



Before We Begin...

Welcome to NIDays 2015



# NIDays 2015 Highlights

## Afternoon Keynote

*Inspiring and Enabling Generations of Innovation*

*Joined by Herman Bontius, Alliander*

## Challenge the Champions

Nearly 20 presentations

# Lunch and Refreshments

Served in all exhibition areas

Lunch – 12:00



# Meet the Engineer

Are you facing an engineering challenge?

Do you have a technical query?

Book your 30-minute slot at reception.



# Feedback Form

- On the way out, turn in your feedback form to collect your **FREE** gift
- All completed feedback forums will be entered into our prize draw
- Check your email for link to presentation materials



Have a Great NIDays!

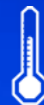




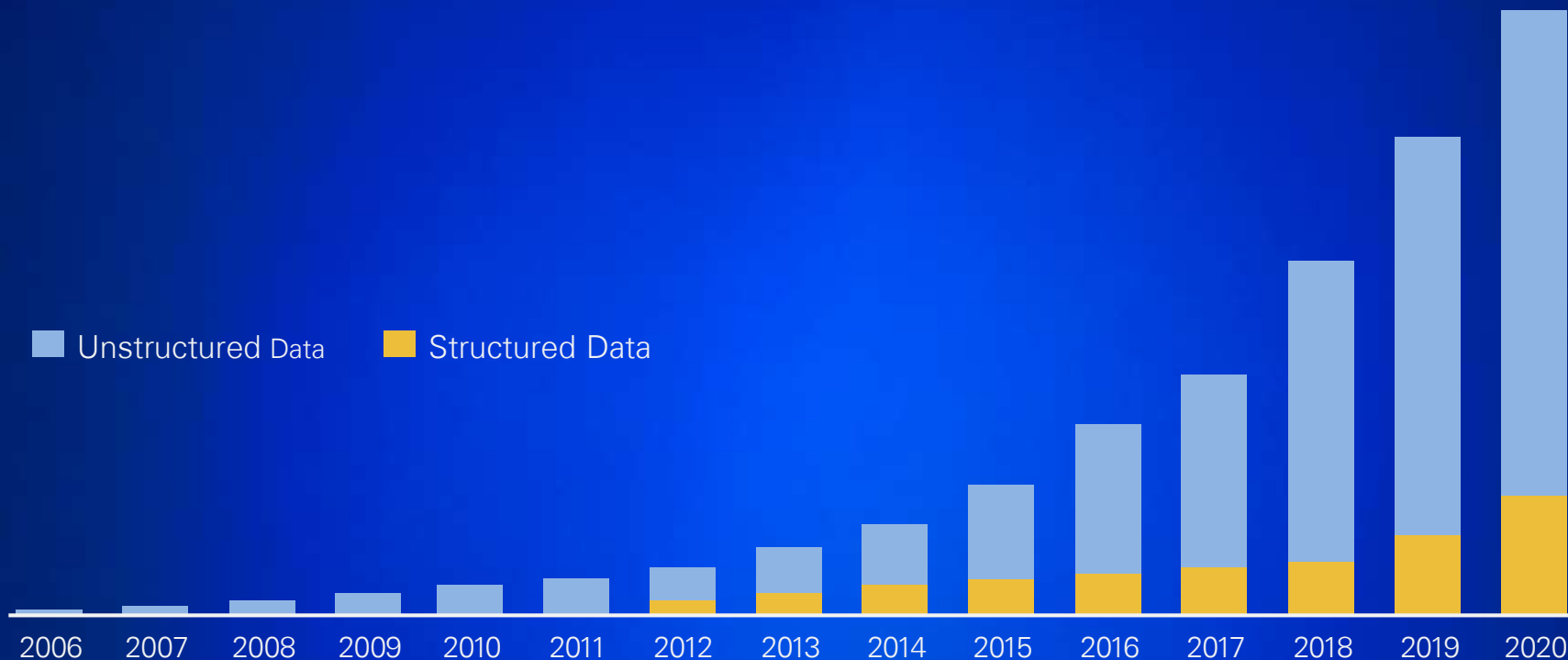


Elijah Kerry

Principal Product Manager  
National Instruments



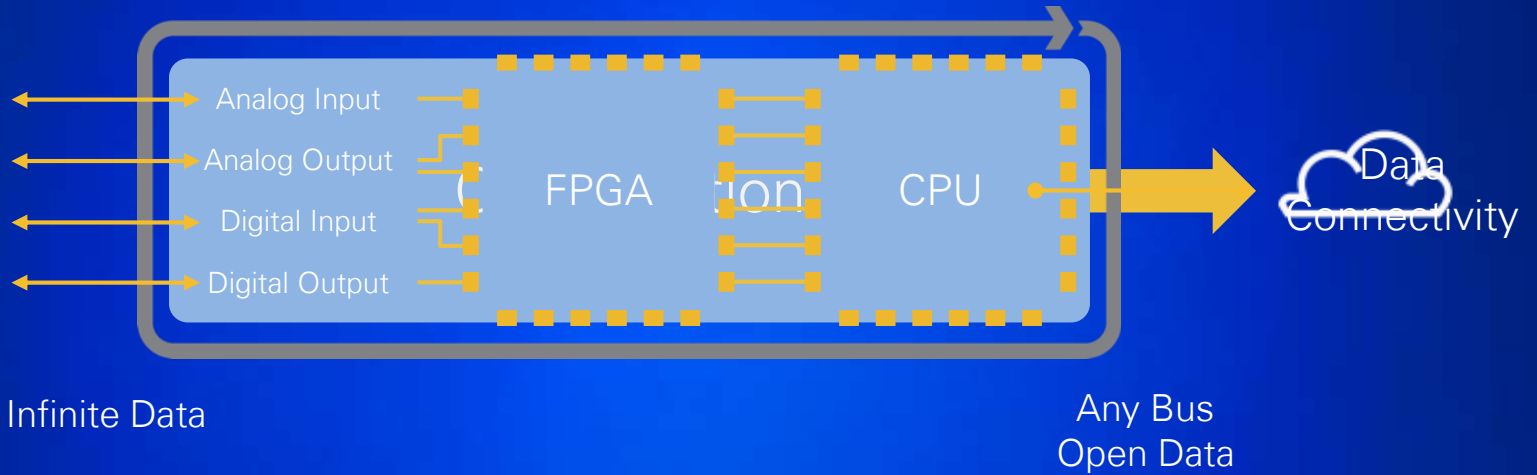
# The Cambrian Explosion of Data



# Unlocking the Internet of Things with Big Analog Data

# 22 Exabytes of Data Generated

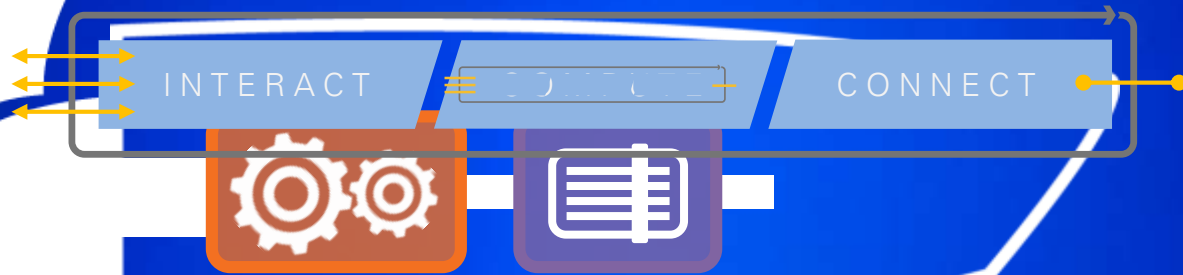
The Physical  
World



# Smart Edge Device Architecture



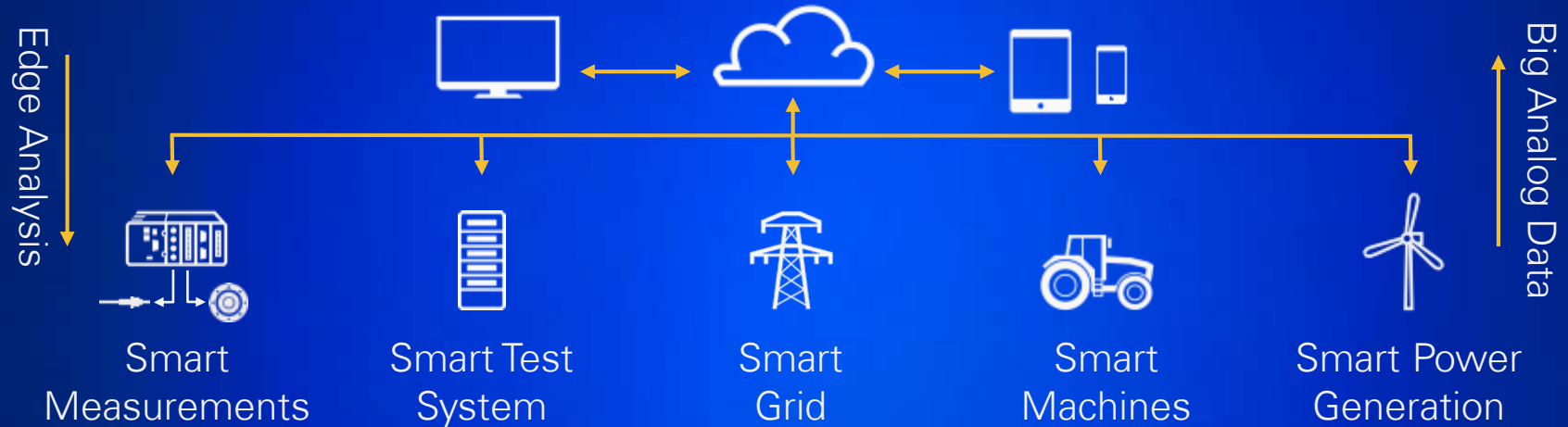






Smart Power  
Generation

# The Industrial Internet of Things





“In the beginning, it was just a way of chronicling the progress, but gradually, it became something that the various industry participants recognized as something they had to stay on or fall behind technologically.”

