

# **LXI Consortium Keynote**

## **LXI Conference – Singapore 2014**



*It's about YOUR time.*

[www.lxistandard.org](http://www.lxistandard.org)

# Agenda

- Introduction
- What is LXI?
- Customer Benefits of LXI
- Internet / Network Trends and Technologies
- Technical Committee
- Conformance Committee
- Marketing Committee
- LXI Future
- Member Benefits of LXI

# LXI Consortium Board 2014



**Steve Schink**  
LXI President/Chairman  
Agilent Technologies



**Bob Stasonis**  
LXI Marketing Chair  
Pickering Interfaces



**Jochen Wolle**  
LXI Conformance Chair  
Rohde & Schwarz



**Xing Fei**  
Rigol Technologies



**Tom Sarfi**  
VTI Instruments



**John Ryland**  
Keithley Instruments



**Bob Helsel**  
Executive Director

# LXI Consortium

- **LAN eXtensions for Instrumentation (LXI)**
- **Formed in 2004**
  - First LXI Conformant products in Dec 2005
- **Role of LXI Consortium**
  - Create/uphold the Standard worldwide
  - Conformance process
    - Ensure interoperability (LXI & other platforms)
  - Globally promote the Standard, create branding program, build awareness
  - Educate users and members
  - Maintain backward compatibility
  - “Future-proof” the Standard

[www.lxistandard.org](http://www.lxistandard.org)

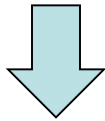
The screenshot shows the LXI Consortium website homepage. At the top, there is a navigation bar with links for Home, About LXI, LXI Consortium, Products, Specifications, Resources, Events/Meetings, and News. The main content area features a large headline: "LXI Makes Testing Easier" with the subtext "It's About Your Time" and a "Benefits of LXI" button. To the right, a "What's New?" section lists several recent news items, including a free conference in Beijing, China, an upcoming conference in China, and a general meeting in Long Beach, CA. Below this, there are four promotional boxes: "Search for LXI products" (highlighting over 1907 certified products), "Download The LXI Primer" (a guide for users), "Going Wireless with LXI" (a video thumbnail), and "Specifications" (a document thumbnail). The footer contains copyright information for 2013, a privacy policy link, and a contact us link.



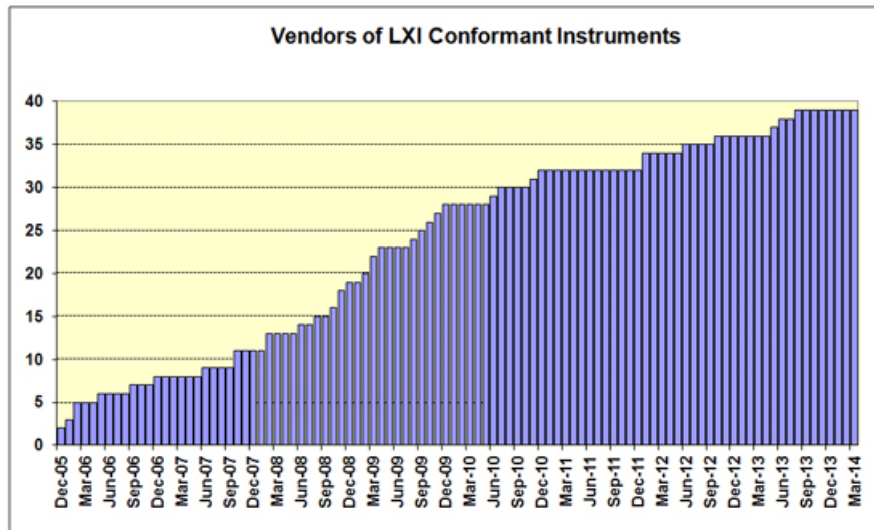
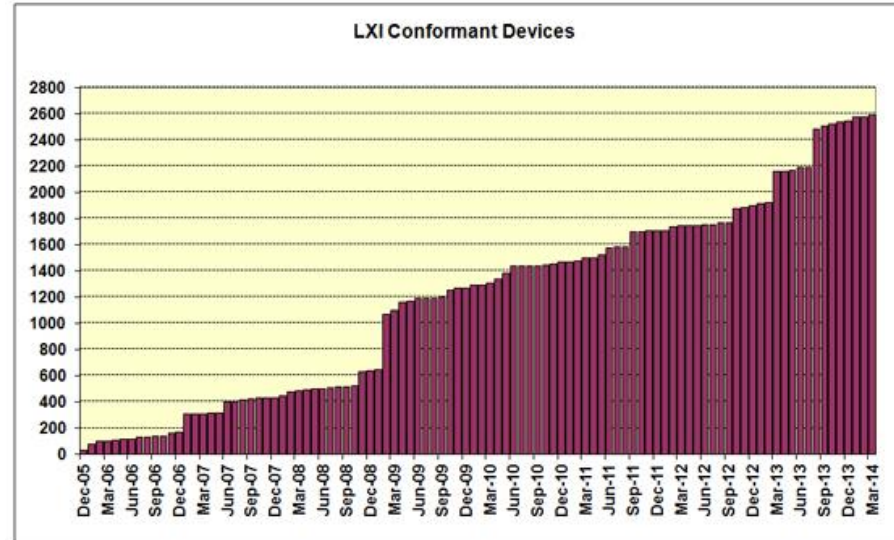
# Success of LXI

