National Instruments

Inter-University PhD training plan proposal

UGent / KU Leuven / VUB / UAntwerpen / UHasselt

Joris Donders – Joris.donders@ni.com

Sales Manager – Belgium

Filip Langenaken – Filip.Langenaken@ni.com

Academic Program Manager – Northern Region

Joeri Wingelinckx – Joeri.Wingelinckx@ni.com

Services Manager – Northern Region

Agenda

- Introduction
- Course Overview
- Seminar Overview
- Question & Answer session

Agenda

- Introduction
- Course Overview
- Seminar Overview
- Question & Answer session

Introduction – Background information

- Government initiative
- Goal = give PhD's the chance to grow individually and professionally by following specific courses
- LabVIEW is a key platform for Engineers & Scientists to know about
- National Instruments mission is to:

> Equip engineers and scientists with tools to accelerate productivity, innovation, and discovery.

National Instruments

NI has established a track record of consistent growth and profitability by delivering solutions that facilitate innovation throughout industry and academia.

Year established: 1976

Revenue: $1.04B revenue in 2011

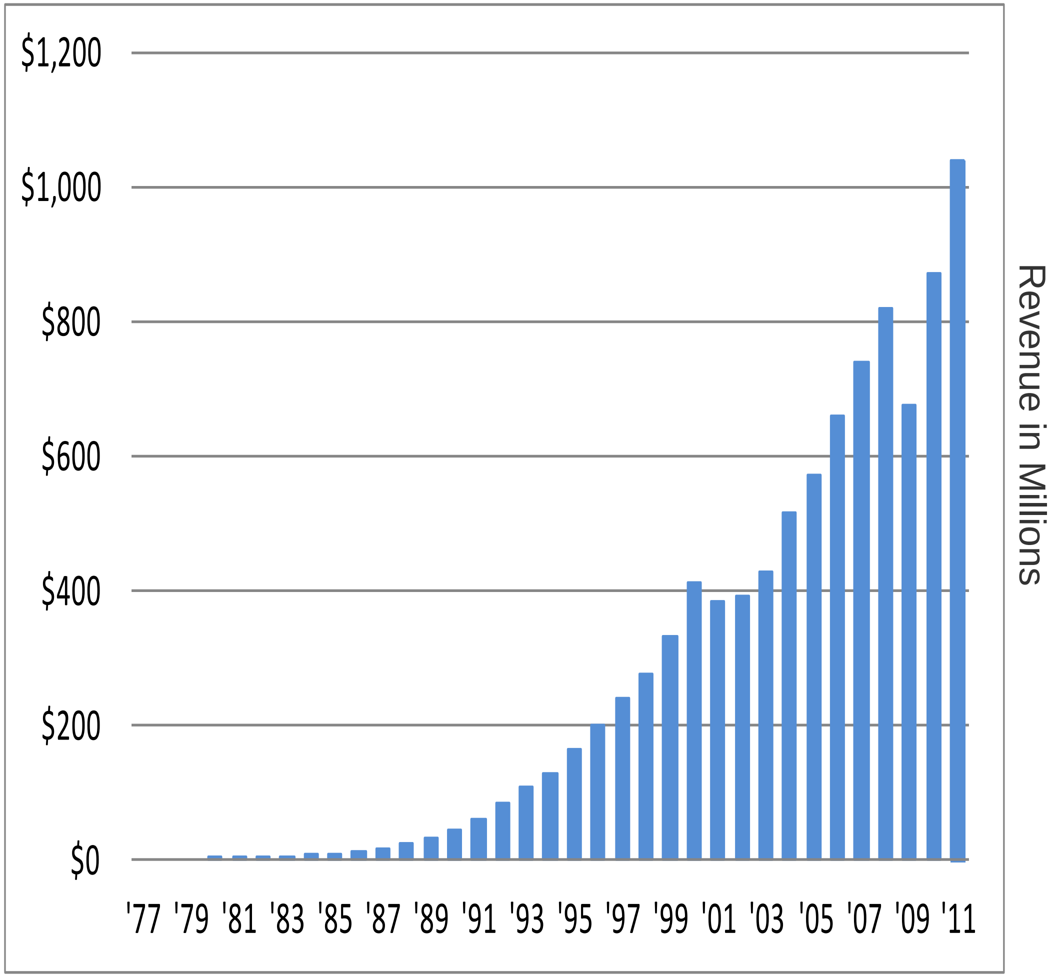
Global Operations: 6,200 employees; operations in 40+ countries

Broad customer base: More than 30,000 companies served annually

Diversity: No industry >15% of revenue

Culture: Named among FORTUNE's Top 25 Multinational Workplaces

Strong Cash Position: Cash and short-term investments of $366M at December 31, 2011



