BrandMeister & TetraPack

Dreiländereck-Sysop-Treffen 2024

ARTÖM DL5ABM

TetraPack.online
Summary

- Introduced at HamRadio 2023 in Friedrichshafen
- Last presentation at Dreiländereck-Sysop-Treffen was a part of this work
- “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 basestations
- Closed integration to Brandmeister Network:
  - Seamless exchange of group calls, individual calls, SMS
  - Almost all services available in Brandmeister Network: APRS, SMS services, etc.

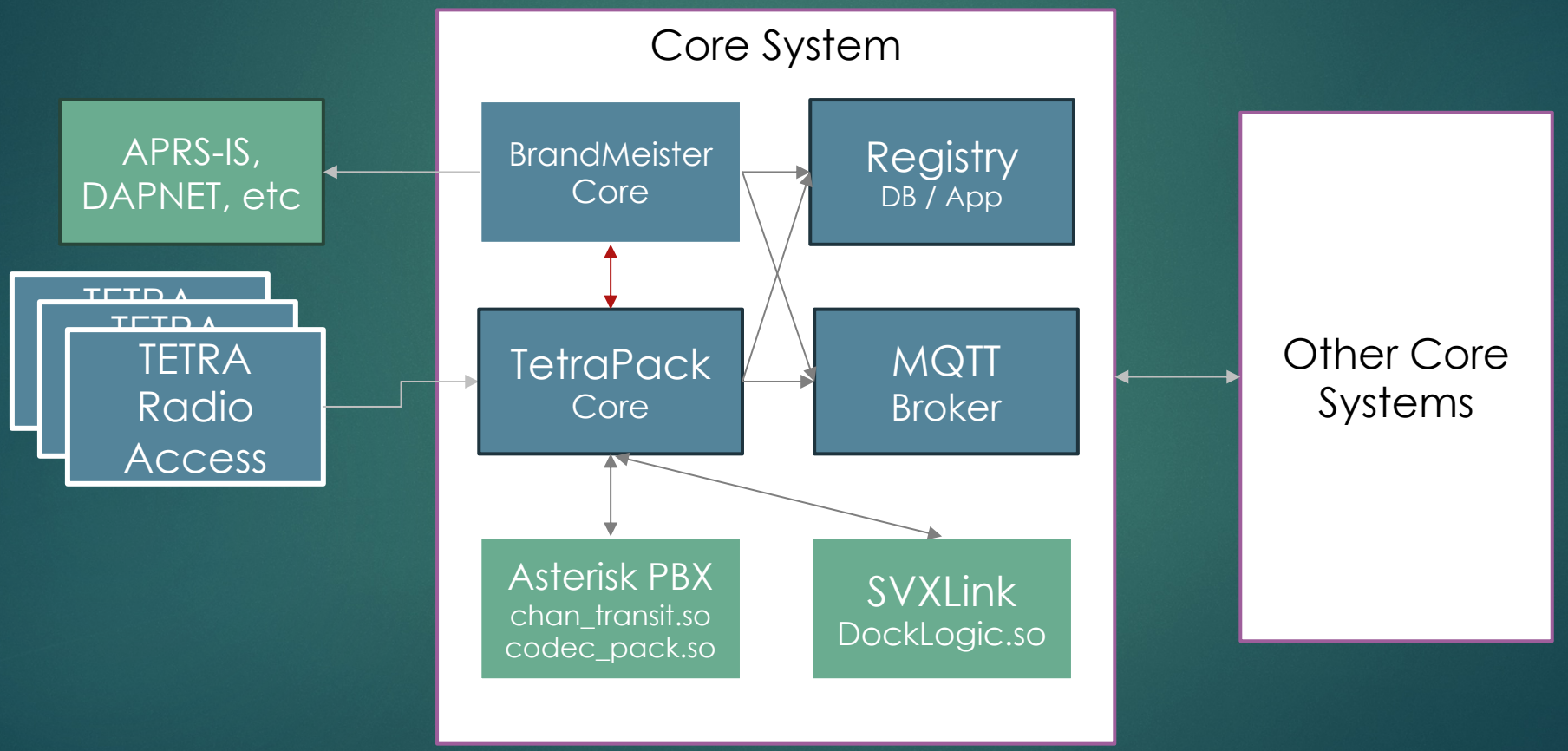
Why not BrandMeister?

