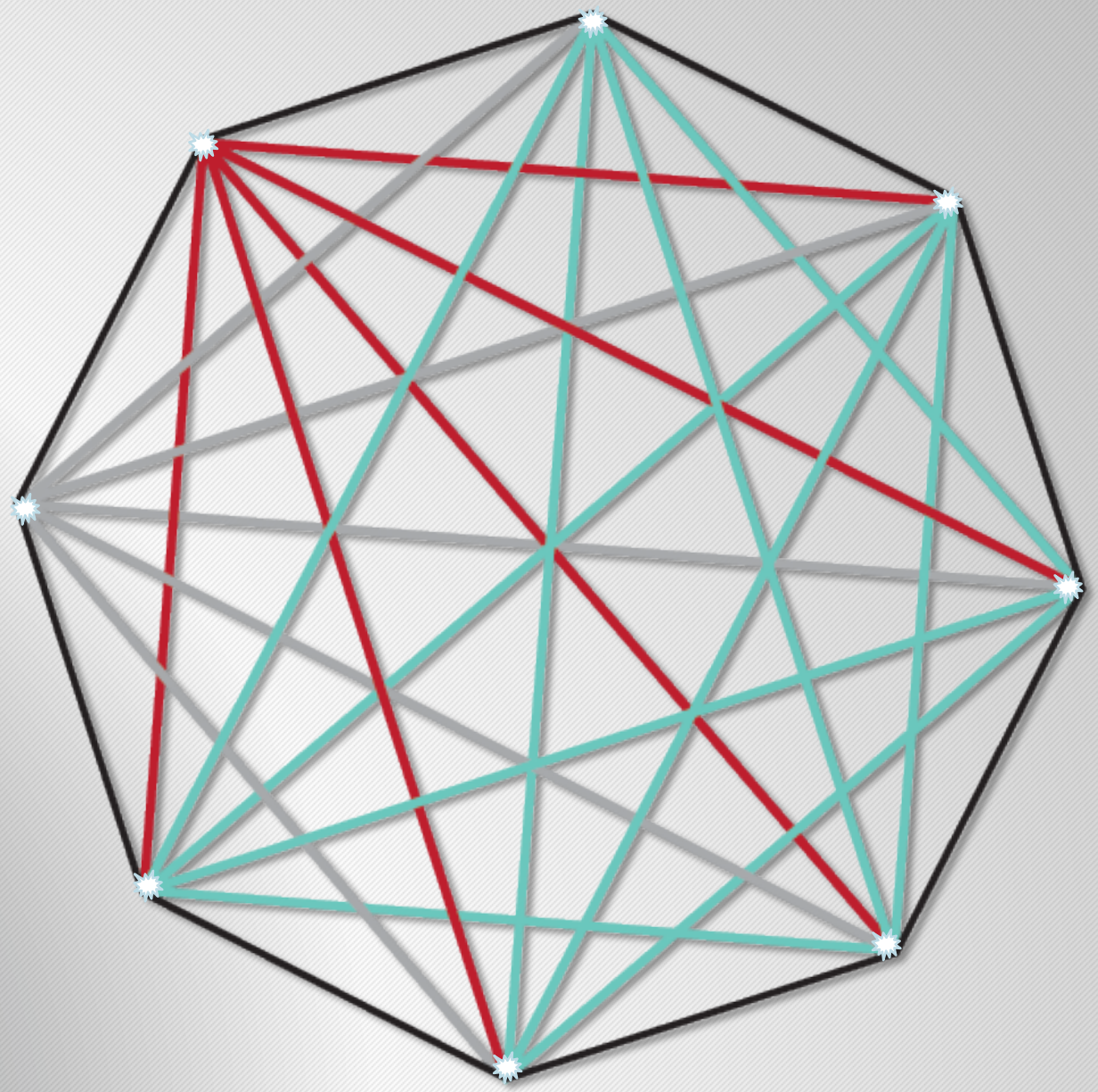

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Building a High-Speed AuxComm Data Network

Andre, Hansen, K6AH

Hamvention 2017
Greene County Fairgrounds, Xenia, OH
May 19 - 21, 2017

How many of you have used a microwave high-speed **data** network?

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I suspect most of you…

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What is AREDN ?