# Graphical System Design



CONTROL



MONITORING



TEST



MEASUREMENT

Test and  
Measurement



Embedded Control  
and Monitoring



PXI



GPIB



COMPACTDAQ



COMPACTRIO



SOLUTIONS AND PARTNER IP



NI PLATFORMS



COMMERCIAL TECHNOLOGIES



iOS



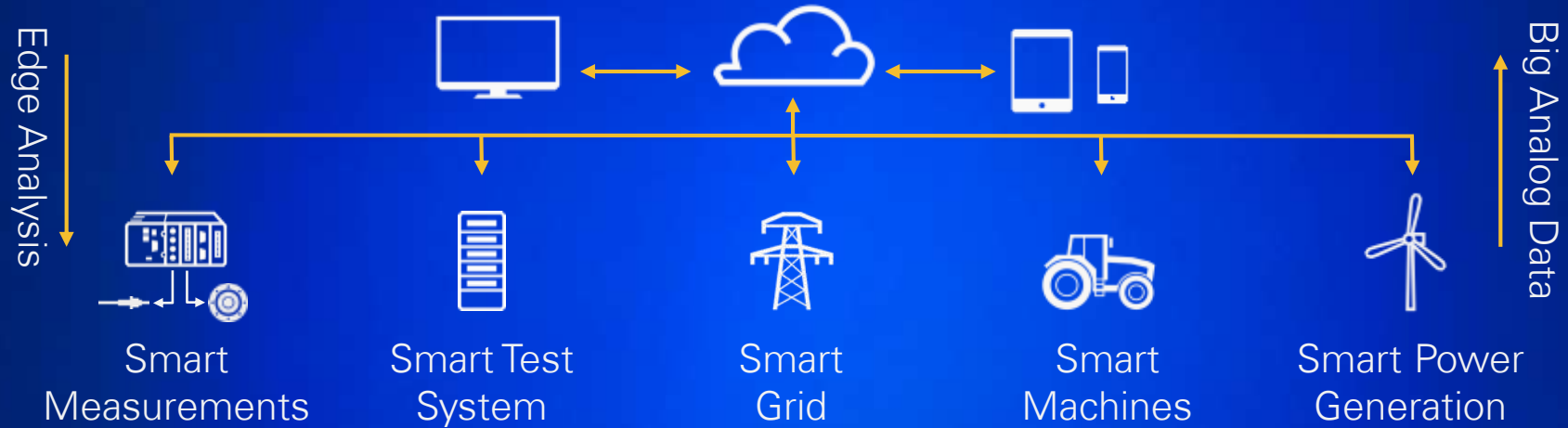


# Casper Klop

Northern European Region Marketing Manager  
National Instruments



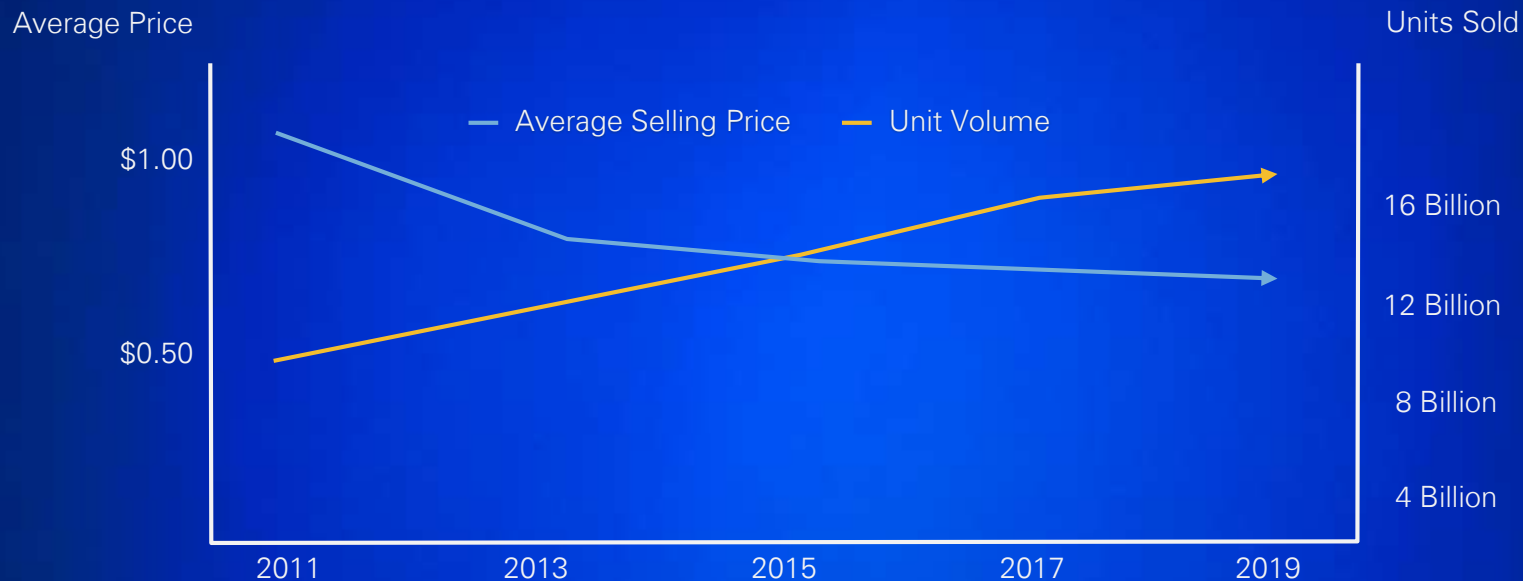
# The Industrial Internet of Things



# Mechanical and Electromechanical Systems



# The Proliferation of Sensing and Networking



# CompactDAQ Platform

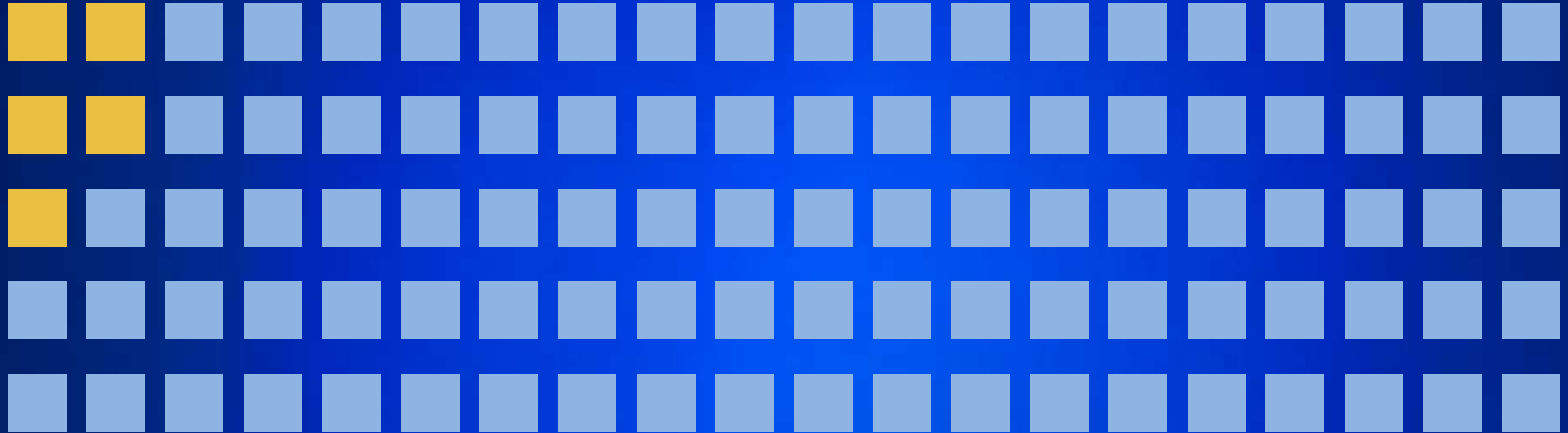


# 14-Slot CompactDAQ Chassis

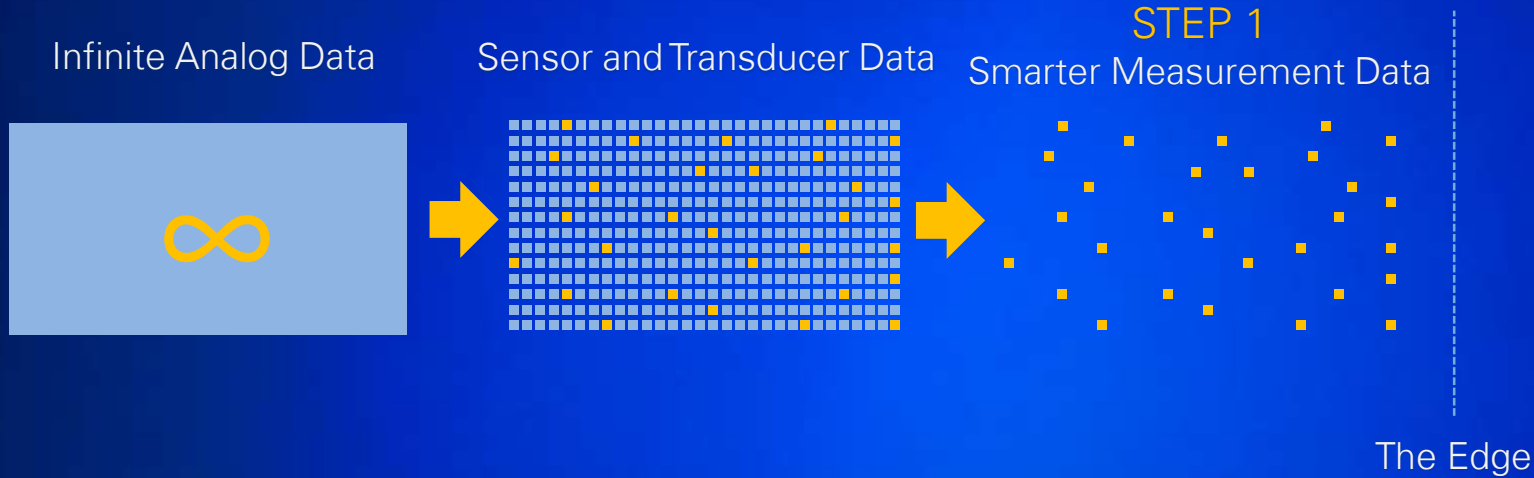
With USB 3.0 Technology



# Only Analyzing 5% of Data on Average



# Solving the Big Analog Data Challenge





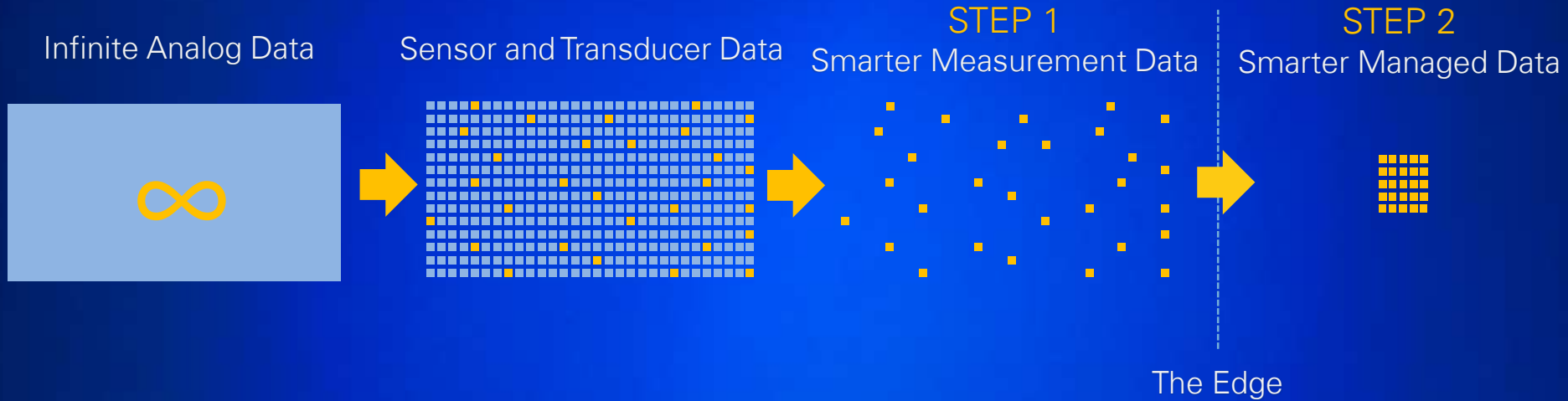


# High Performance CompactDAQ Controllers

Intel Atom Quad-Core Processor



# Solving the Big Analog Data Challenge



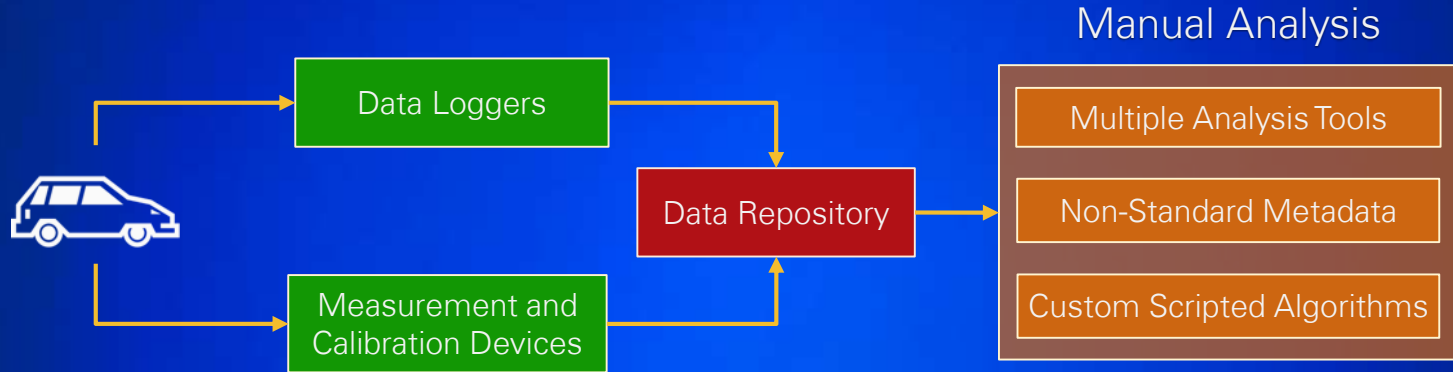
# Rasmus Pettersson

Application Engineer  
National Instruments

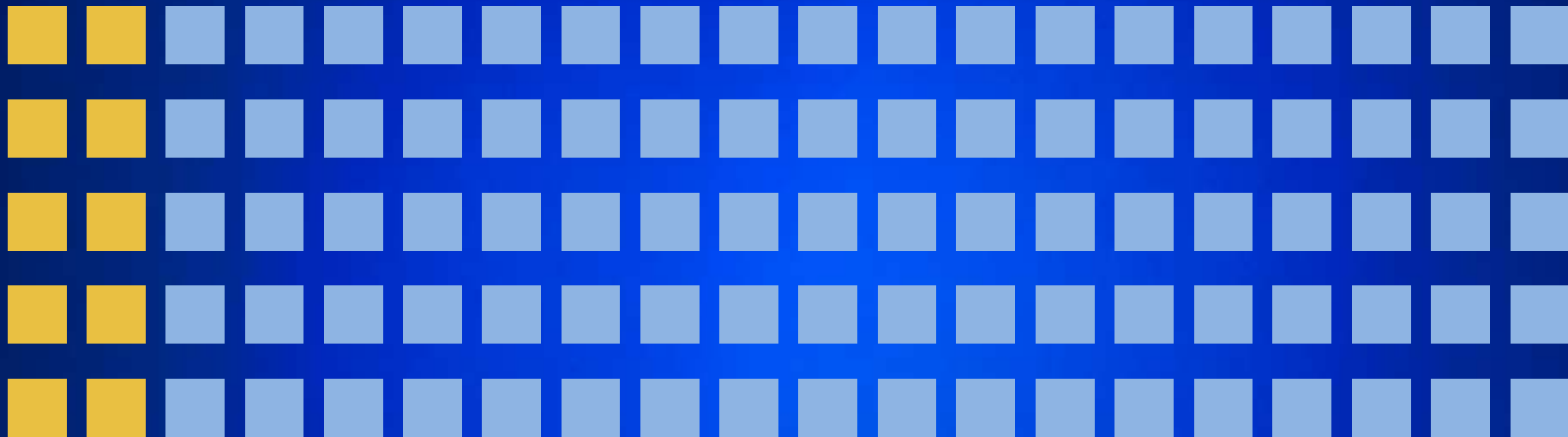


500  
Gigabytes/Day

# 20x Longer with Manual Analysis Routines



# Only Analyzing 10% of Acquired Data



DIAdem - [NAVIGATOR: My DataFinder]

File Find View Settings Window Help

NAVIGATOR

VIEW

ANALYSIS

REPORT

SCRIPT

External Data:

| Level | Property           | Value             |
|-------|--------------------|-------------------|
| File  | <Enter a property> | = <Enter a value> |

< Connect search conditions with AND or OR >

My DataFinder

- Search Area
- Desktop
- NDWeek
- Files Dump Folder
- My Computer (C:\*)

File Browser / Search Results

Properties

Channel Preview

Automatic display is not active  
or the channel cannot be displayed.  
Use the context menu to control the display.

Data Portal: Internal Data

< Enter a group filter >

< Enter a channel filter >

NoTime

Structure / List

| NoName            |                     |
|-------------------|---------------------|
| Name              | NoName              |
| Description       |                     |
| Title             |                     |
| Author            |                     |
| Storage date/time | 01/01/0000 00:00:00 |
| Source Name       |                     |

Channel Preview

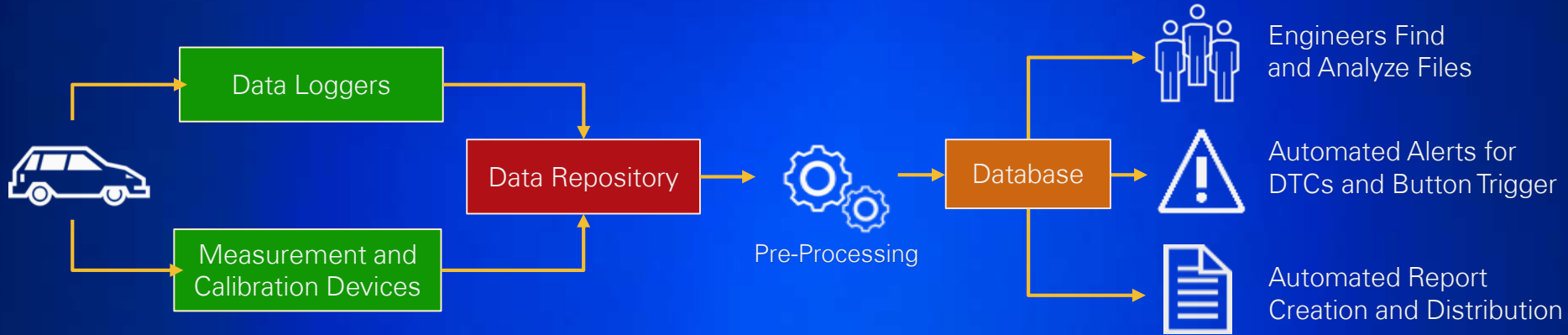
Select a channel from the structure or from the list.

The script is finished.

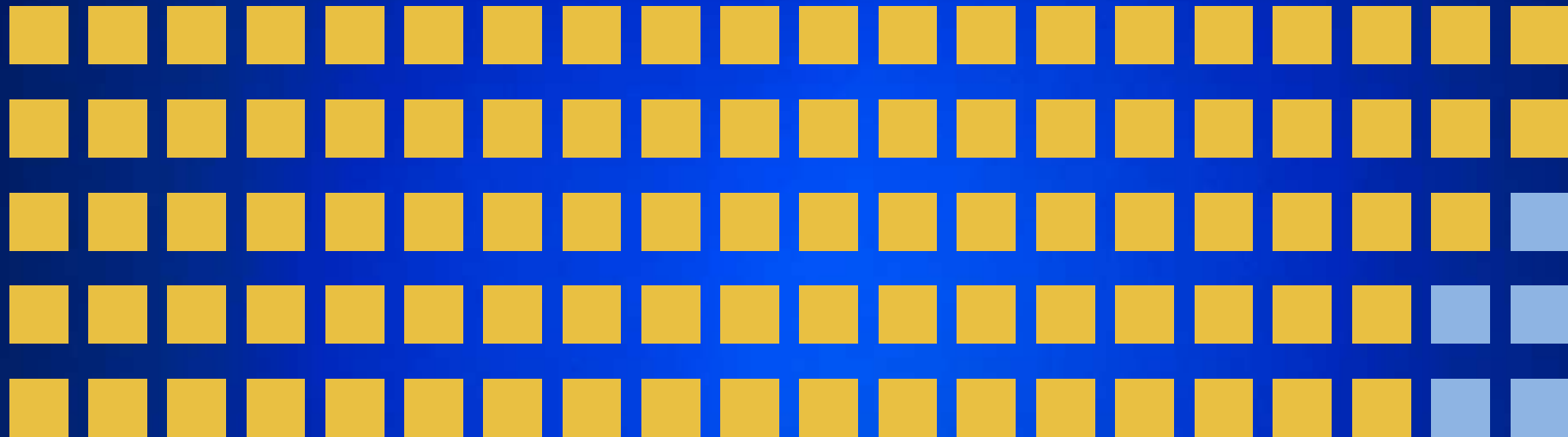
DIAdem - [NA... Worker DIAdem - DIAdem - [NA... DebugView on... Free Downloa... NDWeek

