

NATIONAL INSTRUMENTS

# LabVIEW™



Click to edit Master subtitle style

# LabVIEW 2010

## *What's New*

Zileriu Vlad  
Sales Manager Romania  
National Instruments

# What's New in LabVIEW 2010?

Improved Performance

New Data Acquisition Options

Environment Enhancements

Large Application Development

Target-to-Host Data Transfer

What's New in the LabVIEW Modules

Building LabVIEW Add-ons

# Improved Performance



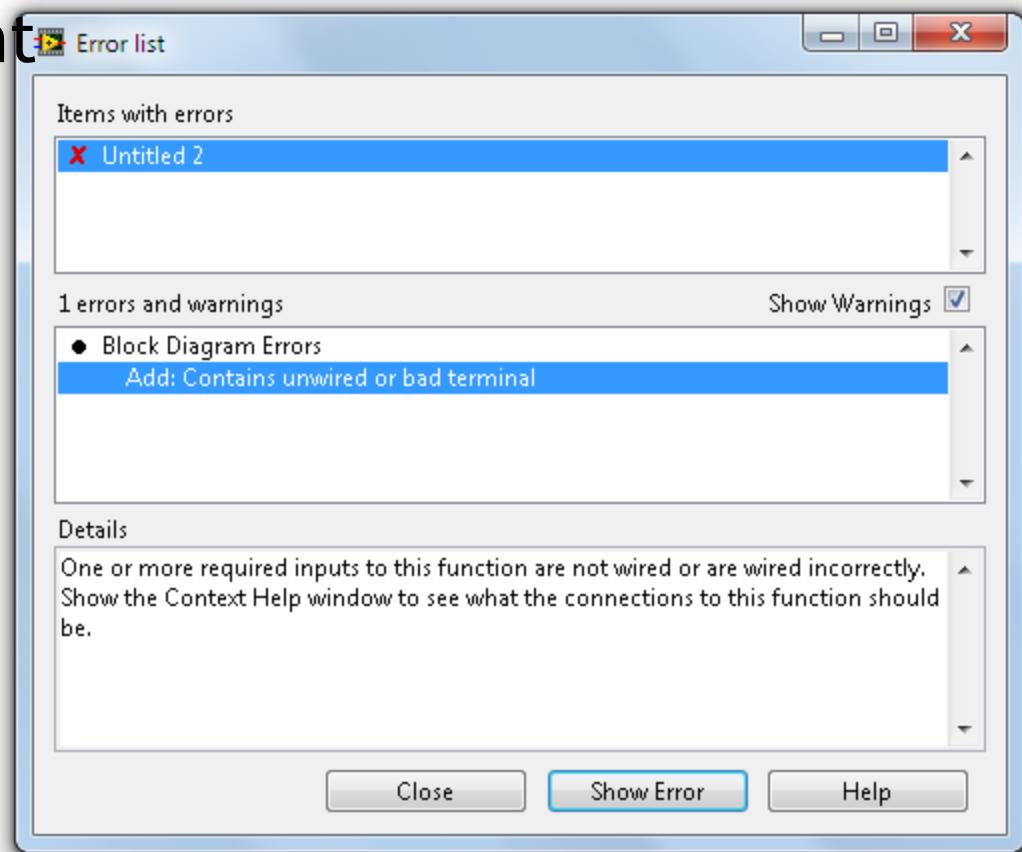
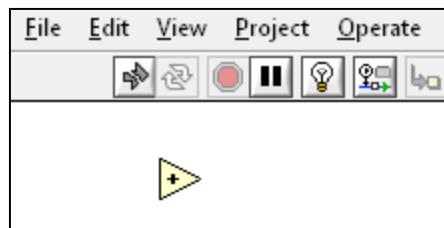
What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# LabVIEW Compiler

Abstracts the complexities of programming

- Memory management
- Thread allocation
- Language syntax



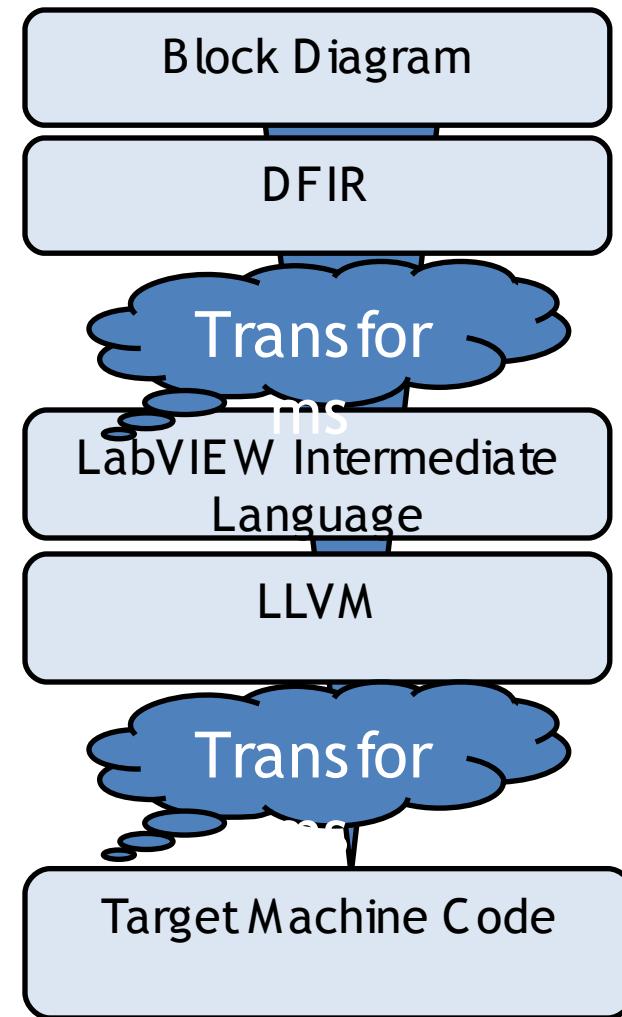
# Optimizing the LabVIEW Compiler

## DataFlow Intermediate Representation (DFIR)

- High-level representation
- Graph-based
- Preserves dataflow, parallelism, and execution semantics

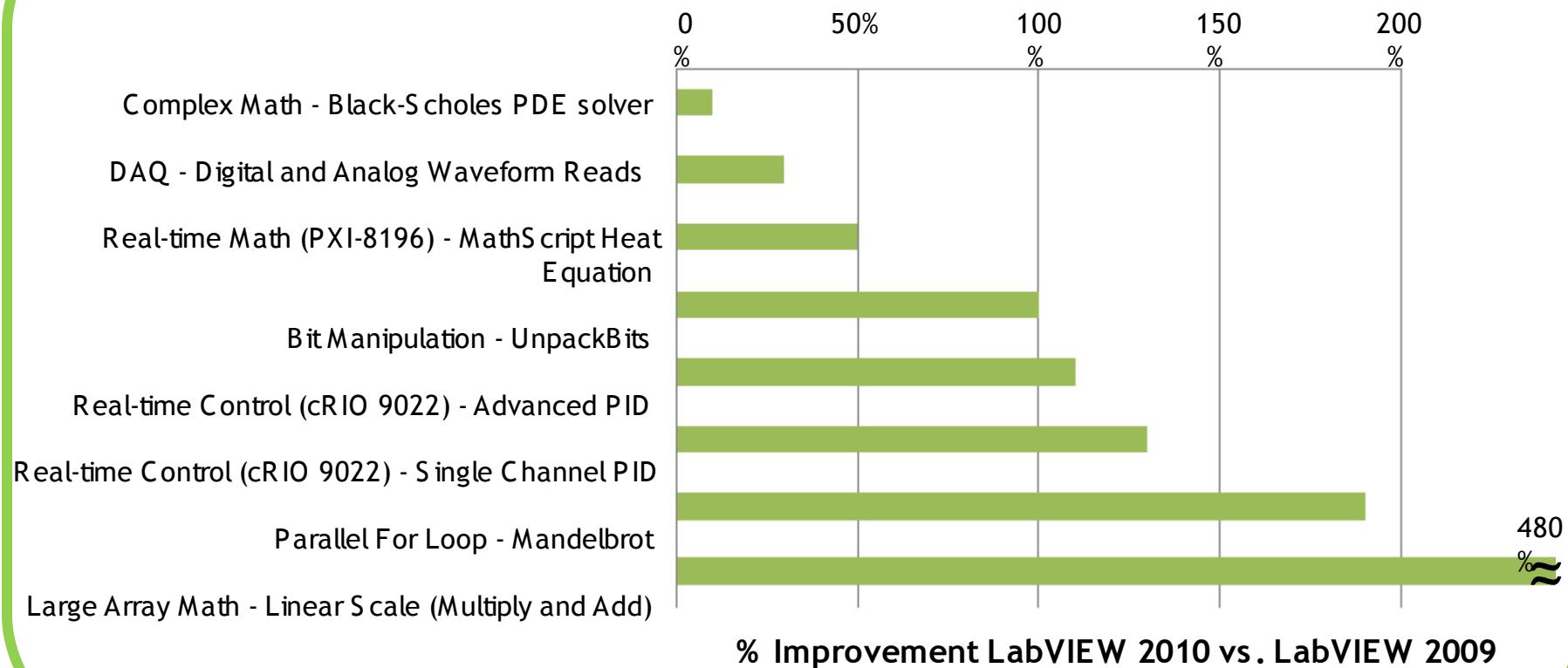
## Low-Level Virtual Machine (LLVM)

- Low-level representation
- Sequential
- Knowledge of target machine characteristics, instruction sets, alignment, etc.

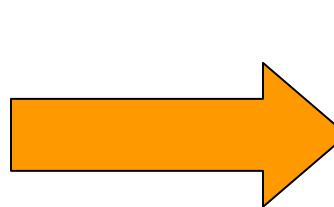
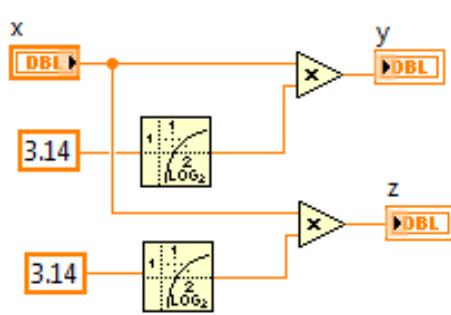


# LabVIEW 2010 Performance Metrics Demo

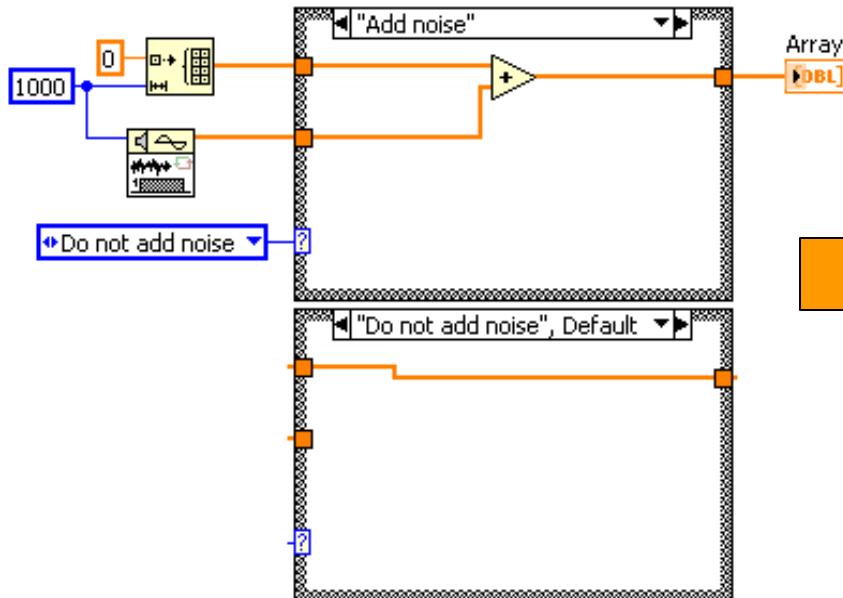
## Run-Time Performance Improvement in LabVIEW 2010



