I.T. Challenges for LXI-based Test Systems

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Introduction

Building an LXI-based Test System involves planning and includes meeting the Test System requirements and company LAN access requirements.   Without understanding both sets of requirements prior to assembling the LXI Devices into a particular LAN Configuration, you run the risk of non-optimal Test System communication, wasted time troubleshooting, and potentially violating company policies with regard to LAN Security.

The LXI Consortium has created three documents to help reduce or eliminate these risks, which are located at GuidesForUsingLxi:

- *LXI Getting Started Guide*
- *Building LXI-based Test Systems*
- *Introducing LXI to your Network Administrator*

The *LXI Getting Started Guide* helps the first-time user understand the behavior of LXI Devices when connecting to LAN. *Building LXI-based Test Systems* and *Introducing LXI to your Network Administrator* contain illustrations and guidelines for combining multiple LXI Devices and connecting them to the company LAN.   They are written for the Test System Developer and the Network Administrator, respectively, with the goal of cooperation to achieve desired outcomes.

This article discusses a real-life project team that built an LXI-based Test System.   They did not have the benefit of these documents as a basis to plan their Test System LAN Configuration and had to discover and overcome these LAN challenges on their own.

The Project Team's First Approach

The first Test System LAN Configuration leveraged a previous Test System which controlled instruments only through GPIB. Some of these instruments had both GPIB and LAN interfaces, and were LXI conformant. New LXI Devices were combined with the previous LXI Devices and all were connected to LAN. The Test System computer was already connected to the company LAN and had been equipped and configured to meet company Security and Backup guidelines.

The Test System computer was granted permission by the Network Administrator to avoid automatic security updates that would restart the computer without permission by the Test System Developer. That is, the computer screen would have a dialog box pop up indicating updates were pushed to the computer, and the Test System Developer could restart the computer when tests were not running. In addition, the computer had automatic backups enabled. On occasion, the previous Test System had experienced test system performance failures due to pushed security updates and backups, but tests were written to restart if a failure occurred, and tests did not typically run for very long.

For this particular company, adding new devices to the company LAN did not require registering their MAC Addresses with the DHCP Server in order to acquire an IP Address. Therefore, it was an easy transition to the *Open System Configuration* shown in Figure 1.   All that was needed was an 8-port LAN Switch. The computer maintained its previous access to the company LAN for security updates, and the

computer and LXI Devices all obtained IP Addresses automatically from the company DHCP Server through the LAN Switch.
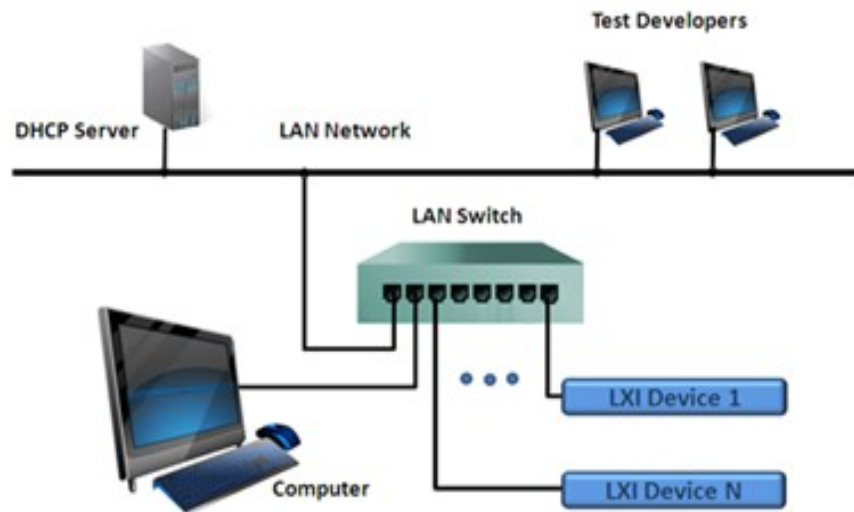
Figure 1.   Open System Configuration

Test Developers were excited about having Web page access to any LXI Device from their cubicles when developing tests, since the previous Test System using GPIB did not provide this capability. The Web pages for LXI Devices provided Web Browser control of the LXI Devices for measurements, signal generation, etc. and helped the developers understand if their software was properly configuring the LXI Devices.

