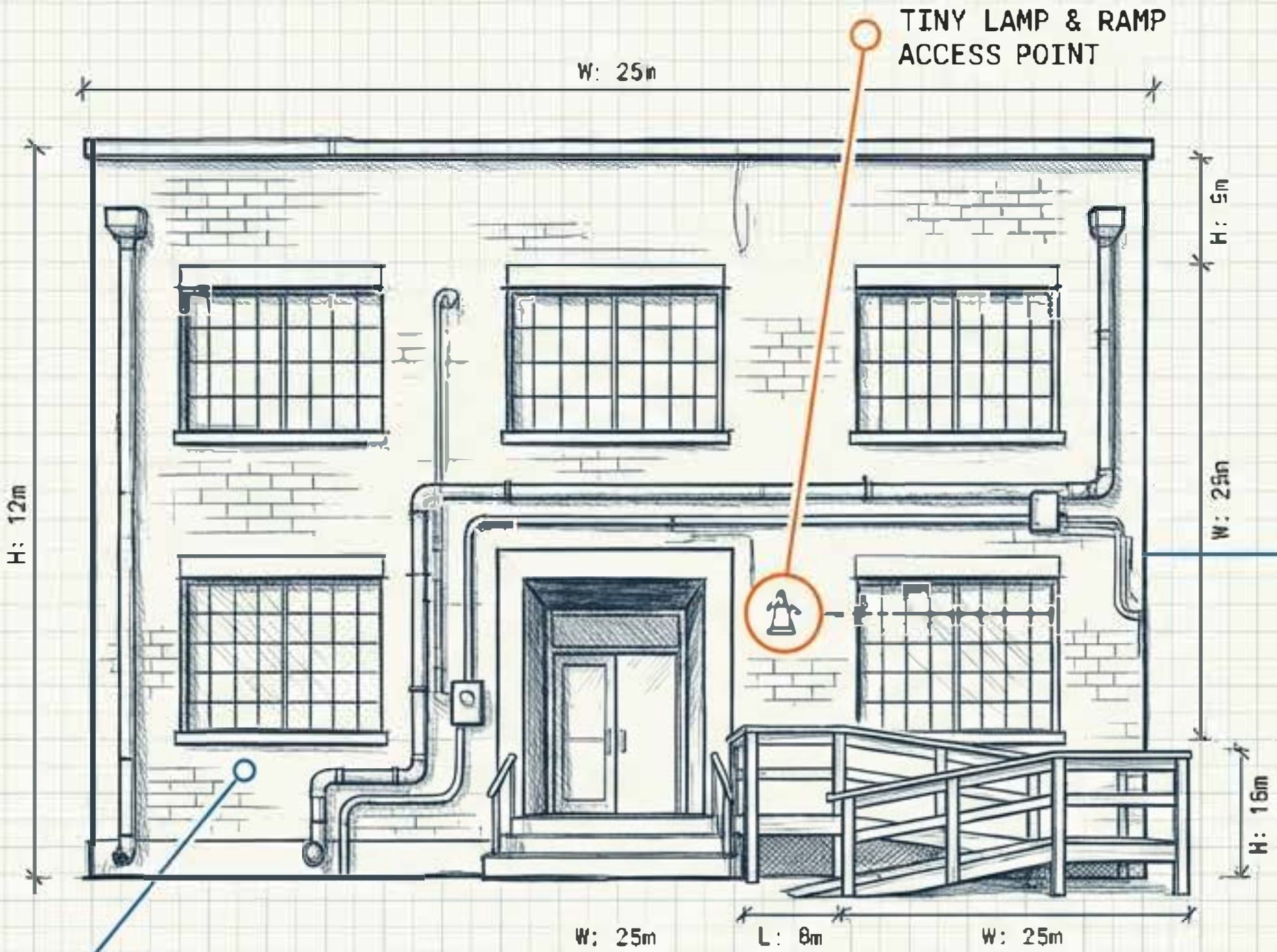


THE JUGAAD MESH NODE

A Visual Field Manual for
Resilient, Off-Grid Community
Infrastructure

Location: 7500 Oakland Ave, Detroit [313]
Operator: Detroit Digital Stewards
Architecture: Archipelago Hybrid
Status: LIVE

7500 OAKLAND AVE



BOX 1 - SITE IDENTIFICATION

THE SITE

7500 Oakland Ave. A living laboratory where Detroit's industrial printing heritage meets digital twin tech, Metroplex techno, and Afrofuturism.



BOX 2 - CORE PHILOSOPHY & CATALYST

THE PHILOSOPHY: JUGAAD

Frugal innovation; the art of making do with available resources to build community resilience and survival infrastructure.

CATALYST

38% of Detroit homes have no internet; 70% of school-age children lack home access.



