Linux and Software Defined Radio

Presented by

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Biographical Information

- Licensed January 2007 (Extra 2009)
- Police Amateur Radio Team (PART) President September 2009
- Linux since 1997:
  - Worcester Linux Users' Group (1997-2005?)
  - Chelmsford Linux Meetup Group (2006 - present)
- Taught Linux through Chelmsford Community Education 2004 – 2011
- Linux ham radio programs:
  - Xlog (maintainer)
  - Andy’s Ham Radio Linux
  - Byonics TinyTrak3 (in progress)
Software Defined Radio

- Radio components such as mixers, filters, (de)modulators are replaced by computer software
- Software does the signal processing
- What is needed?
  - Personal computer
  - SDR software
  - Sound card (analog to digital converter)
  - RF front end
  - Upconverter (optional)
  - Antenna
RF Front Ends

- Ettus Research USRP
  Universal Software Radio Peripheral
- Great Scott Gadgets
  HackRF Jawbreaker (recent Kickstarter success)
- DVB-T dongles based on RTL2832U
- Funcube Dongle
USB Dongle for DVB-T

- DVB-T = Digital Video Broadcasting - Terrestrial
- Cheap USB dongle: $25
- Ordered on eBay, delivered from China
- Linux kernel hacker Antti Palosaari (Finland)
  - Digital television developer
  - Accidentally found I and Q signals
  - SDR needs these – the reset is “easy”!
- Realtek RTL2832U DVB-T
Upconverter

- DVB-T dongle receives:
  - 50MHz – almost 2GHz
  - What about the HF bands below 50MHz?
- Build an upconverter!
  - Add 100 MHz to the incoming signal
  - Puts it in range of the dongle
- Don't need it for:
  - NOAA (162.525 MHz)
  - Broadcast FM (88 – 108 MHz)
  - 6m, 2m, 70cm, and higher frequencies
Upconverter Schematic

FunCube Dongle UpConverter
George (M1GEO) / Chris (G8OCV)
25/September/2011
http://www.george-smart.co.uk/
Ugly Construction - Upconverter
Software for Linux

- GNU Radio
  - Free and Open Source (GPL v3)
  - Software development toolkit
  - Python, C++
  - Filters, demodulators, vocoders, etc.
  - Handles the digital signal processing
Software for Linux

- gqrx – written by Alexandru Csete
  - Free Software (GPL)
  - Qt graphical interface
  - GNU Radio
  - Supports many RF front ends
  - Linux, FreeBSD, Mac
  - AM, FM, SSB, CW
  - FFT plot and waterfall
  - Record/playback to/from WAV file
Broadcast FM
NOAA weather
41m shortwave AM
AFSK Decode of APRS

20:24:10$ fm AB1OC-10 to APWW10-0 via KB1TS0-0,WIDE1-0,WIDE2-1 UI^ PID=F0
>FN42er/#DX: W2DAN-14 60.3mi 183. 20:18 4150.45N 07140.18W
20:26:01$ fm KN1Q-0 to TRRV0S-0 via UNCAN-0,WIDE1-0,WB20SZ-1,WIDE2-0 UI PID=F0
`c+Up}T="/4T{/TinyTrak4 Alpha
20:26:45$ fm WB20SZ-1 to APN383-0 via WIDE2-1 UI PID=F0
!4237.14NS07120.83W#PHG7130Chelmsford, MA
20:27:01$ fm KN1Q-0 to TRRV3X-0 via UNCAN-0,WIDE1-0,WB20SZ-1,WIDE2-0 UI PID=F0
`c+Gl .="/4Y{/TinyTrak4 Alpha
20:27:06$ fm KB1UTS-0 to APWW10-0 via KB1TS0-0,WIDE1-0 UI^ PID=F0
@202650h4235.16N/07121.53W-(Time 0:00:00)
20:27:08$ fm WIcnH-5 to APN391-0 via UNCAN-0,WB20SZ-1,WIDE2-0 UI PID=F0
!4345.33ND07127.48W#PHG3630/W1, Moultonboro W1CNH-5
15m CW
Demonstration

- **Try to receive:**
  - NOAA 162.525 MHz
  - Broadcast FM 106.3 MHz
  - AFSK Decoder 144.390 MHz
  - Local police/fire 154-155 MHz, 450 – 480 MHz
  - Shortwave
    - 49m (5900 – 6200 khz)
    - 41m (7250 – 7500 khz)
    - 31m (9400 – 9900 khz)
  - WWV 5, 10, 15 MHz
What you might hear...
Downloads and Information

- Linux Ham Radio CD
  - http://www.sf.net/projects/kb1oiq-andysham
- Rig Expert program
  - http://www.sf.net/projects/aa-analyzer
- gqrx software
- Upconverter
  - http://www.george-smart.co.uk/wiki/FunCube_Upconverter
- GNU Radio
  - http://gnuradio.org/
The End

Thanks for coming!

I hope you enjoyed this presentation.

73 de Andy KB1OIQ