

MEASUREMENT TIPS

Volume 9, Number 1

Increase Data Acquisition Flexibility Using Wireless LAN



Data acquisition challenges can exist anywhere, from a wind turbine high above the ground, to a dynamometer lab down in the basement. In addition some data acquisition measurements need to be mobile with instruments changing locations on a regular schedule. As the data acquisition instrument moves from location to location, so does the communication interface. In these cases it is valuable to have flexible ways to communicate to the instrumentation.

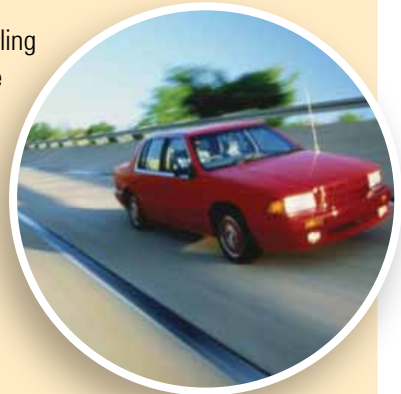
LXI (LAN eXtensions for Instrumentation) instruments combined with industry-standard wireless LAN interface products provide easy and supportable solutions to these mobile data acquisition problems. Wireless LAN standards specified by IEEE 802.11 have matured and now provide fast, reliable, and secure connectivity. Data acquisition applications can capitalize on these solutions in cases where reliable wireless communication is required.

Snapshot: Capture and Download Data on the Move

A wireless LAN-based data acquisition system can be used with vehicles to capture and download data at periodic intervals. For example, during high speed track testing engineers need a way to capture vehicle temperatures and download to a central computer for analysis.

Using the Agilent 34972A, a vehicle is easily instrumented to measure various temperatures. In addition, the 34972A has a standard LAN interface, so using wireless LAN for communications is simple.

After an extended drive on the test track, pulling into a maintenance station re-establishes the wireless LAN connection and data can be downloaded to a central computer for post processing. When the download is complete, the driver can return to the track to continue the test drive.



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Data security

After a decade of real-life field testing and improvements, 802.11n encryption methods have matured and are extremely robust. The latest encryption method (WPA2) uses advanced encryption scheme (AES) coding. AES has been carefully scrutinized worldwide and adopted by many governmental groups because of its effectiveness.

Wireless system topologies

You can choose from a variety of wireless system topologies. Choosing the right one depends on your needs and available hardware. Central to wireless connectivity is an access point, typically a wireless router. The router manages the wireless subnet (cell) by assigning IP addresses, domain names, and isolating the local network from the wide area network. The wireless router assigns IP addresses to clients connected to both wireless and wired sides of the network. The network shown in **Figure 1** is an example. This topology works well when you want to control a single test rack that contains multiple instruments.

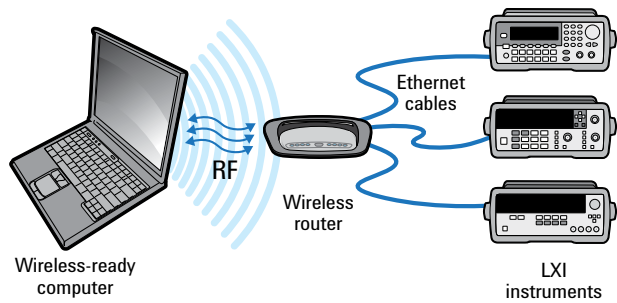


FIGURE 1. Wireless-ready computer with single wireless router

Figure 2 shows a second useful topology. In this case, multiple users need to monitor and control several dispersed instruments. This type of topology might be used in an environmental test area with several temperature chambers. Each chamber has a data acquisition unit such as the Agilent 34972A data acquisition/switch unit. The topology shown in Figure 2 allows easy communication access to the data acquisition systems without the need to run lengthy LAN cables. Wireless bridges allow seamless interconnections between wired LAN devices and wireless networks. As with routers, wireless bridges are available from all the major wireless equipment suppliers.

