Oslo - Stockholm - Utrecht - Brussels - Copenhagen - Helsinki

NIDays 08

WORLDWIDE VIRTUAL INSTRUMENTATION CONFERENCE

ni.com/nidays

NATIONAL INSTRUMENTS

Access Data from Any Industrial Device, Network and PLC with LabVIEW

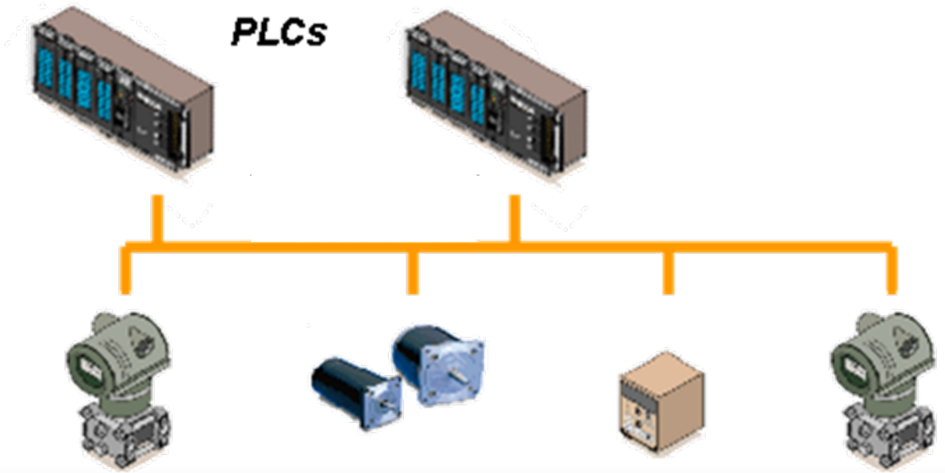
NIDays 2008

Agenda

- Industrial Communications Overview
- Why Connect NI LabVIEW to Industrial Networks and PLCs?
- Basic Analog and Digital I/O
- Native Industrial Network Communication
- OPC with LabVIEW DSC

What Are Industrial Networks?

- Similar to how Ethernet connects computers and printers
- Industrial communications connect industrial devices such as PLCs, sensors, and actuators



Common Industrial Networks

- DeviceNet
- PROFIBUS
- Modbus TCP
- Modbus Serial
- CANopen
- FOUNDATION fieldbus
- Interbus
- CC-Link
- LonWorks
- HART
- PROFINET
- Ethernet/IP

Why Connect NI LabVIEW to Industrial Networks and PLCs?

- High-speed analog measurements
- High-resolution analog measurements
- Advanced analysis (digital filtering, frequency analysis)
- Custom hardware performance with FPGA technology
  - High-speed closed-loop control
  - FPGA-based processing and analysis
- Data logging
- Enterprise connectivity (Web publishing, database)

3 Methods to Connect LabVIEW to Any PLC

Basic I/O

Analog/Digital

Industrial

Communications

OPC

NI PACs

PLCs

Basic I/O – Cheap, Easy, Fast, and Effective

- Available on every platform
- Analog and digital I/O options
- PLC users can easily integrate analog and digital I/O into their ladder logic code
- Allows NI PACs to act as intelligent devices

Basic I/O

- Advantages
  - Fast, deterministic, little or no software overhead
- Considerations
  - Doesn’t scale well
  - Point-to-point wiring (parallel)
  - Can’t communicate lots of data

Example – Automated Filling of Aerosol Cans

- Existing Allen-Bradley PLC system was being used to automate the filling of aerosol cans
- PLC did not have the capability to do high-speed analog for pressure measurements
- CompactRIO was used for high-speed pressure measurements on 8 channels (2 k per channel)
- CompactRIO and Allen-Bradley PLC were integrated using digital I/O


