An open-source digital radio protocol for amateur radio

The M17 protocol

Morgan Diepart

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A brief introduction

Open source and Ham Radio

The obstacles

Workaround

M17
Who am I?

Figure 1: Morgan Diepart

- Research engineer at University of Liège (Belgium) in embedded systems and RF
- Licensed ham radio operator ON4MOD
- Joined M17Project in February 2023 (right after FOSDEM23)
- Doing mostly hardware design and firmware works
Amateur Radio

- It is a technical hobby
- Allows you to legally transmit on certain frequencies
- Extremely vast (antennas, transceivers, DX, ...)
- Most hardware produced by just a few brands...
Open Source in Ham Radio

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Which is not to be confused with...

Some countries disallow ciphered communications. Forces manufacturers to publish their protocol’s specifications. That does not make it FOSS...
Some protocols freely available

Many protocols exist and you could use any of those...
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- YSF: Proprietary mode from Yaesu. Data and digital voice.
- FT-4 / FT-8 : Very long range (1000s km), very low power (10 W), very slow speed, HF
- DMR/TETRA/P.25: A whole range of industrial standards adapted for amateur radio use

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- **DSTAR**: First protocol created for amateur radio. Designed for digital voice. VHF/UHF. Open specifications.
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DSTAR de-facto became ICOM’s proprietary mode.
Main obstacles

Licensing issues

Manufacturers exploit the lack of licenses to lock down their environments...
Main obstacles

Technical issues

Computing power at the time (2001) was limited. The vocoder is implemented in an ASIC and the algorithms are protected by patents, industrial secrets,...
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There are historic reasons, but how does one tinker with it? Answer: you do not.
Main obstacle
Technical issues

The vocoder being an integral part of the protocol. Is it possible to have a fully FOSS protocol?

And how?
The solution

Codec 2

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Since then the computing power increased significantly, so much that a 32-bits ARM MCU is enough.
Then came...

The innovation

This last brick allowed the emergence of fully open-source protocols such as:

▶ FreeDV (GPL v2.1) Using Codec 2 at a low bit-rate, narrower bandwidth in HF. Published in 2012. It is the reference Codec 2 implementation.

▶ M17 (GPL v2) Using Codec2 at highest bit-rate, standard FM bandwidth, for VHF and up. Published in 2019.
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Has all the features one can expect

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▶ Stream mode
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▶ Specifications for traffic over IP
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A whole ecosystem.
Module17
Open source DV modem
Modem that allows you to TX M17 using FM radio

- Open-source protocol...
- Open-source hardware
- Open-source software
- Affordable
- Build it yourself!
OpenHT
Open source portable transceiver

*If you can modulate it we can send it...*

For now...

- Open-source hardware*
- Open-source firmware*
- 430 MHz / 2.4 GHz @25 mW

*FPGA toolchain and IPs are not open-source*
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For the future

- OpenRTX
- USB-C charging!!
- Open-source FPGA
- 5W output
The larger ecosystem

A shootout to very interesting projects close to M17

▶ OpenRTX, *the* open-source firmware,
▶ WPSD, *the* hotspot software,
▶ MMDVM, *the* hotspot hardware,
▶ ...

The end

Thank you for your attention!

m17project.org

Checkout the Ham Radio infobooth in building AW.