What is AREDN &
What Can We Do With It?

HAM-CON 2025

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Acknowledgements
Merrimack Valley Digital Network
a project of

Merrimack Valley Amateur Radio Association

supported by

- **Amateur Radio Digital Communications** (ARDC) Grant
- **Collaborations** with
  - **New England Digital Emergency Communications Network** (NEDECN)
    - 90+ DMR repeater sites in New England
  - **Central New Hampshire Amateur Radio Club**
  - **Capital Area Repeater Society**
  - **Manchester, NH area agencies and hospitals**
- **Organizations and individual hams** who provide time, money, equipment, expertise, and site access

Why get involved with AREDN?

- Have fun learning something new in ham radio
- Relatively low cost of entry
- Combines computer network technology with microwave radio technology
- See AREDNmesh.org for supported microwave equipment
- Use high-speed data applications within bandwidth constraints
- Fixed stations and portable / mobile operations
- Deploy for personal enjoyment and event support as well as EmComm
- Participate in New England-wide networking
- Defend amateur microwave spectrum under commercial pressure
- You will think of many other possibilities

Topics

- AREDN IP-based System (Part 97)
- Network Services
- How you can participate

arednmesh.org

Our Mission

The primary goal of the AREDN® project is to empower licensed amateur radio operators to quickly and easily deploy high-speed data networks when and where they are needed.

**Don't need to be an IT network expert!**

Radios & Frequencies

- Uses inexpensive *off-the-shelf* wifi radios
- Rugged & weatherproof for outdoor deployment
- Single *Power-over-Ethernet* cable *(data + power)*
- High gain antenna options *(some integrated w/ radio)*

(for example 400mw at 20dB gain = 45w EIRP)

- AREDN® firmware opens ham freqs *(some non-shared)*
- Bands: 900MHz *(33cm)*, 2.4GHz *(13cm)*, 5.8GHz *(5cm)*
- Line of sight required for microwave freqs
- Distance: ¼ mile to >30 miles

(our longest 5GHz link is 48 miles)
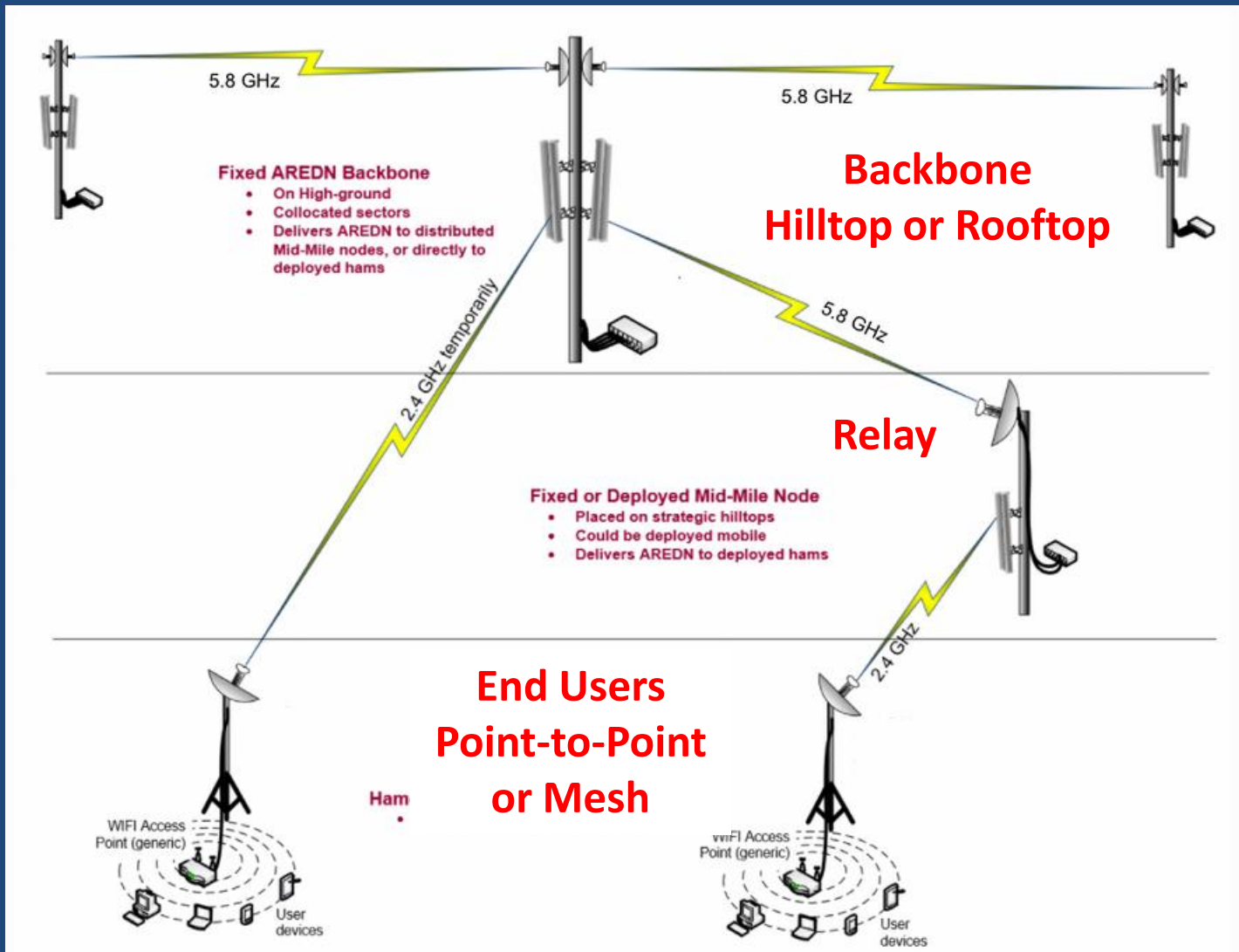
AREDN