“The total LXI instrumentation market was estimated to have generated \$644.0 million in 2012.” (Frost & Sullivan)

Major milestone  
in 2014



Over 2500 LXI  
compliant instruments

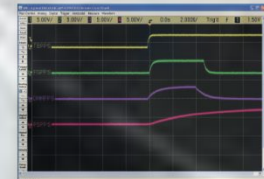
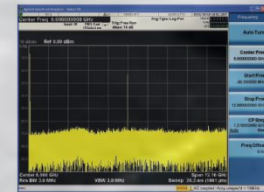


**2594 Instruments**  
**259 Product Families**

**39 Instrument Vendors**  
**53 Member companies**

# What is LXI?

- **Power of Ethernet and the Web inside test systems – leverage Telecom Industry**
- **Standard for LAN instruments**
- **What separates a LAN instrument from an LXI instrument?**
  1. Consistent set of LAN communication services
  2. LAN discovery and configuration support
  3. Standard web page
  4. IVI driver
  5. Interoperability testing
  6. Extensions for triggering and synchronization



# Customer Benefits of LXI



<http://www.lxistandard.org/About/Benefits.aspx>

# Internet / Network Trends and Technologies

- **Industry Trends and Technologies that will have an impact on the Test and Measurement Industry**
- **LXI Consortium member companies and their customers will influence what additional work needs to be done in the LXI Consortium to respond to these trends**





# The Internet of Everything



## Internet of People

1.11B people on Facebook, Mar 2013



## Internet of Things

25B things by 2020

http://w

## Internet of Information

30T web pages in Google index, 2013



## Internet of Places

3B Foursquare check ins, Jan 2013

**... if it makes sense commercially, socially, and personally**

#GartnerSYM  
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# Internet of Things (IoT)

- **Definition:** “a proposed development of the Internet in which everyday objects (things, animals, people) have network connectivity, allowing them to send and receive data.”
  - Gartner: 26 billion devices on the Internet of Things by 2020
  - ABI Research: 30 billion devices wirelessly connected to the Internet of Things by 2020 (10 billion wireless devices today)
- Smartphones, tablets, laptops and the cloud are the enablers of the IoT ecosystem.
- Future growth very dependent on a range of wireless technologies becoming invisible to the consumer
- Device makers will start to think about connecting more of the things more of the time, not just things that are in close proximity to people some of the time.
- All of the device identifiers needed to make the Internet of Things a reality requires IPv6 to accommodate the extremely large address space; **may be the ultimate driver of global adoption of IPv6 in the coming years**



# Mobile Device and Cloud Utilization



**Wearable**



**Pocketable**



**Grab &  
Go**



**Convertible**

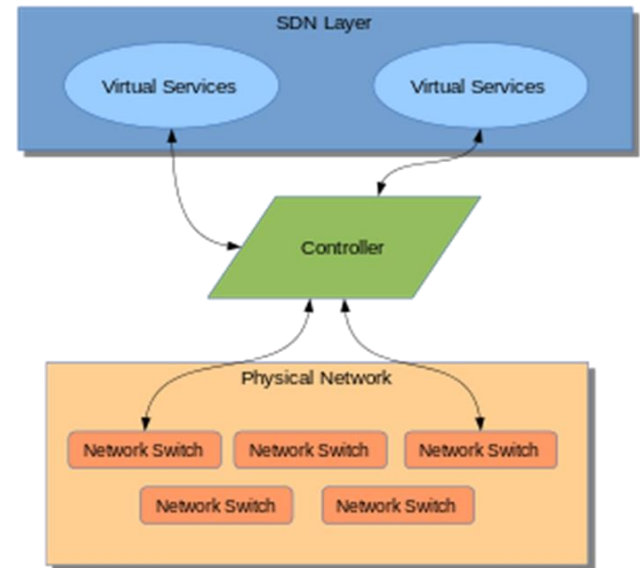


**Portable**

- Increasing trend of Bring Your Own (BYO) device to work, expect innovative engineers to use 3 to 5 devices by 2016
  - Creates IT management and security problems
  - Driving development of enterprise mobile platforms (cloud delivered, multi-channel)
- Cloud / Client architecture
  - Applications in the cloud
  - Apps on the clients expose the Applications capabilities
  - Personal Cloud – center of each user's digital echo system
    - Unique collection of services, devices and information used by each user

