

What is Meshtastic?

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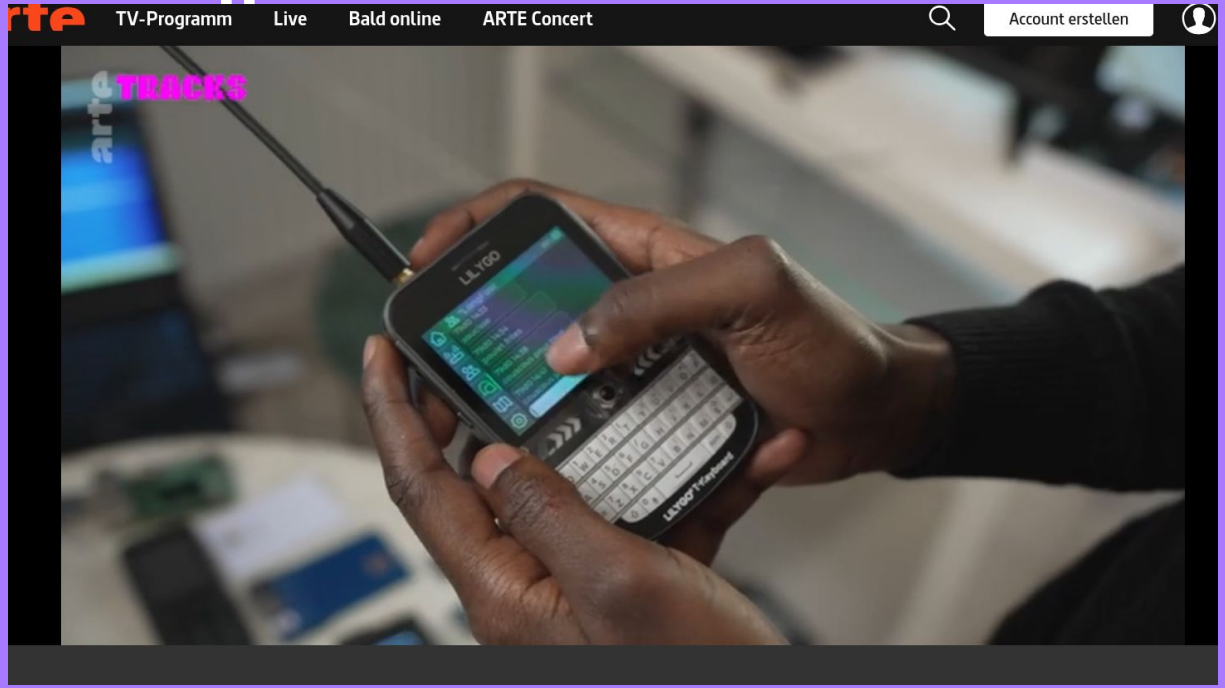
hack-mas.at

About me

- Computer Vision Researcher / Software Developer
- Plays music / rides his bike
- Retro computing / gaming/ cameras (hello floppy-cameras!)
- graz.social/@reini1305



Arte – Tracks: Off Grid



https://www.arte.tv/de/videos/126484-047-A/tracks/

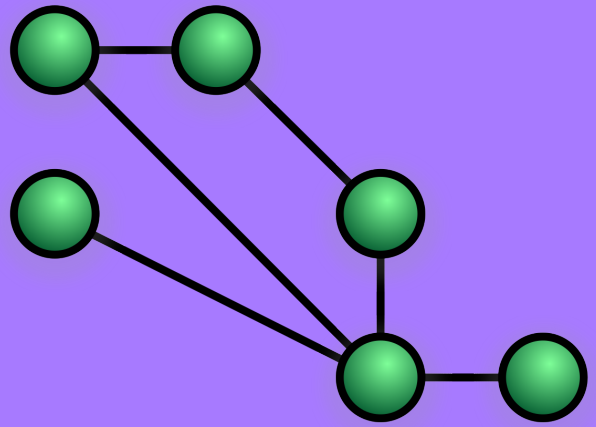
What is Meshtastic?

