What’s New in Instrument Control

Agenda

- Bus Characteristics
  - GPIB, USB, PCI, PCI Express, Ethernet/LAN/LXI
- Hybrid Systems
- GPIB ENET/1000
  - NI Spy, GPIB Analyzer, Performance Tips
- IC SW 2011 Released
  - LabVIEW 2011
  - VISA 5.0
  - Instrument Drivers

Selecting an Instrument Control Bus

Fast Ethernet

PCI

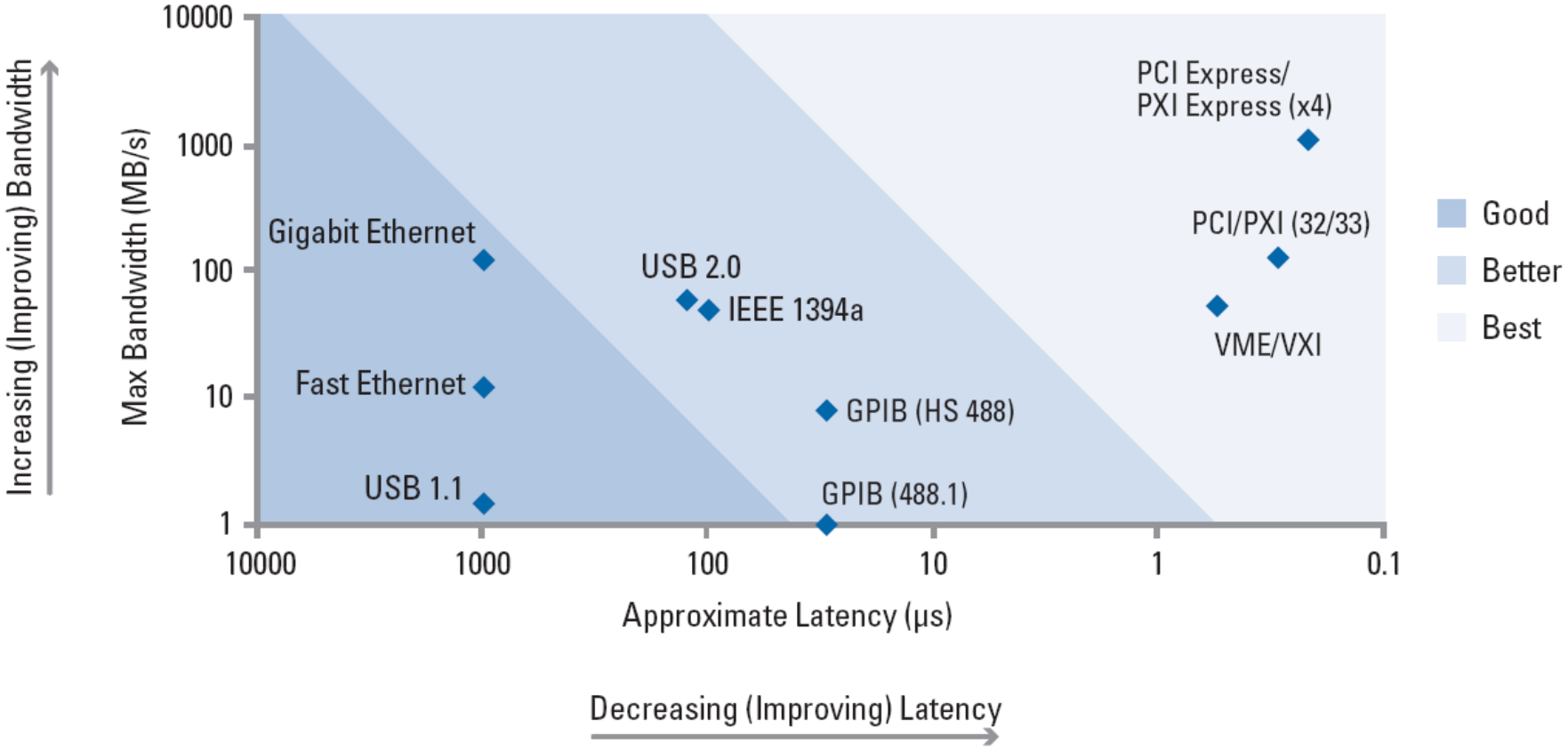
GPIB

Gigabit Ethernet

VMEbus

CompactPCI®

Latency versus Bandwidth



GPIB/IEEE-488

HS488 Max Bandwidth: 8 MB/s
488.1 Max Bandwidth: 1.8 MB/s
Bandwidth Distribution: Shared
Bandwidth Rating: Good
Latency Rating: Better