# LabVIEW Compiler Transforms

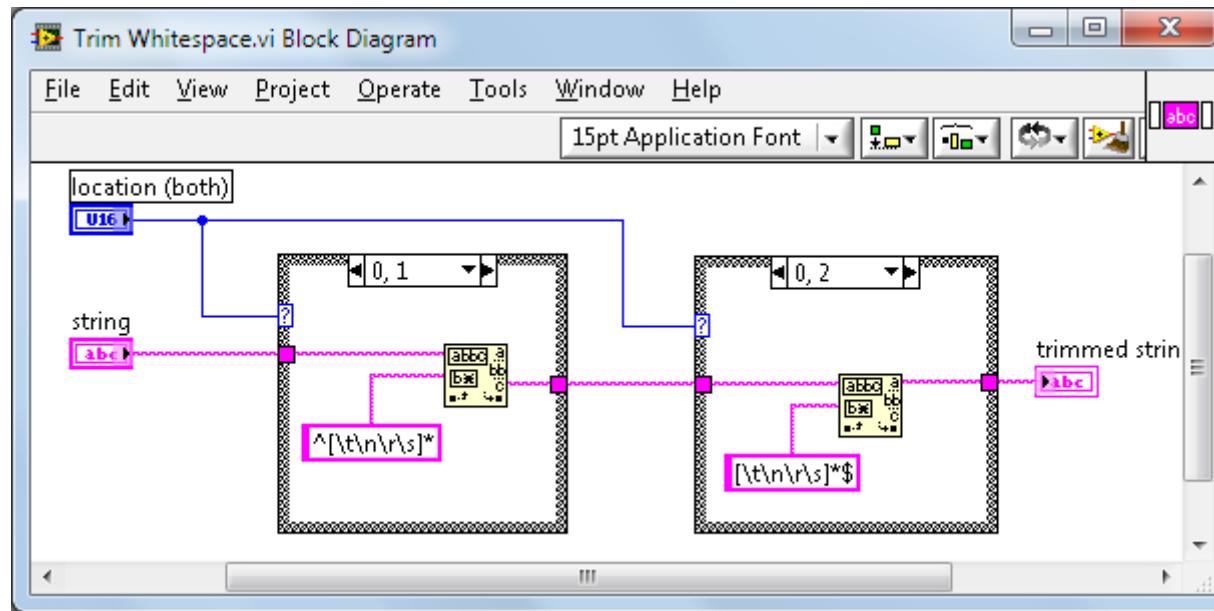
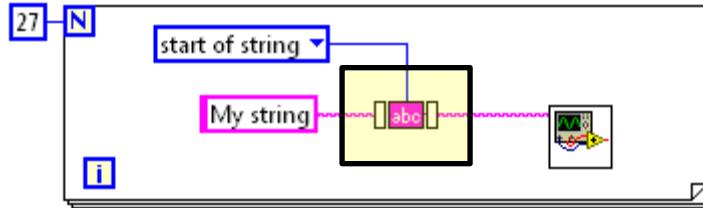


Common Subexpression  
Elimination

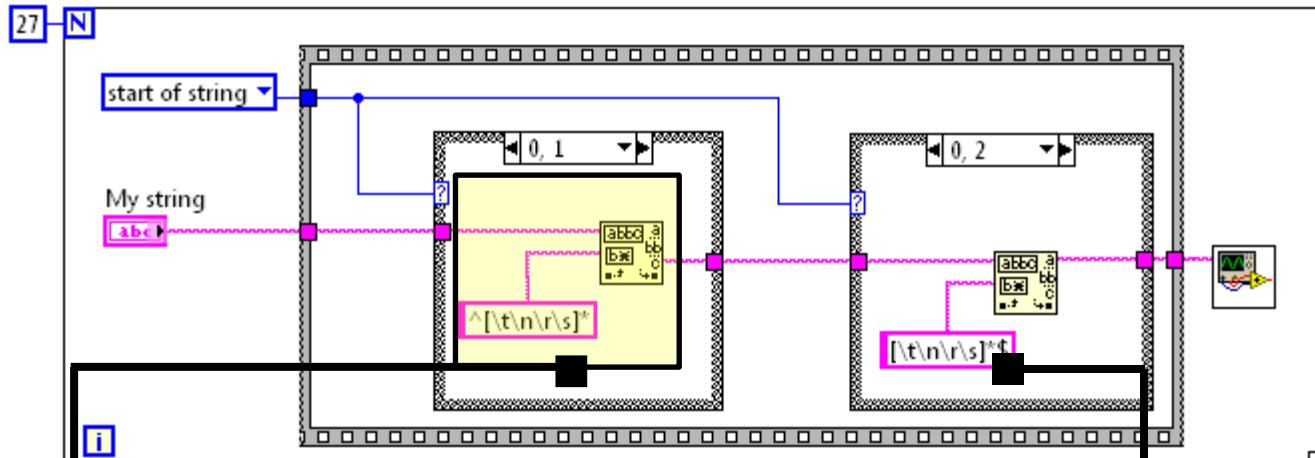


Unreachable Code  
Elimination

# LabVIEW Compiler Optimizes Your Code



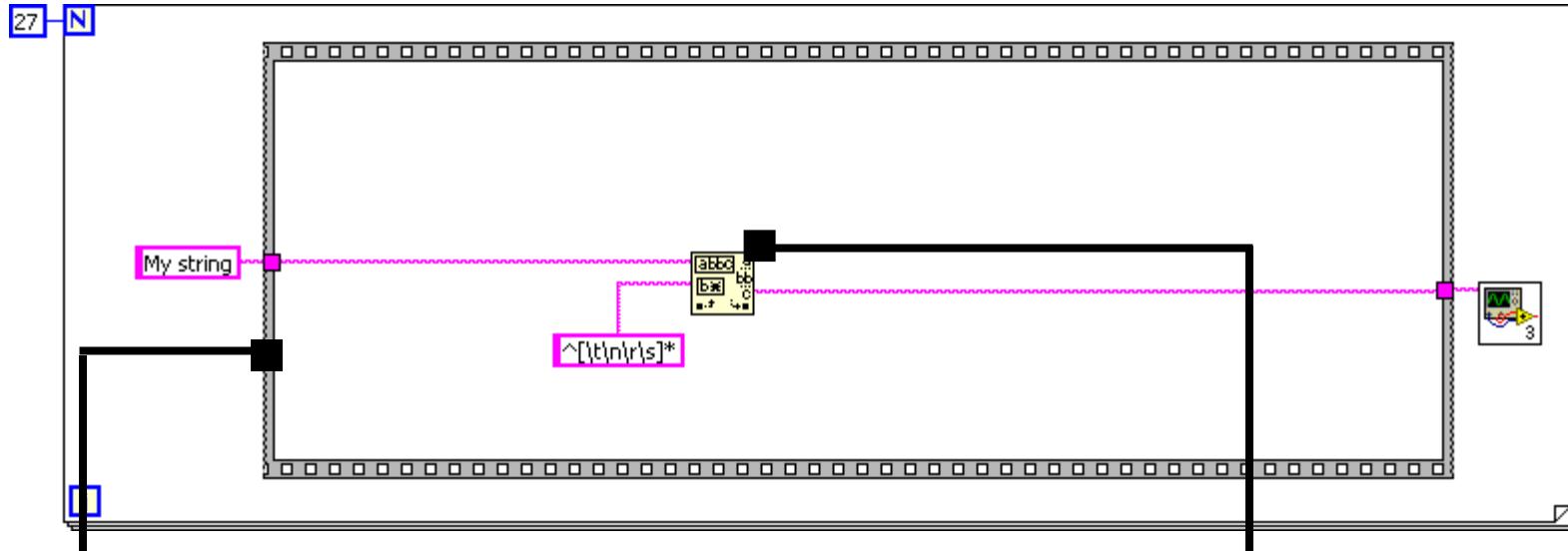
# LabVIEW Compiler Optimizes Your Code



Only this portion of  
the code will  
execute

Because the input is constant, the compiler can determine which code will execute, and remove the unnecessary code

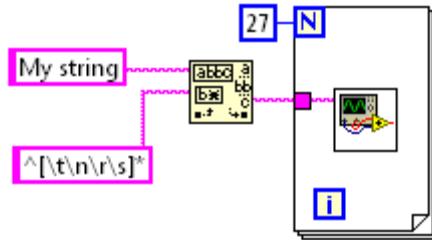
# LabVIEW Compiler Optimizes Your Code



Sequence S structure  
is now unnecessary

The Match Pattern primitive will not  
change from iteration to iteration

# LabVIEW Compiler Optimizes Your Code



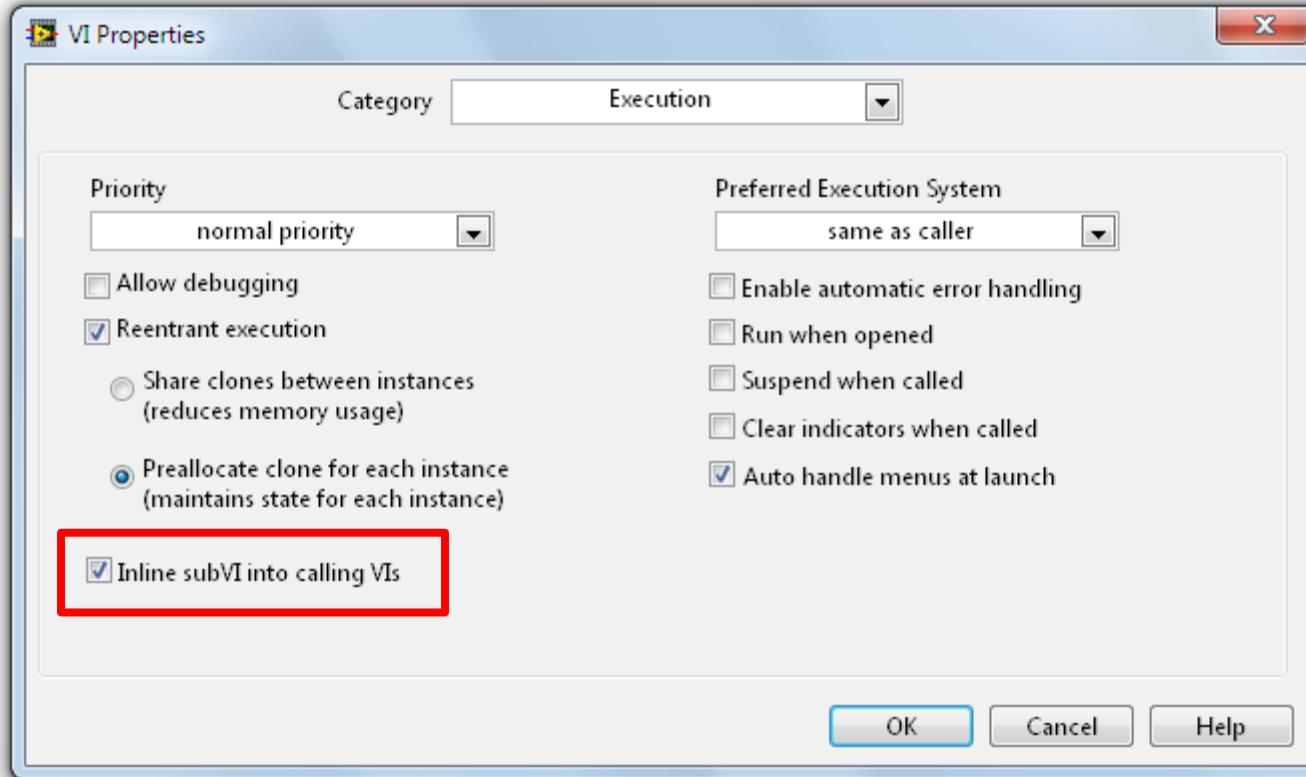
# Transforms Used

- SubVI Inlining
  - Unreachable Code Elimination
  - Dead Code Elimination
  - Loop Invariant Code Motion

# SubVI Inlining

Dem

## Maintain Code Modularity With Minimum Overhead



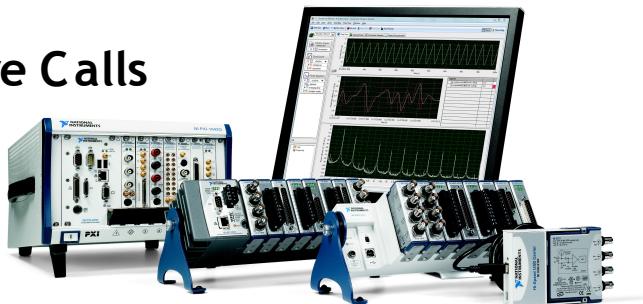
Removes all subVI call overhead

Automatically updates callers when callee's code changes

# LabVIEW 2010 Performance Metrics

## What Won't Get Faster?

### Hardware Calls



### DLL Calls / Optimized C Code

### User Interface Interaction



## Increased Compile Time

### Compile Time

5x

### Mass Compile Time

35%

### Application Build Time

35%

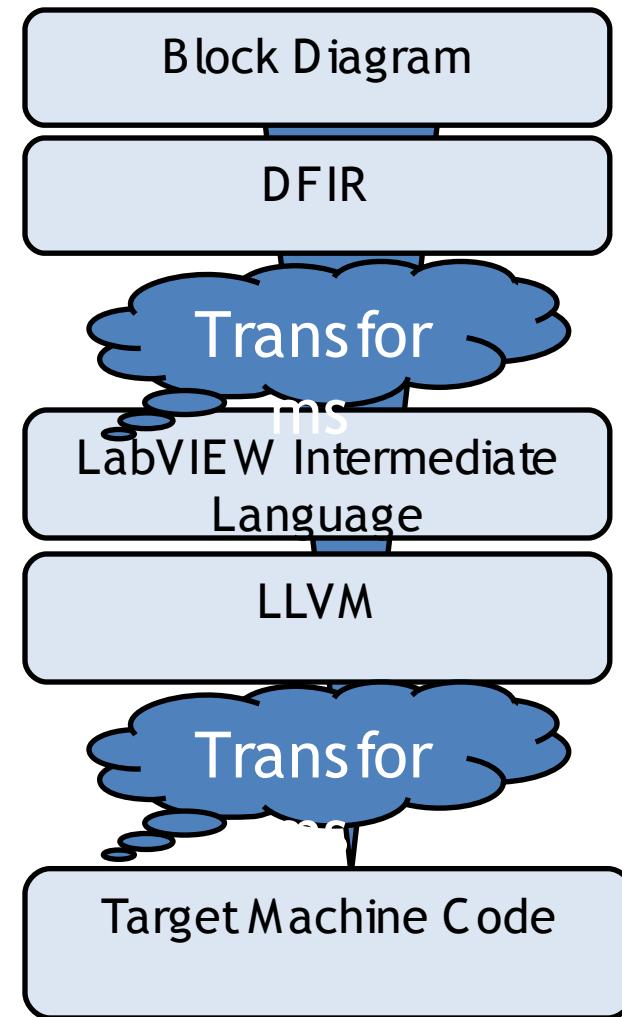
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# New Data Acquisition Options



