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WORLDWIDE GRAPHICAL SYSTEM DESIGN
CONFERENCES

NATIONAL INSTRUMENTS

Parallel Technologies for a New Generation of Applications

Eric Starkloff

Vice President – Product Marketing

NIDays 2009

Engineering Grand Challenges

Make solar energy economical

Provide energy from fusion

Develop carbon sequestration methods

Manage the nitrogen cycle

Provide access to clean water

Restore and improve urban infrastructure

Advance health informatics

Engineer better medicines

Reverse-engineer the brain

Prevent nuclear terror

Secure cyberspace

Enhance virtual reality

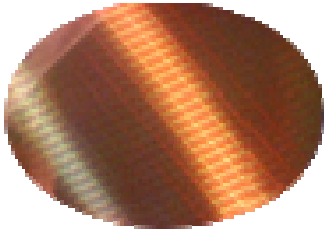
Advance personalized learning

Engineer the tools of scientific discovery

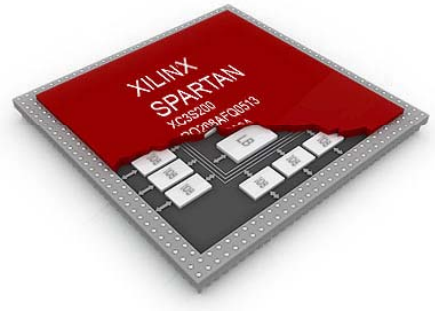
Source: www.engineeringchallenges.org

Today's Technology: Core Value

Multicore



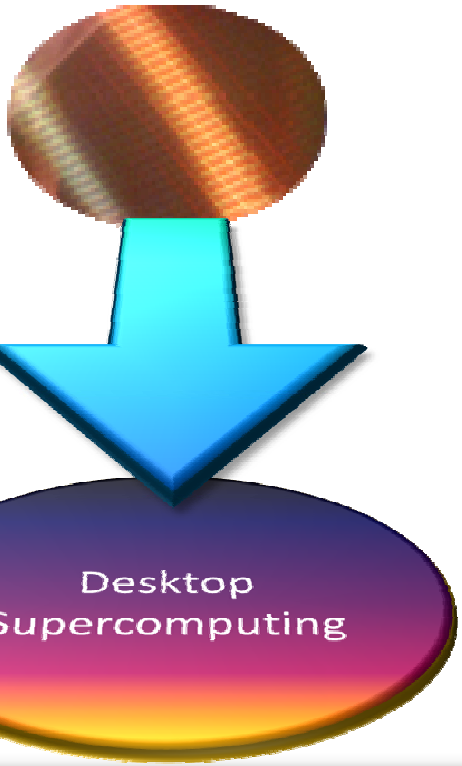
FPGA



Modular I/O

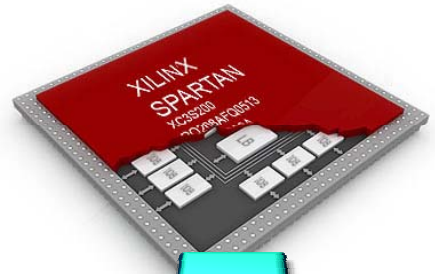
Today's Technology Potential

Multicore



Desktop Supercomputing

FPGA



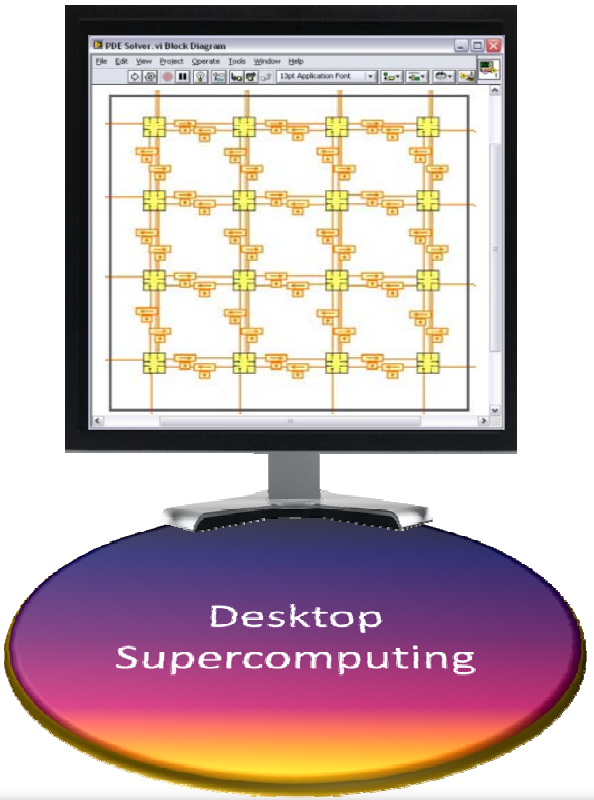
Rapid Embedded Development

Modular I/O

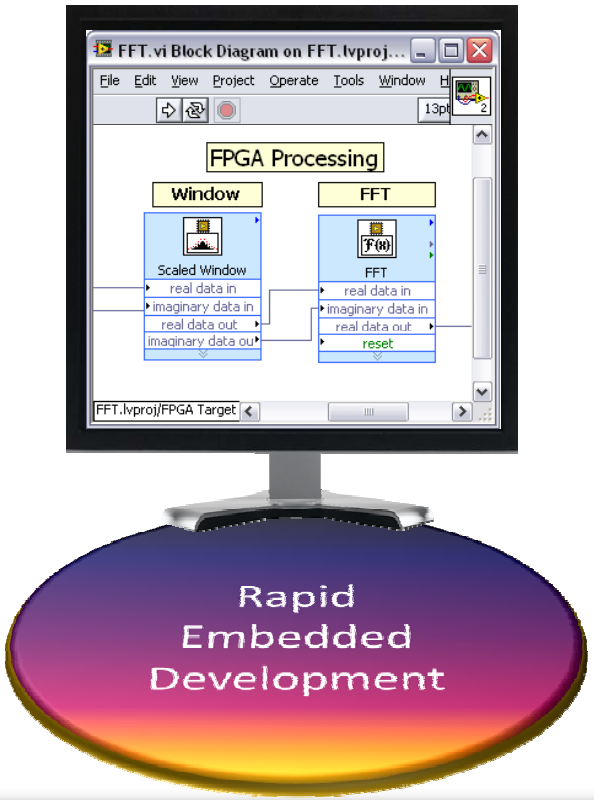
High Performance Interaction

Access through Graphical Programming

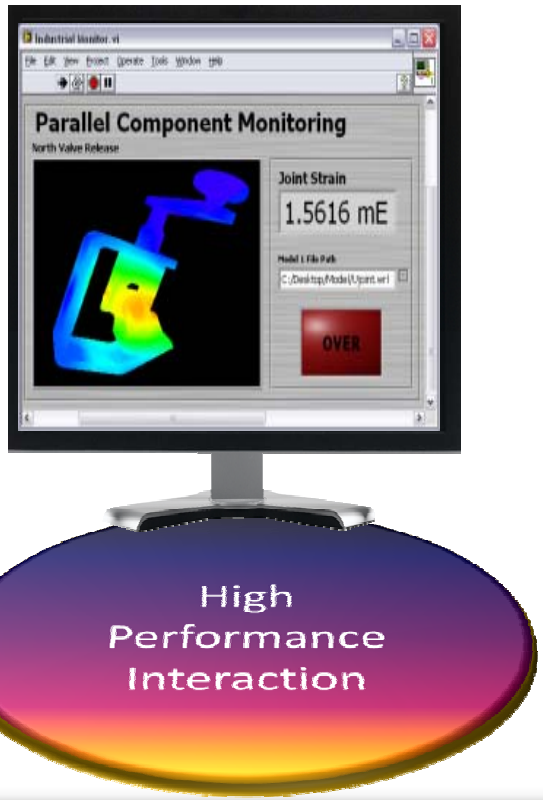
Multicore



FPGA

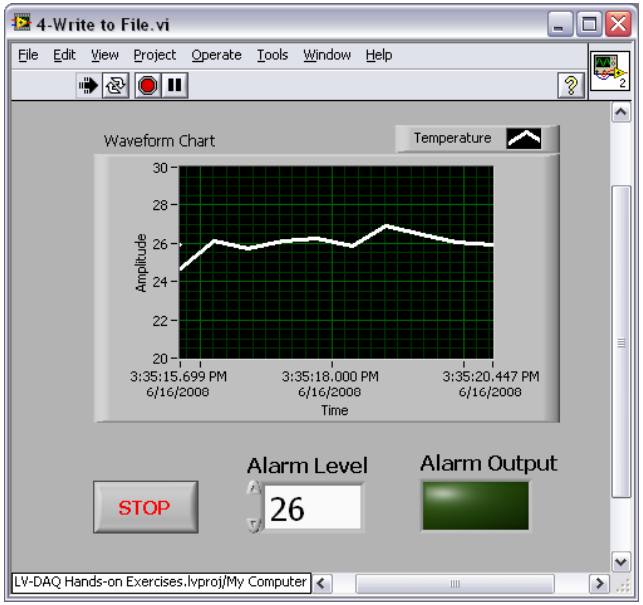


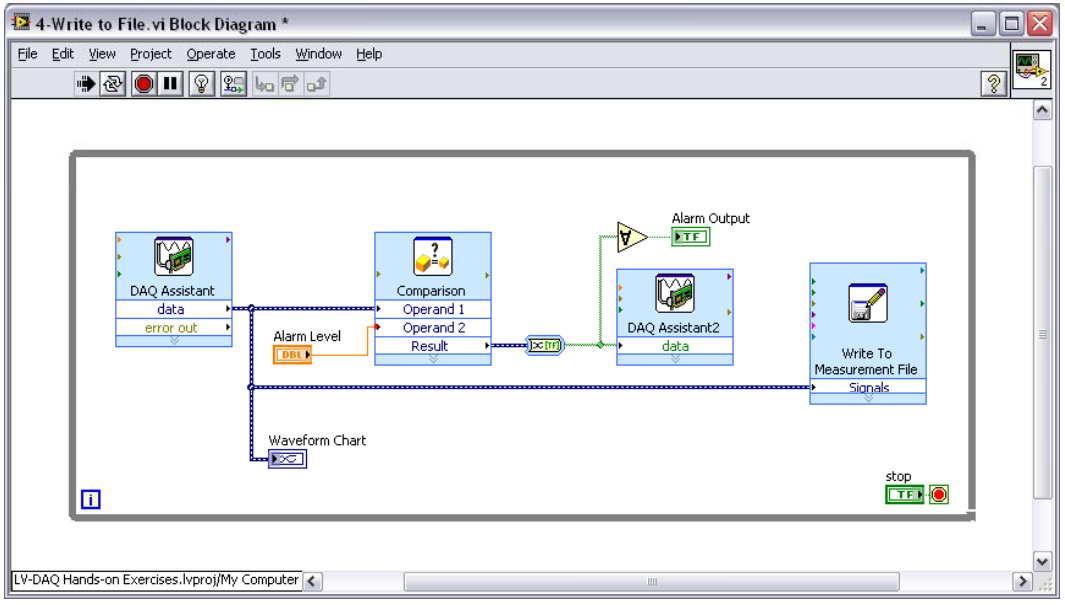
Modular I/O



Simplifying Design of Complex Engineering Systems

- Graphical programming
  - Symbolic Functionality
  - Dataflow
  - Hierarchical
  - Interactive
  - Inherent User Interface



