

MARC Advanced Topics

Radio Linking via Internet

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The Internet



The Internet

okay, for real

- ▶ What is an internet
 - ▶ an interconnection of multiple networks
 - ▶ using a reliable protocol (typically TCP/IP)
 - ▶ using some kind of routing or forwarding mechanism for directing traffic
 - ▶ facilitates communication between networks and networked devices
 - ▶ “The Internet” is defined to be the global internet we all know and love

The Internet

- ▶ Many services, including the “world wide web”, e-mail, chat/video conferencing, file sharing and transfer, telemetry, video, and “other data”
- ▶ Let’s talk about that “other data” for a minute...
- ▶ The underlying protocols ensure delivery of streams of data... they don’t care what is in those streams
- ▶ We can encode audio and pump it through those streams
- ▶ That audio can come from (and go to) a radio!

Radio Linking

- ▶ Repeater networks, such as the Intermountain Intertie, the SINBAD system, CARLA, and many others
- ▶ Individual repeaters use RF links pointed at each other to build an RF network of repeaters
- ▶ Usually limited in scope (although it can be a very wide scope)
 - ▶ Intertie spans from Idaho Falls to Las Vegas
 - ▶ CARLA covers most of California, from Tahoe, Sacramento, Bay Area, down to LA and San Diego
- ▶ Why not replace one (or more) of those RF links with a data stream over the Internet?

Internet Linking

- ▶ Multiple mechanism/systems
 - ▶ IRLP - Internet Radio Linking Protocol
 - ▶ Echolink
 - ▶ WIRES-X - Wide-coverage Internet Repeater Enhancement System (Yaesu)

- ▶ D-star
- ▶ DMR
- ▶ Yaesu System Fusion

IRLP

- ▶ Internet Radio Linking Project
 - ▶ as the name says, links radios together over the Internet
- ▶ Originally developed by David "Dave" Cameron (VE7LTD)
- ▶ First deployed in Canada in 1997
 - ▶ Three nodes, Vancouver BC, Vernon BC, and St. John New Brunswick
 - ▶ Originally used Windows based computers
 - ▶ Not very reliable/stable
- ▶ Re-written on the Linux OS in 1998
- ▶ Deployed across Canada, then the US, and then around the world

IRLP - Hardware Requirements

- ▶ Computer (not high end, Pentium III at 500 MHz, 512 MB RAM, 5 GB disk)
 - ▶ must have a legacy parallel port (or equivalent)
 - ▶ sound card
 - ▶ ethernet connection with Internet service
- ▶ Link radio or repeater (must have carrier operated squelch)
 - ▶ if on a repeater, must be configured with no hang time or courtesy tones
- ▶ IRLP interface board
 - ▶ connects to computer via audio and parallel port
 - ▶ connects to radio mic/speaker/PTT connections

IRLP - How Does It Work?

