

**Amateur Radio  
Networking  
In *this* century...  
Making it relevant**

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# I got involved with Packet Radio in 1984 - 1987...

- ... and was part of, and missed, various waves of innovation... and decline

# 1984-1987

- Discovering packet radio in Ohio
- Rise of the TAPR TNC-2
- Basic packet radio
- 2m only @ 1200 bps
- Digipeaters, crude BBS systems
- National linking using 300 bps over HF

# 1988 - 1993

- Discovering packet radio in Seattle area
- Bit regeneration repeaters (packet that worked!)
- Dual-band VHF / UHF
- 9600 baud
- TCP/IP
- Net/ROM
- Internet gatewaying
- Seattle 9600 baud UHF TCP/IP repeater network
- (missed) 56K, especially the work in Vancouver

# 1993 - 2007

- Amateur Radio was fun, but fatherhood was better
- Collapse of packet radio networks in the wake of the excitement of public access Internet
- (missed) Rise of APRS
- (missed) Integration of APRS services on Internet, APRS widgets
- (missed) Incredible (and finally interesting) rise of HF data systems - finally interesting; not just RTTY
- decline of Seattle 9600 baud UHF TCP/IP repeater network

# 1997 - 2007

- Writing / Watching Broadband Wireless Internet Access / Wireless Internet Service Providers evolve
- Inspiration was learning about Spread Spectrum at 1996 ARRL and TAPR Digital Communications Conference here in Seattle
- If you just want the utility of Internet connectivity, everywhere...
  - It's here (enough) now with cellular broadband Internet
  - It's going to get better - a lot better, with Mobile WiMAX
- But, to me, there's still something magical about doing it with Amateur Radio

# ... Something magical about doing it with Amateur Radio

- Incredible freedom to experiment with radio technology
- If you can find kindred souls that like to “play radio”, oh the fun you can have!
- Can combine things in ways you absolutely could not do commercially
  - Even if you could afford it
- Proud to be part of a hobby that has a (constructive) “weird” fringe
  - Moonbounce
  - Dxpeditions
  - QRP

# But... there's a real problem with Amateur Radio Networking...

- ... and Amateur Radio in general
- Amateur Radio isn't growing... in any relevant measure
- Few younger folks coming in and wanting to play
- I think it's because Amateur Radio isn't perceived as being relevant... cool... interesting
  - Even by this incredible rise of uber-techies that we have now
- Every portrayal of Amateur Radio I've seen is "old white guy, sitting in the basement, tapping out code"

# In my role as a observer...

- Having sat out much of Amateur Radio as an active participant, I saw that there was some incredible innovation going on
- But it wasn't being very well reported except within its own niches.
  - Satellite folks communicated very well... to other satellite folks
  - HF data folks communicated very well... to other HF data folks
  - QRP...

# I've "thought about this" for years

- What it really needs is for me to write a book
- Still does, but I've had a busy last couple of years
- But in the meantime, I've been developing a thesis
- I call it...

# A unified vision of Amateur Radio Networking

- Lots of fascinating... but disparate... applications / services...
  - (I'll talk about all the fascinating, disparate “parts” later)
  - But they're all “silo'd”, with little crossover or integration
- What would happen if we could integrate all those incredibly interesting... but disparate... applications / services?
- I think... wish... that such an integration would create a whole that is greater than the sum of the parts
- And that “whole” would be relevant to young techies!

# Linux as a building block

- As I said, my “formative years” in Packet Radio were in the DOS era
- Lots of potential in what was developed back then, but onerous limitations in the “TNC platform” and the “DOS platform”
- We spent a lot of innovation, energy, time trying to get around those limitations

# Linux fixed all of that

- Cheap!
- Could do “wonders” on basic hardware of 386-and-up
- All the cool (command line) utilities - routing; mail, a full-blown scripting language, telnet, FTP, all that cool stuff that we tried to hack into JNOS, etc.
- Best of all - networking built in - from the beginning!
- Phil Karn predicted all of this; his goal for Net and NOS was as a bridge between “Amateur Radio hardware and “real operating systems”

# But Linux is tough for hams...

- The “good” Linux is mostly command-line
  - Low resource demands suitable for low-end hardware
- It's tough to install sometimes - getting drivers working
- It's tough to manage / update / configure

# OLPC XO as a new paradigm for Amateur Radio

- So, I was excited when I saw the One Laptop Per Child XO laptop
- All the power of Linux...
  - In a standalone “appliance” / laptop
- Linux “baked-in”
  - No complications trying to get Linux installed in whatever oddball / cheap / leftover / may-not-be-working hardware
- Defacto standardization of Linux packages, apps, utilities, etc.
- Server capabilities - web, email, etc.

