

# Migrating from GPIB to LXI

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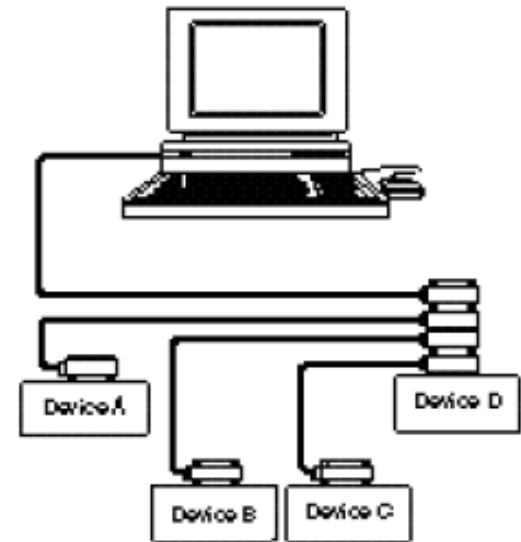


**LAN eXtensions for Instruments**

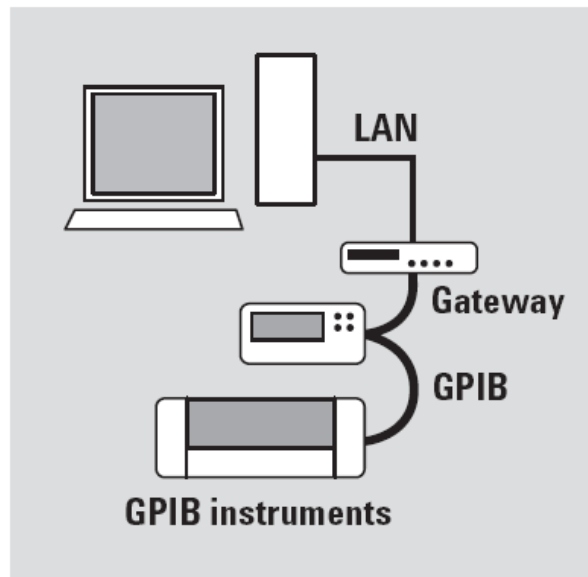


# Test Systems Built with GPIB

- **Guaranteed Interoperability**
- **Rugged**
- **Software techniques are well-defined**
- **They just work**
- **Easy to move instruments to LAN**



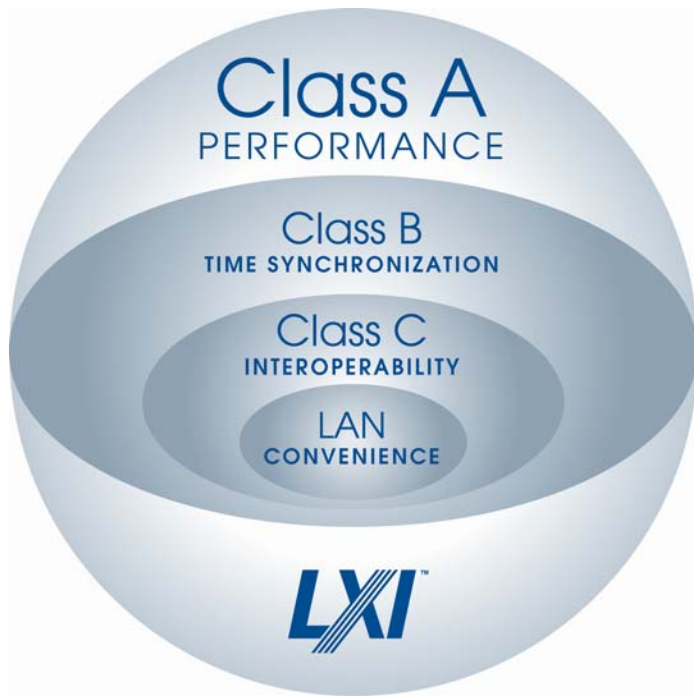
**LAN-to-GPIB Gateway**



# LXI Consortium Objectives

- Leverage telecom industry infrastructure
- Lower test system costs
- Simplify system integration
- Ensure broad instrument availability
- Create local and distributed test systems
- **Provide a successor to GPIB**
- It's about *your* time...
  - LAN Triggering and Messaging
  - Time synchronization and characterization
  - Hardware Trigger Bus

