RABBIT
Semiconductor

TN230

Off-the-Shelf Solutions for 802.11b Wireless Networking

This document describes some off-the-shelf solutions for using wireless networking with Rabbit products. Although these solutions have certain limitations, they may be useful in some circumstances.

What Wireless Solutions Exist?

Currently, the most popular methods for achieving wireless networking are with 802.11b and 802.11a. Bluetooth is another common alternative, although it is generally shorter-range and has not achieved the widespread commercial success of 802.11b. 802.11b operates in the 2.4 GHz spectrum and offers data rates of up to 11 Mbps. 802.11a operates in the 5 GHz spectrum and has data rates of up to 54 Mbps. Some vendor-specific solutions offer higher data rates, but these rates are usually not interoperable with other vendors' products. 802.11b products usually claim ranges of up to 300 feet indoors and about 1000 feet outdoors, but these figures are subject to such concerns as number of obstructions and interference. 802.11a's range tends to be slightly less (although it is capable of higher bandwidth). Bandwidth will decrease as the range increases. Unfortunately, there is no substitute for experimentation in testing the range of a wireless solution.

Wireless Bridging

A number of wireless networking products are currently on the market that can be used with Rabbit solutions. In particular, some, but not all, wireless access points are capable of "wireless bridging," which allows the bridging of two wired networks with a wireless connection. Unfortunately, it can be difficult to determine which products support wireless bridging. Even looking for the term "bridging" in the product documentation is not always helpful, since wireless access points are often described as bridging a wired and a wireless network. If the documentation explicitly discusses bridging two wired networks via a wireless connection, then the product should work for the purposes of connecting one or more Rabbits wirelessly. If the product is advertised as a wireless broadband router (usually with a 4 or 8 port hub included), it probably does not support wireless bridging.

Some other devices are now being released that are designed specifically to connect a wired Ethernet device to a wireless network. These are called "wireless bridges" or "802.11b Ethernet media converters." It is important to note that you cannot use two of these devices to create a wireless bridge between the device and an existing wired network. Instead, these devices must communicate with a wireless access point. These devices are smaller and slightly cheaper than access points.

At the current writing, the following access points are examples that support wireless bridging:

- Linksys WAP11
- Netgear ME102
- D-Link DWL-900AP
- D-Link DWL-900AP+

In general, these devices will not perform wireless bridging with competing devices—that is, don't expect to be able to mix and match. Some examples of the new wireless bridges are:

- Linksys WET11
- D-Link DWL-810
- Buffalo Technology WLI-T1-S11G

These can be used with any standards-compliant 802.11b access point. Note, however, that the Linksys WET11 has a physical layer compatibility problem with Realtek RTL8019AS Ethernet devices (the chipset used by many Rabbit devices) that causes the WET11 device to repeatedly reboot or lock up. We have tested the D-Link DWL-810, and it does not exhibit the same problem. Hence, it is recommended over the Linksys WET11.

When Is a Wireless Solution Useful?

Currently, inexpensive wireless access points that perform wireless bridging cost about $100 to $200. Since two are needed to complete a wireless bridge, this is an expensive solution for wirelessly connecting a Rabbit device. The range and susceptibility to interference also limit the usefulness of wireless bridging, particularly in industrial settings. However, wireless bridging may be useful for connecting two wired networks when it is inconvenient to connect them via a wire. Also, if a number of Rabbit products can be connected via a traditional wired Ethernet, but they need to communicate with another server or the global Internet, then a shared wireless connection for all of them can be convenient.

It is possible to extend the range of some wireless access points with a custom antenna. For instance, the Linksys WAP11 (and most other Linksys wireless products) feature replaceable antennae. However, care should be taken that FCC regulations are obeyed if the devices are modified.

How Do I Set Up a Wireless Connection?

Rabbit Semiconductor has tested Rabbit products with Linksys WAP11 access points and the D-Link DWL-810 wireless bridge. The following explanation on how to set up a wireless connection will be centered around using two WAP11s, but other access points and wireless bridges may be set up similarly.

In general, you will need a pair of access points of the same model to perform wireless bridging, unless the documentation states that it is compatible with other products. Connect one access point to an existing wireless network, and the other to a Rabbit device via a crossover Ethernet cable, as detailed in Figure 1. Some access points have a crossover switch that allows you to flip the switch to the crossover setting and use a normal straight-through cable rather than a crossover cable. The access point connected to the Rabbit can be replaced with one of the wireless bridge products, but the other side will need to be an actual wireless access point.

