
NATIONAL
INSTRUMENTS™

Drie aspecten voor snellere ontwikkeling van embedded systemen

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National Instruments

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Agenda

- Challenges industry
- Custom build vs off-the shelf
- Improve development process
- Leverage community through Linux RTOS
- Summary

Addressing Complex Challenges in a Variety of Industries and Applications

Energy and Oil & Gas

Life Sciences

Machines and Robotics

Transportation and Heavy Equipment

The Dilemma: Build or Buy?

Build

Advantages
Custom HW/SW solution
Maximum flexibility
Ability to get exactly what you want

Disadvantages
Long lead times for new product
Significant resource requirements
Higher life-cycle costs

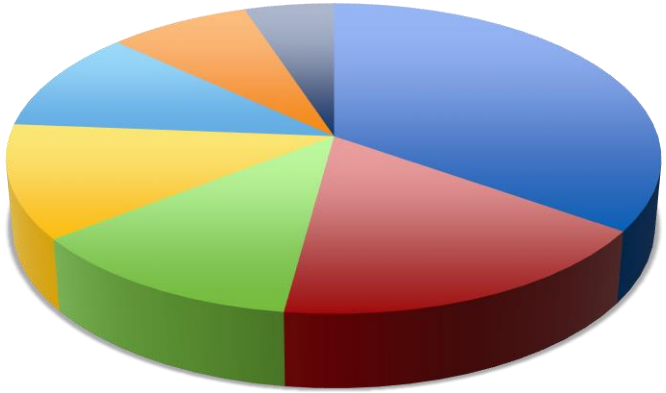
Buy

Advantages
Off-the-shelf hardware/software solution
Use fewer resources because systems are pre-built
Shorter time to market
Lower life-cycle costs

Disadvantages
Often pay for much more than you need
Limited flexibility
Limited functionality

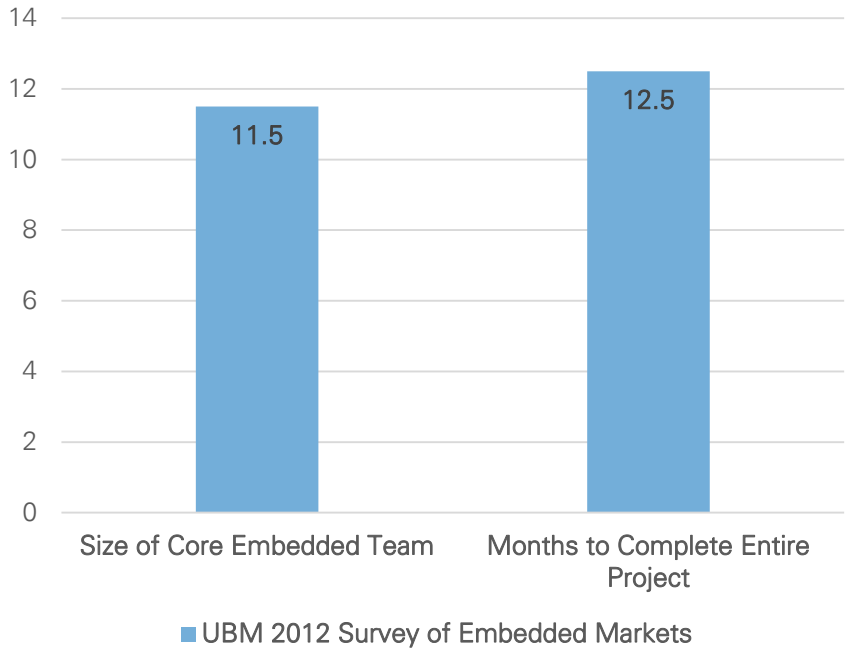
The Complexity of a Custom Build

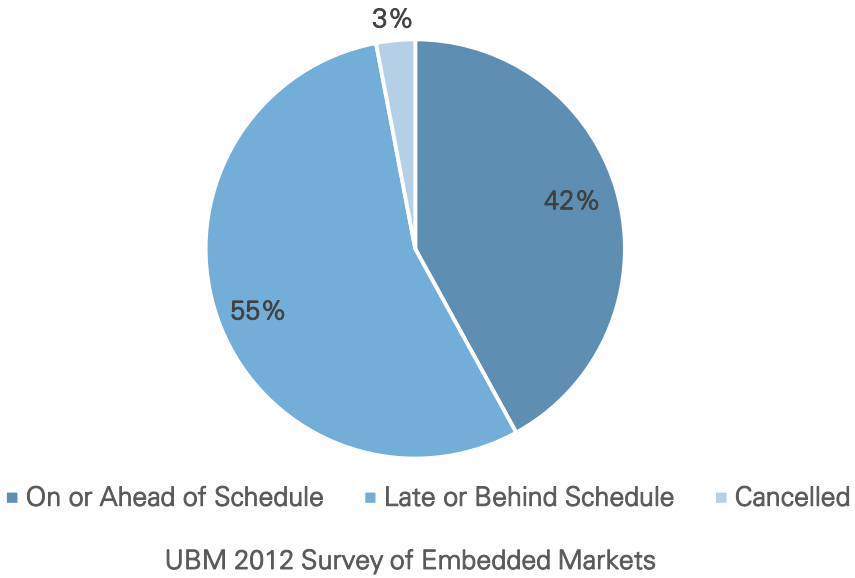
- Hardware and software costs
- Mechanical components (non-electronic)
- EDA development tool costs
- Design specification and component selection
- Prototyping
- Hardware design
- Hardware test and verification
- Software development
- Software test and verification
- Mechanical design
- Manufacturing setup and tooling
- Manufacturing test



- Compliance and environmental engineering
- Documentation, training, and customer support
- Inventory management and EOL issues
- Sustaining engineering
- Opportunity cost

The Reality of Embedded System Design

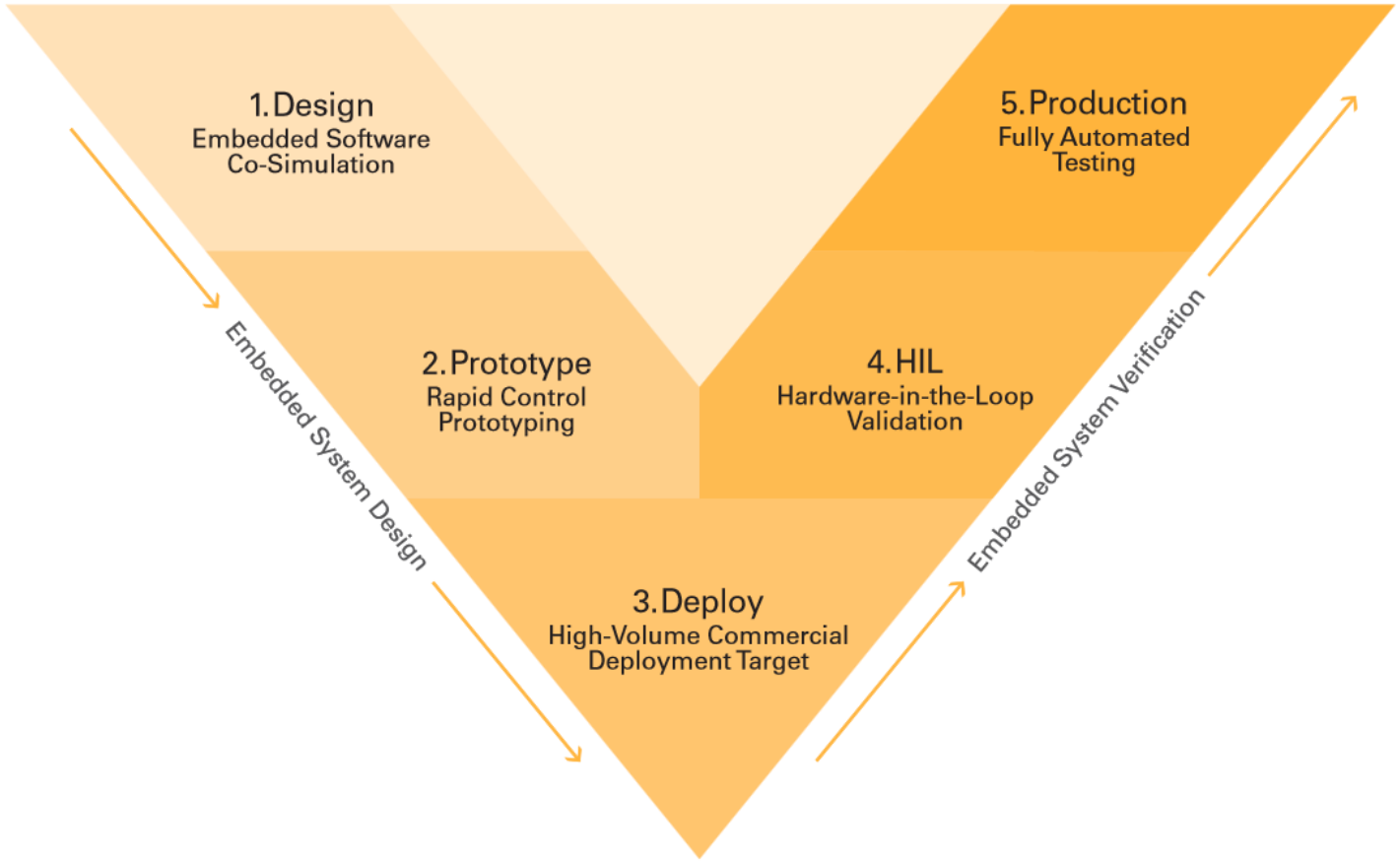




	UBM
Size of core embedded team (average # of SW/HW/firmware engineers)	11.5
Complete projects in months	12.5
On/ahead of schedule	42%
Behind schedule/late	55%

Wilson Research Group, 2012 National Instruments/UBM Survey of Embedded Markets, January–April 2012.

