



WiFi and Boats...

Since our company name and a link to our web site appeared in the December 2005 issue of Sail magazine we have received many queries asking the essential question:

"I want to install a WiFi system on my boat to increase my range; what do I need to buy?"

Frequently that question is accompanied by some description of the "recently purchased laptop computer" and sometimes the comment that the "built in Wireless card is inadequate" (although frequently not stated in a pleasant manner.)

Let's try to address this situation. What do you need to buy? That depends!

Summary:

This document discusses several considerations when choosing to provide wireless networking to a boat or on a boat – any kind of boat. We will cover a lot of information which will help the reader to understand a variety of issues that can help them get the optimum solution for their situation.

For those of you who want the "quick" answer and just need a way to get the one laptop on board to "talk" to the Access Point(s) on shore, here's the answer for the largest percentage of boat owners. Get the [Extended 500mW RV PLUS Kit](#). It has a high powered "radio", a high gain omni-directional antenna, an active USB extension cable and, although it is labeled as an RV Kit, works wonderfully for most boaters and sailors. You might want to stow it below while not in use and perhaps even hoist it on a halyard or Velcro it to the topsides when in use, but it will work for most people better than most anything you might already have.

For the rest of you and those interested, read on. We have tried to cover the bases. If you still have questions feel free to look at our web site (www.netgate.com) or contact us via email (sales@netgate.com) or phone (509-280-8999).

To start with why is the “built in Wireless card inadequate?”

There are three main reasons the typical embedded wireless capability is inadequate for most boats. One, the miniPCI WiFi cards offered by most PC manufacturers have relatively weak transmit power and poor receive sensitivity. Two, the antenna is internal to the case and not very high gain. Three, the radio signals “attenuate” (degrade) over distance. Obstacles, such as trees, buildings, other boats and motors, even the laptop case itself and your own boat contribute significantly to the attenuation of radio signals. In reality there is a fourth aspect over which boat owners generally have little or no control over; the capabilities and set up of the Access Point(s) installed in the club, harbor or marina.

First, a quick look at transmit power. Radio waves attenuate in an exponential manner. That means that a 3 dBm increase represents roughly doubling the power. For a 3 dBm decrease the power is reduced by about one half, making -3 dBm equal to about 0.5 milliwatt. (See <http://en.wikipedia.org/wiki/DBM> for more information).

The typical embedded WiFi card has a transmit power less than 100 mW (20 dBm). Most are actually less than that at either 50 mW (17 dBm) or 30 mW (15 dBm). There are WiFi devices in various form factors (miniPCI cards, USB attached devices, client bridges and PCMCIA/Card Bus cards) that have 200mW (23 dBm) and even 400mW (26dBm) or 600mW (almost 28dBm) available in the market. Increased power generally means increased range.

Except, the radio itself is not effective without an antenna to radiate the transmit power into the air for other radios to receive. Normally, the embedded wireless antenna is integrated inside the laptop’s case and is pretty weak, just a nominal 2 dBi. Like transmit power the antenna gain is measured in dB (decibels) and as such 3 dBi increase in gain is roughly two times the radiated power.

Although there is not much of an “aftermarket for integrated antennas, there certainly are several antennas on the market with higher gain that can be attached externally.

So, the first two issues that result in the less than adequate performance of the embedded wireless in your new laptop can easily be solved. There are higher powered radio cards and higher gain antennas. The big question is in what form (i.e., form factor) should you use to get to the higher performance? The answer is still “it depends.” So, let’s look at some other factors.

What about 802.11b vs 802.11g, isn’t “g” faster and therefore better? And the geek at the local “box store” told me “n” is the latest, greatest and best.

What about 802.11b vs. 802.11g? Without getting into too much technical blabber, suffice it to say that 802.11b runs at a maximum aggregate speed of 11 Mbps and 802.11g runs normally at an aggregate of 54 Mbps. Sounds like everyone ought to use 802.11g, right? Wrong. First, the tradeoff is between speed (g) and distance (b), everything else being equal. Second, the speed of “g” is often wasted by most users. If you are on a corporate network, sharing large files, voice, video and data simultaneously, etc. 802.11g might make all the sense in the world. But, if you are like most WiFi users 802.11g is almost meaningless. People using the internet for email, even for downloading large files, will not see any real benefit of using 802.11g as the internet itself is the limiting factor, not the speed of 802.11b networks. So, when going for distance, as most boat owners are, 802.11b can be quite sufficient. Seeing as

802.11g is pretty prevalent, there is no reason to avoid it, but there is not much reason to demand it, either. Bottom line: 802.11g is not bad, but don't ignore approaches that are 80.211b only.

