction is a spectrum.
Start by taking advantage of out-of-the box abstraction layers.

Hardware Abstraction

- NI family drivers
  - NI DMM support for all NI 40xx instruments
- IVI-compliant drivers

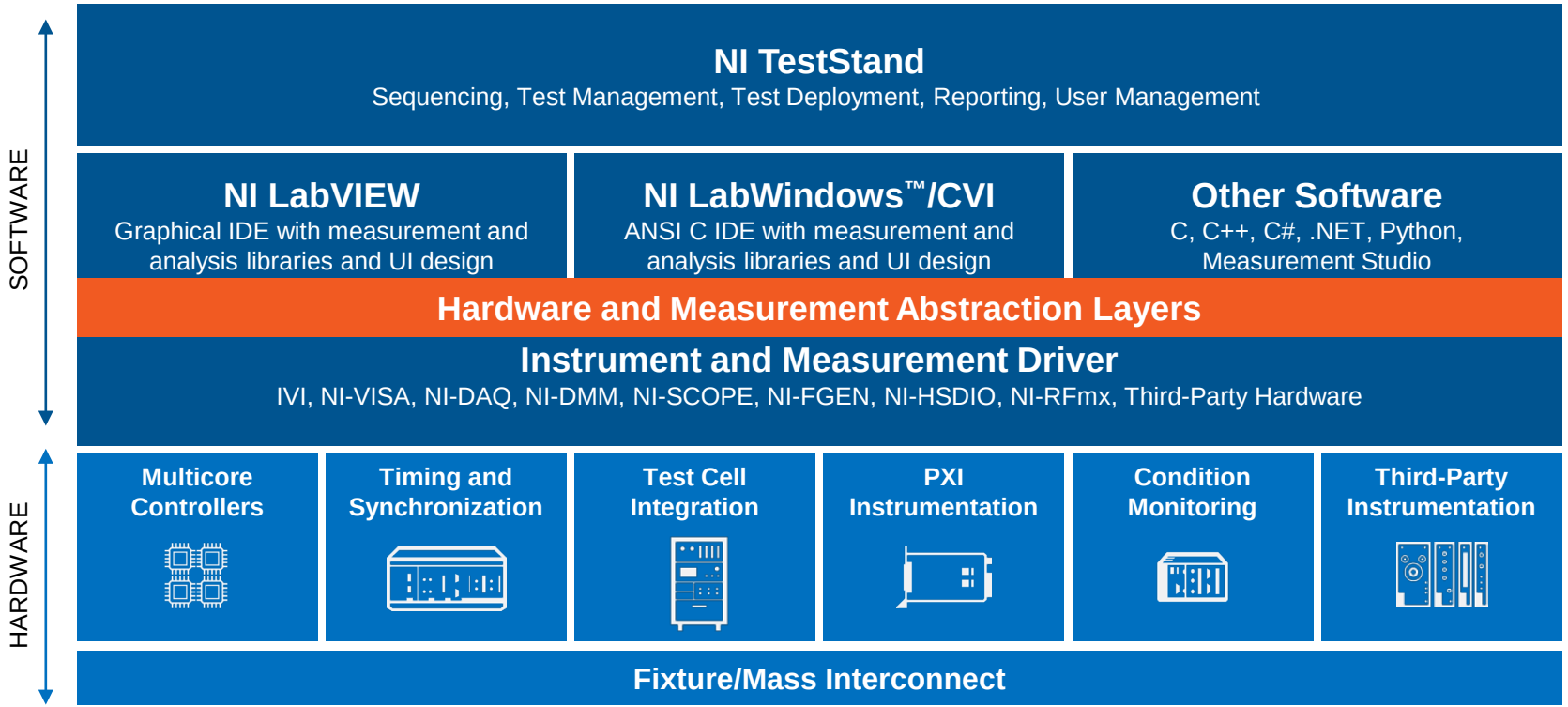
- Custom HAL

Measurement Abstraction

- TestStand custom step types
- LabVIEW subVIs
- NI Switch Executive

- Custom MAL

Hardware and Measurement Abstraction Layers



NI-DMM Hardware Abstraction

Low Cost
- PXI-4060
- PXI-4065

Mid Range
- PXI-4070/2
- PXIe-4080/2

High Performance
- PXI-4071
- PXIe-4081

1998 2002 2005 2007 2016 2028

