BrandMeister & TetraPack

HAMRADIO 2025

Artöm DL5ABM

Elliott 2E0YCA

Ralph DK5RAS

BrandMeister

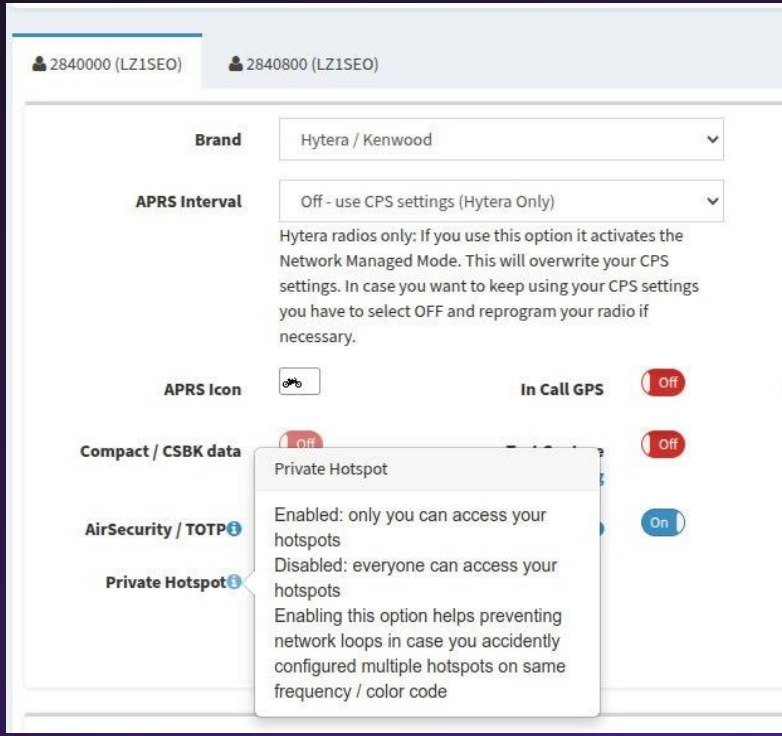
Fresh changes

- Improved stability and logging ☺
- FastForward
  - Fixed link identification passthrough (to prevent cross-network looping)
  - Added QUICKACK (to improve latency)
- Moving to new encryption keys
- Improved jitter buffer scheduling
- Repeater call-sign validation
  - Check for valid UTF-8
  - Strict validation for AX.25 / APRS
- Talker Alias
  - Now accepting full valid Talker Alias only
  - Transmitting complete Talker Alias only

Private hotspot

New feature

- Developed to prevent looping and improve hotspot security
- Allows only owner to transmit to the network
- Will be applied soon by-default for new hotspots