There is also 802.11a that operates pretty much the same way but at a different frequency. 802.11a uses channels in the 5GHz range as opposed to the 2.4GHz range for 802.11b and 802.11g. Fact is that there are times when 802.11a is great to have, but for the most part virtually all existing wireless internet providers do not provide 802.11a capabilities. So, bottom line is that 802.11a capability on board your boat is probably not of any benefit.

Now, there is (actually "will be" is the correct terminology as the IEEE standard is up for confirmation at a latter date) something called 802.11n. 802.11n may have some benefits in some networks. 802.11n builds on previous 802.11 standards by adding multiple-input multiple-output (MIMO) and some other capabilities. The nature of "n" is unlikely to be of much benefit to boaters for two reasons. First, the MIMO characteristics mean that it will have most benefits for indoor networks (where there are lots of signals bounced off walls, etc.) Second, there just aren't that many 802.11n networks deployed yet.

Bottom line on the protocol and frequency issue is, stick with 802.11b/g for now.

Another factor to discuss is the Access Point that you want/need to associate with.

Remember this is a two way radio system. It doesn't matter if you have the highest power system on board your boat if the access point on the dock is too weak to 'hear' your signal (or vice versa). Both ends have to be able to send and receive a signal at the given distance. Transmit power is the ability to radiate a radio signal further while 'receive sensitivity' is the ability of a radio to hear and decipher the incoming radio signals into meaningful data. We all hope that the people who are hooking up marinas are also using a 200mW or better base stations and big antennas. It's the marinas that have a 50mW system that are going to have problems, assuming they bought "off-the-shelf-in-the-big-box-stores" access points.

Let's look at the potential solutions.

Starting with **antennas**:

There are a lot of antennas out there that will work for you on your boat. The main question to ask is: what kind of antenna will you need? An omni directional antenna is nice because they are usually stick like, easy to mount and relatively unobtrusive. The horizontal pattern is like a donut; equal in all directions, but by being spread out over 360° the gain (coverage) is limited. The advantage of a directional antenna (panel, yagi, sector) is you get more bang for the buck in the direction the antenna is pointing (a smaller antenna goes further). However you may have to reposition the antenna to point at the access point or bridge you're trying to connect to while in the harbor. With a direction antenna, the general rule is that the more focused the beam, the greater the gain. Dish and Grid antennas are the most focused, difficult to maintain alignment from a boat and therefore not recommended for this purpose. Yagi antennas are the next most focused, followed by Patch, Panel and sector antennas. All of these antennas come in a variety of beam widths so if you choose to wrestle with frequently realigning your antenna, choose one with something with the widest beam width.

By far, we sell more omni antennas to boaters than directional antennas. Presumably that is so the boat can get a signal without having to be positioned in a specific direction. Frequently boaters like the 8 dBi Omni antenna.

(http://www.netgate.com/product_info.php?cPath=23_33&products_id=66) It is about 15 inches high, has an easy to install mounting and stands up to the weather. A particularly popular choice is an 8.5dB omni antenna that comes complete with a VHF mount. Although boaters hate drilling holes in their boat, for some inexplicable reason they are happy to put VHF mounts all over the place. Another advantage of this antenna is that it comes with 3 ft of lead (approx LMR200) terminating in an RP-SMA connector which is just over ¼ in. in diameter. Most Omni antenna require "N" connectors and these need something like a 13/16 in clearance hole which is a whole new ballgame to the boater. This 8.5 dB antenna may be found at http://www.netgate.com/product_info.php?products_id=327

There are 15 dBi Omni antennas that stand about 40 in high, but the tradeoff here is that the vertical beam width is reduced by half to about 8° so that the horizontal disposition of the boat to the access point becomes an issue. The access point installer will try to position their access point as high as possible so that it can "see" all the boats. If the azimuth of the Access point is two or three degree above the horizontal the boat could lose signal if it rocks by as little as 2°

The directional antennas can push the signal a little farther in one direction. As a result a physically smaller antenna can produce higher gain. The 8 dBi Omni was 15 inches high; while an 8 dBi Patch antenna is only 3.2" x 3.2" x 0.6". That smaller size can be beneficial but you will probably need to reposition the antenna frequently.