BOX 3 - OPERATIONAL UNIT

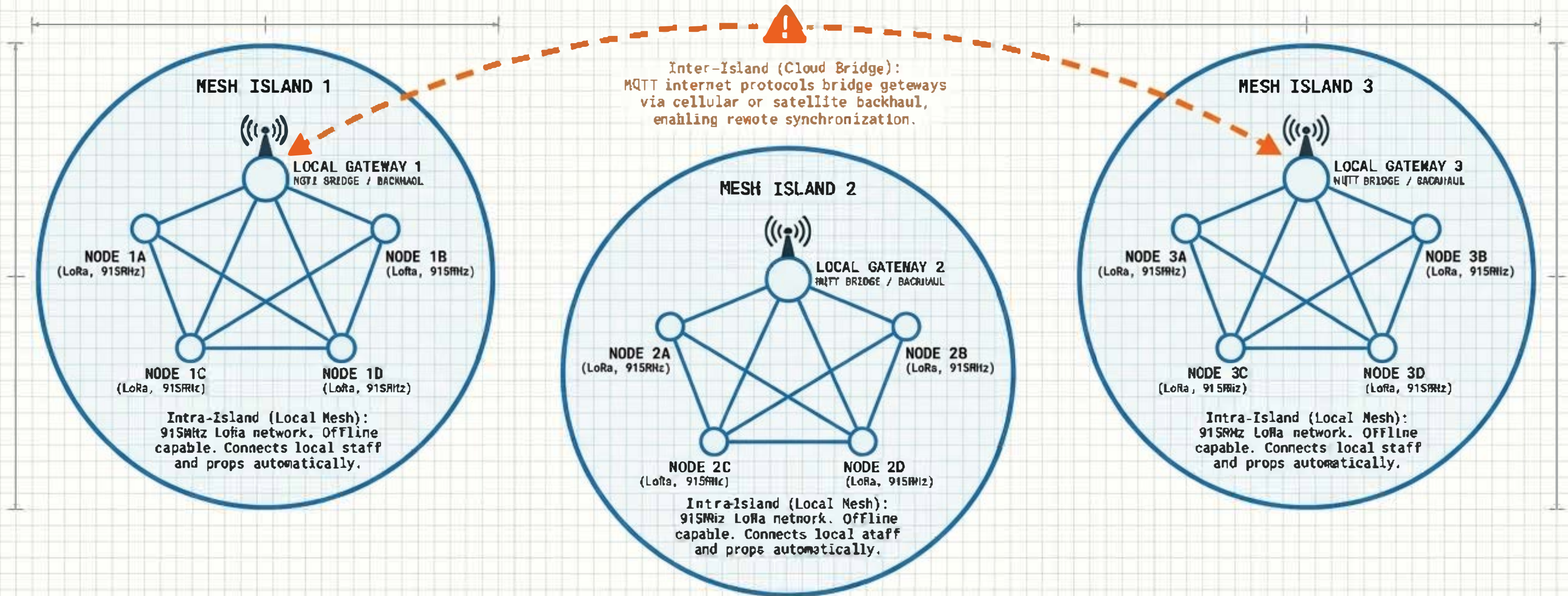
THE OPERATORS

EII Digital Stewards — neighborhood residents trained in a 20-week program covering community organizing and wireless engineering.



The Archipelago Architecture

Challenge: Covering 1000 discontinuous acres with zero Wi-Fi penetration.



Decoupling Signal From Content

Core Strategy: The signal triggers the content; the network never carries the video. Zero congestion.

Control Plane (LoRa/Meshtastic)



- **Characteristics:** Low Bandwidth / High Range / High Reliability
- **Payloads:** Text Commands, GPS Coordinates, Telemetry, Sync Triggers

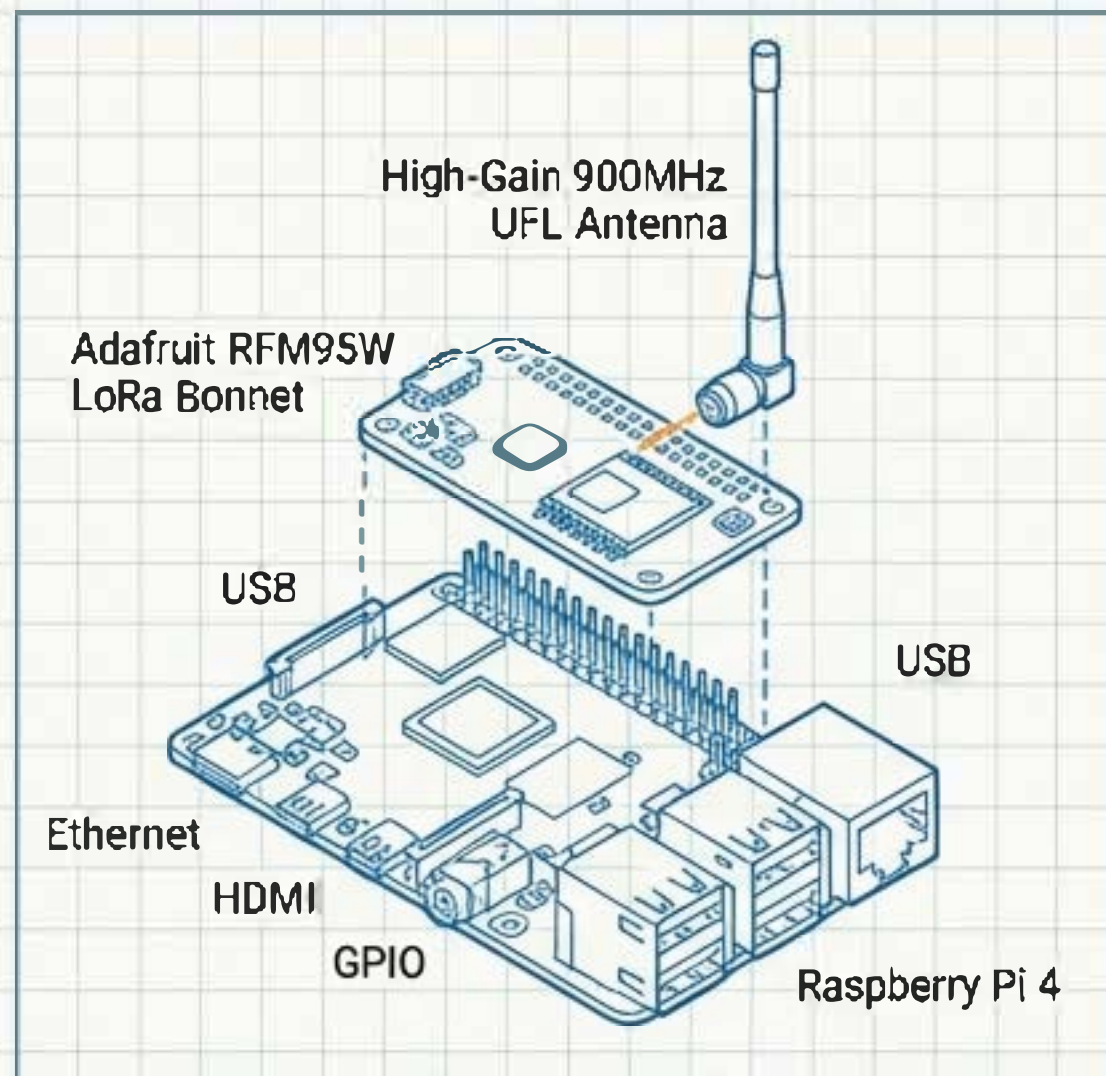
Media Plane (Wi-Fi/Raspberry Pi)



