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2023 AUSTIN





Optimizing Manufacturing Test Strategies for The Automotive E/E Architecture

Evolution through a combination of standardization and flexibility

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Optimizing Manufacturing Test Strategies for The Automotive E/E Architecture

Evolution through a combination of
standardization and flexibility

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Agenda



Automotive Electronics Production Test Overview

E/E Evolution

The Quality Driver



NI ECU Test System

Flexible Consistency

Faster Throughput

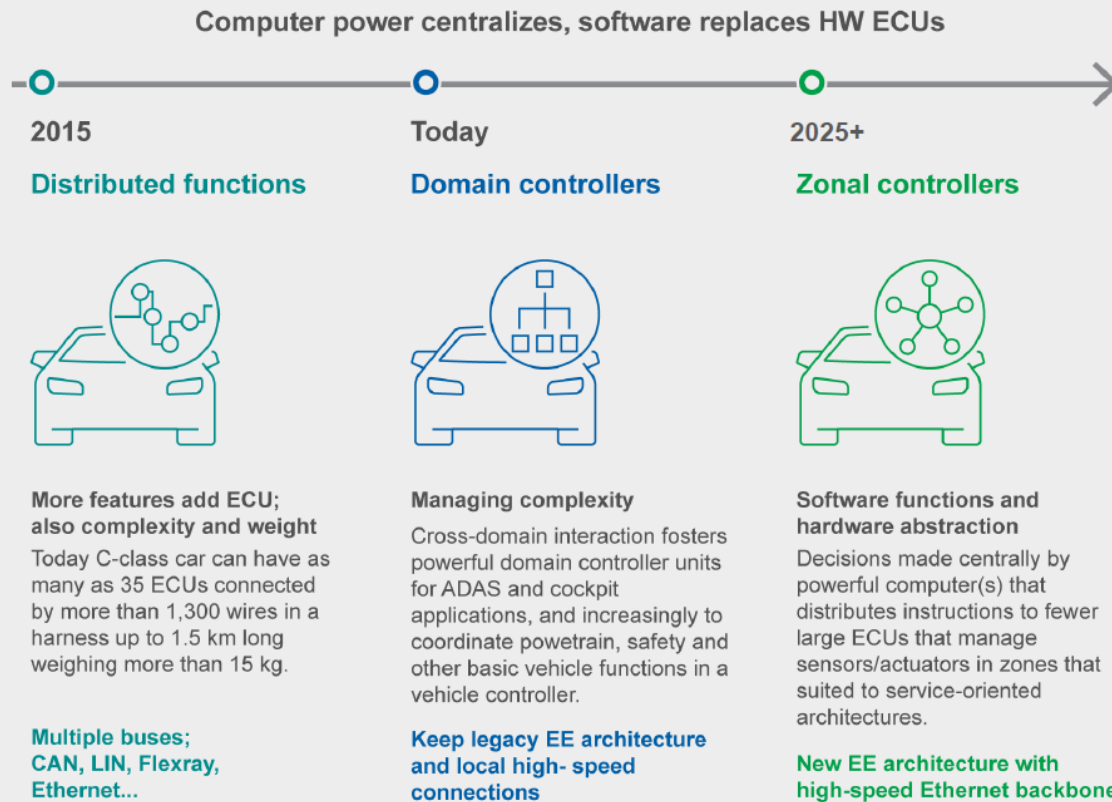
Faster Test Plan Development

Reliability

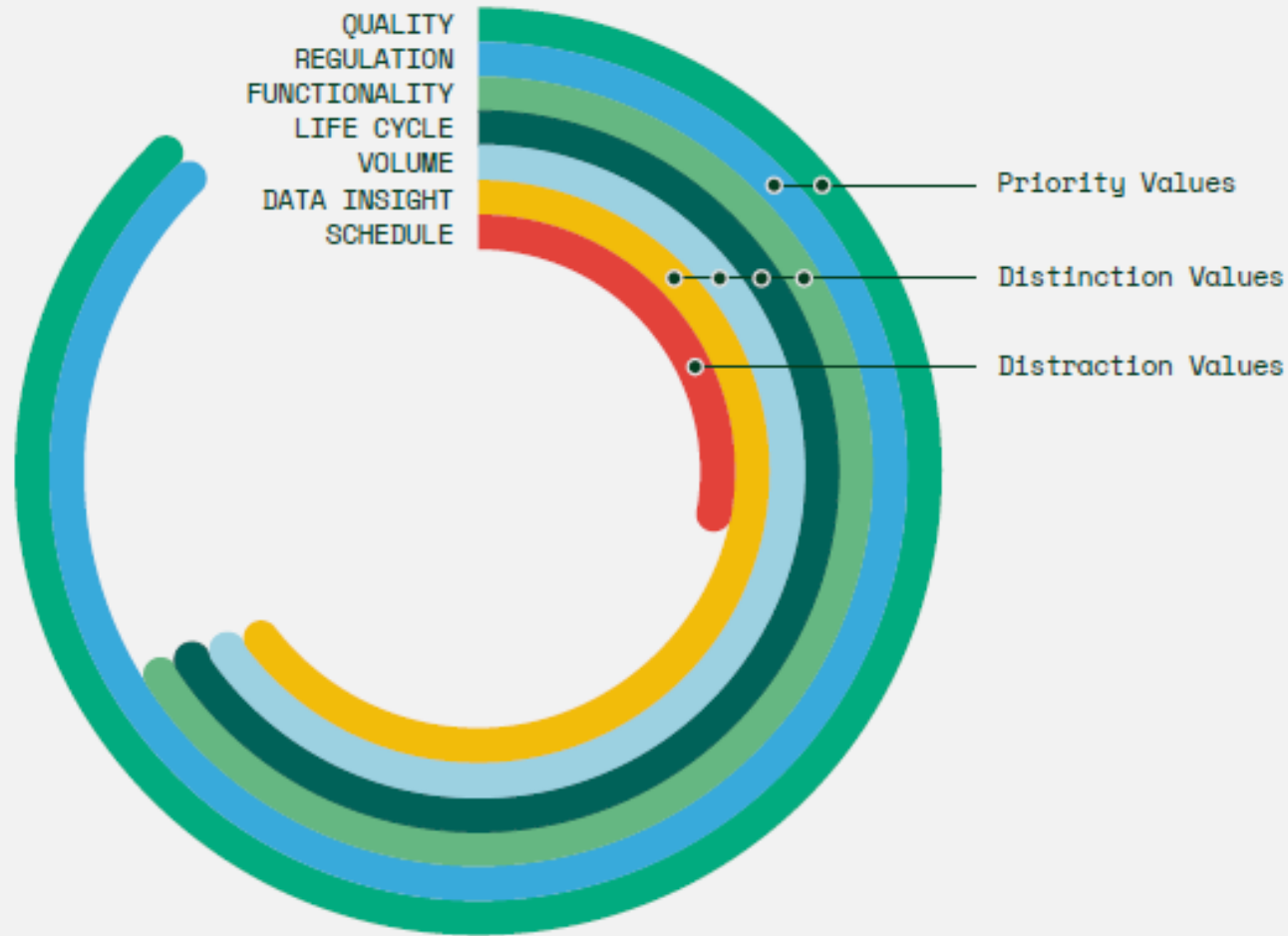
Predictability

E/E Evolution

Overview of main architecture changes in 15 years



- The motivations for new features
 - Electrification
 - Autonomy
 - Connectivity over-air and new service models
 - New mobility models like Robotaxis



The Quality Driver in the Automotive Industry

Where are you investing your time and resources?



Your Priority:
Quality & Regulation



Your Distinction:
Functionality and Volume



Your Distraction:
Schedule



Quality & Regulation

To differentiate and provide additional performance beyond your competition, you need to regularly revisit your quality standards to ensure compliance

Test coverage is not negotiable & high-quality arena is expected by the industry;

Any process, tool, or proficiency gap that jeopardizes quality standards must be addressed immediately.

Increase need around building product Intimacy - focus more on the testing coverage than in the test infrastructure

2023 set to be the 'year for safer cars' as major regulations will kick in from April

