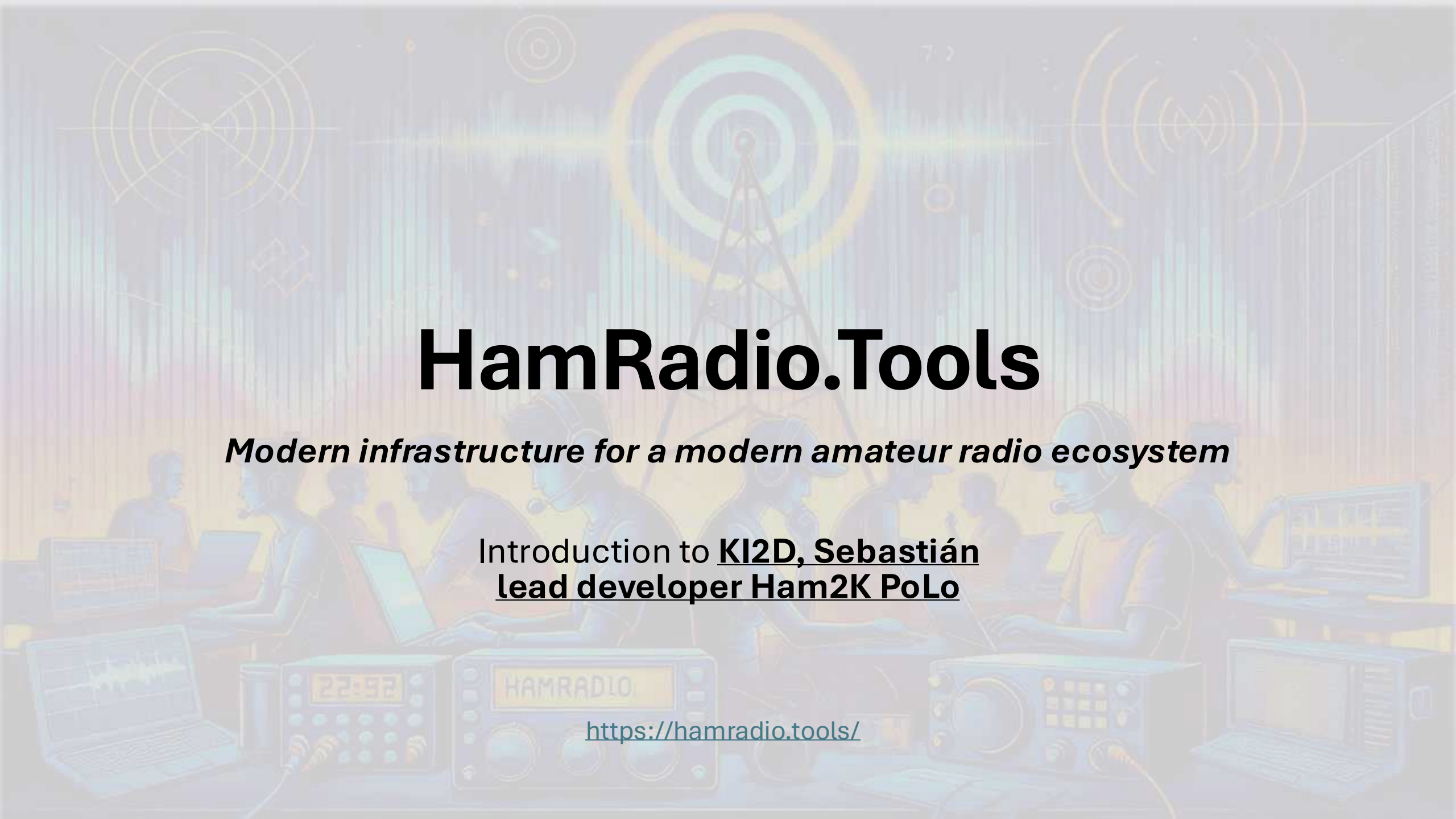


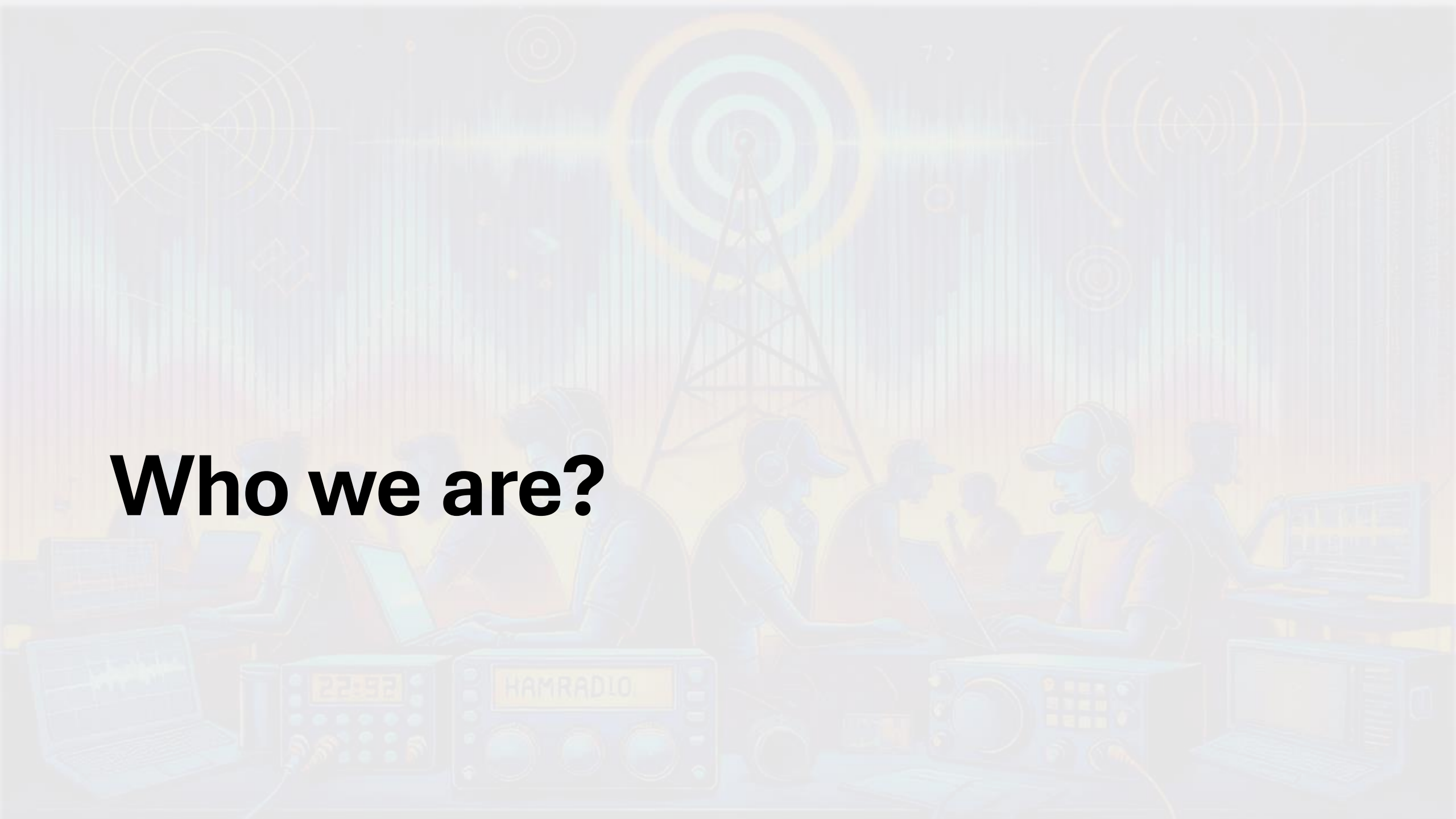
HamRadio.Tools

Modern infrastructure for a modern amateur radio ecosystem

Introduction to **KI2D, Sebastián**
lead developer Ham2K PoLo

https://hamradio.tools/

Who we are?