Software

- OpenSource development project
- Distributed under Free Software Foundation GNU GPL version 3
- Free to Hams (and anyone else for that matter)
- Focused on AuxComm/Emcomm
- Active user forum
- Agile, flexible dev model
- Nightly builds available
- Entirely a Ham volunteer effort
- Developers also implement

What is AREDN ?

Wireless Mesh

- Repurpose WISP routers – replace OEM FW
- In the Ham Bands (.9, 2.4, 3.4, & 5.8 GHz)
- Part 97 Tech License
- Up to 144 Mbps IP Network (802.11n)
- Nodes are comprised of:
  - Linux computer w/Ethernet I/F
  - Software Defined Radio (SDR)
  - Amplifier
  - Often includes an antenna
  - $45-$90

What is AREDN ?

The Team

- Conrad KG6JEI Architect, Lead Developer
- Joe AE6XE Developer
- Darryl K5DLQ Developer
- Trevor K7FPV Developer
- Randy WU2S Promotion, Webmaster
- Andre K6AH Project Manager

HSMM Networks Today

BBHN

First real implementation of Ham-based Mesh

Uses only Part 15 shared spectrum in 2 GHz band

Relatively inactive today

HAMWAN

Traditional fixed point-to-point network

Requires significant network skills

Uses Part 15 shared spectrum in 2 GHz and 5 GHz bands

AREDN

Can be easily deployed on the fly with no network expertise

Commercially robust H/W

Actively developed and supported

Entirely within the .9, 2, 3, and 5 GHz Ham bands

Primarily Use Ubiquiti airMAX M-series WISP routers

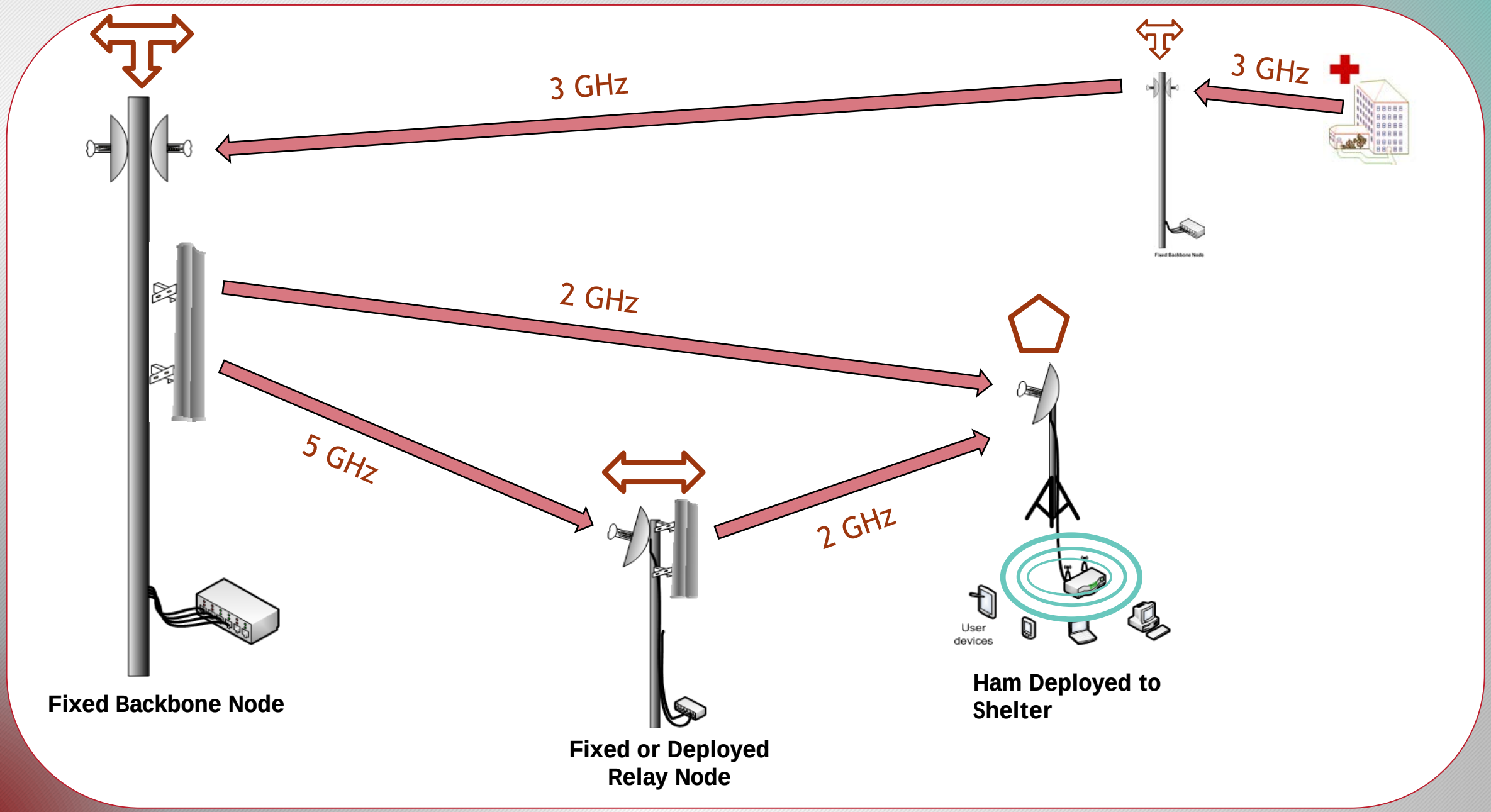
- AirGrid
- AirRouter
- Bullet
- NanoBridge
- NanoStation
- Rocket