In order to get stronger signals from smaller antennas or to get a similar area of coverage using directional antennas in place of omni antennas, some people may be tempted to add an amplifier or splitter to their system. Don't do it unless you are an RF engineer. There are too many issues related to installing splitters to discuss. An amplifier increases both signal and noise. Noise is a problem @ 2.4 GHz in a marine environment. An amplifier can also potentially push you over the legal FCC limit.

Where to mount the antenna is the next issue.

The variety of boats makes a pat answer impossible. The factors to weigh are: Safety and consider locations where the antenna will not be in the way of rigging, sails, or other equipment. Masts, stern pulpits, radar rigs (as long as the various electromagnetic devices do not interfere with each other) are all candidates. (Note:802.11a/b/g does not interfere with VHF radio, cellular wireless or Radar) You might also want to consider whether to use a permanent mounting or one you use only when in the harbor. Some folks just raise an antenna on a flag halyard when they are in port stowing everything below otherwise.

Lots of people like to have their laptop in the Nav-station and that presents another set of issues related to connecting the antenna to the laptop. We have seen many installations where the antenna is mounted topsides and a custom cable is run through the boat to the nav-station where it is terminated at the bulkhead (typically with an N-Female Bulkhead connector). In between the laptop and the bulkhead connector a short pigtail can be used.

But the big issue with this is the length of the cable run. Every cable introduces some amount of attenuation depending up the frequency and length. You want a good quality cable such as LMR400 or equivalent, which has a 6.8 dB/100 ft attenuation rating at 2500MHz. (Thin cable such as LMR195 has a 19 dB/100 ft attenuation at 2500MHz) Basically determine your attenuation by looking at this number/100 x length of your cable, add another 1 dB to cover the connectors at both ends, and subtract this number from your antenna number. So a 35 ft cable run of LMR400 (2.4 dB) + 1 dB for connectors = ~3.4 dB. This would reduce the effective gain from an 8dB omni to 2.6 dB and a 12dB Yagi to 8.6 dB. However, a similar 35ft run of LMR195 would attenuate 6.65dB +1dB = ~7.65 db. This would wipe out the potential gain from the omni antenna.

Clearly the use of LMR400 is the best from an attenuation point of view but the downside is that it is approaching 7/8 in. in diameter, is stiff and unwieldy, and has a minimum bend radius of about 3 in. The N connectors on the end of LMR400 require a 13/16 clearance hole and boat owner has to make another hole in their boats.

Frequently we hear people tell us they "know the antenna needs to be as high as possible." That is not necessarily so. Certainly, to a some extent you want your antenna be higher rather than lower, but there are other considerations. One thing you want to do is get the antenna well above the waterline as water is not good for radio signals. There is an area that must be clear of obstructions at the WiFi frequencies. That area is called a "Fresnel Zone". (See http://en.wikipedia.org/wiki/Fresnel_zone).

Suffice it for purposes of this document, that the area that must be clear in order to have a "clear line of sight" between two antennas is greater than that of a laser beam. Just to give you a couple of quick examples, at one mile, the radius of the Fresnel Zone is about 20 ft.; at a tenth of a mile it is about 6 ft. So, if both antennas (one on your boat and one on shore) were only 3 ft. above the water, there would be a significant "encroachment" into the Fresnel Zone. So, a little higher means the water would be less likely to be encroachment.

On the other hand, if you put your antenna at the top of a 65 ft mast, you will be incurring a lot of insertion loss just by having such a long cable on the RF (antenna) side of the radio. Think of this...trawlers tend be really good boats for WiFi as they typically have a short mast on top of the cabin, which puts the antenna high enough to keep a clear line of sight above the water, and a wireless device could easily be located in the cabin keeping the cable length to a minimum.