About HamRadio.Tools team

- **Who we are**
  - HamRadio.Tools is an **open, community-driven technical initiative**
  - Built by radio amateurs, for radio amateurs
  - Focused on **infrastructure, interoperability and longevity**
  - Not a replacement of existing communities, **an evolution layer**

- **What problem we address**
  - Amateur radio data infrastructure is:
    - fragmented
    - legacy-bound
    - fragile under load
  - Existing clusters were designed with the mentality of decades ago, **before the ham radio operations and Internet scale we have today**

- **Our mission**
  - Build **open, scalable, protocol-first foundations** for ham radio data

A bit of history about this initiative

Date	Action
Fall 2015	Idea sparked during a conversation with other hams in Fall 2015 after a ham convention in Spain. The discussion started due to attacks to cluster with fake data.
2016	- Initial conversation with other peers to decide which data the cluster should carry on. - Initial code were started by March 2016.
2017-2019 (low time for radio)	- Code expanded in modularity. - A technical member of URE (Unión Radioaficionados Españoles) asked for a grant(*) to get the code from GitHub and integrate it in their WebCluster (link) initiative.
2020-2021	Pandemic provided extra time for radio, [un]fortunately.
2022-23	A coffee with other peer hams in Radio Club Lugones sparked again the same cluster improvement idea.
2024	- Research on needs started; numerous 1-to-1 talks with DX-mans and activators to gather ideas on what a new cluster should provide in terms of functionality. Designing a UI was not in scope. - Initial code from scratch
2025	- Main code block finished; time to beta test the system. - Begin of idea socialization among selected groups of hams, dev teams, and so. - We discovered “The Holy Cluster” ☺
2026	Go live!

(*) Grants were never necessary as code is always contributed to community in either MIT or Mozilla Public License 2.0

Project objectives

What we are building (and why)

HamRadio.Tools does not aim to be or become a product; it's a set of coordinated components with core objectives for the community:

- **Next-generation MQTT DX cluster**
  - Real-time, low-latency, globally distributed
  - Designed for scale, filtering and trust models
- **Modern interfaces**
  - Fast, filterable and readable DX & data streams (read only)
  - Designed for humans, not terminals
  - Able to integrate via API
- **Open callbook**
  - Free, and Free as is in "Gratis"
  - API-driven
  - Designed for integration, not scraping
- **API/SDK/Companion software**
  - Empowers ham radio programs
  - Bridges obsolete or legacy logging software
  - Allows old tools to survive in a modern ecosystem

How we got here

- **The technical limitations became clear:**
  - Identity problems
  - Monolithic architecture
  - Tight coupling
  - Scaling pain points
  - Protocol rigidity
  - Lack of trust in community
  - Lack of support for new initiatives needing telemetry.
- **The turning point**
  - We didn’t abandon the idea
  - We **re-thought the foundation again**
- **Result**
  - HamRadio.Tools emerged as:
    - Independent
    - Protocol-focused
    - Built for **the next 10–20 years**, not the next contest

Project structure

- **Core (dev) team**
- Focus:
  - MQTT cluster design
  - Data schemas
  - Filtering, trust, and abuse mitigation
  - Performance, reliability, scalability
- Responsibilities:
  - Cluster protocol
  - Message formats
  - AuthN/AuthZ models
  - Inter-cluster federation

- **Admins team**
- Focus:
  - Support with companion tools
  - User experience
  - Visualization & accessibility
- Responsibilities:
  - Logging bridges
  - Developer tooling
  - Documentation & onboarding