- More than 30 years of compatibility
- Robust and reliable
- Widest industry adoption
- Largest installed base of instruments

- Ideal for:
  - Automating existing equipment
  - Hybrid systems
  - Systems requiring highly specialized instruments

USB

Max Bandwidth: 60 MB/s (Hi-Speed USB)

Bandwidth Distribution: Shared across all ports

Bandwidth Rating: Better

Latency Rating: Better

- PC ubiquity
- Simplest plug-and-play connectivity (autodetection)

- Ideal for:
  - Portable desktop and benchtop applications
  - Small, low-cost systems

Ethernet/LXI

1000BaseT Max Bandwidth: 125 MB/s (Gigabit Ethernet)

100BaseT Max Bandwidth: 12.5 MB/s (Fast Ethernet)

Bandwidth Distribution: Shared across network

Bandwidth Rating: Better

Latency Rating: Good

- Remote capabilities
- PC ubiquity
- LXI adds optional timing and triggering
  - Synchronization through IEEE 1588 (Class B)
  - Triggering support (Class A)

- Ideal for:
  - Distributed systems
  - Remote monitoring

PCI and PCI Express

PCI Express Bandwidth: (x1) 250 MB/s – (x16) 4000 MB/s

PCI Express Bandwidth Distribution: Dedicated per device

PCI Max Bandwidth: 132 MB/s

PCI Bandwidth Distribution: Shared

Bandwidth Rating: Best

Latency Rating: Best

- Best bandwidth and latency
- PC ubiquity
- Enables lower instrument cost

- Ideal for:
  - Useful when a PC is already in the system
  - Data-intensive systems

PXI and PXI Express

PXI Express Bandwidth: (x1) 250 MB/s – (x8) 2000 MB/s

PXI Express Bandwidth Distribution: Dedicated per device

PXI Max Bandwidth: 132 MB/s

PXI Bandwidth Distribution: Shared

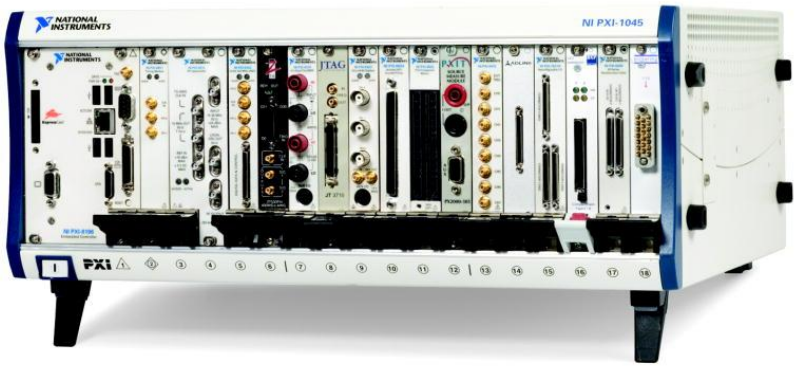
Bandwidth Rating: Best

Latency Rating: Best

- Best bandwidth and latency
- Based on rugged CompactPCI physical standard
- Adds timing and synchronization to CompactPCI
  - Trigger bus
  - Star trigger
  - 10 or 100 MHz shared system clock

Ideal for:

- High-performance systems
- Integration of several types of instruments
- Timing and synchronization



