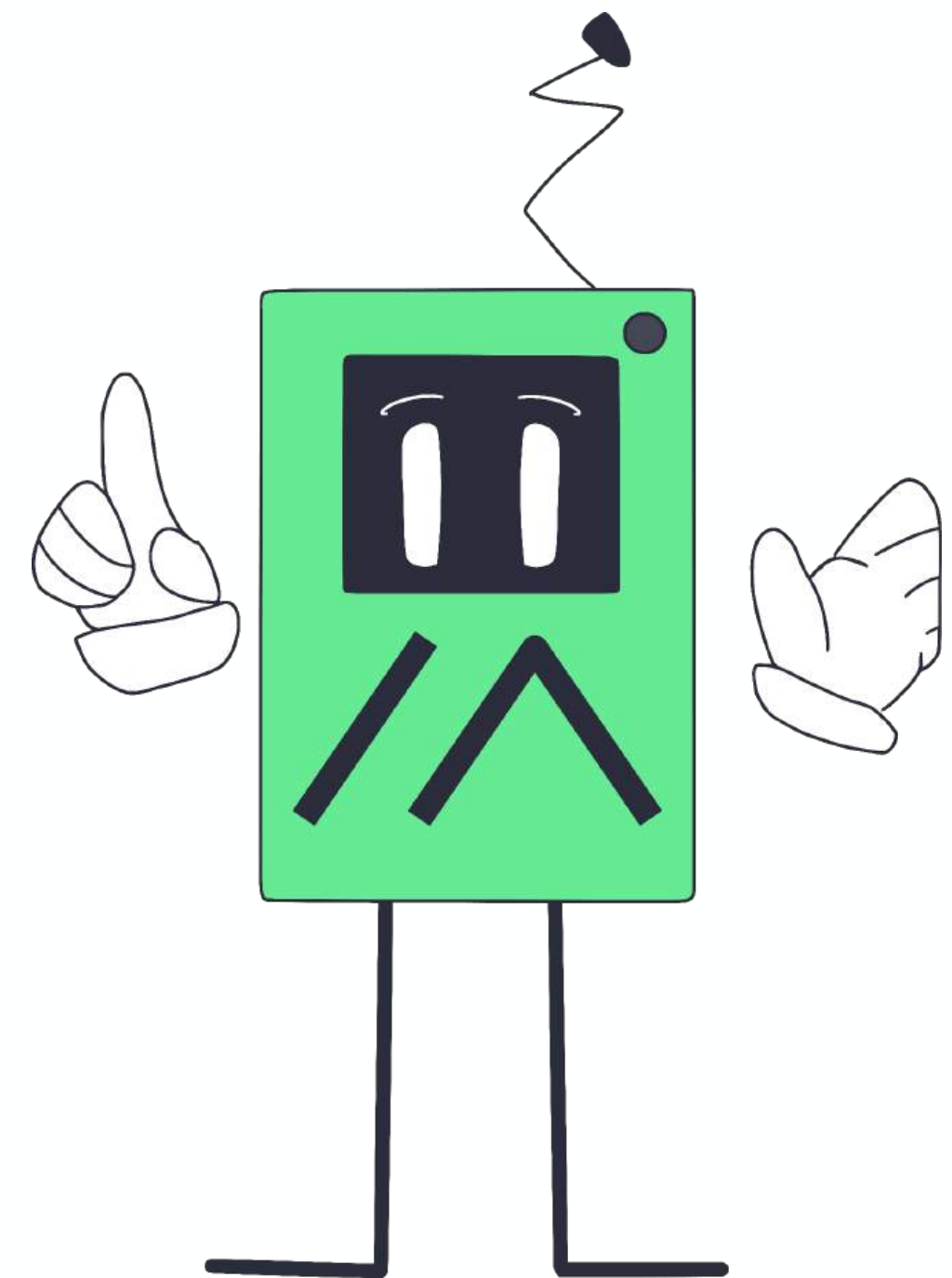


Intro to Meshtastic

For Amateur Radio Operators

M. Patrick (VE6AZX) - March 9 2026



About Me

- Amateur radio operator since 2015
- Interested in packet radio, high altitude balloons, infrastructure and repeaters
- Contributor / developer for Meshtastic site planning utility



