Next Generation Graphical Programming with LabVIEW for ARM Microcontrollers
Profile

- Leaders in Computer-Based Measurement and Automation
- Long-term Track Record of Growth and Profitability
- $821M Revenue in 2008
- More than 5,000 employees; operations in 40+ countries
- Fortune’s 100 Best Companies to Work For 10th Consecutive Year

Record Revenue of $821 Million in 2008
What We Do

Low-Cost Modular Measurement and Control Hardware

Productive Software Development Tools

Highly Integrated Systems Platforms

Used By Engineers and Scientists for Test, Design and Control
Increasing Levels of Software Abstraction

- Machine Code
- Assembly
- C
- C++
- Graphical Programming

Abstraction vs Time
Graphical System Design uses High-Level Design Models

Data Flow

C Code, VHDL

Textual Math

Simulation/MBD

Statechart

Desktop

Real-Time

FPGA

Microprocessors

ni.com
1 \[ c = 0.285 + 0.013i \]
2 \[ 2[X, Y] = \text{meshgrid}(x, y) \]
3 \[ z = x + iY \]
4 \[ \text{for } k = 1:30 \]
5 \[ z = z \cdot 2 + c \]
6 \[ \text{end} \]
LabVIEW Graphical Development Environment

- Intuitive, compiled graphical programming language
- Deployment to desktop, mobile, industrial and embedded targets
Standard Embedded Architecture, Standard Design Tool

- PXI RIO
- CompactRIO
- Singleboard RIO
- Custom Design

Options:
- LabVIEW Real-Time target
- LabVIEW FPGA target
- LabVIEW µP SDK target

Standard Embedded Architecture, Standard Design Tool

COTS I/O

Custom I/O
LabVIEW Microprocessor SDK

Porting LabVIEW

1. Port the LabVIEW Runtime Library to the target OS
2. Build Plug-In VIs
3. Add I/O Drivers and Palettes (Optional)
LabVIEW Embedded Module for ARM® Microcontrollers

- ARM7, ARM9 and Cortex M3
- Over 260 supported processors
- Integrated drivers for analog, digital and communications
- Desktop Simulation support for software development
Demonstration
Elemental I/O
Simple API for Analog, Digital, and Pulse Width Modulation
Timed Loop
Multithreaded programming
Peripheral Drivers
TCP/IP, UDP, Serial, Display, I²C, SPI
Integration with KEIL uVision

- Cycle-accurate simulation
- Advanced debugging
Inline C Node

- Combine graphical and text code in one diagram
What’s Happening
What’s Happening

C code generation

My VI.vi

Build

My_VI.c
What’s Happening

Build

3rd Party Cross-Compiler

My_VI.exe

My_VI.c

existing code.c

Runtime Library
What’s Happening

My_VI.exe

Download over TCP, Serial, JTAG, etc.

Run
What’s Happening

Interactive debug connection over TCP, Serial, JTAG, etc.
High-Level Design Models

Data Flow  C Code  Textual Math  Simulation  Statechart

Desktop  Real-Time  FPGA  Microprocessors

LabVIEW

Control
Filling
Draining
Log

Monitor
Acquire
ARM Processor Family

- ARM7
- ARM9
- ARM11
- Cortex M
- Cortex R
- Cortex A

LabVIEW Microprocessor SDK

LabVIEW Embedded Module for ARM Microcontrollers
Tier 1 vs. Tier 2

Tier 1
- Out-of-the-box
- Palettes for I/O and communication

Tier 2
- Processor Support
- You Develop Drivers

<table>
<thead>
<tr>
<th></th>
<th>Tier 1</th>
<th>Tier 2</th>
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<tbody>
<tr>
<td>Basic Programming Structures</td>
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<td>Numeric, Boolean Logic</td>
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<td>Digital I/O</td>
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<td>Cycle-Accurate Simulation</td>
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Development Kit

Included

- LabVIEW
- ARM Microcontroller Development Kit
- LabVIEW Embedded Module for ARM Microcontrollers
- ULINK2 USB/JTAG Adapter
- Evaluation Board
Development Kits: Option 1

ARM7
- Features NXP LPC2378
  - 2 serial Interfaces
  - LCD
  - Ethernet
  - Analog In/Out
  - Pulse Width Modulation
  - Digital In/Out
Development Kits: Option 2

Cortex M3

- Features LM3S8962
  - OLED Graphics
  - Ethernet
  - Analog In
  - Pulse Width Modulation
  - Digital In/Out
Supporting Tier 2 Devices

More than 260 ARM7, ARM9, and Cortex-M3 microcontrollers: www.keil.com/arm/chips.asp

1. Port RTX Real-Time Kernel
2. Integrate Real-Time Agent module for debugging
3. Create target in LabVIEW and integrate Keil tools
4. Develop peripheral and I/O drivers
Interactive Design
• Control design
• Dynamic system simulation
• Digital filter design
• Advanced mathematics

Deployable Targets
• Rugged deployment platforms
• Distributed networking
• Human-machine interfaces
• Custom designs

Tight I/O Integration
• I/O modules and drivers
• COTS FPGA hardware
• VHDL and C code integration
• Design validation tools

Graphical System Design
Standard Embedded Architecture, Standard Design Tool

PXI RIO

Compact RIO

Singleboard RIO

Custom RIO

COTS I/O

COTS I/O

COTS I/O

Custom I/O

LabVIEW Real-Time target

LabVIEW FPGA target

LabVIEW µP SDK target

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Empowering Users Through Software

LEGO Mindstorms NXT
“the smartest, coolest toy of the year”

CERN Large Hadron Collider
“the most powerful instrument on earth”
For Additional Information

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