02:12

# Smarter Data Management Solution



Now Analyzing 95% of Acquired Data







## Benefits of Data Management

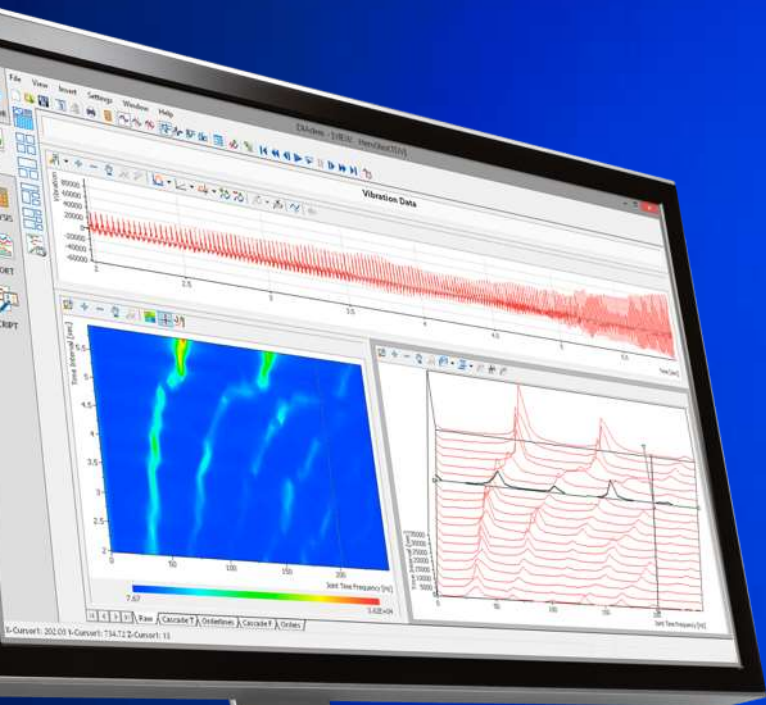
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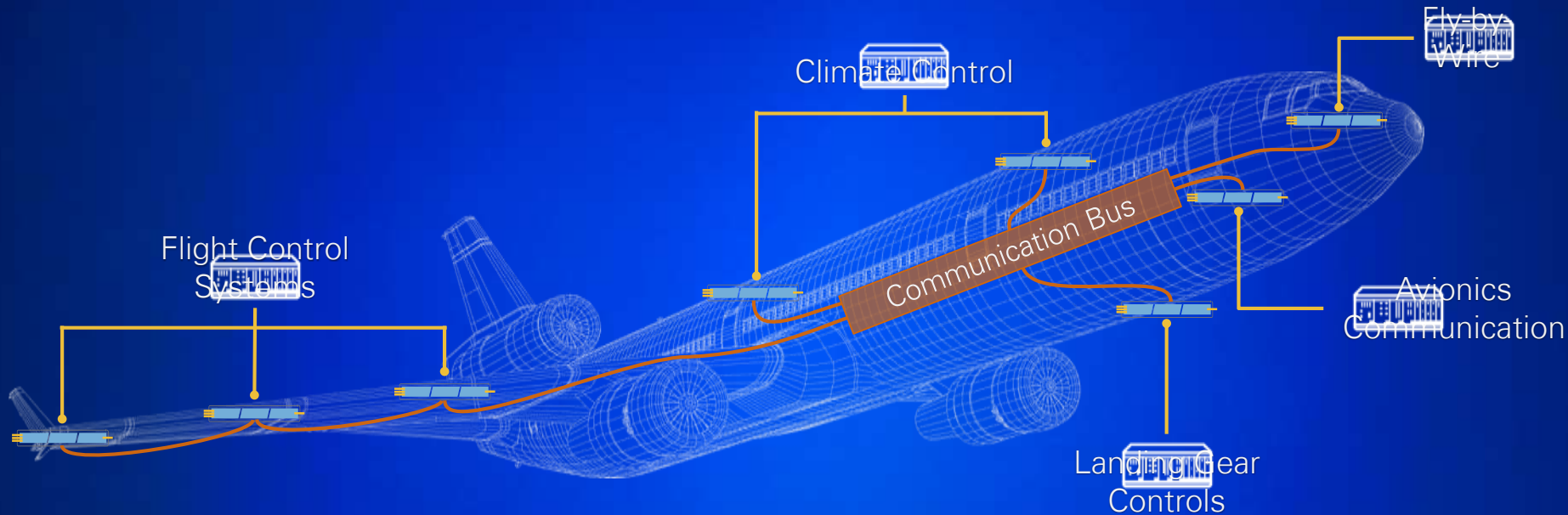
Address More Issues  
Customer Satisfaction  
More Robust Products



# Technical Data Management Solution

## DIAdem 2015 and Data Finder Server Edition









Increased Simulated Ground Testing  
Reduced Time to Market  
Large-Scale Simulation and Physical Test

“NI is the only vendor we’ve found that can do both large-scale simulation and large-scale physical test.”

— Fabio Costa, Senior Manager,  
System Test, Embraer



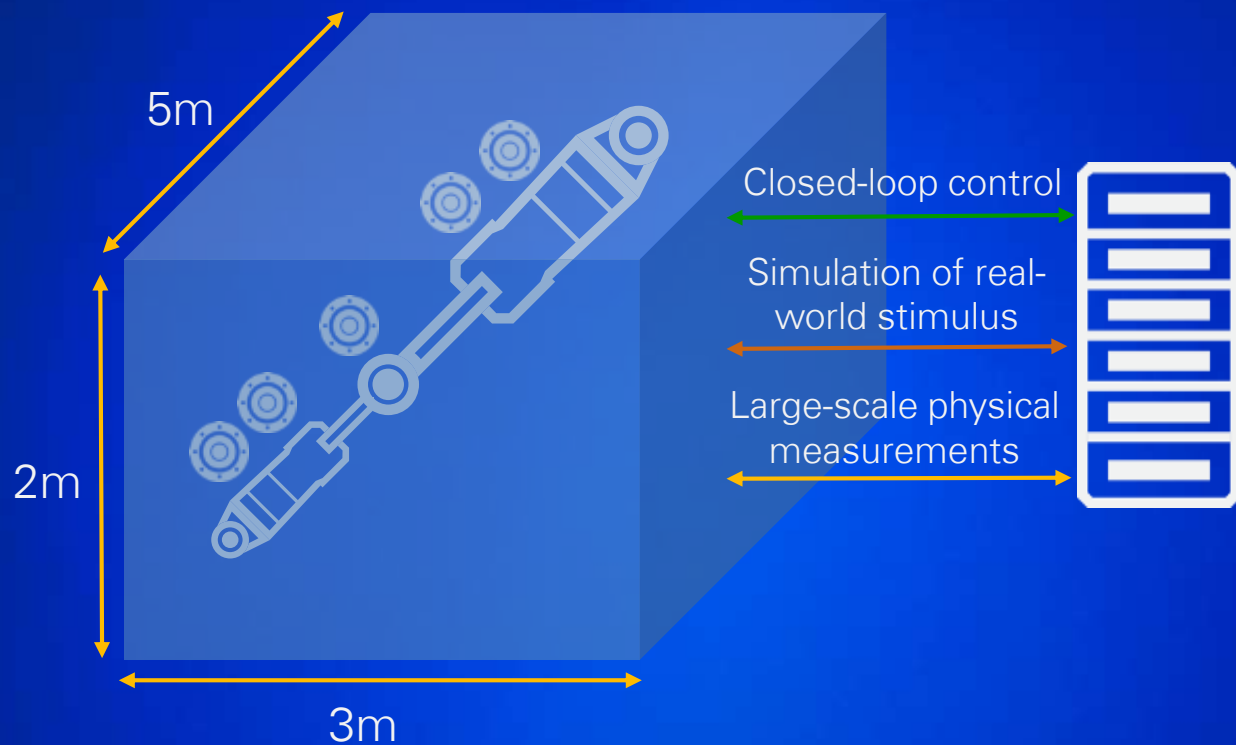
25,000 Hours of Simulated Flight Time



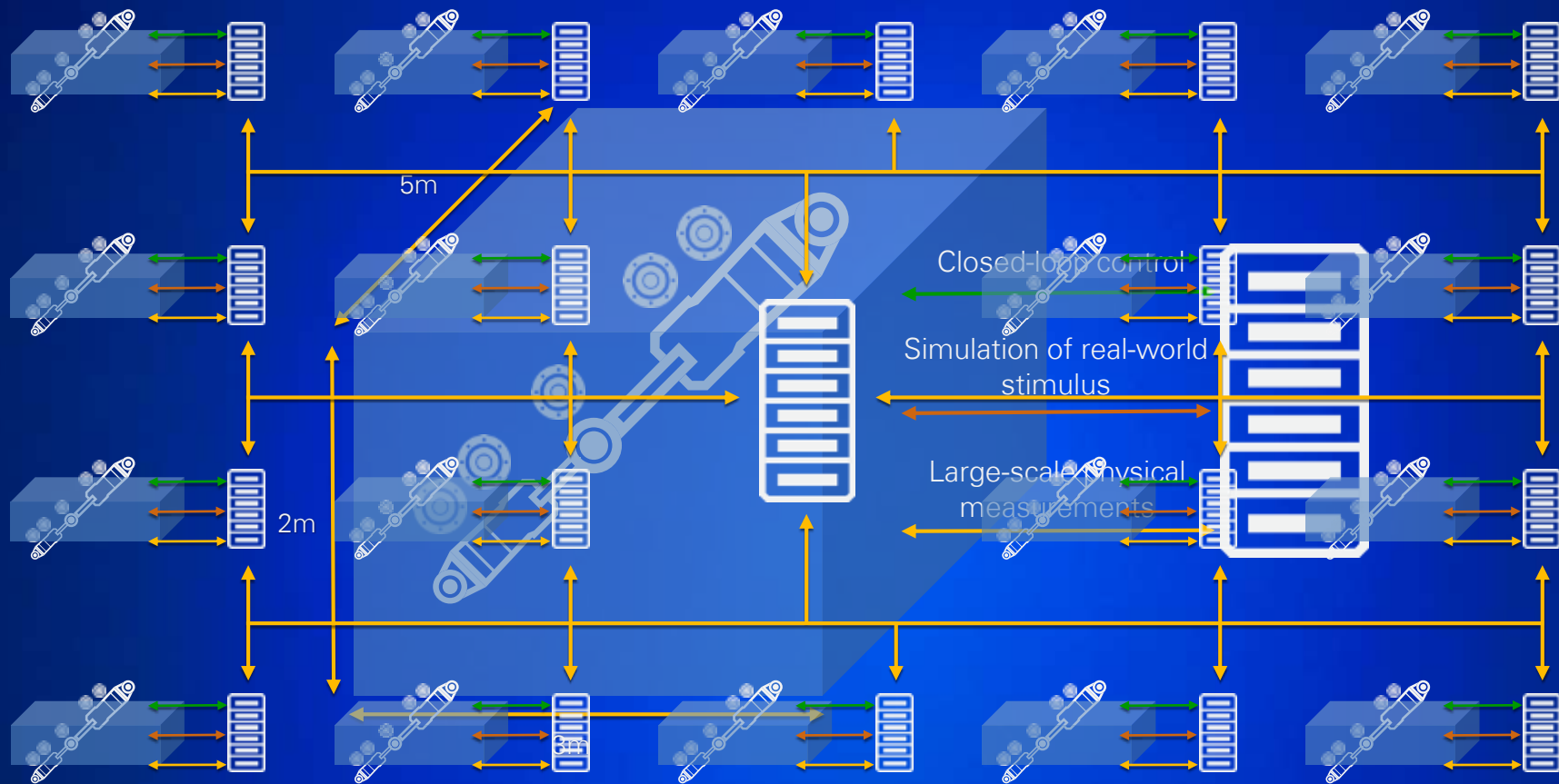
 **EMBRAER**

 **UTC Aerospace Systems**

 **CLEMESSY**









## Advantages of NI Platform

- Scalability of Distributed Systems
- Broad Platform of Measurement I/O
- Best-In-Class Timing and Synchronization
- Open Software Platform

SOLUTIONS AND PARTNER IP



NI PLATFORMS



COMMERCIAL TECHNOLOGIES

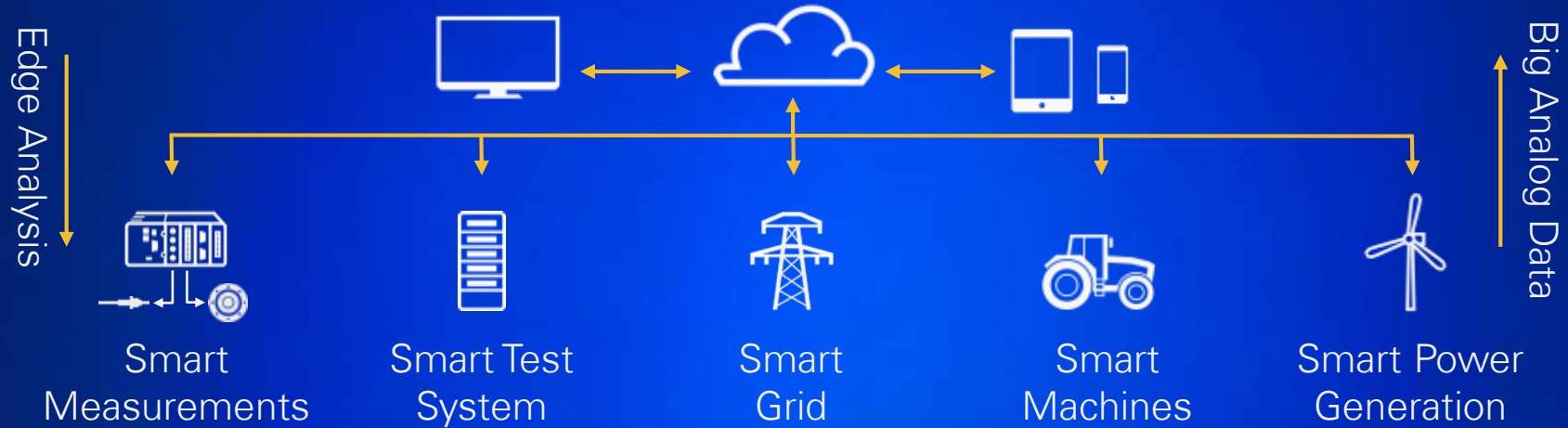


iOS





# The Industrial Internet of Things





## Semiconductor Test System

Built on PXI Platform  
Rugged Enclosure  
Production Floor Ready

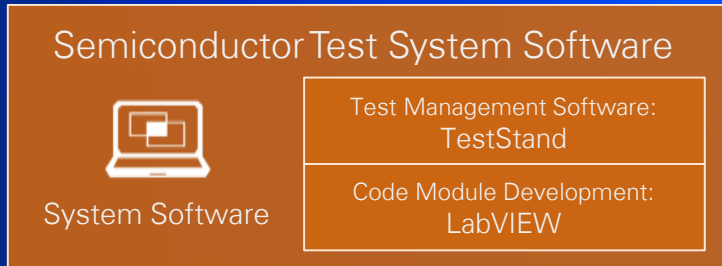
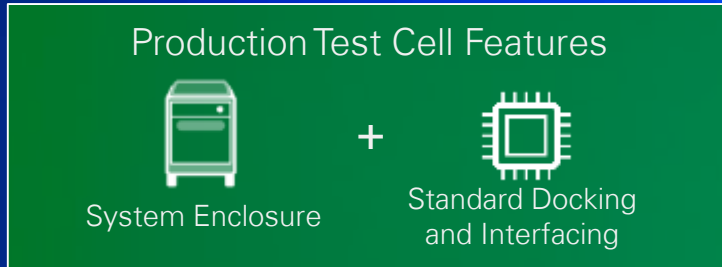


Jeremy Twaits

Senior Technical Marketing Engineer  
National Instruments

Sacha Emery

Senior Systems Engineer  
National Instruments



NI Semiconductor  
Test System





\$700M 2014 Revenue

750 Employees Worldwide

2,200 Patents and Patents Pending

Leader in Audio and Signal Processing ICs

# Competitive Analysis of ATE Systems

## NI STS

Based on PXI Platform  
Flexible Configurations  
Open Architecture



VS.