Diversity of Applications

No Industry >15% of Revenue


Telecom


Academic


Automotive


Semiconductors


Electronics


Computers


ATE


Military/
Aerospace


Advanced
Research


Petrochemical


Food
Processing


Textiles

Graphical System Design

A Platform-Based Approach

Test

Monitor

Embedded

Control

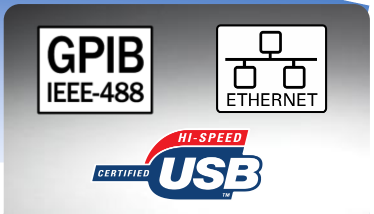
Cyber Physical

NATIONAL INSTRUMENTS LabVIEW™

Desktops and PC-Based DAQ

PXI and Modular Instruments

RIO and Custom Designs

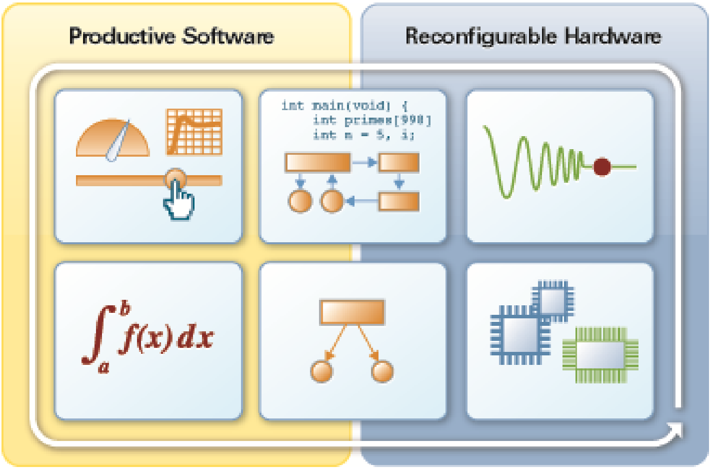


Open Connectivity with 3rd Party I/O

Realizing the Vision of Graphical System Design

"In the past, we would have needed a team of four people – a controls expert, a mechanical engineer, an electrical engineer, and a programmer, now it takes only one person."

Sean Dougherty, Mechatronics Supervisor for MacDonald Dettwiler and Associates



Think Platform.

Invest in a platform-based approach to help you more easily adapt to changing requirements and technology over time.

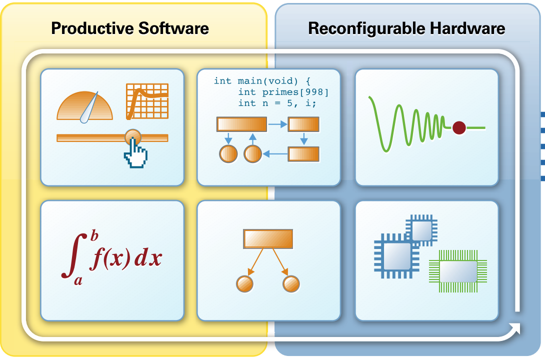
Software

Hardware

COMMUNITY
140,000+ online members
250+ registered user groups
1000+ job postings online
400K+ children through LEGO

CONNECTIVITY
9000+ instrument drivers
8000+ example programs
1000+ motion drives
1000+ smart sensors
1000+ Third-party PAC devices

COLLABORATION
280+ third-party add-ons
400+ Solution partners
1000+ value added resellers
35+ training courses



PROCESSOR
Intel, Microsoft, Freescale, Wind River
Multi-core and real-time technology

FPGA
Xilinx Virtex & Spartan
Reconfigurable hardware

IP
Control & signal processing IP & I/O drivers
Built-in graphical IP, integrate user IP

I/O
Analog Devices, Texas Instruments
Connect to any sensor & actuator

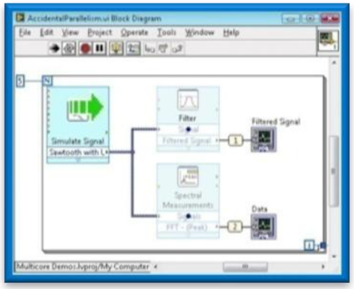
BUS
PCI/PCIe, Enet, USB, wireless, deterministic Enet, Open architecture

Supporting the NI vision with a world-class ecosystem

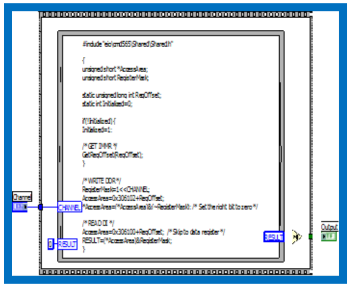
Graphical System Design uses multiple Models of Computation