Bottom line on antennas...select one that meets your needs and fits on your boat; mount them in a safe location; minimize cable runs on the "RF" (antenna) cables or use LMR400 or equivalent. Finally, some times a little creativity can go a long ways.

So, what we hopefully have established at this point is:

- Your integrated WiFi is probably not sufficient (or you would not have read this far.)
- The antenna gain can be substantially increased by using an external antenna
- You can chose an Omni antenna or a directional one
- Mount the antenna where it will be out of the way of the rigging, etc., being cognizant of the length of cable runs.
- The power of the radio can be increased.

Power up the radio. That pretty much leads to a look at potential solutions for the radio. There are several form factors to choose from. There are pros and cons for each.

1. **Upgrade miniPCI card.** These are the embedded cards inside your laptop about the size of a credit card. To see the miniPCI cards Netgate offers, look at http://www.netgate.com/index.php?cPath=26_34. There are a couple of manufacturers of 200mW miniPCI cards. There are even some 400mW and 600mW miniPCI cards available. You could try replacing the miniPCI card in your PC, but I suspect the odds for success are very low unless you do a little surgery on your PC to route a pigtail through the case and connect an external antenna. Look at the kits you could use with various antennas and pigtails at http://www.netgate.com/index.php?cPath=27_44 Another consideration with replacing the miniPCI card has to do with something called a "white list" that certain PC manufacturers have implemented. The white list is a list of approved miniPCI cards that the PC checks during boot up. If you have a card that is not on the white list your PC may not boot successfully. This appears to be a method for the manufacture to assure you buy the cards they sell, although it's likely they will tell you it is for some support or security reason. (You might want to check our FAQ for the latest we know about these white lists.)
2. **PC Card (PCMCIA, Card Bus, or Express Cards)**
Assuming your PC comes with a PC Card Type I/II slot, and most of them do (be careful some of the very newest PCs are using the new "Express" cards which are different), you might want to turn off the internal integrated wireless and use an external card (PCMCIA, Card Bus or Express). There is a CardBus card with an external antenna connector, called the CB-9. You can see it at http://www.netgate.com/product_info.php?cPath=26_39&products_id=130. This card has good transmit and excellent receive capability and if you need to you can add a cable and move the antenna to some appropriate location to avoid obstructions. Look here for the kit using this cardbus card: http://www.netgate.com/index.php?cPath=27_45.

We have sold a lot of sailors a solution with the PCMCIA or Card Bus cards, a pigtail and an antenna, usually the 8 dBi Omni. We suggest that they contact a local cable supplier to run a custom cable (low loss) from the antenna, wherever they need/want to mount it, to the Nav-station where it comes through the bulkhead with an appropriate connector.

The disadvantage of using the PCMCIA card and a pigtail is that you most likely will end up attaching and detaching the pigtail. Pigtails are typically made from a very thin LMR100 because of the size of the connector. So, to avoid the ravages of very high attenuation, the length of the pigtail is usually between 12 and 18 inches. This means that the light and flimsy pigtail will connect to a comparatively rigid LMR 400 within 18 in of the laptop. This offers little flexibility for where to place the laptop, and a high probability of damaging the pigtail or the connector to the PCMCIA card.

3. **USB connected wireless adapter.**
There is an alternative that has been available for the past couple of years. There are 200mW and 500mW USB devices available for 802.11b and 802.11g (and some for 802.11a and 802.11n, but we've already established that 802.11b/g is probably what you need). They have removable antennas, so you can still string coax outside and up to any external antenna you choose. There

are a variety of USB devices, see them all here (but read on)
http://www.netgate.com/index.php?cPath=26_42

One advantage of the USB device is it sits outside your laptop (less heat), is newer technology, is powered by your laptop, and is easy to plug and unplug. There are actually two types we recommend for 802.11b/g; the EUB-362(EXT) transmits at 200mW and the ALFA AWUS036H transmits at up to 500mW. They both come with a removable antenna and a connector for an external antenna. So you can leave the fixed antenna on the boat and take the smaller, removable antenna with you when you go ashore. You can also remove the antenna that comes with the unit and upgrade it to a 7 dBi antenna (http://www.netgate.com/product_info.php?cPath=23_33&products_id=333) or a 9dBi antenna (http://www.netgate.com/product_info.php?cPath=23_33&products_id=495) to get more range

A second advantage is that there is an opportunity to place both the radio and the laptop in an optimum position within the boat. The adaptor is connected to the laptop with a 5 ft USB lead which is flexible, easy to manage and most important does not attenuate the radio signal which is processed at the adaptor itself.