DIPAK K DASH / TNN / Oct 2, 2022, 08:49 IST

Strict EPA Rules for 2027-2032 Vehicles Announced, Garnering a Range of Reactions

These are expected to be the toughest emissions standards yet, a move that should push the industry even more in the direction of EVs.

The European Automobile Manufacturers' Association (ACEA) welcomes the entry into force of the General Safety Regulation (GSR) as part of EU's efforts to halve the number of fatal and serious injuries from traffic accidents in the EU by 2030.



Functionality & Volume

Providing products with new functionalities in the market

Do I have the right domain of expertise?

Optimizing manufacturing high volumes of new and legacy products

How can I increase efficiency?
(throughput, scrap, rework, etc.)



Preparing testing strategy to ensure coverage on new functionalities

Do I have the right tools to accomplish this?

Deploying new product families in the production floor

How do I maintain a mix of legacy and new product volume?

Differentiation can also come through operational excellence!



Schedule

Predictability is more important than pure speed

In today's world scenario, success is measured in hitting deadlines rather than delivery early

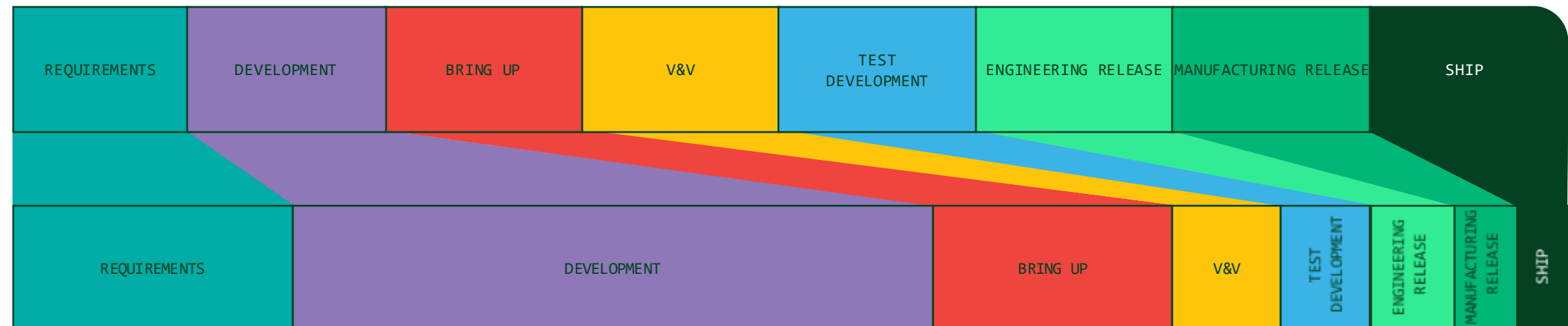
Your customers prepare operations based on hard deadlines

- Delivering early might result on a customer not prepared
- Delivering late will affect the whole supply chain

Schedule becomes a distraction to your operations!

Project Kickoff

Hard Deadline



Sometime Later



Ensuring no failures in the field (Quality Driver) will always supersede any priority around scheduling & volume... although we might not always be conscious about it



How do we bridge the gap?

