Les matinales de l'embarqué : L'Internet des Objets, quel système d'exploitation utiliser ?

L'apport de l'OS temps-réel NI Linux RT pour les objets connectés

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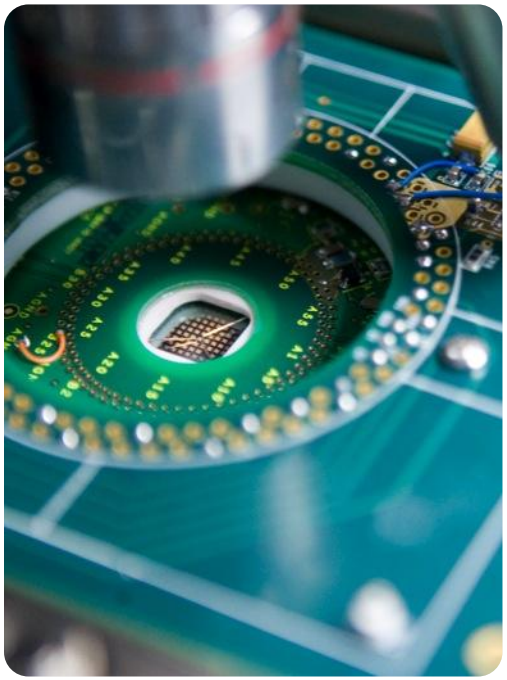
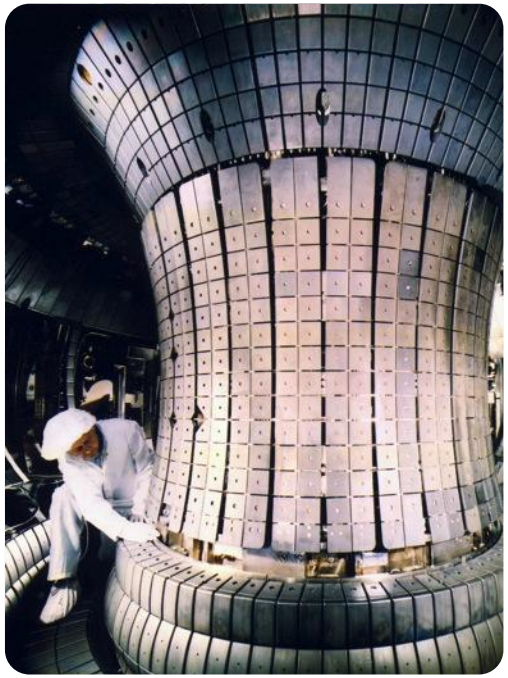
Our Mission

We equip engineers and scientists with tools that accelerate productivity, innovation, and discovery.