Figure 1. Connecting a Single Rabbit Wirelessly to an Existing Ethernet Network
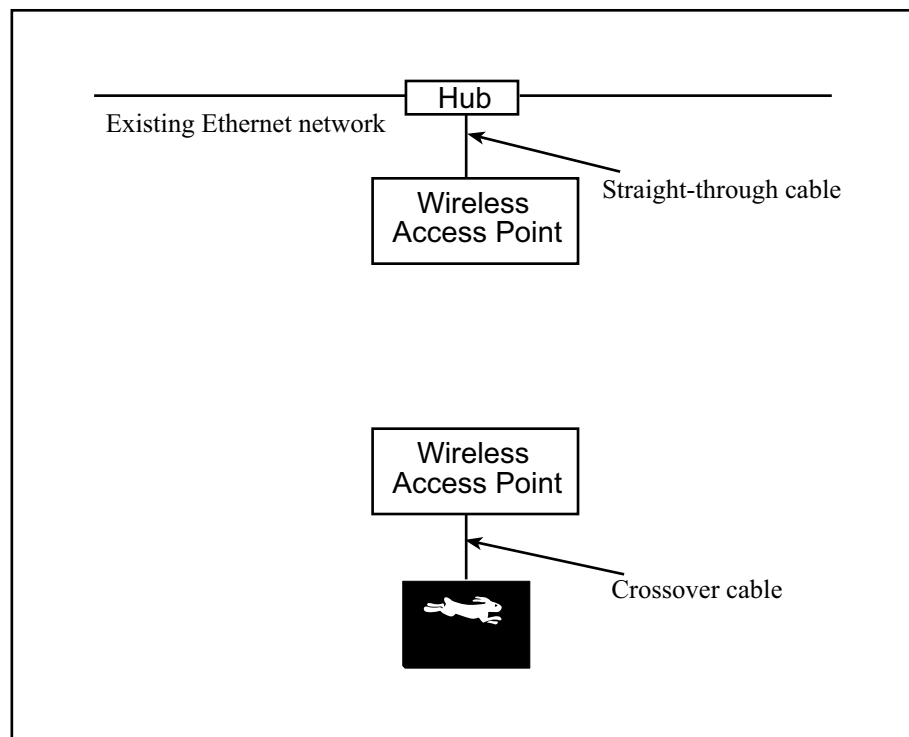
Note that it is possible that the "Existing Ethernet network" above is a single PC so that in effect you are wirelessly connecting a PC and a Rabbit. In this case, the cable connecting the PC and the wireless access point should be a crossover Ethernet cable (or, if your access point has it, you should use the crossover switch).

Alternatively, you may wish to connect a wired network of Rabbits (and possibly other devices) to another network wirelessly. This is pictured in the figure below.

Figure 2. Connecting a Network of Rabbits to an Existing Ethernet Network
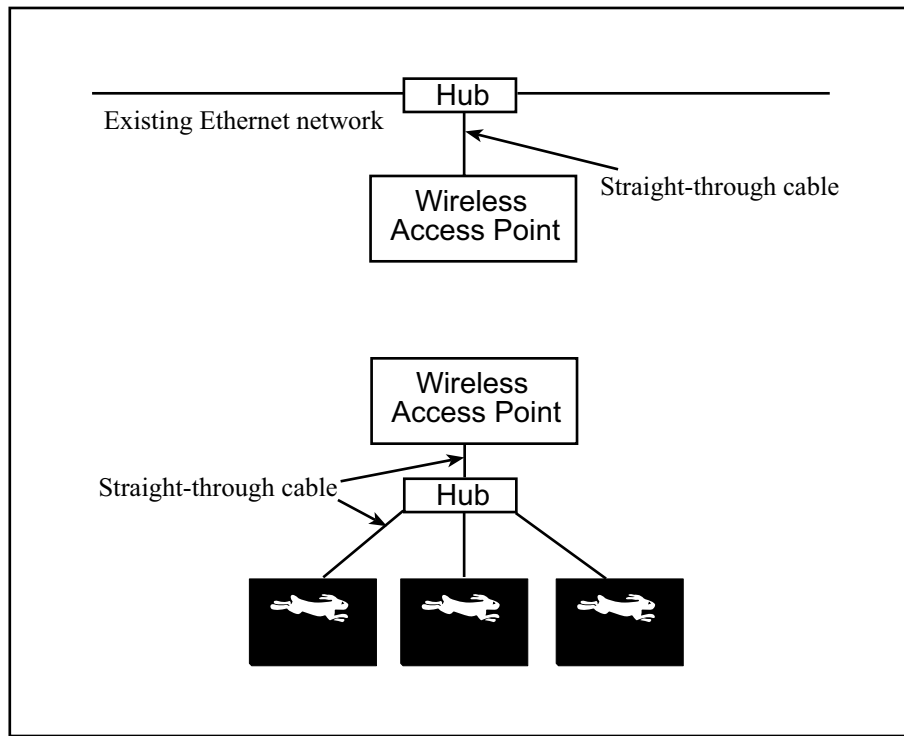
To configure the Linksys WAP11, you will need to connect each one in turn to the same wired network as a PC (probably your existing Ethernet network). Each of the following things needs to be configured on the WAP11. How to configure it will be covered shortly; since there are multiple ways to configure the WAP11, you should first know what you can configure.

