

Getting Started with Meshtastic in Singapore

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“Meshtastic® is a project that enables you to use inexpensive LoRa radios as a long range off-grid communication platform in areas without existing or reliable communications infrastructure. This project is 100% community driven and open source!”

<https://meshtastic.org/docs/introduction/>

Meshtastic

For Laypersons

Like a messaging app

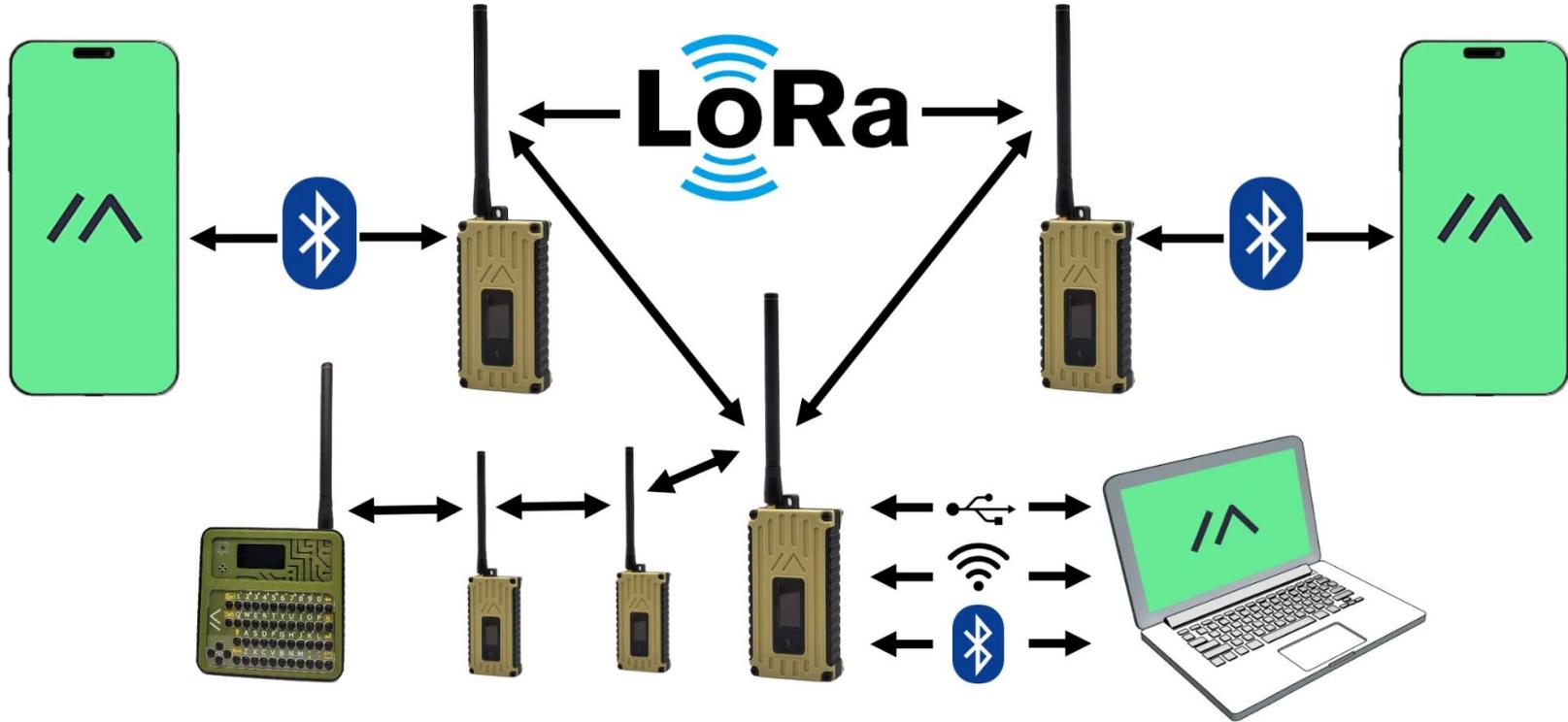
Works without cellular data or Wi-Fi

Mesh network of devices (nodes) that are owned and operated by users

Messages are relayed between nodes in range (several kilometers, record is 254km*)

