



NI TestScale

New Instrumentation Platform for Electronics Functional Test

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Session Topics

- Settle in and introductions – **5min**
- Functional test – business and technical challenges – **5min**
- TestScale overview – **15min**
- Tester design and production line automation – **10min**
- Q&A – **10min**

Functional Test

Business and Technical Challenges

ni Functional Test Challenges

➤ Throughput KPIs

- Optimize per DUT test time
- Parallelization
- Automation to minimize idle time
- Minimize unplanned downtime

➤ CapEx

- Tester BOM (tester hardware, fixturing, instrumentation, cabling/connectivity, software licenses, etc.)

➤ OpEx

- First article tester development (hardware + test software)
- N+1th tester
- Managing changes

➤ Quality and Reliability

- Implemented test plan repeatably meets negotiated test coverage

➤ Calibration and Maintenance

➤ ...



Manufacturing Optimized Instrumentation

When scaling up **production volume** or scaling up **test line distribution**, test engineers must scale down system **cost and size** if they are to meet operational and financial expectations.

This is a challenge as solutions available on the market today are either large, expensive and “overkill” for the task at hand, or small, very custom and a struggle to maintain reliably. These instruments are not optimized for this kind of manufacturing strategy.

Functional test stations in this situation for PCBA or device test must

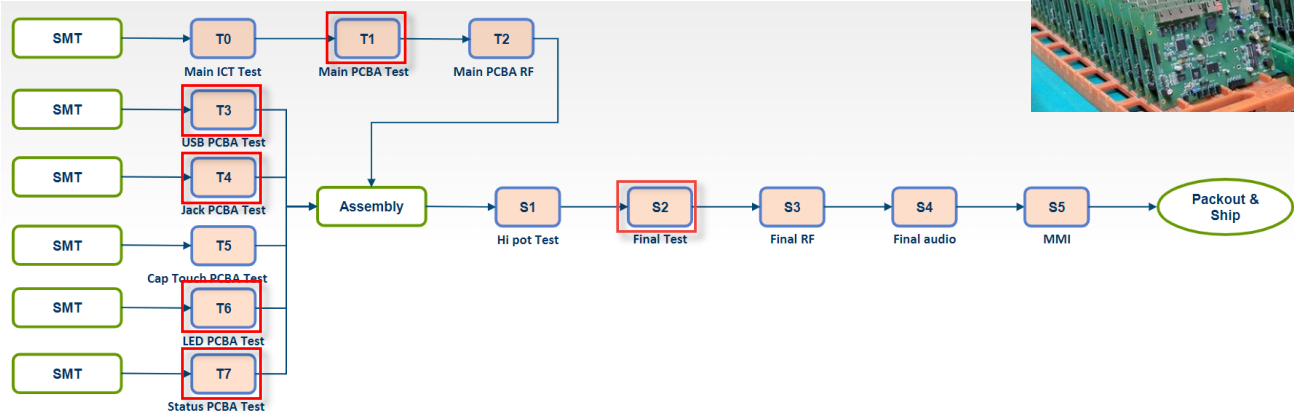
- Meet test coverage with stable reliable instrumentation
- Minimize instrumentation CapEx cost by not “over-specifying” instrumentation
- Minimize footprint while integrating ergonomically into manufacturing process
- Minimize system design and replication costs
- Integrate easily with application software

NI TestScale delivers a **NEW** option for test engineers, enabling them to meet **test coverage**, **simplify development** and **ease sustaining** for electrical functional test of PCBAs and devices.

ni Distributed Test Methodology



Example device: Smart speaker



Electrical Test Station	Test Coverage
Main PCBA	Firmware download, SN write and check, Wi-Fi and BT MAC address write and check, voltage and current test, audio function test
USB PCBA	USB connector open/short
Jack PCBA	LED test, switch test
LED PCBA	N LEDs test, voltage and current test
Status PCBA	N LEDs test
Final	Final SN write and check, DEST data write and check, Wi-Fi and BT MAC address check, NFX tag write and check, button and switch test, adaptive power width, USB connect test

