Meshcore

Holsworthy Amateur Radio Club
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TLDR

- MeshCore is a LoRa-based mesh networking protocol and software project created by Scott Powell in 2024.
- It is designed for low power off-the-grid text communication, therefore not depending on cellular or other networks.
- It forms self-organizing mesh networks in which messages can be relayed across multiple intermediate nodes.

Technology

- Unlicensed Radio
  - Industral Scientific and Medical (ISM) band
  - Country or regionally specific frequencies (869MHz or 915MHz)
- Very Low Power
- Mesh consists of LoRa Routers and Nodes only
  - No internet
- Commonly cheap ESP32 based, often using Lilygo or Heltec devices

Features

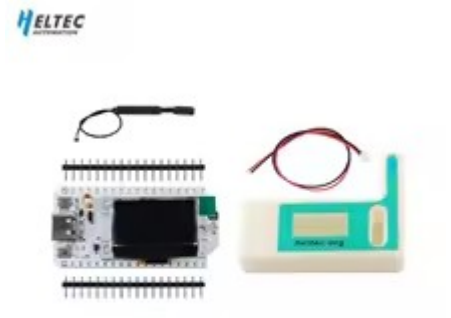
- LoRa
- Distributed
- Low Power Budget
  - Remote Telemetery
- Secure (with encryption)
- Decentralised
  - No servers or internet dependencies

Limitations

- Low Data Throughput
  - Short textual messages only
  - Audio and Images impractical
- Power Limitations and ISM constraints
- Range
  - Influenced by Terrain, Obstacles, Antenna Placement

Typical Devices (Nodes)

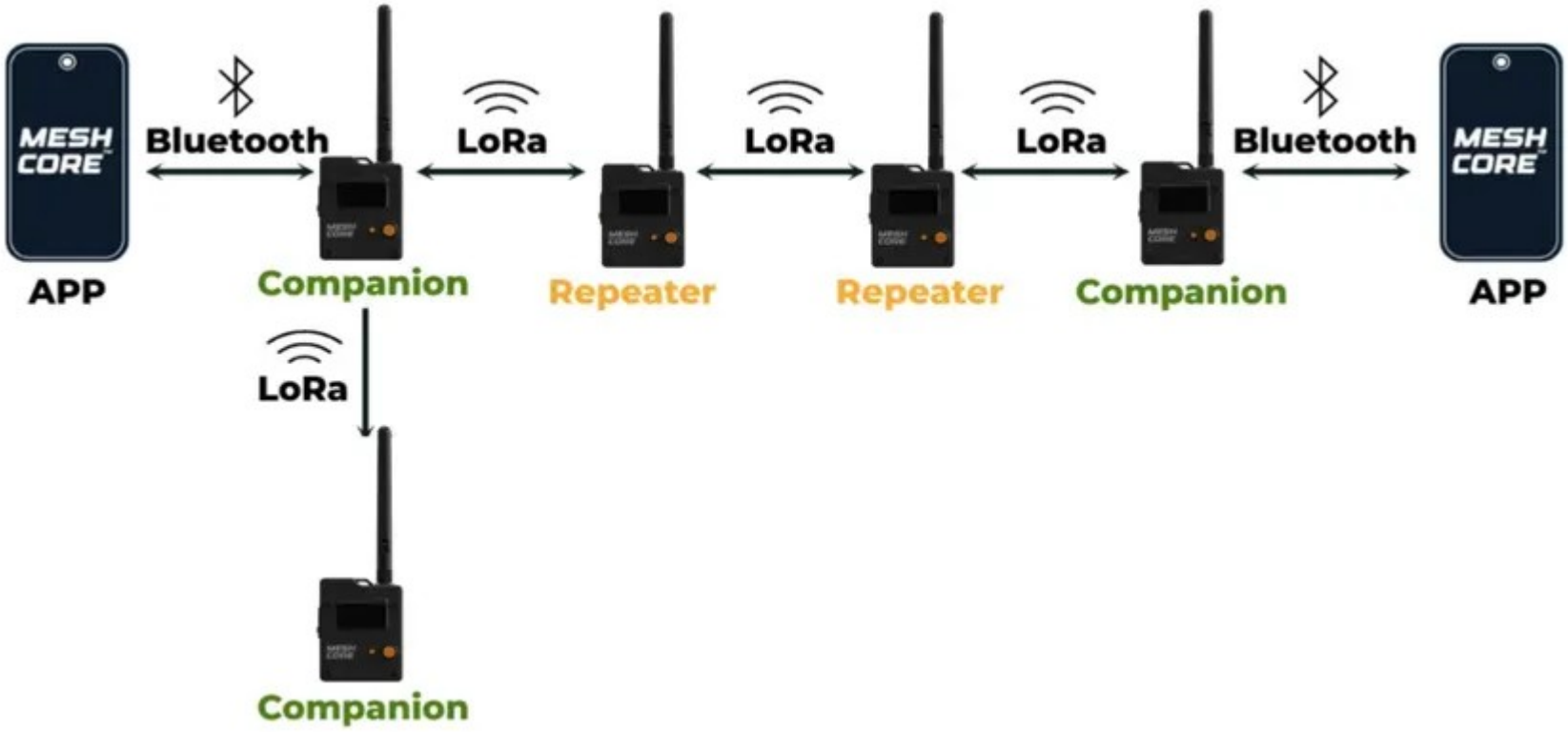
- Heletc V3
- Heltec V4
- Lilygo T-Deck Plus
- Lilygo T-Beam
- SenseCAP T1000
- Thinknode M5