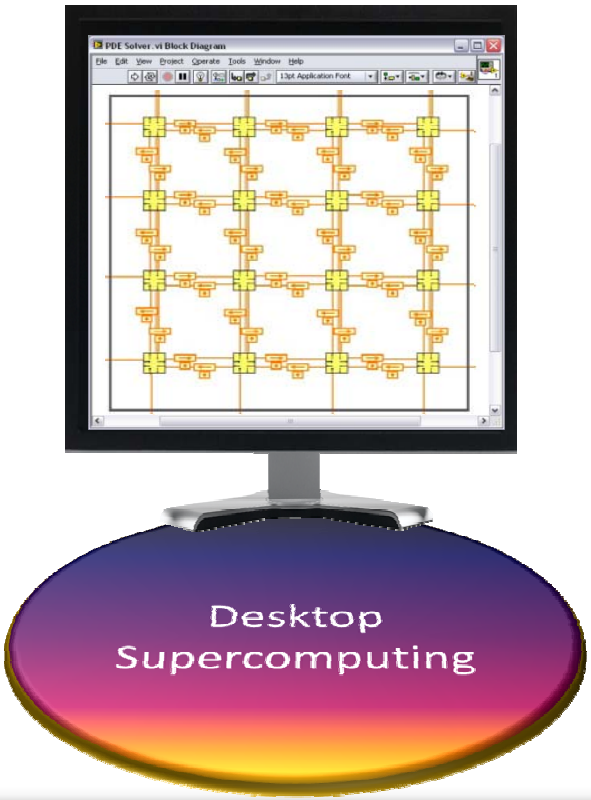


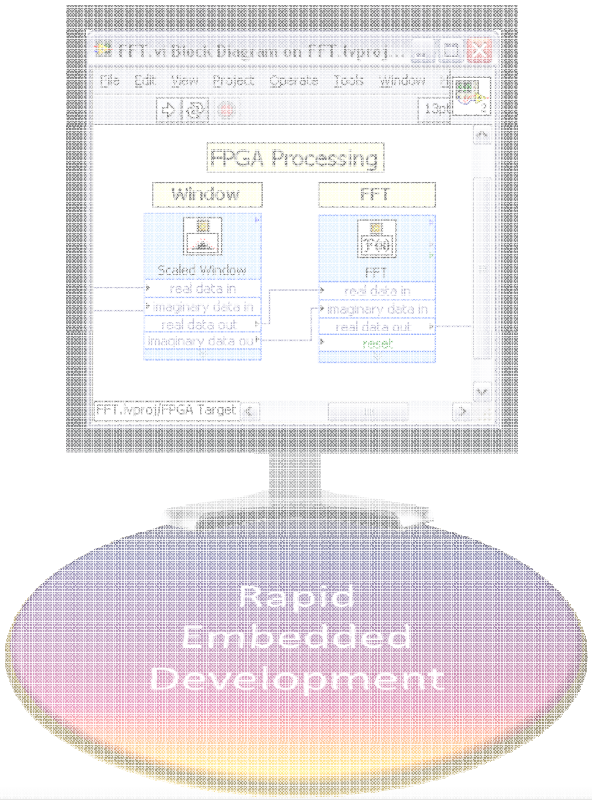
Access through Graphical Programming

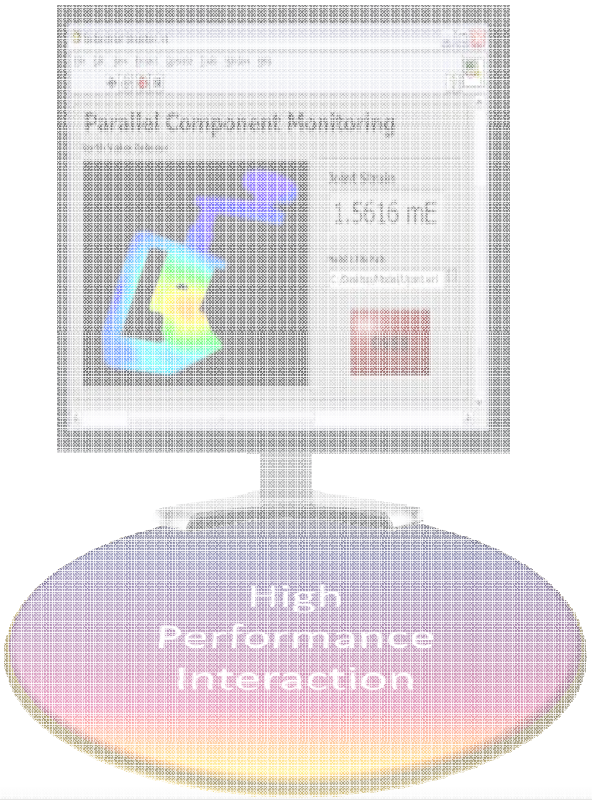
Multicore

FPGA

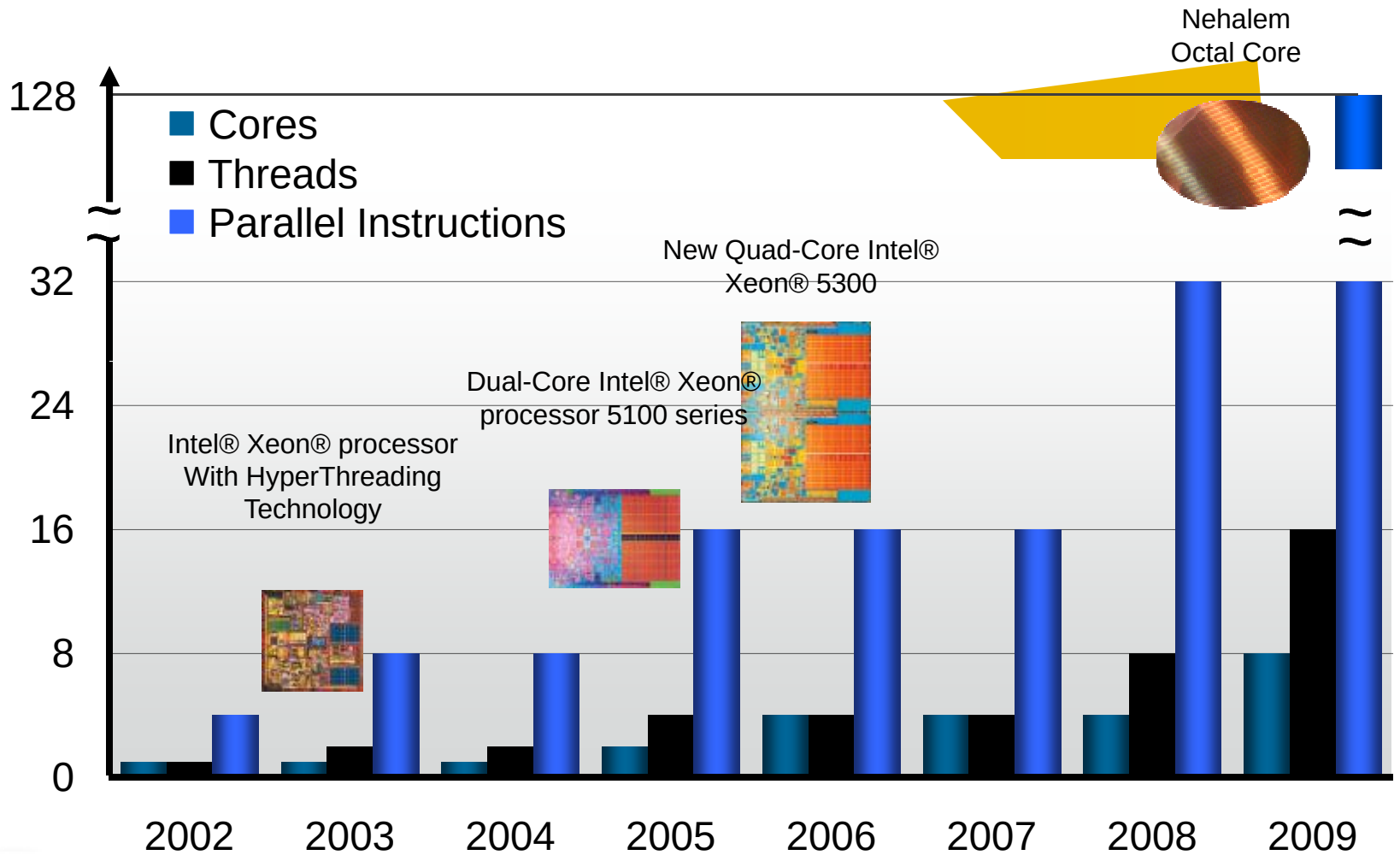
Modular I/O





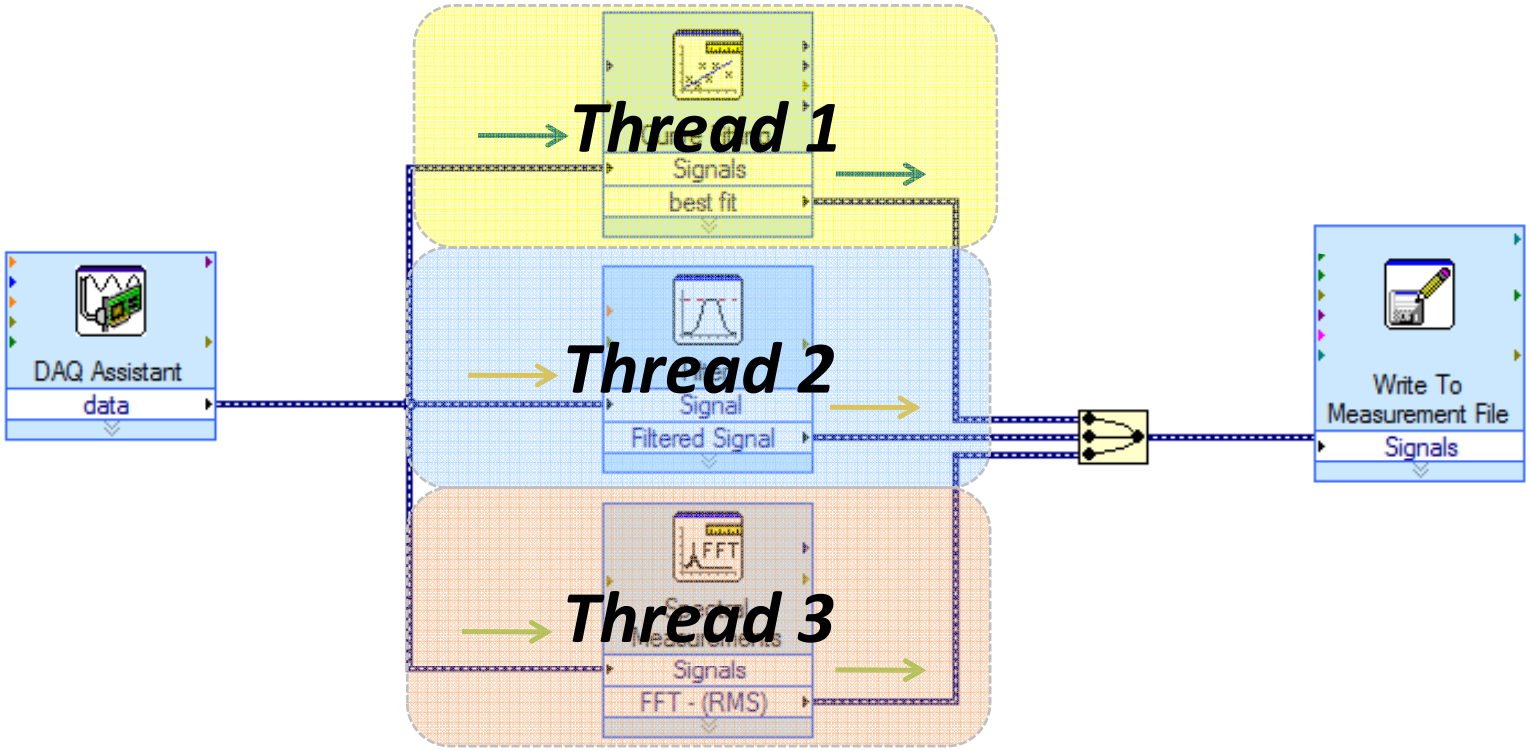


Multi-core: Scalable Parallel Processing



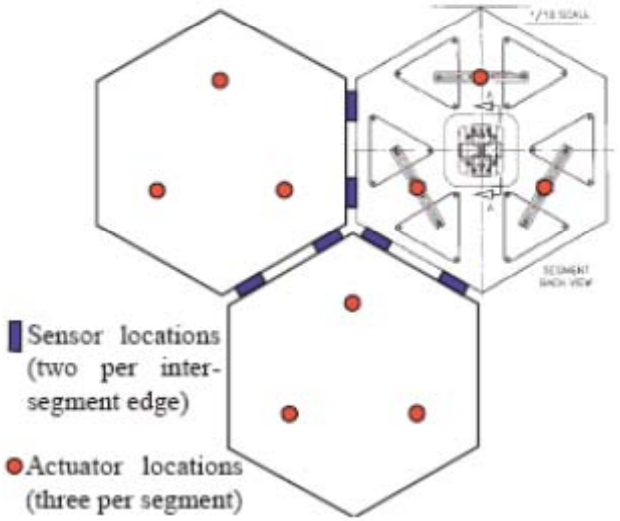