Steve – AB7PA

arednmesh.org
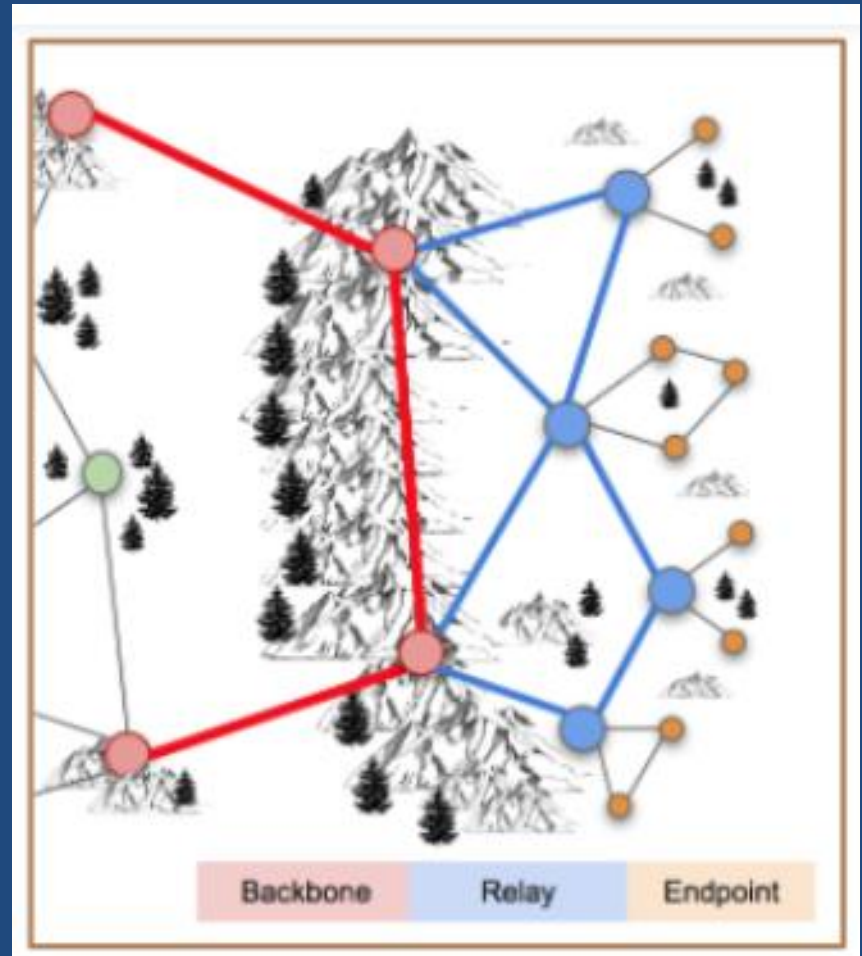
AREDN Configurations

AREDN Configurations
From AREDN Documentation

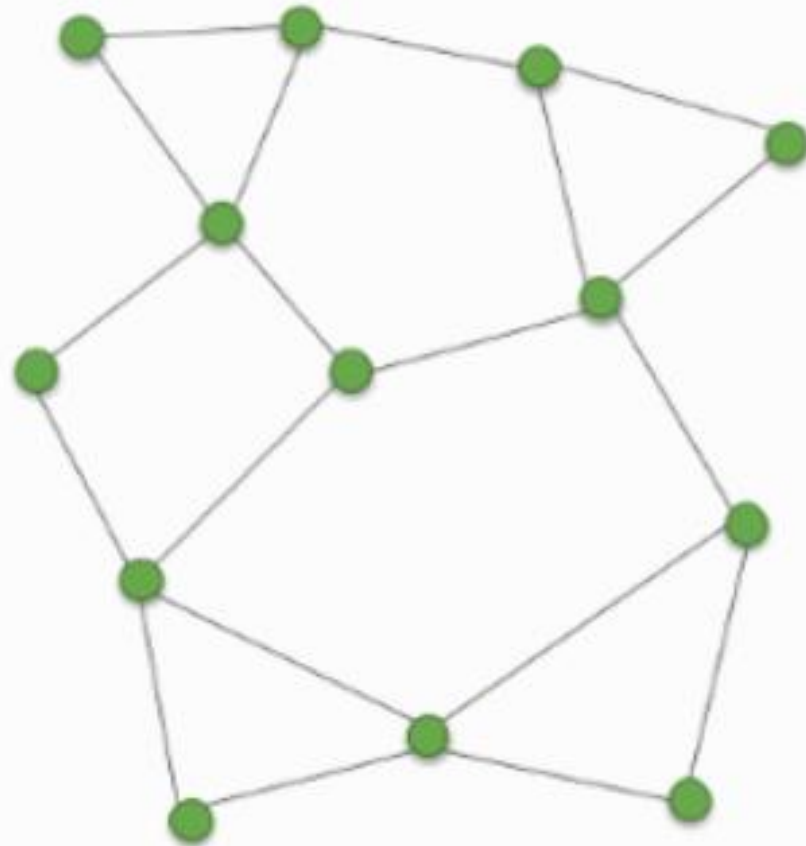# Example Backbone Nodes at DMR Repeaters
AREDN increases DMR resilience with multiple paths to the c-Bridge

Mesh Configuration at End Users
From AREDN Documentation

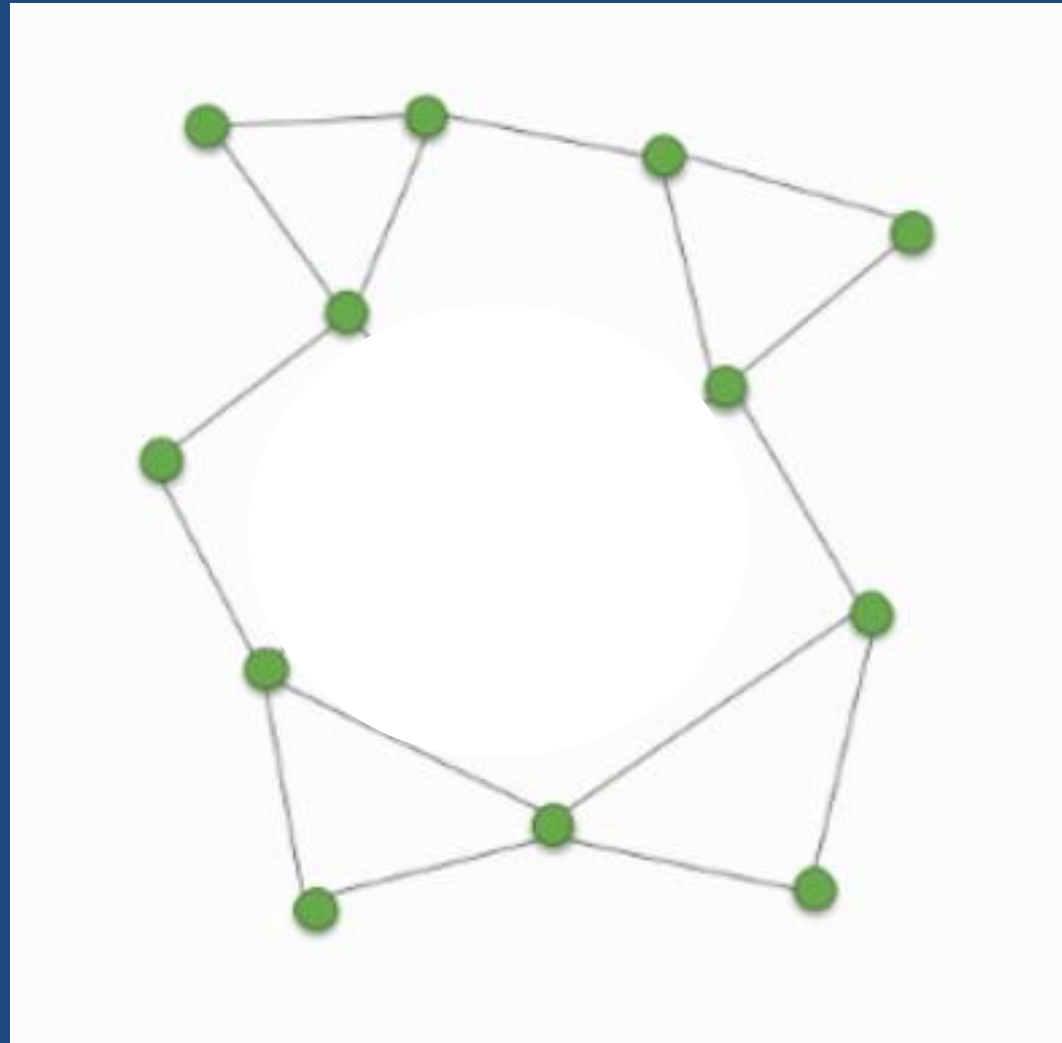**All nodes on same SSID, RF channel and bandwidth**