Design V Approach to Embedded System Design



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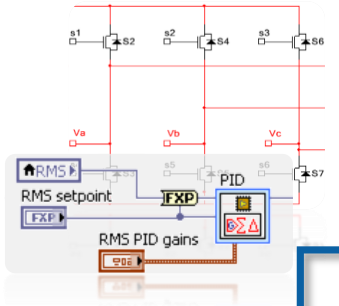

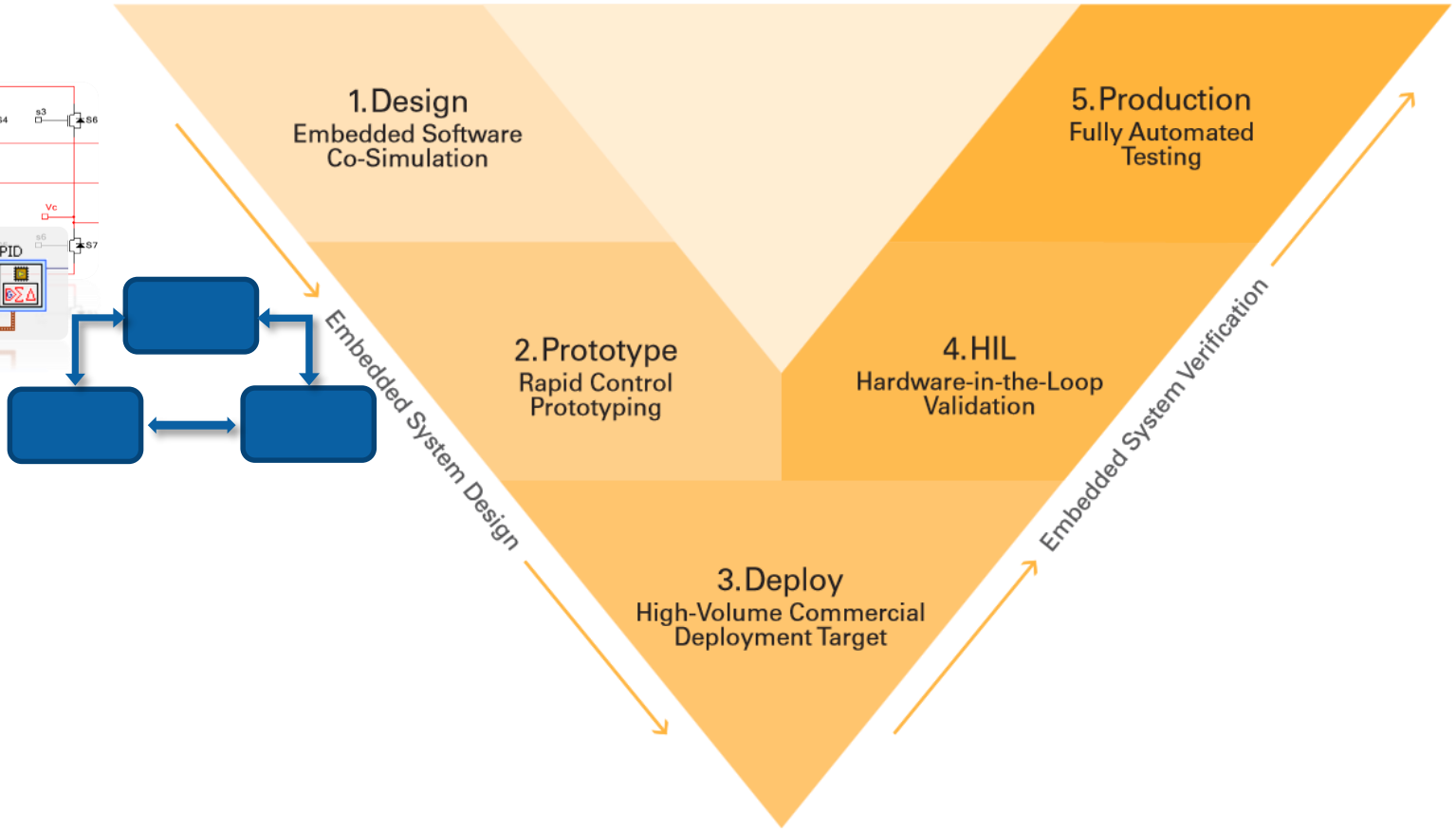

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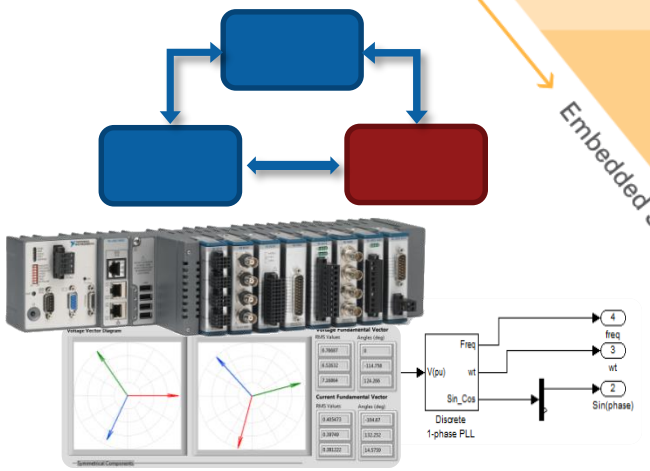