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The company

Annual Revenue: $1.17 billion

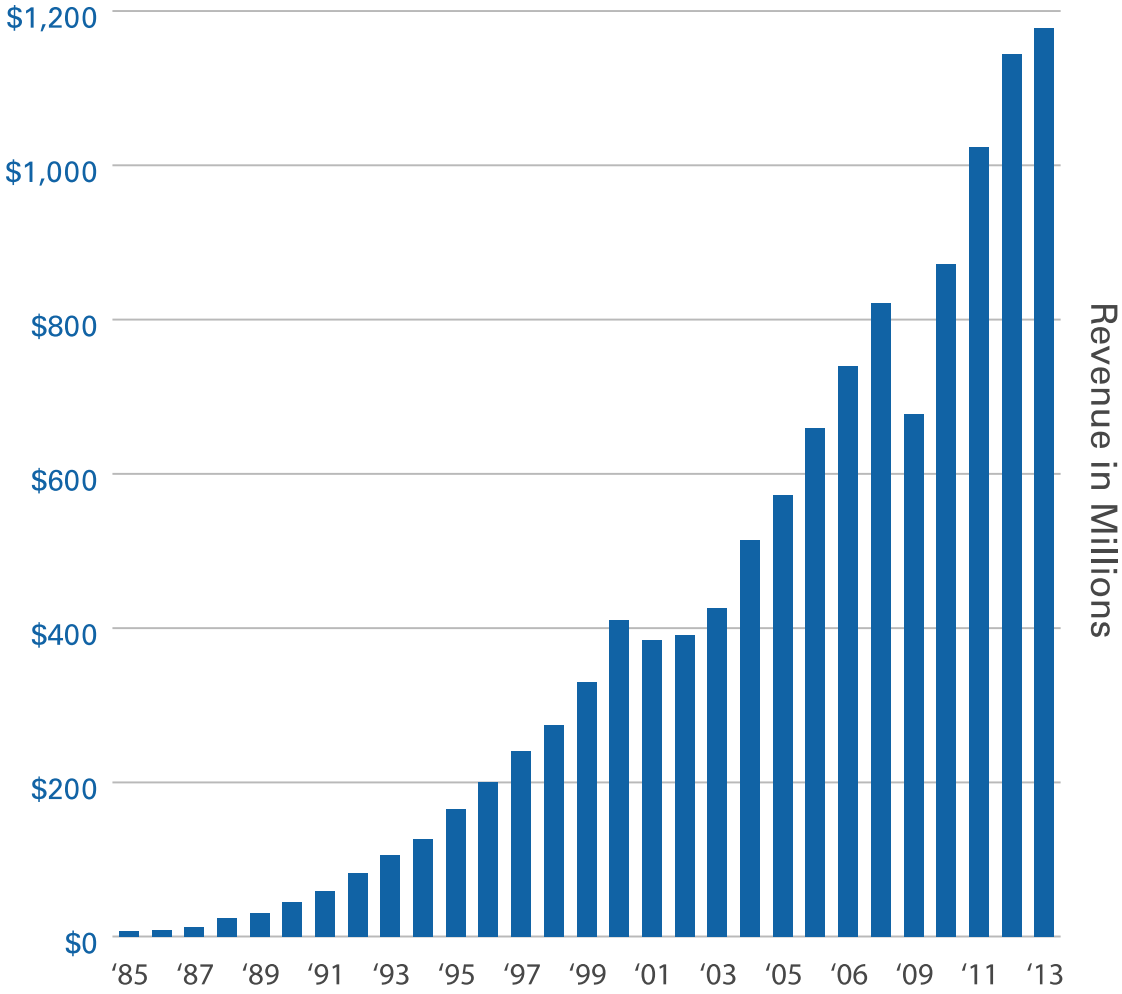
Global Operations:
Approximately 7,100 employees; operations in almost 50 countries

