Customized COTS: An Architecture Overview

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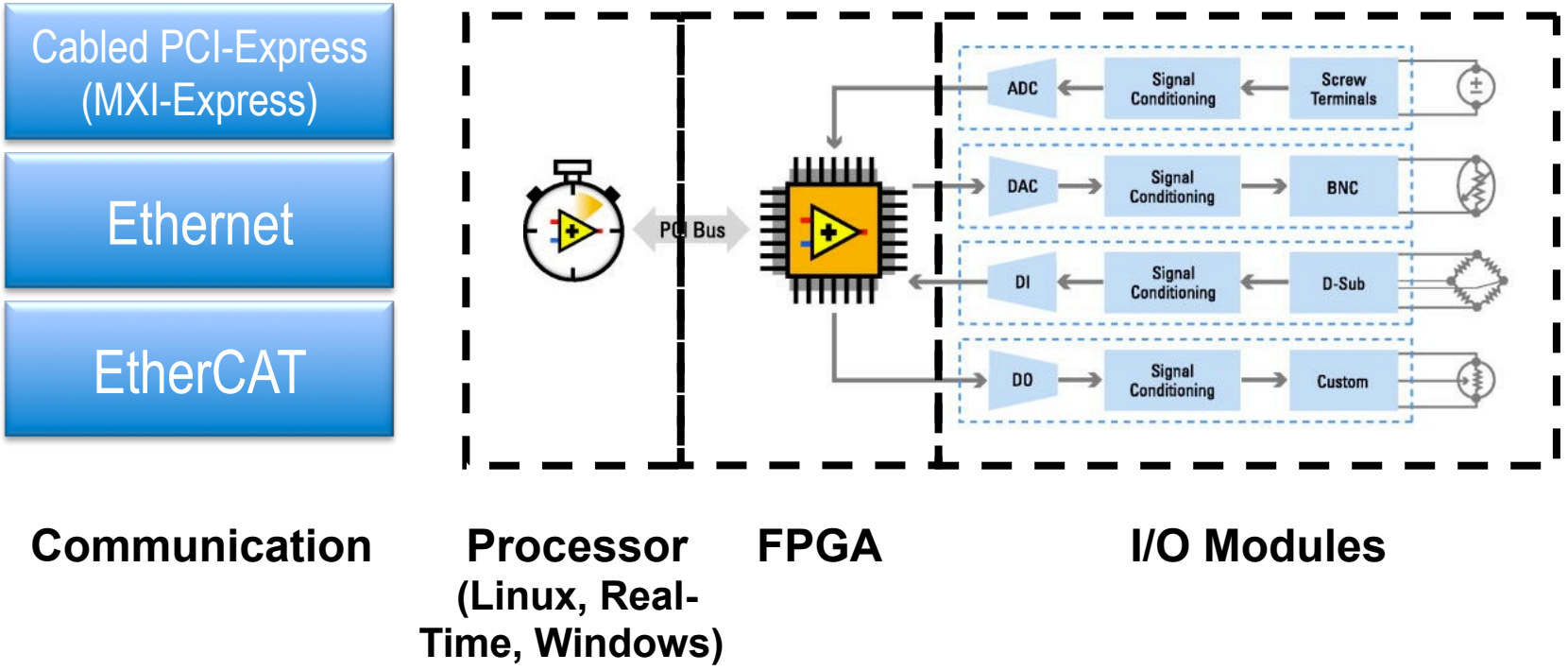
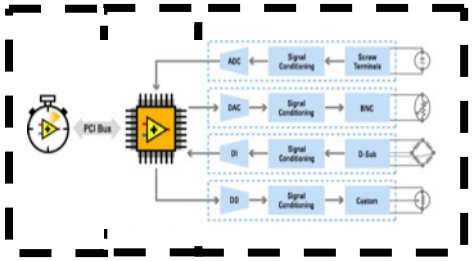
Agenda