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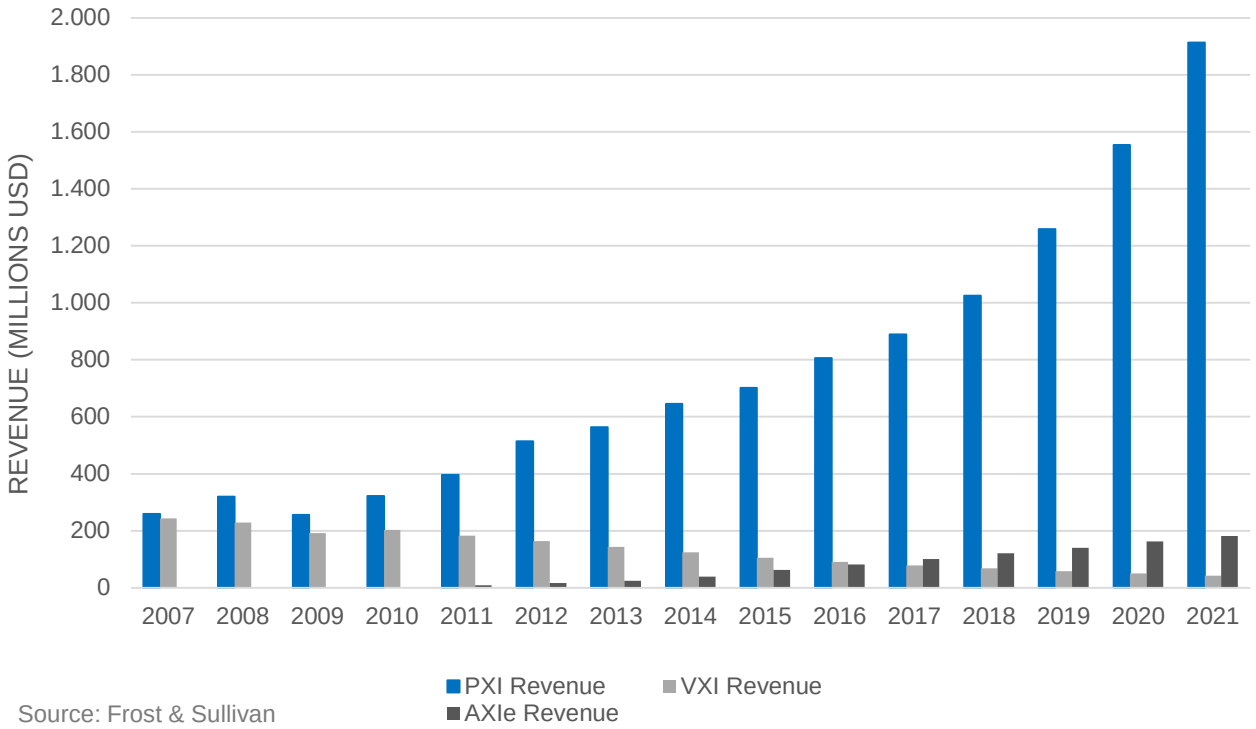
9X Reduction in Test Development Time

60% Code Reuse

“By leveraging commercial off-the-shelf software technologies such as TestStand and LabVIEW, our Automated Test Engineering team was able to achieve up to 60 percent code reuse for each automated test and reduce overall test development time by up to 9X. Using the NI certification program, coupled with in-house training, we were able to develop the skills necessary to produce robust, flexible code and maintain it across over 200 test benches.”