Typical Devices (Repeaters)

- SeeedStudio SenseCAP Solar Node
- Build your Own
  - Heltec devices
  - RAK Devices
  - SeeedStudio devices

Mesh Schematic



Connections between devices

- Mobile Phone App to Node
  - Bluetooth (For firmware updates often a WiFi or USB connection is established)
- Node to Repeater, and Repeater to Repeater
  - 869MHz RF
- Node to Computer
  - Serial over USB, Bluetooth or sometimes TCP/IP

What do I Need?

- To Start with:
  - Companion device (Node) and Android phone or iPhone
  - All-in-one device like Lilygo T-Deck
- Then, maybe:
  - Repeater
    - Processor
    - Antenna
    - Power source
    - Mounting etc

Where do I Get stuff from?

- Ali-express
- Seeed Studio
- Lilygo
- RAKWireless

Remember, in the UK you need to use 869MHz kit!

Set up a Companion Device

- You need
  - The node device itself
  - A computer running Chrome based browser
  - USB data cable
  - Working Internet connection
  - Five minutes!
  - The app for your phone installed

channels

- Add public channels
  - #test
  - #walesandwest-chat
  - #hamradio

Region Scope

- swsw – South Wales and South West
  - Allow this in repeaters -
- Others based on Postcodes (ex, pl, tq, tr…)
- or: Do nothing and flood unscoped traffic everywhere

Identifying Routers and Nodes

- Keep it short
- Keep it likely unique
- In repeaters, don’t add text “repeater”
- Repeater ID / Path Hash Size
  - Start of the string of bytes is used to identifying routers and nodes on maps and lists
  - 1, 2 or 3 Bytes are used – Two is recommended so instead of a pool of 256 there are 65000 unique addresses. There are still clashes!

Sending messages

- Connect with Bluetooth
- Configure settings
  - UK Narrow – use the preset; must match.
  - Name
  - BT Code
  - Set long periods between adverts to keep traffic down
  - Experimental: Path Hash Size
- Send message

Did my message go anywhere?