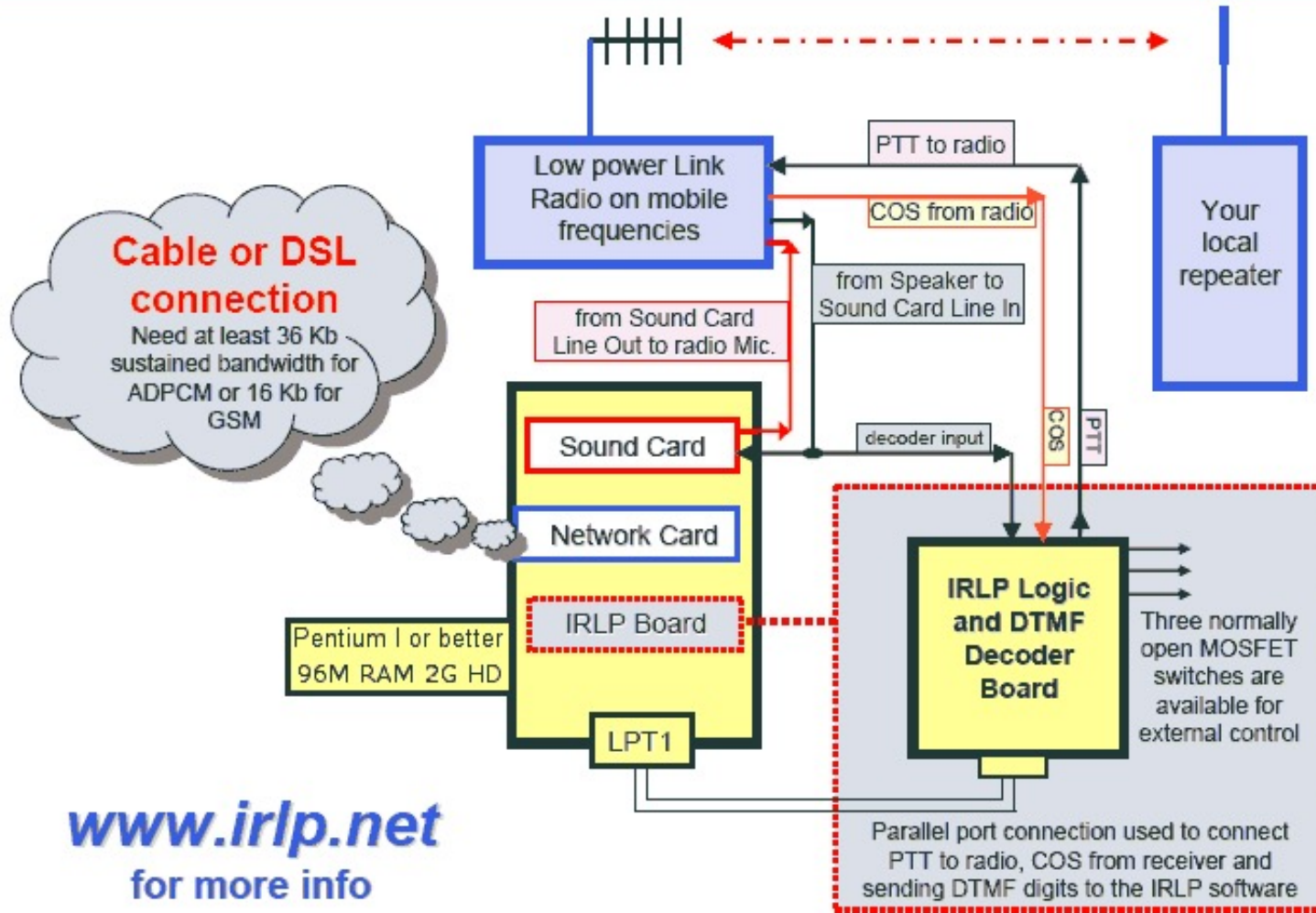
- ▶ Radio receives a signal (just like a normal repeater)
- ▶ The IRLP board asserts the carrier operated squelch with the received signal
- ▶ The audio is sent to the computer over the sound card interface
- ▶ The computer receives the audio, gated by the COS signal
- ▶ The audio is processed by a software package called Speak Freely
 - ▶ software takes the audio, encodes it digitally, chops it up into chunks (packets)
- ▶ Audio packets are sent over the Internet to another node
- ▶ The receiving node hands the incoming packets to the Speak Freely software
- ▶ Speak Freely collects the packets, decodes them, and converts them back to audio

IRLP - How Does It Work?

- ▶ The audio is sent out through the sound card
- ▶ The IRLP board coordinates activation of the radio's PTT with the outbound audio
- ▶ The remote system's radio sends the audio out over the air
- ▶ The IRLP board also includes a DTMF decoder so it can receive instructions from the radio operator
 - ▶ which node(s) to connect to, when to drop the connection, etc.

IRLP - How Does It Work?