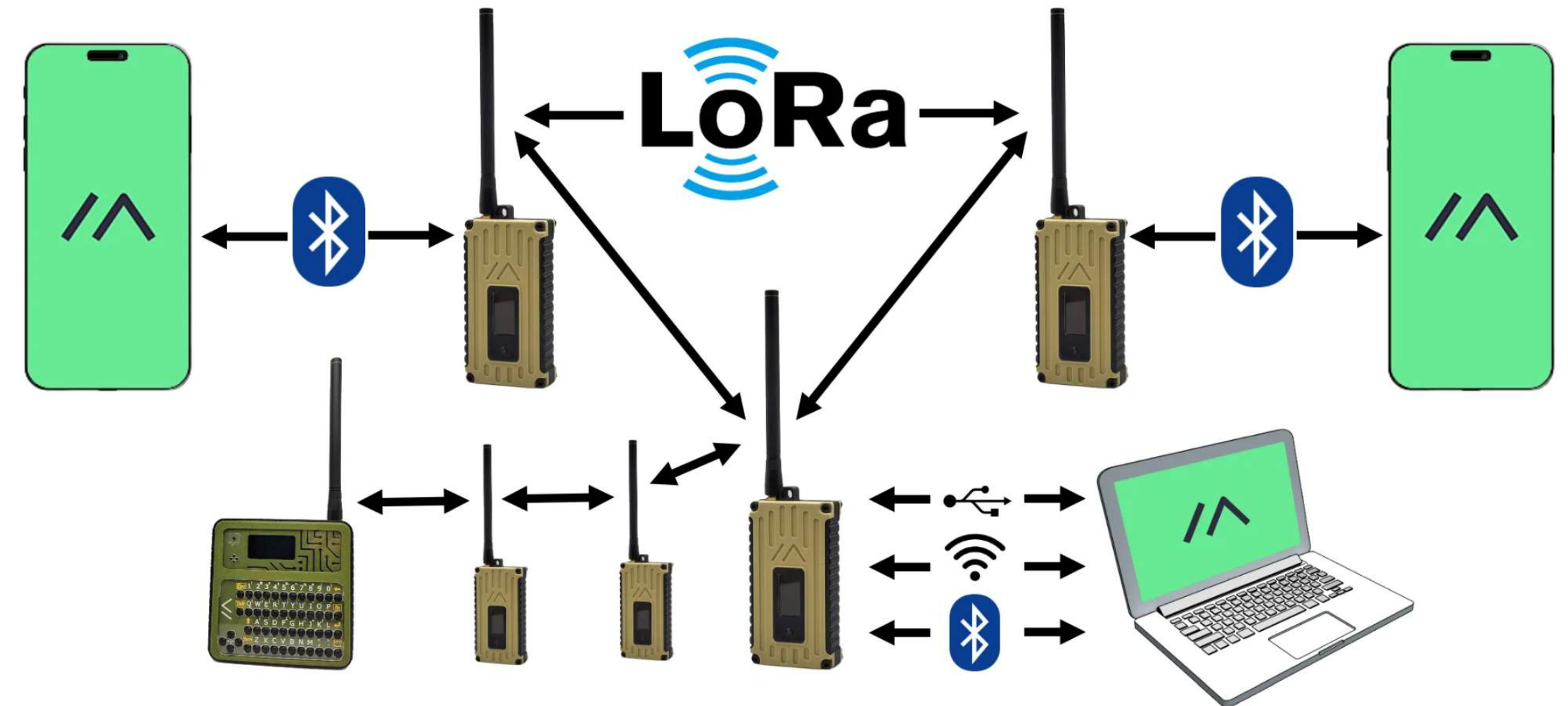
Outline

- The Meshtastic project
 - What it does (esp. compared to APRS)
 - What it's useful for
 - Why we can use (another) packet radio system
 - How we can participate
 - Getting started: hardware and software guide



Meshtastic

- Meshtastic is a mesh radio network built on top of LoRa radios.
- Closest amateur radio analogy: APRS, except that:
 - Every node is also a digipeater
 - There is no central internet gateway / map
 - Messaging is the primary use case, instead of tracking
 - Encryption is on by default (no ham license required)