WE HELP WITH

Functionality

Volume

Schedule

SO THAT YOU CAN FOCUS ON
WHERE YOU ARE THE EXPERT

Quality



Flexible Consistency

Faster Throughput

Faster Test Plan Development

Reliability

Predictability

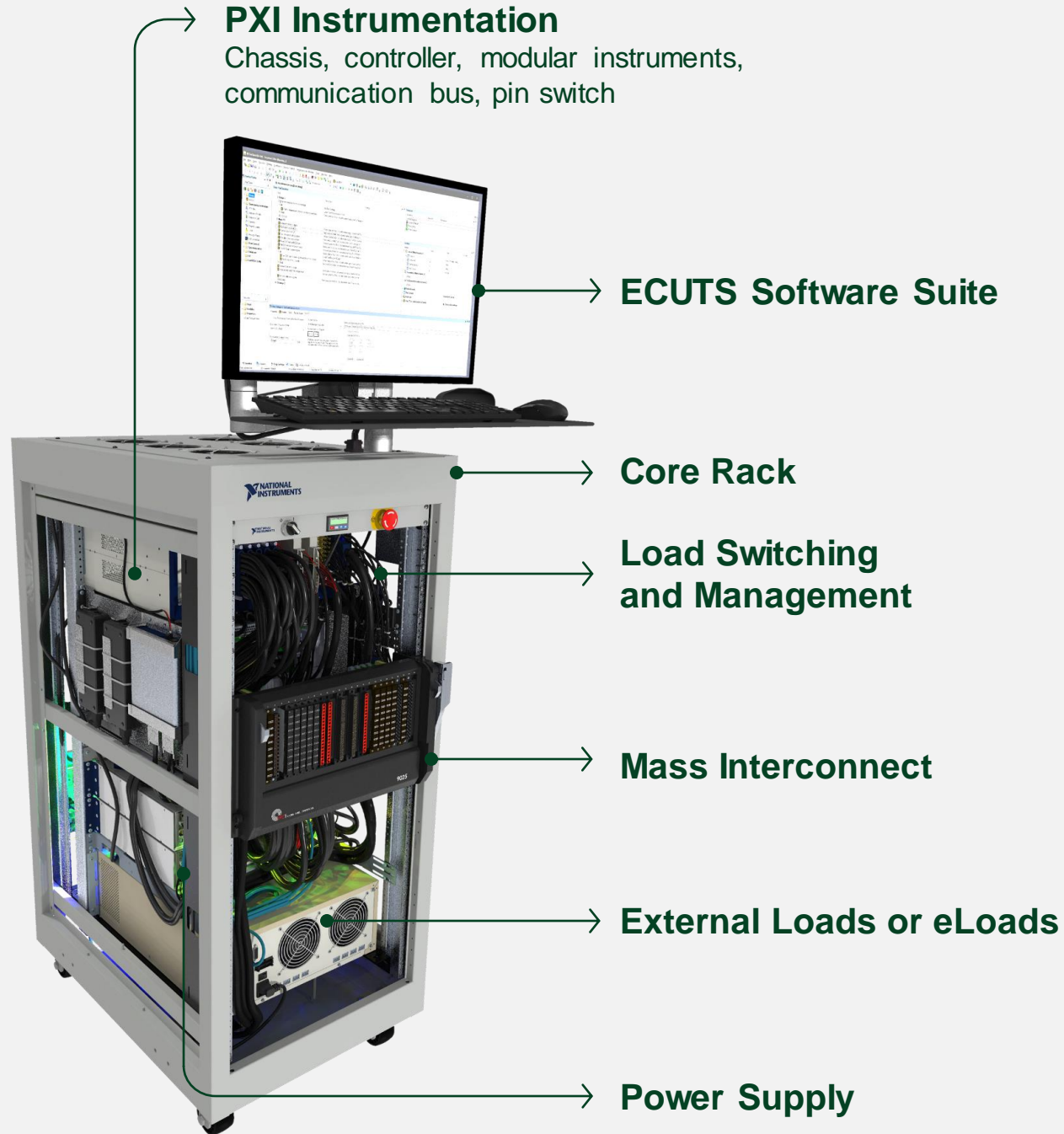
Flexible Consistency

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NI ECU Test System

Addresses testing of
medium pin count
DUTs with **optimized**
instrumentation in a
24 or 40U rack

Mass Interconnect Receiver Arrangement

J3 is now reserved to enable 12 SLSC-12251 slots

Populate only receivers where we have corresponding instruments in a system

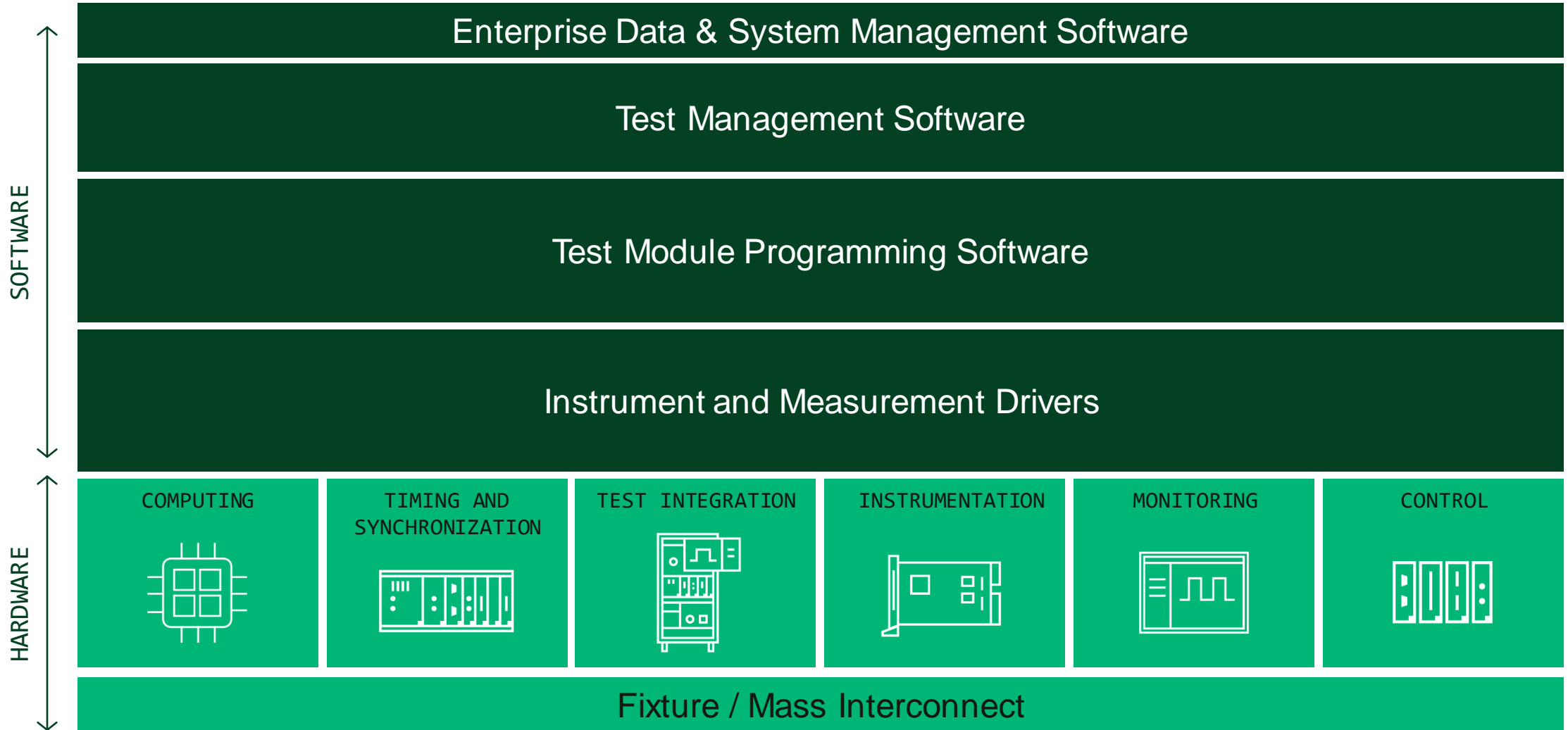
Open Slots (J11, J13, J15, J17, and J25) for future-reserved or second-level integration