Test Coverage and Volume

How NI Instrumentation Maps to Different Test Strategies

		<div> <div></div> <div>Volume</div> <div></div> </div>	
		High Volume Production	Low Volume Production
<div> <div></div> <div>Test Coverage</div> <div></div> </div>	Simple or Distributed Test Systems	<ul style="list-style-type: none"> NI: PC-based DAQ, Instrument Control, and Software Alternative: In-house instrumentation or competitive board-level instruments 	<ul style="list-style-type: none"> NI: PXI and PC-based DAQ DAQ, Instrument Control, and Software Alternative: Box instruments, dataloggers
	Complex or Converged Test Systems	<ul style="list-style-type: none"> NI: PXI for multi-up testers or Instrument Control, DMMs, and SW Alternative: In-house instrumentation or competitive instruments 	<ul style="list-style-type: none"> NI: PXI platform and software Alternative: Higher-end box instrumentation, competitive PXI instruments, high-end custom instrumentats

TestScale Overview

A new approach for volume manufacturing

NI TestScale Overview

Meet your test coverage with range of I/O modules built to NI's high performance and reliability standards

- Analog I/O
- Digital I/O
- Programmable Power supply
- Future I/O (2023+)

Reduce system cost with low price-per-channel.

Speed fixture design and reduce errors with standard 37 pin D-sub connectivity

Reduce design and replication costs with integrated system simplified design

- In fixture
- Rackmount

Reduce 50% footprint costs with compact instrumentation design that can be built into fixture. "No-rack" design also gives 40% cost savings.

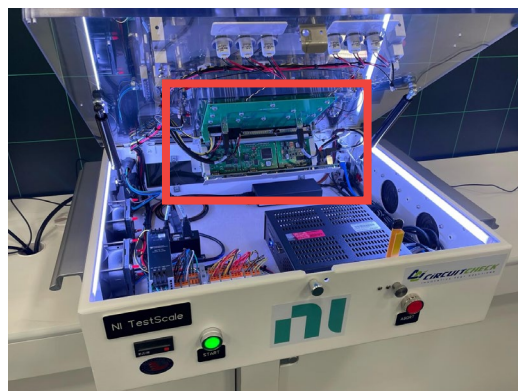
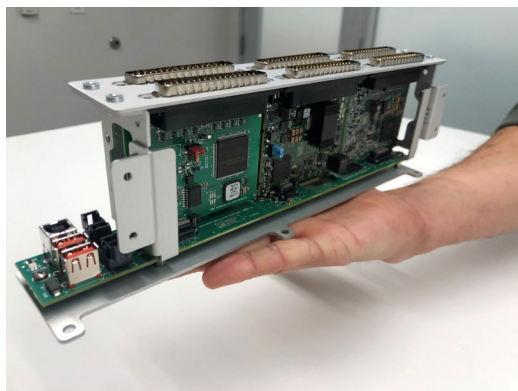
Expand I/O coverage while maximizing channel density with modular design and flexible daisy-chain chassis

Connect via USB for straightforward communication with industrial PC.



TestScale “In Fixture” Variant

- Mount instrumentation inside the fixture either to the fixture pan or directly to the DUT interconnect board
- Minimize/remove need for I/O cables



TestScale Rackmount Variant

- Mount instrumentation in 1U rack space
- 2 backplanes in 19" rack width
- Integrate into existing architectures

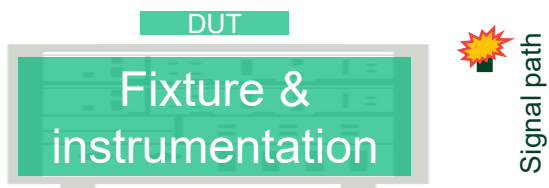


TestScale Mounting Variants

Direct Mount

(in fixture)

Connect directly to the interposer.
Reduce signal path and failure points.



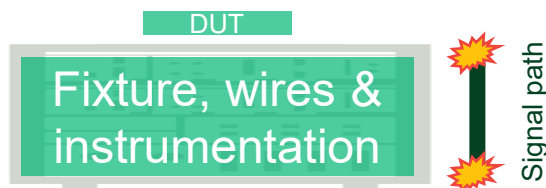
Signal path
~ **0.05m**

Failure points
~ **2**

Fixture Mount

(in fixture)

Attaches to the pan of the fixture, wired to the interposer. Reduce floorspace and cost.