DAS4004
Allen-Bradley

3 Methods to Connect LabVIEW to Any PLC

NI PACs

Basic I/O

Analog/Digital

OPC

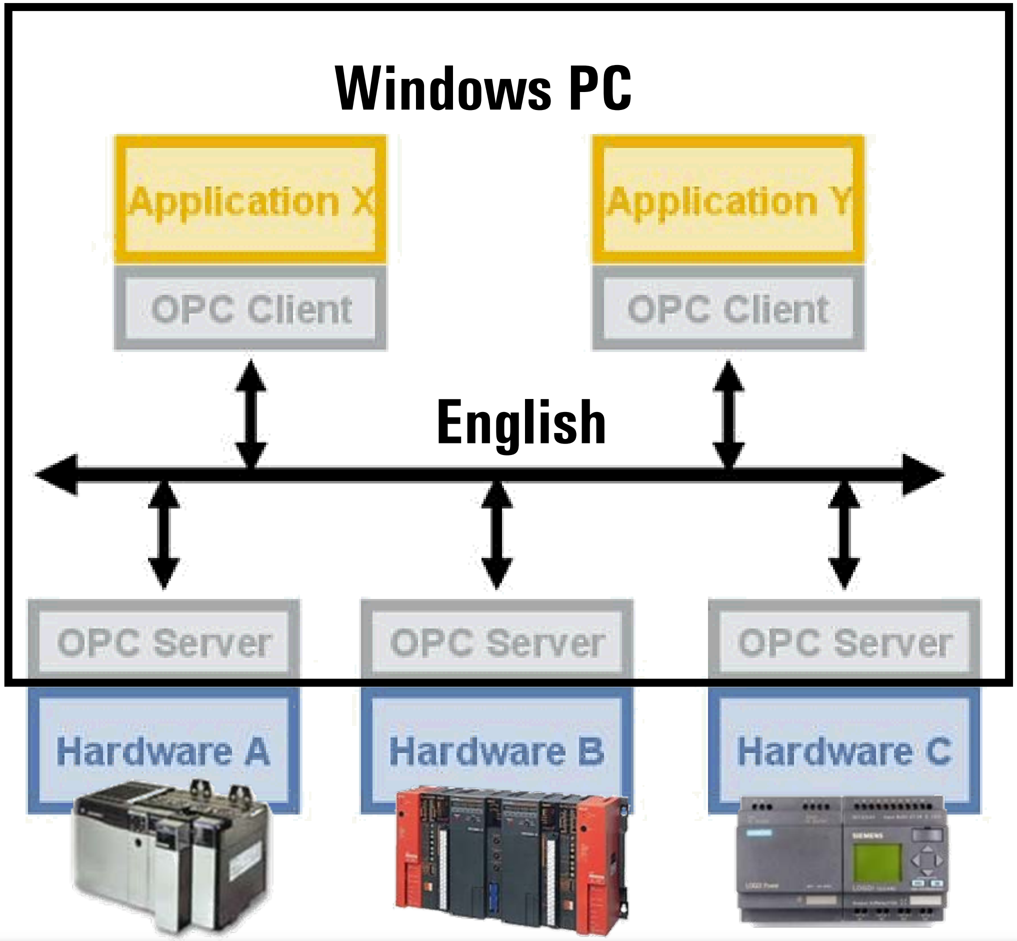
Industrial

Communications

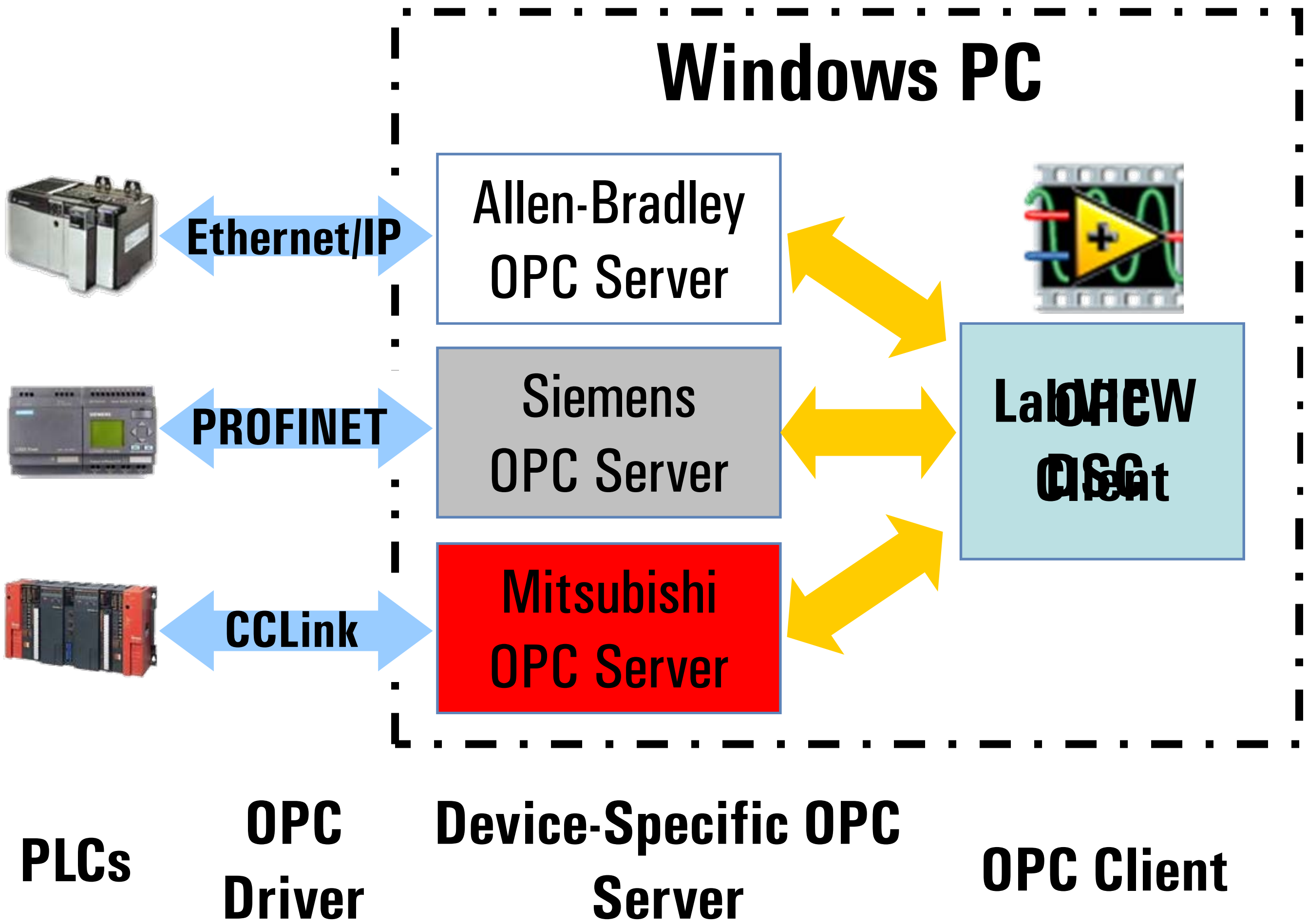
PLCs

What Is OPC?

- Universal language for reading and writing data
- **OPC Client:** Read and write to OPC
- **OPC Server:** Translates between OPC and device-specific protocols