Layout Design Philosophy

- Avoid cable crossovers by having symmetry (Outside for Power/Comm./Coax, Middle for Loads, and Instrumentation in between)
- Keep cables as straight as possible
- Blank space for future expansion



ECU Test System | Architecture Overview



Flexible Consistency

Faster Throughput

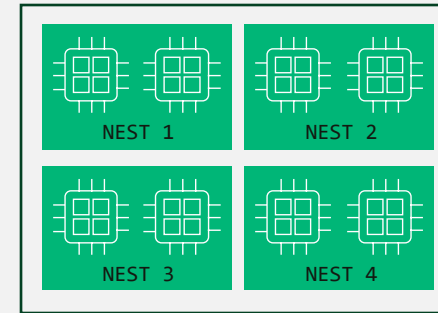
Faster Test Plan Development

Reliability

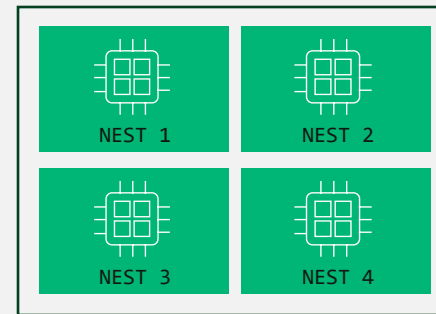
Predictability

Topology Options

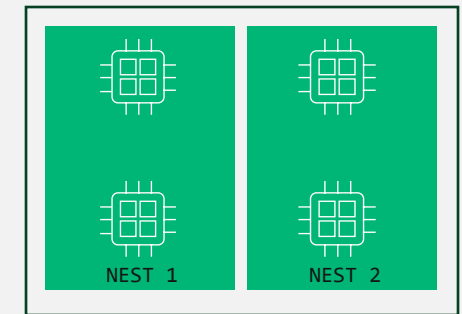
There are several topology options you can select for testing DUTs in parallel based on your desired throughput, DUT complexity, and budget requirements.



4 NESTs with 2 DUTs Each



4 NESTs with 1 DUT each



2 NESTs with 2 DUTs each

Example ECUTS Topologies



INDUSTRY-STANDARD TEST MANAGEMENT SOFTWARE

TestStand

Features at a Glance

Create, execute, and debug test sequences

Extend the software to meet custom requirements

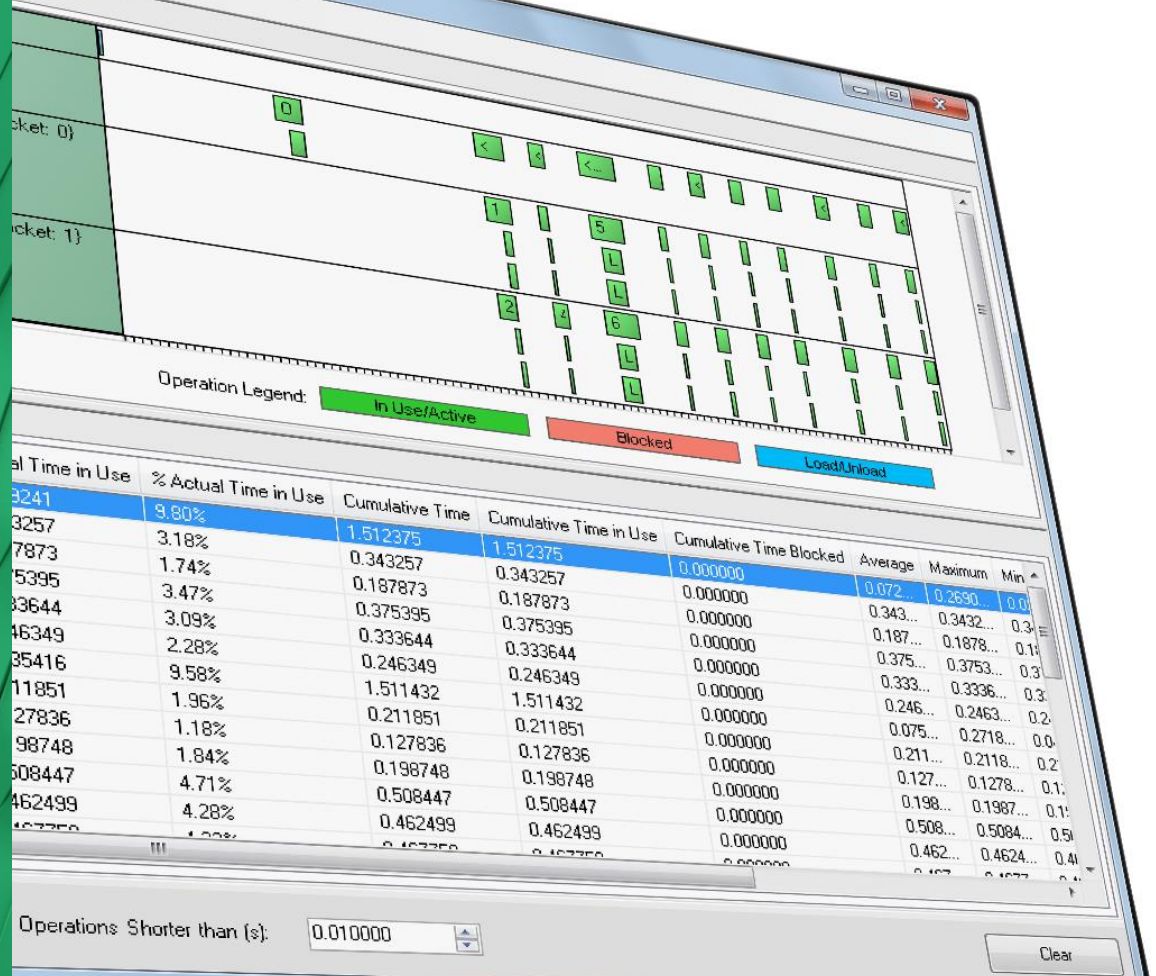
Develop professional operator interfaces