1. Design
Embedded Software
Co-Simulation

2. Prototype
Rapid Control
Prototyping

3. Deploy
High-Volume Commercial
Deployment Target

4. HIL
Hardware-in-the-Loop
Validation

5. Production
Fully Automated
Testing

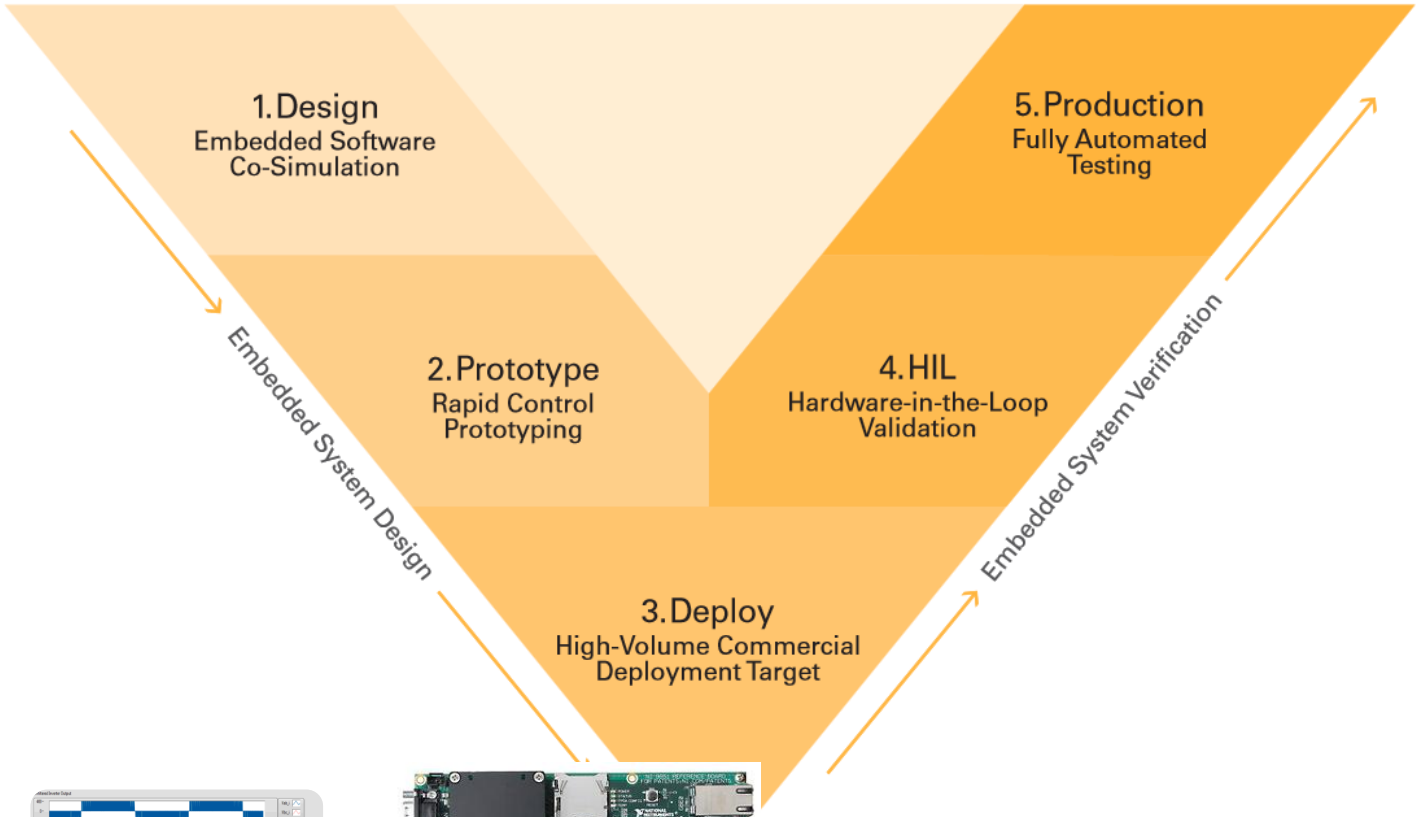
Embedded System Design

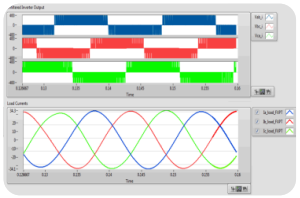
Embedded System Verification

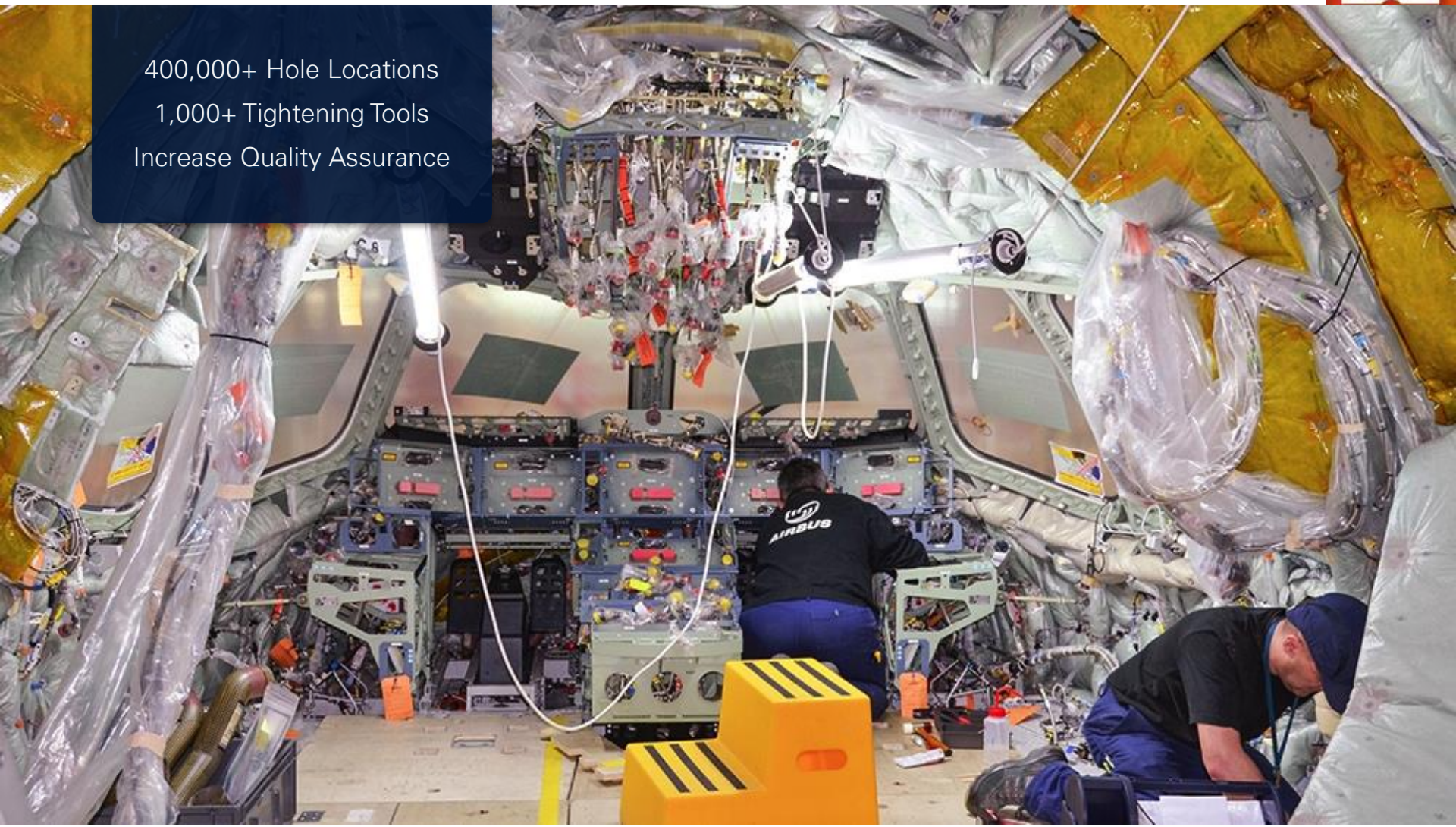
Rapid Control Prototyping

"Our rapid control prototyping (RCP) system demonstrates the capabilities of NI hardware and software when used as the basis for implementing a virtual engine control unit (ECU)…"

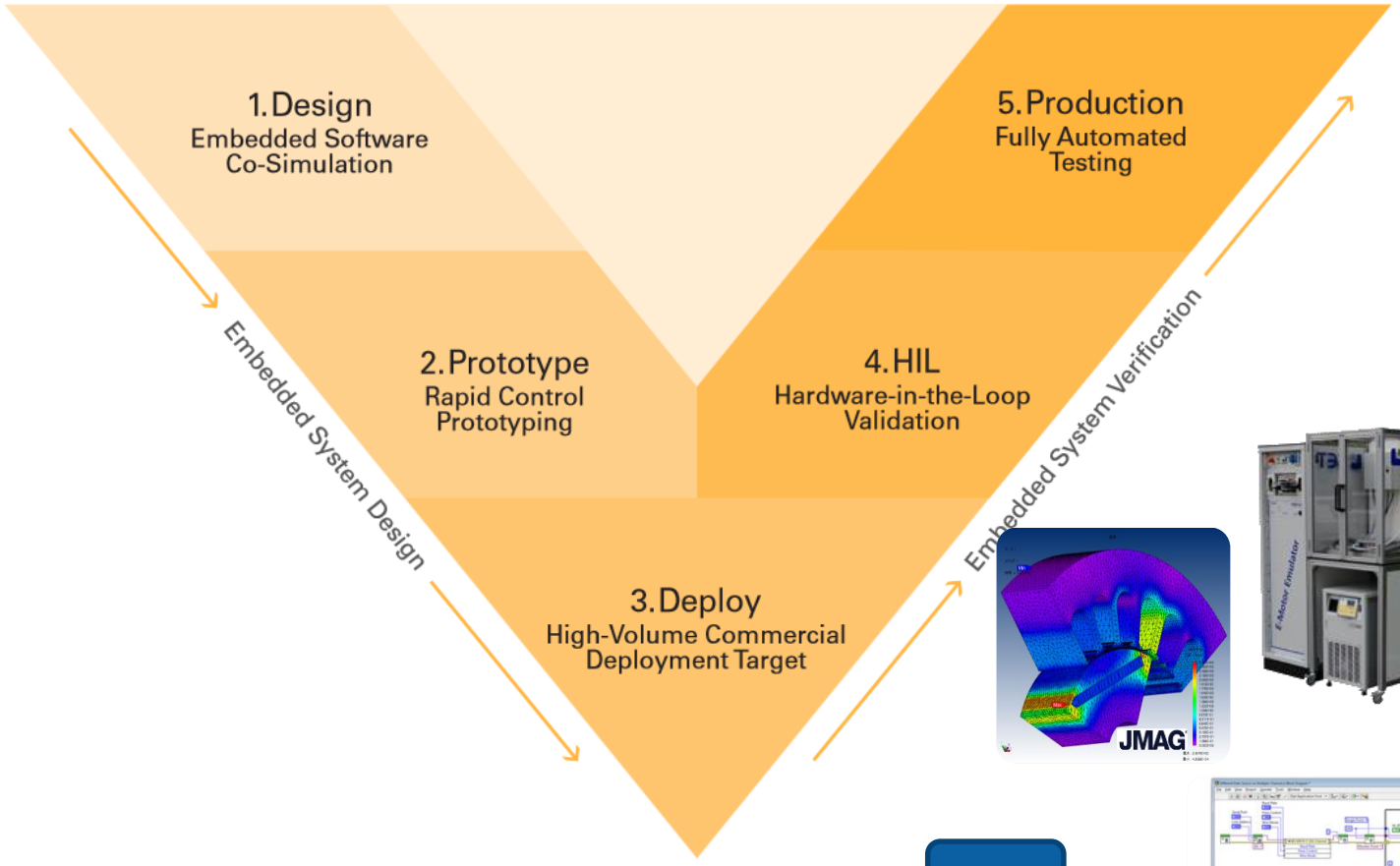
Design V Approach to Embedded System Design

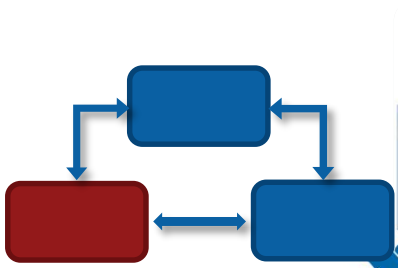


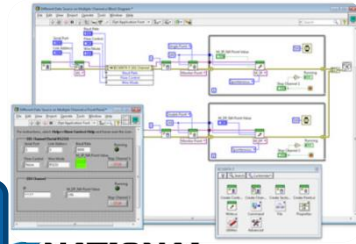



400,000+ Hole Locations
1,000+ Tightening Tools
Increase Quality Assurance
AIRBUS