# Network Technologies of Interest

- **Software-Defined Networking (SDN)**
  - Adds a layer of abstraction to decouple networking services from the underlying physical network (destinations can change)
  - Driven by dynamic nature of cloud and mobile environments
- **Wireless**
  - WI-FI Direct
    - Direct connect to a device w/o an access point
  - LI-FI
    - 5G visible light communication using LEDs
    - Reflective 70 Mbit; researchers attained rates over 10 Gbit
    - Can be used in electromagnetic sensitive areas
- **Security**
  - Will evolve with IoT and mobile expansion





# Technical Committee

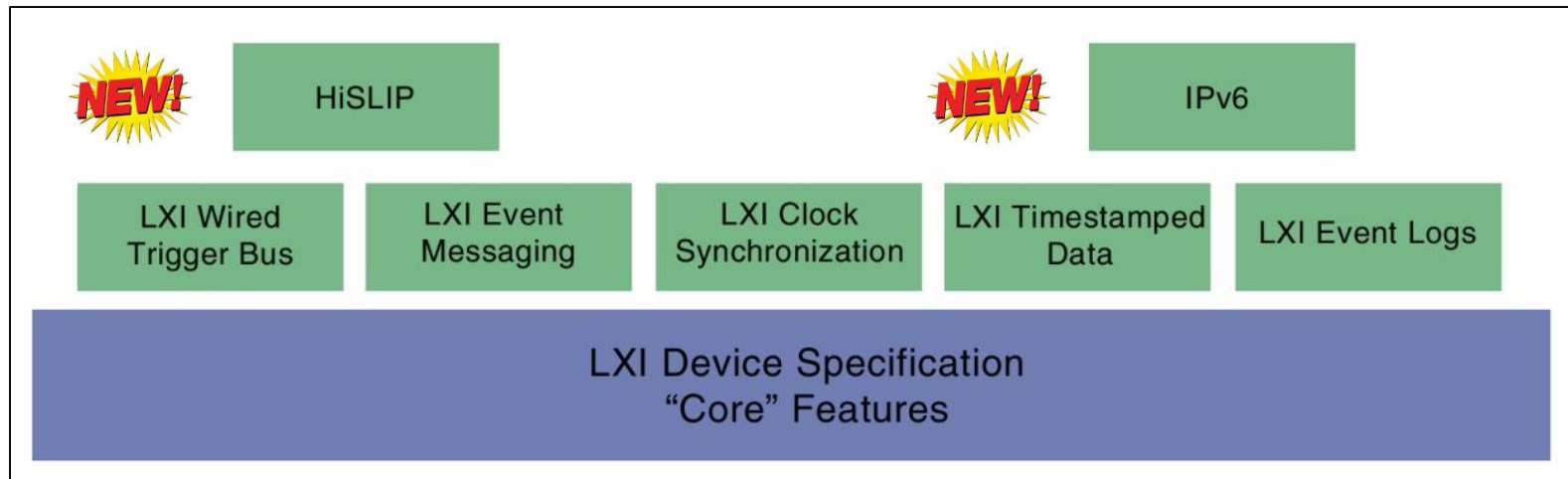
**Goal:** Work with LXI membership to “future-proof” the LXI Standard by leveraging the advances in the Telecom industry as well as insights from our members. Adapt for their use in test & measurement and provide assistance for adoption of LXI technology.



David Owen  
Technical Committee Chair  
Pickering Interfaces

# LXI Device Specification 2011 (Revision 1.4)

- **The *LXI Device Specification 2011* (May 2011)**
  - Contains features that are common to all LXI devices and extended function options, which support more sophisticated uses
  - <http://www.lxistandard.org/Specifications/Default.aspx>
- **Extended Function Options**



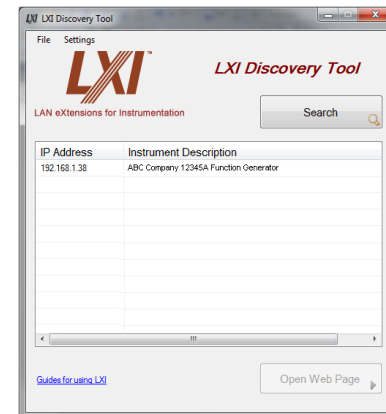
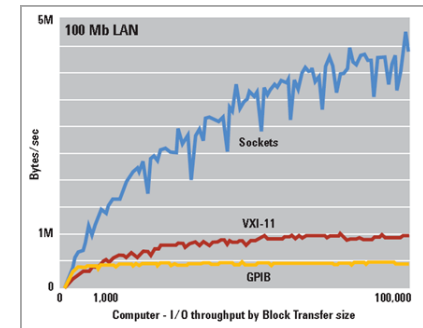
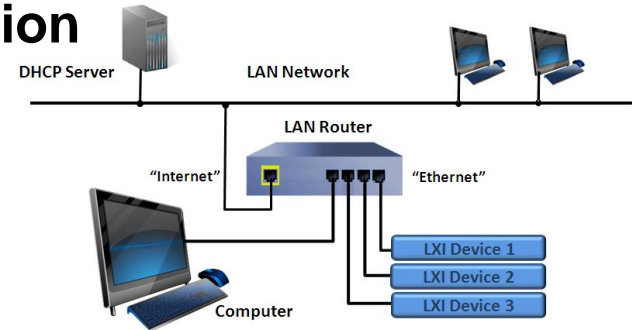
# Technical Committee: IT WG