Some users add a USB extension cord which is readily available in various lengths in order to be able to place the radio and the laptop in convenient positions. Be sure to get a "Repeater" USB extension cable; just a passive USB extension cable has proven to be problematic because the radio derives its power from the Laptop USB BUS and not all laptops are created equal in their ability to provide power. Try it and see, is the best advice here. We have the Active USB Extension Cable at http://www.netgate.com/product_info.php?products_id=476.

A third advantage is that with this configuration the Laptop still considers the radio to be a device it owns and consequently the client utilities for managing connectivity, signal strengths, preferred SSID etc are controlled within the PC.

Yet another advantage is that although these USB devices are not waterproof, they are tiny enough to make waterproofing a snip for the average boater who almost by definition is an ingenious person. And the tiny size also makes placement close to the antenna much easier.

For those interested in a kit that contains the EUB-362(EXT), a cable and Marine antenna, look at the EUB-362-EXT MARINE KIT at http://www.netgate.com/product_info.php?cPath=26_42&products_id=328. It has the USB wireless device, a 20Ft cable and a Marine Mount 8.5 dBi antenna. The cable will introduce some signal loss, so be aware that the main purpose of this kit is to provide the flexibility of locating the antenna some distance away from the USB device attached to your computer.

There are other combinations of USB devices, antennas and extension cables that you might want to look at. Being on a boat is essentially the same as being in an RV (no water, of course). We have a list of kits you might want to check out:

Kit Type	Kit Description	When to use this kit!	Price
Standard RV	USB Adapter: EUB-362-EXT Basic Antenna USB Cable	This low cost package is the high power extended range WiFi gear recommended for RV users who want improved 802.11b, 802.11g connectivity over typical embedded WiFi cards. Power and Gain: 200mW and 2dBi gain	\$47.00 Buy Now!
Standard RV PLUS	USB Adapter: EUB-362 EXT Basic Antenna High Gain Antenna: ANT-70MNI-RPSMA USB Cable	This package is the high power extended range WiFi gear that is recommended for 80% of all RV users. This package includes a high power USB adapter and a stronger indoor antenna than the typical consumer product or even our Standard RV Kit. Power and Gain: 200mW and 7dBi gain	\$65.00 Buy Now!
Extended RV PLUS	USB Adapter: EUB-362 EXT Basic Antenna High Gain Antenna: ANT-70MNI-RPSMA Active USB Repeater Cable	Perhaps you need a little more length on the USB Cable to reach the window closest to the wireless signal in the RV Park? Using a regular "USB Extension" cable can actually reduce the capabilities, while this one "repeats" the signal and maintains the high-power characteristics while allowing more flexibility in where you locate the wireless device.. Power and Gain: 200mW and 7dBi gain, plus active USB extension cable	\$85.00 Buy Now!
Standard 500mW RV	USB Adapter: ALFA 500mW Basic Antenna USB Cable	This package is effectively the same as the "Standard RV" kit except the transmit power is significantly enhanced (500mW as compared to 200mW) and that can make a huge difference. The result is an effective power over twice the kits above. Power and Gain: 500mW and 2dBi gain	\$54.95 Buy Now!
Standard 500mW RV PLUS	USB Adapter: ALFA 500mW Basic Antenna High Gain Antenna: ANT-70MNI-RPSMA USB Cable	When the RV user puts a higher gain antenna on the ultra high powered USB adapter they approach the FCC limits and you can't get much higher power than that Power and Gain: 500mW and 7dBi gain	\$70.50 Buy Now!
Extended 500mW RV PLUS	USB Adapter: ALFA 500mW Basic Antenna High Gain Antenna: ANT-70MNI-RPSMA Active USB Repeater Cable	Even with the ultra high power of the Standard 500mW RV PLUS kit above, sometimes positioning the antenna in a window in the direction of the service provider's antenna might just provide the results not achievable any other way for less than \$100. Power and Gain: 500mW and 7dBi gain, plus active USB extension cable	\$90.00 Buy Now!