Courtesy: Intel Corporation

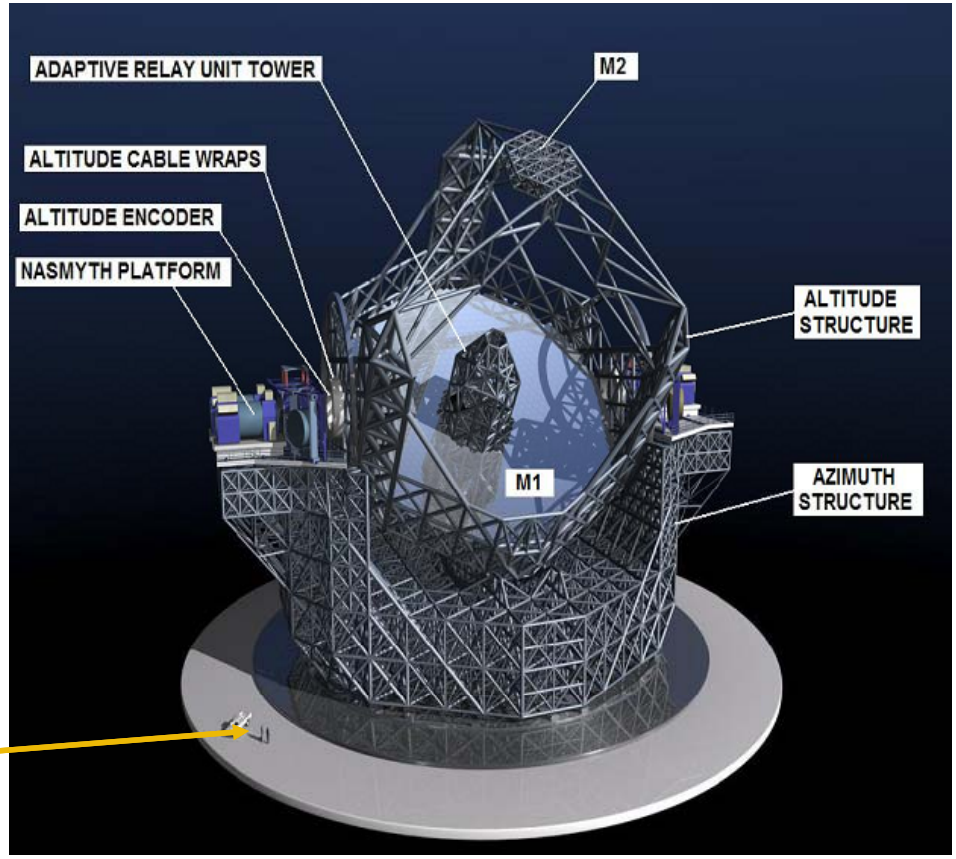
Realizing the Potential:
Inherent Access to Automatically Scalable Parallelism



10 Year Anniversary of Multithreading

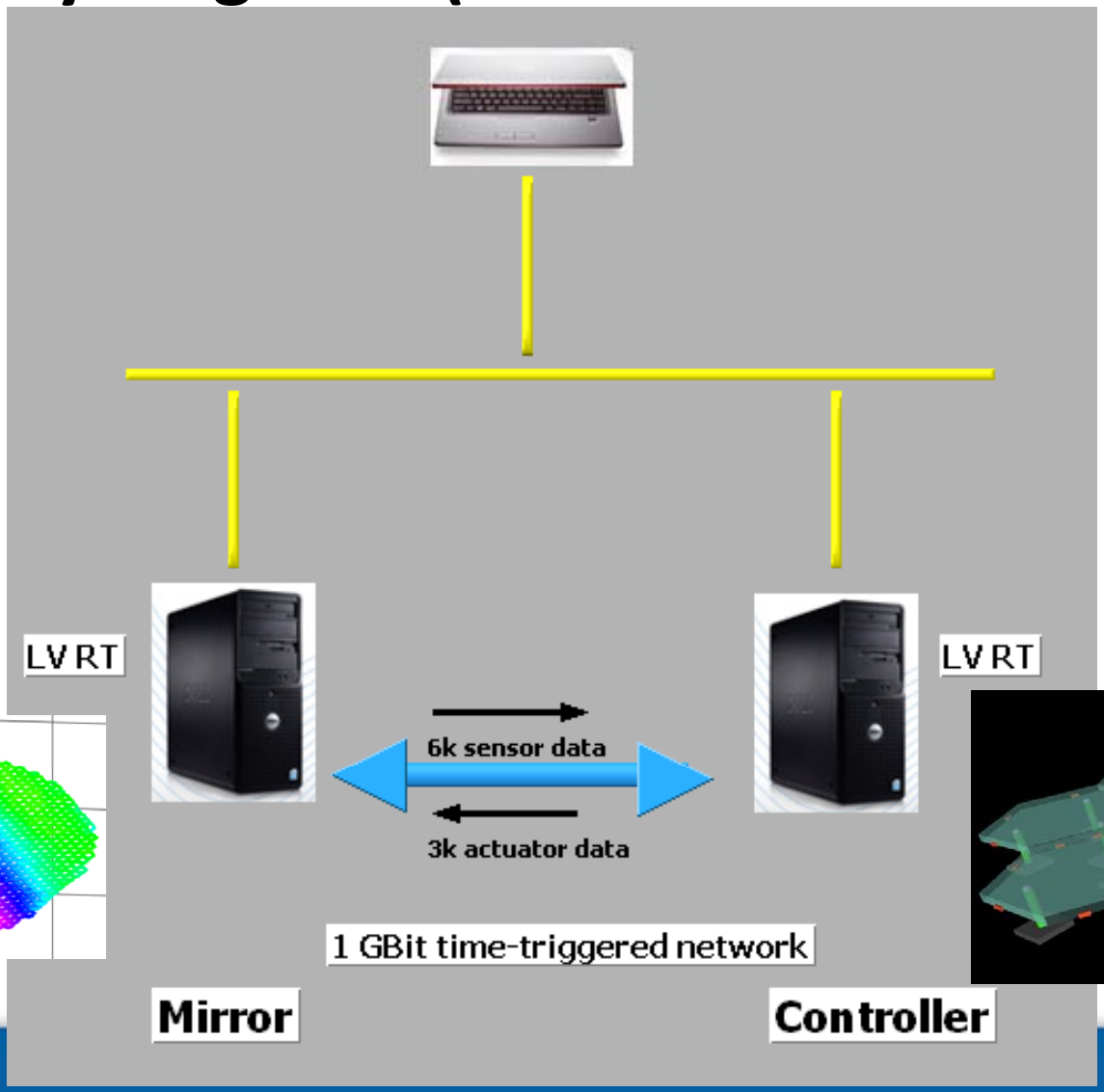
Extremely Large Telescope

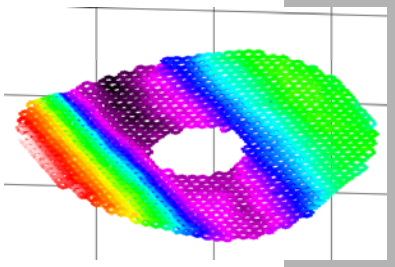


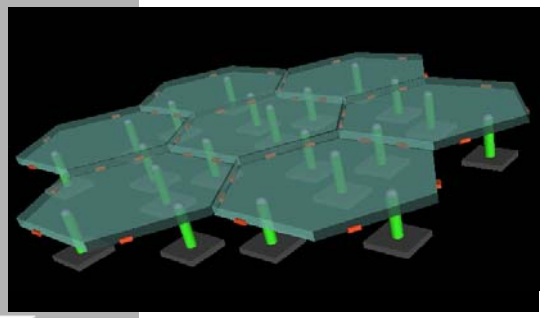


Physicists are getting smaller these days!