Standardize on the Latest Off-the-Shelf Hardware

Modular Instrumentation (PXI) Drives ATE



Source: Frost & Sullivan

- Founded in 1997
- 60+ Vendors
- 2000+ Modules
- Latest Technology
- Growing Market Share

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NI's Industry-Leading Test and Measurement Solution

PXIe-5162
4 ch, 1.5 GHz,
10-Bit Digitizer

PXI-4081
7½-Digit, 1 kV Precision
DMM

PXIe-5668R
26.5 GHz VSA With
765 MHz Bandwidth

PXIe-4135
Precision System SMU
10 fA Sensitivity

PXIe-5646R
6 GHz Vector Signal
Transceiver

PXIe-1085
PXI Chassis
24 GB/s Throughput

PXIe-8880
PXIe Controller
8-Core Intel Xeon

LabVIEW
System Design
Software

TestStand
Test Management
Software

PXIe-2543
6 GHz, 8 ch, Solid-State Mux

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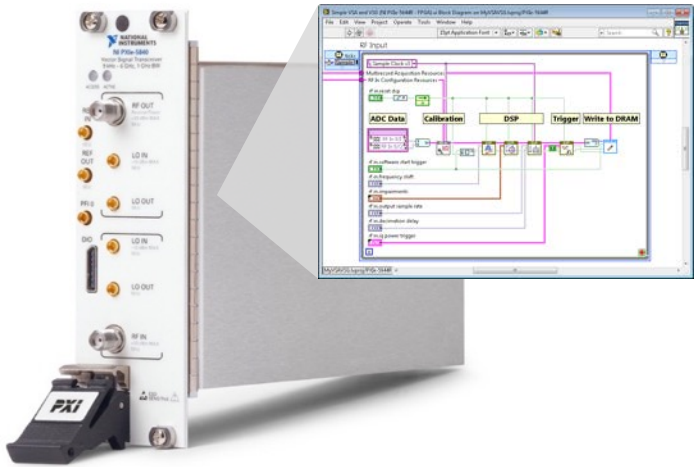
Second-Generation Vector Signal Transceiver

Features at a Glance

- User-programmable FPGA with LabVIEW
- 1 GHz of instantaneous bandwidth for advanced digital predistortion test and wideband signals
- Excellent accuracy enables measurement of 802.11ax error vector magnitude performance of -50 dB
- FPGA enables measurement speeds up to 10X faster than traditional instrumentation
- Small size and tight synchronization allow for up to 8x8 MIMO configuration in a single 18-slot chassis



Application Areas

- Wireless test
- Semiconductor test
- Automotive radar

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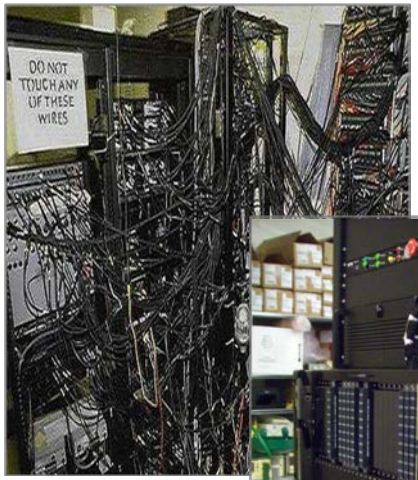
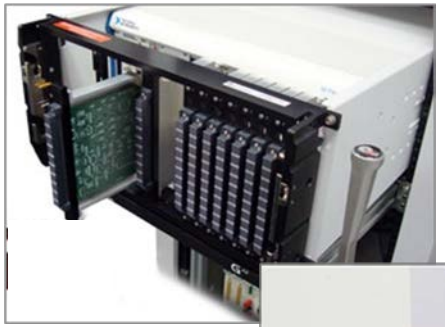
Mass Interconnect and ITAs



VS.