- Assist users LXI setup and configuration
- IT Working Group Deliverables

- LXI Getting Started Guide
  - Make it easy to get started with LXI
  - Based around the Discovery Tool
- Building LXI-based Test Systems
  - Configuration recommendations, benefits and cautions
- Introducing LXI to Your Network Administrator
  - Make it easy for your IT department to accept LXI on the network
- Performance of LXI-based Test Systems
  - Insight into capabilities of LXI and best practices

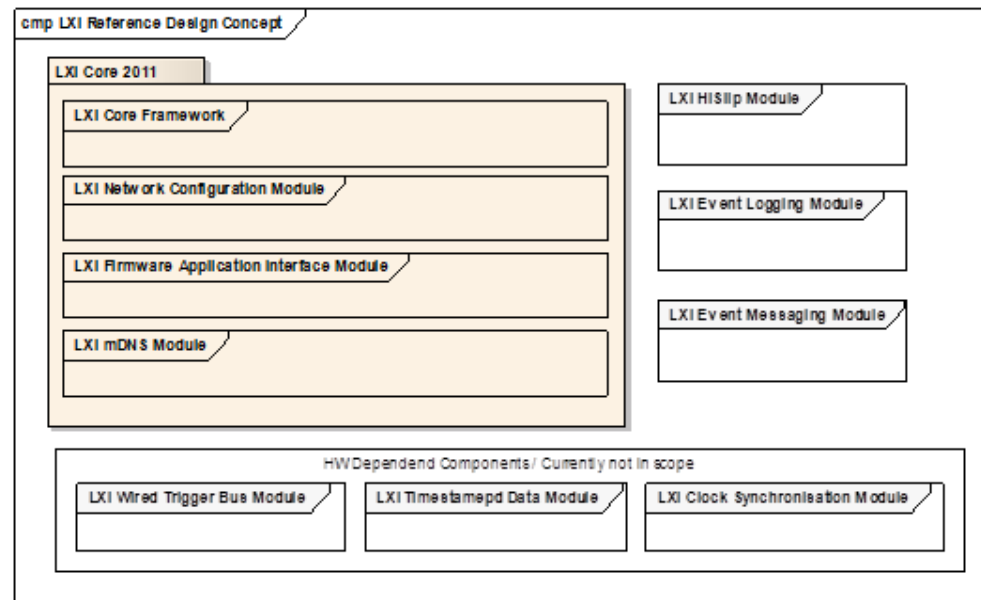
- **LXI Discovery Tool**

- No dependency on vendor specific software or drivers
- Available to users as executable, to members with source code



# Technical Committee: Reference Design WG

- Assist LXI members to develop and maintain LXI instruments
- LXI v1.4 Reference Design and Implementation Supports
  - LXI Core
  - Extended Functions (HiSLIP, Event Logging, Event Messaging)
- LXI Consortium funding the effort, utilizing a 3<sup>rd</sup> party – TSE Plazotta





# Conformance Committee

**Goal:** Provide the LXI Consortium and membership support to ensure products conform to the LXI Standard.

Includes developing and maintaining the LXI conformance process and test suite, providing support for conformance and Plug Fest testing, certifying LXI Test Houses and maintaining a list of LXI conformant devices.



**Jochen Wolle**  
**Conformance Committee Chair**  
**Rohde & Schwarz**

# Conformance Committee

- **All LXI devices are tested on conformance**
  - Ensures interoperability – testing of all rules
  - Only T&M standard requiring conformance testing
  - COTS (COnformance Test Suite) available for all LXI members
- **Conformance specs define general rules and agreements which vendors shall apply**
  - Permission to label their device with the LXI logo
  - Use the LXI logo in literature and other collateral mediums
- **LXI Plug Fests**
- **Certified LXI test houses**
  - Rigol Technologies (China)
  - Wheelwright Enterprises (U.S.)
  - Agilent Böblingen (Germany)



# List of LXI Compliant Devices

The screenshot shows a web browser window displaying the LXI Consortium's product list page. The browser's address bar shows the URL: <http://www.lxistandard.org/Products/ProductList.aspx>. The page features the LXI logo and navigation links such as Home, About LXI, LXI Consortium, Products, Specifications, Resources, Events/Meetings, and News. A search bar is located at the top right. The main content area is titled "Product List" and includes a brief description of the list's purpose and contact information for Bob Halse, Executive Director of the LXI Consortium. Below this, there are several filter sections: "Narrow Results by" with sub-sections for "Extended Functions", "Product", "Category", and "Vendor", each with a "Current Filter" and "All" options. The main part of the page is a table listing various products.