Broad Customer Base:
More than 35,000 companies served annually

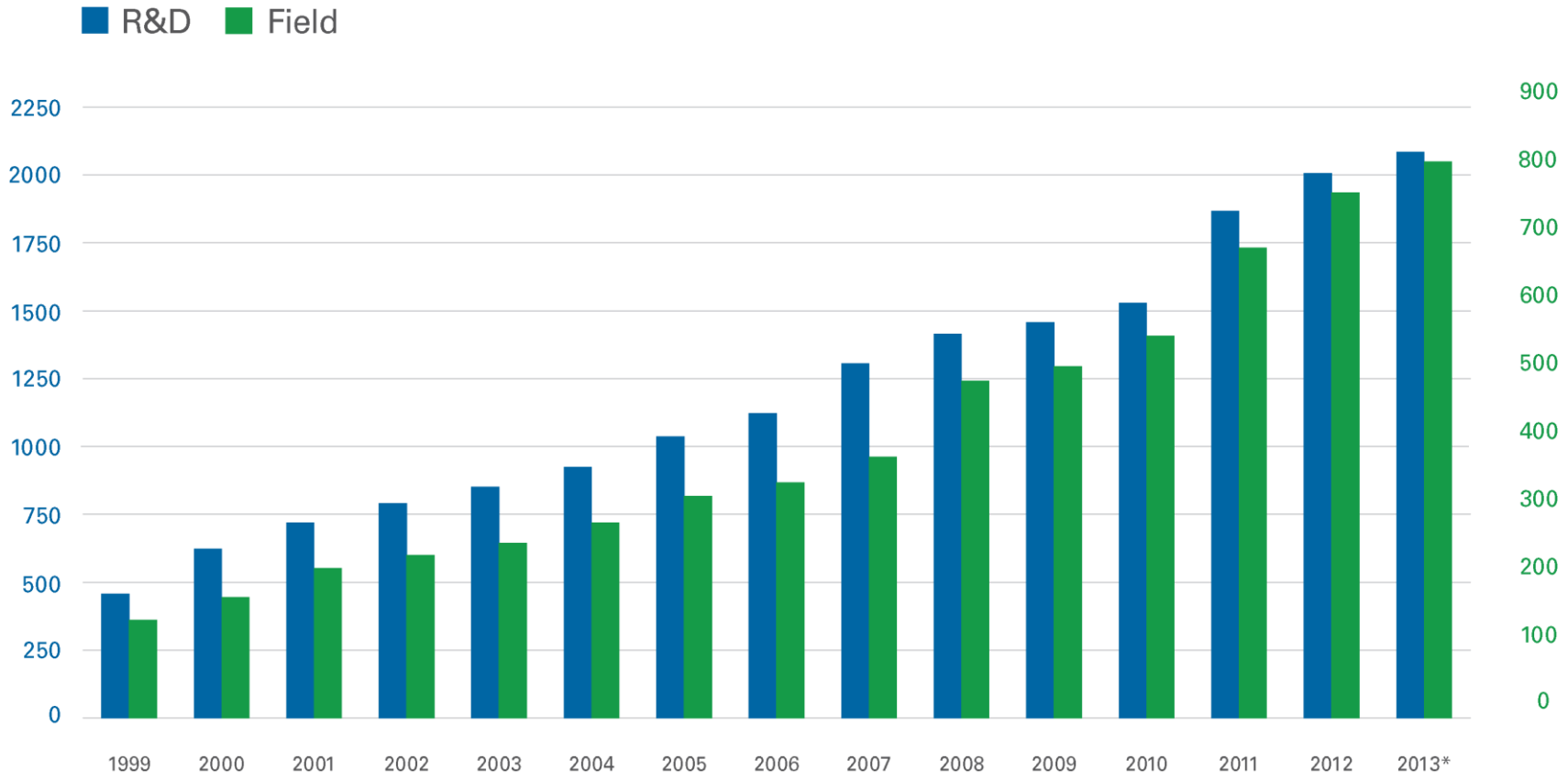
Diversity: No industry >15% of revenue

Culture: Ranked among the top 25 companies to work worldwide by the Great Place to Work Institute

Strong Cash Position:
Cash and short-term investments of $393 million at December 31, 2013