- TETRA TMO:
  - Another user experience (trunking, duplex calls, OACSU)
  - Another codec (ACELP vs. AMBE)
  - Another signalling procedures (OACSU for individual calls)
  - More powerful set of basic services
  - Derived from GSM

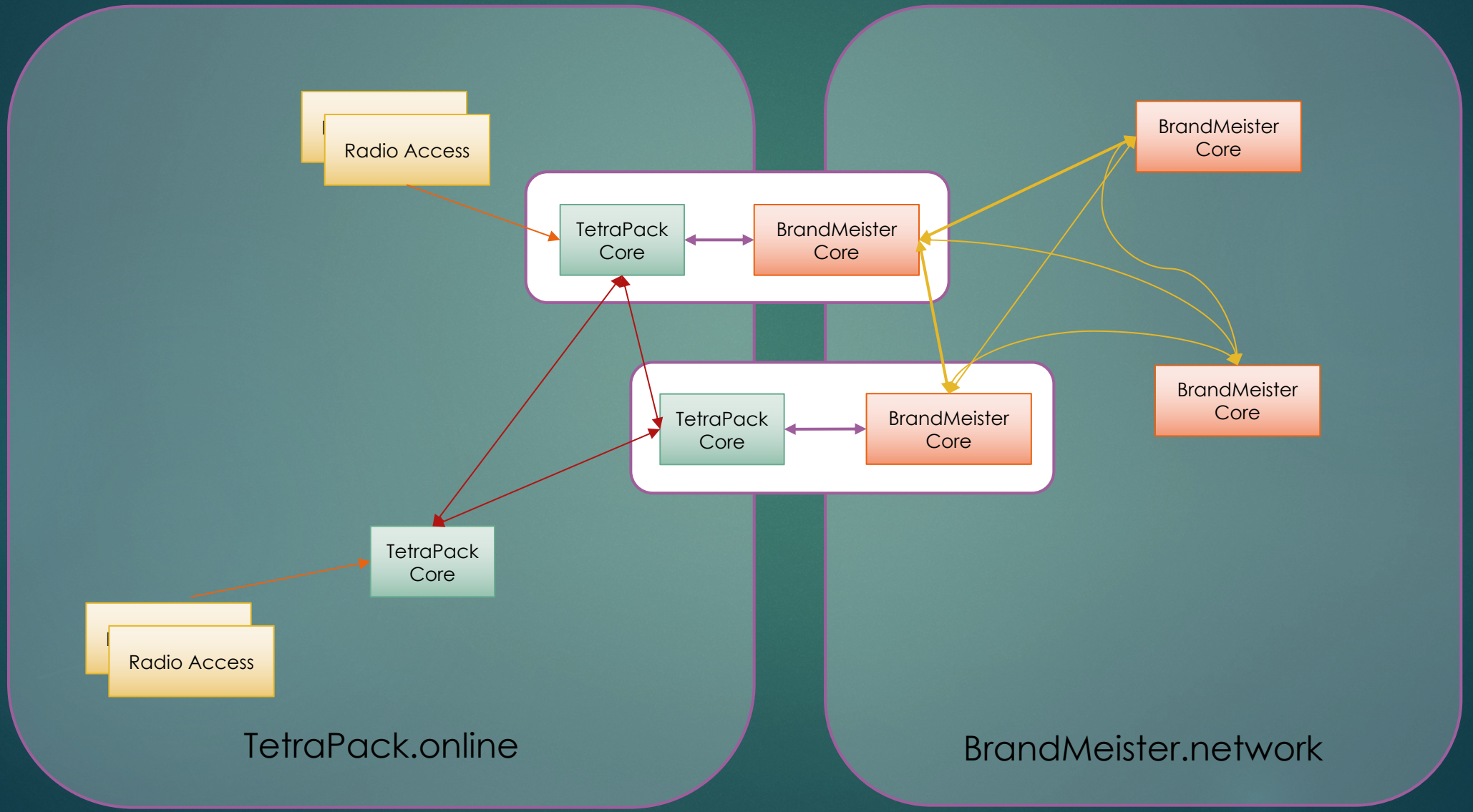
TetraPack Core 20240108-061436 <**ID 2625**> Views ▾ **Linux 6.1.0-17-amd64 x86_64**