Model Based Design

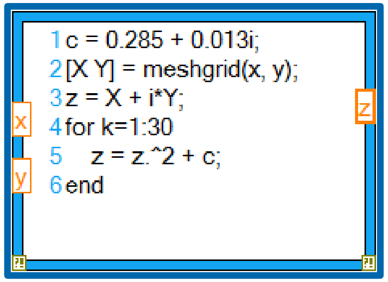
Dataflow



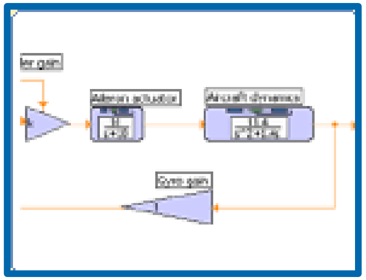
C, VHDL Code



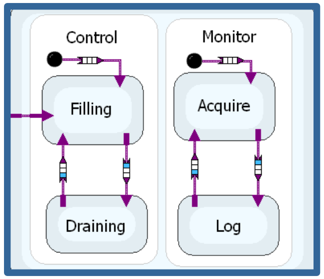
Textual Math



Simulation



Statechart

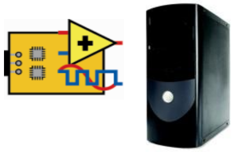


Desktop

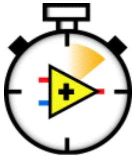
PXI

CompactRIO, NI CompactDAQ

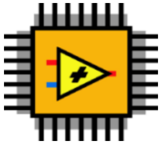
Windows, Linux, Mac



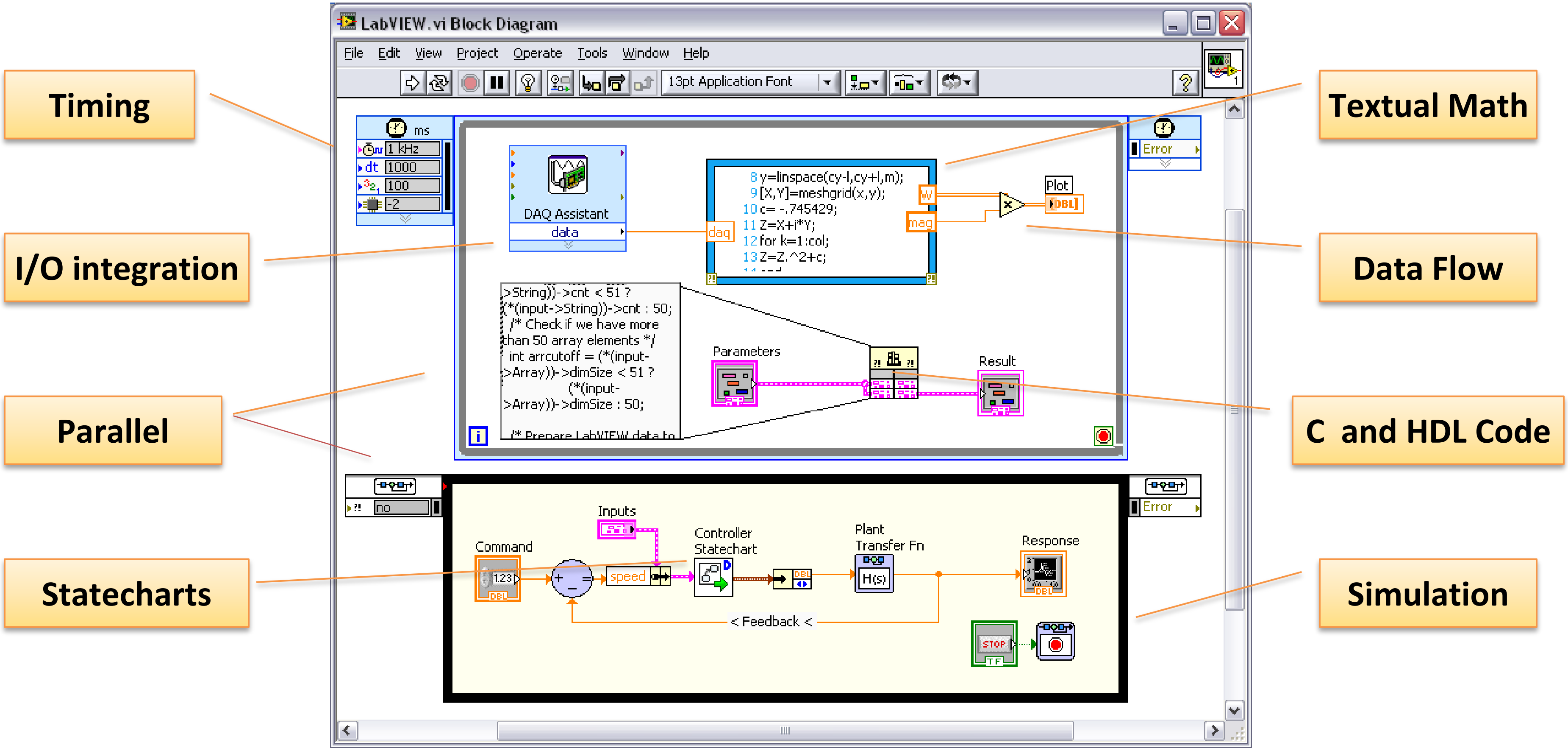
Real-Time



FPGA



LabVIEW System Design Environment



NATIONAL INSTRUMENTS

Introduction – Planning

Course	University	# People	Date
~~Core 1~~	~~UGent~~	~~16*~~	~~04/06-6/06~~
~~Core 2~~	~~UGent~~	~~16*~~	~~07/06-8/06~~
~~Core 1~~	~~VUB~~	~~16*~~	~~18/06-20/06~~
~~Core 2~~	~~VUB~~	~~16*~~	~~21/06-22/06~~
~~Core 1~~	~~UAntwerpen~~	~~16*~~	~~02/07-04/07~~
~~Core 2~~	~~UAntwerpen~~	~~16*~~	~~05/07-06/07~~
~~Core 1~~	~~KU Leuven~~	~~16*~~	~~16/07-18/07~~
~~Core 2~~	~~KU Leuven~~	~~16*~~	~~19/07-20/07~~
Core 1	UHasselt	16*	30/07-1/08
Core 2	UHasselt	16*	02/08-03/08
Core 1	KU Leuven	16*	20/08-22/08
Core 2	KU Leuven	16*	23/08-24/08
Core 3	UAntwerpen	16*	27/08-29/08
DAQ	UAntwerpen	16*	30/08-31/08
DAQ	UGent	16*	04/09-05/09
RT 1	UGent	16*	06/09-07/09
DAQ	VUB	16*	10/09-11/09
FPGA	VUB	16*	12/09-13/09

- Core 1 & 2 at each university
- Free CLAD certification (organized by NI – date TBD)
- Specialized course are organized at few locations
- Core 1 or experience is needed for specialized courses
- Maximum 16 attendees to be able to provide sufficient guidance
- Wait lists will be shared with NI and universities to find solutions
- Seminar Planning will be communicated later on