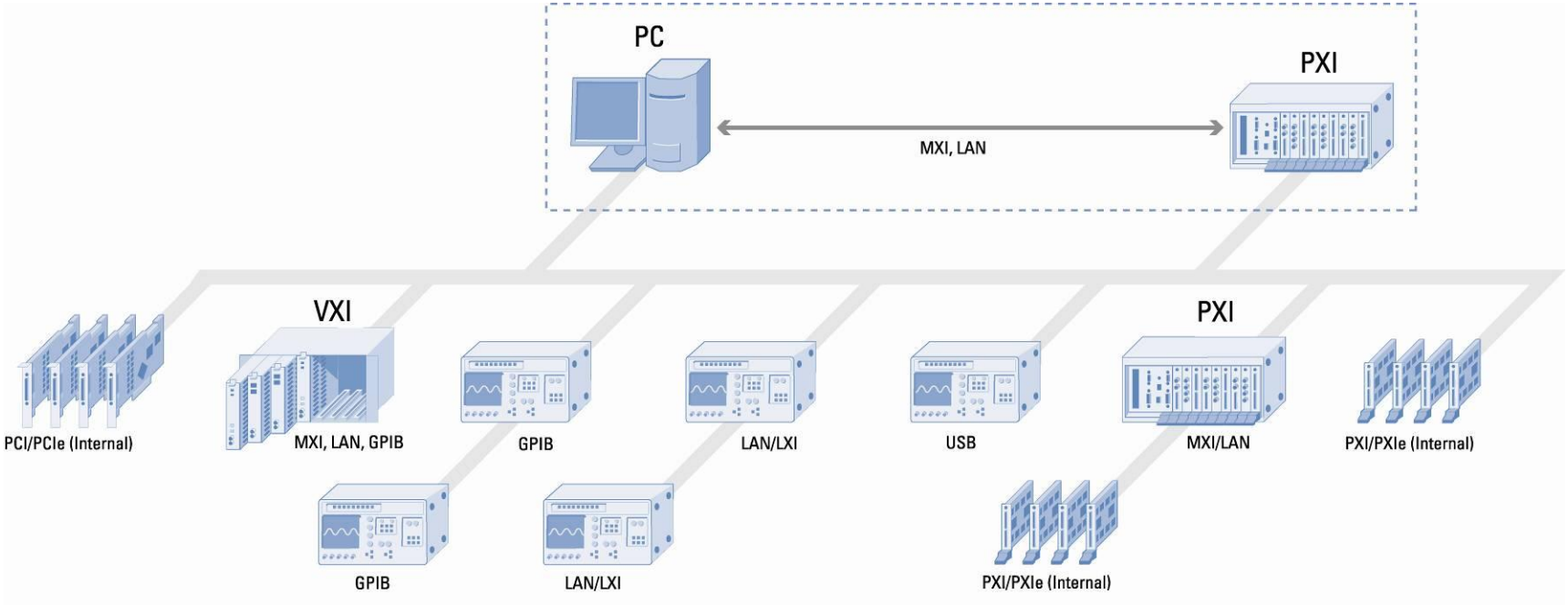
Bus Characteristics

Bus	Features	Application	Stats
	• More than 30 years of compatibility • Robust and reliable • Widest industry adoption	• Automating existing equipment • Hybrid systems • Systems requiring highly specialized instruments	Bandwidth 1.8 / 8 MB/s Latency 30 µs Cable Length 20 m Setup Time Better Ruggedness Best
	• PC ubiquity • Auto-detectable	• Portable desktop and benchtop applications • Small, low-cost systems	Bandwidth 60 MB/s Latency 125 µs Cable Length 5 m Setup Time Best Ruggedness Good
	• Remote capabilities • PC ubiquity • LXI adds optional timing and triggering	• Distributed systems • Remote monitoring	Bandwidth 12.5 /125 MB/s Latency 1000 µs Cable Length 100 m Setup Time Good Ruggedness Good
	• Based on rugged CompactPCI physical standard • Adds timing and synchronization to CompactPCI	• High-performance systems • Integration of several types of instruments •Timing and synchronization	Bandwidth 250 / 4000 MB/s Latency 0.7 µs Cable Length 7 m Setup Time Better Ruggedness Best