- **Characteristics:** High Bandwidth / Zero Range / Local Processing
- **Payloads:** 4K Video Output, High-Fidelity Audio, Local SD Card Storage

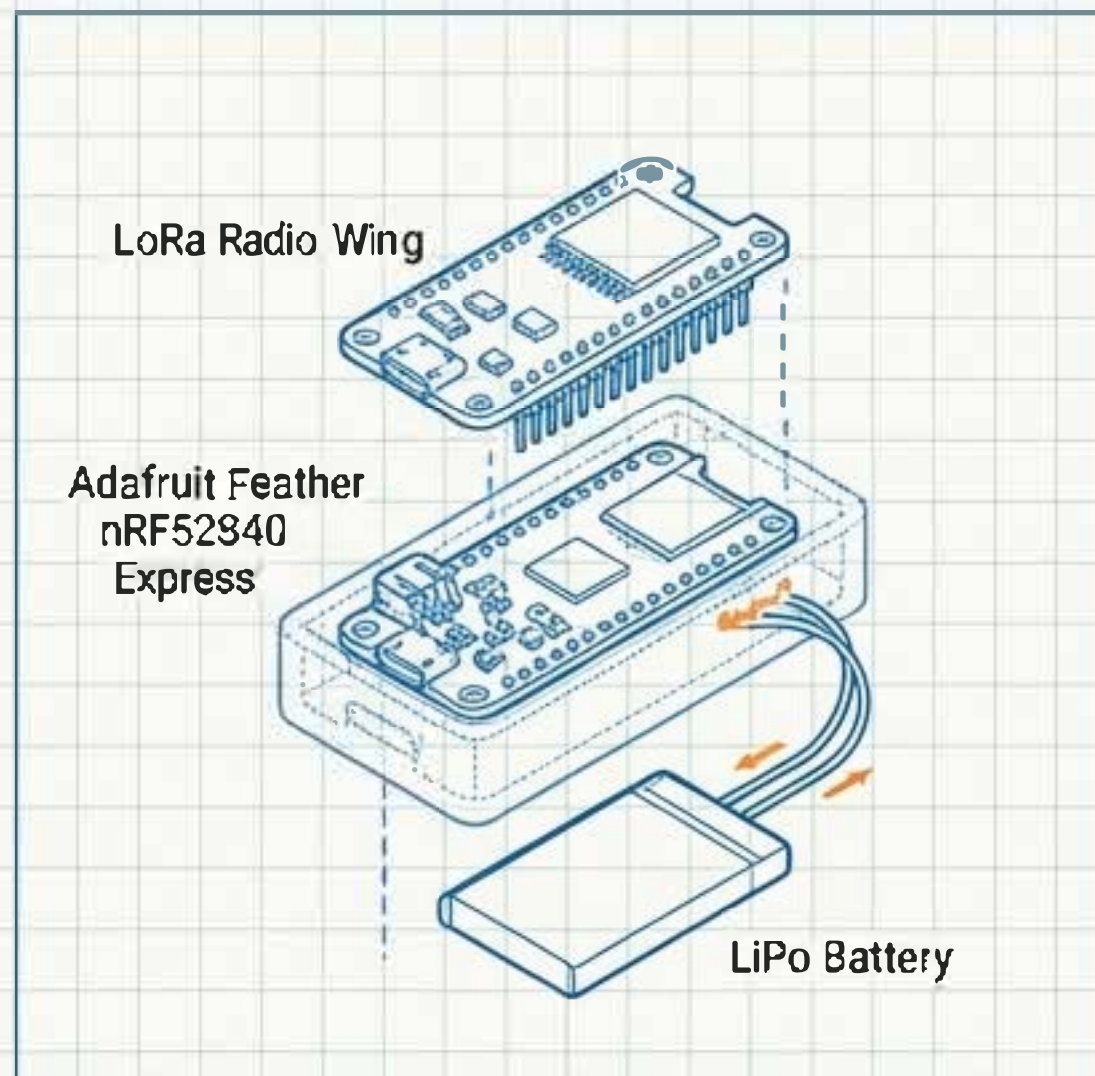
Node Typology & Bill of Materials

Note: Modular Adafruit hardware ensures no vendor lock-in and enables rapid field repair.