## Traditional ATE

Proprietary Architecture  
Limited Selection of Vendors  
Expensive to Maintain



“In the end, we concluded that Cirrus purchasing STS was cheaper than renting traditional ATEs. ”

— John Cooke, Cirrus Logic

# PXI Improves Data Correlation



Semiconductor  
Characterization

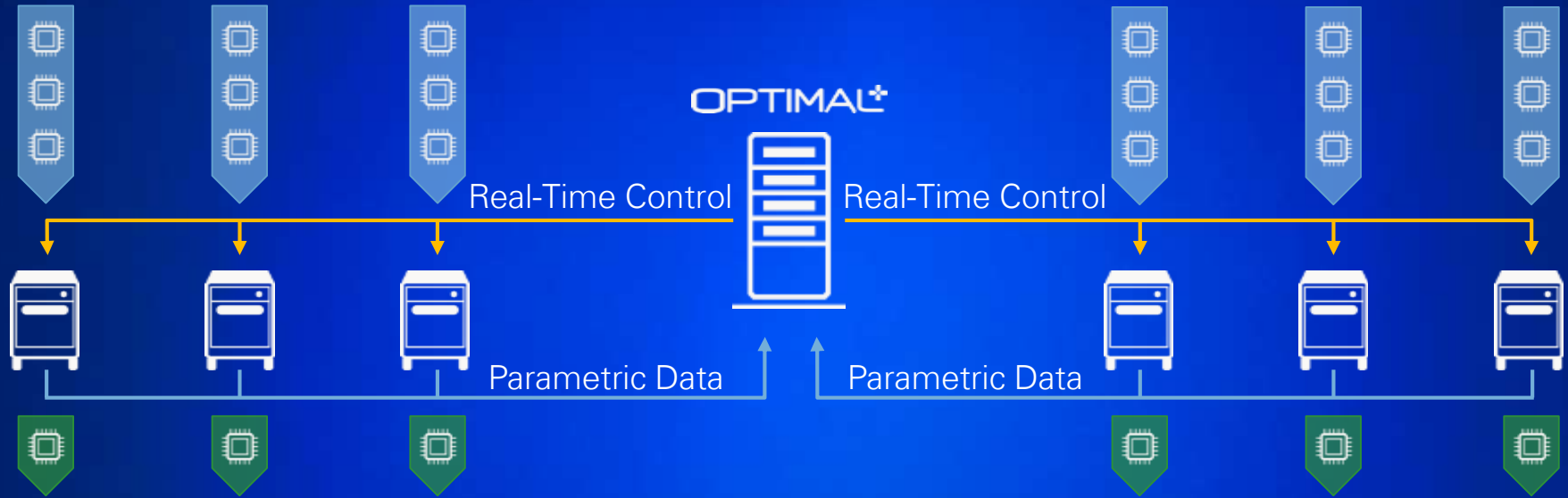


Test Software  
Measurement Algorithms  
PXI Instrumentation  
Fixturing and Cabling



Semiconductor  
Production Test

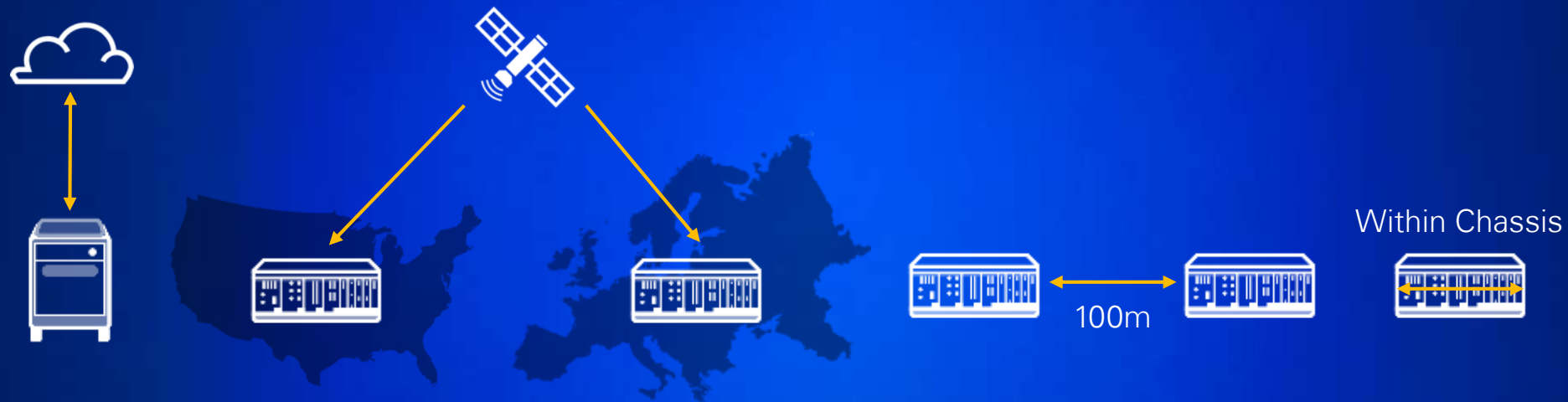
# Delivering Manufacturing Insight with Optimal+



# Smarter Test Systems

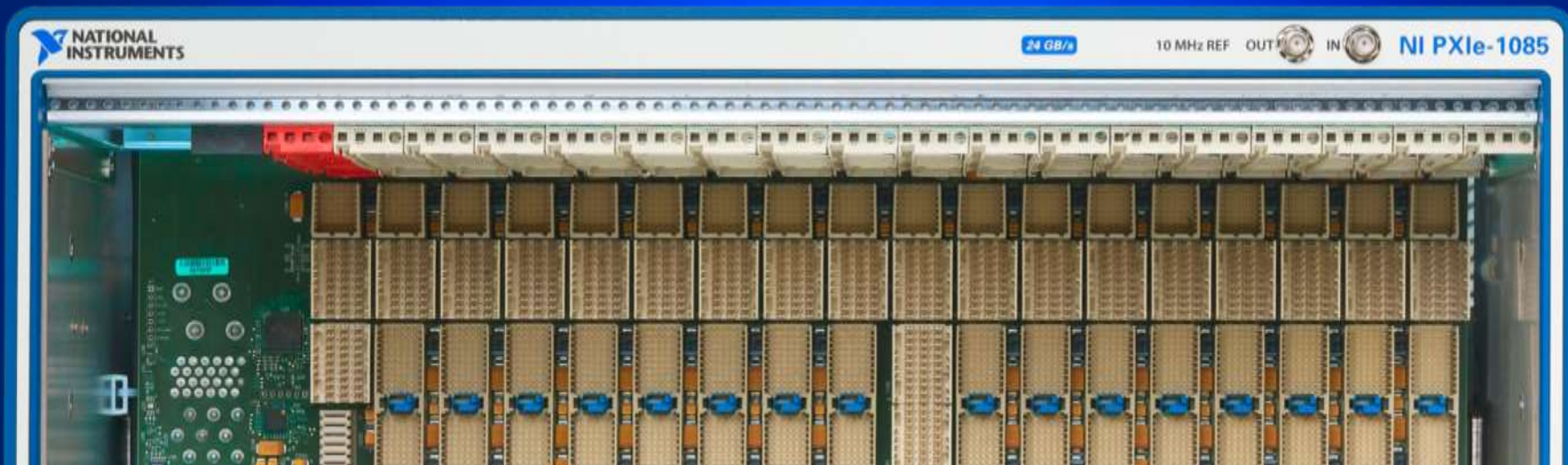


# Continued Innovation in PXI Platform



# All Hybrid 18-Slot PXI Chassis

24 GB/s Total System Bandwidth





# High Performance PXI Controller

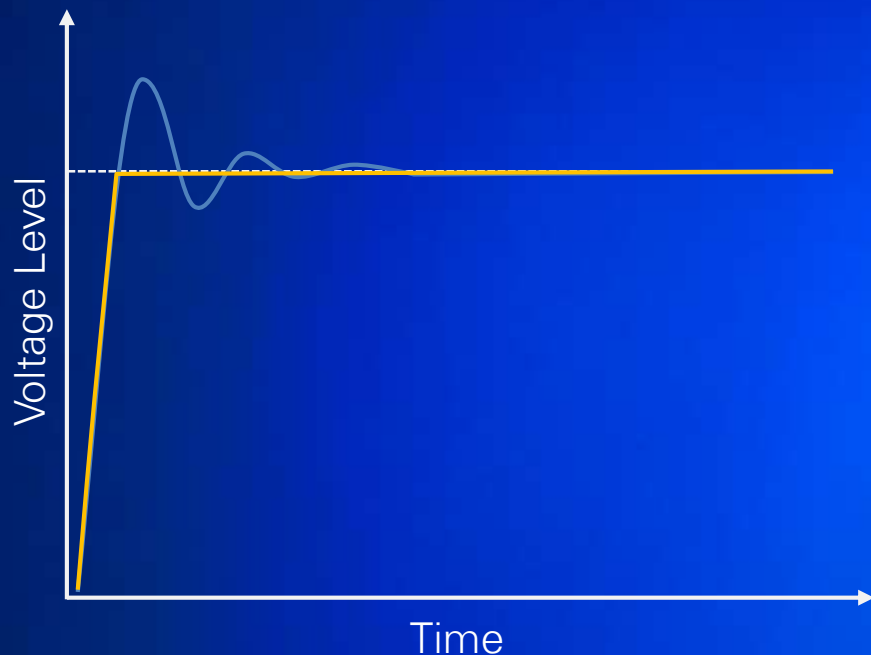
Intel Xeon 8-Core Processor



# Smarter Test Systems



# NI Source Measurement Unit Technology



**6x** Reduction MEMS Research Test Time

**30%** Improvement in Automotive Test Time

**30,000** NI SMU Channels Deployed

# 200V System SMU

100fA Sensitivity



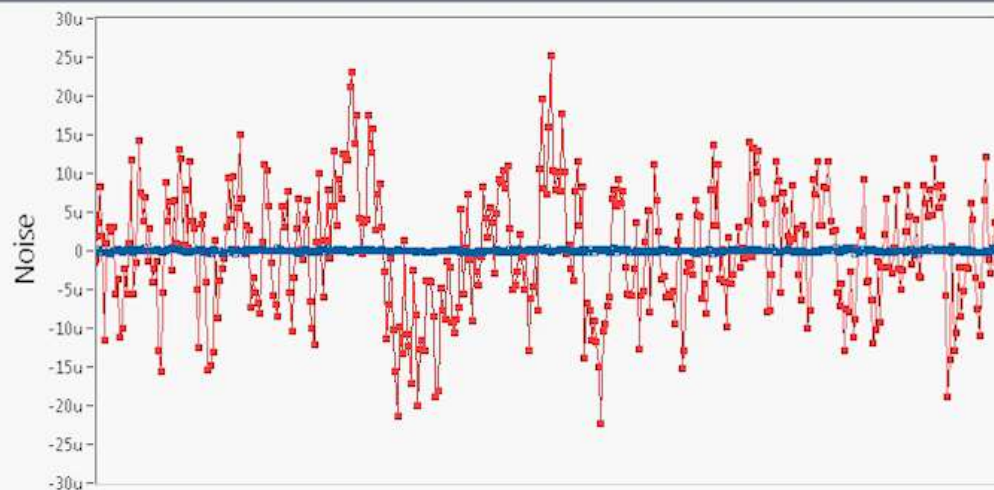


NI SMU

4137

Box SMU

2611

☒ NI SMU☒ Box SMU

Improvement

40.5X

NI SMU

167.5nA

Box SMU

6.78uA

Aperture Time

1 NPLC

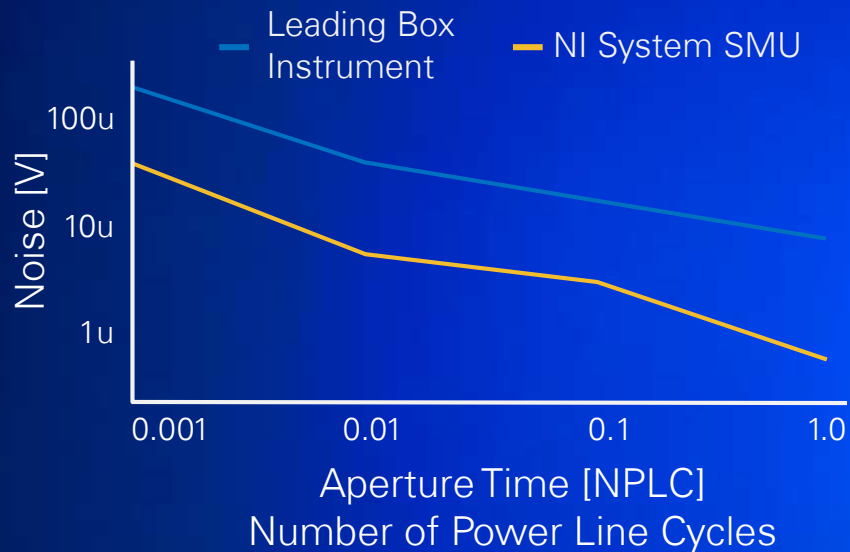
Measurement Range

1 A



STOP

# NI Source Measurement Unit Technology



Semiconductor  
Characterization



Semiconductor  
Production Test



High Precision Measurement  
Test Speed and Channel Density  
Common PXI Instrumentation  
Common Test Software