PCB-Based
or
Cabled Connection

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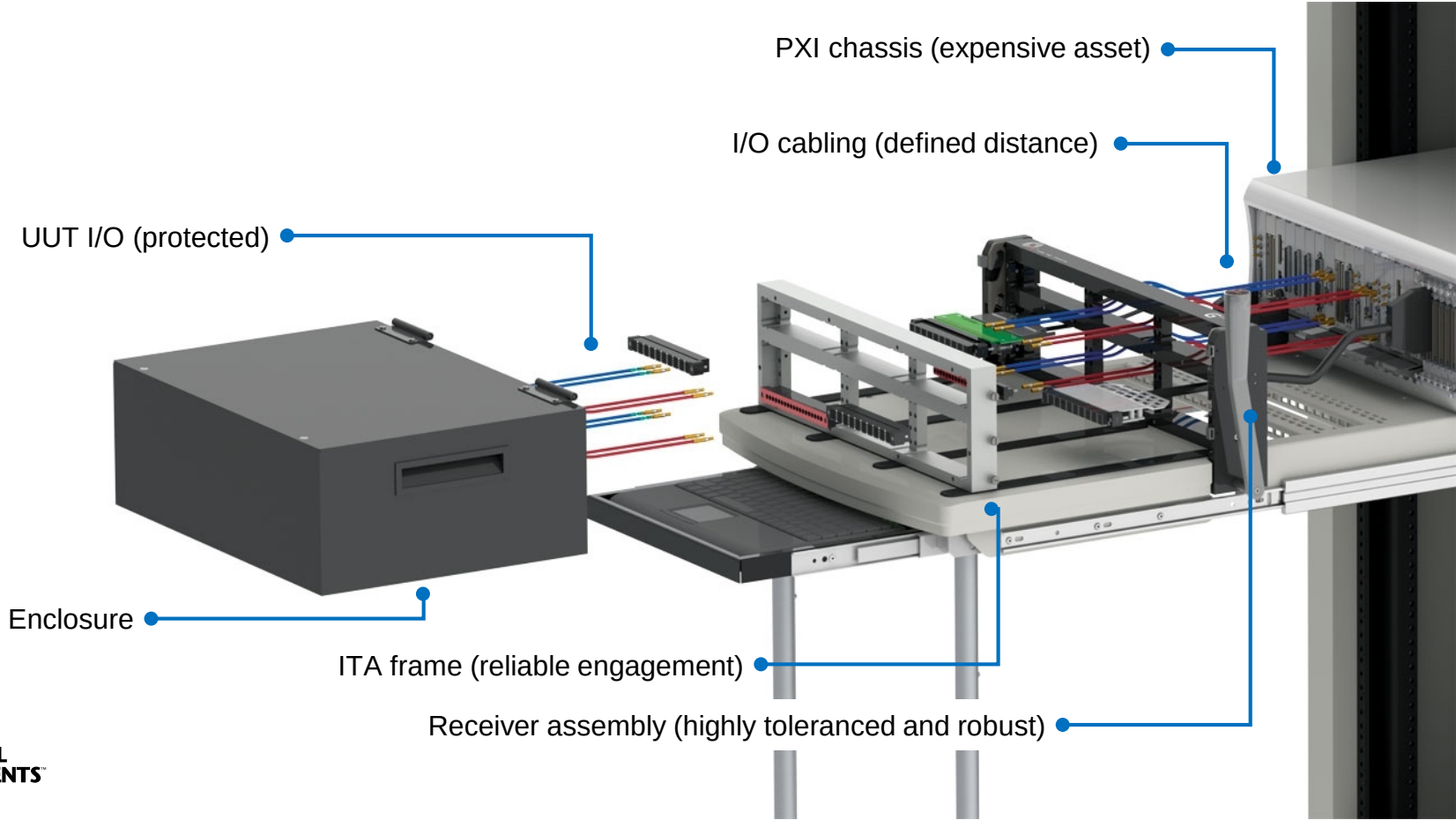
Elements of a Typical Mass Interconnect



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Standardize, Standardize, Standardize

How many DC-programmable power supplies are in your library?

How about 6½-digit DMMs?

General Rule

Standardize what you can, as fast as you can,
if the differences aren’t adding value.