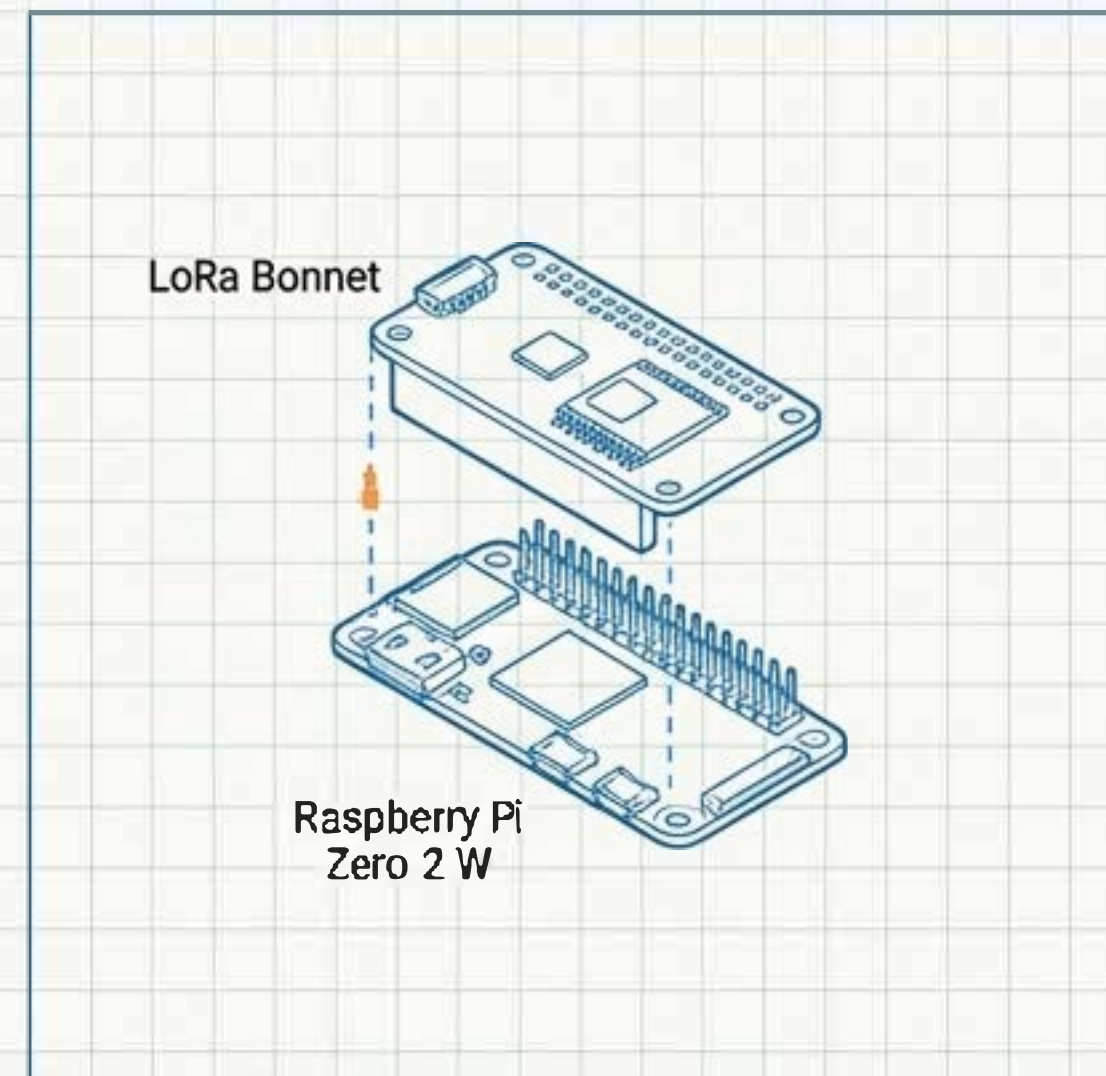
1. The Gateway (The Island Hub)

Function: Runs meshtasticd Linux daemon.



2. Mobile Node (Staff/Trigger)

Function: Wearable command injection.