Tellus Agent

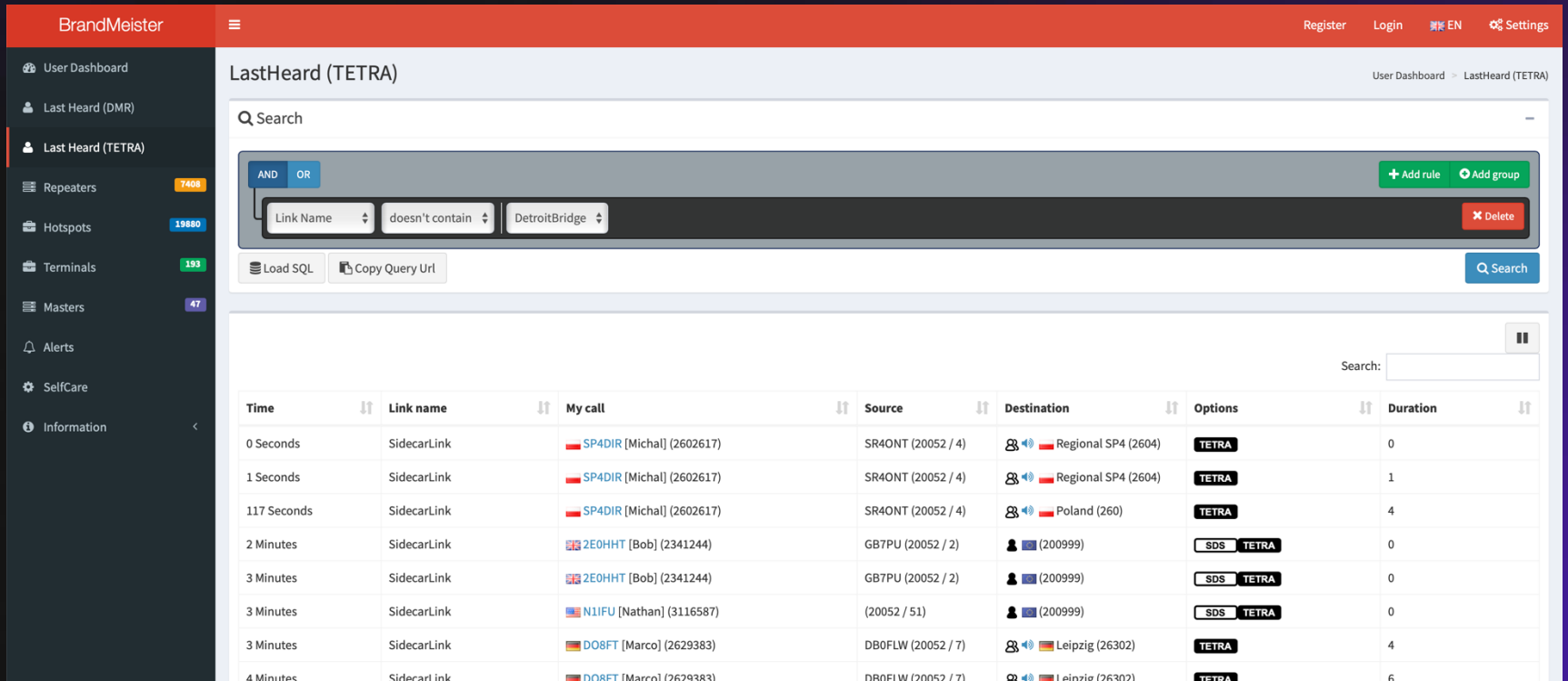
Now as a Docker image / for arm-based Mikrotik routers

- Useful when using multiple Hytera repeaters by single IP
- .. or Hytera's repeater behind unmanaged NAT
- .. available through years ☺
- Available as:
  - Source code, compliable and runnable on Linux, FreeBSD, macOS
  - .deb packages for amd64 and arm64
  - Multi-architecture Docker image, could run on arm-based Mikrotiks (new this year)
  - Prepared for OpenWRT (but we have not motivated to create packages for it)
- Require to run instance per repeater

```
/container/add remote-image=git.brandmeister.network/public/tellusagent:latest interface=veth1
cmd="--connect-port 50000 --control-port 50001 --media-port 5002 --server-address
2002.master.brandmeister.network --server-port 54003" start-on-boot=yes
```

