

MeshPages: A Web Server Framework for

/^ESH/^ST/C

An open source, off-grid, decentralized, mesh network built to run on affordable, low-power devices

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Presented by

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About me

- UMBC Alumni.
- Bachelor's in CMSC Class of 2023
- Master's in CMSC Class of 2024
- Currently an AI Engineer at Rotational Labs
- My area of focus is secure, private, and local AI
- Discovered my love for privacy and security in RJ Joyce's CMSC 426
- Was the CMSC 426 TA for 3 semesters
- (Seriously, take CMSC 426, it's fun)
- My focus on privacy and security had a major role in the development of MeshPages

What is Meshtastic?



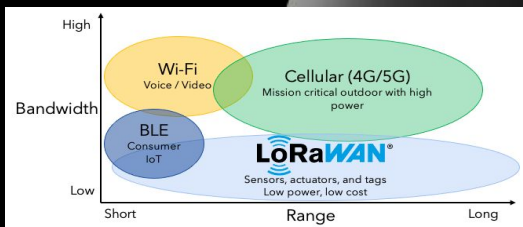
LILYGO T-Deck



Heltec V3



LILYGO T-Watch S3



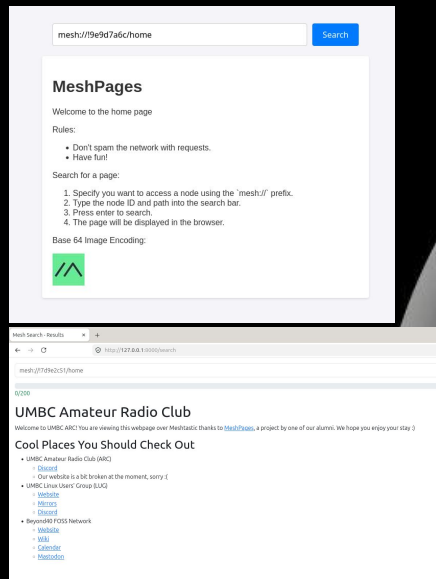
Source: <https://wifivita.com/2022/12/14/lorawan-mapper-overview/>

- "An open source, off-grid, decentralized mesh network built to run on affordable, low-power devices." - Meshtastic
- No cellular network required
- No WiFi required
- No internet required
- Uses LoRa (Long-Range radio) for communication
- 915 Mhz radio frequency range
- Primarily used for messaging
- World record Meshtastic message is 205 miles from Pistoia, Italy to Sneznik, Slovenia (<https://meshtastic.org/docs/overview/range-tests/>)
- Devices are like modern pagers. Some come in the form of old style Blackberries, watches, credit card-sized devices, and even magsafe battery packs for your phone
- There is even native Linux firmware if you have a LoRa radio plugged directly into your system

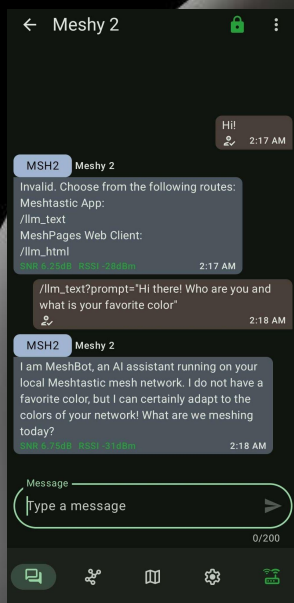
MeshPages history

- Initially started as wanting to send images over Meshtastic
- Thought to do so using ASCII art
- Remembered Meshtastic has a 200 character message limit, so this wouldn't work as I would have wanted it to
- Remembered Meshtastic has a Python API
- Thought to send images over Meshtastic using the API by sending chunks, rebuilding them on the other side, and render them with HTML
- Why stop there? Why not build a web framework out of this? And thus, MeshPages was born

What is MeshPages?



Source: lmn1460 on Discord



- A web framework with a FastAPI-style way of setting up endpoints
- Supports GET-style requests for a customized user experience
- TCP-style and UDP-style support
- A built-in tool called Air Traffic Control to manage mesh network utilization
- Can send large responses by chunking them
- Versatile to be able to receive messages over the built-in MeshPages web client or the Meshtastic messaging app.
- If it can be an endpoint, it can be sent over MeshPages
 - Web pages
 - Images
 - Videos
 - Audio
 - LLM responses
 - You name it

MeshPages web client

- MeshPages has a build-in web client
- Renders HTML received from servers
- Server sends HTML compressed with Brotli
- Adds headers for total chunks the client should expect, the current chunk, and the status code (200, 404, 500, etc)
- Client extracts the headers and decompresses the Brotli HTML
- Client combines all the decompressed HTML into a single message and sends it back to the front end to be rendered

Why would you want to use MeshPages?

- A new way to self-host web pages without needing a domain, port forwarding, cloud server, DNS, and all the other boring stuff that comes with just wanting to host a simple web page
- With the new era of age-verification upon us, MeshPages allows for an anonymous, age-verification-free way of hosting what you want to host. You can't shut down what's decentralized
- Off-grid communication is important in various environments. Having a web page that hosts important community information one can easily visit when disaster strikes can be life or death
- It's cool

What are the downsides?

- It's slow. LoRa is VERY slow compared to WiFi or cellular
- Limited message sizes. Meshtastic only allows you to send 200 bytes of information at a time. Not counting the message headers, MeshPages allows a max of ~50 kb of data to be sent. Brotli should hopefully help with this a bit
- Can't parallelize. Meshtastic can only send or receive one thing at a time, so you will be waiting in a queue for a while if there are many people ahead of you.



Demo Time!

Future ideas and work planned

- Alternate hosting options support (Termux)
- MeshCore and Reticulum support
- Multi-node worker support for offloading
- Permissions documentation update and other QoL changes
- (If you have any other ideas, I'd love to hear them!)

Thank you

Try MeshPages

Visit the Github

<https://github.com/MushroomGecko/MeshPages>

Submit Bugs or Feature Requests

<https://github.com/MushroomGecko/MeshPages/issues>

Become a Contributor

<https://github.com/MushroomGecko/MeshPages/pulls>