The Right Bus for Your Application

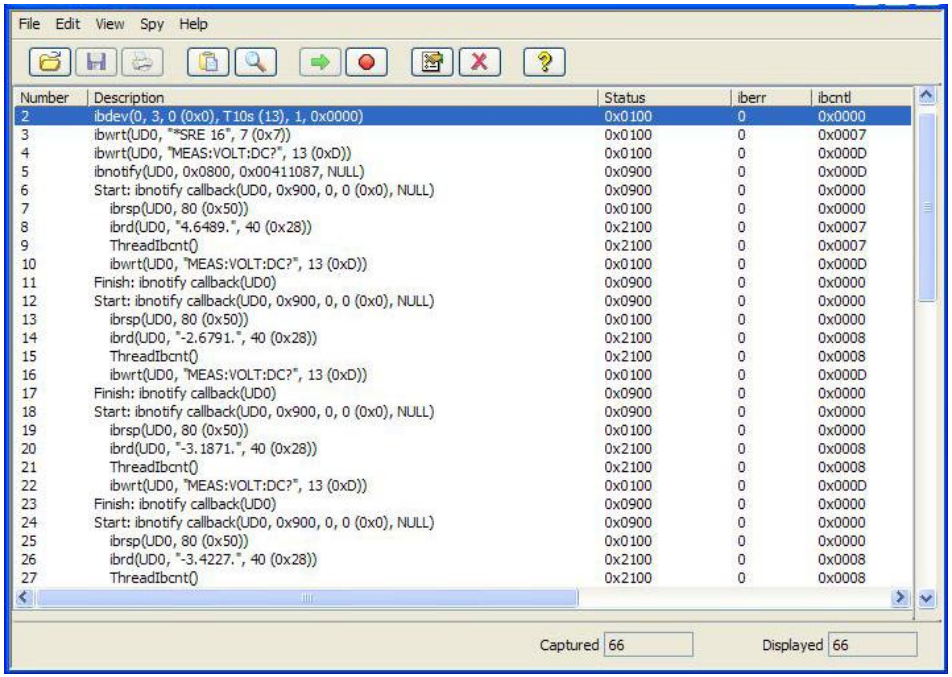
- No single bus technology solves all needs
  - GPIB → stand-alone instrument reuse, specialized instruments
  - PCI/PCI Express → best bandwidth and latency performance
  - PXI/PXI Express → best bandwidth and latency + timing and triggering
  - USB → autodetecting plug-and-play connectivity
  - Ethernet/LAN/LXI → distributed or remote systems
- Hybrid systems are often needed to integrate several technologies

Hybrid Systems Provide Flexibility



NI IO Trace - Driver Logging Utility

- Driver API logging utility for troubleshooting
- Captures low-level driver calls from a variety of NI drivers
  - DAQmx, NI-488.2, NI-VISA, NI-VXI, NI-Sync, NI Modular instruments
- Displays parameters and return values, timestamps and other information for each driver call
- Tool runs in parallel with your application and requires no code changes
- Features include logging to disk, Custom error actions and programmatic control from LabVIEW