Generate reports and integrate with databases

Generate reports and integrate with databases

Reuse code developed in any programming language

Increase throughput with parallel testing





TestStand Demo: Reducing Test Time with Parallel Test

Parallel Test Strategy Performance Comparison

Test Strategy	Time (s)
Sequential	24.5
Parallel	18.3
Auto-Scheduled	16.4
Parallel (additional DMM)	12.3
Auto-Scheduled (additional DMM)	12.3

Operation In Progress: Auto-Scheduled with additional

In parallel, each UUT performs a DMM test using the first available DMM and a Scope test. A UUT locks each instrument it uses to ensure that it has exclusive use of the instrument. The order in which the UUT performs the tests can vary according to the a

Flexible Consistency

Faster Throughput

Faster Test Plan Development

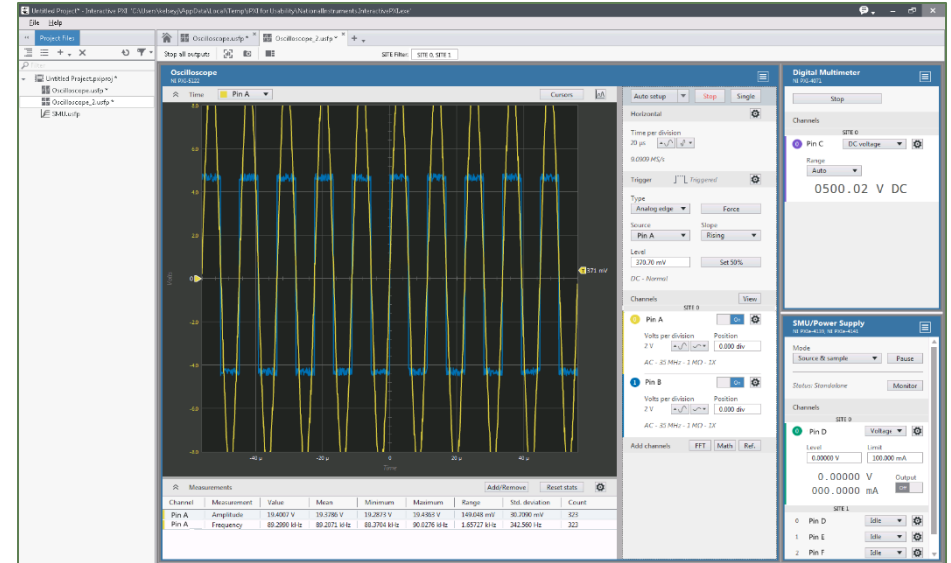
Reliability

Predictability



TestStand ECU Toolkit

- Controls instruments in TestStand based on configurations defined in InstrumentStudio
- Debugs instruments using InstrumentStudio while running a test sequence in TestStand
- Only supports ECU Test System instruments



Step	Description
Setup (1)	
Create Sessions and Apply - Instrument_2_2020-04-28_10-17-... Create Sessions and Apply - Instrument_2_2020-04-28_10-17-...	
<End Group>	
Main (9)	
Instrument Control Steps using the sessions created from Setu...	
▶ SMU/PPS - Initiate	Starts a generation or acquisition.
▶ SMU/PPS - Enable Output	Enables generation on the specified channel.
▶ DMM - Read Measurement	Reads the digital multimeter measurement result.
■ SMU/PPS - Abort	Transitions from the Running state to the Uncommitted state a...
▶ FGen - Initiate Generation	Initiates a waveform generation.
▶ Scope - Initiate Acquisition	Initiates a waveform acquisition.
▶ Scope - Read Waveform	Obtains a waveform from the oscilloscope for the specified ch...
■ Scope - Abort Acquisition	Aborts an acquisition.
<End Group>	
Cleanup (1)	
Close Sessions	Close Sessions
<End Group>	