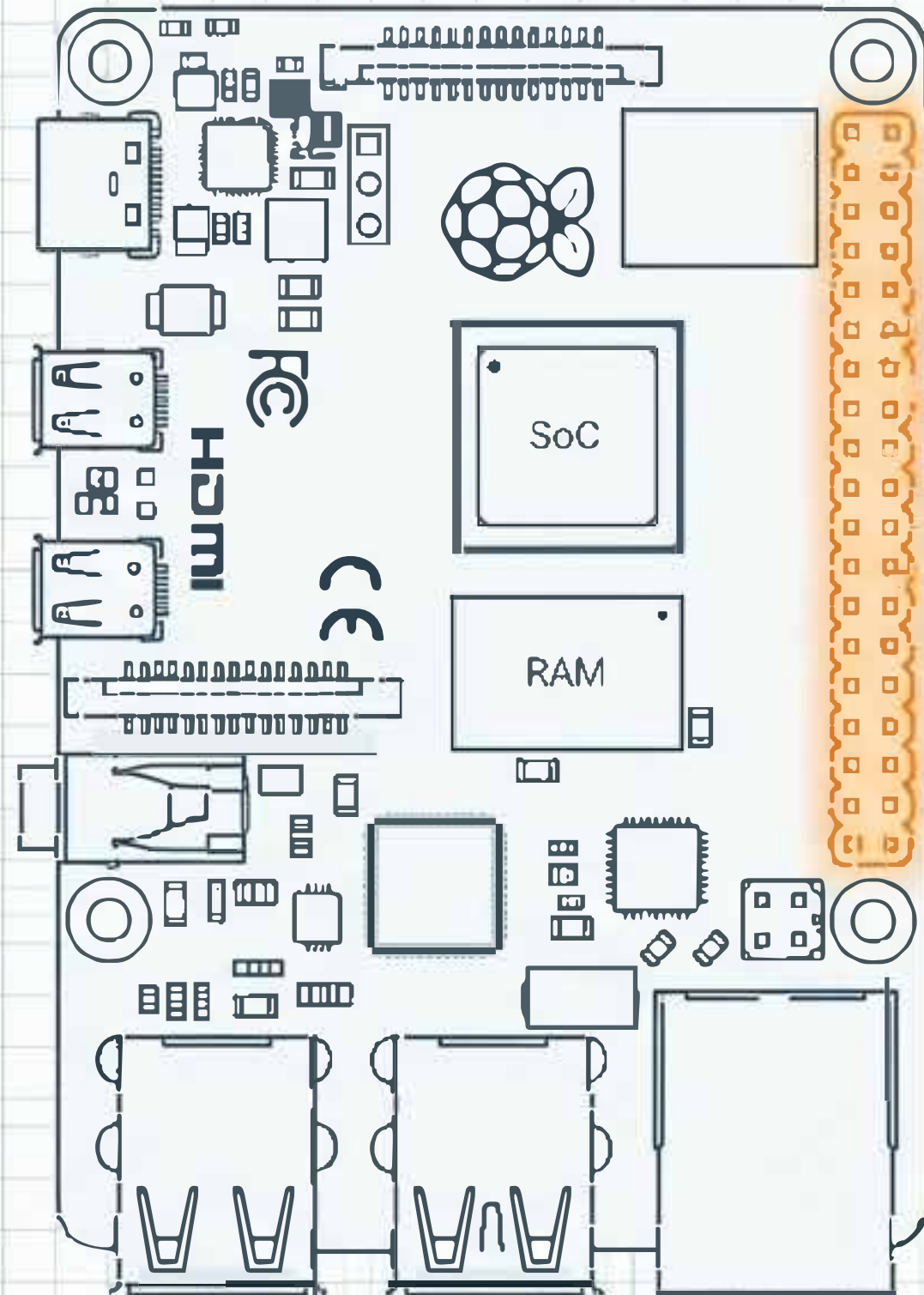


3. Media Trigger (Prop)

Function: Hidden in stage sets to parse cues and fire local HDMI.

| Device Type | Core Components | Est. Cost |
|-------------|---------------------------------------|-----------|
| Gateway | Raspberry Pi 4 + Case + RFM95W Bonnet | ~\$85 |
| Staff Node | Feather nRF52840 + Radio Wing | ~\$45 |
| Accessory | 900MHz UFL Antenna | ~\$5 |

Assembly Phase 1: Gateway Compute & Routing



Mount Adafruit RFM9x Bonnet here. Attach UFL antenna cable.

Rule:

Verticality is King

Mount antenna >10ft high for forest penetration.

Step 1: Physical Interface

Step 2: OS Initialization - Flash 64-bit Raspberry Pi OS for optimized memory handling.

Step 3: Daemon Configuration - Install meshtasticd.

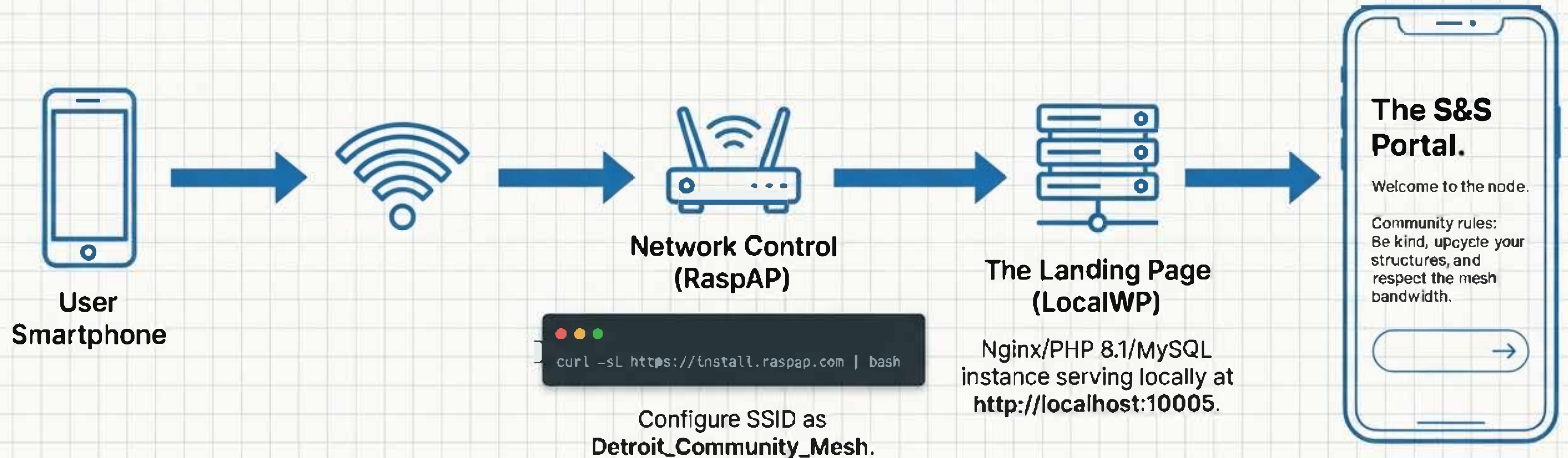
```
nano config.yaml
```

```
# Set node to Client Proxy mode to bridge the local offline mesh to the MQTT Cloud Broker.
```

