

INTRO TO MESHTASTIC

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FOR THE U OF MICHIGAN AMATEUR RADIO CLUB (W8UM)

A tropical sunset scene with palm trees silhouetted against a bright sky. On the left, a modern building with a colorful, geometric facade (red, orange, yellow) is visible. The overall atmosphere is bright and airy.

MESHTASTIC, BRIEFLY

WHAT IS THIS THING, REALLY?

MESH ROUTING OF SHORT MESSAGES

HOW INFORMATION GETS AROUND IN A MESHTASTIC NETWORK

Messages are sent hop by hop through a mesh of cooperating nodes

Nodes that hear a message not for them will repeat it to their neighbors

To avoid eavesdropping private messages are encrypted with public keys

Well known keys are used for public channels

Messages are short - think old-timey text messages, without pictures

No automatic retries, if the message doesn't go through it's dropped

COOPERATION AND NOT CENTRALIZATION

NO CENTRAL NODES NEEDED
EVERY ENDPOINT IS ALSO A ROUTER
NO NETWORK-WIDE COORDINATION
UNLICENSED RADIO SPECTRUM



“THAT’S NOT REAL HAM RADIO”

WHICH SHOULD NOT STOP YOU FROM HAVING FUN WITH IT

GETTING STARTED IN ANN ARBOR

BOOTSTRAPPING A MESH NETWORK

Presentation by Blake KE8SQU to ARROW in March 2025

Buy a node (Wismesh Pocket V1), stick it in my backpack, head out on a bicycle to see what's nearby

Infrastructure: ARROW puts a node on Wolverine Tower (w0t0), credit to Max KF8BNW for the build

Cavity filter added to w0t0 to handle adjacent 800 MHz transmitter that was deafening the receiver

Nodes scattered around town, some with high gain antennas, about 1/4 run by hams

WHAT DO NODES LOOK LIKE?

PICTURE FOLLOWS

900 MHz antenna (33 cm band, so antennas are relatively small)

Low power transmissions (1 watt or less unlicensed)

Battery or solar operation is normal, some nodes have solar controllers

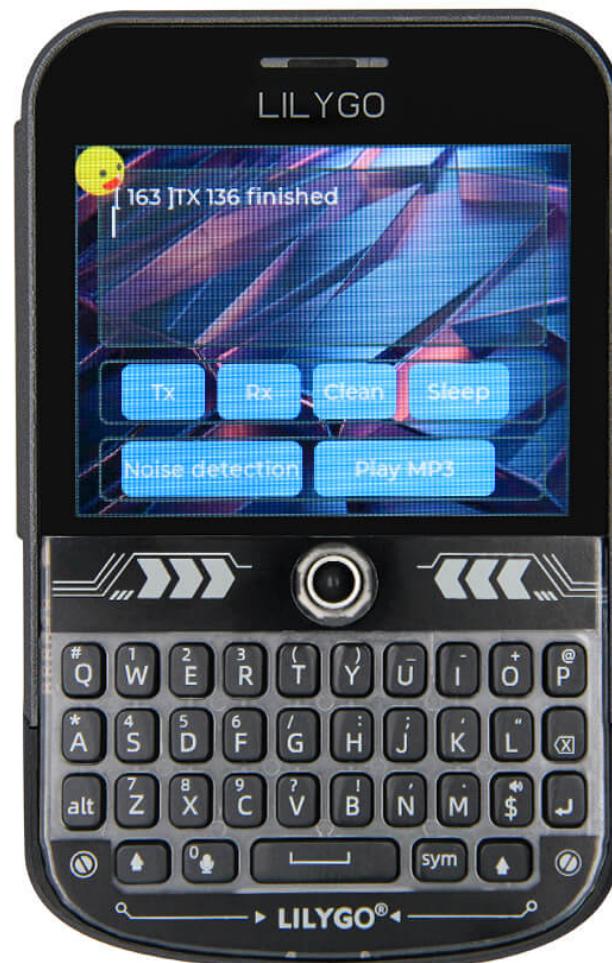
Not expensive as radios go - \$40 to \$100 for ready-to-go units, kits less

Most use a cell phone + Bluetooth as a user interface

Some are completely self-contained like an old Blackberry phone

Eight Meshtastic Radios (and one 2 meter HT)