**Product List**

This page lists the products registered with the LXI Consortium. Information in this list is updated automatically; for concerns or corrections, contact **Bob Halse**, Exec. Dir., LXI Consortium. To view/download a current list of conformant LXI products, please click the "Export to Excel" link at the bottom of the page.

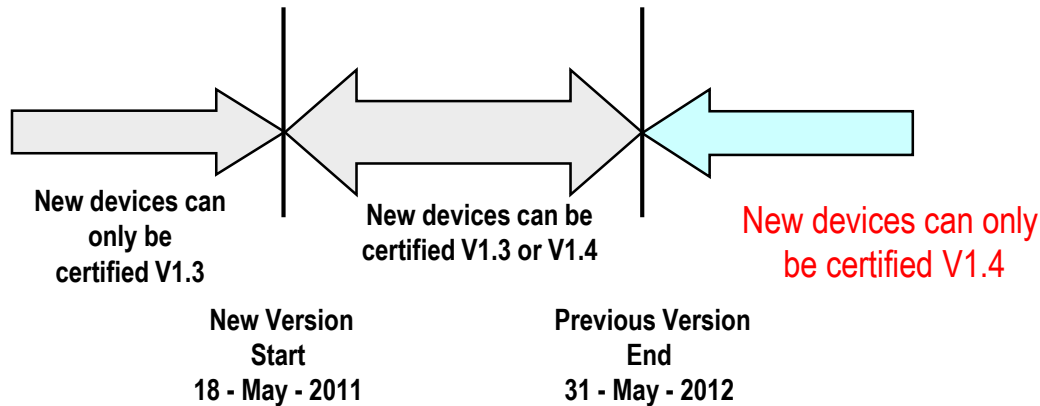
Product Families: 231, Total Products: 2172

Vendor	Category	Product	Members	No	Description	Ext Funcs	Date
Tabor	Function / AWG	WX	WX1281B WX1282B WX1284 WX2181B WX2182B WX2184	6	Single, Dual, Four Channel AWG 500MHz / 1GHz		May 08, 2013
Tabor	Function / AWG	WS	WS8351 WS8352	2	Single, Dual Channel AWG 350MHz		May 08, 2013
Rohde & Schwarz	Spectrum Analyzer	FSW	FSW50	1	Signal and Spectrum Analyzer 50 GHz	HiSlip	Apr 26, 2013
Kepco	Power Supplies	KLN	KLN 6-100E - KLN 600-1.25E	13	750 Watt Power Supply Models		Mar 28, 2013
Kepco	Power Supplies	KLN	KLN 6-200E - KLN 600-2.5E	13	1500 Watt Power Supply Models		Mar 28, 2013
Kepco	Power Supplies	KLN	KLN 6-400E - KLN 600-5E	13	3000 Watt Power Supply Models		Mar 28, 2013
Magna-Power Electronics	Power Supplies	XR	XR5-375 - XR1000-2.0 XR10-375 - XR1000-4.0 XR16-375 - XR1000-6.0 XR20-375 - XR1000-8.0	16	2kW 4kW XR Series Power Supplies 6kW 8kW		Mar 13, 2013
			TS5-900 - TS4000-1.2 TS10-900 - TS4000-2.4 TS16-900 - TS4000-3.6 TS40-900		TS Series II Power Supplies		

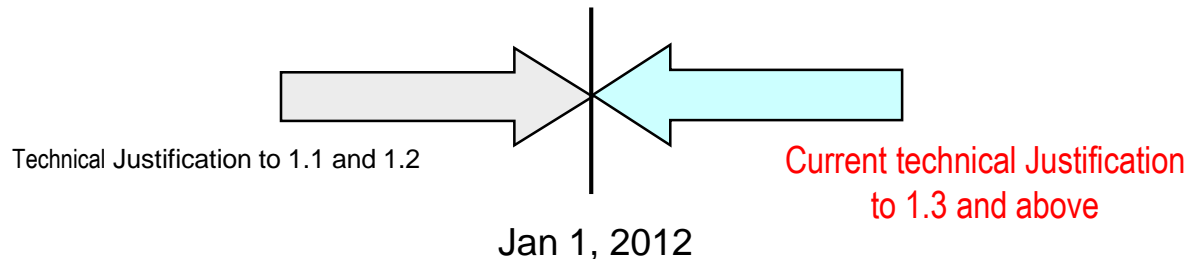
<http://www.lxistandard.org/Products/ProductList.aspx>

# LXI Conformance Policy

- **Backward compatibility important**
- **Version specific conformance restrictions:**



- **Time limits to technical justification**





# Marketing Committee

**Goal:** Our primary focus is to grow awareness of LXI (vs. LAN) including member products via application information on our website, newsletters, press relations and face-to-face activities.