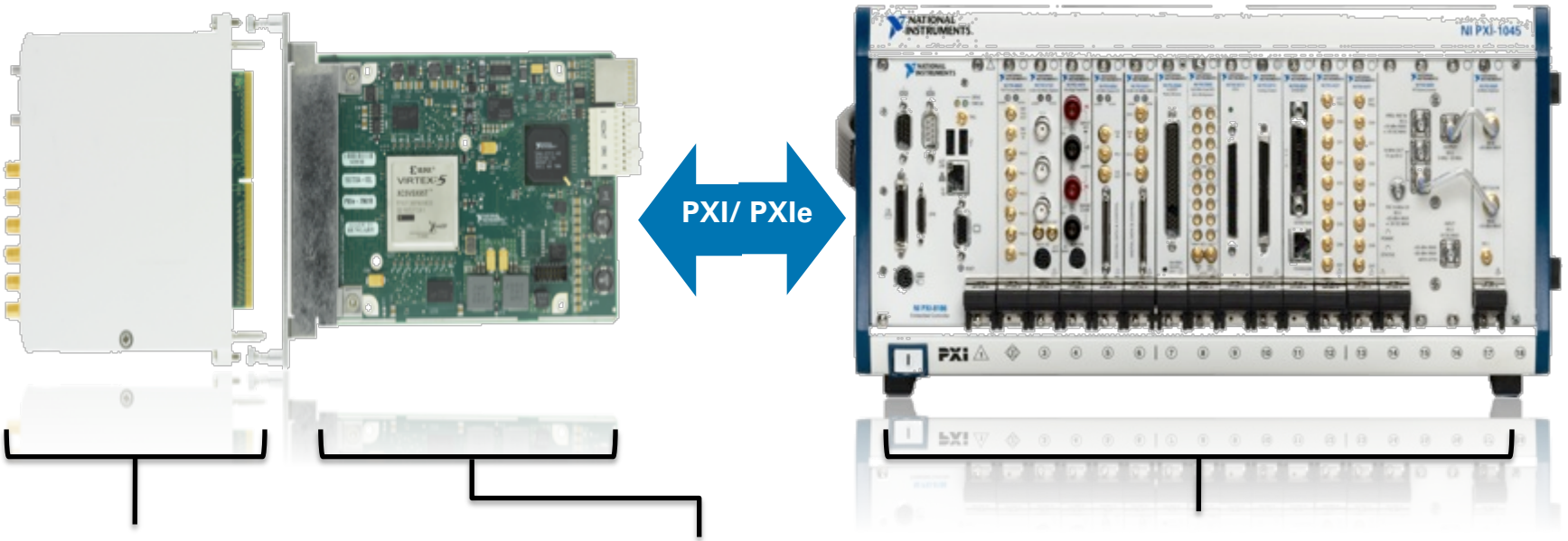
- Customized COTS (commercial of the shelf) Technology
  - Architecture
  - Integrating IP
  - Linux
- Typical COTS-Based System
  - Advantages
- Life cycle management and services

Combining COTS With Your Design
RIO Architecture



NI FlexRIO





NI FlexRIO Adapter Module

- Interchangeable I/O
- Digital or analog
- NI FlexRIO Adapter Module Development Kit (MDK)

NI FlexRIO FPGA Module

- Virtex-5 FPGA
- 132 digital I/O lines
- Up to 512 MB of DRAM
- Peer-to-peer data streaming

