Cycling, Gravel, and Ultra-Endurance Events

Long-distance cycling events - gran fondos, gravel races, bikepacking routes, and ultra-endurance events - span dozens to hundreds of miles, making traditional radio-based support communications challenging. LoRa mesh can supplement support communications for both safety monitoring and participant experience.

> **Mesh is a coordination tool, not a rescue system.** It is best-effort - messages may not get through, and positions can be stale or missing. It is NOT a substitute for a cellular call, licensed event radio, a PLB/satellite messenger, or 911. Search and rescue does NOT monitor Meshtastic. On a long course a downed rider can easily be out of range of any node. Carry dedicated safety gear and run a primary comms plan; use mesh only as a supplement.

Use Cases in Cycling Events

- **SAG wagon coordination:** Support vehicles tracking rider positions and routing efficiently to riders in need
- **Medical team dispatch:** Crash or medical event location sharing to nearest first aid support. *Mesh medical alerting depends on having a deployed, staffed relay network covering the whole course; it is best-effort and unmonitored, so it must be backed by a primary comms plan (cellular, licensed event radio, or formal dispatch) and never relied on alone. A downed rider may be out of range of every node.*
- **Course condition updates:** Road hazards, weather changes, re-routes broadcast to all participants
- **Family tracking:** Participants' families can monitor position via community mesh map (if riders carry nodes)
- **Time station check-ins:** Automated check-in when rider passes a time station node

Participant Node Options

For riders, the node needs to be light, compact, and battery-efficient:

- **LILYGO T-Echo (~120-130 g cased):** Clips to a jersey pocket or handlebar bag. Has an internal ~850 mAh Li-ion cell charged over USB-C (no AAA cells - the battery is built in and not user-removable). Expect roughly a day of active-GPS runtime - more at low duty, much less in cold. The e-ink display shows basic status without backlight power drain.
- **RAK4631 in minimalist case:** ~20g if stripped of display. Mount to handlebar stem with Gorilla tape or 3D-printed bracket.
- **Phone-paired node:** Node in saddlebag, phone on handlebar for map viewing. Useful if participants want messaging capability.

Cold-weather charging: Never charge a lithium cell (the T-Echo's internal Li-ion or any LiPo/LiFePO4 pack) below 0 °C (32 °F) - cold charging causes lithium plating, permanent damage, and a latent short/fire risk. Discharging in the cold is fine. Keep any battery you intend to recharge warm (near body temperature), and bring a cold device into a warm layer before plugging it in.

Event Infrastructure Layout

For a 100-mile gravel event:

- **Start/finish area:** Room server + base station (permanent GPS-located on map)
- **Aid stations (every 20-30 miles):** Fixed node at each station; powered by generator or car battery. Serves as relay and check-in point.
- **Roving support vehicles (3-5):** Mobile nodes in SAG vehicles. Track positions relative to riders on course.
- **Course marshals at critical junctions:** Mobile nodes; can relay course condition reports.

This layout helps, but do not treat node spacing as a coverage guarantee. Single-hop, ground-to-ground LoRa range is typically only a few kilometres - far less than the 20-30 mile aid-station spacing - so a rider at ground level will frequently be out of range of any fixed node between stations. In open line-of-sight terrain the spacing plus SAG vehicles may keep most participants within a few hops; in forested, rolling, or hilly terrain, coverage gaps are likely and additional relays are needed. Do not rely on this layout for safety-critical coverage.

Privacy and Opt-In Considerations

Not all participants want to be tracked. Best practices:

- Clearly disclose tracking capability in pre-event registration materials
- Offer opt-out: participants can turn off position broadcasting while keeping messaging
- Limit position data retention: purge from map and database after event ends
- Position data for safety use only: don't share with sponsors or use for marketing

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