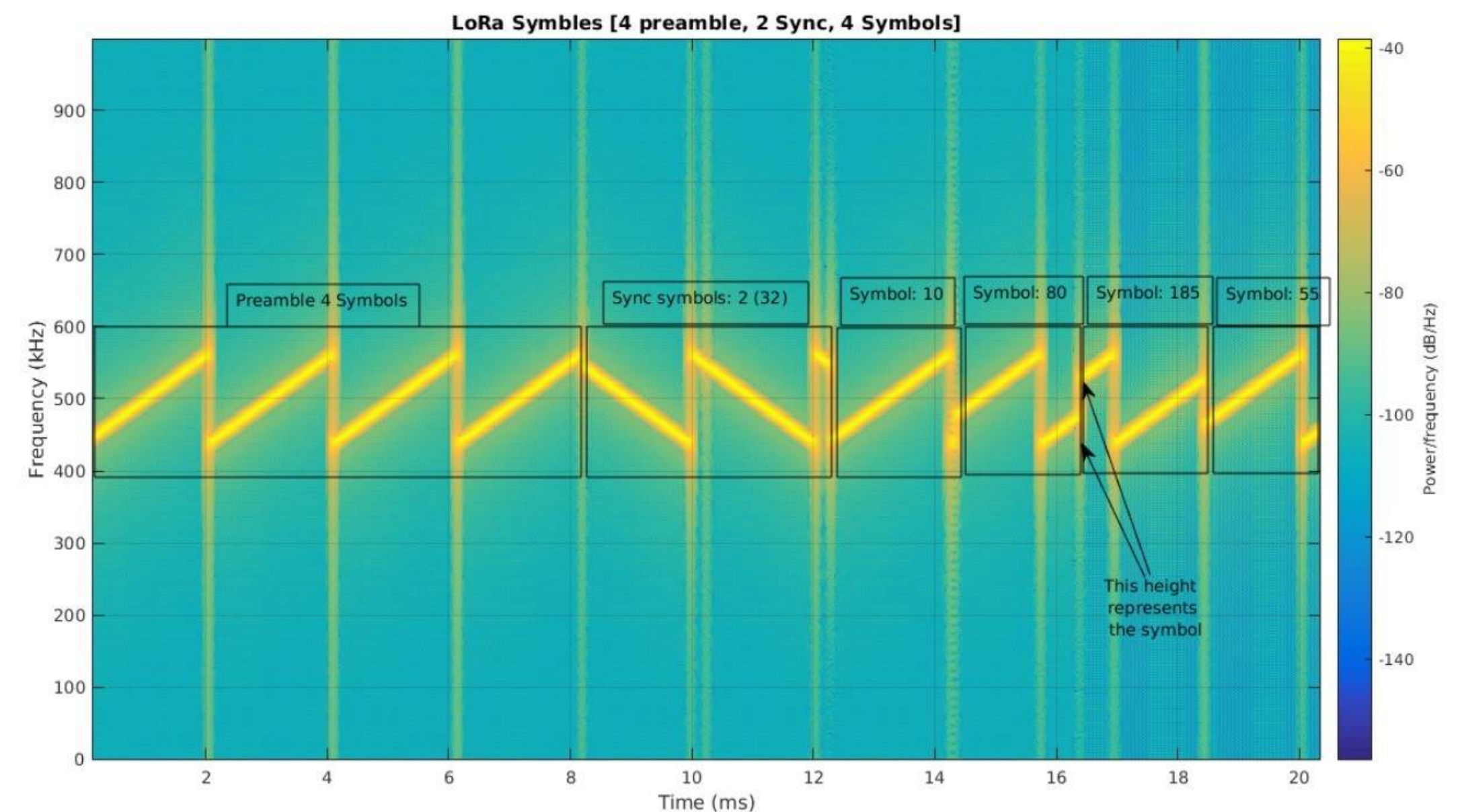
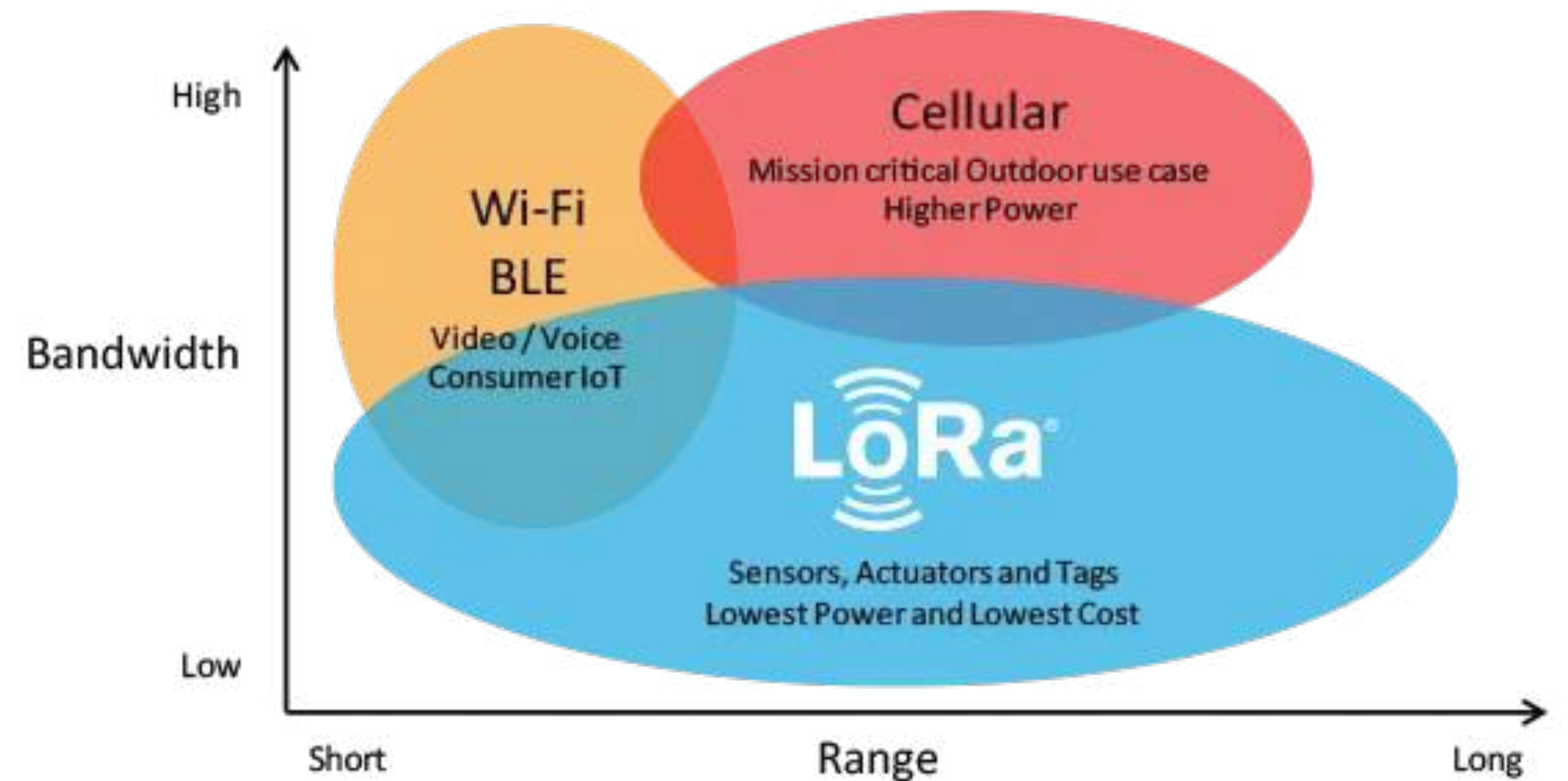
Use Cases