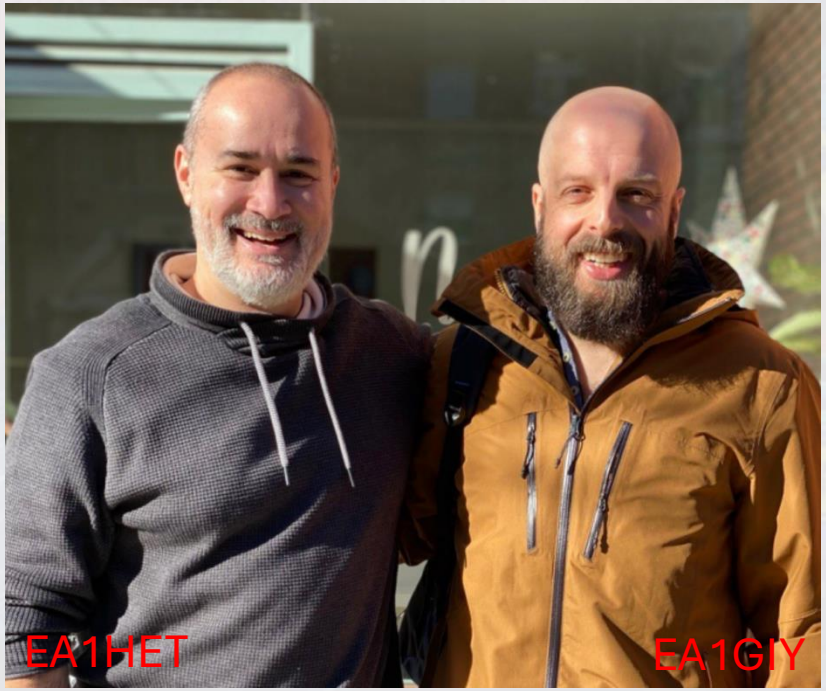
Two teams always in sync

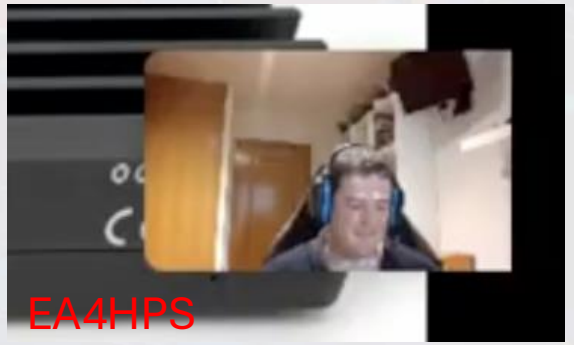
Core (dev) team

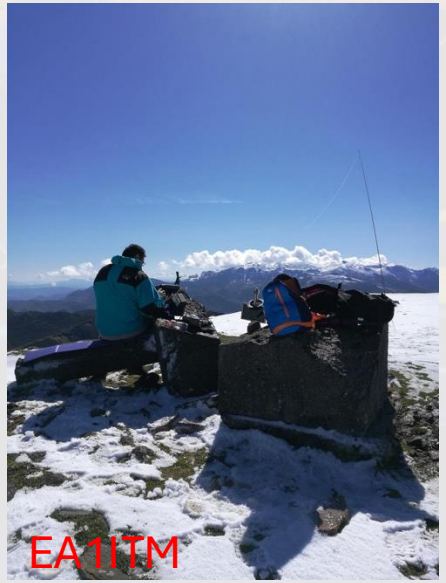
- EA1HET, Jonathan
- EA1GIY, Hugo

Admins team

- EA1ITM, José
- EA10366FD Rafa
- EA4ETJ, Edu
- EA4HPS, Dani







What makes this different?