What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# Evolution of Multifunction DAQ

NI-STC



NI-STC2



NI-STC3



200  
0

201  
0



# Introducing USB X Series

8 new high performance USB DAQ devices, from 500 kS/s to 2 MS/s

Options for simultaneous sampling: up to 2 MS/s/ch on 8 channels

Improved performance and ease of use for the same prices as  
most popular USB M Series



What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# USB Multifunction DAQ Overview

Price

↑  
e

USB-6008/9  
12 to 48 kS/s



Bus-powered M  
Series  
250 to 400 kS/s



X Series: 500 kS/s to 2 MS/s



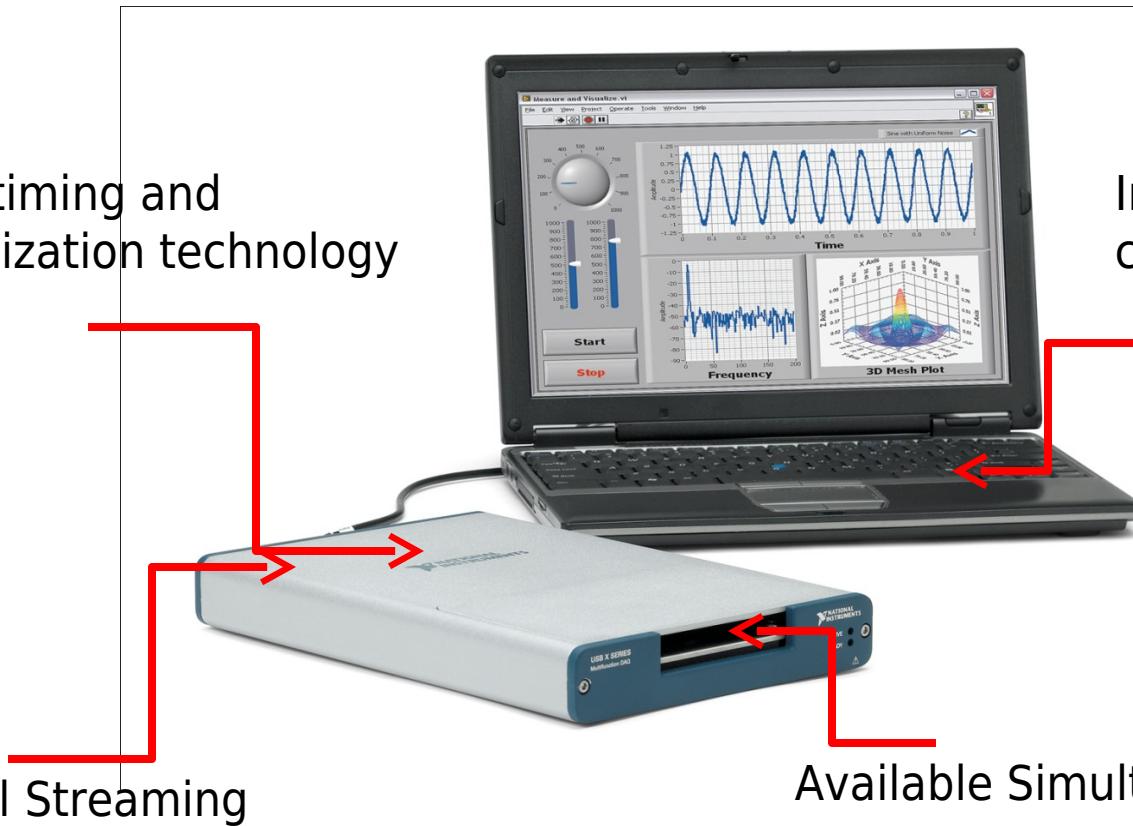
Performance

What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# Key Features

NI-STC3 timing and synchronization technology



NI Signal Streaming

Improved data logging capabilities

Available Simultaneous Sampling

# NI Signal Streaming

## Traditional Devices

- Off-the shelf controllers
- Handles one data stream at the time
- Higher-priority tasks cause low throughput
- Higher latency due to register-level access instructions

## NI Signal Streaming

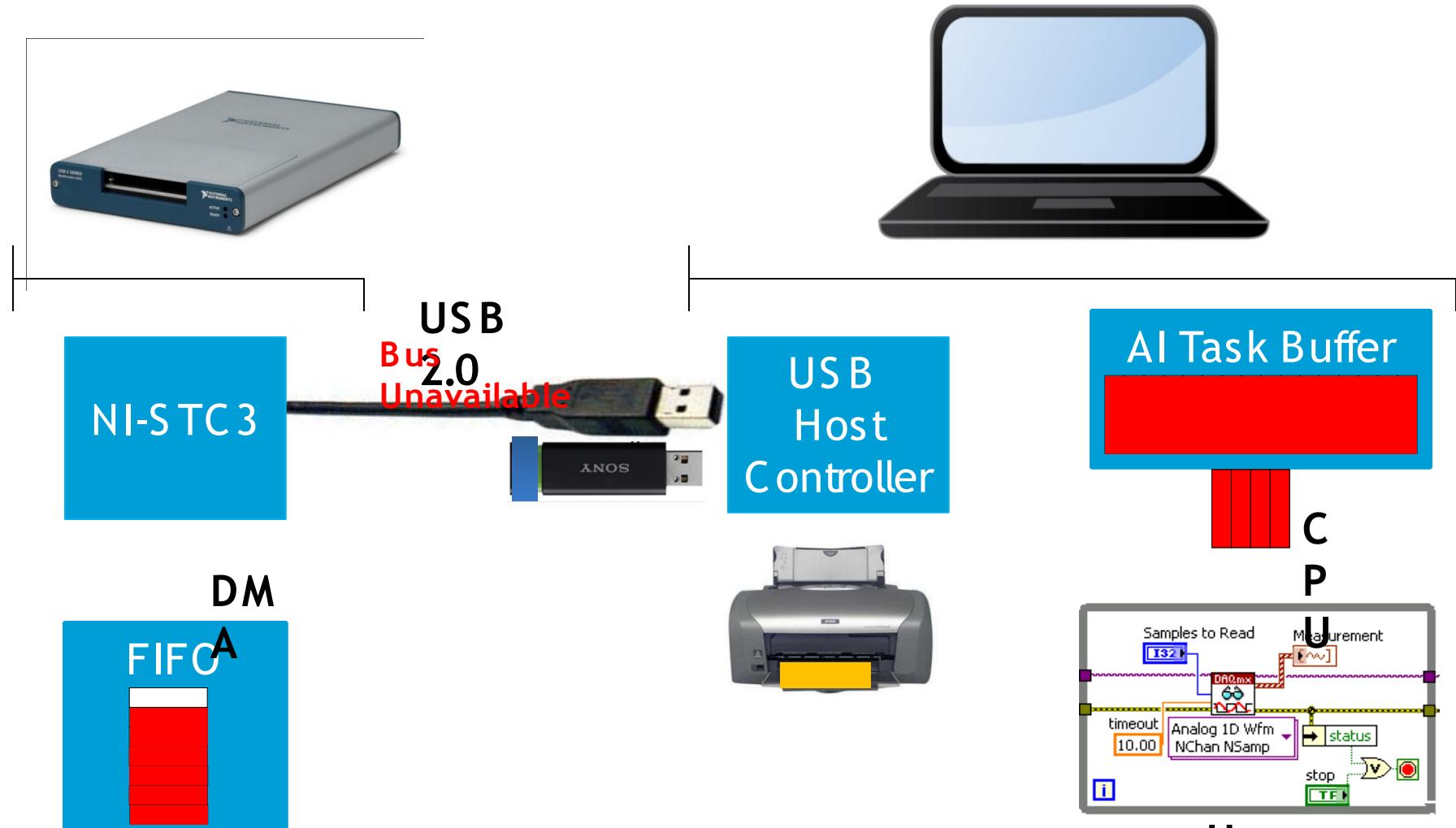
- Patented custom controller
- Handles multiple tasks at the same time
- Data streams mapped directly to USB endpoints resulting in high throughput
- Lower latency due to Message-based instructions



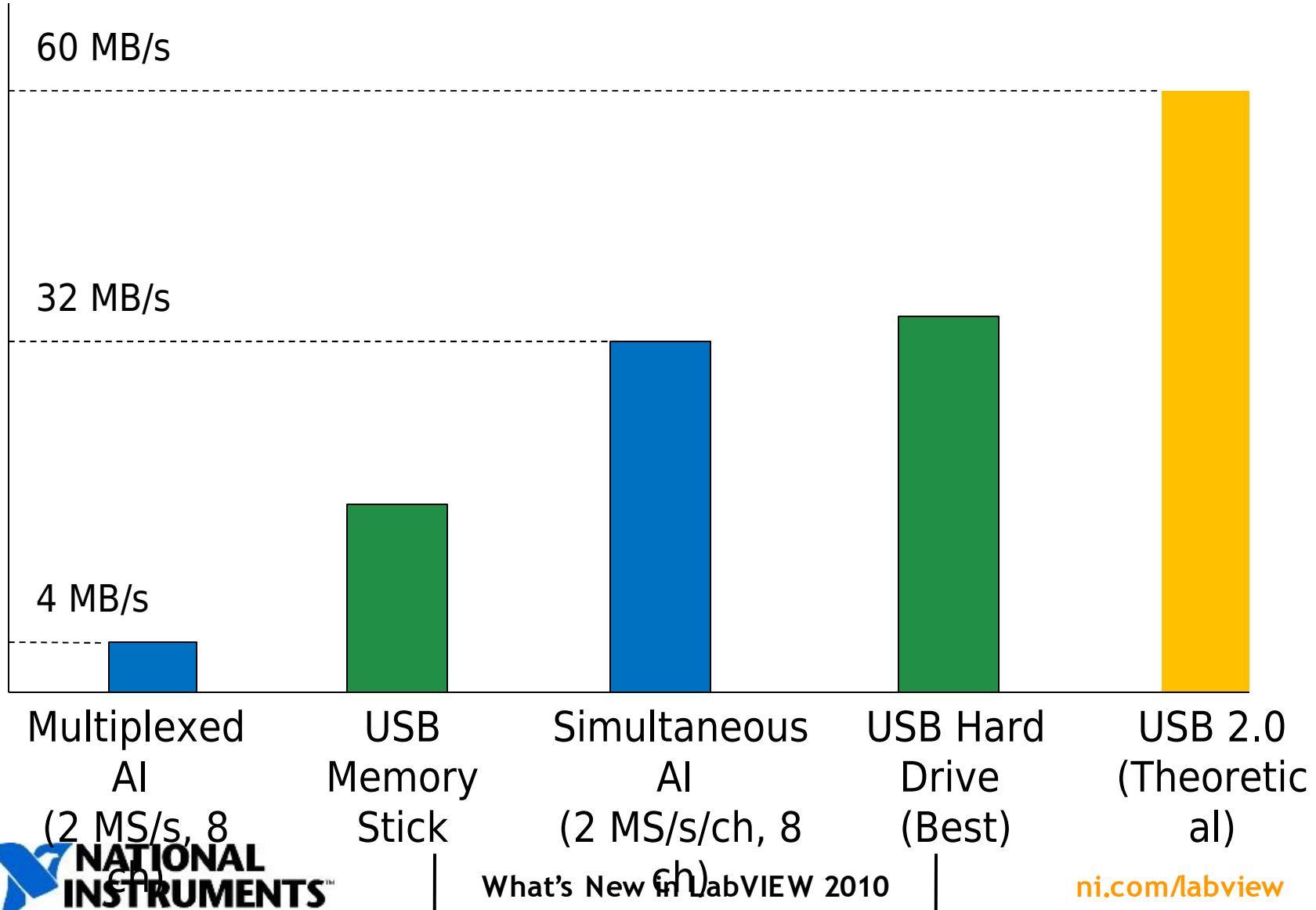
What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# Streaming Input Data



# USB Bandwidth Usage



# Onboard Memory

USB does not guarantee bandwidth or latency

- Onboard Memory for Analog Input on Simultaneous boards
  - 32 MS and 64 MS options
  - Ensure finite acquisition, even with heavy latency or contending bus traffic

# NI CompactDAQ

Simple. Complete. Data Acquisition.