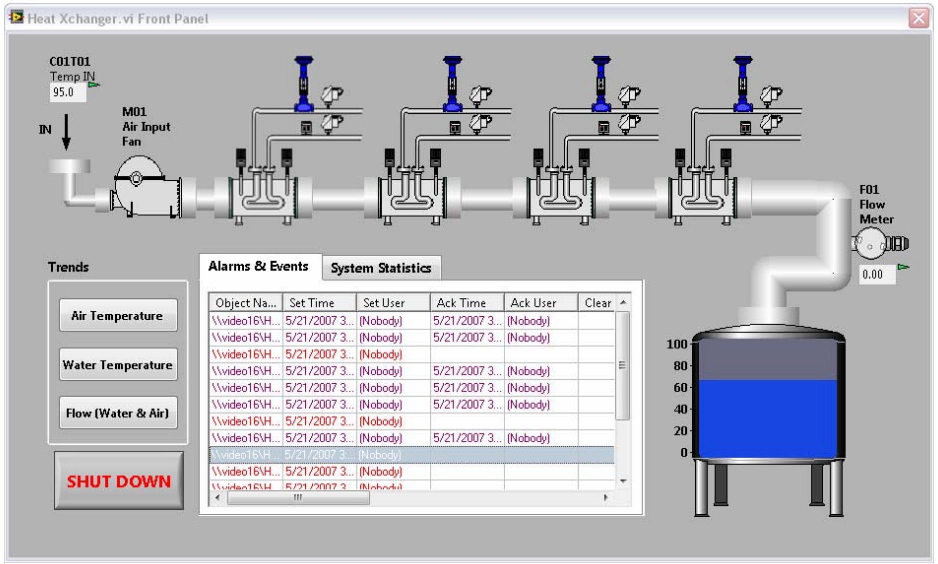


NI LabVIEW DSC OPC Client



What Is the LabVIEW DSC Module?

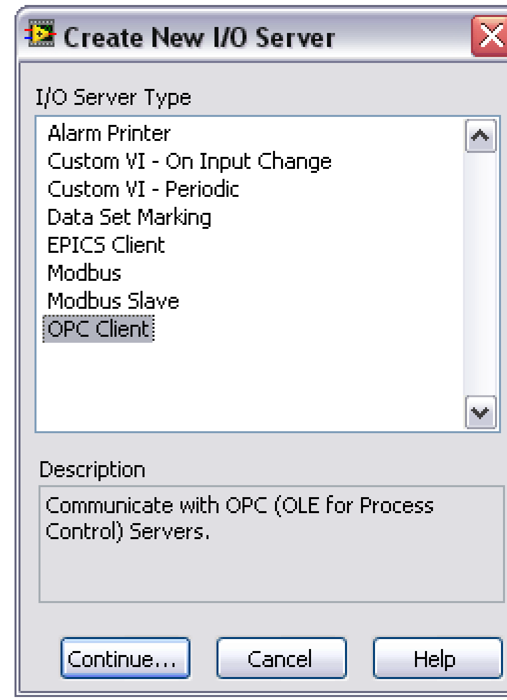
- Makes LabVIEW an OPC client
- Adds features to shared variables
  - Logging
  - Alarming
  - Event monitoring
  - Scaling
- Real-time and historical data trending
- System security
- Extensive industrial graphics library



NI OPC Servers for Third-Party PLCs

- New for LabVIEW 8.5
- Adds OPC support for more than 100 PLCs
- Connects with LabVIEW DSC OPC client
  - Evaluation version included with DSC
- Servers included for:

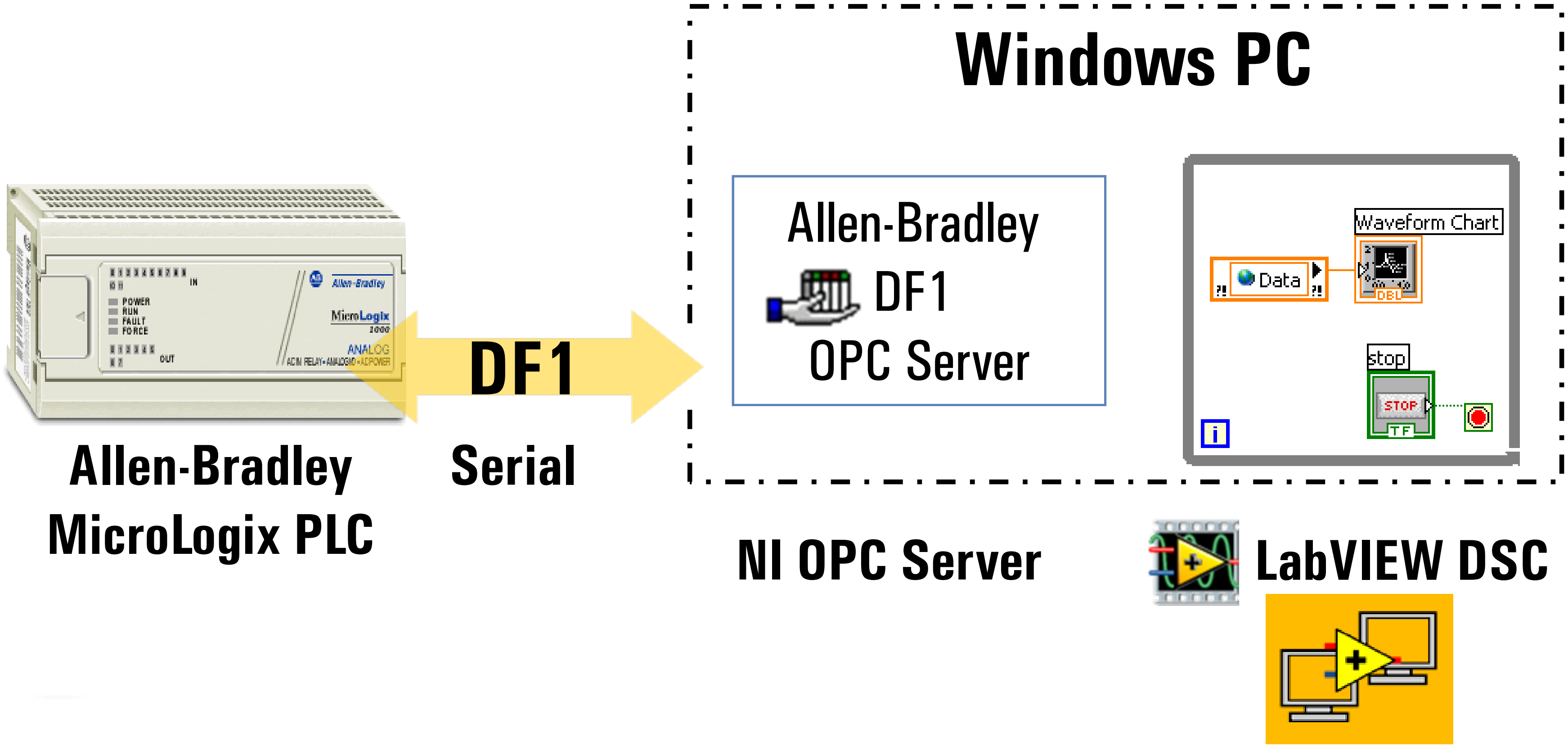
•Allen-Bradley
•AutomationDirect
•Cutler-Hammer
•GE
•Hilscher
•Modbus
•Omron
•Philips
•Siemens
•Toshiba
•WAGO
•Yaskawa
•Yokogawa
•...and more!
• **ni.com/opc**



OPC

- Advantages
  - Most universal
  - Least device-dependent
  - Ideal for HMI and SCADA applications
- Considerations
  - Slower, not deterministic, single-point only
  - Can require PC-based OPC servers
  - Not for safety or critical communications

Demo: Connecting LabVIEW to an Allen-Bradley MicroLogix PLC with OPC



ABCO Adds LabVIEW to PLC System

- ABS brake testing system
- PXI for high-speed encoder measurements
- Added to existing Allen-Bradley PLC assembly line
- OPC used for communication between PXI and Allen-Bradley PLCs

"The ease by which NI can speak to the Allen-Bradley hardware saved me valuable time on this delivery-critical job."

Arif Bustani, electrical engineer ABCO

3 Methods to Connect LabVIEW to Any PLC

NI PACs

Basic I/O

Analog/Digital

OPC

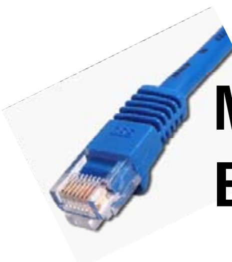
Industrial

Communications

PLCs

Methods for Industrial Communications

Plug-In Interfaces



Modbus over Ethernet/Serial

Modbus Gateways over Ethernet, Serial

Performance/Determinism

Versatility

Plug-In Communication Boards

Plug-In Interfaces

- CAN and CANopen
- DeviceNet
- FOUNDATION fieldbus
- Serial (RS232, RS422, RS485)
- Third-party PROFIBUS (Comsoft)
- Support for PXI, PCI, PCMCIA, and CompactRIO (CAN)