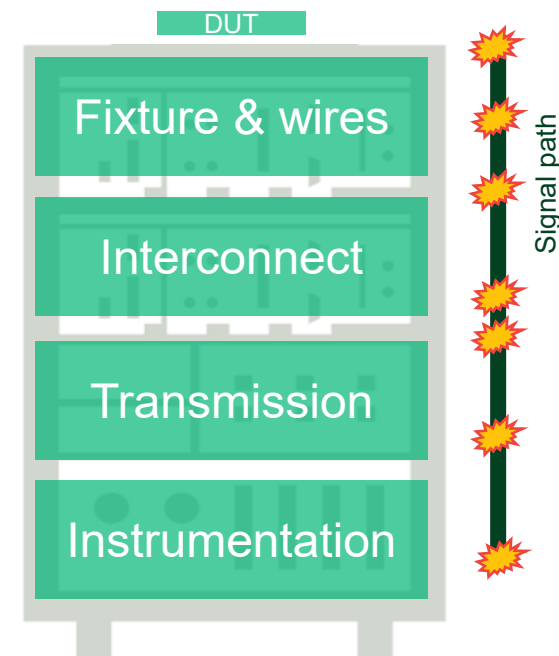
Signal path
~ **0.4m**

Failure points
~ **3**

Rack Mount

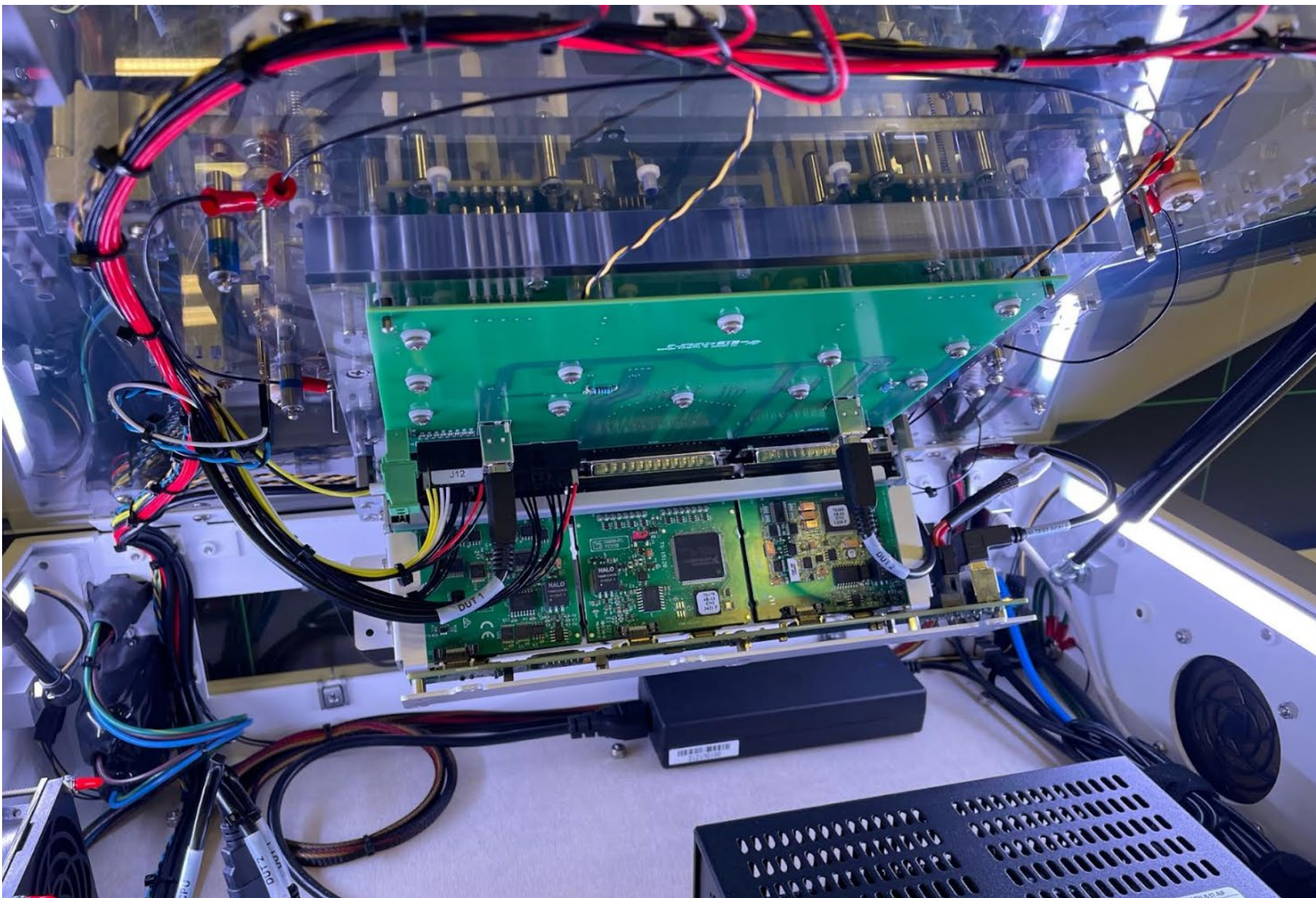
(in rack)