“Any Sensor. Any Bus.”



## DAQmx API + C Series Modules

Portable  
Ch < 32  
\$400 □ \$2,000

Synchronization  
Mixed Signal  
Ch < 128  
\$2,000 □  
\$7,000

Synchronization  
Mixed Signal  
Ch 128+  
Distributed Systems  
\$3,000 □ \$14,000

# NI cDAQ-9188 High-Level Specifications

- Ethernet version of cDAQ-9178
- Gigabit Ethernet (IEEE 802.3ab)
- 50+ cDAQ C Series modules
- Integrated signal conditioning
- NI-DAQmx driver software
- STC-3 (4 counters, timing engines)
- NI Signal Streaming technology
- Zero Configuration Networking
- Web Interface Configuration

# Integrated DAQ, Signal Conditioning, & Connectivity

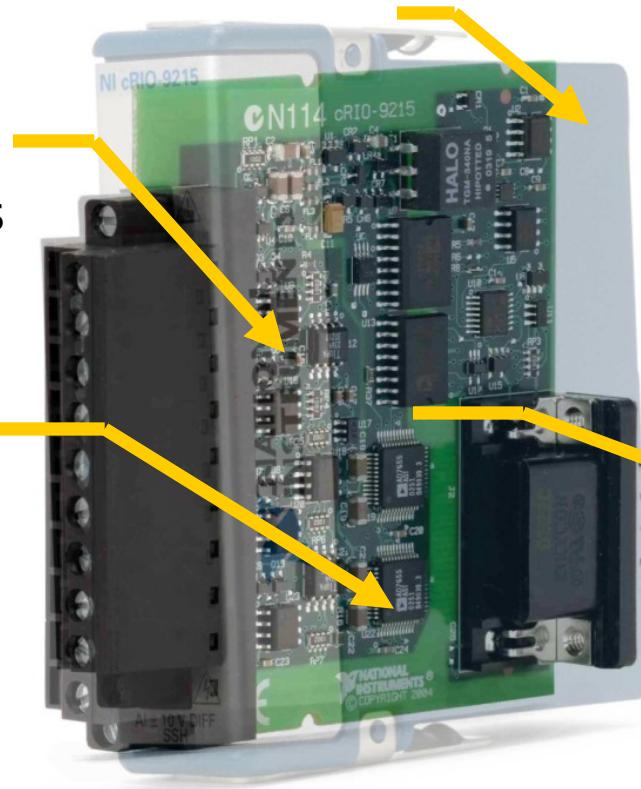
## Click to edit Master Bullet Points Conditioning

Direct connection to sensors for temperature, pressure, acceleration, strain, load cell, current and more

## High Quality Measurements

Streaming up to 1 MS/s/ch

Resolution up to 24-bit resolution



**Guaranteed Accuracy**  
NIST traceable calibration

**Signal to Backplane Isolation barrier**  
Safety, noise immunity, common mode rejection

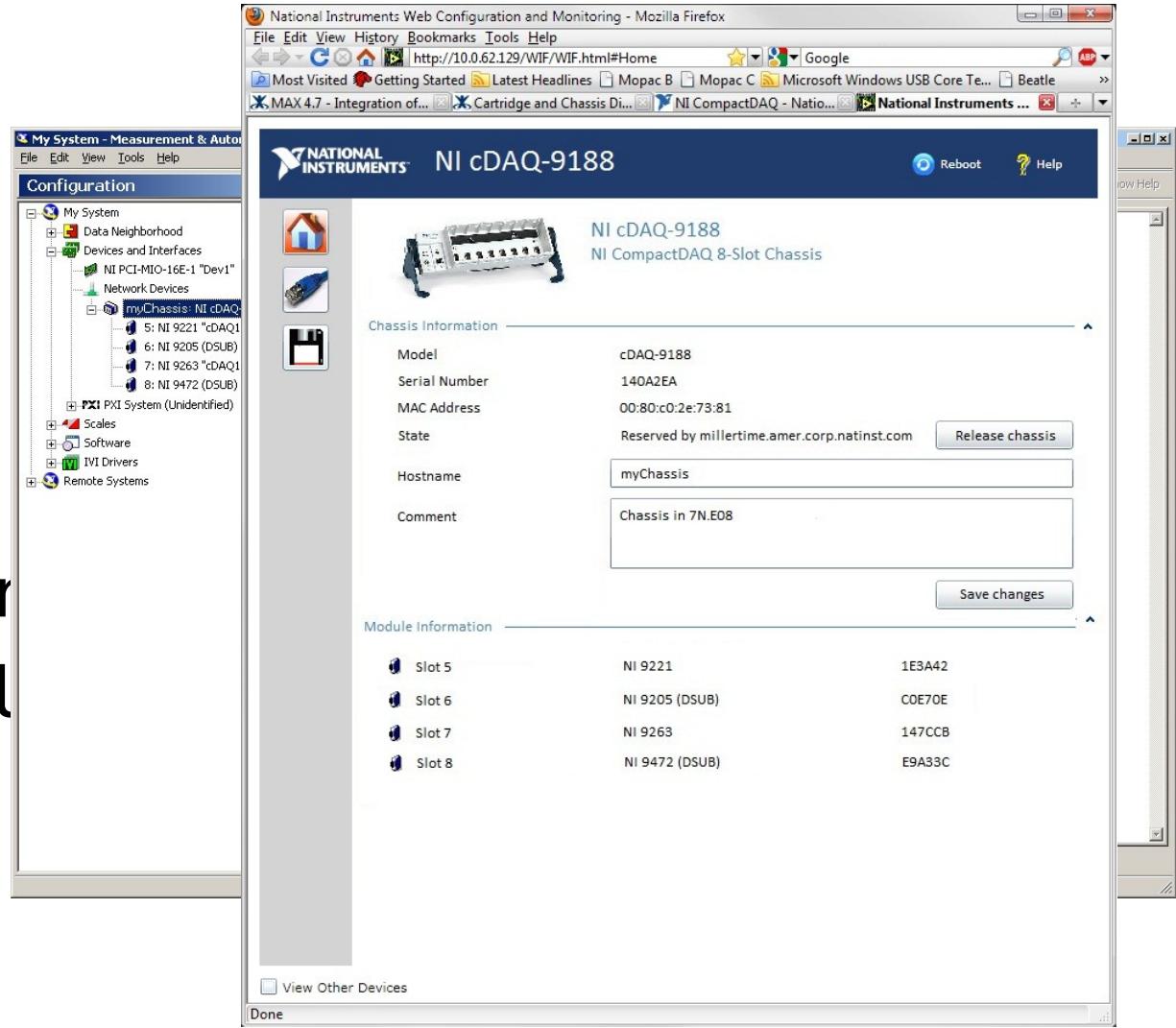
# Multiple Timing Engines

NI CompactDAQ Chassis



# Web-Based Configuration

Systems Settings  
Network Settings  
NI Auth Settings  
View modules  
Update firmware  
Built-in web server  
Built on MS Silverl



# Example NI cDAQ-9188 Applications

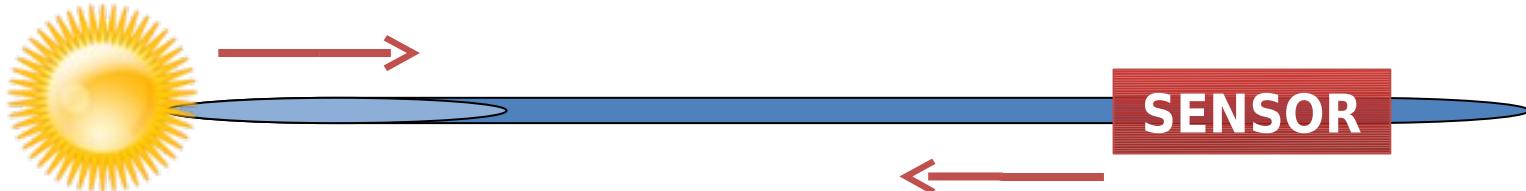
Distributed, Mixed-Signal  
Measurement Systems

- Counters
- Analog Input/Output
- Digital Input/Output

Modular Laboratory Equipment  
Portable Structure Health  
Monitoring

# Optical Sensing

Properties of light sent through an optical fiber  
change in response to temperature and strain  
Immune to electrical effects



- Intensity
- Phase
- Wavelength
- Polarization

# NI Optical Sensor Interrogator

NI PXIe-4844

4 Optical Channels

10 Hz Scan Rate

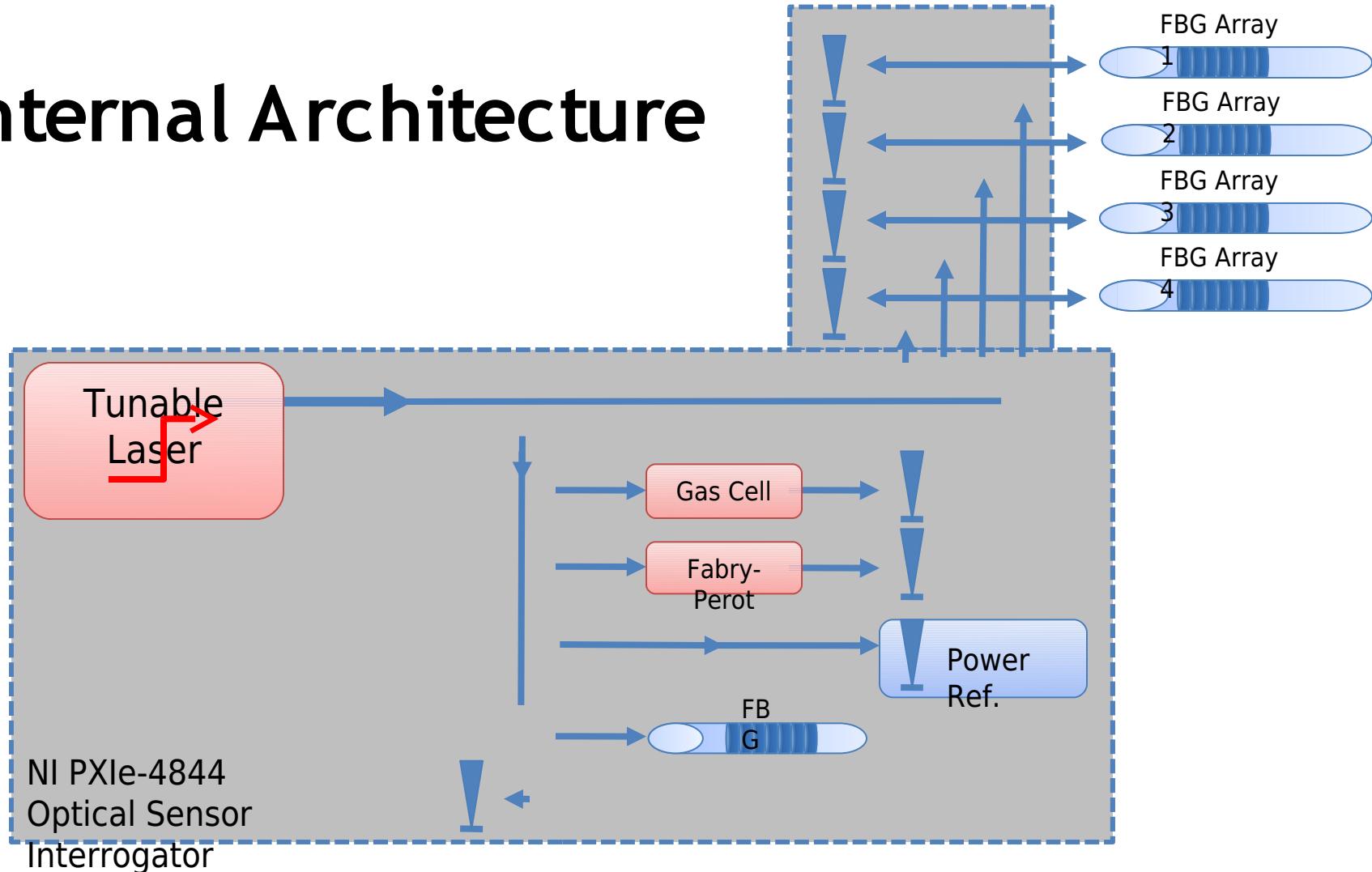
1510 to 1590 nm wavelength range

1 pm Accuracy ( $\sim 1.2 \text{ } \mu\text{m}$ ,  $\sim 0.1 \text{ } ^\circ\text{C}$ )