# LXI Classes



- **Class C: Base class**
  - Built upon LAN standard
  - Predictable LAN behavior
  - Built-in Web server
  - IVI driver API
- **Class B: Adds synchronization**
  - Class C plus
  - IEEE 1588 Precision Time Protocol (PTP)
  - Peer-to-peer messaging and multicast
  - Timestamp data and state changes
- **Class A: Adds a wired trigger bus**
  - Class B plus
  - A fast hardware trigger bus

# Your product may already be LXI-Compliant



**GPIB**



**GPIB + LAN + LXI Behavior**

# GPIB to LAN Migration

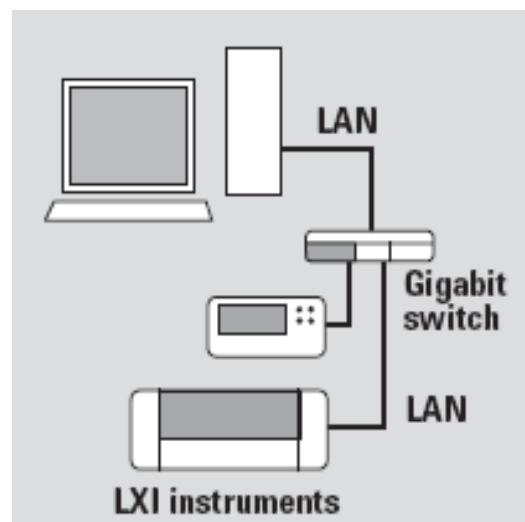
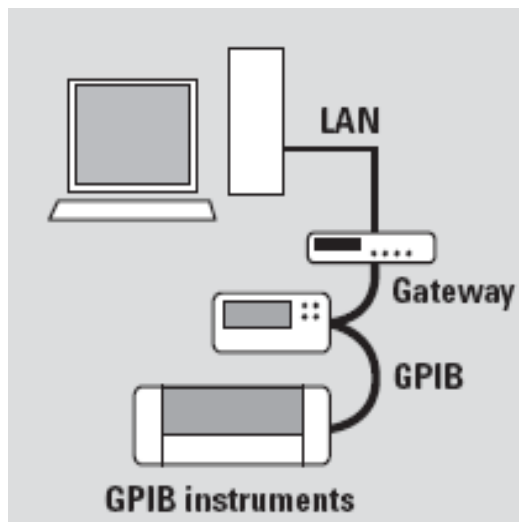
- GPIB is emulated over LAN (VXI-11) to ease migration path for software

Function	GPIB	LAN
	VISA/SICL GPIB	VISA/SICL VXI-11
Write ASCII command	Yes	Yes
Read ASCII/binary data	Yes	Yes
Write ASCII/binary data	Yes	Yes
Device Clear	DCAS	DCAS
Serial Poll	SPOLL	SPOLL
Trigger	GET	GET
SRQ	SRQ	SRQ



- Most GPIB instruments use ASCII- or SCPI-based languages
- LAN Sockets can also be used for ASCII- and SCPI-based languages

# Example of changes to programming code



GPIB	<pre>DirectIO DMM = new DirectIO("GPIB0::22::INSTR"); DirectIO Switch = new DirectIO("GPIB0::9::INSTR");</pre>
LAN/GPIB gateway	<pre>DirectIO DMM = new DirectIO("GPIB2::22::INSTR"); DirectIO Switch = new DirectIO("GPIB2::9::INSTR");</pre>
VXI-11 via LAN	<pre>DirectIO DMM = new DirectIO("TCPIP0::169.254.4.10::inst0::INSTR"); DirectIO Switch = new DirectIO("TCPIP0::169.254.9.80::inst0::INSTR");</pre>
Sockets via LAN	<pre>DirectIO DMM = new DirectIO("TCPIP0::169.254.4.10::5025::SOCKET"); DirectIO Switch = new DirectIO("TCPIP0::169.254.9.80::5025::SOCKET");</pre>

# LXI System – Discovery Tools

Find instruments quickly and get their VISA strings

Create New VISA TCP/IP Resource...

