The M17 Project

Status update and packet mode

Morgan Diepart

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Who am I?

Figure 1: Morgan Diepart

- Research engineer at University of Liège in embedded systems and RF
- Licensed ham radio operator ON4MOD, member of the LGE section
- Joined M17Project in February 2023 (right after FOSDEM23)
- Doing mostly hardware design and firmware development

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About M17

What is M17?

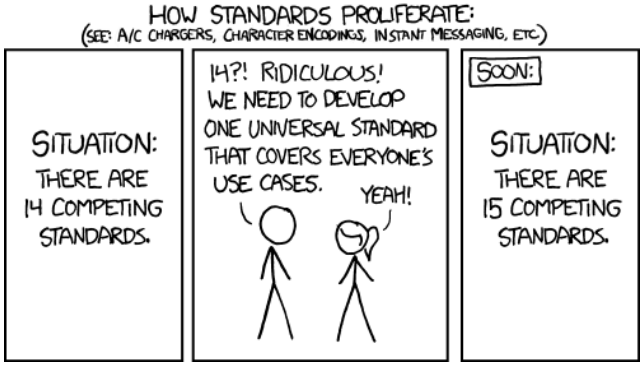
M17 is a digital communication protocol with digital voice.

It is made for hams, by hams.

Why M17?

Mandatory XKCD

M17 is not a protocol designed to unify amateur radio modes but rather an answer to many questions an adventurous operator might have.



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Have you ever tried:

- to modify the way YSF work?
- to work DStar with non-ICOM hardware?
- to work DMR from your computer or phone?

Why M17?

If you answered *yes* to any of these questions, then...

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- make it work on your PC, phone, ...

This is possible because the protocol is fully open-source, **including the voice codec**.

Specifications - PHY

Characteristics of the *physical layer*:

- 4-FSK (same deviations as YSF),
- 4800 baud $\longrightarrow$ 9600 bit per second,
- 9 kHz of bandwidth (fits in 12.5 kHz channels),
- mostly used on VHF, UHF, SHF,
- root-raised-cosine filter.

Specifications - Data Link

This describes how the data (the bits) must be arranged when operating M17.

- Uses encoded callsign for addressing (up to 9 chars in 6 bytes) which means that no registration is needed
- Metadata field for repeater/reflector operation, GPS, cryptography, ...
- FEC (for error detection and correction)

Specifications - Modes

M17 supports two main operating modes, plus one test mode.

- **Packet mode** allows you to send packets of data
- **Stream mode** allows you to send a continuous flow of data that will not stop until the PTT is released. It is the mode used for voice.
- BERT (Bit Error Rate Tester) allows you to test the quality of your link by sending a known bit sequence.

Additional features

M17 supports many features commonly found in other protocols:

- Channel Access Number (coded squelch)
- AES-128 encryption
- AX.25 mode
- APRS mode
- SMS Support
- IPv4 support

The M17 specifications also define the way M17 streams and packets must be transported over the internet.

Project News

Module 17 Revision 1.0

Module 17 Revision 1.0 was released on the 30th of June 2024. It addresses a few issues points :

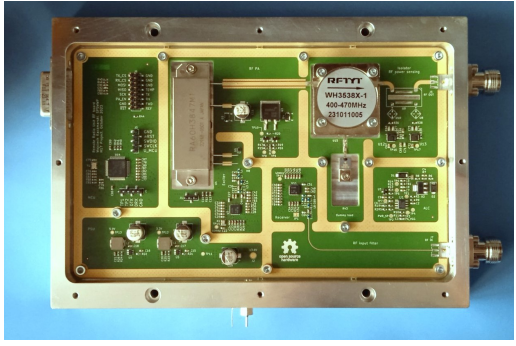
- Low audio output volume
- Audio glitches in the speaker
- Designed for aluminium enclosure
- New, user friendly, User Interface

CS7000-M17

Thanks to a partnership with Connect Systems Inc, a radio compatible with M17 out-of-the-box is now available.
The radio can be switched between OpenRTX and and the OEM firmware and thus can be used to work M17 and DMR.

Remote Radio Unit

The RRU is a device (still under development) mounted on a mast, close to the antenna and remote-controlled from the ground.
No need for long feeder cables, the data can be carried over less expensive fiber optics or Ethernet cable.