Last Heard for TETRA

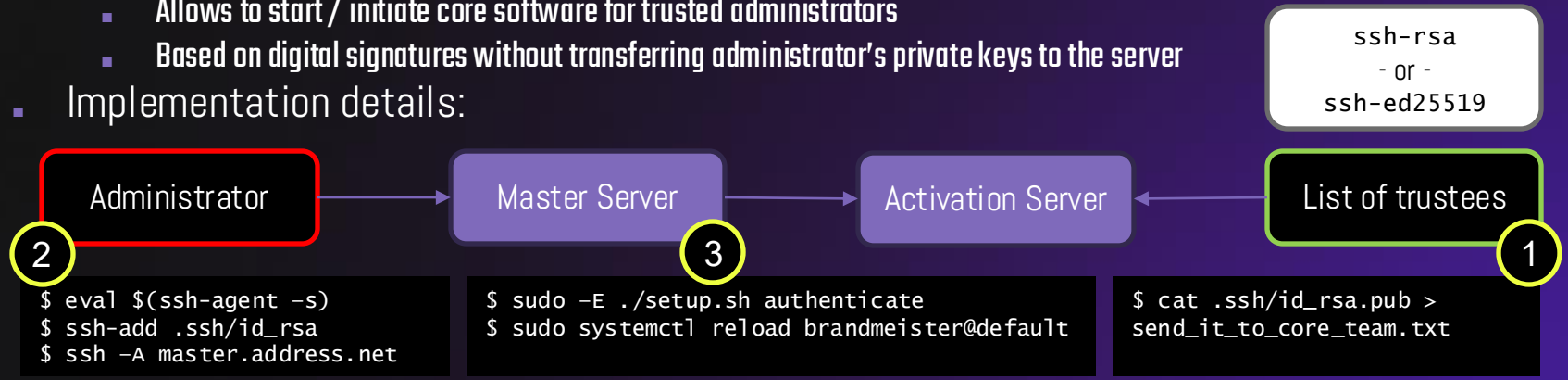
brandmeister.network



Master trustee

Only for master administrators

- After some incidents with unauthorized activities on some master servers
- Will be fully released with Debian 13 out
- The main concept:
  - **Will be applied on numbers of master servers**
  - **Allows to start / initiate core software for trusted administrators**
  - **Based on digital signatures without transferring administrator's private keys to the server**
- Implementation details:

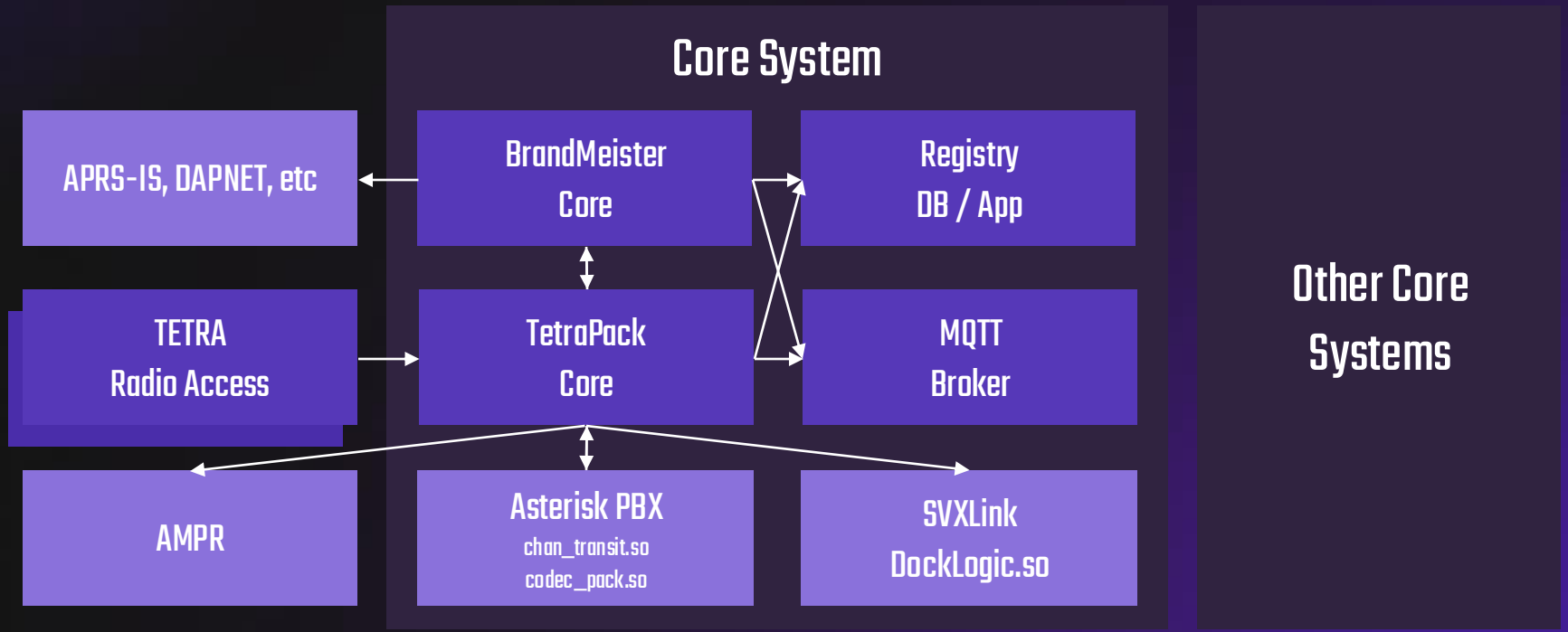


TetraPack

Quick reminder

- Introduced at HamRadio 2023 in Friedrichshafen
- Research started immediately after HamRadio 2022
- “multiple vendor's TETRA TMO in one PACKage”
- The same goals like BrandMeister Network has:
  - Support of different hardware
  - Widely-available talk-groups
  - Most of services and user-experience for TETRA TMO
  - In most cases - connect network controllers (SwMI) instead of base stations
- Closed integration to BrandMeister Network:
  - Seamless exchange of group calls, individual calls, SMS
  - Almost all services available in BrandMeister Network: APRS, SMS services, etc.

Core system architecture



Supported hardware

	Supported since...	Notes	Group calls	Simplex individual calls	Duplex individual calls	Phone calls	Text messaging	Location	Packet data
Motorola CompactTETRA	2023/Q2		✅	✅	✅	✅	✅	✅	✅
Motorola Dimetra	2024/Q2		✅	✅	✅	✅	✅	✅	✅
Hytera RoIP	2024/Q3		✅	✅	✅	❌	✅	✅	❌
Rohill TetraNode	2025/Q1		✅	✅	✅	✅	✅	✅	❌
Brew	2025/Q1	Nonstable	✅	✅	✅	✅	✅	✅	✅

Hytera RoIP

Directly connected radio via wide-band

- Natively implemented in TetraPack Core
- Uses BrandMeister's device password
- Tested on PTC760 (A7 3.5 and A10 4.5 firmwares) and PTC680
- Hytera PDCxxx RoIP ≠ Hytera PTCxxx RoIP
  - **Proprietary Hytera's PTTC proxy protocol**
  - **Uses native HMF TETRA SwMI signalling (ACAPI)**
  - **2 TCP ports for discovery/signalling and UDP for media**
- Trunking mode
- Automatic failover between narrow-band and IP
- https://wiki.tetrapack.online/books/tetra/page/hytera-roip

