Internet Linking:
Extract from the SERA *Repeater Journal* February, 2003

SERA looks at

INTERNET LINKING

Gary Pearce KN4AQ

By most accounts, Internet linking - between repeaters, or just between hams - is booming. IRLP (the Internet Radio Linking Project) has about 800 "node" stations on-line. Echolink has well over a thousand "stations" registered. There are several other linking systems dedicated to ham radio that are smaller, but they're all growing like wildfire. A lot of hams are having a ball.

Yet chances are that *you* have never talked or even listened through any of them! If you have, you're in the minority. Most cities still don't have an IRLP node repeater in operation, and most hams have not downloaded Echolink for their own computer. So there's plenty of room for Internet linking to grow... and grow!

The February 2003 issue of *QST* has a good review of Internet linking, and the November 2001 *Repeater Journal* carried an in-depth look at IRLP, so I won't go into great detail about what it is in this article. But the very basics are that "Internet linking" uses VoIP - Voice over Internet Protocol - to send voice and control signals between computers via the Internet. Connect those computers to ham radios, and you have Internet linking.

The SERA Board had a rousing discussion on Internet Linking on Sunday morning at their winter Board meeting. This article will focus on the issues reviewed at that meeting.

Riley Hollingsworth: To those critical or skeptical of Echolink or IRLP, I am told that it is rejuvenating lots or dormant repeaters, and bringing back into Amateur Radio operators who have not been active. If this is true, those are good developments for our service.

And also, we don't want to be too hard line in the beginning of these new technologies, because we want Amateurs to be excited about experimenting and feel free to do so within the general bounds of the rules. Amateur experimentation has led to great technological breakthroughs. That is the great benefit of the service. And remember, lots if folks were severely critical of SSB and said it would destroy Amateur radio.

FCC Takes Wait-and-See

I talked to the FCC's Riley Hollingsworth K4ZDH at some length about the legal implications of Internet linking. The box inset contains his quotes. He has received a lot of questions, and more than a few complaints about Internet linking, and he makes two things clear. One is that the FCC is not going to stifle the innovation and experimentation that is going on with Internet linking. The other is that, no matter what, a properly licensed Amateur Radio operator must be in control of any transmitter radiating a signal in the ham bands.

An FCC "hands-off" is not license for Amateurs to do absolutely anything we want. We do have a basic set of rules to follow. Part 97 is generally flexible, giving us a lot of leeway in how we set up our stations and connect systems together. Applied to Internet linking, or any kind of linking, there are a few rules that specifically apply, a few that have been interpreted to apply, and a few gray areas where it might be hard to figure out just how to fit new practices into existing rules. Perhaps in the future, the rules will need to be adapted for this operation. What we have now is the opportunity to look at how this works, identify problems and opportunities, and shape the future.

Where SERA Comes In

The SERA Board felt that SERA has three roles to play in shaping Internet linking. One is the fairly limited direct role of a frequency coordination body - to coordinate frequencies for the auxiliary stations that serve as links between computers and repeaters. The second is the broader arena of spectrum management. SERA band plans go beyond FM/Repeaters, recognizing the need to provide regional organization for all modes in the VHF/UHF spectrum. SERA takes a leadership role here somewhat by default - there is no other regional body available to handle this spectrum management. But SERA uses input from the ARRL, other special-interest groups and individual operators (and the multi-mode expertise of the SERA staff) in developing the band plans. And finally, SERA has a general leadership role to play in any activity involving repeaters and VHF/UHF FM.

So, let's take a look at how Internet linking, frequency coordination and spectrum management come together.

Figure 1

Figure 1 is just our baseline - until recently the typical way repeaters have been linked together by radio. The transmitters that do the linking are clearly defined in the rules as *Auxiliary Stations,* and must operate above 222.15 MHz.

Figure 2

Now, it gets interesting. The SERA Board spent close to an hour discussing Figure 2, the left side of which illustrates a very common method for getting audio and push-to-talk control between the computer/Internet and a repeater.

It's easy to connect the radio to the computer. You can use custom interface boards sold by the hams who created the networks, generic interfaces like RigBlaster, or homebrew interfaces (IRLP requires their own interface). The computer runs a program that connects the interface to the Internet, and dedicated servers make the connection between the computers.

It's not so easy to do this directly at the repeater. This stuff can work over a dial-up Internet connection, but it works a lot better over a broadband connection, like DSL or cable. There aren't too many of those at repeater sites. And computers are kind of finicky - crashing and hiccuping a lot. IRLP requires a Linux computer, which is a lot more stable, but even so, it's a lot easier to check everything in the ham shack than make a run to the repeater.