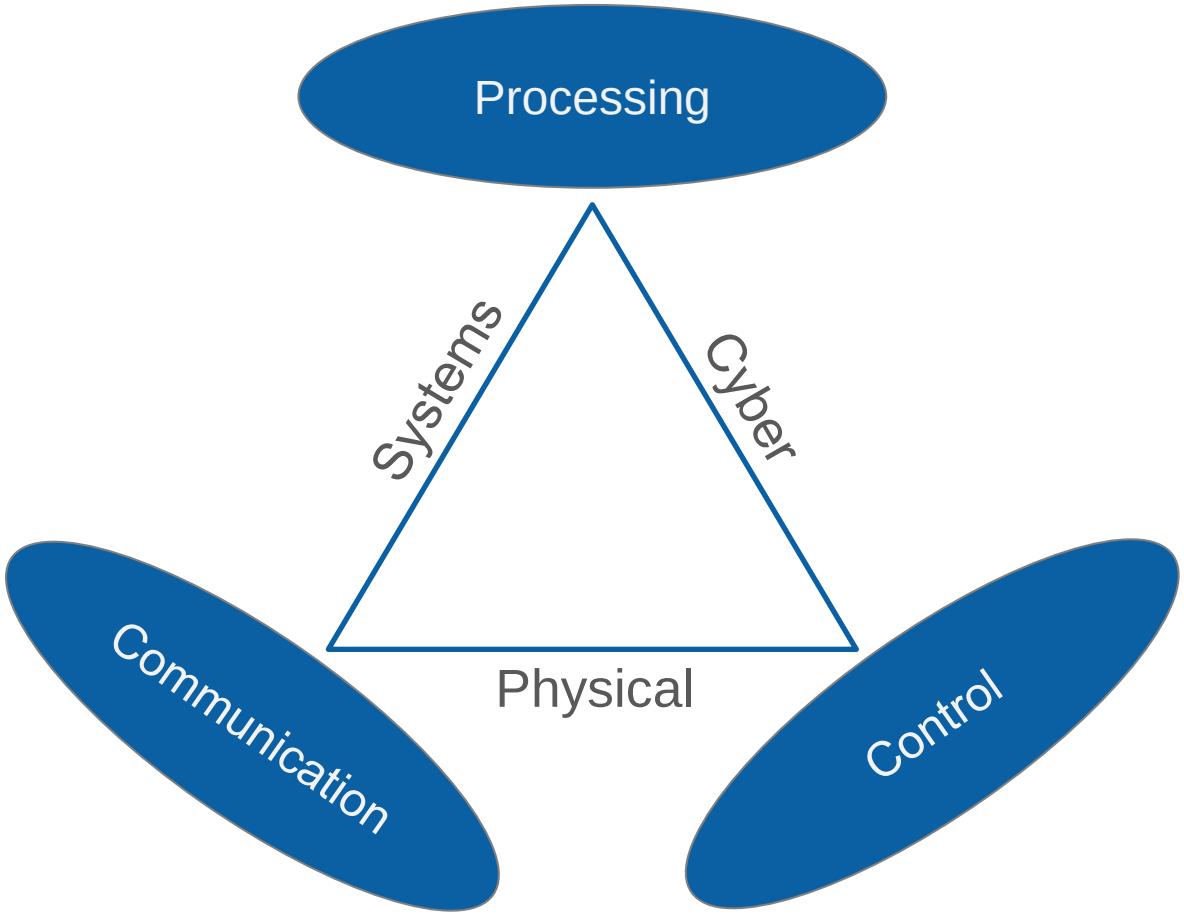


Investments to Drive Service and Innovation



* Represents National Instruments headcount in 2013

National Instruments - Internet of Things (IoT)



"Cyber-physical systems (CPS) enable the physical world to merge with the virtual leading to an Internet of things, data, and services."

– European Institute of Innovation and Technology

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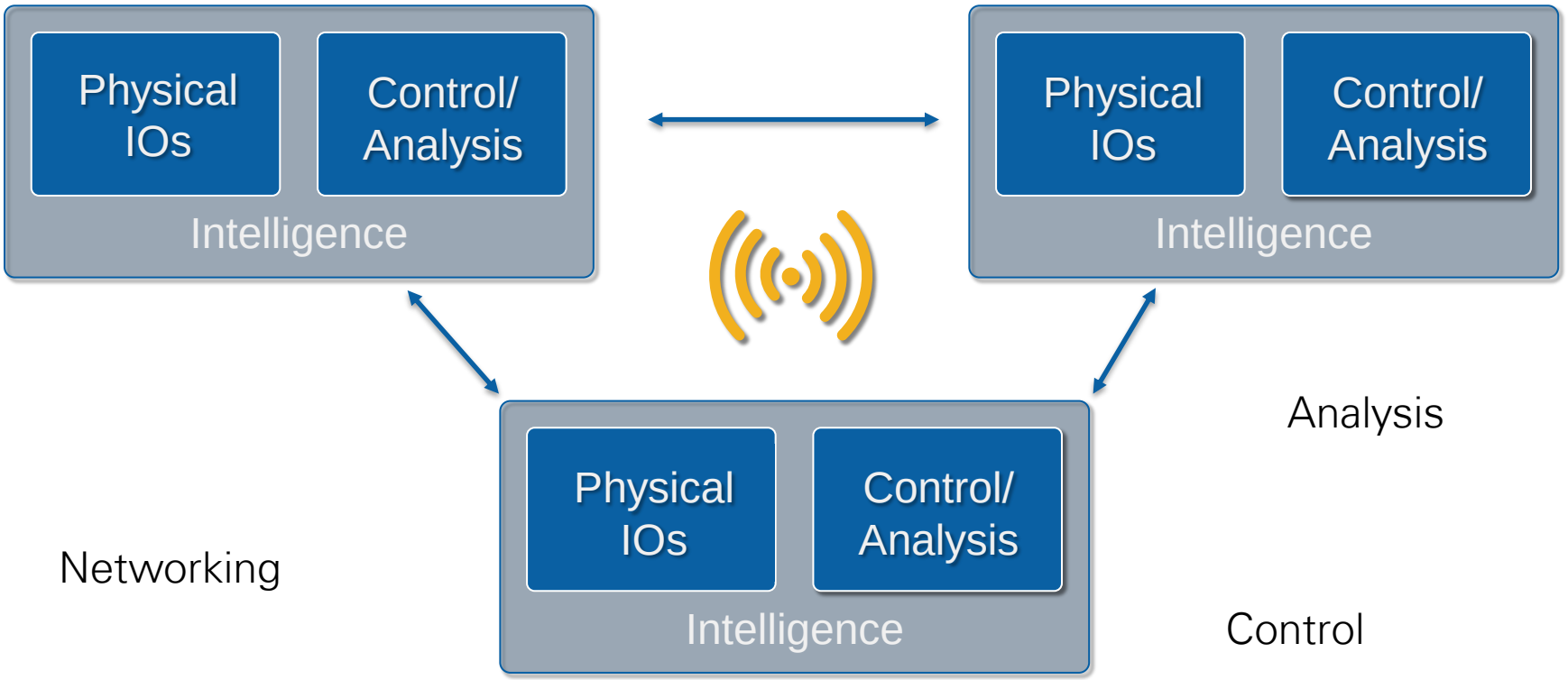
Cyber-phyical systems challenge