PXI Platform

- Data transfer
- Synchronization
- Clocking/triggers
- Power/cooling

NI FlexRIO Partner Modules and MDK

100 MHz PPMU

Camera Link and GigE

Multi-gigabit optical

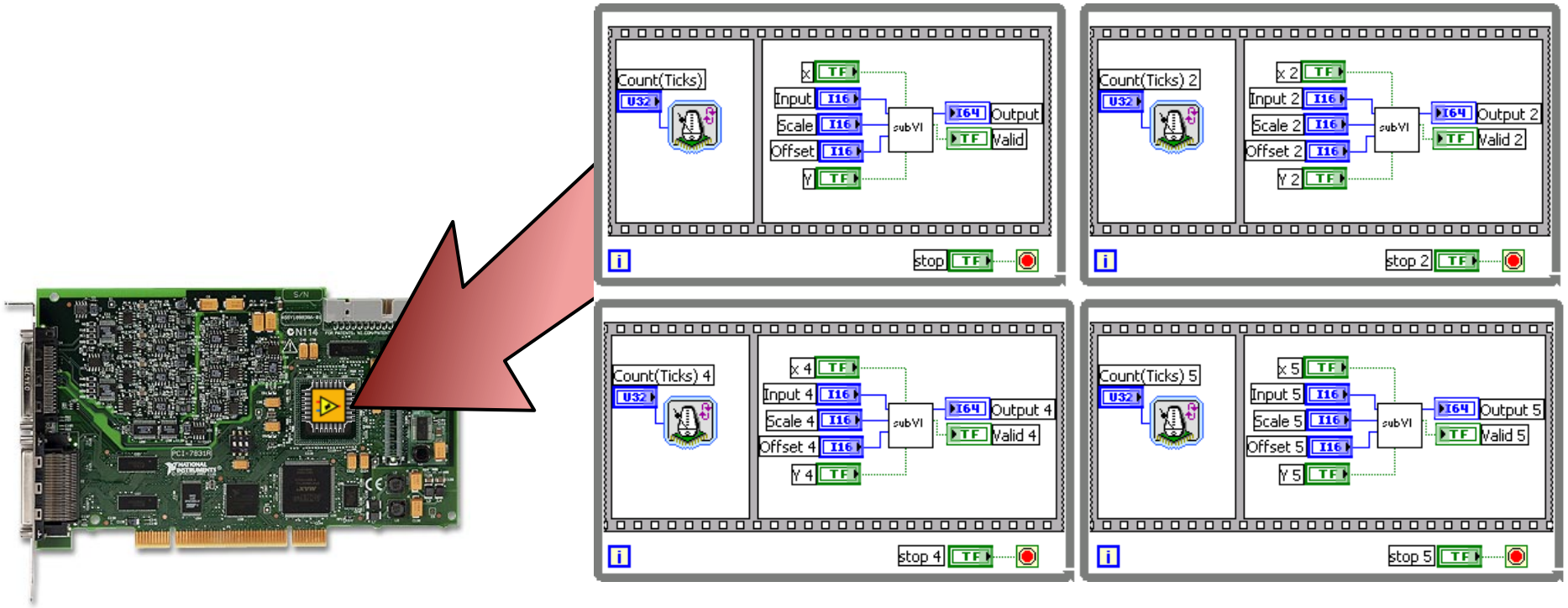
Dual gigabit Ethernet

Video and Automotive

Time to Digital Convertor

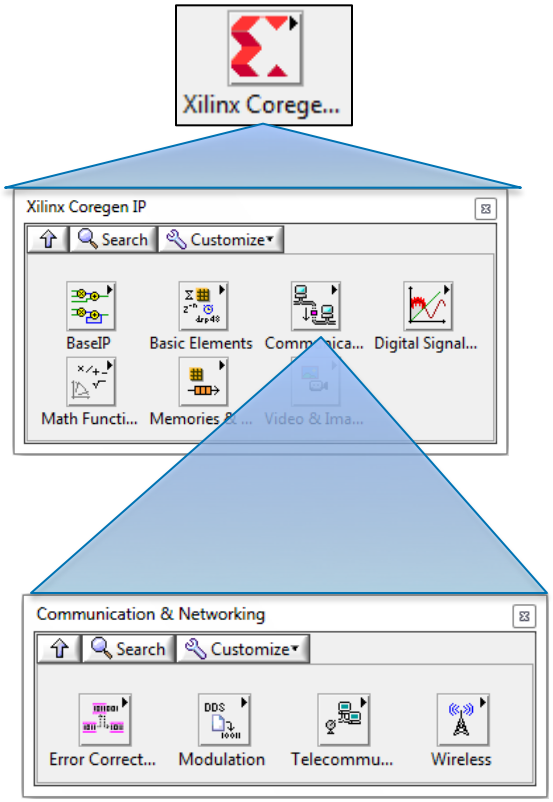
Module Development Kit

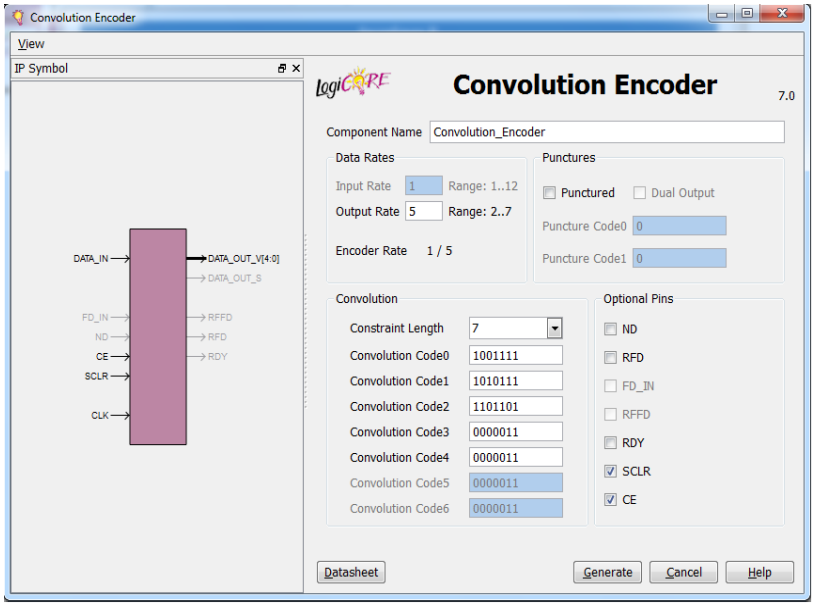
FPGA Programming:
Multicore, Multiprocessor Development