Robust Specifications

- Power Output: 23 – 28 dBm (200mW – 630mW)
- Antenna Gain: 11 – 30 dBi
- Temperature: -40° to 176°F
- Some configurations capable of 50+ mile range

Also support TP-Link Devices

- CPE210 & CPE510


3 GHz
3 GHz
2 GHz
5 GHz
2 GHz
User devices
Fixed Backbone Node
Fixed or Deployed Relay Node
Ham Deployed to Shelter

Design Considerations

Backbone

Elevation

High-gain/high power

Point-to-Point 3 GHz

Distribution downward
2 and 5 GHz

Deployed Nodes

May be Ham-owned

Inexpensive <$100

12v power

Augment go-kits

Typically 2 GHz
(channel -2, 2397 MHz)

Relay Nodes

High-gain upwards

Broad-coverage down

Cross-band 5 to 2 GHz

Strategically placed

Path Prediction tools

Build Considerations

Backbone

Mountains, water towers, buildings, towers

Dish 24-30 dBi

Rockets (MIMO)

Sector distribution downward

Deployed Nodes

NanoBeam

WIFI Access Point

10-20’ mast

Keep it simple

Relay Nodes

Hills, tall masts, buildings

RadioMobile to determine location

Up: NanoBeam, PowerBeam

Down: NanoStations

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Backbone Sites

Using the Vertical Dimension

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Backbone Using High Ground

Mt. Palomar, 6200’ ASL to Mt. Otay at 48 miles

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2 GHz and 5 GHz Downlinks

High Ground at Ham’s Mountain Cabin

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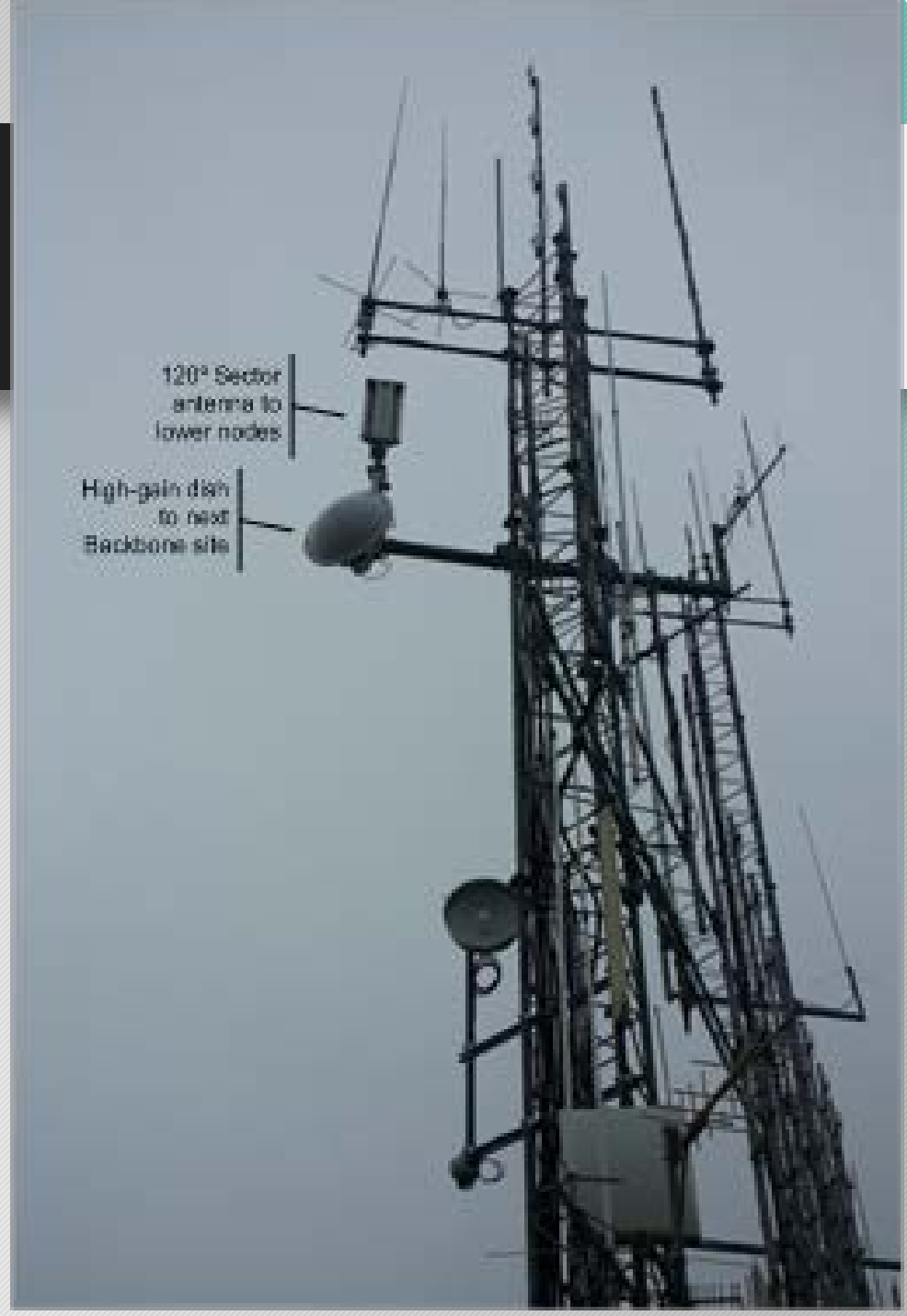
Club Repeater Site Towers