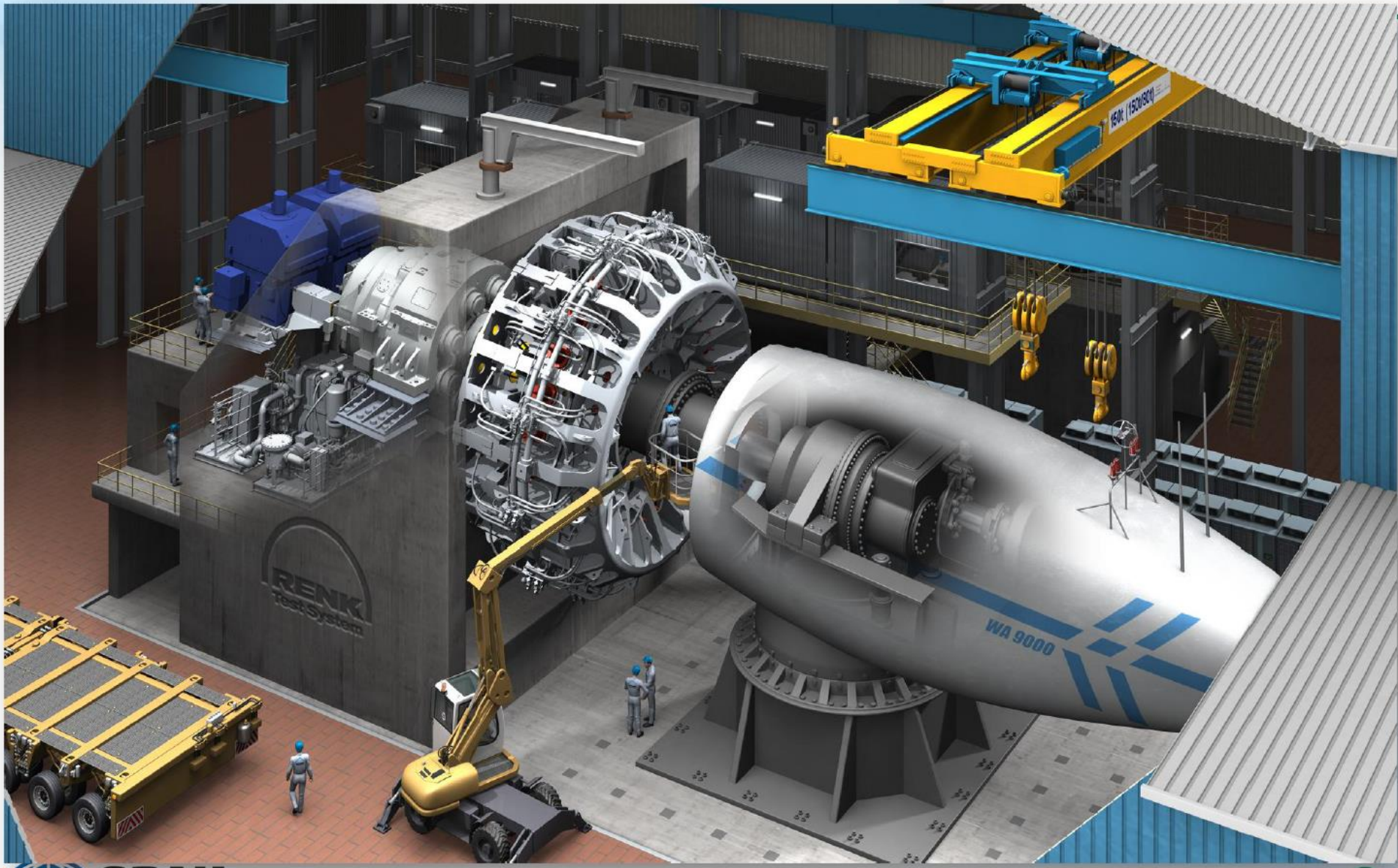
Design V Approach to Embedded System Design







15 MW with Dynamic Load Applicator



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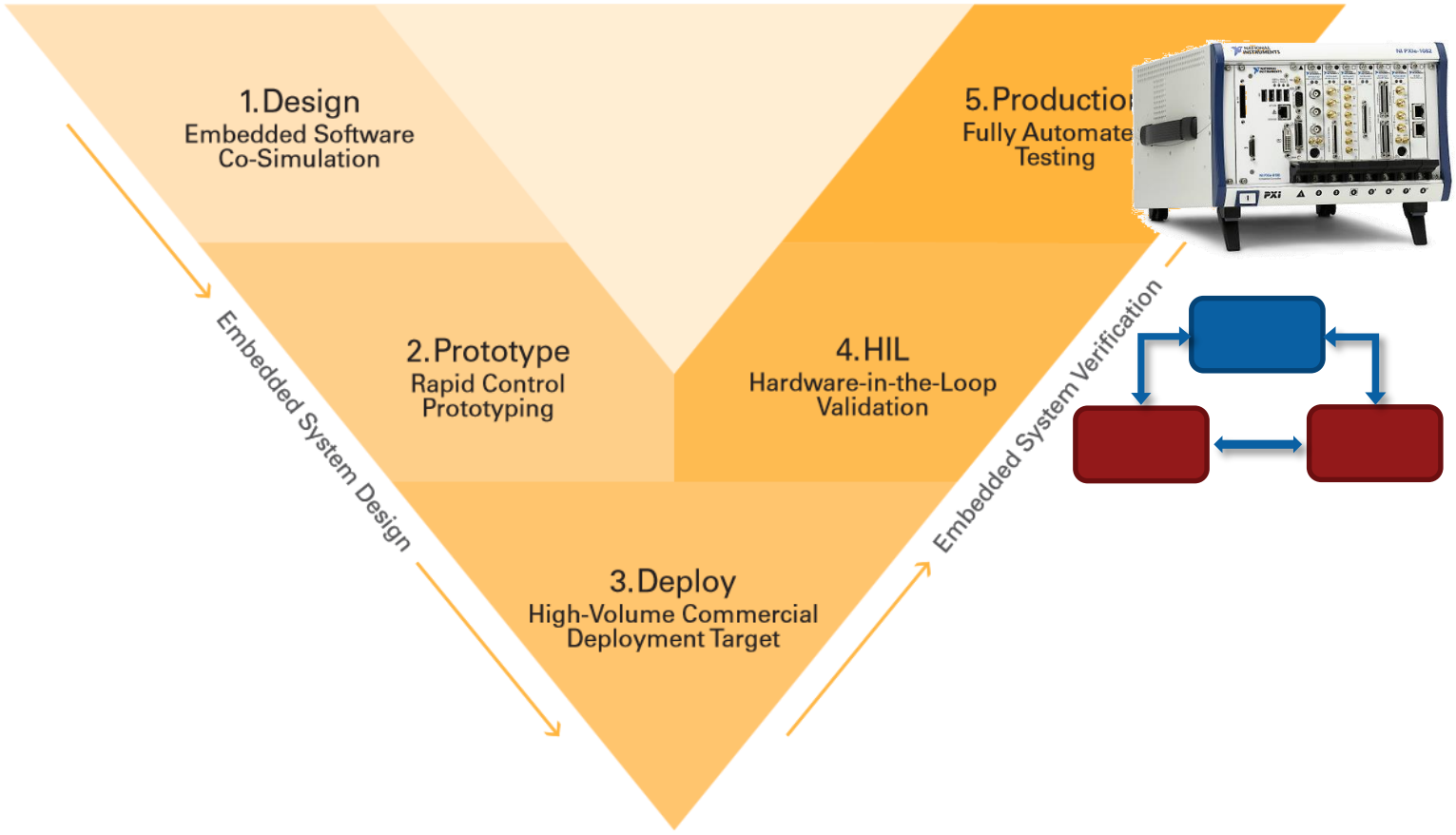
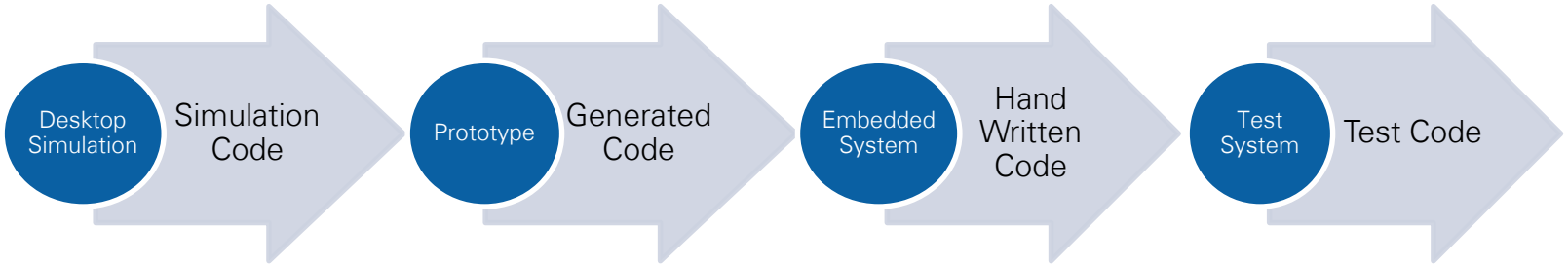


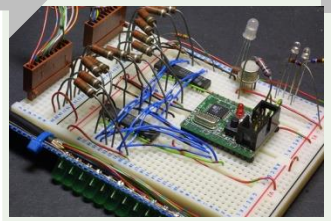
End-of-Line Test Bench for Hybrid Inverters