Plug-In Communication Boards

Plug-In Interfaces

- Advantages
  - Direct, deterministic communication with the processor
  - Timing and synchronization with other I/O (DAQ)
  - High-level API support for LabVIEW and other programming languages
- Considerations
  - Many smaller buses and protocols are not supported
  - Only available on PC and PXI (real-time supported)

CANopen LabVIEW Library

- Works with PCI, PXI, and PCMCIA high-speed NI CAN interfaces
- Turns them into CANopen master interfaces
- Fully compliant with CiA DS301 standard
- Complements the NI SoftMotion Controller for Copley CANopen distributed motion drives

DeviceNet Master Interfaces

- Available in PCI, PXI, and PCMCIA
- Deterministic control using LabVIEW Real-Time
- Master (scanner) and slave protocols for complete access to DeviceNet networks
- 500 V optically isolated physical layer
- Onboard processor
- NI-DNET driver software included

PROFIBUS

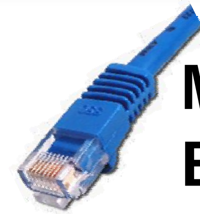
- PROFIBUS master/slave for PXI and PCI
- Siemens
- More than 2 million nodes
- Popular in Europe and Asia
- Recommended: Comsoft DF PROFI II interfaces

Modbus TCP and Serial Communication

Modbus over Ethernet/Serial

- Modbus TCP is the most common industrial protocol based on Ethernet
- Simple protocol that reads and writes to registers
- Native support with LabVIEW 8.x (DSC and Real-Time)
- LabVIEW 8.5 introduces 32-bit addressing
- LabVIEW and PACs can function as slave and master

Modbus Connectivity Options



Modbus over Ethernet/Serial

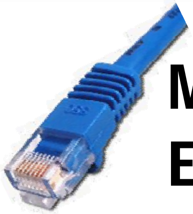
Slave (Connected to Sensors)

Compact FieldPoint	LabVIEW	LabVIEW RT (PACs)
cFP-1808, cFP-1804	Modbus Library	I/O Servers

Master (HMI and Control)

LabVIEW	LabVIEW DSC & RT (PACs)
Modbus Library	I/O Servers

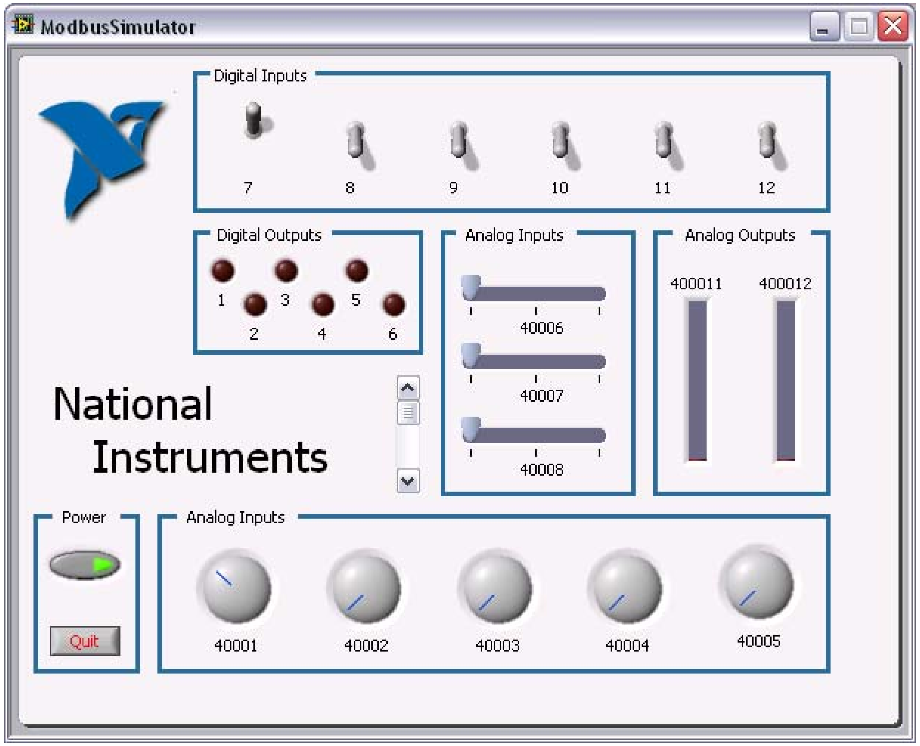
Modbus Connectivity Options



Modbus over Ethernet/Serial

- Advantages
  - Good mix of performance and compatibility
  - Cheap – works with standard Ethernet and Serial
  - Standardized – Not committed to a PLC brand
- Considerations
  - No determinism
  - Slower than direct interfaces – extra software layers