- Text messaging off-grid and without reliance on cellular networks
- Using GPS data to monitor the locations of people (and pets, items, etc)
- Keeping in communication during hikes or communication in areas of poor cellular connectivity.
- Off grid weather/sensor stations
- Creating & sharing waypoints
- Emergency communications



Meshtastic Radios

- Uses long range, low power, ISM band radios (33 cm in ITU region 2)
- Semtech proprietary digital modulation
- Low data rate, but:
 - Very efficient (100+ km on 50mW transmitters)
 - Very inexpensive (30 dollars for a complete radio system).
 - Extreme resistance to QRM



Meshtastic Radios

- APRS: we have a radio and TNC (terminal node controller).
- Optionally: an app or program to control the radio and display APRS data.
- Meshtastic: The radio and TNC are an integrated unit. A phone / tablet running the Meshtastic app pairs via bluetooth.
- Some Meshtastic nodes are standalone (including the display) and don't need the phone + app.



Terminology

- Node: Synonymous with device, can send receive and retransmit messages. One user can have multiple nodes
- Hops: amount of times the message is retransmitted (1-7)
- Preset: a collection of parameters behind 1 setting
- Mesh: the nodes sharing a preset, frequency, and area
- Role: the mode a node can be in such as “client_base” or “client” or "sensor".
- Channel: one or more nodes sharing a specific frequency and pre shared key. We ship with a default channel

Digipeaters

- APRS: A badly placed digipeater can be problematic.
- Meshtastic: Everybody is a digipeater. We handle the packet flooding in software (collisions, timing, retries).
- One node sends, everybody in range receives (within the hop limit)
- Faster / shorter-range presets are used for large meshes (N ~ 100 nodes)