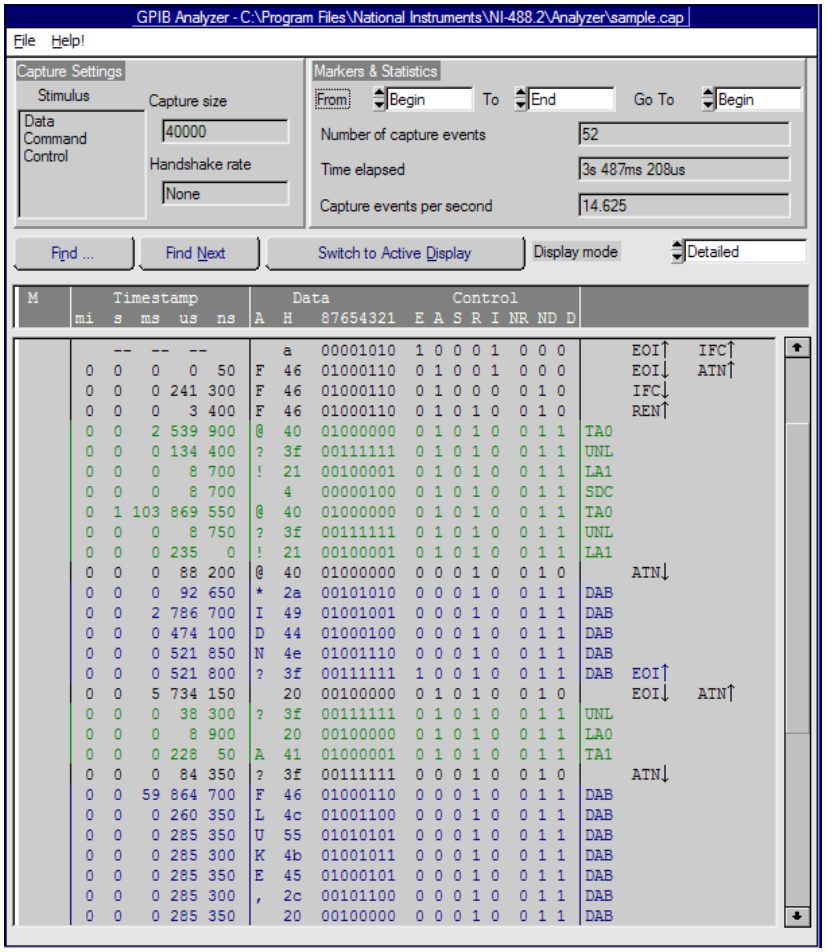


Driver Logging API Support

- LabVIEW
- NI-488.2
- NI-VXI
- NI-VISA
- NI-DAQmx
- IviDmm
- IviScope
- IviSwitch
- IviFgen
- IviDCPwr
- IviPwrMeter
- IviSpecAn
- NI-DMM
- NI-SCOPE
- NI-SWITCH
- NI-FGEN
- NI-DCPower
- NI-RFSA
- NI-RDSG
- NI-CAN
- Switch Executive
- NI-Sync
- IviRFSigGen

GPIB Analyzer

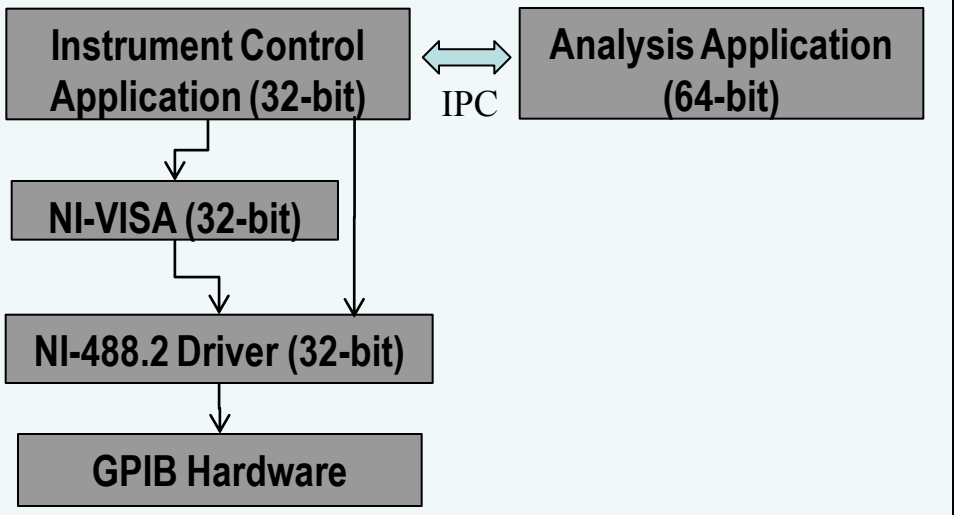
- Powerful GPIB bus analysis and debugging tool
- Requires “+” boards for capturing
  - PCI-GPIB+, PCIe-GPIB+/LP
- Logs each line transition at a resolution of 50ns
- Special markers used for GPIB command messages
- ASCII and Hex representation of GPIB data lines