Identifier	Outcome	Number	Link	Agent	Values	Details
0e3f3a31-f92e-4e2e-b3d7-90c7a0c0fa36	11/01/2024, 10:10:50	0	BlackHole		0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	
41d48349-56d6-4e73-b2b9-bb45e9df0c97	11/01/2024, 10:10:50	0	GroupSpread		0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	
3d312284-9508-4958-a698-77a2d62828dd	11/01/2024, 10:10:52	2505	QuickRapid	TetraPack Core 20240123-142734	1, 1, 13, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	Connected, Ping 13 ms
8d0a4e39-da53-4208-aa27-19d56b10ebec	11/01/2024, 10:10:52	2685	QuickRapid	TetraPack Core 20240108-061436	1, 1, 56, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	Connected, Ping 56 ms

Core system architecture



Network topology



Roles of components

- TetraPack Core
  - User registration / TG affiliations
  - Calls and data switching
  - Radio access connectivity
  - Acts as a transit switching center
- Registry
  - HLR/VLR
  - Calls routing
- BrandMeister Core
  - TETRA <--> DMR individual and group calls, SMS bridging
  - GPS and SMS apps handling (APRS, DAPNET, MQTT, HTTP API)
  - **Any TG > 90 and registered personal IDs seamlessly available across both networks**
- Asterisk PBX / chan_transit.so
  - Individual and phone calls bridging, IVR apps
  - SMS apps and bridging
- SVXLink / DockLogic.so
  - TETRA-DMO group calls bridging (+ passing of ISSI)

SVXLink DockLogic.so

- DockLogic.so – our own SVXLink Logic module, implements TetraPack's Dock IPC protocol (should run on the same host as TetraPack Core)
  - Works on top of pure DL1HRC's SVXLink / tetra-contrib
  - Requires nodes to use the same CALLSIGN in [ReflectorLogic] and [TetraLogic] to make our bridges pass talker's ISSI correctly
- Our patches applied to SVXReflector and ReflectorLogic at DL1HRC's GitHub.com repository (since version 16082023):
  - Pass originating ISSI over SVXReflector to TetraLogic / DockLogic
  - Reflector to Reflector links does not pass originating ISSI
- Not recommended to use:
  - Too many transcoding (ACELP <--> analog <--> OPUS <--> ACELP)
  - Poor quality of analog audio on many SVXLink nodes

Asterisk PBX chan_transit.so

- chan_transit.so – our own Asterisk module, implements TetraPack's Transit IPC protocol (should run on the same host as TetraPack Core)
- codec_pack.so – our own port of TETRA codecs to Asterisk (ACELP, ...)
- Possibilities:
  - Individual simplex calls with PTT control (RADIO_KEY/RADIO_UNKEY)
  - Duplex individual, PSTN or PBX calls
  - TETRA codec selection / DTMF pass
  - TETRA call priority management
  - Short messaging (out-of-band messaging)
- Use-cases:
  - IVR, parrot
  - Ham telephony
  - Direct call to emergency services
  - AllStarLink access (in theory)

Supported radio access technologies

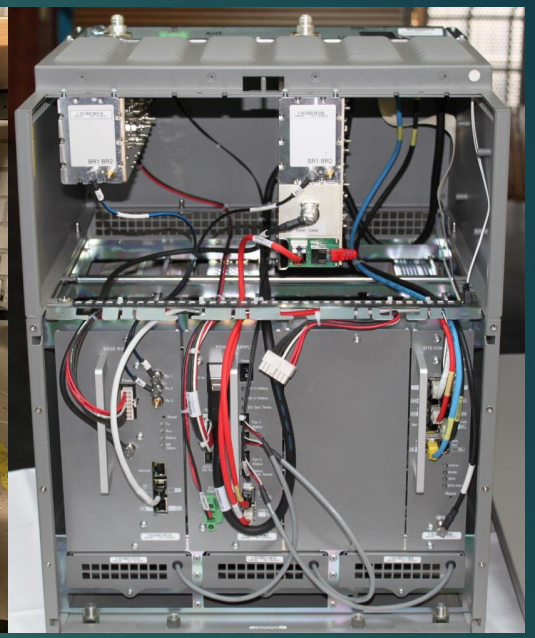
- Motorola CompactTETRA (CTS)
  - Designed by DAMM and Frequentis, labled by Motorola
  - Built-in network controller (BSC)
  - **NOT compatible** with Motorola Dimetra
  - Supported since 2023 with the first release of TetraPack
- Motorola Dimetra
  - Designed and produced by Motorola
  - Support in TetraPack - **new for this year**, early beta today
  - Development and testing based on Dimetra R5.2
  - **Uses dedicated Dimetra Core system**!