LORA AND MESHTASTIC

NOT YOUR ORDINARY RADIO

Meshtastic uses LoRa, a patented chirp spread spectrum modulation

Developed by Semtech (NASDAQ: SMT), company founded in 1960

Version 1.0 of LoRa developed in 2015

SX1262 modem-on-a-chip is a transceiver (rx/tx) used in several Meshtastic radios

168dB maximum link budget means transmissions can be decoded in very weak signal conditions; default “Long Fast” has 153dB link budget

Trade off: faster data rates give you less range (smaller link budget)

Meshtastic configuration options

Radio Preset	Alt Preset Name	Data-Rate	SF / Symbols	Coding Rate	Bandwidth	Link Budget
Short Range / Turbo	Short Turbo	21.88 kbps	7 / 128	4/5	500 kHz ¹	140dB
Short Range / Fast	Short Fast	10.94 kbps	7 / 128	4/5	250 kHz	143dB
Short Range / Slow	Short Slow	6.25 kbps	8 / 256	4/5	250 kHz	145.5dB
Medium Range / Fast	Medium Fast	3.52 kbps	9 / 512	4/5	250 kHz	148dB
Medium Range / Slow	Medium Slow	1.95 kbps	10 / 1024	4/5	250 kHz	150.5dB
Long Range / Fast	Long Fast	1.07 kbps	11 / 2048	4/5	250 kHz	153dB
Long Range / Moderate	Long Moderate	0.34 kbps	11 / 2048	4/8	125 kHz	156dB
Long Range / Slow	Long Slow	0.18 kbps	12 / 4096	4/8	125 kHz	158.5dB

Via yNos (WO8E - MichMesh.net)

SX1262 LoRa Node (HF)



W8EMV 2025-10-16

Photo: waveshare via Amazon

OTHER USES FOR LORA

MESHTASTIC IS ONLY ONE APPLICATION FOR THIS PROTOCOL

LoRaWAN - collecting telemetry, e.g. from Great Lakes buoys to onshore receivers

Helium - cryptocurrency scheme that rewarded people for running nodes

LoRa APRS - automated position reporting for balloons, other tracked devices

Point to point serial ports over LoRa - very small packets, serialized

Low bandwidth, low data rate, low power, very efficient

Some Meshtastic builds use hardware built for other applications, e.g. reusing components from Helium miners which really didn't take off

