Amateur Radio and SDR

BSDCan – BOF

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Introduction

Aaron Poffenberger

- OpenBSD user since ~3.2
- US Novice in late 70s (5 wpm CW - w00t!)
- US Technician Class and General Class - August 2014

Introduction

Iain R. Learmonth

- HamBSD Founder
- UK Foundation License - March 2011
- UK Intermediate License - December 2014
- UK Full License - October 2016

What is Amateur Radio?

- Radio service operated by amateurs, *i.e.* non-professional:
  - Not for monetary gain
  - Typically a real person
  - Clubs can organize for amateurs to work together
- Hobby
- License to experiment with radio

What is Amateur Radio?

- Regulated by international agreement:
  - Established by the International Telecommunications Union
  - Regulations implemented through harmonizing of laws by national governments
- Three regions:
  - Region 1 (Europe, Middle East, CIS, Africa)
  - Region 2 (Americas)
  - Region 3 (South and East Asia, Pacific Ocean)

When Did Amateur Radio Start?

- Officially, early 1900s
- However, amateurs have operated since the beginning
- "Ham" believed to have begun as pejorative because amateurs were "ham fisted" on their key (Morse Code)
- Adopted by amateurs as badge of honor

Notable Accomplishments by Amateur Radio

- Local, regional, national and global relay networks
- Long-distance contact around the world:
  - Skip propagation
  - Meteor scatter
  - Moonbounce (Earth-Moon-Earth EME)
- Developed Slow-Scan and Fast-Scan Television
- Led development of packet radio
- Numerous satellite launches
- Quick mobilization during disaster:
  - Supplementing or replacing local phone systems
  - Sending gear and people to disaster areas

Privileges

- Transmit in numerous bands (by license class)
- Transmission modes:
  - Voice
  - Image
  - Text and Data:
    - Continuous Wave (CW) – Morse Code
    - Phase-Shift Keying
    - Spread Spectrum
    - Digital
    - Packet Radio
- Operate in other countries (with reciprocal agreement)

Privileges

- Build and use unlicensed equipment (within regs):
  - Remember: It's the operator who's licensed in amateur radio, not the equipment!!!
- Help license other hams!
  - Volunteer Examiner
- Help enforce regulations and volunteer band plans

License Classes and Expiry

- 3 US License classes:
  - Technician, General, and Amateur Extra Class
  - Valid 10 years, update mailing address
- 3 UK Licenses:
  - Foundation, Intermediate, and Full License
  - Valid for life, revalidate every 5 years
  - Update mailing address
- 2 CA Licenses + 1 Endorsement(?):
  - Basic, and Advanced Qualification, Morse Code
  - Valid for life, update mailing address
- Check your national regulations

“Basic” License (CA, UK, US)

Requirements:

- Written exam (multiple guess)
- Basic electronics and regulatory details
- No Morse code test (CA has a Morse-code option)

Privileges:

- Voice privileges
- Various modes allowed
- Limited in high-frequency bands

“Advanced” Licenses (UK, US)

Requirements:

- Written exam (multiple guess)
- More electronics and regulatory details
- No Morse code test (CA has a Morse-code option)

Privileges:

- All privileges of “basic” license
- Access to more amateur bands

“Full” License (CA, UK, US)

Requirements:

- Written exam (multiple guess)
- Highest-level of electronics knowledge and regulatory details
- No Morse code test (CA has a Morse-code option)

Privileges:

- All privileges allowed to amateurs

Once You Pass

- Get an inexpensive radio:
  - No easier way to lose interest than to not have a radio
  - BaoFeng handy talkies are cheap (~$35.00 on Amazon)
- Join a local club
- Join national radio society

What Hardware Do I Need?

- Receiver: Not much fun
- Transceiver:
  - Handy talkie like the BaoFeng ($$ - $$$)
  - Mobile rig ($$$)
  - Portable rig ($$$ - $$$$)
  - Bench rig ($$$$ - $$$$$)
- Used equipment can shave 25% - 50% off those prices

What Hardware Do I Need?

Start small and inexpensive with a handy talkie to:

- Battery powered
- 1 to 3 bands (70 cm, 2 m, 6 m)
- 1 to 5 watts
- 100 or so memories
- DTMF keypad
- “Rubber-ducky” antenna
- Some have GPS and APRS built-in
    - with varying degrees of usefulness

Hardware – What Do I Need?