*161.5dB link budget at 90bps

Meshtastic Architecture



For Electronics and Radio Enthusiasts

Experiment with radio communications in the real world

Open source and extensible software, firmware, protocol

APRS-like features (position, telemetry, GPIO, +++)

Integrations to external apps like ATAK

Use Cases

Off-grid communications

- Backcountry hiking, cycling etc.
- Unreliable/outside of cell coverage

Decentralized, off-cloud communications

Disaster Response/Search And Rescue

Tactical situational awareness (e.g.: ATAK)

Sensor networks (environment sensors, GPIO sensors)

And more!

LoRa

- **Long Range**
- **Proprietary**
- **Chirp Spread Spectrum** modulation
 - <https://youtu.be/dxYY097QNs0>
- Sub-GHz ISM **unlicensed band** (e.g.: 433, 868, 915, 923 MHz) & 2.4 GHz
- Up to **170 dB** link budget (Semtech SX1262)
 - +22 dBm transmit (+20 dBm in Singapore 923MHz band)
 - -148 dBm Rx sensitivity
- **Configurable** for higher data rate or higher sensitivity
- **LoRa = PHY**, LoRaWAN = MAC

Meshtastic Limitations

Channel setting	Alt Channel Name	Data-Rate	SF / Symbols	Coding Rate	Bandwidth	Link Budget
Short Range / Fast	Short Fast	10.94 kbps	7 / 128	4/5	250	143dB
Short Range / Slow	Short Slow	6.25 kbps	8 / 256	4/5	250	145.5dB
Medium Range / Fast	Medium Fast	3.52 kbps	9 / 512	4/5	250	148dB
Medium Range / Slow	Medium Slow	1.95 kbps	10 / 1024	4/5	250	150.5dB
Long Range / Fast	Long Fast	1.07 kbps	11 / 2048	4/5	250	153dB
Long Range / Moderate	Long Moderate	0.34 kbps	11 / 2048	4/8	125	156dB
Long Range / Slow	Long Slow	0.18 kbps	12 / 4096	4/8	125	158.5dB
Very Long Range / Slow	Very Long Slow	0.09 kbps	12 / 4096	4/8	62.5	161.5dB

Getting Started

Hardware & Client Software

- Meshtastic Device - Cheap, minimalistic beginner hardware ≈US\$18
- Client Device
 - Android or iOS phone/tablet/DAP
 - Web client (<https://client.meshtastic.org/>)
 - Python CLI
- Antenna
 - Optional, most devices come with an antenna (of dubious quality)

Meshtastic Devices

Basic



[LILYGO T3-S3](#)



[Heltec WiFi LoRa 32\(V3\)](#)

Meshtastic Devices

All-in-One



[LILYGO T-Beam](#)



[Heltec Wireless Tracker](#)



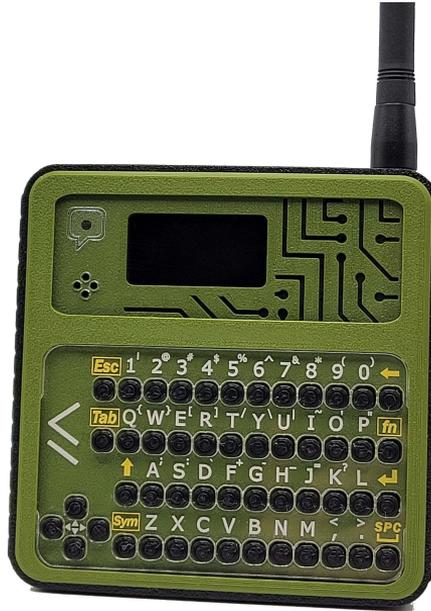
[Station G2](#)