Demonstration:
Extremely Large HIL (Hardware-In-The-Loop)





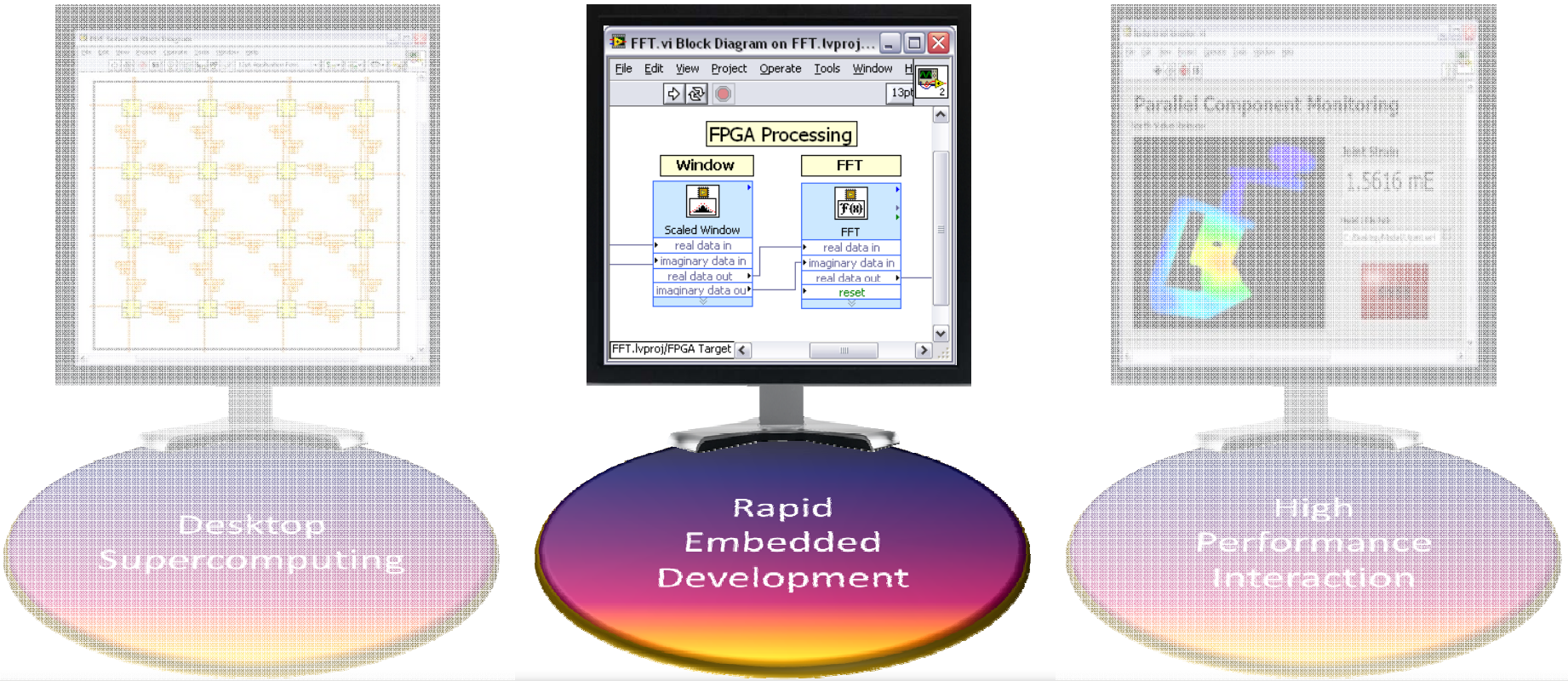


Access through Graphical Programming

Multicore

FPGA

Modular I/O



Advances in FPGA Technology

Size

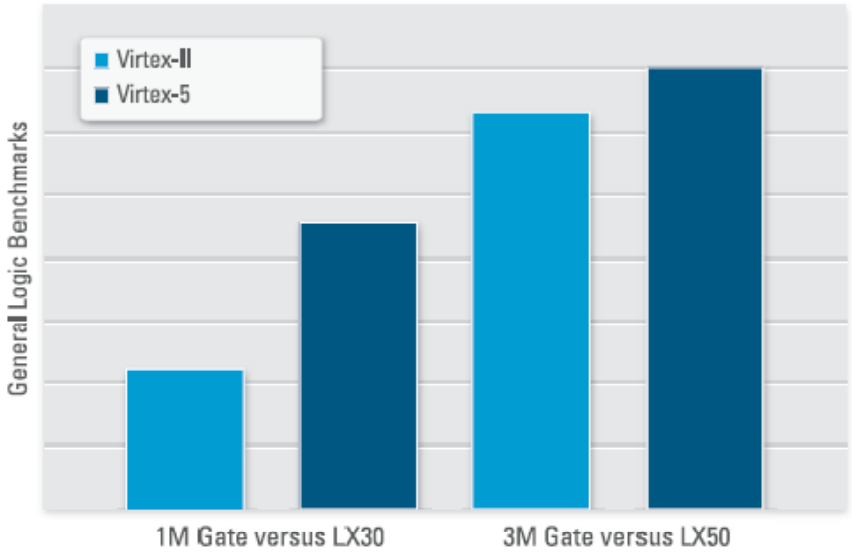


Figure 1. General logic benchmarks show that Virtex-5 FPGAs offer larger sizes when compared to Virtex-II FPGAs.

Speed

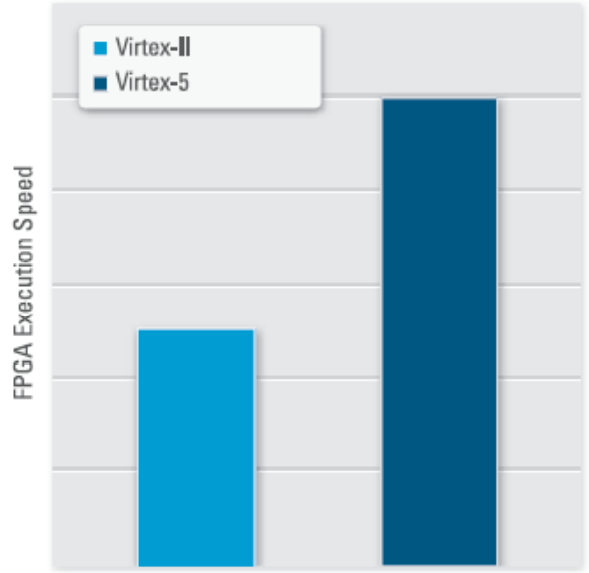


Figure 2. Execution speed benchmarks show that Virtex-5 FPGAs feature faster processing capabilities when compared to Virtex-II FPGAs.