Things to configure:

- SSID (Service Set Identifier): This identifier is used to identify your wireless network. All access points and clients on your wireless network must have the same SSID.

- Channel: 802.11b can operate over a number of channels. All access points and clients on a single wireless network must use the same channel.

- Access Point Name: This name will help identify which access point is which on your wireless network. Assign a unique name for every access point.

- IP Address: Choose a static IP address in your local subnet. Alternatively, if you have a DHCP server on the local subnet, you can use DHCP to acquire a dynamic address. We suggest choosing a static address, since you will need to use the web server configuration interface later. If you choose a static address, you will know which address to use to login to the access point.

- Subnet Mask (or IP Mask or Netmask): This should be provided by your network administrator along with the static IP address. Often, this is "255.255.255.0", but it can vary. This parameter is not required if you use DHCP to acquire the access point's IP address.

- Gateway: This should be the gateway address for your local subnet. This should be provided by your network administrator along with the static IP address and netmask. The gateway address cannot be specified if you use DHCP to acquire the access point's IP address.

- WEP (Wired Equivalent Privacy): This option enables encryption on your wireless network. This should be enabled. Different products have different capabilities. The Linksys WAP11 does 64-bit, 128-bit, or 256-bit shared key encryption. Choose the level according to the importance of keeping your wireless network private. Not enabling this at all can leave your wireless network open to any Joe Hacker with a laptop and an 802.11b card. Note that you will need to pick a key length that will work with all wireless devices you wish to use on the wireless network. Different products support different key lengths.

- Passphrase: This passphrase is used to generate the key used by the WEP algorithm. This same key must be used on all access points and wireless clients to communicate on the wireless network. The passphrase is a convenient shorthand for generating the key. Unfortunately, not all products use the same algorithm for generating the key from the passphrase, so you cannot depend upon the same passphrase working on different models of wireless products.

- WEP Key: This is the key that can be generated from the passphrase. You can also explicitly specify the WEP key, although it is more difficult to enter the full key on every wireless device.

- AP (Access Point) Mode: For the Linksys WAP11, this can take on one of four modes: Access Point, Access Point Client, Wireless Bridge, and Wireless Bridge Point to Multpoint. These options are described below.

The parameters listed above all the way down to "passphrase" can be configured via the Linksys setup wizard. The other two parameters can only be configured via the web interface.

To use the Linksys setup wizard, first attach a WAP to the local wired Ethernet. Then, use the CD that came with the documentation to start the setup wizard. It should detect the WAP on the local network and allow you to configure it. Follow the directions, and see the manual that came with the product for more information. Alternatively, you can use the web interface from the start (for instance, if you are trying to configure the product from a Mac or a Linux box). You will need to configure your PC such that it thinks it is on the network 192.168.1.x. Use the web browser to browse to 192.168.1.251, which is the default address of the WAP11. It will prompt for a username and password. Leave the username empty, and enter "admin" as the password (although you should check your manual—details may have changed since this writing).