NI ATE Core Configurations Make Standardization Easier

Standardized starting point for in-house ATE development

40U Configuration

24U Configuration

Category	Details
Mechanical	40U and 24U Rack Height With Industrial-Grade Casters and Mounting Rails
Power	Power Distribution Unit, Power Entry Panel, and Optional Uninterruptible Power Supply
Safety	Emergency Power Off, Thermal Shutdown, Multilevel Circuit Protection
Instrumentation	PXI, CompactDAQ, CompactRIO, SLSC, Third-Party
Cooling	24 VDC Fan Kit, Air Filtration
Cabling	Integrated Cable Management and 10/100 ENET Switch

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Plan for Obsolescence

Life-Cycle Management Practices

Proactive/Strategic

- Modular open architectures
- Technology roadmapping
- Planned system upgrades
- Technology insertion planning
- Life-cycle analysis and monitoring
- Formal life-cycle strategy

Reactive/Tactical

- Alternate source
- Substitution
- Redefine requirement
- Emulation
- Lifetime buy
- Redesign
- Reverse engineer
- Reclamation

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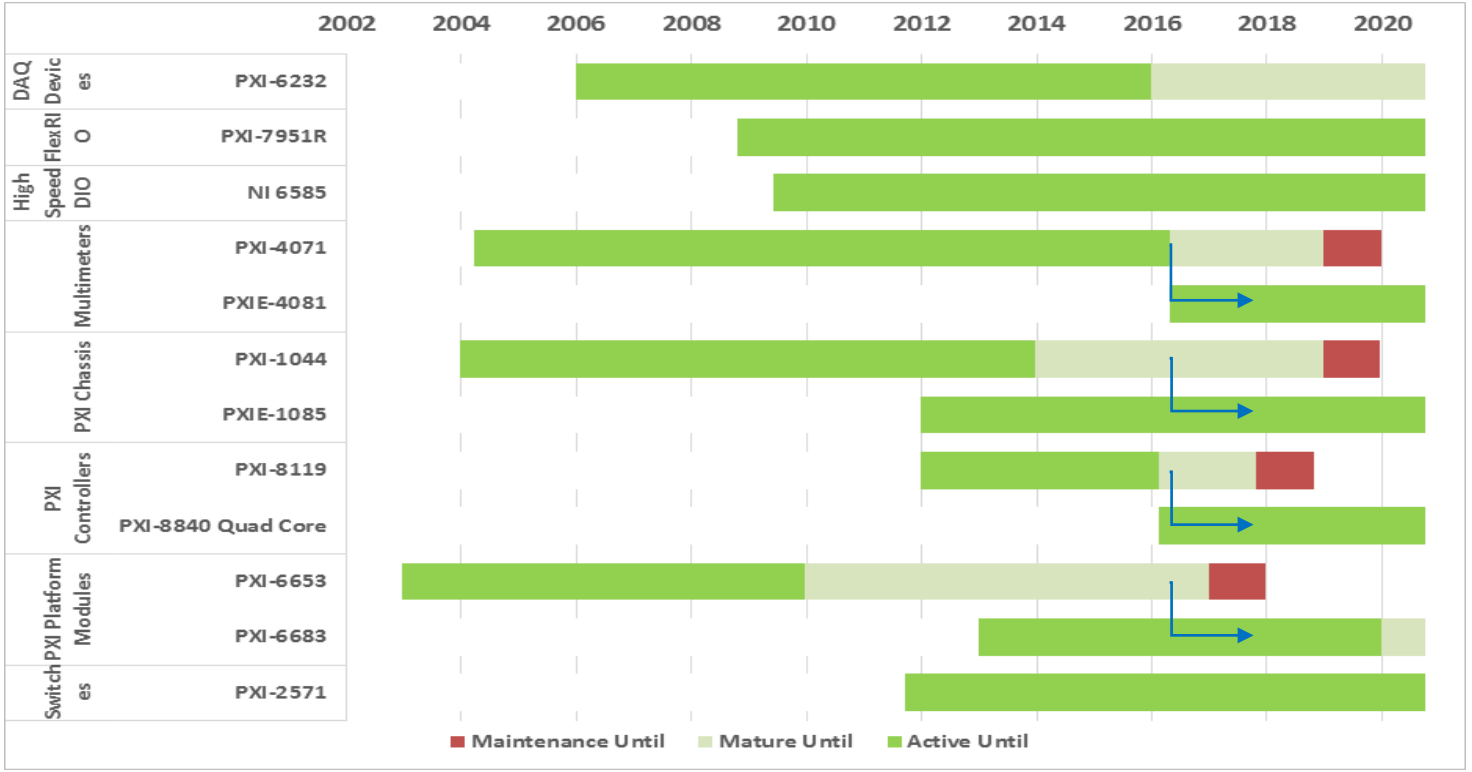
Example Life-Cycle Analysis