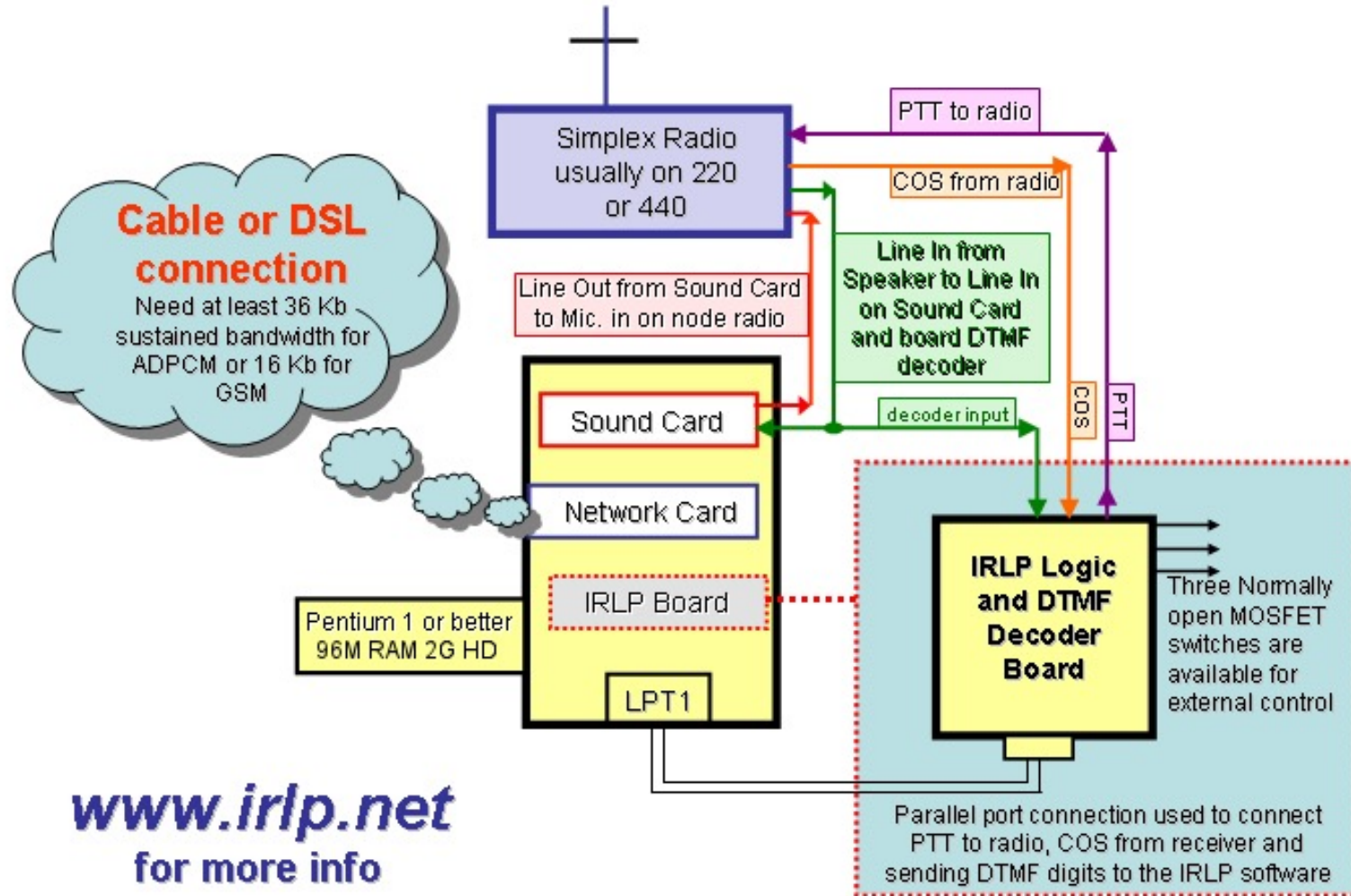
A Typical IRLP Node



www.irlp.net
for more info

IRLP - How Does It Work?

Typical IRLP Simplex Node



www.irlp.net
for more info

IRLP - How Does It Work?

- ▶ Public database of known nodes
 - ▶ each node is identified by a four-digit number
- ▶ Nodes can be connected directly (one-to-one) or...
- ▶ Nodes can connect to a “reflector”
 - ▶ reflectors accept connections from multiple nodes and pass received packets back to all the other connected nodes
- ▶ Reflectors are not connected directly to a radio, but facilitate wide area connections between multiple nodes

IRLP - How Does It REALLY Work?