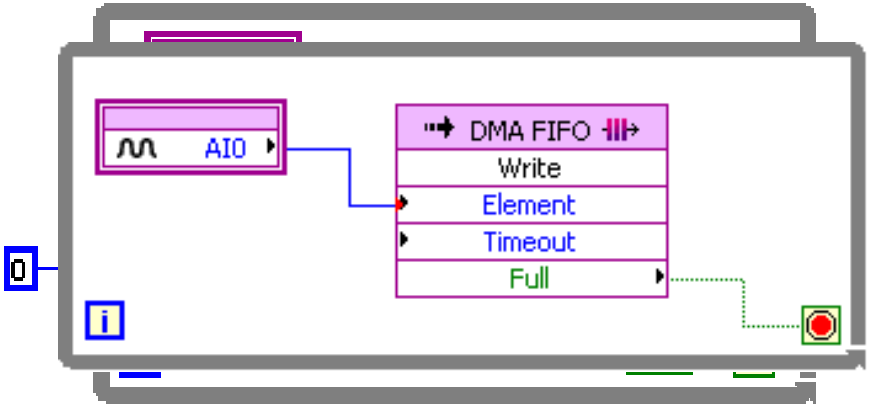
Realizing the Potential

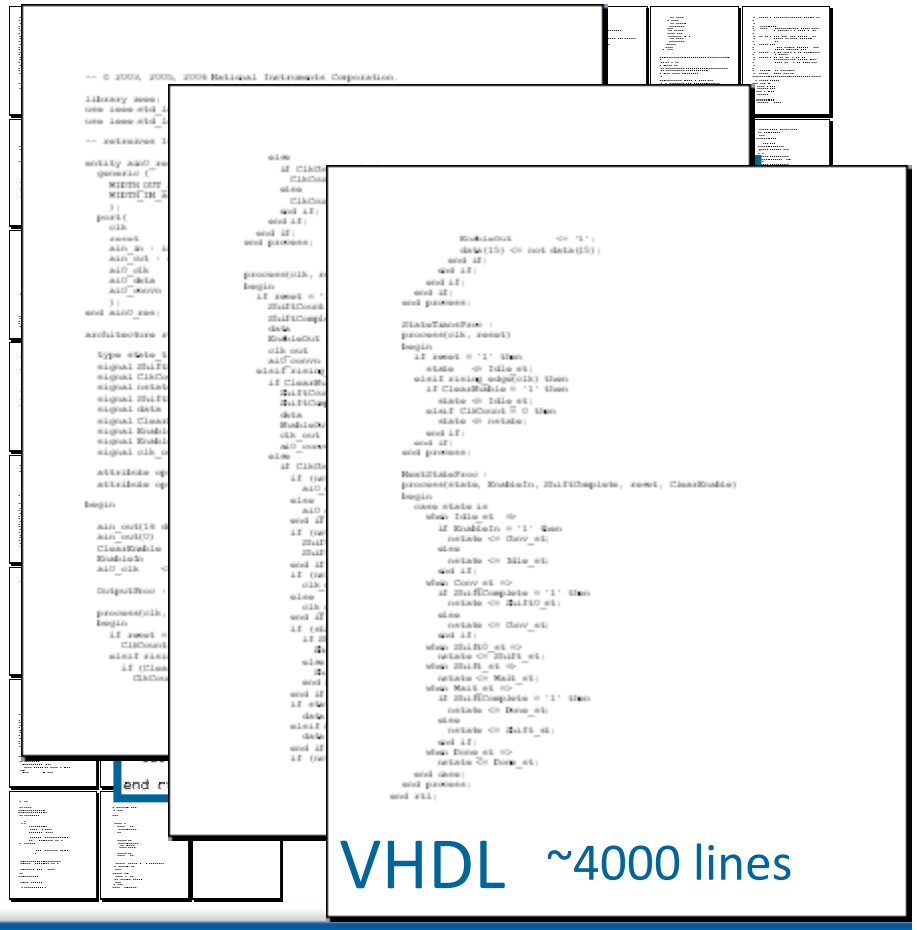
Simplifying Access to FPGAs

Counter

Analog I/O

I/O with DMA

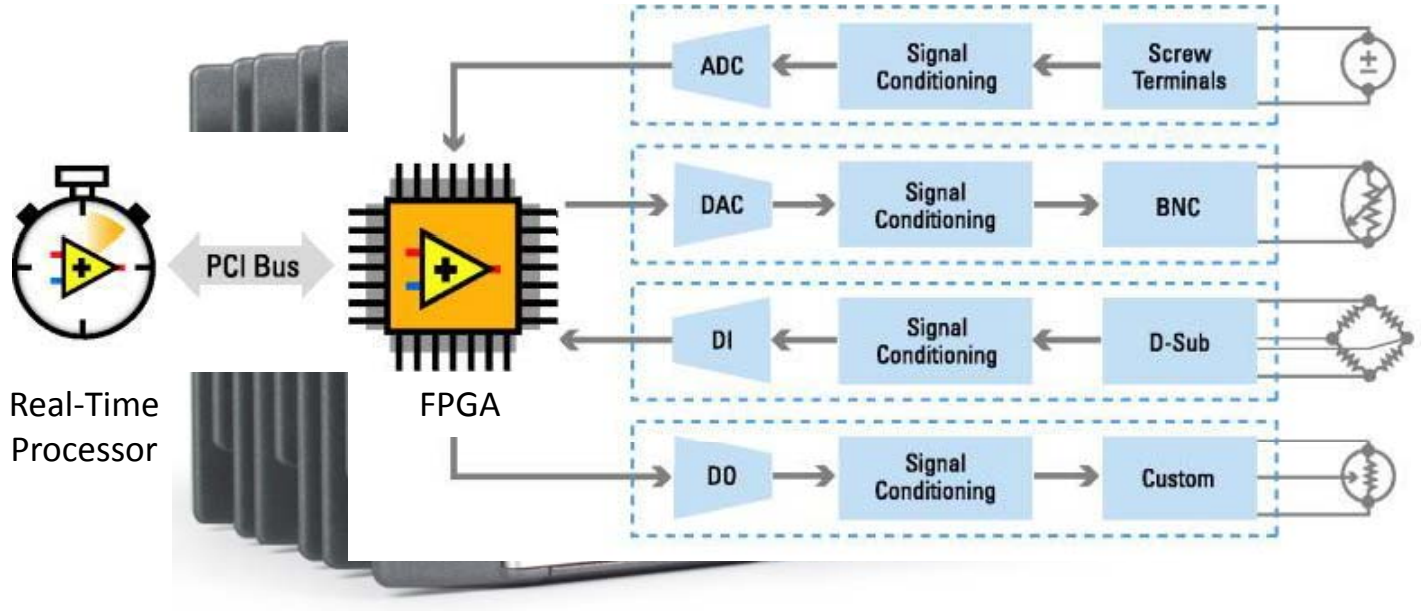




LabVIEW FPGA

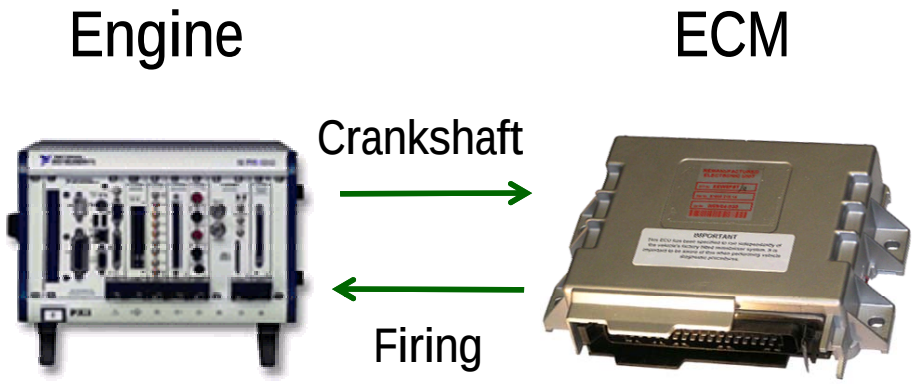
VHDL ~4000 lines

FPGA: Architectures
CompactRIO



- **Reconfigurable FPGA** for high-speed and custom I/O timing, triggering, and control
- **I/O modules** with built-in signal conditioning for connection to sensors/actuators
- **Real-time processor** for reliable measurement, analysis, connectivity, and control

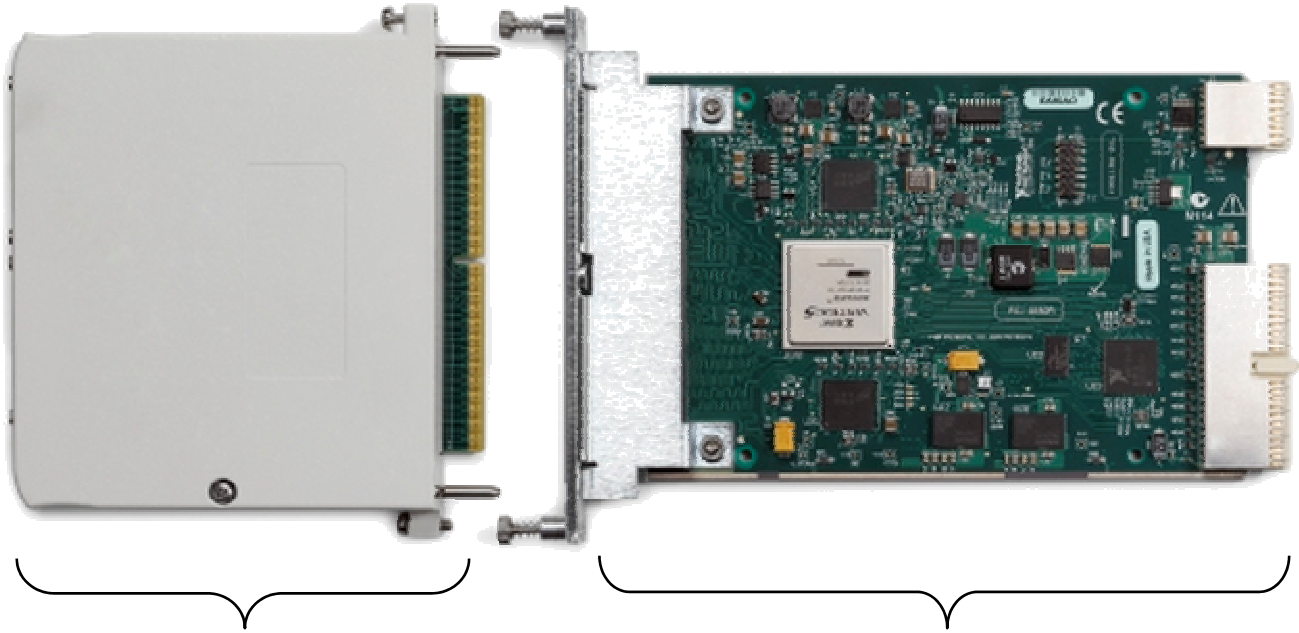
Demanding Test Methodologies



- Hardware-in-the-loop (HIL) test requires fast and deterministic I/O response
- Intelligence embedded into the hardware

FPGA Architectures

FlexRIO

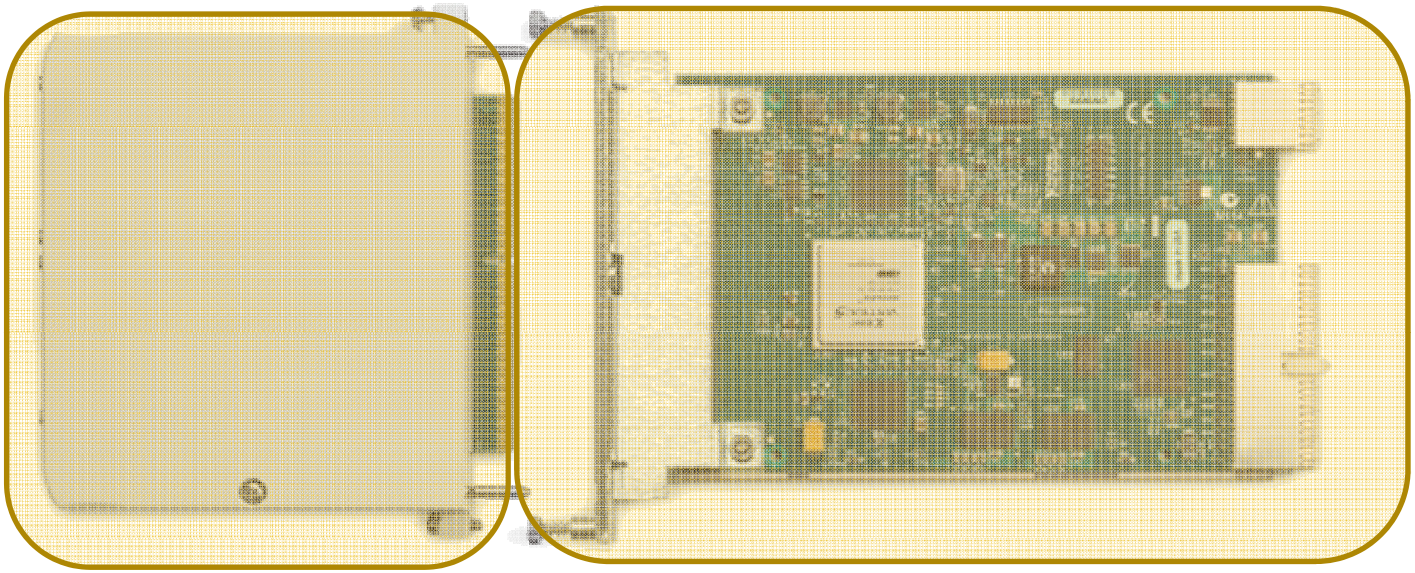


NI FlexRIO Adapter Module
- 64 DIO pairs at 1 Gbs
- Conditioning and connectivity

NI FlexRIO FPGA Module
- High speed PCI interface
- Virtex-5 FPGA
- Up to 128 MB of DDR2 DRAM