**Measurement & Automation Explorer**



**Connection Expert**  
Agilent IO Libraries Suite 15  
[www.agilent.com](http://www.agilent.com)



Agilent Technologies  
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# LXI System – Discovery Tools

Find instruments quickly

**Auto Find**  
Discover local instruments

**Add Address**  
Manually add a known IP address or hostname

**Search**  
Explore a network address range

**Add Other**  
Other instruments reachable through the LAN

Select	Address (IP, MAC, Host)	Description
<input checked="" type="checkbox"/>	192.168.1.100 00-30-d3-0d-19-a8	Agilent Technologies,L4433A
<input checked="" type="checkbox"/>	192.168.1.101 00-30-d3-0d-3a-f4	Agilent Technologies,34411A
<input checked="" type="checkbox"/>	192.168.1.103 00-30-d3-0f-50-6d	Agilent Technologies,33220A
<input checked="" type="checkbox"/>	192.168.1.104 00-30-d3-0e-0f-4f	Agilent Technologies, B.03.12
<input checked="" type="checkbox"/>	192.168.1.105 00-30-d3-0e-c8-5d	AGILENT TECHNOLOGIES,DSO6
<input checked="" type="checkbox"/>	192.168.1.106 00-30-d3-0d-19-c5	Agilent Technologies,L4433A
<input checked="" type="checkbox"/>	192.168.1.107 00-30-d3-0d-19-b9	Agilent Technologies,L4452A
<input checked="" type="checkbox"/>	192.168.1.108 00-30-d3-10-11-18	Agilent Technologies,N6700B

**Instrument I/O on this PC**

Refresh All

- [-] TRAINER12
  - [-] COM4 (ASRL4)
  - [-] LAN (TCPIP0)
    - [+] L4433A (TCPIP0::192.168.1.100::inst0::INSTR)
    - [+] 34411A (TCPIP0::192.168.1.101::inst0::INSTR)
    - [+] 33220A (TCPIP0::192.168.1.103::inst0::INSTR)
    - [+] E5818A (TCPIP0::192.168.1.104::inst0::INSTR)
    - [+] DSO6104L (TCPIP0::192.168.1.105::inst0::INSTR)
    - [+] L4433A (TCPIP0::192.168.1.106::inst0::INSTR)
    - [+] L4452A (TCPIP0::192.168.1.107::inst0::INSTR)
    - [+] N6700B (TCPIP0::192.168.1.108::inst0::INSTR)
  - [+] Remote (GPIB1)
  - [+] USB/GPIB (GPIB0)
  - [+] USB0

**LAN Instrument - L4433A**

An instrument connected to the LAN

Both the address check and the identification were done

[Change Properties...](#)

VISA address: TCPIP0::192.168.1.100::inst0::INSTR

[Instrument Web Interface...](#)

IDN string: Agilent Technologies,L4433A,MY4610

Manufacturer: Agilent Technologies

Model code: L4433A

Serial number: MY46100129

Firmware: 1.00-1.00-0.00-0.00 [Less <<](#)