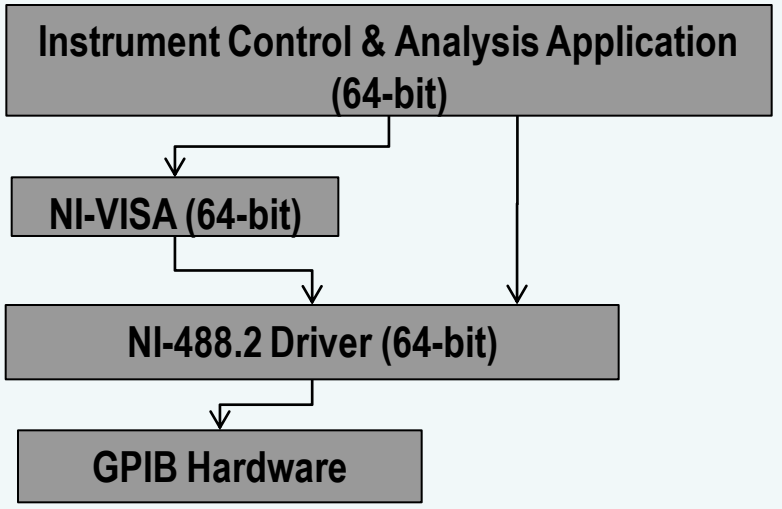
64-bit Support

- Developer memory intensive instrument control applications for 64-bit OSs
- Development Environment support
  - LabVIEW
  - LabWindows/CVI, C/C++
  - Visual Studio .NET
- Driver support
  - NI-488.2
  - VISA

64-bit Support



- Instrument Control application in a separate process
- Limited to 4GB RAM
- IPC or other means necessary to communicate between processes



- Single 64-bit process for entire application
- Application not limited to 4GB RAM

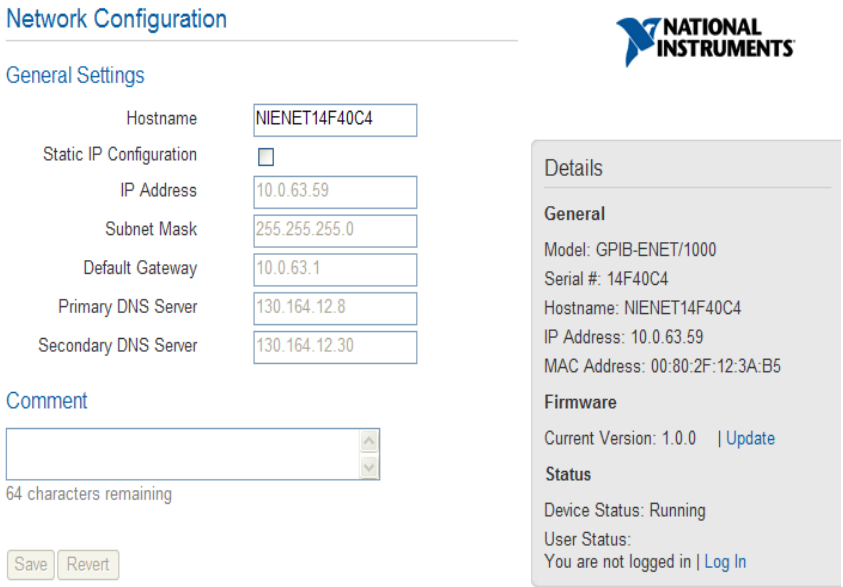
GPIB-ENET/1000

GPIB-ENET/1000 Features

- Improved performance over the GPIB-ENET/100 (about 3x faster)
- **Compatible with existing GPIB-ENET/100 applications**
- **Links at 10Mbit, 100Mbit, and Gigabit speeds**
- DHCP, AutoIP, Link Local or static IP address assignment
- **Ethernet configuration through built-in webpage**
- **Supported on Windows XP, Windows Vista, and Windows 7**