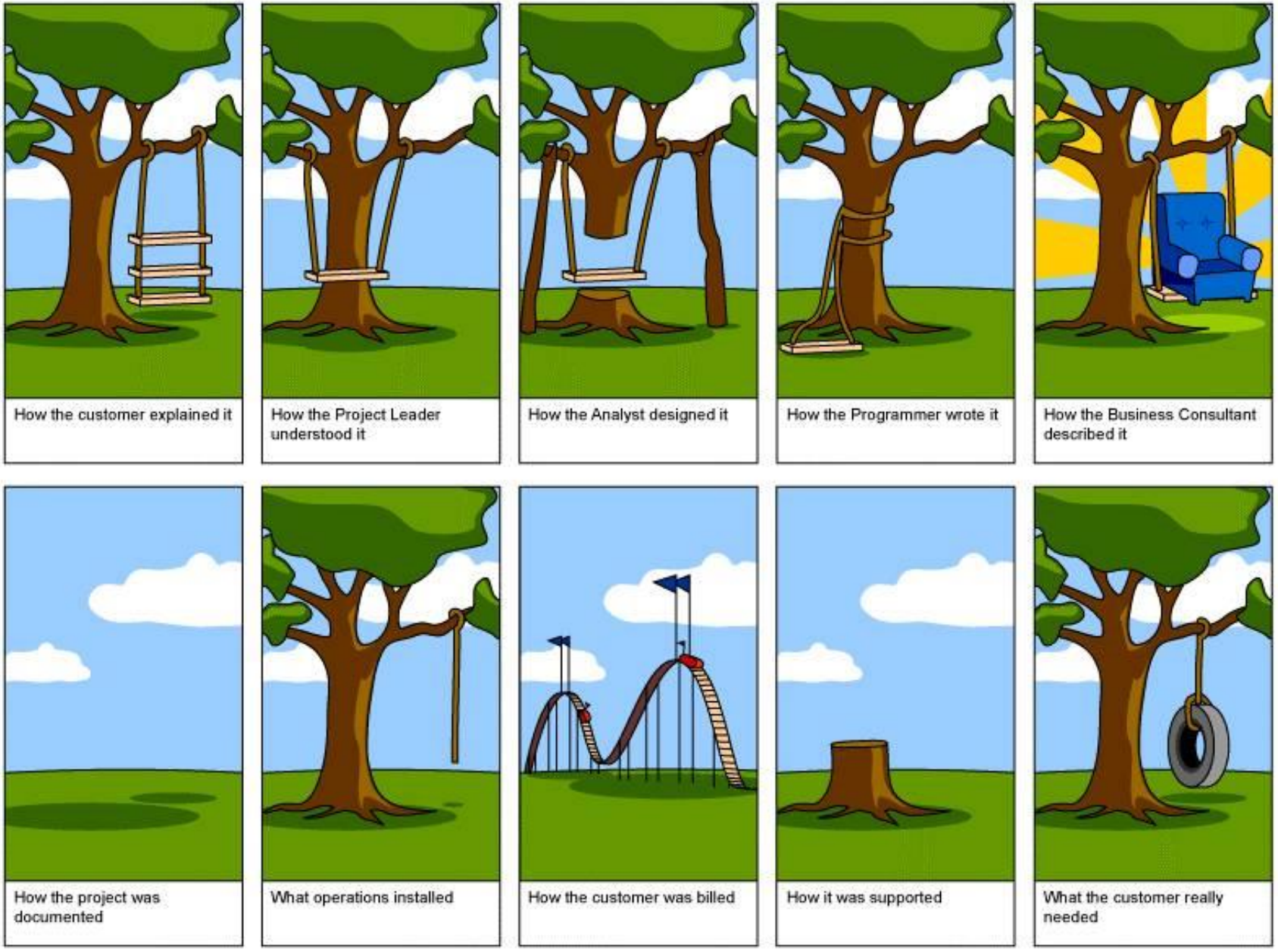
"The support of the NI team was fundamental in developing a standard hardware platform for the electronic components, including the ECU and inverter. Furthermore, created a standard software framework that can work on different electronic components."

Alessandro Andreoli,
Project Manager, Loccioni

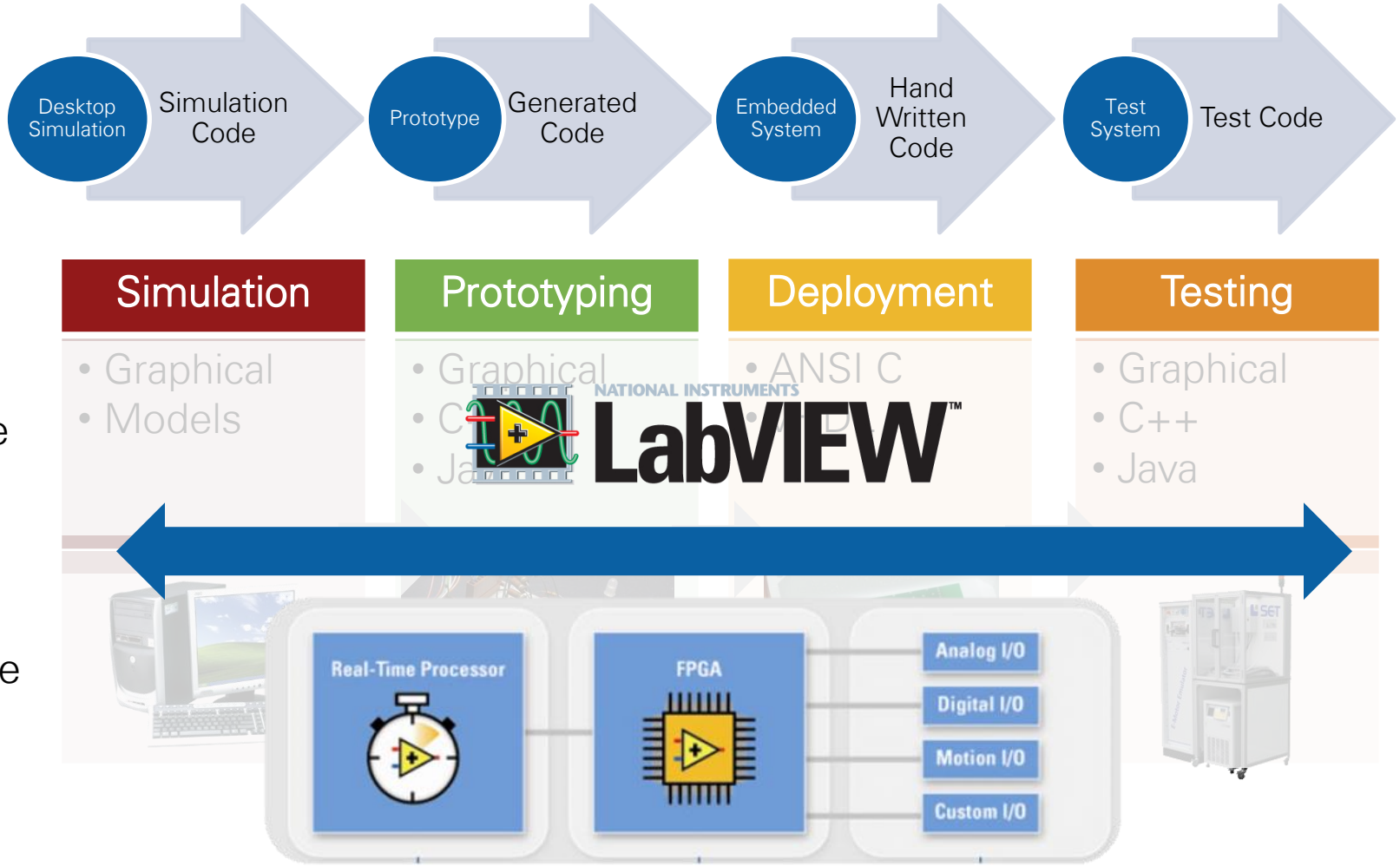
System Development Process:
Traditional approach leverages highly fragmented toolchain



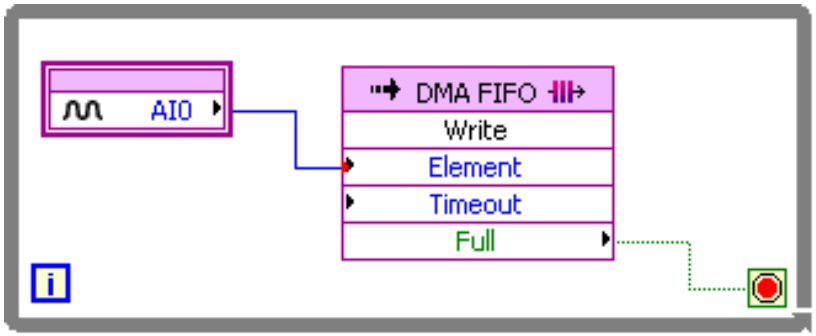
	Simulation	Prototyping	Deployment	Testing
Software	• Graphical • Models	• Graphical • C++ • Java	• ANSI C • VHDL	• Graphical • C++ • Java
Hardware				

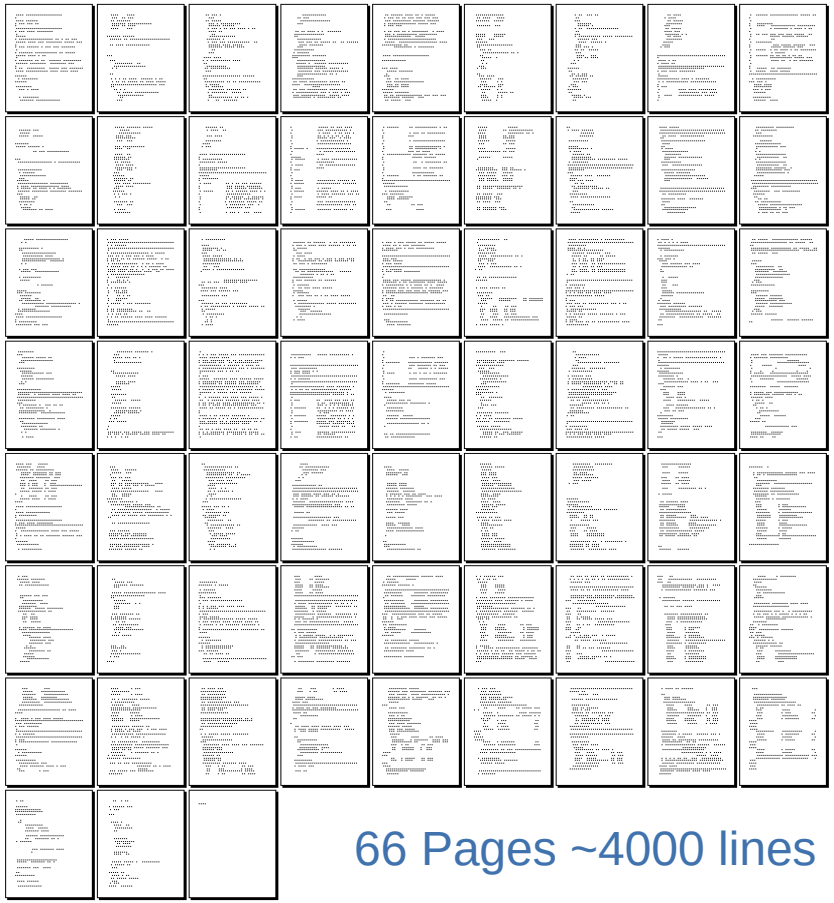

How the customer explained it
How the Project Leader understood it
How the Analyst designed it
How the Programmer wrote it
How the Business Consultant described it
How the project was documented
What operations installed
How the customer was billed
How it was supported
What the customer really needed