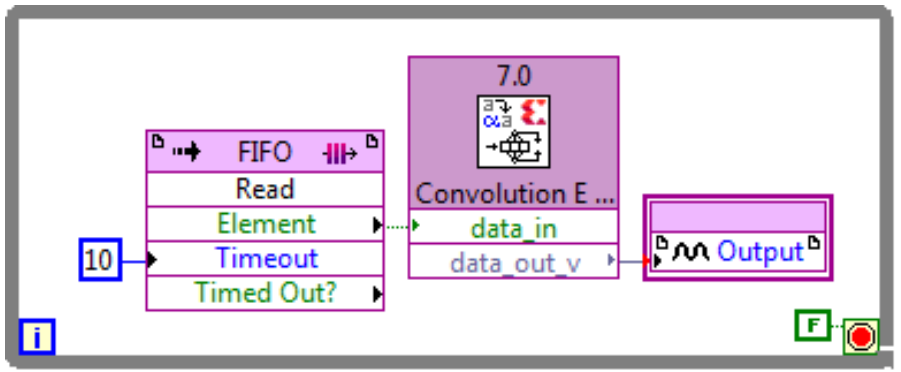


LabVIEW FPGA

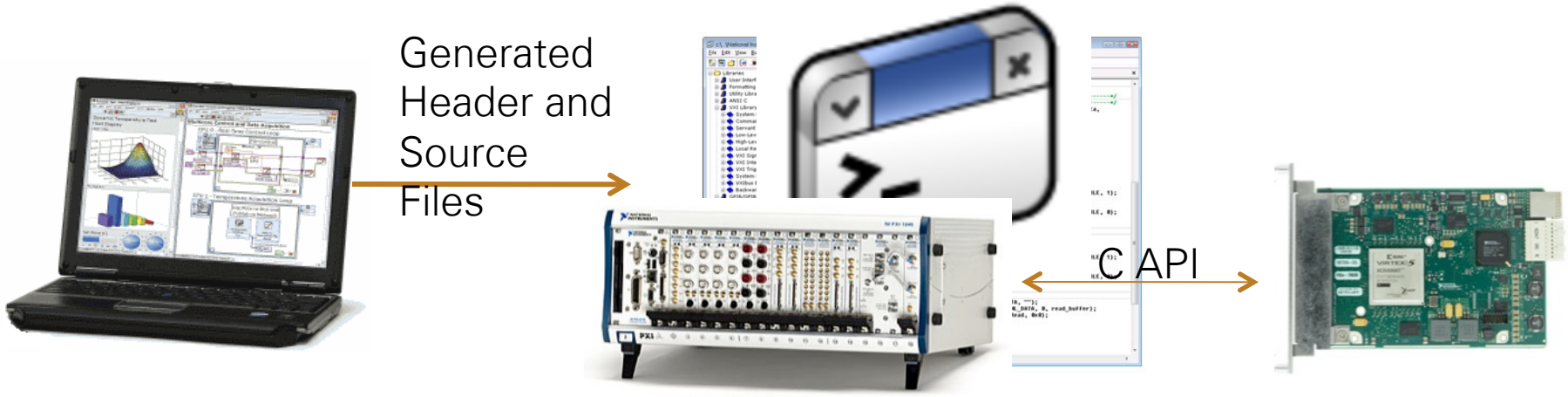
Direct Access to Preexisting Xilinx CORE Generator IP Libraries







Linux: C Interface for FPGA



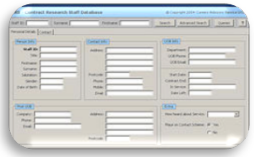
1. Develop LabVIEW FPGA VI, compile bitfile, and generate C API.
2. Develop and build C/C++ application with generated C API.
3. Deploy built application and bitfile to Linux target, and run.