Note: Prices and specifications subject to change without notice. Check our web site for updates.

A word about Apple **Mac** computers.

Generally the USB devices are well supported on PC (Microsoft Windows of various types) and not so well supported on Apple Mac computers. The reason is simply because there are a lot more PCs than Macs. So, be careful when choosing a USB WiFi solution. The ALFA unit mentioned above has drivers for the MAC OS while others may not. It may be necessary to download the latest version of MAC OS drivers.

If we know about support/drivers for various operating systems we will have that information on the product page under the "Additional Information" heading.

Should you can't find drivers for the MAC OS version you use, you might be better off using the "Client Bridge" approach discussed below.

4. **A Client Bridge.**

You can get an 802.11b/g Client Bridge to replace the integrated radio and antenna.

Basically, a Client Bridge plugs into a hub or switch via a regular Ethernet port using an RJ45 connector *or* directly into your PC or MAC using a CAT5 crossover cable.

When you use a client bridge your computer is not aware that it is communicating over a wireless link; rather the computer is communicating using its Ethernet (normally wired) connection. This has the effect of removing all the wireless logic to a separate device. As a result, drivers are not required and compatibility with a PC or a MAC is not an issue. No processing power, no heat issues, no client utilities are in the computer. Rather a Web browser, such as Internet Explorer or Firefox is used to perform any set up or maintenance of the wireless connection.

There are several indoor and outdoor units that have the ability to be a client bridge.

If you purchase an ECB-3220, an indoor client bridge for example, everything comes with it...plug it in to an 110V power outlet and the CAT5 into your PC and you are ready. You position the unit where it gets the best connection. Typically higher is better and being in line of site to the access point if you can find it is almost certain to help. You might want or need to put a higher gain antenna on it...that's easily done; or, you might need to add a short low loss cable and mount an antenna outdoors (the ECB-3220 is an indoor unit.) The worst aspect of the ECB-3220 is that it is an indoor unit and needs to be inside, but even the salt air (assuming you are on a salt-water body of water) might corrode the insides after a few years. The trick is to place the client bridge radio as close to the antenna as possible so that the antenna lead connection is kept very short. Getting to three feet or less is often possible by placing the radio in a radar arch and the antenna on top. A similar result can be achieved with a rigid cockpit roof. Some users have had a good result mounting the radio in a 6x6x6 waterproof electrical box with an 8 DB omni mounted right on it. Watertight cable glands allow the passing of the Ethernet cable to the PC (use exterior grade waterproof Cat5). A power over Ethernet adaptor (POE) can avoid the necessity of taking power to the box

http://www.netgate.com/product_info.php?cPath=24_55&products_id=50

The ECB-3220 supports 802.11b/g with very good transmit power of 26 dBm (400mW) and excellent receive sensitivity. It can be seen at

http://www.netgate.com/product_info.php?cPath=32&products_id=361

In order to protect their client bridge from the ravages of sodium chloride in a salt air environment some users take their client bridges out of the box and seal them into waterproof containers like a "Glad bag". Wire entry is sealed by silicon. However be advised that this will clearly invalidate the warranty.

There are other indoor client bridges. But effectively the above applies equally to those as well.

The good news is that there are outdoor units with the same transmit power and receive sensitivity called the EOC-3220 or the Ubiquiti NanoStation2 units. These are all 400mW (26dBm) units which perform several times better than the integrated wireless capabilities. The EOC-3220 comes in a version with an integrated directional antenna with 9 dBi gain; another version has an integrated 16dBi directional antenna. The NanoStation2 has an integrated 10dBi gain directional antenna. That's significantly more than you have now and, in theory, each 3 dBi of increased gain should just about double your power....but that's theory. Take a look at them all at:
http://www.netgate.com/index.php?cPath=31_61

For boaters we specifically recommend the EOC-3220EXT version or the NanoStation2, both of which have external antenna connectors so you can add a different type of antenna if needed, such as a high gain Omni-directional antenna

We have several sailboat customers who have used the client bridges by mounting one inside their stern lazarette. They run power to the unit and a CAT 5 cable is strung from the unit to a location amidships, for example to the nav station. They take the antenna cable up to either the stern pulpit, to a radar arch or some even get creative and mount an antenna to their backstay. That's pretty effective and out of the way implementation. Some place client bridges in other locations and run an antenna up a flag halyard or put antennas up only while they are in port (and therefore not concerned about running rigging.)