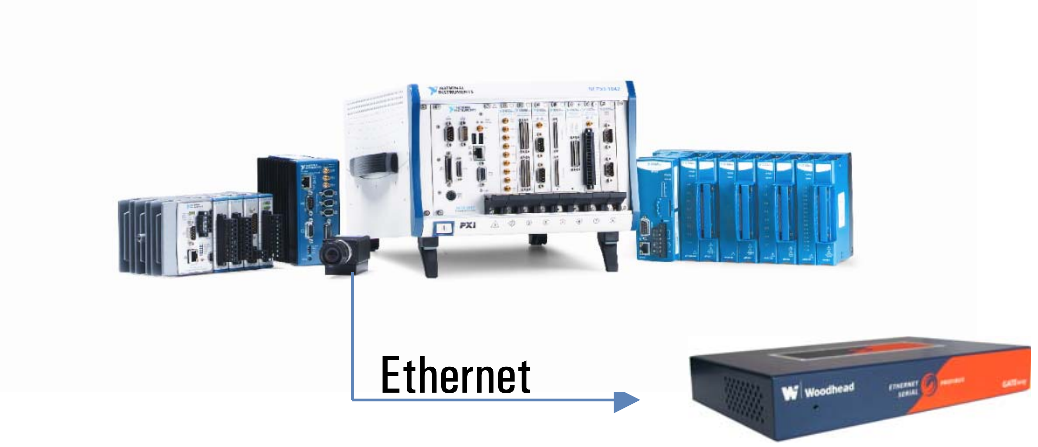
Demo: LabVIEW as a Modbus Master



Third-Party Gateways

Modbus Gateways over Ethernet, Serial

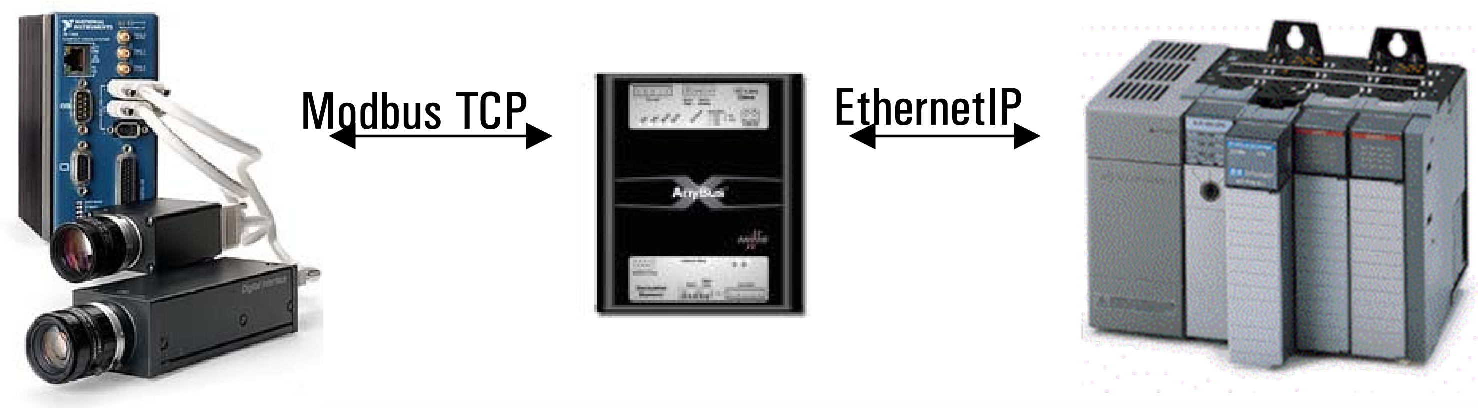
- Wide variety of communication buses and protocols supported
- Ethernet or serial-based
- Perfect for non-PXI, PCI, and PCMCIA systems