Mesh Configuration at End Users
From AREDN Documentation

Self-Healing

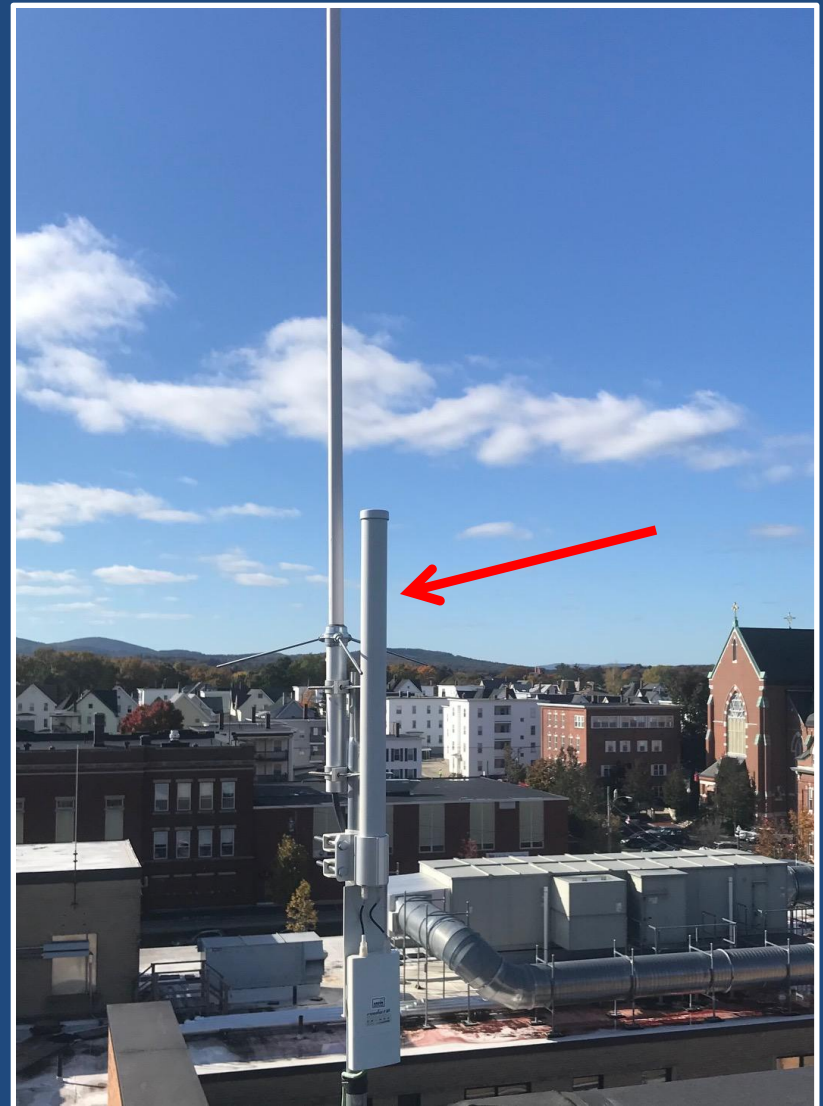**Alternate paths remain if one node drops out**
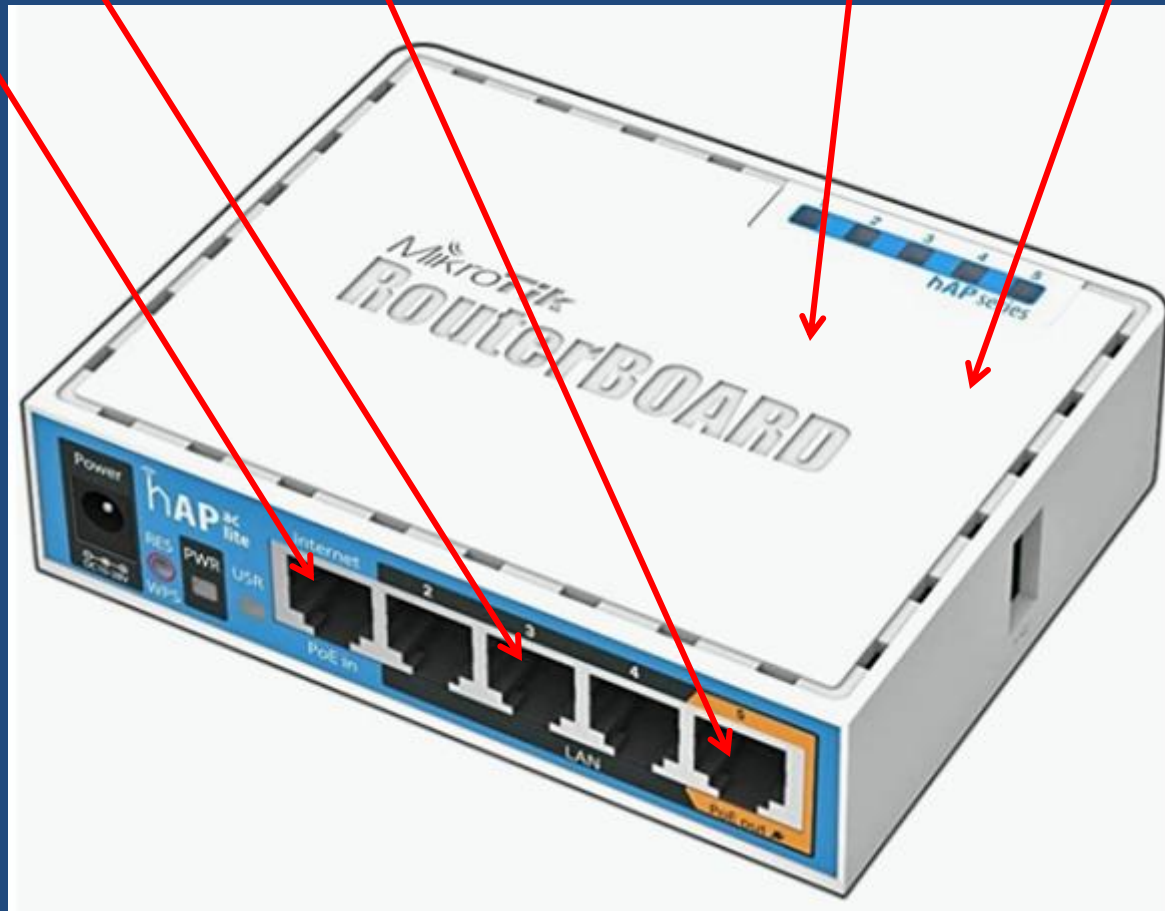
Mesh Nodes – Omni Antennas

Elliot Hospital

Catholic Medical Center

What can we do with AREDN?
MikroTik 2.4 / 5.8GHz Router & Access Point (~$65)
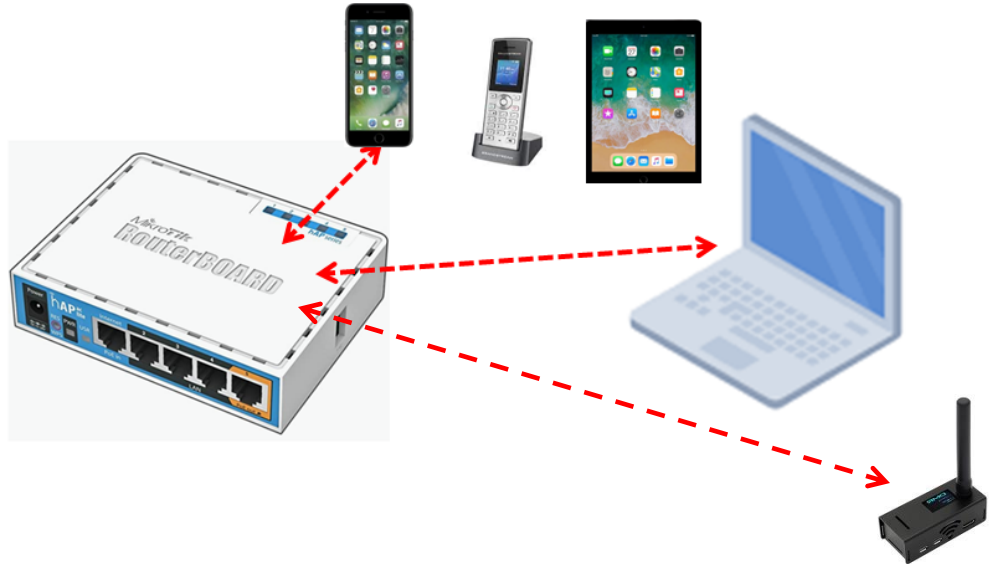**WAN, LAN, Device-to-Device*, WiFi AP, AREDN Node**