So you set the computer up at home and use a link radio. And the easy way to do that is to just use your base station radio using the repeater's input and output frequencies, as in the left side of Figure 2. You've already got all the equipment you need, and you don't have to do anything to the repeater. SERA calls this an "on-channel link."

Here's the rub: that base station radio just entered the category of *Auxiliary Station*. And by FCC rules, it's not permitted on two meters. So, if you're linking to a two meter repeater, your link is not legal.

"Rules, shmools, what's the real problem?" you might think. And you'd have a good point. The FCC doesn't explain why Auxiliary Stations aren't permitted on two meters, but two reasons are pretty clear.

1 - There's not enough room. The two meter band is only four Megahertz wide, and it's full, coordination-wise. (It's hard to convince a ham who tunes from one end of the band to the other and *maybe* comes across two or three signals that the band is "full," but from a spectrum-management point of view, it is.)

But reason #1 runs into a problem with Figure 2 - the link isn't using any extra spectrum. It's on the frequency already in use by the repeater. A model of spectrum *efficiency*, you might say.

2 - There is a significant potential for interference to co-channel repeaters. This is the real problem. Figure 2's graphic is a little misleading here - that beam pointed up at the repeater antenna makes it look like the link signal is tightly controlled.

In practice, it is very difficult to "tightly control" a two meter signal. We are mostly talking Band Opening here, where a one-watt signal into even a small, directional antenna can reach the co-channel neighbor. Use CTCSS? That masks the problem, but doesn't eliminate interference. Yes, if you know what you're doing, you can probably build an on-channel link system that has almost no chance of interfering with a co-channel repeater. But we're worried about the guy who literally plugs into his base station and turns it on, easy as pie.

SERA's recommendation: build a real link on 220, 440 or above, using a coordinated, band-plan link frequency. It is possible that SERA will de-coordinate a repeater that allows an on-channel link to interfere with a neighbor repeater.

Figure 3

This one created some debate at the Board Meeting. Some SERA people felt this is a repeater, since it is connected to a repeater and is acting as an input (and output) to that repeater. That would make it have to follow repeater rules for spectrum use, but would also open up the privilege of automatic control.

We color this station a little **gray.** Most Board members felt it isn't a repeater (it would be a very odd-duck repeater). It could be an Auxiliary Station, depending on the specific use. But probably it is just an ordinary, everyday ham radio station. It would not qualify for automatic control, though it could be used with remote control. Its control operator must be present at all times. And SERA would not provide frequency coordination for it.

This is a very common setup, for both IRLP and Echolink. If you own one of these, realize that you should not turn it on and walk (or drive) away, letting it play without active control. But even assuming you do it "right," is it a good idea? How many of these stations can the two meter band handle? Simplex channels are the likely spectrum for Figure 3 stations, and so far, simplex on two meters is lightly used. Does this have the potential to rapidly change that scenario?

By the way, "remote base" is a ringer of an answer. There is no such thing in the rules.

Figure 4

Echolink permits this configuration - a computer at home connected by the Internet to a repeater or other on-air station. IRLP does not let you get into its network from your own computer.

The ham at the computer is *not* the control operator. The repeater control operator is the one and only control op in this scenario. The reason is simple. The ham at the computer does not have the ability to shut off the transmitter in the event of trouble.

Echolink goes to some pains to assure that the guy at the computer is a licensed ham. Their procedure is not flawless, but in practice, just about everyone using Echolink is a ham. If you're the control op, the risk of opening your station to a non-ham is