Benefits

Cheap or free

Gets the club involved

No QRM from ISPs



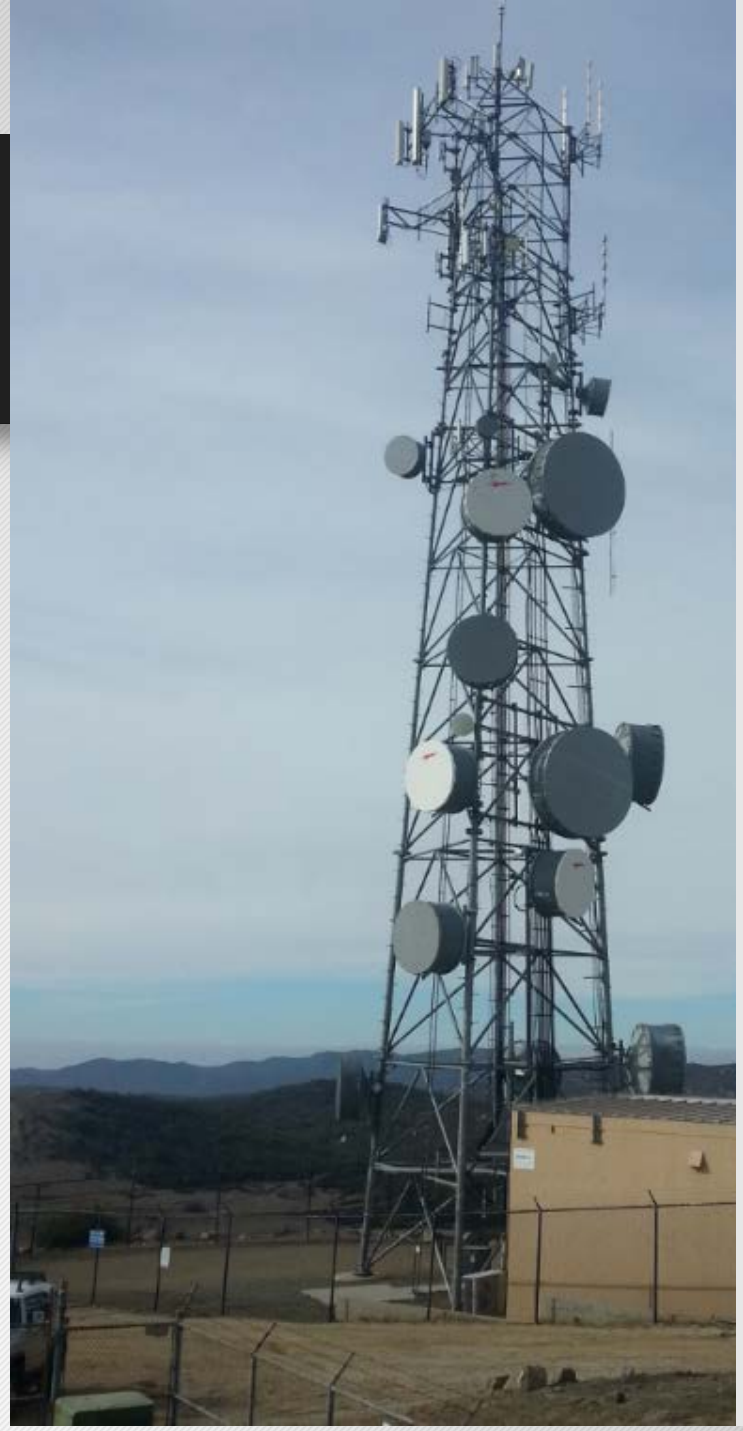
Commercial Towers

Benefits

Generally well-placed

Often much taller

May be ham-owned



Self Contained Backbone Site

Ventura County - Camarillo Hills, CA

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Relay Sites

Relay Node “In the Wild”

Unspecified location

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Small Footprints / Wide Coverage

Chatsworth Peak - Ventura County, CA

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Small Footprints / Wide Coverage