- Open source off-grid decentralized mesh protocol
- Runs on low-power devices
- No dependency on cell towers or other infrastructure
- Encrypted messaging (channels, DMs)
- Low-bandwidth (in the kBit/s), no internet replacement



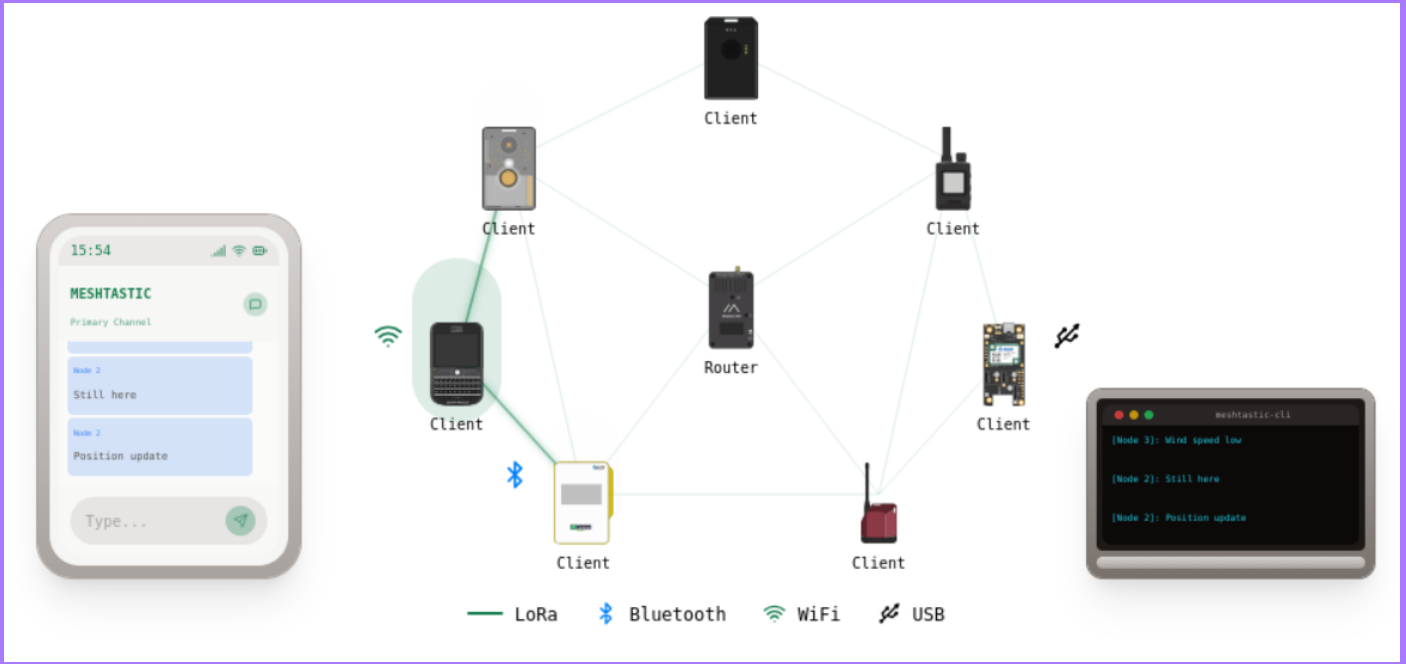
What is a Mesh?

- Network topology where nodes connect directly, non-hierarchically and dynamically and cooperate to route data
- In case of Meshtastic, hops are via non-reliable wireless connections