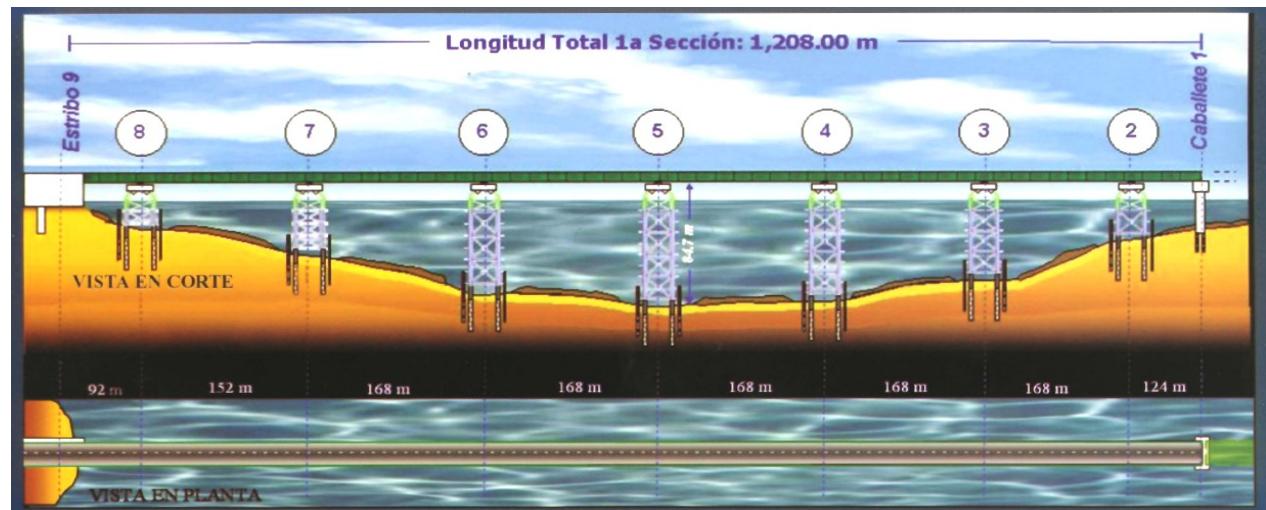
PXI Triggering



# Internal Architecture



# Example Applications



# Environment Enhancements



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# Smarter Installer

## Select Your Software Based on Serial Number(s)

Select Installation Option

NATIONAL INSTRUMENTS

I have serial numbers for one or more products in this installer.

Select and activate products based on my serial numbers (Internet connection required).

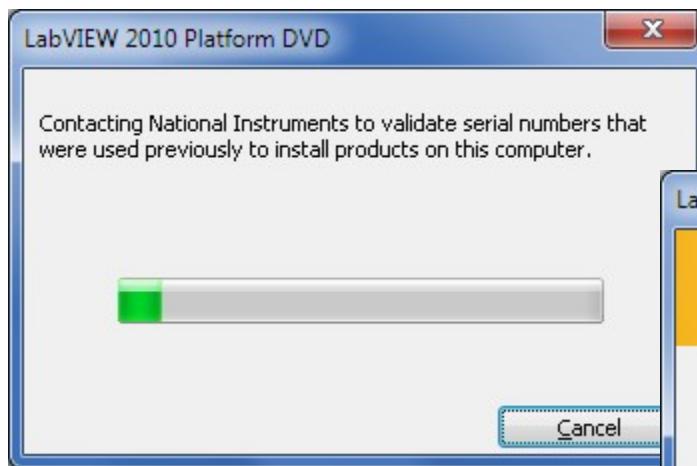
[Privacy Statement](#)

I only want to evaluate products.

