Amateur Radio with Linux:
Opening Doors without Windows

David Ranch
Pacificon 2013
Salon D @ 10:45am
What is this talk about?

- This talk is meant to interest both the Linux novice as well as the Linux expert.
- We cover what's available for Amateur Radio run on Linux covering a broad array of interests.
- Homework: How you can try Linux on your own computer without touching your hard drive!
So who is the presenter anyway?

- Been running Linux since 1991 installed from floppies
- Author of the Linux documentation sets: IP Masquerade (NAT), TrinityOS (entire system administration), Linux Security - Step by Step*, and now the Centos HamPacket set
- First licensed 2009 and quickly moved up to Extra
A Poll: Who is the Audience?

- What OS is running on your primary amateur radio computer?
  - XP, 7, 8, OSX, Linux, other

- What is your primary digital modes program?
  - HRD+DM780, Fldigi, cocoaModem, etc

- What is your primary logging program?
  - HRD, Fldigi, N1MM, WriteLog, other?
I've heard of Linux but why this talk.. Why now?

- Most HAMs like to build, create, and learn and there is no better environment for this than Linux for *many reasons*

- Windows XP is about to go EOL (End of Life) and must be replaced to keep computers secure

- Many (many!) people don't like the prospect of Windows 8
Other Reasons to Consider Linux..

- People are interested in learning something new: Linux presents GUIs in very intuitive ways, many people are very productive in a short time.
- Huge wealth of other applications like OpenOffice (office suite), Gimp (photo editor), Web browsers (Firefox, Chrome).. *all free!*
- Learn a programming language: Python, Scratch, Ruby, Java, Perl, Scala, shell scripting, C, C++, Fortran, Cobal, Assembly.. they are ALL here.. *all free!*
Ok, I'm listening.. What can Linux do for Amateur Radio?

There are so many uses with a computer but here is what I'm going to talk about..

- Digital modes (PSK31, JT65, RTTY, SSTV, ...)
- SDR, Echolink / IRLP server & client, D*star
- Propagation Simulation, Logging & Rig Control
- APRS client/server, soft TNCs, Packet
- Satellite tracking, CW trainers
- Antenna modeling, PCB layout, etc.
So I thought Linux was for servers

- Sure, it's well suited for dedicated servers.
But it's also well suited for desktops, laptops and recently.. small Arm computers!
Ok, so Linux is adaptable..

- What can it do for Amateur Radio operators?
  - It runs your needed applications
  - It supports very powerful automation
  - Easily supports adaption to the external world for experimentation and other purposes...

- So let's talk software for a bit...
Digital Modes
Digital modes with Fldigi

ete
NK71 ~ XE1/AA0AA
thanks for coming back

My info:
my name ... Scott Scott
my OTH .... Dache r - H 2alg0, Mexico Pachuca, Hidalgo,
Mexico
my LDC .... EL00pc EL0c
Report .... 599 59
PODXS 10 Club: 1550
QSL by
Fldigi supports many many modes..

- CW
- Contestia (10 variants)
- DominoEX (8 variants)
- Hell (8 variants)
- MFSK (9 variants)
- MT63 (6 variants)
- Olivia (9 variants)
- PSK (13 variants)
- QPSK (5 variants)
- PSKR (24 variants)
- AFSK RTTY (4 variants)
- FSK RTTY
- THOR (10 variants)
- THROB (6 variants)
- WEFAX (2 variants)
- Navtex / SITOR-B
WSJT

- Weak Signal (terrestrial, m.scatter, moon bounce) for HF / VHF with SDR support and more

![WSJT Interface](image)
WSJT-X

- New generation application with new JT9 mode and support for JT65... no other modes supported yet
- Does not have IQ interface support for SDRs yet
- Now natively supports 44kHz sampling for soundcards
- Re-written in Qt (KDE) for improved UI, speed, and sound support
WSPR – most stations run <5w!

- Weak signal / Internet enabled Beacon network
SSTV: Analog modes

- Full QSO editor with templates and macros
- Supported modes
  - Martin
  - Scottie
  - Robot
  - PD
  - MP & more
SSTV: Digital modes

- Supports HAM-DRM QAM modes
- Interoperates with EasyPal and the new Hybrid mode
Digital Voice with OpenDV and CODEC2

- A new, open digital mode is here for HF + VHF
- CODEC2 is the open source codec
- FreeDV is the HF modem and there are GMSK modems for VHF
Rig Control and Radio Programming
Rig Control

- Hamlib for the backend
- Over 200 radios, SDRs, rotators, etc. Supported
- Run from the command line or Grig

- Or Flrig for the frontend
- 46 rigs and counting
Supported Rigs today..

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Programming Radios: Chirp

- Supports 79+ radios
- Import / export via CSV files
- Flexibility allows to synchronize all your HT, Mobile, etc. Memories!
SDR: The next generation of radio..