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23% Decrease in LRU Repair Time

80% Reduction in Quality Deficiency Reports

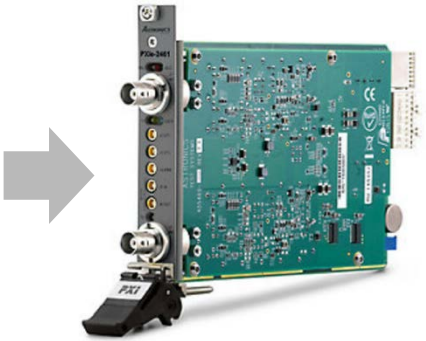
18 Obsolete Test Sets Replaced

“CACI selected many NI instruments for the core of the CBATS test system based on the relationship with the company and the quality of its products. CACI’s relationship with NI has grown to a level of mutual trust as we work together to deliver high-quality, sustainable test solutions at affordable prices.”

CACI

NI and Astronics Collaborate on VXI to PXI Transition

Astronics VXIbus 2461C
2-Channel, 200 MHz Frequency Time Interval Counter



Astronics PXIe-2461 for PXI Express
2-Channel, 200 MHz Frequency Time Interval Counter

Astronics PXIe-2461
2-Channel, 200 MHz Frequency Time Interval Counter

Astronics PXIe-6943
32-Channel, 200 MB/s Digital I/O Module

Astronics PXIe-3352
Rubidium Clock Source Module

Astronics PXIe-1209
100 MHz Pulse Pattern Generator Module

"Full TPS and Driver Compatibility"

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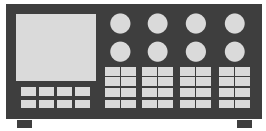
Emulating Legacy Instrumentation

Challenge

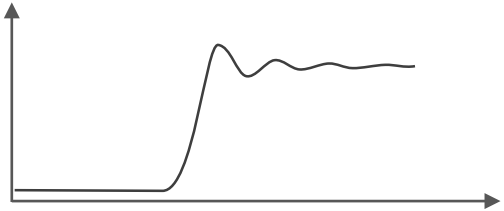
- Previous instrument is end of life
- New instrument behavior
- Test system depends on old behavior
  - Trigger types
  - Analog bandwidth
  - Sample rate
  - Dynamic range

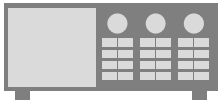
Solution

- Software-defined instrumentation
- Digital signal processing
- FPGA technology

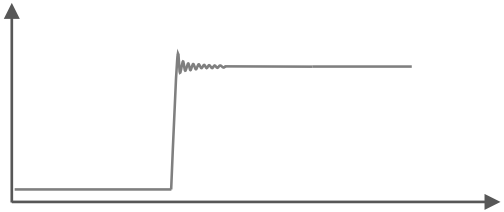


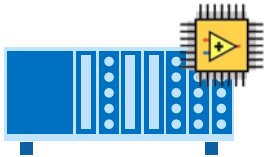
Legacy Instrument



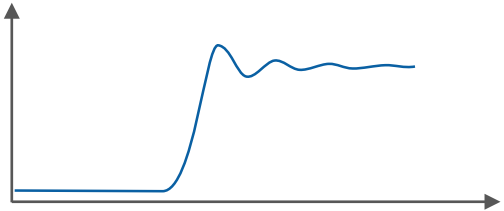


New Box Instrument





Software-Defined Instrument



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Real-Time Spectrum Analysis

100% POI with full accuracy on 320 ns minimum duration signals from 20 Hz to 26.5 GHz