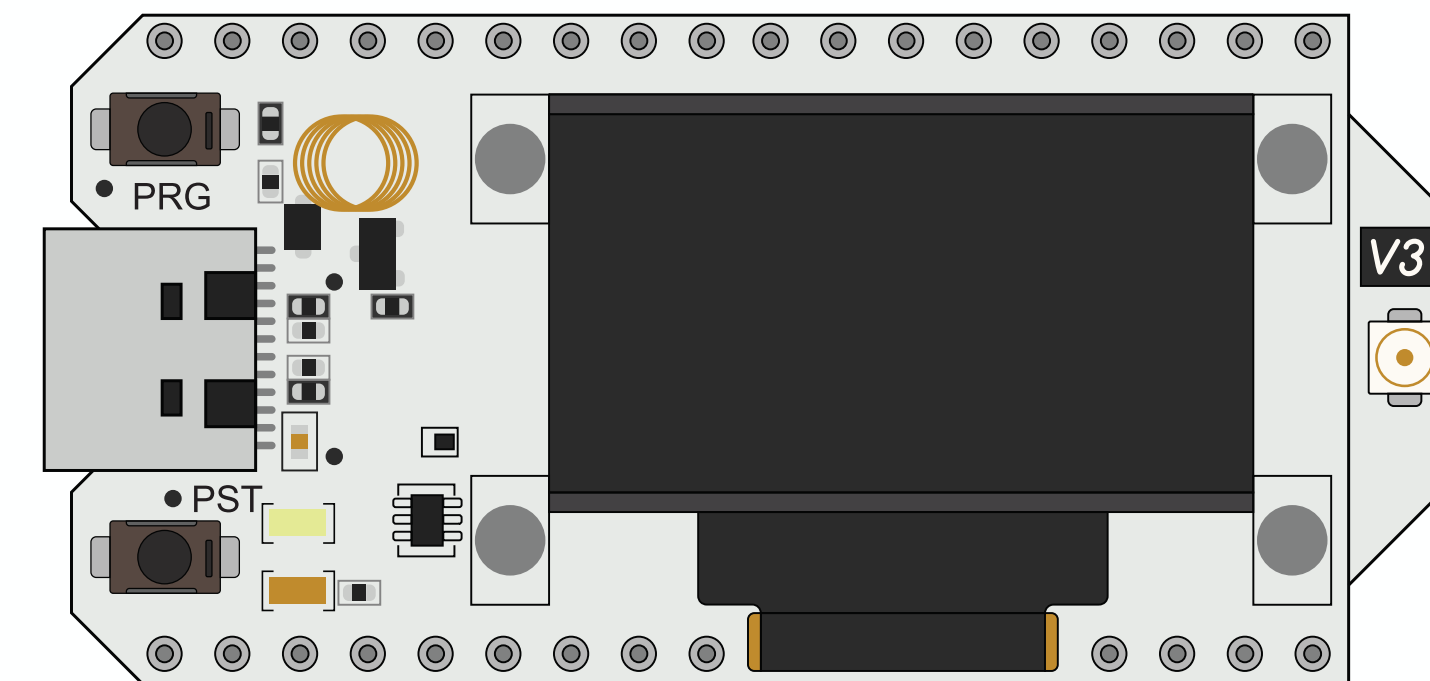
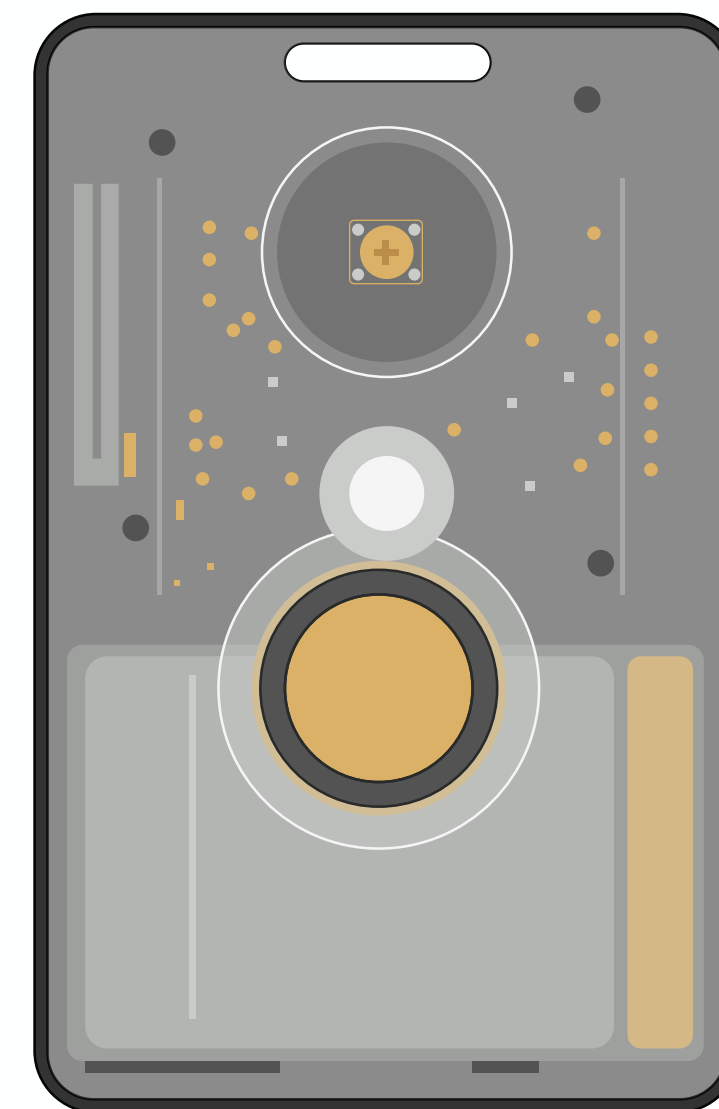


Routing Algorithm

- Meshtastic uses a flooding algorithm to route packets.
- When a node receives a packet with a non-zero hop count, it retransmits it with the hop count reduced by 1.
- A node won't retransmit a packet if:
 - It has already done so recently (tracked in buffer),
or
 - Another node retransmits it (and we hear them doing so).
- Nodes wait a random amount of time before retransmitting to avoid collisions (CSMA like)

