



# MESHTASTIC

*Off-Grid Mesh Networking for Everyone*

Open source · Long range · No internet required

# WHAT IS MESHTASTIC?

Meshtastic is a free, open-source project enabling long-range, encrypted mesh networking using affordable LoRa radio hardware — with no internet or cellular connection required.



## Mesh Network

Every device is both sender & repeater — the more nodes, the stronger the network



## Encrypted

AES-256 encryption keeps your messages private across the mesh



## Ultra Low Power

Runs for days or weeks on a small battery — ideal for remote deployment



## Open Source

Free software & hardware designs with an active global community

# THE TECHNOLOGY BEHIND IT: LoRa

## LoRa = Long Range

LoRa is a radio modulation technique that trades data speed for extraordinary range and battery life. It operates in unlicensed ISM bands (915 MHz in the US), meaning no license is needed to transmit.

**10–16 km**

Line-of-sight range

**250 kbps**

Max data rate (enough for text)

**-148 dBm**

Receiver sensitivity

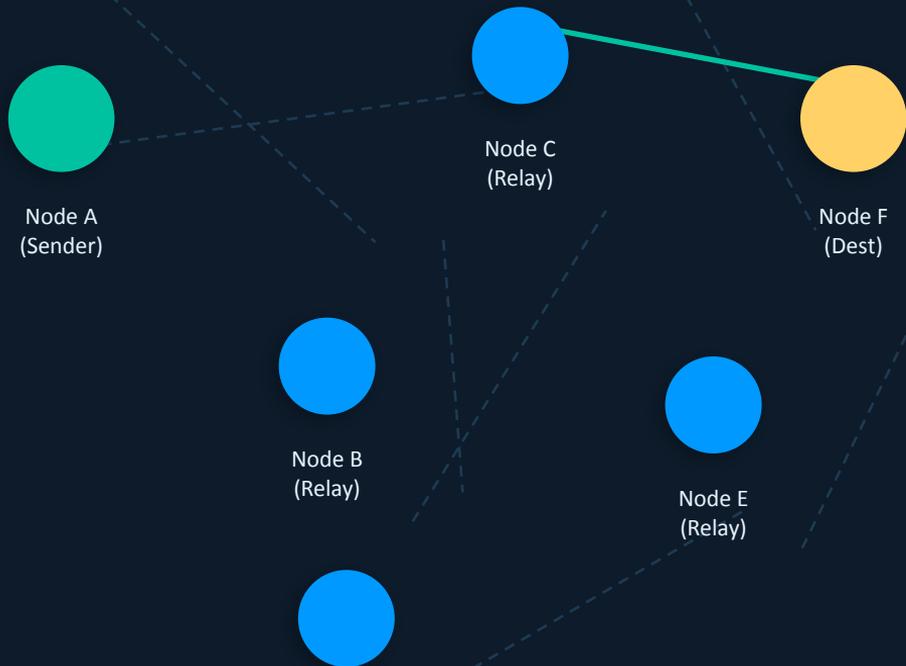
**< 50 mA**

Typical TX current draw

## LoRa vs. Other Radios

Technology	Range	Power	Cost
LoRa (Meshtastic)	10+ km	★★★★★	\$\$
WiFi	~100 m	★★☆☆☆	\$
Bluetooth	~30 m	★★★★☆	\$
Cellular LTE	km+	★★☆☆☆	\$\$\$
Ham Radio (VHF)	km+	★★☆☆☆	\$\$\$\$

# HOW MESH NETWORKING WORKS



1

## Broadcast

Node A sends message to all in range

2

## Relay

Nearby nodes re-broadcast to extend range

3

## Deliver

Message arrives at destination via multiple hops

4

## Deduplicate

Each node ignores messages it already relayed

Default hop count: 3 | Max hops: 7 | Flood routing — no infrastructure needed

# USE CASES: OUTDOOR & EMERGENCY



## Hiking & Backpacking

Keep your group connected on trails where there's zero cell signal. Real-time position sharing and text messaging across mountain ranges.



## Disaster Response

When cellular towers are down, Meshtastic keeps SAR teams, relief workers, and affected communities coordinated.



## Marine & Sailing

Crew-to-crew and boat-to-base messaging in coastal and offshore environments without satellite subscriptions.



## Ski Patrol & Resorts

Reliable comms across ski areas for patrol, lift operators, and families tracking each other on slopes.



## Overlanding / Off-Road

Convoy communication and GPS sharing between vehicles traveling remote dirt roads and backcountry.



## CERT & Preparedness

Community Emergency Response Teams use Meshtastic for neighborhood resilience networks that work when nothing else does.

# USE CASES: COMMUNITY & EVENTS



## Festivals & Events

Coordinate volunteers and staff across large outdoor venues without relying on overloaded cell networks.



## Schools & Campuses

Off-grid messaging across school grounds, college campuses, or research stations in remote locations.



## Community Mesh Nets

Cities and neighborhoods deploy fixed nodes on buildings to create a permanent off-grid messaging backbone.