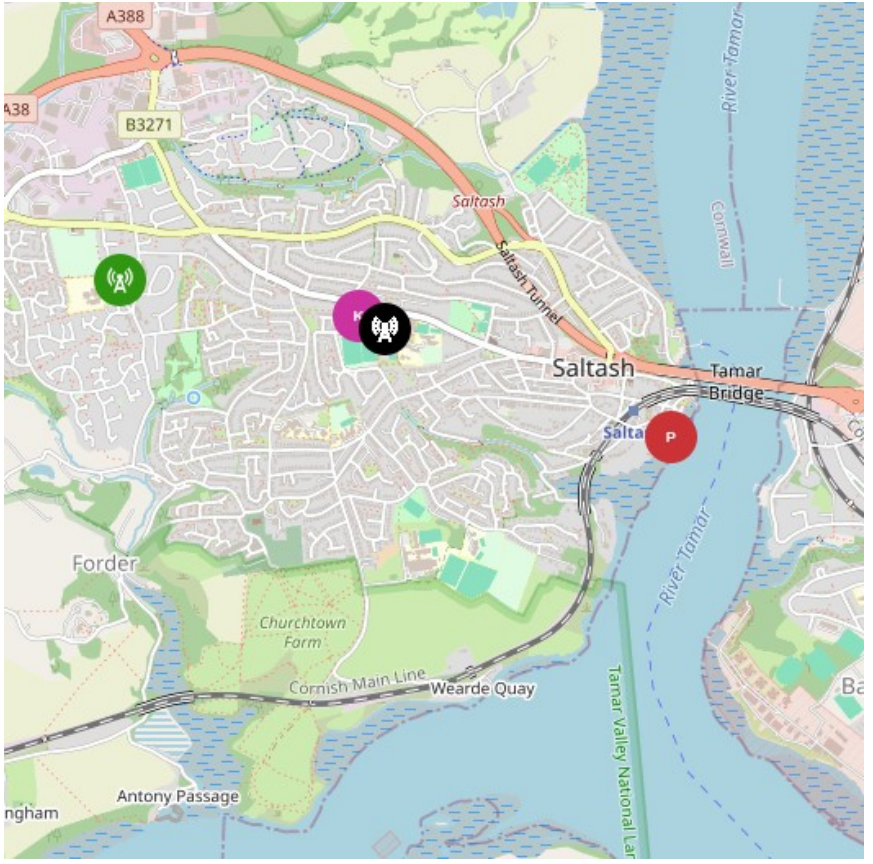
- The app will tell you if your message was repeated
  - ONLY the first hop – so “repeated 2 times” means two repeaters 1 hop away saw the message
- Bots – if you send certain strings, autoresponders *may* reply
  - !test, test, ping, harc
- Your buddy or some random stranger replies!
- Meshrank.net and other monitors record traffic

The Internet Connection

- Observers
  - Clients that simply listen to the RF stream
  - Usually feed out to an MQTT stream
  - Sites aggregate reports to determine message paths and success
- They ARE NOT part of the mesh