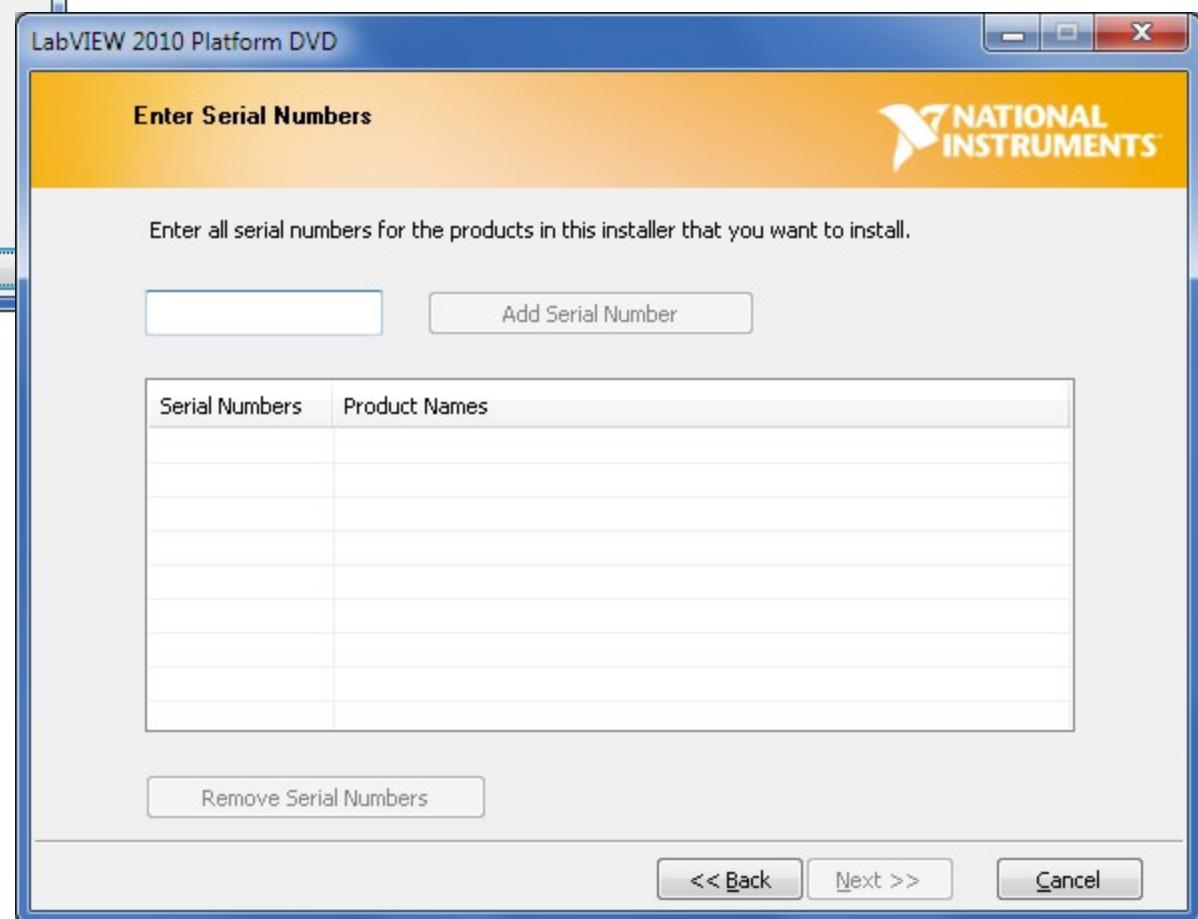
<< Back    Next >>    Cancel

*Enter your Serial Number(s), and the installer will determine what to install*

# Smarter Installer

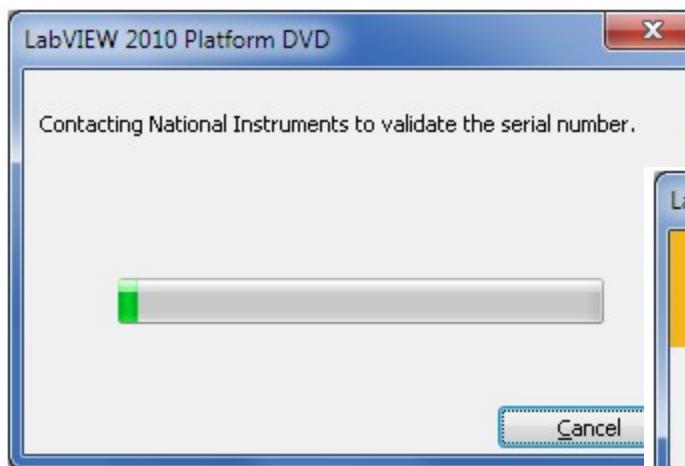


The installer will search your PC for previous serial numbers

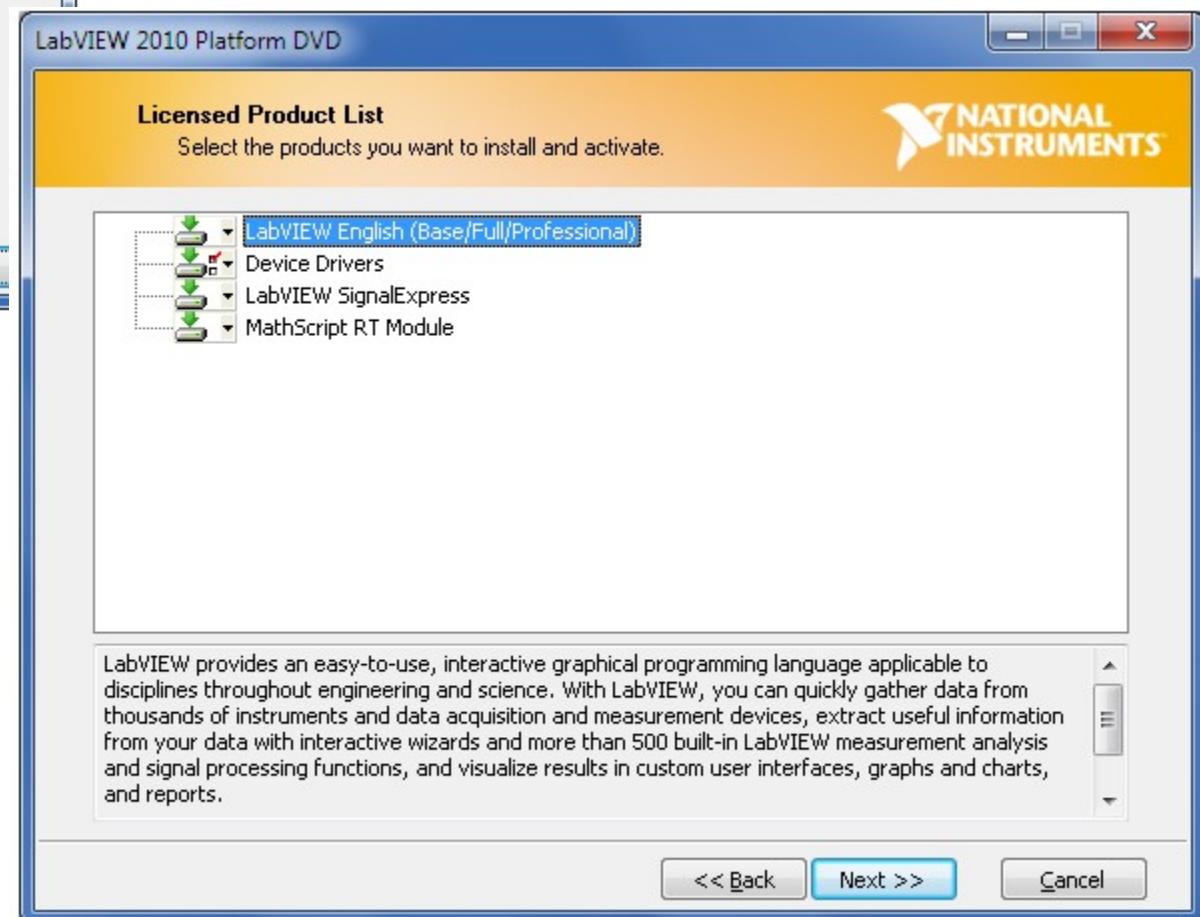


If none found, you can enter each serial number

# Smarter Installer

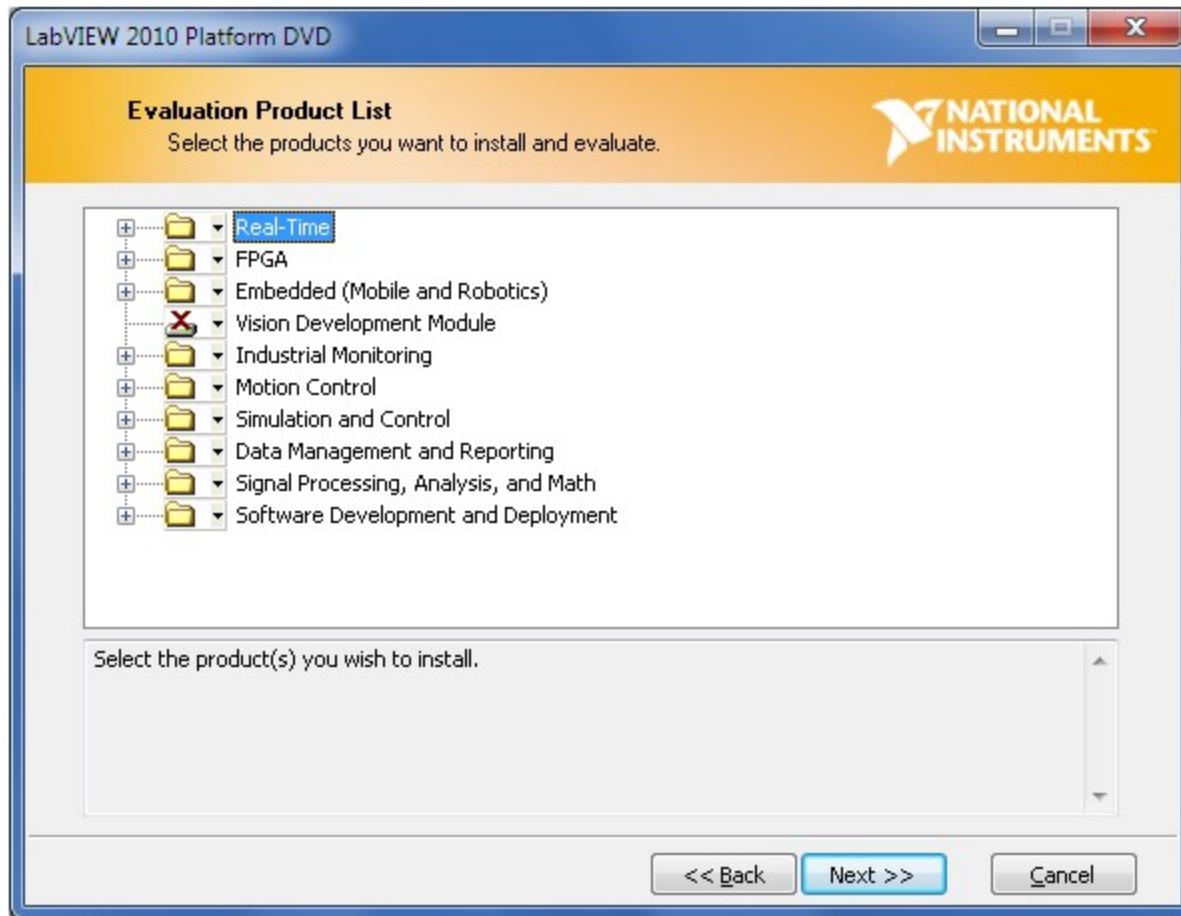


The installer will validate your serial number(s)



Then, show you what products will be installed and licensed

# Smarter Installer



Next, you can choose additional products to install for a fully-functional 30-day evaluation

# LabVIEW Idea Exchange

288



Kudos!

## New Boolean Diagram constant design!

Labels: UI & Usability    Status: In Beta

by altenbach

07-03-2009 04:37 PM

The current boolean diagram constant is potentially confusing and too elaborate.

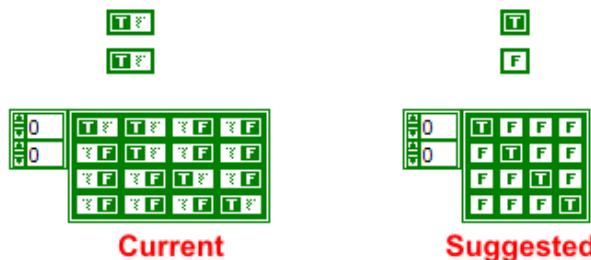
**Confusing**, because it almost looks like a toggle switch, so the new user might click on the **right half**, expecting an unconditional FALSE. However, there are no active areas, and an inversion of the current value occurs no matter where we click.

**Too elaborate**. All we need to see is the current value! Why do we need to see the "other" value greyed out??? We can guess that by simple elimination. 😊 There is too much redundant information, wasting twice as much diagram space than actually needed to display relevant information. The current design also makes e.g. 2D boolean diagram constant very confusing. Have a look at the image. Can you immediately tell that the 2D array on the left is only true on the diagonal? (I did not think so!). Now look at the suggestion on the right. Ahh... much better! 😊

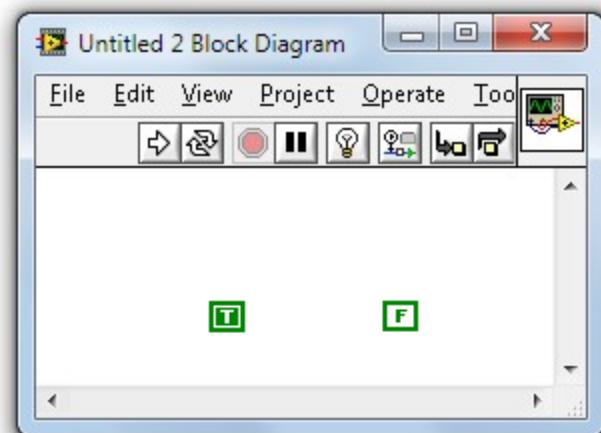
### Suggestion:

The boolean diagram constant should be **smaller, simpler, and cleaner**.

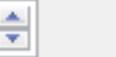
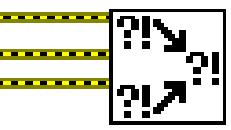
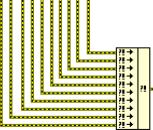
The image shows the current design on the left and the suggested design on the right.



What a difference in clarity and economy!!



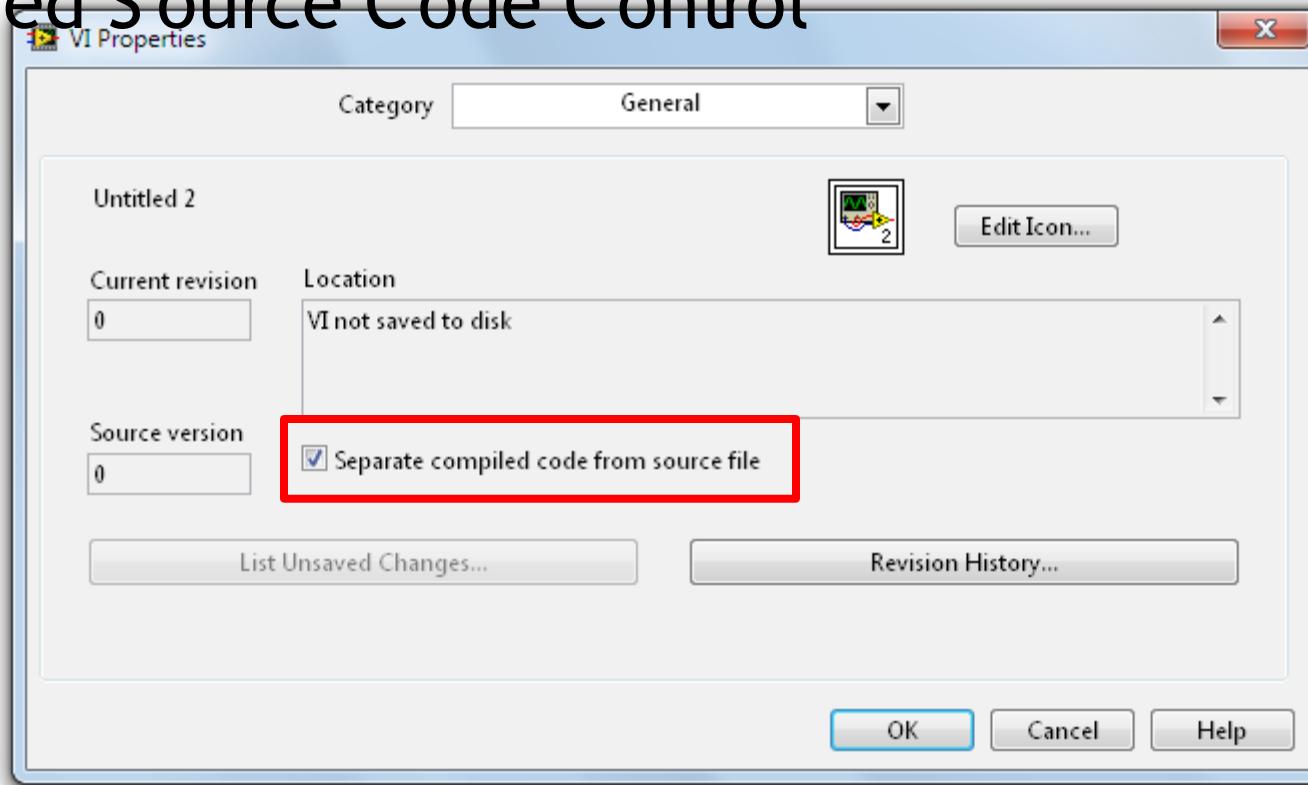
# LabVIEW 2010 Idea Exchange

Feature Name	LabVIEW 2009	LabVIEW 2010	User
<i>Default Number of Undo Steps</i>	Maximum undo steps per VI 8 	Maximum undo steps per VI 99 	PJM_LabVIEW
<i>Local Variable Redesign</i>			Altenbach
<i>String Radix</i>			Altenbach
<i>Wire Labels</i>			Falkpl
<i>Growable Merge Error Node</i>			Dany.
<i>Move Switch Items in the connector pane</i>	 8 Mouse Clicks	 2 Mouse Clicks	tst

# Large Application Development

# Separate Compiled Code From Source File

## Improved Source Code Control



Eliminate the need to re-save and re-submit files to source code control unless the graphical source code has been changed by the developer

# Packed Project Libraries

## Distribute and Reuse LabVIEW Code Easily

- Deploy the VI hierarchy with a single file
- Shorter build times for calling VIs
- Simplified code deployment
- .lvlibp file type

Example	# Source VIs	EXE Build Time	# VIs Built Into PPL	EXE Build Time	Build Time Improvement
Agilent 34401 Acquire and Graph - SW Triggered.vi	53	6.3 s	22	5.15 s	18.2%
E-Mail Notification.vi	102	8.66 s	68	5.82 s	32.8%
Update Weather Data.vi	71	12.97 s	46	5.48 s	57.8%
Custom Example	1000	53.93 s	999	15.94 s	70.4%

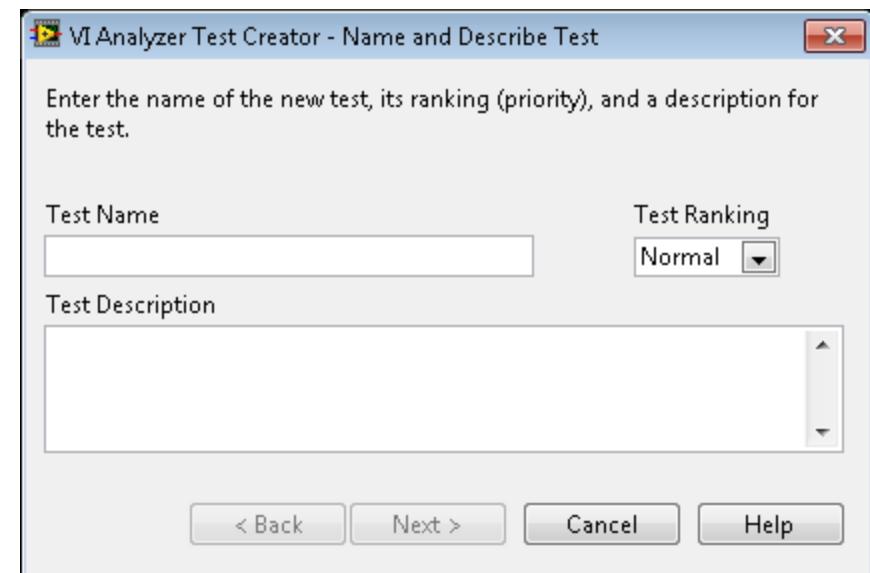
# LabVIEW Add-Ons for Software Validation

## Unit Test Framework Toolkit

- 30% faster test execution
- Custom definition of test vector ranges

## VI Analyzer Toolkit

- Create your own tests in VI Analyzer using LabVIEW Scripting



# Target-to-Host Data Transfer



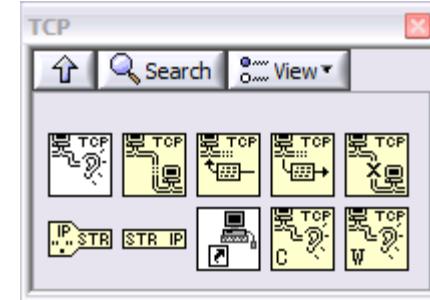
What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# Network Connectivity Options in LabVIEW