ROHILL

TetraNode

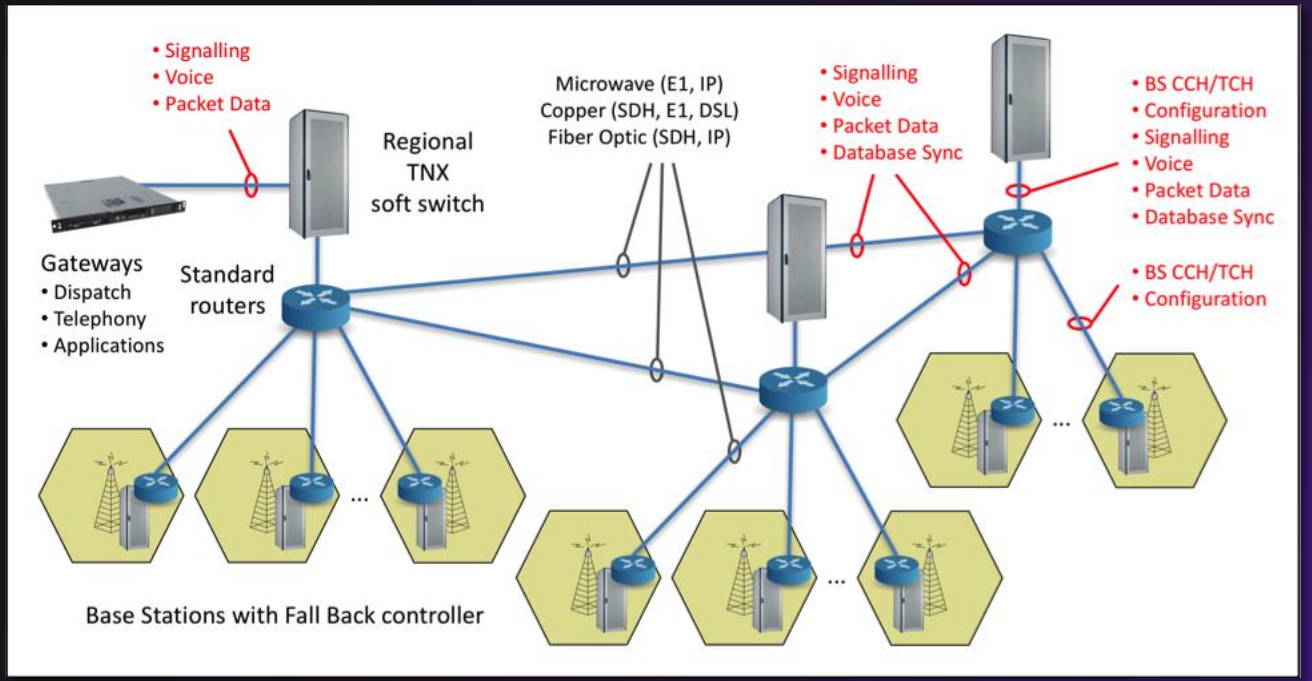
Rohill TetraNode

Overview

- Our research and development is done using Rohill R-8060 and TetraNode 2.28.37
- TetraNode system contains following components:
  - Base station transceiver (BSS) module with IP connectivity
  - TetraNode eXchange (TNX) SwMI which is normally a Linux-based server
  - Several optional systems such as Dispatch Server, Logging Server, etc.
- Each TNX can handle traffic from BSSs on different sites
- TNXs could form a redundant distributed network
- Normally applications should be connected to TNX using proprietary TIGv2 protocol