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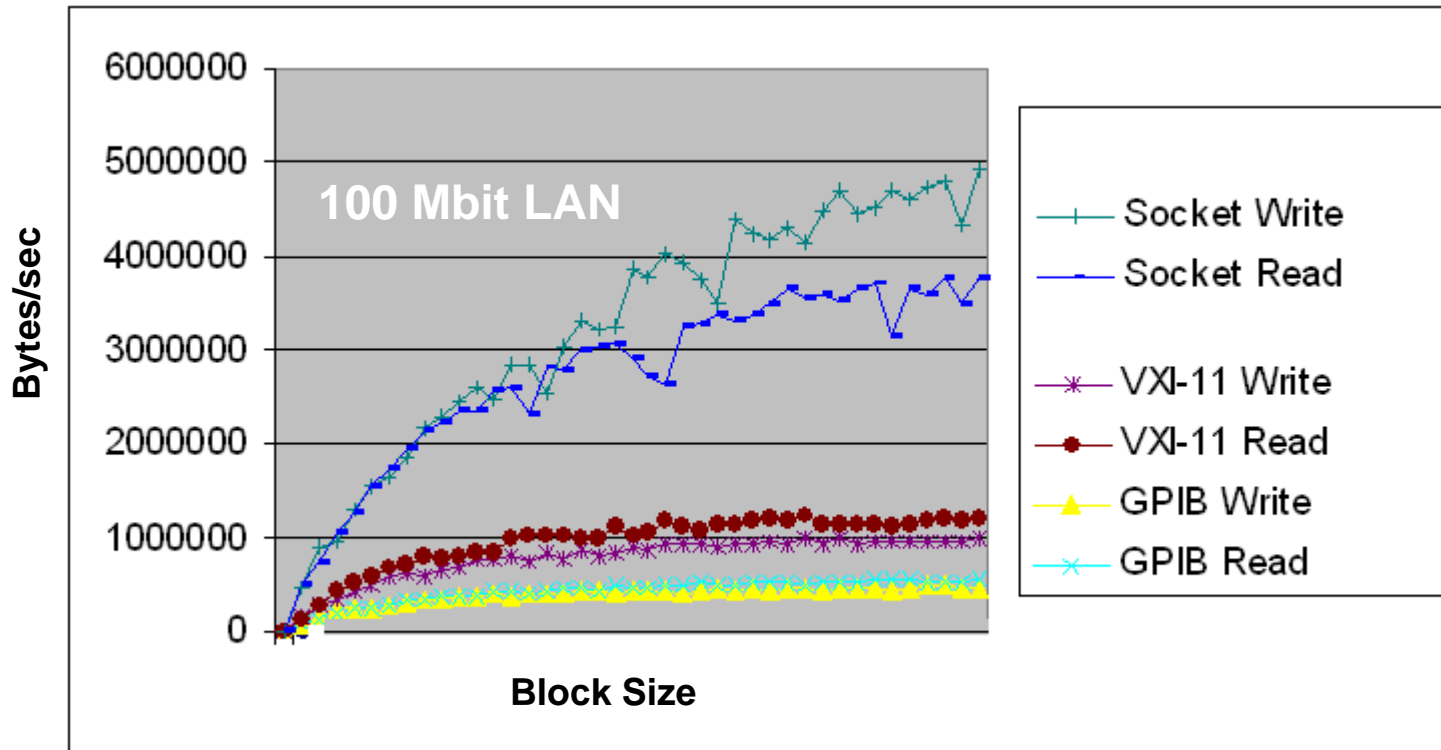
IP address: 192.168.1.100

SICL address: lan[192.168.1.100]:inst0

Address check: Yes

Auto-identify: Yes

# LAN vs. GPIB Performance



**Agilent  
34411A DMM**

**270k rdgs/sec  
from memory**

**50k Rdgs/sec  
continuous**

**Performance often more dependent upon measurement hardware**

# Troubleshooting

- Wrong measurement results – settling/setup problems?
- Wrong resolution – what range am I on?
- Noisy measurements – something interfering?

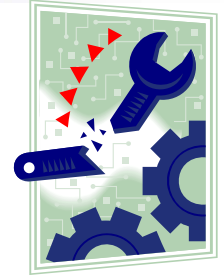
## Software

```
instrument.WriteString "TRIGger:" & param6 & ":SOURce " & "" & param4 & ""  
instrument.WriteString "TRIGger:" & param6 & ":STATe 1"  
  
instrument.WriteString "LXI:TRIGger:" & param4 & ":COUNT " & param3  
instrument.WriteString "LXI:TRIGger:" & param4 & ":PERiod " & param2  
  
instrument.WriteString "LXI:TRIGger:" & param4 & ":TIME " & param7  
  
instrument.WriteString "LXI:TRIGger:" & param4 & ":ENABle 1"  
  
instrument.WriteString "LXI:EVENT:LANSet0:IDENtifier " & "" & param5 & ""  
  
instrument.WriteString "LXI:EVENT:LANSet0:STAT WOR"
```

## Hardware



# Troubleshooting Software



- Step through program or stop at breakpoint
- Be able to see state of instrument
- Be able to change state of instrument