FPGA Architectures

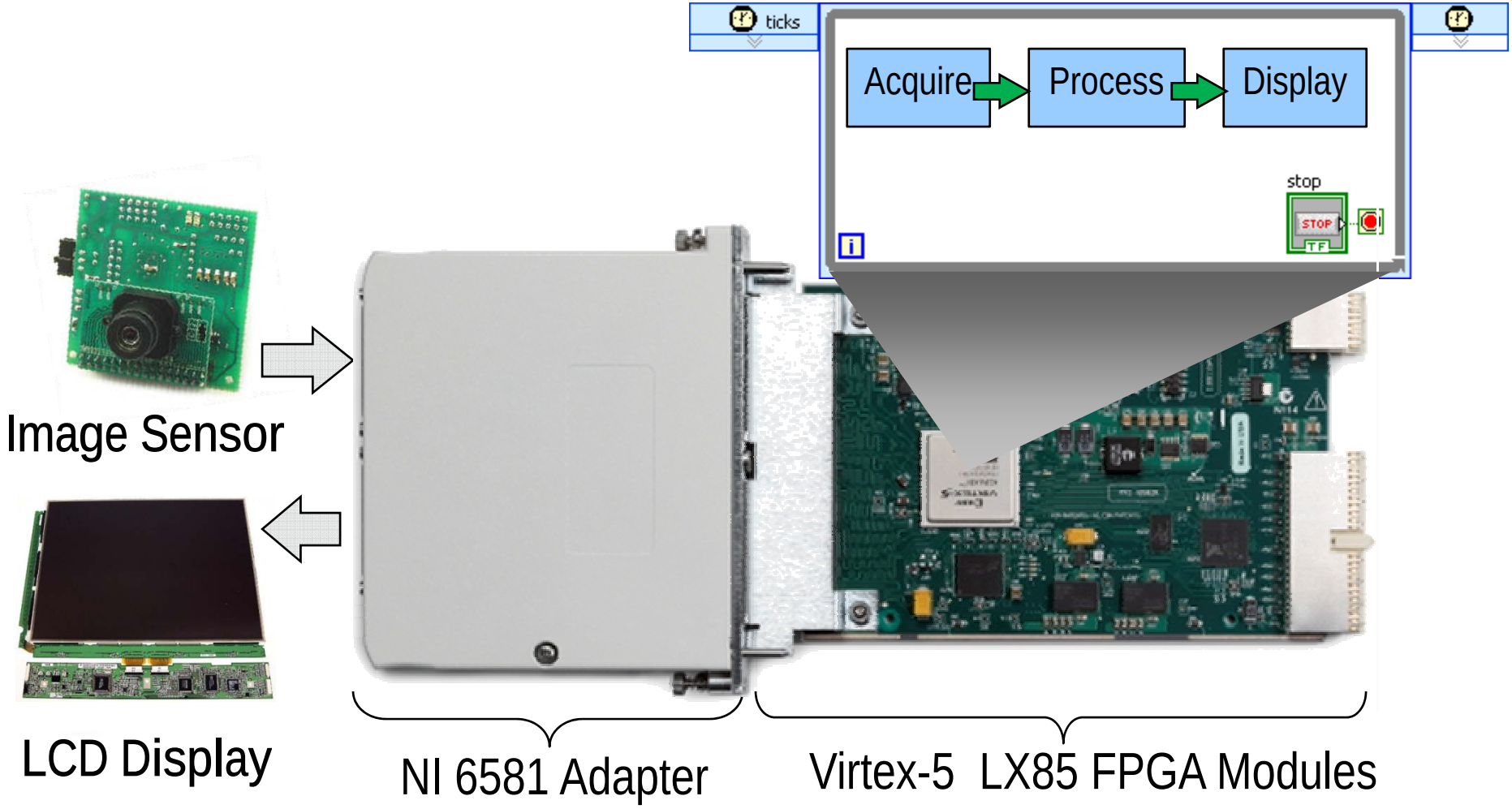
FlexRIO



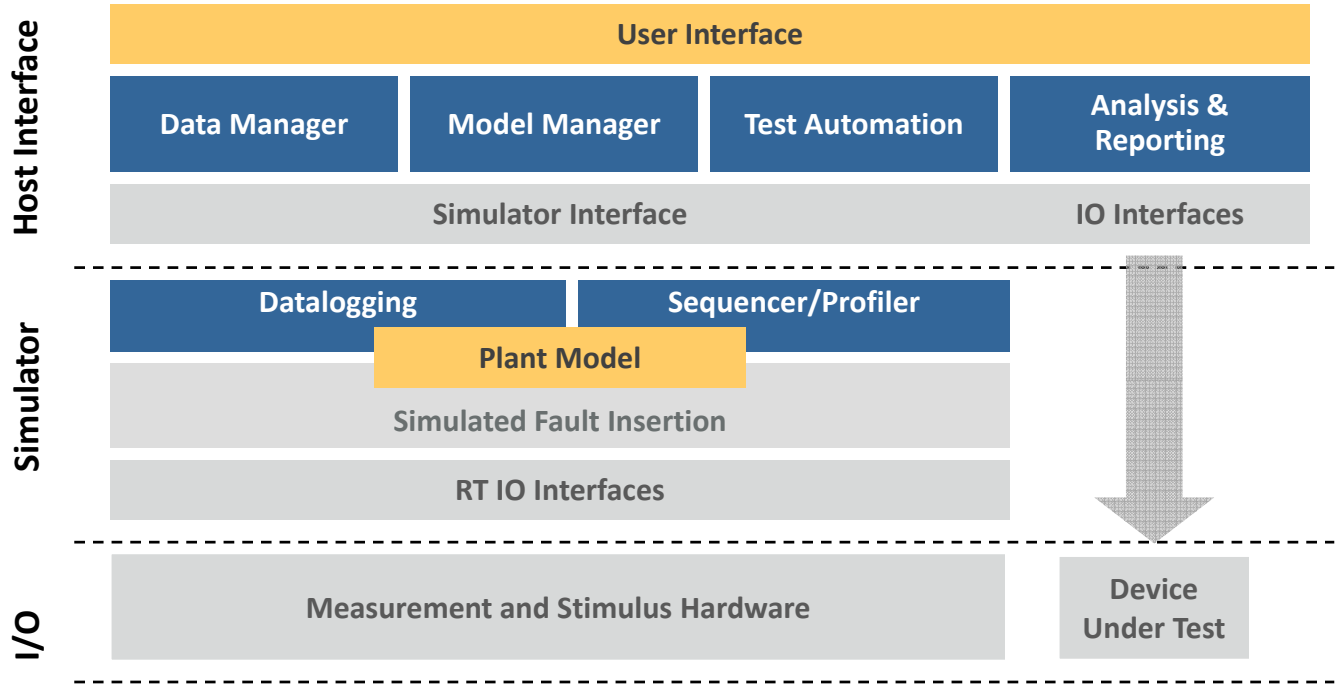
NI *or* Custom Adapter Module
- Interchangeable I/O
- Customizable by users through Adapter Module Development Kit

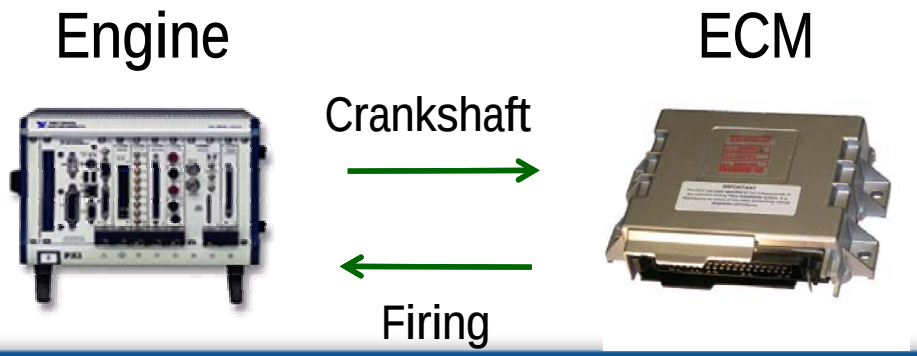
•NI Hardware with Custom Software/Firmware

Demonstration:
FlexRIO Real-time Image Processing



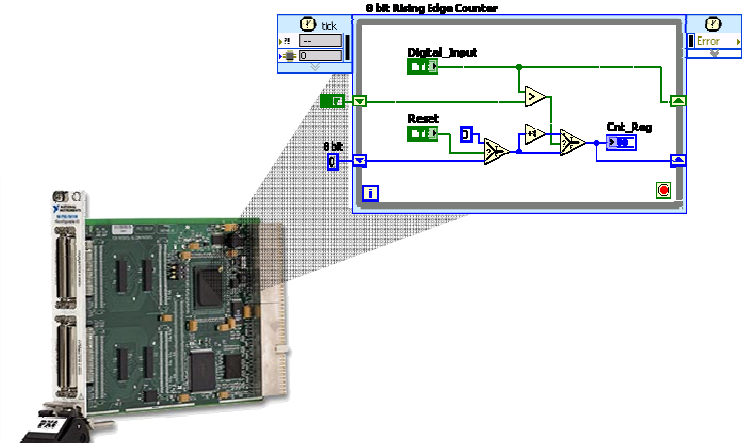
Demanding Test Methodologies





Introducing NI VeriStand

Software for Real-time Testing



Demonstration: HIL Testing with NI VeriStand

Real Time Testing Application
HIL Testing at Volvo Trucks

Application: Volvo Trucks needed efficient and flexible ways of testing the ECU's manually, semi-automatically or automatically.

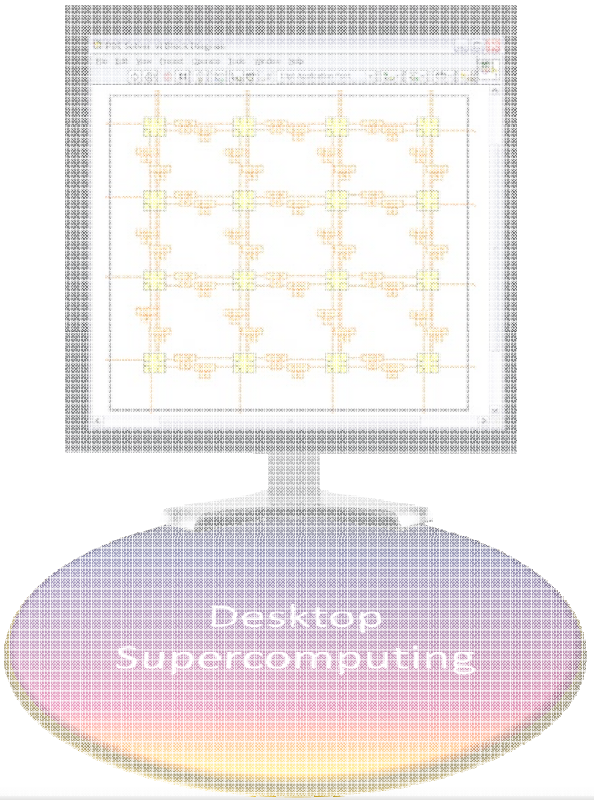
Challenge: Simulating all physical interfaces simultaneously

Solution: LabVIEW Real-Time, FPGA , PXI, and cRIO for HIL test. Support environmental simulation models with LabVIEW SIT in order to resemble a complete truck driving on the road.