Fixed with 1U slot using half-rack width.
Align to existing test architectures



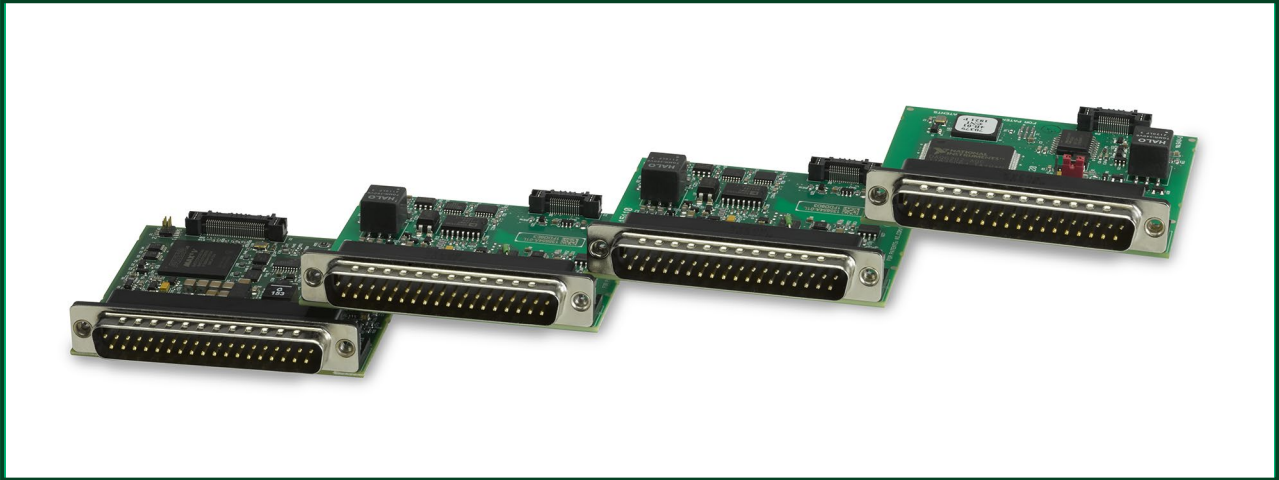
Signal path
~ **1.6m**

Failure points
~ **8**



TestScale I/O Module Options

Fully occupied backplane = ~\$5,000



Measurement Modules

- High channel density
- Reliable measurement quality
- 37 pin connection

I/O Type	Channel Count	Details
Analog Input	32ch	<ul style="list-style-type: none">• $\pm 10\text{ V}$ (multiple ranges)• 250 kS/s• 16-Bit
Analog Output	4ch	<ul style="list-style-type: none">• $\pm 10\text{ V}$ (multiple ranges)• 100 kS/s/ch• 16-Bit
Digital I/O	32ch (bidirectional)	<ul style="list-style-type: none">• 3.3V and 5V TTL• 64mA max output current
Digital Output	32ch (sinking output)	<ul style="list-style-type: none">• Up to 60V logic level• Voltage level determined by V_{AUX} input on I/O connector

Programmable Power Supply

- Single-channel, single-quadrant
- Single, full-scale voltage and current range
- Requires Vaux power input

Output	<ul style="list-style-type: none">• 6V, 3A, 18W DC
Resolution	<ul style="list-style-type: none">• Programming: 2.5mV, 1.5mA• Measurement: 600uV, 400uA
Accuracy	<ul style="list-style-type: none">• Programming & Measurement: 0.2% + 10mV, 0.4% + 15mA
Remote sense readback with closed loop	
NI-DAQmx API support	
Overvoltage, Overcurrent and Overtemperature protection features	