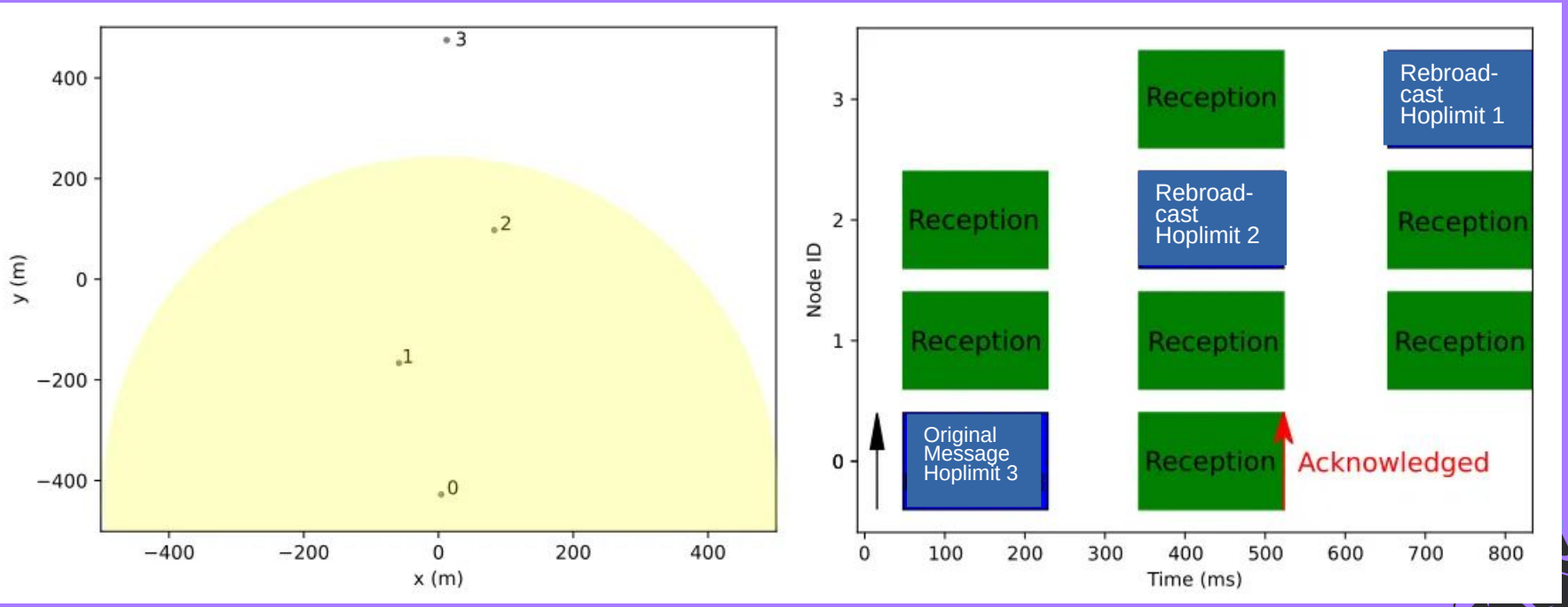


By Original: Foobaz / SVG: Rehua - Own work based on: NetworkTopology-Mesh.png, Public Domain, https://commons.wikimedia.org/w/index.php?curid=31012050

Meshtastic Components

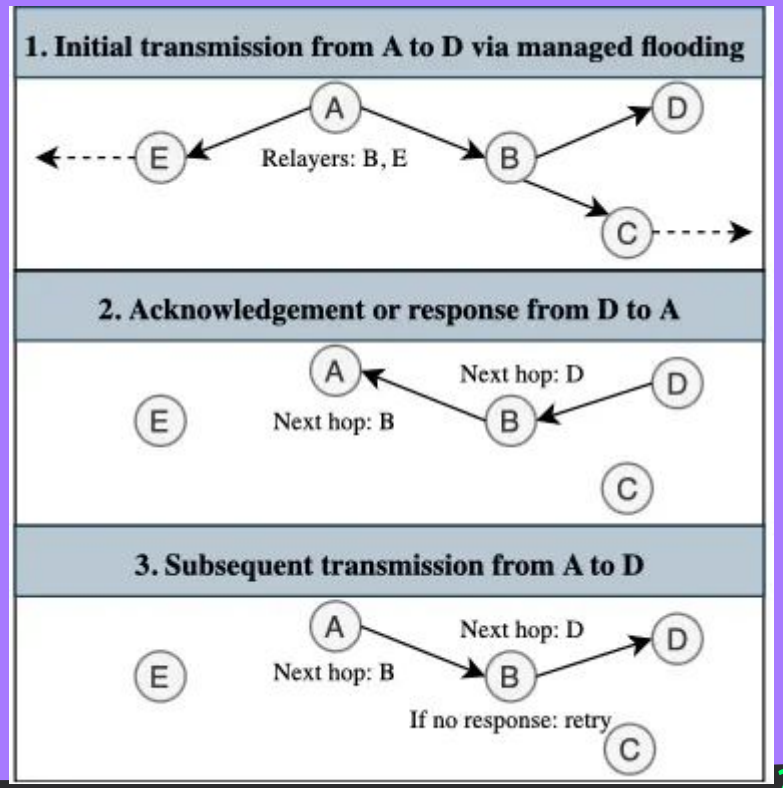


Routing Protocol - Broadcasts (Managed Flooding)



Routing Protocol – DMs (Next-Hop Routing)