PROFIBUS
DeviceNet
EthernetIP
ControlNet

Example: Adding Vision for Food Processing Optimization

- Needed NI Compact Vision System to calculate the mass/volume of the food item coming through on the conveyor belt
- Cognex and DVT software too basic
- Ethernet/IP connectivity was a requirement

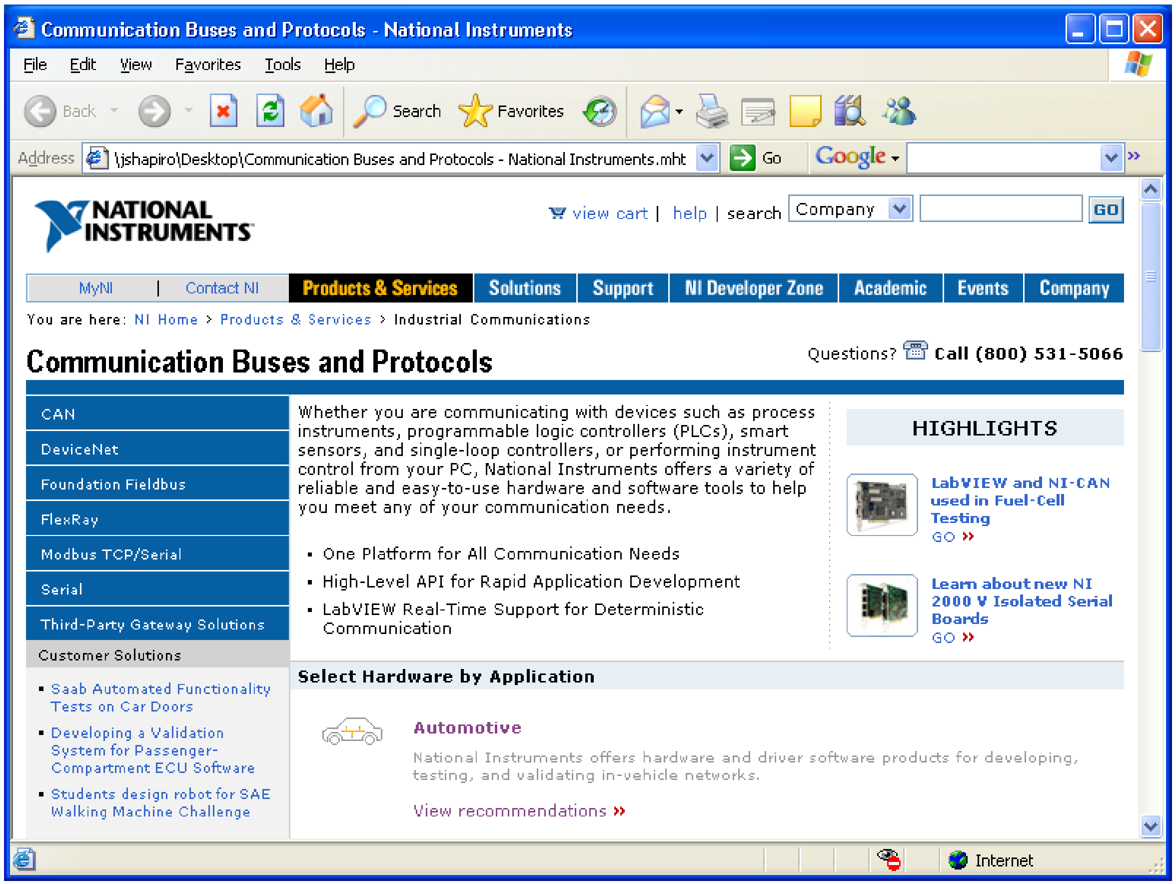


Summary

- Basic Analog and Digital I/O
- OPC
- Native Industrial Communications

Communication Buses and Protocols Home Page

For more information visit: ni.com/comm



APPENDIX

OPC Servers for NI Hardware and Software