motorola dimetra

Dimetra hardware
Base stations

EBTS (gen1, gen2)

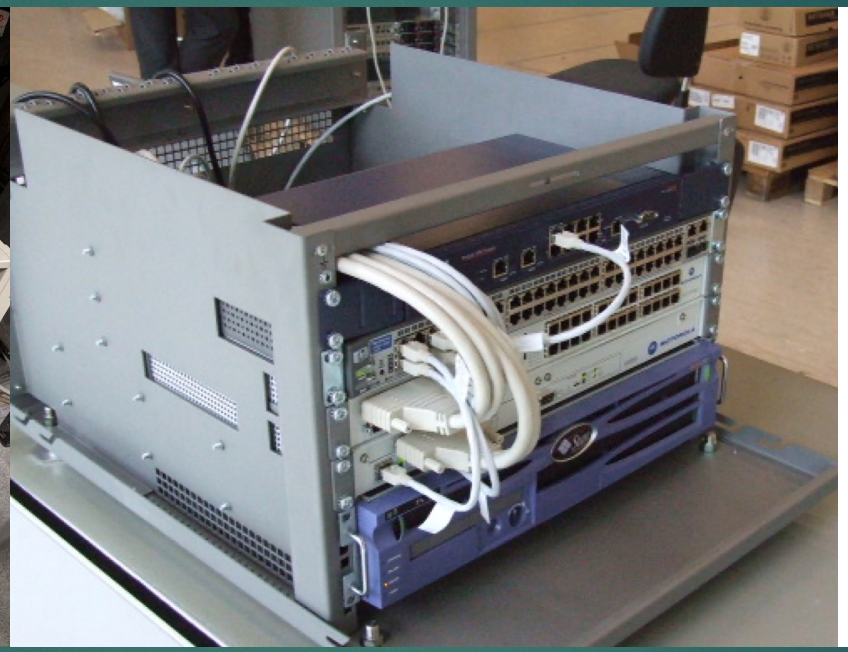
MBTS



MTS2/4

Dimetra hardware
Core systems

CP1500
(gen1)



Sun Netra +
HP Proliant
(gen2+)

Core X /
Core Express

Dimetra hardware
Core systems

- Sun CP1500-based
  - Can run Dimetra up to R6.2
  - Fully hardware
  - Motorola-proprietary cPCI boxes, ZNYX redundant ethernet blades
- Sun Netra + HP Proliant
  - Standard 19" equipment
  - Solaris 9+ containers
  - Multiple support boxes based on PowerPC / x86 / Linux / Windows
  - Dimetra R6-R9 (?)
- Core X / Core Express
  - Many virtual machines running on a single box