Data transfers using M17

M17 Packet mode

The M17 specs contains a whole section about packet mode:

- Correction code in the data link layer
- By chunks of 25 bytes (becomes 46 bits with FEC)
- Max raw payload of 825 bytes (incl. 1 byte specifier and 2 byes CRC)
- Max bit-rate if 4566 bps

M17 Packet mode

The following protocols already have a data type specifier allocated:

- AX.25
- APRS
- 6LoWPAN
- IPV4
- SMS

M17 Packet mode

The following protocols have been used in the amateur radio community with relatively little documentation available:

- NET/ROM
- ROSE

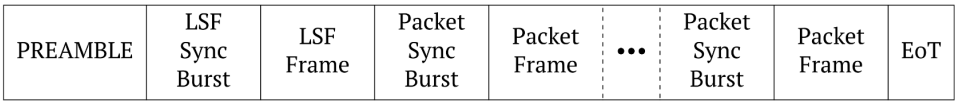
A proposition to use M17 for data transfer

In cases where low bit-rate applications are used, M17 can have a place:

- Remote station control / reports
- Messaging service
- Sensors readings

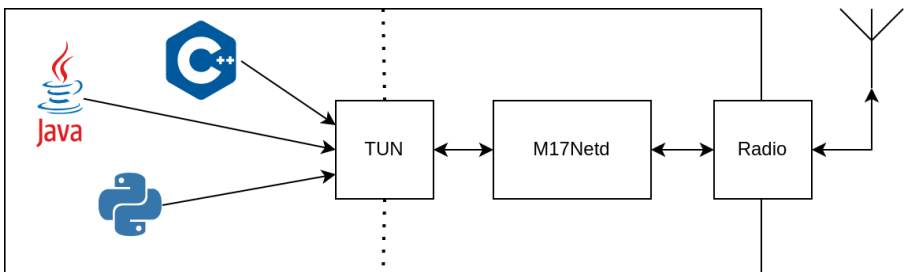
M17 Packet Mode

Structure of an M17 transmission in packet mode:



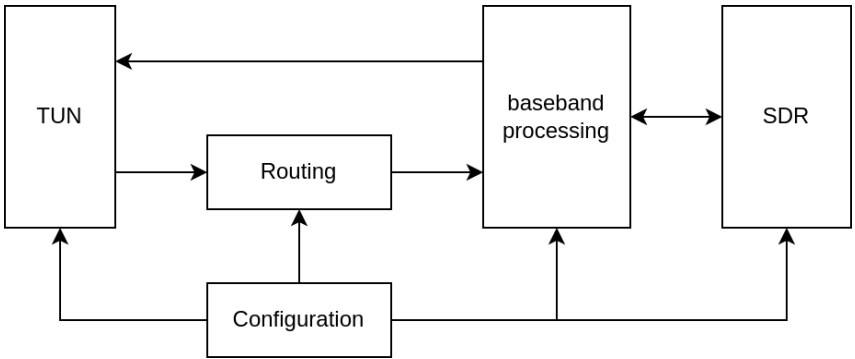
M17Netd

This is the current architecture selected for M17Netd, a daemon allowing you to create IP links like a VPN would do:



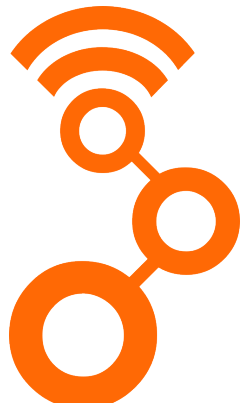
M17Netd

Overview of the structure of M17Netd: TUN operated in IPv4, the goal is to rely on OS settings as much as possible



gr-m17

`gr-m17` is a GNU Radio *Out-Of-Tree module* that enables the modulation and demodulation of M17 signals from (or to) a binary data stream.



libm17

`libm17` is a C library that contains all the blocks and functions described in the protocol specifications (callsign encoding/decoding, framing, FEC,...). It is basically the reference M17 implementation provided for free to anyone interested in using it.

If this was not enough...

- **M17 Activity Day** Reflector M17-C on all the Fridays of the globe
- **M17 Website** `https://m17project.org/`
- **M17 Specifications** `https://spec.m17project.org/`
- **M17 Discord** `https://discord.gg/G8zGphypf6`
- **M17 Repositories** `https://github.com/M17-Project`
- **OpenRTX Website** `https://openrtx.org/`

Thank you

Come check out our booth for demos and trials

If you have an MD-UV380/RT3s we can mod it for free

OpenRTX talk tomorrow @ 10:00

Pictures licenses

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- Euro banknotes - CC0 - https://www.publicdomainpictures.net/fr/view-image.php?image=150724
- Pirate flag - Free for use and download - https://pixabay.com/vectors/pirate-skull-crossed-bones-47705/
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