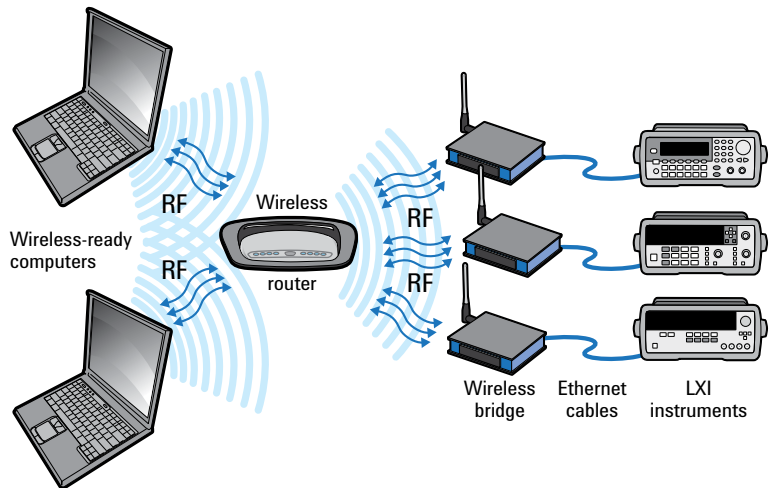


FIGURE 2. Single wireless router with multiple PCs and wireless bridges

Configuring a wireless data acquisition network

To construct your wireless data acquisition network, first select a wireless network topology. If you can co-locate all of the instrumentation in one area, a topology similar to Figure 1 may work well. In this case, a single router and a wireless-ready computer are required. If the instrumentation is distributed across a large area, the topology shown in Figure 2 may work better.

Configuring the wireless data acquisition network can be intimidating at first, but the wireless LAN equipment manufacturers provide documentation and tools to make the process easier.

To demonstrate, we will outline the steps for configuring a wireless cell to communicate with the Agilent 34972A data acquisition/switch unit. In this case, we'll use the Linksys 802.11n router WRT610N and a single wireless bridge WET610N. We'll configure a wireless network similar to one shown in Figure 2. Our computer is wireless-ready and connects to the cell created by the WRT610N wireless router. A single WET610N wireless bridge connects to the 34972A.

Here are the major steps required to manually configure the wireless data acquisition network:

1. Configure the router to create the wireless cell

- Direct connect the wireless router to your computer with an Ethernet cable
- Determine the wireless router IP address and open its (built-in) web server homepage. The IP address, login and passwords can be found in the manufacturer documentation.
- Using the router Web server home page, configure the wireless router settings (see **Figure 3**):
 - Create a unique SSID (service set identifier)
 - Select security mode (such as WPA2-AES) and enter encryption passphrase (key)
- Save the settings, disconnect the Ethernet cable and re-locate the router central to the wireless cell

2. Configure the wireless bridge to connect to the wireless cell

- Direct connect the wireless bridge to your computer with an Ethernet cable
- Determine the wireless bridge IP address and open its Web server home page
- Configure the wireless bridge settings identical to the wireless router:
 - Set the SSID to match the wireless router
 - Select security mode and set encryption passphrase also to match wireless router
- Save the settings and disconnect the Ethernet cable from the bridge. Locate the bridge near the 34972A and reconnect the Ethernet cable from the bridge to the 34972A.

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To maximize wireless LAN security:

- Choose WPA2-AES encryption
- Create a strong key by using at least 13 randomized characters
- Turn off SSID broadcast
- Change the router's administrator login and password from the manufacturer's default

3. Set the PC wireless interface to connect to the wireless cell

- Open your PC's wireless interface configuration utility
- Set the SSID, security mode and encryption passphrase identical to the wireless router

4. Verify the 34972A data acquisition connectivity

- Power on the router, bridge and 34972A. Make sure to allow time for the router DHCP's service to assign addresses to the PC and 34972A.
- On the PC, open a Web browser and type in the 34972A IP address.

5. Begin using your favorite application software as you would with any LXI system

- The wireless LAN network is transparent to the LAN communications, and standard LAN tools and methods work seamlessly.