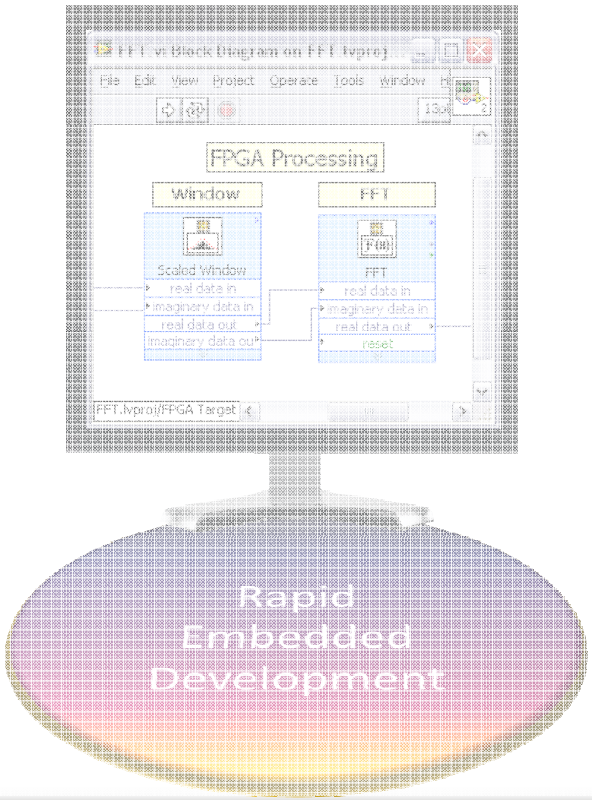
With LabVIEW RealTime we reduced the processor load from close to 100% to around 60%, taking advantage of multicore technology. - Hans Nyström, Prevas

Access through Graphical Programming

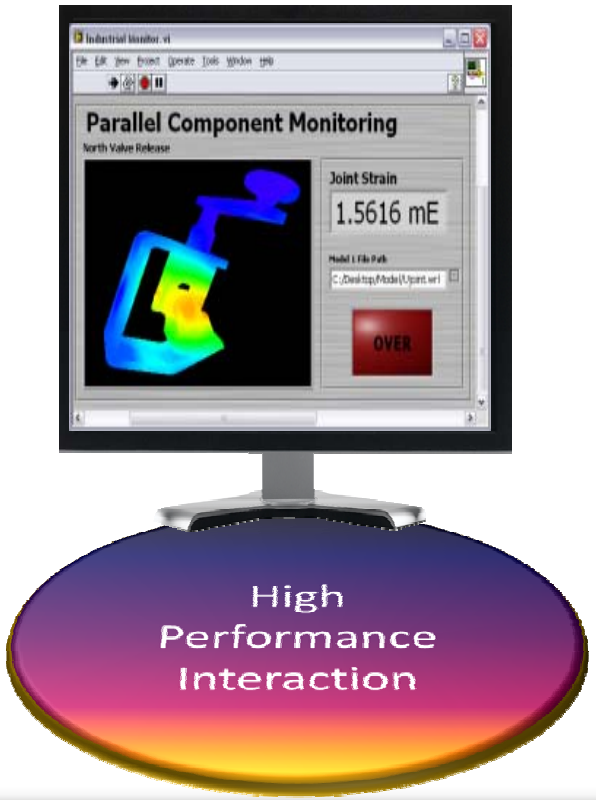
Multicore



FPGA

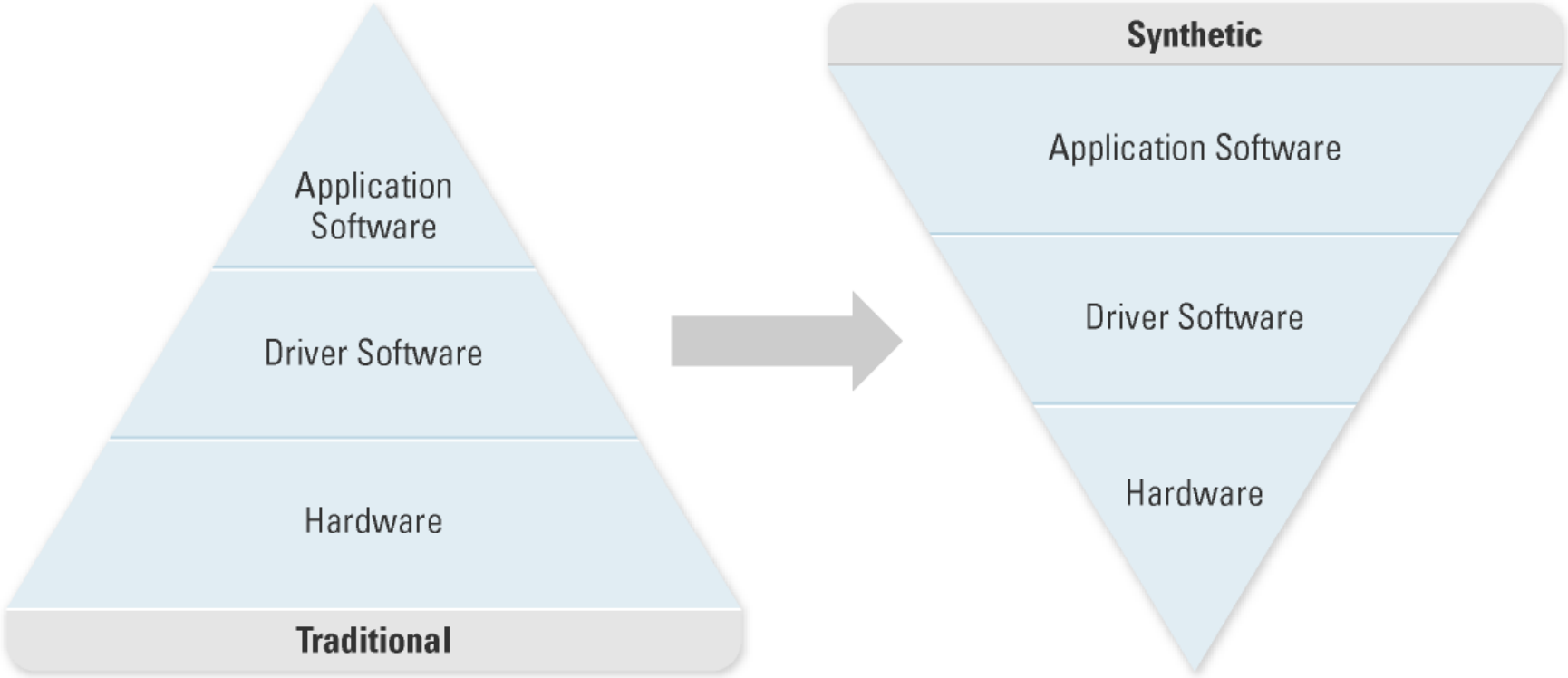


Modular I/O



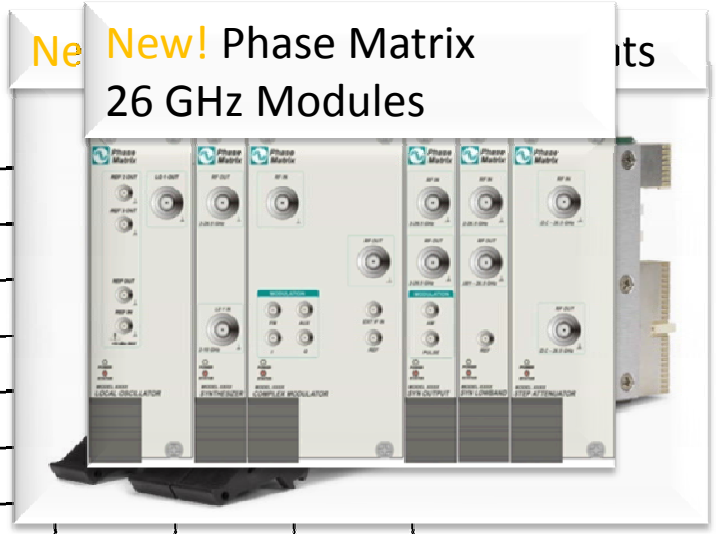
Trend Toward Software-Based Instrumentation

"Software is the core of a [Synthetic Instrumentation] test system…, it is the task of the software to define and control the hardware…"



Frost and Sullivan 2006 World Synthetic Instrumentation Test Equipment Report

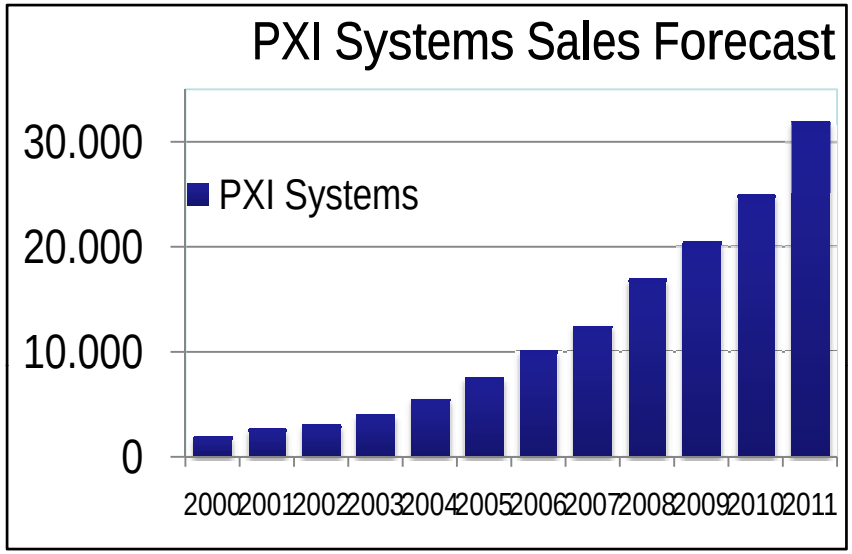
Comprehensive Measurement I/O



Advances in Modular I/O:

- Faster, higher resolution ADCs and DACs
- High bandwidth data transfer
- On-board processing in FPGAs
- Growing standardization around PXI

Industry Acceptance of PXI

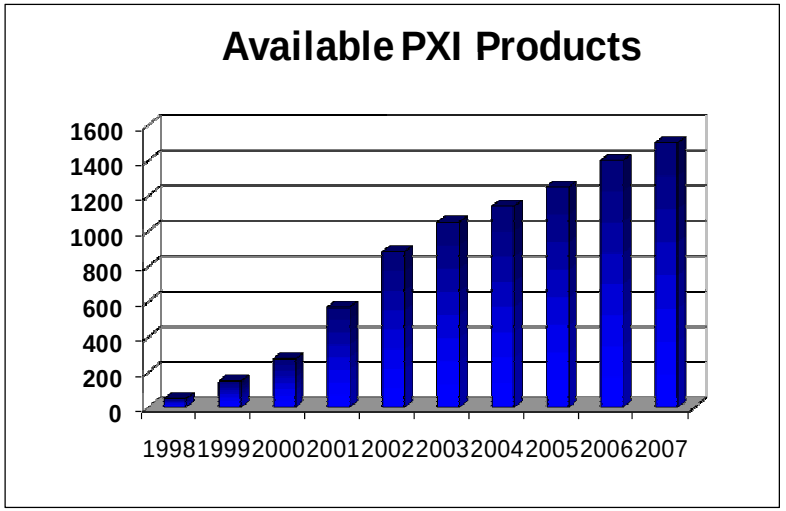


25% growth forecast for 2007 – 2012

Source: World VXI & PXI Test Equipment Markets, Frost & Sullivan, April 2005

More than 1,500 PXI Products from 60 vendors

Source: PXI Systems Alliance



PXI-Based RF Application
GPS Production Testing

Application: A system that simulates real GPS satellite signals over the air, and performs mixed-signal and radio frequency (RF) measurements.