Meshtastic Nodes

- Dozens of commercial / DIY devices available.
- Vary in cost, features (display, physical controls, antenna options)
- All of them basically work at this point.
- Limited or no difference in the actual radio, tradeoff is features/cost / interface.
- See <https://meshtastic.org/docs/hardware/devices/> for supported hardware
- I've picked 2 which are good for starting out with



Recommended Node #1

Seeed T1000-E

- Credit-card shaped unit with integrated battery, antenna, GPS, and buzzer + LED
- Extremely popular, comes pre-flashed with Meshtastic firmware
- Long battery life (3 days or more)
- Form factor makes it good for tracking, uses phone app for messaging.
- Cost: ~\$54 CAD + shipping



Recommended Node #2

Heltec Lora V3/V4



- Small USB dongle
- Cheap! (30 CAD on amazon)
- External antenna connection (u.fl to SMA)
- Can be battery powered (less longevity than the T1000E)
- Includes WiFi - if you want to turn it into an i-gate.



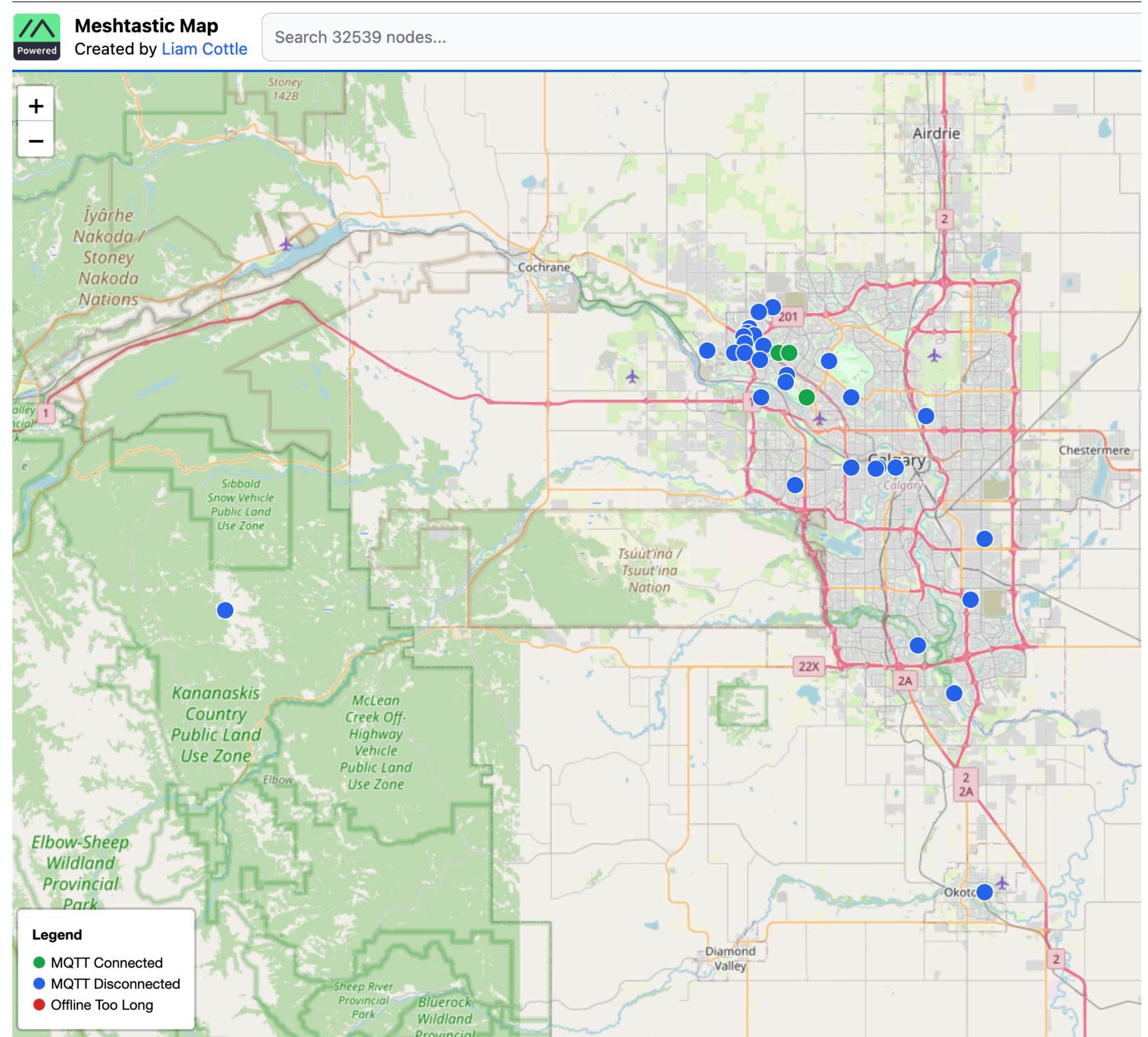
Infrastructure Nodes

- NRF52840 based nodes are very power efficient
- Solar panels of ~5W can sustain them year-round
- Pre-made and custom options:
 - RAK Wireless WisBlock series (varies depending on features, can be had for ~60 CAD)
 - Seeed solar P1 node (~120 CAD)