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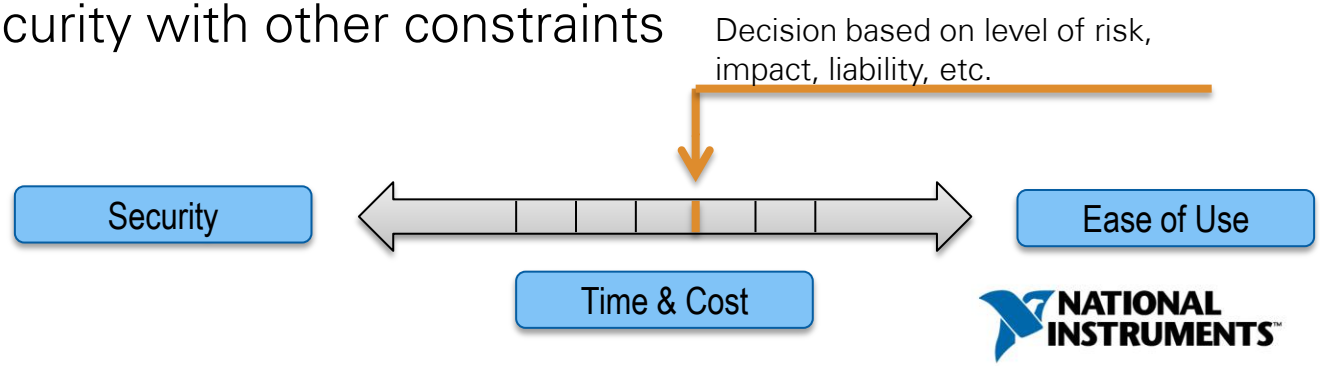
Key challenges for an IoT OS

- Flexibility
  - Fast evolution
  - Modularity
- Openness
  - Communication with 3rd party modules
  - Networking
- Security
  - Balancing security with other constraints



Which OS approach for the IoT?
NI Linux Real-Time

LONG TERM SUPPORT INITIATIVE

- Owned and maintained by NI
  - Custom built and optimized for NI embedded hardware
    - Supports ARM and IA64, with cross-compilers provided
  - Based on **OpenEmbedded** framework
  - NI Package Repository: **download.ni.com/ni-linux-rt/**
    - Over 3,000 packages
  - OS source: **github.com/ni**
- PREEMPT_RT
  - Enables real-time reliability through pre-emption, priority inheritance, and scheduling
  - Standard approach to real-time performance on Linux

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Which OS approach for the IoT?
NI Linux Real-Time

Architectures	X86_64	ARMv7
Bootloader	GRUB	uBoot
Kernel Version	3.10-rt-ltsi	3.2-rt
File System	ext4	UBIFS
Desktop Environment	XFCE	N/A
Built With	Yocto/OpenEmbedded	
Package Management	OPKG	
Init System	SysV	
Device Manager	udev	