TESTSTAND ECU TOOLKIT



Instrument Studio™



TestStand™

Flexible Consistency

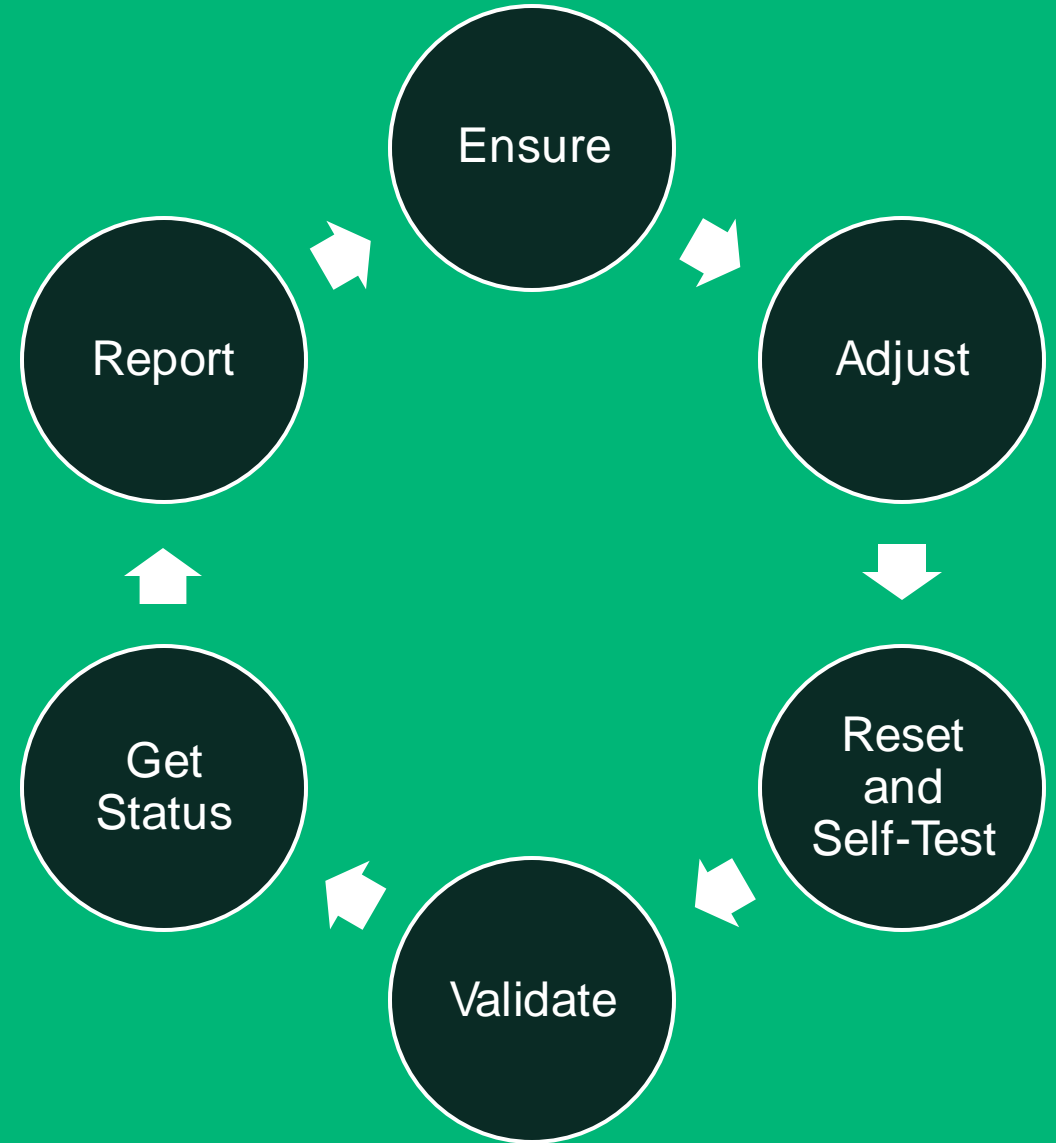
Faster Throughput

Faster Test Plan Development

Reliability

Predictability

Use The
Maintenance
Software to...





Simplified Maintenance with Field Diagnostic Tester (FDT)

FDT Tool for higher maintenance and serviceability

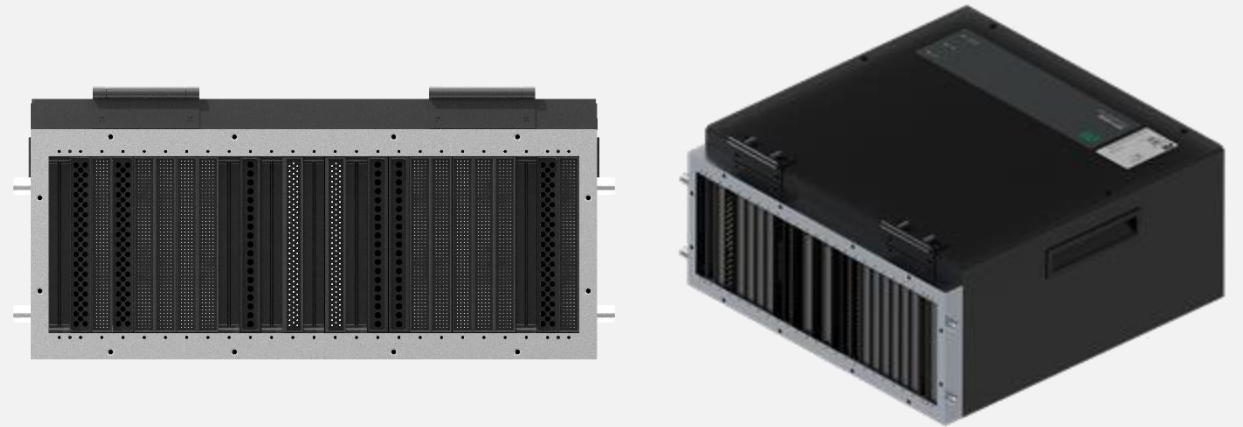
ECU Test System Maintenance Software provides a report of components expected in the system and performs a continuity check*

*NOTE: FDT WORKS ONLY FOR PRE-DEFINED SLOTS AND PINS.

The screenshot displays the 'Test System Maintenance' software interface. The main window shows a 'REPORT' section with a table of system components and their test results. A summary indicates that one or more operations failed. The table lists components such as CAN1, CAN2, CAN3, CAN4, LIN5, LIN6, ELOAD_RMX_1, FIU_MIO_1, J1_DIO, J4_RELAY, J5_MATRIX, J6_AO, J6_DMM, J6_MATRIX, J7_MATRIX, and J10-FIU. The 'Continuity Check' column shows various failure statuses like 'Failed', 'Failed²', 'Failed³', 'Failed⁴', and 'Failed⁵'. A sidebar on the right shows a 'REPORTS' list with columns for STATUS, DATE, and OPERATIONS, including entries for 'All operations', 'No operations', 'Check Continuity', and 'Check Continuity'.