- ▶ I tune my radio to a repeater frequency that has an IRLP node connected
- ▶ I key up and enter the DTMF code to instruct the node to connect to a different node (or reflector) - typically just the node number
- ▶ The node makes the connection to the other node
- ▶ I key up and talk, the audio is sent to the other node where it is transmitted in the (far away) location
- ▶ Some other operator there hears my signal and responds
- ▶ We have a nice QSO
- ▶ When done, I key up and enter the DTMF code to instruct the node to disconnect - typically “73”

IRLP - Finding Nodes

▶ <http://status.irlp.net/index.php>

▶ INSERT LIVE DEMO HERE

EchoLink

- ▶ Linking hams (not necessarily radios) over the Internet
- ▶ Originally developed by Jonathan Taylor (K1RFD) circa 2002
- ▶ Runs on Windows
 - ▶ compatible versions exist for Android, iOS (iPhone/iPad), MacOS, and Linux
 - ▶ can also run on MacOS and Linux using WINE
- ▶ Requires “validation” of your amateur radio license (more on this later)
- ▶ Can be run in “user” mode or “sysop” mode
 - ▶ user mode is for a user connected directly to the Internet, no radio required
 - ▶ sysop mode is similar to the IRLP model, where the node connects to a repeater or simplex radio and allows RF communications

EchoLink - Hardware Requirements

- ▶ In user mode, all you need is a PC with a sound card, mic, and speakers (or headphones) and a connection to the Internet
- ▶ In sysop mode, you need some type of interface board to allow your PC to key up the radio and a sound card connected to the radio's mic and headphone ports
 - ▶ custom devices to do this are available
 - ▶ commercial solutions (i.e. RigBlaster) already exist
 - ▶ you can build your own

EchoLink - How Does It Work?

- ▶ Mandatory license validation
 - ▶ before you can use EchoLink
 - ▶ send an “official copy” of your amateur license
 - ▶ <https://secure.echolink.org/validation/uls/>
 - ▶ other countries have different mechanisms for obtaining an official copy
- ▶ Log into the application
- ▶ search for or browse to a station, repeater, or conference
 - ▶ station names are callsigns
 - ▶ stations with -R are connected to physical repeaters
 - ▶ stations with -L are connected to simplex frequencies

EchoLink - How Does It Work?

- ▶ Double-click on the station to connect to it
- ▶ Talk via your PC's mic and speakers (or headset)
- ▶ To end the call, click Disconnect

- ▶ What about EchoLink connected to a repeater (or simplex)?
 - ▶ key up, announce that you are going to be using EchoLink
 - ▶ send the node number you want to connect to via your DTMF pad
 - ▶ have your QSO
 - ▶ send # from your DTMF pad to disconnect

EchoLink

▶ INSERT LIVE DEMO HERE

EchoIRLP

- ▶ Special software that can be run on an IRLP node to allow it to also be an EchoLink station
- ▶ IRLP is the primary mode, so connecting to IRLP nodes is done in the standard fashion
- ▶ EchoLink is an auxiliary mode, so you typically have to prefix the EchoLink user/system/link with a special character (determined by the owner of the system)

WIRES-X

- ▶ This is Yaesu specific.
- ▶ for more information:

<https://www.yaesu.com/jp/en/wires-x/index.php>

Digital Modes

- ▶ DMR, D-star, System Fusion
- ▶ all provide some node linking mechanism
- ▶ these are a topic for another discussion

Internet-based Linking Etiquette

- ▶ If the node wasn't connected when you started, don't leave it connected when you're done
- ▶ Don't forget to PAUSE when keying up the link... you need to give time for systems on the other end to activate
- ▶ Don't hog it... keep your usage short (scheduled nets and rag chew reflectors and conferences are an exception to this, but you might want to check with the repeater owner first)
- ▶ Remember that emergency traffic trumps your QSO about the weather
- ▶ Avoid local comms while connected to a distant machine (the people in Peoria don't care about the traffic on I-15 today)

Internet-based Linking Etiquette

- ▶ Listen first - listen for at LEAST 15 seconds before you start to use it
- ▶ Wait at least five seconds between transmissions to allow for others on simplex links to have time to disconnect
- ▶ Don't forget to IDENTIFY at least every ten minutes
- ▶ Remember when allowing third-party use of your radio and talking to international stations that there may be restrictive third-party regulations specific to the country you are calling
- ▶ Don't plan or start a net on a reflector/conference server without the owner's knowledge and permission
- ▶ Do participate in nets and direct communications with other hams!
- ▶ Have a lot of FUN

Q&A

▶ Links of interest

- ▶ <http://www.irlp.net/>
- ▶ <https://secure.echolink.org/>
- ▶ <https://github.com/wd5m/echoirlp>