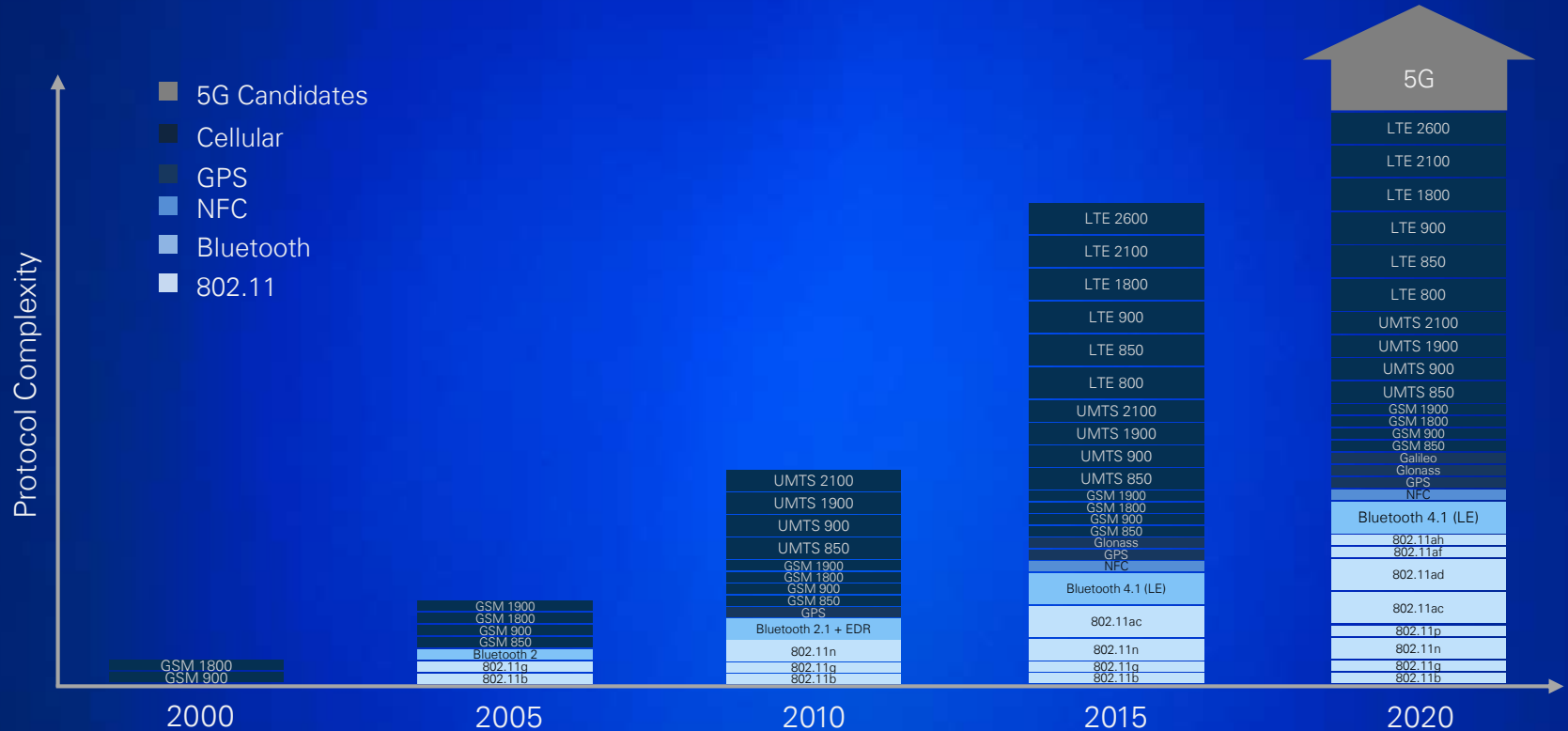


## NI Vector Signal Transceiver

The Most Successful PXI  
Instrument of all Time



# Rising Complexity of Wireless Test





SOLUTIONS AND PARTNER IP



NI PLATFORMS



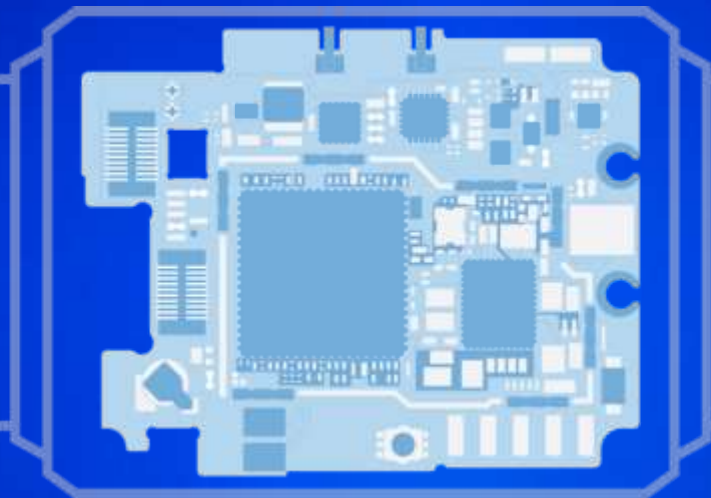
COMMERCIAL TECHNOLOGIES



iOS



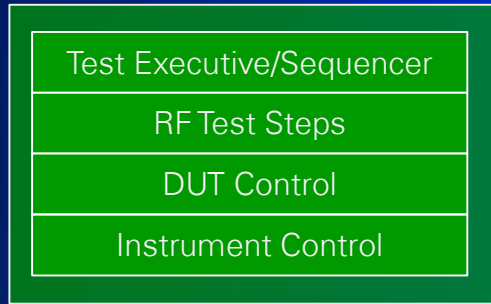
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# Wireless Test System Architecture

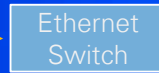
## Wireless Test Module



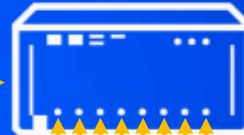
## Client PC



## Ethernet Switch

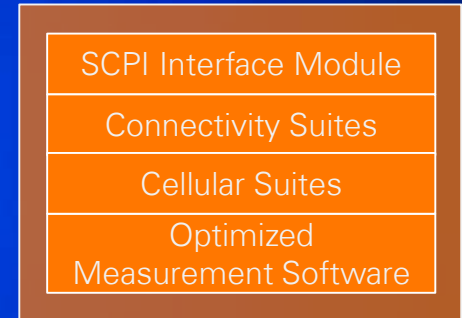


## Wireless Test System



DUT 1 DUT 2 DUT 3 DUT 4

## Wireless Test System Instrument Software





harman/kardon  
by HARMAN

Infinity  
by HARMAN



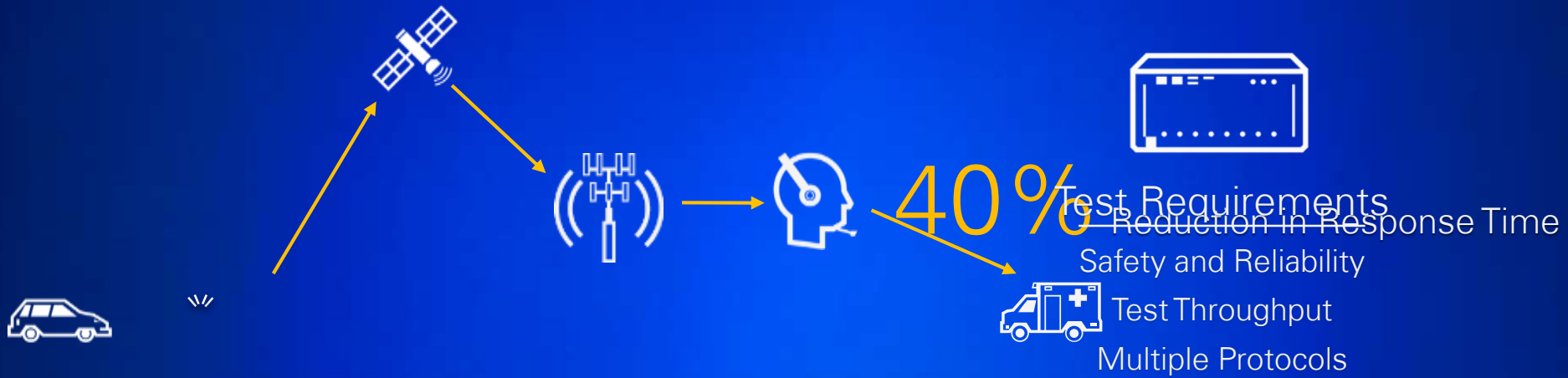
Fortune 500 Company

50+ Locations in 20 Countries

25,000+ Professionals Worldwide

5,600+ Patents and Patents Pending

58 Design Awards in 2014







“The main advantage in this solution is the reduction in test time by as much as 30% compared to existing single DUT test. This translates to reduction in the number of testers required to meet demand.”

— Ehab Beshay, Harman







Semiconductor  
Characterization



Semiconductor  
Production Test



Wireless  
Production Test



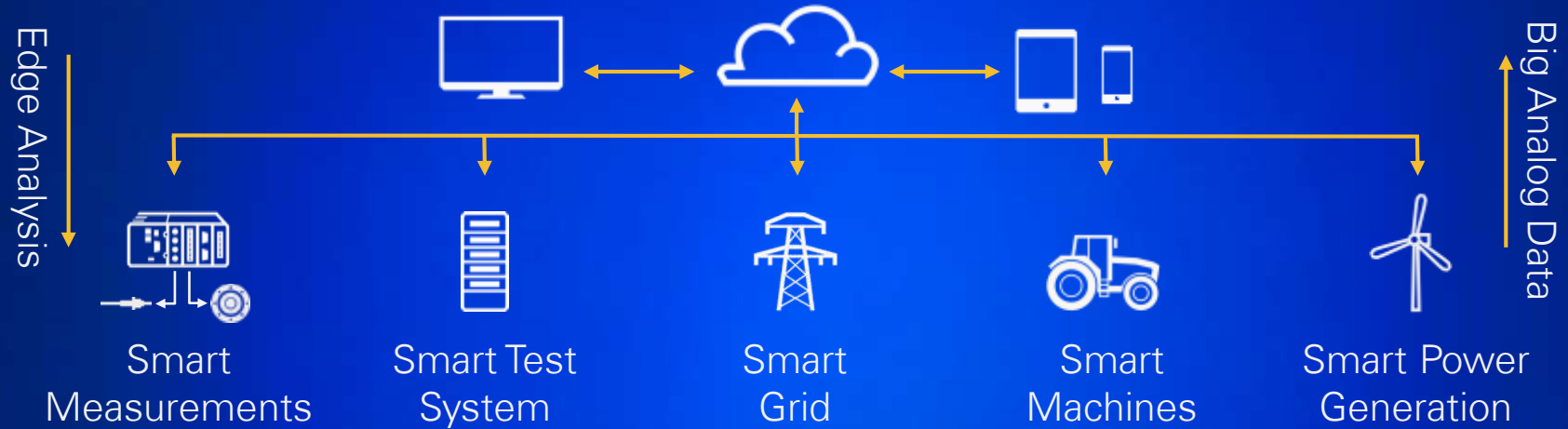
## The PXI Platform Advantage

Common Test Software  
Common Measurement Algorithms  
Common PXI Instrumentation

# Smarter Test Systems



# The Industrial Internet of Things



# Erik van Hilten

Technical Marketing Engineer Embedded Systems  
National Instruments

Erik van Hilten

Senior Technical Marketing Engineer  
National Instruments

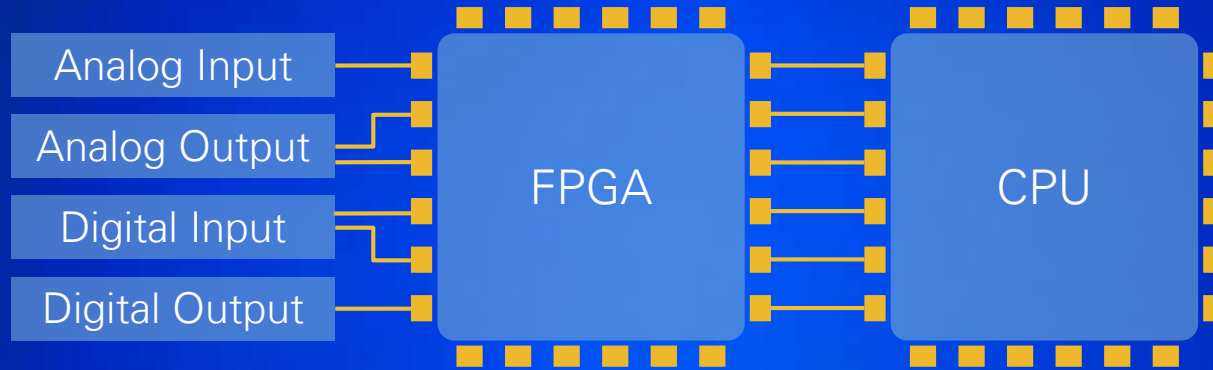
Gavin Hill

Technical Marketing Engineer  
National Instruments

# Industrial Internet Application Areas



# LabVIEW RIO Architecture



# LabVIEW RIO Deployment Targets

LabVIEW FPGA



LabVIEW Real-Time

Single-Board RIO



CompactRIO

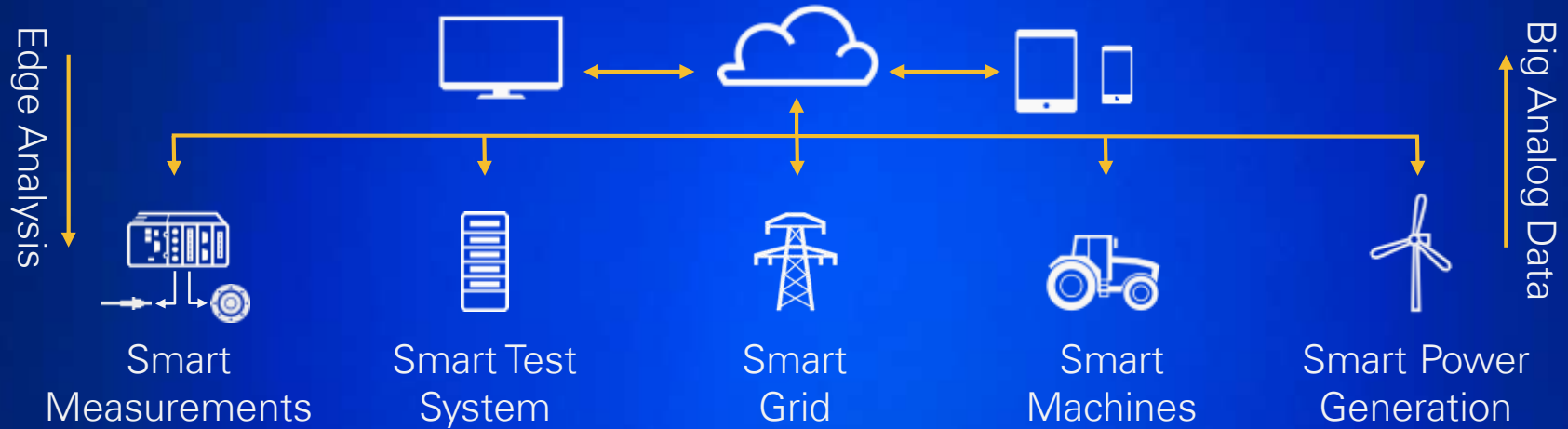


FlexRIO





# The Industrial Internet of Things

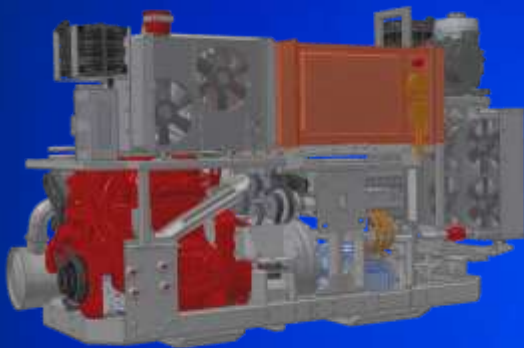




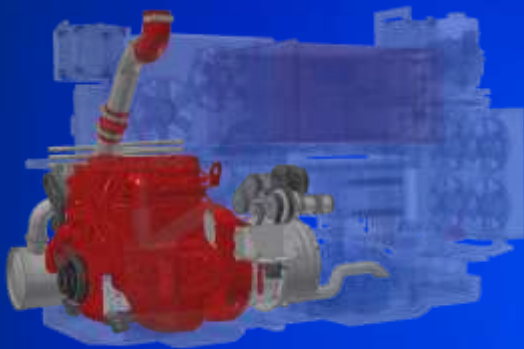




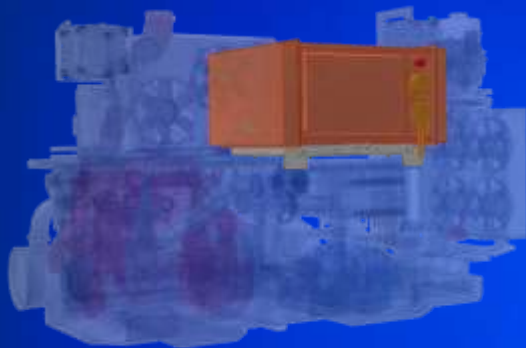




## The B320 System



Engine and Generator

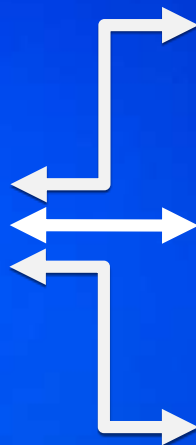
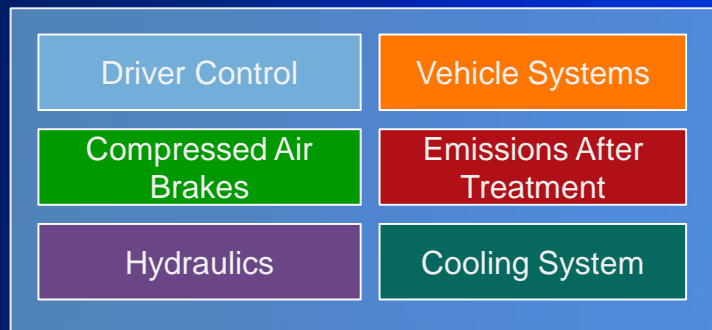