Name	Reset	Self Test	Self Calibration	Continuity Check
CAN1,CAN2,CAN3,CAN4,LIN5,LIN6	N/A	✓ Passed	N/A	✗ Failed ¹
ELOAD_RMX_1	✓ Passed	✓ Passed	N/A	N/A
ELOAD_RMX_1, Channel 3	N/A	N/A	N/A	✗ Failed ²
ELOAD_RMX_1, Channels 1 and 2	N/A	N/A	N/A	✗ Failed ³
FIU_MIO_1	✓ Passed	✓ Passed	✓ Passed	N/A
J1_DIO	✓ Passed	✓ Passed	N/A	✓ Passed
J4_RELAY	✓ Passed	✓ Passed	N/A	✓ Passed
J5_MATRIX	✓ Passed	✓ Passed	N/A	✗ Failed ⁴
J6_AO	✓ Passed	✓ Passed	N/A	✓ Passed
J6_DMM	✓ Passed	✓ Passed	✓ Passed	✓ Passed
J6_MATRIX	✓ Passed	✓ Passed	N/A	✓ Passed
J7_MATRIX	✓ Passed	✓ Passed	N/A	✓ Passed
J10-FIU	✗ Failed ⁵	N/A	N/A	✗ Failed ⁶

EXAMPLE : ECUTS MAINTENANCE REPORT



FIELD DIAGNOSTIC TESTER (ECUTS-16001, PN 787926-01)

Flexible Consistency

Faster Throughput

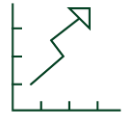
Faster Test Plan Development

Reliability

Predictability

Predictable Operations

Be one step ahead



Streamline Using Standardization



Safety, Environmental, and
Regulatory Compliance



Expedited Global Deployment
(8-12W ESD)



Plan the Maintenance of Your Equipment





Services and Support Programs for ECUTS

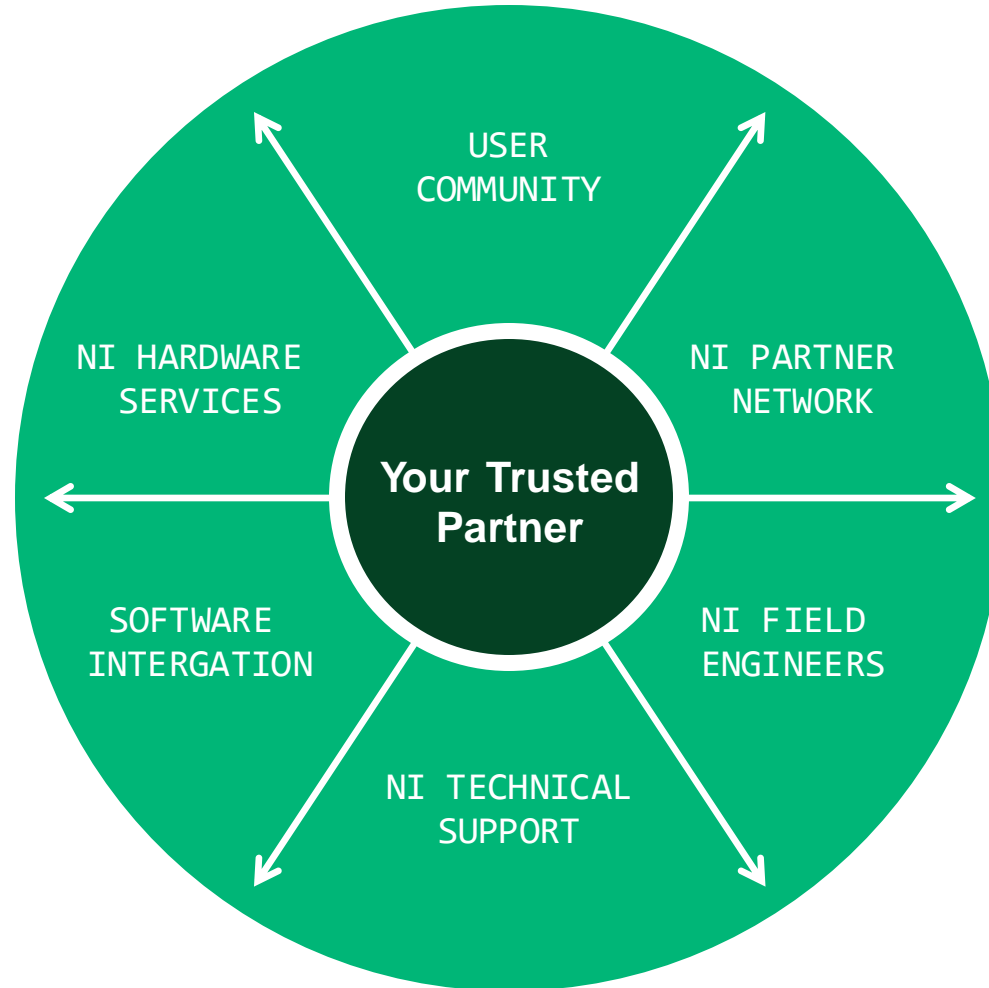
	BASIC	FULL	CUSTOM
Software Support Access to updates and bug fixes	Access to Software Updates	Access to Software Updates	Scope to be defined with customer on a case-by-case basis
Repair and Replacement Minimize downtime	3-5 Days Replacement	<24h Replacement	
Technical Support Resolve issues quickly	Technical Support 8x5	Technical Support 8x5	
Field and Remote Services Fixed maintenance cost		Troubleshooting & Support	
Life Cycle Management Mitigate obsolescence risk	Standard Product Notifications	Standard Product Notifications	
On-Demand Training Ensure user success	Online Safety and Maintenance Training	Online Safety and Maintenance Training	
	OPTIONS		
Calibration Quality measurements and traceability	Laboratory Calibration On-site Calibration Calibration Replacement		
Bring-Up Assistance Hassle-free commissioning	On-site or Remote Tester Bring-Up		
Training Ensure user success	On-Demand Safety and Maintenance Training Test Engineer VILT Training		
Professional Services	Integration Services, Process & Technology Standardization Technology Refresh & Migrations, Design Assistance, Upgrade Assistance Resident Engineer		

We're committed to your success.

300k+
COMMUNITY USERS

30+
SERVICE CENTERS

900+
SOFTWARE ADD-ONS
AND APPLICATIONS



1000+
PARTNERS

700+
FIELD ENGINEERS

700+
SUPPORT ENGINEERS



Partnering with NI to solve our ECU functional test challenges has lowered our total cost of test while maintaining high quality standards. By standardizing on NI testers we reduced cycle and development time, increased system re-use, and made debugging, deploying, and maintenance easier.