## Airsoft / LARPing

Tactical communication and real-time GPS tracking for teams in field games and live-action events.



## Research & Science

Environmental sensors, weather stations, and field researchers relay data back over long distances autonomously.



## Developing Regions

Low-cost messaging infrastructure where cellular coverage is sparse — enabling community communications.

# HOW IT WORKS — INSIDE THE SYSTEM

## Protocol Stack

### Mobile App (iOS / Android)

User interface, maps, messaging

### Bluetooth / WiFi

Device ↔ phone link

### Meshtastic Firmware

Routing, encryption, channel mgmt

### Protobuf Packets

Serialized message format

### LoRa Radio Module

Physical radio transmission

## Key Features

### Channels & Encryption

Named channels with shared PSK — only channel members can read messages. AES-256 encryption.

### GPS Position Sharing

Nodes broadcast their GPS coordinates automatically. View friend locations on map in real-time.

### Store & Forward

Router nodes can cache messages and deliver them when a destination node comes back online.

### MQTT Gateway

Optional: nodes with internet can bridge the mesh to the internet for wider-area networking.

### Telemetry & Sensors

Battery voltage, temperature, air quality sensors — all transmitted automatically over the mesh.

# CHANNELS, PRIVACY & SECURITY

## How Channels Work

### LongFast (Default)

Public default — anyone can join

### Your Private Channel

Custom name + shared secret key

### Admin Channel

Device management — highly restricted

## Security Details



### AES-256-CTR Encryption

All channel messages encrypted end-to-end with a 256-bit key shared among channel members.



### PKI for DMs (v2.5+)

Direct messages use public-key cryptography. Only the intended recipient can decrypt.



### No Central Server

There is no Meshtastic server that can read your messages. Encryption happens on-device.



### QR Code Channel Share

Share channel credentials via QR code — simple and secure onboarding for new members.

# HARDWARE: SUPPORTED DEVICES

## Most Popular

### LILYGO T-Beam

~\$35–50

- GPS built-in
- 18650 battery holder
- 0.96" OLED display
- SX1276 LoRa chip
- ESP32 processor

## Budget Pick

### Heltec V3

~\$20–30

- Compact form factor
- Built-in 0.96" OLED
- USB-C charging
- SX1262 LoRa chip
- WiFi + BT

## Pro Grade

### RAK WisBlock

~\$40–70

- Modular system
- Ultra-low power
- Industrial grade
- GPS module add-on
- Many sensor options

## Long Battery

### LILYGO T-Echo

~\$50–65

- E-ink display
- nRF52840 chip
- GPS built-in
- Exceptional battery life
- Tiny & rugged

# HARDWARE: FORM FACTORS & ANTENNAS

## Device Form Factors



### Handheld / Pocket

Small devices with screen, GPS, battery — carried like a GPS tracker or walkie-talkie



### Fixed Node / Router

Mains-powered or solar node mounted at height to maximize range and act as backbone relay



### Base Station

Connected to computer via USB for monitoring, administration, and MQTT bridging



### Solar-Powered Remote

Solar + LiPo setup deployed in remote areas for permanent infrastructure without maintenance

## Antenna Matters — A Lot

*Upgrading from the stock antenna is the single biggest range improvement you can make.*

### Stock Stubby Antenna

1–3 km



### Quality Whip (e.g. Taoglas)

5–8 km



### Fiberglass Omni (outdoor)

10–20 km



### Yagi Directional

30–100+ km



# GETTING STARTED

1

## Buy a Device

Pick a supported board — LILYGO T-Beam or Heltec V3 are great starters (~\$25–50 on AliExpress or Amazon). Make sure it's the 915 MHz version for North America.

2

## Flash the Firmware

Go to [flasher.meshtastic.org](https://flasher.meshtastic.org) in Chrome, connect via USB, and flash in one click. No command line needed.

3

## Download the App

Install the Meshtastic app on iOS or Android. Pair via Bluetooth. You're on the mesh!

4

## Set Up a Channel

Use the default LongFast channel to talk to anyone nearby, or create a private channel with a name and key for your group.

5

## Extend Your Network

Deploy a second node at height (rooftop, ridge) to dramatically extend range. Add solar and it runs indefinitely.



**Entry cost: ~\$25–50 per node | No subscription, no fees, no account required**

# WHY MESHTASTIC?

## Free & Open Source

No vendor lock-in, active global community, constantly improving

## Works Anywhere

Mountains, oceans, deserts, disaster zones — no infrastructure needed

## Private & Encrypted

Your messages stay yours — no corporation reads your comms

## Affordable

A functional node costs less than a dinner out

## Resources

[meshtastic.org](https://meshtastic.org) — Official site & docs | [flasher.meshtastic.org](https://flasher.meshtastic.org) — Flash firmware | [r/meshtastic](https://r/meshtastic) — Reddit community | [discord.gg/ktMAKGBn](https://discord.gg/ktMAKGBn) — Official Discord