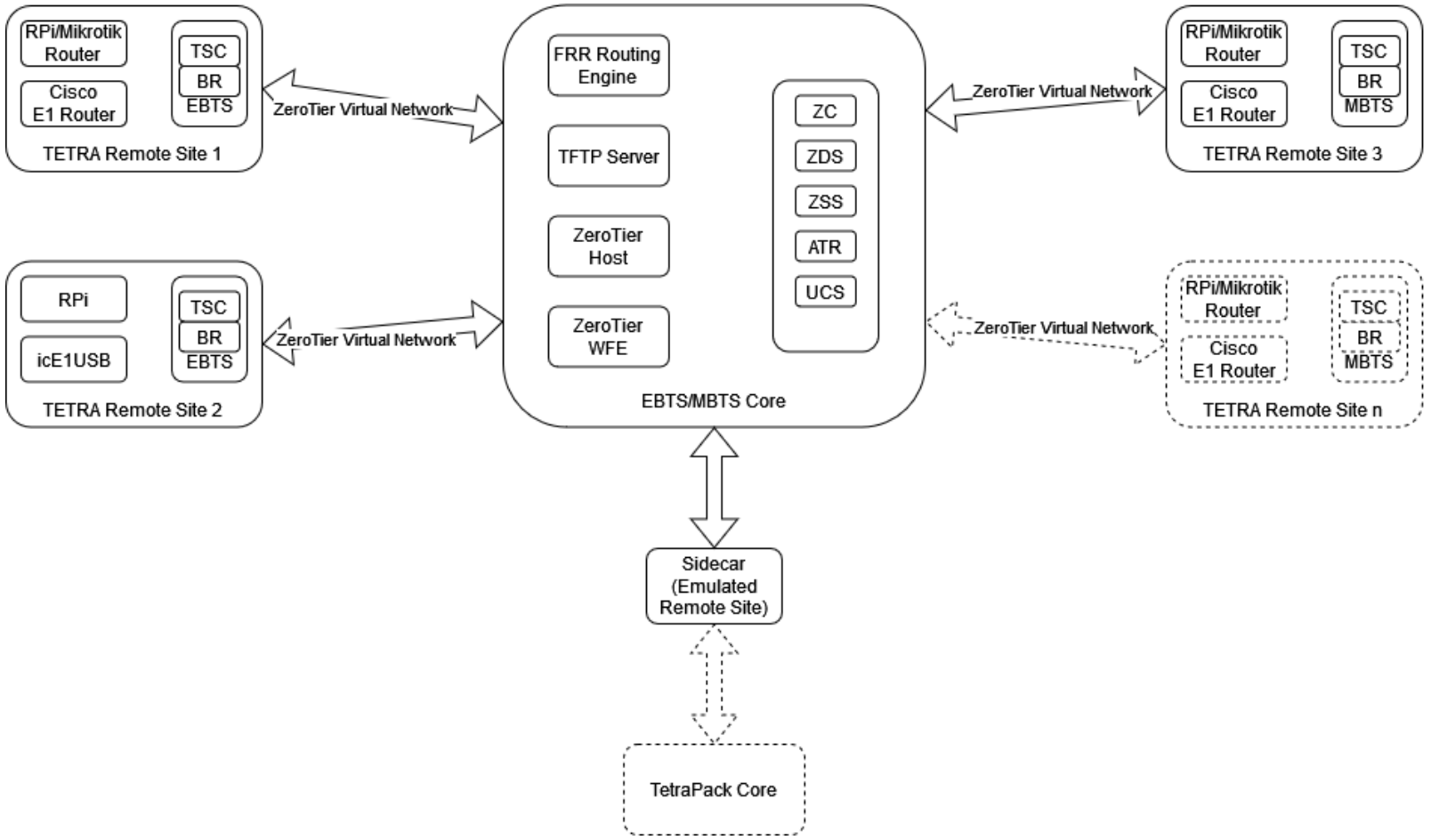
General information

- Centralized switching and network management
- Shares many core components with SmartZone, Astro P25, MOTOTRBO Capacity+
- Pure IPv4-based private (RFC1918) packet-switched transport
  - EBTS/MBTS base stations use IP over FrameRelay (E1 or X.25)
  - MTS2/4 base stations use IP over IP VPN
  - Predefined fixed IP plan
- Media and signaling use mostly IP multicast

Our core system

- CP1500-based Dimetra R5.2
  - We have missed ZoneController Application CD for upgrade to R6.1
  - No MTS support (it has been introduced in R6)
  - **Only EBTS/MBTS!**
  - **No scan-lists support**
- ZeroTier MP-VPN to connect sites and core
- OSPF for unicast routing, PIM dense-mode for multicast routing
- Several options to connect base stations
  1. Cisco router with E1 card + any box (Linux/OpenWRT/Mikrotik) for ZT
  2. Osmocom icE1usb + any Linux box for osmo-e1d + fred + FRR + pimdd + ZT
- https://wiki.tetrapack.online/books/tetra/page/ebts
- https://wiki.tetrapack.online/books/tetra/page/framerelay-over-e1