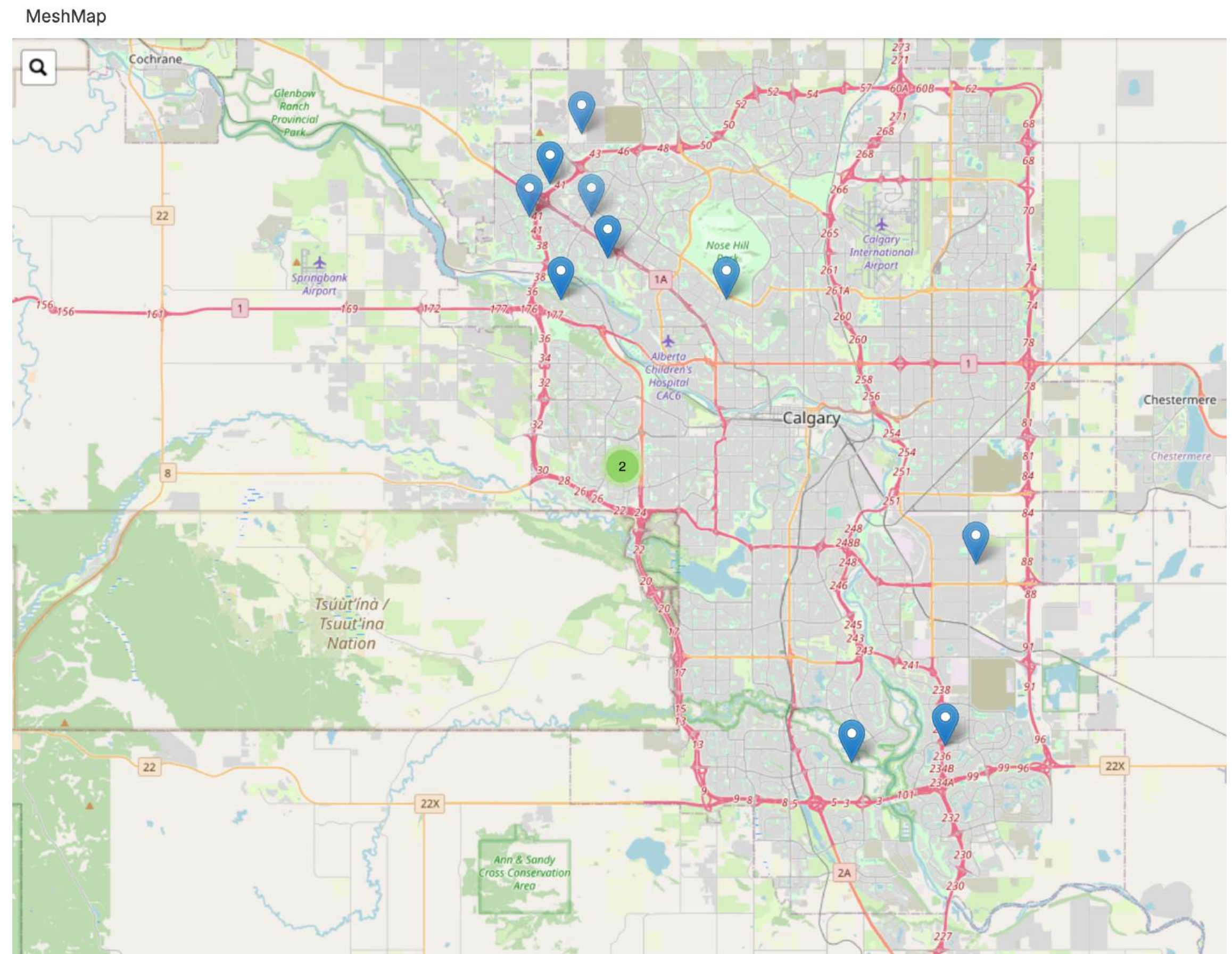
Calgary Mesh

- There are at least two meshes in Calgary
- One uses the default presets (~1000 bps). When you turn on your node for the first time, this is what you will see
- A newer, smaller mesh uses a wider bandwidth for faster data rates (~2000 bps) which allows for more nodes
- Some of the best infrastructure is on the second mesh (see <https://yycmesh.com/about> for channel settings)