Rohill TetraNode

Network topology



Rohill TetraNode

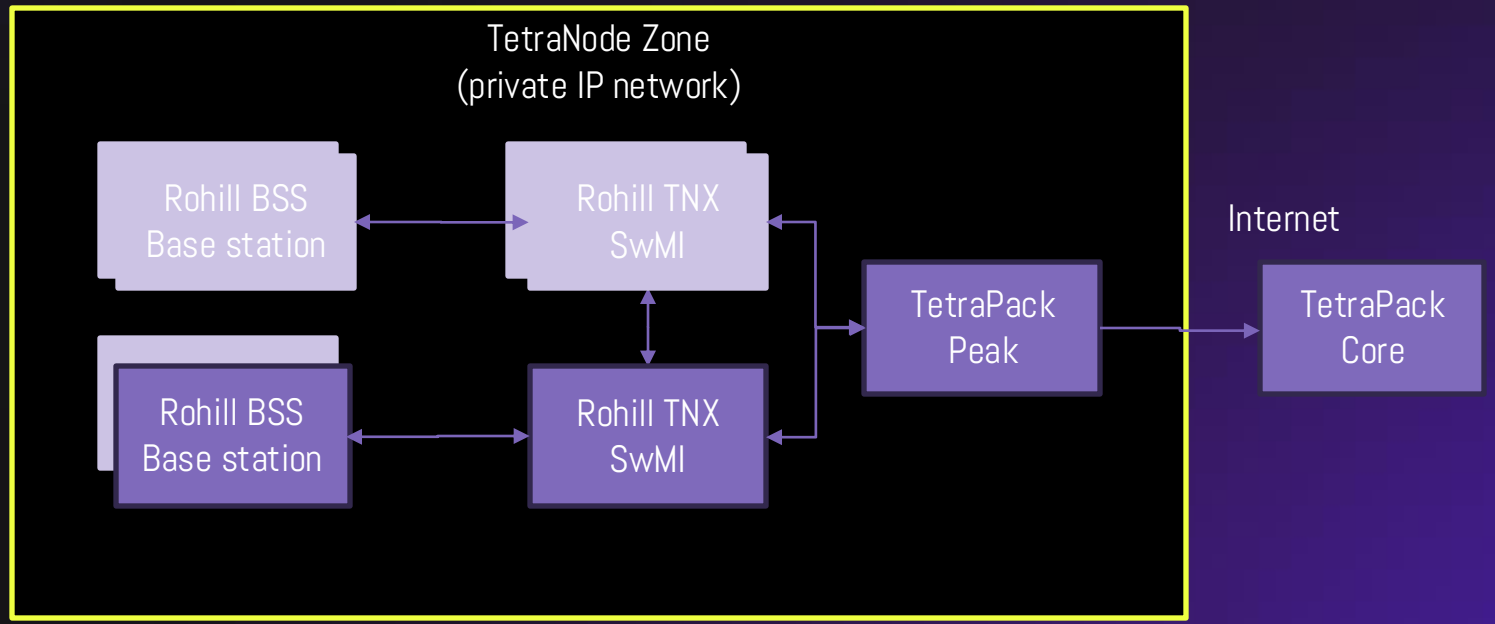
Integration

- **We decided to avoid TIGv2**
  - TIGv2 uses XML over UDP for everything, mostly very abstracted from TETRA-specific
  - TIG is very restrictive, allows to emit traffic from limited ISSIs
  - Requires licensing by capacity
- **We decided to emulate TNX through Internode protocol**
  - Covers our typical cases for TetraPack integration
  - Has many advantages such as database synchronization and ISSIs routing
  - Less CPU overhead on message processing
- **Internode protocol**
  - Proprietary
  - Uses XML over UDP only for (automatic) discovery and keep-alive
  - Uses own UDPCP-based transport and proprietary IPC

TetraPack Peak

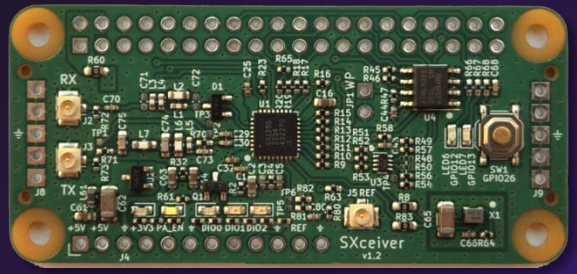
- Client software to connect Rohill TetraNode zones
- Emulates Rohill TetraNode, supports up to 61 nodes in zone
- Has next requirements for zone:
  - TetraPack Peak should be run inside TNX' private network
  - It requires separated Debian Linux host with amd64 or arm64 architecture (could be dedicated PC, Raspberry PI or virtual machine)
  - All TNX nodes inside zone have to use numeric node names from 1 to 62
  - TetraPack phone trunks should have numeric names that equal to corresponding ISSIs (16777184, 16777186)
  - At least TetraNode 2.28
  - Good license to pass as much ISSIs as possible :)
  - Every ISSI to be accepted by TNX from TetraPack should be added to TNX database (e.g. to make a Group Call, every ID involved in the call needs to be in TNX database)
- https://wiki.tetrapack.online/books/tetra/page/tetranode

Rohill TetraNode + TetraPack Peak



What is Brew?

Open protocol for TETRA cells and client connection



- Based on WebSockets transport protocol
  - Better NAT-traversal
  - TCP_NODELAY, TCP_QUICKACK
  - HTTP Digest Access Authentication
- Suitable for
  - Home-made TMO cells
  - Dispatch console / monitoring (hoseline)
- We have ported TETRA CodecPack as a WebAssembly library in 2022
- Specification is sill nonstable (waiting for the first client implementation)
- https://wiki.tetrapack.online/books/tetra/page/brew

Debian 13

Our roadmap regarding to its release

- Breaking changes:
  - Io_uring 2.3 → io_uring 2.9 (still have issue with IOWAIT, will be fixed in 2.10)
  - pcre3 (aka PCRE 1.3, discontinued) → pcre2
  - php 8.2 → php 8.4
- Core systems (BrandMeister Core, TetraPack Core)
  - Already prepared and tested
  - Support of Debian 12 will be immediately discontinued when we publish releases for Debian 13
  - Smooth upgrade this time
- Client systems (FRED, Dummy, Sidecar, Peak)
  - AMD64: Support of Debian 12 will be immediately discontinued when we publish releases for Debian 13
  - ARM64: Debian 12 support will be discontinued next to Raspberry Pi OS based on Debian 13 outs
- …