- Beyond SDR applications available, GnuRadio is a *premier* SDR development platform.
GnuRadio – SSB transmitter

Audio Source
Sample Rate: 48kHz

Multiply Const
Constant: 500m

Rational Resampler
Decimation: 24
Interpolation: 25
Taps: Fractional BW: 0

Constant Source
Constant: 0

Signal Source
Sample Rate: 50k
Waveform: Sine
Frequency: 0
Amplitude: 1
Offset: 0

Float To Complex

Multiply

Band Pass Filter
Interpolation: 1
Gain: 1
Sample Rate: 50k
Low Cutoff Freq: 300
High Cutoff Freq: 3k
Transition Width: 100
Window: Hamming
Beta: 6.76

Multiply

Rational Resampler
Decimation: 1
Interpolation: 5
Taps: Fractional BW: 0

Multiply Const
Constant: 1k

USRP Sink
Unit Number: 0
Interpolation: 512
Frequency (Hz): 432.15M
Gain (dB): 0
Side: A
Transmit: Auto T/R

FFT Sink
Title: Modulator output
Sample Rate: 50k
Baseband Freq: 0
Y per Div: 10 dB
Y Divs: 10
Ref Level (dB): 0
Ref Scale (p2p): 2
FFT Size: 512
Refresh Rate: 15
Average Alpha: 500m
Window Size: 800, 300
Grid Position: 0, 0, 4, 4
GnuRadio graphics
From amazing SDR receivers also using GnuRadio: GQRX
To full blown SDR Transceivers

QUISK

Linrad
Logging, Modeling, Simulation & Satellite Tracking
Casual to Contest grade logging with CQRLog
Antenna Simulation with XNEC
Propogation Analysis: SPLAT
Propogation Analysis: VOACAP
Satellite Tracking and Rig Control with Gpredict
Amateur Radio VoIP Systems
VoIP Applications

- All IRLP Nodes available today run Linux!
- All AllStar (Allstar, IRLP, Echolink hybrid) nodes run Linux
- Most homebrew D*star nodes run Linux
Echolink Server and Client
APRS & Packet
Packet: Native AX.25 support

- Unlike requiring different applications to support AX.25, Linux has the stack built in!
  - One station can have any number of radios connected and communication between each other
- You can connect up classic hardware TNCs to an RS232 serial port
- Or have dedicated HW... for your project such as..
APRS Servers

- There are so many native packages to:
  - Transmit telemetry and position
  - Digipeater
  - IGATE
  - Etc

- Then there are the APRS programs available running under Java such as javAPRSvr

- Then there are full APRS clients to graphically show stations in your area, show higher level alerts, etc.
APRS Clients: Xastir

- Full APRS clients to graphically show stations in your area, show higher level alerts, etc.
Low cost Packet:
Raspberry Pi & TNC-Pi
Even lower cost: Soft TNCs just using the soundcard (no more hardware)

- Soundmodem, DireWolf, Extmodem, etc.
Packet Radio: KB 2 KB
Compatibility with other Applications
But I *need* to use XYZ program..

Beyond all the native Linux applications for Amateur Radio, Linux supports three ways to run your other programs:

- Emulators like DOSemu
- Compatibility libraries like WINE
- Full Virtualization systems like KVM, VirtualBox, and others
For example, Santa Clara County EmComm uses Outpost ..., running under Wine.

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Linux + YOUR computer
Things to consider with Linux

- Andy's HAM DVD is just one example of a Linux distribution. Others have different focuses for look (Gnome, KDE, LXDE, etc), feel (Sys-V, BSD, Upstart), features (multimedia), etc.
- I encourage new users to try other “Live Cds” to see what distribution, UI, etc they might prefer.
Thinks to consider #2: HW Requirements

- Linux is highly adaptable and supports almost ALL hardware – I do recommend to stay away from bleeding edge hardware for new users.
- Most modern Linux distros require CPUs with the PAE instruction – this means no Pentium-M or older (there are work arounds though..)
- Most people want a GUI so I would argue that you need at LEAST 512MB of RAM & 20GB HD
- Dual booting into Linux or Windows on the same hard drive is COMMON and easy
So on to your homework.. Really!

- Trying out Linux for your Amateur Radio and general interest is easy
- It doesn't require you to install anything to your computer
- If your computer can boot from a CD / DVD or better yet, a USB Pen drive, you're ready to go!
Wrapping it up..

- Linux is an excellent platform for Amateur Radio
- All major HAM applications are well represented
- Strong learning environment for automation and learning other programming languages
- Check out my Amateur Radio document for Centos Linux and other docs at:
  http://www.trinityos.com --> HAM --> hampacketizing centos
Credits:

- Most screen captures done by David Ranch
- Front Tux 'hamradio' image copyright of Linux Journal
- Other images owned by their respective owners
Any Questions?
Backup Slides
Homework: So where do I start?

- There are several Amateur Radio LiveCDs available but some are out of date
- I recommend KB1OIQ's - Andy's HAM Radio Linux DVD
  - Over 45 Amateur Radio packages pre-installed including almost all of these programs mentioned in this presentation!
Copying Andy's DVD to your Bootable device

- Download “Unetbootin” for Windows (or similar tool) to image USB Pendrives. Runs in place, no installation
- Insert the USB Pendrive
- Select “Disk Image”, point to the downloaded ISO and wait
- The image only takes 775MB so click on “Space used to preserve files across reboots” and give it at least 225MB say for a 1GB drive
Booting your new Andy DVD pendrive

- Turn *off* your computer
- Insert the newly created USB pendrive into a free USB port
- Turn on the computer
- Your computer should briefly show you options to boot off other media say “Press F10 for boot options”
  - If you don't see anything like this, you need to go into the BIOS and either enable this option or change the boot order to boot from USB first and Hard Disk second