Building a High-Speed AuxComm Data Network

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How many of you have used a microwave high-speed data network?
I suspect most of you...
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

<table>
<thead>
<tr>
<th>BBHN</th>
<th>HAMWAN</th>
<th>AREDN</th>
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<tbody>
<tr>
<td>First real implementation of Ham-based Mesh</td>
<td>Traditional fixed point-to-point network</td>
<td>Can be easily deployed on the fly with no network expertise</td>
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<tr>
<td>Uses only Part 15 shared spectrum in 2 GHz band</td>
<td>Requires significant network skills</td>
<td>Commercially robust H/W</td>
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<tr>
<td>Relatively inactive today</td>
<td>Uses Part 15 shared spectrum in 2 GHz and 5 GHz bands</td>
<td>Actively developed and supported</td>
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<td>Entirely within the .9, 2, 3, and 5 GHz Ham bands</td>
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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
Ham Deployed to Shelter

Fixed Backbone Node

Fixed or Deployed Relay Node

Ham Deployed to Shelter

3 GHz

2 GHz

5 GHz
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
Backbone Using High Ground
Mt. Palomar, 6200’ ASL to Mt. Otay at 48 miles
2 GHz and 5 GHz Downlinks
High Ground at Ham’s Mountain Cabin
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
Relay Sites
Relay Node “In the Wild”
Unspecified location
Small Footprints / Wide Coverage
Chatsworth Peak - Ventura County, CA
Small Footprints / Wide Coverage
Saddleback Peak - Mission Viejo, CA
Water Tower Relay Site
San Bernardino County - Redlands, CA
Deployed Relay Node
Temporary Shelter Deployment
Locating Relay Sites
Using RadioMobile to Find Common Ground
Network Services
Network Services
Connect the disaster area to the outside world
Exercise Your Skills
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
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
Contact Info

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www.aredn.org/forum