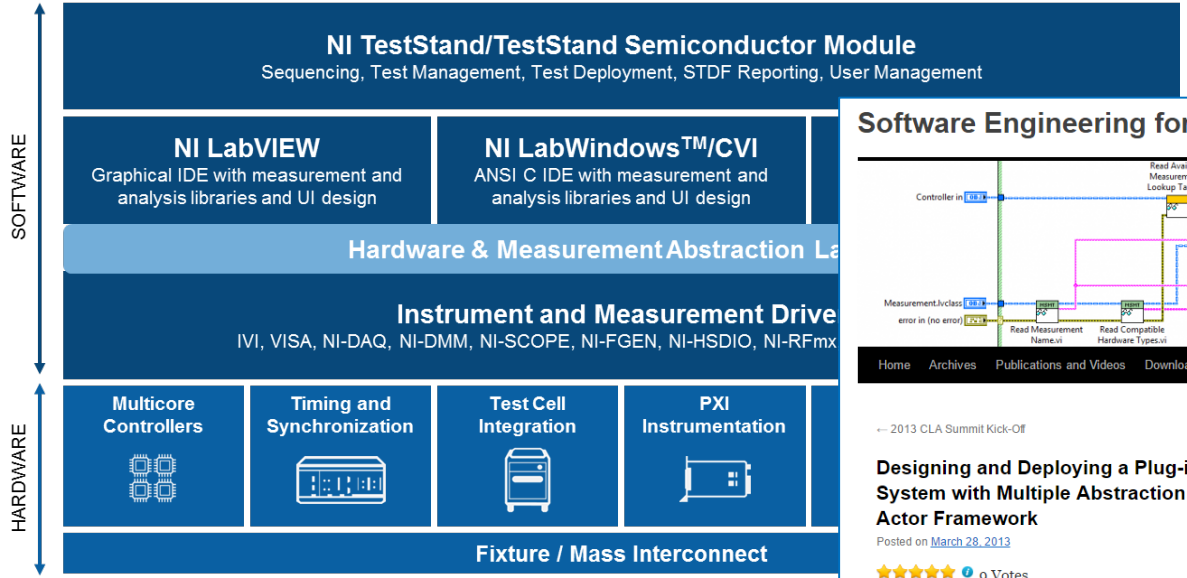
765 MHz analysis bandwidth and real-time DSP throughput of up to 62 million FFTs

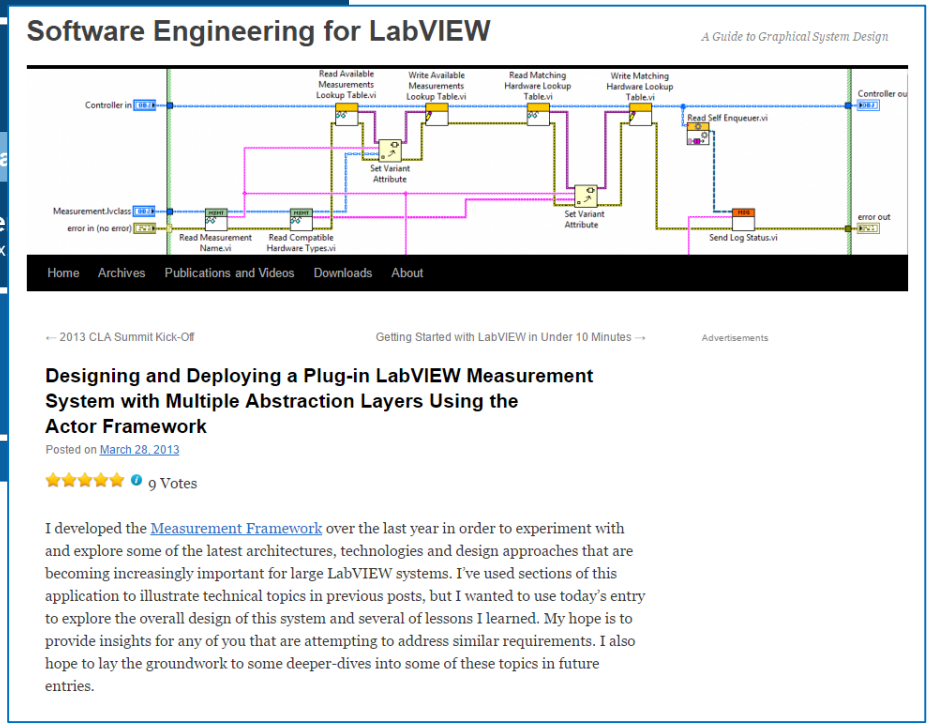
“NI’s PXIe technology provides unparalleled scalability, upgradeability, and technology insertion capability that minimizes obsolescence, repair, and test program portability issues that plague box instruments.”