# OLPC XO, cont.

- Rugged, highly reliable, easy to make mobile
- Wi-Fi - with mesh networking
- Standard interfaces
  - Power - eats 12V direct, low power consumption
  - USB 2.0 (3)
  - Audio in/out (enhanced range for A/D “instrumentation” applications)
  - Big (enough) disk - 8 GB on SD card
- Cheap! \$200
- “Integrated display” (readable in sunlight)

# But then I had this chat with my friend Bill...

- Bill Vodall WA7NWP - “Good” friend
  - Don’t go to him when you want your assumptions / biases unchallenged
  - Has stayed active in Amateur Radio Networking
  - He’s a skilled Linux geek
- Bill has patiently listened to all of the above “waxing philosophic” about the “unifying wonders” of Linux and patiently tore my arguments apart

# Windows as the new Linux (for Amateur Radio purposes)

- Windows isn't expensive any more in resources, cost, or complexity
- It's plenty capable for anything needed, including scripting
  - Bill says it's gotten a lot, lot better, like Perl and Python
- One big issue I had that's moot - overall reliability
- Most importantly, usable by the average ham
- And what won the argument in Bill's favor is that all of the stuff I'm going to talk about "integrating" into a "greater whole" is already out there for Windows.

# Disclaimer 1

- Despite the venue, I didn't craft this conclusion to "please" Microsoft, Microsofties, or Microhams
- It was a hard conclusion to arrive at (for me, with historical biases of all the things DOS / Windows couldn't do)
- I'm going to move on from that point because there are Amateur Radio things I want to do...
- And I don't want to wait for... or pine for... those things to be created for Linux.
- So I'm moving on

# Disclaimer 2

- As will become rapidly apparent, I haven't actually used very much of what I'm about to describe
- I'm here much more to learn

# First I'll describe “pieces”

- Then I'll start talking about “integration effects”

# Amateur Radio Email

## (Over the air! Novel concept!)

- Airmail is the dominant / best email client for Amateur Radio
- Yeah, it is closed source, somewhat unsupported... but it works
- Designed primarily for HF via the WinLink network
- But it also works peer-to-peer over VHF
- Simple, robust, works with existing Amateur hardware - (Kantronics TNCs in host mode)

# Amateur Radio Short Messaging / Location

- UI-View on APRS
- I never did get into APRS and so nearly anything APRS is a bit mysterious to me, but from what I've learned, anything I had ever imagined doing with APRS under Linux, UI-View already does, on Windows
- Short messaging is an under-appreciated capability of APRS

# Amateur Radio Short Messaging - worldwide

- PSK 31
- So many other digital communications modes I have no idea
- Cheap digital signal processing embedded in sound cards... and radios

# Amateur Radio Voice (Relevant to “networking”)

- EchoLink
- Creates access to repeaters in other areas via PC / Internet
- Yeah, it is Amateur Radio

# Amateur Radio Voice

- Digital Voice on VHF / UHF
- D-Star is one example
- APCO P-25 is another
- Better quality, overall
- Interleaved with some data

# Amateur Radio Networking (local)

- D-Star (1.2 GHz version)
- 128 Kbps half/duplex
- Icom did a lot wrong, especially with the networking
- But at least they tried, and created a turnkey, plug-and-play data networking radio usable for Amateur Radio
- One great thing is that it works mobile

# Amateur Radio Mesh Networking

- This is something we did well - 20 years ago
- Remember Net/ROM?
  - It had all the key aspects of mesh networking
  - Maintained known good routes / paths
  - Directory of known nodes
  - Made it possible / worked better to have separate backbone
  - Systems could use Net/ROM automatically
  - Limitation was processor power, data storage
    - No longer issues, so we could be doing mesh networking much, much better now

# Amateur Packet Radio Infrastructure now

- Lots of digipeaters for APRS
- Lots of audio-only repeaters... that are very, very quiet
- Smattering of Net/ROM, general purpose packet, etc., but also very, very quiet

# Integration Potential

- What I want to see ultimately on my Radio Room (Windows) computer is an integrated display
- I want it to display (somehow - I haven't even mocked this up):
  - Ham friends - click on their callsign (or it highlights) and see:
    - Where they (vehicle - APRS) are at the moment
    - If they've been heard recently on a repeater (Echolink)
    - Any emails or messages I've had from them

# Integration Potential (cont.)

- Ham friends (cont.)
  - If I want to send a message to them, I want that link to be easy and quick to send them an email message, or quick text message (APRS or HF messaging)
  - If I want to send them a file, etc. I want to be able to send that quickly and easily, without knowing what particular system he happens to be using
  - If I want to look something up on his station, I want to check out the web site / Wiki page that he maintains - fetch the data over the air