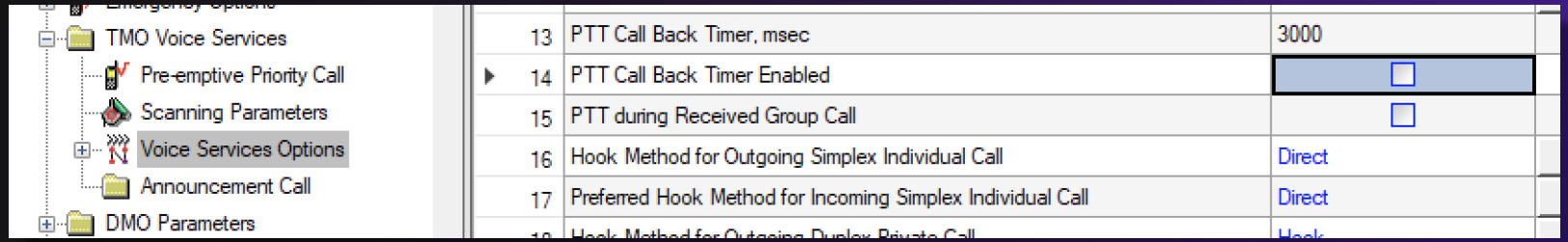
TETRAPACK

User Experience

DMR <-> TETRA

Individual calls

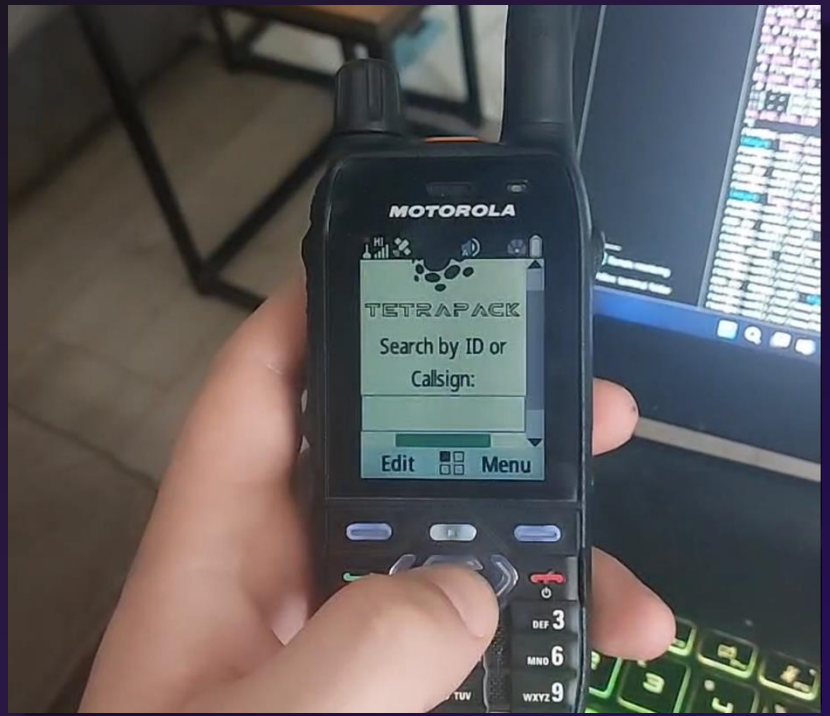
- TETRA -> DMR: DOUBLE PTT TO SETUP A CALL AND THEN TO TRANSMIT
- Recommended settings:
  - PTT Call Back Timer – Disabled
    (respond for initial delay on call DMR->TETRA)
  - Hook Method for Outgoing Simplex Individual Call – Direct
    (respond only for transmitted call capabilities, the bridge is tolerant to this setting)
  - Preferred Hook Method for Incoming Simplex Individual Call – Direct
    (allows TETRA radio to hook a call automatically - DMR side doesn't know about when the call hooked)



Mobile IP-data and WAP

Updated features

- Static IP allocation (172.16.0.0/22)
- WAP gateway based on Kannel (kannel.org) now with ISSI via HTTP header X-WAP-Network-Client-MSISDN
- Single IP and settings for any access types
- Pool 172.16.1.0/24 interconnected using NAT1:1
  - **HAMNET (44.148.206.0/24)**
  - **ARDC (BGP, 44.32.147.0/24)**



Links

- https://tetrapack.online/
- https://t.me/TetraPackGeneralSupport