NATIONAL INSTRUMENTS

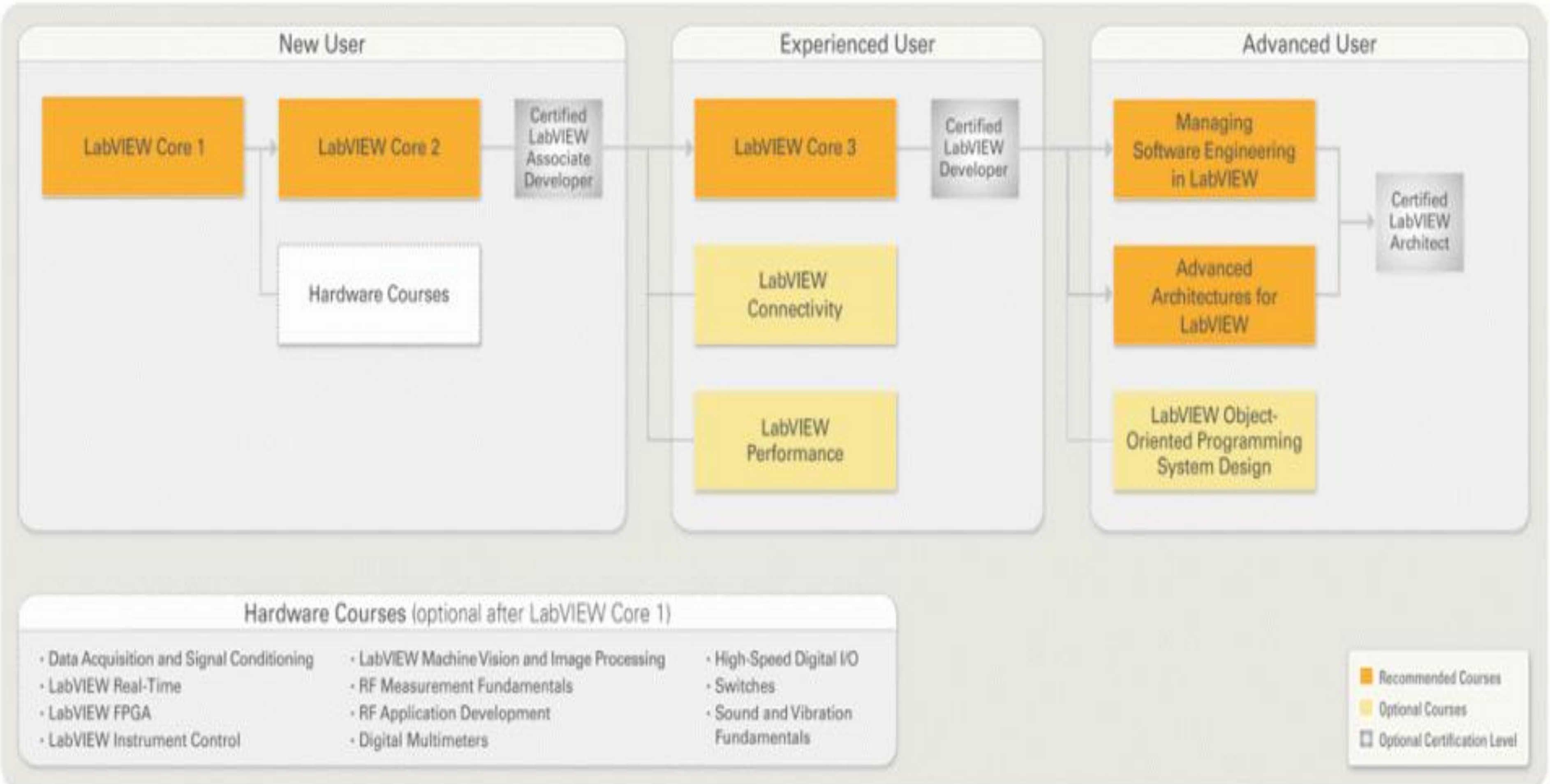
Introduction – Information Sharing

- Custom made website with information
  - http://belgium.ni.com/inter-university/
- Mail your NI specific questions to Info.belgium@ni.com

Agenda

- Introduction
- Course Overview
- Seminar Overview
- Question & Answer session

NI Training Path



Course Overview

- Core 1
  - Software focused, the basics about LabVIEW
  - Get familiar with the LabVIEW environment
- Core 2
  - Software focused, simple architectures in LabVIEW
  - Some advanced user interactions
- Core 3
  - Software Engineering focused, managing applications in LabVIEW
  - Look at some more complex architectures
- DAQ
  - Hardware focused, how to do DAQ with the DAQmx driver
- FPGA
  - Hardware focused, how take advantage of FPGA's without VHDL
- Real Time
  - Hardware focused, how to have stand alone robust reliable applications running on processors with a real time OS

Core 1

This course prepares you to do the following:

- Understand front panels, block diagrams, icons, and connector panes
- Use the programming structures and data types that exist in LabVIEW
- Use various editing and debugging techniques
- Create and save VIs so you can use them as subVIs
- Display and log data
- Create applications that use plug-in DAQ devices
- Create applications that use serial port and GPIB instruments

This course does *not describe the following:*

- Every built-in VI, function, or object; refer to the *LabVIEW Help for* more information about LabVIEW features not described in this course
- Analog-to-digital (A/D) theory
- Operation of the serial port
- Operation of the GPIB bus
- Developing an instrument driver
- Developing a complete application for any student in the class; refer to the NI Example Finder, available by selecting **Help»Find Examples,** for example VIs you can use and incorporate into VIs you create

Core 2

This course prepares you to do the following:

- Apply common design patterns that use notifiers, queues, and events
- Use event programming effectively
- Programmatically control user interface objects
- Evaluate binary file I/O formats and use them in applications
- Modify existing code for improved usability
- Prepare, build, and deploy stand-alone applications

You will apply these concepts as you build a project that uses VIs you create throughout the course. While these VIs individually illustrate specific concepts and features in LabVIEW, they constitute part of a larger project built throughout the course.

This course does *not describe any of the following:*

- LabVIEW programming methods covered in the *LabVIEW Core 1* course
- Every built-in VI, function, or object; refer to the *LabVIEW Help for* more information about LabVIEW features not described in this course
- Developing a complete application for any student in the class; refer to the NI Example Finder, available by selecting **Help»Find Examples,** for example VIs you can use and incorporate into VIs you create

NATIONAL INSTRUMENTS™

DAQ – Data Acquisition

The purpose of this course is to teach you the components of a DAQ system and to teach you how to use that system. By the end of this course, you will understand the components of a DAQ system:

- Sensors
- Signals
- Signal conditioning
- DAQ hardware
- DAQ software

You also will know how to use LabVIEW with a DAQ device to:

- Acquire analog signals
- Generate analog signals
- Perform digital input and output
- Use counters for event counting, pulse generation, pulse measurement and frequency measurement
- Perform signal conditioning on acquired signals
- Synchronize multiple tasks and multiple devices

DAQ

This course does *not describe any of the following:*

- Basic principles of LabVIEW covered in the *LabVIEW Core 1 course*
- Every built-in VI, function, or object; refer to the *LabVIEW Help for* more information about LabVIEW features not described in this course.
- Developing a complete application for any student in the class; refer to the NI Example Finder, available by selecting **Help»Find Examples,** for example VIs you can use and incorporate into VIs you create

Refer to the *LabVIEW Help for more information about a particular* DAQmx VI.

FPGA

This course presents the following topics:

- Design and implement applications using the LabVIEW FPGA Module
- Control timing and synchronization on the FPGA target
- Compile your LabVIEW FPGA VI and deploy to NI RIO hardware
- Create deterministic control and simulation solutions on the NI LabVIEW platform

This course does not present any of the following topics:

- Every built-in VI, function, or object; refer to the *LabVIEW Help for* more information about LabVIEW features not described in this course
- Developing a complete application for any student in the class; refer to the NI Example Finder, available by selecting **Help»Find Examples,** for example VIs you can use and incorporate into VIs you create

Real Time I

This course presents the following topics:

- Concepts of real-time and determinism
- Configuring and communicating with real-time hardware
- Understanding memory usage, multithreading, priorities, and shared resource in the LabVIEW Real-Time Module
- Communicating between a host computer and RT target over the network
- Developing a deterministic, reliable application

This course does not present any of the following topics:

- Information and concepts covered in *LabVIEW Core 1 course*
- Control, PID, and/or Fuzzy Logic theory
- Analog-to-digital (A/D) theory
- Operation of GPIB, RS-232, Motion, CAN, or VISA

Agenda

- Introduction
- Course Overview
- Seminar Overview
- Question & Answer session

Seminar Overview

Data-acquisition Technology Seminar
Control Design & Validation Seminar
Semiconductor Test Seminar
Software Defined Radio Seminar
Data mining, data management & Reporting Seminar
Sound & Vibration, dynamic signal acquisition Seminar
Trends in Energy, measurements & monitoring Seminar
…..

- Organized by National Instruments
- Location selected by NI and number of subscriptions
- Promoted both by National Instruments & Doctoral School
- Timeframe: July – December

Agenda

- Introduction
- Course Overview
- Seminar Overview
- Question & Answer session

I'm a PhD in … - What should I follow?

- Core 1 is a must for every engineer
  - You will know about LabVIEW Environment
- Core 2 is highly recommended for every engineer
  - You will know about programming with LabVIEW
- Core 3 is recommended for long lasting applications
  - These applications require a very good programming architecture
- Real Time is a must for PhD's that needs deterministic control in their application or have to develop an embedded system
  - Even in chemistry, biomedical, mechanical engineering you need your system to react to inputs and generate the desired output
  - Implement simple PID's
- DAQ is interesting for every engineer.
  - To do measurements is to learn new things and gain more insight. Therefore being able to do great DAQ is interesting for engineers
- FPGA is a key technology for the future and interesting for everyone.
  - Yesterday a customer said to his colleagues: I know one thing. There are 2 kinds of people. The people that are using FPGA's or the ones that are going to use them in the near future.

High-Level FPGA Applications

- Digital Protocols and Communication Busses
- High-Speed or Precision Control
- Automated Test
- Custom Data Acquisition
- Fast Stimulus/Response Testing
- Signal Processing (DSP) – Filtering/Transforms
- Certified Reliability Applications – Medical, Mil/Aero
- RF & Wireless Modulation/Downconversion/Encoding
- HIL Simulation – Sensors and systems
- Off-Loading or In-Line processing