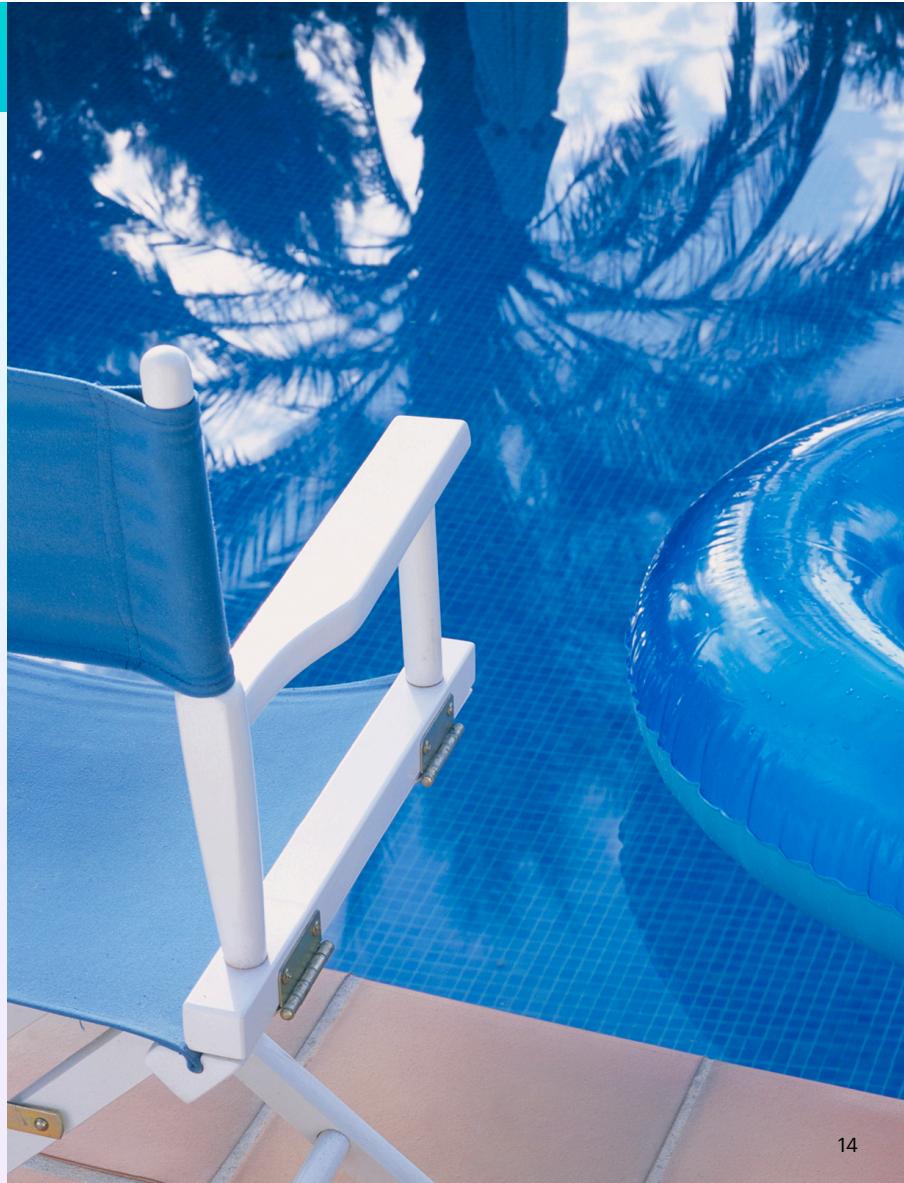
FUN WITH RADIOS

BIG FUN

Fly with a Meshtastic radio - we will occasionally see nodes connecting that are airborne on commercial flights.

Text message your friends or acquaintances, see if you can get a message through to plan lunch - or a meetup at the football game.

Experiment with antenna position and location for best results



ORDINARY RANGE OF MESHTASTIC

CALIBRATE YOUR EXPECTATIONS

Indoor, stubby antennas on both ends - a few blocks

Exterior antennas above the tree canopy - 2-3 miles

Atop a tall building on high ground, omni antenna - 5-6 miles

Directional antenna on mountain top pointing over water - maybe much more

Plus: 3 hops of mesh

Plus: MQTT gateways through Internet

EXTRAORDINARY RANGE OF MESHTASTIC

HOW FAR CAN I EXPECT TO GO IF ALL GOES EXCEPTIONALLY WELL

Record: 205 miles / 330 km, "Very Long Slow", mountaintop to mountaintop

In Michigan: Grand Haven MI to Chicago IL: 108 miles over Lake Michigan

What helps:

Elevation - Height is Might

Line of Sight - Avoid obstacles like buildings, trees, hills

Atmospheric ducting - fog, temperature inversions, stationary fronts

Directional antennas - more antenna gain in one direction than others, e.g Yagi



Goose N8GMZ

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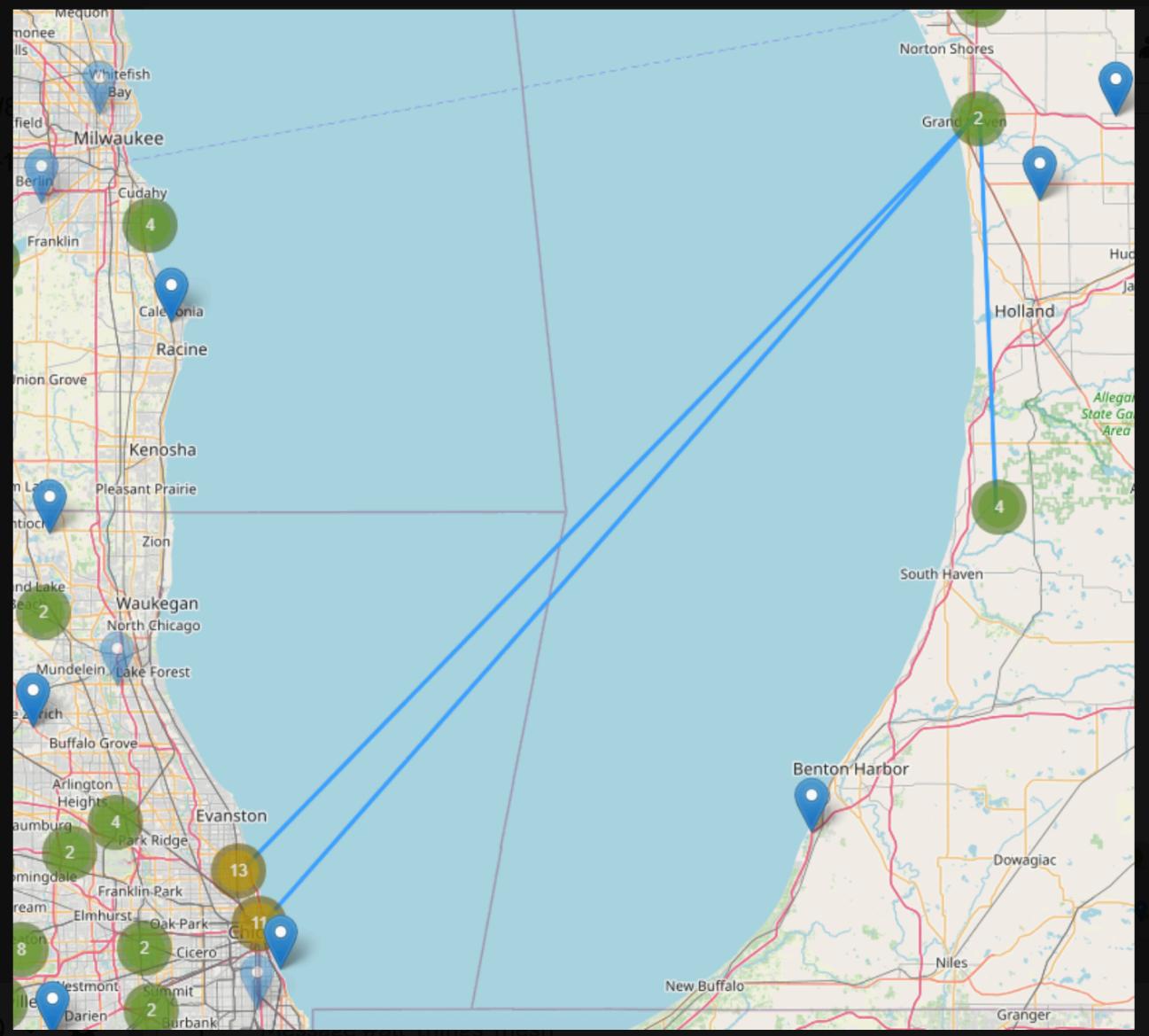
Meshtastic 101 with Ed W

Meshtastic 101, 2025-10-

- ▶ # weather
- ▶ Technical ▾
- ▶ # tech-n-gear-n-antennas
- ▶ # emcomm-etc
- ▶ # hf-cb-6m
- ▶ # hf-digital-and-cw
- ▶ # vhf-uhf-analog-n-digital
- ▶ # all-things-mesh
- ▶ # all-things-hotspot
- Society related topics ▾
- # society-related
- # meeting-minutes
- # club-call-usage

Voice Channels ▾

W8EMV - Ed
Online





MESHTASTIC IN MICHIGAN

PROJECTS UNDERWAY

Communications via Discord, “Michigan Meshtastic Network”

<https://discord.gg/jXtpzh4B>

Channels for communities (e.g. #ann-arbor-psi)

Hardware under development locally, “Michtastic”

https://github.com/Hamspiced/MichTastic_Node



DO NEXT?

IF YOU WANT TO FIND OUT MORE

Borrow, build or buy nodes and try them out

Borrow, build or buy 900 MHz antennas and see how they perform

Read or write code that interfaces with the mesh, like a mesh BBS

Find and get agreements for use of elevated locations

Experiment with mobile use - walk or bike or bus around the city

Build a game that runs over Meshtastic

THANK YOU

(THUNDEROUS APPLAUSE)

W8EMV 2025-10-16