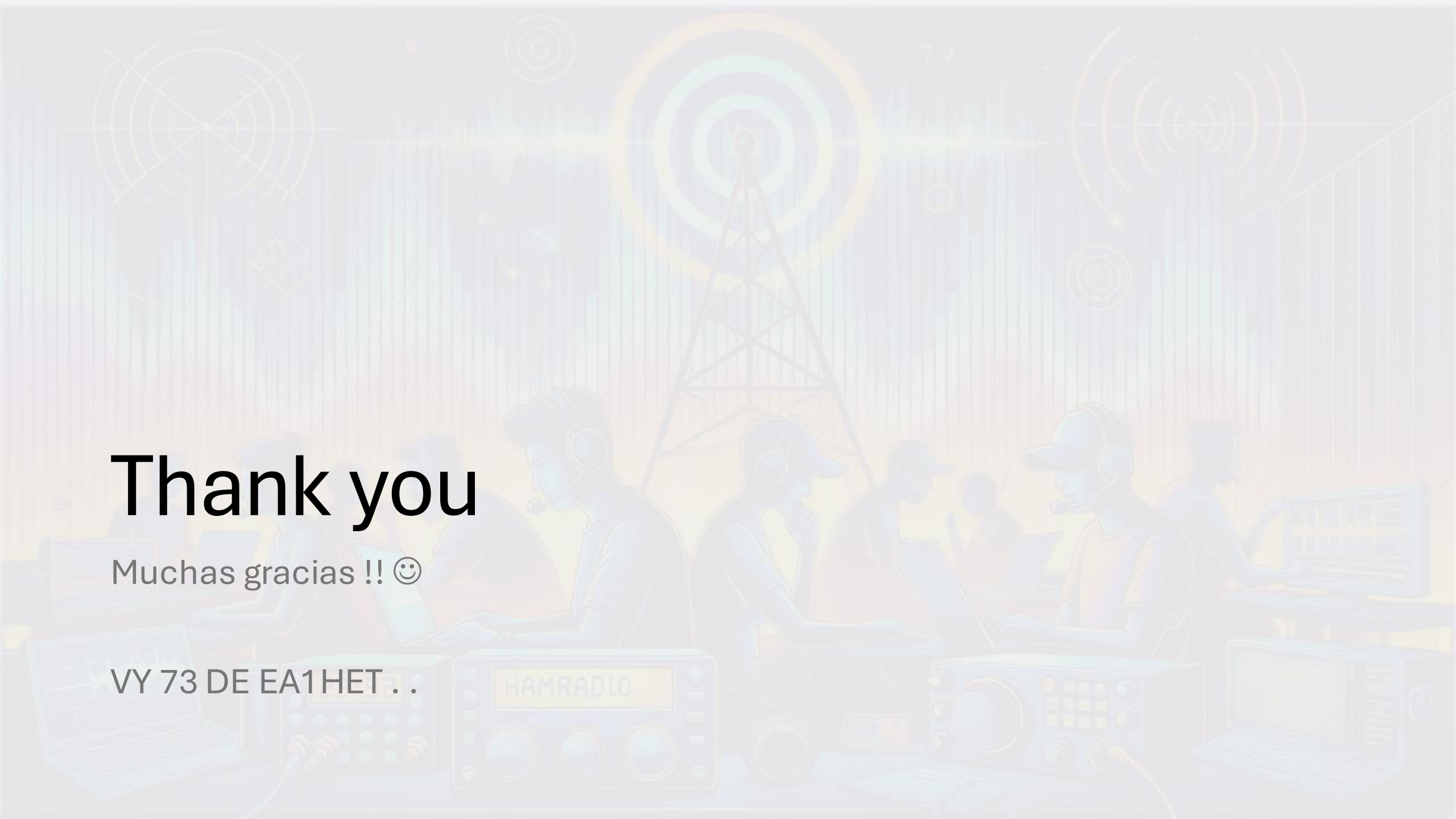
- **Protocol-first**
  - JSON today
  - Protobuf / AVRO tomorrow
  - Backward compatibility as a rule
- **Filtering at the core**
  - Not clients fighting noise
  - The network itself helps reduce abuse
- **Federated by design**
  - Clubs, regions, communities keep autonomy
  - Global visibility without hard central control
- **Built for the future**
  - Radio → Internet → Mesh → LoRa → Unknown next step
  - Same data model, different transports
- **Open documentation**
  - Specs, not screenshots
  - Everything is documented at https://hamradio.tools/docs

Technology stack

Something… *boring, proven, scalable*

Design philosophy: we prefer simple systems that can be composed over complex systems that can’t be understood or explain

- **Python**
  - APIs
  - Data processing
  - Integration glue
- **Rust**
  - High-performance services
  - Telemetry & ingestion
  - Memory-safe concurrency
- **PostgreSQL**
  - Persistent structured data
  - Callbook & metadata
- **Redis / Dragonfly DB**
  - Caching
  - Rate limiting
  - Fast lookup tables
  - Cluster-wide state
- **MQTT (EMQX / Mosquitto)**
  - Core transport layer
  - Pub/Sub by design
  - Efficient over unreliable links
  - Perfect match for radio-driven data



Thank you

Muchas gracias !! ☺

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