Webpage Features

- Visibility and access to the GPIB-ENET/1000
- Change Network Settings
- Update firmware
- See the current status of the ENET
- Password protected



Feature comparison

GPIB-ENET/100	GPIB-ENET/1000
Up to 1.5 MB/s throughput	Up to 5.4 MB/s throughput, 3 times faster overall
Link speeds of 10Mbit and 100Mbit	Link speeds of 10Mbit, 100Mbit, and Gigabit
Use configuration utility to discover the device and change network settings	Use webpage to change network settings
	Compatible with existing GPIB-ENET/100 applications, just upgrade the driver!
	Additional locking allows use from multiple hosts at once

Instrument Control Software

Software and Hardware Integration

NATIONAL INSTRUMENTS LabVIEW™

Graphical Development Environment

Communication Bus for Instrumentation

GPIB | USB | LXI | Serial | PXI | VXI




Programming with SCPI Commands

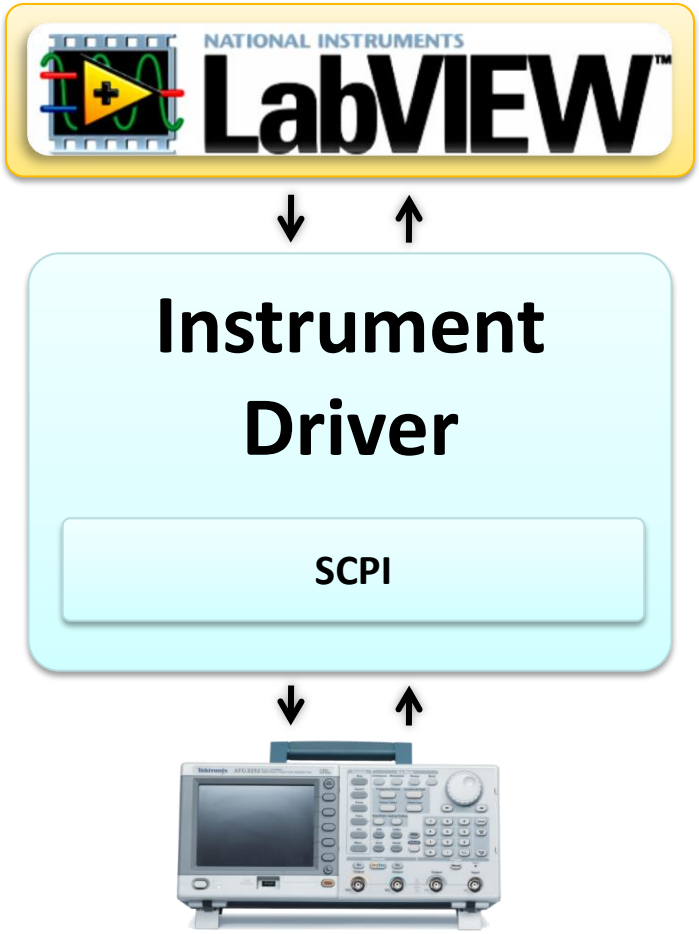
- Device Manuals
- Commands
- Bus
- More intense programming

Mnemonic	Group	Description
*IDN?	System Data	Identification query
*RST	Internal Operations	Reset
*TST?	Internal Operations	Self-test query
*OPC	Synchronization	Operation complete
*OPC?	Synchronization	Operation complete query
*WAI	Synchronization	Wait to complete
*CLS	Status and Event	Clear status
*ESE	Status and Event	Event status enable
*ESE?	Status and Event	Event status enable query
*ESR?	Status and Event	Event status register query
*SRE	Status and Event	Service request enable
*SRE?	Status and Event	Service request enable query
*STB?	Status and Event	Read status byte query

Instrument Driver API

Reduce development time

- No manual needed
- Abstraction of Bus communication protocols
- Fewer function calls
- Example code included