- Start with managed flooding
- Wait for acknowledge
- If node forwarding acknowledge was also retransmitting, save as next hop
- Fall back to managed flooding if topology changes



Device Roles

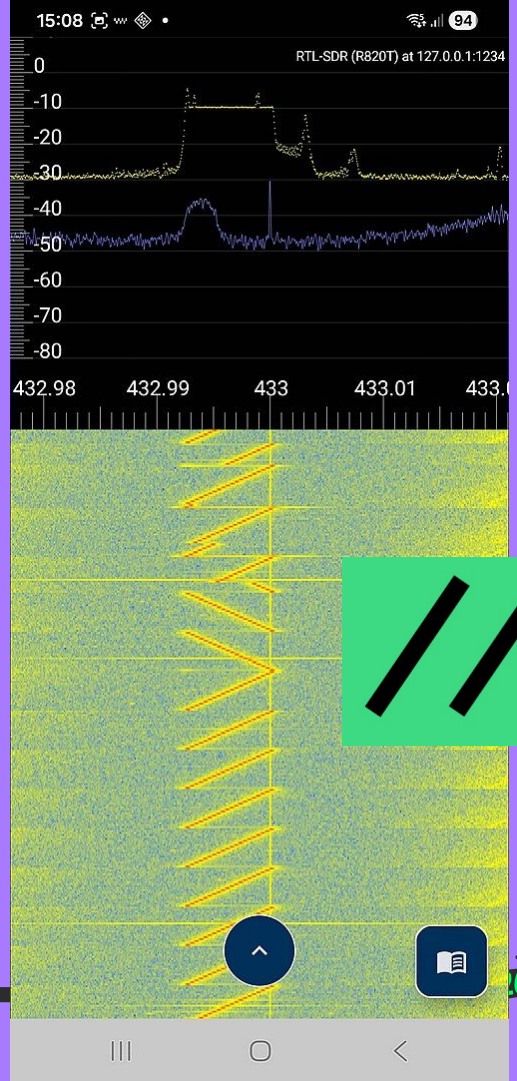
- Client: default role, forwards messages
- Client Mute: Client, but doesn't forward messages
- Client Base: Client, but 0-hop forwards messages from favorite nodes
- Router: strategically placed node (mountain)
- (Sensor, Tracker)



https://meshtastic.org/blog/choosing-the-right-device-role/

LoRa - Long Range

- CSS (Chirp Spread Spectrum) modulation
- Up/Down sweep frequency modulation
- Spreading factors 5-12 (number of bits per symbol)
- 868 / 433 MHz in EU (10% duty cycle)
- 0.18 – 21.8 kBit/s (default 1.07 kBit/s)



By Xofc - Own work, CC BY-SA 4.0,
https://commons.wikimedia.org/w/index.php?curid=190243617

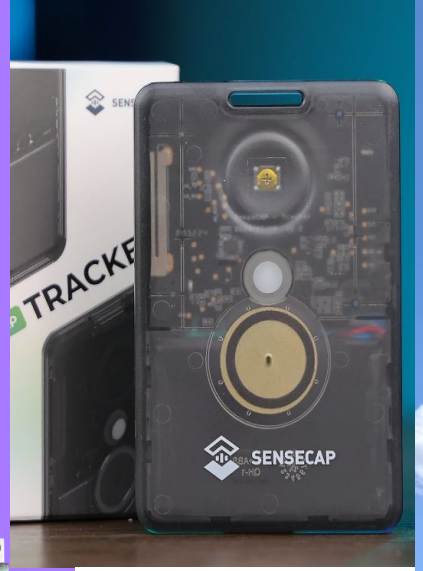
What is a node?

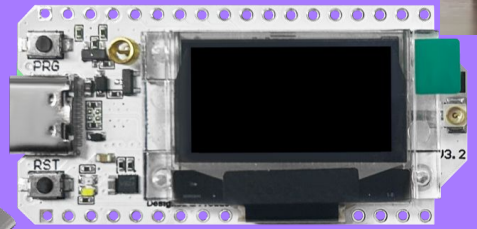
- LoRa radio module
- Microcontroller
- Power supply
- Optional
  - Input / Output
  - GPS
  - Sensors



Commercially available nodes

- Dev Boards
- Trackers (keychain, lanyard)
- Self-contained (Blackberry-style)
- Solar-Powered











Håck ma's!