Sergio Mejía

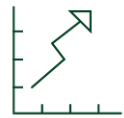
I&IE TEST ENGINEER

VITESCO TECHNOLOGIES

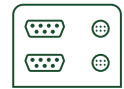


Summary

The ECUTS addresses testing of **medium pin count DUTs** with **optimized instrumentation** and a **powerful test executive**



Improved Standardization



10-40% Faster Test Time*



30-40% Faster Development*



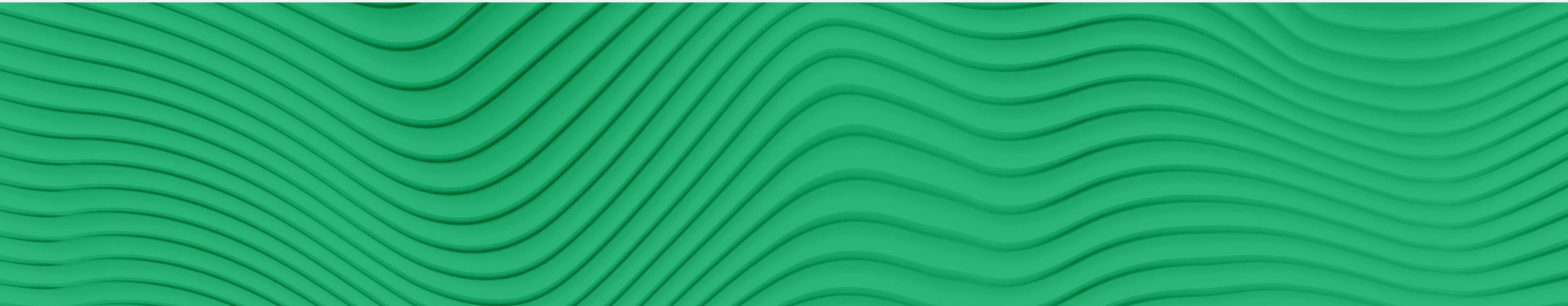
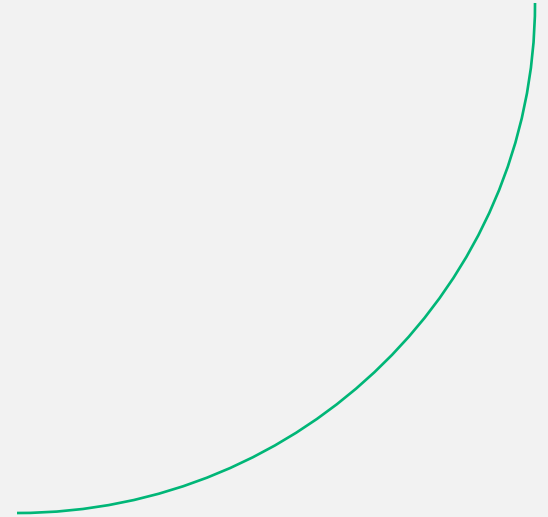
Simplified Maintenance



Expedited Global Deployment

Question & Answers

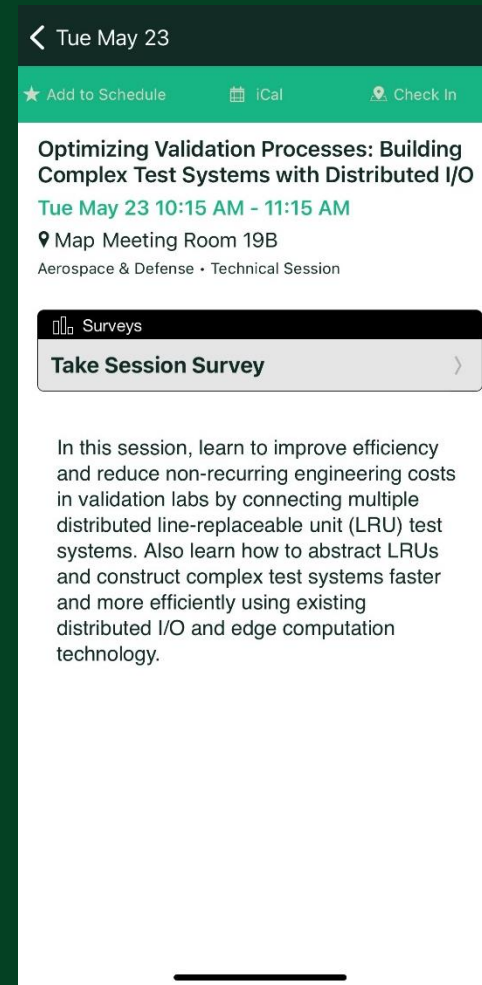
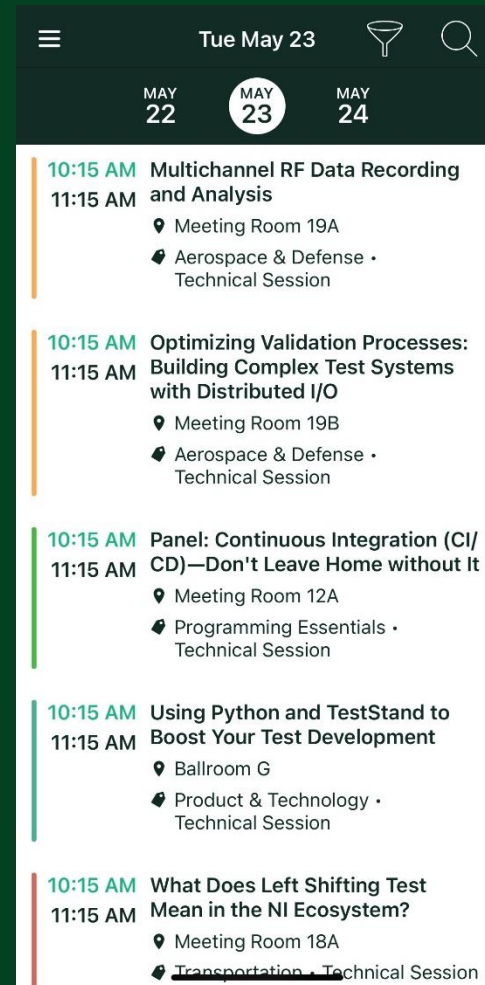
Please submit your question through Q/A chat pod.



Give us your feedback!

Quick 2 Question Survey

In the mobile app, click into the session you would like to provide feedback for



Click “Take the Session Survey”



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