System Development Process: Overcome challenges with a platform-based approach



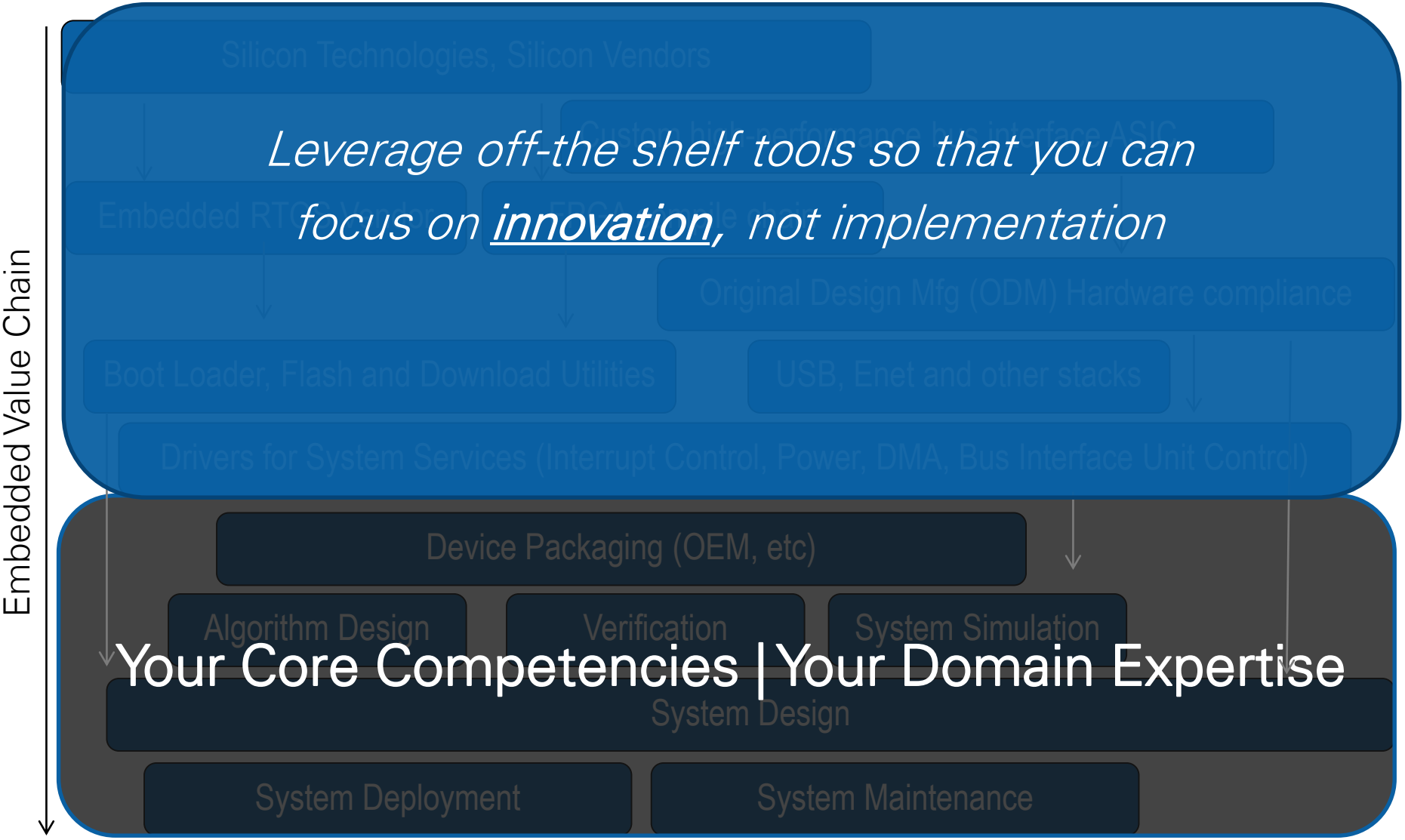
LabVIEW FPGA vs VHDL



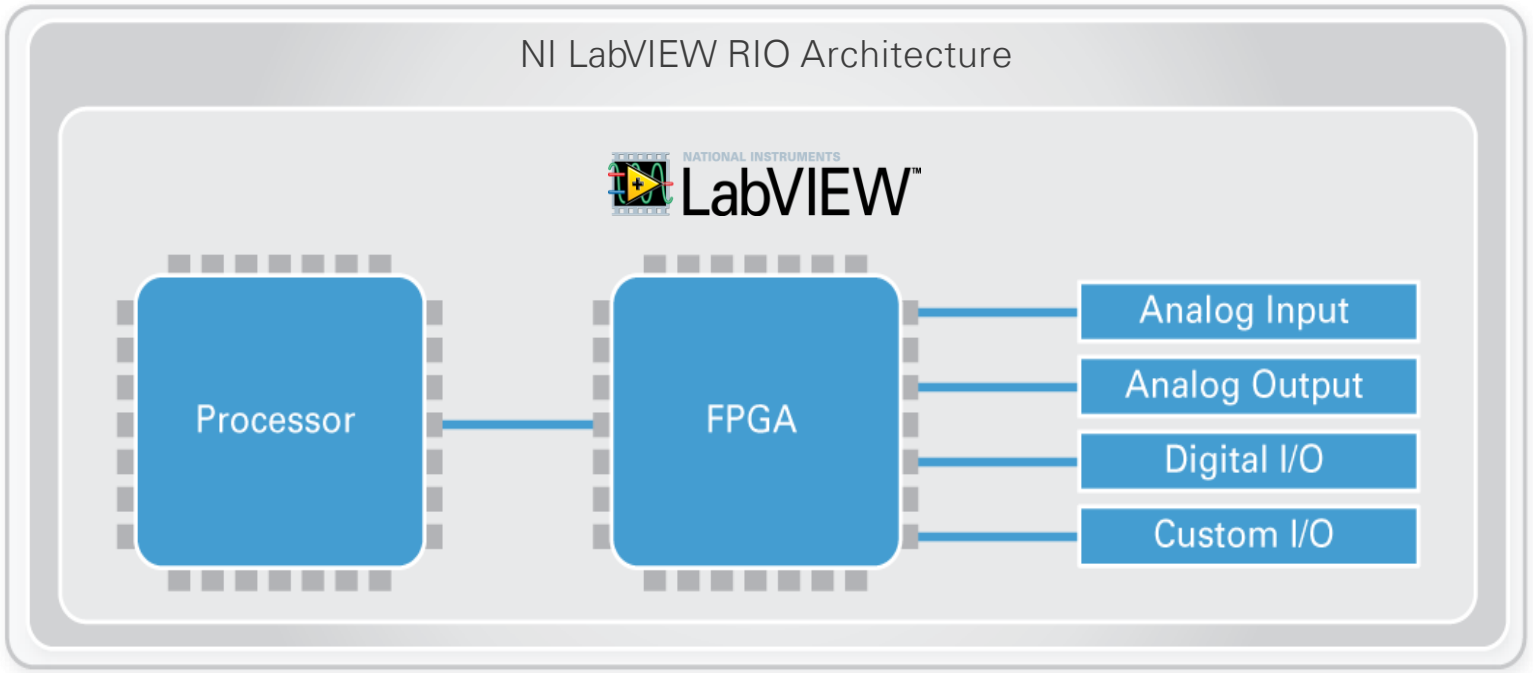


66 Pages ~4000 lines

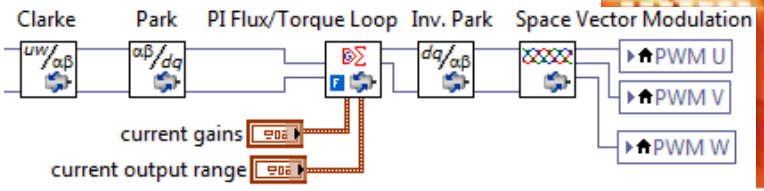
Traditional Embedded Value Chain vs. Graphical System Design