* Wire connection between AREDN routers

What can we do with AREDN?
WiFI Access with Browser and IP Phone

Password Protected
WiFi Browser
VOIP
Smart Phone Apps
DMR HotSpot

What can we do with AREDN?
Internet WAN, LAN, and Device-to-Device Ports

Internet

Email

Video

Device-to-Device Microwave Network

What can we do with AREDN?
Add Computers to LAN Ports

Computer with NoMachine Remote Access Software

- **Free**
- **Supports various computer platforms**
- **No central internet server required**
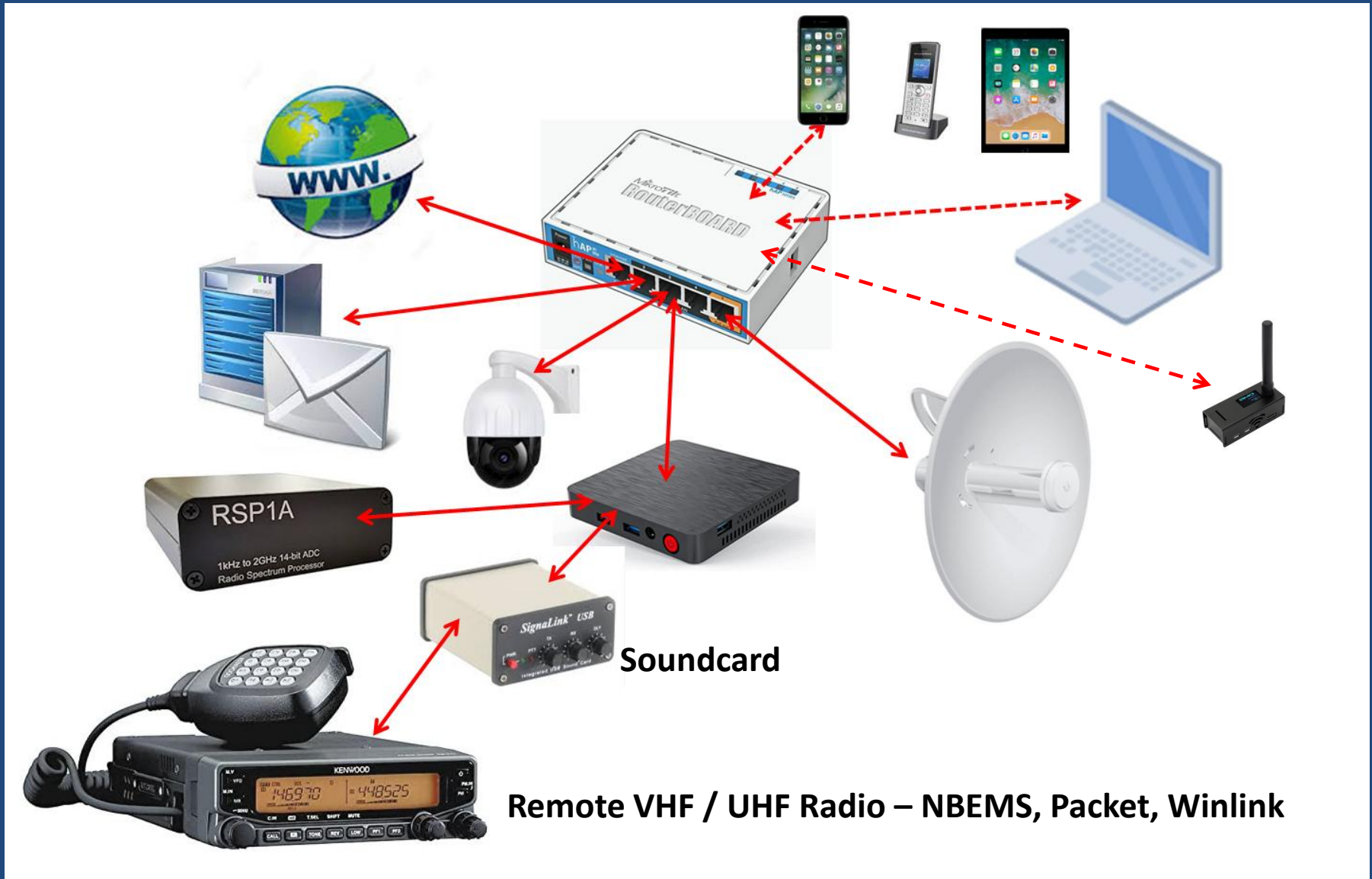
What can we do with AREDN?
Add a Spectrum Analyzer to Computer

WebSDR / Spectrum Analyzer
At Repeater Site

What can we do with AREDN?
Remote VHF / UHF Radio Operation via Computer

Soundcard

Remote VHF / UHF Radio – NBEMS, Packet, Winlink

RSP1A
1kHz to 2GHz 14-bit ADC
Radio Spectrum Processor

What can we do with AREDN?
Remote HF Radio Operation

Remote HF Radio –
NBEMS, Packet,
Winlink, FT8

What can we do with AREDN?
DMR Repeater Link to c-Bridge

DMR Repeater

How You Can Participate
AREDN 2.4GHz RF Node & Tunnel Router
HamXpo 2023 Workshop by Jim Garner KC1BHD
Great Club Project or Individual Training

Purchased Sep 2023

GL.iNet

GL-AR300M16-Ext Portable Mini Travel Wireless Pocket Router - WiFi Router | OpenWrt | 2 x Ethernet…