FIGURE 1

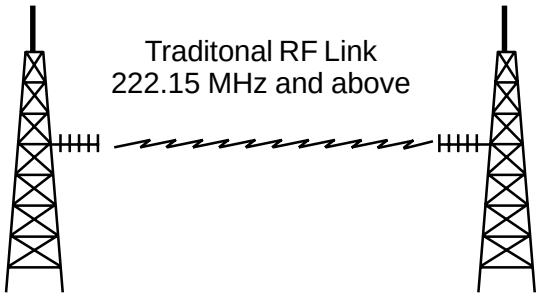


FIGURE 2

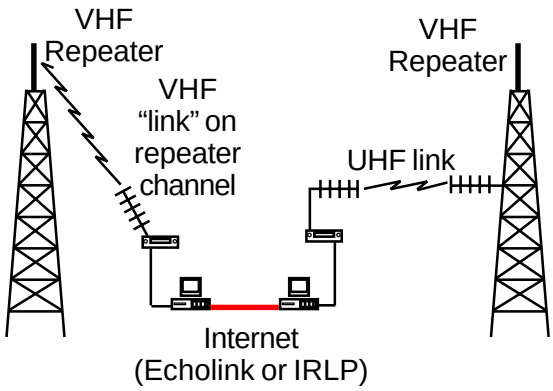


FIGURE 3

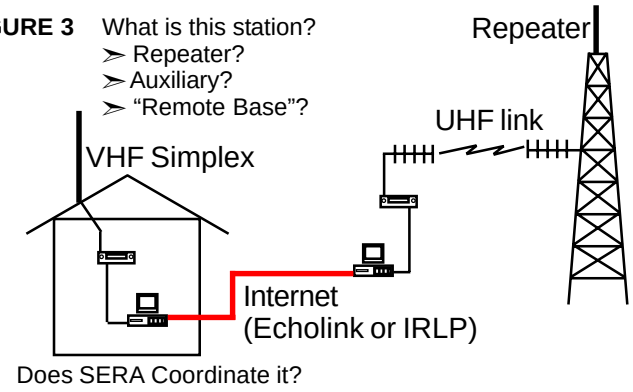


FIGURE 4

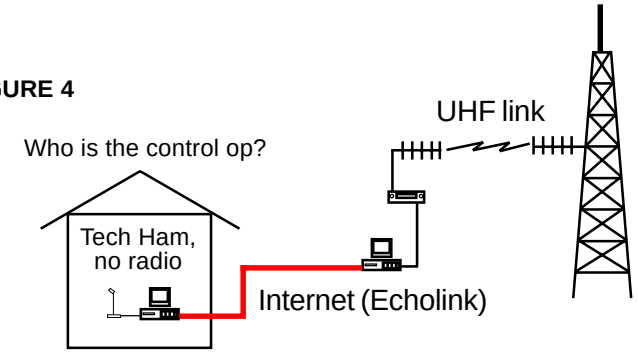
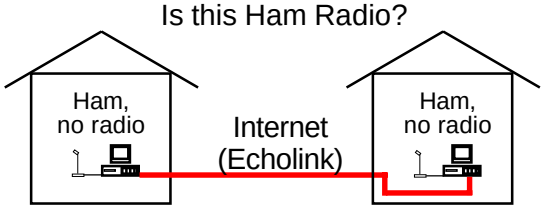


FIGURE 5



similar to having a bootlegger talk through your repeater. If you become aware of it, you need to stop it.

There are more alternatives for Figure 4 than the diagram shows. Replace the repeater with any other station - a home HF station for example. There isn't a lot of that happening, yet, but is it legal?

That's another gray area question. With Echolink software, the keyboard "spacebar" becomes your push-to-talk button. You push the bar, and a transmitter comes on, somewhere. Someone else is the control op, but it seems that if you are a licensed ham with privileges to use the band and mode you're about to activate, it's OK for them to let you do that with only the pre-approval that you've qualified yourself by registering your Echolink software.

If the fingers hovering over the spacebar belonged to a non-ham (or a ham not licensed to use the band/mode of the transmitter connected to the remote computer), then the answer is different. The control operator can't just let you go ahead without, well, getting to know you a little bit first.

The rules don't spell this out at all - the details of just how distant a non-ham can be and still press the "PTT button." OK if they're in your shack with you watching. OK if they're on a phone patch (using VOX). But not OK if they're an unknown quantity who just happened to dial your station up on the 'net.

Figure 5

Figure 5 was fun. I put up this slide, and took a quick poll of the room. It was almost unanimous - not just "no," but... "*heck no!*"

But think about it. What is ham radio? Obviously getting on the air and talking. But is that all? Isn't going to your club meeting "ham radio?" Building a project. Working on the repeater, climbing the tower, teaching a class, or attending a hamfest?

In that spirit, even Figure 5, a chat between hams over the Internet, is ham radio.

Now, if the real radio component of ham radio went away, or was even seriously diminished, our reason-to-be would be gone. The Internet can't *be* ham radio. Anyone with a sound card can play Internet audio. Maybe that's what the hams who say "no" are worried about. But Internet linking of, by and for hams is clearly part of ham radio.

We re-voted the poll after some discussion, and Figure 5 was back in the fold.

We'll conclude the way we began. Internet linking is fun, and it's going to get bigger fast. It presents some challenges to the rules and to good operating practices. The FCC is inclined to let us work our way through it for a while. If you use it, and especially if you set up a linked transmitter, consider how you want the system to work. Not just for your immediate needs, but for the long haul. ■