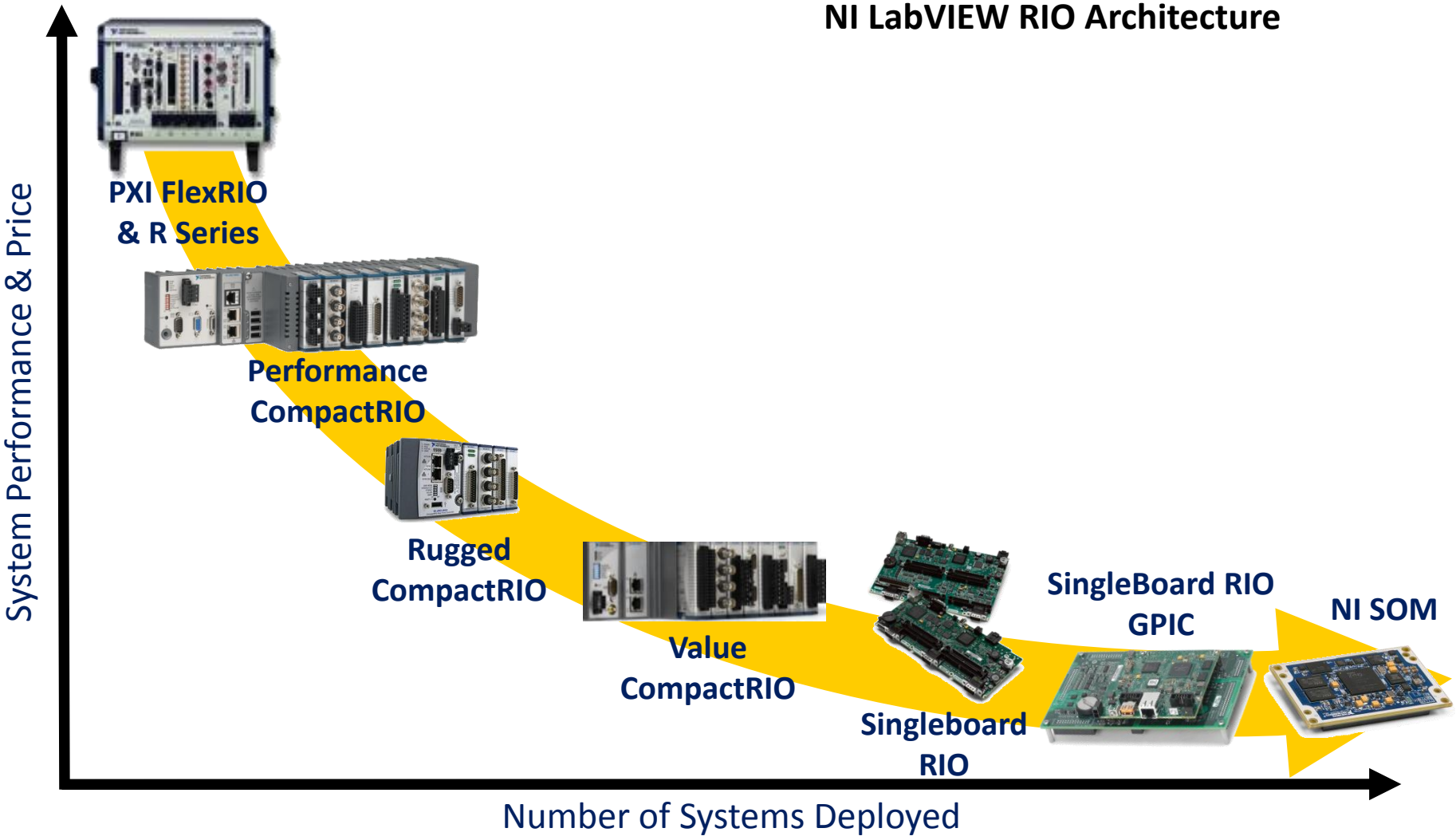
The foundation for flexibility



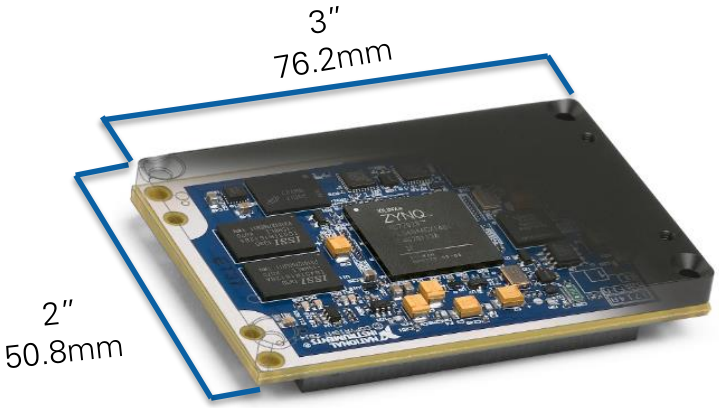
Deployment Curve



NI LabVIEW RIO Architecture



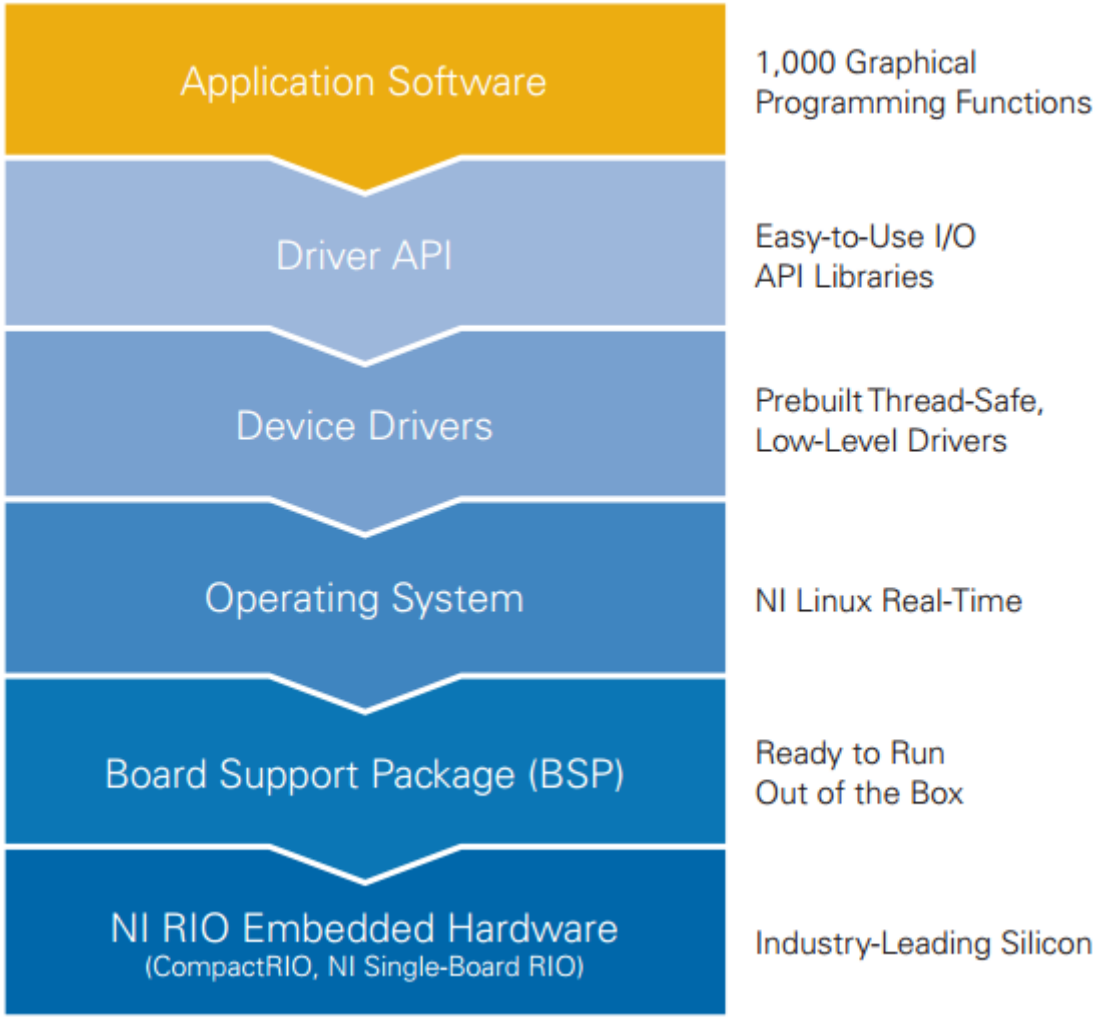
System on Module (SOM) Specifications



Specifications

Processor SoC
Xilinx Zynq-7020 667 MH Dual-Core ARM Cortex-A9 Artix-7 FPGA Fabric
Size and Power
50.8mm x 78.2mm (2 in. X 3 in.) Typical Power: 3 W to 5 W
Memory
Nonvolatile: 512 MB DRAM: 512 MB
Operating Temperature
-40 °C to 85 °C Local Ambient

Integrated, Validated Board Support Package (BSP)



C/C++

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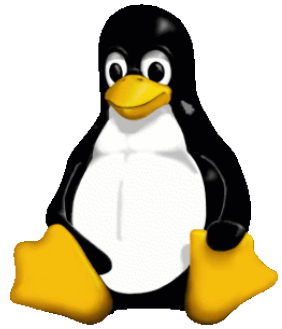
Community Applications and Libraries

NI Linux Real-Time Operating System

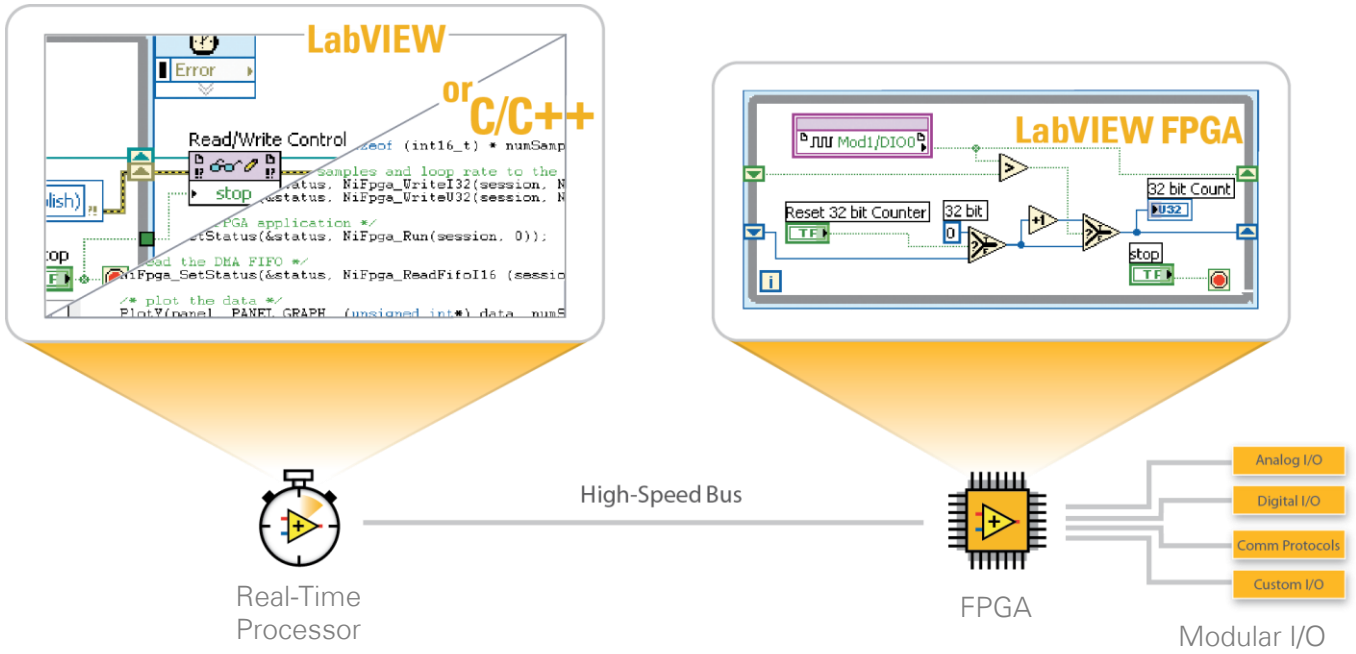
NI Linux Real-Time Operating System

- Why Linux?
  - Support across CPU architectures (ARM, x86, etc)
  - Offers better security
  - Not vendor tied, not proprietary
  - Large ecosystem
- NI investment
  - Reliable, real-time performance
  - Future NI maintenance and management