Energy Storage System





Drive Motor



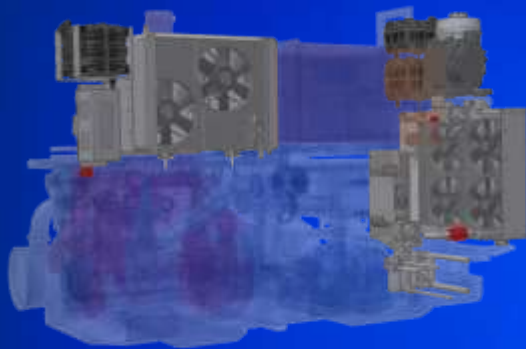
Drive Motor



Energy Storage System



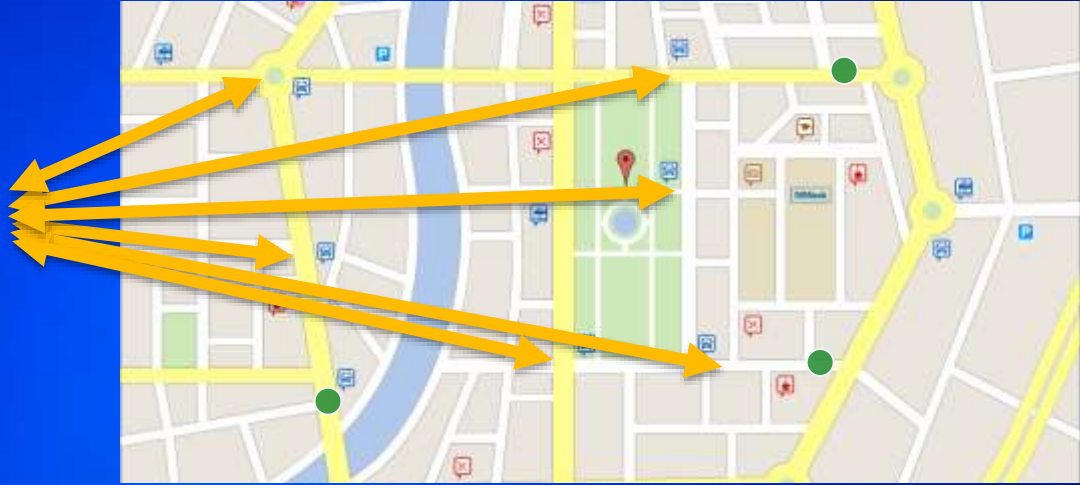
Engine and Generator



Cooling System

6000 Network Variables on Each Bus

Internet of Buses





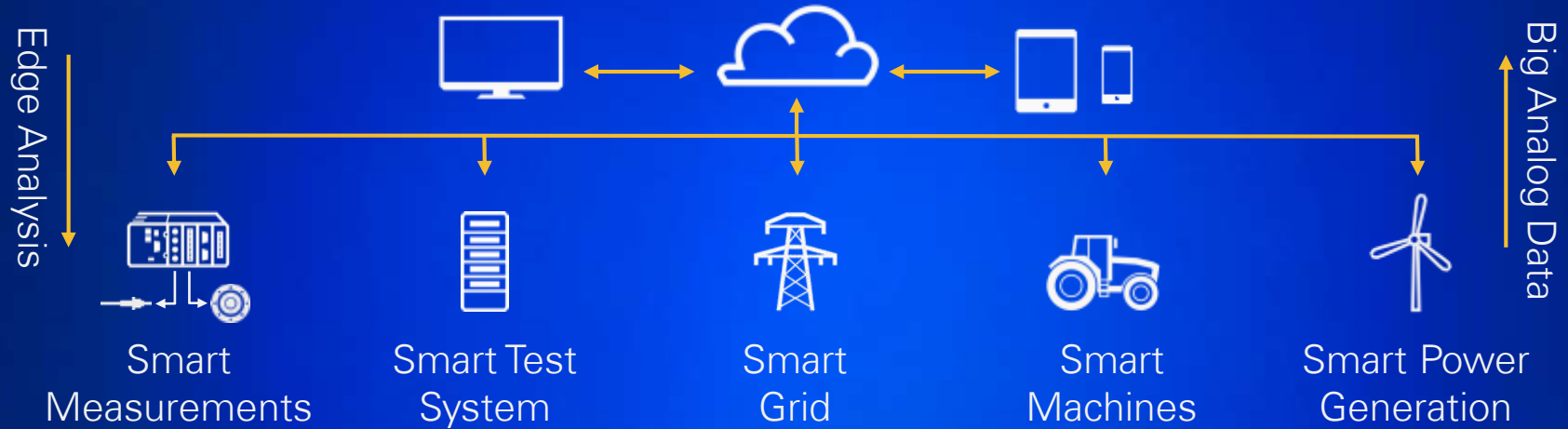
The First Retrofitted Fleet Will Use  
National Instruments System on Module

# Single-Board RIO Controllers

Xilinx Zynq System-on-a-Chip



# The Industrial Internet of Things

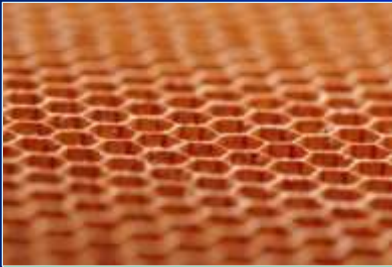






# *Diagnostic Sonar*

# Flexible and Scalable Ultrasound System



Composite Materials



Organic Materials



## Aircraft Composite Materials

Lighter Composites  
More Fuel Efficient  
Non-Destructive Test



# Controller for FlexRIO

Stand-Alone, High-Performance FPGA and I/O









Evolution of Agriculture



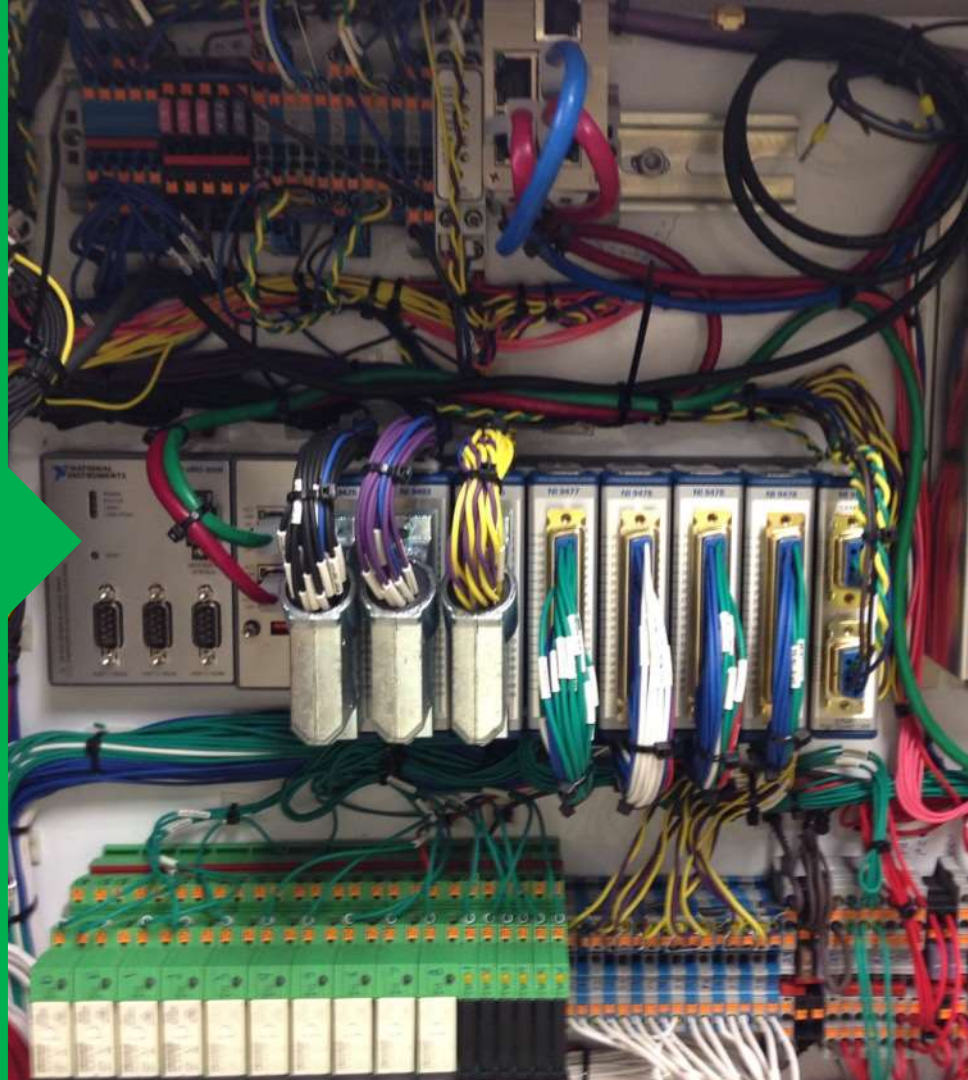
200,000 km<sup>2</sup>  
40 Billion Dollars





2X  
More Productive  
**FireFly**  
20%  
EQUIPMENT™  
Faster

1/2  
the Fuel







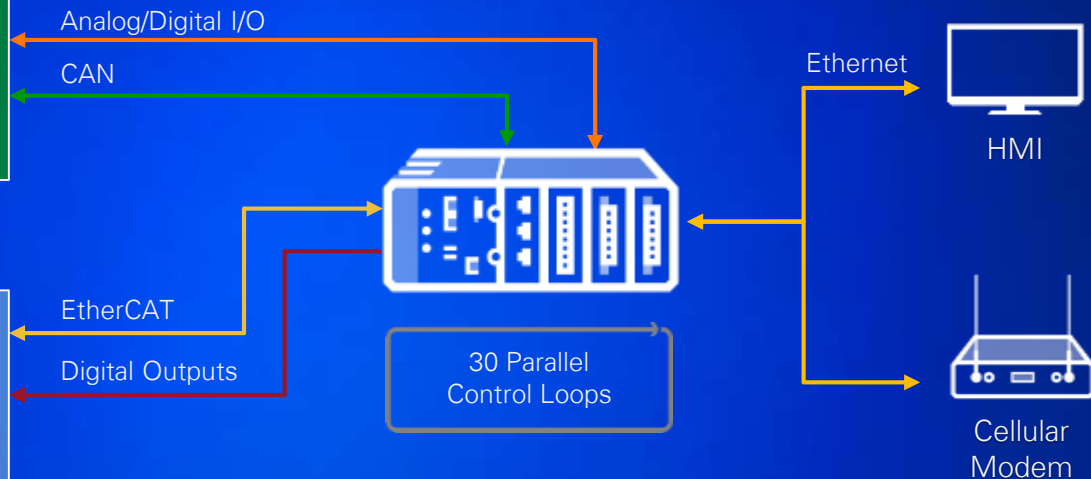
# Firefly ProSlab 155 System Diagram

## Sensors, Engine, User Controls

|                  |                      |
|------------------|----------------------|
| Encoders         | Joystick             |
| Prox. Sensors    | Load Cell            |
| Pressure Sensors | Steer-by-wire Device |
| J1939 Keypad     | Optical Level Sensor |
| Photo Sensors    | John Deere Engine    |

## Harvester Control Systems

|   |   |   |   |
|---|---|---|---|
|  |  |  |  |
| Electric Actuators  | Hydraulic Valves  | Hydrostatic Transmission  | Servo Motion  |