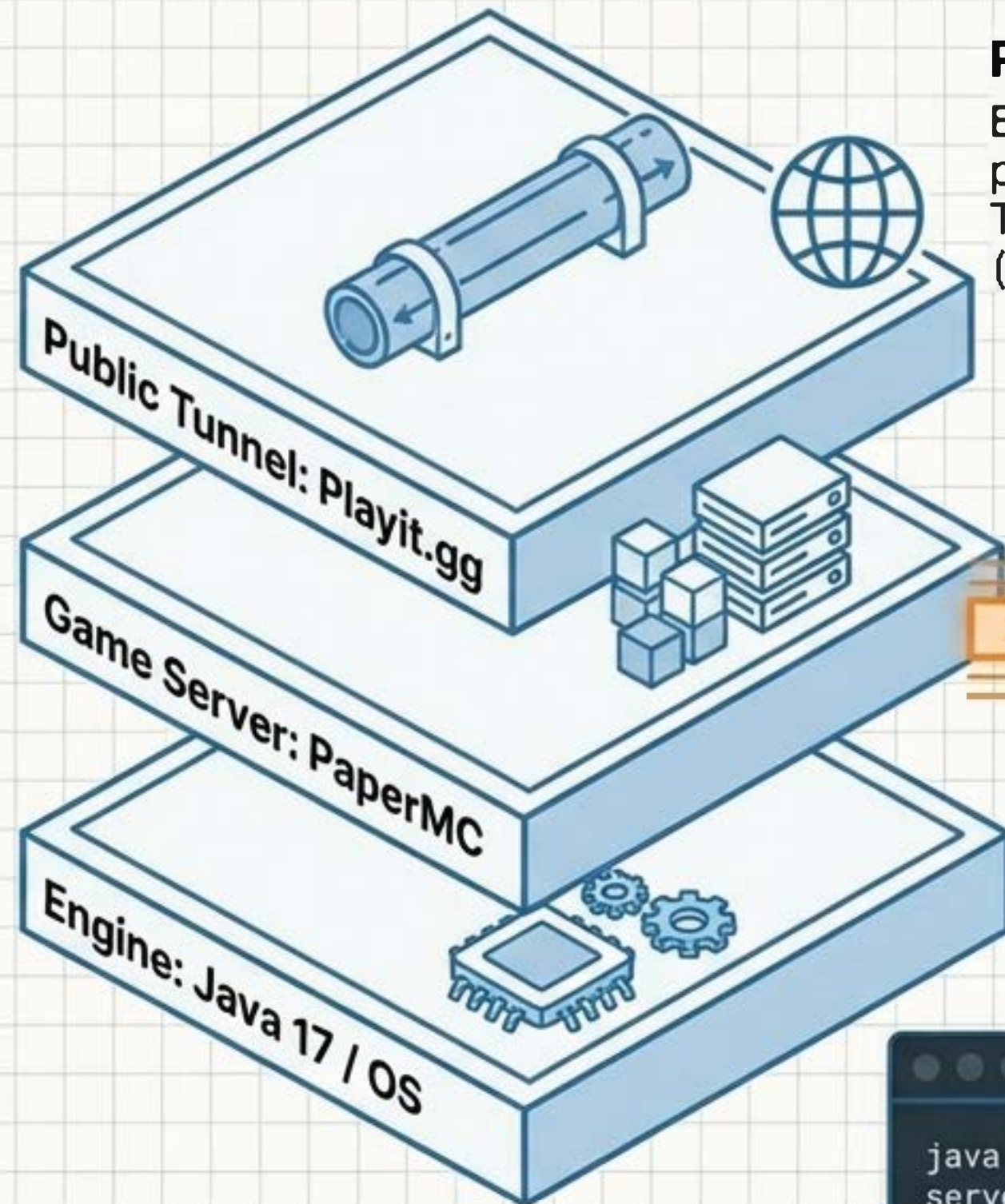
```
# Create a secondary channel named MEDIUMCUES with High Reliability settings.
```

Assembly Phase 2: The Captive Portal

Goal: Turn the Pi into a localized Access Point (AP) that traps users in a community hub independent of the broader internet.



Assembly Phase 3: The Minecraft Relay



Public Tunnel: Playit.gg

Bypasses local firewalls without port forwarding, creating dedicated TCP/UDP tunnels (detroit-mesh.playit.gg).

The Mesh Bridge

A local Python script monitors PaperMC server logs. When triggered, it pushes a broadcast to the Meshtastic serial port.



Meshtastic Radio

```
java -Xmx1024M -Xms1024M -jar  
server.jar nogui
```

```
[Server thread/INFO]: [Mesh-Bridge]  
RELAYING: Ulysses joined the smidgen-realm.  
  
-> Broadcasts to channel #LongFast-Primary
```

Assembly Phase 4: The 313af Subdomain Uplink

Strategy: Avoid Port Forwarding. Punch through ISP restrictions securely using a Cloudflare Tunnel.