Real-time reliability WITH usability/ecosystem of a general-purpose OS

Flexible Software Integration



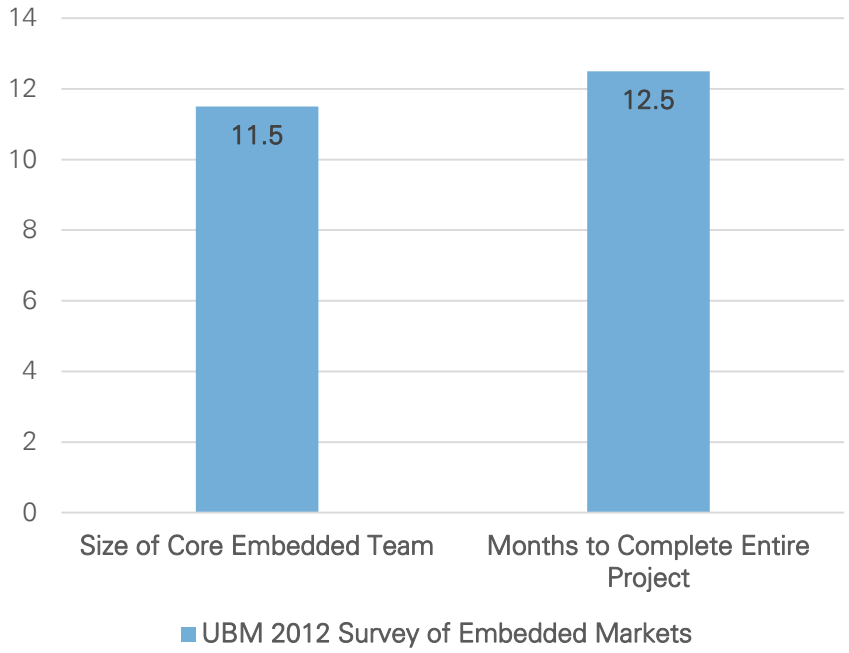
Code Reuse

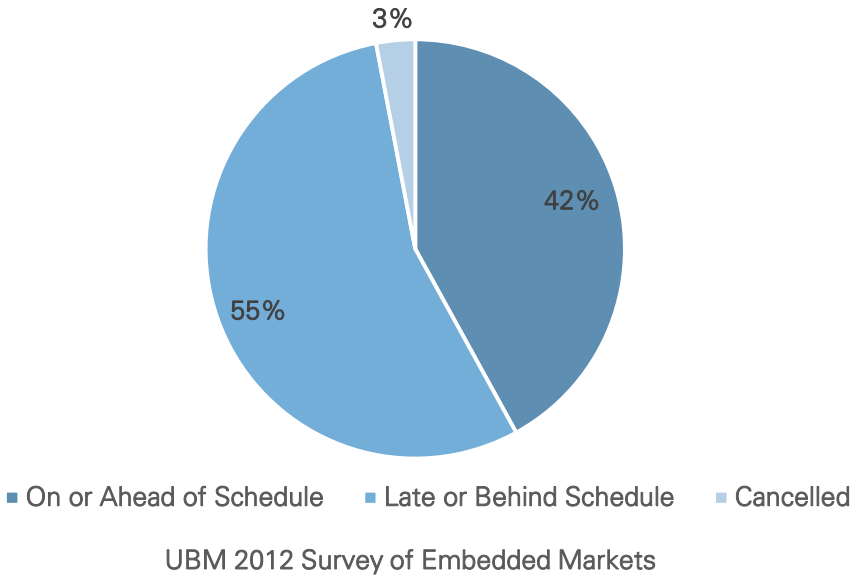
- Integrate existing applications and libraries
- Develop, debug and deploy C/C++ code
- Use Eclipse or IDE of choice
- Leverage the Linux ecosystem
- Interoperate with LabVIEW-programmed FPGA

Programmable Hardware

- Offload critical, decision-making code to the FPGA
- Reliable, precision timing for control or processing
- Use graphical programming to leverage FPGA technology without HDL expertise
- Re-use existing (V)HDL code

The Reality of Embedded System Design





	UBM
Size of core embedded team (average # of SW/HW/firmware engineers)	11.5
Complete projects in months	12.5
On/ahead of schedule	42%
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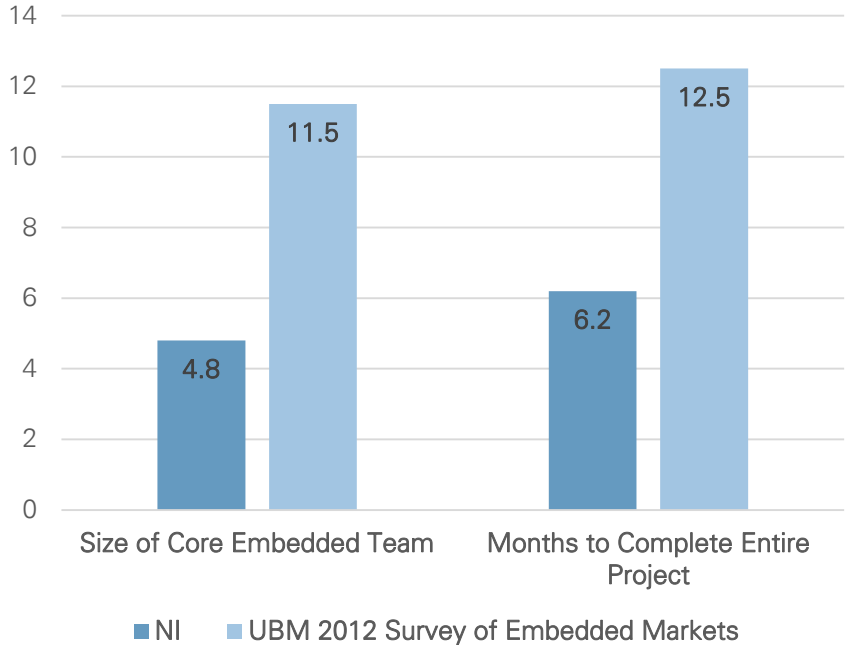
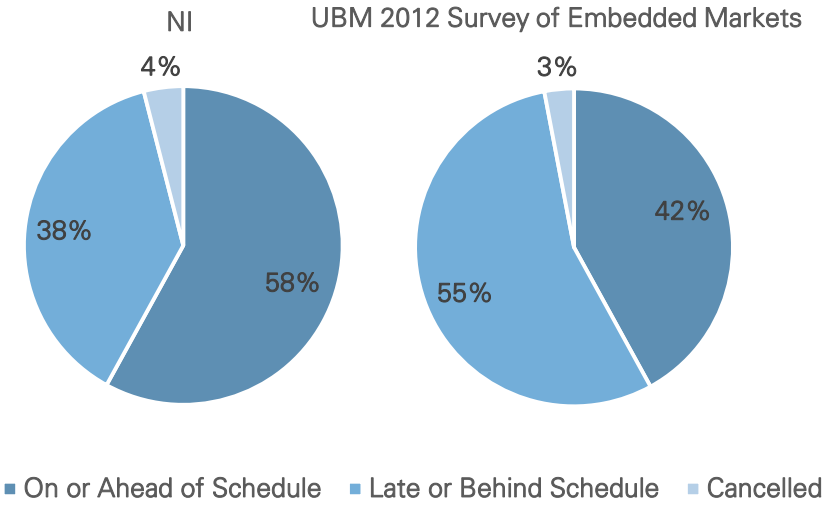
UBM Electronics

Wilson Research Group, 2012 National Instruments/UBM Survey of Embedded Markets, January–April 2012.

The Reality of Embedded System Design With Graphical System Design





	NI	UBM
Size of core embedded team (average # of SW/HW/firmware engineers)	4.8	11.5
Complete projects in months	6.2	12.5
On/ahead of schedule	58%	42%
Behind schedule/late	38%	55%

UBM Electronics

Wilson Research Group, 2012 National Instruments/UBM Survey of Embedded Markets, January–April 2012.

The NI Embedded Advantage

- Globally trusted and recognized organization with direct sales, services, and support throughout the world
- The platform-based Graphical System Design approach allows you to:
  - Maximize profitability
  - Increase productivity
  - Focus on innovation, not implementation
  - Get your products to market faster with smaller design teams
  - Leverage the latest advancements in technology
  - Customize your solution to achieve the benefits of custom design
  - Reuse software, IP, and resources from prototype to deployment and across projects

Learn more at www.ni.com/embeddedsystems

Questions

For more information:

Visit our booth 11

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