- NI Linux RT enables the use of different languages for processor programming:
  - LabVIEW, C/C++, interoperates with LabVIEW-programmed FPGA
- Access FPGA technology without HDL expertise

Quality of Life on NI Linux Real-Time

- Convenience of a General Purpose OS
  - Desktop UI, File Manager, Terminal Emulator, Text Editor
  - Permissions, Application Isolation, Virtual Memory, no reboot required for Time Zone and IP Configuration changes
- Access to popular interpreters
  - Python, Perl, etc.
- Common Linux utilities
  - top, ps, netstat, etc.

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Security on NI Linux Real-Time

- SSL enabled by default
  - Can programmatically install software over SSL
  - Can use public keys for SSH
- HTTPS-only communication possible
  - Can turn off HTTP version of the System Web Server
- IPTables available for setting up a firewall

- OpenVPN available for setting up a VPN

OPENVPN™

- SELinux

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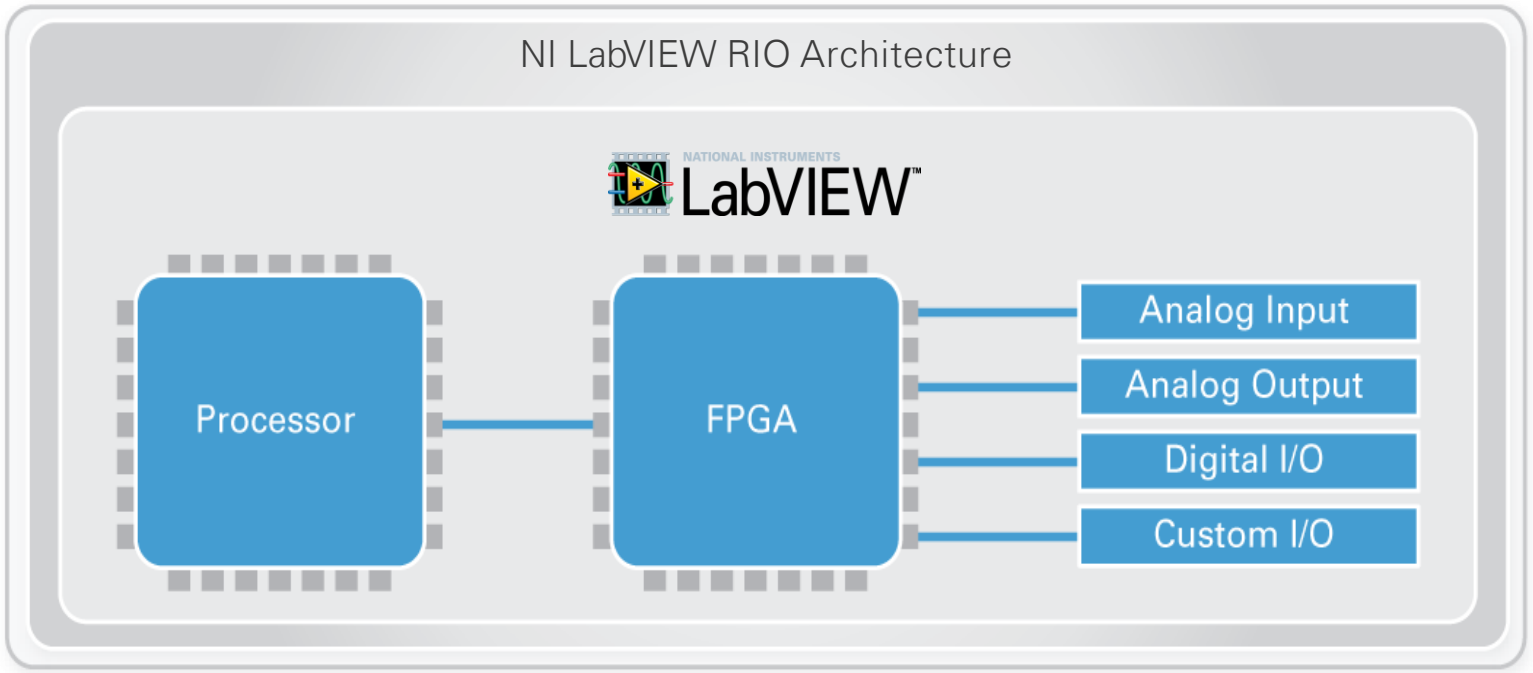
The foundation for innovation



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What platform can be targeted?