1. The Package

```
sudo dpkg -i cloudflared-linux-arm64.deb
```

Download and install the ARM64 package to the Pi 4.

2. The Auth

```
cloudflared tunnel login
```

Execute login. Authorize 313af.space via the browser.

3. The Route

```
cloudflared tunnel create pi-uplink  
cloudflared tunnel route dns pi-uplink your-subdomain.313af.space
```

Create the tunnel and route the specific subdomain.

Result: Local historical preservation data pushed live from the 313 to the world.

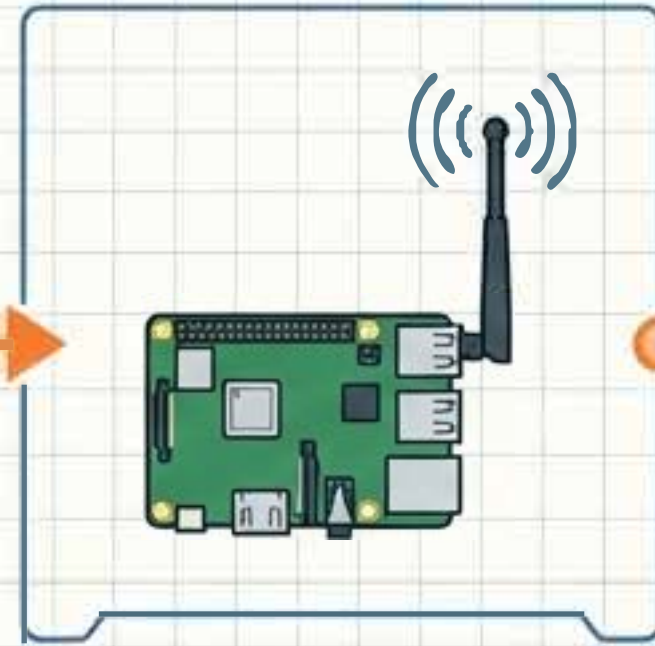
Operation: The Store-and-Trigger Protocol



1. Input

A Stage Manager on an isolated mesh island types "EXECUTE SCENE 4" into their wearable Feather node.

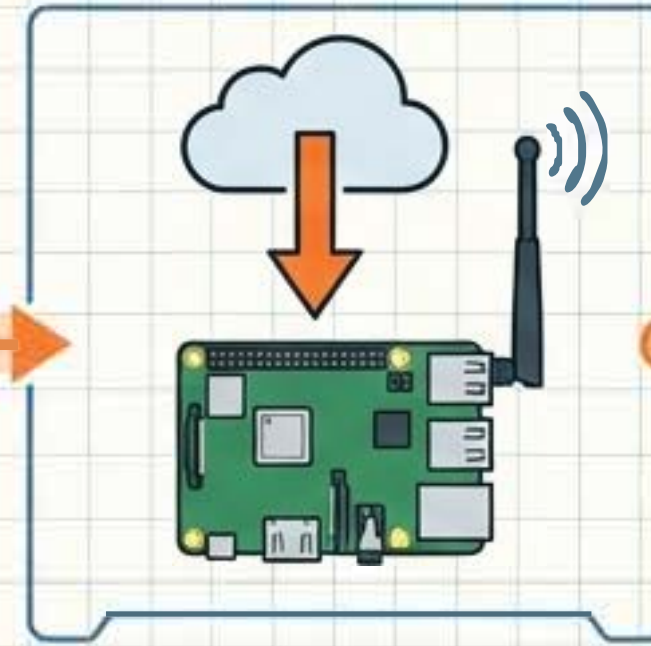
```
> EXECUTE SCENE 4
```



2. Uplink

The local Pi Gateway receives the LoRa signal and pushes it to the Cloud MQTT Broker (Topic: meshtastic/location_B/cues).

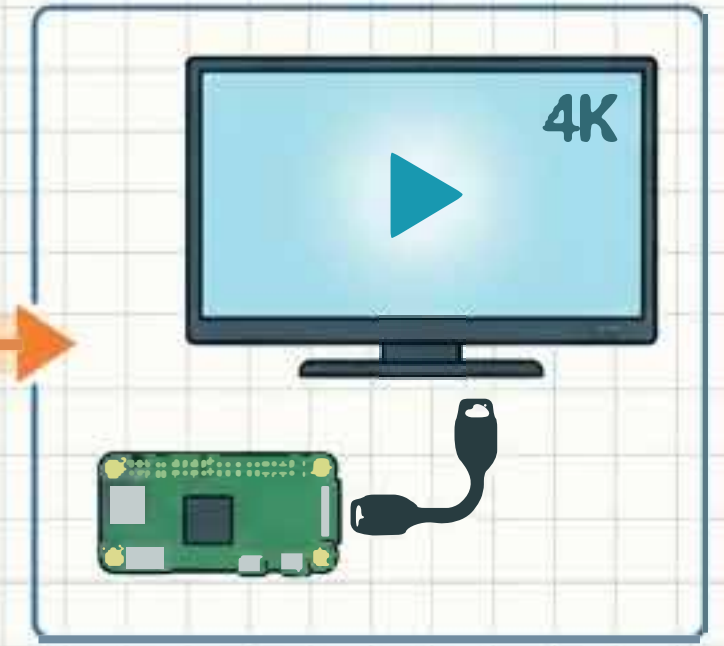
```
MQTT PUSH: meshtastic/location_B/cues  
PAYLOAD: 'EXECUTE SCENE 4'  
STATUS: SENT
```



3. Downlink

The target Gateway miles away pulls the string from the Cloud and rebroadcasts it to its local LoRa mesh.

```
MQTT PULL: meshtastic/location_B/cues  
MQTT2082 PAYLOAD: 'EXECUTE SCENE 4'  
LoRa REE804B8227: AE1792
```



4. Execution

A hidden Pi Zero Prop Node parses the string "EXECUTE SCENE 4". A Python script instantly fires a 4K local video file via HDMI. Zero streaming. Zero lag.