Instrument Driver Network

Industry's largest source of instrument drivers

ni.com/idnet

- 9,000+ Instrument Drivers
- Plug and Play, IVI, DLL
- NI Certified Drivers

Instrument Driver Network

Tektronix TPS 2012

Model Specifications

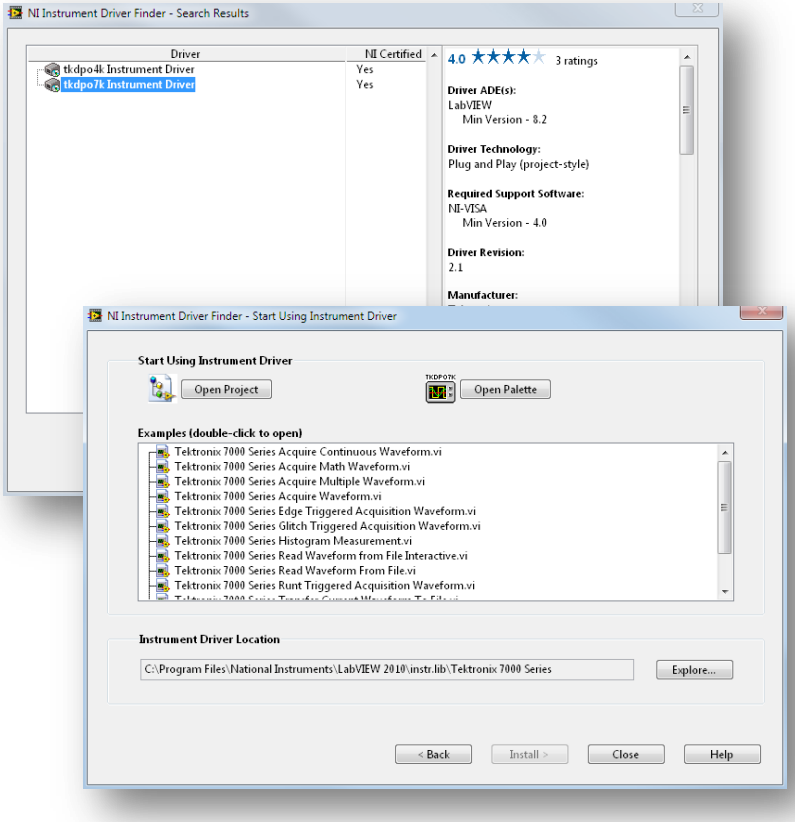
Manufacturer(s):	Tektronix
Instrument Model:	TPS 2012
Description:	Digital Oscilloscope
Instrument Family	TPS2000
Instrument Type(s):	Oscilloscope
Application Area(s):	Test and Measurement

Drivers Available For This Instrument Model

ADE	Driver Type	Interface(s)	NI Certified	Rating	
LabVIEW	Plug and Play (project-style)	IEEE 488.2 (GPIB) , USB , Serial	Yes	3.44	Go To Driver Page
LabVIEW	Plug and Play	IEEE 488.2 (GPIB) , USB , Serial	Yes	3.57	Go To Driver Page
LabVIEW LabWindows/CVI Measurement Studio for Visual Studio	IVI	IEEE 488.2 (GPIB) , USB , Serial	Yes	3.48	Go To Driver Page

Finding Instrument Drivers

- IDFinder in launched with LabVIEW 2010
  - Download drivers from within LabVIEW
  - Auto install and refresh of LabVIEW palettes
  - Instrument specific examples
- Launching IDFinder
  - LabVIEW Getting Started Window
  - Measurement and Automation Explorer (MAX)
  - LabVIEW Toolbar Tools»Instrumentation



NI-VISA 5.1 Benefits to Customers

- Easier to find Instrument Drivers
  - Launch from MAX
- User control over size of NI-VISA on smaller RT targets
  - Select VISA passport requirement
- Better troubleshooting for writing custom USB drivers
- Support for updated VISA 5.0 industry specification

Summary

- New GPIB ENET/1000 – improved performance, web configuration
- LabVIEW – any instrument, any bus
- New Instrument control ‘ease of use’ features in LabVIEW 2011

ni.com/gettingstarted