- From prototyping to deployment using NI RIO Hardware

- **NI CompactRIO Controller**
  - Xilinx Zynq-7020
    - 667 MHz Dual-Core ARM Cortex-A9
    - Artix-7 FPGA Fabric

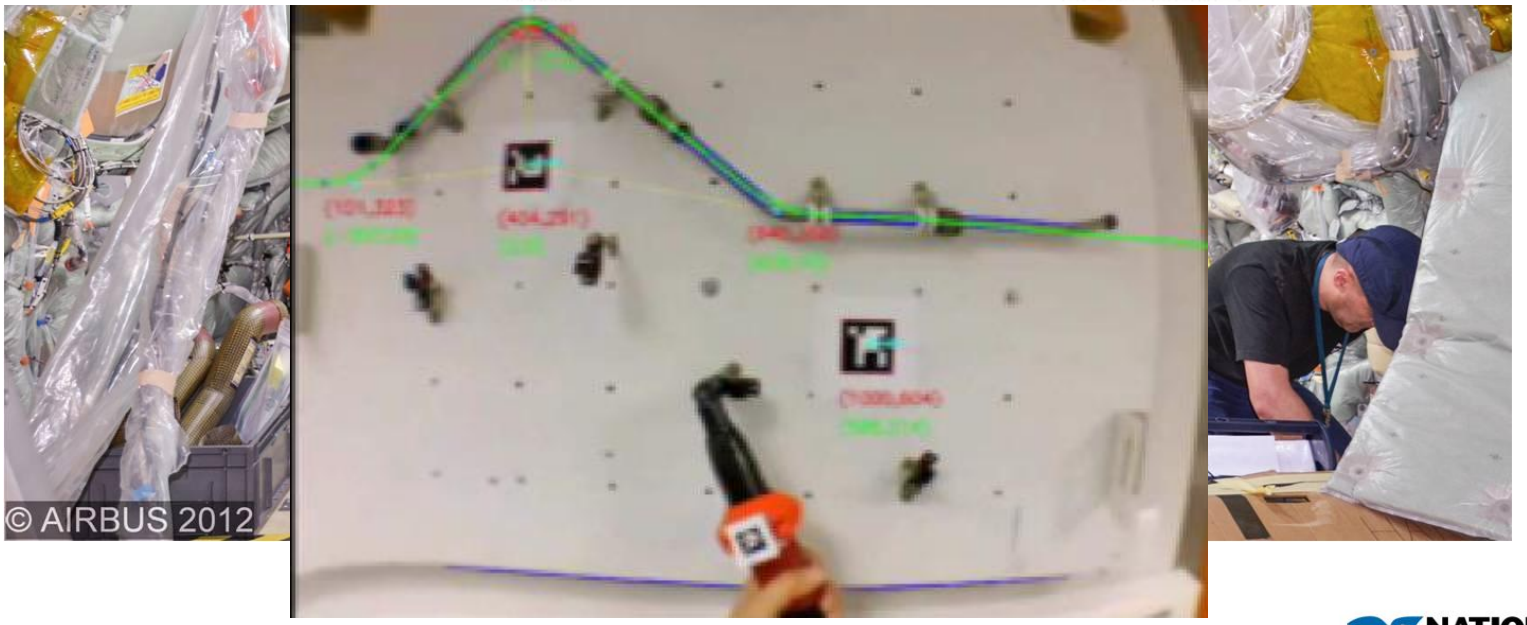
- **NI System on Module**
  - Xilinx Zynq-7020
    - 667 MHz Dual-Core ARM Cortex-A9
    - Artix-7 FPGA Fabric
  - 5.08 cm x 7.82 cm

Example: Airbus and NI collaboration
Intelligent devices for the Future of Aircraft Factory