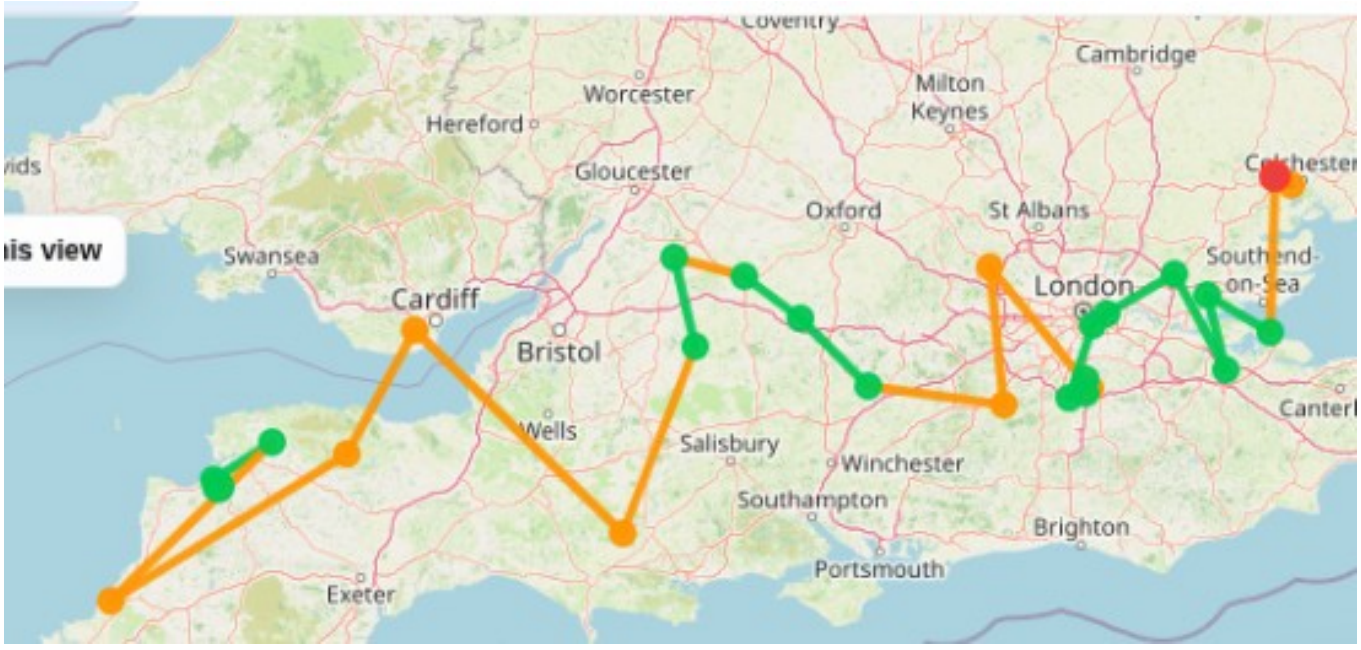
Maps

- Some of the MQTT streams are used to populate maps with nodes and repeaters
- Some maps are manually populated
- Most maps seem incomplete

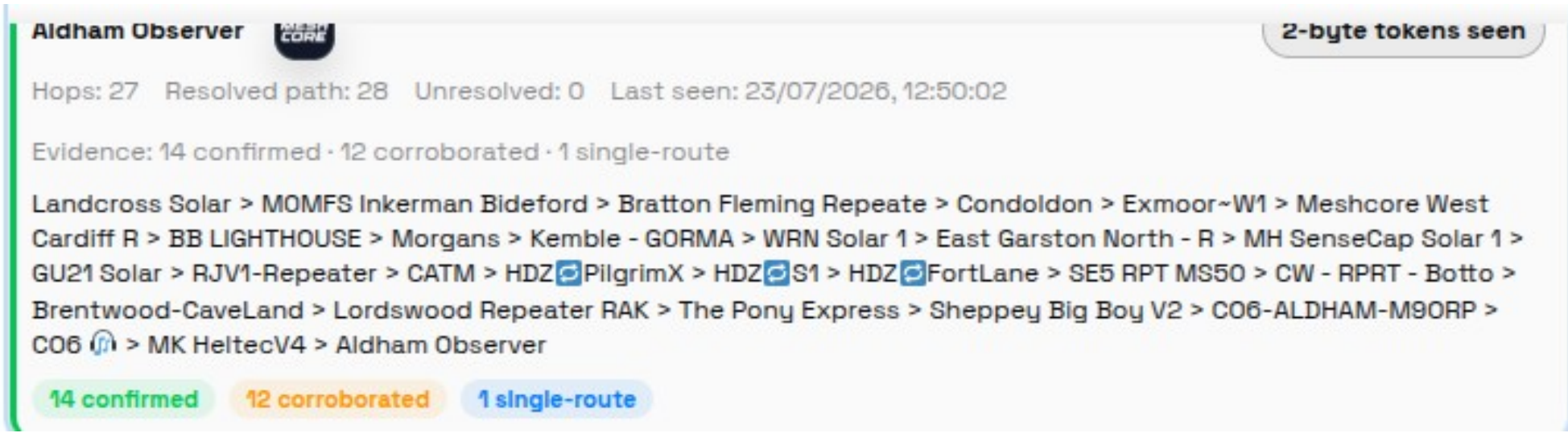


Tracing Tools

- Meshrank.net lets you see
  - Which & how many observers saw your message pass by
  - Where your message travelled



Path Tracing



Repeaters

- Only relay messages
- More Height Means Better Range
- Line of sight maximum range suggested up to 9 miles
  - Occasionally more with good conditions
  - Yagi antenna will concentrate directional gain
  - Atmospheric conditions can lead to skip

Meshcore for Ham Radio

- There is a #hamradio public channel
  - Traffic seems quite low, though
- For spotting
  - Alternative where APRS or Mobile signals poor
- Experimenting with propagation
- Emergency or Grid-Down situations

Other Tools

- Meshmonitor
  - Docker application running on Linux PC
  - USB attached node
  - Web interface

Web Site Sources

- https://meshcore.io/
  - This is the REAL Official site for Meshcore itself
  - The “official” on-line firmware flasher
- https://meshrank.net/
- https://meshmonitor.org/
- https://www.ukmesh.com/
- https://meshmapper.net/
- https://discord.com/ meshcore.io channel
- https://github.com/psidnell/swsw-mc-strategy/blob/main/README.md

- A PDF version of this document including the notes pages will be available for download from https://nicknick.co.uk/