A screenshot of the Microsoft Visual Basic IDE. The window title is "Microsoft Visual Basic - Shorts and Opens Sockets.xls - [Sheet1 (Code)]". The menu bar includes File, Edit, View, Insert, Format, Debug, Run, Tools, Add-Ins, Window, and Help. The Project Explorer on the left shows a project named "VBAPROJECT" containing "VBAPROJECT (SHORTS AND OPEN SOCKETS.XLS)", "Microsoft Excel Objects", "Sheet1 (Program)", "Sheet3 (Sequences)", and "ThisWorkbook". The main code window shows VBA code with a red highlight on the line: `instrument.WriteString "TRIG:SOUR BUS;:TRIG:COU 36;:TRIG:DELAY:AUTO 0;:TRIG:DELAY 0;:SAMP:C".` The code includes comments and various instrument control commands like `Set ioMgr = New AgilentRMLib.SRMCLs`, `Set instrument = New VisaComLib.FormattedIO488`, and `instrument.IO.Timeout = 10000`.

```
Microsoft Visual Basic - Shorts and Opens Sockets.xls - [Sheet1 (Code)]
Type a question for help

Project - VBAPROJECT
  VBAPROJECT (PERSONAL.XLS)
  VBAPROJECT (SHORTS AND OPEN SOCKETS.XLS)
  Microsoft Excel Objects
    Sheet1 (Program)
    Sheet3 (Sequences)
    ThisWorkbook

(General) (Declarations)

' The VISA address can be found in the spread sheet
Set ioMgr = New AgilentRMLib.SRMCLs
Set ioMgr = New ResourceManager
Set instrument = New VisaComLib.FormattedIO488
Set instrument = New FormattedIO488
Set instrument.IO = ioMgr.Open(ActiveSheet.Cells(2, 2))

' Set the timeout to 10 seconds
instrument.IO.Timeout = 10000
' Set termination character
instrument.IO.TerminationCharacterEnabled = True

' Read from the Non-volatile Reading Storage
' Readings come back comma separated when in ASCII
instrument.IO.Clear
instrument.WriteString "*idn?;*rst;*cls"
id = instrument.ReadString
instrument.WriteString "FUNC 'RES';:RES:RANGE:AUTO OFF;:RES:RANGE 1 KOhm::RES:NPLC 0.02;:R
instrument.WriteString "TRIG:SOUR BUS;:TRIG:COU 36;:TRIG:DELAY:AUTO 0;:TRIG:DELAY 0;:SAMP:C
done = False
n = 1
m = 1
key = "Test Sequence"
Do While Not done
  If ActiveSheet.Cells(n, 1) = key Then
    done = True
```

# Troubleshooting Software

- Welcome Page
- Browser Web Control
- View & Modify Configuration
- System Status
- Print Display
- Help with this Page

Observe Only
 **Allow Full Control**
Scan Control...
Sequences...
System Overview...
Alarms...
Commands...
Update View

**Modules in Mainframe**

(1) 40-Ch Arm MUX [34921A]	(5) Slot 5 empty
(2) 4-Ch Isolated DAC [34951A]	(6) Slot 6 empty
<b>(3) 2, 4x16 Arm Matrix [34932A]</b>	(7) Slot 7 empty
(4) Slot 4 empty	(8) Slot 8 empty

**Analog Bus Overview**

	Slot								
	1	2	3	4	5	6	7	8	
ABus1			●						MEAS
ABus2									SENS
ABus3									
ABus4									

**Slot 3: Dual 4x16 Armature Matrix**

	ABus 1	ABus 2	
Column 16	3516	3616	3716
Column 15	3515	3615	3715
Column 14	3514	3614	3714
Column 13	3513	3613	3713
Column 12	3512	3612	3712
Column 11	3511	3611	3711
Column 10	3510	3610	3710
			3810

**DMM Configuration**

DMM State  
 Enabled    Disabled

Function: AC volts   AC Bandwidth:  3 Hz    20 Hz    200 Hz

Range: Auto

Scaling (Mx + B)  
 Enabled   Gain (M): 1.0   Offset (B): 0.0   Units:  

OK  
 Close  
 Apply

Java Applet Window

# Where to go for more information...

- [www.lxistandard.org](http://www.lxistandard.org)
  - Specifications
  - Papers and presentations
    - ... "Introducing LXI to your IT Department"
    - ... "Getting to know LXI", "Getting started with LXI"
    - ... "Migrating from GPIB to LXI", "What LXI Class B can do"
  - Products and vendors
- [www.lxiconnection.com](http://www.lxiconnection.com)
  - Articles on all aspects of LXI
  - Includes multi-vendor cooperation
- Vendor Web sites – find links on the LXI Web site