The *Open System Configuration* also permitted any Test Developer to run tests from their cubicle computers and later deploy those working tests to the Test System computer to run at night. This simply required Test Developers time-share the system to avoid interrupting each other's tests during the day.

This LAN configuration seemed ideal. The computers all maintained updated security configurations and Test Developers were productive. The LAN Switch provided a level of isolation for the Test System from the company LAN as long as just the computer and LXI Devices were talking to each other.

So, why would this project team change their LAN Configuration?   Here are the key issues that forced a change:

- Tests began running for 8 to 10 hours which opened a wider window for interruptions
- Test System failures due to interruptions from company LAN increased
  - Other LAN users would access Test System devices and affect test setups
  - Broadcasts on company LAN affected Test System performance
- Network Administration changes caused DHCP Server reconfigurations, which caused changes to LXI Device IP Addresses, and resulted in failed tests

The Project Team's New Approach

The project team decided the isolate the Test System from the company LAN, since interrupting tests was the biggest issue to resolve. It was not acceptable to have overnight tests failing due to the **Open System LAN Configuration.** Two isolated LAN configurations were considered, as illustrated in Figure 2.
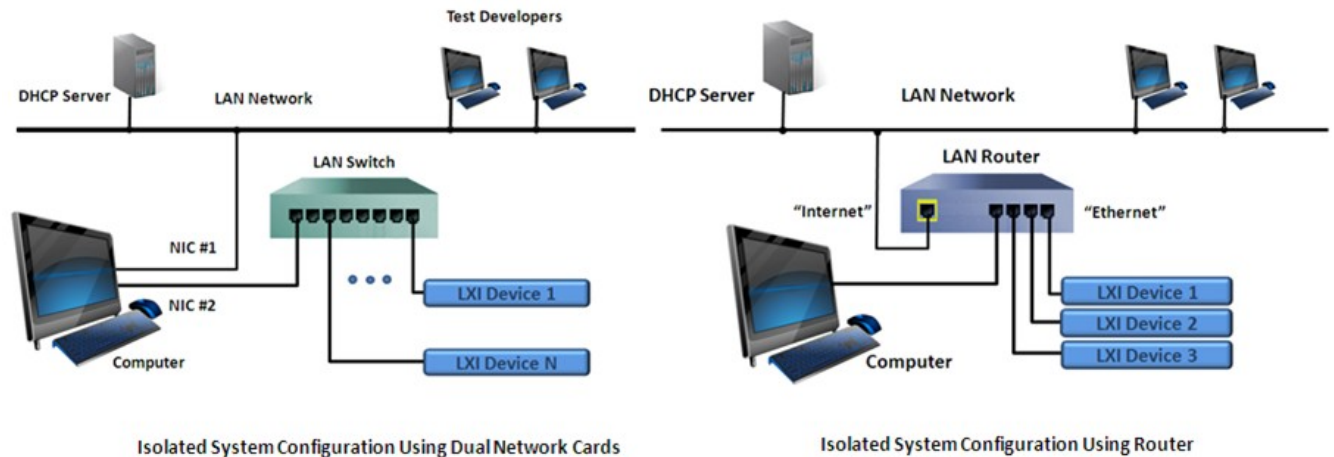

Figure 2. Two Isolated System Configurations

Dual Network Card Configuration Attributes

- Network Administrator software maintains access to Test System computer
- LXI Devices are isolated from the company LAN
- Test Developers can access Test System by remote-login to computer
- LXI Devices lose DHCP Server setting of IP Addresses and resort to Static or AutoIP Addresses