Meshtastic Devices

Standalone



[LILYGO T-Deck](#)



[Meshenger](#)



[HelixT](#)

Meshtastic Devices

Modular



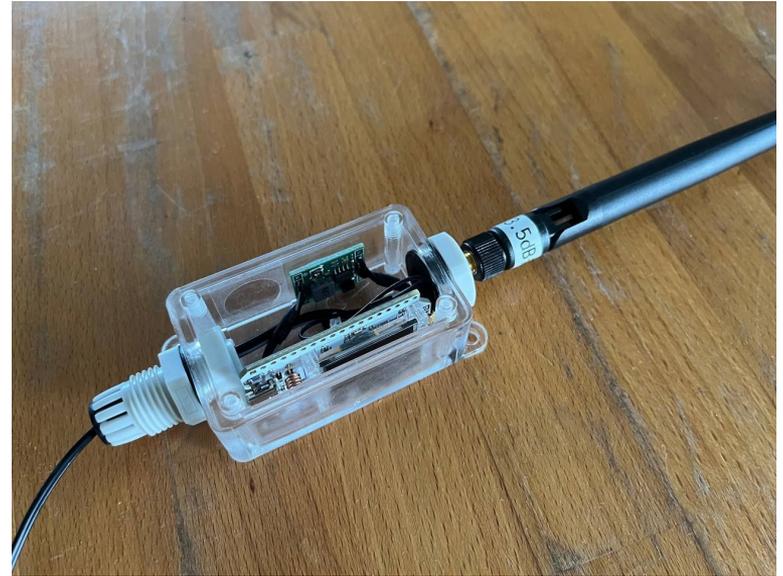
[RAK Wireless WisBlock](#)

Enclosures

3D Print



DIY



Firmware

- <https://flasher.meshtastic.org/>

Region Configuration

Regions suitable for Singapore:

- **EU_433** (433 - 434 MHz @ 10 mW)
@ 10% duty cycle
- **SG_923** (917 - 925 MHz @ 100 mW)

Different regions nodes and channels will not be able to inter-communicate, even with MQTT bridging!

Regions **ILLEGAL** to use in Singapore (not exhaustive, just examples!)

- EU_868 (868 MHz band) - refarming
- US (915 MHz band) - SingTel GSM

Channel Configuration

Logical channels

- Primary (0) - Telemetry and position data
- Secondary (1 - 7) - Customizable
- Name and encryption per-channel
- Shareable as QR code or special deeplink
- “admin” channel - configure nodes OTA

LoRa Frequency Slot

- 250 kHz spacing
- 917.0 MHz through 925.125 MHz

What to Expect

151 dB link budget (+20 dBm output, -131 dBm sens.)

- Urban NLOS = 2 km
- LOS = ?

Need more users to test! There are several clusters of users with large gaps

- Use MQTT (Internet backhaul) to bridge clusters until community expands

“Meshtastic Mondays”

- Weekly check-in on 9V1 channel

Resources

Off-mesh Community: Telegram

- <https://t.me/+LSWPaj9TwWFiZTU1>
- Can't send photos on the mesh...



https://ndoo.sg/projects:amateur_radio:meshtastic:start

- My personal Wiki
- Wrote about devices, enclosure, first time setup, firmware, lots more
- Please contribute, most of the website is editable after login with Google or GitHub account

Meetup Tomorrow

The "Lawrence is PM" Celebration of the Very Volumetrically Viscous Veni Vidi Vici Voluble Volunteers Version 1 Mesh Group (in short: 9V1Mesh) is on next Saturday! There will be a Show and Tell by Andrew, new antenna displays by Soragan, and giveaways of free hardware to anyone looking to start.

- Venue: Ideactio, 562A Seragoon Road (above Mosanco Cafe)
- Date: Saturday, 1 June 2024
- Time: 1pm till 4pm
- There is Beer, Wine, Cheese, and some other snacks.
- We have power, WiFi too, so come say Hi! to Laura.

Demo/Hands-on