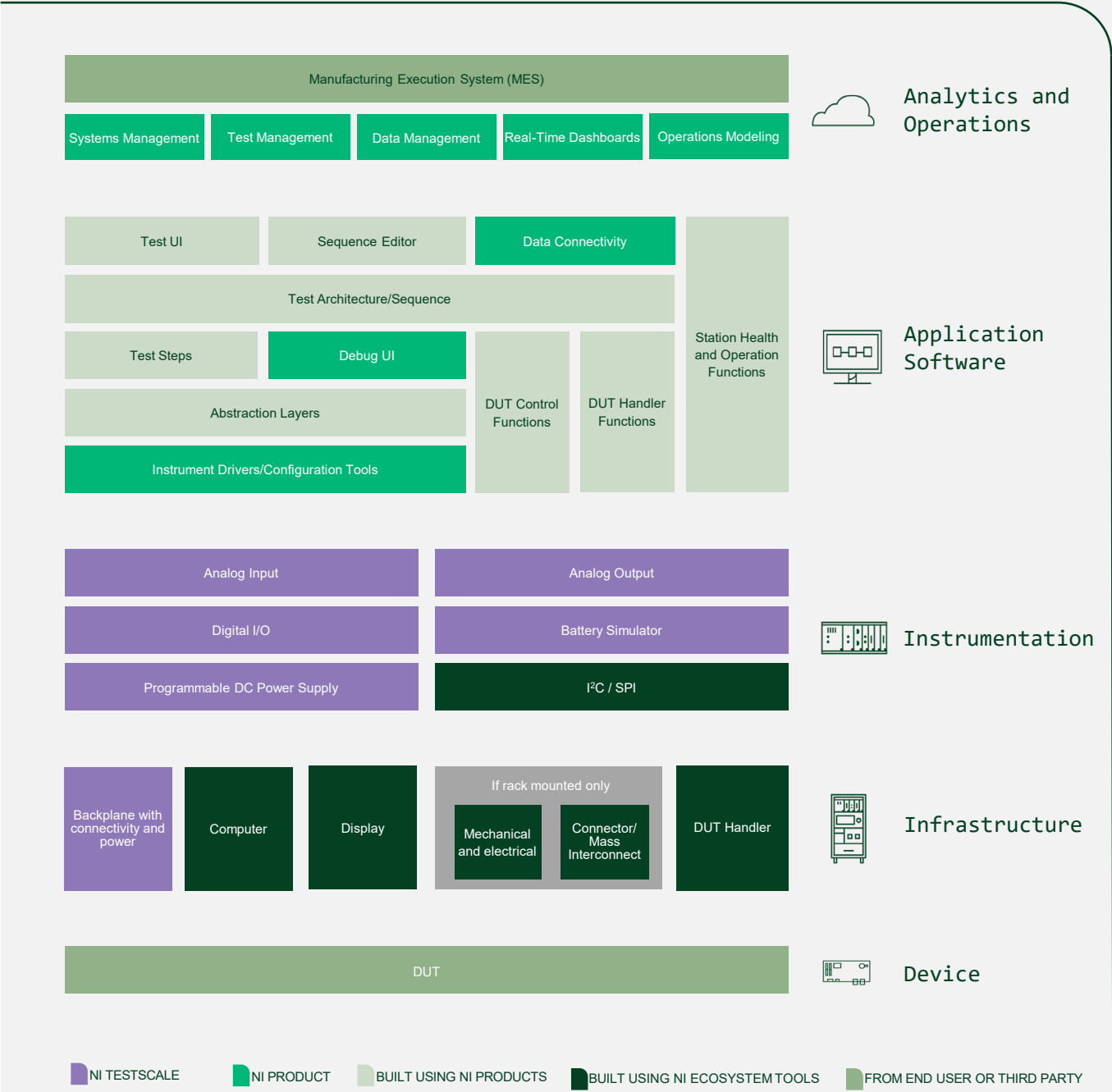
System architecture

SOFTWARE

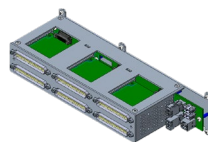
- TestScale is closely integrated for best user experience with NI's industry leading software products including TestStand, LabVIEW and SystemLink.
- TestScale is open to be used with most common languages and has drivers for LabVIEW, Python, C/C++, and .NET
- Support for common Linux desktop distros

HARDWARE

- Fixture connected either directly to I/O modules or through mass interconnect
- Instrument modules enclosed within a mounting frame to a backplane
- One or more backplanes connected via USB to PC running application software



Comparison of Functional Test Instrumentation



● strong
 ◐ average
 ○ weak
 ◑ varied

TestScale

DAQ Devices

PXI

Custom
Design

Box
Instruments

Measurement Quality



Measurement Variety



Throughput to Host



Multi-instrument Synchronization



Physical Footprint / Size



Hardware Integration Effort



Software Integration Effort



Long-Term Sustaining Effort



Global Support Availability



Price





NI TestScale

Design, Develop and Deploy your System

In-house Solution

Use the full TestScale data sheets, schematics and specifications available from NI along with NI technical support and services to assist your engineers in developing your own solution.