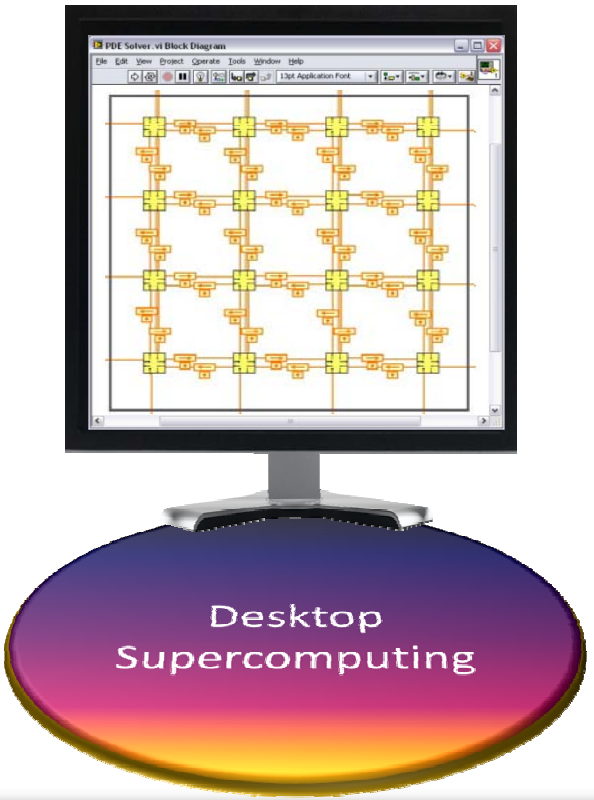
Challenge: Maximizing production throughput while minimizing test system footprint and overall cost.

Key Benefit: NI TestStand and LabVIEW helped create a flexible software architecture. PXI-based RF minimized cost and maximized throughput.

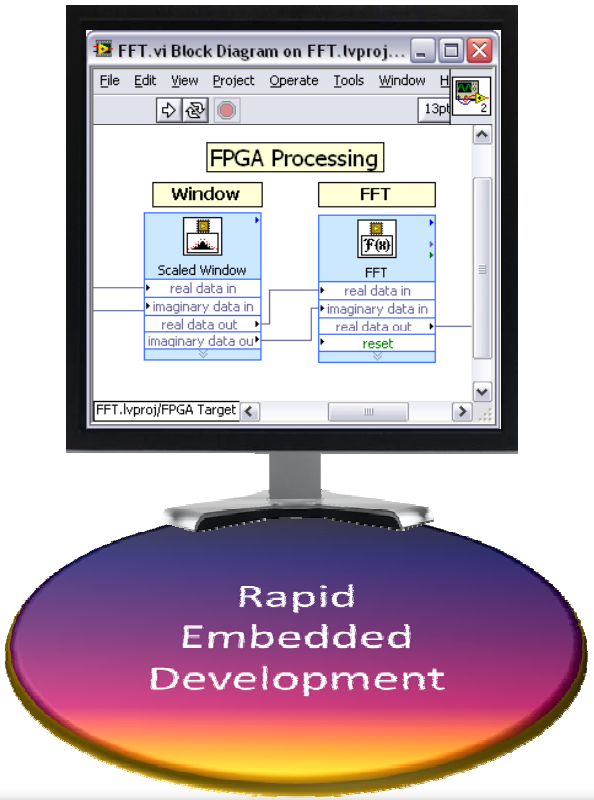
"Overall, we minimized cost by using modular PXI hardware and NI software for system development and completed our testing time for both assembly programming and test in less than two minutes."
– Rick Garza, G Systems

Key Technology Drivers

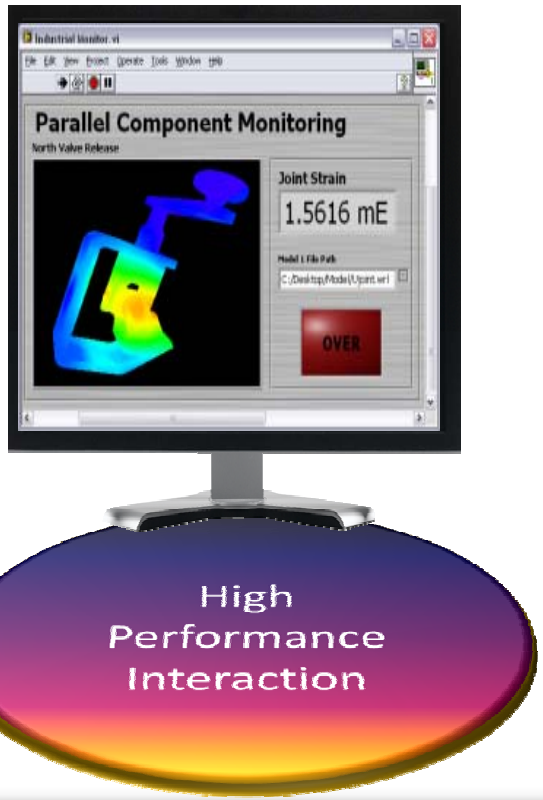
Multicore



FPGA



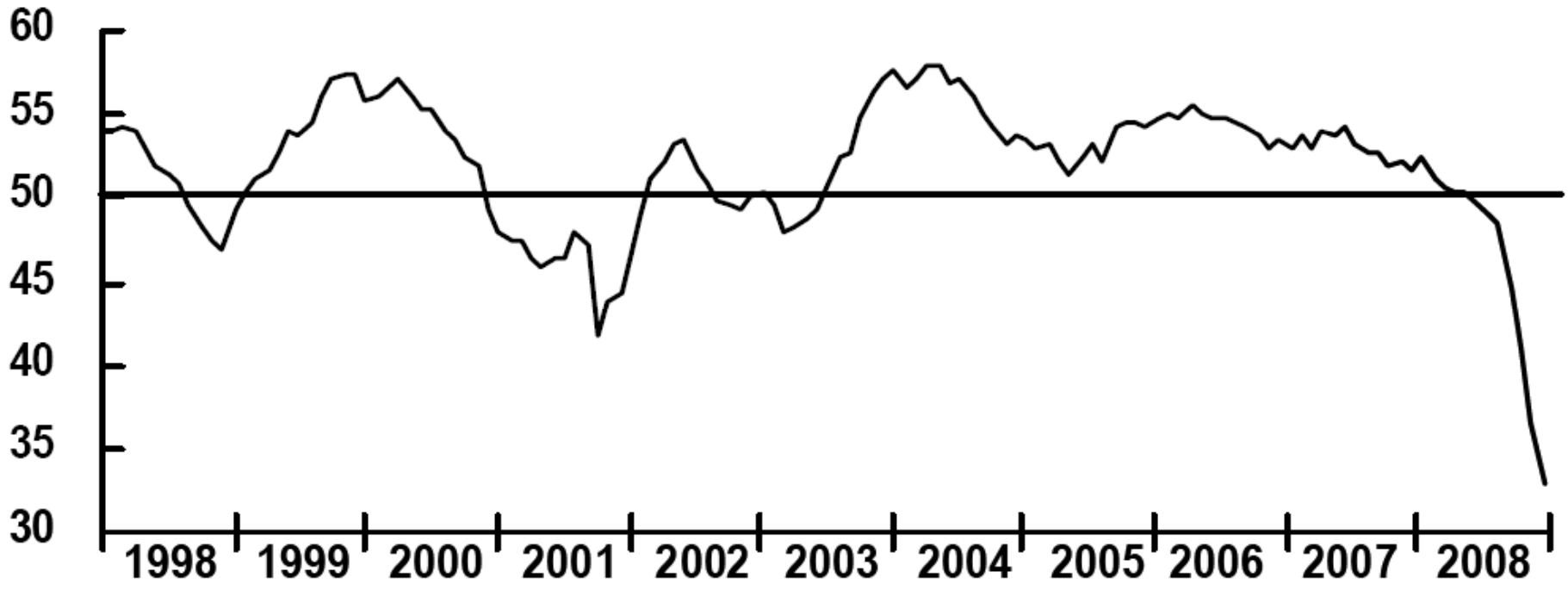
Modular I/O



Innovating in Tough Times

Its Tough Out There….

JPMorgan global manufacturing PMI




hp


CNN


FedEx


iPod
Playlists
Artists
Songs
Contacts
Settings
menu

Lean Innovation

- Do more with less
- Prototype It
- Leverage the Network

Do More with Less

- Rapid development tools
- Repurpose existing equipment
- Parallel test: maximize throughput and utilization

Test More with Less:

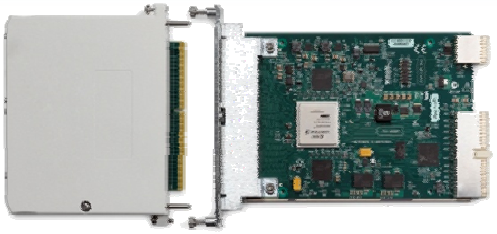
Harris Decreases Test Cost by 74 Percent

- Parallel testing for 4X throughput increase
- 83% reduction in floor space
- Maximize resource use with COTS tools

HARRIS

Prototype It

DESIGN → PROTOTYPE → DEPLOY



Leverage the Network

"The scope of your dreams and innovations depends on the scope of your network"

-Andrew Hargadon, author of *How Breakthroughs Happen*

Leverage the Network

70,000+ online members
100+ registered user groups
500,000+ children through LEGO

Community

280+ third-party add-ons
400+ Solution partners
35+ training courses

Collaboration

NATIONAL INSTRUMENTS
LabVIEW™

Connectivity

6000+ instrument drivers
1000+ smart sensors
1000+ Third-party PAC devices

Lean Innovation

- Do more with less
- Prototype It
- Leverage the Network

Engineers Most Rise to the Challenge

"The problems that exist in the world today cannot be solved by the level of thinking that created them."

Albert Einstein

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