One thing we didn't discuss much was the power requirement. Clearly, all these solutions have a way to use 110V power (or 240V in other countries). But, you probably have a 12V DC system on your boat. It might take a little creativity on your part to wire it directly, but the some client bridges actually use 12V DC power. Just make sure you get the polarity right! The PoE (Power over Ethernet) injectors all require 48VDC power (the units come with a 110-240VAC to 48VDC transformer) so either some power step up/down or 110VAC source is required. One of our customers recently told us about a "Regulated Switching Mode Car Adapter" that can convert 12VDC to 48VDC. We haven't seen or tested one yet, but it might be worth an online search.

The client bridge takes the radio signal being received from an access point and turns into Ethernet. That Ethernet cable (which is infinitely easier to handle than LMR400) plugs into an Ethernet port of your computer which can be up to 330 feet away. One consideration with using a client bridge is that the client utilities on your computer can no longer tell you anything about which source you are connecting to of anything about the quality of the signal. All the wireless logic is in the client bridge.

The client bridge interface to the user for set up, scanning for available access points, etc. is performed through a Web browser. To change your connection to a different source you will have to reconfigure the IP address of your computer to be on the same subnet as the client bridge, open a web browser and enter the IP address of the client bridge (it's not difficult, just different). The client bridges have a default IP of 192.168.1.1 (or some similar default IP address – see the documentation for the specific unit) so your computer could be configured to a 192.168.1.10 address with a subnet mask of 255.255.255.0 – leave other settings the same. Then type 192.168.1.1 into your browser and follow the client bridge instructions from there. This is OK for

people staying pretty close to homebase but not so convenient for people on the move. An Interesting little tool for overcoming the difficulty of messing with your IP address can be found online. As a suggestion, when you first set up the client bridge, go to the LAN Settings menu and set the IP address for the client bridge to something other than 192.168.1.1 as some marinas leave their access points at that same default and an IP Address Conflict may occur. For example, you might want to set it to 192.168.1.10; just write it down whatever you decide to make it as you will need to know it to get access when you move to the next marina down the coast.

Another opportunity offered by the client bridge is that since it delivers an Ethernet signal, that signal can be plugged into a wireless access point and rebroadcast as your own little onboard network under "the good Ship My Name" However, now you are creating some RF turmoil on your dock. At the least, chose a channel that is not in use around you and use WEP (at least) or WPA encryption to prevent all your neighbors from piggy backing your connection. Bury this radio and even take the antenna off to minimize its field of reach to your boat. Weaker is better here. If you want to have wireless access to multiple computers on your boat at the same time, this is what you probably want to do...we can help you understand the methods to set up and manage your own little WiFi network.

So what approach should I use?

Bottom line is that there are several alternatives depending on what you want and need. If you have a desktop or tower PC, you probably should use the USB or Client Bridge approach. If you have a laptop, any of the above solutions will work.

The type of boat can make a difference. Get yourself a more powerful radio in one of the form factors listed above. Add a higher gain antenna that meets your needs (directional vs. Omni, ability to mount where you want/need, etc.) and attach them to each other through the shortest, low loss cable you can.

Set up on most of these approaches is very simple. All of the drivers you need for any of the above solutions either comes with them or is easily downloaded from our (and other) web sites. So, turn off the integrated WiFi and turn on some power.

Happy surfing while sailing! If it helps you to know, we too are sailors. Our Hawaii staff actively race at the Waikiki Yacht Club & Kane'ohe Yacht Club; while the Texas contingent sails out of the Austin Yacht Club.

Aloha! Y'all!