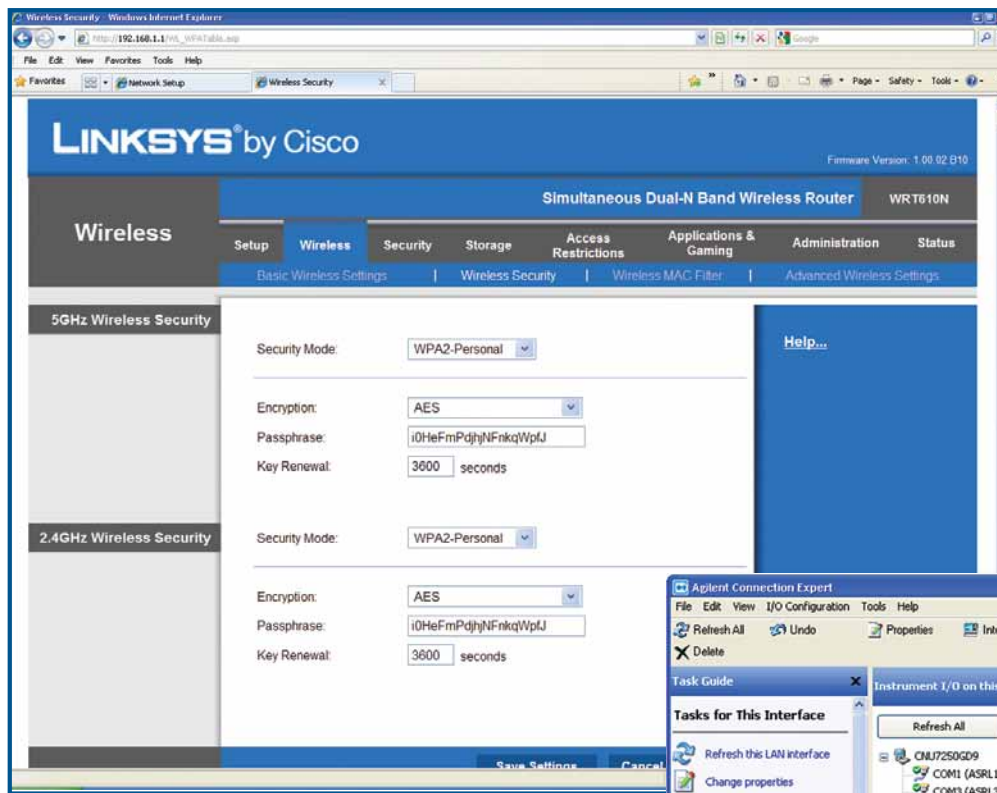


FIGURE 3. Set up the wireless router using the built-in Web server (security window shown here).

You will find details of configuring the wireless router and bridge in the manufacturer's documentation. Most wireless routers provide hundreds of setting options. Fortunately, the majority of the options can be left at their default settings. But here are a few important settings to remember:

- To prevent someone from physically connecting a LAN cable to the router and viewing the settings, change the (manufacturer's default) login/password to a new, unique one that only you know.
- Set the SSID (service set identifier) to a unique name that you can remember.
- For extra security, turn off the router SSID broadcast. By default, routers periodically broadcast their SSID so wireless clients can identify available wireless cells. This works great in coffee shops and airports, but for dedicated wireless cells, it is not necessary to broadcast the SSID.
- For maximum security, select the WPA2 AES encryption method and use a strong passphrase.
- Reduce the chance of a "brute force" attack by using at least 13 random characters to create your passphrase. Notice in **Figure 3** the WPA2 mode with AES encryption and strong passphrase.

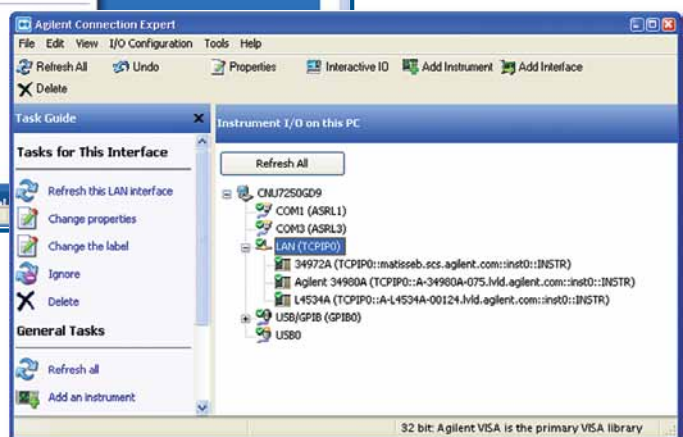


FIGURE 4. Agilent Connection Expert (ACE) instruments on LAN.

Once the wireless network is configured and operational, you can use standard LAN tools to connect and communicate with the 34972A. It doesn't matter if you are using an Ethernet cable or a wireless connection. The connection method is transparent to the application and application software.

You can use tools such as the Agilent I/O connection expert (ACE) to auto-discover instruments present on the wireless network.

Figure 4 shows the I/O libraries successfully discovering the Agilent 34972A as well as a 34980A and an L4534A. You cannot tell which instruments are on a wireless network and which ones are on the wired network. The LAN tools and methods to which you are accustomed on wired LAN interfaces work the same way on wireless LAN interfaces.

IEEE 802.11 wireless LAN

Using standard IEEE 802.11 wireless LAN for instrument communications capitalizes on millions of engineering hours invested in product development, security, and product robustness. Easy-to-use LXI instrument tools make configuration and operation of the wireless network simple. The Agilent 34972A LXI data acquisition/switch unit combined with a wireless bridge connects seamlessly to a wireless LAN network.

When you need distributed wireless instrument communications, use 802.11 wireless LAN and LXI certified instruments such as the 34972A to create your data acquisition system.



FIGURE 5. Agilent 34972A LXI data acquisition/switch unit.

Acknowledgments

History of 802.11 security,
by Jesse Walker, Communications Technology Lab, Intel Corporation

IEEE 801.11, Wikipedia The free encyclopedia

Testing 802.11n, by Fanny Mlinarsky, Octoscope

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