**Bob Stasonis**  
**Marketing Committee Co-Chair**  
**Pickering Interfaces**



**Deborah Homan**  
**Marketing Committee Co-Chair**  
**Agilent Technologies**

# Marketing Activities

- **Maintain website:** [www.lxistandard.org](http://www.lxistandard.org)
  - Products, members, specifications, videos, etc.
- **Newsletter**
  - All members can contribute articles and new product announcements
- **Magazine articles – application examples highlighting member products & solutions**
- **The LXI Primer – an Introduction to LXI**
- **Member usable customer LXI material**
- **Customer Events**
- **Press releases**
- **Social media**
- **Videos**



**LXI**  
LAN extensions for Instrumentation

**IVI FOUNDATION**

**Agenda**  
**LXI Conference – Singapore 2014**  
May 21, 2014  
Hosted by Rohde & Schwarz  
Sponsored by the LXI Consortium, Rohde & Schwarz, and IVI Foundation

Track 1			Track 2		
Time	Presentation	Speaker	Time	Presentation	Speaker
08:30	Registration	Robert Weller	08:30		
09:00	LXI Overview	Steve Schick	09:00		
09:30	IVI Keynote	Joe Mueller	09:30		
09:45		Joe Mueller	09:45		
10:00	Break - LXI Product Demonstrations		10:00		
10:30	LXI Technical Committee		10:30		
11:00	Workshop: Introduction to LXI	David Owen	11:00		
11:30	Application	Robert Weller	11:30		
12:00	Lunch		12:00	Lunch	
13:00	Understanding Configuration and Performance of LXI	Steve Schick	13:00	IVI Instrument Driver Fundamentals Course (Part 1)	Joe Mueller
13:30	Signal Processing in LXI	David Owen	13:30		
14:00	IVI LXI		14:00		
14:30	LXI Reference Design	Felix Plante	14:30		
15:00			15:00		
15:30	Break - LXI Product Demonstrations		15:30	Break - LXI Product Demonstrations	
16:00	Efficient Programming on LXI-based IOT Systems	Ed Ling	16:00	IVI Instrument Driver Fundamentals Course (Part 2)	Joe Mueller
16:30	IVI IOT	Rob Fanta	16:30		
17:00	Power Solutions	Steve Schick	17:00		
17:30	Q & A and Conference A rebite	Robert Weller	17:30		

[www.lxistandard.org](http://www.lxistandard.org)  
[www.ivi-foundation.org](http://www.ivi-foundation.org)



It's about YOUR time.

# Application Examples

- LXI in Cloud Computing for T&M (Agilent Technologies)
- Whole Body Vibration (WBV) Testing Using LXI Devices (Data Translation)
- LXI Missile Launcher Test System (Bustec)
- Pulse Radar System Testing with LXI Vector Network Analyzer (Rohde & Schwarz)
- LXI Gas Turbine Data Acquisition Testing (VTI Instruments)
- Simplified I/V Characterization of DC-DC Converters (Keithley)