Wi-Fi, USB, Ethernet

4.2 ★★★★☆ (1,626)
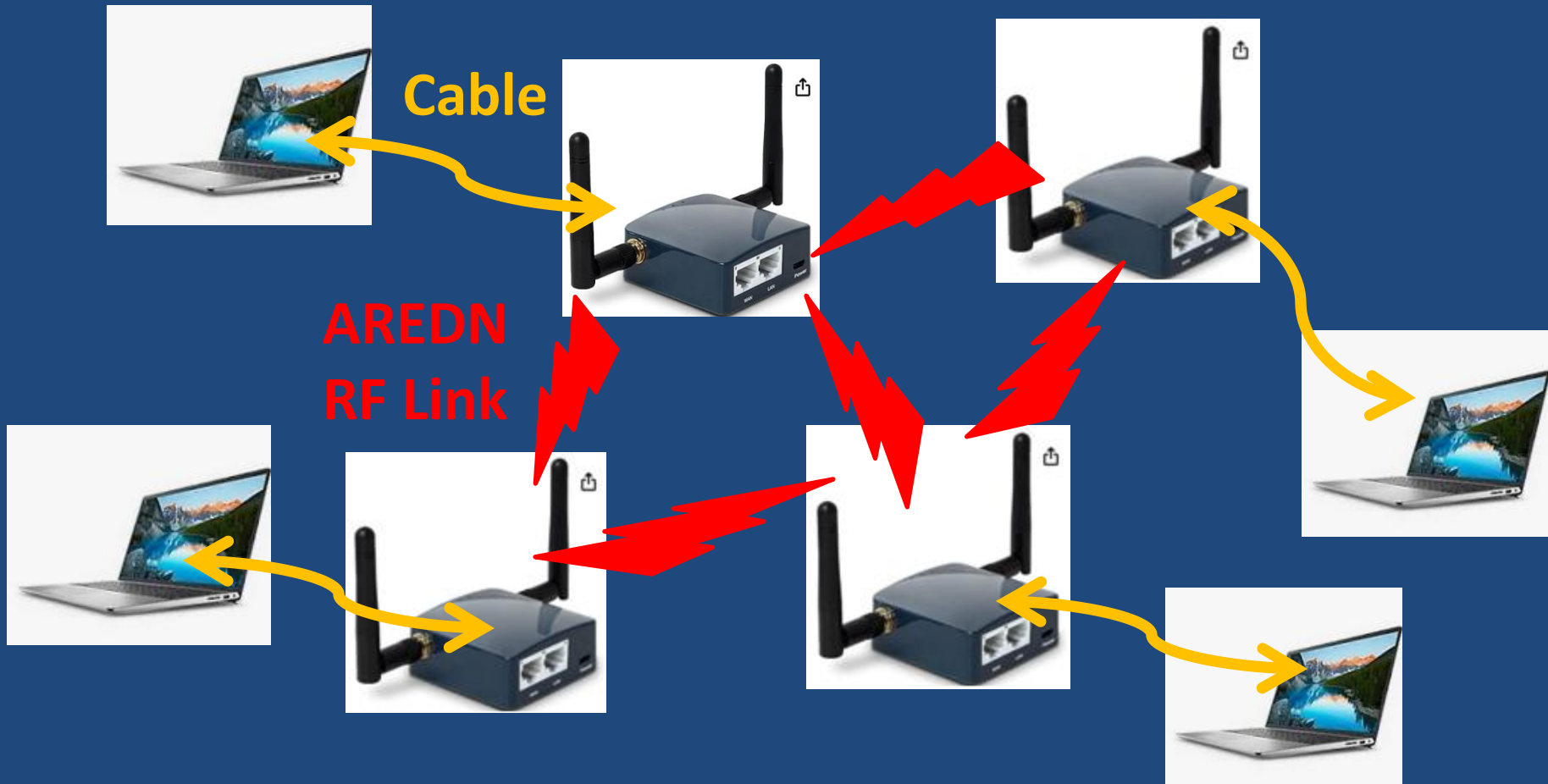200+ bought in past month

$31⁹⁰ List: $36.90
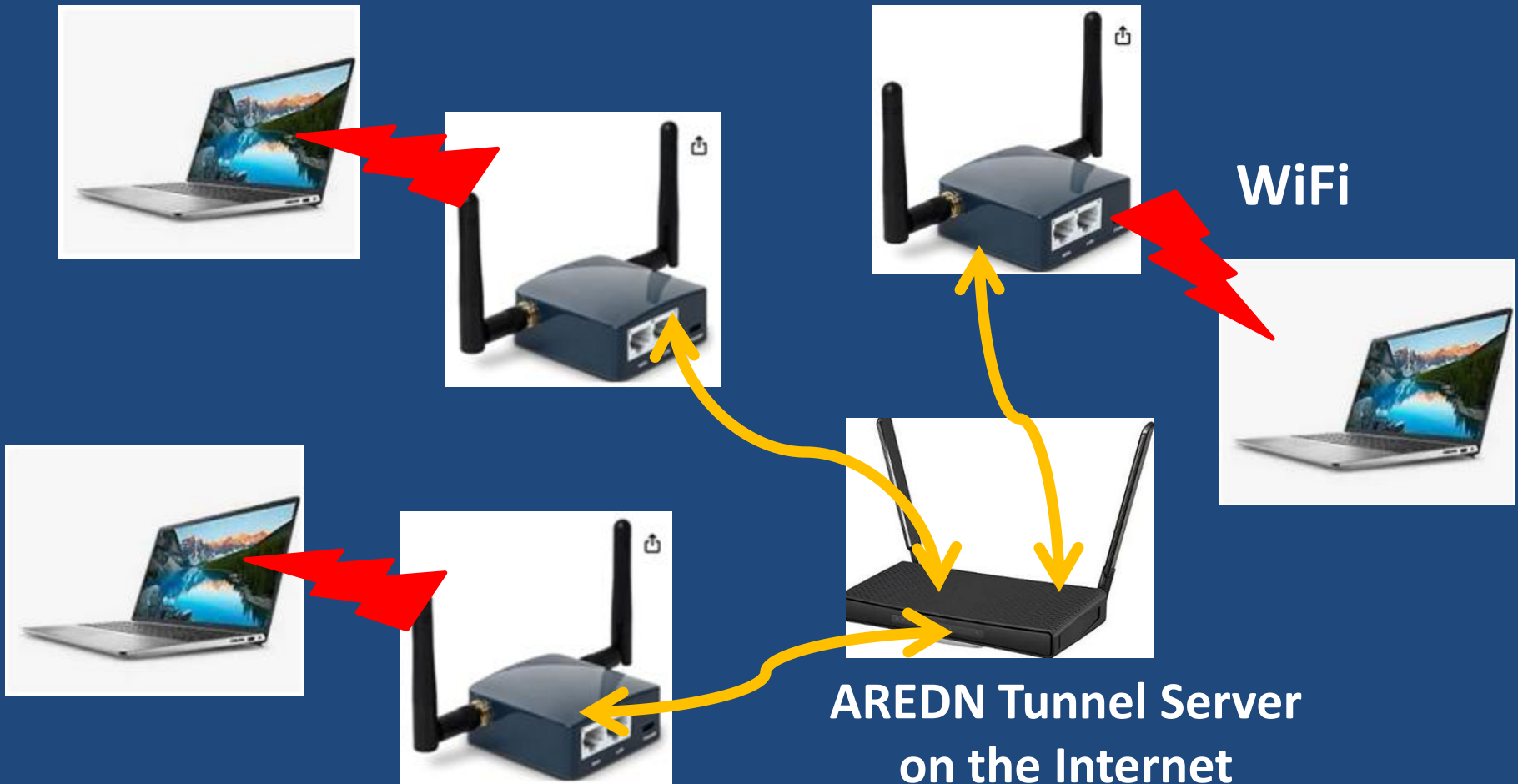
✓prime Overnight
FREE delivery **Overnight 4 AM - 8 AM**

Ways To Use GL.iNet AR300M16
Mesh Network Router – WiFi Distances

Cable

**AREDN
RF Link**

Ways To Use GL.iNet AR300M16
Internet Tunnel Client Built-in to AREDN
(Of course, don't rely on internet for EmComm)