Advantages of Customized COTS Architecture

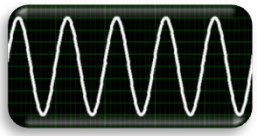
- Ability to incorporate multiple functionality in one system
- Integration with multiple timing systems
  - Event receiver/generators, White Rabbit, IEEE 1588
- Access to raw data through high performance PXIe bus
- Integration to control systems
  - EPICS, TANGO and other middleware

System Complexity : Technological

HMI



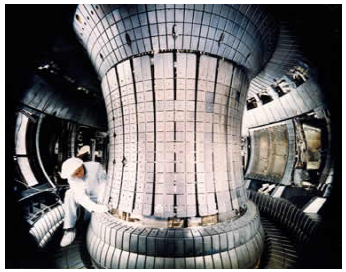
Logging, Database

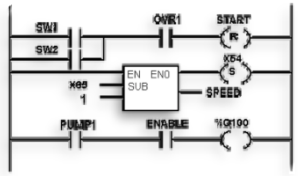


Sensors and Signal Conditioning

Mechanical Design

Networking

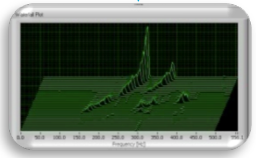




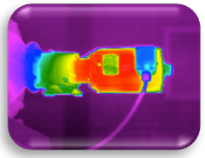
Discrete and Sequential Logic

Embedded System Design

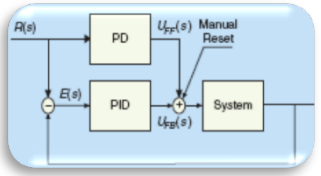
Motors and Actuators



Machine Condition Monitoring



Machine Vision



Motion Control Design

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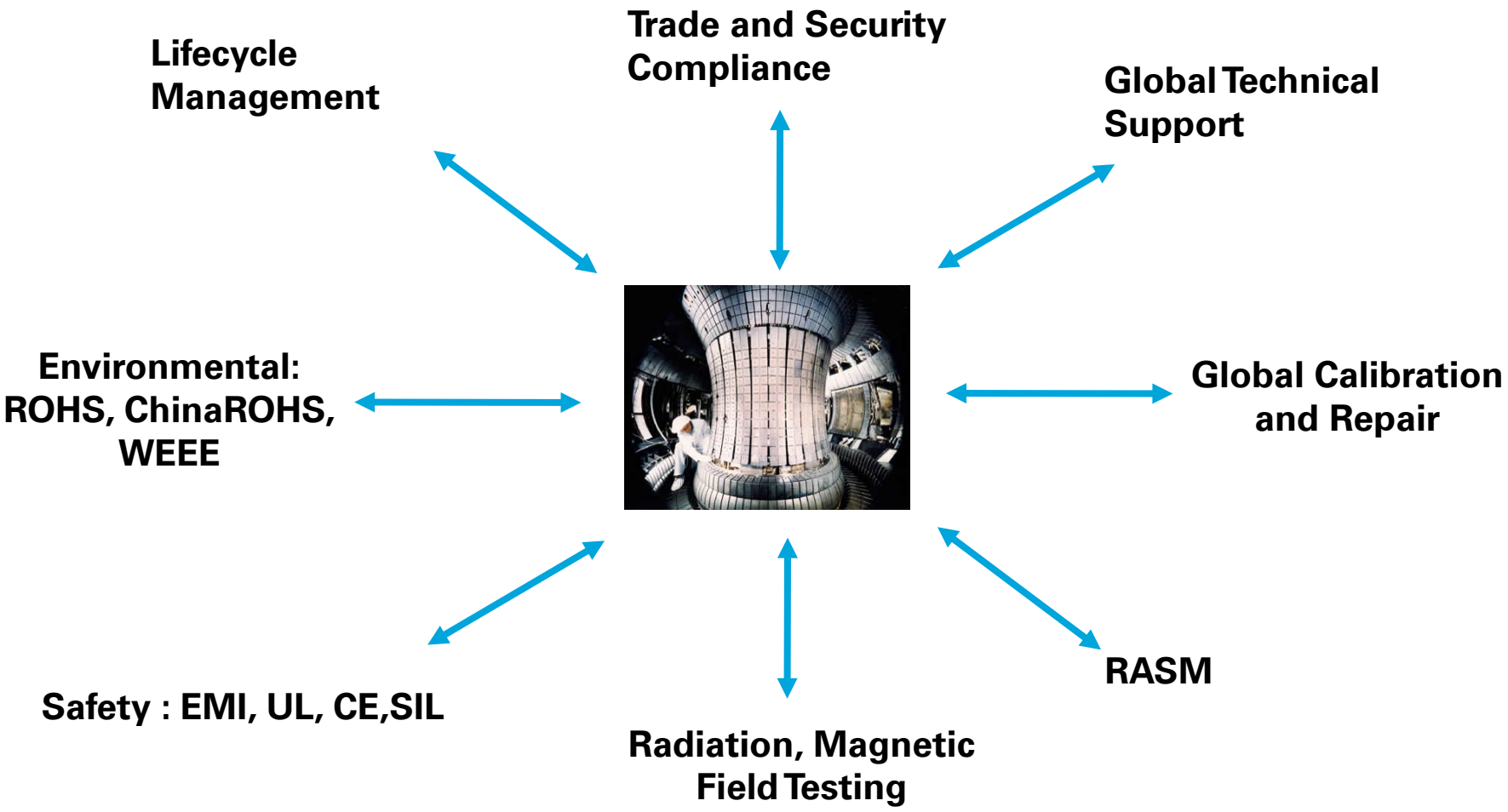
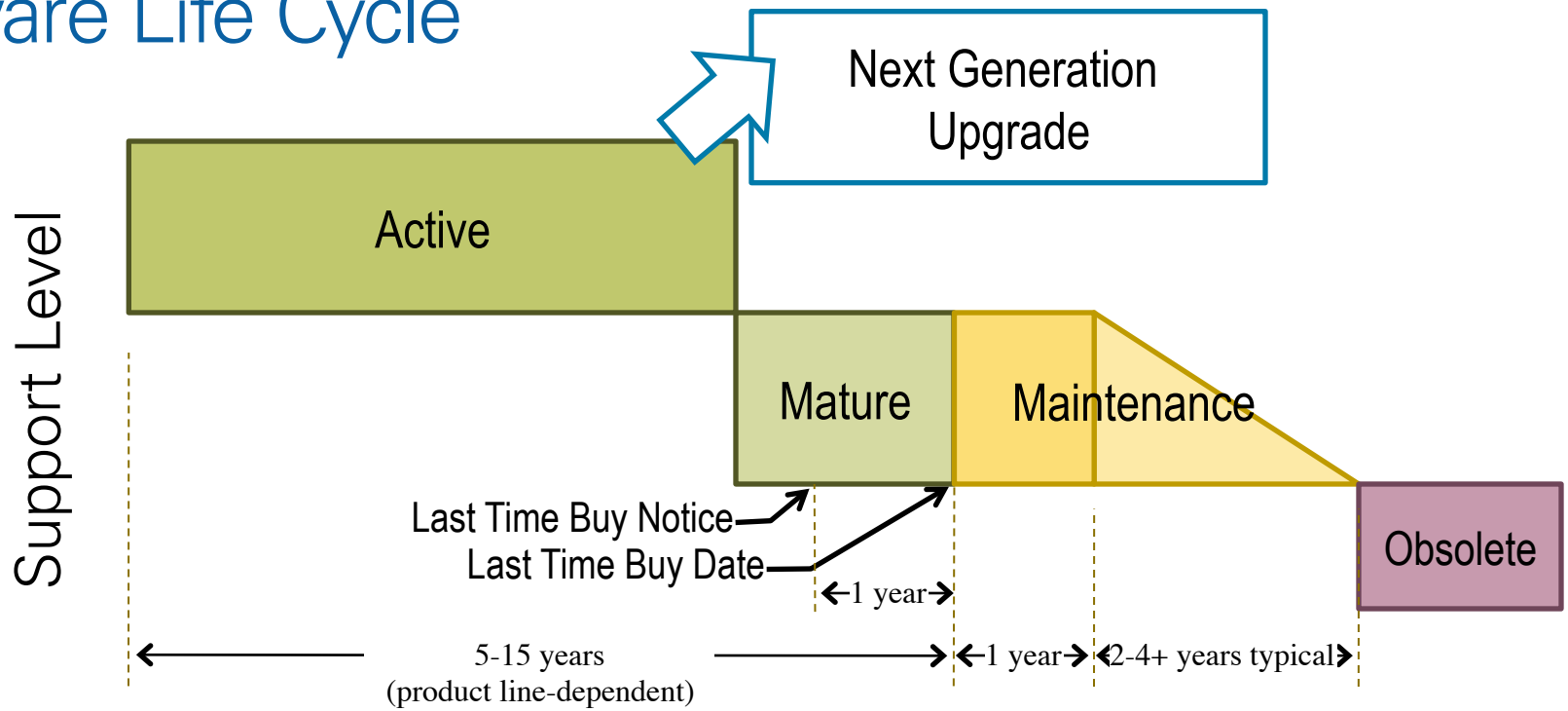
System Complexity : Logistical