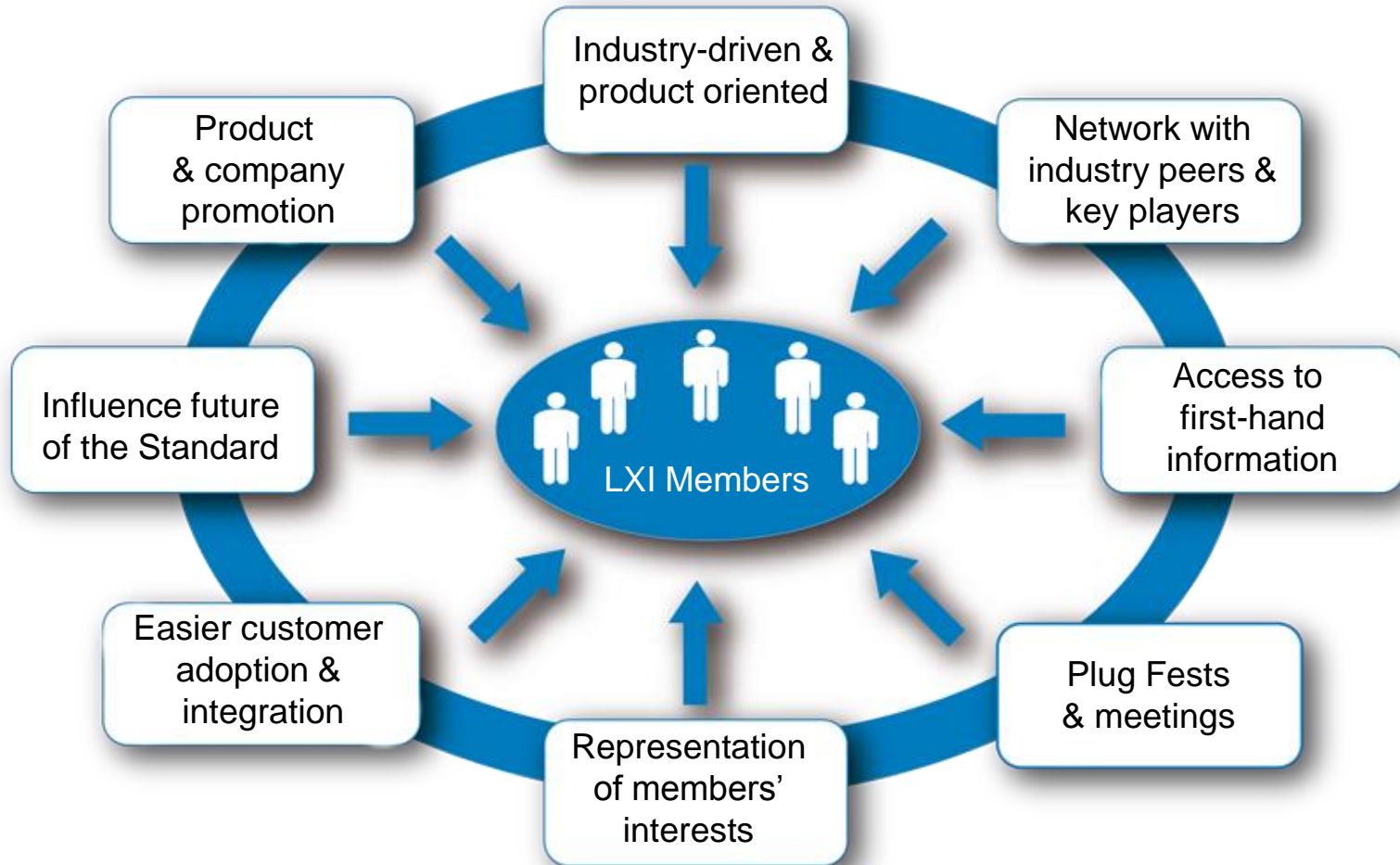
# LXI Future

- **2015 celebrating 10<sup>th</sup> Anniversary of LXI**
  - Build global customer awareness and utilization
  - Promote global vendor adoption utilizing the LXI Reference Design
- **Maintain and “future-proof” the LXI Standard and Implementation**
  - Monitor Ethernet and wireless technology advances
    - IoT, Mobile, Cloud, SDN, Security, WI-FI Direct / LI-FI, 1588, ...
  - Investigate LXI / Modular hybrid standards / solutions
  - Support and extend the LXI Reference implementation
- **Maintain, simplify and expand the conformance testing capability**
  - Simplified conformance testing with LXI Reference Implementation





# Member Benefits of LXI



# More Information on LXI

- **Visit website**

<http://www.lxistandard.org/>

- **Contact Bob Helsel, Executive Director or any other board member**

<http://www.lxistandard.org/ContactUs.aspx>

Thank You!

# Backup

# Why is LXI Important to China?

- **Chinese general-purpose test equipment market expected to reach \$713.5 million in 2017 (*Frost & Sullivan*)**
  - CAGR of 9.1% from 2010 to 2017
- **Key growth drivers include (*Frost & Sullivan*):**
  - Mobile communications
  - Aerospace and defense
  - Expansion of electronic devices
  - R&D globalization in China
- **Transition of “Made in China” to “Designed in China”**
- **9 of 51 (17.6%) LXI Consortium members from China**
  - Rigol Technologies is a Strategic member and certified LXI Conformance Test House

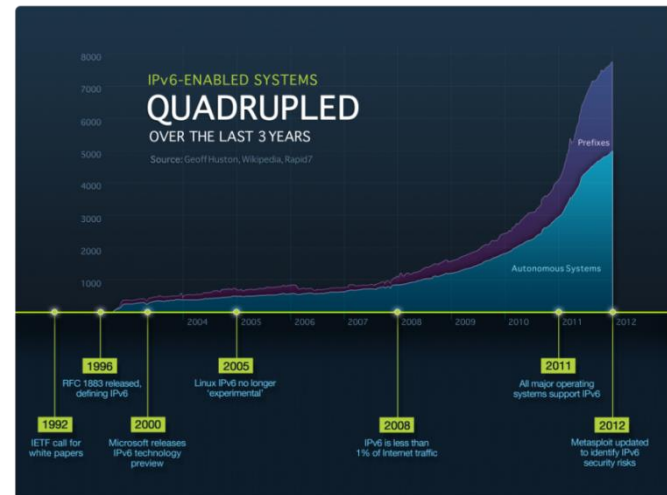


# LXI IPv6 Extended Function

- LXI Future-proofing
  - Ensures that LXI vendors approach IPv6 in a consistent way
  - Compliance with government requirements
  - Approval complete June 2012
  - LXI conformance process in place