# Integration Potential - Mobility

- I'll acknowledge up front that this concept was created, as far as I'm aware, by Ken Koster N7IPB
- He called it JeepNet because this pile of radios and a computer stuffed in the back of his Jeep-something
- Tie in all the capabilities listed above, but make them mobile
- Ken had VHF, UHF, HF radios in his Jeep all talking to a vehicle-mounted computer
- What was really cool was that Ken put a Wi-Fi access point into the mix and then ran the whole thing from a Wi-Fi laptop while sitting in a restaurant

# Int. Potential - Mobility (cont.)

- What's missing when Ken did this was a way to do peer-to-peer in Amateur Radio
- We should be able to show up and have our "JeepNet" systems all find out about each other and start communicating
- We should use Wi-Fi (there's plenty of ways to make it work better without "Amateur Radio" hacking it)
- We should add Net/ROM capability to the mix
- How about sharing / caching / replicating disks between JeepNets?

# Integration Potential - Fixed and Mobile

- Take it one step further - have the JeepNets talk to home stations
- If your JeepNet is within range of (any) home station, it connects / communicates / synchs
- JeepNet “communications protocol” autodiscovers local resources - repeaters, digipeaters, local ham hangouts, etc.

# The power of all the things we can do...

- Is in being able to do all those things
- Any one of those things is a pale imitation to commercial / Internet implementations
- But combining them all, showing off all that Amateur Radio can do, in a unified way...
- That's powerful... impressive...
- Relevant!
- And doing it with Amateur Radio

# Some Parting Thoughts

- Considering that Amateur Radio as an overall hobby is supposed to be about communicating... we do a surprisingly lousy job of it.
- One of the best parts of Amateur Radio was the Elmering... and we seem to have lost that.
- We need to develop a way (we have dozens right now...) to find each other and find kindred souls that are into some of the same things we are
- And most of of all, if we want to see Amateur Radio survive us, we need to develop a way for newbies to find us easily for what they want to know

# Where's Myspace / LinkedIn / Facebook for hams?

- I should be able to browse hams in my area to find out what they're into
- I should be able to browse interests, like satellite, to find out who's into those things
- I should be able to easily find Amateur Radio clubs
- We don't have uniform, consistent ways to do those things, and we should
- Amateur Radio Wikipedia?

# Amateur Radio Magazines

- Sad fact that a lot of our “knowledge base” is locked up in magazines that aren’t publicly accessible
- Antennas haven’t changed that much - imagine how much “tribal knowledge” on Amateur Radio antennas is locked up in magazines
- Just my opinion, but the ARRL keeps way too much information restricted as “members only” - to the detriment of Amateur Radio

# R&D Funding in Amateur Radio

- We need some patient, generous R&D funding for pushing Amateur Radio forward
- Example of TAPR FHSS Radio - developed on Amateur Time Units (years) and parts were obsoleted twice before the project was abandoned
- Amateur Radio's Catch-22 is that potential sales don't justify large R&D investments
- So it's not economical for companies to develop truly new technology - they'll never get a payback
- Imagine what could have happened if we had cheap 2.4 GHz to 1.2 GHz transverters / power amplifiers?

# R&D Funding (cont.)

- Dewayne Hendricks WA8DZP pointed out that the cheapest, most capable “wireless data communications device” in the world is the humble DOCSIS cable modem
- What would happen if we could get transverters for those to operate them at 440 or 915 or 1.2 GHz?
- The funding is needed for bootstrapping the Non-Recurring Engineering expenses - paying for professional engineering, prototypes, certification, etc.
- Once a product is real and buildable, there’s usually takers that will build it for the Amateur Radio market as long as they don’t have the overhead of the NRE

# R&D Funding (cont.)

- One example of what patient, generous R&D funding could do in Amateur Radio is to buy Metricom (Ricochet).
- Yes, it's still alive... just barely.
- In Denver, but on it's... fifth?... owner, and likely to be killed completely any month now
- 902-928 MHz, 2.4 GHz (and 2.3 GHz) mesh backhaul
- Needs some infrastructure services development that would be easily done with Linux / Windows now
- Warehouse full of equipment from years ago.

# Interesting stuff that I'll be looking at and playing with

- Besides the stuff mentioned above
- Asterisk - all the capability of a #5 ESS - voice switching / transcoding / “anything imaginable”
- Inevitably I'll eventually do D-Star (1.2 GHz / 128 Kbps)
- Putting as many of my TNC collection on the air as I can, likely all with little “serial to Ethernet helper modules”
- Virtualization - there's a lot of interesting DOS and old Windows stuff for Amateur Radio out there
- Writing it down - book, wiki, blog

# References

- Steve Stroh N8GNJ - [www.n8gnj.org](http://www.n8gnj.org)
- OLPC XO - [www.laptop.org](http://www.laptop.org)
- AirMail - [www.airmail2000.com](http://www.airmail2000.com)
- UI-View - [www.ui-view.org](http://www.ui-view.org)