Reliability Lab Testing

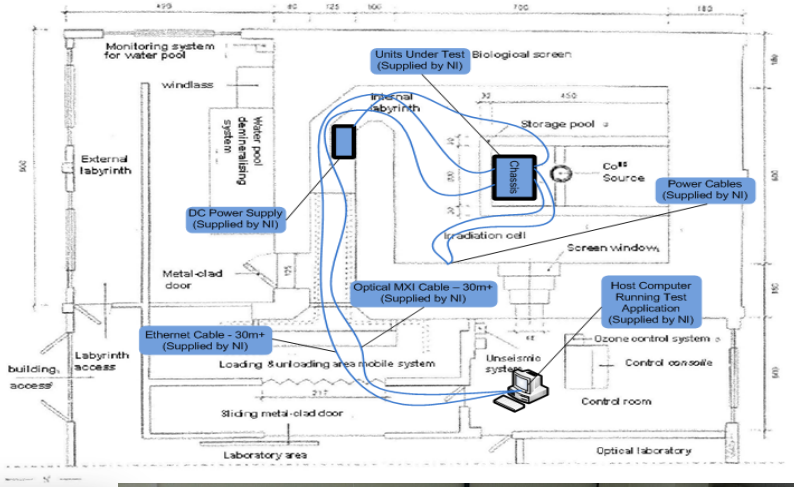
- 24/7 testing of multiple systems for years
- Temperature variation, vibration, `dirty power' testing

Hardware Life Cycle



	Active	Mature	Maintenance		Obsolete
Purchase new	Yes	Yes	No	No	No
Repair	Yes	Yes	Yes	Reasonable effort	No
Calibration	Yes	Yes	Yes	Reasonable effort	No
Service Agreements	Yes	Yes	Yes	Yes	Yes

Gamma and Neutron Testing



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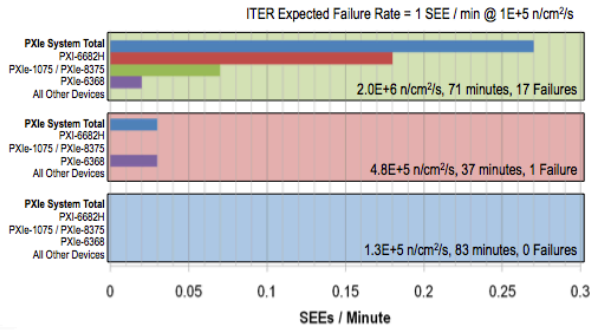
Results Published

PXIe SEEs per min – Neutron Test Summary



cRIO and PXIe systems ran at 1.3e5 n/cm²/s for 83 minutes with no errors

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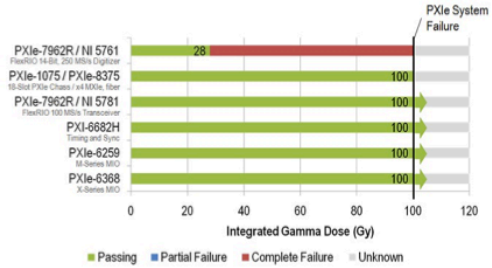
PXIe System Gamma Irradiation Test Summary