Usage (Demo)

- Default public channel (LongFast)
- Private channels
- DMs



Applications

- Off-grid text communication (emergency, hiking, cruise ships, fun, ...)
- Sensor networks (MQTT uplink, HomeAssistant integration)
- People/Animal tracking (TAK/ATAK)
- Whatever you can think about (that doesn't need more than a few kBit/s of bandwidth)



Encryption

- Public channels
  - PSK AES256-CTR
- DMs
  - Public / Private keys (x25519 and AES256-CCM)
- Problems / Missing Features
  - Device security: happily pair with new host
  - If lost, keys and all public channels are retrievable (“Harvest now, Decrypt later”)
  - No Authentication (“Trust On First Use”)
  - No Integrity check



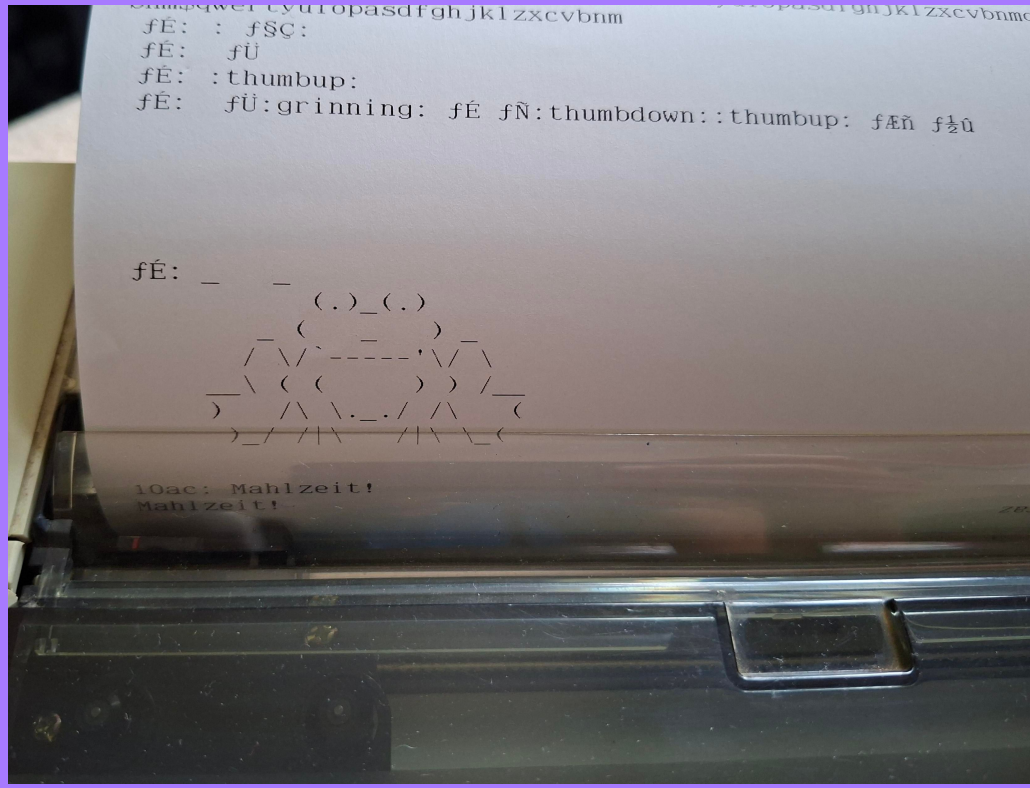
Modules

- Telemetry
- Detection Sensor
- MQTT
- Canned Message
- Range Test
- Mesh Beacon
- Serial



Having Fun with Meshtastic

- Brother EP44 typewriter
- 25-pin serial connection (terminal)
- HelTec V3
- MAX232 level shifters
- Modified Serial module
- = Mesh-Teletype



How to get started

- Order two nodes minimum, two is a mesh!
- While you wait, read https://meshtastic.org/docs/introduction/
- Flash newest firmware https://flasher.meshtastic.org/
- Find default settings for your region (typically LongFast in Austria, sometimes also MediumFast)
- Write a “Hello” or “ping” in the default channel and see what happens :)



What's next for Meshtastic?

- 2.8 firmware currently in beta (stress tested at DEFCON)
- New (default) presets for larger meshes (EU default unreliable above e.g. 120 nodes)
- XEdDSA based packet signing
- More and more commercial nodes



Thanks for your attention!

- graz.social/@reini1305
- Meshtastic FRG3