RADX® TECHNOLOGIES, INC.

Summary

Architecture of an Automated Test System With Abstraction





Fundamentals of Building a Test System

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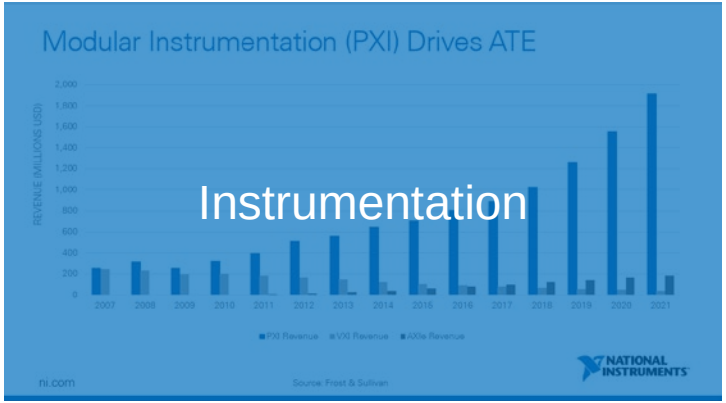
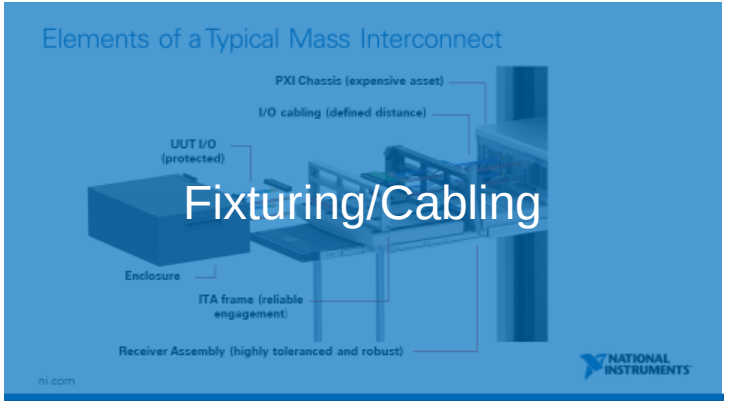
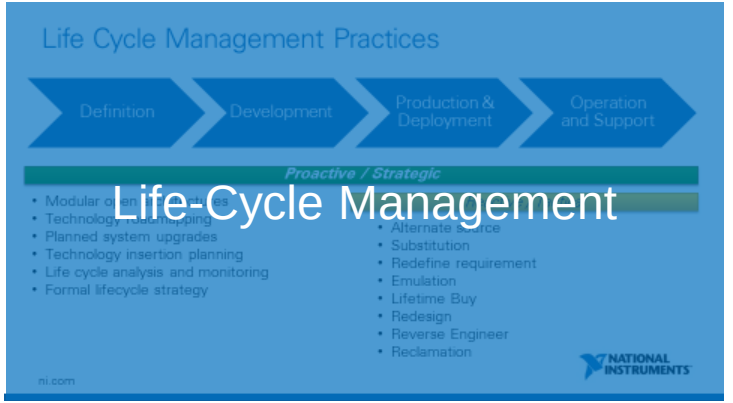
ATE Hardware Architecture Considerations







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*Provides NI Repair, Calibration, and Inventory Services

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NI Staff

OR: Leave a message…

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