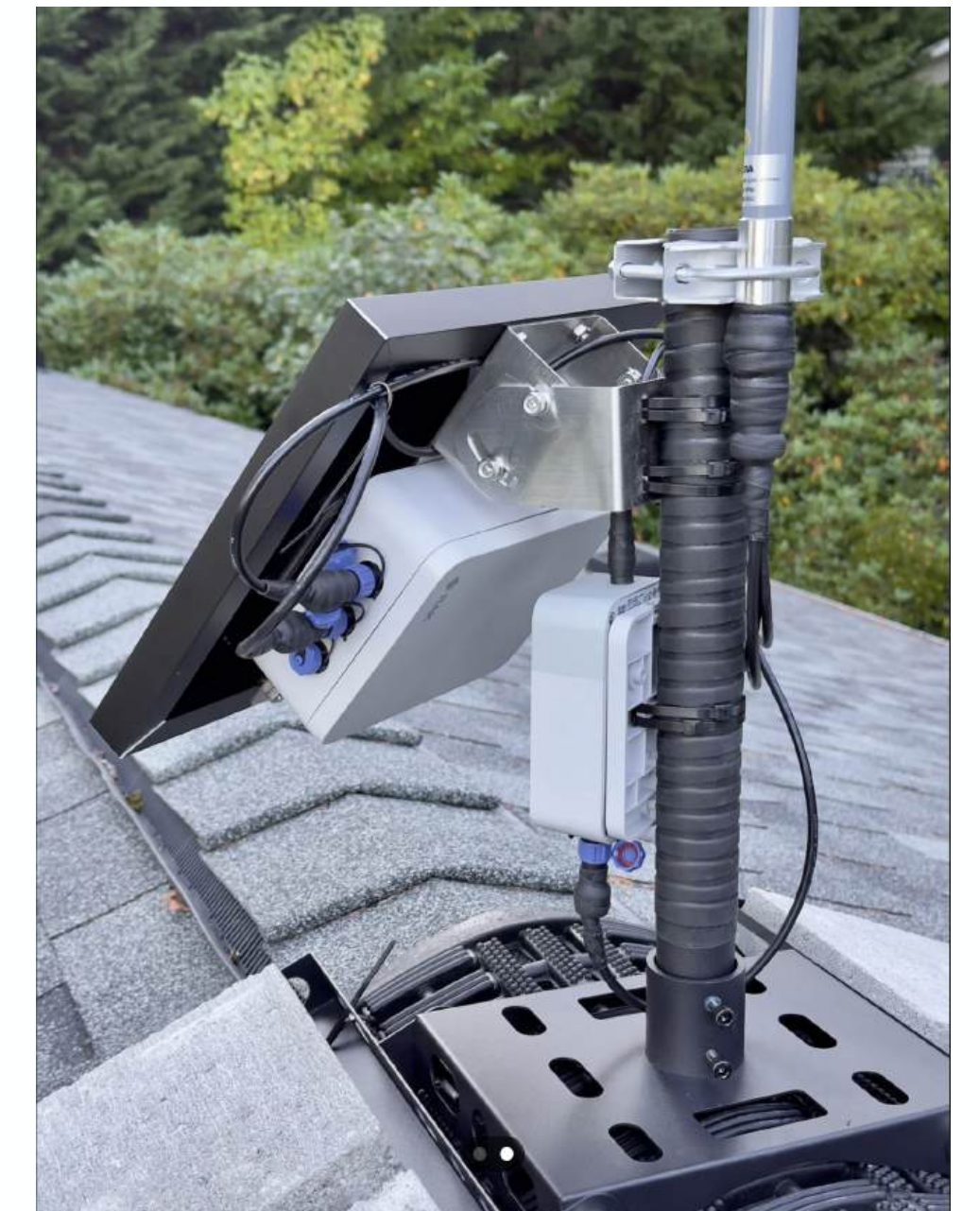
A note about i-gates

- Meshtastic keeps MQTT traffic (roughly equivalent to I-gated traffic in APRS) to a minimum.
- RF traffic first.
- Different meshes use different presets, not all have an internet gateway.
- Node count and layout is not centrally maintained (no real equivalent to aprs.fi)
- This is a good thing



Repeater nodes

- There is no difference in software (a node is a node is a node), however...
- Remote, solar powered infrastructure nodes form the backbone of the mesh
- Mountains, tall buildings, cell towers are all important.
- Cheap hardware and low power requirements make deployment on a large scale possible.



How can we help?

- **Infrastructure.**
- Amateur radio operators have access to some of the best repeater sites available
- We know how to build remotely operated hardware which survives challenging conditions
- Getting access to building roofs, towers, or mountains is incredibly difficult without a good network
- **We can help expand and build the mesh to achieve APRS-like coverage.**



Demonstration

Conclusions

- If you want a new take on APRS, which emphasizes text-messaging, this is worth a look!
- Encryption, transmit power, are not automatically compatible with amateur radio
- There is still significant overlap
- The amateur radio community has much to offer - technical knowledge (remote sites particularly), networking, and RF are absolutely needed to build a strong mesh.
- Meshtastic provides a path to bring new people to our hobby (low barrier to entry, no need to pass a test to get started), and that's an opportunity.