Saddleback Peak - Mission Viejo, CA

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Water Tower Relay Site

San Bernardino County - Redlands, CA

Deployed Relay Node

Temporary Shelter Deployment

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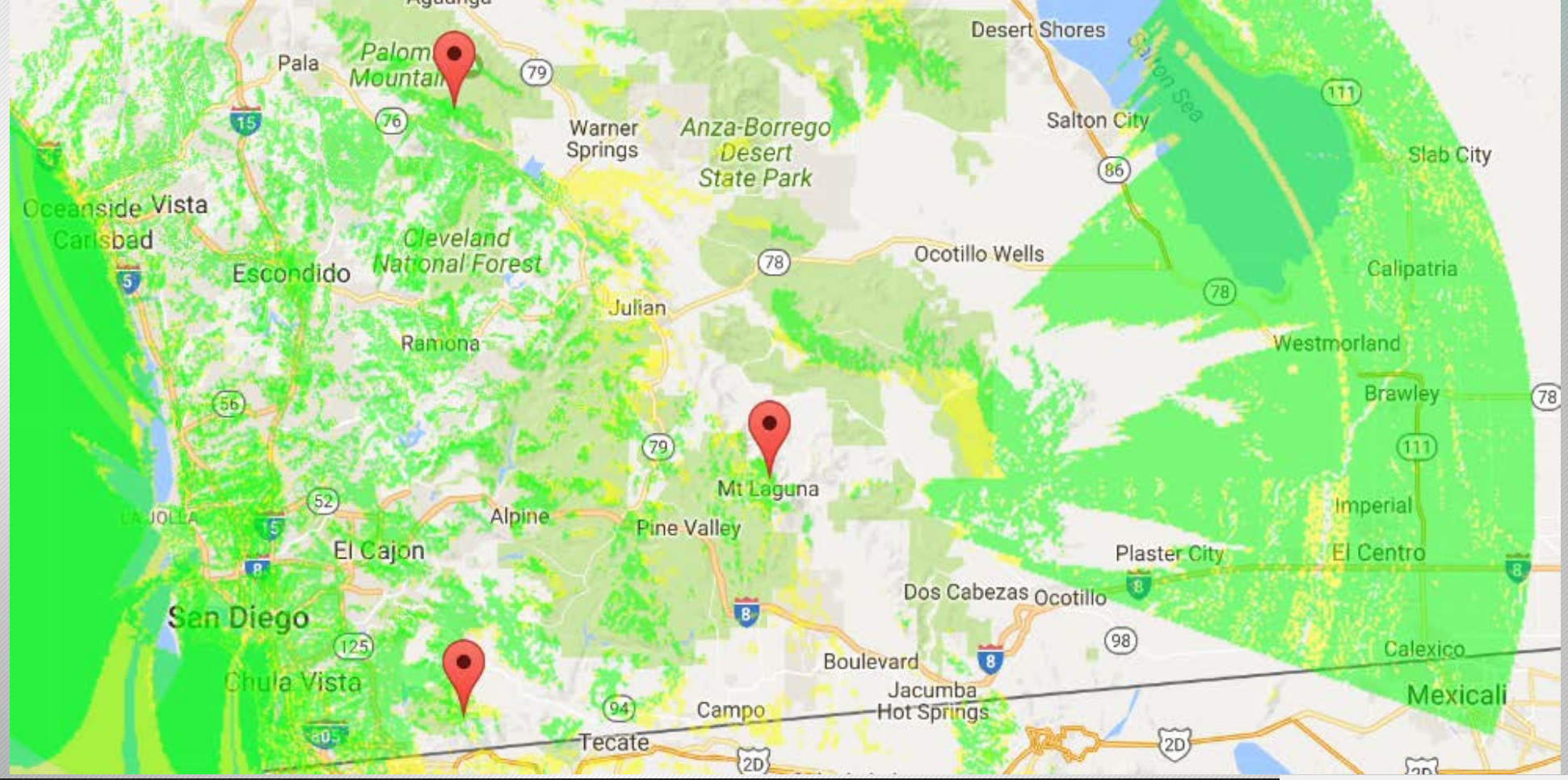

Locating Relay Sites

Using RadioMobile to Find Common Ground

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Network Services

Network Services

Connect the disaster area to the outside world

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WINLINK Global Radio Email