Hybrid Solution

Collaborate with NI and NI's partners to focus your team where their device domain knowledge adds the most value. e.g., outsource the fixture and instrumentation, while keeping software inhouse.

Outsourced Solution

NI partners with experienced global integration companies that along with NI's own consulting and development teams can provide your solution from concept to deployment.

Booster

Specialists in manufacturing test and automation solutions Booster has a team of over 100 test engineers dedicated to building high quality solutions. Booster can scale to any size of project meeting design needs and deployment schedules.

Based in China with a global service and support network



Averna

With more than 20 years in business, Averna has a proven record in helping clients accelerate product development, reduce manufacturing costs, achieve uncompromising test coverage, and solve supply-chain issues.

Based in Canada with global development, service and support



Circuit Check

Circuit Check is a leading provider of automated test systems and interfacing solutions (test fixtures and interface test adapters) for complex industrial, medical, automotive, military/aerospace, and computer networking industry electronic products.

Based in USA with a global service and support network



Averna

Production Line Design, Development, and Deployment

Our Global Design, Production & Support Locations



Averna at a Glance

WHAT WE OFFER

SOLUTIONS



PROTOTYPING
& CONSULTING SERVICES



PRECISION ASSEMBLY
& PRODUCTION



AUTOMATED TEST
SOLUTIONS



IN-LINE TEST SYSTEMS



TEST SYSTEM
REPLICATION



TEST PLATFORMS
& PRODUCTS

GLOBAL NETWORK & SUPPORT CHANNEL

WHAT WE KNOW

EXPERTISE



VISION SYSTEMS



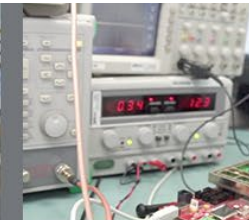
RF & MICROWAVE



OPTICS



ROBOTICS
& MOTION



INSTRUMENTATION



SMART
MANUFACTURING

SYSTEM DESIGN & INTEGRATION

WHAT WE USE

SKILLS



SOFTWARE



MECHANICAL



ELECTRICAL



PNEUMATICS &
HYDRAULICS



ELECTRONICS



SIGNALS/DSP

PROJECT MANAGEMENT & EXECUTION

Test Expertise for Every Industry



Aerospace
& Defense



Automotive &
Transportation



Consumer
Electronics



Life
Sciences



Semi-
conductors



Telecom
Infrastructure

Automated Factories

Manufacturing floor of the future

- Standardized line
- Fully automated
- Independent cells
- Deployed globally and managed remotely

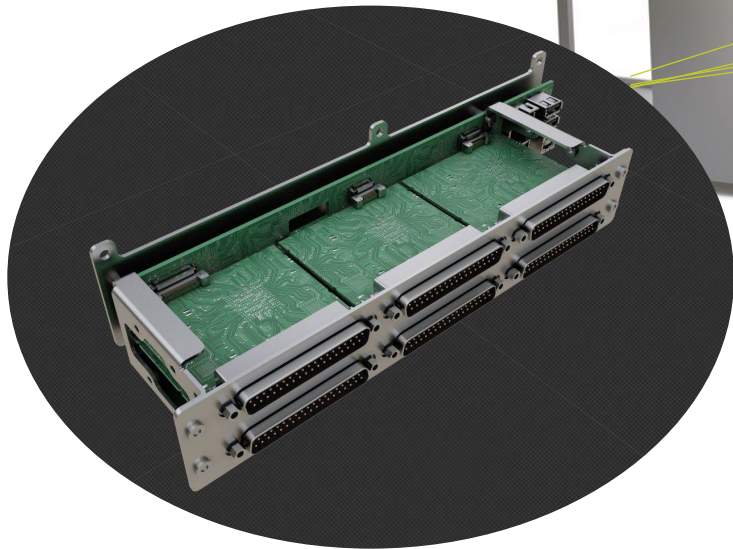


UniLine: Universal In-Line Tester

Automate all
safety,
functional,
ICT, End Of
Line tests and
perform part
labeling and
programming.

Automate Manufacturing Test

- Standardized Test
- Modular Design
- Easy Deployment



Q&A