Solution overview

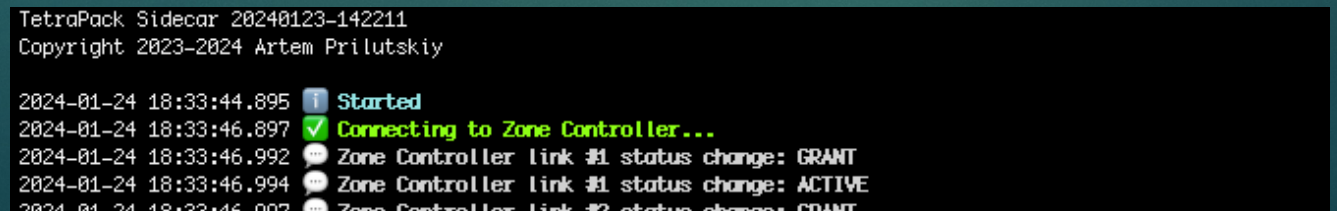


Option 2: FRED FrameRelay-over-E1

- Our own gateway software to run on on-site E1 connection
- Bridges IPv4/IPv6/Ethernet packets between Linux kernel and FrameRelay over E1 (RFC 2427, RFC 2590)
- Supports FRF.12 (inner and outer) fragmentation for incoming traffic (FrameRelay -> Linux)
- Implements basic DCE-PVC LMI with support of ITU-T Q.933-A, ANSI T1.617-D, GOF (automatic detection)
- Acts via TUN/TAP network interfaces (one per DLCI) on Linux side
- Can share icE1usb interface with another FRED / dummy / etc
- Debian 12 arm64 or amd64, tested on Raspberry Pi CM4, Raspberry Pi 5

TetraPack Sidecar

- Agent software to connect Dimetra Core (on per-zone basis) with TetraPack Core (like TetraPack Dummy for CompactTETRA)
- Should run close to Dimetra Core in the same private network
- Single TCP connection to TetraPack Core over Internet
- Emulates EBTS TSC to register users and to pass calls
- Watches for signaling between TSCs of real base stations and Zone Controller to grab registrations, group affiliations and group calls
- **First beta released at the end of January 2024, only group calls without priority management at this moment**



Credits • Team

- Artöm DL5ABM – software design, research and development
- Elliott 2E0YCA – infrastructure research and development
- Stefan LZ1SEO – infrastructure research and development
- Krzysztof SQ4LWO – hardware support
- Manoel ON6RF - hardware support

Connected

Location	Callsign	Model	Connection	Operator
Lincolnshire - UK		MBTS	Our Dimetra Core R5.2 + Sidecar	Elliott - 2E0YCA
Lancashire - UK		MBTS	Our Dimetra Core R5.2 + Sidecar	Gareth - M0VXT
Newbury - UK		EBTS	Our Dimetra Core R5.2 + Sidecar	Krys - M0LWO
Waterloo - Belgium	ON0LMR	EBTS	Our Dimetra Core R5.2 + Sidecar	Manoel - ON6RF
Brussels - Belgium	ON0MSF	CTS100	Dummy	Manoel - ON6RF
Leipzig - Germany	DB0FLW	EBTS	Our Dimetra Core R5.2 + Sidecar	Lawrence - DL1FLW
Frankfurt - Germany		EBTS	Our Dimetra Core R5.2 + Sidecar	
Ingolstadt - Germany	DM0FOX	CTS100	Dummy	Torben - DH6MBT
AFu-Nord group - Germany	DB0CSH, DB0HEI, DB0XH, DB0XN, DB0ZOD, DM0FL, DM0KIL, DM0SL, DO0ATR	CTS100	Dummy + DL1NE's proxy	Simon - DL1NE
Espoo - Finland	OH2DMR	EBTS	Our Dimetra Core R5.2 + Sidecar	Erik - OH2LAK
Gdynia - Poland		EBTS	Our Dimetra Core R5.2 + Sidecar	Sebastian - SP2FRN
Wroclaw - Poland		EBTS	Our Dimetra Core R5.2 + Sidecar	Pawel - SQ6POG

Links

- http://wiki.tetrapack.online/
- https://t.me/TetraPackGeneralSupport
- http://core.tetrapack.online:8081/page/

Q&A

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