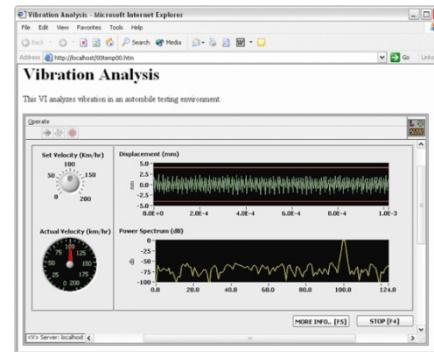
## TCP/IP and UDP

Define low-level communication protocols



## Remote Front Panels

Quickly embed a front panel in a browser



## Shared Variables

Quickly develop distributed systems through drag-and-drop configuration



# Dem o

# Network Streaming in LabVIEW

Based on TCP

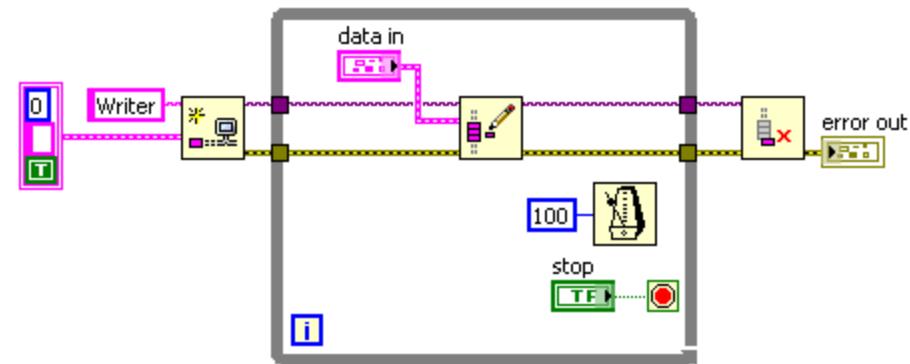
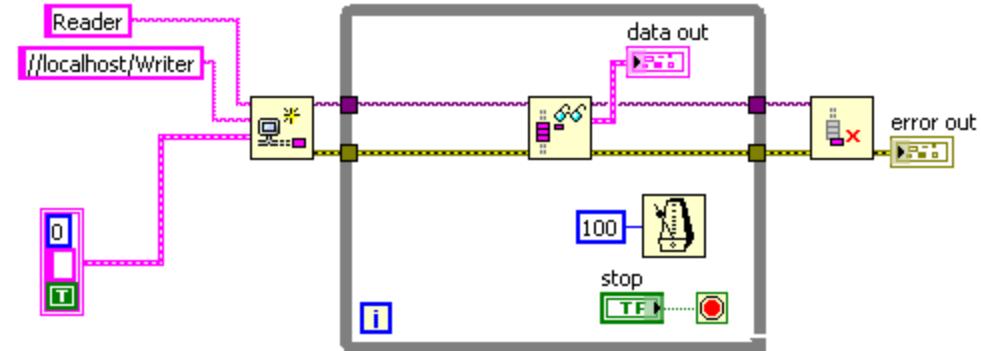
High throughput

Queues -like Experience

Easy to program

Adaptive Data Type

No need to type cast



## What's New

# LabVIEW 2010 Modules



What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# LabVIEW 2010 Real-Time Products

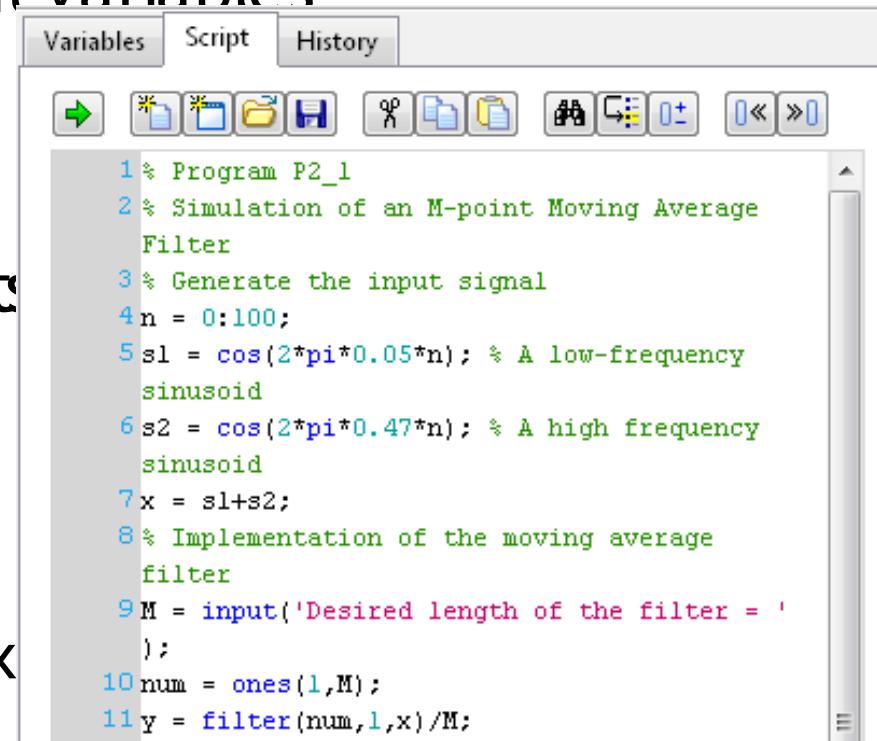
- **LabVIEW Real-Time Module**
  - Web-based configuration and monitoring of networked targets
  - Simpler host-to-target transfer of data using Network Streams
  - Publish variables via Web Services
  - Software IEEE 1588 as timing source for Timed Loop
- **NI-Real-Time Hypervisor 2.0 - One PC, Two OSs!**
  - Shared memory for higher data transfer rates between OSs
  - Higher customization for CPU partitioning
  - Added Linux support



# LabVIEW 2010 MathScript RT Module

## MathScript Node

- Validate your custom .m files for deterministic behavior
- Automatically create output variables



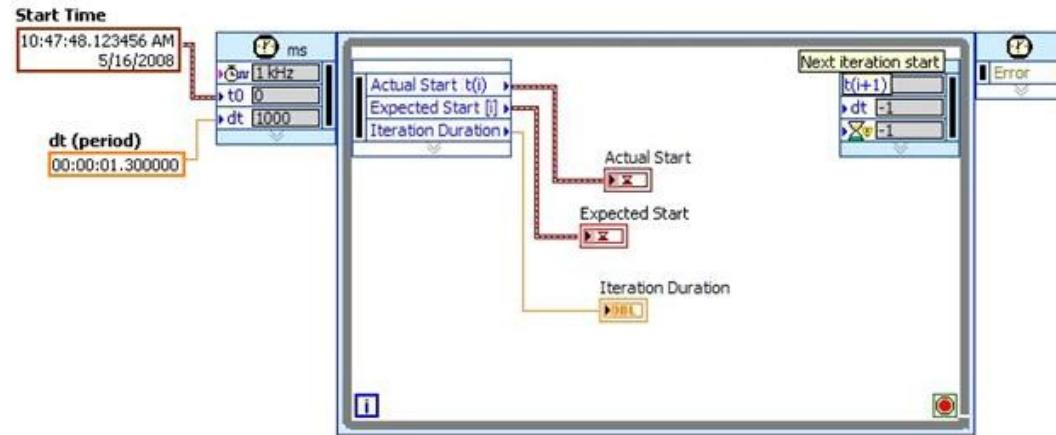
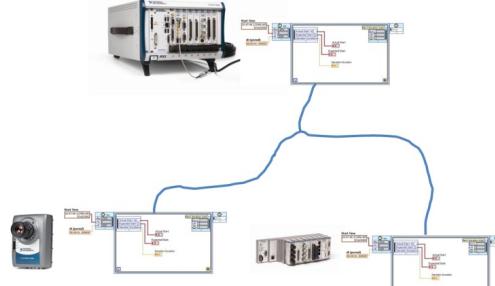
```
1 % Program P2_1
2 % Simulation of an M-point Moving Average
3 % Filter
4 n = 0:100;
5 s1 = cos(2*pi*0.05*n); % A low-frequency
6 sinusoid
7 s2 = cos(2*pi*0.47*n); % A high frequency
8 sinusoid
9 x = s1+s2;
10 % Implementation of the moving average
11 filter
12 M = input('Desired length of the filter = ')
13 num = ones(1,M);
14 y = filter(num,1,x)/M;
```

## MathScript Window

- Performance improvements
- Enhanced text-editor
  - Syntax highlighting
  - Line numbers
  - Find/replace text dialog box
  - Bookmarks

# Free Software-1588 Synchronization

Synchronization across NI Platforms



- **Specifications**
  - 10's nanosecond event resolution on PCI and PXI
  - Sub millisecond event resolution on other LabVIEW RT targets
- **Features**
  - Control the timed loop with



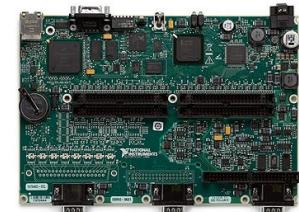
absolute time driven by 1588 or GPS

What's New in LabVIEW 2010

- Connect over standard network/switch hardware

[ni.com/labview](http://ni.com/labview)

# Dem NI TimeSync Platform Support

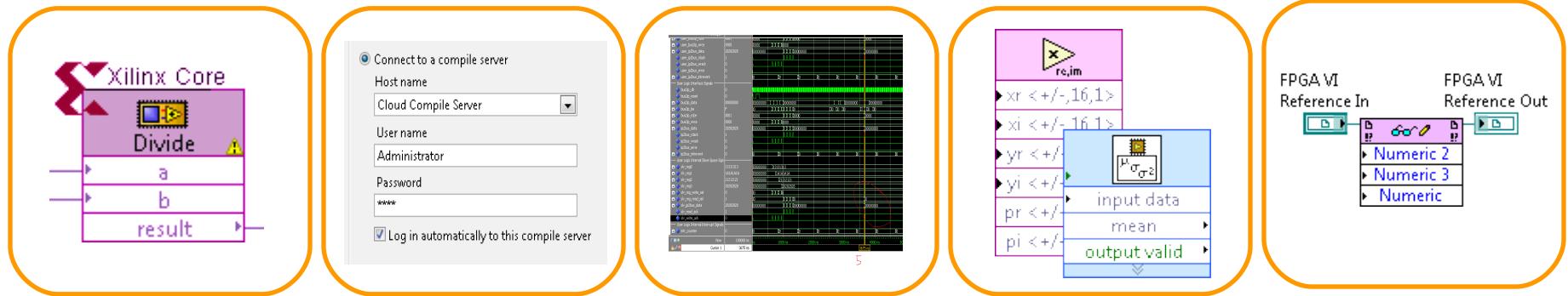


PXI  
CompactRIO  
Single-BoardRIO  
Compact FieldPoint  
 National  
Instruments™  
Smart Cameras

What's New in LabVIEW 2010

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# LabVIEW 2010 FPGA Module



**IP Integration Node** - Directly import Xilinx .xco files or your own VHDL easily

**New Compilation Flow** - Earlier Compilation Estimates and Build Specifications

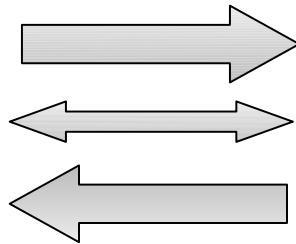
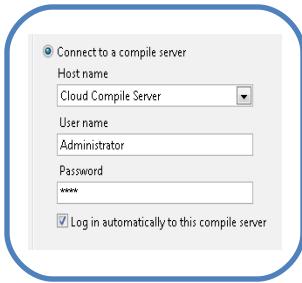
**Cycle-Accurate Simulation** - Use ModelSim for Cycle-Accurate Simulation

**More IP Blocks** - New IP for Statistics, Complex Multiplication, and More

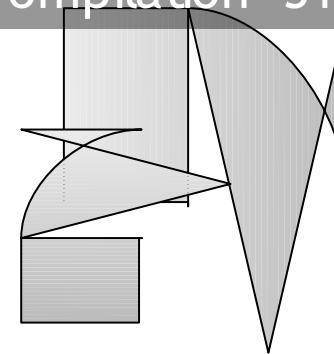
**Host Improvements** - New Dynamic reference for Host VI reuse