- Most (1 PXI / 1cRIO) failed devices exceeded expected failure dose of 50Gy
- More than half of the devices exceeded the maximum expected failure dose of 100 Gy

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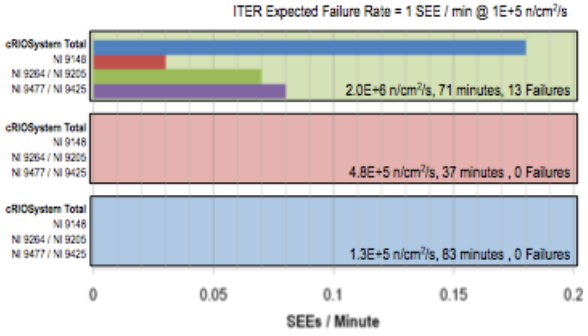
cRIO SEEs per Minute



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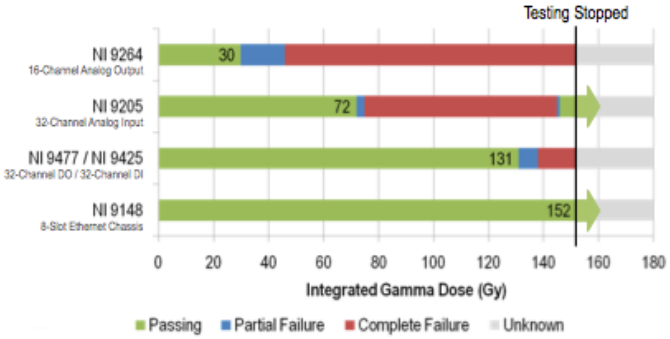
cRIO System Irradiation Test Summary



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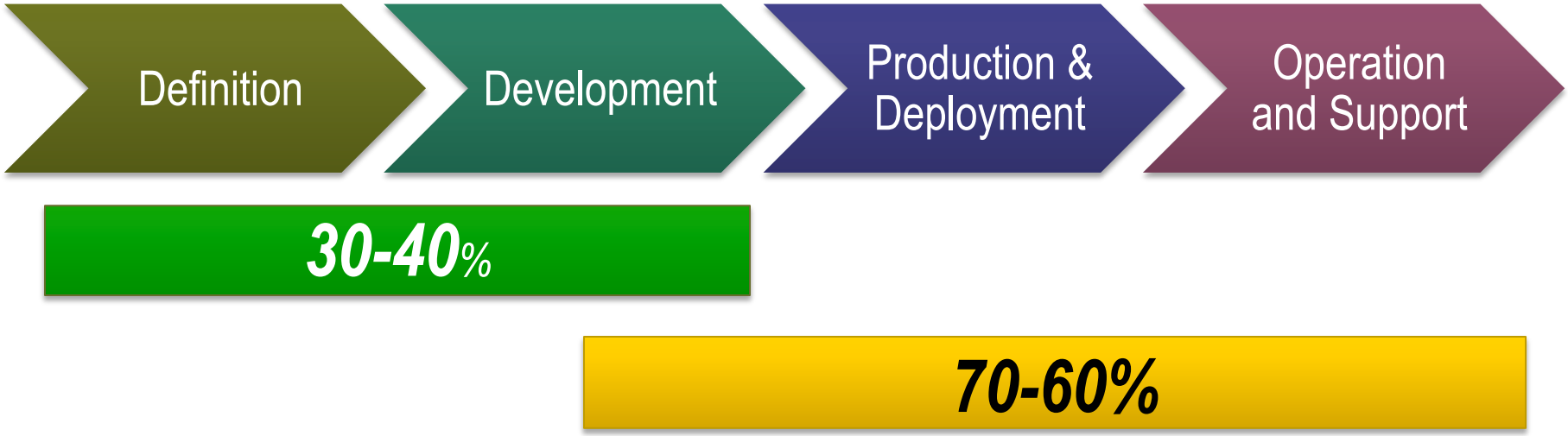
Cradle to Grave Investment



Summary

- Varying application requirements
- FPGA-based architecture allows for user customization
  - FlexRIO provides open architecture
  - User programmable FPGA's with LabVIEW FPGA
- Scalability
  - Integration with control and timing systems
- Life cycle management and services
  - Reliability and availability lab
  - Special radiation and magnetic testing