WiFi

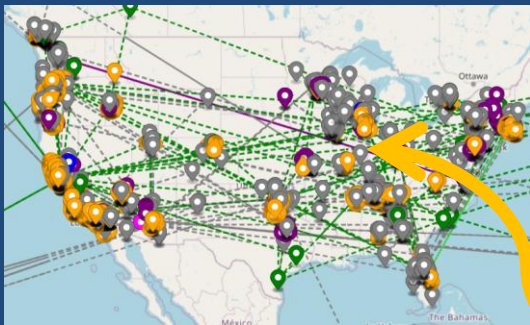**AREDN Tunnel Server on the Internet**

Ways To Use GL.iNet AR300M16
Internet Tunnel Client Built-in to AREDN
(Of course, don't rely on internet for EmComm)
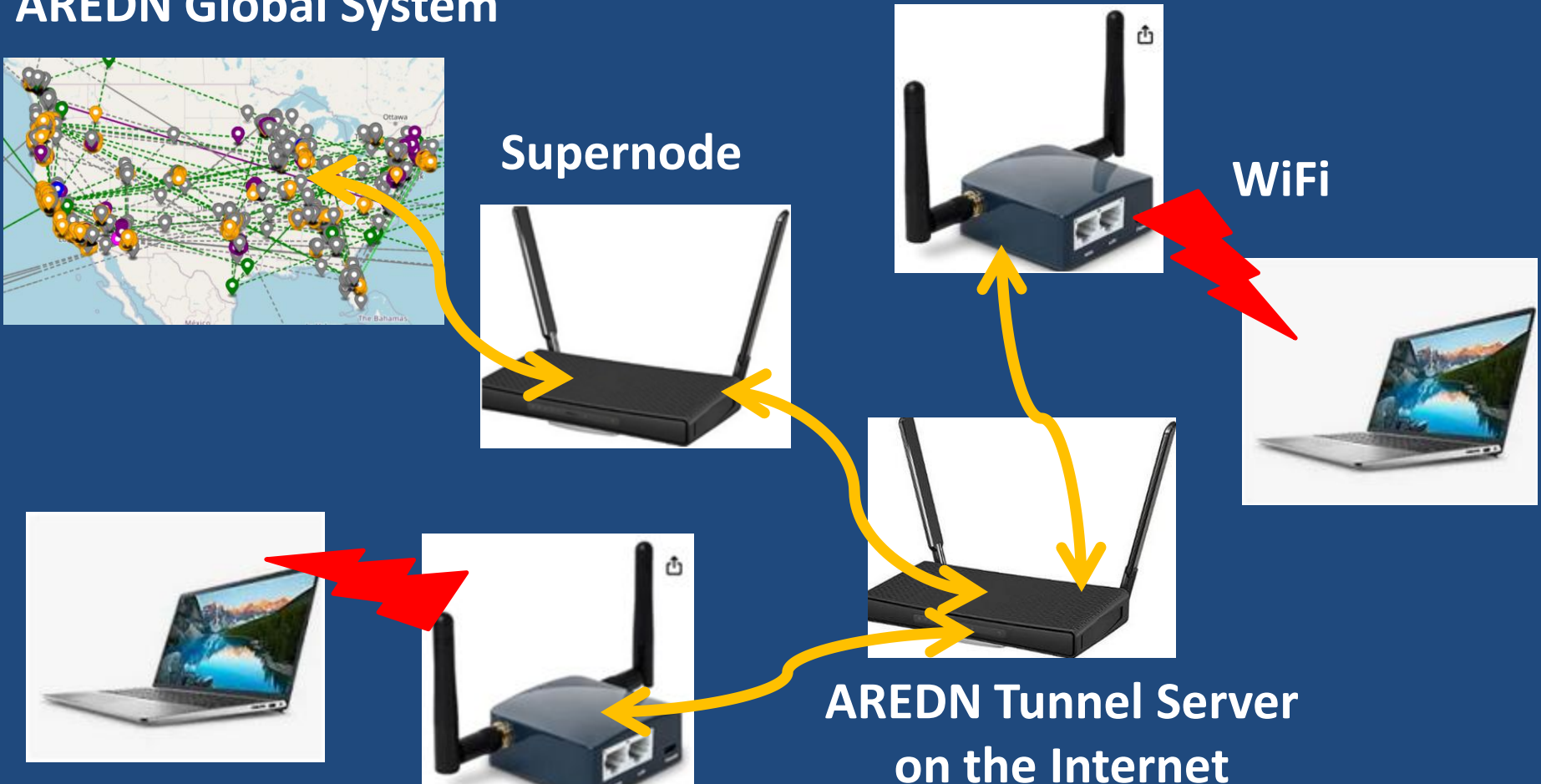

AREDN Global System

Supernode

WiFi

AREDN Tunnel Server on the Internet
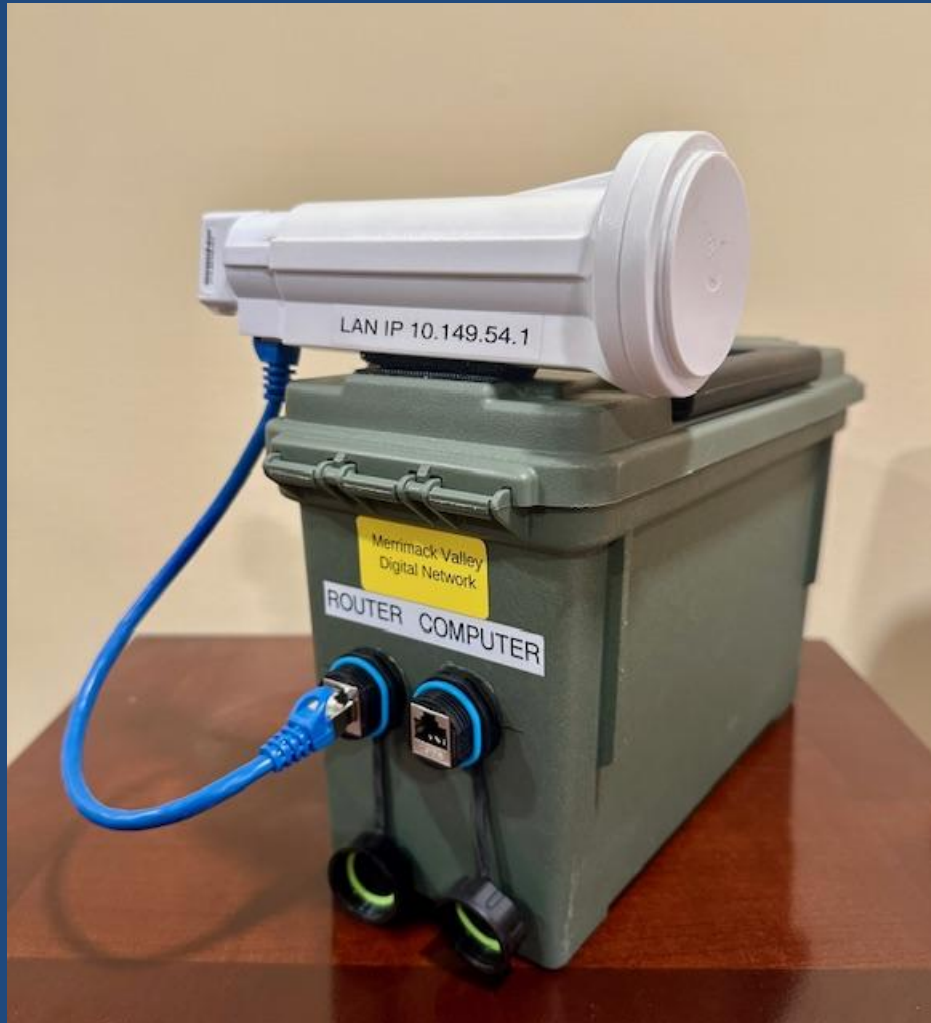
MikroTik hAP ac3 Tunnel Server (~$110)