### LAN Router Configuration Attributes

- Network Administrator software loses access to Test System computer
- Test System computer can still access company LAN and pull updates through Router
- Test Developers lose access to computer and LXI Devices
- LXI Devices acquire IP Address from built-in DHCP Server of Router

The project team did not have much LAN Configuration expertise nor did they have a Network Administrator that understood LXI Devices or Test Systems. They basically did not talk to each other because they did not understand each other's needs. The project team decided upon a hybrid of the two configurations, as illustrated in Figure 3, and settled on the following key attributes of that configuration:

Dual NIC with 8-Port LAN Router Configuration Attributes

- Network Administrator software maintains access to Test System computer
- LXI Devices are isolated from company LAN
- Test Developers time-share access to Test System by remote-login to computer
- LXI Devices acquire IP Address from built-in DHCP Server of Router

The Test Developers had to give up the ability to directly access Web pages of LXI Devices or run tests from their cubicles. They now time-share access by remote-login to the Test System computer. This was deemed a reasonable compromise to eliminate Test System interruptions, and they were already familiar with time-sharing the Test System.
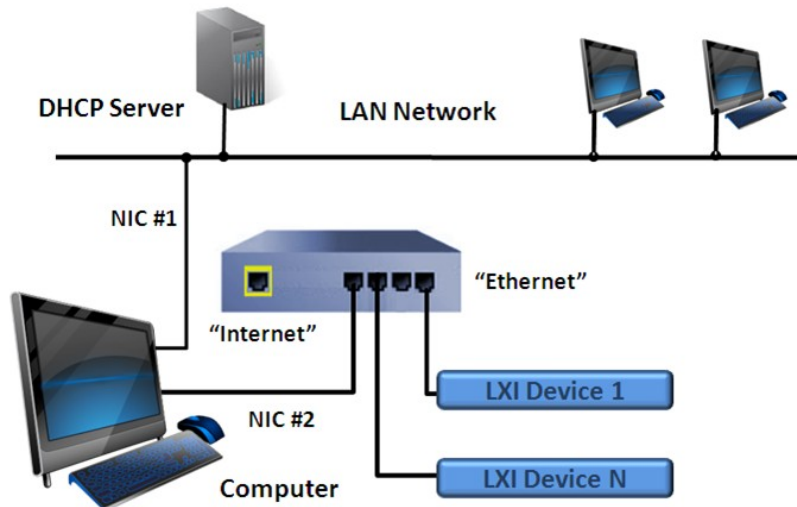
Figure 3. Dual NIC with LAN Router System Configuration

This configuration achieved the most important project team goals. However, a lot of time was spent figuring out this configuration, and it required opening up the computer to install a second NIC interface for the isolated LAN. It also permitted the team to avoid working with the Network Administrator.

Reflections

The project team could have used the Router configuration in Figure 2 and avoided the second NIC installation. However, it would require understanding how to configure the Router to make the Test System computer accessible for Network Administrator software and for remote-login. Using such things a MAC Address Cloning, allowing anonymous requests like Ping, Port Forwarding, or using the DMZ (Demilitarized Zone) of a Router is not common knowledge for Test System Developers.

The documents *Building LXI-based Test Systems* and *Introducing LXI to your Network Administrator* are oriented towards building this understanding of recommended Test System LAN Configurations for LXI Devices, including the Dual NIC and Router Configurations. They provide information for the Test System Developer and the Network Administrator to coordinate and achieve maximum performance for the Test System while maintaining company LAN Security.

These documents go much deeper and discuss many other topics, such as Remote Access of the Test System from outside the company LAN, site-to-site communication, wireless communication, LXI Device protocols, ports, and services, and addressing security for LXI Devices with embedded computers running commercial operating systems.

A lot of time and aggravation can be avoided by using these documents. The ultimate goal is the cooperation between the Test System Developer and the Network Administrator, because they can now understand how to leverage each other's expertise.