Mobile or portable:

- Mobile rigs can mount in a car, but have small screens
- Heavier, more interface controls, and larger screens
- Dual band to all band
- Voice modes to all mode
- Serial or other computer interfaces
- Antenna connected by feed line
- Perhaps an antenna tuner
- Some have GPS and APRS built-in

Hardware – What Do I Need?

Bench Rig:

- Require AC or perhaps converter
- Usually all band, not always
    - Some purpose-built rigs, especially DXing
- Serial or other computer interfaces
- Antenna connected by feed line
- Often an antenna tuner
- Might be an SDR, especially as price goes up

Hardware Other

- Antenna
- Antenna tuner
- Computer
- Sky's the limit

What is HamBSD?

The HamBSD project aims to bring amateur packet radio to OpenBSD, including support for TCP/IP over AX.25 and APRS tracking/digipeating in the base system.

What is APRS?

- Automatic Packet Reporting System
- Developed since the late 1980s by Bob Bruninga, WB4APR
- Amateur radio-based system for real time digital communications of information of immediate value in the local area. Data can include:
  - Global Positioning System (GPS) coordinates
  - Weather station telemetry
  - Text messages
  - Announcements
  - Queries
  - Other telemetry

What Do I Need to Use APRS?

- Radio
- GPS (built-in or external)
- TNC (built-in or external)
- Software

What is HamBSD?

Goals:

- KISS TNC support
- AX.25 networking support
- APRS application support
- APRS-IS compatibility

What Does HamBSD Provide?

AX.25 NETWORKING

Amateur packet networking support in HamBSD is provided by a number of kernel drivers, userspace applications and library functions.

Kernel Drivers:

- axtap(4) - AX.25 network tunnel interface
- kiss(4) - AX.25 network interface using a KISS TNC

Userspace Applications:

- rkissd(8) - Remote KISS daemon

Library Functions:

- ax25_aton(3) - convert AX.25 address representation

What Does HamBSD Provide?

AUTOMATIC PACKET REPORTING SYSTEM

Tools are provided for building APRS infrastructure on top of the AX.25 networking support.

Userspace Applications:

- aprsd(8) - APRS tracker and digipeater
- aprsisd(8) - APRS-IS client daemon

Using HamBSD?

- Can I run it today?
- Will the software compile and run on my OpenBSD?

HamPKI: A root CA bundle for amateur radio

`HamPKI ... [provides] a framework for authenticating radio amateurs using packet radio systems.`

- ARRL Logbook of the World
- APRS Tier 2 servers
- *Your Club Here*

Securing Amateur Packet Radio with IPSec

Draft RFC Specification:

- Obsoletes https://tools.ietf.org/html/rfc1226 (Internet Protocol Encapsulation of AX.25 Frames)

Summary Overview:

- Internet Protocol Encapsulation
- Quality of Service
  - Priority Frames
  - Automatic Packet Reporting System
- Security Considerations

Security Considerations in Detail

- Work in Progress(!)
- IPSec
- ESP
- NULL Algorithm
- Replay Protection

More Details

- https://hambsd.org/
- https://hambsd.org/pki.html
- https://tools.ietf.org/html/draft-learmonth-intarea-rfc1226-bis-01

Conclusion

- Questions - You have them, we may have answers

Support OpenBSD and HamBSD

- http://www.openbsdfoundation.org/
- https://hambsd.org/ (See links)

Contact Details

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- Twitter: @hambsdorg
- bsd.network: @irl
- Amateur Radio: MM0ROR
- IRC: ircs://chat.freenode.net/hambsd

Ham Radio Resources

US:

- ARRL
- ARRL Club Finder
- FCC
- HamExam
- QST

Canada:

- [RAC - Radio Amateurs of/du Canada]
- Government of/du Canada
- Canada Ham FAQ

UK:

- Radio Society of Great Britain

Radio Gear

- BaoFeng
- Icom
- Kenwood
- Motorola
- Yaesu

SDR People and Resources

- rtl-sdr: http://www.rtl-sdr.com/
- HackRF and YardStick: https://greatscottgadgets.com/
- BladeRF: http://nuand.com/
- AirSpy: http://airspy.us/