**FireFly**  
EQUIPMENT™





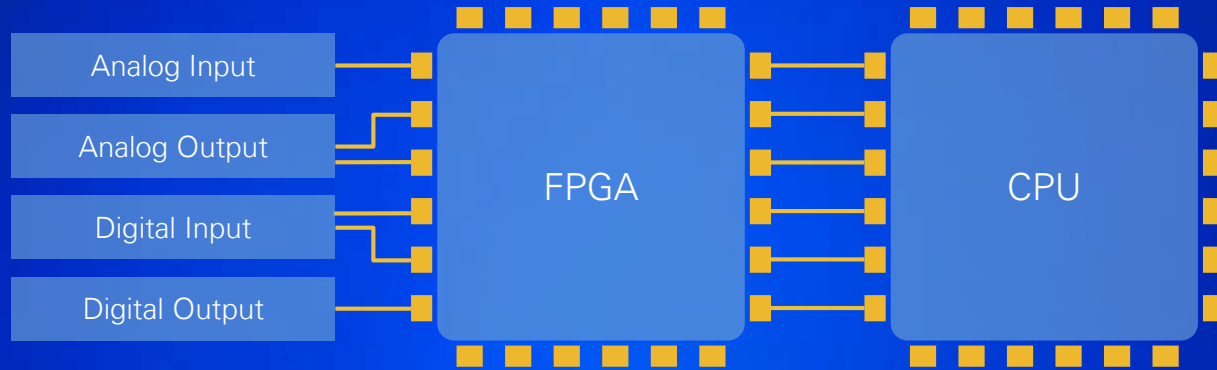


# High Performance CompactRIO Controllers

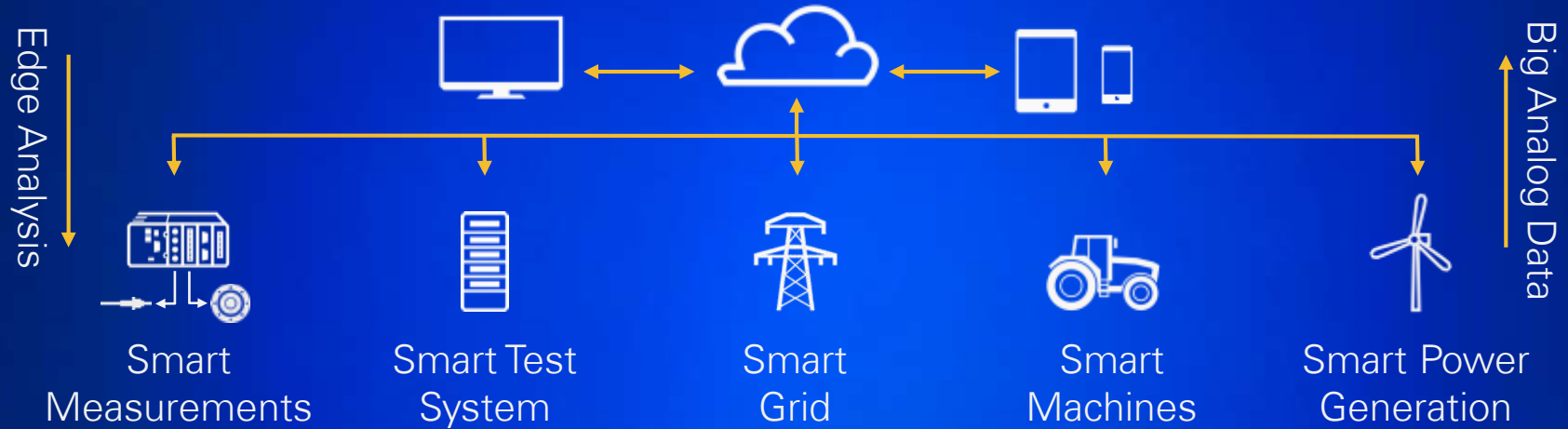
Intel Atom Quad-Core Processor



# LabVIEW RIO Architecture

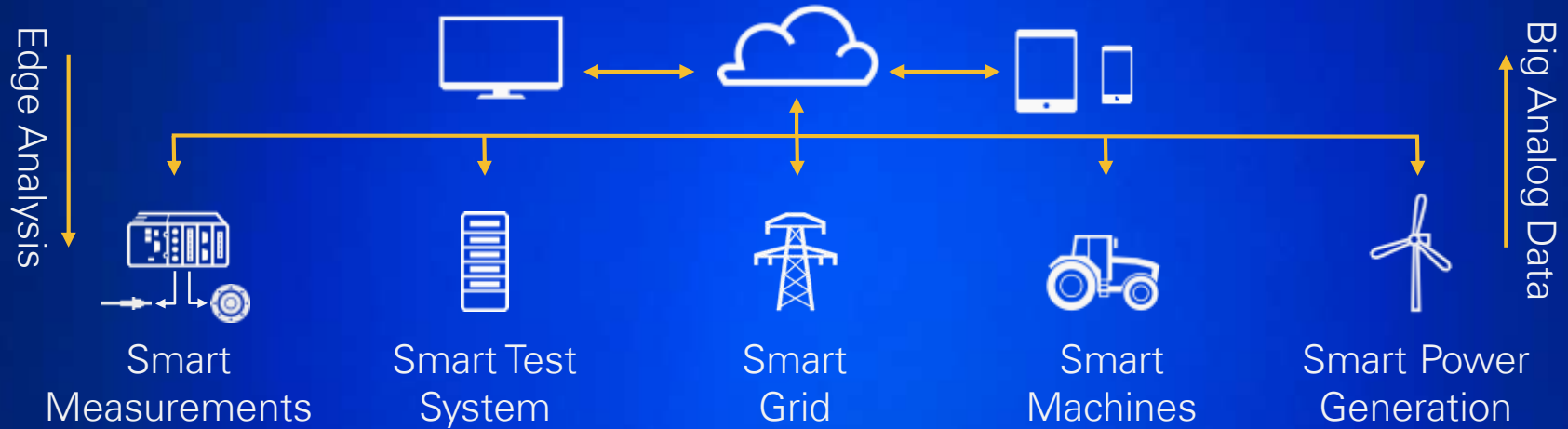


# The Industrial Internet of Things





# The Industrial Internet of Things

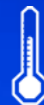


Charlotte Nicolaou

Technical Marketing Engineer  
National Instruments

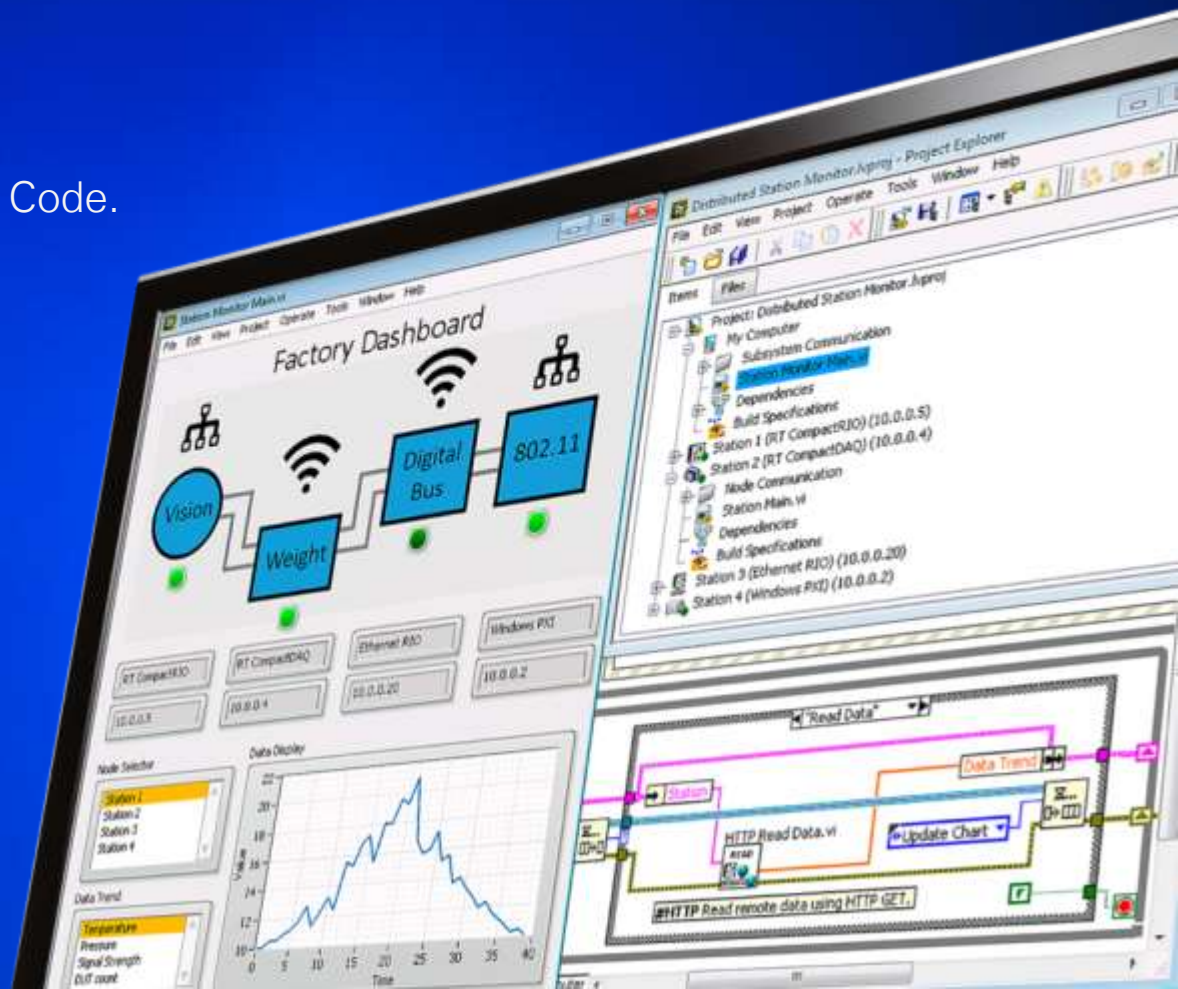
Liam Adams

Applications Engineering Specialist  
National Instruments



# LabVIEW 2015

Write Code Faster. Write Faster Code.



# The App Store for Engineers and Scientists

Download 600+ Free and Paid Add-Ons

More than 4,000,000 downloads

i.                                                                                                                                         



# New Toolkits on the LabVIEW Tools Network

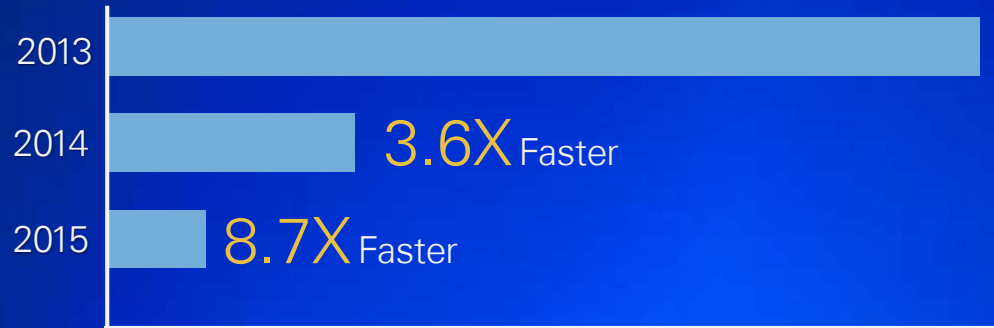
Multicore Analysis and  
Sparse Matrix Toolkit

Jitter  
Analysis Toolkit

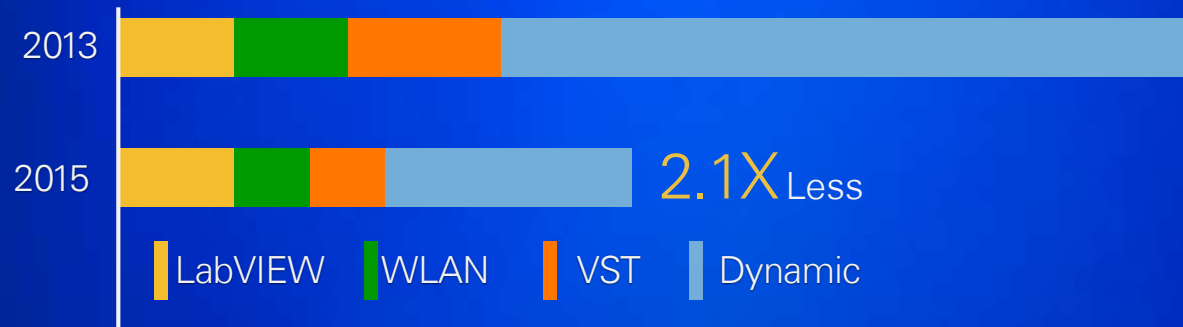
GPU  
Analysis Toolkit

Biomedical  
Toolkit

## Warm Load Time in Seconds



## Dynamic Memory Usage













## Offshore Wind Advantages

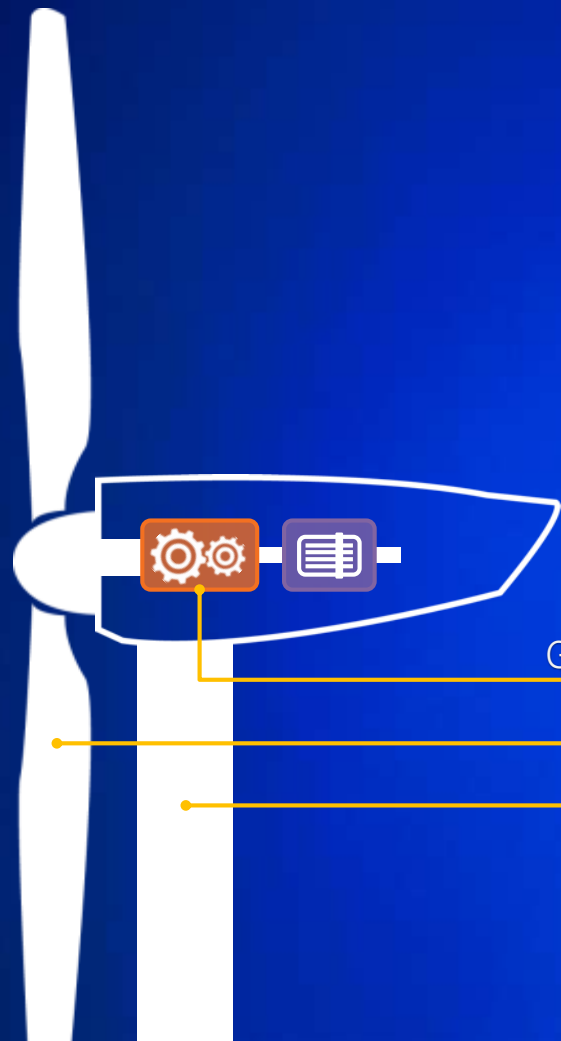
Wind Speed  
Energy Density  
Turbine Size



8.0  
Mega Watts



180  
Meters



## DIROM4i Monitoring Tasks



Gearbox

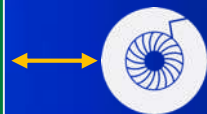
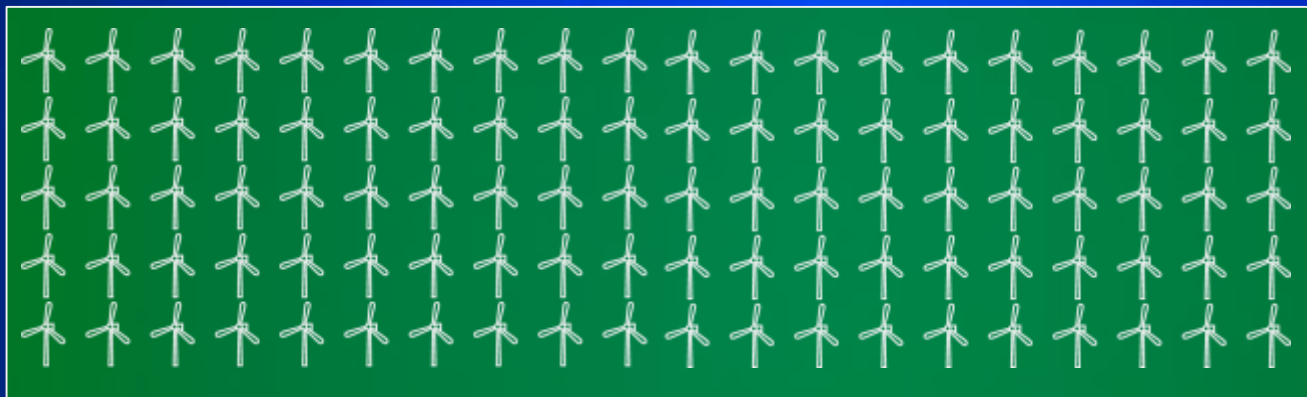
Rotor

Tower

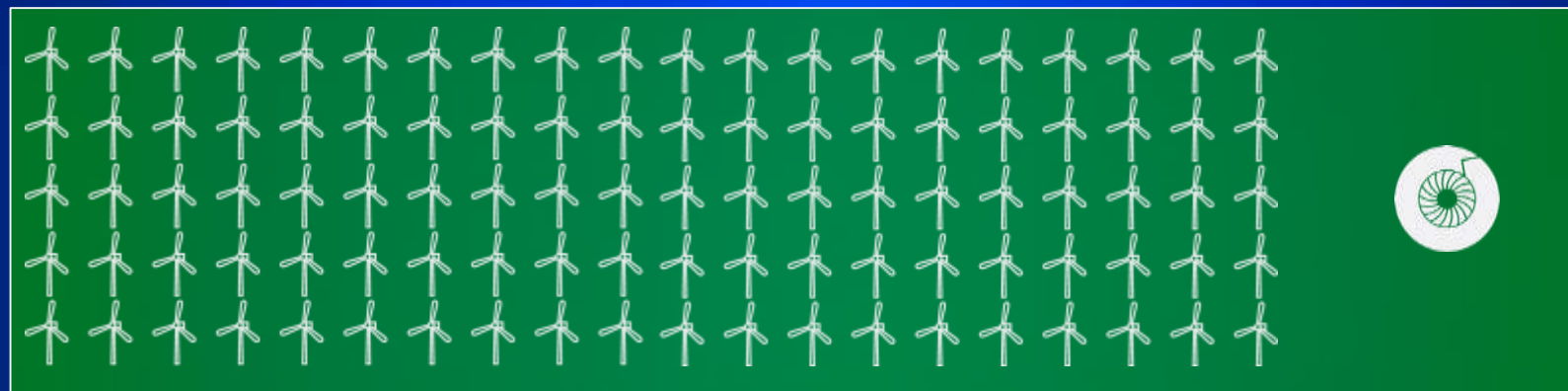
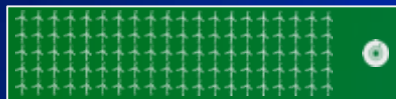
Electrical Signature Monitoring