# LabVIEW 2010 FPGA Compilation

## LabVIEW FPGA Compile Farm Toolkit



Compilation "Smart" Server



Compilation Workers

# New Rugged CompactRIO: cRIO 9023/9025 Real-Time Controllers



533 and 800 MHz Processors

Dual 9-30V Inputs

Up to 4 GB internal Storage

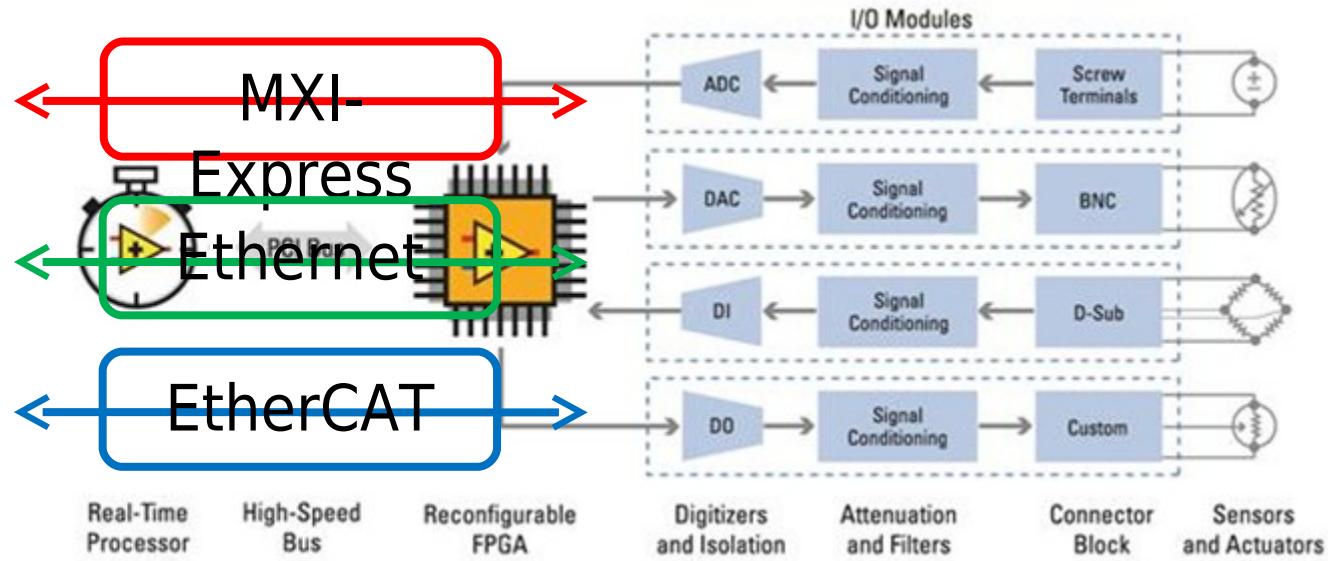
-40 to 70C Operating temp

**NATIONAL INSTRUMENTS** Dual I/O Expansion

What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# New cRIO (with FPGA) Chassis



# NI RIO Expansion Chassis

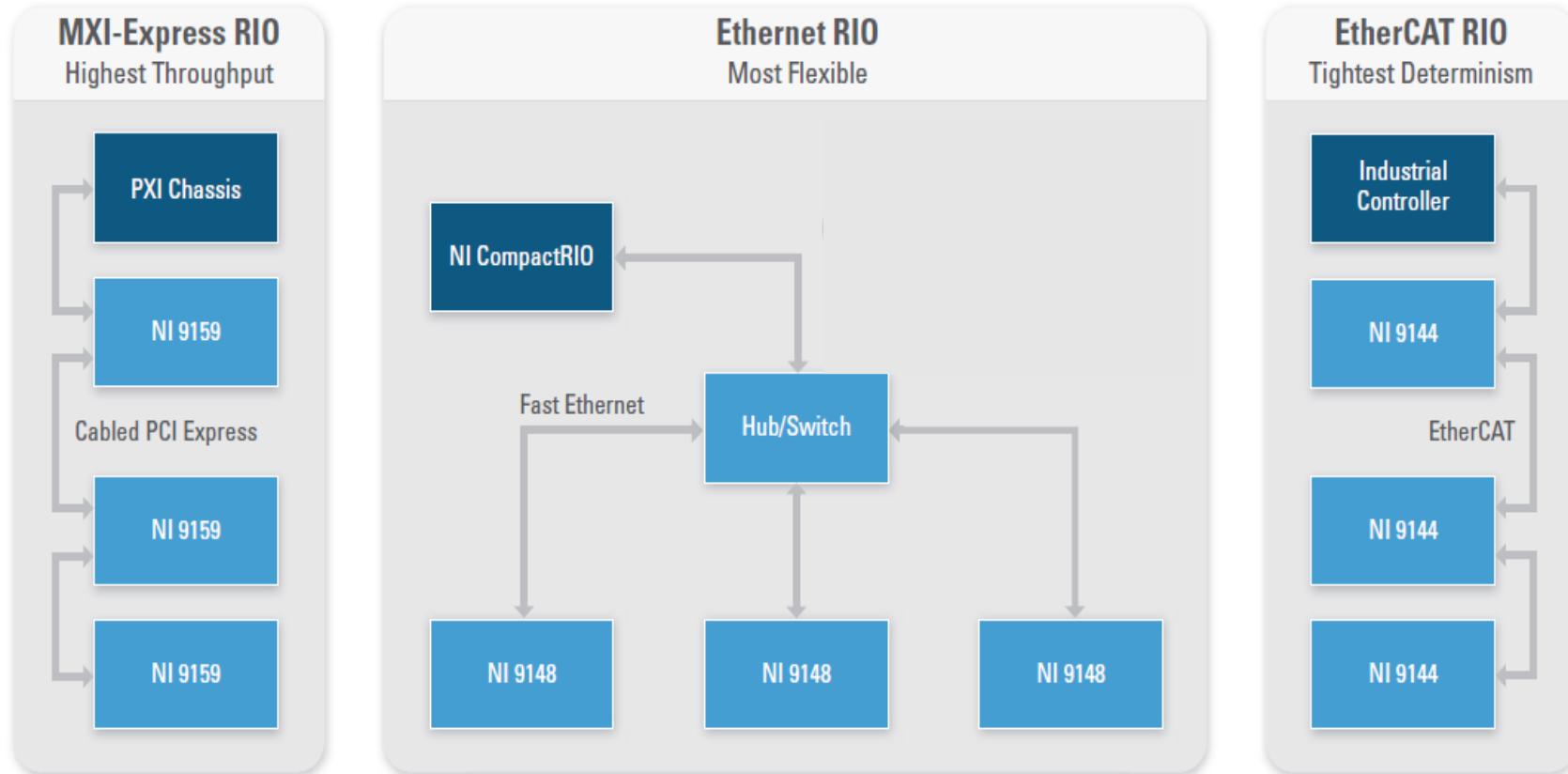


Figure 1. RIO expansion I/O provides solutions for high-performance rack-mount test, distributed deterministic control, and more.

# Expansion Chassis Details

	<b>MXI-Express RIO</b>	<b>Ethernet RIO</b>	<b>EtherCAT RIO</b>
	NI 9157, 9159	NI 9148	NI 9144
<b># Slots</b>	14	8	8
<b>FPGA</b>	Virtex5 (LX85 or LX110)	Spartan 2M	Spartan 2M
<b>Network Topology</b>	Daisy-Chain	Same as Ethernet	Daisy-Chain
<b>Distance</b>	7m between nodes	100m before repeater	100m before repeater
<b>Synchronization</b>	FPGA based DIO	FPGA based DIO	Implicit in bus operation
<b>Jitter</b>	<10µs	No Spec	<1µs
<b>Bus Performance</b>	250MB/s	100Mb/s	100Mb/s
<b>API Support</b>	Host Interface	Host Interface/RSI	RSI
<b>Windows / RT</b>	Yes / Yes	Yes / Yes	No / Yes

# Building LabVIEW Add-Ons



What's New in LabVIEW 2010

[ni.com/labview](http://ni.com/labview)

# LabVIEW 2010

## Extending the Platform

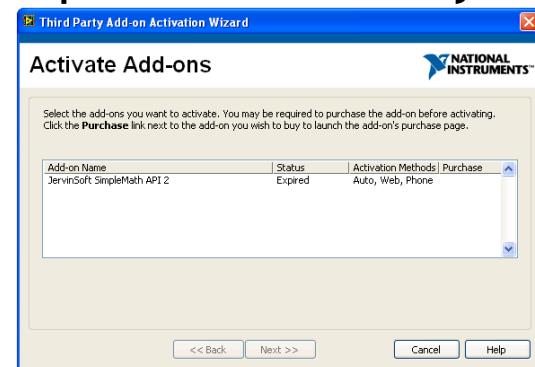
Dem  
o

### Licensing and Activation for 3rd Party Add-ons

Commercial Grade Activation solution from Concept Software

Allows for LabVIEW Add-ons created by the development community to implement 30-day software trials

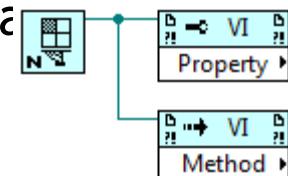
Fully integrated in LabVIEW 2010



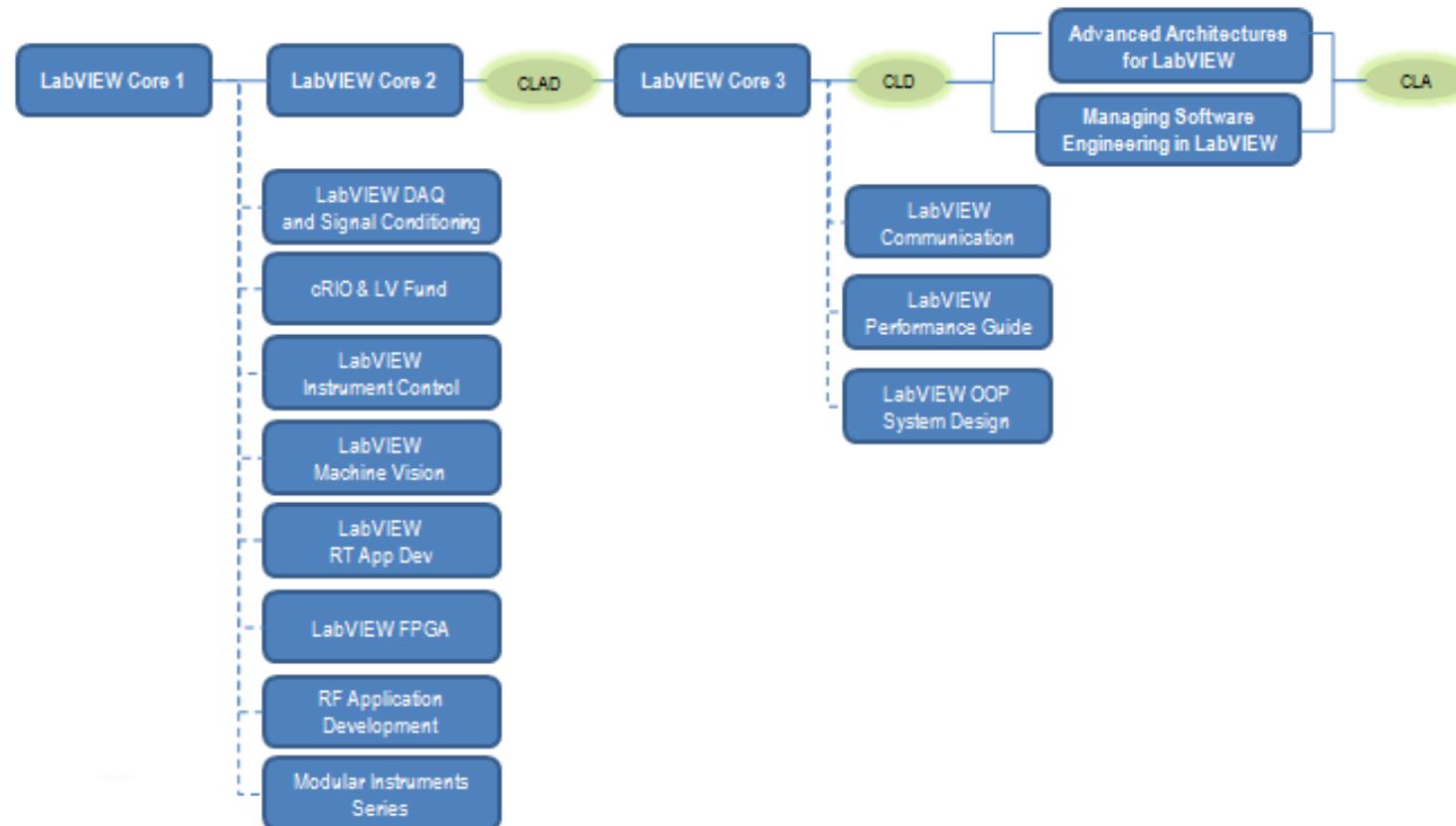
### LabVIEW Scripting

Intended for power users to enhance the capabilities of LabVIEW during editing

Used to inspect, modify, or generate LabVIEW code automatically



# LabVIEW Training and Certification Path



[ni.com/romania/training](http://ni.com/romania/training)

# Training and Certification Membership Program



**Flat rate training program with**

- ✓ unlimited access to all scheduled courses for one or two years,
- ✓ personalized training programs,
- ✓ option to retake all courses,
- ✓ skill validation with professional credentials,
- ✓ and money-back satisfaction guarantee.

# Thank you for your attention!