WebEOC 8.2 Login
Username
Password
Log In
intermedix

csipsimple

3CX

Asterisk

FreePBX
let freedom ring™

verizon

GRANDSTREAM
CONNECTING THE WORLD

Safe and Well
Register yourself or search for a loved one.

American Red Cross

CERT
COMMUNITY EMERGENCY RESPONSE TEAM

Exercise Your Skills

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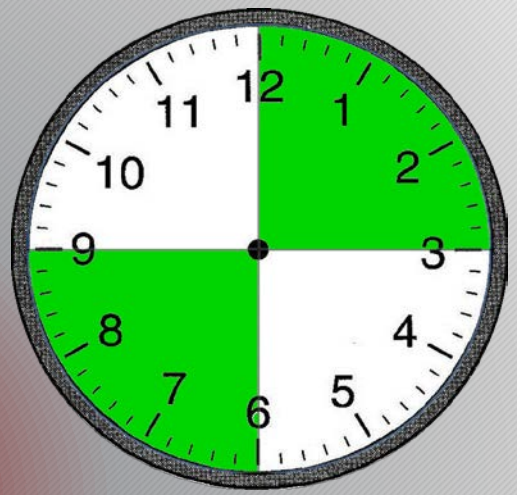
Presence at Hamvention

Visit the MVMA Booth, #1001

Tutorials

15-minute talks on the hour and 1:1 Q&A on the half hour



SME Advice

Learn from the experts

See demos

Talk with members of the team:

- Randy, WU2S
- Andre, K6AH
- MVMA

If you're Local

Connect with members of the Miami Valley Mesh Alliance

Fire up your AREDN node

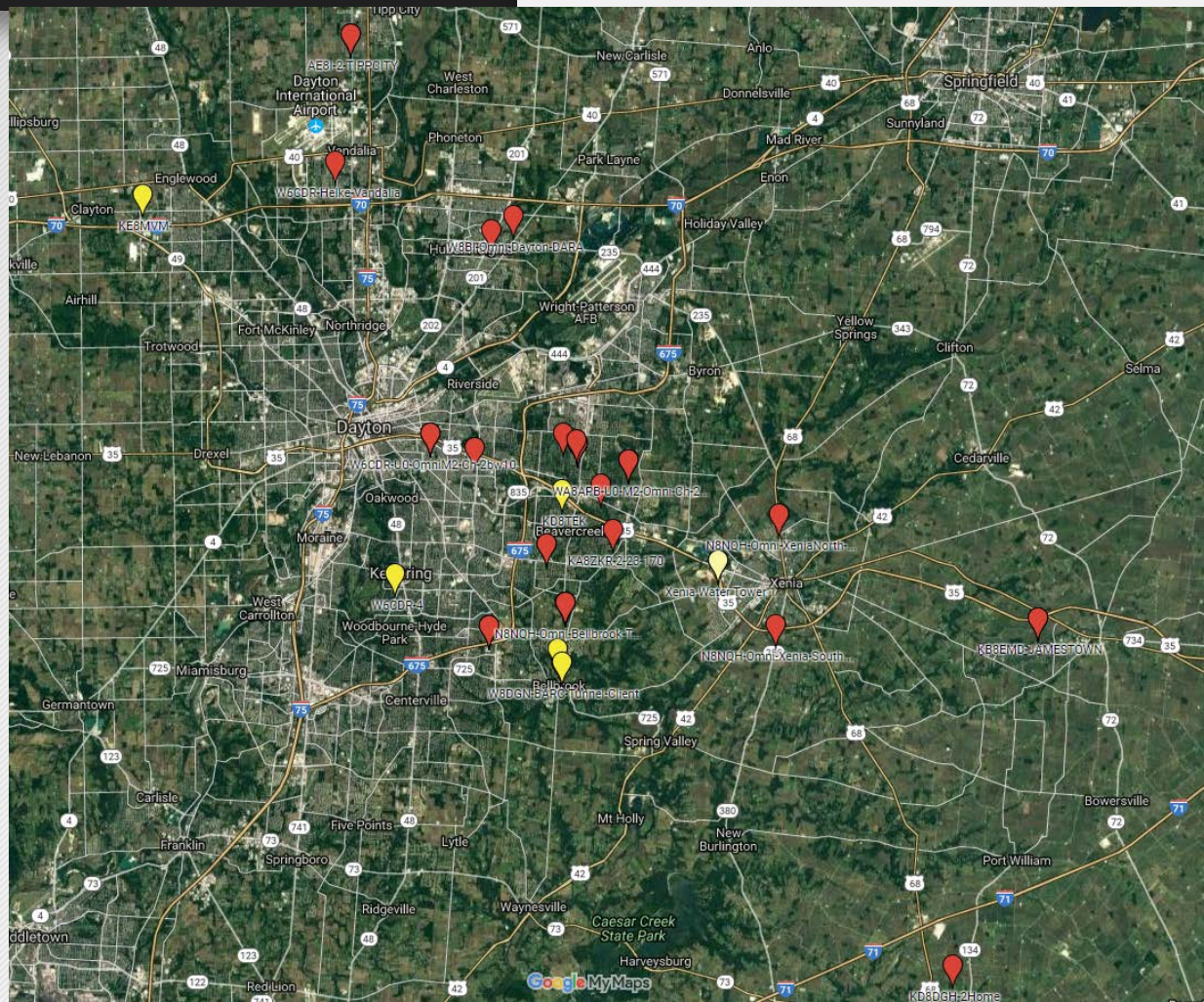
- 2.4 GHz
- Channel -2 (2397 MHz)
- 10 MHz Bandwidth

Thanks to MVMA for Hosting AREDN

Provided:

- Booth Space
- Local AREDN Infrastructure
- This Forum/Presentation Slot

Support the Dayton AREDN effort



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For More Info

- WWW.AREDN.ORG
- QST June 2017, ARRL
- TAPR/ARRL DCC Proceedings 2015
- TAPR/ARRL DCC Proceedings 2016
- Search YouTube, HamRadio360, HamRadioNow, HamNation videos

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Contact Info

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www.aredn.org/forum