To complete the configuration, use a web browser to browse to the IP address you gave the WAP in the setup wizard. It will prompt for a username and password—leave the username blank and use "admin" as the password (as mentioned in the previous paragraph, you should confirm this in your manual). From the setup screen, you can configure everything listed above. Setting the WEP key is done from a popup window.

In particular, you will need to configure the AP mode, depending on how you plan to use the access points. The simplest method is to use the Wireless Bridge setting for both WAPs. This setting also requires you to set the MAC address of the other WAP. (The MAC address of each WAP should be located on the bottom of each unit.) This creates a one-to-one bridge between the two access points. No other wireless devices will be able to communicate with the access points. Any data that an access point receives on its Ethernet interface will be forwarded to the other access point and its Ethernet interface, and vice versa.

If you need to wirelessly connect more than two existing networks, you will need to use the "Wireless Bridge - Point to Multipoint" setting. All WAP11s with the same wireless network parameters (SSID, channel, and WEP key) will forward their traffic amongst themselves. Be careful with this method since busy networks can degrade network performance. Linksys recommends no more than three LANs be connected this way.

If you want to use one of the WAP11s as an access point for other wireless clients (such as PCs), then you can set the WAP connected to the existing Ethernet network to be in Access Point mode, and the other one connected to the Rabbit(s) to Access Point Client mode. This mode requires you to enter the MAC address of the Access Point to which you wish to connect.

After you have completed configuring one of the access points, you will need to go through the above process again for the other access point. Make sure you choose a different IP address for the second access point. Also, if you set one access point to "Access Point" mode, make sure to set the other to "Access Point Client" mode.

Configuration for devices other than the Linksys WAP11 will be somewhat different. For example, the D-Link DWL-810 does not have a dedicated setup wizard. Instead, you must temporarily change the IP address of your PC to be able to use a web browser to contact the device. Once you have changed the IP address of the device, you can set your PC's network settings back to the original values.

Testing the Connection

Once the configuration is done, you can attach the access points as directed earlier. To test the connection, you can use the sample program SAMPLES\ICMP\PINGYOU.C. First, have the Rabbit ping the IP address of the access point to which it is directly connected. This verifies that the Rabbit can communicate with the local access point. Next, run the program again with the IP address of the remote access point. This verifies that the wireless bridge is working. Finally, try running the program again with the IP address of some machine on the remote network. You can also try running PINGME.C on the Rabbit and pinging the Rabbit from a PC on the remote network.

It Isn't Working! Why not?

Rabbit-based Ethernet products should work with any access points that perform wireless bridging. There is nothing special to do in order to get Rabbit Ethernet support working. It should also work with the "wireless bridging" products, with the exception of the Linksys WET11 mentioned earlier.

If you have a Linksys WET11 device and a Rabbit device with a Realtek Ethernet chipset, you may have problems with the WET11 constantly rebooting and locking up. It can be made to work by connecting with a 50 foot or longer Ethernet cable or by adding 15 ohm resistors inline on the TX+ and TX- lines of the Ethernet cable on the WET11 side of the cable. Because of this problem, we do not recommend the Linksys WET11.

If you cannot ping the local access point from the Rabbit, then check that you are using a crossover cable from the Rabbit to the access point. If your access point has a crossover switch, then set it to the "X" position and use a straight-through cable. Try hooking a PC directly to the access point (reconfigure the network interface on the PC to be on the same subnet as the access point, if necessary).

If the wireless connection is not working, there are several possible sources of errors. Make sure that all devices are on the same subnet (with the same netmask). Check the SSID and channel values on the access points. Make sure that the encryption keys match—if you entered it via a passphrase, check that the passphrases and the keys are the same on each access point. You could be outside the range of the access points, or interference could be causing problems. The more walls between the access points, the smaller the range. Try testing the connection with the access points close to each other. If it still is not working, try connecting a PC with the access points and verify that that works.

Also note that your two wireless access points will probably need to be the same model. It is also possible that the model of access point you have does not support wireless bridging. Query the product's technical support if you are unsure.

If, after all of this, your wireless connection with your Rabbit is still not working, try hooking the Rabbit up through a wired connection to make sure that there is not a more general problem. If you are all out of ideas, and a wireless connection between PCs works, then contact Rabbit Semiconductor technical support for further assistance.

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http://www.rabbitsemiconductor.com/support/questionSubmit.shtml
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