HD camera embedded on operator glasses

Processor embedded in operator suit

Embedded Image Processing Software



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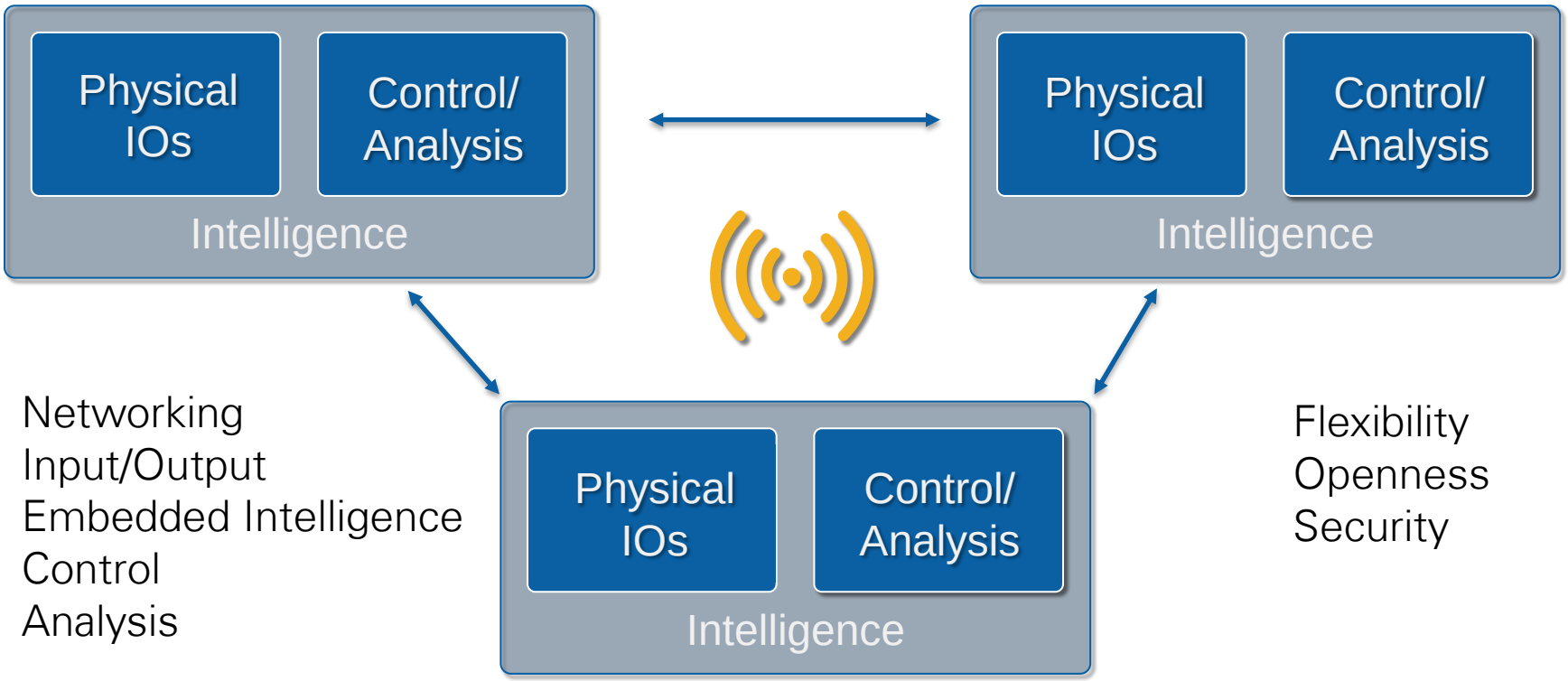
Example: Airbus and NI collaboration
Intelligent devices for the Future of Aircraft Factory

- Key points:
  - Open real-time OS based on Linux distribution
    - Desktop UI, Peripherals, System Administration, Real-Time schedulers
  - Reuse of internal libraries
    - Networking, Configuration Management, Simulation, Monitoring, etc.
  - Reuse C/C++ code in and alongside LabVIEW Real-Time built applications
    - FPGA Interface C API, System Configuration C API
  - Same approach for prototyping and deployment (cRIO to SoM)

Key Take-Aways



Networking
Input/Output
Embedded Intelligence
Control
Analysis

Flexibility
Openness
Security

Thank you

Questions?