- Free DDNS from NoIP.com aimed at your home router IP
- Static IP address on home router for tunnel server
- Forward port 5525 from home router to tunnel server

Portable AREDN RF Network Router
Training up to ~500 feet with just a feedhorn
Add parabolic reflector to increase distance up to ~15 miles

Portable AREDN RF Network Router Components
Most from Amazon

Plano Ammo Box
Visit the Plano Store
4.7 ★★★★★ (5,339)
Plano 131250 1312 Ammo Box, OD Green 131250,4.80 x 7.40 x 11.60 inches
500+ bought in past month
$11.99

CYCLENBATT Battery
Purchased Nov 2024
CYCLENBATT
12V 10Ah Lithium Battery, 5000+ Cycles LiFePO4 12V 10Ah Battery Built-in 10A BMS, 12V Lithium...
4.5 ★★★★★ (143)
400+ bought in past month
$28.99
Save 10% with brand promotion
✓prime One-Day

Ubiquiti PowerBeam (eBay)
ebay
6 ♡
Ubiquiti Networks (LOT OF 10) PowerBeam M5 PBE-M5-400 (Feed Horn Only) Bridge
wifistore powered by SWG Inc (2577)
100% positive feedback
$120.00
or Best Offer

ANMBEST Panel Mounting Connectors
ANMBEST 10PCS Panel Mounting Shielded CAT6 RJ45 Waterproof Connector Cat5/5e/6 8P8C Ethernet LAN Cable Coupler Double...
Purchased 1 time Last purchased Nov 15, 2024
4.5 ★★★★★ (143)
Length: **10PCS**
$38.99 ($3.90 / count)

SIOCEN DC Pigtails
Sponsored
Brand: SIOCEN
4.3 ★★★★★ (32)
2Pack 16AWG DC Plug Connector DC Power Pigtails Cable,2.1mm x 5.5mm DC Male Plug to Bare Wire Open End,12 Volt DC Barrel Supply Adapter Repair Cord for CCTV Security Camera,12v LED Strip Light 3FT
200+ bought in past month
$8.99

LUORNG POE Splitter
LUORNG POE Splitter Injector Kit 1Pair Power Over Ethernet Passive PoE Adapter Injector Splitter Cable with 5.5x2.1mm DC...
Purchased 4 times Last purchased Dec 7, 2024
4.7 ★★★★★ (8)
$6.96
✓prime Two-Day
FREE delivery **Tuesday, February 4**
Ships from   Amazon
Sold by   zzwslsm

Elecan Cat 6 Flat Ethernet Cable
Elecan Cat 6 Flat Ethernet Cable 1 Ft/5 Pack, High Speed Slim Short Patch Cables Internet Cables, 30 AWG Pure Copper 10Gbps 500MHz,Thin Flexible for POE Cat6 Cat 5e Cat 5 Network Cable...
★★★★☆ ⌄ 98
$8.99 ($1.80/Count)
✓prime
FREE delivery **Fri, Feb 7** on $35 of items shipped by Amazon
Or fastest delivery **Tomorrow, Feb 3**
Add to cart

Portable AREDN RF Node

Parts List	
1-Plastic Ammo Box	$12
1-12v 10Ah LiFePO4 Battery	$30
1-Ubiquiti 5GHz Feedhorn	$12
1-Power Cable 2.1mm Plug	$5
1-POE Injector	$7
2-RJ45 Feedthrus	$4
1-1ft Flat Ethernet Cable	$1
1-1ft Ethernet Cable	$2
1-5ft Ethernet Cable	$3
Total	**$76**

Services Added to Router Firmware
MeshChat for Chat and File Transfer

Chat

File Transfer

Services Added to Router Firmware
iPerf for Data Throughput – 48-mile Link - 2/16/2025 Storm


```
iperf3 test started

Client: N1MVA-Shapleigh2-ME-CHS
Server: N1MVA-Chester4-NH-SHP

[ 17] local 10.202.67.34 port 33536 connected to 10.202.67.39 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[ 17]   0.00-1.00   sec  2.09 MBytes  17.5 Mbits/sec    0    253 KBytes
[ 17]   1.00-2.00   sec  1.56 MBytes  13.1 Mbits/sec    0    253 KBytes
[ 17]   2.00-3.00   sec  2.23 MBytes  18.7 Mbits/sec    0    272 KBytes
[ 17]   3.00-4.00   sec  1.42 MBytes  11.9 Mbits/sec    0    287 KBytes
[ 17]   4.00-5.00   sec  1.94 MBytes  16.3 Mbits/sec    0    287 KBytes
[ 17]   5.00-6.00   sec  1.61 MBytes  13.5 Mbits/sec    0    315 KBytes
[ 17]   6.00-7.00   sec  1.98 MBytes  16.7 Mbits/sec    0    324 KBytes
[ 17]   7.00-8.00   sec  1.88 MBytes  15.7 Mbits/sec    0    324 KBytes
[ 17]   8.00-9.00   sec  1.55 MBytes  13.0 Mbits/sec    0    324 KBytes
[ 17]   9.00-10.00  sec  2.30 MBytes  19.3 Mbits/sec    0    643 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[ 17]   0.00-10.00  sec  18.6 MBytes  15.6 Mbits/sec    0         sender
[ 17]   0.00-10.07  sec  18.0 MBytes  15.0 Mbits/sec              receiver

iperf Done.

Sun Feb 16 2025 08:33:20 GMT-0500 (Eastern Standard Time)
```
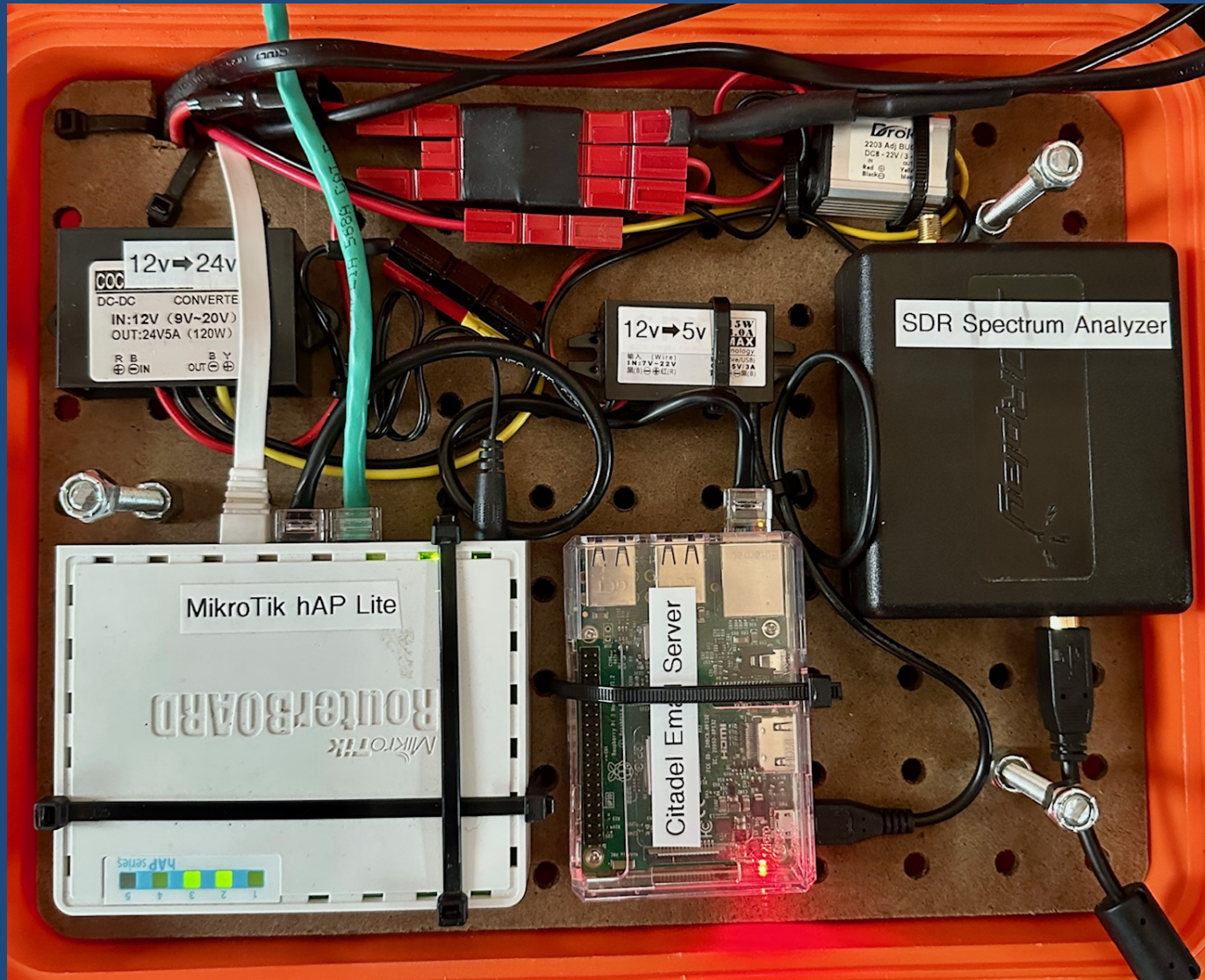
AREDN GoBox With Computers