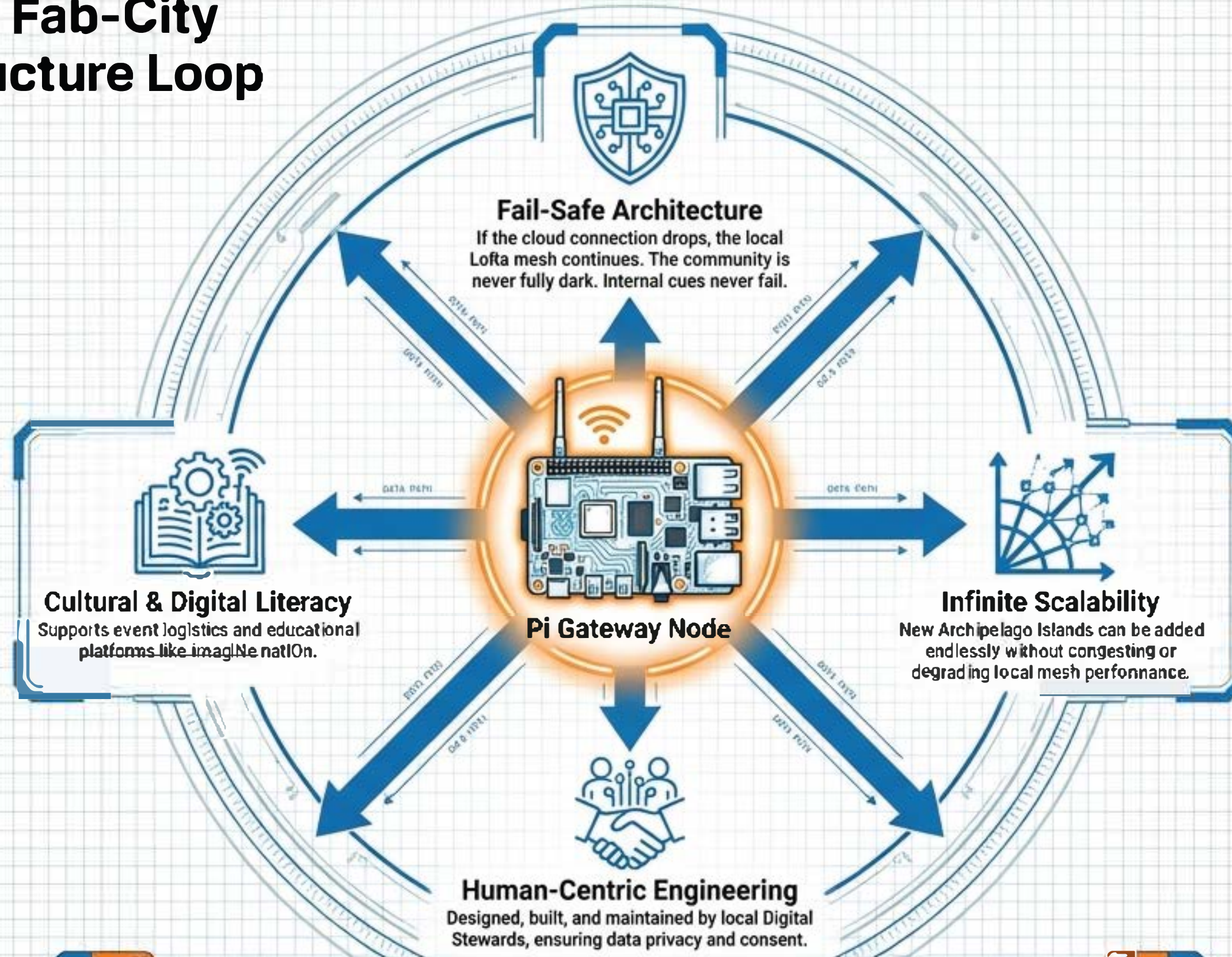
```
# Python Script  
if __name__ == '__main__':  
    subprocess.run(['vncplayer', '/local/scenes/4k.mp4'])  
STATUS: RA1100 AB
```

The Node Dashboard (System View)

```
[SYSTEM_DASHBOARD :: ULYSSES_MESH_NODE_01]
```

| | |
|--|---|
| <pre>Network Panel SSID: Detroit_Community_Mesh Gateway: 10.3.1.1 Captive Portal: ACTIVE</pre> | <pre>Hardware Telemetry Panel CPU Temp: 58°C RAM: [-----] 1.2GB / 4.0GB Storage: 12GB / 64GB</pre> |
| <pre>Mesh Bridge Panel Port: /dev/ttyUSB0 Node ID: !313_AFRO_FUTURIST</pre> | <pre>Recent Packets Log [2:50:11] [TELEMETRY] - BATT: 82% SN: 12.1 GPS: 42.3314° N, 83.0458° W</pre> |

Synthesis: The Fab-City Micro-Infrastructure Loop



Conclusion: This is not just a network. It is the physical manifestation of Jugaad-resilience through resourceful, decentralized design.