Academic & Research

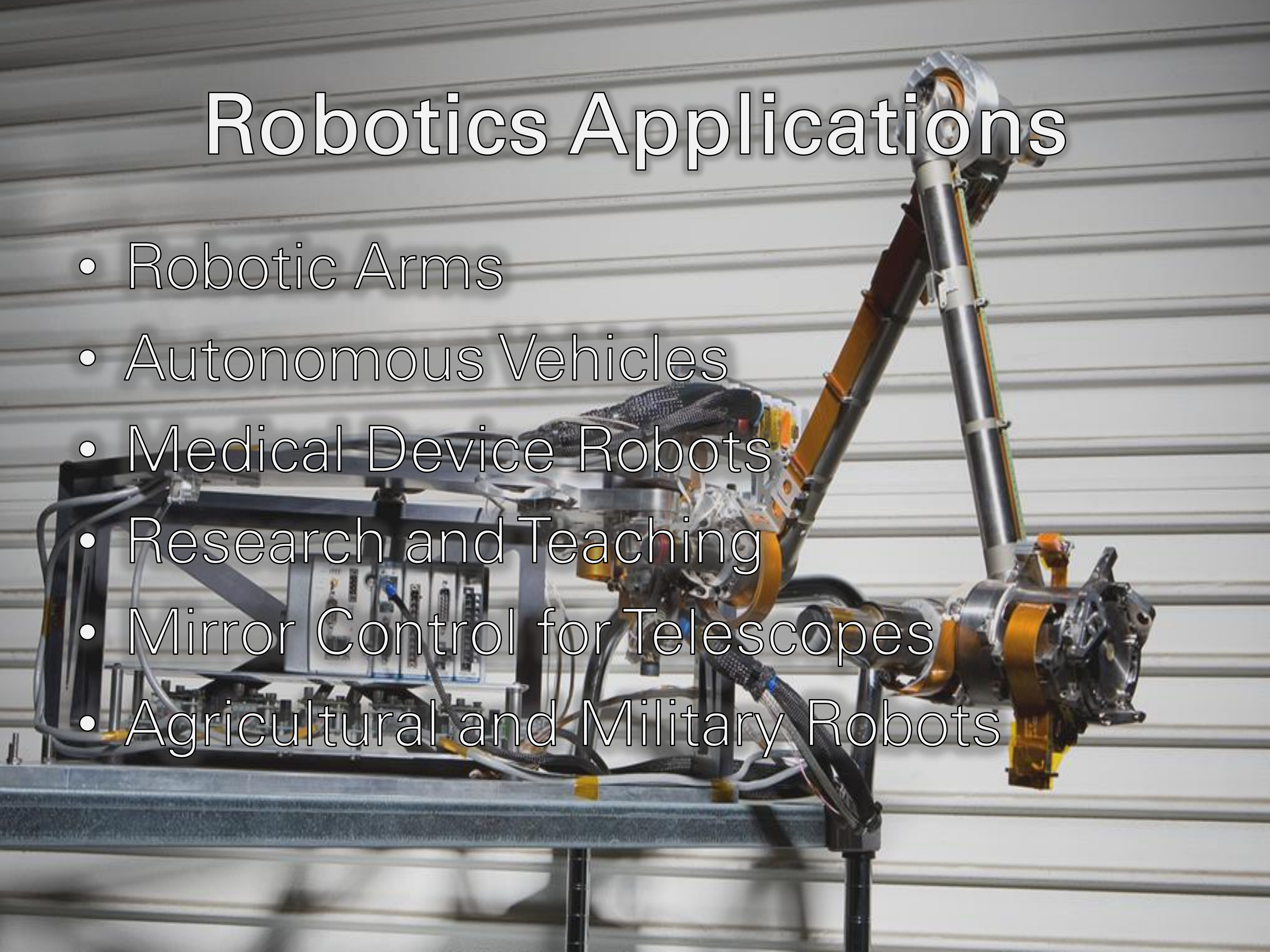
- Physics
- Robotics
- Life Science
- Nanotechnology
- Structural Dynamics
- RF & Communication
- Control & Mechatronics

Green Energy

- Renewable Energy Research
- Photovoltaic Tests
- Solar Panel Verification
- Solar Panel Manufacturing
- MPPT Testing and Control
- Solar Harvesting Control and Monitoring

Automotive

- Hardware in the Loop Testing
- ECU test & Validation
- Test Rigs (engine, ...)
- Safety Testing
- Acoustic Testing
- Hybrid Propulsion Research
- In-vehicle Measurements and Data-logging



Robotics Applications

- Robotic Arms
- Autonomous Vehicles
- Medical Device Robots
- Research and Teaching
- Mirror Control for Telescopes
- Agricultural and Military Robots

Aerospace / Defense

- Communications
- Simulation
- HIL
- UAV
- Wind Tunnel Test & Control


Green Energy
• Structural Health Monitoring
• Generator / Gearbox Monitoring
• Power Quality Monitoring
• Pitch / Yaw Control
• HiL Turbine Simulation
• Power Inverter Control
• Component Testing
• Acoustic Emissions Testing
• Blade Testing


Aerospace / Defense
Digital Test Systems
Structural Test
Radar
Noise Vibration Test
Electronics Manufacturing Test
1071