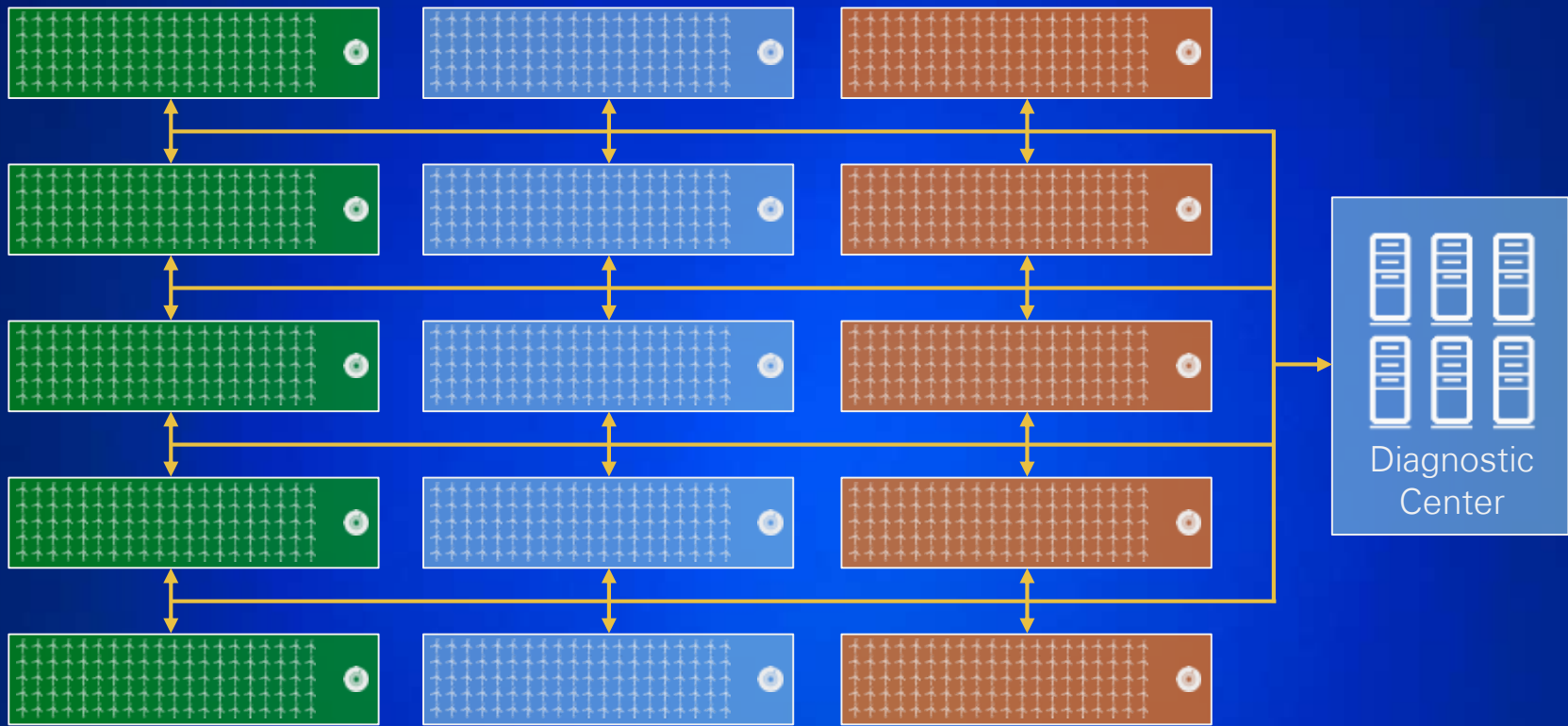


NI InsightCM™  
Enterprise



NI InsightCM™  
Enterprise





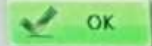


[illegible]

# AREVA - DIMAX

Monitoring Results Live Signals AMU Files Module Infos Short Time Trends

Online View

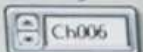


OK

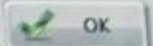
Select Signal 1



Select Signal 2

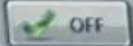


dB On



OK

Envelope



OFF

Time Waves

Histogram

FFT Spectrum

Cepstrum

FRF Spectrum

Order Spectrum

Amplitude

250,00  
225,00  
200,00  
175,00  
150,00  
125,00  
100,00  
75,00  
50,00  
25,00  
0,00  
-25,00  
-50,00  
-75,00  
-100,00  
-125,00  
-150,00  
-175,00



## Leveraging NI InsightCM™ SDK

Deterministic, Adaptive Monitoring

Local Data Storage

Custom Server Algorithms



# The Need for 5G

50B

Devices Connected  
by 2020

1.9B

Smart Phones

85%

of Embedded Devices  
are Unconnected

# New 5G Vector Candidate Technologies

Nokia Networks Research

5G Area Interface and Architecture

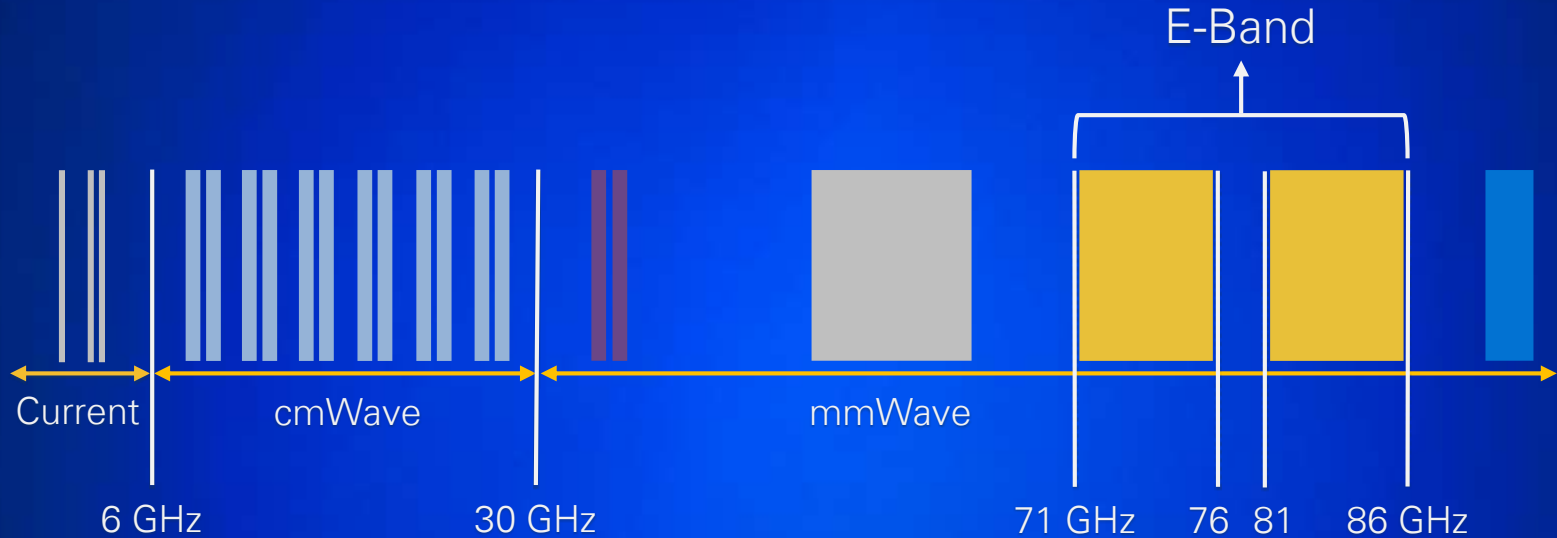
5G IoT and LTE-M

Massive MIMO

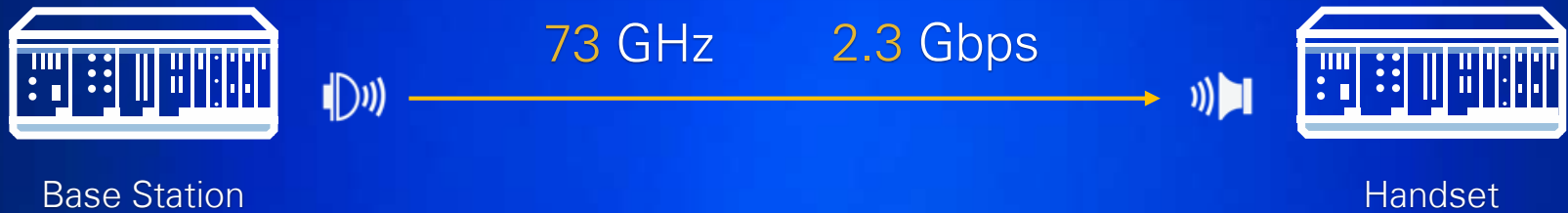
5G Proof of Concept

5G Spectrum

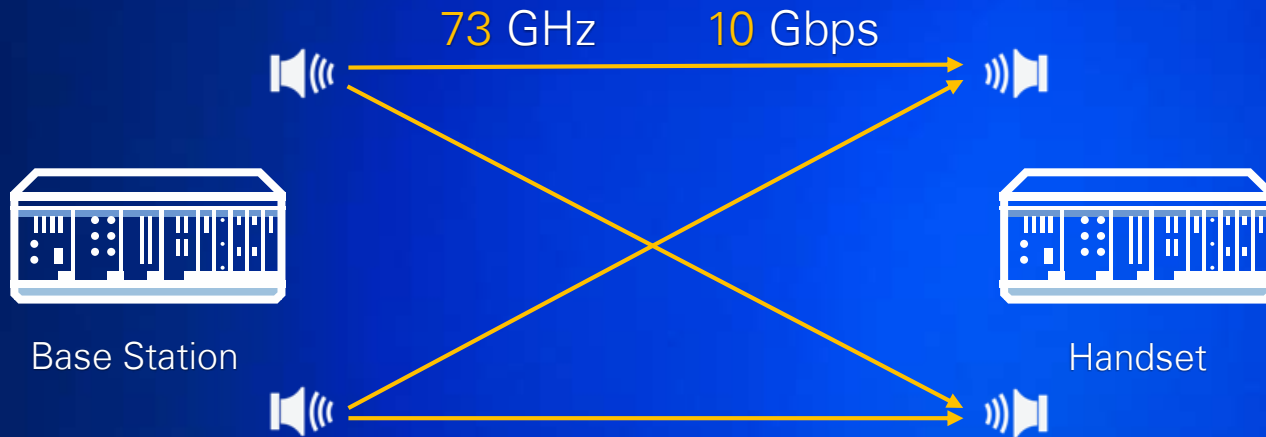
# mmWave Provides Greater Spectrum Opportunity



# First Wireless Prototype at 2.3 Gbps in E-Band



# First Wireless Prototype at Peak Rate in E-Band



## Specifications

73 GHz, 2x2 MIMO

10 Gbps Data Rate

2 GHz Bandwidth

Single Carrier NCP With  
Coding



# Four Vectors of 5G Research

## Massive MIMO

Samsung  
KU Leuven  
Lund University

## Wireless Networks

Nokia Networks  
CROWD (FP7)

## PHY Enhancements

InterDigital  
NTT Docomo  
Alcatel Lucent  
Samsung  
TU Dresden  
Texas A&M University

## mmWave

Nokia Networks  
NTT Docomo  
NYU Poly  
MiWaves (FP7)

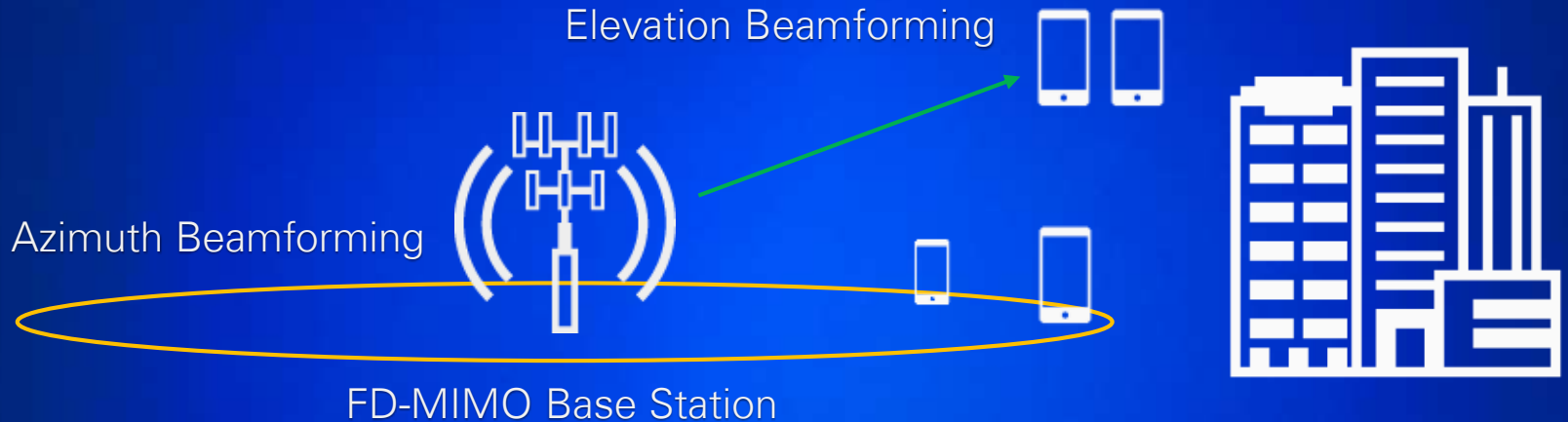


Millimeter Wave

Massive/Full-dimension MIMO

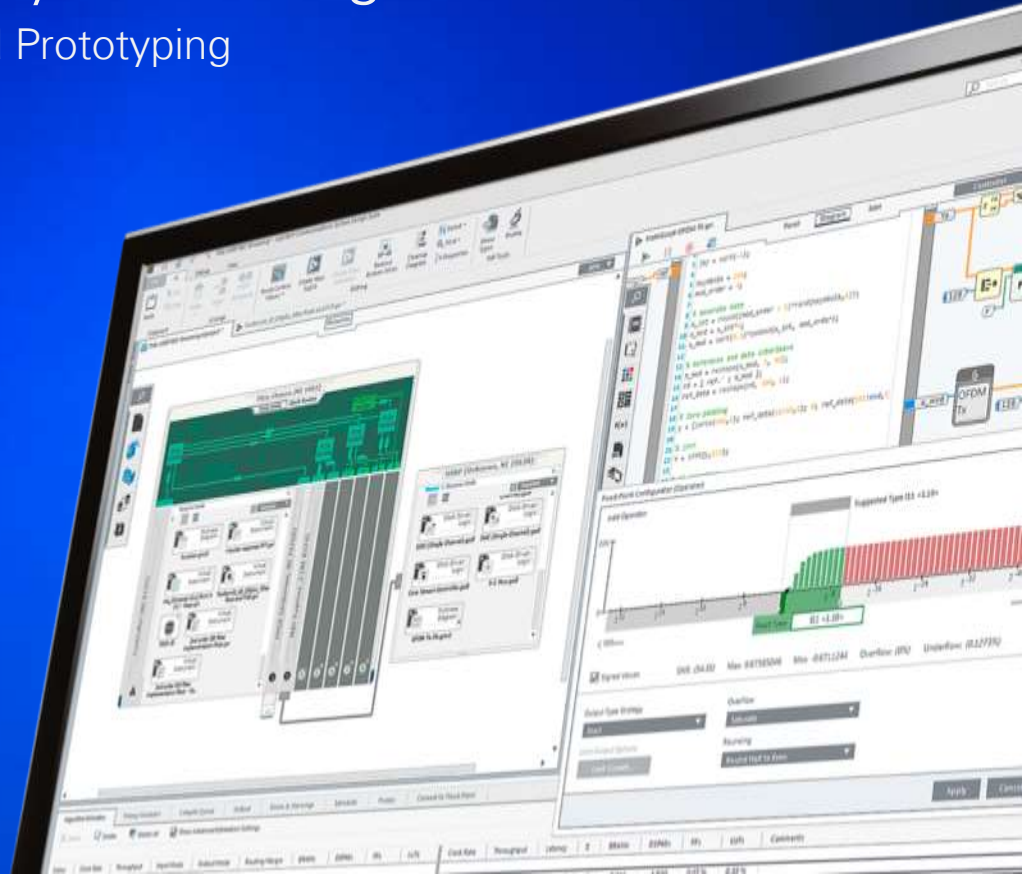
Multi-Comm-Core

# Full Dimension MIMO (FD-MIMO)



# LabVIEW Communications System Design Suite

## The Revolution in Rapid Prototyping





# 120 MHz USRP RIO

Software Defined Radio





# Four Vectors of 5G Research

## Massive MIMO

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## mmWave

Nokia Networks  
NTT Docomo  
NYU Poly  
MiWaves (FP7)



World's first working FD-MIMO prototype

World's first real-time MIMO system with 100 synchronized antennae

World's first over-the-air prototype for GFDM

World's first 2x2 MIMO system in the mmWave spectrum at 73 GHz and 10 Gbps



# The Industrial Internet of Things