AREDN Map
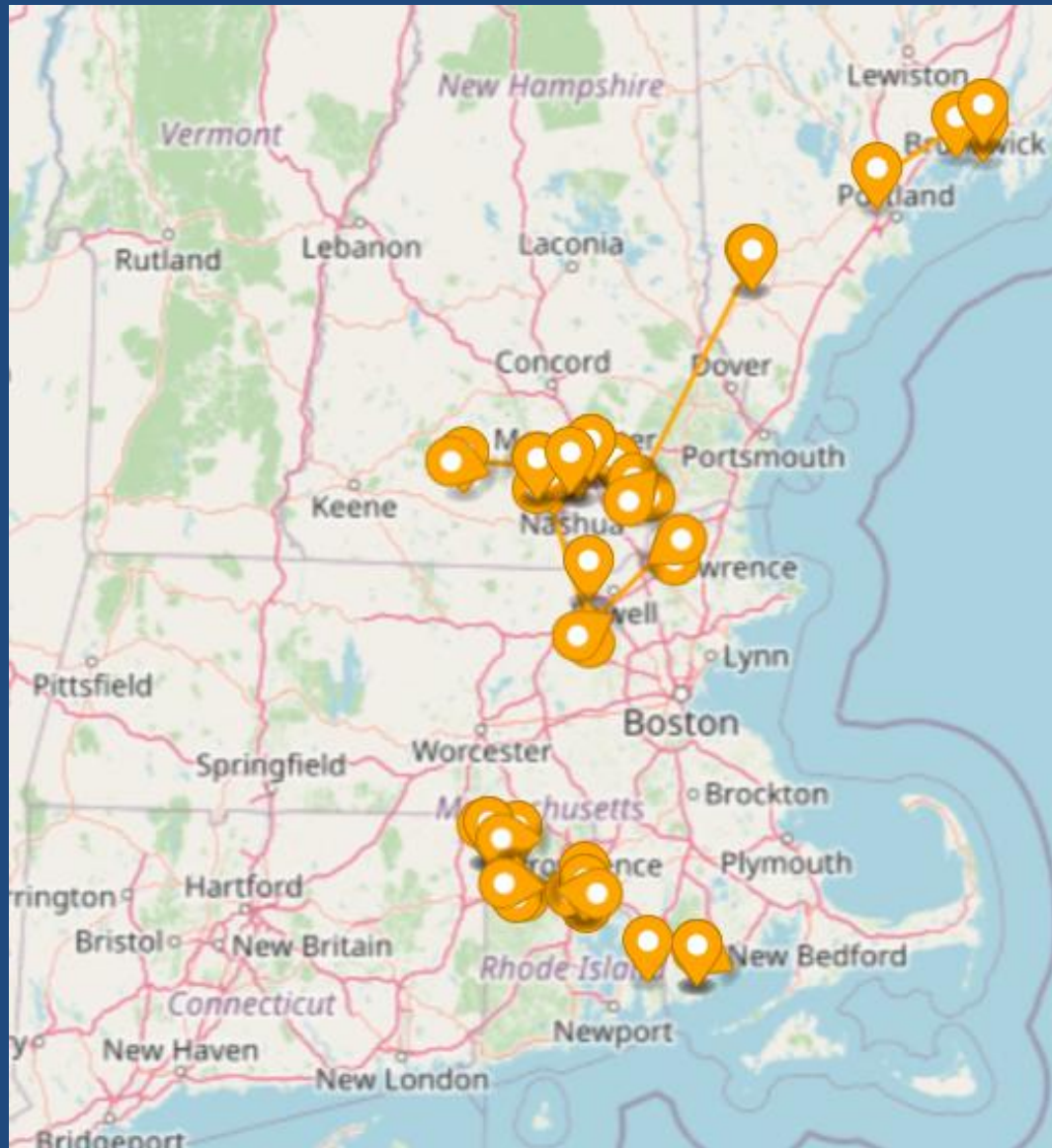## Internet Tunnel Nodes in New England

AREDN Map
5GHz RF Nodes in New England

Summary

- AREDN IP-based System
    - Data network easily deployable by hams without much networking expertise
- Network Services
    - Many internet applications within available bandwidth
- You can participate for about $35
    - Group nets on RF or internet tunnel
    - Chat, file transfer, and data speed programs on nodes, no separate servers needed
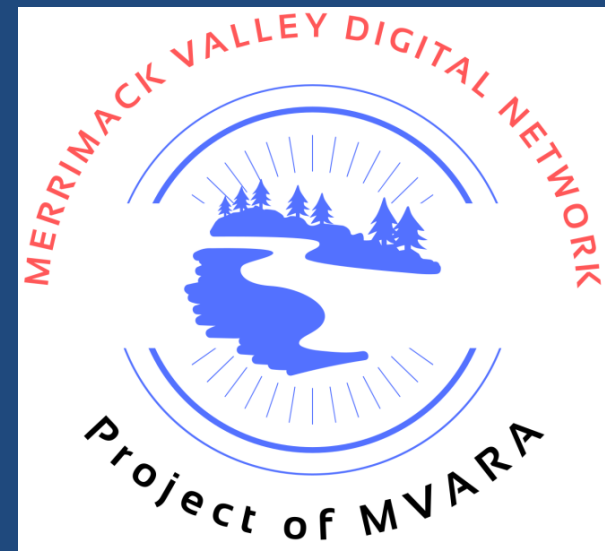   - Internet tunnel to global AREDN system from home

Merrimack Valley Amateur Radio Association
501(c)3 Nonprofit Corporation

We welcome members wherever you live

merrimackvalleyara.org

Discussion

merrimackvalleyara.org