Communications

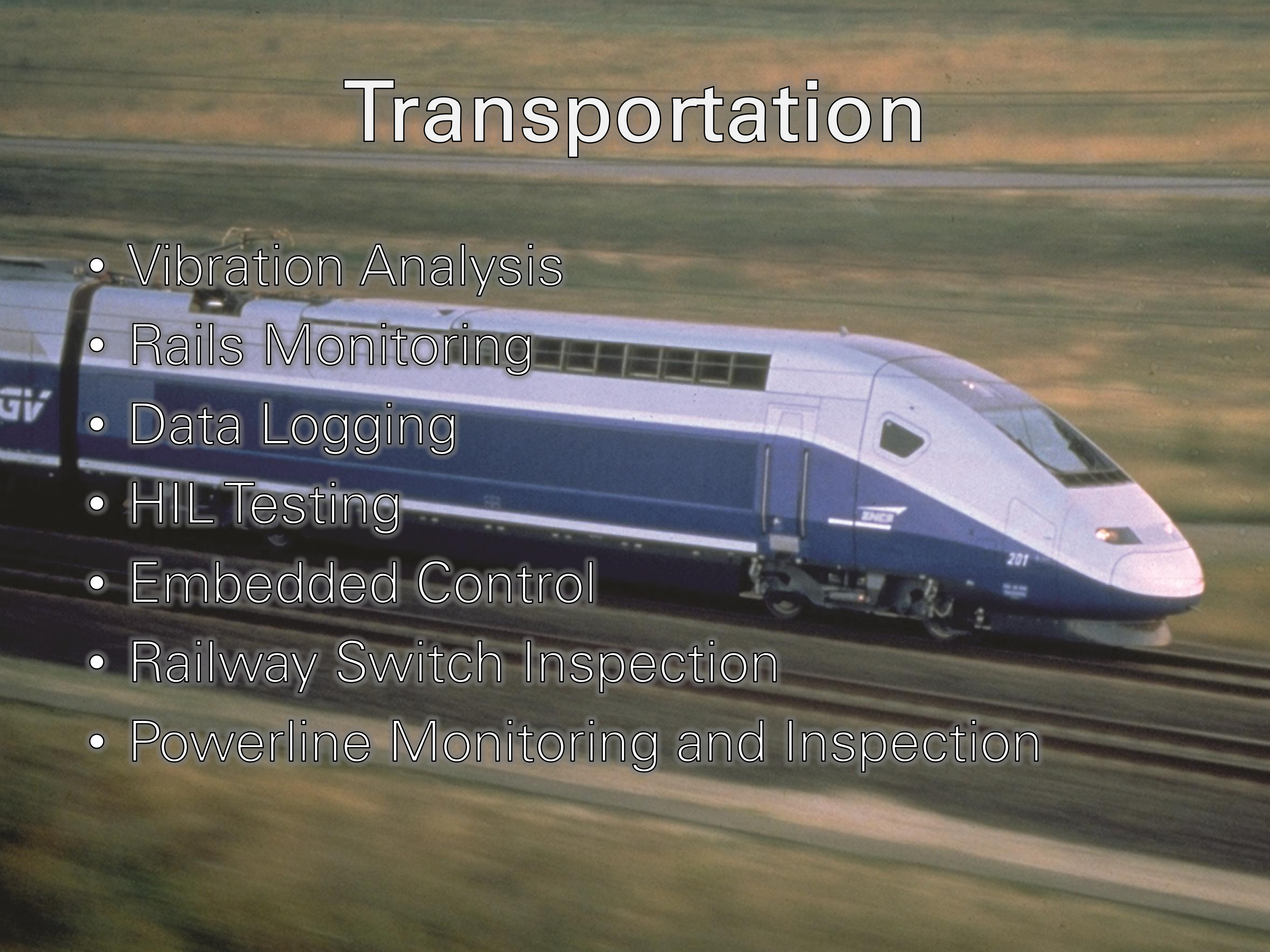
- Wireless Technologies
- WLAN
- WiMax
- GPS Test
- Zigbee
- RFID Testing
- Phase Coherent MIMO
- Automated Testing

Physics Research

- Particle accelerators
- Fusion Reactors
- Tokamak Plasma Control
- Mirror Control for Telescopes
- Embedded Control
- Synchronization

Green Energy

- Wave and Tidal Energy
- Wind Energy
- Solar Energy
- Energy Storage Systems
- Environmental Monitoring
- Power Quality Monitoring



Transportation

- Vibration Analysis
- Rails Monitoring
- Data Logging
- HIL Testing
- Embedded Control
- Railway Switch Inspection
- Powerline Monitoring and Inspection

Communications

- Base Stations
- Protocol Testing
- Digital Testing
- Design Validation
- Functional Testing
- Spectrum Monitoring

Medical

- Medical Device Design
- Prototyping
- FDA Validation
- Medical Device Test
- Quality Inspection

Q&A