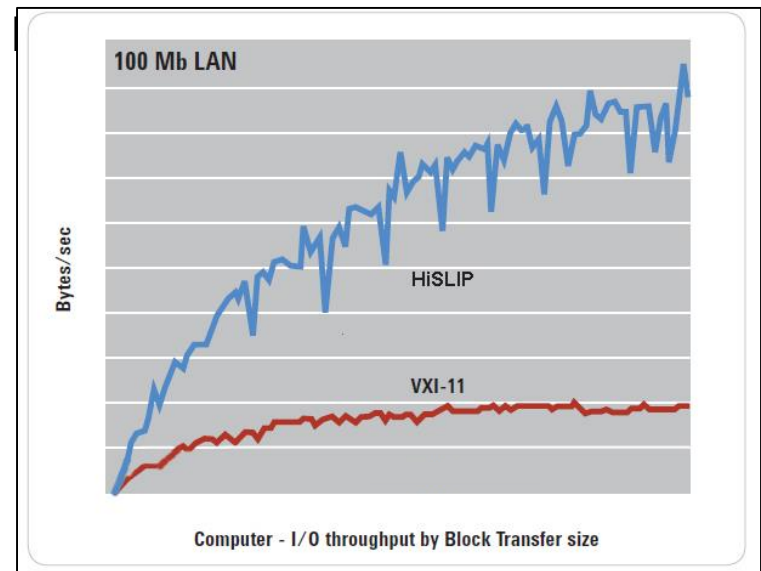
- 3000 orgs turn on IPv6
- 1% - 4% IPv6 traffic
- IPv4 addresses running out





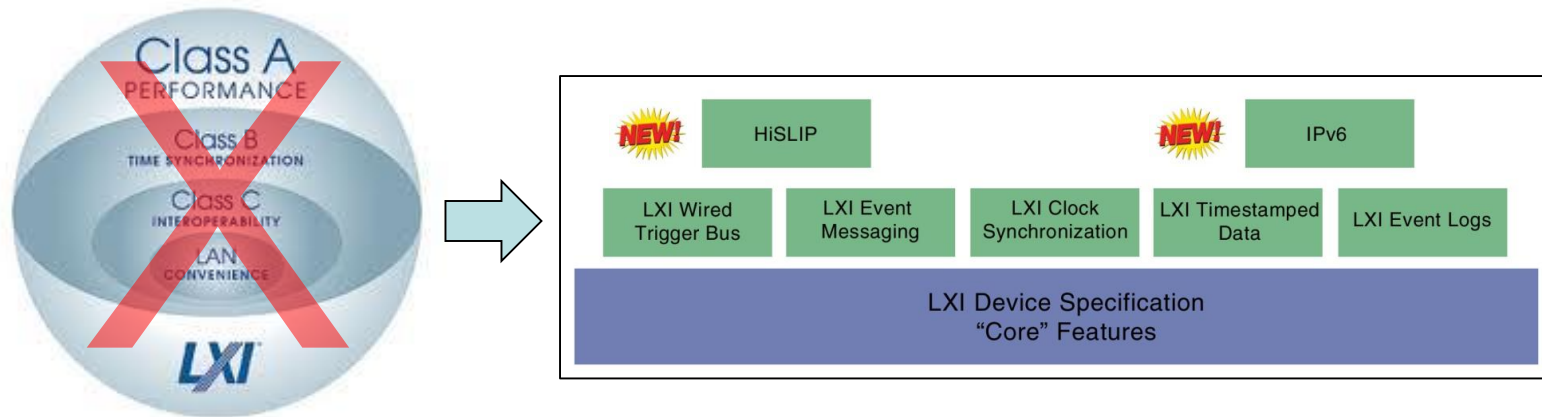
# LXI HiSLIP Extended Function

- HiSLIP (High Speed LAN Instrument Protocol)
  - Faster than any other current interface
  - Some instruments can approach the theoretical limit of Gigabit LAN for TCP/IP connections
- LXI leverages the HiSLIP standard created by the IVI Foundation
  - Creates a fast control interface by VXI-11
  - Emulates the capabilities of GPIB devices
  - Operates over IPv6 networks



# Replacement of LXI Classes

- As of LXI Specification revision 1.4, previous LXI classes have been replaced by optional extended functions
  - Class structure made it very hard to migrate the specification
  - New extended functions provide more flexibility



LXI Classes replaced by LXI Core with Extended Functions

# LXI Satellite Application Example

- **LXI in Satellite System Testing by Jochen Wolle at Rohde & Schwarz**
  - Cover article in January issue of Evaluation Engineering
  - New method for group delay measurements in distributed systems
- **Advantages of LXI solution**

